Ferrites and Accessories

S+M COMPONENTS **Siemens Matsushita Components**

Ferrite inductors from SCS stock

Transformation at its best

Not just one-off solutions but complete ones designed precisely to a requirements profile are more in demand than ever. So we are offering surface-mount transformers for power and broadband applications straight from SCS stock:

- **E 6,3** with small dimensions, low leakage inductance and high electric strength
- **ER 11** flat and with low leakage inductance
- **RM 4 LP** for high DC biasing
- **S interface transformer RM 5** for precise pulse transmission in ISDN terminals
- **U interface transformer RM 6** for ISDN applications
- **Planar inductor RM 7** with high power density and extremely flat for DC/DC applications

SCS – dependable, fast and competent

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RM cores

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H [1]	Individual parts of assembly set	Part number	Page
RM 4	IEC 60431		Core	B65803	185
		$10{,}16^2 \times 10{,}8$	Coil former	B65804	187
			Insulating washers	B65804	188
			Clamp	B65806	188
			Adjusting screws	B65539	189
RM 4 LP			Core	B65803	193
		$10{,}5^2 \times 8{,}1$	Coil former	B65804	194
			Clamp	B65804	195
			Insulating washers	B65804	195
		14 × 17,5 × 8,1	SMD coil former/Clamp	B65804	196
RM 5	IEC 60431		Core	B65805	198
		$12{,}7^2 \times 10{,}8$	Coil former	B65806	200
			Clamp	B65806	201
			Insulating washers	B65806	201
		16,5 × 19 × 10,6	SMD coil former	B65822	202
			Clamp	B65806	202
			Adjusting screws	B65539/ B65806	204
RM 5 LP			Core	B65805	209
		20 × 16 × 8	SMD coil former	B65822	210
			Clamp	B65804	210
RM 6	IEC 60431		Core	B65807	212
		$15{,}24^2 \times 12{,}8$	Coil former	B65808	214
			Clamp/Insulating washers	B65808	217
			Coil former for SMPS transf.	B65808	215
		19,5 × 25 × 12,8	Coil former for power appl.	B65808	216
		19,6 × 22,2 × 13	SMD coil former	B65821	218
			Clamp	B65808	218
			Adjusting screws	B65659	220
RM 6 LP			Core	B65807	225
		23 × 20 × 9,5	SMD coil former	B65821	226
			Clamp	B65808	226

1) Height above mounting plane

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H 1)	Individual parts of assembly set	Part number	Page
RM 7	IEC 60431		Core	B65819	228
		$17,78^2 \times 13,8$	Coil former	B65820	230
			Clamp/Insulating washers	B65820	231
			Adjusting screws	B65659	232
RM 7 LP			Core	B65819	235
			Coil former	B65820	236
RM 8	IEC 60431		Core	B65811	238
		$20,32^2 \times 16,8$	Coil former	B65812	240
			Coil former for SMPS transf.	B65812	241
		$26 \times 30 \times 16,8$	Coil former for power appl.	B65812	242
			Clamp/Insulating washers	B65812	243
			Adjusting screws	B65812	244
RM 8 LP			Core	B65811	248
			Coil former	B65812	249
			Clamp/Insualting washers	B65812	250
RM 10	IEC 60431		Core	B65813	252
		$25,4^2 \times 19$	Coil former	B65814	254
		$31 \times 40 \times 19$	Coil former for power appl.	B65814	255
			Clamp/Insulating washers	B65814	256
			Adjusting screws	B65679	257
RM 10 LP			Core	B65813	259
RM 12	IEC 60431		Core	B65815	261
		$30,48^2 \times 24,9$	Coil former	B65816	263
		$32 \times 45,7 \times 24,9$	Coil former for power appl.	B65816	264
			Clamp/Insulating washers	B65816	265
RM 12 LP			Core	B65815	266
RM 14	IEC 60431		Core	B65887	268
		$35,56^2 \times 30,5$	Coil former	B65888	270
		$44 \times 29 \times 30,5$	Coil former for power appl.	B65888	271
			Clamp/Insulating washers	B65888	272
RM 14 LP			Core	B65887	273
Adjusting tools (see individual data sheets)				B63399, B6580*	

1) Height above mounting plane

PM cores

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H [1])	Individual parts of assembly set	Part number	Page
PM 50/39	IEC 61247	65 × 52 × 45	Core	B65646	276
			Coil former	B65647	277
			Mounting assembly	B65647	278
PM 62/49	IEC 61247	76 × 64 × 55	Core	B65684	279
			Coil former	B65685	280
			Mounting assembly	B65685	281
PM 74/59	IEC 61247	85,5 × 75 × 65	Core	B65686	282
			Coil former	B65687	283
			Mounting assembly	B65687	284
PM 87/70	IEC 61247	101 × 87 × 72	Core	B65713	285
			Coil former	B65714	286
			Mounting assembly	B65714	287
PM 114/93	IEC 61247	114 × 92 × 93	Core	B65733	288
			Coil former	B65734	289

1) Height above mounting plane

EP cores

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H [1])	Individual parts of assembly set	Part number	Page
EP 7	IEC 61596		Core	B65839	291
		7,5 × 10 × 10	Coil former/Cap yoke	B65840	292
		13 × 9,2 × 8,8	SMD coil former	B65840	293
EP 10	IEC 61596		Core	B65841	294
		12 × 14,2 × 12,5	Coil former	B65842	295
			Mounting assembly	B65842	296
			Cap yoke	B65842	296
EP 13	IEC 61596		Core	B65843	297
		15 × 16 × 13,7	Coil former	B65844	298
		15 × 16 × 13,7	Coil former for high-voltage applications	B65844	299
			Mounting assembly	B65844	300
			Cap yoke	B65844	300
		19,5 × 13 × 12,5	SMD coil former	B65844	301
EP 17	IEC 61596		Core	B65845	302
		20 × 21,6 × 16,2	Coil former	B65846	303
			Mounting assembly	B65846	304
			Cap yoke	B65846	304
EP 20	IEC 61596		Core	B65847	305
		23 × 27,5 × 20,5	Coil former	B65848	306
			Mounting assembly	B65848	307

1) Height above mounting plane

P cores (pot cores)

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H [1])	Individual parts of assembly set	Part number	Page
P 3,3 × 2,6			Core	B65491	310
P 4,6 × 4,1			Core	B65495	312
		5,5 × 5 × 5,1	Coil former	B65496	313
		6,8 × 5 × 5,1	Terminal carrier	B65496	314
			Adjusting screws	B65496	315
P 5,8 × 3,3			Core	B65501	318
P 7 × 4			Core	B65511	320
		7,5 × 7,5 × 7,1	Coil former	B65512	321
			Mounting assembly	B65512	322
			Adjusting screws	B65512	323
P 9 × 5	IEC 60133		Core	B65517	328
		9,9 × 9,9 × 8,3	Coil former/Insulating washer	B65522	329
		(4 solder terminals)			
		9,9 × 12,3 × 8,3			
		(6 solder terminals)			
		12,2 × 17 × 6,0	SMD coil former	B65524	330
			Mounting assembly	B65518	331
			Adjusting screws	B65518	332
P 11 × 7	IEC 60133		Core	B65531	338
			Coil former/Insulating washer	B65532	339
		12,3 × 12,3 × 9,5	Mounting assembly	B65535	340
		(4 solder terminals)			
		12,3 × 14,6 × 9,5			
		(8 solder terminals)	Adjusting screws	B65539	341
P 14 × 8	IEC 60133		Core	B65541	347
		16,8 × 15 × 11,3	Coil former/Insulating washers	B65542	348
		(4 solder terminals)			
		16,8 × 19,6 × 11,3	Mounting assembly	B65545	349
		(6 solder terminals)	Adjusting screws	B65549	350
P 18 × 11	IEC 60133		Core	B65651	355
		19,9 × 20,7 × 13,5	Coil former/Insulating washers	B65652	356
			Mounting assembly	B65655	357
			Adjusting screws	B65659	358

1) Height above mounting plane

Core type	Standards	Mounting dimensions (mm) of assembly set Base area × H 1)	Individual parts of assembly set	Part number	Page
P 22 × 13	IEC 60133	24,5 × 26 × 16,6	Core	B65661	365
			Coil former/Insulating washers	B65662	366
			Mounting assembly	B65665	367
			Adjusting screws	B65669	368
P 26 × 16	IEC 60133	27,8 × 28,5 × 19	Core	B65671	373
			Coil former/Insulating washers	B65672	374
			Mounting assembly	B65675	375
			Adjusting screws	B65679	376
P 30 × 19	IEC 60133	32,5 × 33,5 × 22,8	Core	B65701	381
			Coil former/Insulating washers	B65702	382
			Mounting assembly	B65705	383
			Adjusting screws	B65679	384
P 36 × 22	IEC 60133	40 × 41,8 × 27,5	Core	B65611	388
			Coil former/Insulating washer	B65612	389
			Mounting assembly	B65615	390
			Adjusting screws	B65679	391
P 41 × 25		39 × 55 × 28,1	Core	B65621	394
			Coil former	B65622	395
			Mounting assembly	B65623	396
			Adjusting elements	B65579	397
Adjusting tools (see individual data sheets)				B63399	

1) Height above mounting plane

P core halves and PS cores

Core type (∅ × height)	Standards	Material	Individual parts of assembly set	Part number	Page
5,6 × 3,7		N22, M33	Core	B65931	400
PS 7,35 × 3,6	DIN 41001	N22, M33	Core	B65933	401
			Coil former	B65512	401
PS 9 × 3,5	DIN 41001	N22, M33	Core	B65935-E	402
			Coil former	B65936	402
9,4 × 4,6		N22, M33	Core	B65935-A	403
			Coil former	B65522	403
14 × 5,3		N22, M33	Core	B65926	404
14,4 × 7,5		N22	Core	B65937	405
			Coil former	B65542	405
PS 25 × 8,9	DIN 41001	N22	Core	B65939	406
			Coil former	B65940	406
PS 30,5 × 10,2	DIN 41001	N22	Core	B65941	407
			Coil former	B65942	407
PS 35 × 10,8	DIN 41001	N22	Core	B65947	408
PS 47 × 14,9	DIN 41001	N22	Core	B65943	409
			Coil former	B65944	409
PS 68 × 14,5	DIN 41001	N22	Core	B65928	410
			Coil former	B65946	410
70 × 14,5		N22	Core	B65945	411
			Coil former	B65946	411
150 × 30		N27	Core	B65949	412

TT/PR cores

Core type	Individual parts of assembly set	Part number	Page
TT 14 × 8	Core	B65754	414
PR 14 × 8	Core	B65755	414
TT 18 × 11	Core	B65756	415
PR 18 × 11	Core	B65757	415
TT 23 × 11	Core	B65716-L	416
PR 23 × 11	Core	B65738-L	416
TT 23 × 18	Core	B65716-J	417
PR 23 × 18	Core	B65738-J	417
TT 30 × 19	Core	B65730	418
PR 30 × 19	Core	B65735	418

E cores

Core type [1]	Standards	Mounting dimensions (mm) of assembly set L × W × H [2]	Individual parts of assembly set	Part number	Page
E 5			Core	B66303	426
E 6,3			Core	B66300	427
		8,5 × 8 × 5,7	SMD coil former	B66296	428
		9 × 8 × 5,7	SMD coil former/Cover cap	B66301	429
E 8,8	IEC 61246		Core	B66302	430
		10 × 12,5 × 5,5	SMD coil former/Cover cap	B66302	431
E 13/7/4			Core	B66305	432
(EF 12,6)	IEC 61246	15 × 17 × 12	Coil former (horizontal)	B66202	434
		10 × 15 × 17	Coil former (vertical)	B66202	434
		13,5 × 19,5 × 9,3	SMD coil former	B66306	436
			Cover plate	B66414	436
			Yoke	B66202	434
E 14/8/4			Core	B66219	437
E 16/8/5			Core	B66307	438
(EF 16)	IEC 61246	18 × 20 × 14	Coil former (horizontal)	B66308	440
		11 × 18 × 20	Coil former (vertical)	B66308	440
			Yoke	B66308	440
E 16/6/5			Core	B66393	442
E 19/8/5 E 187 [3]			Core	B66379	443
E 20/10/6			Core	B66311	444
(EF 20)	IEC 61246	22 × 22 × 17	Coil former (horizontal)	B66206	445
		15 × 22 × 24	Coil former (vertical)	B66206	445
		24 × 21,5 × 14	Coil former (right-angle pins)	B66206	446
		15 × 22 × 24	Coil former for luminaires	B66206	447
			Yoke	B66206	446
E 21/9/5			Core	B66314	448
		22 × 20 × 20	Coil former	B66314	449

1) The E core designations have been brought into line with IEC; the previous designations are given in parentheses.
2) Height above mounting plane
3) US designation (size based on U.S. lam. size E cores)

Core type [1]	Standards	Mounting dimensions (mm) of assembly set L × W × H [2]	Individual parts of assembly set	Part number	Page
E 25/13/7			Core	B66317	450
(EF 25)	IEC 61246	28 × 28 × 21	Coil former (horizontal)	B66208	451
		18 × 28 × 29	Coil former (vertical)	B66208	451
		19 × 26 × 30	Coil former for SMPS	B66208	453
			Yoke	B66208	451/453
E 25,4/10/7 E2425 [3]			Core	B66315	454
ED 29/14/11			Core	B66407	455
E 30/15/17			Core	B66319	456
		36 × 36 × 12	Coil former (horizontal)	B66232	458
		19 × 36 × 36	Coil former (vertical)	B66232	458
			Yoke	B66232	458
E 32/16/9			Core	B66229	460
(EF 32)	IEC 61246	35 × 37 × 24	Coil former	B66230	461
			Yoke	B66230	461
E 32/16/11			Core	B66233	462
E 34/14/9 E 375 [3]			Core	B66370	463
E 36/18/11			Core	B66389	464
		39 × 38 × 31	Coil former	B66390	465
E 40/16/12 E 21 [3]			Core	B66381	466
E 42/21/15			Core	B66325	467
	IEC 61246	42,5 × 43 × 33	Coil former	B66242	468
E 42/21/20			Core	B66329	469
	IEC 61246	38 × 46 × 52	Coil former	B66243	470
			Case	B66243	471
E 47/20/16 E 625 [3]			Core	B66383	472
E 55/28/21			Core	B66335	473
	IEC 61246	56 × 57 × 46	Coil former	B66252	475
E 55/28/25			Core	B66344	476

1) The E core designations have been brought into line with IEC; the previous designations are given in parentheses.
2) Height above mounting plane
3) US designation (size based on U.S. lam. size E cores)

Core type [1])	Standards	Mounting dimensions (mm) of assembly set L × W × H [2])	Individual parts of assembly set	Part number	Page
E 56/24/19 E 75 [3])			Core	B66385	477
E 65/32/27			Core	B66387	478
E 70/33/32			Core	B66371	480
		73 × 60 × 59	Coil former	B66372	481
E 80/38/20			Core	B66375	482

ELP cores

Core type	Individual parts of assembly set	Part number	Page
EELP 18	Core	B66283	484
	Clamp	B65804	484
EILP 18	Core	B66283	485
EELP 22	Core	B66285	486
EILP 22	Core	B66285	487
	Clamp	B65804	487
EELP 32	Core	B66287	488
	Clamp	B65808	488
EILP 32	Core	B66287	489
	Clamp	B66288	489
EELP 43	Core	B66291	490
EILP 43	Core	B66291	491
EELP 64	Core	B66295	492
EILP 64	Core	B66295	493

1) The E core designations have been brought into line with IEC; the previous designations are given in parentheses.
2) Height above mounting plane
3) US designation (size based on U.S. lam. size E cores)

ER, ETD cores

Core type	Standards	Mounting dimensions (mm) of assembly set L × W × H [1]	Individual parts of assembly set	Part number	Page
ER cores					
ER 9,5			Core	B65523	496
		12 × 10 × 5,7	SMD coil former	B65527	497
ER 11			Core	B65525	498
		12,8 × 11,7 × 6	SMD coil former	B65526	499
			Yoke	B65526	499
ER 28			Core	B66433	500
ER 35			Core	B66350	501
ER 42			Core	B66347	502
		33 × 46 × 55	Coil former	B66348	503
ER 46			Core	B66377	504
ER 49			Core	B66391	505
ER 54			Core	B66357	506
ETD cores					
ETD 29	IEC 61185		Core	B66358	508
		35,5 × 35,5 × 25,5	Coil former (horizontal)	B66359	510
		24 × 35,5 × 41,2	Coil former (vertical)	B66359	511
			Yoke	B66359	510
ETD 34	IEC 61185		Core	B66361	512
	CECC 25301-001	43 × 40 × 35	Coil former (horizontal)	B66362	514
		27,5 × 40 × 46	Coil former (vertical)	B66362	515
			Yoke	B66362	514
ETD 39	IEC 61185		Core	B66363	516
	CECC 25301-002	48 × 45 × 38	Coil former/Yoke	B66364	518
ETD 44	IEC 1185		Core	B66365	519
	CECC 25301-003	53 × 50 × 41	Coil former/Yoke	B66366	521
ETD 49	IEC 61185		Core	B66367	522
	CECC 25301-004	58 × 55 × 43,5	Coil former/Yoke	B66368	524
ETD 54	IEC 61185		Core	B66395	525
		62 × 62 × 47	Coil former/Yoke	B66396	527
ETD 59	IEC 61185		Core	B66397	528
		67 × 71 × 50	Coil former/Yoke	B66398	530

1) Height above mounting plane

EC, EFD cores

Core type	Standards	Mounting dimensions (mm) of assembly set L × W × H [1])	Individual parts of assembly set	Part number	Page
EC cores					
EC 35	IEC 60647		Core	B66337	532
		47 × 36 × 28	Coil former (solder tags)	B66272	533
			Coil former (solder pins)	B66272	534
EC 41	IEC 60647		Core	B66339	535
		52,5 × 47,5 × 42	Coil former (horizontal)	B66274	536
			Mounting assembly	B66274	536
EC 52	IEC 60647		Core	B66341	538
		61 × 57,5 × 43,5	Coil former (horizontal)	B66276	539
		54 × 52,5 × 53	Coil former (vertical)	B66276	539
			Mounting assembly	B66276	539
EC 70	IEC 60647		Core	B66343	541
		82 × 81 × 48,5	Coil former (horizontal)	B66278	542
		72 × 57,5 × 75	Coil former (vertical)	B66278	542
			Mounting assembly	B66278	542
EFD cores					
EFD 10			Core	B66411	546
		19 × 12 × 5,5	SMD coil former	B66412	547
EPF 12			Core	B66427	548
EFD 15			Core	B66413	549
		19,3 × 17 × 8	Coil former/Yoke	B66414	550
		21 × 16 × 8	SMD coil former/Yoke	B66414	551
			Cover plate	B66414	551
EFD 20			Core	B66417	552
		24,3 × 22 × 10	Coil former/Yoke	B66418	553
EFD 25			Core	B66421	554
		29,3 × 27,3 × 12,5	Coil former/Yoke	B66422	555
EFD 30			Core	B66423	556
		34,4 × 32,5 × 12,5	Coil former/Yoke	B66424	557

1) Height above mounting plane

EV, DE cores

Core type	Standards	Mounting dimensions (mm) of assembly set L × W × H	Individual parts of assembly set	Part number	Page
EV cores					
EV 15/9/7			Core	B66434	558
EV 25/13/13			Core	B66408	559
EV 30/16/3			Core	B66432	560
DE cores					
DE 24			Core	B66426	561
DE 28			Core	B66399	562
DE 35			Core	B66409	563

U, UI and UR cores

Core type	Standards	Individual parts of assembly set	Part number	Page
U 11/9/6		Core	B67366	566
U 15/11/6		Core Coil former	B67350 B67350	567 567
U 17/12/7		Core	B67364	568
U 20/16/7	DIN 41 296 (Dimensions)	Core Coil former	B67348 B67348	569 569
U 21/17/12		Core	B67318	570
U 25/20/13		Core Coil former	B67352 B67352	571 571
U 26/22/16		Core	B67355	572
U 30/26/26		Core	B67362	573
U 93/76/16 UI 93/104/16		Cores	B67345	574
U 93/76/20 UI 93/104/20		Cores	B67345	575
U 93/76/30 UI 93/104/30		Cores	B67345	576
U 101/76/13		Core	B67370	577
U 141/78/30		Core	B67374	578
UR 29/18/16		Core	B67354	579
U 35/28/12,5		Core	B67327	580
UR 38/32/13		Core	B67313	582
UR 39/35/15		Core	B67317	582
UR 41,7/34/16		Core	B67368	583
UR 42/36/15		Core	B67320	584
UR 42,7/33/14		Core	B67322	585
UR 46/37/15		Core	B67314	586

Ring cores/Double-aperture cores

Core type	Standards	Individual parts of assembly set	Part number	Page
Ring cores R 2,5 … R 200	R2,5; R4; R6,3; R10 based on IEC 60525	Core	B64290	591
Double-aperture cores Core height 2,5 … 14,5 mm	6,2; 8,3 and 14,5: DIN 41279, shape G	Core	B62152	608

FPC film

Material	Part number	Page
C 350, C 351	B68450, B68451, B68452	611

(In numerical order)

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

clf. = coil former, ins. = insulating washer, adj. = adjusting screw

Based on IEC 60401, the data specified here are typical data for the material in question, which have been determined principally on the basis of ring cores.

The purpose of such characteristic material data is to provide the user with improved means for comparing different materials.

There is no direct relationship between characteristic material data and the data measured using other core shapes and/or core sizes made of the same material. In the absence of further agreements with the manufacturer, only those specifications given for the core shape and/or core size in question are binding.

1 Material application survey

Usage	Frequency range	Mate-rial	Specific application	Type
High Q inductors in resonant circuits and filters	up to 0,1 MHz	N 48	Filters in telephony, MW IF filters	Gapped P and RM cores, adjusting cores, TT/PR
	0,2 – 1,6 MHz	M 33		
	1,5 – 12 MHz	K 1		
	6 – 30 MHz	K 12	VHF filters	
	up to 100 MHz	U 17		
Line attenuation	up to 2 MHz	M 13	Balun transformers	Ring cores, double-aperture cores
		K 10		
Broadband transformers (e.g. antenna transformers for MW, SW, VHF, TV) ISDN transformers, digital data transformers (xDSL), current-compensated interference suppression chokes	up to 3 MHz	T 46	ISDN transformers Impedance and matching transformers	Ring cores
		T 42		RM, P, ER, EP, ring cores
		T 38		
		T 37	Current-compensated chokes	Ring cores, DE cores
		T 35		RM, P, ring, DE
		T 65		P, ring cores, TT/PR, EP
	up to 5 MHz	N 30	Current-compensated chokes	Ring cores, double-aperture cores
		N 26	Radio-frequency transform-ers	
	up to 10 MHz	M 33		
	up to 250 MHz	K 1		
		K 12		
	up to 400 MHz	U 17		
Sensors, ID systems	up to 1 MHz	N 22	Inductive proximity switches	P core halves
	up to 2 MHz	M 33		
	up to 100 MHz	FPC		

<table>
<tr><th>Usage</th><th>Frequency range</th><th>Material</th><th>Specific application</th><th>Type</th></tr>
<tr><td rowspan="10">Power transformers, chokes</td><td rowspan="2">1 to 100 kHz</td><td>N 27</td><td>Transformers for flyback converters</td><td>E, EC, ETD, U, RM, PM</td></tr>
<tr><td>N 41</td><td>Chokes</td><td>Pot cores, RM</td></tr>
<tr><td rowspan="4">up to 200 kHz</td><td>N 53</td><td rowspan="2">Diode splitting transformers</td><td>E, U, UR</td></tr>
<tr><td>N 62</td><td rowspan="2">E, U, UR, ETD, ER</td></tr>
<tr><td>N 67</td><td>High-voltage transformers</td></tr>
<tr><td>N 72</td><td>Electronic lamp ballast devices</td><td>E, ETD</td></tr>
<tr><td>up to 300 kHz</td><td>N 82</td><td>Diode splitting transformers</td><td>U, UR</td></tr>
<tr><td>up to 500 kHz</td><td>N 87</td><td>Transformers for forward and push-pull converters</td><td>ETD, EFD, RM, TT/PR, ER, ELP</td></tr>
<tr><td>0,3 – 1 MHz</td><td>N 49</td><td rowspan="2">Transformers for DC/DC converters, particularly resonance converters</td><td rowspan="2">EFD, ER, ELP, RM (low profile)</td></tr>
<tr><td>0,5 – 1 MHz</td><td>N 59</td></tr>
</table>

2 Material properties

Preferred application			Resonant circuit inductors				
Material			U 17[1]	K 12[1]	K 1	M 33[2]	N 48
Base material			NiZn	NiZn	NiZn	MnZn	MnZn
Color code (adjuster)			gray	yellow	violet	white	—
	Symbol	Unit					
Initial permeability (T = 25 ˚C)	μ_i		10 ± 30 %	26 ± 25 %	80 ± 25 %	750 ± 25 %	2300 ± 25 %
Meas. field strength Flux density (near saturation) (f = 10 kHz)	H B_S (25 ˚C) B_S (100 ˚C)	A/m mT mT	10000 180 170	2000 230 210	5000 310 280	2000 400 310	1200 420 310
Coercive field strength (f = 10 kHz)	H_c (25 ˚C) H_c (100 ˚C)	A/m A/m	1900 1800	450 410	380 350	80 65	26 19
Optimum frequency range		MHz	10 … 220	3 … 40	1,5 … 12	0,2 … 1,0	0,001 … 0,1
Relative loss factor at f_{min} at f_{max}	tan δ/μ_i	10^{-6} 10^{-6}	< 100 < 1700	< 150 < 600	< 40 < 120	< 12 < 20	2,7 4,2
Hysteresis material constant	η_B	10^{-6}/mT	< 27	< 45	< 36	< 1,8	< 0,4
Curie temperature	T_C	˚C	> 550	> 450	> 400	> 200	> 170
Relative temperature coefficient at 25 ... 55 ˚C at 5 ... 20 ˚C	α_F	10^{-6}/K	25 … 50 45 … 20	3 … 14 12 … 0	2 … 8 7 … 1	0,5 … 2,6 —	0,4 … 0,5 0,7 … 0,5
Mean value of α_F at 25 ... 55 ˚C		10^{-6}/K	37	9	4	1,6	0,50
Density (typical values)		kg/m³	4400	4600	4650	4500	4700
Disaccommodation factor at 25 ˚C	DF	10^{-6}	—	—	20	8	2
Resistivity	ρ	Ωm	10^5	10^5	10^5	5	3
Core shapes			P, Double aperture	P, Ring	RM, P, Ring, P core half	RM, P, Ring, Double aperture, P core half	RM, P
Other material properties (graphs) see page			49	51	53	55	57

1) Perminvar ferrite: irreversible variations in quality and permeability may occur in case of strong fields in the core (> 1500 A/m). In the case of shape-related dimensions, these dimensions may be exceeded by up to 5%.
2) For threaded cores μi = 600 ± 20%

Material properties (continued)

Preferred application			Inductors for line attenuation		Special type
Material			K 10	M 13	N 22
Base material			NiZn	NiZn	MnZn
Color code (adjuster)			—	—	red
	Symbol	Unit			
Initial permeability (T = 25 °C)	μ_i		800 ± 25 %	2300 ± 25 %	2300 ± 25 %
Meas. field strength Flux density (near saturation) (f = 10 kHz)	H B_S (25 °C) B_S (100 °C)	A/m mT mT	5000 320 240	1200 280 135	1200 370 260
Coercive field strength (f = 10 kHz)	H_c (25 °C) H_c (100 °C)	A/m A/m	40 25	12 8	18 14
Optimum frequency range		MHz	0,1 … 1	0,001 … 0,1	0,001 … 0,2
Relative loss factor at f_{min} at f_{max}	tan δ/μ_i	10^{-6} 10^{-6}	< 15 < 60	< 5 < 20	< 2 < 20
Hysteresis material constant	η_B	10^{-6}/mT	< 5	< 4	< 1,4
Curie temperature	T_C	°C	> 150	> 105	> 145
Relative temperature coefficient at 25 ... 55 °C at 5 ... 20 °C	α_F	10^{-6}/K	 — —	 3,0 … 5,0 5,0 … 7,5	 — —
Mean value of α_F at 25 ... 55 °C		10^{-6}/K	10,0	3,7	0,9
Density (typical values)		kg/m³	5000	5200	4700
Disaccommodation factor at 25 °C	DF	10^{-6}	—	—	4
Resistivity	ρ	Ωm	10^5	10^5	1
Core shapes			Ring, Double aperture	Ring, Double aperture	Ring, P core half, Double aperture
Other material properties (graphs) see page			59	60	61

Material properties (continued)

Preferred application			Broadband transformers				
Material			N 26	N 30	T 65	T 35	T 37
Base material			MnZn	MnZn	MnZn	MnZn	MnZn
	Symbol	Unit					
Initial permeability (T = 25 ˚C)	μ_i		2300 ± 25 %	4300 ± 25 %	5200 ± 30 %	6000 ± 25 %	6500 ± 25 %
Meas. field strength Flux density (near saturation) (f = 10 kHz)	H B_S (25 ˚C) B_S (100 ˚C)	A/m mT mT	1200 380 260	1200 380 240	1200 460 320	1200 390 270	1200 380 240
Coercive field strength (f = 10 kHz)	H_c (25 ˚C) H_c (100 ˚C)	A/m A/m	23 17	12 8	12 11	12 9	9 8
Optimum frequency range		MHz	0,001 … 0,1	— —	— —	— —	— —
Relative loss factor at f_{min} at f_{max}	tan δ/μ_i	10^{-6} 10^{-6}	< 2,8 < 3,8	— —	— —	— —	— —
Hysteresis material constant	η_B	10^{-6}/mT	< 0,3	< 1,1	< 1,1	< 1,1	< 1,1
Curie temperature	T_C	˚C	> 150	> 130	> 160	> 130	> 130
Relative temperature coefficient at 25 ... 55 ˚C at 5 ... 25 ˚C	α_F	10^{-6}/K	0 … 1,5 0 … 1,8	— —	— —	— —	— —
Mean value of α_F at 25 ... 55 ˚C		10^{-6}/K	1,0	0,6	– 0,5	0,8	– 0,3
Density (typical values)		kg/m^3	4700	4800	4930	4900	4900
Disaccommodation factor at 25 ˚C	DF	10^{-6}	—	—	—	—	—
Resistivity	ρ	Ωm	2	0,5	0,30	0,2	0,2
Core shapes			RM, P, EP	RM, P, EP, E, Ring, Double aperture	RM, P, ER, Ring	RM, P, EP, Ring	Ring, DE
Other material properties (graphs) see page			62	64	66	68	70

Material properties (continued)

Preferred application			Broadband transformers		
Material			T 38	T 42[3]	T 46[3]
Base material			MnZn	MnZn	MnZn
	Symbol	Unit			
Initial permeability (T = 25 °C)	μ_i		10000 ± 30 %	12000 ± 30 %	15000 ± 30 %
Meas. field strength Flux density (near saturation) (f = 10 kHz)	H B_S (25 °C) B_S (100 °C)	A/m mT mT	1200 380 240	1200 400 250	1200 400 240
Coercive field strength (f = 10 kHz)	H_c (25 °C) H_c (100 °C)	A/m A/m	9 6	7 6	7 6
Optimum frequency range		MHz	— —	— —	— —
Relative loss factor at f_{min} at f_{max}	tan δ/μ_i	10^{-6} 10^{-6}	— —	— —	— —
Hysteresis material constant	η_B	10^{-6}/mT	< 1,4	< 1,4	< 2,0
Curie temperature	T_C	°C	> 130	> 130	> 130
Relative temperature coefficient at 25 ... 55 °C at 5 ... 20 °C	α_F	10^{-6}/K	— —	— —	— —
Mean value of α_F at 25 ... 55 °C		10^{-6}/K	– 0,4	– 0,3	– 0,6
Density (typical values)		kg/m³	4900	4950	5000
Disaccommodation factor at 25 °C	DF	10^{-6}	—	—	—
Resistivity	ρ	Ωm	0,1	0,1	0,01
Core shapes			RM, P, EP, ER, E, Ring	RM, EP	Ring
Other material properties (graphs) see page			72	74	76

3) Material values defined on the basis of small ring cores (≤ R10)

Material properties (continued)

Preferred application			Power transformers				
Material			N 59	N 49	N 53	N 82[4)]	N 62
Base material			MnZn	MnZn	MnZn	MnZn	MnZn
	Symbol	Unit					
Initial permeability (T = 25 ˚C)	μ_i		850 ± 25 %	1300 ± 25 %	1700 ± 25 %	1900 ± 25 %	1900 ± 25 %
Flux density (H = 1200 A/m, f = 10 kHz)	B_S (25 ˚C) B_S (100 ˚C)	mT mT	460 370	460 370	490 420	490 415	500 410
Coercive field strength (f = 10 kHz)	H_c (25 ˚C) H_c (100 ˚C)	A/m A/m	60 50	55 45	26 16	17 11	18 11
Typical frequency range		kHz	500 … 1500	300 … 1000	16 … 200	16 … 300	16 … 200
Hysteresis material constant	η_B	10^{-6}/mT	—	—	—	—	—
Curie temperature	T_C	˚C	> 240	> 240	> 240	> 240	> 240
Mean value of α_F at 20 … 55 ˚C		10^{-6}/K	—	—	—	—	—
Density (typical values)		kg/m³	4750	4750	4800	4800	4800
Relative core losses (typical values)	P_V						
25 kHz, 200 mT, 100 ˚C		mW/g mW/cm³			20 100	14 69	16 80
100 kHz, 200 mT, 100 ˚C		mW/g mW/cm³			125 625	84 421	105 525
300 kHz, 100 mT, 100 ˚C		mW/g mW/cm³		120 600	135 670	88 440	
500 kHz, 50 mT, 100 ˚C		mW/g mW/cm³	39 180	24 120			
1 MHz, 50 mT, 100 ˚C		mW/g mW/cm³	110 510	115 560			
Resistivity	ρ	Ωm	26	11	6	11	4
Core shapes			EFD	RM, Ring, EFD, ER ELP	E, U	U, UR	ETD, E, U
Other material properties (graphs) see page			78	81	84	87	90

4) Preliminary data

Material properties (continued)

Preferred application			Power transformers				
Material			N 27	N 67[5]	N 87	N 72	N 41
Base material			MnZn	MnZn	MnZn	MnZn	MnZn
	Symbol	Unit					
Initial permeability (T = 25 ˚C)	μ_i		2000 ± 25 %	2100 ± 25 %	2200 ± 25 %	2500 ± 25 %	2800 ± 25 %
Flux density (H = 1200 A/m, f = 10 kHz)	B_S (25 ˚C) B_S (100 ˚C)	mT mT	500 410	480 380	480 380	480 370	490 390
Coercive field strength (f = 10 kHz)	H_c (25 ˚C) H_c (100 ˚C)	A/m	23 19	20 14	16 9	15 11	22 20
Typical frequency range		kHz	25 … 150	25 … 300	25 … 500	25 … 300	25 … 150
Hysteresis material constant	η_B	10^{-6}/mT	< 1,5	< 1,4	< 1,4	—	< 1,4
Curie temperature	T_C	˚C	> 220	> 220	> 210	> 210	> 220
Mean value of α_F at 20 … 55 ˚C		10^{-6}/K	3	4	4	—	4
Density (typical values)		kg/m^3	4750	4800	4800	4800	4800
Relative core losses (typical values)	P_V						
25 kHz, 200 mT, 100 ˚C		mW/g mW/cm^3	32 155	17 80		16 80	35 180
100 kHz, 200 mT, 100 ˚C		mW/g mW/cm^3	190 920	105 525	80 385	110 540	280 1400
300 kHz, 100 mT, 100 ˚C		mW/g mW/cm^3		115 560	85 410		
500 kHz, 50 mT, 100 ˚C		mW/g mW/cm^3					
1 MHz, 50 mT, 100 ˚C		mW/g mW/cm^3					
Resistivity	ρ	Ωm	3	6	8	12	2
Core shapes			P, PM, ETD, EC, ER, E, U, Ring	RM, P, EP, ETD, ER, EFD, E, U, Ring	RM, TT, P, PM, ETD, EFD, E, ER, ELP	E, EFD	RM, P
Other material properties (graphs) see page			93	96	99	102	105

5) Not for new design

Material properties (continued)

Preferred application			Injection-molded parts	Film	
Material			Ferrite Polymer Composite (FPC)		
Base material			C302	C350	C351
	Symbol	Unit			
Initial permeability *f* = 1 MHz	μ_i		17 ± 20 %	9 ± 20 %	9 ± 20 %
Flux density (near saturation) *H* = 25 kA/m *f* = 10 kHz	B_S (25 °C)	mT	330	255	255
Remanent induction *H* = 25 kA/m *f* = 10 kHz	B_r (25 °C)	mT	15	9	9
Coercive field strength *H* = 25 kA/m *f* = 10 kHz	H_C (25 °C)	A/m	770	600	600
Relative loss factor *f* = 1 MHz *f* = 100 MHz *f* = 1 GHz	$\tan\delta/\mu_i$		 < 0,0004 < 0,03 	 < 0,005 < 0,400	 < 0,005 < 0,400
Hysteresis material constant	η_B	10^{-3}/mT	< 0,25	< 2	< 2
Temperature coefficient	$\alpha = \Delta\mu/\mu\Delta T$	1/K	< 0,0002	$< 5 \cdot 10^{-5}$	$< 5 \cdot 10^{-5}$
Density		kg/m³	3500	2930	2930
Resistivity *f* = 1 kHz *f* = 10 kHz *f* = 10 MHz	ρ	Ωm	 21 13	 500 100	 500 100
Relative permittivity *f* = 1 kHz *f* = 10 kHz *f* = 10 MHz	ε_r		 280 100	 700 21	 700 21
Maximum operating temperature	T_{max}	°C	180	120	200
Dielectric strength		kV/mm	—	1	0,8
Tensile strength 6)	σ_Z	N/mm²	—	1,5	2,5
Tearing resistance 6)		%	—	25	25
Compressibility 6)	κ	N/mm²	—	70	70
Other material properties (graphs) see page			108	—	—

6) T = 23 °C and 50 % relative humidity

3 Measuring conditions

The following measuring conditions, which correspond largely to IEC 60401, apply for the material properties given in the table:

Properties (valid only for ring cores of sizes R 10 to R 36)			Measuring conditions			
			Frequency kHz	Field strength (material-dependent) kA/m	Max. flux density mT	Temper-ature ˚C
Initial permeability	μ_i		≤ 10		≤ 0,25	25
Flux density near to saturation	B	mT	≤ 10	≥ 1,2		25; 100
Coercive field strength	H_{cB}	A/m kA/m	≤ 10	≥ 1,2	near saturation	25; 100
Relative loss factor	$\tan \delta/\mu_i$		–		≤ 0,25	25
Hysteresis material constant	η_B	T^{-1}	 10 ($\mu_i \geq 500$) 100 ($\mu_i < 500$)		B_1 B_2 1,5 3,0 0,3 1,2	25
Curie temperature	T_c	˚C	≤ 10		≤ 0,25	
Relative temperature coefficient	α_F	10^{-6}/K	≤ 10		≤ 0,25	5 … 20 25 … 55
Density		kg/m^3				25
Disaccommodation factor	DF	10^{-6}	≤ 10		≤ 0,25	25; 60 [1)]
Resistivity	ρ	Ωm			—	25

The following properties are given only for materials for power applications:

Power loss	P_V	mW/cm^3 mW/g	25 100 300 500 1000		200 200 100 50 50	100

1) Higher temperature than specified by IEC (40˚C)

4 Specific material data

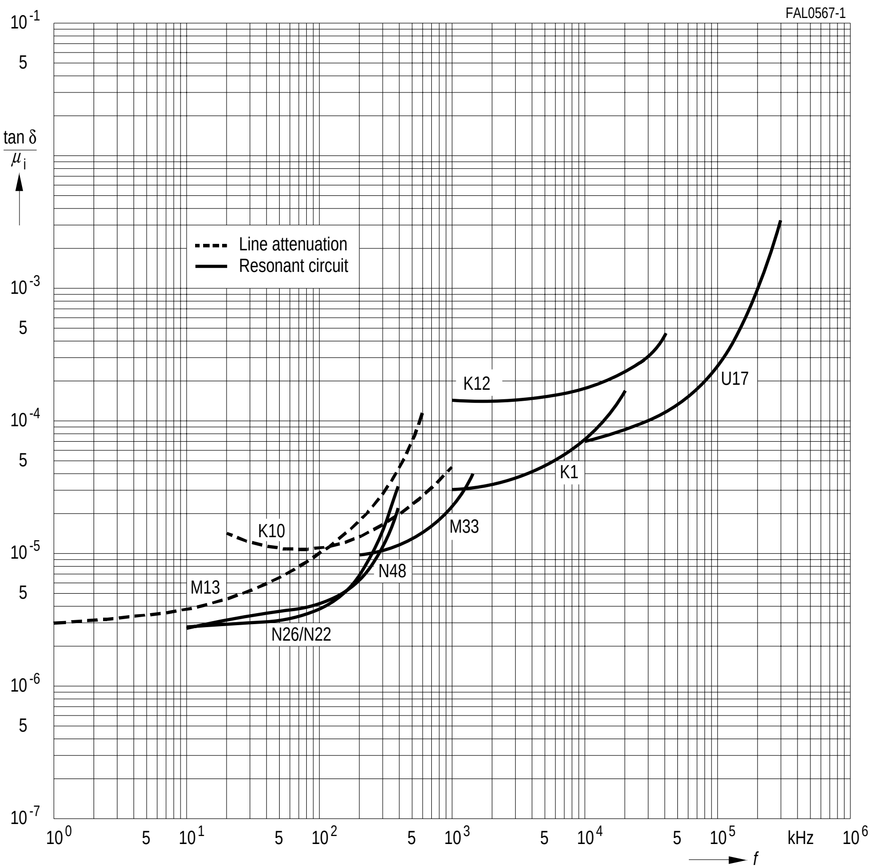
DC magnetic bias

$$H_{\_} = \frac{I_{\_} \cdot N}{l_e}$$

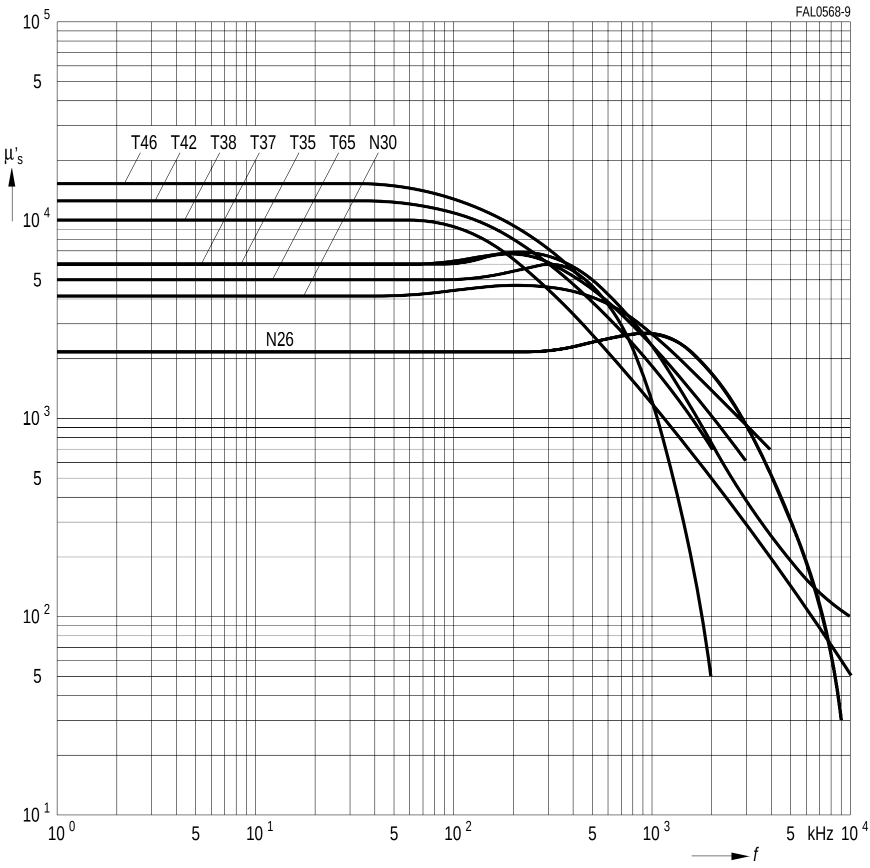
$H_{\_}$ = DC field strength [A/m]
$I_{\_}$ = Direct current [A]
N = Number of turns
l_e = Effective magnetic path length [m]

The curves of $\mu_{rev} = f(H_{\_})$ allow an approximate calculation of the variation in reversible permeability (μ_{rev}) and A_L value caused by magnetic bias. These curves are of particular interest for cores for transformers and chokes, since magnetic bias should be avoided if possible with inductors requiring high stability (filter inductors etc.). In the case of geometrically similar cores (i.e. in particular the same A_{min}/A_e ratio) the effective permeability of the core in question in conjunction with the given curves suffices to determine the reversible permeability to a close approximation.

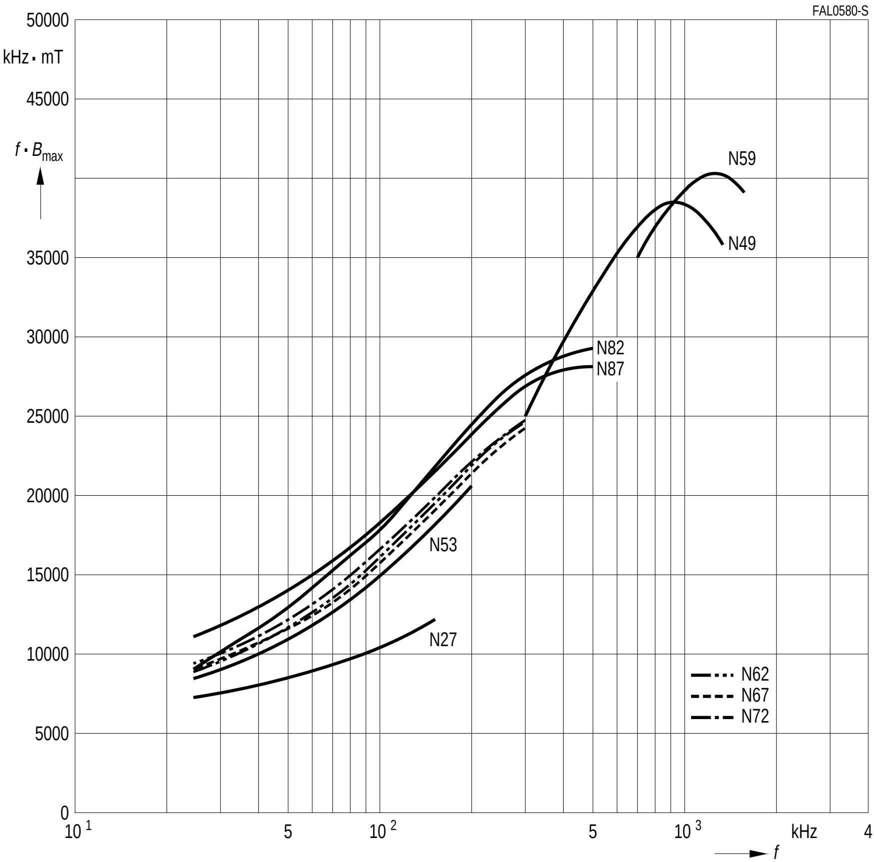
Relative loss factor versus frequency
(measured with ring cores, measuring flux density $\hat{B} \leq 0{,}25$ mT)



Relative inductance component versus frequency
(measured with ring cores, measuring flux density $\hat{B} \leq 0{,}25$ mT)

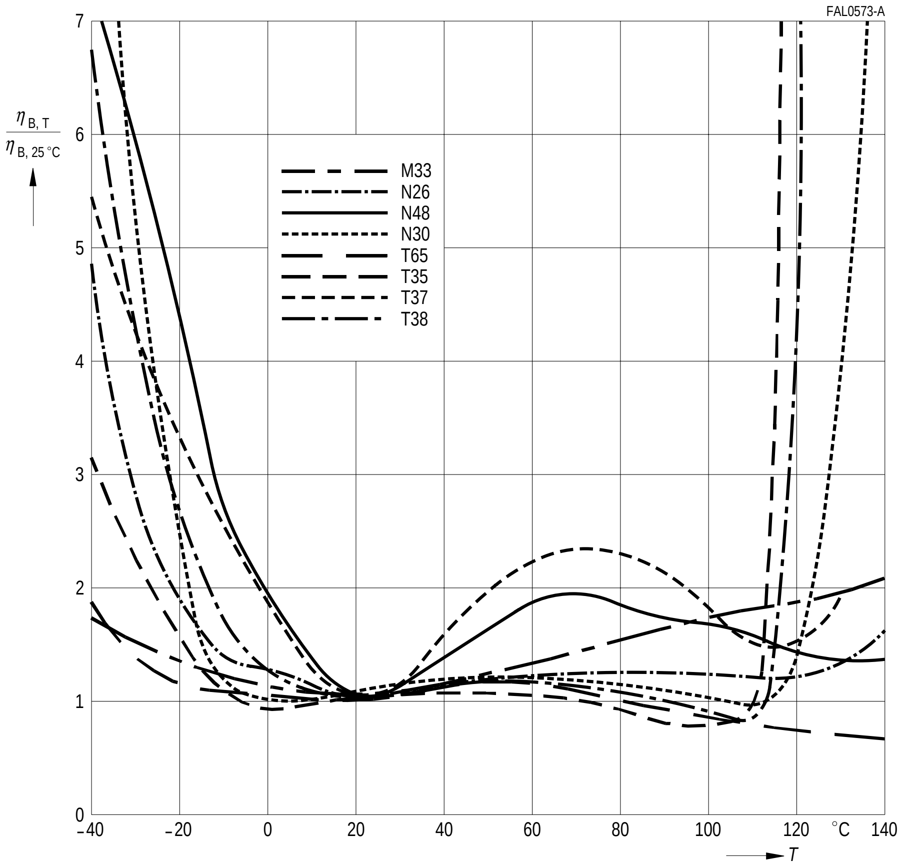


Performance factor versus frequency
(measured with ring cores R29, T = 100 ˚C, P_V = 300 kW/m³)

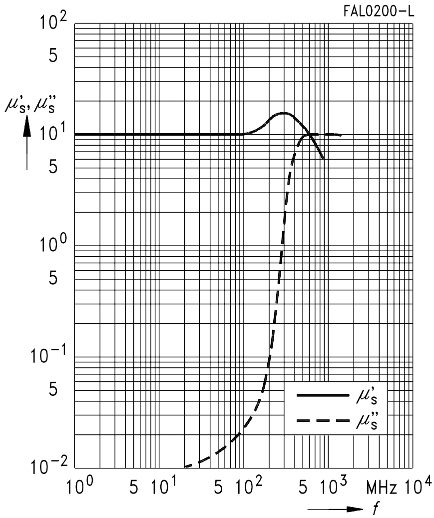


For definition of performance factor see page 120.

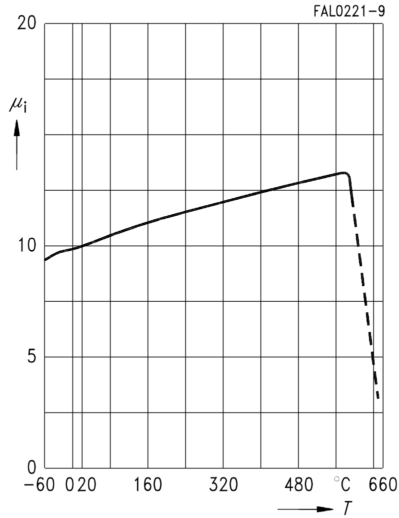
Standardized hysteresis material constant versus temperature



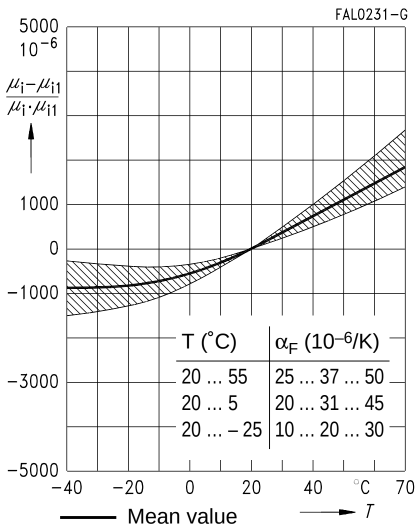
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq$ 0,25 mT)



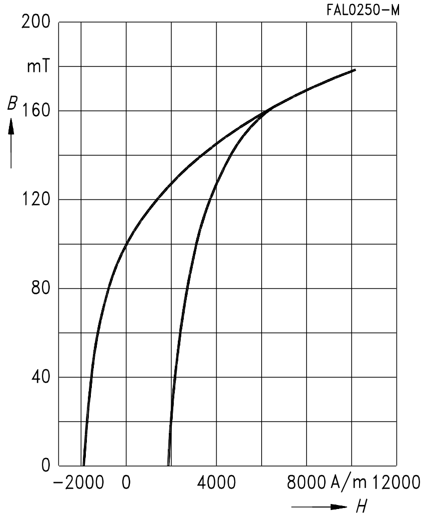
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \leq$ 0,25 mT)



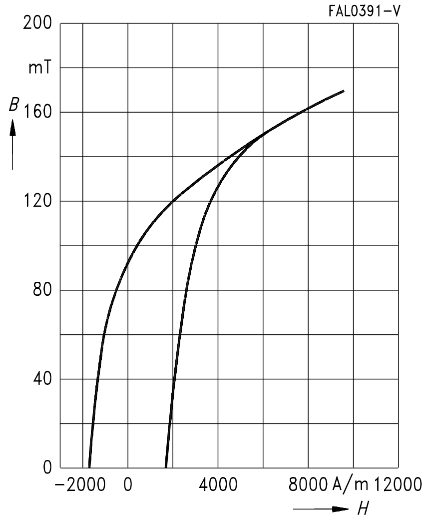
Permeability factor versus temperature
(measured with P and RM cores,
$\hat{B} \leq$ 0,25 mT), $\mu_i \approx 10$



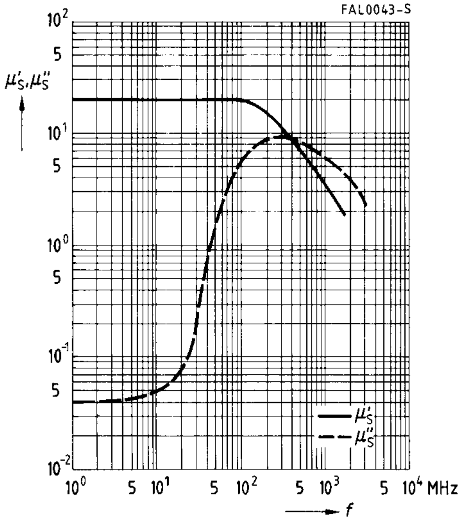
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



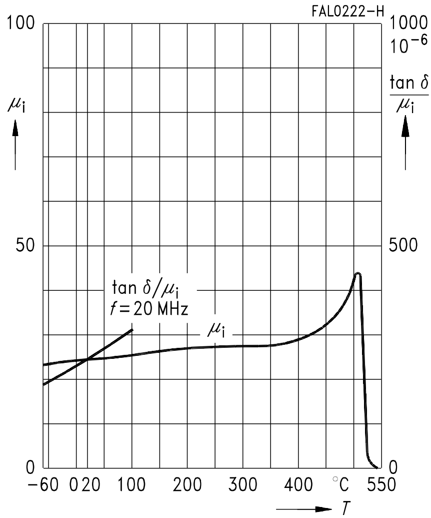
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



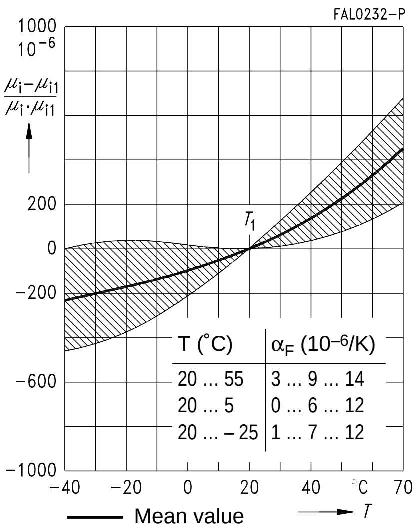
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



Initial permeability μ_i and relative loss factor tan δ/μ_i versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)

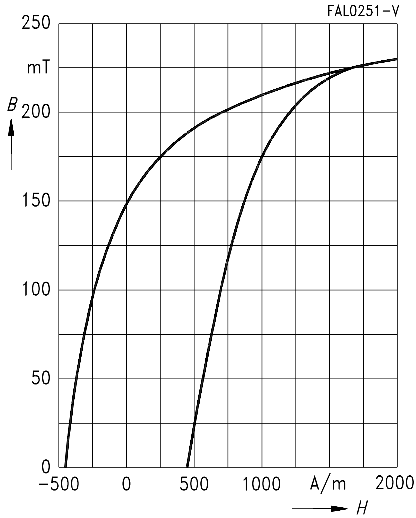


Permeability factor versus temperature
(measured with P and RM cores,
$\hat{B} \leq 0{,}25$ mT), $\mu_i \approx 26$

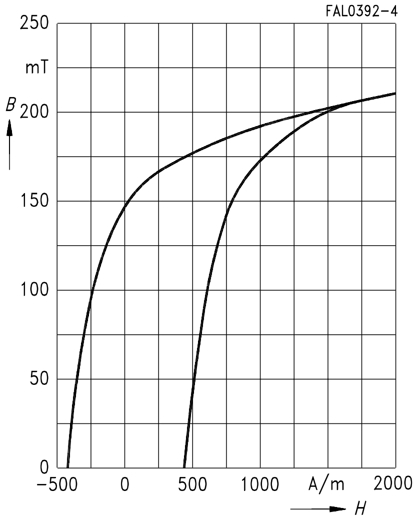


T (˚C)	α_F (10^{-6}/K)
20 ... 55	3 ... 9 ... 14
20 ... 5	0 ... 6 ... 12
20 ... – 25	1 ... 7 ... 12

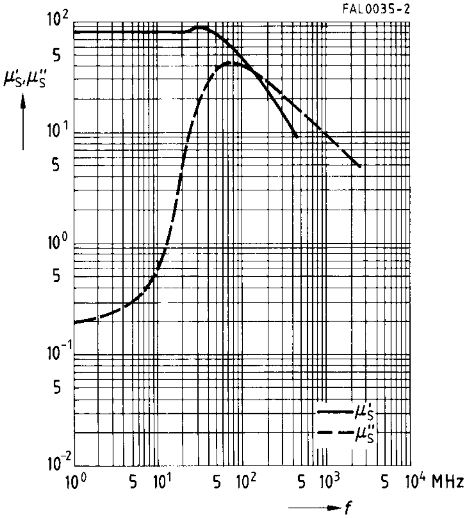
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



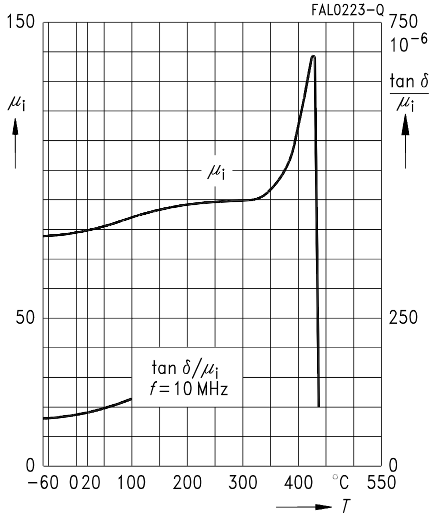
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



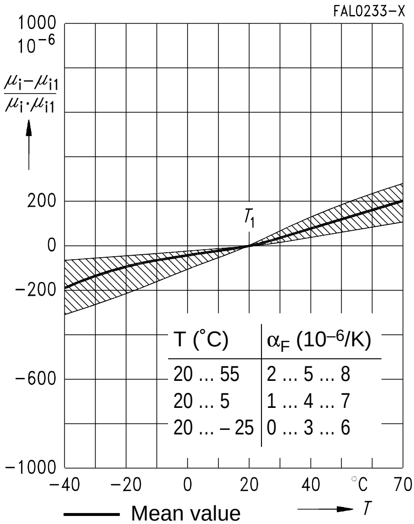
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



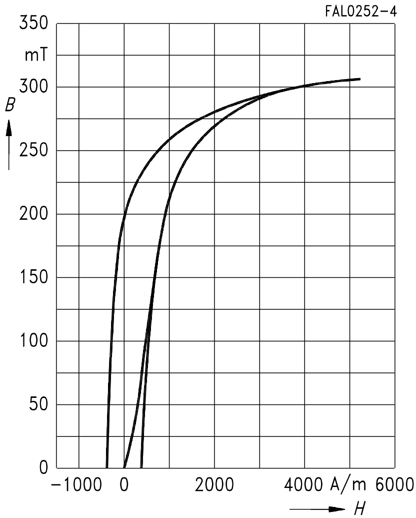
Initial permeability μ_i and relative loss factor
tan δ/μ_i versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



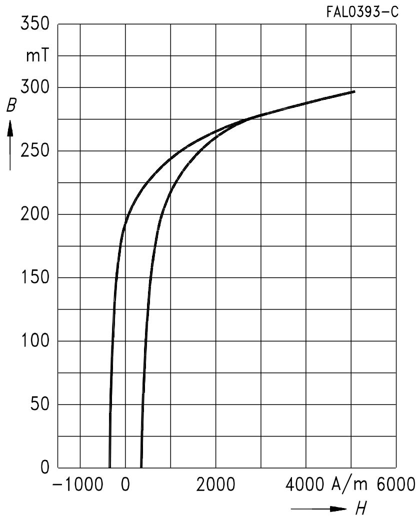
Permeability factor versus temperature
(measured with P and RM cores,
$\hat{B} \leq 0{,}25$ mT), $\mu_i \approx 80$



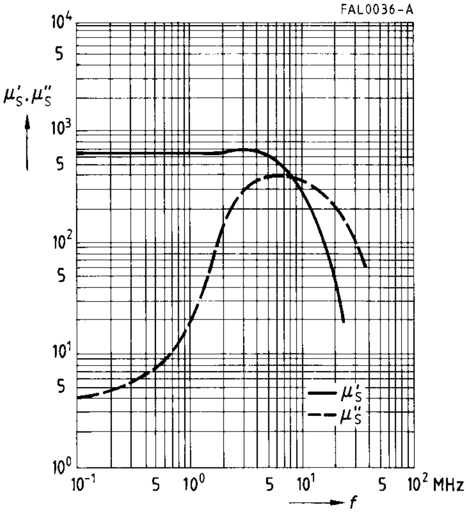
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



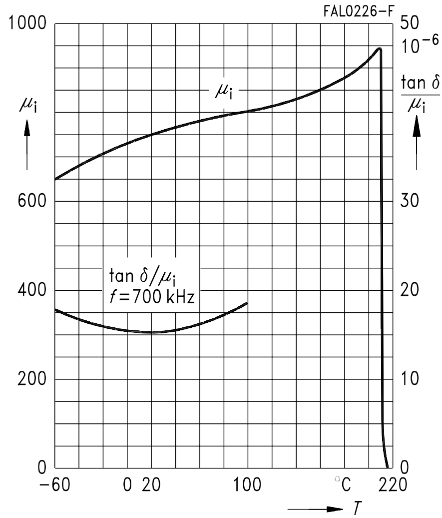
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T =100 ˚C)



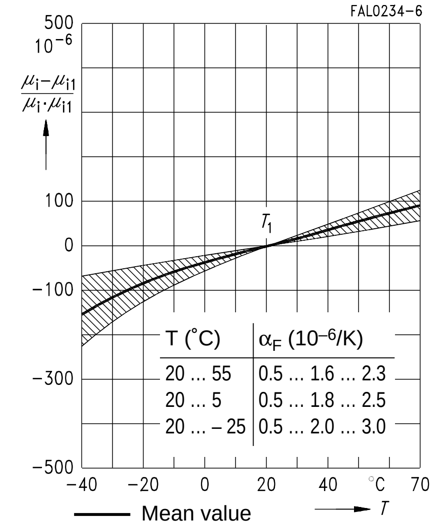
Complex permeability versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



Initial permeability μ_i and relative loss factor $\tan\delta/\mu_i$ versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)

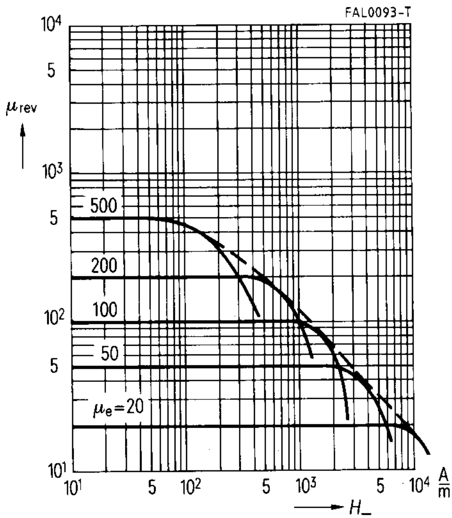


Permeability factor versus temperature
(measured with P and RM cores, $\hat{B} \leq 0{,}25$ mT), $\mu_i \approx 750$

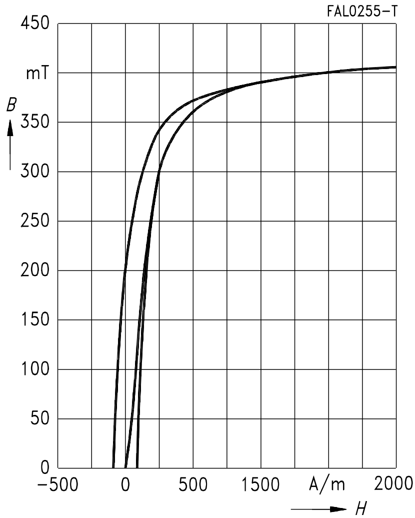


T (˚C)	α_F (10^{-6}/K)
20 ... 55	0.5 ... 1.6 ... 2.3
20 ... 5	0.5 ... 1.8 ... 2.5
20 ... – 25	0.5 ... 2.0 ... 3.0

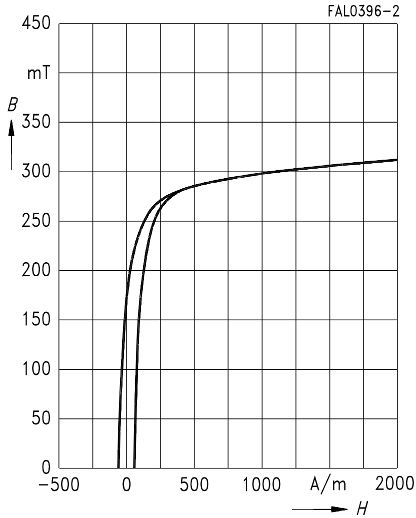
DC magnetic bias of P and RM cores
(typical values)
($\hat{B} \leq 0{,}25$ mT, f = 10 kHz, T = 25 ˚C)



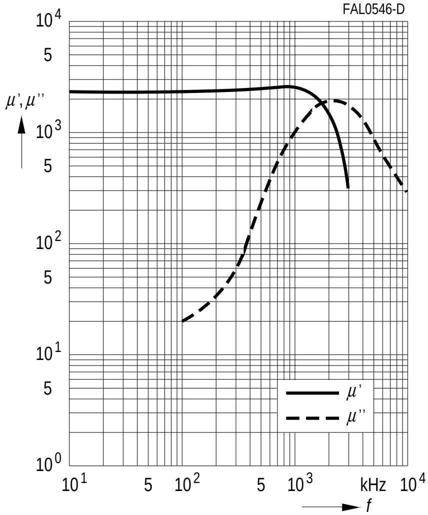
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



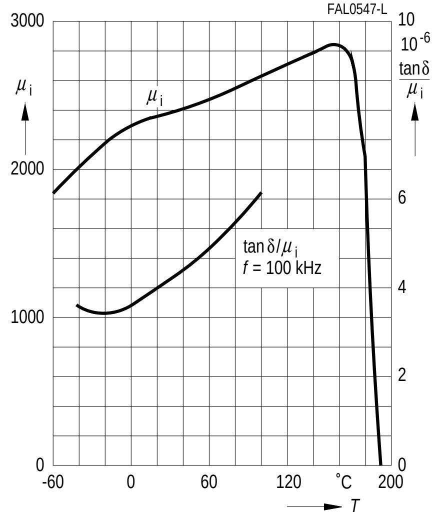
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



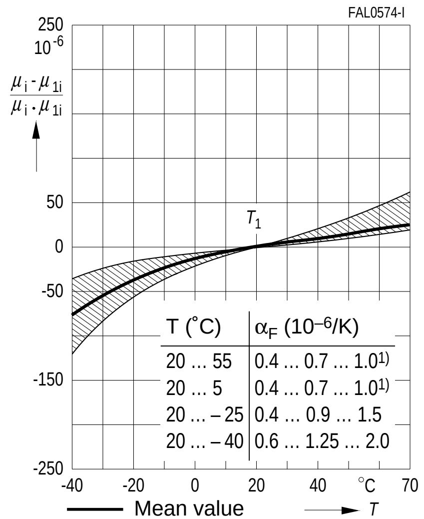
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



Initial permeability μ_i and relative loss factor
tan δ/μ_i versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)

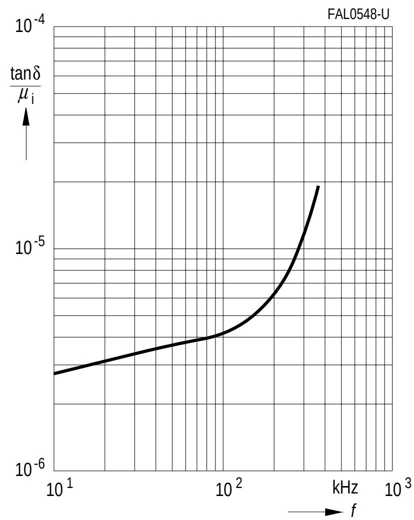


Permeability factor versus temperature
(measured with P and RM cores,
$\hat{B} \leq 0{,}25$ mT), $\mu_i \approx 2300$



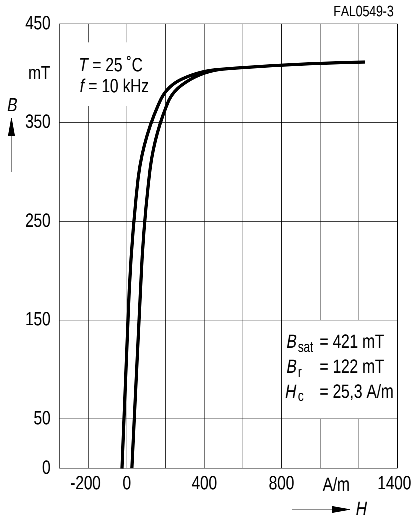
T (˚C)	α_F (10^{-6}/K)
20 … 55	0.4 … 0.7 … 1.0[1)]
20 … 5	0.4 … 0.7 … 1.0[1)]
20 … – 25	0.4 … 0.9 … 1.5
20 … – 40	0.6 … 1.25 … 2.0

Relative loss factor tan δ/μ_i versus frequency
(measured with R29 ring cores)

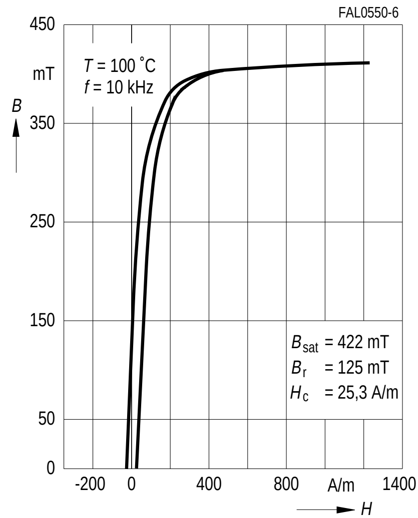


1) With P cores ≥ P22 × 13 and RM cores ≥ RM 8 the α_F value may deviate by up to $1{,}2 \cdot 10^{-6}$/K.

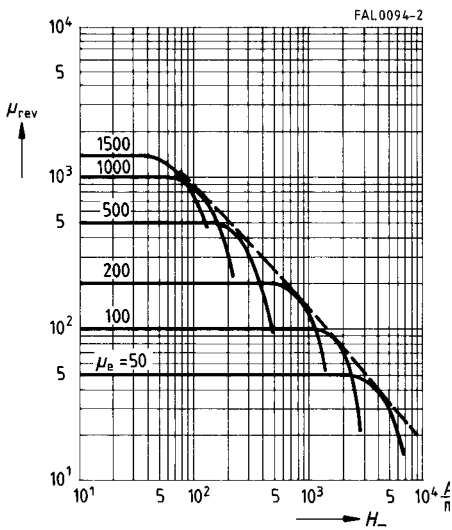
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



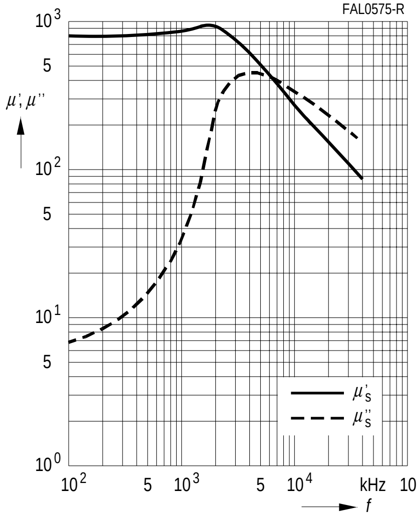
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



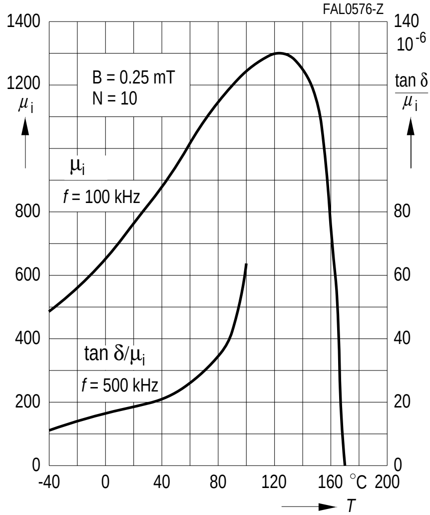
DC magnetic bias of P and RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



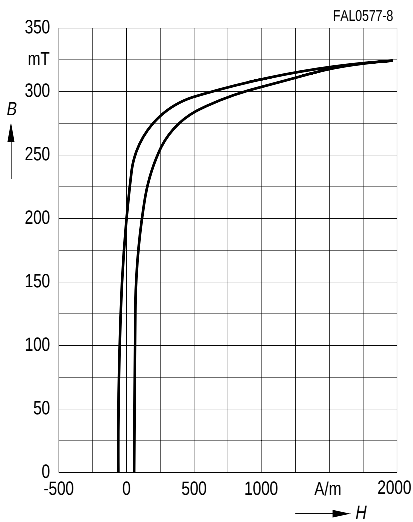
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



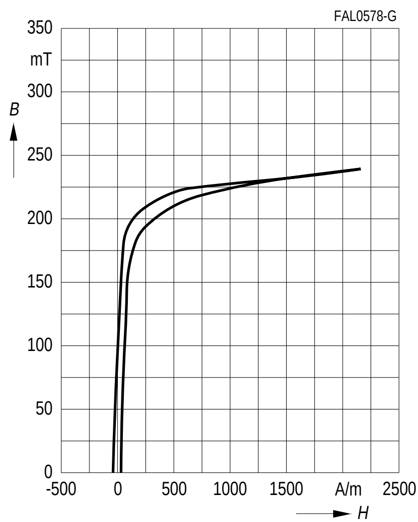
Initial permeability μ_i and relative loss factor $\tan \delta/\mu_i$ versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



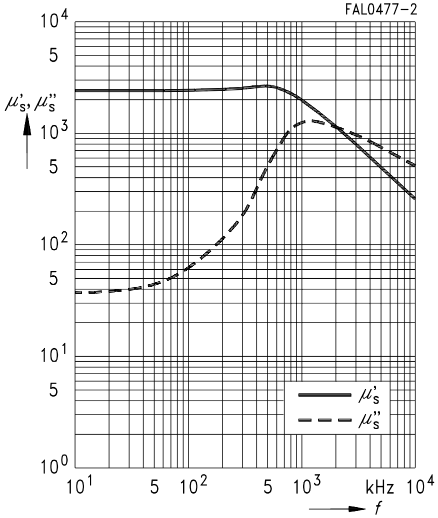
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



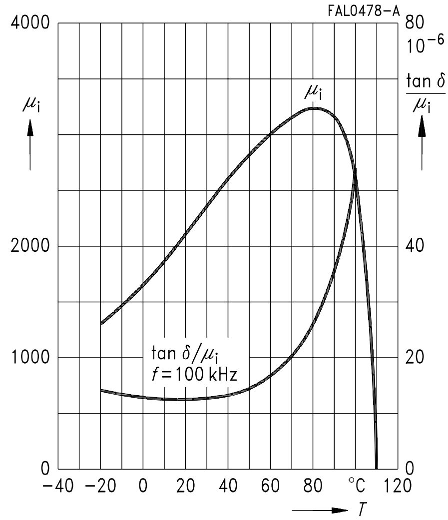
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



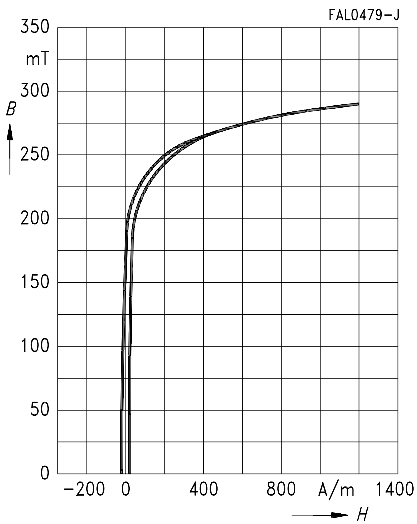
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0,25$ mT)



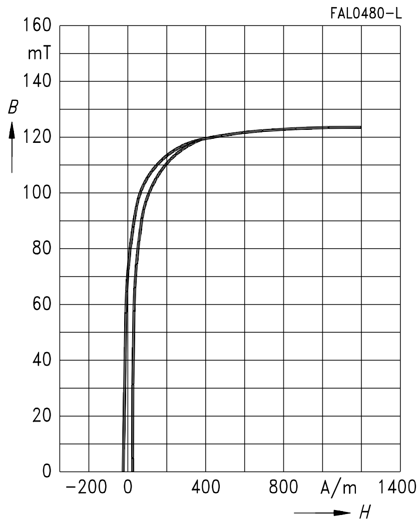
Initial permeability μ_i and relative loss factor
tan δ/μ_i versus temperature
(measured with R25 ring cores, $\hat{B} \leq 0,25$ mT)



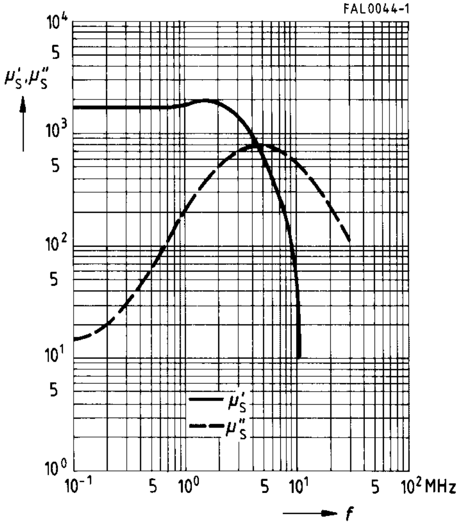
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



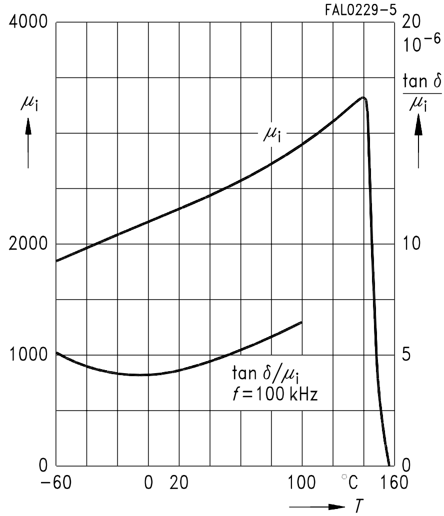
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



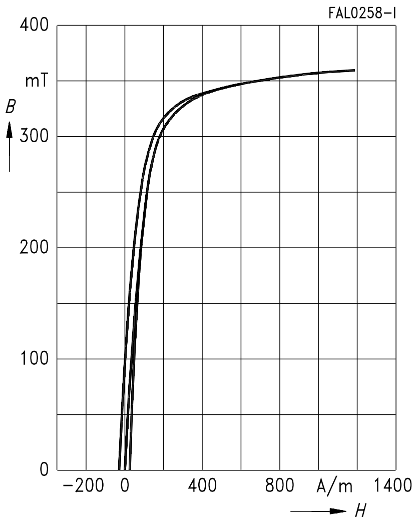
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



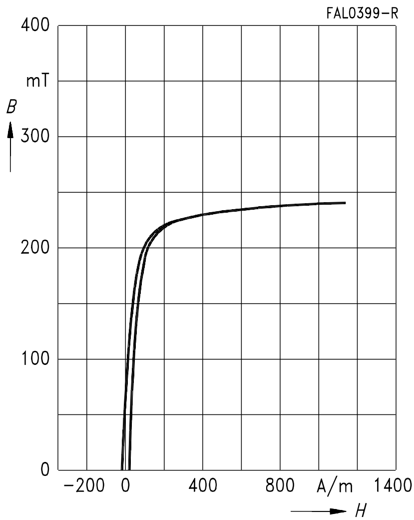
Initial permeability μ_i and relative loss factor
$\tan \delta/\mu_i$ versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



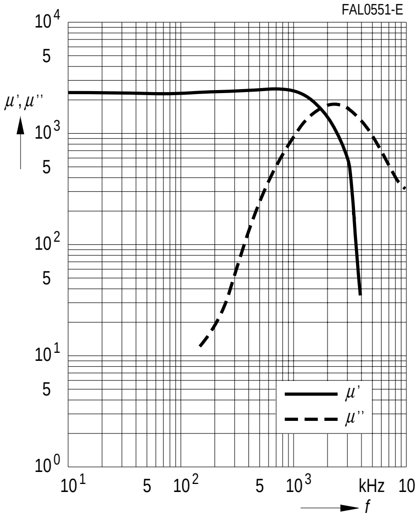
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



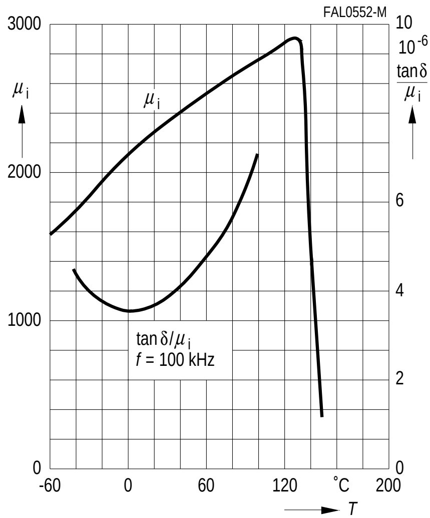
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



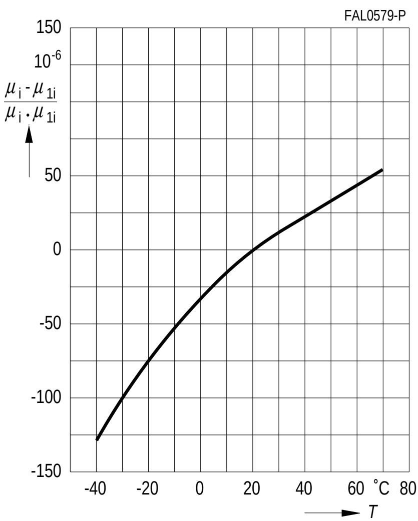
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



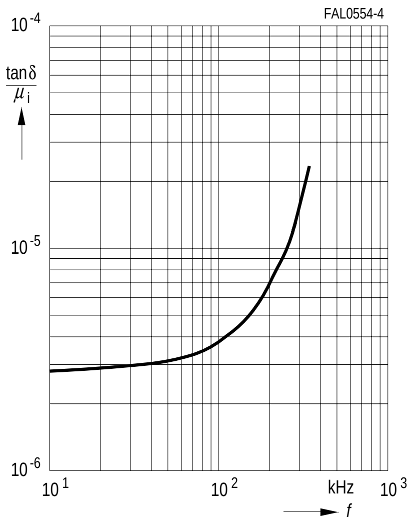
Initial permeability μ_i and relative los factor
tan δ/μ_i versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



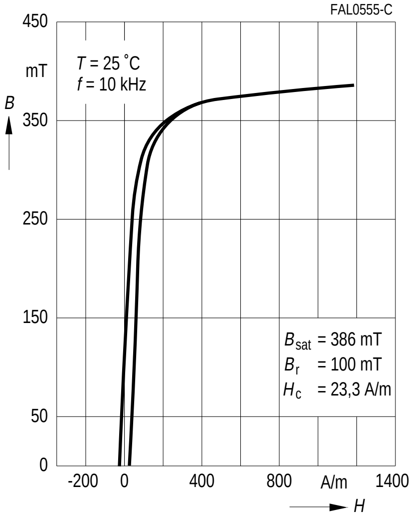
Permeability factor
versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



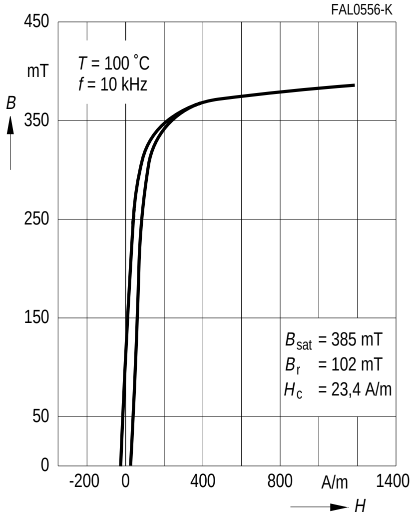
Relative loss factor
versus frequency
(measured with R14 ring cores, $\hat{B} \leq 0{,}25$ mT)



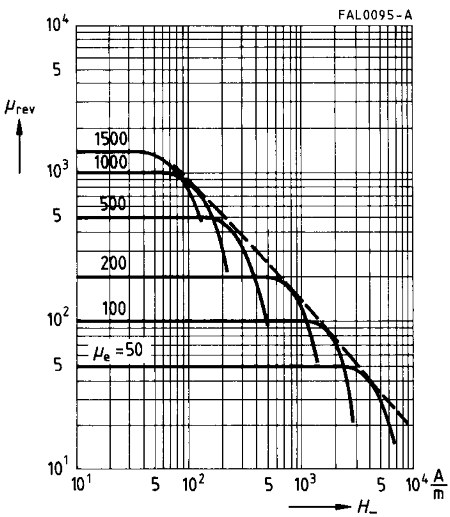
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



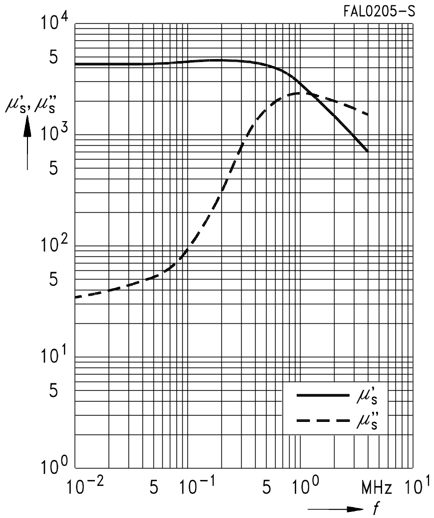
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



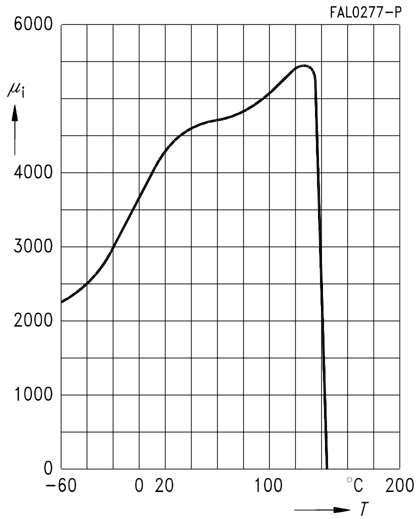
DC magnetic bias of P and RM cores
(typical values)
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 ˚C)



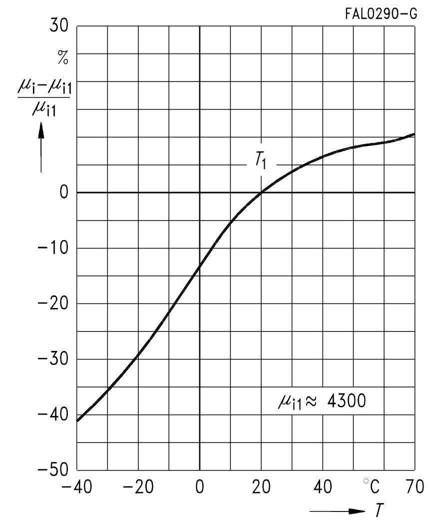
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



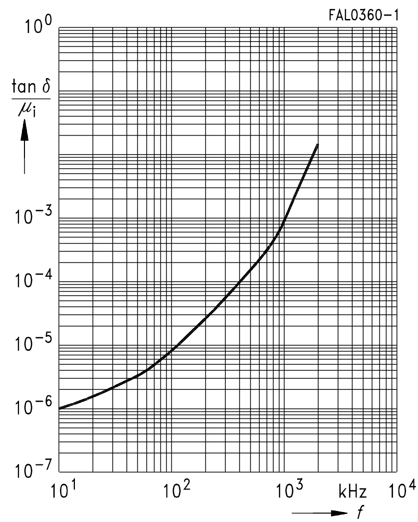
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



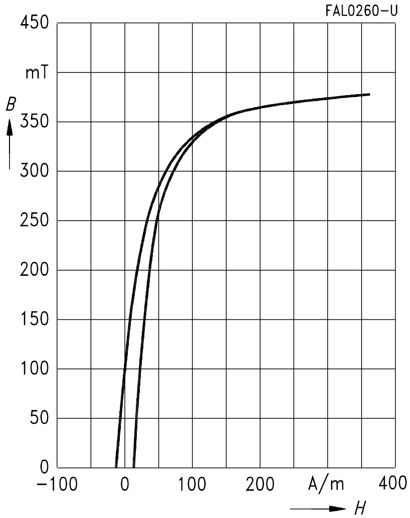
Variation of initial permeability
with temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



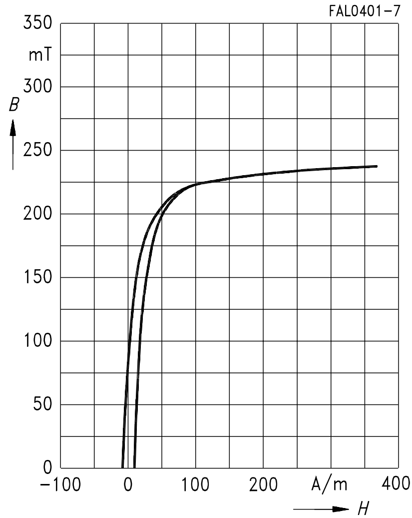
Relative loss factor
versus frequency
(measured with R20 ring cores, $\hat{B} \leq 0{,}25$ mT)



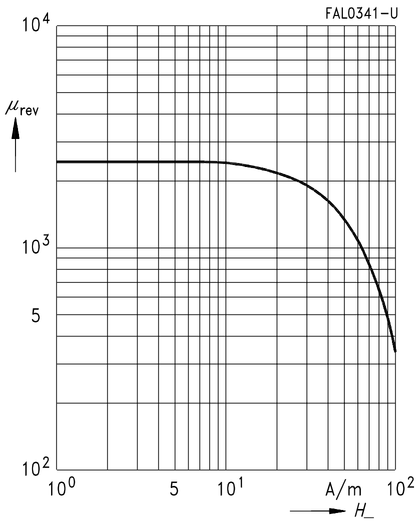
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



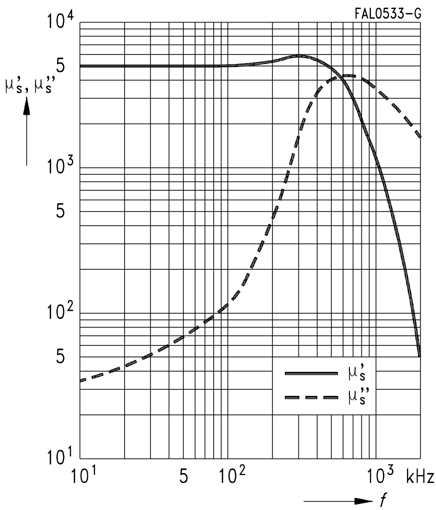
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



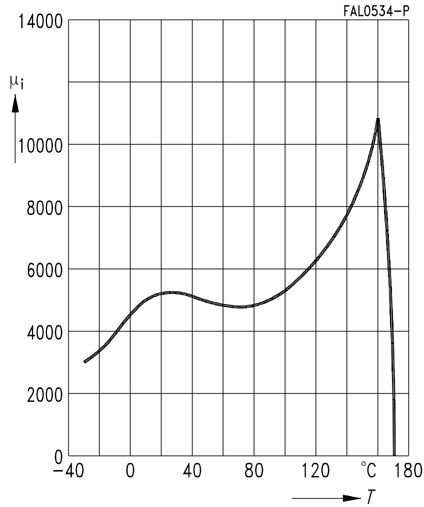
DC magnetic bias of RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



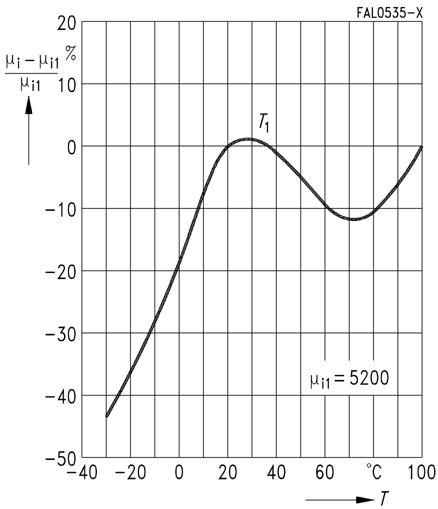
Complex permeability
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



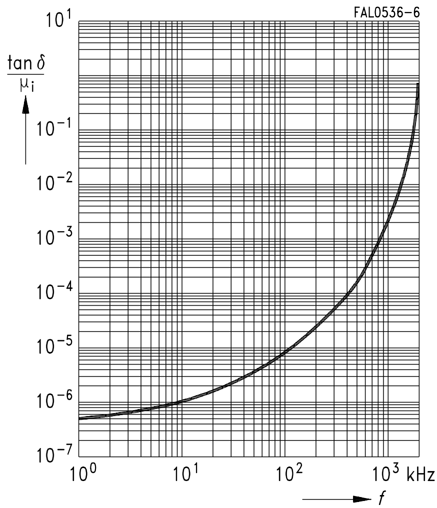
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



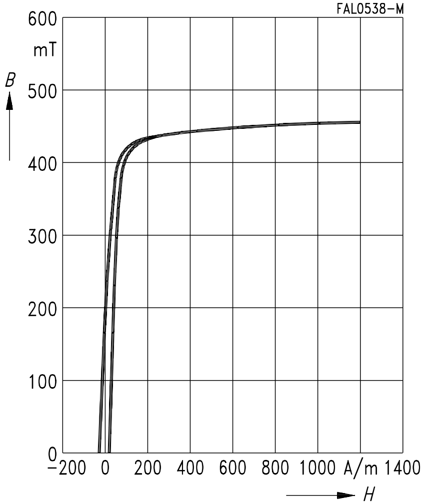
Variation of initial permeability
with temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



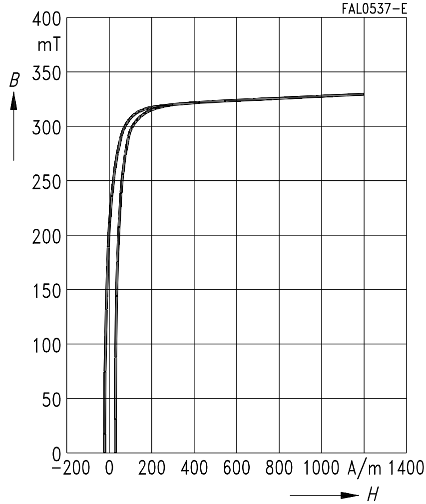
Relative loss factor
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



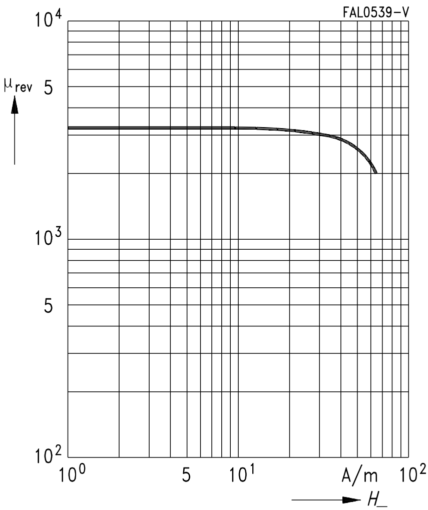
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



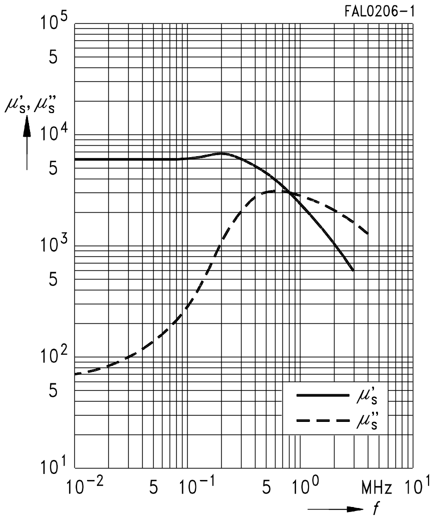
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



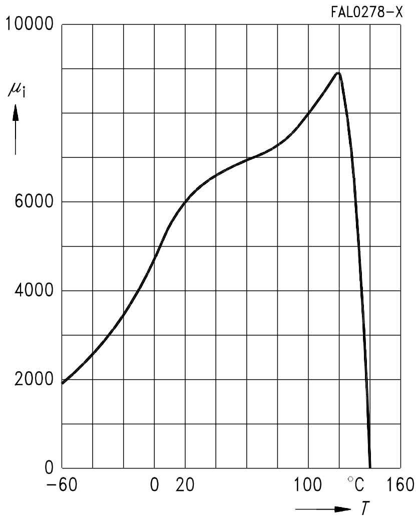
DC magnetic bias of RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



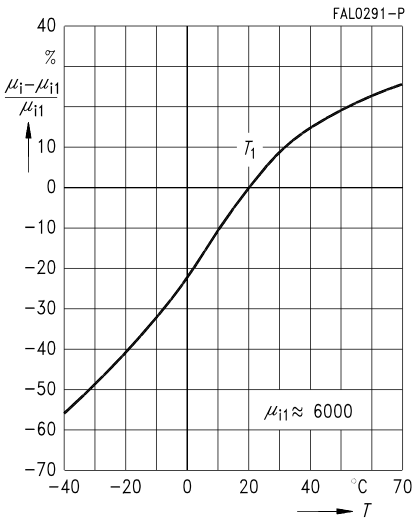
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



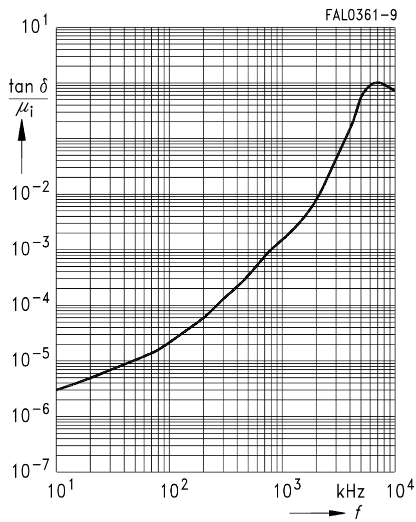
Initial permeability μ_i
versus temperature
(measured with R16 ring cores, $\hat{B} \leq 0{,}25$ mT)



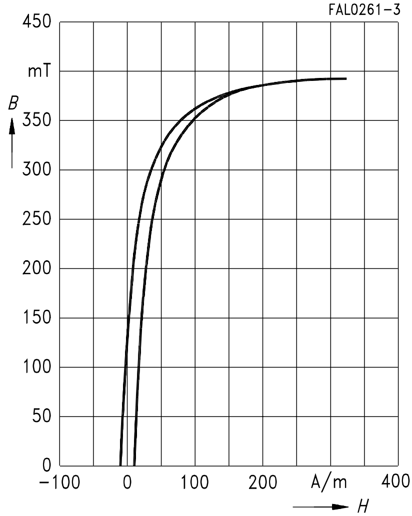
Variation of initial permeability
with temperature
(measured with R16 ring cores, $\hat{B} \leq 0{,}25$ mT)



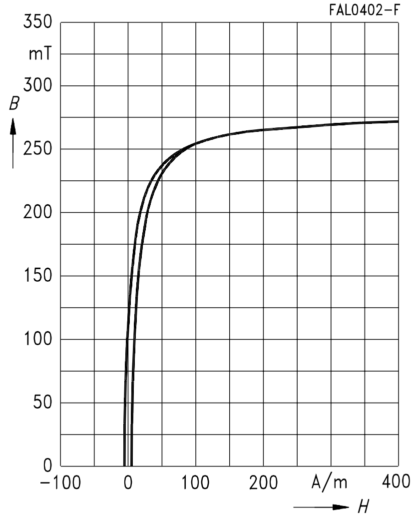
Relative loss factor
versus frequency
(measured with R16 ring cores, $\hat{B} \leq 0{,}25$ mT)



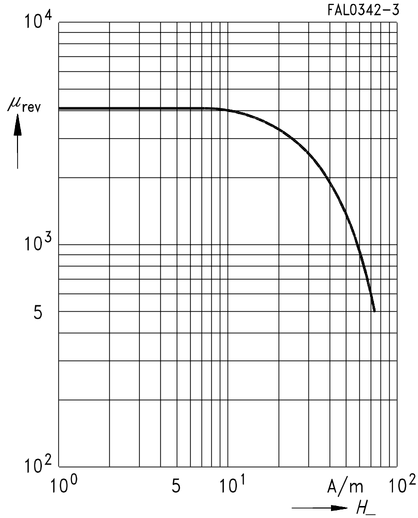
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



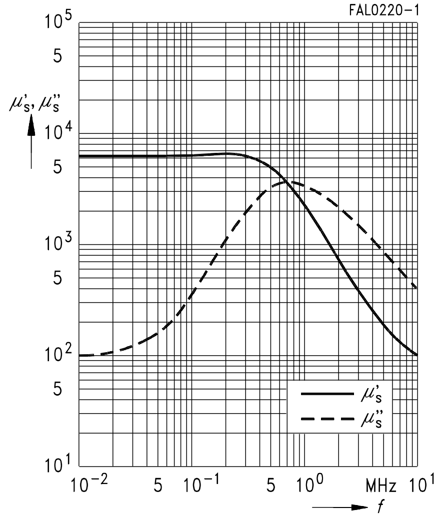
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



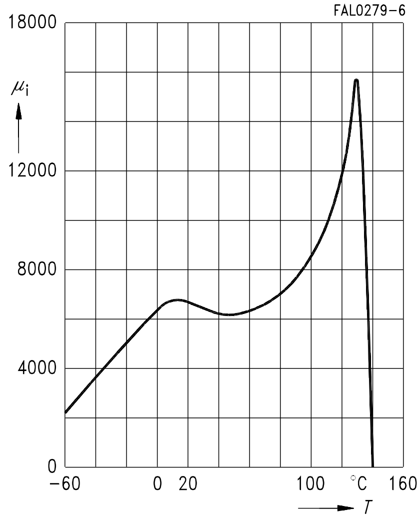
DC magnetic bias of RM cores
(typical values)
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 ˚C)



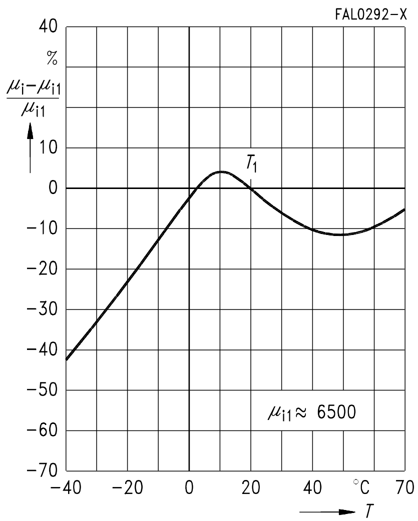
Complex permeability
versus frequency
(measured with R16 ring cores, $\hat{B} \le 0{,}25$ mT)



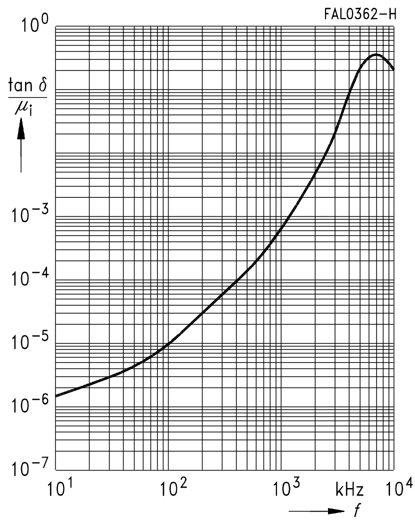
Initial permeability μ_i
versus temperature
(measured with R22 ring cores, $\hat{B} \le 0{,}25$ mT)



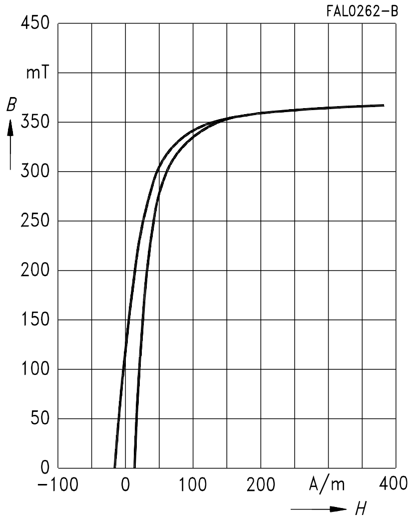
Variation of initial permeability
with temperature
(measured with R22 ring cores, $\hat{B} \le 0{,}25$ mT)



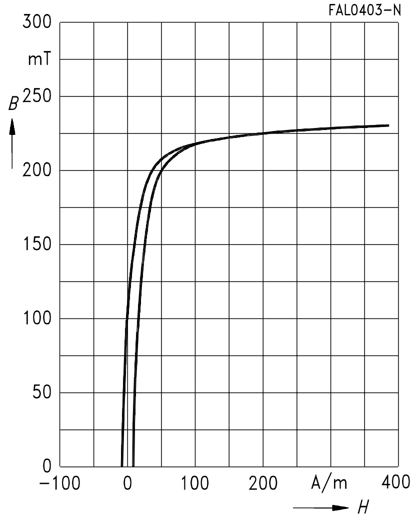
Relative loss factor
versus frequency
(measured with R16 ring cores, $\hat{B} \le 0{,}25$ mT)



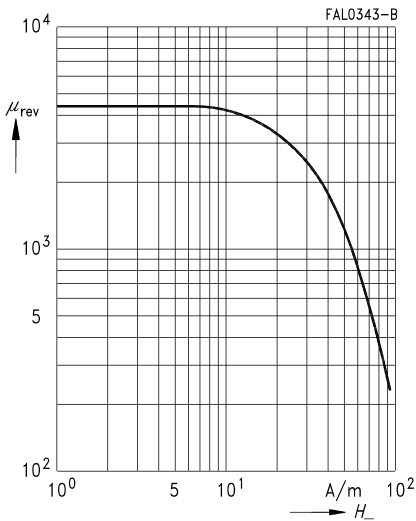
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



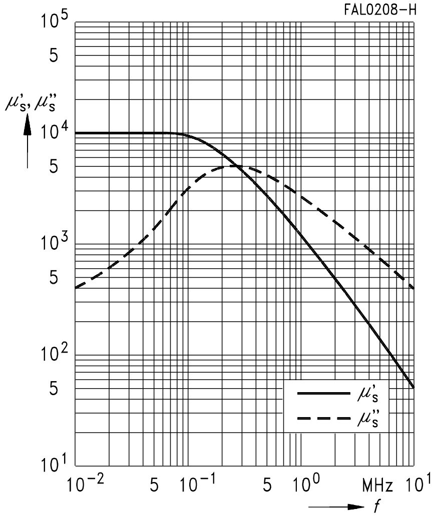
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



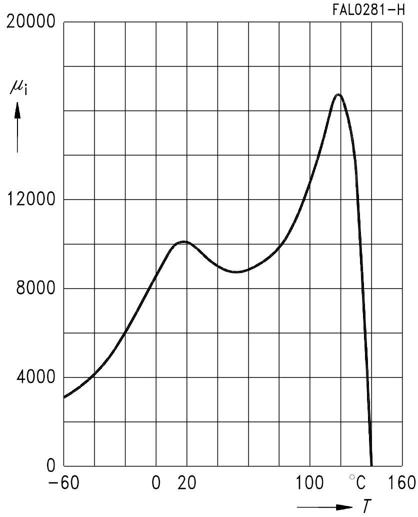
DC magnetic bias of RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



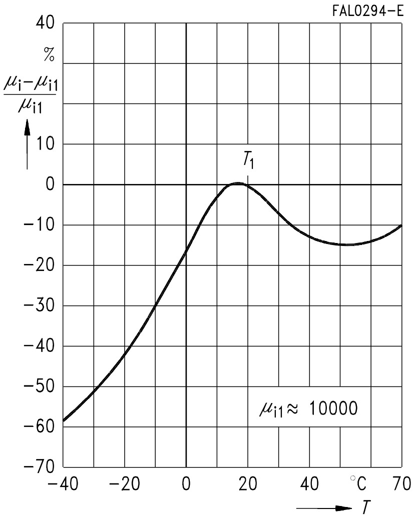
Complex permeability
versus frequency
(measured with R14 ring cores, $\hat{B} \leq 0{,}25$ mT)



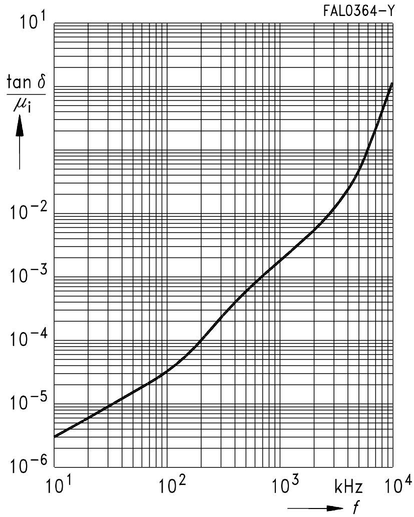
Initial permeability μ_i
versus temperature
(measured with R16 ring cores, $\hat{B} \leq 0{,}25$ mT)



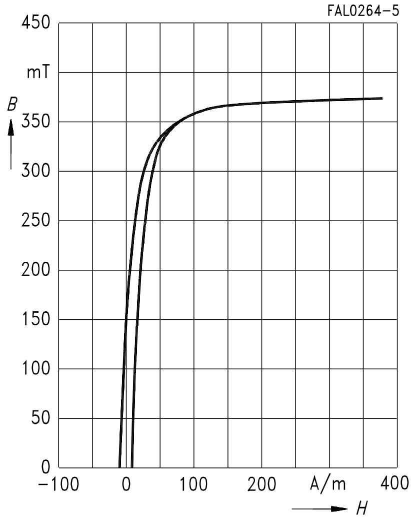
Variation of initial permeability
with temperature
(measured with R16 ring cores, $\hat{B} \leq 0{,}25$ mT)



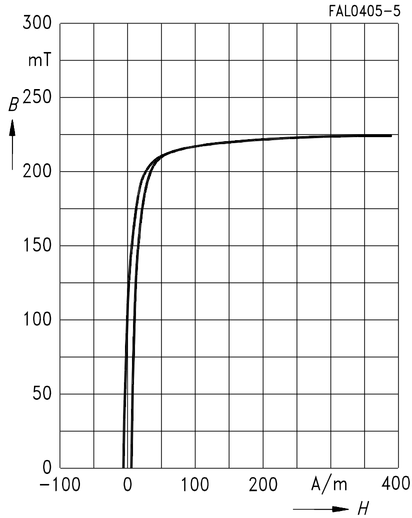
Relative loss factor
versus frequency
(measured with R14 ring cores, $\hat{B} \leq 0{,}25$ mT)



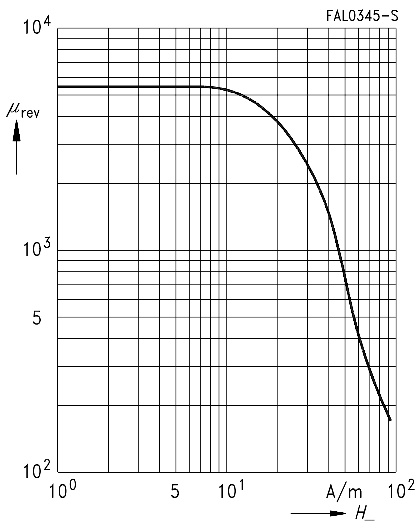
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



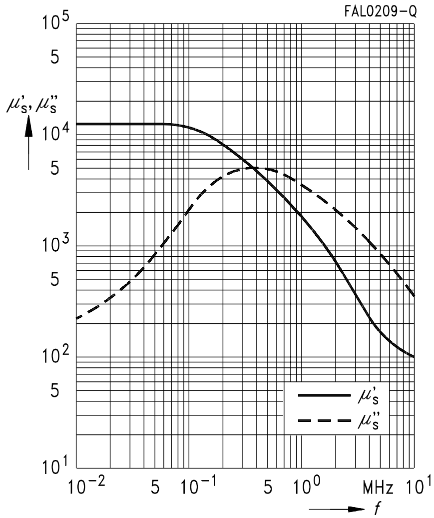
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



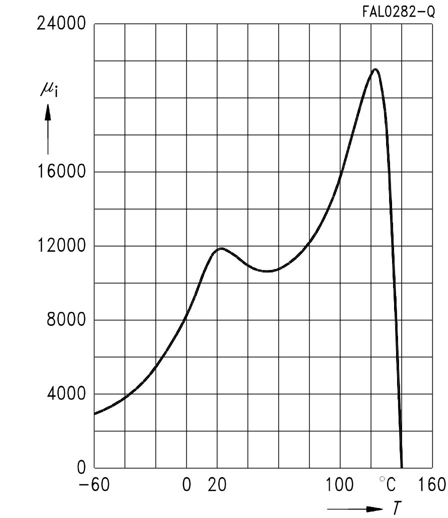
DC magnetic bias of RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



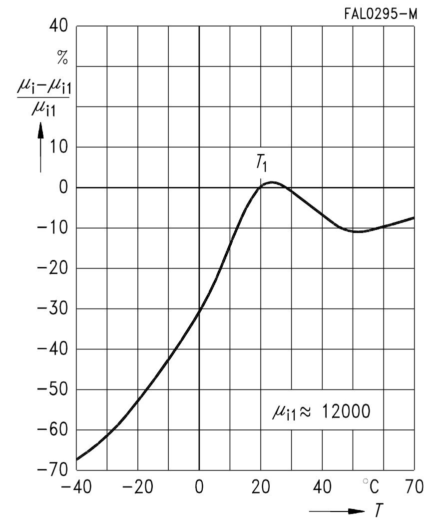
Complex permeability
versus frequency
(measured with R9,5 ring cores, $\hat{B} \leq 0{,}25$ mT)



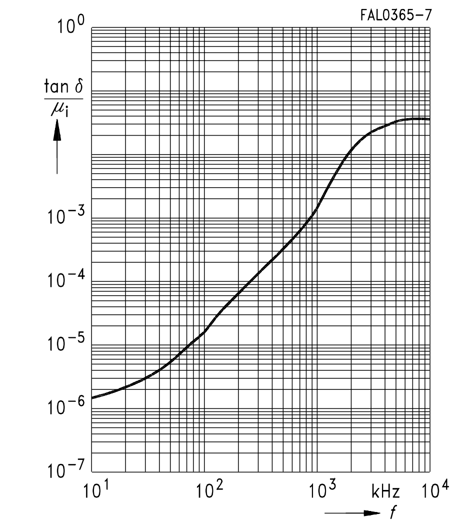
Initial permeability μ_i
versus temperature
(measured with R9,5 ring cores, $\hat{B} \leq 0{,}25$ mT)



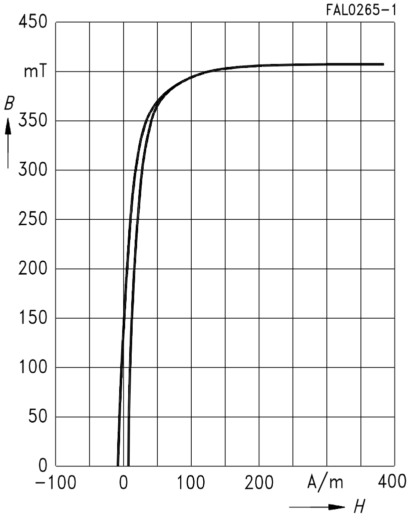
Variation of initial permeability
with temperature
(measured with R9,5 ring cores, $\hat{B} \leq 0{,}25$ mT)



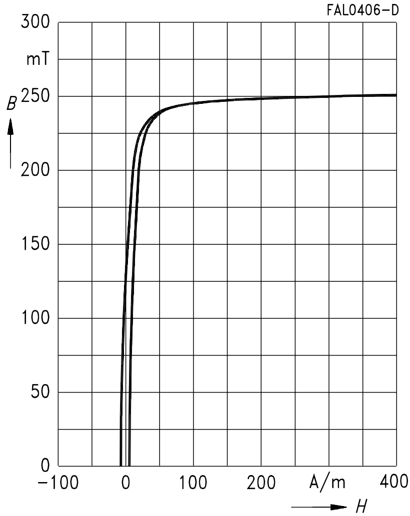
Relative loss factor
versus frequency
(measured with R9,5 ring cores, $\hat{B} \leq 0{,}25$ mT)



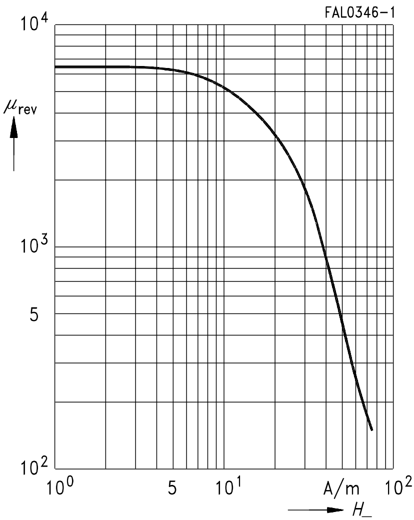
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



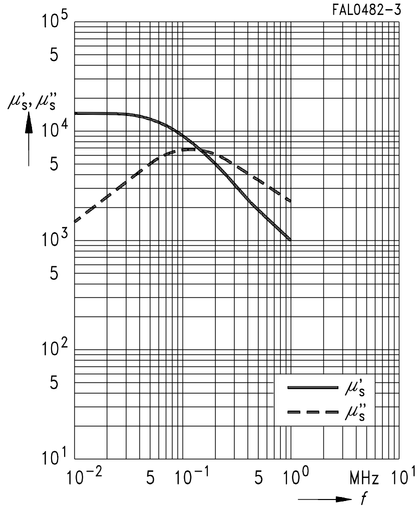
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



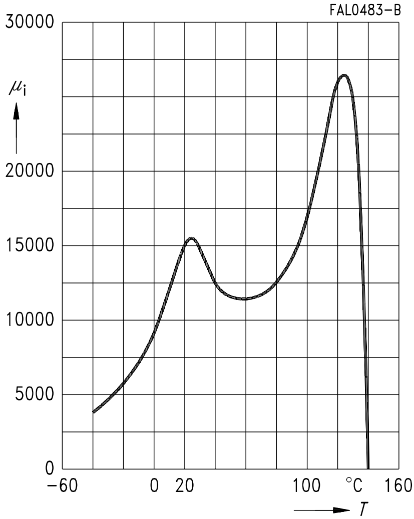
DC magnetic bias of RM cores
(typical values)
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



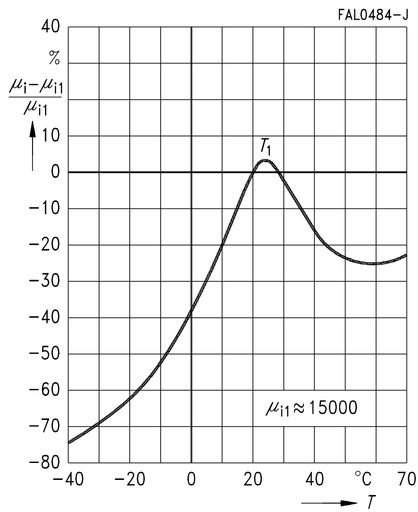
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



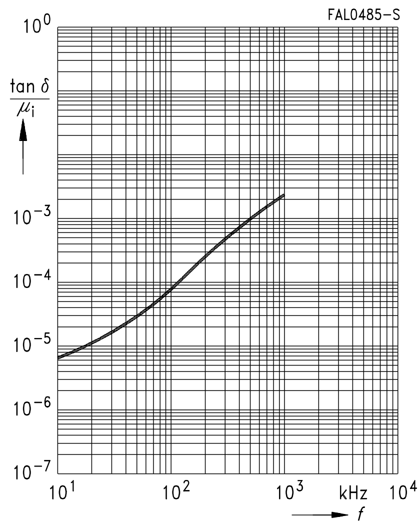
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



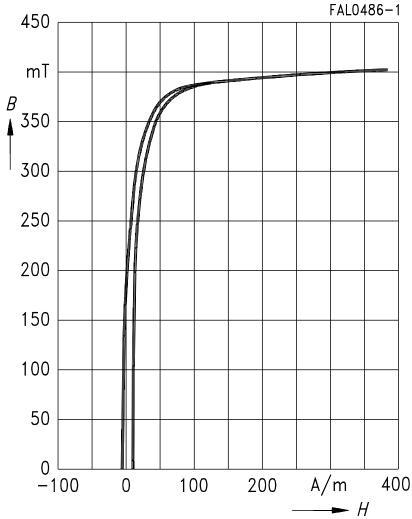
Variation of initial permeability
with temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



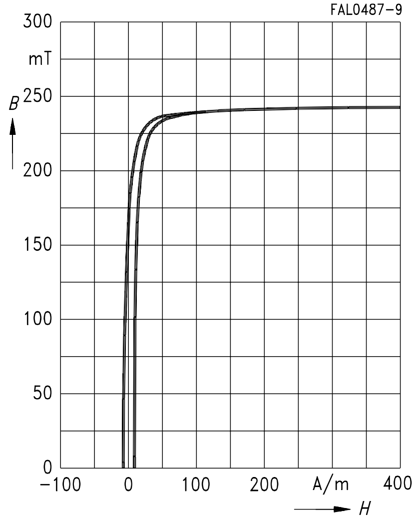
Relative loss factor
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



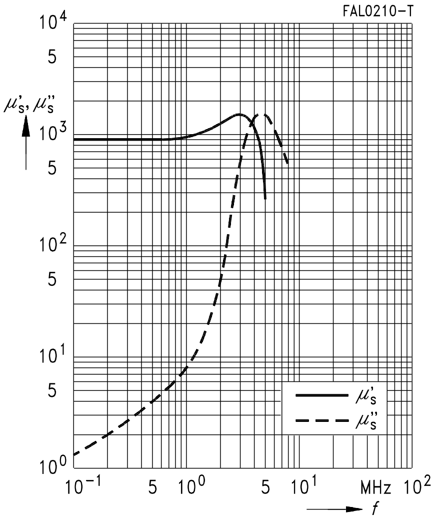
Dynamic magnetization curves
(typical values)
(*f* = 10 kHz, *T* = 25 ˚C)



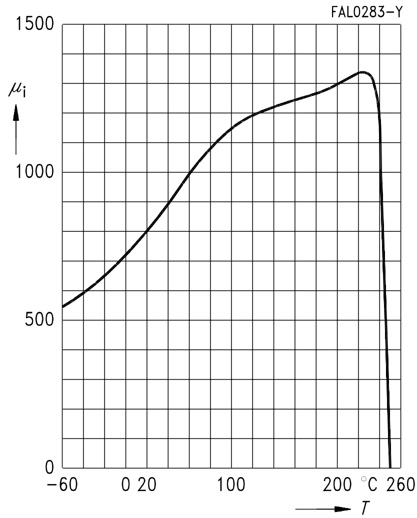
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



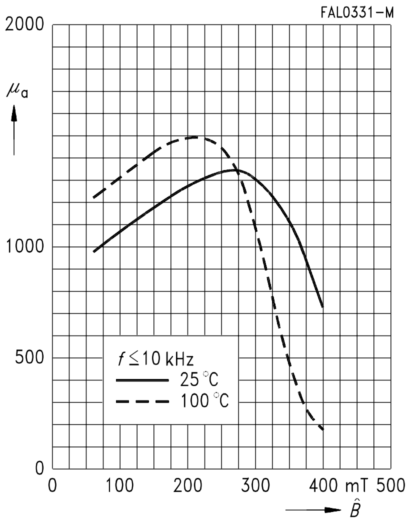
Complex permeability
versus frequency
(measured with R25 ring cores, $\hat{B} \leq 0{,}25$ mT)



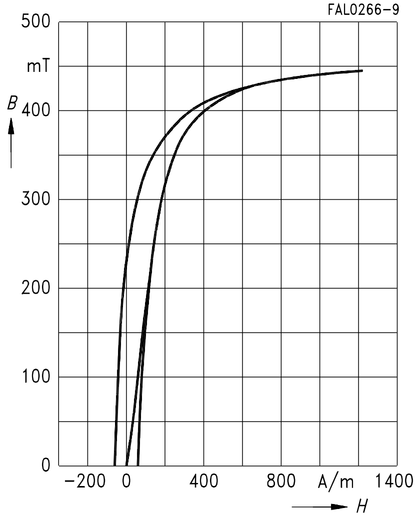
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



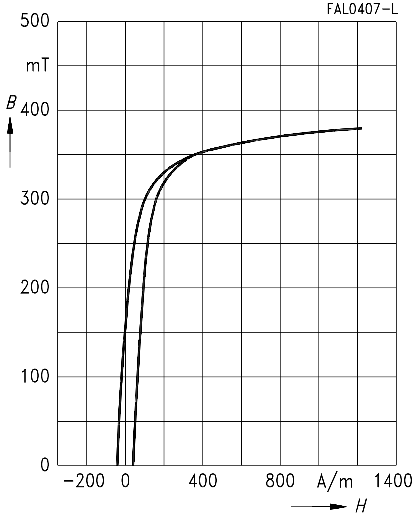
Amplitude permeability
versus AC field flux density
(measured with ungapped E cores)



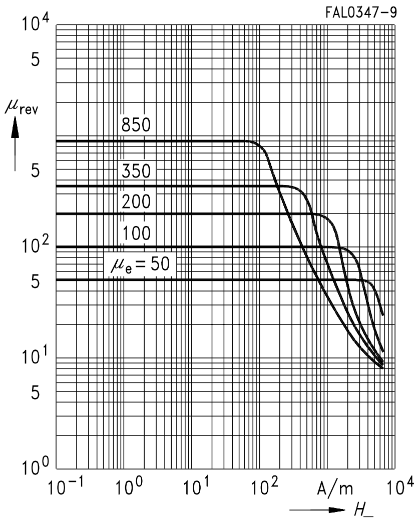
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



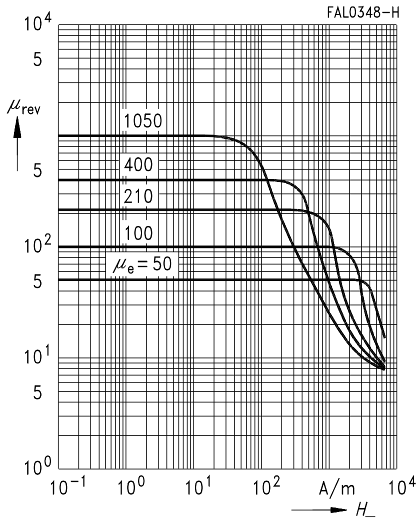
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



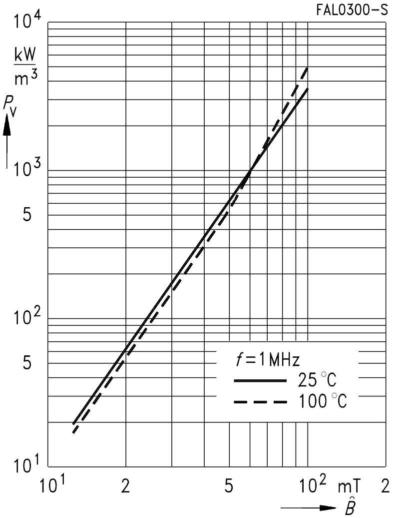
DC magnetic bias
of P, RM, PM and E cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 ˚C)



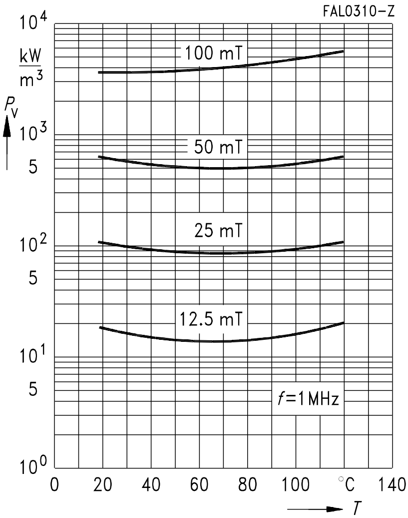
DC magnetic bias
of P, RM, PM and E cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 100 ˚C)



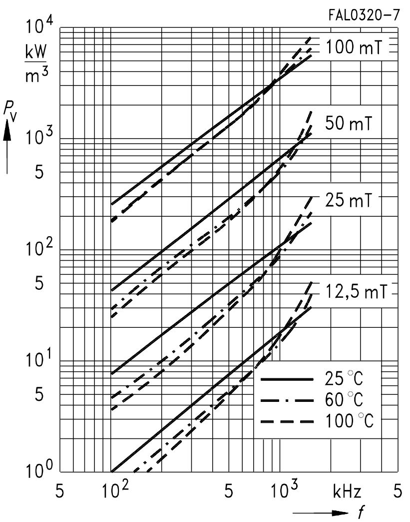
Relative core losses
versus AC field flux density
(measured with R29 ring cores)



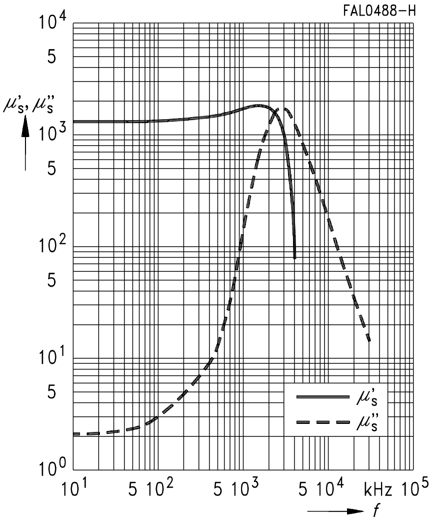
Relative core losses
versus temperature
(measured with R29 ring cores)



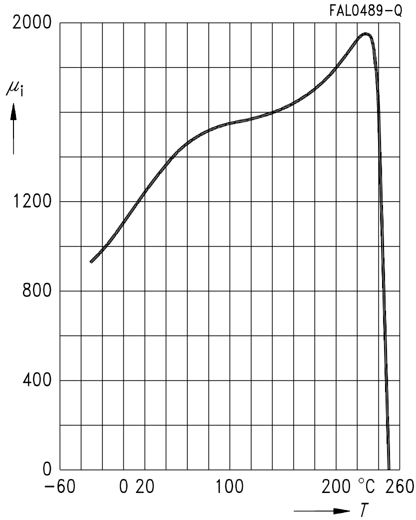
Relative core losses
versus frequency
(measured with R29 ring cores)



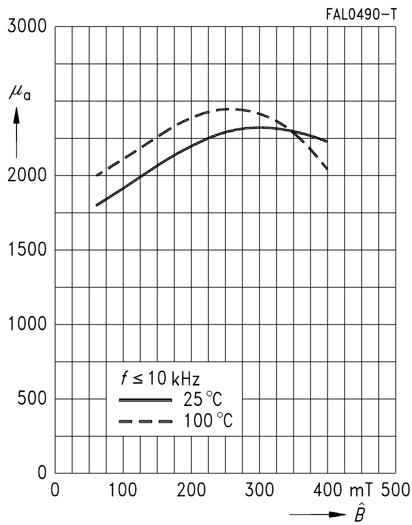
Complex permeability
versus frequency
(measured with R17 ring cores, $\hat{B} \leq 0{,}25$ mT)



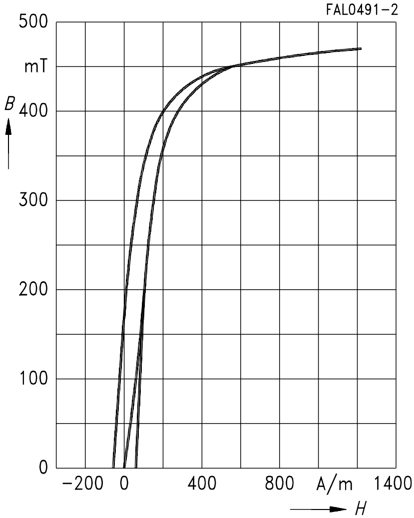
Initial permeability μ_i
versus temperature
(measured with R17 ring cores, $\hat{B} \leq 0{,}25$ mT)



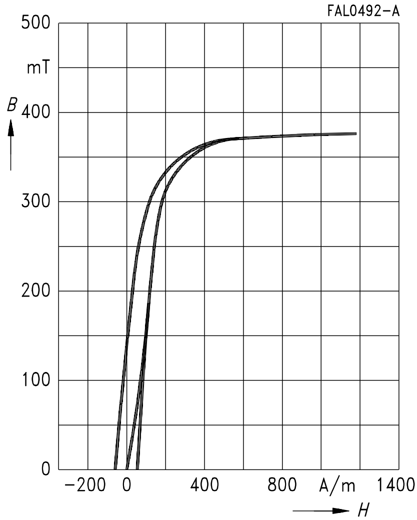
Amplitude permeability
versus AC field flux density
(measured with ungapped E cores)



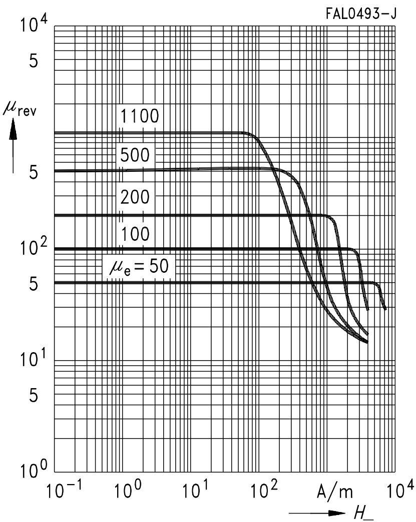
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



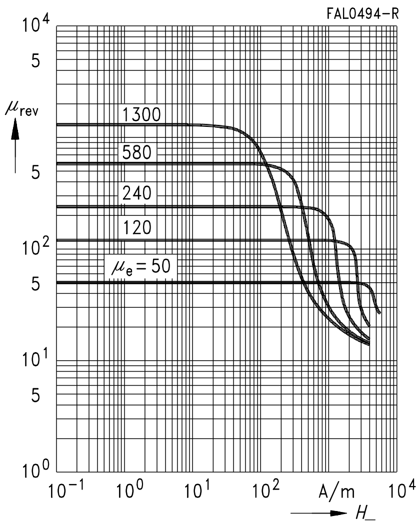
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



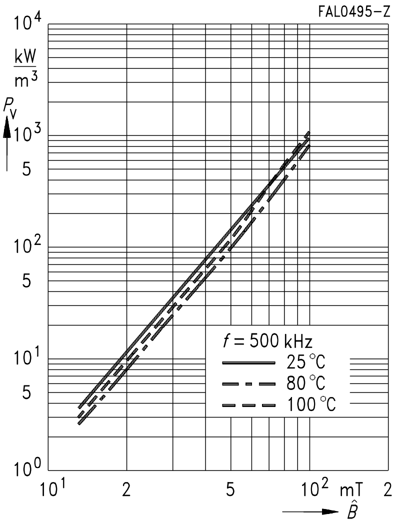
DC magnetic bias
of P, RM, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



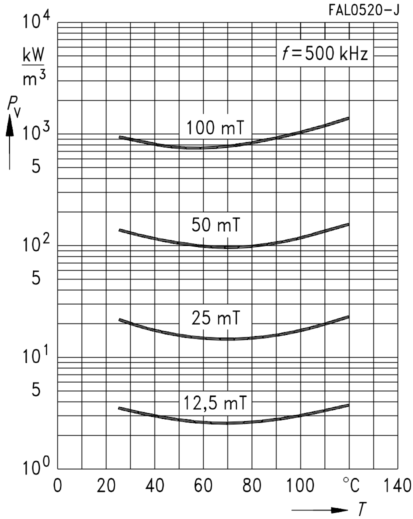
DC magnetic bias
of P, RM, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 100 ˚C)



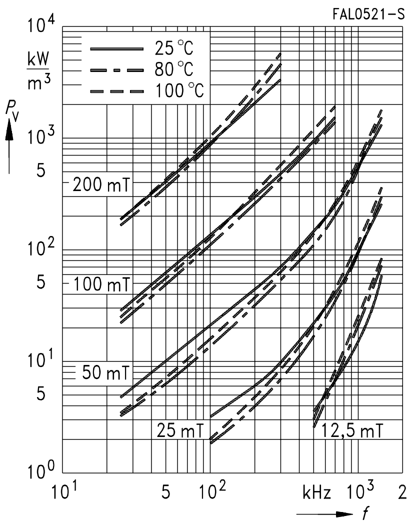
Relative core losses
versus AC field flux density
(measured with R17 ring cores)



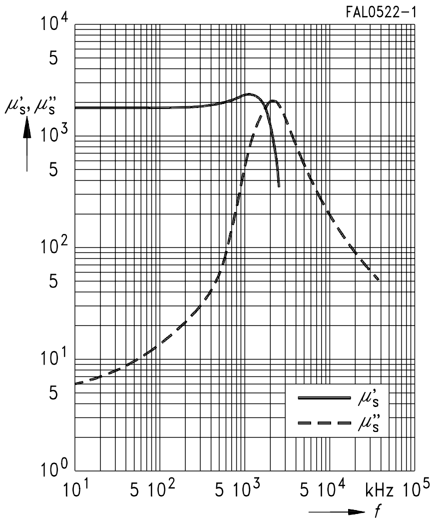
Relative core losses
versus temperature
(measured with R17 ring cores)



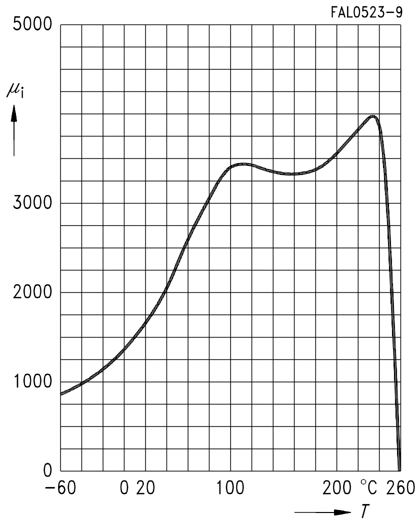
Relative core losses
versus frequency
(measured with R17 ring cores)



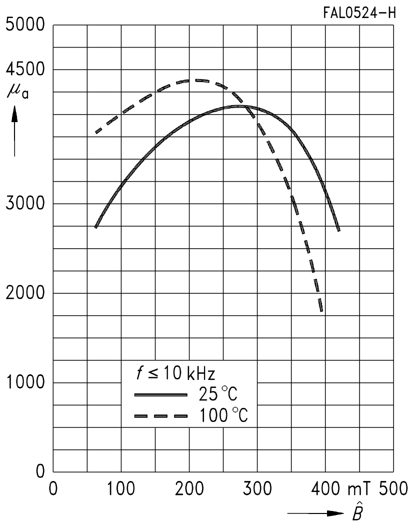
Complex permeability
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



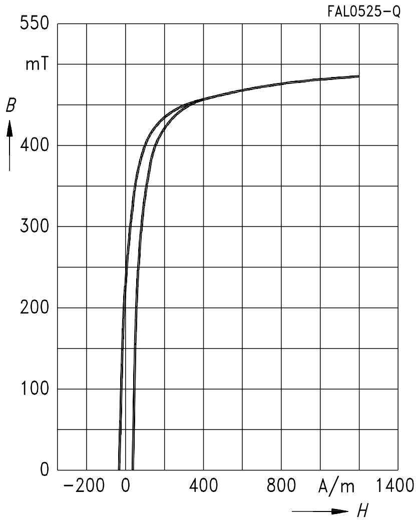
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



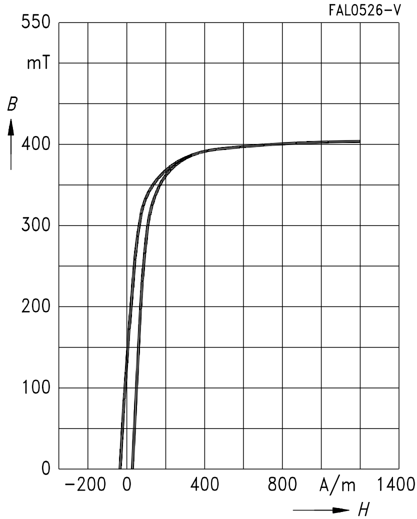
Amplitude permeability
versus AC field flux density
(measured with ungapped E and U cores)



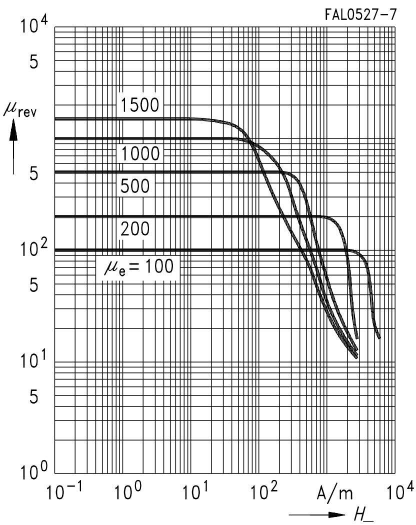
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



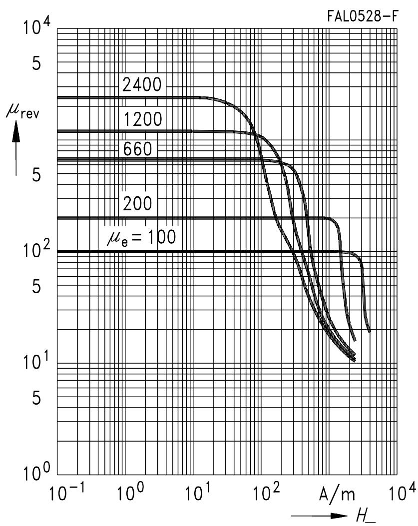
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



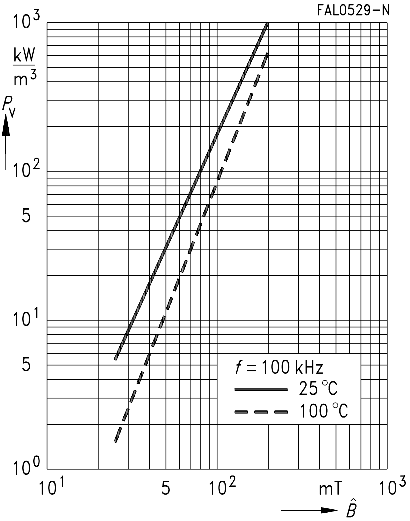
DC magnetic bias
of P, RM, PM, E and U cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



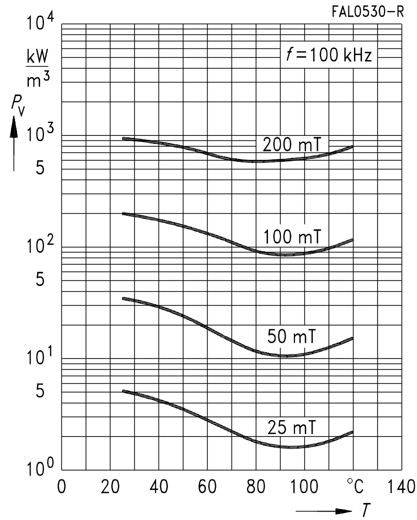
DC magnetic bias
of P, RM, PM, E and U cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 100 ˚C)



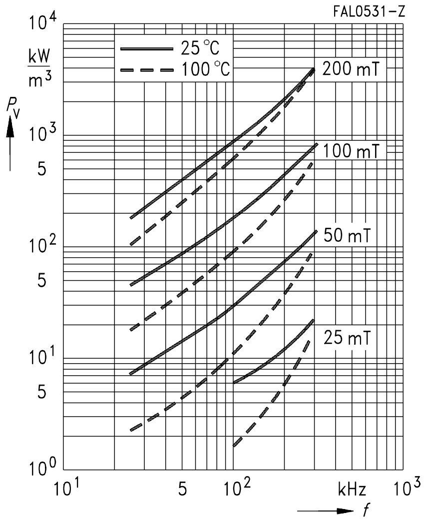
Relative core losses
versus AC field flux density
(measured with R17 ring cores)



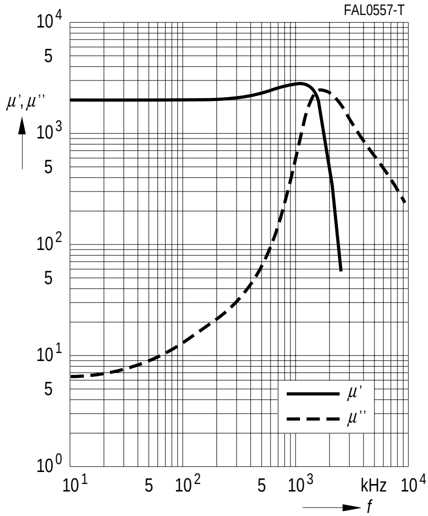
Relative core losses
versus temperature
(measured with R17 ring cores)



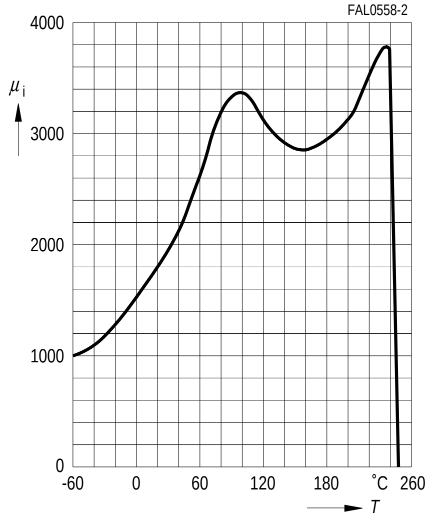
Relative core losses
versus frequency
(measured with R17 ring cores)



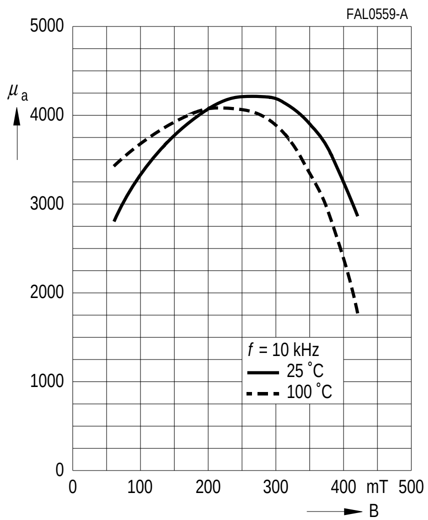
Complex permeability
versus frequency
(measured with R29 ring cores)



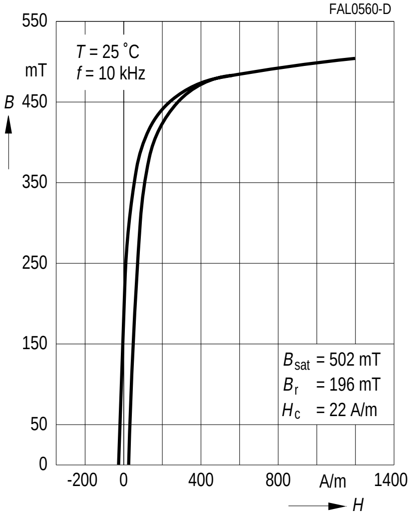
Initial permeability μ_i
versus temperature
(measured with R29 ring cores)



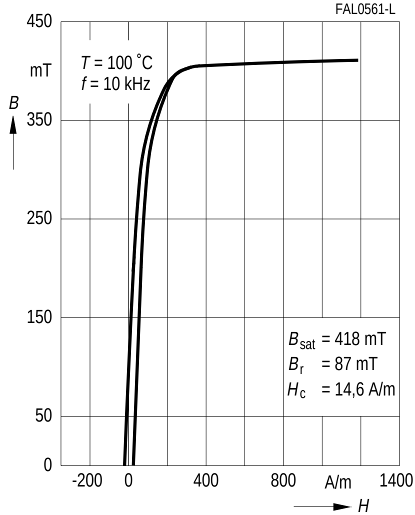
Amplitude permeability
versus AC field flux density
(measured with R29 ring cores)



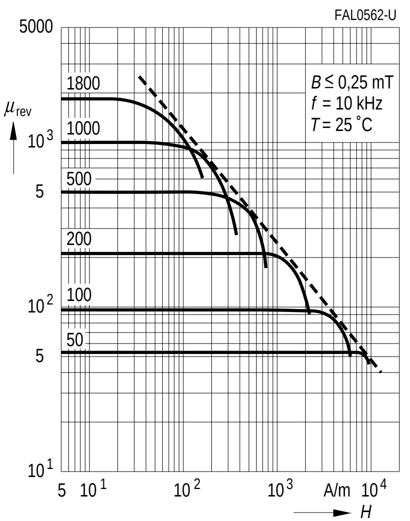
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 °C)



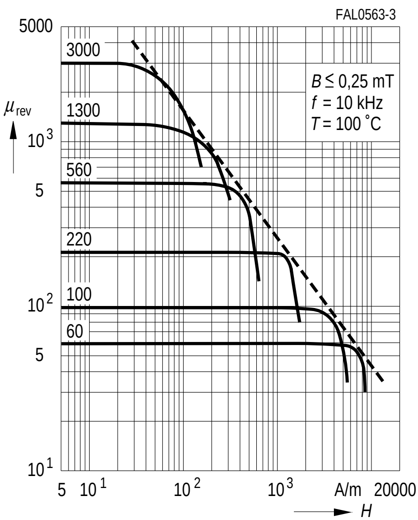
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 °C)



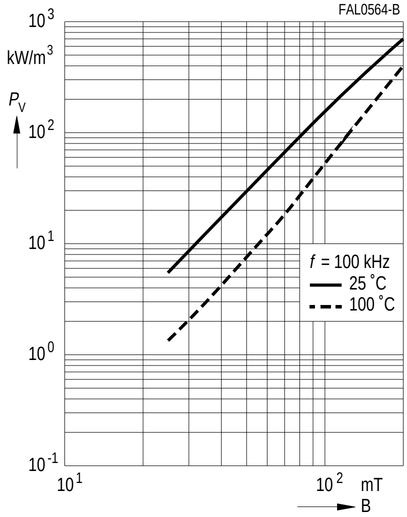
DC magnetic bias
of E, ETD and U cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 °C)



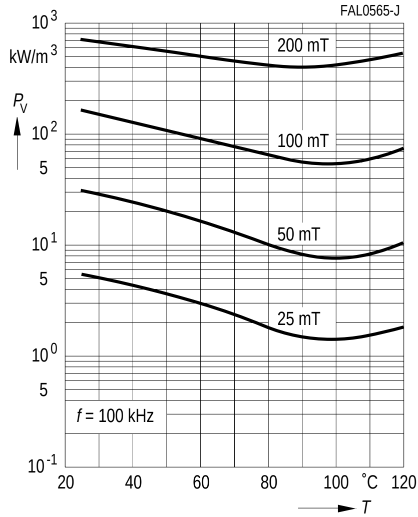
DC magnetic bias
of E, ETD and U cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 100 °C)



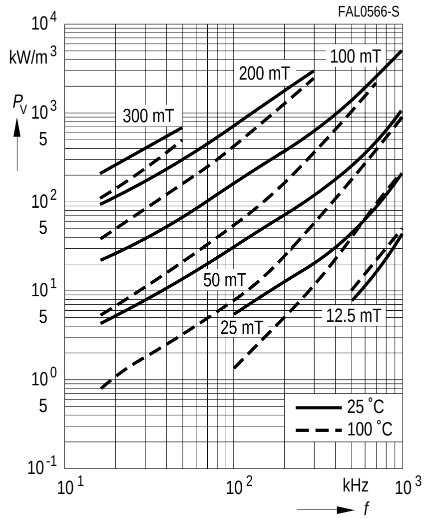
Relative core losses
versus AC field flux density
(measured with R29 ring cores)



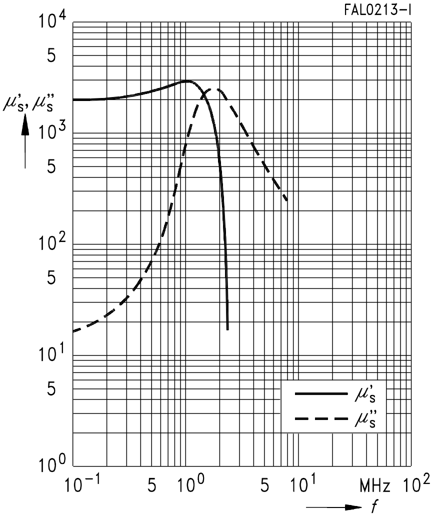
Relative core losses
versus temperature
(measured with R29 ring cores)



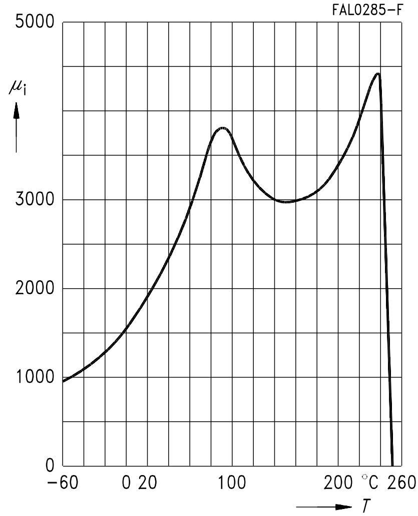
Relative core losses
versus frequency
(measured with R29 ring cores)



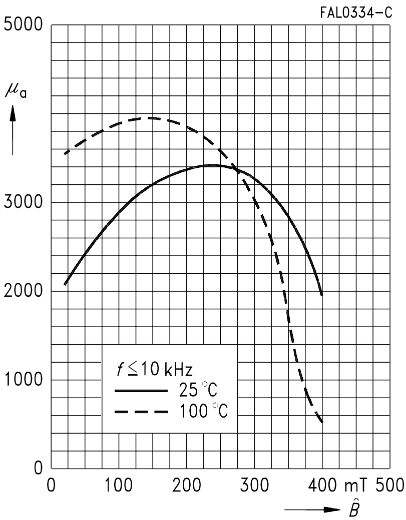
Complex permeability
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



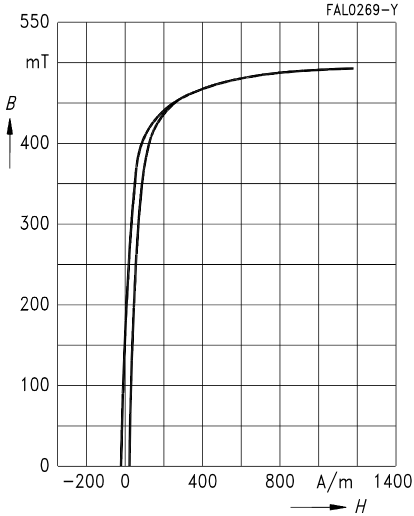
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



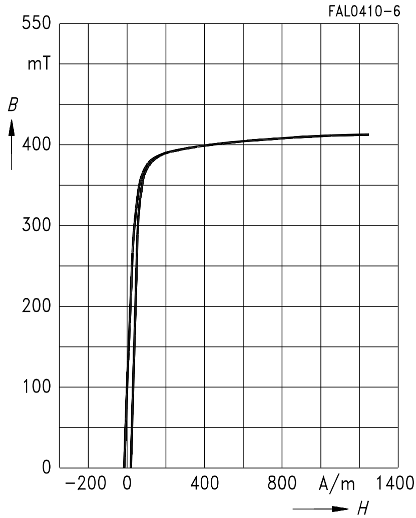
Amplitude permeability
versus AC field flux density
(measured with ungapped U cores)



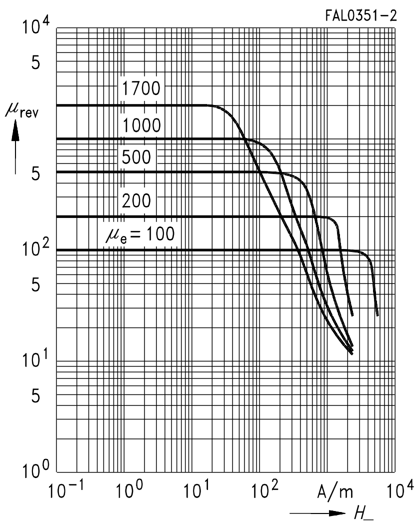
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



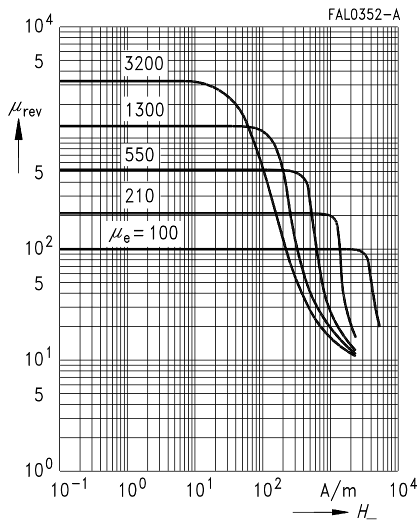
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



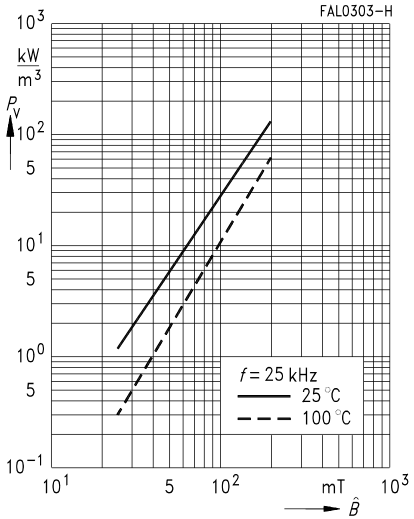
DC magnetic bias
of E, ETD and U cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



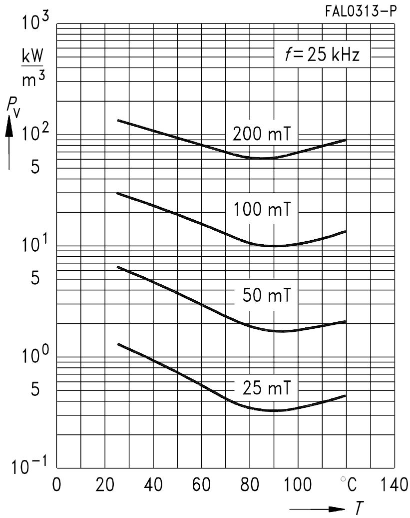
DC magnetic bias
of E, ETD and U cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 100 ˚C)



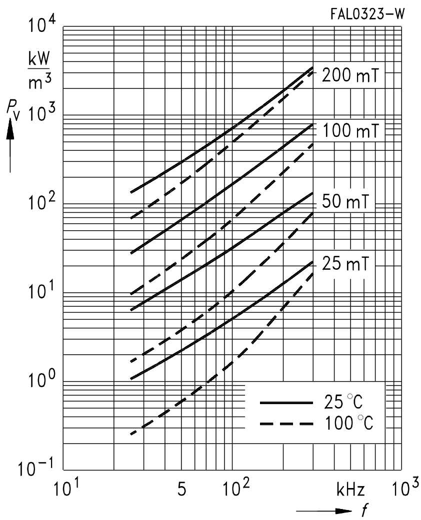
Relative core losses
versus AC field flux density
(measured with R29 ring cores)



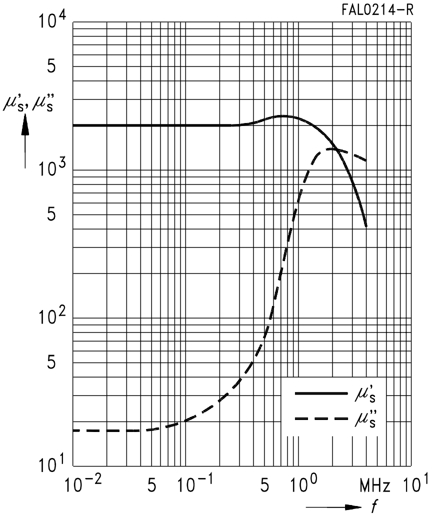
Relative core losses
versus temperature
(measured with R29 ring cores)



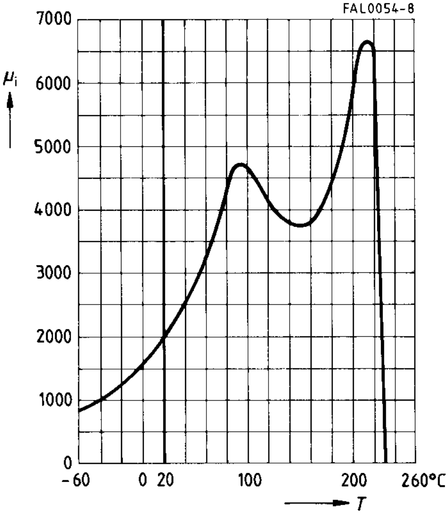
Relative core losses
versus frequency
(measured with R29 ring cores)



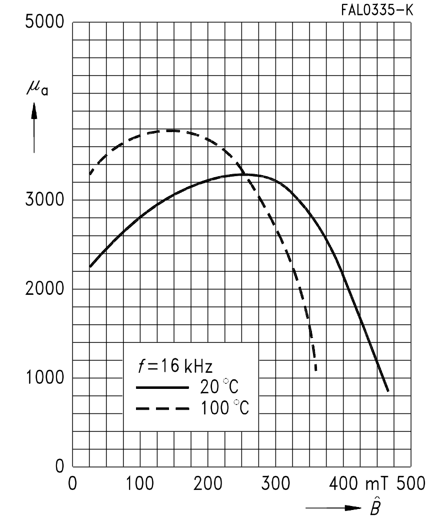
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



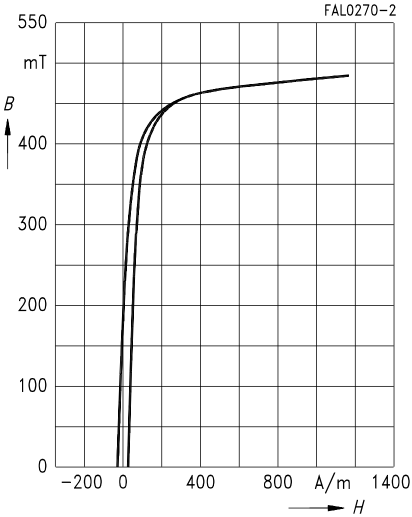
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



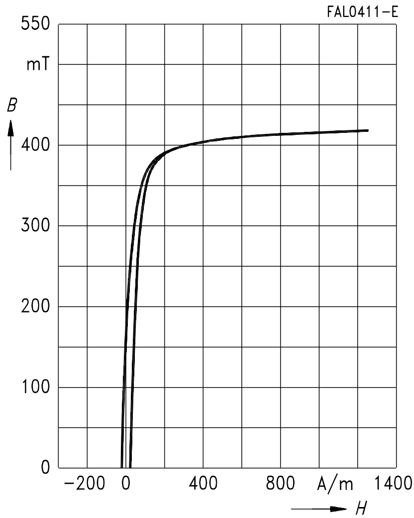
Amplitude permeability versus AC field
flux density
(measured with ungapped E cores)



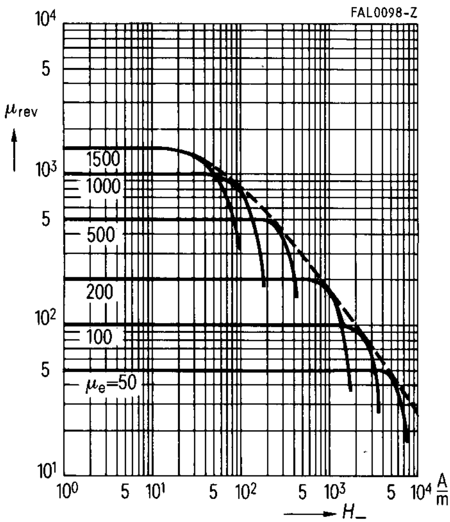
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



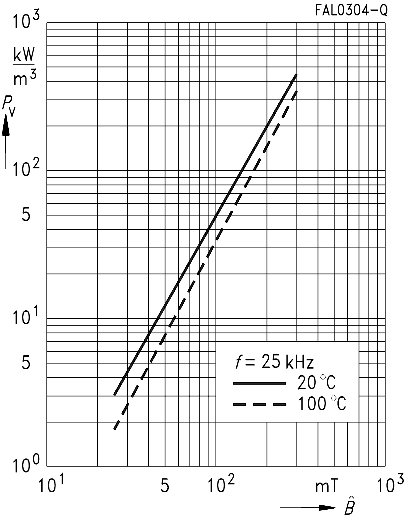
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



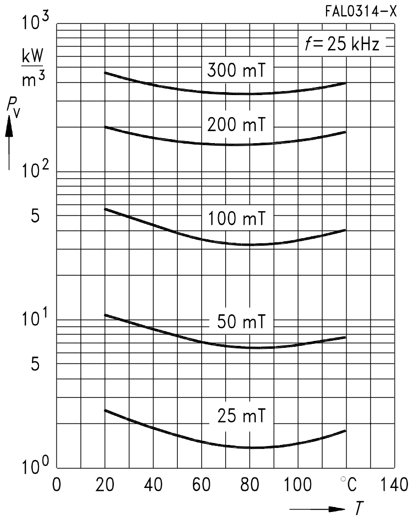
DC magnetic bias
of P, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



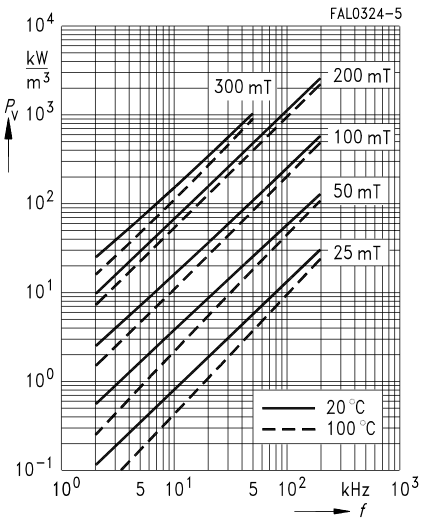
Relative core losses versus AC field flux density
(measured with R16 ring cores)



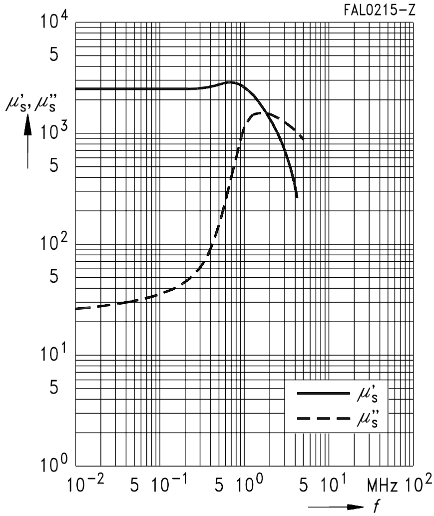
Relative core losses versus temperature
(measured with R16 ring cores)



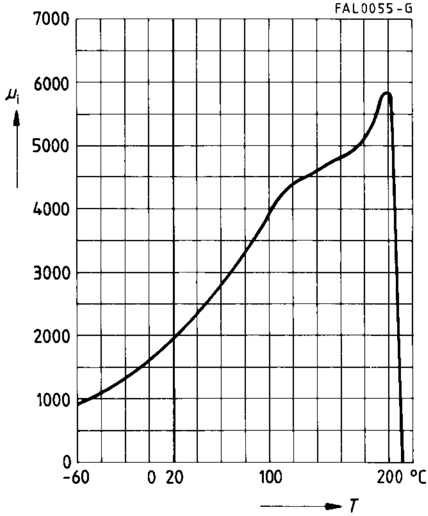
Relative core losses versus frequency
(measured with R16 ring cores)



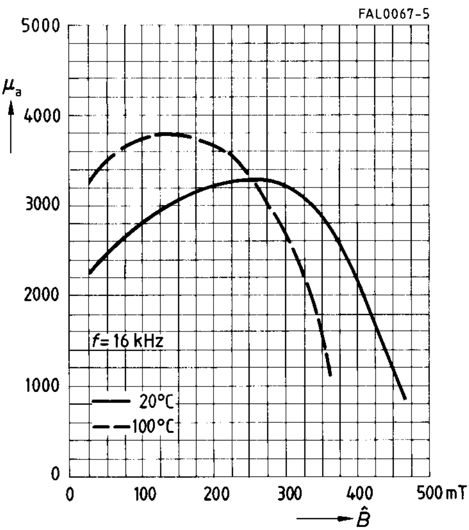
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \le 0{,}25$ mT)



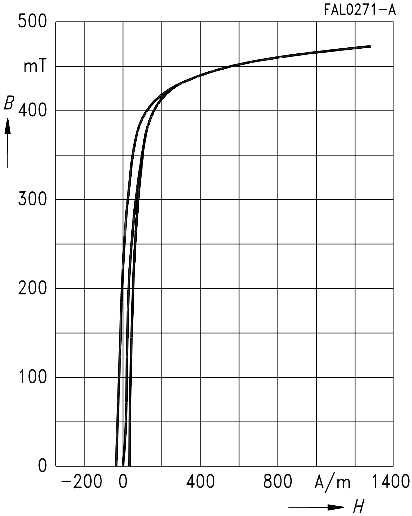
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \le 0{,}25$ mT)



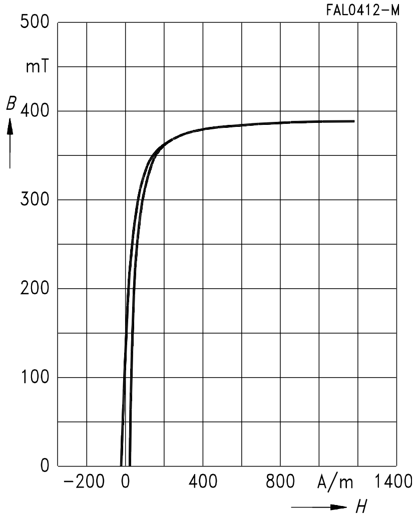
Amplitude permeability versus AC field
flux density
(measured with ungapped E cores)



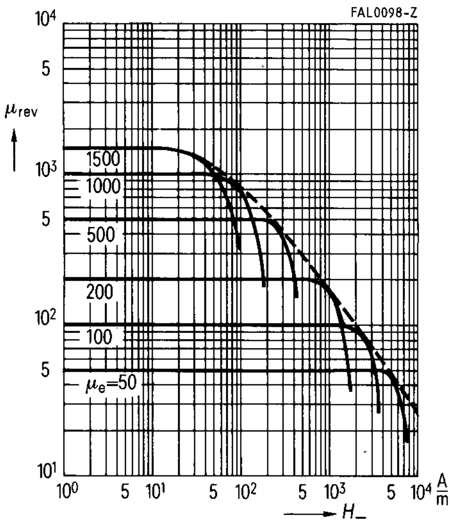
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



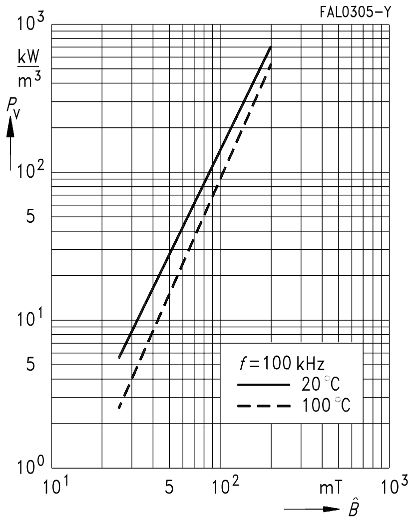
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



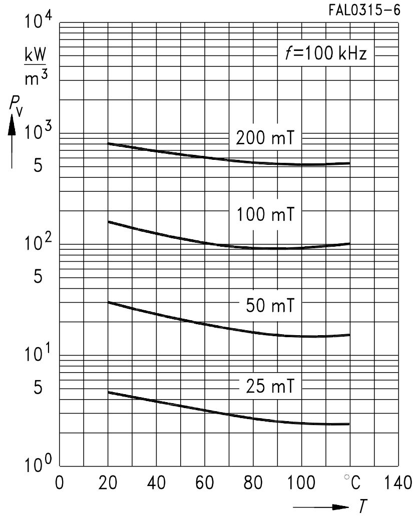
DC magnetic bias
of P, RM, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



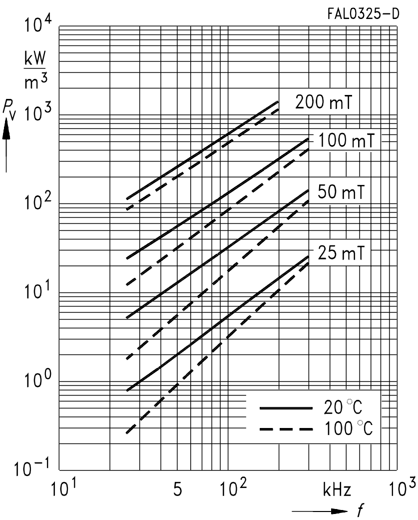
Relative core losses versus AC field flux density
(measured with R16 ring cores)



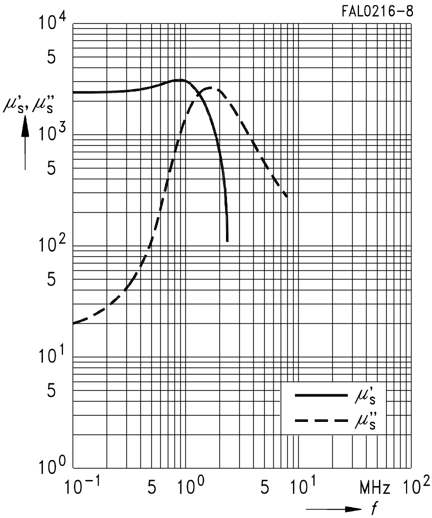
Relative core losses versus temperature
(measured with R16 ring cores)



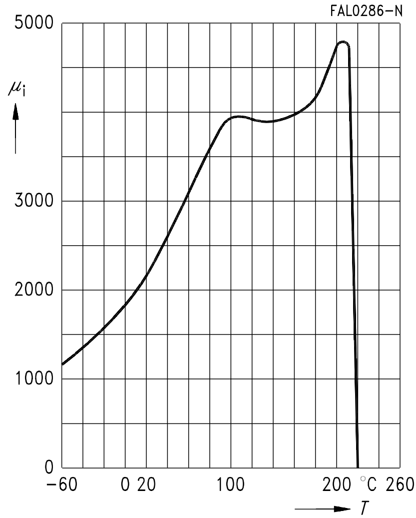
Relative core losses versus frequency
(measured with R16 ring cores)



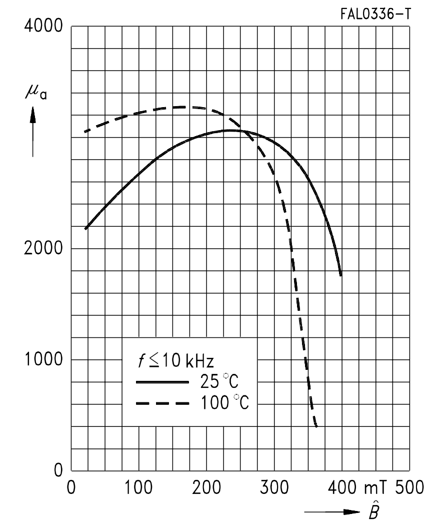
Complex permeability
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0,25$ mT)



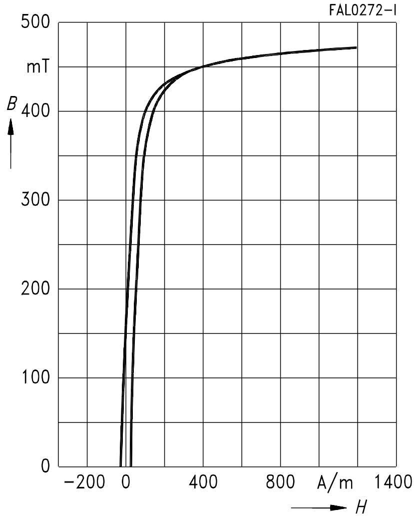
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0,25$ mT)



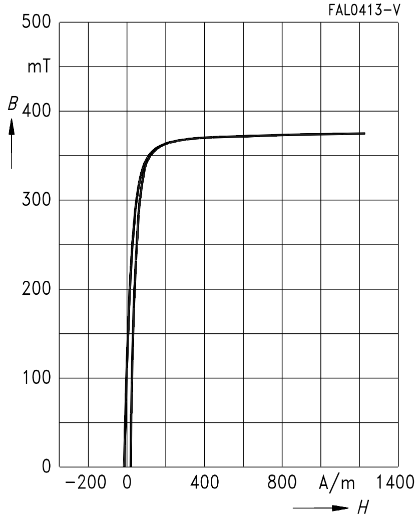
Amplitude permeability versus AC field
flux density
(measured with ungapped E cores)



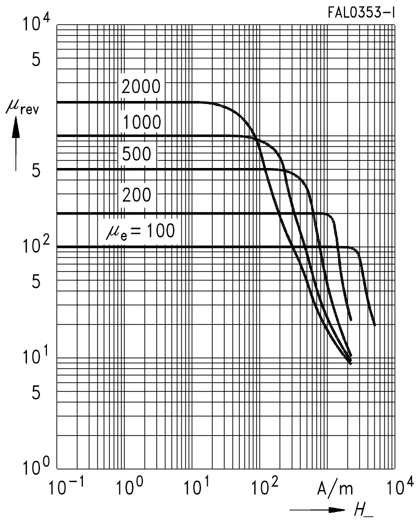
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



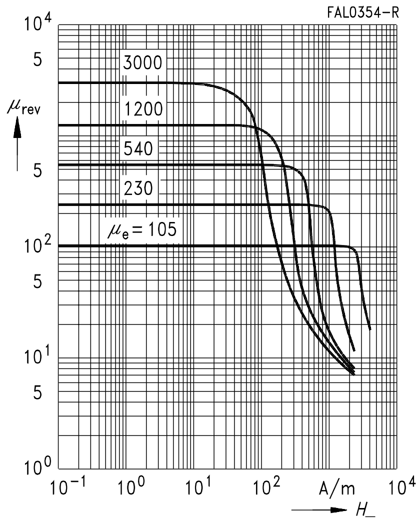
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



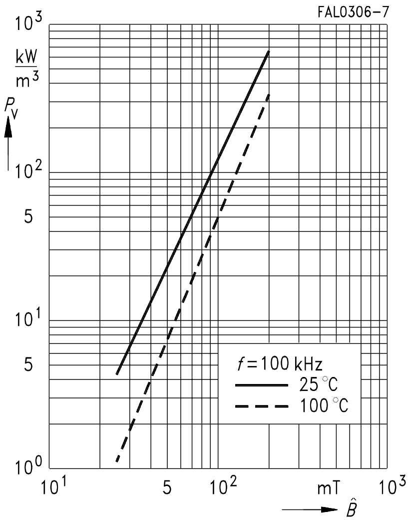
DC magnetic bias
of P, RM, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 25 ˚C)



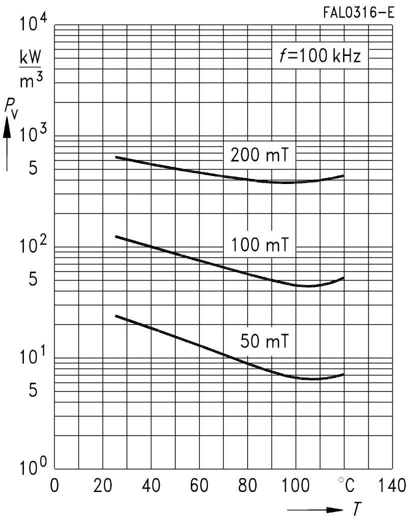
DC magnetic bias
of P, RM, PM and E cores
($\hat{B}$ ≤ 0,25 mT, f = 10 kHz, T = 100 ˚C)



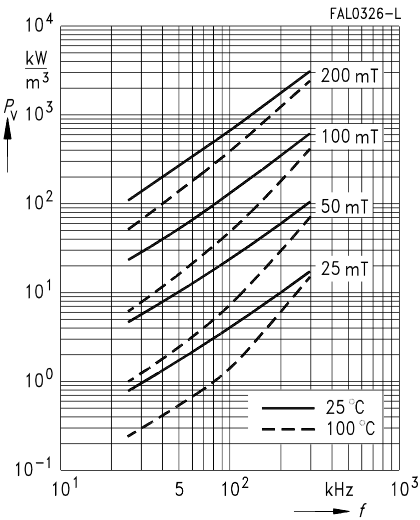
Relative core losses
versus AC field flux density
(measured with R29 ring cores)



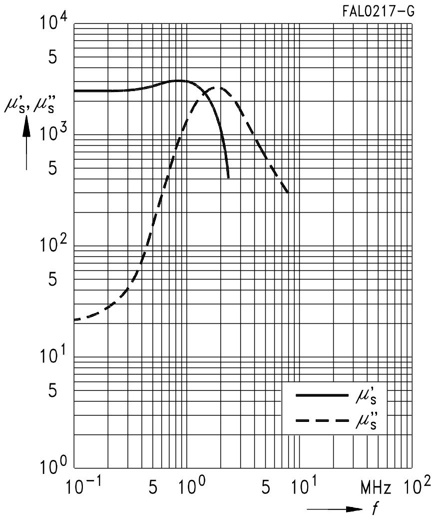
Relative core losses
versus temperature
(measured with R29 ring cores)



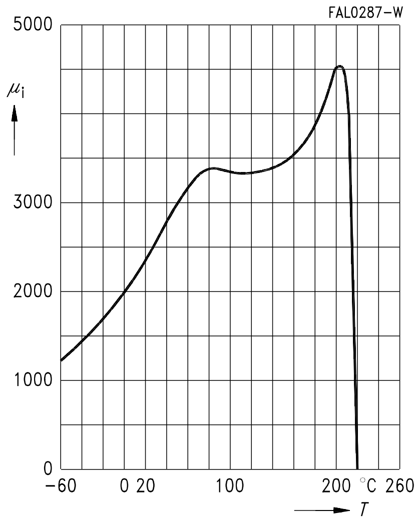
Relative core losses
versus frequency
(measured with R29 ring cores)



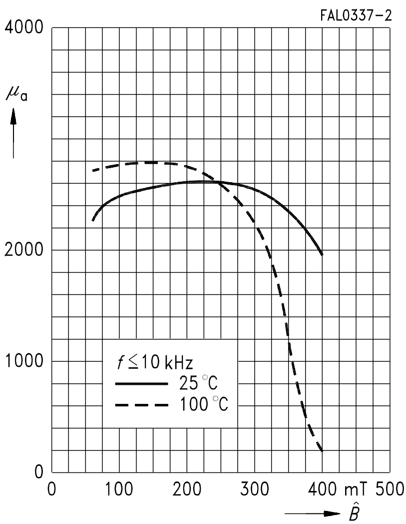
Complex permeability
versus frequency
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



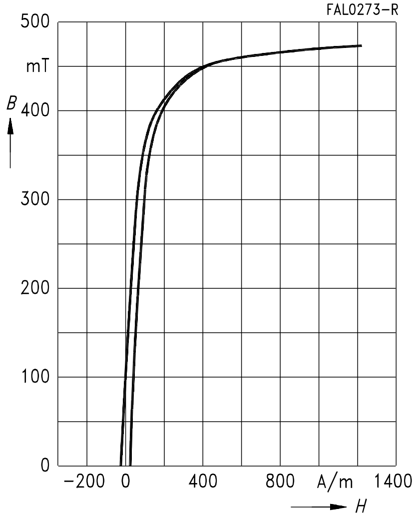
Initial permeability μ_i
versus temperature
(measured with R29 ring cores, $\hat{B} \leq 0{,}25$ mT)



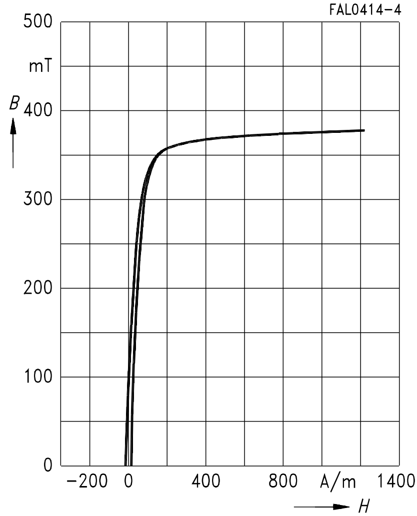
Amplitude permeability versus AC field
flux density
(measured with ungapped U cores)



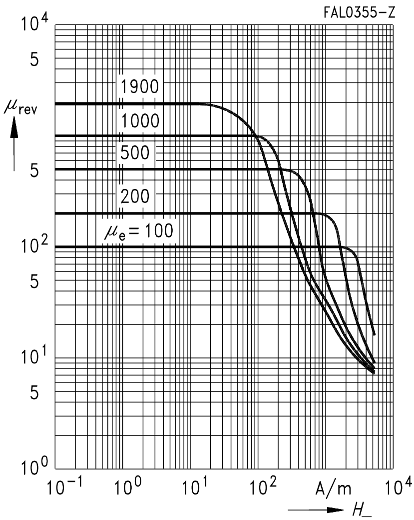
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



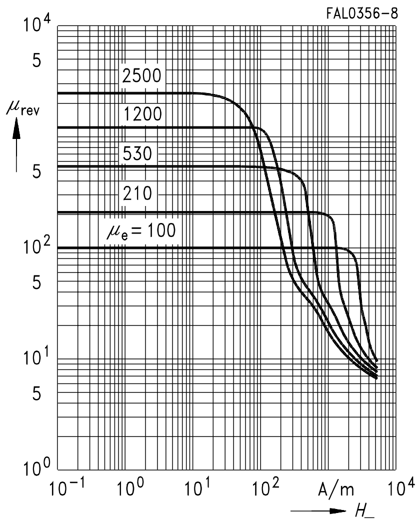
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



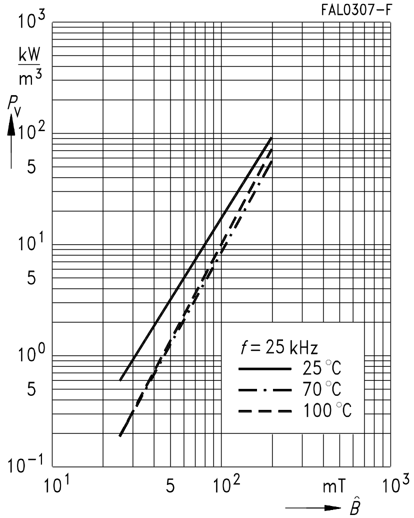
DC magnetic bias of E cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 ˚C)



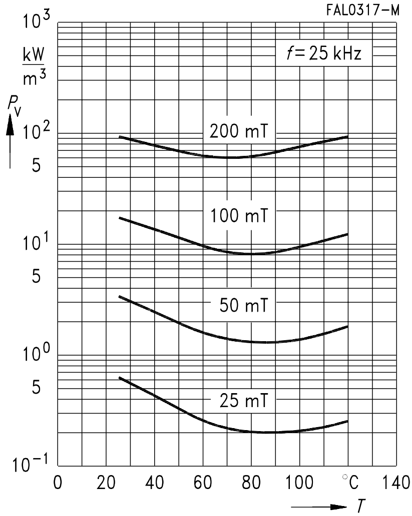
DC magnetic bias of E cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 100 ˚C)



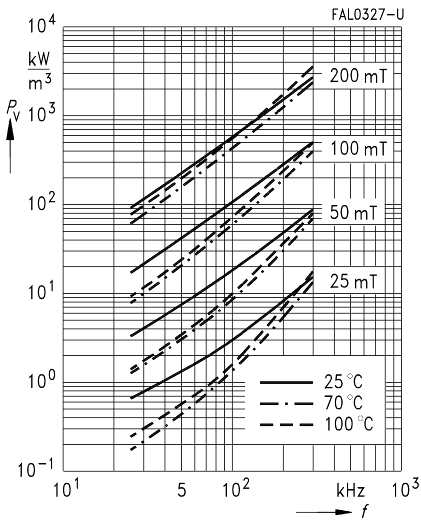
Relative core losses versus AC field flux density (measured with R29 ring cores)



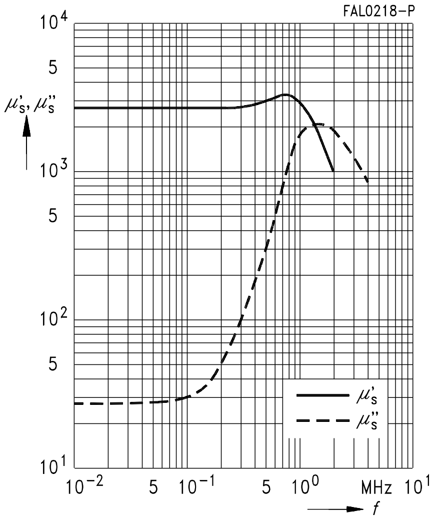
Relative core losses versus temperature (measured with R29 ring cores)



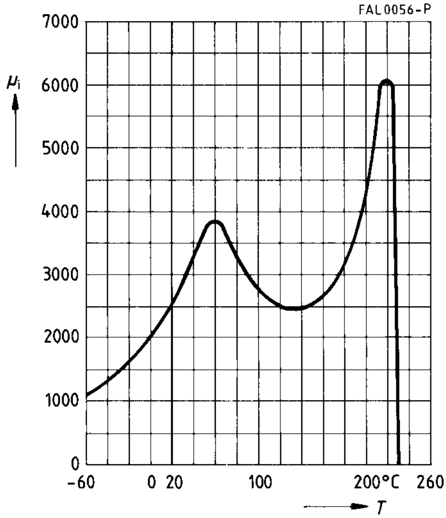
Relative core losses versus frequency (measured with R29 ring cores)



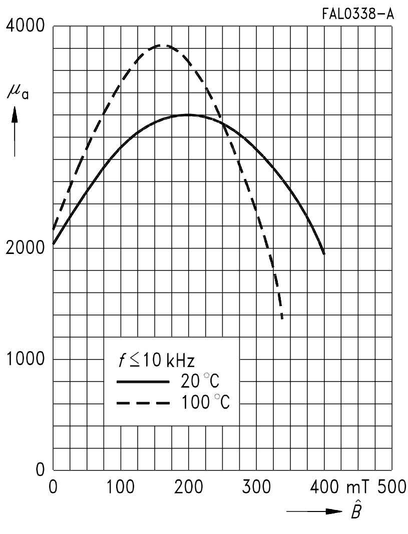
Complex permeability
versus frequency
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



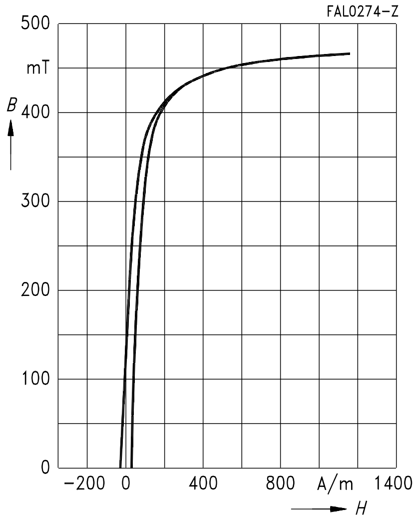
Initial permeability μ_i
versus temperature
(measured with R10 ring cores, $\hat{B} \leq 0{,}25$ mT)



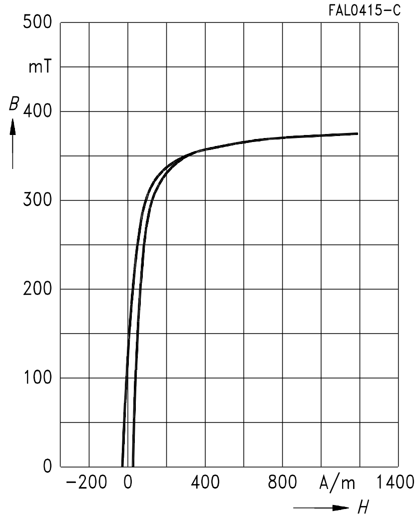
Amplitude permeability
versus AC field flux density
(measured with ungapped E cores)



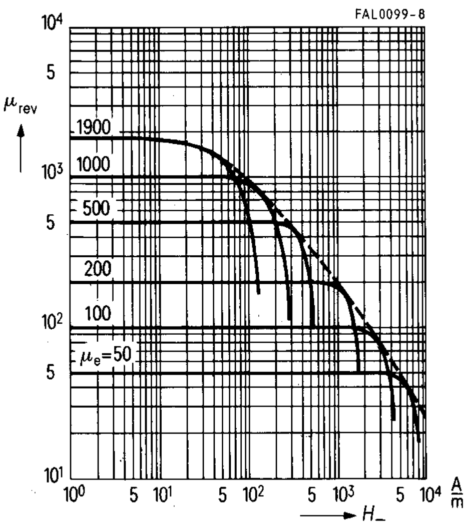
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 25 ˚C)



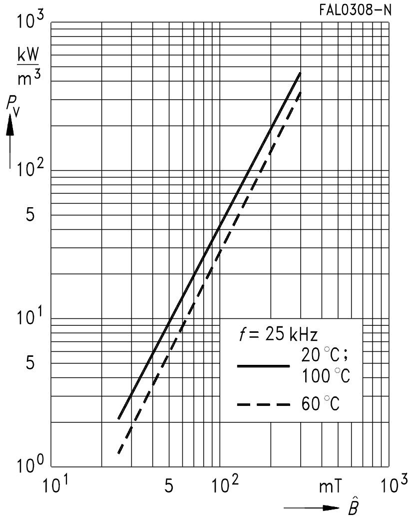
Dynamic magnetization curves
(typical values)
(f = 10 kHz, T = 100 ˚C)



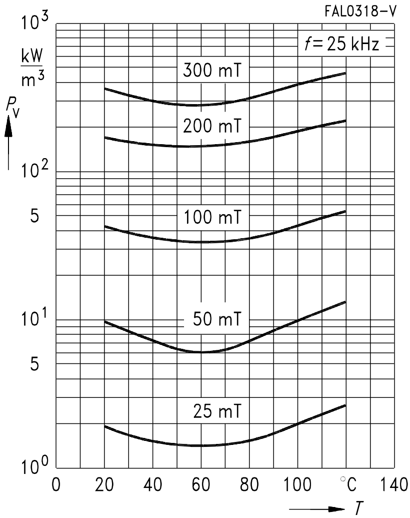
DC magnetic bias
of P and RM cores
($\hat{B} \leq$ 0,25 mT, f = 10 kHz, T = 25 ˚C)



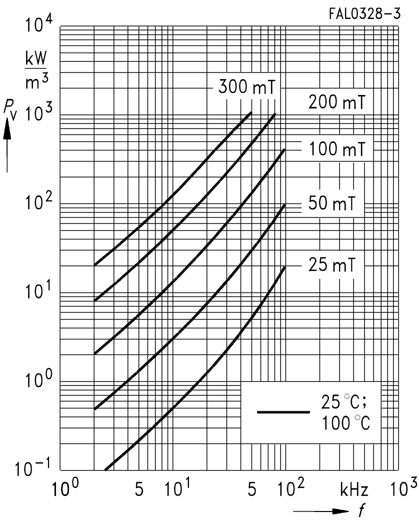
Relative core losses
versus AC field flux density
(measured with R16 ring cores)



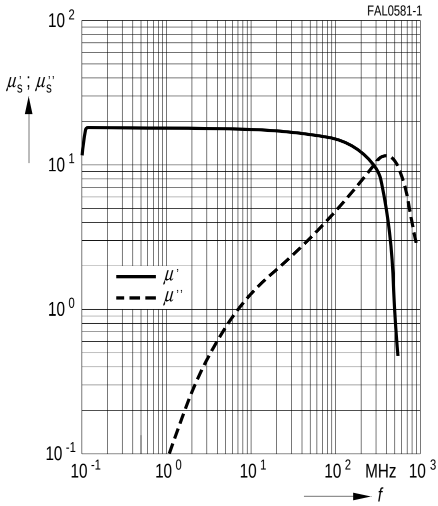
Relative core losses
versus temperature
(measured with R16 ring cores)



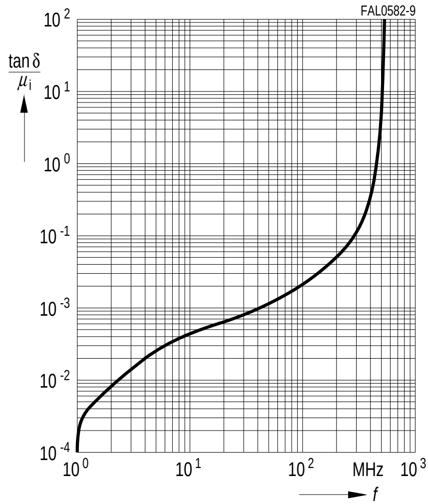
Relative core losses
versus frequency
(measured with R16 ring cores)



Complex permeability versus frequency
(measured with R20/10 ring cores, $\hat{B} \leq 0{,}25$ mT)



Relative loss factor versus frequeny
(measured with R20/10 ring cores, $\hat{B} \leq 0{,}25$ mT)



5 Plastic materials, manufacturers and UL numbers

- RM coil formers of thermosetting plastic with molded-in pins:
  Bakelite UP 3420® [E 61040 (M)], blue; Bakelite
- Pinned coil formers P9×5, P11×7, P14×8, P18×11, EP7 special coil former:
  AMC 2568® [E 48036 (M)], blue; Synres Almoco
- EP, EFD coil formers:
  Vyncolit/X611/green® [E167521 (M)]; Vyncolit
- RM, EP and EFD coil formers with post-inserted pins:
  Vyncolit/X611/green® [E167521 (M)]; Vyncolit
- RM coil formers with post-inserted pins:
  Sumikon PM 9630® [E41429 (M)]; Sumitomo Bakelite
- RM power, P, PM, E, EF, EC, ETD, ER coil formers and
  terminal carriers P7×4, P9×5, P11×7, P36×22:
  Valox 420-SE0® [E 45329 (M)], black; General Electric Plastics
  Vestodur GF30-FR1® [E66645 (M)], black; Creanova
  Crastin CE 7931® [E 69578 (M)], black; DuPont
  Pocan 4235® [E 41613 (M)], black; Bayer
  Amite TV4264SN® [E 47960 (M)], black; DSM
- Terminal carrier P4,6×4,1:
  Luvocom 1105/GF/20/EM® [---], natural; Lehmann u. Voss & Co.
- Terminal carriers P14×8, P18×11, P22×13, P26×16, P30×19:
  Pocan 4235® [E 41613 (M)], gray; Bayer
- SMD coil formers (except of ER11 coil former):
  Zenite 7130® [E 123598 (M)], black; DuPont
- ER11 SMD coil former :
  Sumika Super E4008® [E 54705 (M)], black; Sumitomo Chemical
  Zenite 7130® [E 123598 (M)], black; DuPont

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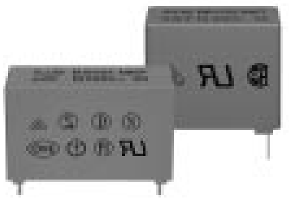

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1 Hysteresis

The special feature of ferromagnetic and ferrimagnetic materials is that spontaneous magnetization sets in below a material-specific temperature (Curie point). The elementary atomic magnets are then aligned in parallel within macroscopic regions. These so-called Weiss' domains are normally oriented so that no magnetic effect is perceptible. But it is different when a ferromagnetic body is placed in a magnetic field and the flux density *B* as a function of the magnetic field strength *H* is measured with the aid of a test coil. Proceeding from $H = 0$ and $B = 0$, the so-called initial magnetization curve is first obtained. At low levels of field strength, those domains that are favorably oriented to the magnetic field grow at the expense of those that are not. This produces what are called wall displacements. At higher field strength, whole domains overturn magnetically – this is the steepest part of the curve – and finally the magnetic moments are moved out of the preferred states given by the crystal lattice into the direction of the field until saturation is obtained, i.e. until all elementary magnets in the material are in the direction of the field. If *H* is now reduced again, the *B* curve is completely different. The relationship shown in the hysteresis loop (Fig. 1) is obtained.

1.1 Hysteresis loop

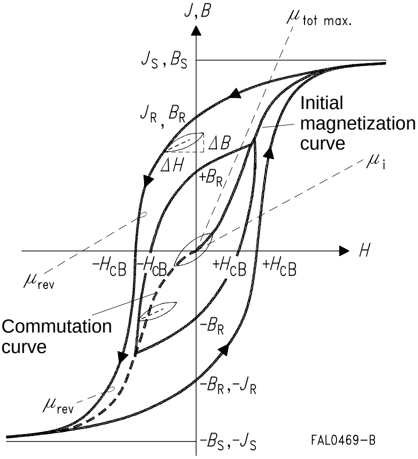


Fig. 1
Magnetization curve
(schematic)

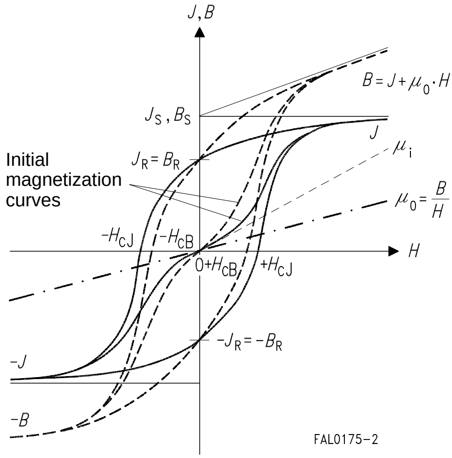


Fig. 2
Hysteresis loops for different
excitations and materials

Magnetic field strength $H = \frac{I \cdot N}{l} = \frac{\text{ampere-turns}}{\text{length in m}}$ $\left[\frac{\text{A}}{\text{m}}\right]$

Magnetic flux density $B = \frac{\phi}{A} = \frac{\text{magnetic flux}}{\text{permeated area}}$ $\left[\frac{\text{Vs}}{\text{m}^2}\right] = [\text{T(Tesla)}]$

Polarization J $' = B - \mu_0 H$ $\mu_0 \cdot H \ll J \Rightarrow B \approx J$

General relationship between B and H:

$B = \mu_0 \cdot \mu_r(H) \cdot H$ μ_0 = magnetic field constant

$\mu_0 = 1{,}257 \cdot 10^{-6} \left[\frac{Vs}{Am}\right]$

μ_r = relative permeability

In a vacuum, $\mu_r = 1$; in ferromagnetic or ferrimagnetic materials the relation $B(H)$ becomes nonlinear and the slope of the hysteresis loop $\mu_r \gg 1$.

1.2 Basic parameters of the hysteresis loop

1.2.1 Initial magnetization curve

The initial magnetization curve describes the relationship $B = \mu_r \mu_0 H$ for the first magnetization following a complete demagnetization. By joining the end points of all “sub-loops” , from $H = 0$ to $H = H_{max}$, (as shown in Figure 1), we obtain the so-called commutation curve (also termed normal or mean magnetization curve), which, for magnetically soft ferrite materials, coincides with the initial magnetization curve.

1.2.2 Saturation magnetization B_S

The saturation magnetization B_S is defined as the maximum flux density attainable in a material (i.e. for a very high field strength) at a given temperature; above this value B_S, it is not possible to further increase $B(H)$ by further increasing H.

Technically, B_S is defined as the flux density at a field strength of H = 1200 A/m. As is confirmed in the actual magnetization curves in the chapter on “Materials”, the $B(H)$ characteristic above 1200 A/m remains roughly constant (applies to all ferrites with high initial permeability, i.e. where $\mu \geq 100$).

1.2.3 Remanent flux density $B_R(H)$

The remanent flux density (residual magnetization density) is a measure of the degree of residual magnetization in the ferrite after traversing a hysteresis loop. If the magnetic field H is subsequently reduced to zero, the ferrite still has a material-specific flux density $B_R \neq 0$ (see Fig. 1: intersection with the ordinate $H = 0$).

1.2.4 Coercive field strength H_C

The flux density B can be reduced to zero again by applying a specific opposing field $-H_C$ (see Fig. 1: intersection with the abscissa $B = 0$).

The demagnetized state can be restored at any time by:

a) traversing the hysteresis loop at a high frequency and simultaneously reducing the field strength H to $H = 0$.
b) by exceeding the Curie temperature T_C.

2 Permeability

Different relative permeabilities μ are defined on the basis of the hysteresis loop for the various electromagnetic applications.

2.1 Initial permeability μ_i

$$\mu_i = \frac{1}{\mu_0} \cdot \frac{\Delta B}{\Delta H} \qquad (\Delta H \to 0)$$

The initial permeability μ_i defines the relative permeability at very low excitation levels and constitutes the most important means of comparison for soft magnetic materials. According to IEC 60401, μ_i is defined using closed magnetic circuits (e.g. a closed ring-shaped cylindrical coil) for $f \leq 10$ kHz, $B < 0{,}25$ mT, $T = 25$ °C.

2.2 Effective permeability μ_e

Most core shapes in use today do not have closed magnetic paths (Only ring, double E or double-aperture cores have closed magnetic circuits.), rather the circuit consists of regions where $\mu_i \neq 1$ (ferrite material) and $\mu_i = 1$ (air gap). Fig. 3 shows the shape of the hysteresis loop of a circuit of this type.

In practice, an effective permeability μ_e is defined for cores with air gaps.

$$\mu_e = \frac{1}{\mu_0} \frac{L}{N^2} \sum \frac{l}{A}$$

$\sum \frac{l}{A}$ = form factor

L = inductance
N = number of turns

It should be noted, for example, that the loss factor tan δ and the temperature coefficient for gapped cores reduce in the ratio μ_e/μ_i compared to ungapped cores.

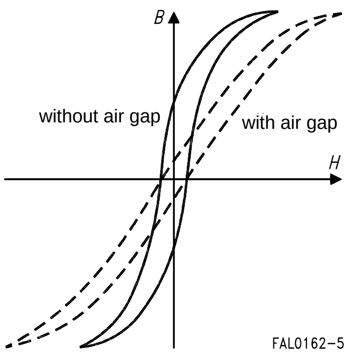


Fig. 3
Comparison of hysteresis loops for a core with and without an air gap

The following approximation applies for an air gap $s \ll l_e$:

$$\mu_e = \frac{\mu_i}{1 + \frac{s}{l_e} \cdot \mu_i}$$

s = width of air gap
l_e = effective magnetic path length

For more precise calculation methods, see for example E.C. Snelling, “Soft ferrites”, 2nd edition.

2.3 Apparent permeability μ_{app}

$$\mu_{app} = \frac{L}{L_0} = \frac{\text{inductance with core}}{\text{inductance without core}}$$

The definition of μ_{app} is particularly important for specification of the permeability for coils with tubular, cylindrical and threaded cores, since an unambiguous relationship between initial permeability μ_i and effective permeability μ_e is not possible on account of the high leakage inductances. The design of the winding and the spatial correlation between coil and core have a considerable influence on μ_{app}. A precise specification of μ_{app} requires a precise specification of the measuring coil arrangement.

2.4 Complex permeability $\overline{\mu}$

To enable a better comparison of ferrite materials and their frequency characteristics at very low field strengths (in order to take into consideration the phase displacement between voltage and current), it is useful to introduce μ as a complex operator, i.e. a complex permeability $\overline{\mu}$, according to the following relationship:

$\overline{\mu} = \mu_s' - j \cdot \mu_s''$
where, in terms of a series equivalent circuit, (see Fig. 5)
μ_s' is the relative real (inductance) component of $\overline{\mu}$
and μ'' is the relative imaginary (loss) component of $\overline{\mu}$.

Using the complex permeability $\overline{\mu}$, the (complex) impedance of the coil can be calculated:
$\overline{Z} = j\,\omega\,\overline{\mu}\,L_0$
where L_0 represents the inductance of a core of permeability $\mu_r = 1$, but with unchanged flux distribution.
(cf. also section 4.1: information on tan δ)

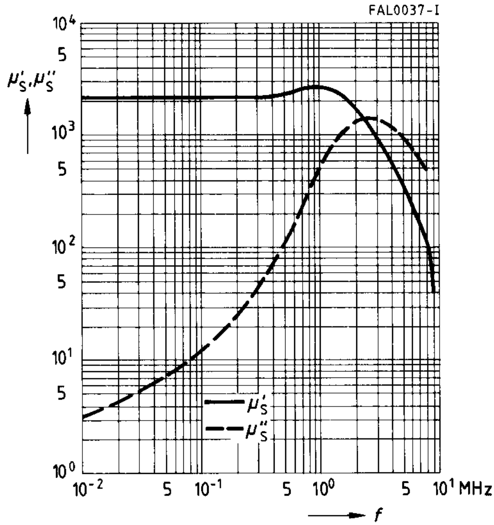


Fig. 4
Complex permeability versus frequency
(measured with R10 ring cores, N 48 material, measuring flux density $B \leq 0{,}25$ mT)

Fig. 4 shows the characteristic shape of the curves of μ_s' and μ_s'' as functions of the frequency, using N 48 material as an example. The real component μ_s' is constant at low frequencies, attains a maximum at higher frequencies and then drops in approximately inverse proportion to *f*. At the same time, μ" rises steeply from a very small value at low frequencies to attain a distinct maximum and, past this, also drops as the frequency is further increased.

The region in which μ' decreases sharply and where the μ" maximum occurs is termed the cut-off frequency f_{cutoff}. This is inversely proportional to the initial permeability of the material (Snoek's law).

2.5 Reversible permeability μ_{rev}

$$\mu_{rev} = \frac{1}{\mu_0} \cdot \lim_{\Delta H \to 0} \left(\frac{\Delta B}{\Delta H}\right)_{H\_}$$ (Permeability with superimposed DC field $H\_$)

In order to measure the reversible permeability μ_{rev}, a small measuring alternating field is superimposed on a DC field. In this case μ_{rev} is heavily dependent on $H\_$, the core geometry and the temperature.

Important application areas for DC field-superimposed, i.e. magnetically biased coils are broadband transformer systems (feeding currents with signal superimposition) and power engineering (shifting the operating point) and the area known as “nonlinear chokes” (cf. chapter on RM cores). For the magnetic bias curves as a function of the excitation $H_{\_}$ see the chapter on “SIFERRIT materials”.

2.6 Amplitude permeability μ_a, A_{L1} value

$$\mu_a = \frac{\hat{B}}{\mu_0 \hat{H}}$$ (Permeability at high excitation)

$\hat{B}$ = peak value of flux density
$\hat{H}$ = peak value of field strength

For frequencies well below cut-off frequency, μ_a is not frequency-dependent but there is a strong dependence on temperature. The amplitude permeability is an important definition quantity for power ferrites. It is defined for specific core types by means of an A_{L1} value for $f \leq 10$ kHz, $B = 320$ mT (or 200 mT), $T = 100$ ˚C.

$$A_{L1} = \frac{\mu_0 \cdot \mu_a}{\sum \frac{l}{A}}$$

3 Magnetic core shape characteristics

Permeabilities and also other magnetic parameters are generally defined as material-specific quantities. For a particular core shape, however, the magnetic data are influenced to a significant extent by the geometry. Thus, the inductance of a slim-line ring core coil is defined as:

$$L = \mu_r \cdot \mu_0 \cdot N^2 \cdot \frac{A}{l}$$

Due to their geometry, soft magnetic ferrite cores in the field of such a coil change the flux parameters in such a way that it is necessary to specify a series of effective core shape parameters in each data sheet. The following are defined:

l_e effective magnetic length
A_e effective magnetic cross section
A_{min} min. magnetic cross section of the core
(required to calculate the max. flux density)
$V_e = A_e \cdot l_e$ effective magnetic volume

With the aid of these parameters, the calculation for ferrite cores with complicated shapes can be reduced to the considerably more simple problem of an imaginary ring core with the same magnetic properties. The basis for this is provided by the methods of calculation according to IEC 60205, 60205A and 60205B, which allow the following factors $\Sigma l/A$ and A_L to be calculated:

3.1 Form factor

$$\sum \frac{l}{A} = \frac{l_e}{A_e}$$

The inductance L can then be calculated as follows:

$$L = \frac{\mu_e \cdot \mu_0 \cdot N^2}{\sum \frac{l}{A}}$$

where μ_e denotes the effective permeability or another permeability μ_{rev} or μ_a (or μ_i for cores with a closed magnetic path) adapted for the B/H range in question.

3.2 Inductance factor, A_L value

$$A_L = \frac{L}{N^2} = \frac{\mu_e \cdot \mu_0}{\sum \frac{l}{A}}$$

A_L is the inductance referred to number of turns = 1. Therefore, for a defined number of turns N:

$$L = A_L \cdot N^2$$

3.3 Tolerance code letters

The tolerances of the A_L are coded by the letters in the third block of the ordering code in conformity with IEC 60062.

Code letter	Tolerance of A_L value	Code letter	Tolerance of A_L value
A	± 3%	M	± 20%
G	± 2%	Q	+ 30/– 10%
J	± 5%	R	+ 30/– 20%
E	± 7%	U	+ 80/– 0%
K	± 10%	X	filling letter
L	± 15%	Y	+ 40/– 30%

The tolerance values available are given in the individual data sheets.

4 Definition quantities in the small-signal range

4.1 Loss factor tan δ

Losses in the small-signal range are specified by the loss factor tan δ.

Based on the impedance $\overline{Z}$ (cf. also section 2.4), the loss factor of the core in conjunction with the complex permeability $\overline{\mu}$ is defined as

$$tan\delta_s = \frac{\mu_s''}{\mu_s'} = \frac{R_s}{\omega L_s} \qquad \text{and} \qquad tan\delta_p = \frac{\mu_p''}{\mu_p'} = \frac{\omega \cdot L_p}{R_p}$$

where R_s and R_p denote the series and parallel resistance and L_s and L_p the series and parallel inductance respectively.

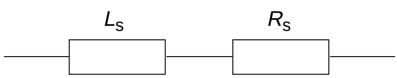


Fig. 5
Lossless series inductance L_s with loss resistance R_s resulting from the core losses.

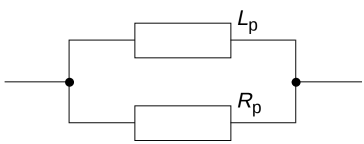


Fig. 6
Lossless parallel inductance L_p with loss resistance R_p resulting from the core losses.

From the relationships between series and parallel circuits we obtain:

$$\mu'_p = \mu'_s \cdot (1 + (tan\delta)^2)$$

$$\mu''_p = \mu''_s \cdot \left(1 + \left(\frac{1}{\tan\delta}\right)^2\right)$$

4.2 Relative loss factor tan δ/μ_i

In gapped cores the material loss factor tan δ is reduced by the factor μ_e/μ_i. This results in the relative loss factor tan δ_e (cf. also section 2.2):

$$tan\delta_e = \frac{tan\delta}{\mu_i} \cdot \mu_e$$

The table of material properties lists the relative loss factor tan δ/μ_i. This is determined in accordance with IEC 60401 at f = 10 kHz, B = 0,25 mT, T = 25 ˚C.

4.3 Quality factor Q

The ratio of reactance to total resistance of an induction coil is known as the quality factor *Q.*

$$Q = \frac{\omega L}{R_L} = \frac{\text{reactance}}{\text{total resistance}}$$

The total quality factor Q is the reciprocal of the total loss factor tan δ of the coil; it is dependent on the frequency, inductance, temperature, winding wire and permeability of the core.

4.4 Hysteresis loss resistance R_h and hysteresis material constant η_B

In transformers, in particular, the user cannot always be content with very low saturation. The user requires details of the losses which occur at higher saturation, e.g. where the hysteresis loop begins to open.

Since this hysteresis loss resistance R_h can rise sharply in different flux density ranges and at different frequencies, it is measured in accordance with IEC 60401 for μ_i values greater than 500 at B_1 = 1,5 and B_2 = 3 mT (ΔB = 1,5 mT), a frequency of 10 kHz and a temperature of 25 °C (for μ_i < 500: f = 100 kHz). The hysteresis loss factor tan δ_h can then be calculated from this.

$$tan\delta_h = \frac{R_h}{\omega \cdot L} = tan\delta(B_2) - tan\delta(B_1)$$

For the hysteresis material constant η_B we obtain:

$$\eta_B = \frac{tan\delta_h}{\mu_e \cdot \Delta \hat{B}}$$

The hysteresis material constant, η_B, characterizes the material-specific hysteresis losses and is a quantity independent of the air gap in a magnetic circuit.

The hysteresis loss factor of an inductor can be reduced, at a constant flux density, by means of an (additional) air gap

$$tan\delta_h = \eta_B \cdot \Delta \hat{B} \cdot \mu_e$$

For further details on the measurement techniques see IEC 60367-1.

5 Definition quantities in the high-excitation range

While in the small-signal range ($H \leq H_c$), i.e. in filter and broadband applications, the hysteresis loop is generally traversed only in lancet form (Fig. 2), for power applications the hysteresis loop is driven partly into saturation. The defining quantities are then

μ_{rev} reversible permeability in the case of superimposition with a DC signal (operating point for power transformers)

μ_a amplitude permeability and

P_V core losses.

5.1 Core losses P_V

The losses of a ferrite core or core set P_V is proportional to the area of the hysteresis loop in question. It can be divided into three components:

$$P_V = P_{V,\,hysteresis} + P_{V,\,eddycurrent} + P_{V,\,residual}$$

Owing to the high specific resistance of ferrite materials, the eddy current losses in the frequency range common today (1 kHz - 2 MHz) may be practically disregarded except in the case of core shapes having a large cross-sectional area.

The power loss P_V is a function of the temperature T, the frequency f, the flux density B and is of course dependent on ferrite material and core shape.

The temperature dependence can generally be approximated by means of a third-order polynomial, while

$$P_V(f) \sim f^{(1+x)} \qquad 0 \leq x \leq 1$$

applies for the frequency dependence and

$$P_V(B) \sim B^{(2+y)} \qquad 0 \leq y \leq 1$$

for the flux density dependence. The coefficients x and y are dependent on core shape and material, and there is a mutual dependence between the coefficients of the definition quantity (e.g. T) and the relevant parameter set (e.g. f, B).

In the case of cores which are suitable for power applications, the total core losses P_V are given explicitly for a specific frequency f, flux density B and temperature T in the relevant data sheets.

When determining the total power loss for an inductive component, the winding losses must also be taken into consideration in addition to the core-specific losses.

$$P_{V\,tot} = P_{V\,core} + P_{V\,winding}$$

where, in addition to insulation conditions in the given frequency range, skin effect and proximity effect must also be taken into consideration for the winding.

5.2 Performance factor ($PF = f \cdot B_{max}$)

The performance factor is a measure of the maximum power which a ferrite can transmit, whereby it is generally assumed that the loss does not exceed 300 kW/m^3. Heat dissipation values of this order are usually assumed when designing small and medium-sized transformers. Increasing the performance factor will either enable an increase of the power that can be transformed by a core of identical design, or a reduction in component size if the transformed power is not increased.

If the performance factors of different power transformer materials are plotted as a function of frequency, only slight differences are observed at low frequencies (< 300 kHz), but these differences become more pronounced with increasing frequency. This diagram can be used to determine the optimum material for a given frequency range (for diagram see page 47) .

6 Influence of temperature

6.1 $\mu(T)$ curve, Curie temperature T_C

The initial permeability μ_i as a function of T is given for all materials (see chapter on SIFERRIT materials). Important parameters for a $\mu(T)$ curve are the position of the **s**econdary **p**ermeability **m**aximum (SPM) and the Curie temperature. Minimum losses occur at the SPM temperature.

Above the Curie temperature T_C ferrite materials lose their ferrimagnetic properties, i.e. μ_i drops to $\mu_i = 1$. This means that the parallel alignment of the elementary magnets (spontaneous magnetization) is destroyed by increasing thermal activation. This phenomenon is reversible, i.e. when the temperature is reduced below T_C again, the ferrimagnetic properties are restored.

6.2 Temperature coefficient of permeability α

By definition the temperature coefficient α represents a straight line of average gradient between the reference temperatures T_1 and T_2. If the $\mu(T)$ curve is approximately linear in this temperature range, this is a good approximation; in the case of heavily pronounced maxima, as occur particularly with highly permeable broadband ferrites, however, this is less true. The following applies:

$$\alpha = \frac{\mu_{i2} - \mu_{i1}}{\mu_{i1}} \cdot \frac{1}{T_2 - T_1}$$

μ_{i1} = initial permeability μ_i at T_1 = 25 ˚C
μ_{i2} = the initial permeability μ_i associated with the temperature T_2

6.3 Relative temperature coefficient α_F

$$\alpha_F = \frac{\alpha}{\mu_i} = \frac{\mu_{i2} - \mu_{i1}}{\mu_{i2} \cdot \mu_{i1}} \cdot \frac{1}{T_2 - T_1}$$

In a magnetic circuit with an air gap and the effective permeability μ_e the temperature coefficient is reduced by the factor μ_e/μ_i (cf. also section 2.4).

6.4 Permeability factor

The first factor in the equation for determining the relative temperature coefficient $\frac{\mu_{i2} - \mu_{i1}}{\mu_{i2} \cdot \mu_{i1}}$ is known as the permeability factor.

In the case of SIFERRIT materials for resonant circuits, the temperature dependence of the permeability factor can be seen from the relevant diagram.

6.5 Effective temperature coefficient α_e

$$\alpha_e = \frac{\mu_e}{\mu_i} \cdot \alpha$$

In the case of the ferrite materials for filter applications, the α/μ_i values for the ranges 25 ... 55˚C and 5 .... 25˚C are given in the table of material properties.

The effective permeability μ_e is required in order to calculate α_e; therefore this is given for each core in the individual data sheets.

6.6 Relationship between the change in inductance and the permeability factor

The relative change in inductance between two temperature points can be calculated as follows:

$$\frac{L_2 - L_1}{L_1} = \frac{\alpha}{\mu_i} \cdot (T_2 - T_1) \cdot \mu_e$$

$$\frac{L_2 - L_1}{L_1} = \frac{\mu_{i2} - \mu_{i1}}{\mu_{i2} \cdot \mu_{i1}} \mu_e$$

6.7 Temperature dependence of saturation magnetization

The saturation magnetization B_S drops monotonically with temperature and at T_C has fallen to B_S = 0 mT. The drop for B_S(25˚C) and B_S(100˚C), i.e. the main area of application for the ferrites, can be taken from the table of material properties.

6.8 Temperature dependence of saturation-dependent permeability (amplitude permeability)

It can be seen from the $\mu_a(B)$ curves for the different materials that μ_a exhibits a more pronounced maximum with increasing temperature and drops off sooner on account of decreasing saturation.

7 Disaccommodation

Ferrimagnetic states of equilibrium can be influenced by mechanical, thermal or magnetic changes (shocks). Generally, an increase in permeability occurs when a greater mobility of individual magnetic domains is attained through the external application of energy. This state is not temporally stable and returns logarithmically with time to the original state.

7.1 Disaccommodation coefficient *d*

$$d = \frac{\mu_{i1} - \mu_{i2}}{\mu_{i1} \cdot (\lg t_2 - \lg t_1)}$$

where μ_{i1} = permeability at time t_1
μ_{i2} = permeability at time t_2 and $t_2 > t_1$

7.2 Disaccommodation factor *DF*

$$DF = \frac{d}{\mu_{i1}}$$

Accordingly, a change in inductance can be calculated with the aid of *DF*:

$$\frac{L_1 - L_2}{L_1} = DF \cdot \mu_e \cdot log\frac{t_2}{t_1}$$

8 General mechanical, thermal, electrical and magnetic properties of ferrites

Typical figures for the mechanical and thermal properties of ferrites

Tensile strength	approx. 30 MPa/mm^2
Compressive strength	approx. 800 MPa/mm^2
Vickers hardness HV_{15}	approx. 600 MPa/mm^2
Modulus of elasticity	approx. 150000 N/mm^2
Fracture toughness K_{1c}	approx. 0,8 ... 1,1 MPam$^{1/2}$
Thermal conductivity	approx. 4 ... 7·10^{-3} J/mm·s·K
Coefficient of linear expansion	approx. 7 ... 10 ·10^{-6} 1/K
Specific heat	approx. 0,7 J/g·K

8.1 Mechanical stability

If one wishes to describe the mechanical properties or stability of a ferrite core, the best method is to consider the general properties of ceramic bodies.

As is the case with any ceramic, the ferrite core is brittle and sensitive to any shock, bending or tensile load. Therefore its resistance to temperature change (e.g. in an ultrasonic bath) is restricted, as is shown by the following diagrammatic analysis of a thermal shock test.

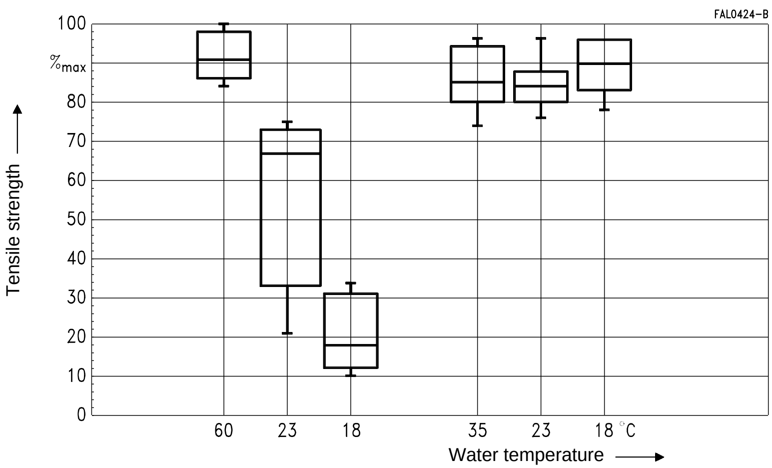


Fig. 7
Tensile strength distribution for ferrite core, resistance to temperature change
box diagram: the respective maximum and minimum values for the tensile strength (vertical lines) at each bath temperature can be seen, 50% of the values for the tensile strength lie within the box, with 25 % above and 25 % below in each case. The horizontal line in the box gives the median.

As can be seen from the illustration, the tensile strength of the cores under test falls to about 10 to 15 % of the initial maximum value in the first test cycle (60 °C → 23 °C → 18 °C). The reason for this behavior lies in the stresses produced in the core as a result of the high cooling rate (medium: water). These stresses are relieved through the formation of cracks in the core material. The tensile strength of the core is thus dramatically reduced. These events are represented in the following relation:

$$\sigma_T = \alpha \cdot \Delta T \frac{E_0}{1 + 2\pi N l^2}$$

σ_T Actual effective stress
α Coefficient of thermal expansion (7 … 12 · 10^{-6} 1/K)
E_0 Modulus of elasticity
N Number of temperature changes
l Crack length

In order to quantify the brittleness of a ferrite core, a fracture mechanism quantity must first be found which is also a material property. This quantity is the fracture toughness. It is the quantity which indicates the order of stress magnitude in the core at which a subcritical fracture growth becomes unstable. This relationship is represented in the following

$$K_1 \geq K_{1C} \quad \text{with} \quad K_1 = \sigma\sqrt{l}Y \quad \text{and} \quad K_{1C} = \sqrt{G_C E}$$

K_1 Stress intensity factor
K_{1C} Fracture toughness
Y Factor for fracture/sample geometry
G_C Critical fracture area energy
E E modulus

The K_{1C} value – determined by indentation testing – can be regarded as the desired measure of the brittleness of a material. A typical value for fracture toughness can be obtained from the table on page 123.

8.2 Stress sensitivity of magnetic properties

Stresses in the core affect not only the mechanical but also the magnetic properties. It is apparent that the initial permeability is dependent on the stress state of the core. With

$$\mu_i \cong \frac{1}{\frac{1}{\mu_{io}} + k \cdot \sigma_T}; \qquad k \approx 30 \cdot 10^{-6} \cdot \frac{1}{\text{MPa}}$$

where μ_{io} is the initial permeability of the unstressed material, it can be shown that the higher the stresses are in the core, the lower is the value for the initial permeability. Embedding the ferrite cores (e.g. in plastic) can induce these stresses. A permeability reduction of up to 50% and more can be observed, depending on the material. In this case, the embedding medium should have the greatest possible elasticity.

8.3 Magnetostriction

Linear magnetostriction is defined as the relative change in length of a magnetic core under the influence of a magnetic field. The greatest relative variation in length $\lambda = \Delta l/l$ occurs at saturation magnetization. The values of the saturation magnetostriction (λ_s) of our ferrite materials are given in the following table (negative values denote contraction).

SIFFERIT material	K 12	K 1	N 48
λ_s in 10^{-6}	– 21	– 18	– 1,5

Magnetostrictive effects are of significance principally when a coil is operated in the frequency range < 20 kHz and then undesired audible frequency effects (distortion etc.) occur.

8.4 Resistance to radiation

SIFERRIT materials can be exposed to the following radiation without significant variation ($\Delta L/L \leq 1\%$ for ungapped cores):

gamma quanta:	10^9 rad
quick neutrons	$2 \cdot 10^{20}$ neutrons/m^2
thermal neutrons	$2 \cdot 10^{22}$ neutrons/m^2

8.5 Resistivity ρ, dielectric constant ε

At room temperature, ferrites have a resistivity in the range 1 Ωm to 10^5 Ωm; this value is usually higher at the grain boundaries than in the grain interior. The temperature dependence of the core resistivity corresponds to that of a semiconductor:

$$\rho \sim e^{\frac{E_a}{k \cdot T}}$$

E_a Activation energy (0,1 ... 0,5 eV)
k Boltzmann constant
T Absolute temperature [K]

Thus the resistivity at 100 ˚C is one order of magnitude less than at 25 ˚C, which is significant, particularly in power applications, for the magnitude of the eddy-current losses.

Similarly, the resistivity decreases with increasing frequency.

Example: Material N 48

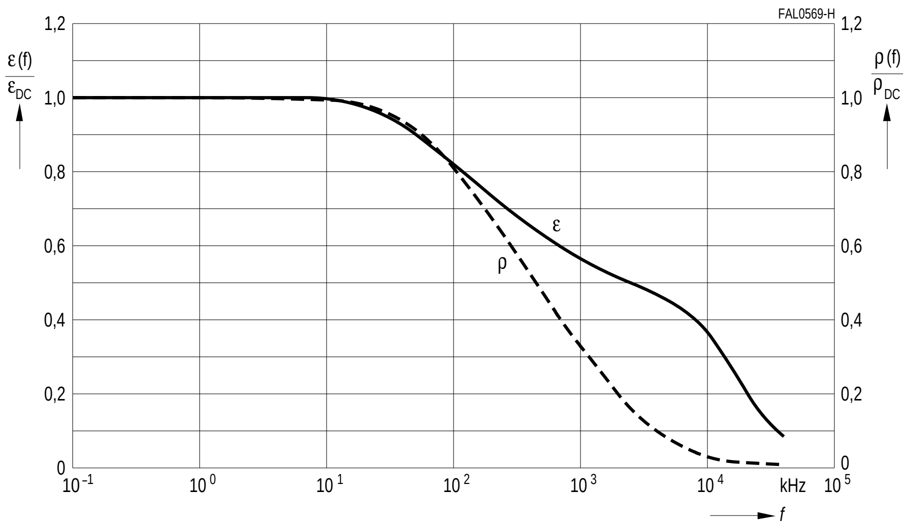


Fig. 8
Resistivity and dielectric constant versus frequency

The different resistivity values for grain interior and grain boundary result in high (apparent) dielectric constants ε at low frequencies. The dielectric constant ε for all ferrites falls to values around 10 … 20 at very high frequencies. NiZn ferrites already reach this value range at frequencies around 100 kHz.

SIFFERIT material	Resistivity (approx.) Ωm	Dielectric constant ε at (approximate values) 10 kHz	100 kHz	1 MHz	100 MHz	300 MHz
K1 (NiZn)	10^5	30	15	12	11	11
N 48 (MnZn)	1	$140 \cdot 10^3$	$115 \cdot 10^3$	$80 \cdot 10^3$		

Magnetostrictive effects are of significance principally when a coil is operated in the frequency range < 20 kHz and then undesired audible frequency effects occur.

9 Coil characteristics

Resistance factor A_R

The resistance factor A_R, or A_R value, is the DC resistance R_{Cu} per unit turn, analogous to the A_L value.

$$A_R = \frac{R_{Cu}}{N^2}$$

When the A_R value and number of turns N are given, the DC resistance can be calculated from $R_{CU} = A_R\ N^2$.

From the winding data etc. the A_R value can be calculated as follows:

$$A_R = \frac{\rho \cdot l_N}{f_{Cu} \cdot A_N}$$

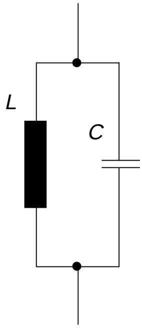
where ρ = resistivity (for copper: 17,2 μΩ mm), l_N = average length of turn in mm, A_N = cross section of winding in mm², f_{Cu} = copper space factor. If these units are used in the equation, the A_R value is obtained in $\mu\Omega = 10^{-6}\ \Omega$.

For coil formers, A_R values are given in addition to A_N and l_N. They are based on a copper filling factor of f_{Cu} = 0,5. This permits the A_R value to be calculated for any filling factor f_{Cu}:

$$A_{R(f_{Cu})} = A_{R(0,5)} \cdot \frac{0{,}5}{f_{Cu}}$$

1 Cores for filter applications

1.1 Gapped cores for filter/resonant circuits



Basic requirements:

- low tan δ
- close tolerance for A_L value
- close tolerance for temperature coefficient
- low disaccommodation factor *DF*
- wide adjustment range

Gapped cores are therefore always used in high quality circuits (for materials see application survey, page 34).

In the case of small air gaps (max. 0,2 mm) the air gap can be ground into only one core half. In this case the half with the ground air gap bears the stamp. The other half is blank.

The air gap enables the losses in the small-signal area and the temperature coefficient to be reduced by a factor of μ_e/μ_i in the small-signal area. More important, however, is that close A_L value tolerances can be achieved.

The rated A_L values for cores with ground air gap can be obtained from the individual data sheets. The data for the individual cores also include the effective permeability μ_e used to approximately determine the effective loss factor tan δ_e and the temperature coefficient of the effective permeability α_e from the ring core characteristics (see table of material properties).

It should be noted at this point that in cores with a larger air gap the stray field in the immediate vicinity of the air gap can cause additional eddy current losses in the copper winding. If the coil quality must meet stringent requirements, it is therefore advisable to wind several layers of polystyrene, nylon tape or even FPC film under the wire in the part of the winding that is in the proximity of the air gap; with a 3-section coil former this would be the part of the center section near the air gap.

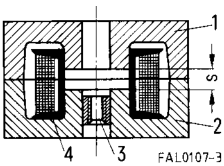


Fig. 9
Schematic drawing showing the construction of a P or RM core set with a total air gap *s*, comprising 2 core halves (1 and 2), threaded part (3) and padded winding (4)

1.2 P and RM cores with threaded sleeves

P and RM cores are supplied with a glued-in threaded sleeve. S+M Components uses automatic machines featuring high reliability in dosing of the adhesive and in positioning the threaded sleeve in the core.

The tight fit of the threaded sleeve is regularly checked – including a humid atmosphere of 40 ˚C/93 % r.h. (in accordance with IEC 60068-2-3) over 4 days – and also by periodic tests over 3 weeks. The usual bonding strengths of 20 N for ∅ 2 mm holes (e.g. for P 11 × 7, RM 5) and 30 N for ∅ 3 mm holes (e.g. for P 14 × 11, RM 6) are greatly exceeded, reaching an average of > 100 N. The threaded sleeve is continuously checked for proper centering. Overall, the controlled automated procedure guarantees higher reliability than manual gluing with its unavoidable inadequacies. Owing to the porosity of the ferrite, tension of the ferrite structure due to hardened adhesive that has penetrated cannot always be avoided. Hence, the relative temperature coefficient α_F may be increased by approximately $0{,}2 \cdot 10^{-6}$/K.

1.3 Inductance adjustment

Inductance adjustment curves are included in the individual data sheets for P and RM cores. These represent typical values. The indicated percentage change in inductance is referred to *L* (inductance without adjusting screw). For adjustment the air gap is bridged with a cylindrical or threaded core. Consequently, only gapped cores permit adjustment.

The combinations of gapped cores and adjusting screws recommended in the data sheets ensure a sufficient range of adjustment at stable adjustment conditions.

Suitable plastic adjusting tools are also listed in the data sheets.

1.4 Typical calculation of a resonant circuit inductor

The following example serves to illustrate the dependencies to be considered when designing a resonant circuit inductor:

A SIFERRIT pot core inductor is required with an inductance of L = 640 µH and a minimum quality factor Q = 400 ($\tan \delta_L = 1/Q = 2{,}5 \cdot 10^{-3}$) for a frequency of 500 kHz. The temperature coefficient α_e of this inductor should be $100 \cdot 10^{-6}$/K in the temperature range + 5 to + 55 ˚C.

a) Choice of material

According to the table of material properties and the $\tan \delta/\mu_i$ curves (see chapter "SIFERRIT materials") the material M 33, for example, can be used for 500 kHz.

b) Choice of A_L value

The Q and temperature coefficient requirements demand a gapped pot core. The relative temperature coefficient α_F of SIFERRIT M 33 according to the table of material properties is on average about $1{,}6 \cdot 10^{-6}$/K. Since the required α_e value of the gapped P core should be about $100 \cdot 10^{-6}$/K, the effective permeability is

$$\alpha_F = \frac{\alpha_e}{\mu_e} \quad \Rightarrow \quad \mu_e = \frac{\alpha_e}{\alpha/\mu_i} = 100 \cdot 10^{-6}/\mathrm{K} \cdot \frac{1}{1{,}6 \cdot 10^{-6}/\mathrm{K}} = 62{,}5$$

With pot core P 18 × 11 (B65651): μ_e = 47,9 for A_L = 100 nH.
With pot core P 22 × 13 (B65661): μ_e = 39,8 for A_L = 100 nH.

c) Choice of winding material

RF litz wire 20×0,05 with single natural silk covering is particularly suitable for frequencies around 500 kHz. The overall diameter of the wire including insulation of 0,367 mm and the average resistivity of 0,444 Ω/m are obtained from the litz-wire table (refer to pertinent standard). It is recommended that the actual overall diameter always be measured, and this value used for the calculation.

d) Number of turns and type of core

For an A_L value of 100 nH and an inductance of 640 µH the equation $N = (L/A_L)^{1/2}$ yields 80 turns. The nomogram for coil formers on page 154 shows that for a wire with an external diameter of 0,367 mm the two-section former for core type P 18 × 11 80 can easily take 80 turns. This type can therefore be used with a two-section former.

e) Length of wire and DC resistance

The length of an average turn l_N on the above former is 35,6 mm. The length of litz wire necessary for the coil is therefore 80 · 35,6 mm = 2848 mm plus say 2 · 10 cm for the connections, giving a total length of 3,04 m. The average resistivity of this wire is 0,444 Ω/m; the total DC resistance is thus 3,04 m · 0,444 Ω/m ≈ 1,35 Ω. It should be noted that the length of an average turn l_N given in the individual data sheets always refers to the fully wound former. If the former is not fully wound, the length of an average turn must be corrected according to the extent of the winding.

f) Quality test

The mathematical calculation of the total loss, i.e. the losses of the core and windings is very laborious and only approximate. At the specified frequency of 500 kHz considerable dielectric and eddy-current losses occur. The quality is therefore checked on a sample coil wound as specified above, in this case the value being about 550 as shown in the Q factor characteristics for P 18 × 11 in the data sheet.

g) Checking the temperature coefficient

The core P 18 × 11 with A_L = 100 nH has an effective permeability μ_e = 47,9. SIFERRIT M 33 has a relative temperature coefficient $\alpha_F \approx 1{,}6 \cdot 10^{-6}$/K; therefore the following temperature coefficient can be calculated

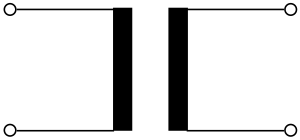
$$\alpha_e = \mu_e \cdot \alpha_F = 47{,}9 \cdot 1{,}6 \cdot 10^{-6}/\mathrm{K} = 76{,}6 \cdot 10^{-6}/\mathrm{K}$$

Actual measurement yielded $90 \cdot 10^{-6}$/K.

It should be pointed out that with pot cores the temperature coefficient of the unwound coil has almost no influence since the flux density lies primarily in the core.

For effective permeabilities $\mu_e < 80$, however, due to the influence of the winding an additional temperature coefficient of approx. $(10 \ldots 30) \cdot 10^{-6}$/K must be included in the calculation.

2 Cores for broadband transformers



General requirements:

- high A_L values (≙ high effective permeability) to restrict number of turns
- good broadband properties, i.e. high impedance up to highest possible frequencies
- low total harmonic distortion (≙ low hysteresis material constant η_B)
- low sensitivity to superimposed DC currents (≙ highest possible values for T_C and B_S)
- low tan δ for high-frequency applications

2.1 Precision-ground, ungapped cores for broadband transformers

For fields of application such as matching transformers in digital telecommunication networks, pulse signal transformers or current-compensated chokes, either cores which form a closed magnetic circuit (ring, double E or double-aperture cores) or paired core sets without air gap are used. In order to achieve the highest possible effective permeability here, these cores are precision ground with residual air gaps s ~ 1 µm. By selecting the low-profile core types, the A_L value can be further increased, and the number of turns reduced.

For this reason, RM and pot cores made of materials N 30, T 35, T 37, T 38 and T 42 are especially suitable for these applications. For high-frequency applications, N 26, M 33, K 1, K 12 and U 17 are suitable.

2.2 Fundamentals for broadband transformers in the range 10 kHz to over 1 GHz – an example

Broadband transformers are constructed primarily using closed core shapes, i.e. ring cores and double-aperture cores. Divided core designs such as P/RM cores or small E/ER cores, which allow more simple winding, are particularly suitable for transformers up to approximately 200 MHz.

The bandwidth $\Delta f = f_{oG} - f_{uG}$ (f_{oG} = upper cut-off frequency, f_{uG} = lower cut-off frequency) is considered the most important transformer characteristic.

Cut-off frequency: Frequency at which the voltage at the transformer drops by 3 dB (≙ – 30%)

The following holds true for circuit quality Q > 10 (typical value):

$$\Delta f = \frac{f_r}{R_i} \cdot \sqrt{\frac{L_H}{C_0}}$$

f_r = Resonance frequency
R_i = Internal resistance of generator (normally, R_i << loss resistance of ferrite)
L_H = Main inductance
C_0 = Winding capacitance

Transmission loss curve

$\alpha = \ln \frac{U}{U_r}$

U_r = voltage at f_r
α = attenuation when matched with line impedance (e.g. 50 Ω)

Example: 1 : 1 transformer based on E6,3/T38 with 2 ×10 turns

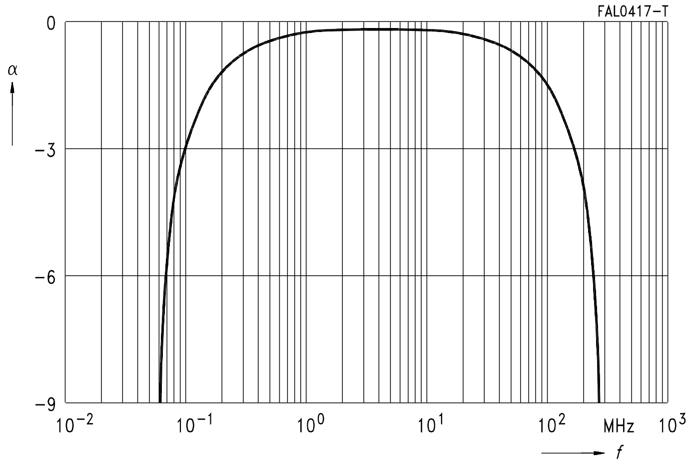


Fig. 10
Transmission loss curve for transformer E6,3/T38 with 2 ×10 turns (parallel)

2.3 Low-distortion transformers for digital data transmission (ISDN, xDSL)

The new digital transmission technologies over copper like ISDN, HDSL (high-rate digital subscriber line) and ADSL (asymmetric digital subscriber line) require very small harmonic distortion in order to maintain maximal line length. This requirement can be calculated from material parameters for the third harmonic distortion with the Rayleigh model for small-signal hysteresis (sinusoidal current).

$$k_3 = \frac{u_3}{u_1} = 0,6 \cdot tan\delta_h$$
$$= 0,6 \cdot \mu_e \cdot \eta_B \cdot \hat{B}$$

For a typical design a transformer has to be matched to a chipset via the turn ratios $N1 : N2 : N3$ …, the inductances L_1, L_2, L_3 … and the maximum dc resistances R_1, R_2, R_3 …

The third harmonic distortion for winding j can then be calculated as

$$k_3 = \frac{0,6}{\mu_0} \cdot \underbrace{\eta_B}_{\text{Material}} \cdot \underbrace{\frac{\hat{U}}{2\pi f}}_{\substack{\text{Circuit}\\\text{conditions}}} \cdot \underbrace{L_j \cdot \left[\frac{\rho}{f_{Cu}} \sum_{j=1} \left(\frac{N_j}{N_1}\right)^2 \cdot \frac{1}{R_j}\right]^{3/2}}_{\text{Design constraints}} \cdot \underbrace{\underbrace{\frac{\sum_i l_i}{l_e} \cdot \frac{l_e}{A_e^{\,2}}}_{\text{Core}} \cdot \underbrace{\frac{l_N^{\,3/2}}{A_N^{\,3/2}}}_{\text{Coil former}}}_{\text{Geometry}}$$

This equation shows the contribution of the various design parameters:

– The material is characterized by the hysteresis material constant η_B. Limit values for this parameter are given in the SIFERRIT material tables. The actual level for η_B varies for different cores. In order to select the best material for an application, the normalized temperature dependence $\eta_B(T)/\eta_B(25\ °C)$ is of great help (cf. graph on page 48). Being mainly composition-dependent, these curves are thus material-specific.
– The geometry can be taken into account by a core distortion factor (*CDF*) defined as

$$CDF = \frac{\sum l_i}{l_e} \cdot \frac{l_e}{A_e^{\,2}} \cdot \frac{l_N^{\,3/2}}{A_N^{\,3/2}}$$

The factor $\Sigma l_i / l_e$ is the closer to 1, the less the core section varies along the magnetic path (homogeneous core shape). The values for *CDF* are given in the following table for the core shapes preferred for these applications.

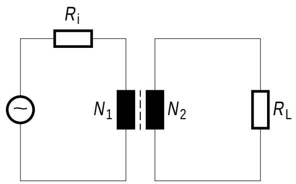
Cores w/o hole	*CDF* ($mm^{-4,5}$)	Cores w. hole	*CDF* ($mm^{-4,5}$)	EP cores	*CDF* ($mm^{-4,5}$)
P 9 × 5	1,25	P 3,3	85,9	EP 7	1,68
P 11 × 7	0,644	P 4,6	46,7	EP 10	0,506
P 14 × 8	0,164	P 7	4,21	EP13	0,191
P 18 × 11	0,0470	P 9	1,72	EP17	0,0619
P 22 × 13	0,0171	P 11	0,790	EP 20	0,00945
P 26 × 16	0,00723	P 14	0,217		
P 30 × 19	0,00311	P 18	0,0545		
P 36 × 22	0,00149	P 22	0,0220		
RM 4	0,498	P 26	0,0099		
RM 5	0,184	P 30	0,00366		
RM 6	0,0576	P 36	0,00166		
RM 7	0,0339	P 41	0,00112		
RM 8	0,0162	RM 4	0,814		
RM 10	0,00676	RM 5	0,243		
RM 12	0,00215	RM 6	0,0779		
RM14	0,00100	RM 7	0,0415		
TT/PR 14 × 8	0,205	RM 8	0,0235		
TT/PR 18 × 11	0,0561	RM 10	0,00906		
TT/PR 23 × 11	0,0217	RM 12	0,00273		
TT/PR 23 ×18	0,0119	RM 14	0,00118		
TT/PR 30 × 19	0,00465				

The values of this parameter indicate that roughly

$$CDF \sim \frac{1}{V_e^{3/2}}$$

I.e. the larger the core, the smaller is the distortion. Due to space restriction, however, the choice has to be made among the core shapes of a given size.

- The circuit conditions, i.e. voltage amplitude $\hat{u}$ and frequency f affect directly the flux density in the core. For increasing flux density, a deviation of the absolute value of k_3 from the calculated test value is expected, since the tan δ_h vs. $\hat{B}$ curve deviates from linear.
- The distortion k_{3c} for a transformer in a circuit with given impedance conditions can be obtained from the following formula:



$$k_{3c} = \frac{k_3}{\sqrt{1 + \left[3\omega L_1 \cdot \left(\frac{1}{R_i} + \left(\frac{N_2}{N_1}\right)^2 \cdot \frac{1}{R_L}\right)\right]^2}}$$

R_i = internal resistance of generator
R_L = load resistance
L_1 = primary inductance

The actual circuit distortion k_{3c} will in general be smaller than the calculated sinusoidal current value k_3.

3 Cores for inductive sensors

The proximity switch, widely used in automation engineering, is based on the damping of a high-frequency LC oscillator by the approach of a metal. The oscillator inductor consists of a cylindrical coil and a ferrite core half whose open side forms what is known as the active area. The function of the ferrite core consists in spatially aligning the magnetic field so as to restrict the interaction area.

The oscillator design must take into account that the inductor forms a magnetically open circuit. The inductance and quality are decisively dependent on the coil design, unlike in the case of closed circuits. The initial permeability plays a subordinate role here, as is shown by the following example:

Core: P9 × 5 (B65517-D …)
Coil: 100 turns, 0,08 CuL
Current: 1 mA
Frequency: 100 kHz

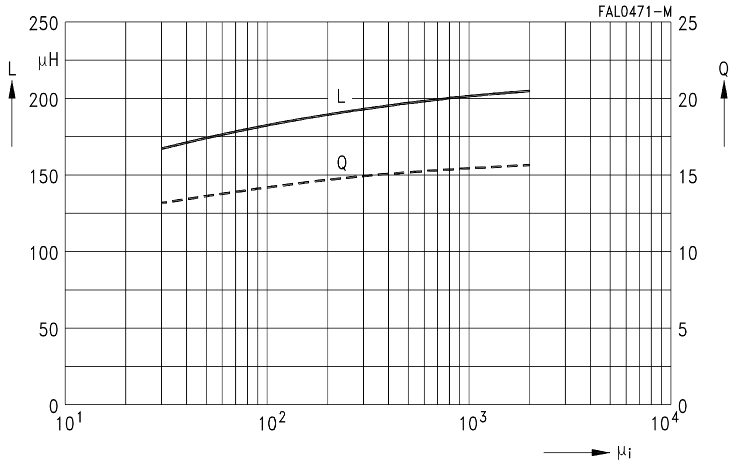


Fig. 11
Inductance and quality versus initial permeability
P9,3 × 2,7, N = 100, f = 100 kHz, I = 1 mA

Decisive for this application is the attainment of as high a Q as possible, with the lowest possible dependence on temperature at the oscillator frequency. When the distance between the damping lug and the active area changes, the oscillator Q should however change as strongly as possible.

If the relative change in Q $\Delta Q/Q$ exceeds a predefined threshold, e.g. 10 %, a switching operation is initiated at the so-called operating distance. Attainment of the target values depends on appropriate coil dimensioning and can generally only be performed empirically.

4 Cores for power applications

4.1 Core shapes and materials

The enormously increased diversity of application in power electronics has led to a considerable expansion not only in the spectrum of core shapes but also in the range of materials.

To satisfy the demands of higher-frequency applications, the EFD cores have been developed in sizes EFD10, 15, 20, 25 and EFD30. These are characterized by an extremely flat design, optimized cross-sectional distribution and optimized winding shielding.

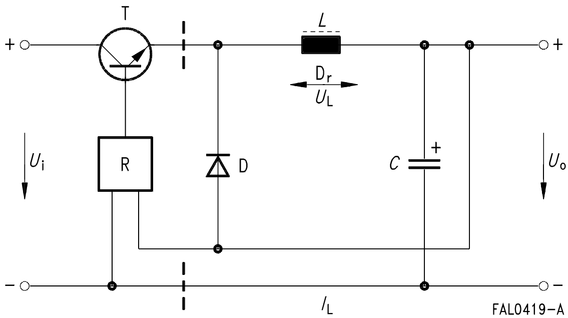
For many standard applications up to 100 kHz, materials N27, N53 and N41 can be used. For the range up to 200 kHz, materials N62, N67, N72 and N82 are suitable. N87 continues the series up to 500 kHz, while N49 and N59 cover the range from 300 kHz to 1 MHz e.g. for DC/DC (resonance) converters.

For detailed information on core shapes see the individual data sheets, for general information on materials see the chapter on SIFERRIT materials.

4.2 Correlation: Applications – core shape/material

4.2.1 Step-down converters

Typical circuit diagram (Fig. 12)



Advantages

- only one choke required
- high efficiency
- low radio interference

Disadvantages

- only one output voltage
- restricted short-circuit withstand capability (no line isolation)

Application areas

- providing a constant output voltage, isolated from input voltage
- regulation in a forward converter
- regulated voltage inversion
- sinusoidal line current draw

Core/material requirements

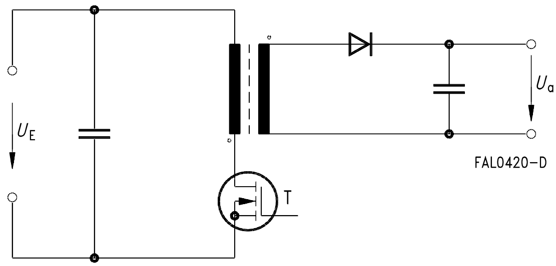
- Standard requirements regarding losses and saturation

S+M recommendations for core shape/material

- E/ETD/U cores made of material N27,
  RM cores made of material N41 (specially suitable for nonlinear chokes)

4.2.2 Single-ended flyback converter

Typical circuit diagram (Fig. 13)



Advantages

- simple circuit variant (low cost)
- low component requirement
- only one inductive component
- low leakage losses
- several easily regulatable output voltages

Disadvantages

- close coupling of primary and secondary sides
- high eddy current losses in the air gap area
- large transformer core with air gap restricts possible applications
- average radio interference
- exacting requirements on the components

Application areas

- low and medium powers up to max. 200 W with wide output voltage range
- maximum operating frequency approx. 100 kHz

Core/material requirements

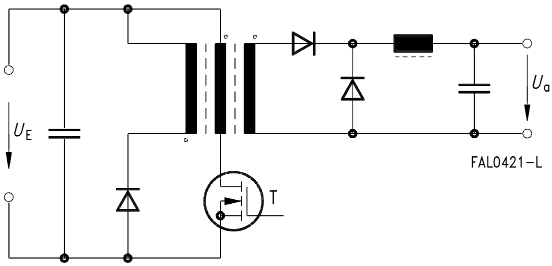
- low power losses at high temperature
- very high saturation with low dependence on temperature
- gapped cores (recently also with A_L value guarantee)

S+M recommendations for core shape/material

- E/U cores in
  N27 (standard)
  N62 (low losses, high saturation)

4.2.3 Single-ended forward converter

Typical circuit diagram (Fig. 14)



Advantages

- higher power range than flyback converter
- lower demands on circuit components
- high efficiency

Disadvantages

- 2 inductive components
- large choke
- demagnetization winding
- high radio interference suppression complexity
- increased component requirement, particularly with several regulated output voltages

Application areas

- medium and high powers (up to 500 W) especially in the area of low output voltages
- PWM (pulse width) modulation up to approx. 500 kHz

Core/material requirements

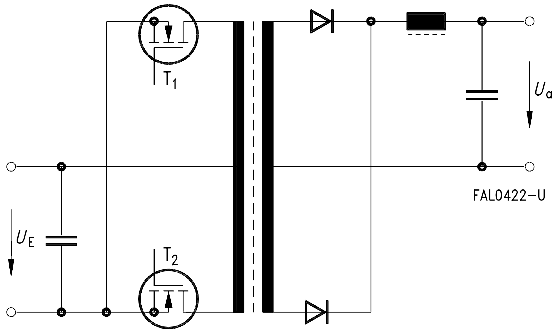
- low losses at high temperatures and at high frequencies (low eddy-current losses)
- generally, ungapped cores

S+M recommendations for core shape/material

- E/ETD, small EFD cores, RM/PM cores made of
  N27, N41 (up to 100 kHz)
  N62, N67, N72 (up to 300 kHz)
  N87 (up to 500 kHz)
  N49, N59 (500 kHz to 1 MHz)

4.2.4 Push-pull converter

Typical circuit diagram (Fig. 15)



Advantages

- powers up to the kW range
- small choke
- high efficiency
- low radio interference suppression complexity

Disadvantages

- 2 inductive components
- complex winding
- high component requirement, particularly with several regulated output voltages

Application areas

- high powers (>>100 W), also at high output voltages
- PWM (pulse width) modulation up to 500 kHz

Core/material requirements

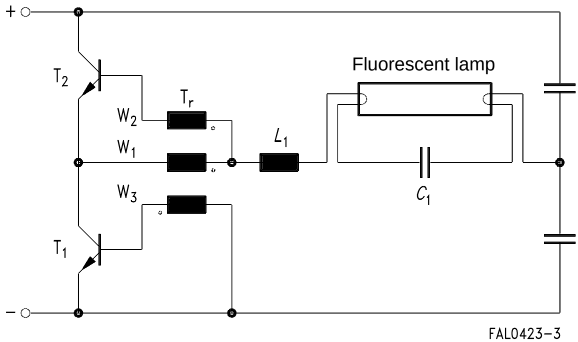
- low losses at high temperatures
- low eddy-current losses since application areas is up to 500 kHz and above
- generally, ungapped cores

S+M recommendations for core shape/material

- large E/ETD, RM/PM cores made of N27, N67, N87 (with large core cross sections ($A_e \geq 250$ mm^2), on account of eddy-current losses N87 must be used even where $f < 100$ kHz)

4.2.5 Electronic lamp ballast device

Typical circuit diagram (Fig. 16)



Advantages

- considerably reduced size compared to 50 Hz line solution
- significantly higher efficiency than line voltage regulator

Disadvantages

- high component requirement

Application areas

- control unit for fluorescent lamps

Core/material requirements

- low losses in the range 50 – 80 ˚C
- pulse power requirements
- gapped and ungapped E cores
- ring cores with defined pulse characteristic

S+M recommendations for core shape/material

- E/ETD/EFD cores made of N62, N72 for L_1

4.3 Selection of switch-mode power supply transformer cores

The previous section (Correlation: Applications – core shape/material) provides a guide for the rough selection of core shape and material.

The following procedure should be followed when selecting the actual core size and material:

1) Definition of requirements
– range of power capacities P_{trans}
– specification of the SMPS type
– specification of pulse frequency and maximum temperature rise
– specification of the maximum volume

2) Selection of “possible” core shapes/materials on the basis of the “Power capacity” tables starting on page 144.

These tables associate core shape/material combinations (and the volume V) with the power capacity of the different converter types at a “typical” frequency f_{typ} and a “cut-off frequency” f_{cutoff}.

The typical frequency specified here is a frequency for which specific applications are known, or which serves as the base frequency for the specified core loss values.

The cut-off frequency is selected such that the advantages of other materials predominate above this frequency and that it is therefore advisable to switch to a different material which is better optimized for this range.

3) Final selection of core shape/material

The core shapes/materials selected as possibilities under 2) must now be compared with the relevant data sheets for the specific core types and the material data (typical curves), taking the following points into consideration:

– volume
– accessories (power coil former)
– A_L values of ungapped core
– A_L values/air gap specifications
– temperature minimum for losses, Curie temperature T_C, saturation magnetization B_S, magnetic bias characteristic, amplitude permeability characteristic

Core shape/material combinations which are not contained in the individual data sheets can be requested from S + M Components.

4.4 Selection tables: Power capacities

In order to calculate the transmissible power, the following relationship is used (transformer with two equal windings):

$$P_{\text{trans}} = C\,\Delta B\,f A_e \cdot A_N \cdot j$$

where C is a coefficient characterizing the converter topolgy[1], i.e.

$C = 1$: push-pull converter
$C = 0{,}71$: single-ended converter
$C = 0{,}62$: flyback converter

Both the core losses associated with the flux swing ΔB and the copper losses due to the current density j result in a temperature increase ΔT. Assuming that both loss contributions are equal and that $P_V \sim B^2$, the power capacity can be approximated by

$$P_{\text{trans}} \approx C \cdot \underbrace{\frac{PF}{\sqrt{P_V}}}_{\text{Material}} \cdot \underbrace{\frac{\Delta T}{R_{th}}}_{\text{Thermal design}} \cdot \underbrace{\sqrt{\frac{f_{Cu}}{\rho_{Cu}}}}_{\text{Winding}} \cdot \underbrace{\sqrt{\frac{A_N \cdot A_e}{l_N \cdot l_e}}}_{\text{Geometry}}$$

The equation shows how the different aspects in the design contribute to the power capacity:

– The material term is the performance factor PF divided by the square root of the specific core loss level for which it was derived (cf. pages 47 and 120). For a given core shape deviations from this value are possible as given by its data sheet.
– The values for ΔT are associated with the material according to the following table.

	ΔT_{max} K
N59	30
N49	20
N62	40
N82	50
N27	30
N67	40
N87	50
N72	40
N41	30

– The thermal resistance is defined as

$$R_{th} = \frac{\Delta T}{P_{\text{Vcore}} + P_{\text{Vcopper}}}$$

– These values should be regarded as typical for a given core shape. They were determined by measurement under the condition of free convection in air and are given in the table on page 148 ff.

1) G. Roespel, "Effect of the magnetic material on the shape and dimensions of transformers and chokes in switched-mode power supplies",J. of Magn. and Magn. Materials 9 (1978) 145-49

For actual designs the actual values for R_{th} should be determined and the tabulated P_{trans} values adjusted accordingly.

- The winding design was taken into account in the calcualtions by f_{Cu} = 0,4 and ρ_{Cu} for DC. In actual design large deviations of the dc resistance due to high frequency effects (skin effect, proximity effect) occur, unless special wire types such as litz wires are used. If the R_{AC}/R_{DC} ratio for a given winding is known, this can be used to correct the tabulated power capacities accordingly.
- The geometry term is related to the core shape and size. However, note that the thermal resistance is also size-dependent via the empirical relation (cf. figure 17):

$$R_{th} \sim \frac{1}{\sqrt{V_e}}$$

The tabulated power capacities provide a means for making a selection among cores, although the absolute values will not be met in practice for the reasons explained before.

In the calculation of power capacities the following conditions were also applied:

- The application area for flyback converters was restricted to $f < 150$ kHz.
- The power specifications for N49/N59 should be read as applicable to DC/DC (quasi) resonance converters (single-ended forward operation).
- The maximum flux densities were defined as follows:
  For flyback converters: $\Delta B \leq 200$ mT ($\Delta B \leq 50$ mT for materials N49, N59)
  For push-pull converters: $\Delta B \leq 400$ mT.

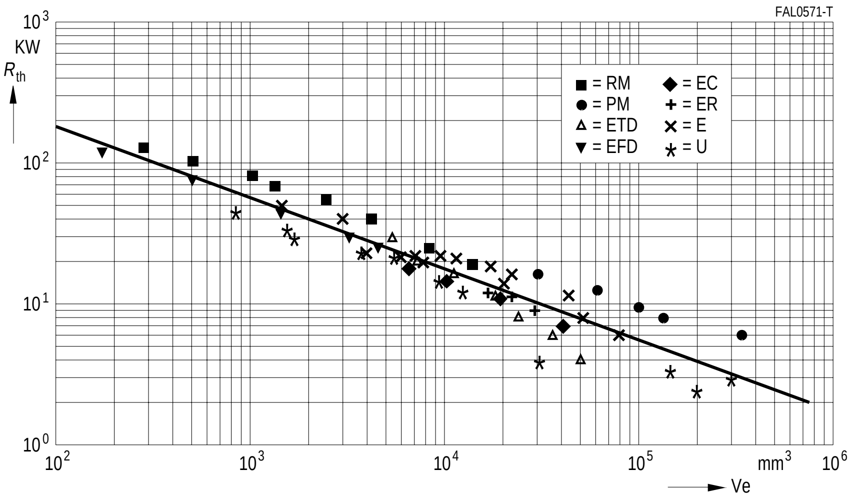


Fig. 17
Thermal resistance versus core effective volume

Selection tables: Power capacities

P_{trans} of cores for wound transformers (f_{Cu} = 0,4)

	N27	N53	N41	N72	N62	N82	N67	N87	N49	N59
f_{typ} [kHz]	25	100	25	25	25	100	100	100	500	750
RM4LP							17	20	19	
RM4							20	24	22	
RM5LP							26	35	29	
RM5			9				36	48	38	
RM6LP							42	56	45	
RM6			17				59	79	64	
RM7LP							62	82	67	
RM7			23				80	107	86	
RM8LP							90	121	97	
RM8			35				121	162	131	
RM10LP							160	214	173	
RM10			63				216	289	234	
RM12LP							339	453	366	
RM12			136				465	622	503	
RM14LP							565	756	611	
RM14			229				782	1046	846	
PM50/39	391							1742		
PM62/49	673							2999		
PM74/59	1131							5036		
PM87/70	1567									
PM114/93	2963									
EP7							12	13		
EP10							22			
EP13							45			
EP17							85			
EP20							246			
P9×5							12			
P11×7							22			
P14×8			12				48			
P18×11							99			
P22×13							173			
P26×16			86				294			
P30×19							458			
P36×22							717			

P_{trans} of cores for wound transformers (f_{Cu} = 0,4)

	N27	N53	N41	N72	N62	N82	N67	N87	N49	N59
f_{typ} [kHz]	25	100	25	25	25	100	100	100	500	750
TT/PR14×8								52		
TT/PR18×11								117		
TT/PR23×11								204		
TT/PR23×18								217		
TT/PR30×19								540		
E6,3							2			
E8,8							4			
E13/7/4	5						24			
E16/8/5	13						50			
E16/6/5	9									
E19/8/5	16						61			
E20/10/6	26						88			
E21/9/5	15									
E25/13/7	49						163			
E25.4/10/7	42						141			
E28/13/11							321			
ED29/14/11	128									
E30/15/7	94						312			
E32/16/9	118						392			
E32/16/11							423			
E34/14/9	118									
E36/18/11	146						487			
E40/16/12	172			574			768			
E42/21/15	214						711			
E42/21/20	289						961			
E47/20/16	304						1011			
E55/28/21	538						1791	2396		
E55/28/25	763									
E56/24/19	532						1770			
E65/32/27	1091						3632			
E70/33/32	1453									
E80/38/20	1503									
ER9,5								9		
ER11/5							13	14	15	
ER28/17/11				290						
ER35/20/11	309									

P_{trans} of cores for wound transformers (f_{Cu} = 0,4)

	N27	N53	N41	N72	N62	N82	N67	N87	N49	N59
f_{typ} [kHz]	25	100	25	25	25	100	100	100	500	750
ER42/22/15	384						1280			
ER46/17/18	376									
ER49/27/17	636									
ER54/18/18	482						1605			
ETD29/16/10	96						320	428		
ETD34/17/11	151						504	674		
ETD39/20/13	230						765	1023		
ETD44/22/15	383						1277	1708		
ETD49/25/16	594						1977	2645		
ETD54/28/19	897						2988	3998		
ETD59/31/22	1502						5002	6692		
EC35/17/10	145									
EC41/20/12	220									
EC52/24/14	402									
EC70/35/16	907									
EFD10/5/3								12	13	21
EPF12/6/3								27		
EFD15/8/5								42	38	
EFD20/10/7								115	93	
EFD25/13/9							183	245	198	
EFD30/15/9							239	319	258	
U11/9/6	18									
U15/11/6	31									
U17/12/7	37									
U20/16/7	72									
U21/17/12	116				167					
U25/20/13	199									
U26/22/16	267									
U30/26/26	1139									
UI93/104/16	1028									
UU93/152/16	1413									
UI93/104/20	1283									
UU93/152/20	1780									
UI93/104/30	1784									
UU93/152/30	2874									
UR29/18/16	199	477			326	873	663			

P_{trans} of cores for wound transformers (f_{Cu} = 0,4)

	N27	N53	N41	N72	N62	N82	N67	N87	N49	N59
f_{typ} [kHz]	25	100	25	25	25	100	100	100	500	750
UR35/28/12,5	354	848			581	1550	1178			
UR38/32/13	433	1037			710	1897	1441			
UR39/35/15	494	1183			811	2165	1645			
UR42,7/33/14	552	1323			906	2420	1839	2460		
UR42/34/16	562	1346			922	2463	1872			
UR42/36/15	628	1504			1031	2753	2091	2798		
UR46/37/15	691	1656			1135	3030	2302			

P_{trans} of low-profile cores for planar transformers (f_{Cu} = 0,1)

	N67	N87	N49
RM4LP	8,5	10	9,5
RM5LP	13	17,5	14
RM6LP	21	28	22
RM7LP	31	41	33
RM8LP	45	60	48
RM10LP	80	107	86
RM12LP	170	226	183
RM14LP	282	378	305
ER9.5		4,5	
ER11/5	6,5	7	7,5
EILP14		11	12
EELP14		17	16
EILP18		37	30
EELP18		55	44
EILP22		96	78
EELP22		134	109
EILP32		177	143
EELP32		252	203
EILP38		323	262
EELP38		470	380
EILP43		445	360
EELP43		619	500
EILP64		991	800
EELP64		1397	1130

4.5 Thermal resistance for the main power transformer core shapes

Core shapes	R_{th} (K/W)	Core shapes	R_{th} (K/W)	Core shapes	R_{th} (K/W)
RM 4	120	TT/PR 14 $\times$ 8	77	ER 9,5	164
RM 4 LP	135	TT/PR 18 $\times$ 11	54	ER 11/5	134
RM 5	100	TT/PR 23 $\times$11	39	ER 28/17/11	22
RM 5 LP	111	TT/PR 23 $\times$ 18	31	ER 35/20/11	18
RM 6	80	TT/PR 30 $\times$ 19	24	ER 42/22/15	14
RM 6 LP	90			ER 46/17/18	13
RM 7	68	E 5	308	ER 49/27/17	9
RM 7 LP	78	E 6,3	283	ER 54/18/18	11
RM 8	57	E 8,8	204		
RM 8 LP	65	E 13/7/4	94	ETD 29/16/10	28
RM 10	40	E 14/8/4	78	ETD 34/17/11	20
RM 10 LP	45	E 16/8/5	65	ETD 39/20/13	16
RM 12	25	E 16/6/5	76	ETD 44/22/15	11
RM 12 LP	29	E 19/8/5	60	ETD 49/25/16	8
RM 14	18	E 20/10/6	46	ETD 54/28/19	6
RM 14 LP	21	E 21/9/5	59	ETD 59/31/22	4
		E 25/13/7	40		
PM 50/39	15	E 25,4/10/7	41	EC 35/17/10	18
PM 62/49	12	ED 29/14/11	24	EC 41/20/12	15
PM 74/59	9,5	E 30/15/7	23	EC 52/24/14	11
PM 87/70	8	E 32/16/9	22	EC 70/35/16	7
PM 114/93	6	E 32/16/11	21		
		E 34/14/9	23	EFD 10/5/3	120
EP 7	141	E 36/18/11	18	EFD 15/8/5	75
EP 10	122	E 40/16/12	20	EFD 20/10/7	45
EP 13	82	E 42/21/15	19	EFD 25/13/9	30
EP 17	58	E 42/21/20	15	EFD 30/15/9	25
EP 20	32	E 47/20/16	13		
		E 55/28/21	11	EV 15/9/7	55
P 3,3 $\times$ 2,6	678	E 55/28/25	8	EV 25/13/13	27
P 4,6 $\times$ 4,1	390	E 56/24/19	9,5	EV 30/16/13	21
P 5,8 $\times$ 3,3	295	E 65/32/27	6,5		
P 7 $\times$ 4	214	E 70/33/32	5,5	DE 28	41
P 9 $\times$ 5	142	E 80/38/20	7	DE 35	25
P 11 $\times$ 7	106	EI LP 18	61		
P 14 $\times$ 8	73	EE LP 18	56		
P 18 $\times$ 11	51	EI LP 22	38		
P 22 $\times$ 13	37	EE LP 22	35		
P 26 $\times$ 16	27	EI LP 32	26		
P 30 $\times$ 19	22	EE LP 32	24		
P 36 $\times$ 22	17	EI LP 43	16		
P 41 $\times$ 25	15	EE LP 43	15		
		EI LP 64	9,5		
		EE LP 64	9		

continued on next page

Core shapes	R_{th} (K/W)	Core shapes	R_{th} (K/W)	Core shapes	R_{th} (K/W)
U 11/9/6	46	UU 93/152/16	4,5	UR 29/18/16	19
U 15/11/6	35	UI 93/104/16	5	UR 35/28/12,5	15
U 17/12/7	30	UU 93/152/20	4	UR 38/32/13	12,5
U 20/16/7	24	UI 93/104/20	4,5	UR 39/35/15	11,5
U 21/17/12	22	UU 93/152/30	3	UR 43/34/16	11
U 25/20/13	15	UI 93/104/30	4	UR 42/36/15	10
U 26/22/16	13	U 101/76/30	3,3	UR 42,7/33/14	11
U 30/26/26	4	U 141/78/30	2,5	UR 46/37/15	10

1 Gapped and ungapped ferrite cores

Even with the best grinding methods known today, a certain degree of roughness on ground surfaces cannot be avoided, so that the usual term “without air gap” or “ungapped” does not imply no air gap at all. The A_L values quoted allow for a certain amount of roughness of the ground faces. The tolerance of the A_L value for ungapped cores is – 20 to + 30 % or – 30 to + 40 %. Closer tolerances are not available for several reasons. The spread in the A_L values of ungapped cores practically equal the spread in ring core permeability (± 20 % … ± 30 %), and the A_L value largely depends on the grinding quality of the matching surfaces.

The following are normally defined:

precision-ground/lapped cores	s_{resid}	$\approx$ 1 µm
normally ground cores	s_{resid}	$\approx$ 10 µm
gapped cores	s	$\geq$ 10 µm

The residual air gap s_{resid} here is the total of the residual air gaps at the leg or centerpost contact surfaces.

With increasing material permeability the influence of the inevitable residual air gap grows larger. The spreads in the A_L value may also be increased by the mode of core assembly. Effects of mounting and gluing can result in a reduction of the A_L value.

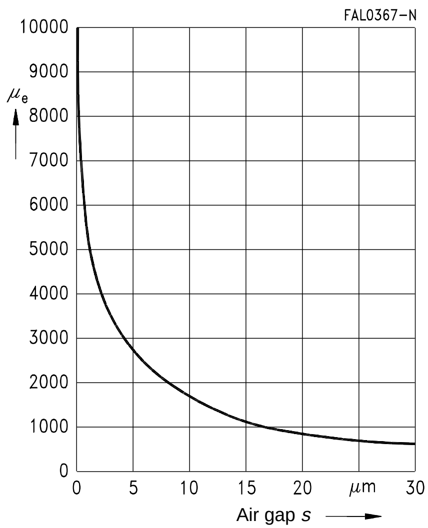


Fig. 18
Relationship between permeability μ_e and air gap s for an RM 4/T 38 ferrite core

2 Processing notes for the manufacture of wound products for small-signal and power applications

2.1 Winding design

For the most common core types the maximum number of turns for the individual coil formers can be seen from the following nomograms. The curves have been derived from the equation

$$N = \frac{A_N}{A_{wire}} \cdot f_{Cu}$$

where

N = max. number of turns
A_N = winding cross section in mm^2
A_{wire} = wire cross section in mm^2
f_{CU} = copper space factor versus wire diameter
(f_{CU} approx. 0,55 for wire diameter 0,05)

Common wires and litz wires are specified in the pertinent standards (IEC 60317-11; IEC 60182-1, IEC 60182-2).

As can be seen from Fig. 19, as high a winding level as possible should be employed because at low μ_e values in particular a low winding level (h/H ratio) can cause an A_L drop of up to 10% compared to the maximum value with full winding. (By our standards, the A_L values are always related to fully wound 100-turn coils.)

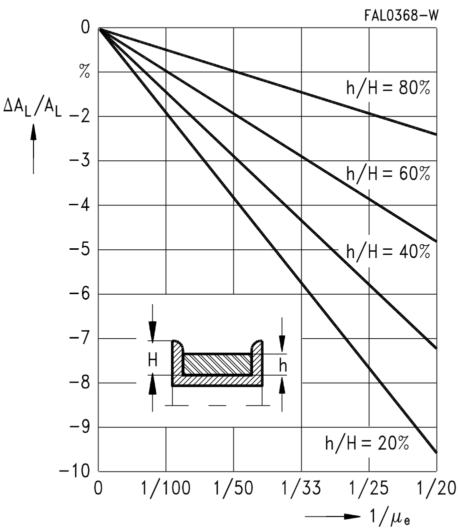
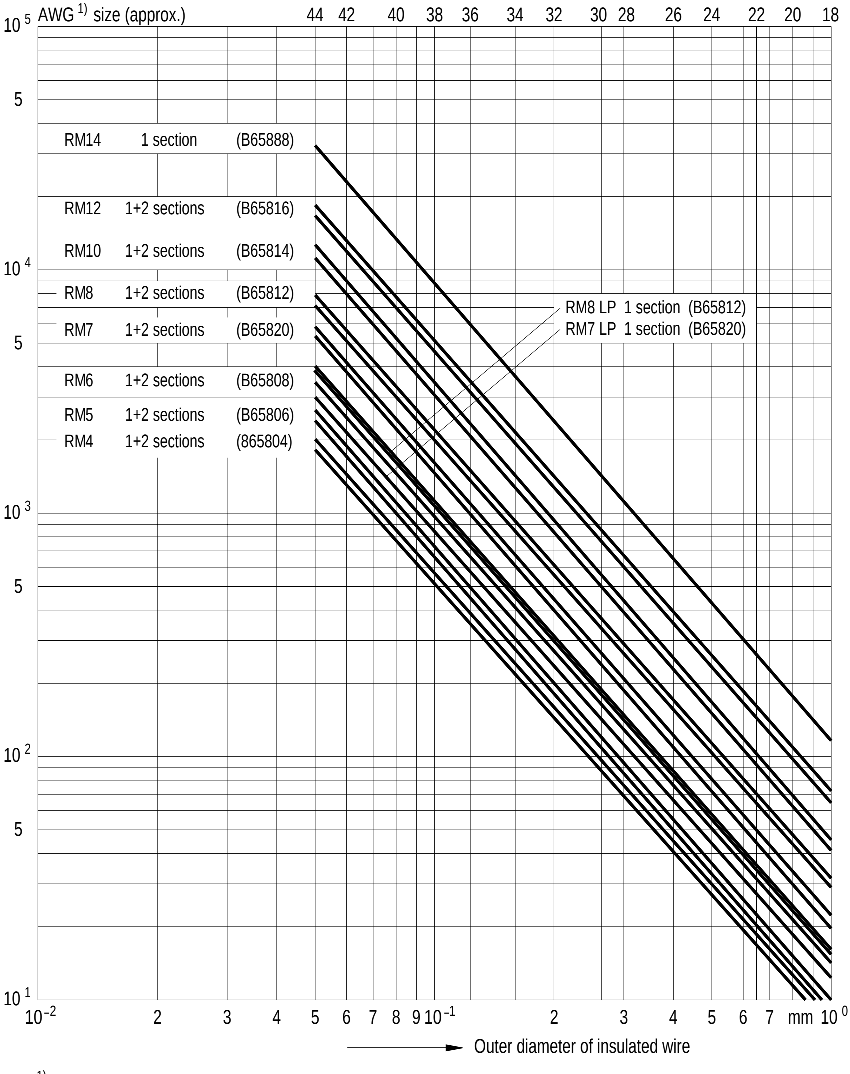


Fig. 19
Percentage change in A_L value versus relative winding height h/H

RM cores

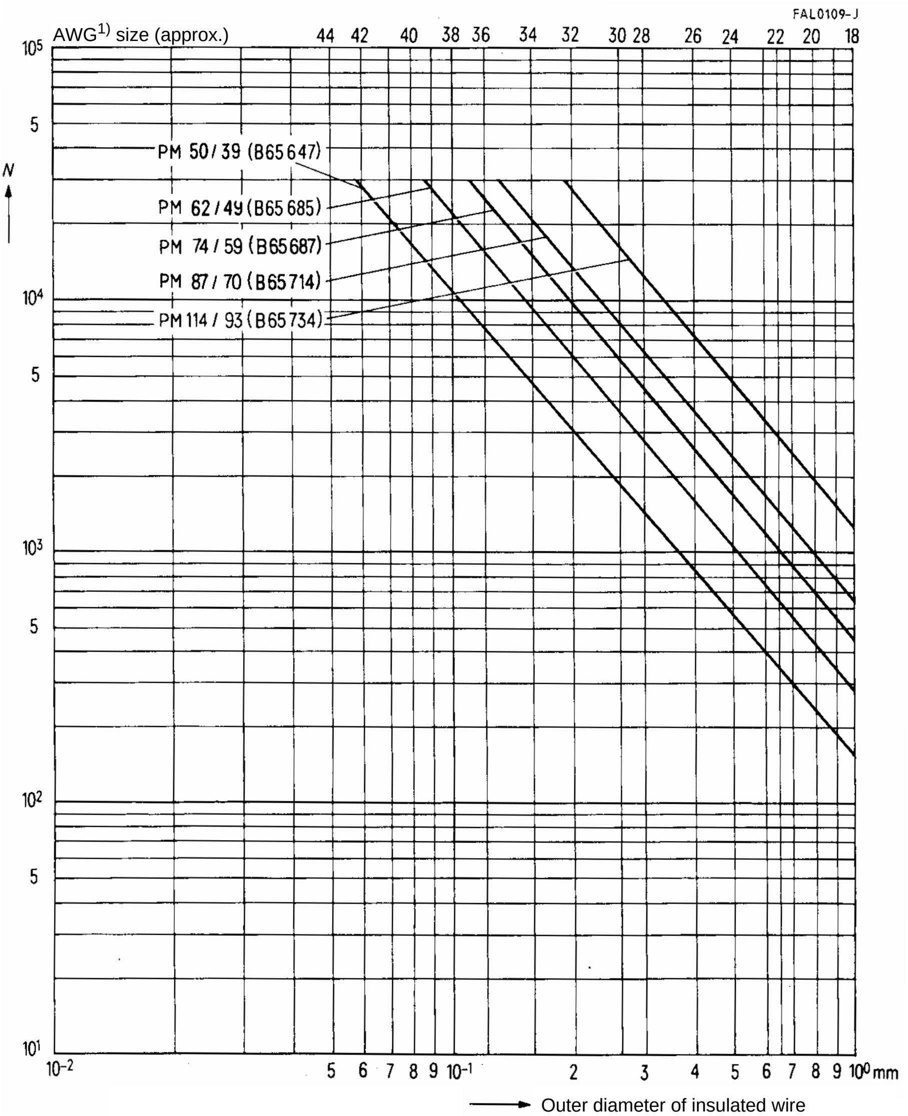
Maximum number of turns *N* for coil formers



[1] American Wire Gauge (AWG)

PM cores

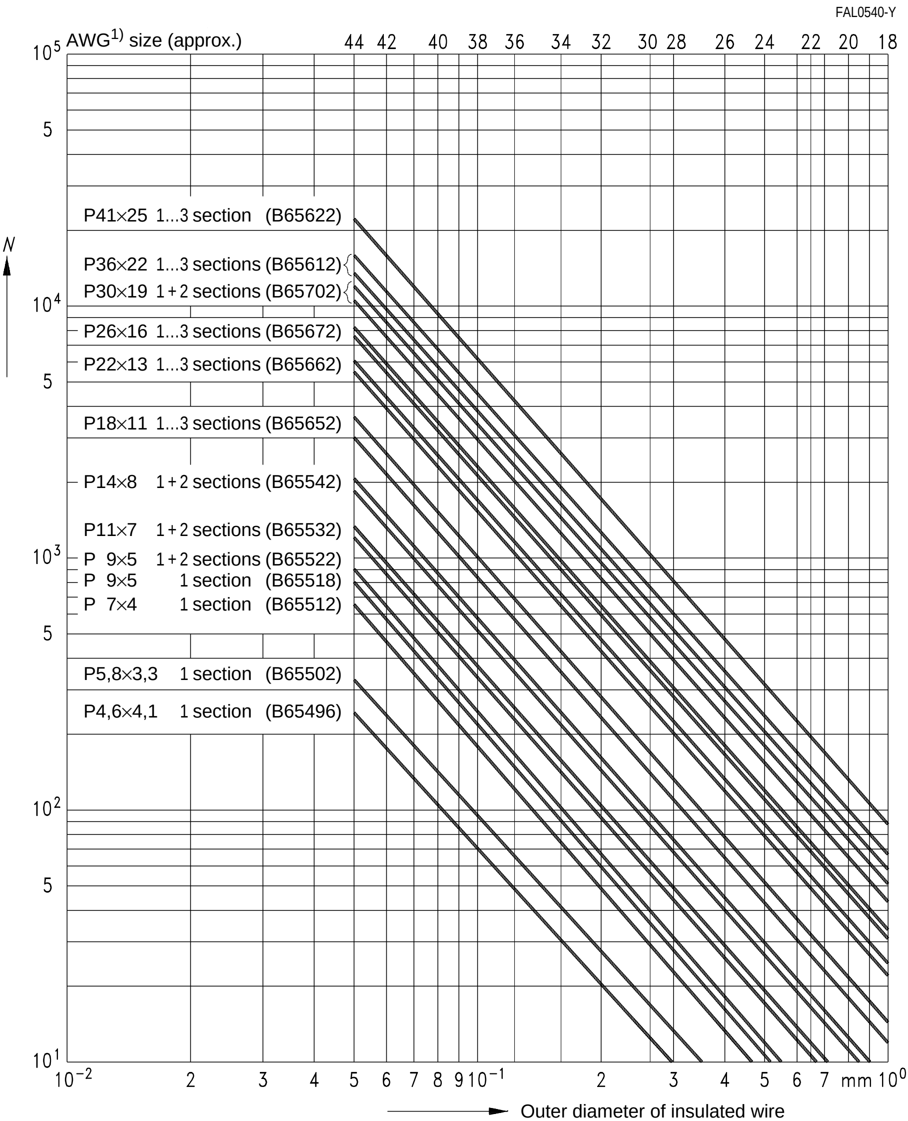
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

P cores

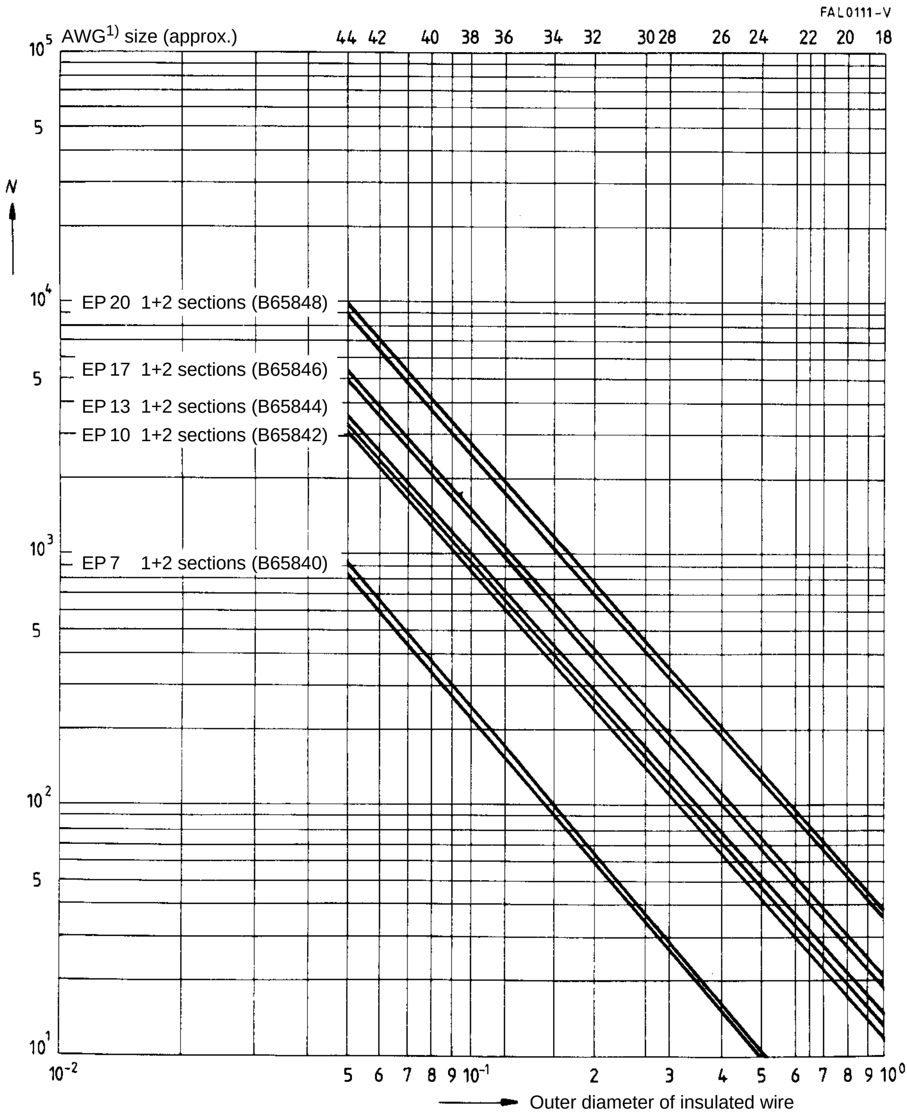
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

EP cores

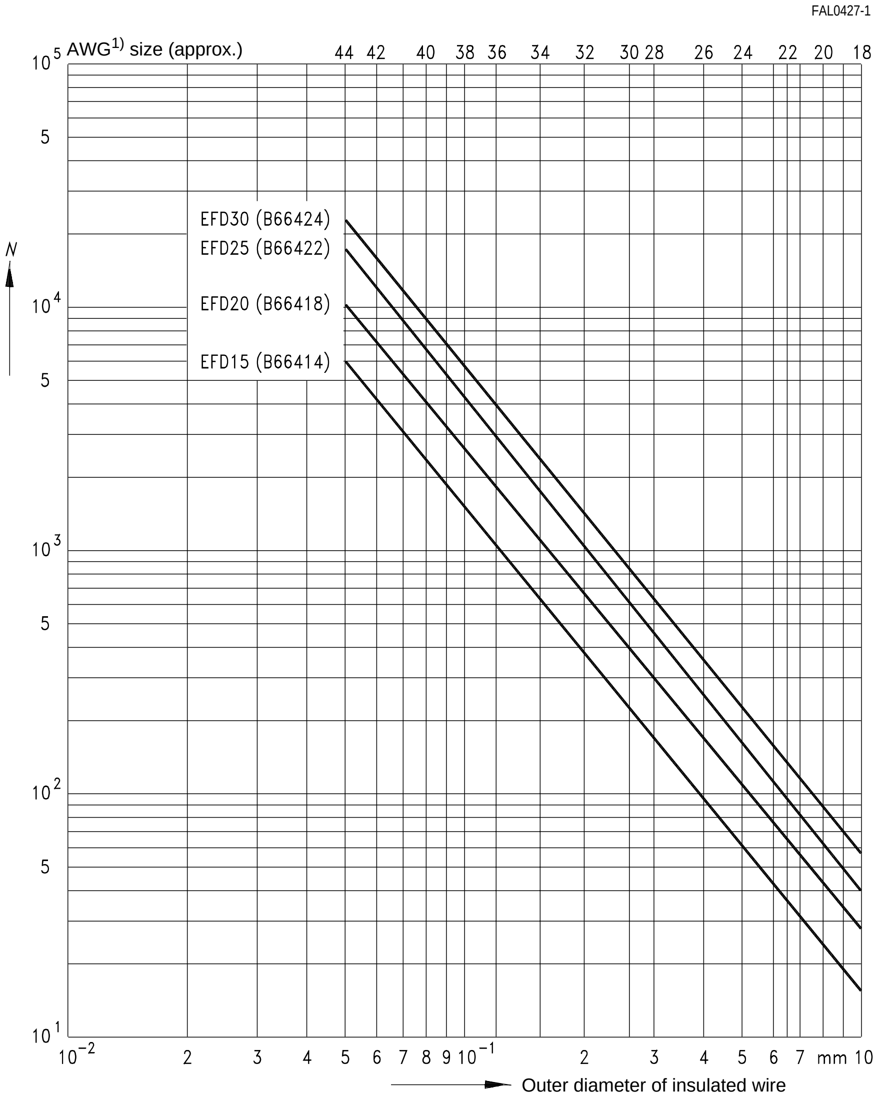
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

EFD cores

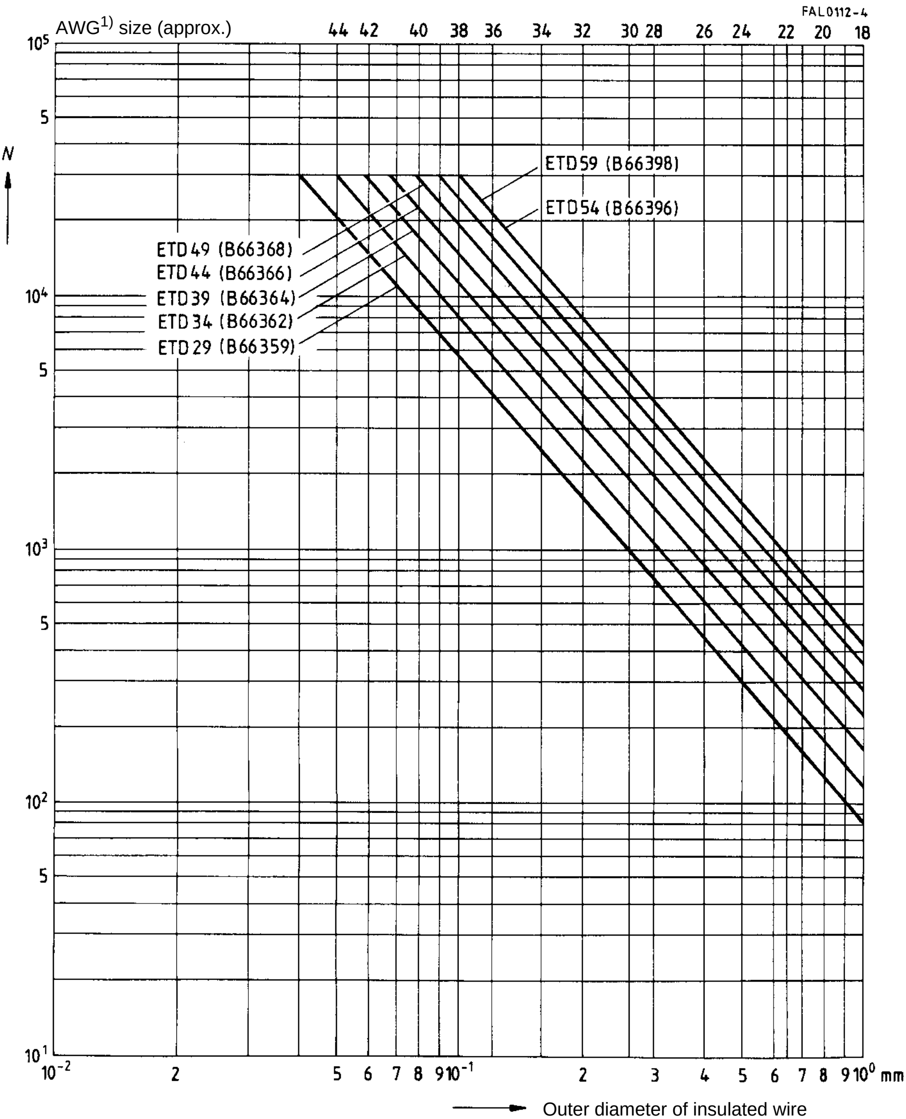
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

ETD cores

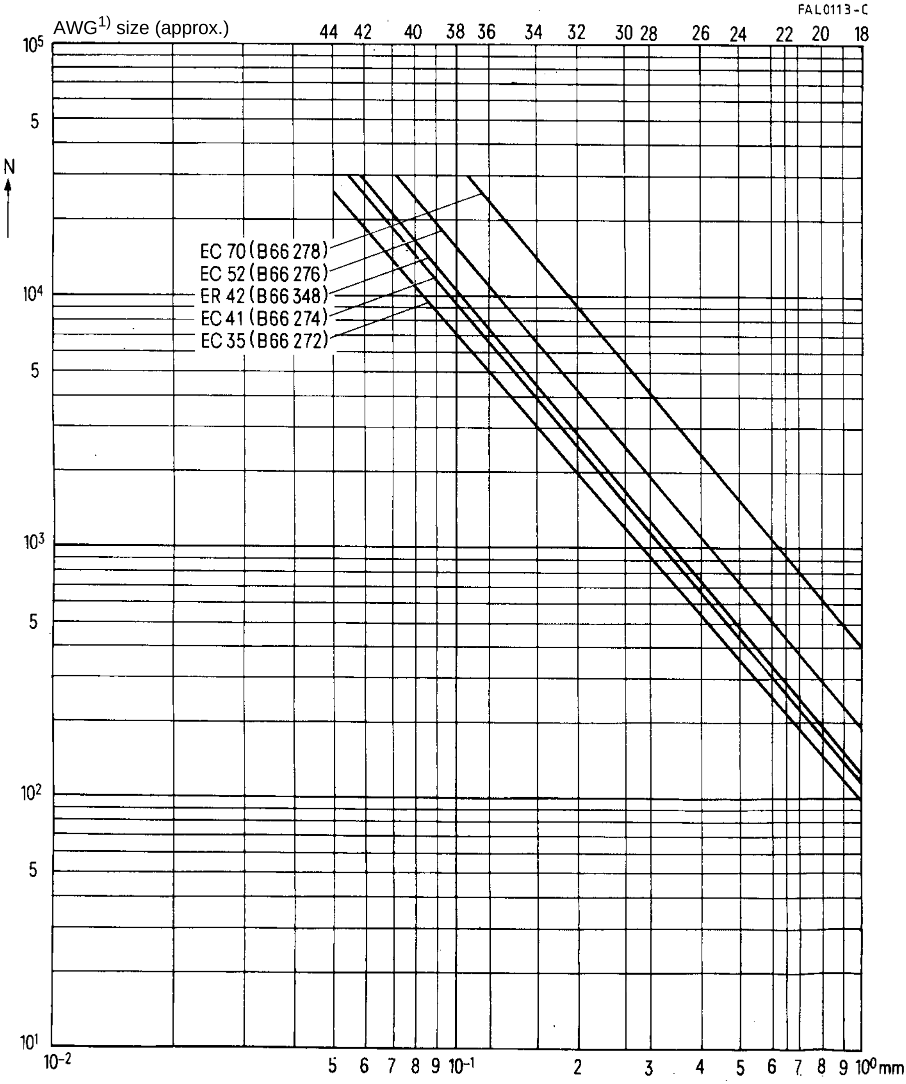
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

EC and ER cores

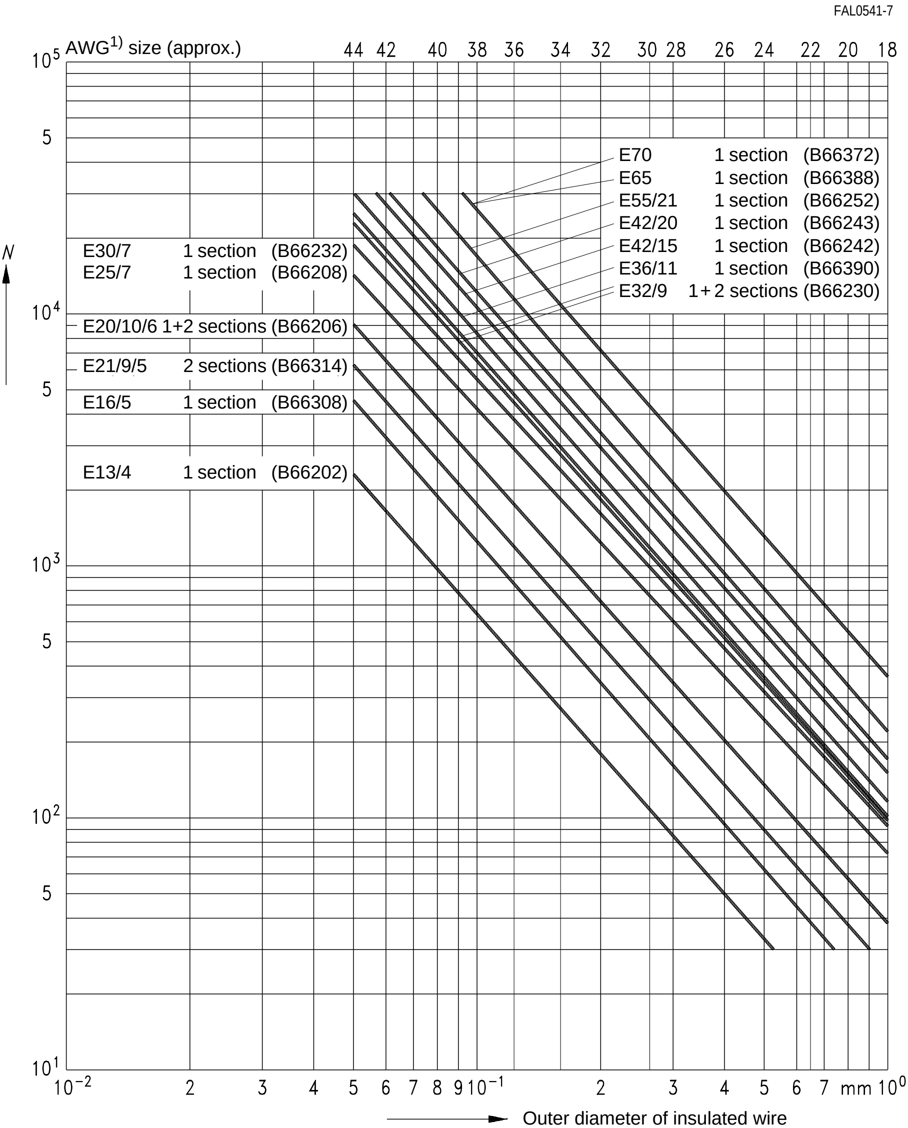
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

E cores

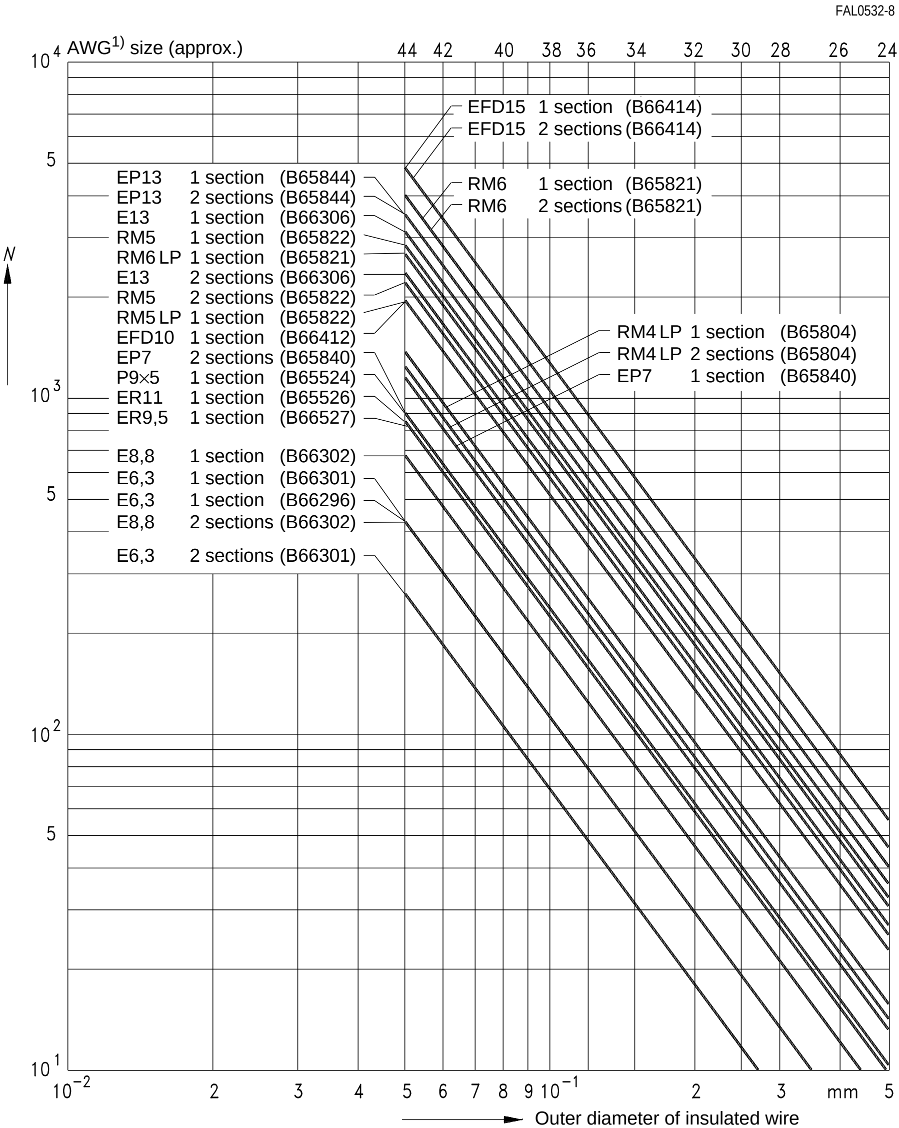
Maximum number of turns *N* for coil formers



1) American Wire Gauge (AWG)

SMD types

Maximum number of turns *N* for coil formers

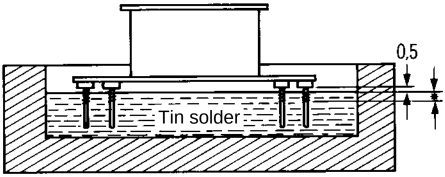


1) American Wire Gauge (AWG)

2.2 Soldering/Inductor assembly

The winding wires are preferably connected to the pins by dip soldering. Note the following when soldering:

- Prior to every dip soldering process the oxide film must be removed from the surface of the solder bath.
- 2 to 3 turns of the wire are dipped into the solder bath; the coil former must not be allowed to come too close to the solder or remain there for too long (see diagram).
- The following are typical values:
  Bath temperature: 400 ˚C, soldering time: 1 s



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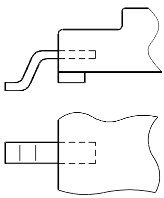
For inductor assembly, it is advisable to clamp the cores with the associated relevant mounting assemblies for the coil formers and cores. In this way it is possible to avoid the effects of external mechanical stress.

2.3 Terminal geometry

If thick wires need to be used in order to meet the electrical requirements, then either a greater manufacturing effort (with longer production times and increased production costs) will be necessary, or a terminal geometry suitable for use with thick wires will have to selected. Two different SMD terminal geometries are available from S+M: gullwings and J terminals.

Gullwing terminals



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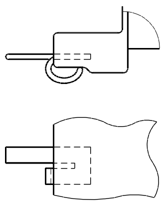
J terminals



FAL0497-G

With gullwing terminals the wire is wound direct on the terminal, which is then soldered on the circuit board. With J terminals the wire is wound on a separate pin, and the J terminal is soldered to the circuit board.

So gullwings are suitable for applications with thin wire (up to approx. 0,18 mm in diameter), and J terminals for use with thick wire (upwards from 0,18 mm in diameter). These figures for wire diameter are only intended as guidelines. Depending on wire diameter, the winding arrangement, the pinning and electrical requirements, one has to decide from case to case which solution is best for the particular application.

2.4 Gluing

The mating surfaces must be free of dust, grease and fibers. From the numerous adhesives available, epoxy resins with appropriate hardeners have proved particularly suitable. The following adhesives can be recommended:

a) for cores:
100 g Araldite AY 103
16 g hardener HY 956
Pot life 1 hour max.
Curing 3 hours at 60 ˚C
Thermal stability of the glued joint 60 ˚C
(for a short period 90 ˚C)

b) for cores:
100 g Araldite AY 103
7 g hardener HY 992
Pot life approx. 8 hours
Curing 3 hours at 100 ˚C
Thermal stability of the glued joint 90 ˚C
(for a short period 120 ˚C)

c) for cores:
100 g Araldite AY 103
40 g hardener HY 991
Pot life 1 hour
Curing 60 minutes at 80 ˚C
Thermal stability of the glued joint 80 ˚C

d) for cores:
100 g Araldite AY 105
50 g hardener HY 991
Pot life approx. 1 hour
Curing 45 minutes at 80 ˚C
Thermal stability of the glued joint 100 ˚C

e) for coil formers:
100 g adhesive A
200 cm^3 filler Aerosil 200
Curing same as a)

f) for external gluing:
Single-component adhesive AV 118
Open pot life
Curing 10 minutes 180 ˚C,
20 minutes 160 ˚C,
45 minutes 140 ˚C
Thermal stability of the glued joint 120 ˚C

(Manufacturer of adhesives a) – f): Ciba Geigy)

2.5 Adhesive application and core mating

A quantity of adhesive appropriate to the area in question is applied to the cleaned surface of the core’s side walls. The centerpost must remain free of adhesive. The two core halves without coil former are then placed on a mandrel and rotated against each other two or three times to spread the adhesive. A slight ring of adhesive exuding around the edges indicates that sufficient adhesive has been applied.

On porous, low-permeability SIFERRIT materials (U and K) the adhesive should be applied and spread twice.

The next step should follow immediately since the adhesive film easily attracts dust and absorbs moisture. Therefore, the core pair with adhesive already applied is opened for a short time and the wound coil is inserted without touching the mating surfaces.

The wound coil is then fixed into position. This can be done by using resilient spacers which must be inserted before applying the adhesive. Appropriate spacers are available on request.

The coil former can also be fixed by gluing, e.g. using adhesive e), but only at one spot on the core bottom to avoid any mechanical stress caused by the difference in thermal expansion of core and coil former.

Adhesive f) is suitable for external gluing, which implies only four dots of adhesive at the joints on both sides of the openings. Because of the somewhat lower torsional strength, it should be noted that this kind of gluing should only be used with mounted cores.

2.6 Holding jigs

The core assembly is cured under pressure in a centering jig. The core center hole – where present – is used for centering, and two to eight coils can be held in one jig with a pressure spring. Spacers will ensure that the pressure is only exerted on the side walls of the core.

Single jigs facilitate the coil inductance measurement, which has proved useful for checking cores with small air gaps before the adhesive has hardened. Small inductance corrections can be made by slightly turning the core halves relative to each other.

2.7 Final adjustment

(possible only with adjustable cores)

With all assembled ferrite cores, a magnetic activation takes place as a result of mounting influences such as clamping, gluing and soldering, i.e. a disaccommodation process commences. Therefore the final adjustment for high-precision inductors should take place no earlier than one day after assembly; preferably, one week should first elapse.

2.8 Hole arrangement

For drilling the through-holes into the PC board we recommend the dimensions given in the hole arrangement for each coil former, which depend on the distance of the pins on the pin outlet level.

Survey of packing modes

Ferrites

	Type	Packing	Para.	Page
RM cores	RM 3 to RM 10 RM 12, RM 14	Blister tapes Standard trays	3.2 2.2.1	170 168
PM cores	PM50/39 to PM114/93	Standard trays	2.2.1	168
P cores	all P cores P 9 × 5 to P 22 × 13	Standard trays Blister tapes on request	2.2.1 3.2	168 170
P core halves	5,6 × 3,7 to 150 × 30	Standard trays	2.2.1	168
TT/PR cores		Standard trays	2.2.1	168
EP cores	EP 7 to EP 20	Standard trays Blister tapes on request	2.2.1 3.2	168 170
E cores	E 6,3 and E 8,8 Core length 12,6 … 36 mm Core length > 36 mm	Bags Block packs Standard trays	2.3.1 2.2.2 2.2.1	169 168 168
ELP cores ER cores ETD cores EC cores EFD cores EV cores DE cores		Standard trays	2.2.1	168
U and I cores	U15, U17, U25, U26, UR42 others	Block packs Standard trays	2.2.2 2.2.1	168 168
Ring cores	Packing depends on size and version (coated/uncoated)	Standard trays Boxes Bags	2.2.1 2.3.2 2.3.1	168 169 169
Double-aperture cores		Bags	2.3.1	169

Accessories

Coil formers with pins	Polystyrene boards	2.2.3	169
Coil formers without pins	Boxes Bags	2.3.2 2.3.1	169 169
Mounting assemblies	Boxes Bags	2.3.2 2.3.1	169 169
Clamps	Bags (individual clamps)	2.3.1	169
Insulating washers	Bags (individual washers)	2.3.1	169

1 General information

Our product packaging modes ensure maximum protection against damage during transportation. Moreover, our packing materials are selected with environmental considerations in mind. They are marked with the appropriate recycling symbols.

Because of the large variety of types and sizes, we use five basic kinds of packing, which are described in points 2 and 3 below:

- blister tape
- tray
- container
- reel
- magazine

The packing units are based on the following system:

1.1 Packing unit (PU)

Usually, a packing unit is a collection of a number of basic packages. The size of the packing unit is stated for the particular components in their data sheets. When ordering, please state complete packing units if possible. We reserve the right to round the ordered quantity accordingly.

1.2 Dispatch unit

A number of packing units are combined to form a dispatch unit. Standard dispatch units for large quantities are a Europallet or pallet carton. For small quantities, folding corrugated cardboard boxes are used in standard sizes. In the case of small quantities a dispatch unit may also include packages with other components.

1.3 Bar-code standard label

On the product packing label (standard label) we include bar-code information in addition to plain text. In addition to benefits relating to the internal flow of goods, this provides above all a more rapid and error-free means of identification checking for the customer.

Example of a barcode label with production ID (1P), lot number (1T), date code (10D), production number (30P) and quantity (Q)

S+M FERRITE CORE U CORE N87
UR 72/65/39
[1P] PROD ID: B67326GX187

[1T] LOT NO: 982044 [10D] D/C: 98293

[30P] PRODUCT NO. 94065413 [Q] QTY: 500

Example of a customer-specific barcode label

Kundeninformation CUSTOMER INFORMATION 94014039
[K] CUSTOMER ORDER NO. 006436

[P] CUSTOMER PART NO: 23388

[Q] QTY: 500

VENDOR CODE: 0007130 DISPATCH NOTE NO: 64521586

2 Modes of packing

2.1 Blister tape

Blister packing was specially devised for handling by automatic systems but has also proved to be very good for conventional handling, especially where small quantities are concerned. See point 3.2 for a detailed description and a list of the core types that can be supplied in this type of packing.

2.2 Tray (pallet)

2.2.1 Standard tray

The polystyrene tray (basic package) is the standard packing for most types of core. The area of 200 mm × 300 mm corresponds to the module dimensions of DIN 55 510 and is based on the area of the 800 mm × 1200 mm Europallet. Depending on the overall height of the trays and the numbers contained, several trays will be stacked to form a packing unit and provided with a corrugated cardboard cover. For the protection of the cores the entire stack is also shrink-wrapped in polyethylene film.

Each core is enclosed in a separate compartment. When P cores and similar types are packed in sets, the halves of the core pairs are packed so that their pole faces are opposite one another. As a rule their association is identified by markings in the polystyrene (recessed webs, thinner webs). In the case of P3,3 × 2,6 and P4,6 × 4,1 cores the halves of a set are not located in a single tray but in different trays of a packing unit.

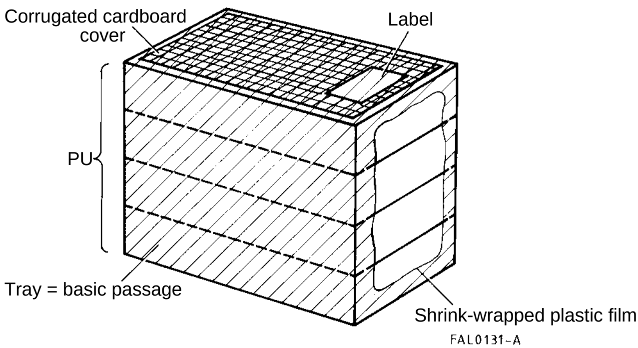
2.2.2 Block packing

For E and U core we prefer block packing in trays with the dimensions 200 mm × 300 mm. The symmetry, position, length and spacing of the blocks are always the same. The height of the tray is dependent on the size of the core. For the makeup of a packing unit see point 2.2.1.

Block packing can be supplied in boxes of corrugated cardboard (special packing unit!) on request.

Block packing permits highly rationalized handling and is designed for automatic processing.

Packing unit for standard or block packing



2.2.3 Board for coil formers with pins

For coil formers with pins, a polystyrene board is generally used. The coil formers are inserted in the board with the pins downwards. A number of stacked boards (packing unit) are enclosed in a jacket of cardboard, or packed in a folding box, and in some cases are shrink-wrapped in plastic.

2.3 Container

2.3.1 Bag

Small ferrite parts are packed in flat polyethylene bags. The number per bag depends on the volume of the parts. Generally four bags in a corrugated cardboard box form a packing unit.

Small accessories (clamps, mounting assemblies, and also pinless and SMD coil formers) are also packed in this way. The size of the bag depends on the volume of the parts (packing unit).

2.3.2 Box

Coated ring cores of medium size are packed in cardboard boxes with cardboard or polyethylene foam inlays. The number per box depends on the volume of the cores.

Accessories (large mounting assemblies, coil formers etc.) are packed in boxes of cardboard or corrugated cardboard.

3 Delivery modes for automatic processing

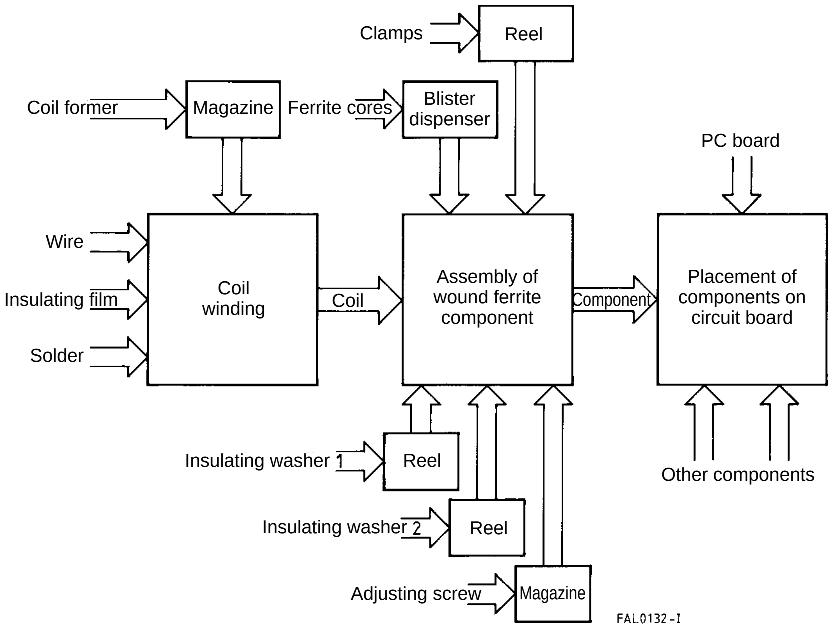
3.1 General information on inductor production

The inductor parts described in the following can be handled by automatic manufacturing systems. In addition to automatic winding machines - which can be combined with wrapping, fluxing and soldering stations - flexible, high-performance automatic assembly lines are available. Design and packing of the individual parts (ferrite cores, coil formers, clamps, insulating washers and adjusting screws) have been optimized for automatic processing and permit easy feeding to the various stations of production lines.

We supply RM cores up to RM10 (P and EP cores on request) blister-taped in dispenser boxes. By inserting a plate-shaped resilient insulating washer between core and coil former, gluing can be dispensed with.

We also provide consulting services with examples of implementations to customers planning to introduce automatic production lines.

Production sequence



3.2 Cores in blister tape (strips)

The cores are packed in sets ready for assembly, i.e. a stamped core with the base upwards and an unstamped core (possibly with a threaded sleeve) with the pole face upwards. The blister tapes have a hole at one end for orientation purposes (see also illustration). The tapes are sealed with a paper cover. Looking at a tape with the hole on the left and the paper cover on top, then after removing the paper cover the stamped cores will be in the upper row and the unstamped cores of the sets in the lower row.

Several blister tapes are combined in a box with a perforated tear-off cover (dispenser pack) to form a packing unit. The tapes are packed so that the orientation hole appears in the dispenser opening. The box is shrink-wrapped in polyethylene film.

3.3 Cores in blister tape (reeled)

E 5 and E 6,3 cores can also be supplied taped and reeled as per IEC 60286-3, optionally in conductive or non-conductive tapes. The cores are oriented for automatic feeding. The tapes are sealed with a transparent cover tape and wound on 330-mm polystyrol reels. Each reel is identified with a bar code label and a release label. Five reels in a corrugated cardboard box form a packing unit.

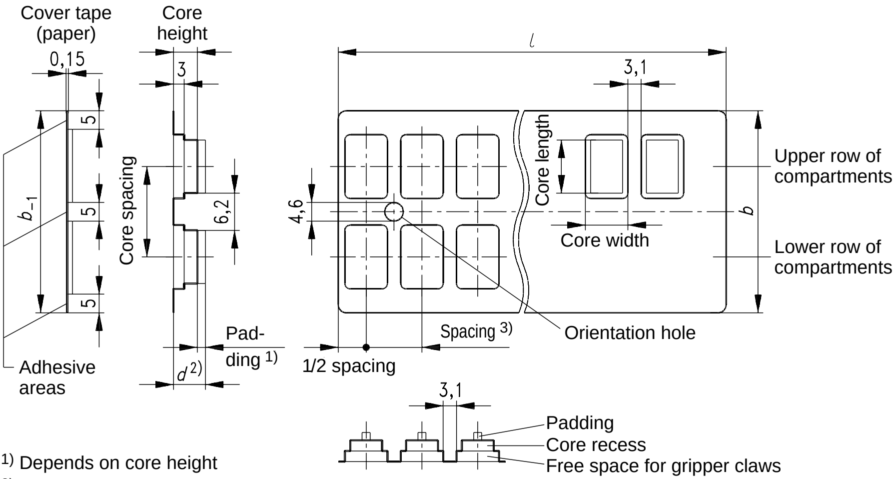
The following table lists the core types which are available in blister tape:

Type	Dimensions of blister tape $l \times b \times d$ mm	Spacing mm	Spacing upper/ lower row mm	Dimensions of dispenser pack $l \times b \times h$ mm	Sets/ tape	Tapes/ box	Sets/ box	Approx. net weight g
RM cores [1]								
RM 4	340 × 60 × 6,6	17,0	27,5	349 × 63 × 203	20	30	600	1000
RM 4 LP	340 × 60 × 5,0	17,0	27,5	349 × 63 × 203	20	40	800	
RM 5	340 × 60 × 8,0	17,0	27,5	349 × 63 × 203	20	25	500	1550
RM 5 LP[2]	340 × 60 × 5,0	17,0	27,5	349 × 63 × 203	20	40	800	
RM 6	340 × 60 × 8,0	17,0	27,5	349 × 63 × 203	20	25	500	2550
RM 6 LP[2]	340 × 60 × 5,7	17,0	27,5	349 × 63 × 203	20	35	700	
R 6	340 × 60 × 8,0	17,0	27,5	349 × 63 × 203	20	25	500	2550
RM 7	295 × 82 × 9,4	29,5	38,5	301 × 85 × 240	10	25	250	1925
RM 7 LP[2]	295 × 82 × 5,9	29,5	38,5	301 × 85 × 240	10	40	400	
RM 8	295 × 82 × 11,8	29,5	38,5	301 × 85 × 240	10	20	200	2600
RM 8 LP[2]	295 × 82 × 7,9	29,5	38,5	301 × 85 × 240	10	30	300	
RM10	295 × 82 × 11,8	29,5	38,5	301 × 85 × 240	10	20	200	4600
RM10 LP[2]	295 × 82 × 9,4	29,5	38,5	301 × 85 × 240	10	20	250	
EP cores [3]								
EP 7	340 × 60 × 5,0	17,0	27,5	349 × 63 × 203	20	40	800	1260
EP 10	340 × 60 × 8,0	17,0	27,5	349 × 63 × 203	20	25	500	1375
EP 13	340 × 60 × 8,0	17,0	27,5	349 × 63 × 203	20	25	500	2550
EP 17	295 × 82 × 11,8	29,5	38,5	301 × 85 × 240	10	20	200	2220
EP 20	295 × 82 × 11,8	29,5	38,5	301 × 85 × 240	10	20	200	5640
P cores [3]								
P 9 × 5	340 × 60 × 4,0	17,0	27,5	349 × 63 × 203	20	50	1000	800
P 11 × 7	340 × 60 × 4,0	17,0	27,5	349 × 63 × 203	20	50	1000	1700
P 14 × 8	295 × 82 × 5,9	29,5	38,5	301 × 85 × 240	10	40	400	1280
P 18 × 11	295 × 82 × 9,4	29,5	38,5	301 × 85 × 240	10	25	250	1500
P 22 × 13	295 × 82 × 9,4	29,5	38,5	301 × 85 × 240	10	25	250	3250
E cores					Pcs/ reel	Pcs/ box		
E 5	27000 × 12 × 2,7	4,0	4,0	370 × 340 × 100	6500	32500		
E 6,3	27000 × 12 × 2,7	4,0	8,0	370 × 340 × 100	3400	17000		

For ordering codes refer to the individual data sheets.
Dimensions are nominal; tolerances given in design drawings.

1) Blister packing is standard
2) Blister packing for RM 5 LP to RM 10 LP in preparation
3) Polystyrene tray is standard (blister packing on request)

3.4 Blister tapes



1) Depends on core height
2) Thickness incl. cover tape
3) For RM3: 2 sets per spacing

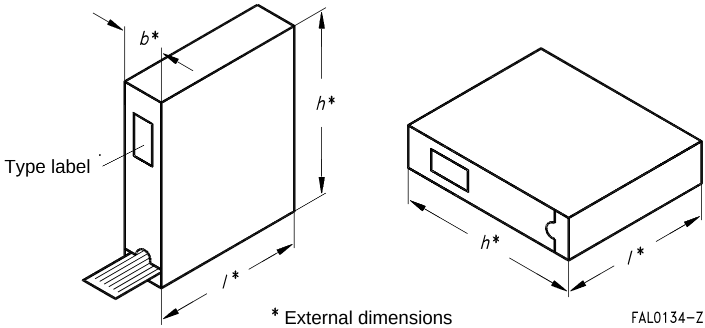
The blister compartments always comprise the following function spaces: a free space for the gripper claws, the recess in which the core rests and the padding.

The free space enables the cores to be removed by mechanical grippers. On the reverse side of the blister, these free spaces lead to a regular grid arrangement with a spacing of 6,2 mm and 3,1 mm. The blisters should be guided and stopped at these intervals. A hanging arrangement is to be preferred, because this avoids problems arising in case the blister height or padding thickness varies.

The core recess centers the core in the blister compartment.

The padding serves as protection during transport and as spacing to achieve correct filling of the dispenser pack. The shape and position of the padding may vary, depending on the production method used. All padding dimensions given must therefore be considered to be subject to change at any time.

3.5 Dispenser pack



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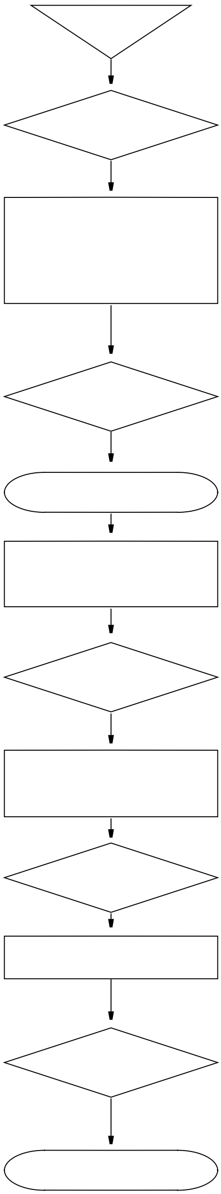
To open a blister tape manually, peel back the paper cover tape smoothly but not too quickly, along the axis of the tape as shown in the following illustration.

FAL0135-8

When opening a blister tape automatically, it is advisable not to completely remove the paper cover. Rather, the cover paper should be divided up by means of 4 longitudinal cuts so that the mating surfaces remain on the blister (cf. blister tape illustration). The paper strips produced above the two rows of compartments can then be easily lifted. This avoids malfunctions resulting from fluctuations in the adhesive properties of the paper sealing tape.

1 Production sequence and quality assurance during ferrite manufacture (schematic)



Process step	Quality records Traceability
Raw materials (powder)	
Incoming inspection Analysis of chemical comp. (X-ray fluorescence analysis)	X-ray fluorescence analysis reports
Granulate production Weighing, mixing, presintering, grinding, stirring in binder. Homogenization, spraying incl. process control checks	
Bulk mix release Chemical analysis Manufacture and testing of sample cores	Bulk mix release report
Granulate storage	
Parts production Pressing, decarbonizing, sintering incl. process control checks	
Sinter check Testing of electrical and mechanical properties	Sinter check test report
Parts processing e.g. surface grinding, AL grinding, etc. incl. process control checks	
Final inspection/Monitoring Testing electr./mech. properties	Final inspection reports
Packing in PU (factory packing)	
Delivery release Outgoing inspection, checking of reports and finish Labeling with “FER QA Release”	“FER QA Release” label or date code on packing
Sales warehouse	

2 General information

2.1 Ferrites quality objectives

Quality plays a central role in the competition for the better and more favorable product. As a guiding principle for the continual improvement of product and service quality, the Ferrites Division has set quality objectives which are regularly updated and successively extended to all products. These serve as target criteria for new developments and are similarly required of current products.

To realize the objectives for existing products, projects involving teams of staff from all areas are working on product and process improvements without regard to departmental boundaries.

2.2 Total Quality Management and Siemens *top* campaign

The aim of Total Quality Management (TQM) and the Siemens *top* campaign is to gear the entire organization to optimally satisfying customer requirements.

Following the principle of "quality from the very start", everyone in our company is involved in realizing this objective. Systematic planning, careful selection of our suppliers and mastery of the development and production processes are the most important guarantors for maintaining a high quality level.

Internal measures to promote quality, such as training courses, quality group work, working committees and Q audits, strengthen the sense of responsibility of every employee and help to recognize and avoid errors.

Modern quality instruments such as FMEA[1)] and SPC[2)] supplement and support our quality assurance and enhancement measures.

3 Ferrites quality assurance system

The documented QA system of the Ferrites Division forms the basis for all quality assurance activities. At all locations the Ferrites QA systems satisfy the international QA standard ISO 9000, as witnessed by certificates from the DQS (Deutsche Gesellschaft zur Zertifizierung von Qualitätssicherungssystemen) or the AFAQ (Association Française pour l'Assurance de la Qualité).

3.1 Quality assurance for incoming goods

To ensure the quality of raw materials and bought-in parts, the ferrite plants of S+M Components work only with suppliers who can establish proof of both a high quality product and an effective quality assurance system.

Where it is necessary for process control – as in the case of the iron oxide for example – the plants perform their own incoming inspections.

3.2 Quality assurance in production

The production processes are monitored and controlled by constant examination of the process parameters and (intermediate) products. These inspections are included in the company-wide statistical process control (SPC).

At the conclusion of each major production stage a release inspection ("quality control gate") is performed to establish proof of the quality.

1) FMEA Failure Mode and Effects Analyses
2) SPC Statistical Process Control

3.3 Traceability

By recording the lot or batch numbers on the documentation accompanying the process, complete traceability is maintained in the production sequence.

After delivery, traceability to the internal release inspections ("quality control gates") is ensured by the date code which is printed on the label (see page 167).

4 Delivery quality

The quality level of the products released for delivery is constantly monitored, recorded and evaluated. These data for ferrite cores are available on request.

5 Classification of defects, AQL values

A product is considered defective if it does not comply with the specifications given in the data sheets or in the agreed technical purchase specification.

Use of the sampling plan according to IEC 60410/DIN ISO 2859 (previously DIN 40 080, contents identical to MIL STD 105 D) is recommended where incoming inspections are carried out by the user.

5.1 Electrical properties

The measuring conditions can be found in the chapter "General – Definitions". The product data and relevant tolerance limits are defined in the respective data sheets. The material data given in the chapter "SIFERRIT materials" are to be understood as typical values.

Measuring conditions deviating from the data book require agreement between the customer and the S+M Ferrites plant.

5.2 Dimensions

The dimensioned drawings in the individual data sheets are definitive for the dimensions.

5.3 Finish

Assessment of the finish of ferrite cores is performed in accordance with S+M finish specifications. These are based on IEC 60421 and have been introduced by S+M Components as a proposed standard. Detailed drawings, which are available on request, specify the maximum permissible limit values for damage which can never be totally excluded with ceramic components. Assessment of the solderability of terminal pins for coil formers and clamps is carried out in accordance with IEC 68 2-20, test Ta, method 1 (aging 3).

5.4 AQL values

Within the framework of our quality goals, we are gradually tightening the AQL values which are intended for use in the customer's incoming goods inspection, currently the value AQL 0,25 is applicable.

1 General information

Ferrite parts from S+M Components are manufactured in accordance with IEC specifications. The relevant standards are quoted in the selector guide and in the individual data sheets.

It would take up too much space here to enumerate all standards dealing with ferrites. In the supplement to DIN 41 280 (Soft Magnetic Ferrite Cores: Material Properties) all relevant DIN, CECC and IEC standards are listed. This supplement is regularly updated.

The EU's standardization system currently being set up is exclusively restricted to the harmonization of international standards. A binding CE identification mark is envisaged for components having a safety implication.

The following standards should be mentioned because of their general significance:

IEC 60068	Basic environmental testing procedures
IEC 60085	Thermal evaluation and classification of electrical insulation
IEC 60367-1	Cores for inductors and transformers for telecommunications Part 1. Measuring methods
IEC 60401 (1993)	Information on ferrite materials appearing in manufacturers´ catalogs of transformer and inductor cores
IEC 60410 and DIN ISO 2859	Sampling plans and procedures for inspection by attributes
DIN 40 040	Application categories and reliability
DIN EN 50 008	Industrial low-voltage switchgear Inductive proximity switches, type A, for DC voltage, 3 or 4 terminals
UL 94	Tests for flammability of plastic materials for parts in devices and appliances
DIN ISO 9000 to DIN ISO 9004	Quality management and quality assurance standards

2 Quality assessment

The IEC standards mainly specify dimensions, designations and magnetic characteristics, whereas the European system of quality assessment CECC and the harmonized DIN-CECC standards additionally define methods of measurement and quality levels.

Since 1982 the IEC has been establishing the so-called IEC Q-system, which will have worldwide applicability. German DIN IEC standards are being harmonized with this quality system.

CECC and IEC-Q standards have a similar structure: they are subdivided into generic specifications (GS), sectional specifications (SS) and blank detail specifications (BDS). The numbering system of QC is analogous to that of CECC.

The detail specifications of CECC and IEC do not fully correspond to each other.

A quality assessment system of “Capability Approval” for the production of ferrite parts is being established.

2.1 DIN-CECC system

GS	DIN 45 970 Part1 (CECC 25 000)	Inductor and transformer cores for telecommunications
SS/BDS	DIN 45 970 Part 11 (CECC 25 100)	Magnetic oxide cores for inductor applications
SS/BDS	DIN 45 970 Part 12 (CECC 25 200)	Magnetic oxide cores for linear transformers
SS/BDS	DIN 45 970 Part 13 (CECC 25 300)	Magnetic oxide cores for power applications
SS	DIN 45 970 Part 14 (CECC 25 400)	Adjusters used with magnetic oxide cores for use in inductors and tuned transformers
BDS	DIN 45 970 Part 141 (CECC 25 401)	Adjusters used with magnetic oxide (ferrite) cores for use in inductors and tuned transformers
GS	CECC 26 000	Custom-built transformers and inductor cores

2.2 IEC system

GS	IEC 60723-1 QC 250 000	Inductor and transformer cores for telecommunications
SS	IEC 60723-2 QC 250 100	Magnetic oxide cores for inductor applications
BDS	IEC 60723-2-1 QC 250 101	Magnetic oxide cores for broadband transformer applications; quality assessment level A
SS	IEC 60723-3 QC 250 200	Magnetic oxide cores for broadband transformers
BDS	IEC 60723-3-1 QC 250 201	Magnetic oxide cores for broadband transformer applications; quality assessment level A
SS	IEC 60723-4 QC 250 300	Magnetic oxide cores for transformers and chokes for power applications
BDS	IEC 60723-4-1 QC 250 301	Magnetic oxide cores for transformers and chokes for power applications; quality assessment level A
SS	IEC 60723-5 QC 250 400	Ferrite adjusters for adjustable inductors and transformers
BDS	IEC 60723-5-1 QC 250 401	Ferrite adjusters for adjustable inductors and transformers; quality assessment level A

2.3 Detail specifications

DIN 45 970 (CECC) contains the following detail specifications for P and RM cores, material classes J4, J5 and M1 (DIN 41 280).

Part 114	P 9 × 5	J 4
Part 115	P 11 × 7	J 4
Part 116	P 14 × 8	J 4
Part 117	P 18 × 11	J 4
Part 118	P 22 × 13	J 4
Part 119	P 26 × 16	J 4
Part 1110	P 30 × 19	J 4
Part 1111	P 36 × 22	J 4
Part 1112	RM 5	J 5
Part 1113	RM 6	J 5
Part 1114	RM 8	J 5
Part 1115	P 11 × 7	J 5
Part 1116	P 14 × 8	J 5
Part 1117	P 18 × 11	J 5
Part 1118	P 22 × 13	J 5
Part 1119	P 26 × 16	J 5

Part 121	RM 5	M 1	
Part 122	RM 6	M 1	
Part 123	RM 8	M 1	
Part 124	RM 5	M 1	without center hole
Part 125	RM 6	M 1	without center hole
Part 126	RM 8	M 1	without center hole

The material properties of J4 and J5 can be implemented with N48 and those of M1 with materials N30 and T35.

Further specifications that are relevant for S+M Components products are the French UTE standards:

UTE 83313-001	CECC 25301-001	ETD 34	8P
UTE 83313-002	CECC 25301-002	ETD 39	8P
UTE 83313-003	CECC 25301-003	ETD 44	8P
UTE 83313-004	CECC 25301-004	ETD 49	8P

Class 8P can be implemented with N27.

3 IEC standards

The IEC standardization has been concluded for:

IEC 61246 (1994)	E cores
IEC 60647 (1979)	EC cores
IEC 61596 (1995)	EP cores
IEC 61185 (1995)	ETD cores
IEC 60133 (1985)	P cores
IEC 61247 (1995)	PM cores
IEC 60431 (1983)	RM 4 to RM 10 RM 12, RM 14 (amendment 1, 1995)

Please refer to the latest CO publications.

1 General information

The demand for coil formers with integrated pins for efficient winding gave rise to the development of compact RM (**R**ectangular **M**odular) cores. Furthermore, this design allows high PCB packing densities. RM coil formers and accessories are suited to automatic processing.

During assembly, RM cores are held in place by clamps which engage in recesses in the core base. The holding forces defined for our further developed RM clamps mean that in the majority of applications the glue bonding usually employed previously (cf. chapter on "Processing notes", page 162) is no longer required. The various clamping forces defined, which have been verified by S+M Components through measurements, are specified in the individual data sheets.

The core dimensions are matched to standard PCB grids. RM6 means, for example, that the core with coil former fills a square basic area 6 × 6 modules (1 module ≙ 2,54 mm) = 15,24 × 15,24 mm^2. The mainly used core sizes RM4 through RM14 are specified in IEC 60431.

2 Applications

- Originally RM cores from Siemens (today S+M Components) were essentially designed for two major applications, i.e.
  – very low-loss, highly stable filter inductors and other resonance determining inductors (materials N48, M33 and K1) and
  – low-distortion broadband transmission at low signal modulation (materials T42, T38, T35, N30, N26).

  Even today there is still a high demand for RM cores suited to these applications.
- RM cores are increasingly required for power applications. For this purpose our core series made of materials N87 and N49 (ungapped) is particularly well suited. Matching coil formers with larger pin spacings are available. RM cores without center hole (higher A_L value and greater power capacity) are used for transformer applications.
- Our product range also includes low-profile RM cores, whose significantly reduced overall height makes them suitable for small-signal, interface and matching transformers and also for transformer and energy storage chokes in DC/DC converters with a high pulse rate (materials N87 and N49). The low-profile types are particularly suited for applications where the winding is printed onto the PCB and the core is fitted to the board from either side.
- In addition to conventional accessories, SMD coil formers are available for RM4 Low Profile, RM5, RM6 and RM6 Low Profile.
- RM cores with or without center hole can be supplied in any material on request.
- For power applications, particularly for compact energy storage chokes, we supply the RM12 and RM14 cores with optimized, strengthened base thickness.

3 Marking of RM core sets

The material and the A_L value are always stamped on RM cores ≥ RM4, the material and "o. L." (= without air gap) are stamped onto ungapped cores. Only one core half of the two comprising a set carries the marking. With cores having an unsymmetrical air gap (the total air gap is ground into one half) the ground half carries the marking, with cores including a glued-in threaded sleeve the half without sleeve is marked.

4 Clamping instead of glue bonding

Investigation of further rationalization in the automatic processing of RM cores has led to the result that a complete assembly step – glue bonding ot the core halves – can be omitted.

The following benefits result for the user:

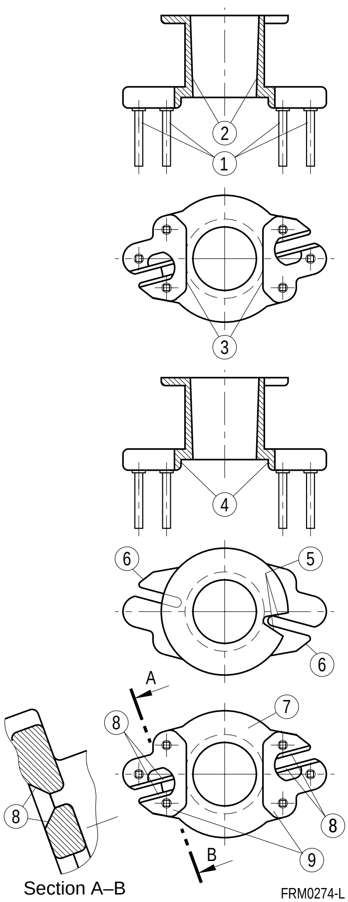
- shorter assembly times
- no investment costs for gluing machines
- shorter idle times during coil assembly
- no cost for glue

For this reason, S+M Components has developed a stainless steel clamp for RM cores that guarantees a defined clamping force. We are the sole supplier of this type of clamp, which is available with or without ground terminal. The core is provided with a nose to prevent the clamp from slipping off.

5 Coil formers for automatic processing

Automated manufacture is gaining more and more importance for the low-cost production of inductive components. The prerequisites are high-performance winding and assembly machines on the one hand, and suitable accessories on the other.

The new S+M Components RM coil formers were developed to meet this demand. These coil formers are not only matched to the versatile concepts of automation, but also offer advantages for manual winding. The essential improvements of the version optimized for automatic processing will be described in the following, taking the example of an RM6 coil former. The consistent utilization of these benefits will in most cases bring about a reduction of production costs for inductors and transformers.



① Squared pins
Secure restraint of the ends of the winding even with 2 to 3 winding corners; the winding process is considerably accelerated

② Internal diameter slightly conical and highly accurate
Easy and fast slipping-on and snug fit on the winding tools

③ Shortened wire guidance slots
Substantially higher flange breaking strength

④ Almost parallel flanges with minimum radii at the winding cylinder to the flange
Correct winding layers, more turns, neat and rapid winding

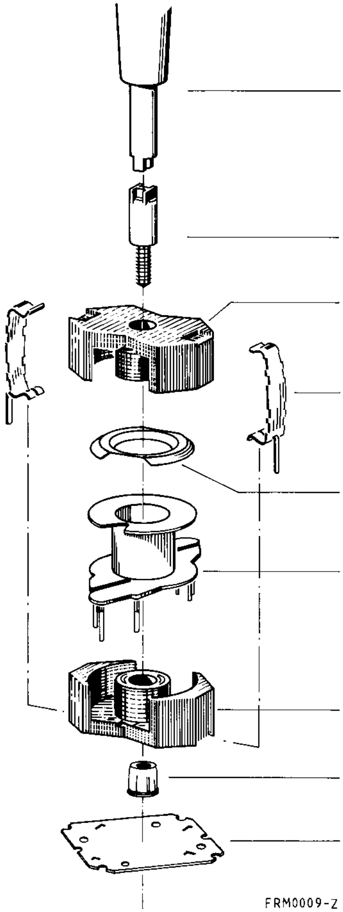
⑤ V-shaped slot in the pinless flange
Automatic loading and unloading of winding machine possible. Substantially more accurate fixing and arrangement of the coil formers

⑥ Lengthened wire catching nose
Leads all wires safely into the wire guidance slots, even at high winding speed

⑦ Pinless flange without marking
Substantially more accurate arrangement of the coil formers for winding and wrapping

⑧ Slot outlet stepped in height
Owing to the transfer of the wire crossing to the level of the slot, short circuit is prevented when soldering the ends of the winding to the pins

⑨ Insulation web
Improved insulation between the winding wires and the ferrite core



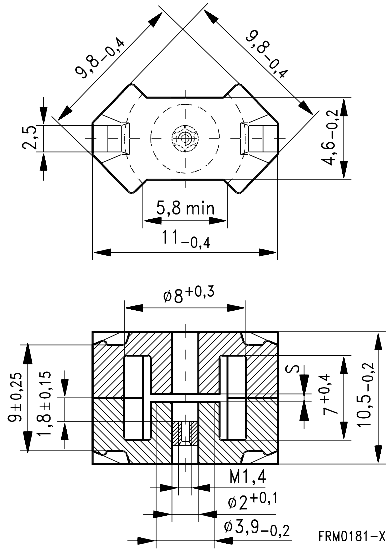
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	189
Matching handle	B63399	189
Adjusting screw	B65539	189
Core	B65803	185
Clamps	B65806	188
Insulating washer 1	B65804	188
Coil former	B65804	187
Core	B65803	185
Threaded sleeve (glued-in)		
Insulating washer 2	B65804	188

Also available:

RM 4 low profile:		
Core	B65803-P	193
Coil former	B65804	194
Clamp	B65804	195
Insulating washer 1 + 2	B65804	195
SMD coil former	B65804	196

- In accordance with IEC 60431
- Core without center hole for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	1,9	1,7	mm^{-1}
l_e	21	22	mm
A_e	11	13	mm^2
A_{min}	—	11,3	mm^2
V_e	232	286	mm^3

Approx. weight (per set)

m	1,45	1,65	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code[1)] -A with center hole -N with threaded sleeve
K1	16 ± 3 %	1,0	24,2	B65803-+16-A1
	25 ± 3 %	0,40	37,8	B65803-+25-A1
M33	40 ± 3 %	0,36	60,4	B65803-+40-A33
	63 ± 3 %	0,18	95	B65803-+63-A33
N48	63 ± 3 %	0,16	95	B65803-+63-A48
	100 ± 3 %	0,10	151	B65803-+100-A48
	160 ± 3 %	0,06	242	B65803-+160-A48

1) Replace the + by the code letter “A” or “N” for the required version.

Ungapped

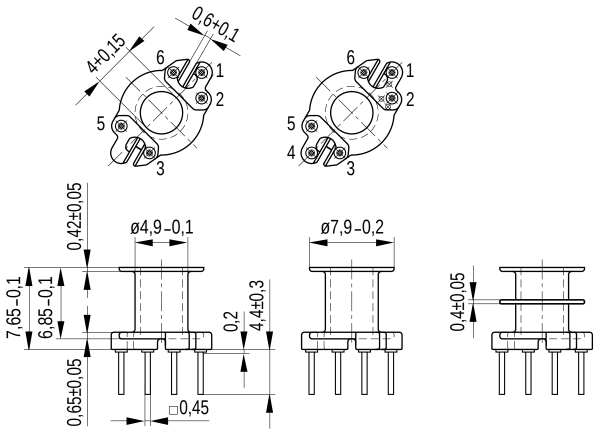
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -J w/o center hole
N30	1900 + 30/– 20 %	2570			B65803-J-R30
T35	2800 + 40/– 30 %	3790			B65803-J-Y35
T38	3700 + 40/– 30 %	5000			B65803-J-Y38
N49	750 + 30/– 20 %	1010	450	0,04 (50 mT, 500 kHz, 100 °C)	B65803-J-R49
N87	1100 + 30/– 20 %	1480	650	0,20 (200 mT, 100 kHz, 100 °C)	B65803-J-R87

Coil former

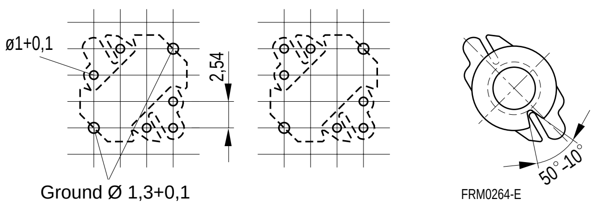
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins
For matching clamp and insulating washers see page188

Sections	A_N mm²	l_N mm	A_R value μΩ	Pins	Ordering code
1	8,7	20,1	80	5	B65804-N1005-D1
				6	B65804-N1006-D1
2	8,1	20,1	85	5	B65804-N1005-D2
				6	B65804-N1006-D2

5 pins 6 pins



Hole arrangement
View in mounting direction



Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,335 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

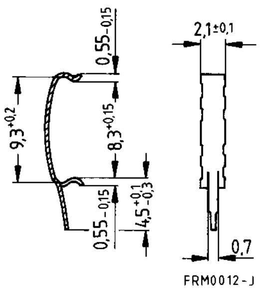
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

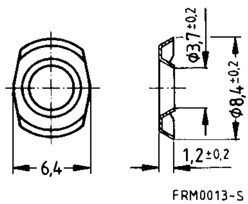
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65806-A2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65804-A5000
Insulating washer 2 (bulk)	B65804-C2005

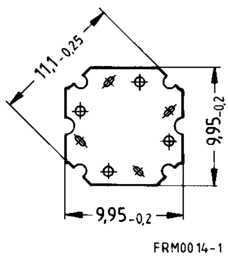
Clamp



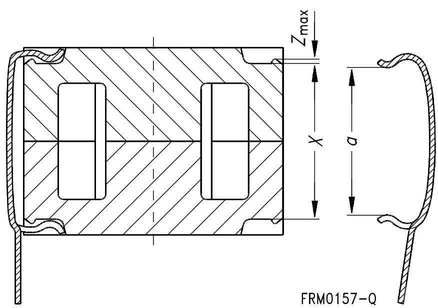
Insulating washer 1



Insulating washer 2



Clamping forces for RM 4



F_{min}: Extension of clamp from a to $a_2 = X_{min}$
F_{max}: Extension of clamp from a to $a_1 = X_{max}$

Clamp opening a (mm)		8,3 + 0,15
Core nose Z_{max} (mm)		0,15
Height of core pair X (mm)	X_{min}	8,75
	X_{max}	9,25
Clamping force F (N)	F_{min}	5
	F_{max}	40

Adjusting screw

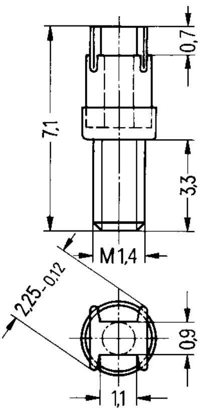
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core RM 4		**Adjusting screw**			Min. adjusting range	Ordering code
		Tube core				
Material	A_L value nH	∅ × length mm	Material	Color code	%	
K 1	16	1,81 × 2,0	Si 1	black	20	B65539-C1003-X101
	25	1,81 × 2,0	K 1	yellow	21	B65539-C1003-X1
M 33	40	1,81 × 2,0	Si 1	black	17	B65539-C1003-X101
	63	1,81 × 2,0	K 1	yellow	21	B65539-C1003-X1
N 48	63	1,81 × 2,0	Si 1	black	12	B65539-C1003-X101
	100	1,81 × 2,0	K 1	yellow	17	B65539-C1003-X1
	160	1,81 × 2,7	N 22	red	12	B65539-C1002-X22
Adjusting screwdriver						B63399-B4
Handle						B63399-B5

Adjusting screw

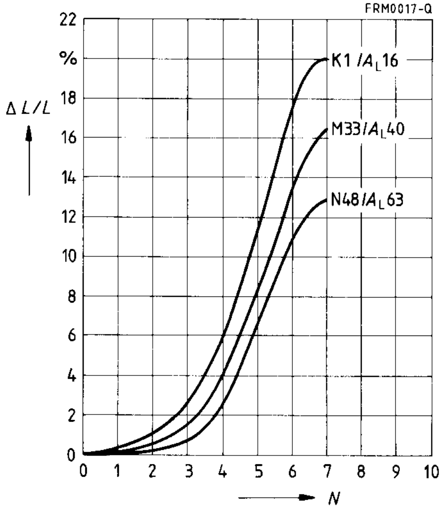


FRM0015-9

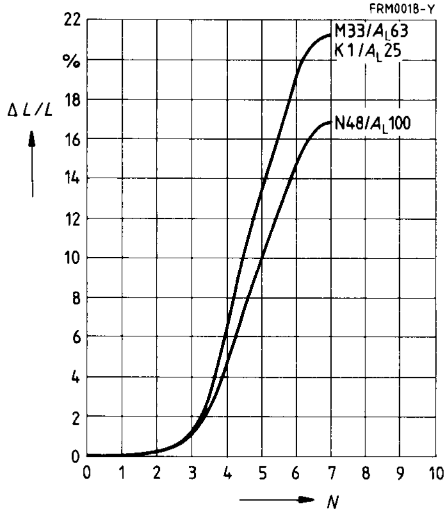
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

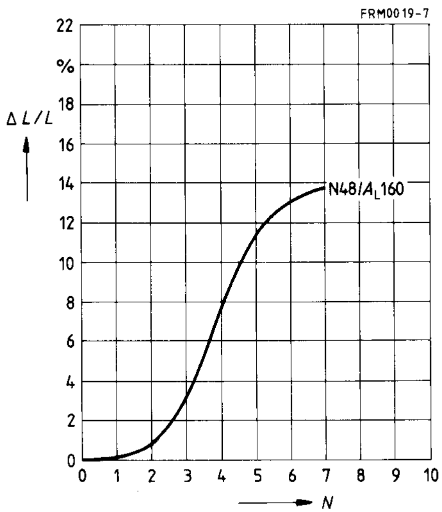
Adjusting screw B65539-C1003-X101
Color code black



Adjusting screw B65539-C1003-X1
Color code yellow

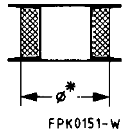


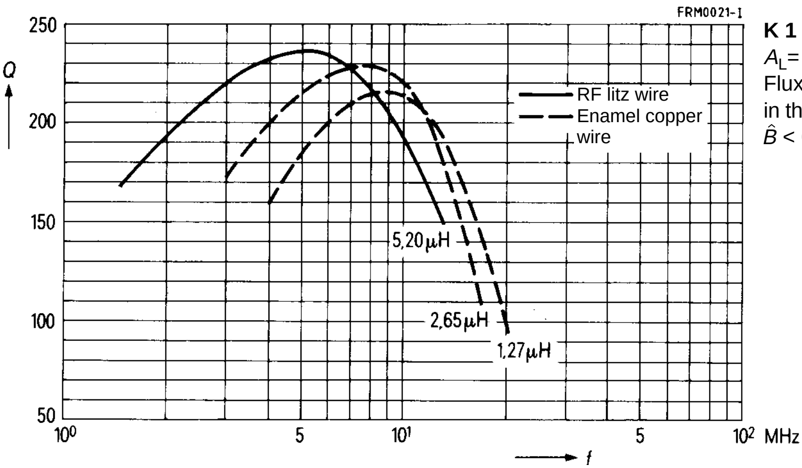
Adjusting screw B65539-C1002-X22
Color code red



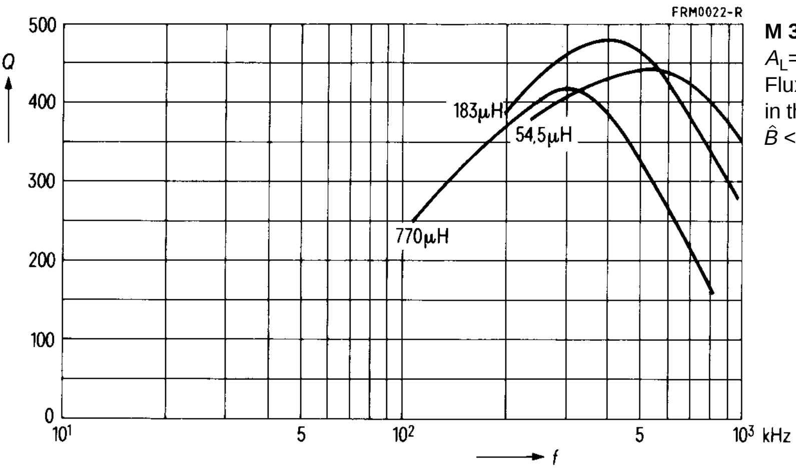
Q factor characteristics (typical values)

Material	A_L value	L µH	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	25 nH	5,20 2,65 1,27	14 10 7	45 × 0,04 CuLS 0,5 CuL 0,6 CuL	1 1 1	6,6 6,6 6,4
M 33	63 nH	770 183 54,5	100 52 29	20 × 0,04 CuL 45 × 0,04 CuL 90 × 0,04 CuL	1 1 1	— — —





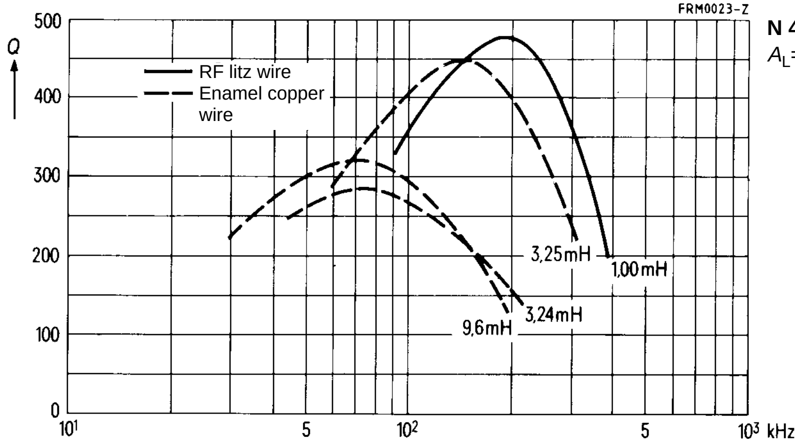
K 1
A_L = 25 nH
Flux density in the core
$\hat{B}$ < 0,5 mT



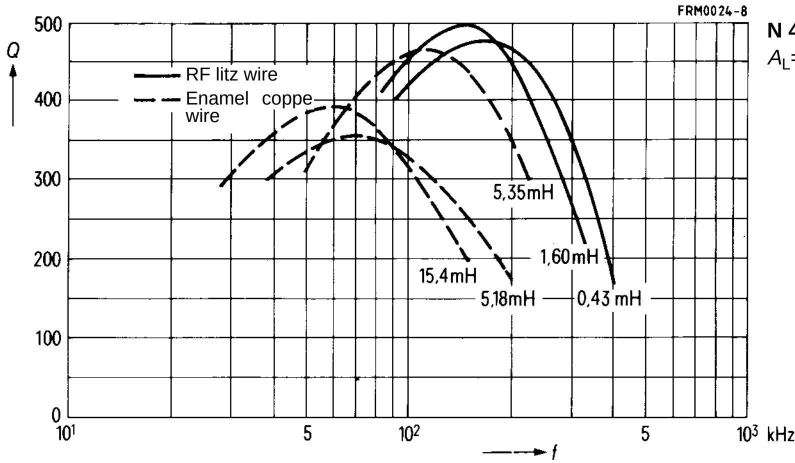
M 33
A_L = 63 nH
Flux density in the core
$\hat{B}$ < 1 mT

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1 mT

Mate-rial	*L* (mH) for A_L = 100 nH	*L* (mH) for A_L = 160 nH	Turns	Wire; RF litz wire	Sec-tions
N 48	—	0,43	52	45 × 0,04 CuLS	1
	1,00	1,60	100	20 × 0,04 CuLS	1
	3,24	5,18	180	0,18 CuL	1
	9,60	15,40	310	0,14 CuL	1
	3,25	5,35	183	10 × 0,05 CuL	1

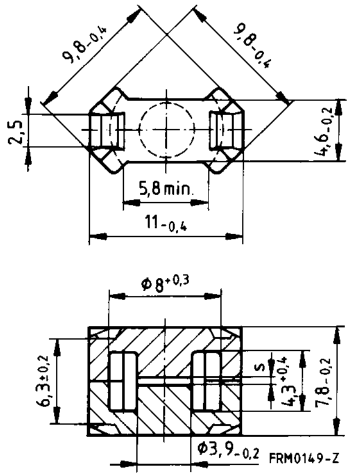


N 48
A_L = 100 nH



N 48
A_L = 160 nH

- For compact transformers with high inductance
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,2 mm^{-1}
l_e = 17,3 mm
A_e = 14,5 mm^2
A_{min} = 11,3 mm^2
V_e = 251 mm^3

Approx. weight 1,2 g/set

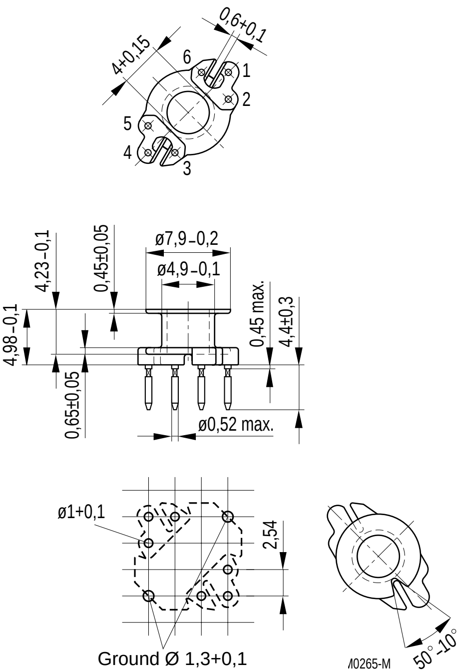
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
T38	5000 + 40/– 30 %	4770			B65803-P-Y38
N49	860 + 30/– 20 %	820	630	0,03 (50 mT, 500 kHz, 100 °C)	B65803-P-R49
N87	1300 + 30/– 20 %	1234	950	0,09 (200 mT, 160 kHz, 100 °C)	B65803-P-R87

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 180 °C), color code blue
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 160 (as SMD coil former)
Pins squared in the start-of-winding area
For matching clamp and insualting washers see page195

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	4,7	20,1	147	6	B65804-R1006-D1



Hole arrangement
View in mounting direction

Clamp

- With and without ground terminal, made of stainless spring steel, 0,3 mm thick, clamp with ground terminal tinned
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Clamping force 40 N per pair of clamps (typical value)
- Also available as strip clamp on reels on request

Insulating washer 1 between core and coil former

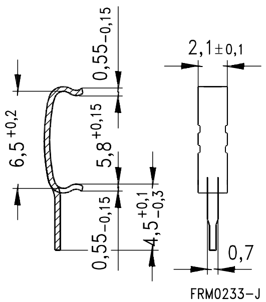
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

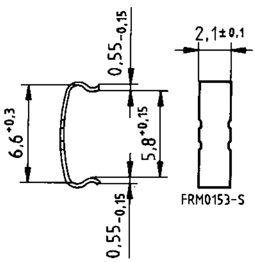
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp with ground terminal (ordering code per piece, 2 are required)	B65804-P2203
Clamp without ground terminal (ordering code per piece, 2 are required)	B65804-P2204
Insulating washer 1 (reel packing, PU = 1 reel)	B65804-A5000
Insulating washer 2 (bulk)	B65804-C2005

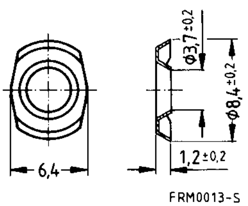
Clamp with ground terminal



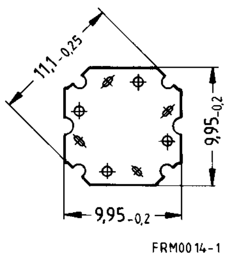
Clamp without ground terminal



Insulating washer 1



Insulating washer 2



SMD coil former with J terminals

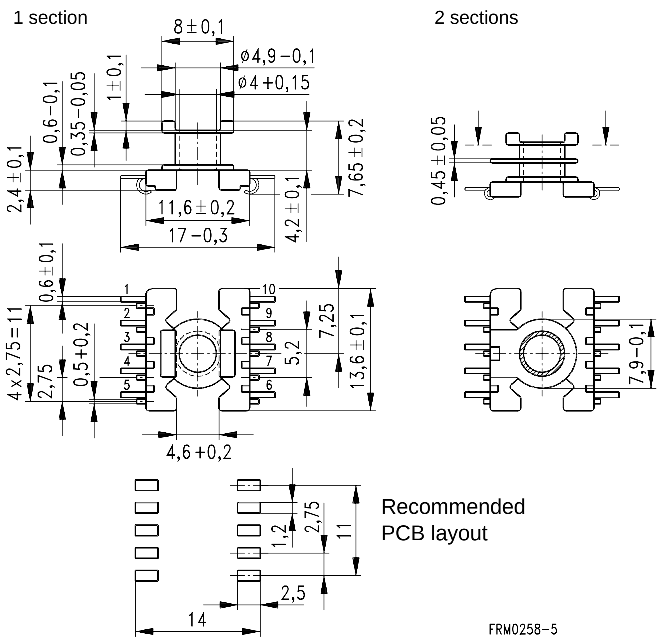
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

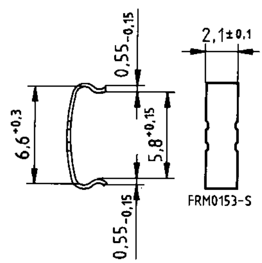
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels), also on a reel on request

Sections	A_N mm[2]	l_N mm	A_R value µΩ	Termi-nals 1)	Ordering code
1	5,0	20,1	138	10	B65804-B6010-T1
2	4,4	20,1	157	10	B65804-B6010-T2
Clamp	(ordering code per piece, 2 are required)				B65804-P2204

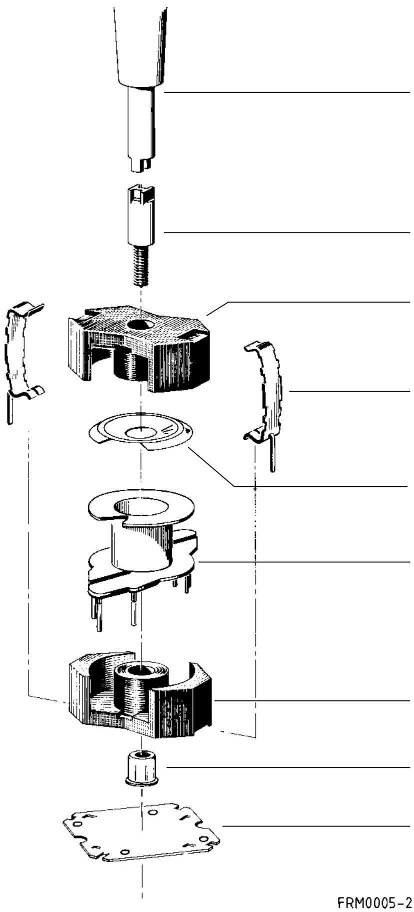
Coil former



Clamp



1) 6 and 8 terminals on request



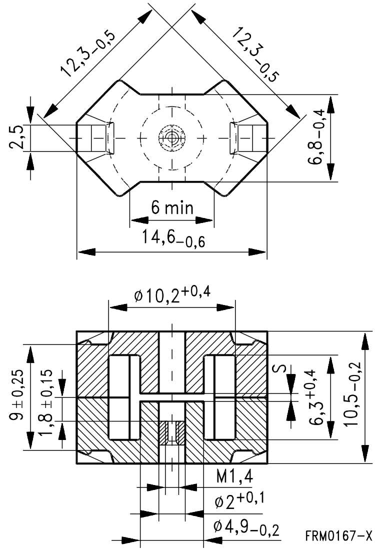
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	204
Matching handle	B63399	204
Adjusting screw	B65539 B65806	204
Core	B65805	198
Clamps	B65806	201
Insulating washer 1	B65806	201
Coil former	B65806	200
Core	B65805	198
Threaded sleeve (glued-in)		
Insulating washer 2	B65806	201

Also available:

SMD coil former	B65822	202, 203
RM 5 low profile:		
Core	B65805-P	209
SMD coil former	B65822	210
Clamp	B65804	210

- In accordance with IEC 60431
- Core without center hole
  for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	1,0	0,93	mm^{-1}
l_e	20,8	22,1	mm
A_e	20,8	23,8	mm^2
A_{min}	15	18	mm^2
V_e	430	526	mm^3

Approx. weight (per set)

m	2,9	3,0	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code[1)] -C with center hole -N with threaded sleeve
K1	25 ± 3 %	1,0	19,9	B65805-+25-A1
	40 ± 3 %	0,40	31,8	B65805-+40-A1
M33	63 ± 3 %	0,4	50,2	B65805-+63-A33
	100 ± 3 %	0,2	79,6	B65805-+100-A33
N48	125 ± 2 %	0,16	100	B65805-+125-G48
	160 ± 3 %	0,12	128	B65805-+160-A48
	250 ± 3 %	0,06	200	B65805-+250-A48
	315 ± 3 %	0,03	255	B65805-+315-A48

1) Replace the + by the code letter “C” or “N” for the required version.

Ungapped

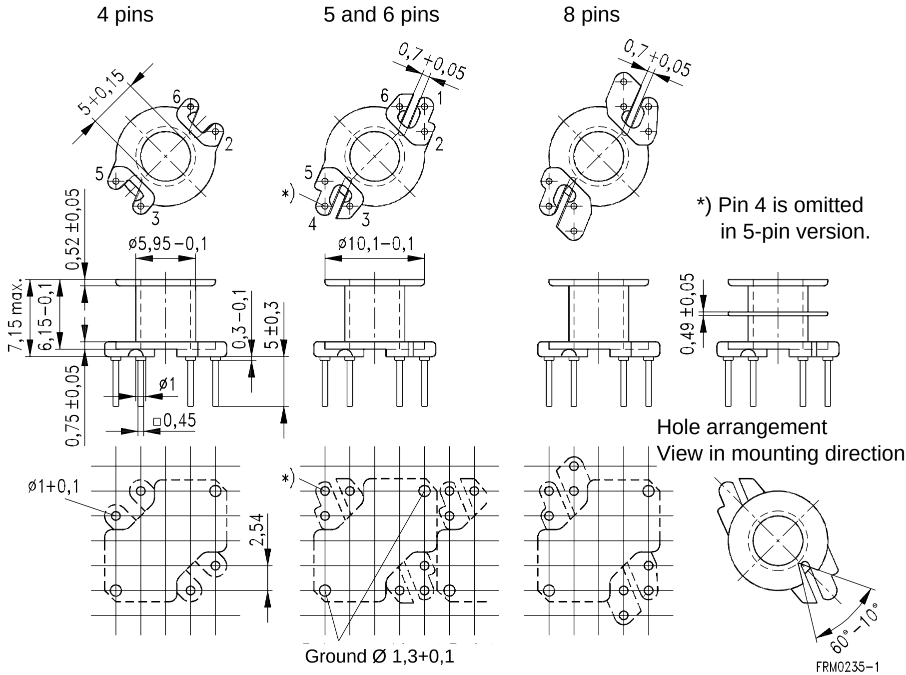
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code[1)] -C with center hole -J w/o center hole
N26	1800 + 30/– 20 %	1430			B65805-C-R26
N30	3500 + 30/– 20 %	2590			B65805-J-R30
T35	5200 + 30/– 20 %	3850			B65805-J-R35
T38	6700 + 40/– 30 %	4960			B65805-J-Y38
T42	9600 + 40/– 30 %	7090			B65805-J-Y42
N49	1300 + 30/– 20 %	960	810	0,06 (50 mT, 500 kHz, 100 °C)	B65805-J-R49
N67	1800 + 30/– 20 %	1330	1200	0,40 (200 mT, 100 kHz, 100 °C)	B65805-J-R67
N87	2000 + 30/– 20 %	1470	1200	0,32 (200 mT, 100 kHz, 100 °C)	B65805-J-R87
N41	2600 + 30/– 20 %	1920	1200	0,10 (200 mT, 100 kHz, 100 °C)	B65805-J-R41

1) Replace the + by the code letter “C” or “J” for the required version.

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins
For matching clamps and insulating washers see page 201

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	9,5	25	90	4	B65806-N1004-D1
				5	B65806-N1005-D1
				6	B65806-N1006-D1
				8	B65806-N1008-D1
2	8,7	25	94	4	B65806-N1004-D2
				5	B65806-N1005-D2
				6	B65806-N1006-D2



Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,335 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

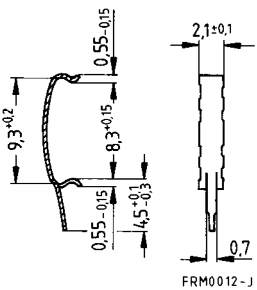
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

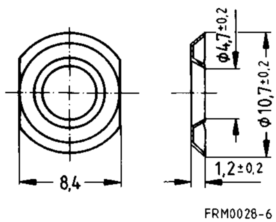
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65806-A2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65806-A5000
Insulating washer 2 (bulk)	B65806-D2005

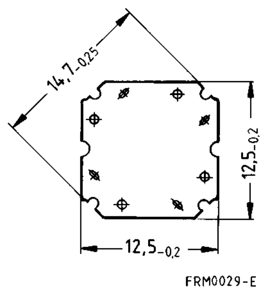
Clamp



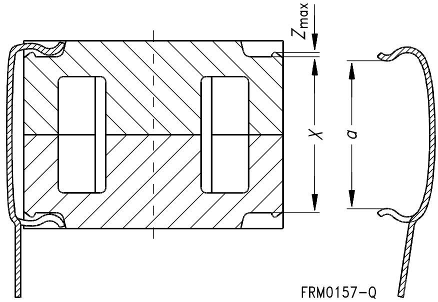
Insulating washer 1



Insulating washer 2



Clamping forces for RM 5



F_{min}: Extension of clamp from a to $a_2 = X_{min}$
F_{max}: Extension of clamp from a to $a_1 = X_{max}$

Clamp opening a (mm)		8,3 + 0,15
Core nose Z_{max} (mm)		0,15
Height of core pair X (mm)	X_{min}	8,75
	X_{max}	9,25
Clamping force F (N)	F_{min}	5
	F_{max}	40

SMD coil former with gullwing terminals

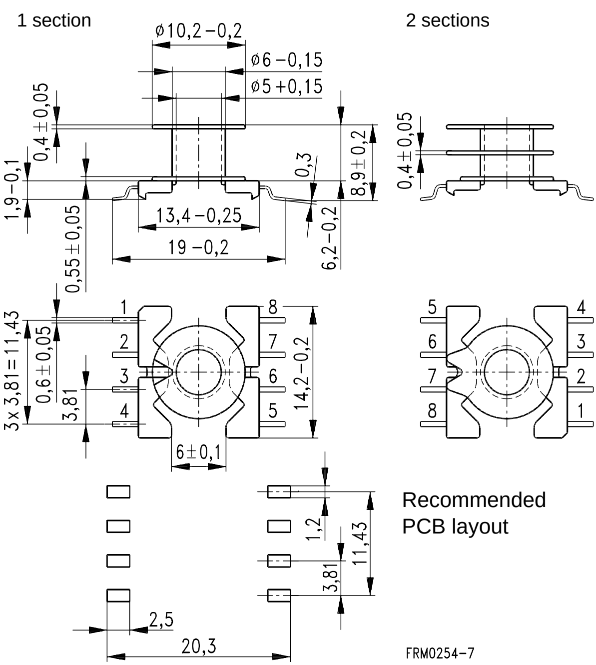
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

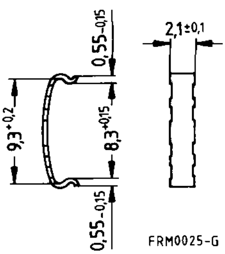
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels), also on a reel on request

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	11,1	25	77	8	B65822-F1008-T1
2	10,2	25	85	8	B65822-F1008-T2
Clamp	(ordering code per piece, 2 are required)				B65806-J2204

Coil former



Clamp



SMD coil former with J terminals

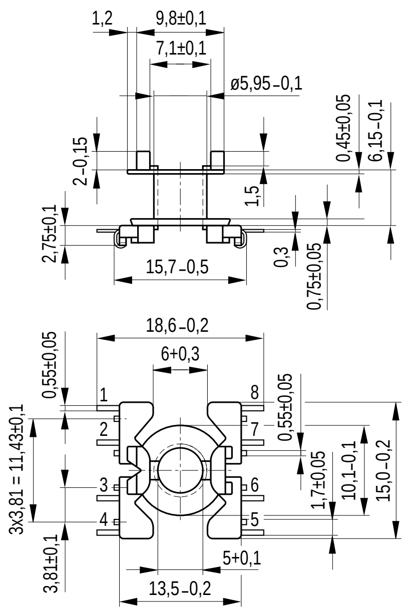
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

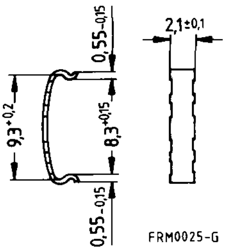
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels)
- Also available on a reel on request

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	11,1	25	73	8	B65822-J1008-T1
Clamp	(ordering code per piece, 2 are required)				B65806-J2204

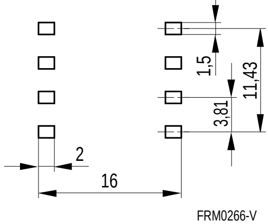
Coil former



Clamp



Recommended
PCB layout



Adjusting screw

- Tube core with thread and core brake made of GFR polyterephthalate

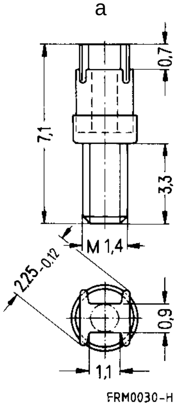
Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

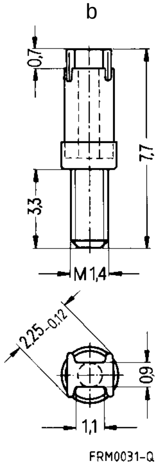
Core RM 5		**Adjusting screw**				Min. adjusting range	Ordering code
Material	A_L value nH	Fig.	Tube core ∅ × length mm	Material	Color code	%	
K 1	25	a	1,81 × 2,0	Si 1	black	13	B65539-C1003-X101
	40	a	1,81 × 2,0	K 1	yellow	16	B65539-C1003-X1
M 33	63	a	1,81 × 2,7	Si 1	white	11	B65539-C1002-X101
	100	a	1,81 × 2,0	K 1	yellow	14	B65539-C1003-X1
N 48	125	a	1,81 × 2,0	K 1	yellow	13	B65539-C1003-X1
	160 200	a	1,81 × 2,7	N 22	red	15 11	B65539-C1002-X22
	250 315	b	1,81 × 3,4	N 22	green	13 9	B65806-C3001-X22
	315	b	1,90 × 3,4	N 22	blue	12	B65806-A3002-X22
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

Adjusting screws

a



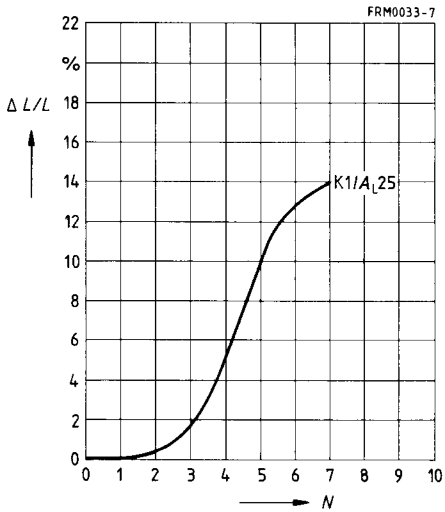
b



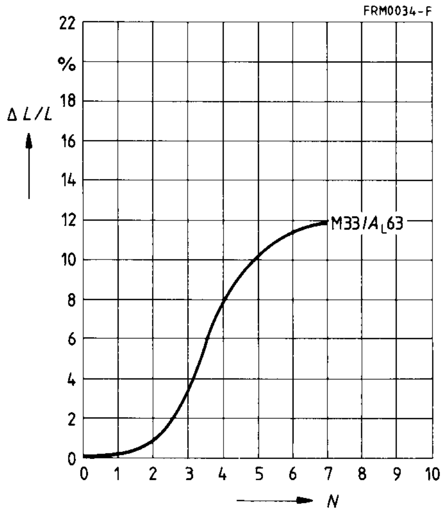
Inductance adjustment curves (nominal values)

Relative inductance change Δ L/L versus turns N of adjusting screw.
0 ≙ at least 1 turn engaged.

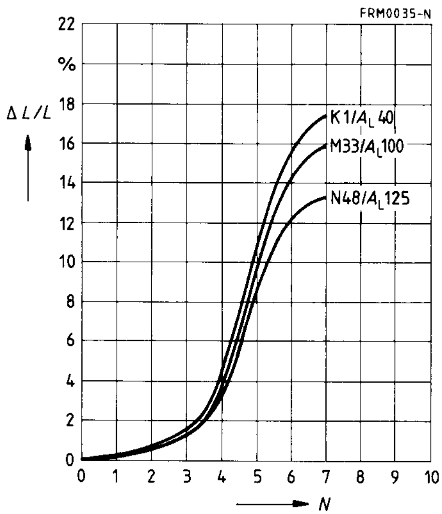
Adjusting screw B65539-C1003-X101
Color code black



Adjusting screw B65539-C1002-X101
Color code white



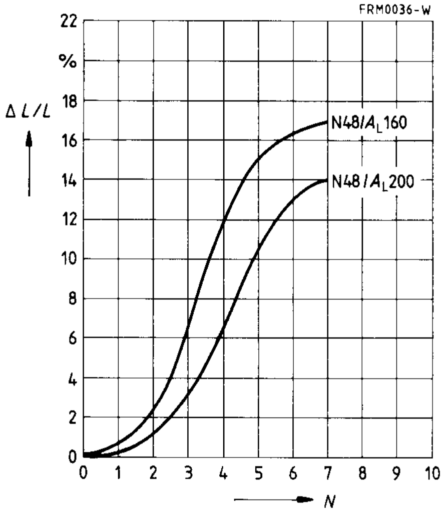
Adjusting screw B65539-C1003-X1
Color code yellow



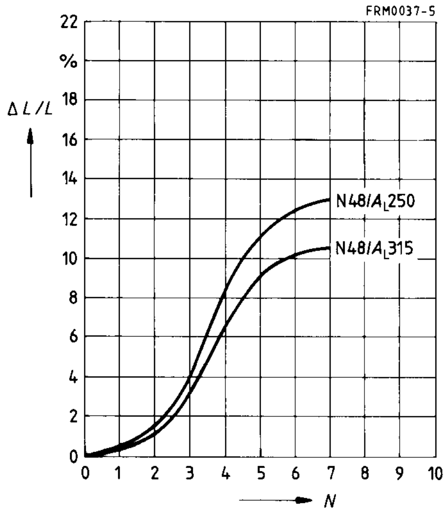
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

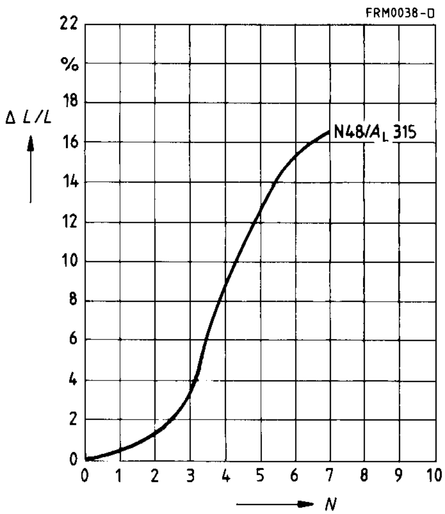
Adjusting screw B65539-C1002-X22
Color code red



Adjusting screw B65806-C3001-X22
Color code green

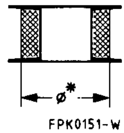


Adjusting screw B65806-A3002-X22
Color code blue

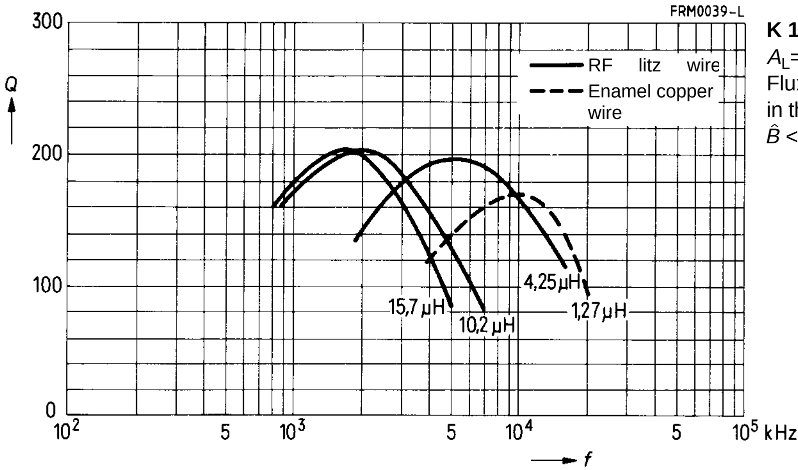


Q factor characteristics (typical values)

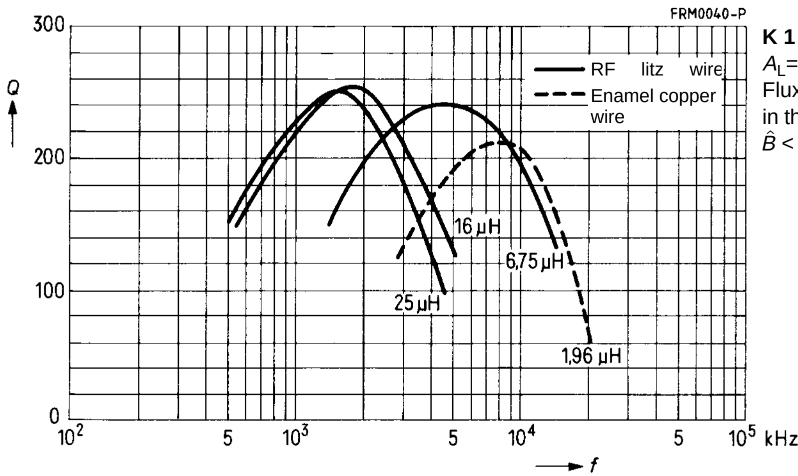
Mate-rial	L (µH) for A_L = 25 nH	L (µH) for A_L = 40 nH	Turns	Wire; RF litz wire	Sec-tions	Ø* mm
K 1	1,27	1,96	7	0,6 CuL	1	8,5
	4,25	6,75	13	30 × 0,04 CuLS	1	9,0
	15,7	25	25	30 × 0,04 CuLS	1	8,4
	10,2	16	20	40 × 0,04 CuLS	1	8,2



* Pad of polystyrene tape up to diameter Ø



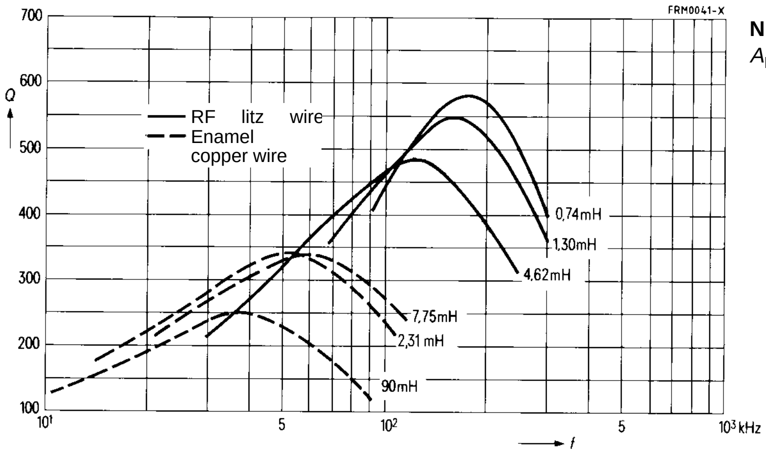
K 1
A_L = 25 nH
Flux density in the core
$\hat{B}$ < 0,5 mT



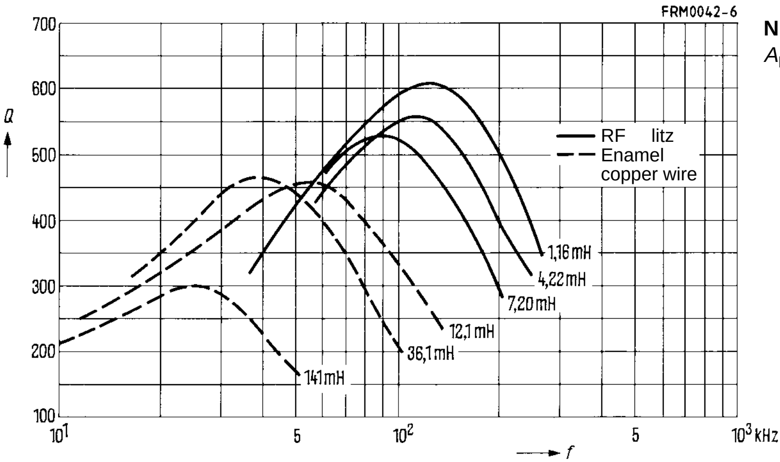
K 1
A_L = 40 nH
Flux density in the core
$\hat{B}$ < 0,6 mT

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1 mT

Material	*L* (mH) for A_L = 100 nH	*L* (mH) for A_L = 160 nH	Turns	Wire; RF litz wire	Sections
N 48	90	141	750	0,1 CuL	1
	23,1	36,1	380	0,14 CuL	1
	7,75	12,1	220	0,18 CuL	1
	4,62	7,20	170	10 × 0,05 CuLS	1
	—	4,22	130	20 × 0,04 CuLS	1
	1,30	—	90	30 × 0,04 CuLS	1
	0,74	1,16	68	45 × 0,04 CuLS	1

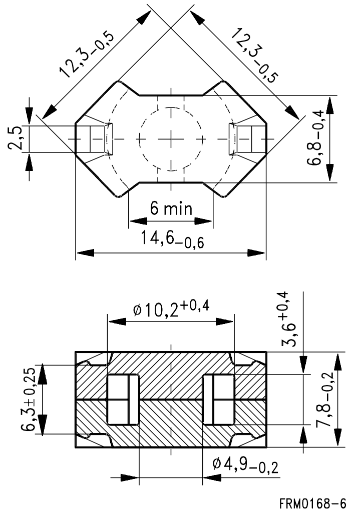


N 48
A_L = 160 nH



N 48
A_L = 250 nH

- For compact transformers
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,71 mm^{-1}
l_e = 17,5 mm
A_e = 24,5 mm^2
A_{min} = 18 mm^2
V_e = 430 mm^3

Approx. weight 2,6 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1}	P_V W/set	Ordering code
N49	1700 + 30/– 20 %	960	800	0,09 (50 mT, 500 kHz, 100 °C)	B65805-P-R49
N87	2400 + 30/– 20 %	1360	2590	0,26 (200 mT, 100 kHz, 100 °C)	B65805-P-R87

SMD coil former with gullwing terminals

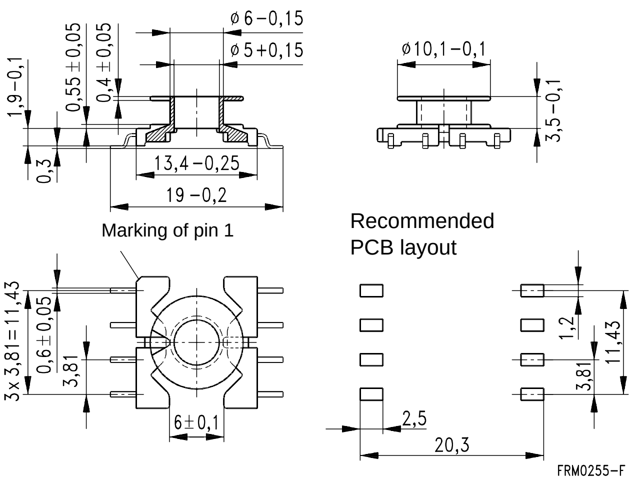
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

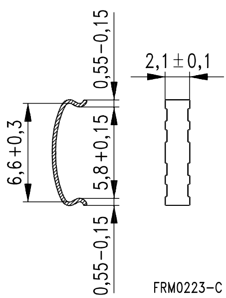
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels)
- Also available on a reel on request

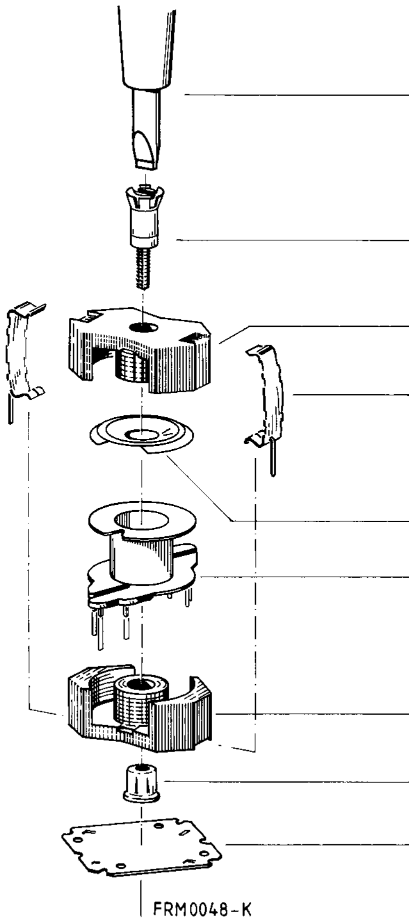
Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	5,1	25	169	8	B65822-A6008-T1
Clamp	(ordering code per piece, 2 are required)				B65804-P2204

Coil former



Clamp





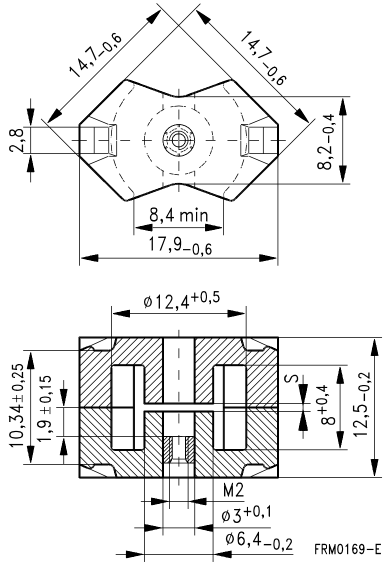
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	220
Matching handle	B63399	220
Adjusting screw	B65659	220
Core	B65807	212
Clamps	B65808	217
Insulating washer 1	B65808	217
Coil former	B65808	214
Core	B65807	212
Threaded sleeve (glued-in)		
Insulating washer 2	B65808	217

Also available:

Coil former for SMPS transf.	B65808	215
Coil former for power applications	B65808	216
SMD coil former	B65821	218, 219
RM 6 low profile:		
Core	B65807-P	225
SMD coil former	B65821	226
Clamp	B65808	226

- In accordance with IEC 60431
- Core without center hole for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,86	0,78	mm^{-1}
l_e	26,9	28,6	mm
A_e	31,3	36,6	mm^2
A_{min}	—	31	mm^2
V_e	840	1050	mm^3

Approx. weight (per set)

m	4,9	5,3	g

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code[1)] -J without center hole -N with threaded sleeve -C with center hole
K1	40 ± 3 %	0,80	27,4	B65807-+40-A1
M33	63 ± 3 %	0,60	43,2	B65807-+63-A33
	100 ± 3 %	0,38	68,5	B65807-+100-A33
N48	160 ± 2 %	0,22	110	B65807-+160-G48
	250 ± 3 %	0,12	171	B65807-+250-A48
	315 ± 3 %	0,08	216	B65807-+315-A48
	400 ± 3 %	0,05	274	B65807-+400-A48
N41	250 ± 3 %	0,17	155	B65807-J250-A41
N26	1000 ± 10 %	0,03	685	B65807-+1000-K26

1) Replace the + by the code letter "C" or "N" for the required version. Standard version is "C".

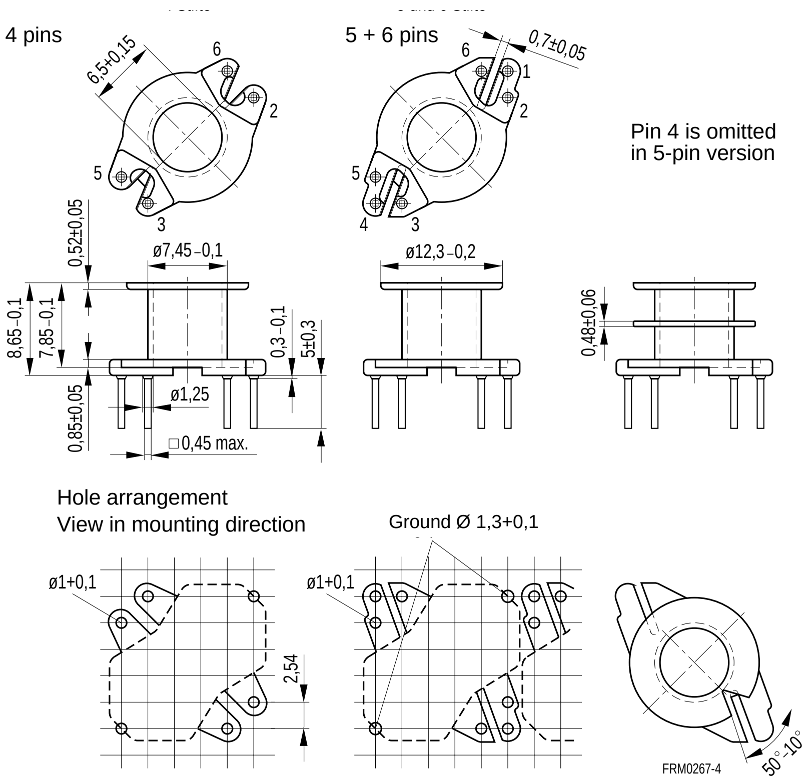
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -C with center hole -J w/o center hole
N26	2200 + 30/– 20 %	1500			B65807-C-R26
N30	4300 + 30/– 20 %	2670			B65807-J-R30
T35	6200 + 30/– 20 %	3850			B65807-J-R35
T38	8600 + 40/– 30 %	5340			B65807-J-Y38
T42	12300 + 40/– 30 %	7630			B65807-J-Y42
N49	1700 + 30/– 20 %	1060	960	0,15 (50 mT, 500 kHz, 100 °C)	B65807-J-R49
N67	2200 + 30/– 20 %	1490	1450	0,64 (200 mT, 100 kHz, 100 °C)	B65807-J-R67
N87	2400 + 30/– 20 %	1490	1450	0,51 (200 mT, 100 kHz, 100 °C)	B65807-J-R87
N41	3100 + 30/– 20 %	1920	1450	0,16 (200 mT, 25 kHz, 100 °C)	B65807-J-R41

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins. For matching clamp and insulating washers see page 217.

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	15	30	69	4	B65808-N1004-D1
				5	B65808-N1005-D1
				6	B65808-N1006-D1
2	14	30	73	4	B65808-N1004-D2
				5	B65808-N1005-D2
				6	B65808-N1006-D2



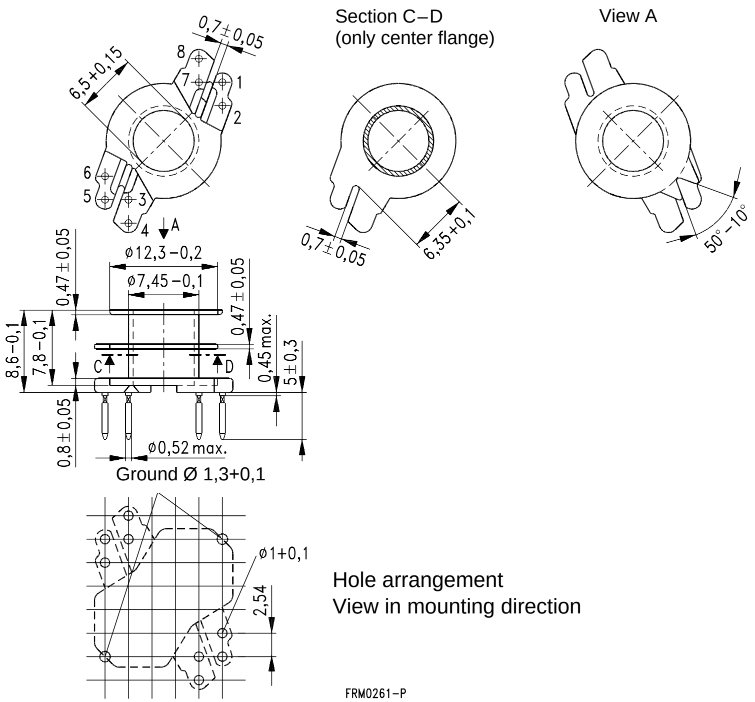
Coil former for SMPS transformers with line isolation

The creepage distances and clearances are designed such that the coil former is suitable for use in SMPS transformers with line isolation.

- Closed center flange with external wire guide
- Pins squared in the start-of-winding area
- Optimized for use with automatic winding machines

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
2	14	30	73	8	B65808-X1108-D2

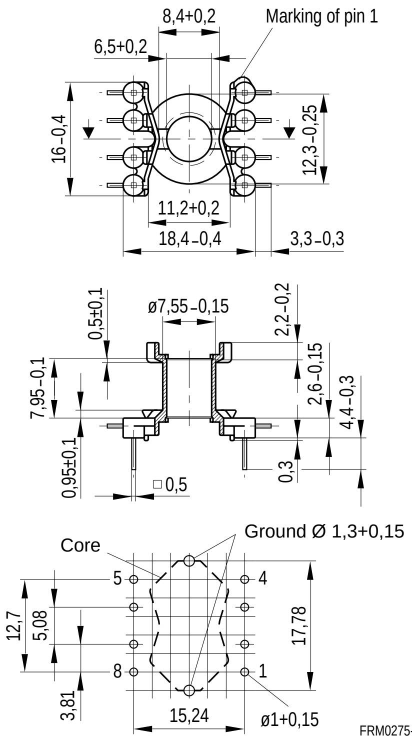


Coil former for power applications

Optimized for automatic winding
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

For matching clamp and insulating washer 1 see page 217

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	15	30	69	8	B65808-E1508-T1



FRM0275-U

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,435 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

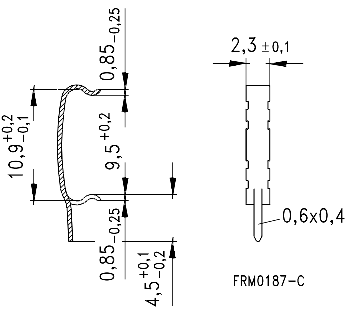
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

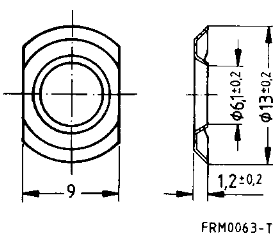
Insulating washer 2 for double-clad PCBs

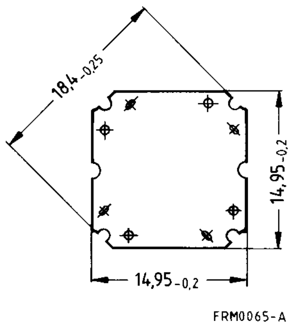
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65808-A2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65808-A5000
Insulating washer 2 (bulk)	B65808-C2005

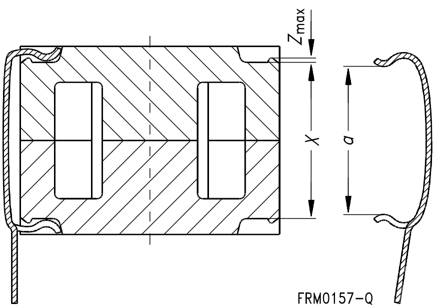
Clamp **Insulating washer 1** **Insulating washer 2**







Clamping forces for RM 6



F_{min}: Extension of clamp from a to $a_2 = X_{min}$
F_{max}: Extension of clamp from a to $a_1 = X_{max}$

Clamp opening a (mm)		9,5 + 0,2
Core nose Z_{max} (mm)		0,22
Height of core pair X (mm)	X_{min}	10,1
	X_{max}	10,6
Clamping force F (N)	F_{min}	7
	F_{max}	50

SMD coil former with gullwing terminals

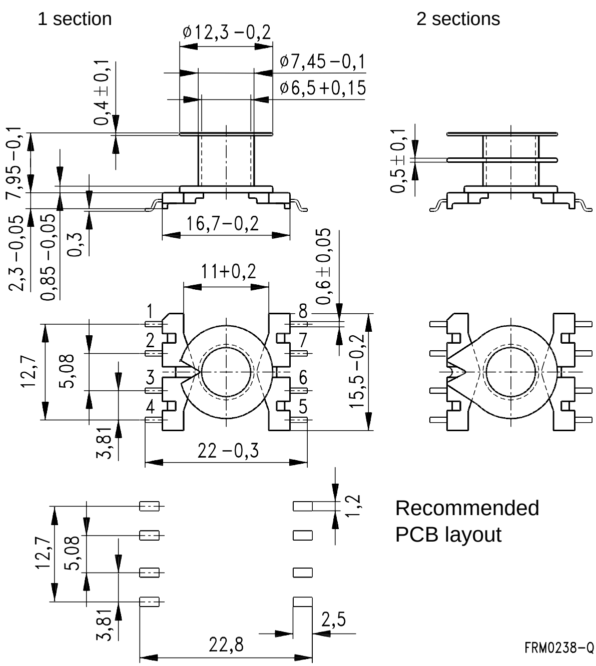
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

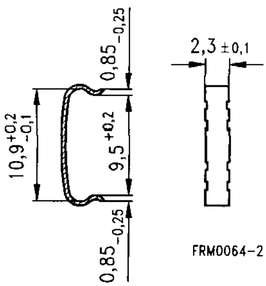
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels)
- Also available on a reel on request

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	16,2	31	66	8	B65821-C1008-T1
2	15,2	31	69	8	B65821-C1008-T2
Clamp	(ordering code per piece, 2 are required)				B65808-J2204

Coil former



Clamp



SMD coil former with J terminals

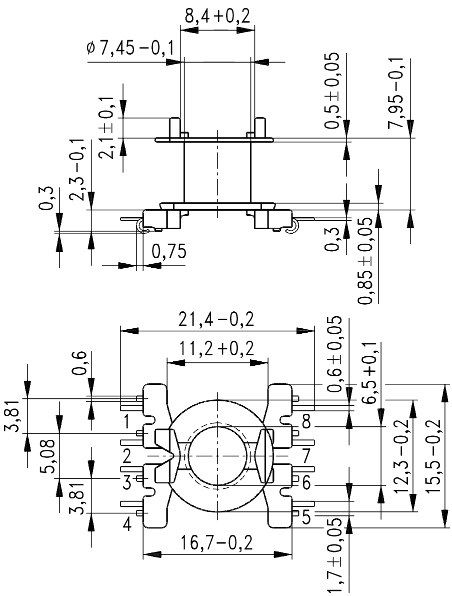
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

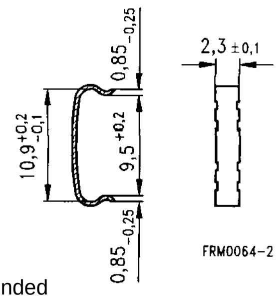
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels)
- Also available on a reel on request

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	16,2	31	66	8	B65821-J1008-T1
Clamp	(ordering code per piece, 2 are required)				B65808-J2204

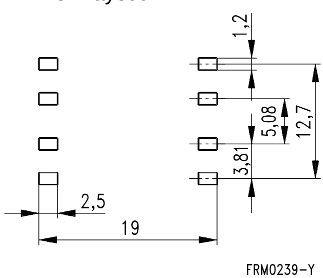
Coil former



Clamp



Recommended
PCB layout



Adjusting screw

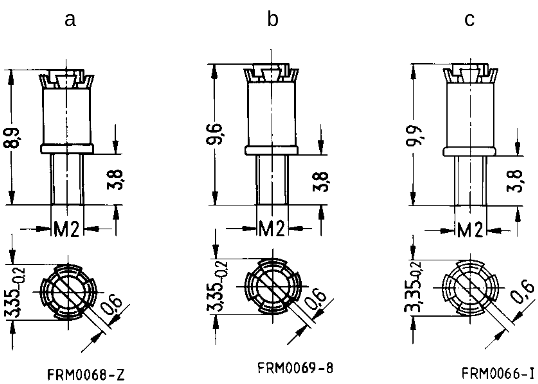
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core RM 6		**Adjusting screw**				Min. adjusting range	Ordering code
Material	A_L value nH	Fig.	Tube core ∅ × length mm	Material	Color code	%	
K 1	40	a	2,62 × 3,7	Si 1	white	15	B65659-F1-X101
M 33	63	a	2,62 × 3,7	Si 1	white	17	B65659-F1-X101
	100	c	2,82 × 4,4	Si 1	brown	16	B65659-F4-X101
N 48	160	a	2,62 × 3,7	K 1	green	17	B65659-F1-X1
	200 250	a	2,62 × 3,7	N 22	red	16 11	B65659-F1-X23
	315	b	2,75 × 4,4	N 22	black	13	B65659-F3-X23
	400	c	2,82 × 4,4	N 22	yellow	11	B65659-F4-X23
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

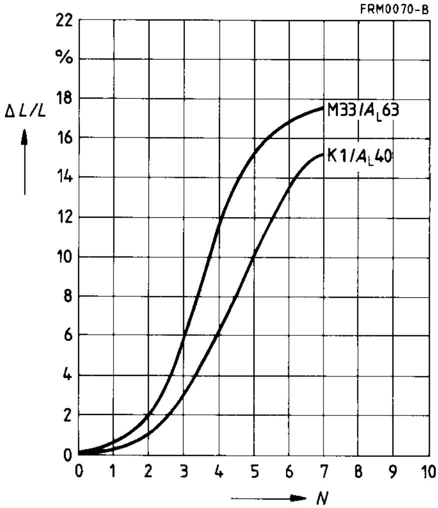
Adjusting screws



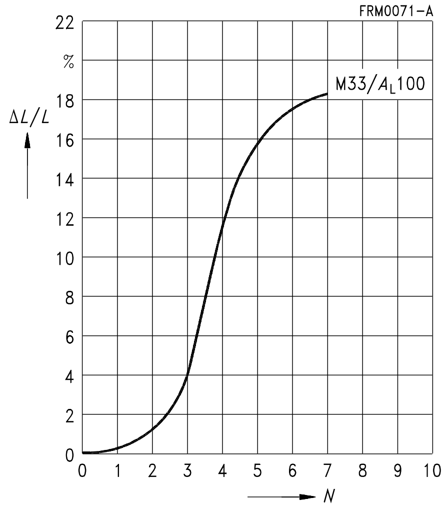
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

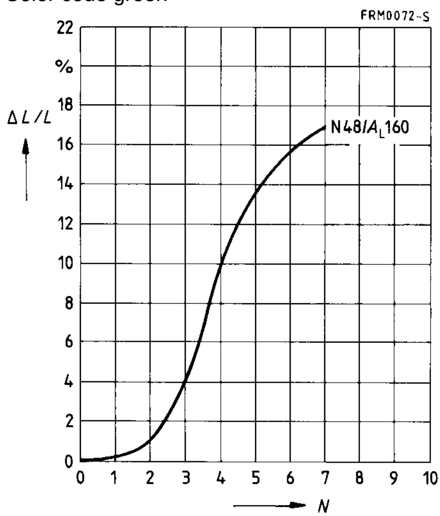
Adjusting screw B65659-F1-X101
Color code white



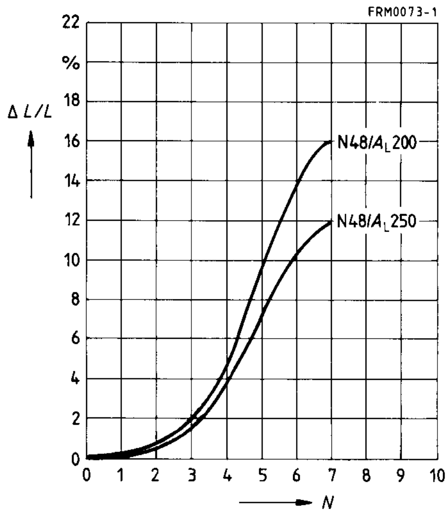
Adjusting screw B65659-F4-X101
Color code brown



Adjusting screw B65659-F1-X1
Color code green



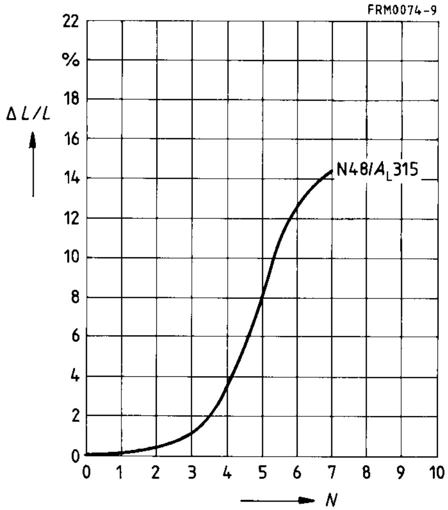
Adjusting screw B65659-F1-X23
Color code red



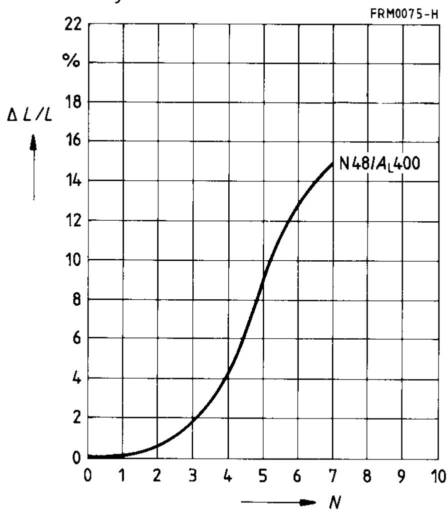
Inductance adjustment curves (nominal values)

Relative inductance change ∆ L/L versus turns N of adjusting screw.
0 ≙ at least 1 turn engaged.

Adjusting screw B65659-F3-X23
Color code black

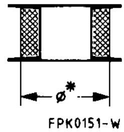


Adjusting screw B65659-F4-X23
Color code yellow

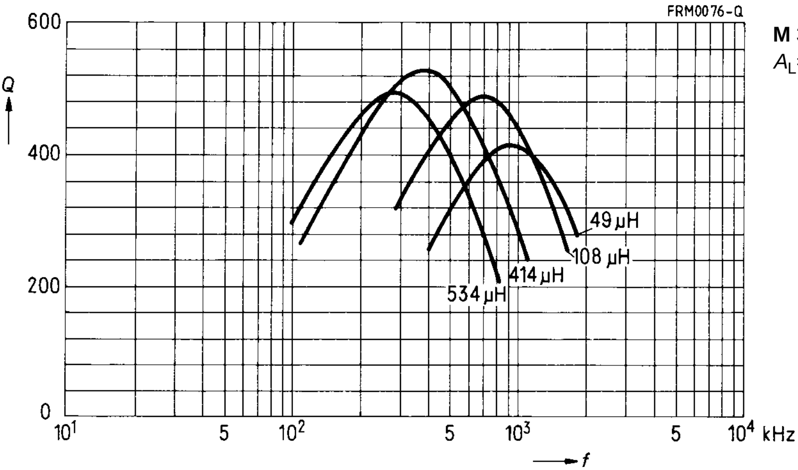


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

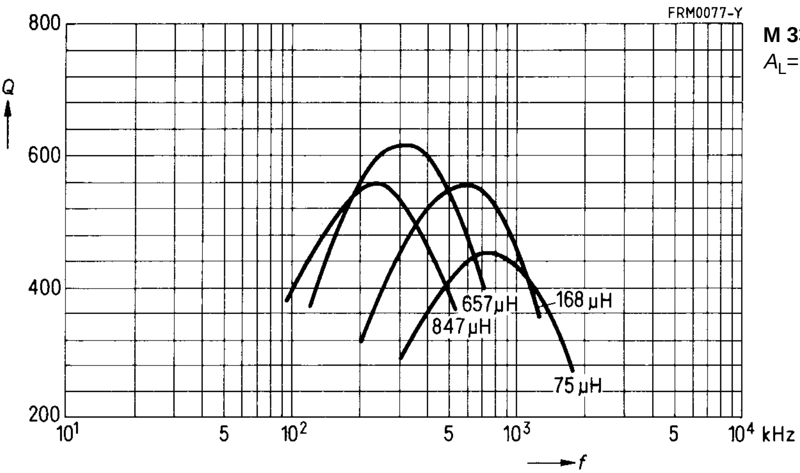
Mate-rial	L (µH) for A_L= 63 nH	A_L= 100 nH	Turns	RF litz wire	Sec-tions	∅* mm
M 33	534	847	92	45 × 0,04 CuLS	1	—
	414	657	81	45 × 0,04 CuLS	2	—
	108	168	41	45 × 0,04 CuLS	2	9,8
	49	75	27	45 × 0,04 CuLS	2	10,6



* Pad of polystyrene tape up to diameter ∅



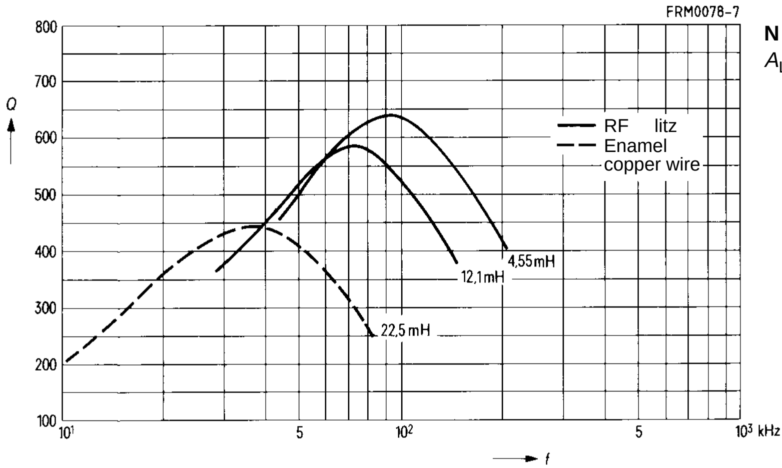
M 33
A_L= 63 nH



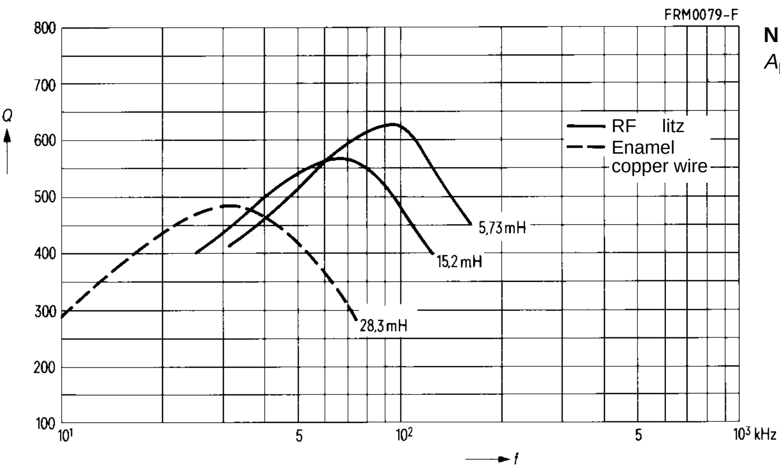
M 33
A_L= 100 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Mate-rial	*L* (mH) for A_L = 250 nH	A_L = 315 nH	Turns	Wire; RF litz wire	Sec-tions
N 48	22,5	28,3	300	0,20 CuL	1
	12,1	15,2	220	6 × 0,07 CuLS	1
	4,55	5,73	135	20 × 0,05 CuLS	1

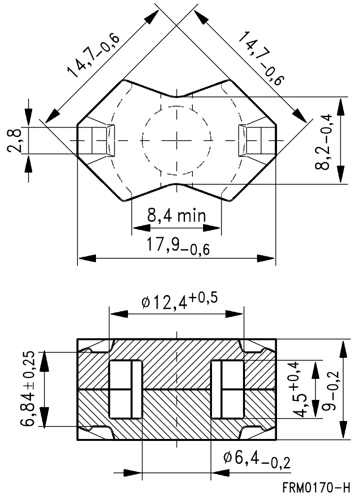


N 48
A_L = 250 nH



N 48
A_L = 315 nH

- For compact transformers
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,58 mm^{-1}
l_e = 21,8 mm
A_e = 37,5 mm^2
A_{min} = 31,2 mm^2
V_e = 820 mm^3

Approx. weight 4,0 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min}	P_V W/set	Ordering code
T38	10500 + 40/– 30 %	4830			B65807-P-Y38
N49	2200 + 30/– 20 %	1020	1500	0,14 (50 mT, 500 kHz, 100 °C)	B65807-P-R49
N87	3000 + 30/– 20 %	1380	1950	0,40 (200 mT, 100 kHz, 100 °C)	B65807-P-R87

SMD coil former with gullwing terminals

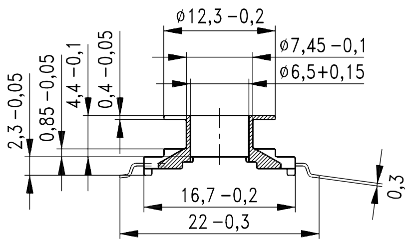
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Clamp

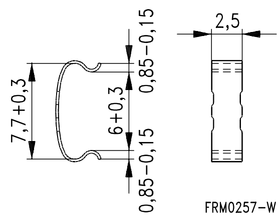
- Without ground terminal, made of stainless spring steel, 0,3 mm thick
- Also available as strip clamp (each carton containing 2 reels)
- Also available on a reel on request

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	7,6	31	66	8	B65821-A6008-T1
Clamp	(ordering code per piece, 2 are required)				B65808-P2204

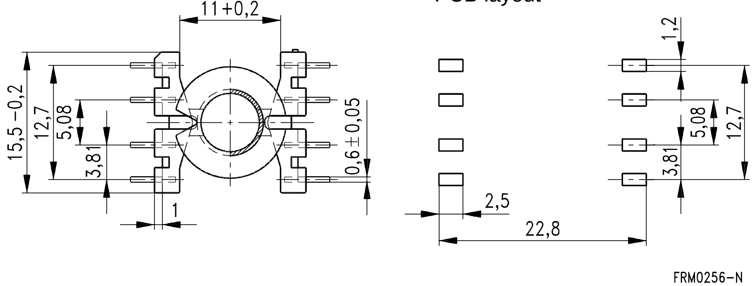
Coil former



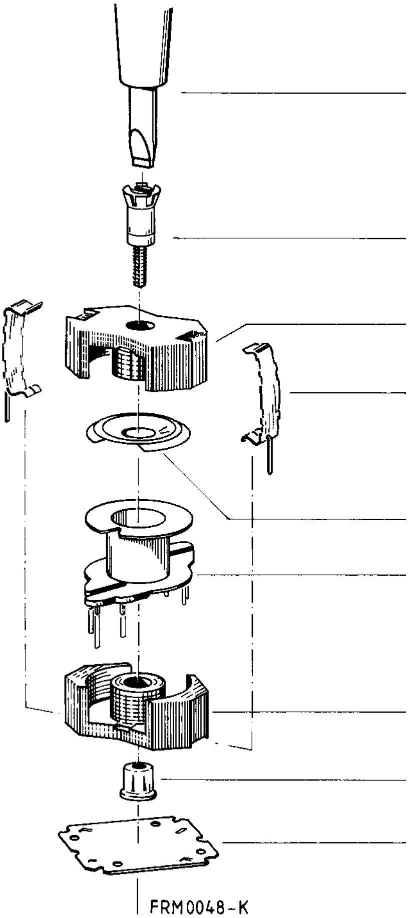
Clamp



Recommended PCB layout



RM 7
Core and Accessories



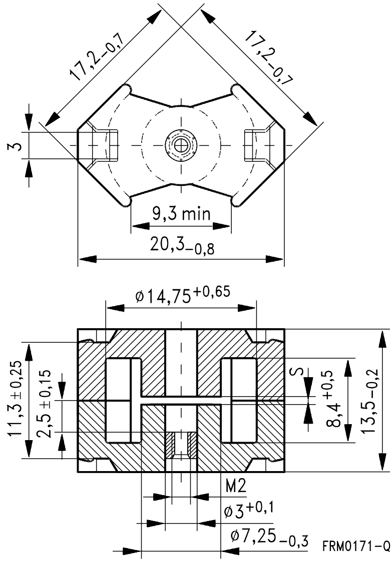
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	232
Matching handle	B63399	232
Adjusting screw	B65659	232
Core	B65819	228
Clamps	B65820	231
Insulating washer 1	B65820	231
Coil former	B65820	230
Core	B65819	228
Threaded sleeve (glued-in)		
Insulating washer 2	B65820	231

Also available:

RM 7 low profile core	B65819-P	235
Coil former	B65820	236

- In accordance with IEC 60431
- Core without center hole for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,74	0,7	mm^{-1}
l_e	29,8	30,4	mm
A_e	40	43	mm^2
A_{min}	—	39	mm^2
V_e	1 200	1 340	mm^3

Approx. weight (per set)

m	6,5	7,2	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code[1)] -A with center hole -N with threaded sleeve -J without center hole
N48	250 ± 3 %	0,16	147	B65819-+250-A48
	315 ± 3 %	0,12	186	B65819-+315-A48
N41	160 ± 5 %	0,30	89	B65819-J160-J41
	250 ± 5 %	0,18	139	B65819-J250-J41

1) Replace the + by the code letter "A" or "N" for the required version.

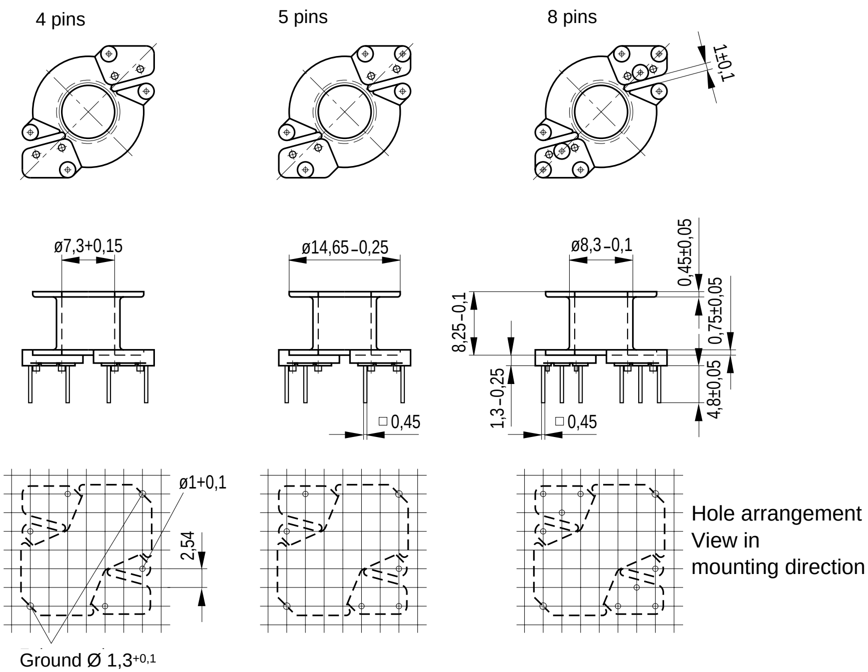
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -J w/o center hole
N30	5000 + 30/– 20 %	2780			B65819-J-R30
T38	10000 +40/– 30 %	5570			B65819-J-Y38
N49	1900 + 30/– 20 %	1070	1070	0,22 (50 mT, 500 kHz, 100 °C)	B65819-J-R49
N87	2700 + 30/– 20 %	1510	1600	0,77 (200 mT, 100 kHz, 100 °C)	B65819-J-R87

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins
For matching clamp and insulating washers see page 231

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	21,4	35,6	56	4	on request
	21,4	35,6	56	5	on request
	21,4	35,6	56	8	B65820-B1008-D1
2	with 4 or 8 pins on request				



FRM0276-3

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,4 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Insulating washer 1 between core and coil former

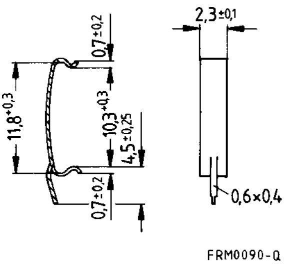
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

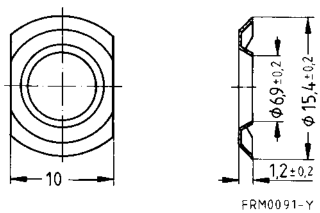
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65820-B2001
Insulating washer 1 (reel packing, PU = 1 reel)	B65820-A5000
Insulating washer 2 (bulk)	B65820-C2005

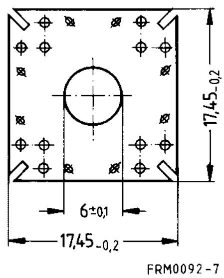
Clamp



Insulating washer 1



Insulating washer 2



Adjusting screw

- Tube core with thread and core brake made of GFR polyterephthalate

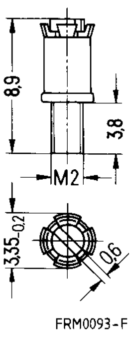
Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

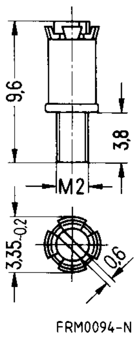
Core RM 7		**Adjusting screw**				Min. adjusting range	Ordering code
Material	A_L value nH	Fig.	Tube core ∅ × length mm	Mate-rial	Color code	%	
M33	63	a	2,60 × 3,7	Si 1	white	16	B65659-F1-X101
M48	250	a	2,60 × 3,7	N 22	red	12	B65659-F1-X23
	315	b	2,75 × 4,4	N 22	black	16	B65659-F3-X23
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

Adjusting screws

a



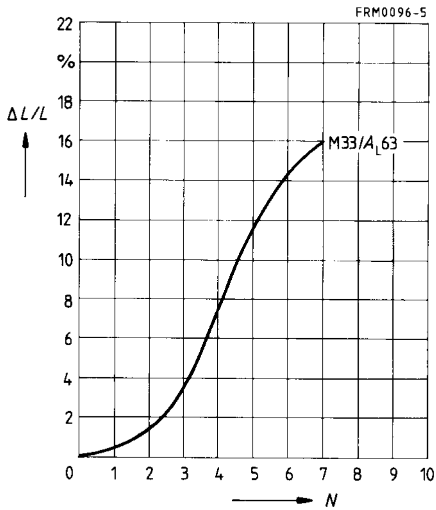
b



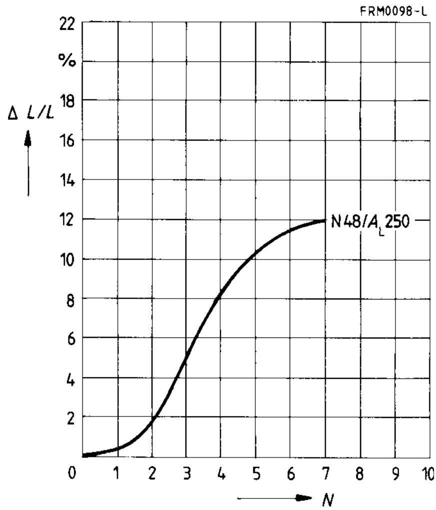
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

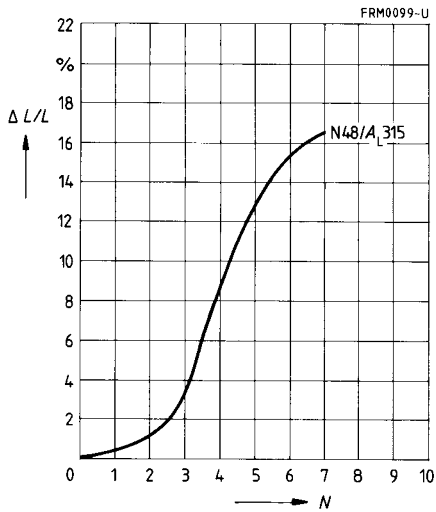
Adjusting screw B65659-F1-X101
Color code white



Adjusting screw B65659-F1-X23
Color code red

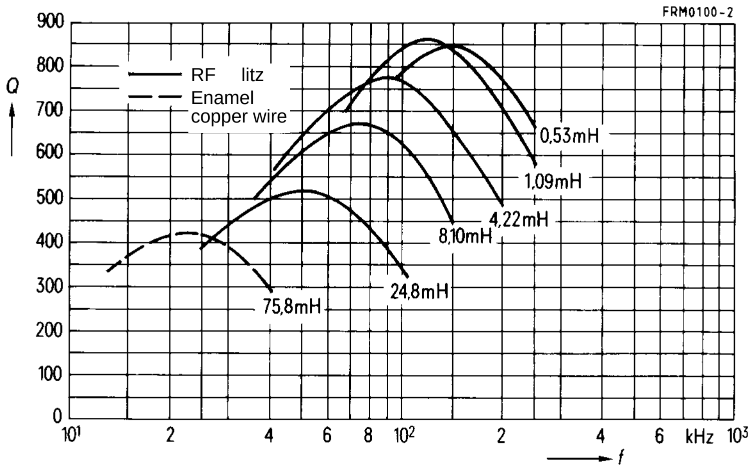


Adjusting screw B65659-F3-X23
Color code black

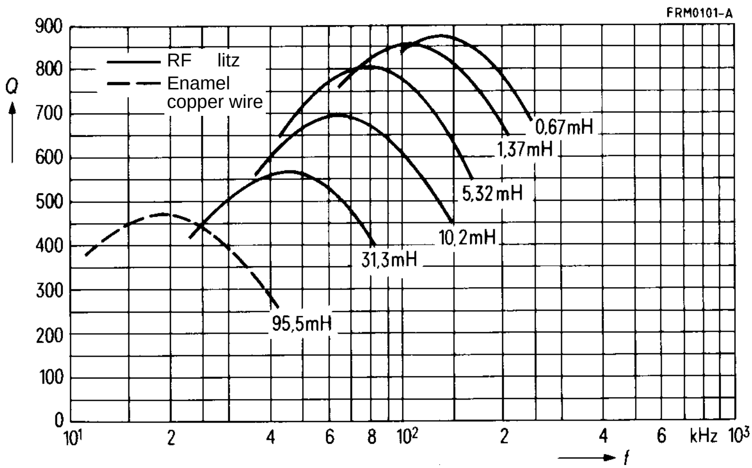


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1 mT

Mate-rial	L (mH) for A_L = 250 nH	L (mH) for A_L = 315 nH	Turns	Wire; RF litz wire	Sec-tions
N 48	75,80	95,50	550	0,18 CuL	1
	24,80	31,30	315	6 × 0,07 CuLS	1
	8,10	10,20	180	20 × 0,05 CuLS	1
	4,22	5,32	130	45 × 0,04 CuLS	1
	1,09	1,37	66	90 × 0,04 CuLS	1
	0,53	0,67	46	120 × 0,04 CuLS	1

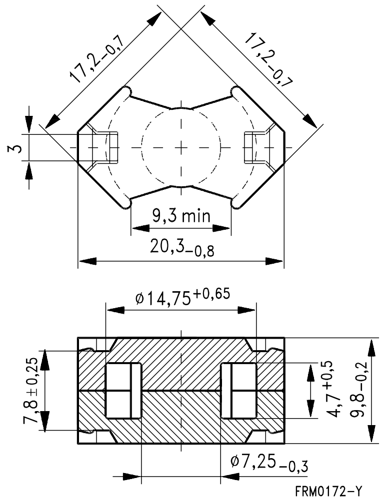


N 48
A_L = 250 nH



N 48
A_L = 315 nH

- For compact transformers
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,52 mm^{-1}
l_e = 23,5 mm
A_e = 45,3 mm^2
A_{min} = 39,6 mm^2
V_e = 1 060 mm^3

Approx. weight 5,7 g/set

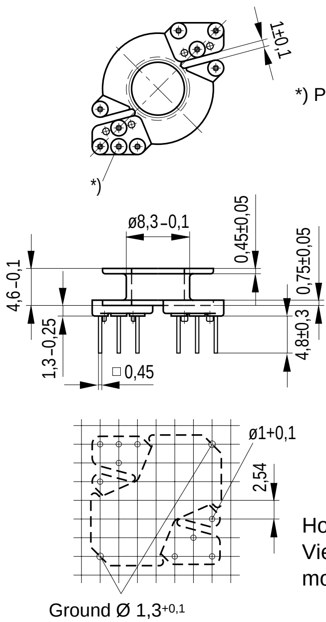
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	5600 + 30/– 20 %	2310			B65819-P-R30
T38	11500 + 40/– 30 %	4740			B65819-P-Y38
N49	2400 + 30/– 20 %	990	1700	0,21 (50 mT, 500 kHz, 100 °C)	B65819-P-R49
N67	3300 + 30/– 20 %	1360	2200	0,71 (200 mT, 100 kHz, 100 °C)	B65819-P-R67
N87	3300 + 30/– 20 %	1360	2200	0,57 (200 mT, 100 kHz, 100 °C)	B65819-P-R87

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins
For matching insulating washers see page 231

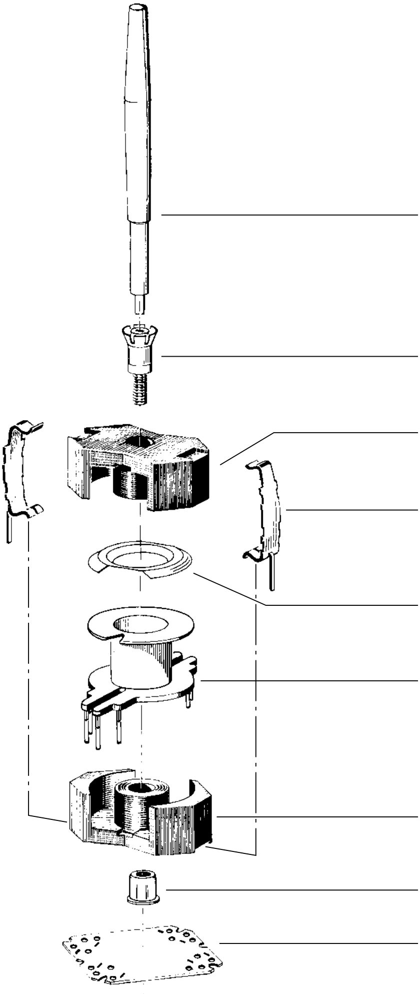
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	10,8	35,6	113	8	B65820-R1008-D1



*) Pin 9 is not connected

Hole arrangement
View in
mounting direction

FRM0268-C



FRM0051-5

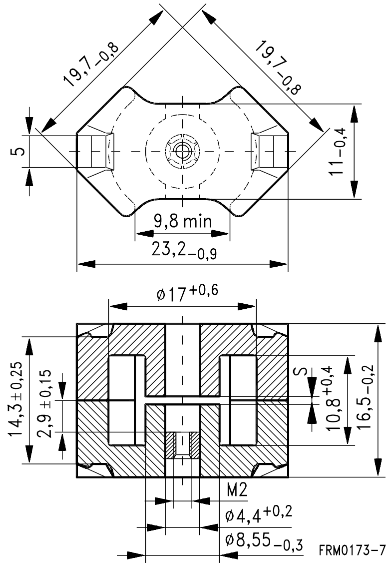
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	244
Matching handle	B63399	244
Adjusting screw	B65812	244
Core	B65811	238
Clamps	B65812	243, 250
Insulating washer 1	B65812	243, 250
Coil former	B65812	240, 249
Core	B65811	238
Threaded sleeve (glued-in)		
Insulating washer 2	B65812	243, 250

Also available:

Coil former for SMPS transformers	B65812	241
Coil former for power applications	B65812	242
RM 8 low-profile core	B65811-P	248
Coil former	B65812	249

- In accordance with IEC 60431
- Cores without center hole for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,67	0,59	mm^{-1}
l_e	35,1	38	mm
A_e	52	64	mm^2
A_{min}	—	55	mm^2
V_e	1840	2430	mm^3

Approx. weight (per set)

m	10,7	12	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code[1)] -D with center hole -F with threaded sleeve -J without center hole
N48	250 ± 3 %	0,23	133	B65811-+250-A48
	315 ± 3 %	0,17	168	B65811-+315-A48
	400 ± 3 %	0,14	213	B65811-+400-A48
	630 ± 5 %	0,10	336	B65811-+630-J48
N41	160 ± 3 %	0,49	76	B65811-J160-A41
	250 ± 5 %	0,24	117	B65811-J250-J41
	630 ± 5 %	0,11	298	B65811-J630-J41
	1600 ± 10 %	0,04	752	B65811-J1600-K41
N87	250 ± 3 %	0,30	118	B65811-J250-A87
	400 ± 3 %	0,18	189	B65811-J400-A87

1) Replace the + by the code letter “F” or “D” for the required version. Standard version is “D”.

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -J w/o center hole
N26	2900 + 30/– 20 %	1550			B65811-D-R26
N30	5700 + 30/– 20 %	2680			B65811-J-R30
T35	8400 + 30/– 20 %	3940			B65811-J-R35
T38	12500 + 40/– 30 %	5870			B65811-J-Y38
N49	2200 + 30/– 20 %	1040	1270	0,37 (50 mT, 500 kHz, 100 °C)	B65811-J-R49
N67	3300 + 30/– 20 %	1560	1900	1,50 (200 mT, 100 kHz, 100 °C)	B65811-J-R67
N87	3300 + 30/– 20 %	1560	1900	1,20 (200 mT, 100 kHz, 100 °C)	B65811-J-R87
N41	4100 + 30/– 20 %	1930	1900	0,36 (200 mT, 25 kHz, 100 °C)	B65811-J-R41

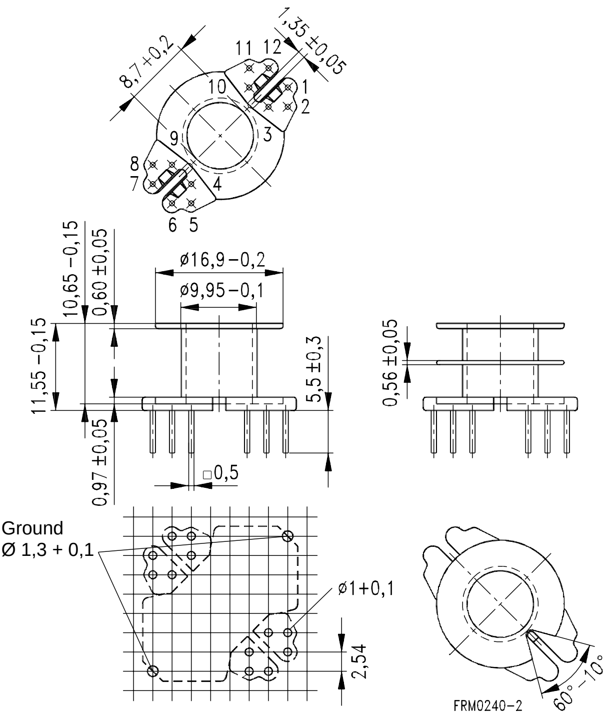
Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins
For matching clamp and insulating washers see page 243

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	30	42	47	5	B65812-N1005-D1
				8	B65812-N1008-D1
				12	B65812-N1012-D1
2	28,4	42	50	5	B65812-N1005-D2
				8	B65812-N1008-D2
				12	B65812-N1012-D2

12 pins

Version	Pins omitted
5 pins	3, 4, 6, 7, 9, 10, 12
8 pins	3, 4, 9, 10



Hole arrangement
View in mounting direction

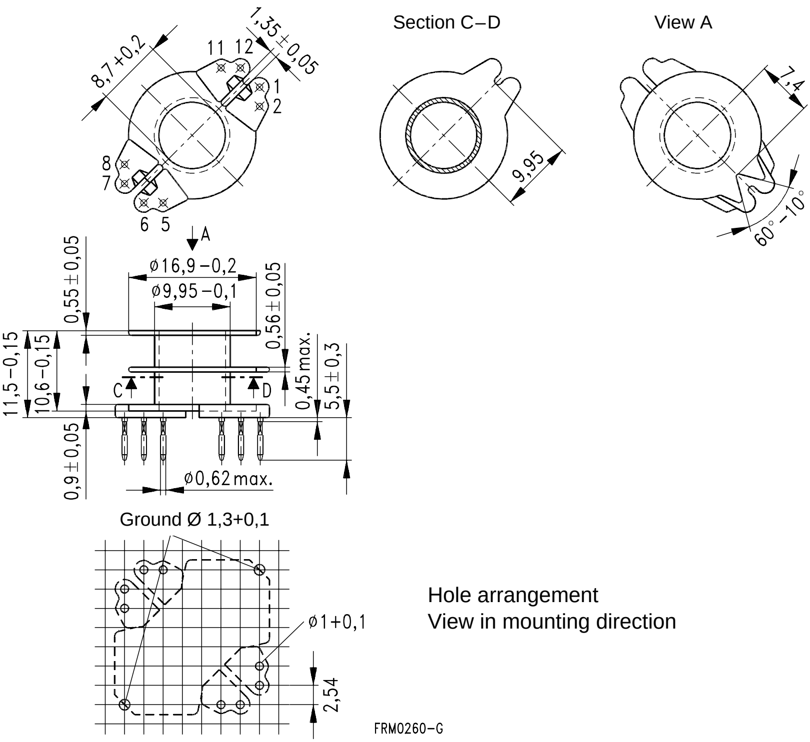
Coil former for SMPS transformers with line isolation

The creepage distances and clearances are designed such that the coil former is suitable for use in SMPS transformers with line isolation.

- Closed center flange with external wire guide
- Pins squared in the start-of-winding area
- Optimized for use with automatic winding machines

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
2	28,4	42	50	8	B65812-X1108-D2



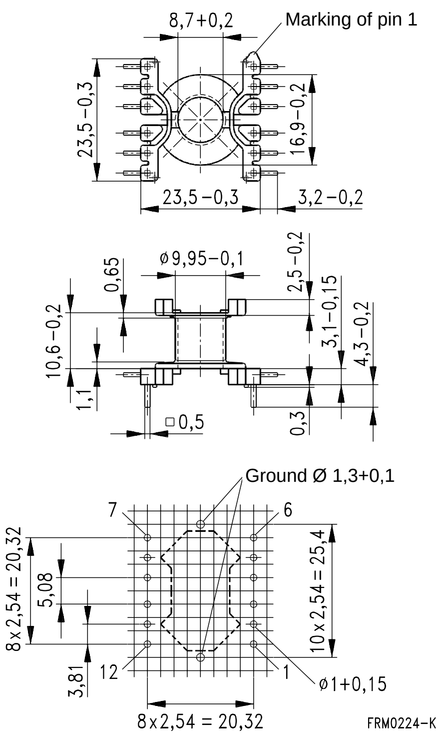
Hole arrangement
View in mounting direction

Coil former for power applications

Optimized for automatic winding
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

For matching clamp and insulating washer 1 see page 243

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	30	42	47	12	B65812-C1512-T1



Hole arrangement
View in mounting direction
(Note half pitch!)

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,4 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

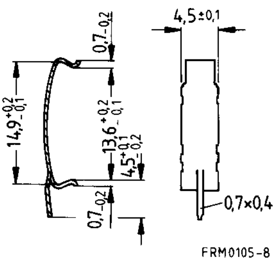
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

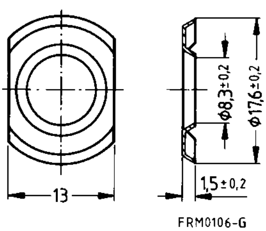
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65812-A2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65812-A5000
Insulating washer 2 (bulk)	B65812-C2005

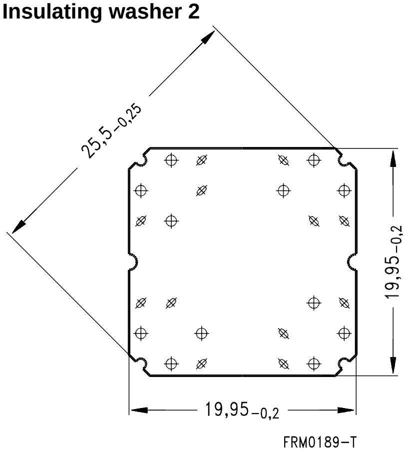
Clamp



Insulating washer 1



Insulating washer 2



Adjusting screw

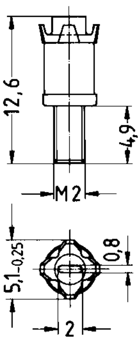
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core RM 8		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Mate-rial	Color code	%	
M 33	100	3,85 × 5,0	Si 1	yellow	16	B65812-B3003-X101
N 48	250	4,18 × 5,0	Si 1	white	12	B65812-B3001-X101
	315	3,85 × 5,0	N 22	gray	13	B65812-B3003-X22
	400	4,18 × 4,0	N 22	brown	17	B65812-B3002-X22
	500 630	4,18 × 5,0	N 22	black	13 9	B65812-B3001-X22
Adjusting screwdriver						B63399-B1
Handle						B63399-B5

Adjusting screw

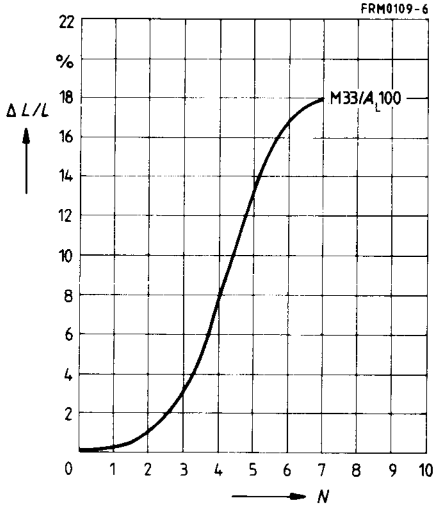


FRM0108-X

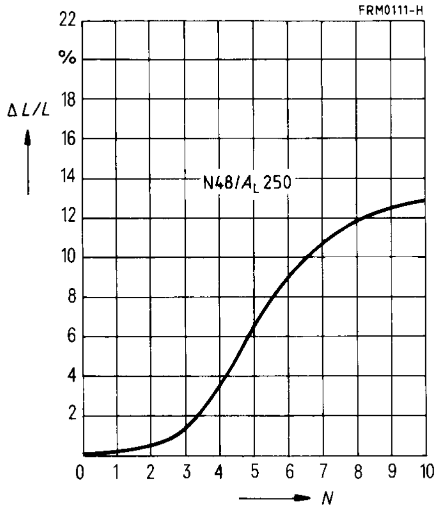
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

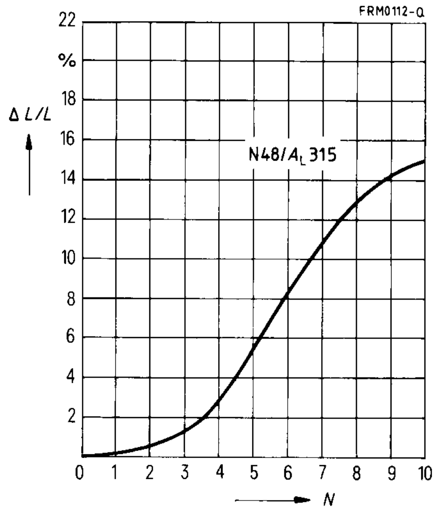
Adjusting screw B65812-B3003-X101
Color code yellow



Adjusting screw B65812-B3001-X101
Color code white



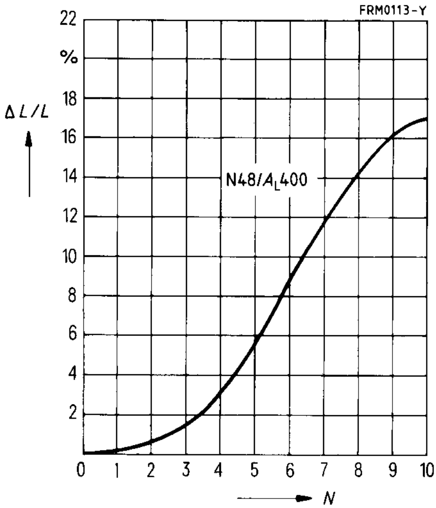
Adjusting screw B65812-B3003-X22
Color code gray



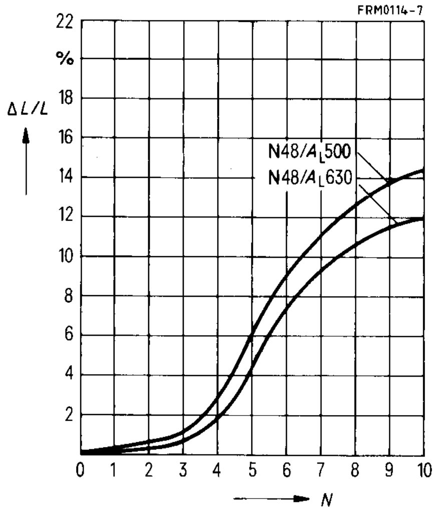
Inductance adjustment curves (nominal values)

Relative inductance change Δ L/L versus turns N of adjusting screw.
0 ≙ at least 2 turns engaged.

Adjusting screw B65812-B3002-X22
Color code brown

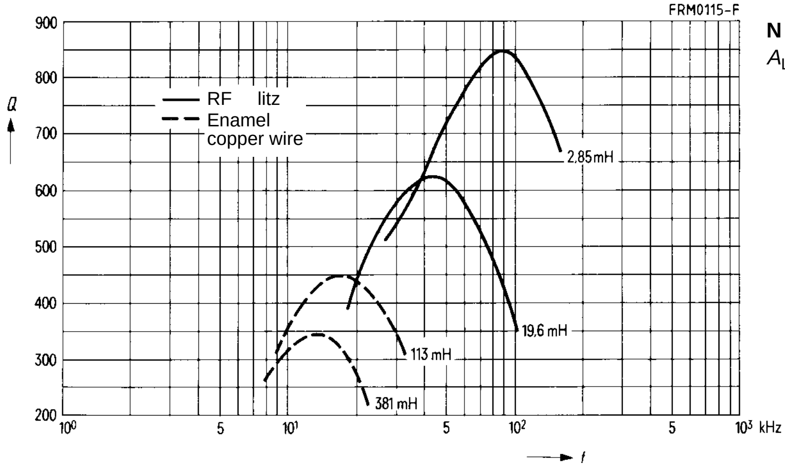


Adjusting screw B65812-B3001-X22
Color code black

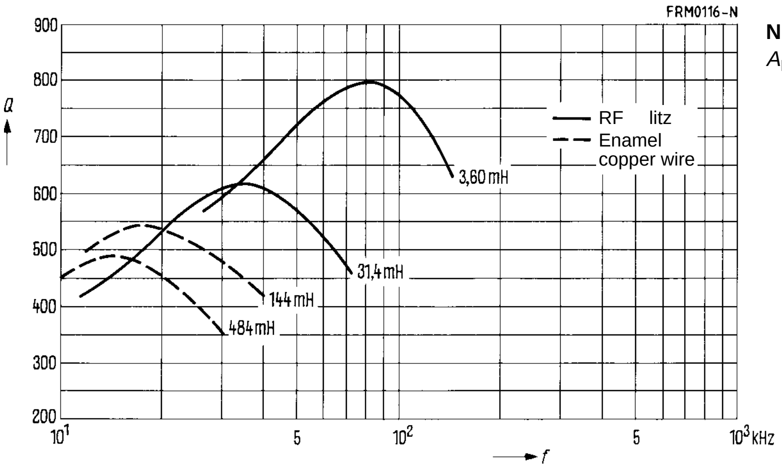


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Mate-rial	L (mH) for A_L = 315 nH	L (mH) for A_L = 400 nH	Turns	Wire; RF litz wire	Sec-tions
N 48	381	484	1100	0,15 CuL	1
	113	144	600	0,2 CuL	1
	19,6	31,4	280	20 × 0,05 CuLS	1
	2,85	3,6	95	60 × 0,05 CuLS	1

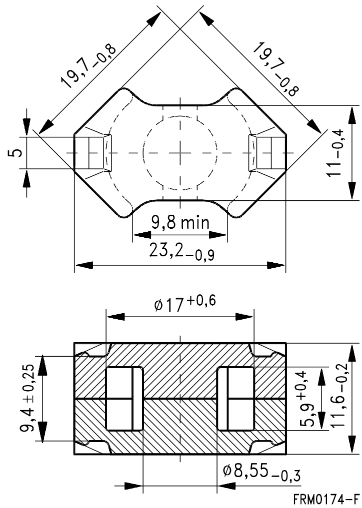


N 48
A_L = 315 nH



N 48
A_L = 400 nH

- For compact transformers
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,44 mm^{-1}
l_e = 28,7 mm
A_e = 64,9 mm^2
A_{min} = 55,4 mm^2
V_e = 1 860 mm^3

Approx. weight 9,2 g/set

Ungapped

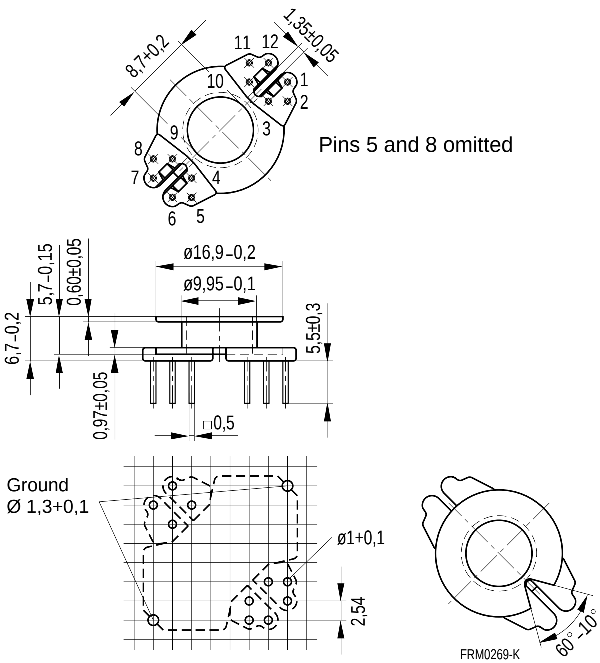
Material	A_L value nH	μ_e	A_{L1min}	P_V W/set	Ordering code
N49	2900 + 30/– 20 %	1020	2000	0,33 (50 mT, 500 kHz, 100 °C)	B65811-P-R49
N87	4100 + 30/– 20 %	1440	2550	0,92 (200 mT, 100 kHz, 100 °C)	B65811-P-R87

Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins

For matching clamp and insulating washers see page 250

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	14,3	42	101	10	B65812-P1010-D1



Hole arrangement
View in mounting direction

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,4 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

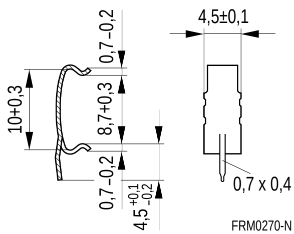
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

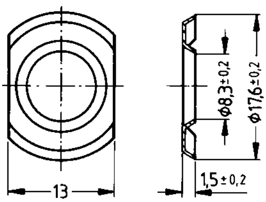
	Ordering code
Clamp (ordering code per piece, 2 are required)	B65812-P2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65812-A5000
Insulating washer 2 (bulk)	B65812-C2005

Clamp



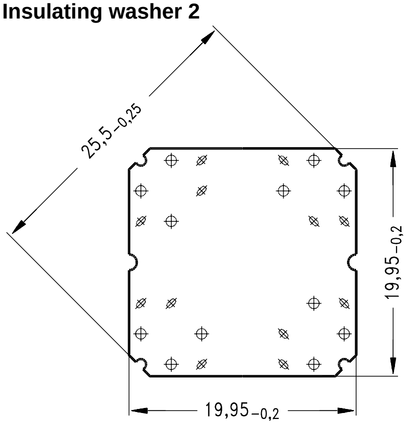
FRM0270-N

Insulating washer 1

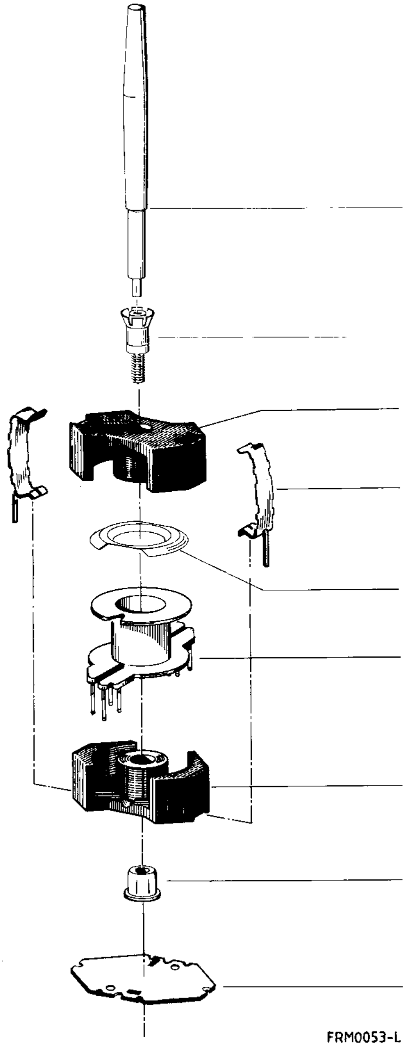


FRM0106-G

Insulating washer 2



FRM0189-T



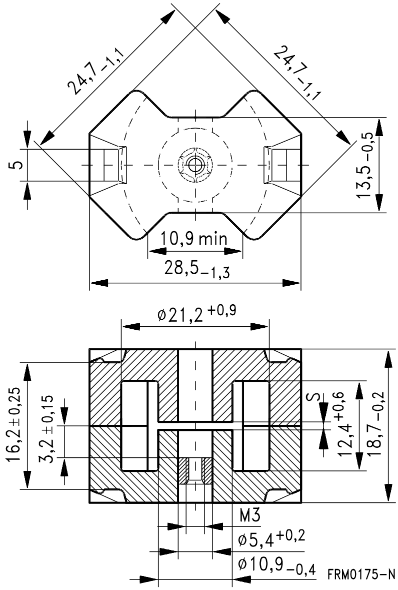
Example of an assembly set

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	257
Matching handle	B63399	257
Adjusting screw	B65679	257
Core	B65813	252
Clamps	B65814	256
Insulating washer 1	B65814	256
Coil former	B65814	254
Core	B65813	252
Threaded sleeve (glued-in)		
Insulating washer 2	B65814	256

Also available:

Coil former for power applications	B65814	255
RM 10 low-profile core	B65813-P	259

- In accordance with IEC 60431
- Cores without center hole for transformer applications
- RM cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,5	0,45	mm^{-1}
l_e	42	44	mm
A_e	83	98	mm^2
A_{min}	—	90	mm^2
V_e	3 470	4 310	mm^3

Approx. weight (per set)

m	20,7	22	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code[1)] -D with center hole -N with threaded sleeve -J without center hole
N48	400 ± 3 %	0,21	160	B65813-+400-A48
	630 ± 3 %	0,13	250	B65813-+630-A48
N41	250 ± 3 %	0,44	90	B65813-J250-A41
	630 ± 5 %	0,13	226	B65813-J630-J41
	1600 ± 10 %	0,04	573	B65813-J1600-K41
N87	630 ± 5 %	0,18	225	B65813-J630-J87

1) Replace the + by the code letter “D” or “N” for the required version.

Ungapped

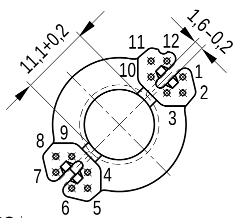
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -J w/o center hole
N30	7600 + 30/– 20 %	2720			B65813-J-R30
T35	11000 + 30/– 20 %	3940			B65813-J-R35
T38	16000 + 40/– 30 %	5730			B65813-J-Y38
N49	2900 + 30/– 20 %	1040	1680	0,75 (50 mT, 500 kHz,100 °C)	B65813-J-R49
N67	4200 + 30/– 20 %	1500	2550	2,90 (200 mT, 100 kHz, 100 °C)	B65813-J-R67
N87	4200 + 30/– 20 %	1500	2550	2,30 (200 mT, 100 kHz, 100 °C)	B65813-J-R87
N41	5500 + 30/– 20 %	1960	2550	0,80 (200 mT, 25 kHz, 100 °C)	B65813-J-R41

Coil former

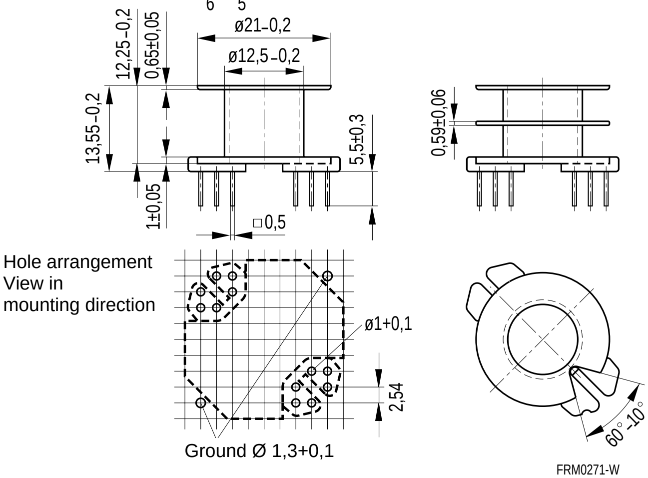
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins. For matching clamp and insulating washers see page 256.

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	41,5	52	43	8	B65814-N1008-D1
				10	B65814-N1010-D1
				11	B65814-N1011-D1
				12	B65814-N1012-D1
2	39	52	46	8	B65814-N1008-D2
				10	B65814-N1010-D2
				11	B65814-N1011-D2
				12	B65814-N1012-D2

12 pins



Version	Pins omitted
8 pins	2, 5, 8, 11
10 pins	2, 11
11 pins	9

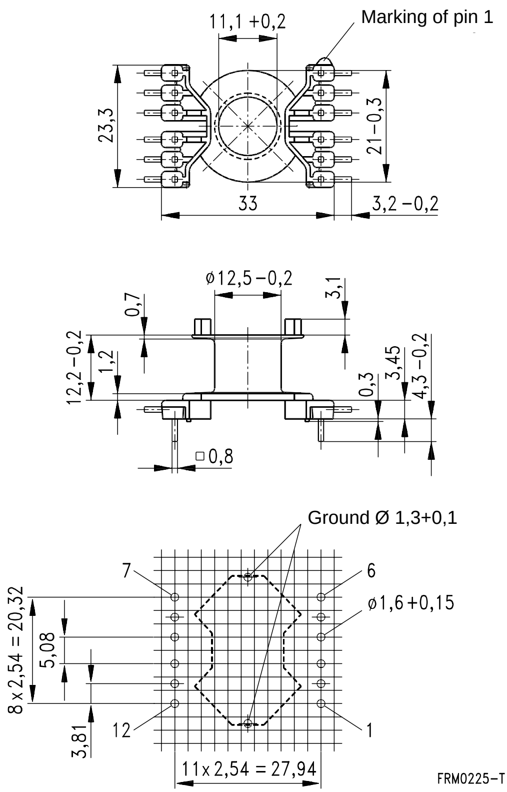


Coil former for power applications

Optimized for automatic winding
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

For matching clamp and insulating washer 1 see page 256

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	41,5	52	43	12	B65814-C1512-T1



Hole arrangement
View in mounting direction
(Note half pitch!)

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,45 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
- Also available as strip clamp on reels

Insulating washer 1 between core and coil former

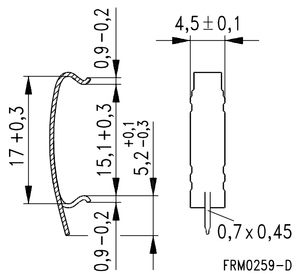
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 for double-clad PCBs

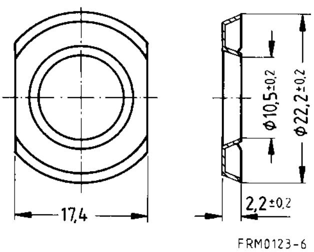
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65814-A2203
Insulating washer 1 (reel packing, PU = 1 reel)	B65814-B5000
Insulating washer 2 (bulk)	B65814-B2005

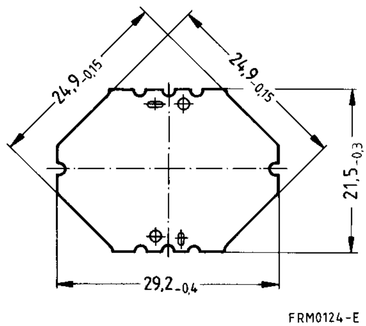
Clamp



Insulating washer 1



Insulating washer 2



Adjusting screw

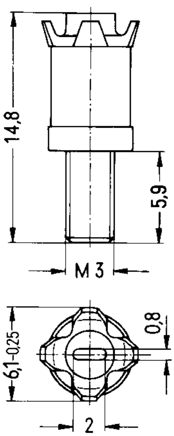
● Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core RM 10		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Mate-rial	Color code	%	
N 48	315 400	4,55 × 6,3	N 22	red	13 10	B65679-E3-X22
	400 630	4,98 × 6,3	N 22	black	18 11	B65679-E2-X22
	630	5,15 × 6,3	N 22	white	17	B65679-E1-X22
Adjusting screwdriver						B63399-B1
Handle						B63399-B5

Adjusting screw

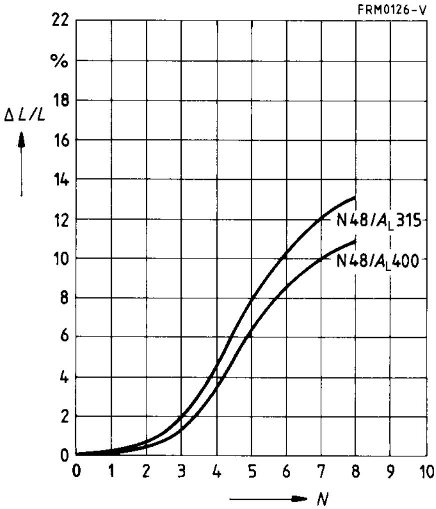


FRM0125-M

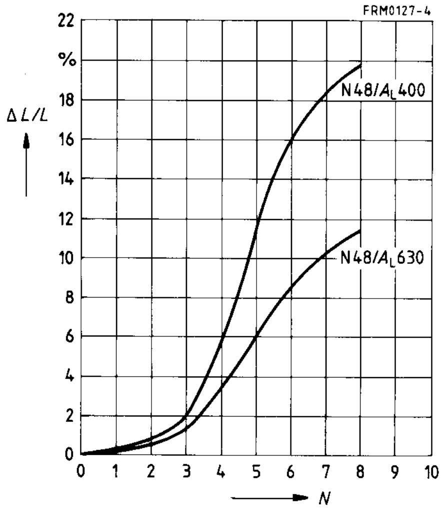
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

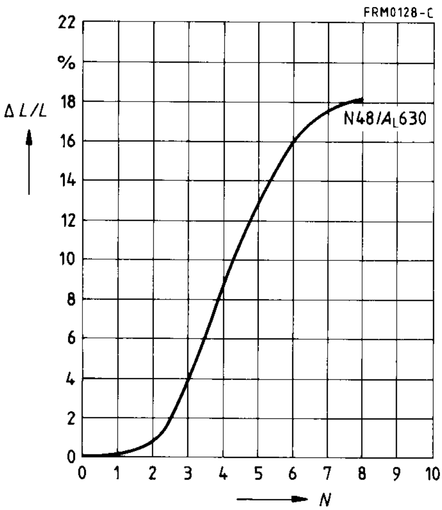
Adjusting screw B65679-E3-X22
Color code red



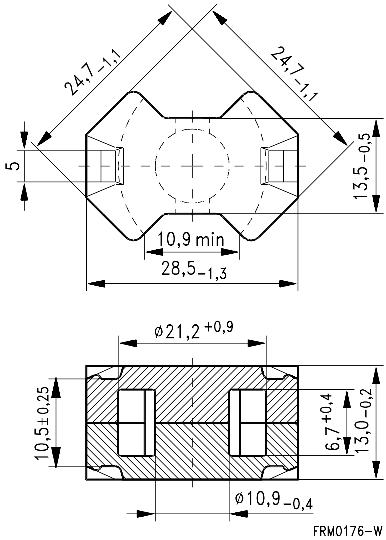
Adjusting screw B65679-E2-X22
Color code black



Adjusting screw B65679-E1-X22
Color code white



- For compact transformers
- Without center hole
- RM cores are supplied in sets



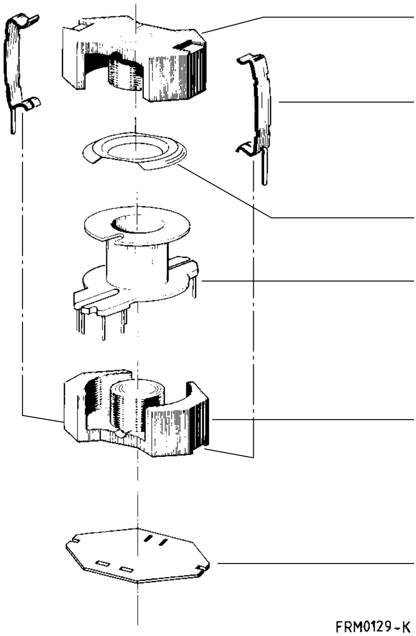
Magnetic characteristics (per set)

$\Sigma l/A$ = 0,34 mm^{-1}
l_e = 33,9 mm
A_e = 99,1 mm^2
A_{min} = 93,3 mm^2
V_e = 3 360 mm^3

Approx. weight 17,2 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min}	P_V W/set	Ordering code
N49	3700 + 30/– 20 %	1000	2600	0,62 (50 mT, 500 kHz, 100 °C)	B65813-P-R49
N87	5200 + 30/– 20 %	1410	3300	1,72 (200 mT, 100 kHz, 100 °C)	B65813-P-R87



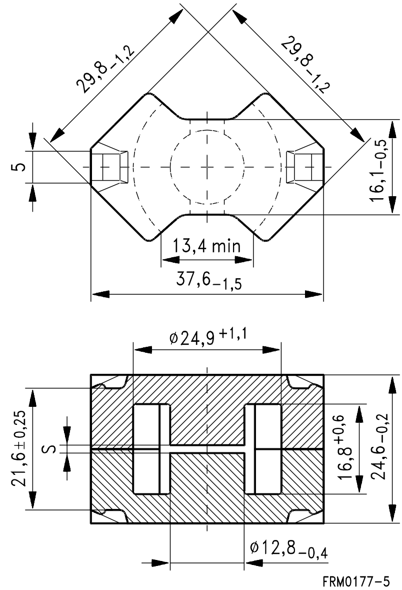
Individual parts	Part no.	Page
Core	B65815	261
Clamps	B65816	265
Insulating washer 1	B65816	265
Coil former	B65816	263
Core	B65815	261
Insulating washer 2	B65816	265

Example of an assembly set

Also available:

Coil former for power applications	B65816	264
RM 12 low-profile core	B65815-P	266

- In accordance with IEC 60431
- Optimized core cross section and increased thickness of base for power applications
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,39 mm^{-1}
l_e = 57 mm
A_e = 146 mm^2
A_{min} = 125 mm^2
V_e = 8 340 mm^3

Approx. weight 45 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code -E without center hole
N41	160 ± 3 %	1,30	50	B65815-E160-A41
	250 ± 3 %	0,70	78	B65815-E250-A41
	400 ± 3 %	0,35	124	B65815-E400-J41
	1000 ± 5 %	0,12	310	B65815-E1000-J41
N87	250 ± 3 %	0,71	78	B65815-E250-A87

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -E w/o center hole
N30	8400 + 30/– 20 %	2610			B65815-E-R30
N49	3700 + 30/– 20 %	1090	1930	1,41 (50 mT, 500 kHz, 100 °C)	B65815-E-R49
N67	5300 + 30/– 20 %	1640	2900	5,50 (200 mT, 100 kHz, 100 °C)	B65815-E-R67
N87	5300 + 30/– 20 %	1640	2900	4,50 (200 mT, 100 kHz, 100 °C)	B65815-E-R87
N41	6000 + 30/– 20 %	1860	2900	1,50 (200 mT, 25 kHz, 100 °C)	B65815-E-R41

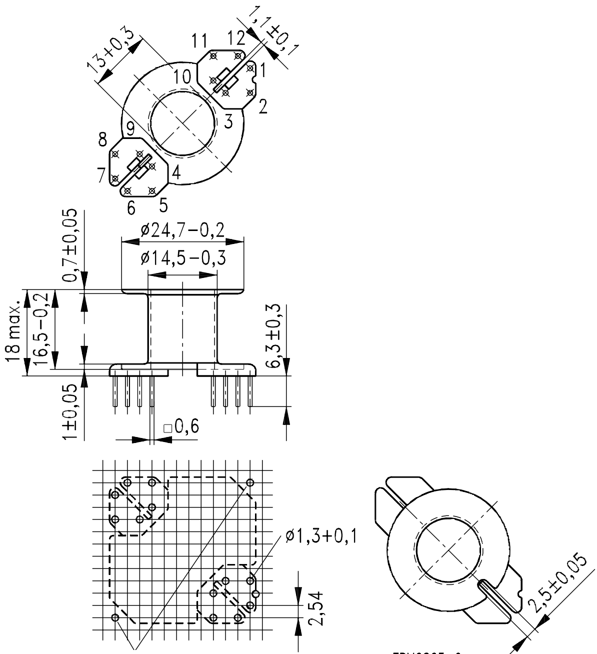
Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
H ≙ max. operating temperature 180 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins

For matching clamp and insulating washers see page 265

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	73	61	28,7	11	B65816-N1011-D1
				12	B65816-N1012-D1

12 pins



Hole arrangement
View in mounting direction

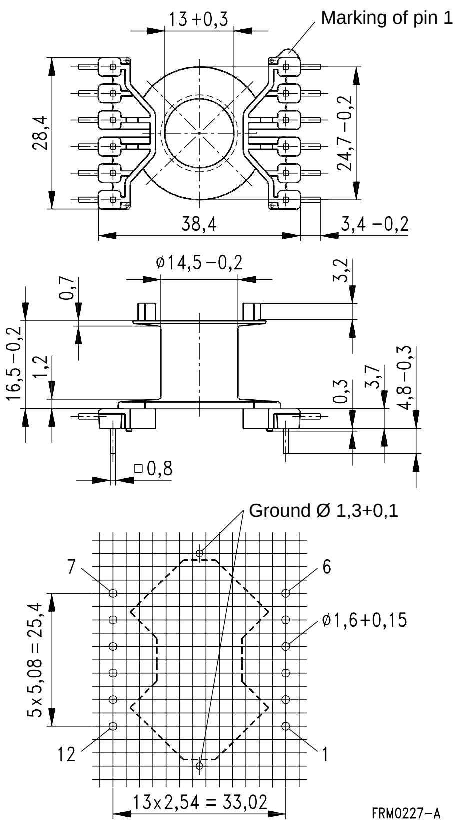
Version	Pins omitted
11 pins	9

Coil former for power applications

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

For matching clamp and insulating washer 1 see page 265

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	72	61	28,7	12	B65816-C1512-T1



Hole arrangement
View in mounting direction
(Note half pitch!)

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,45 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Insulating washer 1 between core and coil former

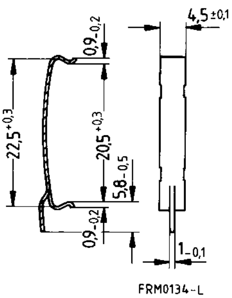
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,1 mm thick

Insulating washer 2 for double-clad PCBs

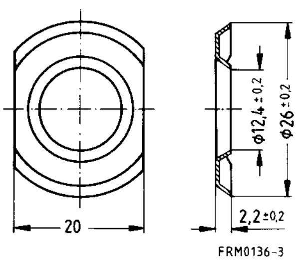
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65816-A2002
Insulating washer 1 (reel packing, PU = 1 reel)	B65816-B5000
Insulating washer 2 (bulk)	B65816-D2005

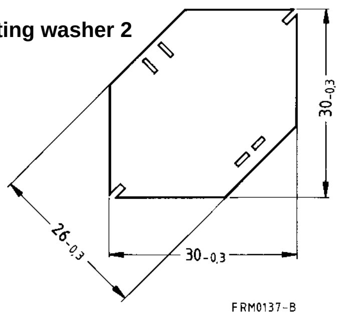
Clamp



Insulating washer 1



Insulating washer 2

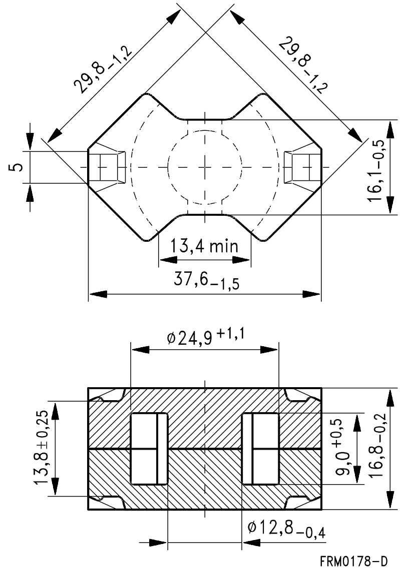


- For compact transformers
- Without center hole
- RM cores are supplied in sets

Magnetic characteristics (per set)

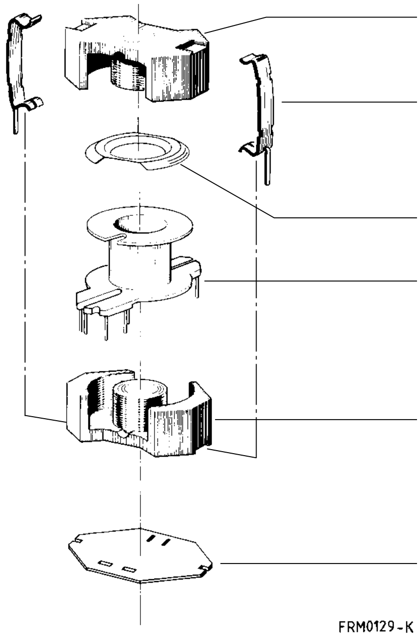
$\Sigma l/A$ = 0,28 mm^{-1}
l_e = 42 mm
A_e = 147,5 mm^2
A_{min} = 124,7 mm^2
V_e = 6 195 mm^3

Approx. weight 33,6 g/set



Ungapped

Material	A_L value nH	μ_e	A_{L1min}	P_V W/set	Ordering code
N49	4500 + 30/– 20 %	1010	3100	1,21 (50 mT, 500 kHz, 100 °C)	B65815-P-R49
N87	6300 + 30/– 20 %	1420	4000	3,36 (200 mT, 100 kHz, 100 °C)	B65815-P-R87

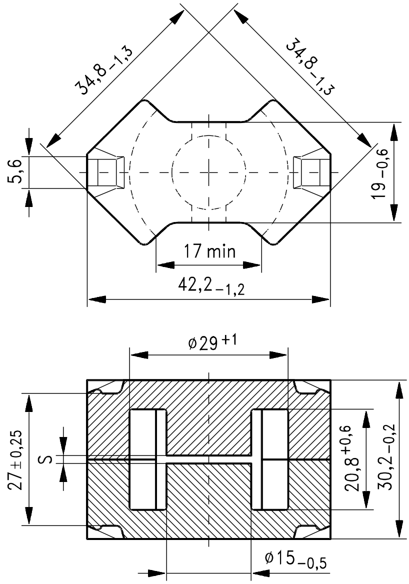


Example of an assembly set

Individual parts	Part no.	Page
Core	B65887	268
Clamps	B65888	272
Insulating washer 1	B65888	272
Coil former	B65888	270
Core	B65887	268
Insulating washer 2	B65888	272

Also available:

Coil former for power applications	B65888	271
RM 14 low-profile core	B65887-P	273



- In accordance with IEC 60431
- Optimized core cross section and increased thickness of base for power applications
- Without center hole
- RM cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,35 mm^{-1}
l_e = 70 mm
A_e = 200 mm^2
A_{min} = 170 mm^2
V_e = 14 000 mm^3

Approx. weight 74 g/set

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code -E without center hole
N41	160 ± 3 %	1,90	45	B65887-E160-A41
	250 ± 3 %	1,00	70	B65887-E250-A41
	400 ± 3 %	0,50	111	B65887-E400-A41
	1000 ± 5 %	0,15	278	B65887-E1000-J41

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -E without center hole
N49	3900 + 30/– 20 %[1)]	1030[1)]	2150[1)]	2,37[1)] (50 mT, 500 kHz, 100 °C)	B65887-E-R49
N67	6000 + 30/– 20 %	1670	3250	9,00 (200 mT, 100 kHz, 100 °C)	B65887-E-R67
N87	6000 + 30/– 20 %	1670	3250	7,40 (200 mT, 100 kHz, 100 °C)	B65887-E-R87
N41	6800 + 30/– 20 %	1890	3250	2,52 (200 mT, 25 kHz, 100 °C)	B65887-E-R41

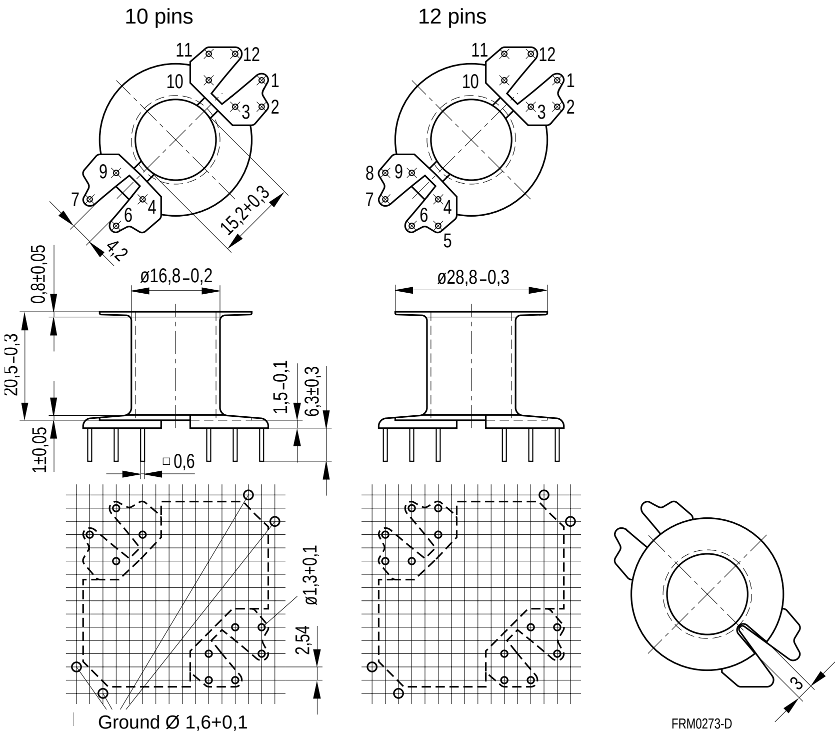
1) Preliminary data

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152
Squared pins

For matching clamp and insulating washers see page 272

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	107	71,5	23	10	B65888-C1010-D1
				12	B65888-C1012-D1



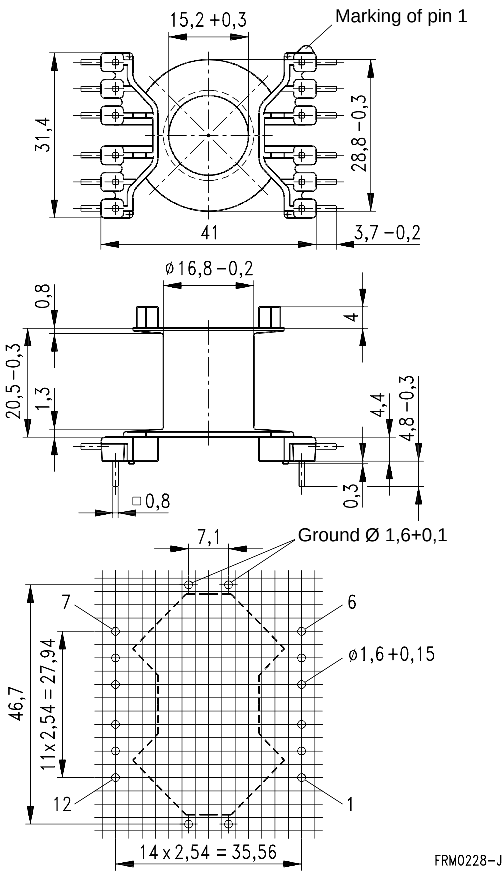
Hole arrangement
View in mounting direction

Coil former for power applications

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 152

For matching clamp and insulating washer 1 see page 272

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	106	71,5	23	12	B65888-C1512-T1



Hole arrangement
View in mounting direction
(Note half pitch!)

Clamp

- With ground terminal, made of stainless spring steel (tinned), 0,5 mm thick
- Solderability to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Insulating washer 1 between core and coil former

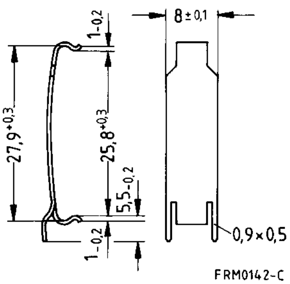
- For tolerance compensation and for insulation
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,1 mm thick

Insulating washer 2 for double-clad PCBs

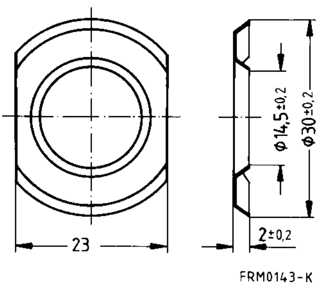
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,3 mm thick

	Ordering code
Clamp (ordering code per piece, 2 are required)	B65888-A2002
Insulating washer 1 (reel packing, PU = 1 reel)	B65888-B5000
Insulating washer 2 (bulk)	B65888-B2005

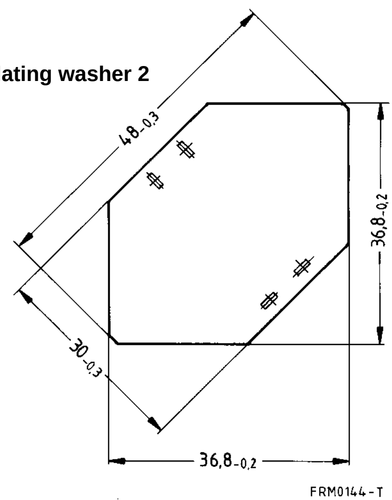
Clamp



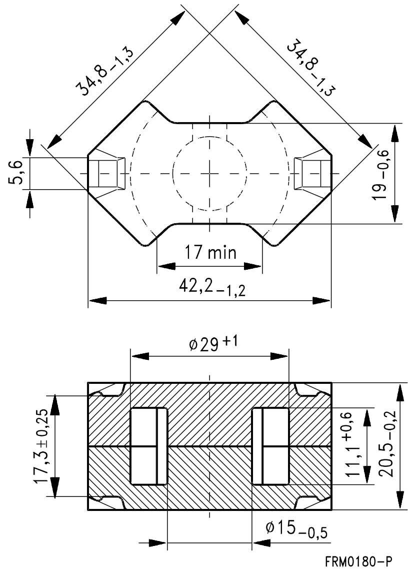
Insulating washer 1



Insulating washer 2



- For compact transformers
- Without center hole
- RM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,25 mm^{-1}
l_e = 50,9 mm
A_e = 201 mm^2
A_{min} = 170 mm^2
V_e = 10 230 mm^3

Approx. weight 55 g/set

Ungapped

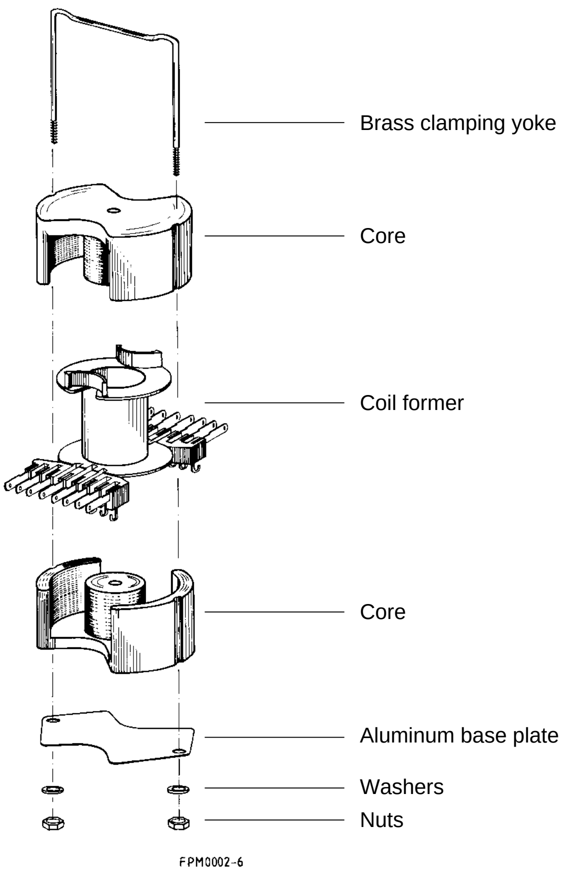
Material	A_L value nH	μ_e	A_{L1min}	P_V W/set	Ordering code
N49	5100 + 30/– 20 %	1020	3500	2,0 (50 mT, 500 kHz, 100 °C)	B65887-P-R49
N67	7100 + 30/– 20 %	1430	4500	6,9 (200 mT, 100 kHz, 100 °C)	B65887-P-R67
N87	7100 + 30/– 20 %	1430	4500	5,5 (200 mT, 100 kHz, 100 °C)	B65887-P-R87

PM cores are particularly suitable for use in transformers handling high powers in the frequency range up to 300 kHz. For numerous design tasks in telecommunications and industrial electronics (e.g. power pulse transformers in radar transmitters, antenna matching networks, machine control systems, thyristor firing transformers, energy storage chokes in switch-mode power supply equipment and others), the pot core shape offers various advantages: wide flux area for high power at a minimum number of turns, thus causing only low magnetic leakage and stray capacitance, as well as good shielding owing to the closed form, precisely ground air gaps, straightforward assembly and economic mounting.

A family of large pot cores, briefly designated PM cores (for **P**ot core **M**odule), is presented in the following.

Due to the weight of these pot cores, particularly in the case of the large cores 87/70 and 114/93, mounting on PC boards may not always be possible. In these cases, the coil former should be mounted with its terminals upwards.

Example of an assembly set:



1 Core losses

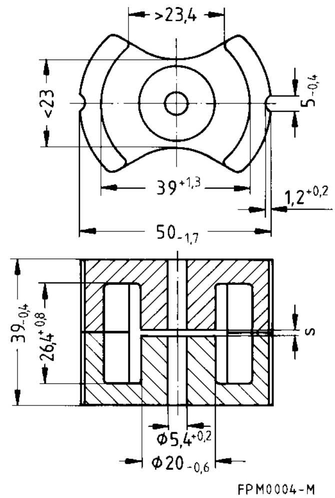
For each core type, the maximum dissipation loss is specified in W/set with the relevant measurement parameters. The flux density has been calculated on the basis of a sinusoidal voltage and is referred to the minimum cross-sectional area A_{min}.

2 Torque

When using the mounting assembly, the torques for tightening the nuts (without printed circuit board) are as follows:

Type	Torque
PM 50	0,4 Nm
PM 62	0,6 Nm
PM 74	0,8 Nm
PM 87	1,0 Nm
PM 114	1,2 Nm

- In accordance with IEC 61247
- Particularly suitable for power transformers and energy storage chokes
- PM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,227 mm^{-1}
l_e = 84 mm
A_e = 370 mm^2
A_{min} = 280 mm^2
V_e = 31 000 mm^3

Approx. weight 140 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N27	250 ± 3 %	2,00	45	B65646-A250-A27
	630 ± 3 %	0,63	114	B65646-A630-A27

Ungapped

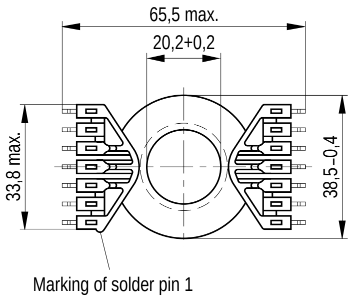
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	7400 + 30/– 20 %	1330	5000	4,2 (200 mT, 25 kHz, 100 °C)	B65646-A-R27
N87	7400 + 30/– 20 %	1330	5000	15,5 (200 mT, 100 kHz, 100 °C)	B65646-A-R87

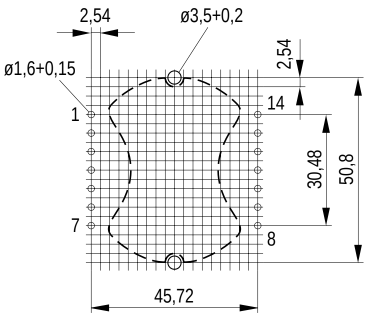
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 153

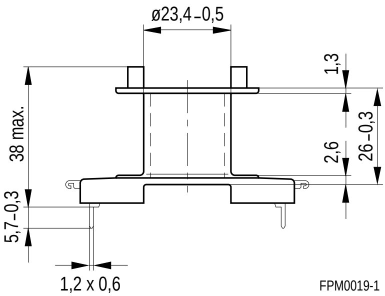
Also available without solder pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Solder pins	Ordering code
1	154	96,8	21,6	14	B65647-B1014-T1
1	154	96,8	21,6	—	B65647-A1000-T1





Hole arrangement
View in mounting direction



Mounting assembly

- For chassis mounting[1)] or printed circuit boards
- The set comprises a yoke and a base plate
- Fixing nuts M3 and washers are supplied

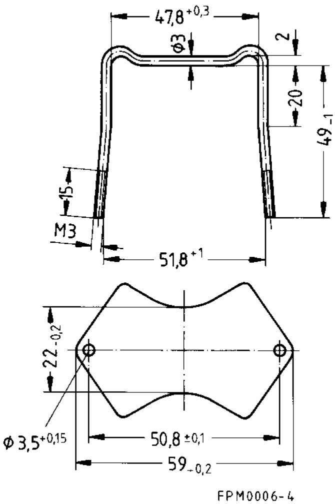
Yoke

- Material: Brass clamping yoke (∅ 3 mm) with thread

Base plate

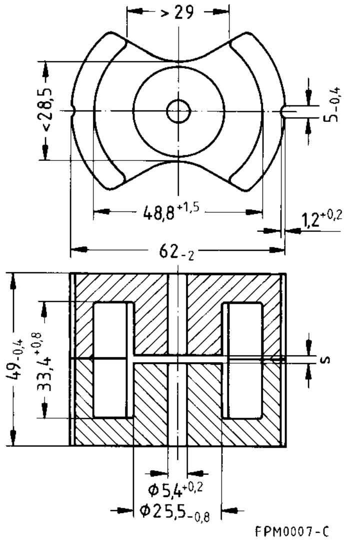
- Material: Aluminum (0,6 mm)

	Ordering code
Complete mounting assembly including nuts and washers	B65647-A2000



1) On a chassis the coil former must be mounted with its solder pins upward.

- In accordance with IEC 61247
- Particularly suitable for power transformers and energy storage chokes
- PM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,191 mm^{-1}
l_e = 109 mm
A_e = 570 mm^2
A_{min} = 470 mm^2
V_e = 62 000 mm^3

Approx. weight 280 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N27	315 ± 3 %	2,60	48	B65684-A315-A27
	630 ± 3 %	1,10	95	B65684-A630-A27

Ungapped

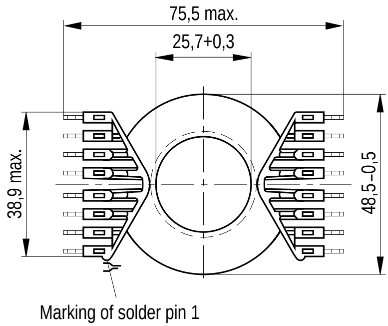
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	9200 + 30/– 20 %	1400	5950	9,5 (200 mT, 25 kHz, 100 °C)	B65684-A-R27
N87	9200 + 30/– 20 %	1400	5950	5,8 (200 mT, 100 kHz, 100 °C)	B65684-A-R87

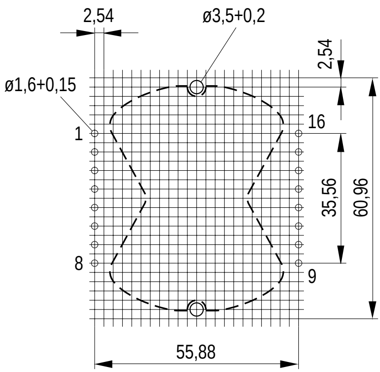
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 153
Pins squared in the start-of-winding area

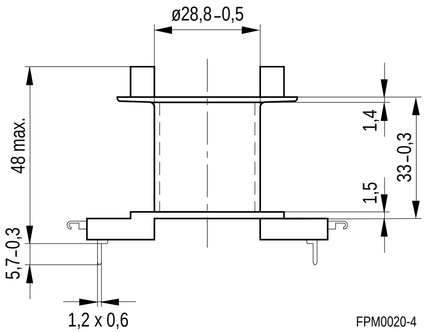
Also available without solder pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Solder pins	Ordering code
1	270	120	15,4	16	B65685-B1016-T1
1	270	120	15,4	—	B65685-A1000-T1





Hole arrangement
View in mounting direction



Mounting assembly

- For chassis mounting[1)] or printed circuit boards
- The set comprises a yoke and a base plate
- Fixing nuts M3 and washers are supplied

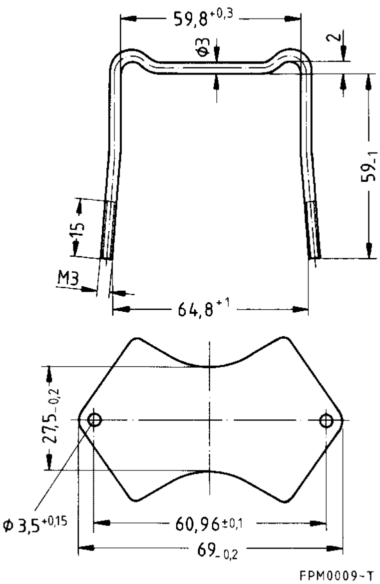
Yoke

- Material: Brass clamping yoke (∅ 3 mm) with thread

Base plate

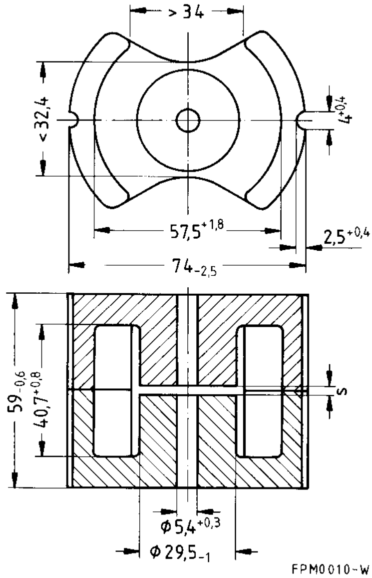
- Material: Aluminum (0,6 mm)

	Ordering code
Complete mounting assembly including nuts and washers	B65685-A2000



1) On a chassis the coil former must be mounted with its solder pins upward.

- In accordance with IEC 61247
- Particularly suitable for power transformers and energy storage chokes
- PM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,162 mm^{-1}
l_e = 128 mm
A_e = 790 mm^2
A_{min} = 630 mm^2
V_e = 101 000 mm^3

Approx. weight 460 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N27	315 ± 3 %	3,80	41	B65686-A315-A27
	630 ± 3 %	1,50	81	B65686-A630-A27

Ungapped

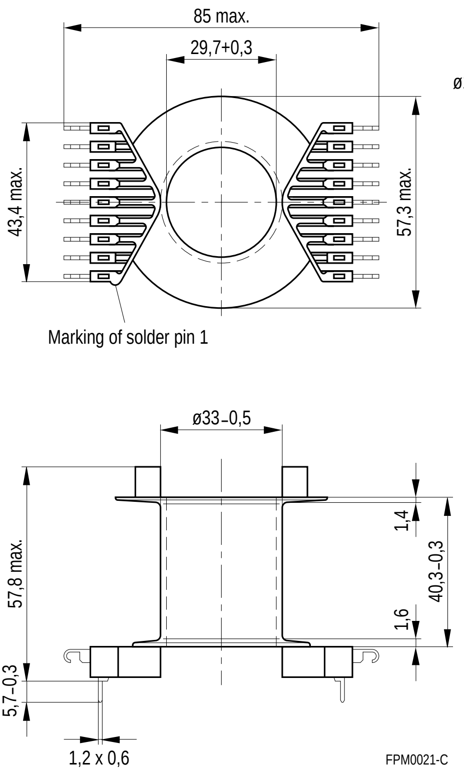
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	10000 + 30/– 20 %	1290	7000	7,5 (150 mT, 25 kHz, 100 °C)	B65686-A-R27
N87	10000 + 30/– 20 %	1290	7000	9,6 (100 mT, 100 kHz, 100 °C)	B65686-A-R87

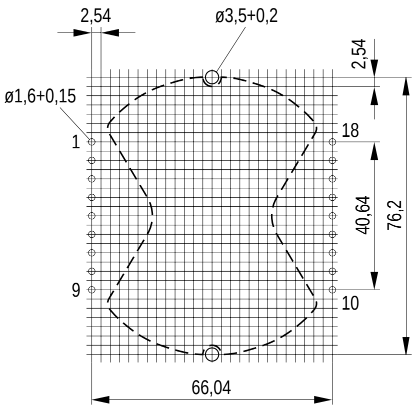
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 153

Also available without solder pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Solder pins	Ordering code
1	442	140	10,9	18	B65687-A1018-T1
1	442	140	10,9	—	B65687-A1000-T1





Hole arrangement
View in mounting direction

Mounting assembly

- For chassis mounting[1]) or printed circuit boards
- The set comprises a yoke and a base plate
- Fixing nuts M3 and washers are supplied

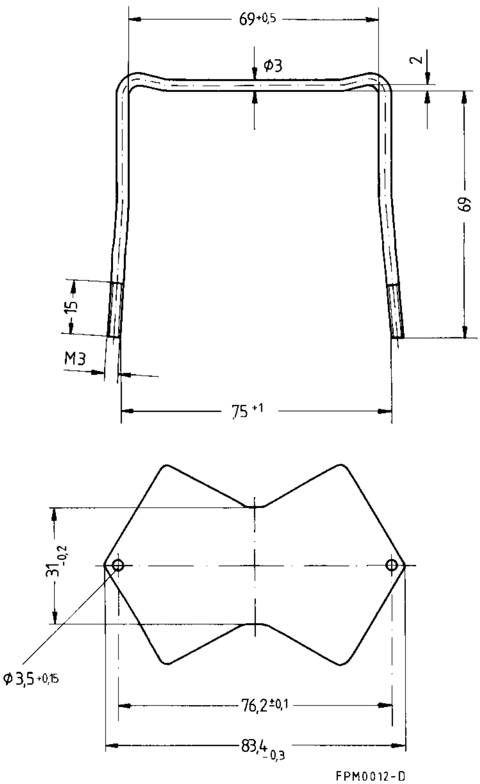
Yoke

- Material: Brass clamping yoke (∅ 3 mm) with thread

Base plate

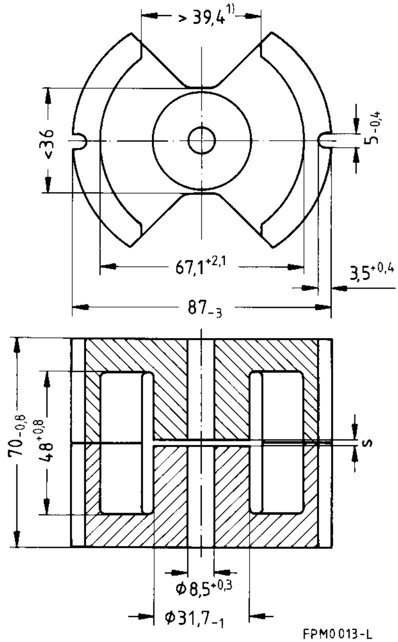
- Material: Aluminum (0,6 mm)

	Ordering code
Complete mounting assembly including nuts and washers	B65687-A2000



1) On a chassis the coil former must be mounted with its solder pins upward.

- In accordance with IEC 61247
- For power transformers
  > 1 kW (20 kHz) and energy storage chokes
- PM cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,161 mm^{-1}
l_e = 146 mm
A_e = 910 mm^2
A_{min} = 700 mm^2
V_e = 133 000 mm^3

Approx. weight 770 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N27	400 ± 3 %	3,50	51	B65713-A400-A27
	5000 ± 15 %	0,14	640	B65713-A5000-L27

Ungapped

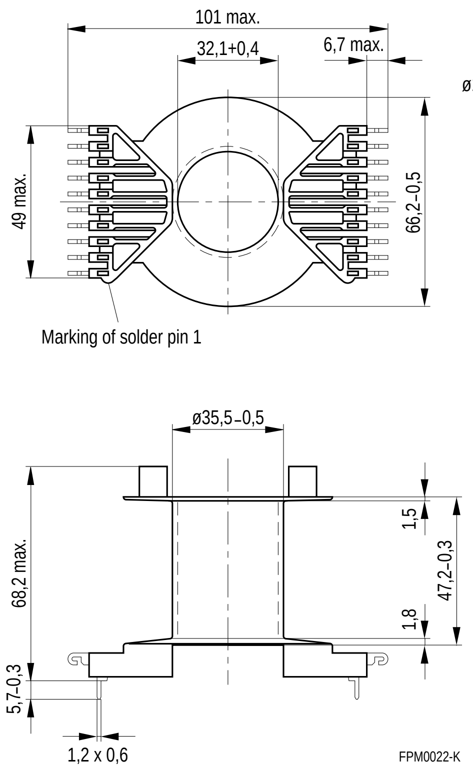
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	12000 + 30/– 20 %	1530	7050	12,4 (150 mT, 25 kHz, 100 °C)	B65713-A-R27

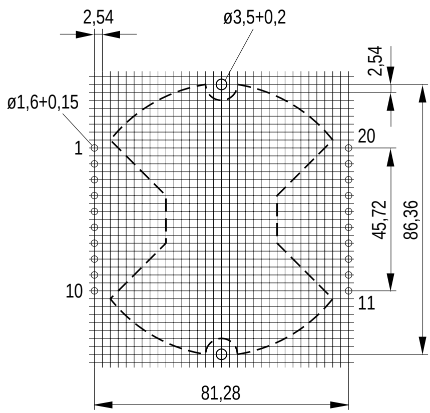
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 153
Pins squared in the start-of-winding area

Also available without solder pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Solder pins	Ordering code
1	657	158	8,27	20	B65714-K1020-T1
1	657	158	8,27	—	B65714-J1000-T1





Hole arrangement
View in mounting direction

Mounting assembly

- For chassis mounting[1)] or printed circuit boards
- The set comprises a yoke and a base plate
- Fixing nuts M3 and washers are supplied

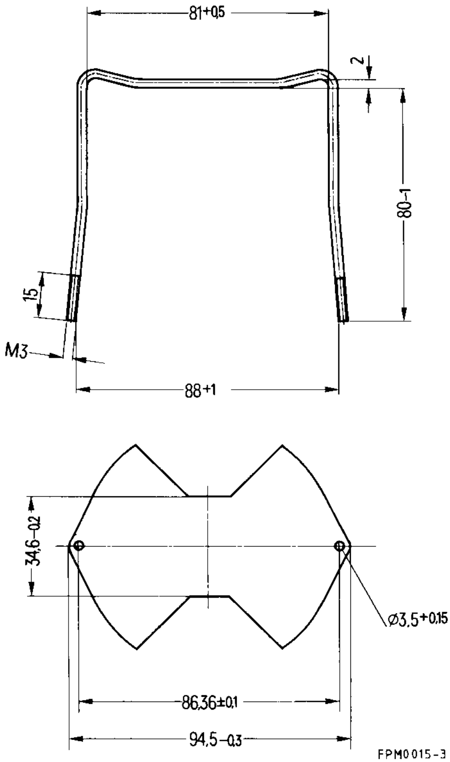
Yoke

- Material: Brass clamping yoke (∅ 3 mm) with thread

Base plate

- Material: Aluminum (0,6 mm)

	Ordering code
Complete mounting assembly including nuts and washers	B65714-A2000



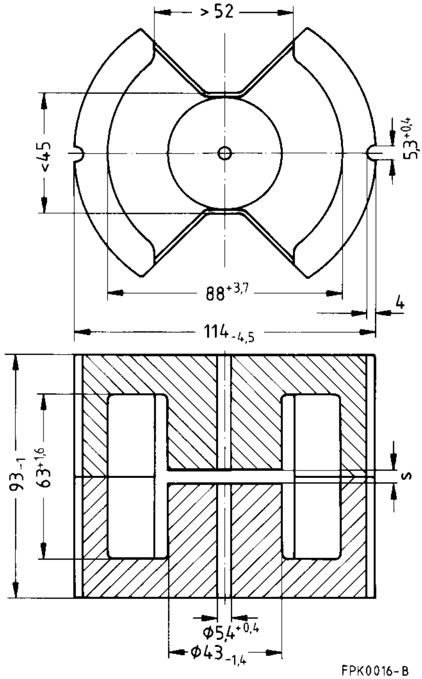
1) On a chassis the coil former must be mounted with its solder pins upward.

- In accordance with IEC 61247
- For power transformers
  > 1 kW (20 kHz) and energy storage chokes
- PM cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,116 mm^{-1}
l_e = 200 mm
A_e = 1 720 mm^2
A_{min} = 1 380 mm^2
V_e = 344 000 mm^3

Approx. weight 1940 g/set



Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N27	630 ± 3 %	3,80	58	B65733-A630-A27
	6300 ± 15 %	0,22	581	B65733-A6300-L27

Ungapped

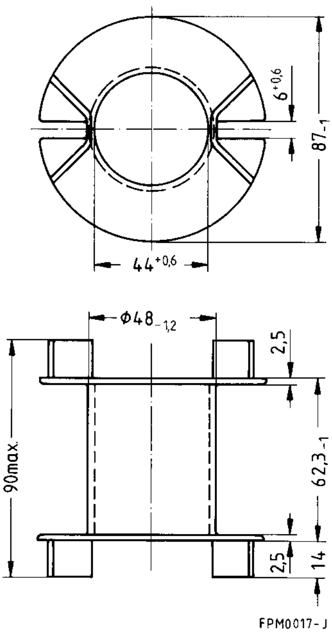
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	16000 + 30/– 20 %	1480	9750	14,0 (100 mT, 25 kHz, 100 °C)	B65733-A-R27

Coil former without solder pins

Material: Polyphenylene sulphide (UL 94 V-0, insulation class to IEC 85:
F ≙ max. operating temperature 155 °C), color code brown

Winding: see page 153

Sections	A_N mm²	l_N mm	A_R value µΩ	Ordering code
1	1070	210	6,75	B65734-B1000-T1

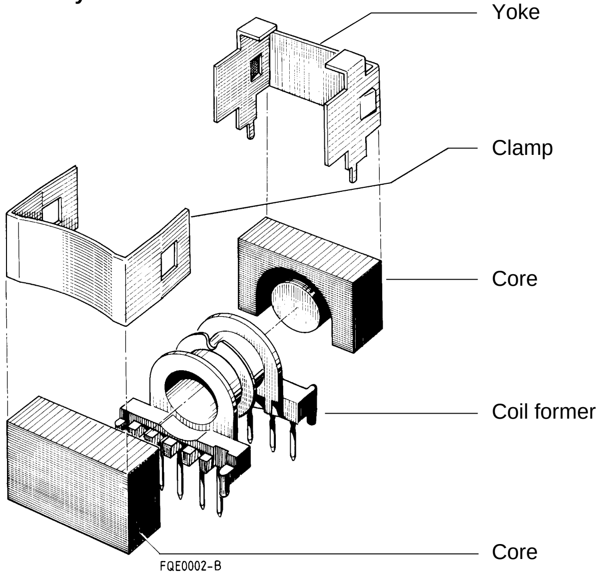


EP cores are typically used for transformer applications. Their cubic shape provides an excellent volume ratio to total space used and permits high PCB packing densities. The compact design and the broadband materials used (N26, N30, T35, T65, T38 and T42) ensure low magnetic leakage and excellent properties for broadband small-signal transmission.

EP cores are increasingly being used for power applications. Here we recommend the series EP7 through EP20 made of N67 and N87for operation up to about 300 kHz.

Matching pinned coil formers suitable for automatic processing and shielding accessories (yoke, clamp or cap yoke) complete the product line.

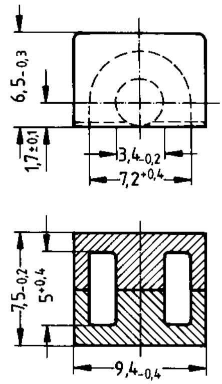
Example of an assembly set EP13



Core losses

The maximum dissipation loss for each core type employing power materials is specified in W/set together with the measurement parameters. The flux density has been calculated on the basis of a sinusoidal voltage and is referred to the minimum cross-sectional area A_{min}.

- In accordance with IEC 61596
- For transformers featuring high inductance and low overall height
- For power applications
- EP cores are supplied in sets



FQE0008-Q

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,52 mm^{-1}
l_e = 15,7 mm
A_e = 10,3 mm^2
A_{min} = 8,5 mm^2
V_e = 162 mm^3

Approx. weight 1,4 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N87	140 ± 5 %	0,08	170	B65839-A140-J87
N30	250 ± 5 %	0,05	300	B65839-A250-J30

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	1100 + 30/– 20 %	1330	750	0,11 (200 mT, 100 kHz, 100 ˚C)	B65839-A-R67
N87	1100 + 30/– 20 %	1330	750	0,08 (200 mT, 100 kHz, 100 ˚C)	B65839-A-R87
N26 1)	1100 + 30/– 20 %	1330			B65839-A-R26
N30	2000 + 30/– 20 %	2420			B65839-A-R30
T65 1)	3000 + 30/– 20 %	3640			B65839-A-R65
T38	5200 + 40/– 30 %	6290			B65839-A-Y38
T42	5800 + 40/– 30 %	7000			B65839-A-Y42

1) Preliminary data

Coil former

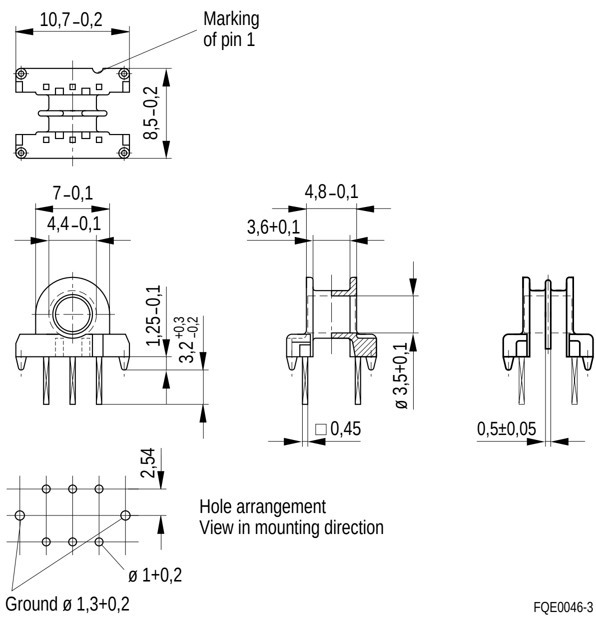
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 155
Squared pins

Cap yoke

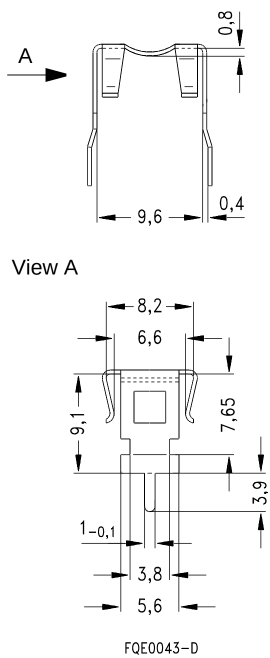
Material: With ground terminal, made of stainless spring steel (tinned), 0,25 mm thick

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	
1	3,7	17,9	166	6	B65840-B1006-D1
2	3,2	17,9	192	6	B65840-B1006-D2
Cap yoke					B65840-C2000

Coil former



Cap yoke



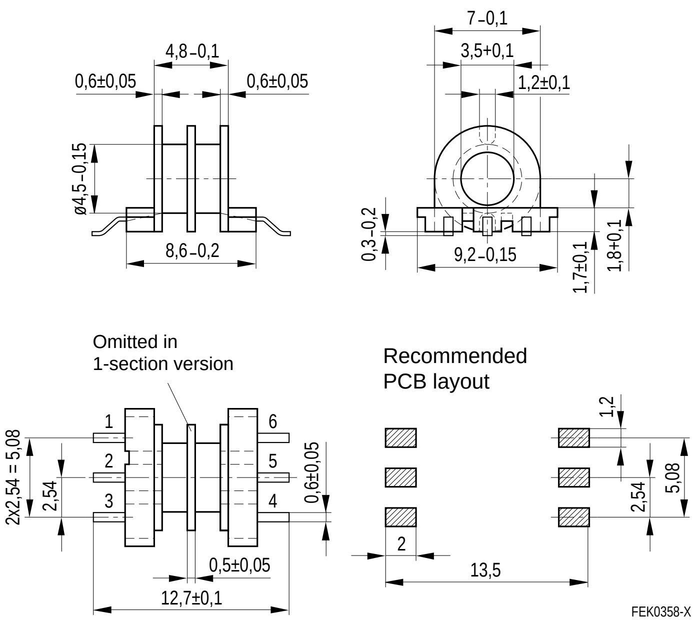
SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black

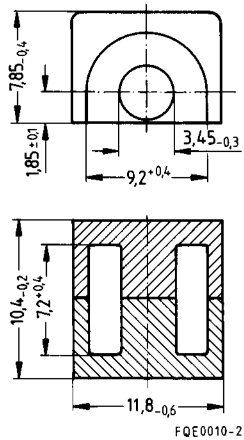
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s

Winding: see page 160

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	4,0	17,9	154	6	B65840-N1106-T1
2	3,6	17,9	171	6	B65840-N1106-T2



- In accordance with IEC 61596
- For transformers featuring high inductance and low overall height
- For power applications
- EP cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,7 mm^{-1}
l_e = 19,2 mm
A_e = 11,3 mm^2
A_{min} = 8,5 mm^2
V_e = 217 mm^3

Approx. weight 2,8 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N67	100 ± 3 %	0,13	135	B65841-A100-A67

Ungapped

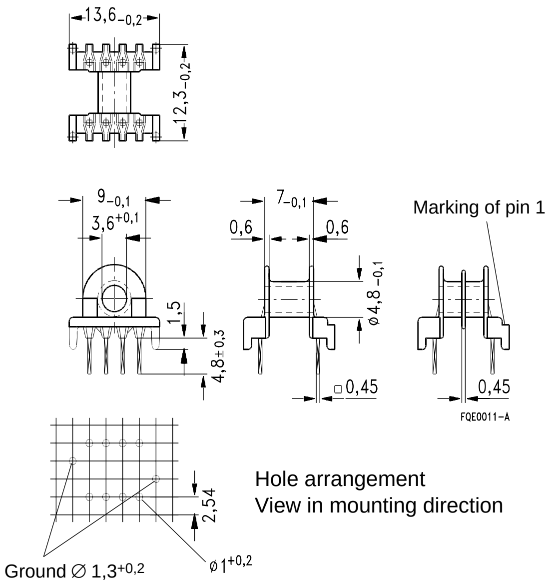
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	1100 + 30/– 20 %	1480	650	0,14 (200 mT, 100 kHz, 100 ˚C)	B65841-A-R67
N87[1)]	1100 + 30/– 20 %	1480	650	0,10 (200 mT, 100 kHz, 100 ˚C)	B65841-A-R87
N26[1)]	1100 + 30/– 20 %	1480			B65841-A-R26
N30	2000 + 30/– 20 %	2700			B65841-A-R30
T65[1)]	2900 + 30/– 20 %	3920			B65841-A-R65
T35	3200 + 30/– 20 %	4330			B65841-A-R35
T38	4800 + 40/– 30 %	6490			B65841-A-Y38
T42	6000 + 40/– 30 %	8000			B65841-A-Y42

1) Preliminary data

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 68-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 155
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	11,4	21,5	65	8	B65842-C1008-D1
2	10,0	21,5	74	8	B65842-C1008-D2



Hole arrangement
View in mounting direction

Mounting assembly

The set comprises a yoke and a clamp

Yoke

Material: Made of nickel silver (0,4 mm) with ground terminal (tinned)

Clamp

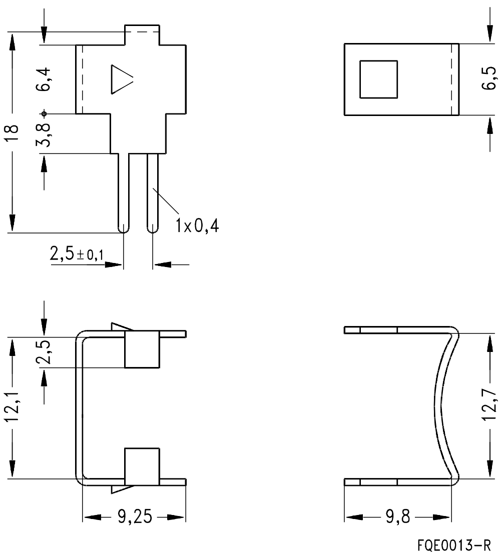
Material: Spring clamp, made of nickel silver (0,3 mm)

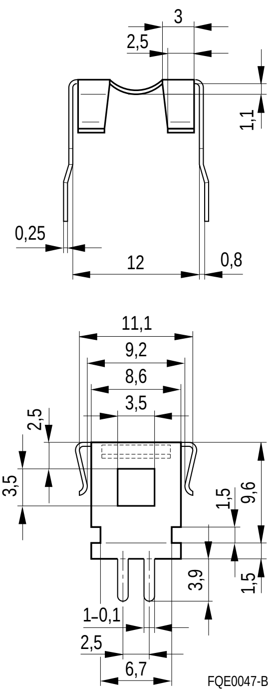
Cap yoke

Material: With ground terminal, made of stainless spring steel (tinned), 0,25 mm thick
Available from IV/98
Matching coil former in preparation

	Ordering code
Complete mounting assembly	B65842-A2000
Cap yoke[1]	B65842-C2000

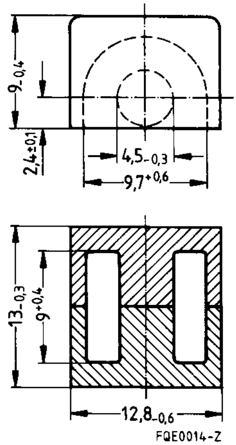
Yoke **Clamp** **Cap yoke**





1) Preliminary data

- In accordance with IEC 61596
- For transformers featuring high inductance and low overall height
- For power applications
- EP cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,24 mm^{-1}
l_e = 24,2 mm
A_e = 19,5 mm^2
A_{min} = 14,9 mm^2
V_e = 472 mm^3

Approx. weight 4,5 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N67	300 ± 5 %	0,07	296	B65843-A300-J67

Ungapped

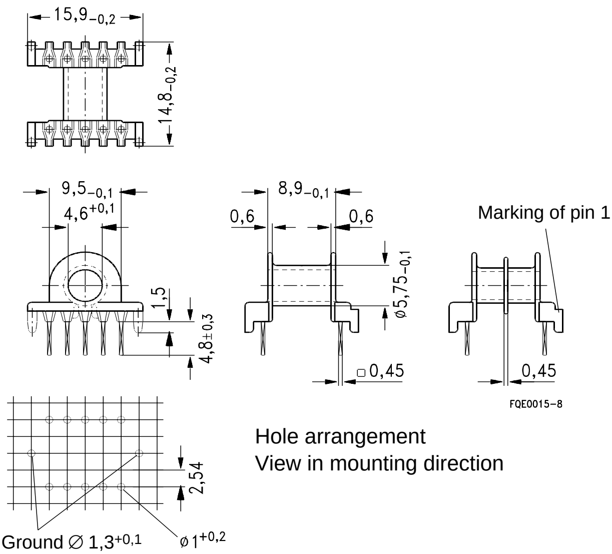
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	1600 + 30/– 20 %	1580	900	0,22 (200 mT, 100 kHz, 100 ˚C)	B65843-A-R67
N87	1600 + 30/– 20 %	1580	900	0,18 (200 mT, 100 kHz, 100 ˚C)	B65843-A-R87
N26 1)	1400 + 30/– 20 %	1380			B65843-A-R26
N30	2800 + 30/– 20 %	2760			B65843-A-R30
T65 1)	4000 + 30/– 20 %	3950			B65843-A-R65
T35	4400 + 30/– 20 %	4340			B65843-A-R35
T38	7000 + 40/– 30 %	6910			B65843-A-Y38
T42	8500 + 40/– 30 %	8300			B65843-A-Y42

1) Preliminary data

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 155
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	13,8	23,8	59,4	10	B65844-C1010-D1
2	13,0	23,8	63,2	10	B65844-C1010-D2

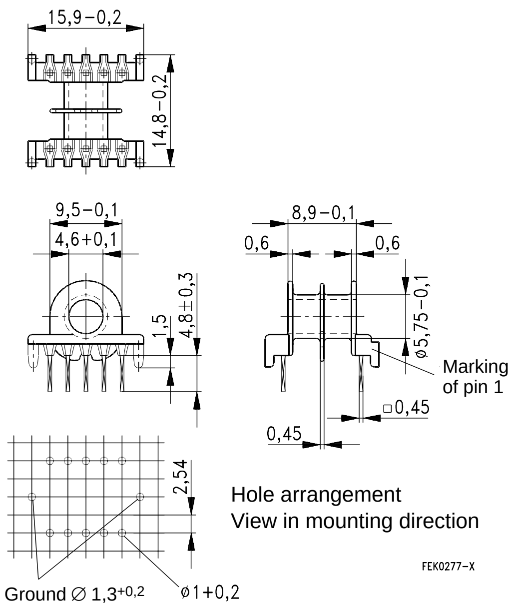


Hole arrangement
View in mounting direction

Coil former with closed center flange for high-voltage applications

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 155
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
2	13,0	23,8	63,2	10	B65844-L1010-D2



Mounting assembly

The set comprises a yoke and a clamp

Yoke

Material: Made of nickel silver (0,4 mm) with ground terminal (tinned)

Clamp

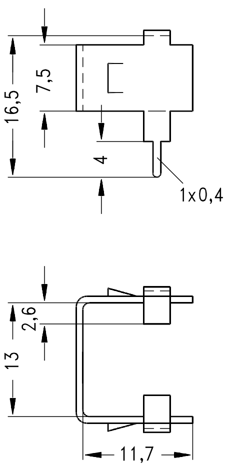
Material: Spring clamp, made of nickel silver (0,4 mm)

Cap yoke

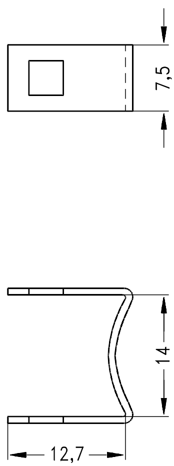
Material: With ground terminal, made of stainless spring steel (tinned), 0,3 mm thick
Available from I/99
Matching coil former in preparation

	Ordering code
Complete mounting assembly	B65844-A2000
Cap yoke[1]	B65844-C2000

Yoke

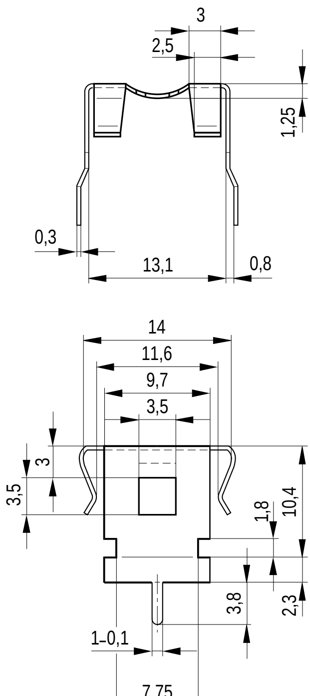


Clamp



FQE0016-G

Cap yoke



FQE0048-J

1) Preliminary data

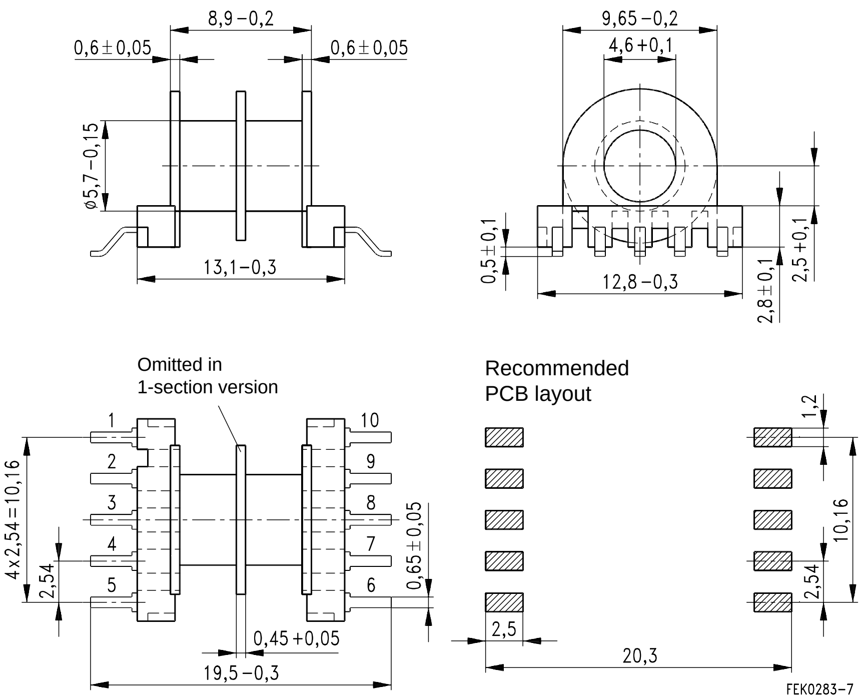
SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code natural or black

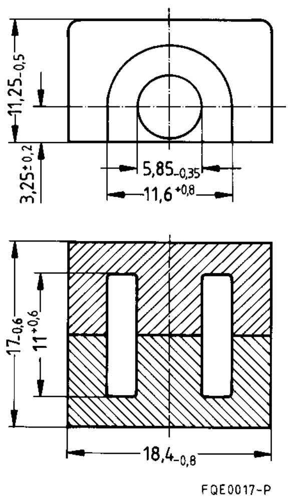
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400˚C, 1 s

Winding: see page 160

Sections	A_N mm^2	l_N mm	A_R value µΩ	Terminals	Ordering code
1	14,0	23,8	59,4	10	B65844-N1110-T1
2	13,2	23,8	63,2	10	B65844-N1110-T2



- In accordance with IEC 61596
- For transformers featuring high inductance and low overall height
- For power applications
- EP cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,84 mm^{-1}
l_e = 28,5 mm
A_e = 33,9 mm^2
A_{min} = 25,5 mm^2
V_e = 966 mm^3

Approx. weight 12 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N67	250 ± 5 %	0,157	167	B65845-J250-J67

Ungapped

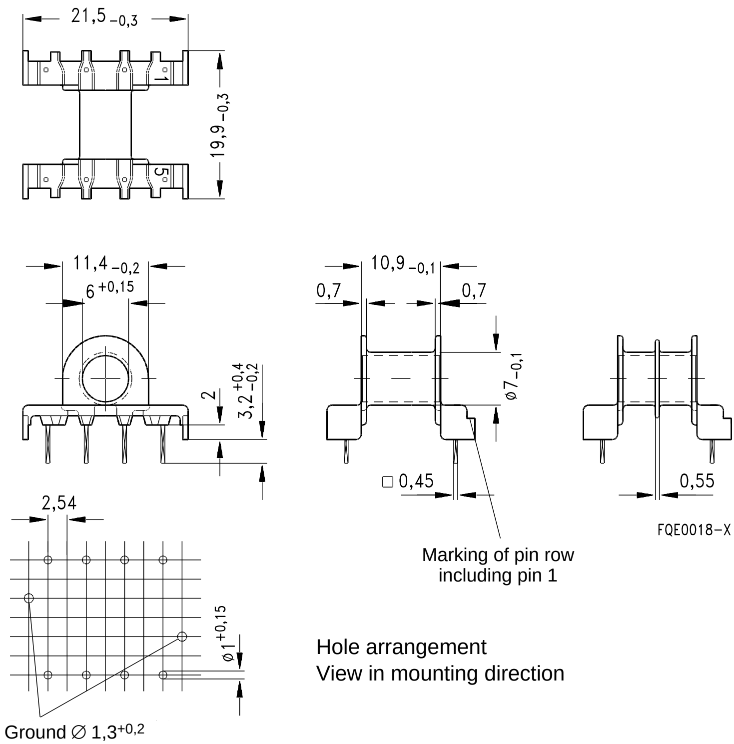
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	2400 + 30/– 20 %	1600	1350	0,5 (200 mT, 100 kHz, 100 °C)	B65845-J-R67
N87	2400 + 30/– 20 %	1600	1350	0,4 (200 mT, 100 kHz, 100 °C)	B65845-J-R87
N26[1)]	2400 + 30/– 20 %	1600			B65845-J-R26
N30	4300 + 30/– 20 %	2870			B65845-J-R30
T65[1)]	6200 + 30/– 20 %	4190			B65845-J-R65
T35	6900 + 30/– 20 %	4610			B65845-J-R35
T38	10800 + 40/– 30 %	7220			B65845-J-Y38
T42	13000 + 40/– 30 %	8700			B65845-J-Y42

1) Preliminary data

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 155
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	18,8	28,8	52,7	8	B65846-L1008-D1
2	17,7	28,8	55,9	8	B65846-L1008-D2



Mounting assembly

The set comprises a yoke and a clamp

Yoke

Material: Made of nickel silver (0,4 mm) with ground terminal (tinned)

Clamp

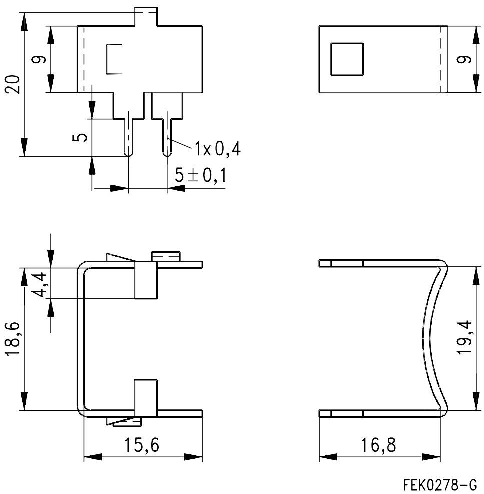
Material: Spring clamp, made of nickel silver (0,4 mm)

Cap yoke

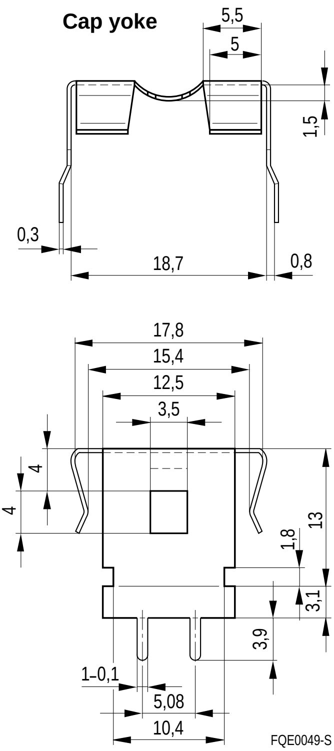
Material: With ground terminal, made of stainless spring steel (tinned), 0,3 mm thick
Available from I/99
Matching coil former in preparation

	Ordering code
Complete mounting assembly	B65846-J2000
Cap yoke[1]	B65846-C2000

Yoke **Clamp**

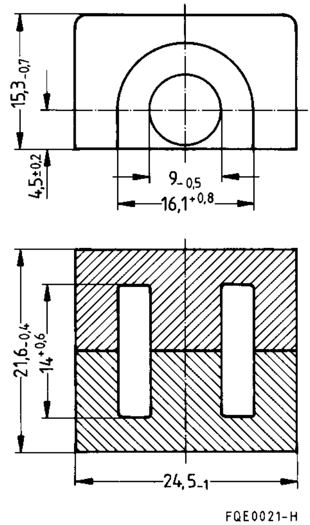


Cap yoke



1) Preliminary data

- In accordance with IEC 61596
- For transformers featuring high inductance and low overall height
- For power applications
- EP cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,51 mm^{-1}
l_e = 40 mm
A_e = 78 mm^2
A_{min} = 60 mm^2
V_e = 3 120 mm^3

Approx. weight 27,5 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code
N87	200 ± 3 %	0,20	134	B65847-A200-A87

Ungapped

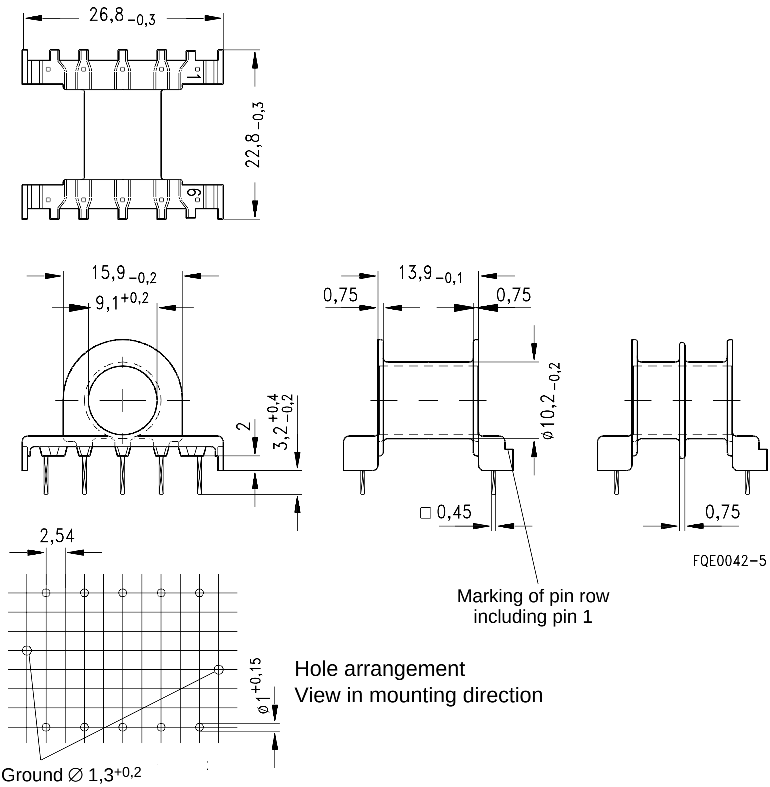
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	4000 + 30/– 20 %	1630	2200	1,5 (200 mT, 100 kHz, 100 ˚C)	B65847-A-R67
N87	4000 + 30/– 20 %	1630	2200	1,2 (200 mT, 100 kHz, 100 ˚C)	B65847-A-R87
N26[1)]	3500 + 30/– 20 %	1430			B65847-A-R26
N30	6700 + 30/– 20 %	2720			B65847-A-R30
T65[1)]	10200 + 30/– 20 %	4160			B65847-A-R65
T38	18700 + 40/– 30 %	7590			B65847-A-Y38

1) Preliminary data

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 155
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	33,8	38,9	39,6	10	B65848-D1010-D1
2	31,8	38,9	42,1	10	B65848-D1010-D2



Mounting assembly

The set comprises a yoke and a clamp

Yoke

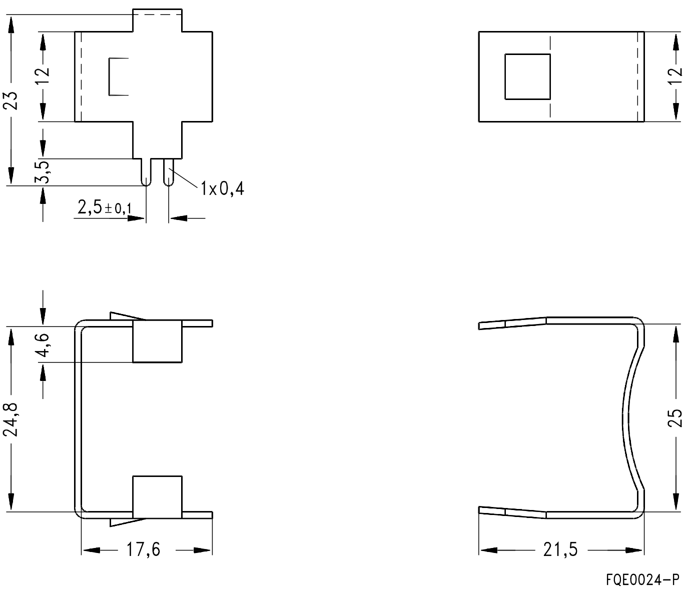
Material: Made of nickel silver (0,4 mm) with ground terminal (tinned)

Clamp

Material: Spring clamp, made of nickel silver (0,4 mm)

	Ordering code
Complete mounting assembly	B65848-A2000

Yoke **Clamp**



1 General information

P cores (**P**ot cores) are available in a wide range of sizes from S+M Components; 8 types in our product line comply with IEC 60133. We offer a choice of different SIFERRIT materials, which permits the cores to be used for a large variety of applications to over 100 MHz. Since the wound coil is completely enclosed by the ferrite core, P cores feature low magnetic leakage. They can be easily and precisely adjusted to the most manifold inductor requirements.

We naturally also supply the appropriate accessories for each core version. Most of the cores are available with threaded sleeves and screws for precision inductance adjustment. Adjustment curves are given for this purpose. These relate to the particular recommended combination of screw core/core material A_L value and must be understood as typical values. Notes on gluing the core halves may be found on page 162.

2 Applications

The cores are suitable for:

- High-quality resonant circuit inductors (filters) with high inductance stability (materials N48, M33, K1).
- Low-distortion broadband small-signal transformers in materials T38 and N30 with high A_L value
- Power applications. Here, pot cores without center hole made of material N67 are used as standard. As a result of their larger effective magnetic cross-sectional area, these types are characterized by a higher A_L value, better flux density distribution and, consequently, a reduced power loss.

Your attention is drawn particularly to the following developments:

- The pot cores P5,8×3,3 through P36×22 have broadened side slots to protect the wires.
- In additional to conventional accessories, an SMD coil former is available for core type P9×5.

3 Marking

The material and the A_L value are always stamped on P cores with a diameter > 5,8 mm, the material and “o, L.”(=without air gap) are stamped on ungapped cores. Only one core half of the two comprising a set carries the marking. With cores having an unsymmetrical air gap (the total air gap is ground into one half) the ground half carries the marking, with cores including a glued-in threaded sleeve the half without sleeve is marked.

4 Power loss

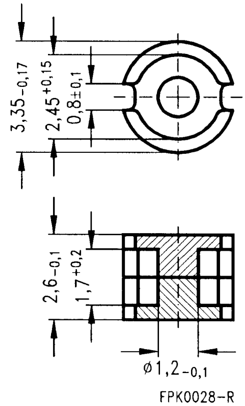
For each core type with power materials the maximum power loss is specified in W/set. The flux density has been calculated on the basis of a sinusoidal voltage and is referred to the minimum cross-sectional area A_{min}.

- Pot cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l/A$ = 3,72 mm^{-1}
l_e = 5,1 mm
A_e = 1,37 mm^2
V_e = 7 mm^3

Approx. weight 0,06 g/set



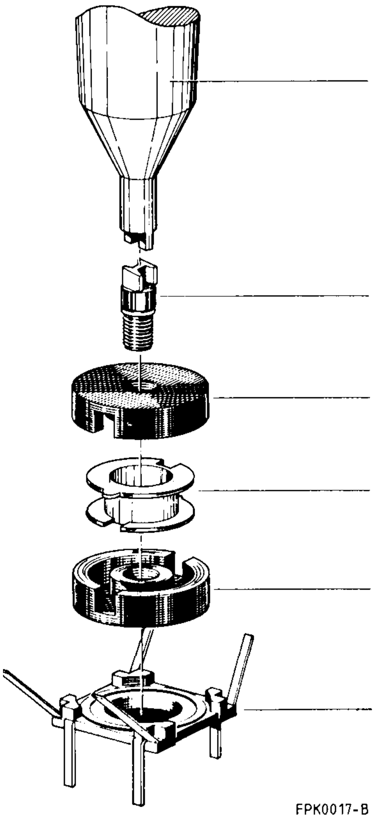
Ungapped

Material	A_L value nH	μ_e	Ordering code -C without center hole
K1	25 + 40/– 30 %	75	B65491-C-Y1
N30	500 + 40/– 30 %	1480	B65491-C-Y30

Winding data

Usable winding cross section A_N without coil former mm^2	Average length of turn A_N mm	A_R value µΩ
0,65	5,8	310

Adjustable miniature assembly set for printed circuit boards and surface mounting

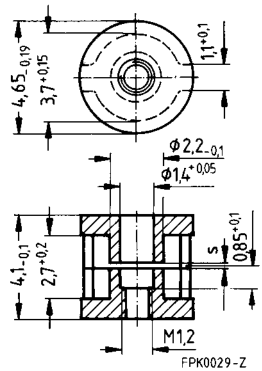


Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	315
Matching handle	B63399	315
Adjusting screw	B65496	315
Core	B65495	312
Coil former	B65496	313
Core with internal thread	B65495	312
Terminal carrier for PCB through-hole assembly	B65496	314

Example of an assembly set

Also available:

Terminal carrier for SMT	B65496	314



Miniature pot cores
for adjustable miniature inductors

- One of the two cores is equipped with an internal thread for the adjusting screw
- The unit can be fixed to the terminal carrier by glue
- Space requirements of the inductor 5 × 5,1 mm (without terminals)
- Pot cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l/A$ = 2,6 mm^{-1}
l_e = 7,6 mm
A_e = 2,8 mm^2
V_e = 21,3 mm^3

Approx. weight 0,17 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code -K with thread
K1	16 ± 3 %	0,20	33	B65495-K16-A1
M33	40 ± 5 %	0,07	83	B65495-K40-J33
N48	63 ± 5 %	0,04	130	B65495-K63-J48

Ungapped

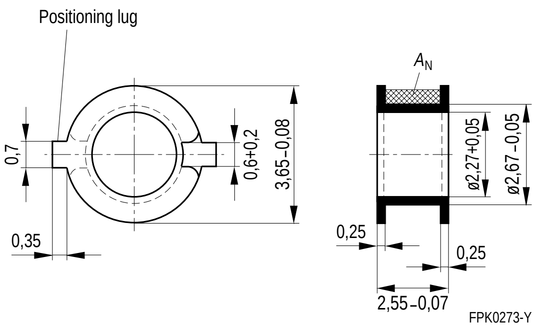
Material	A_L value nH	μ_e	Ordering code -B with center hole
M33	200 + 40/– 30 %	414	B65495-B-Y33
N30	800 + 40/– 30 %	1660	B65495-B-Y30

Coil former with positioning lug

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black

Winding: see page 154

Sections	A_N mm²	l_N mm	A_R value µΩ	Ordering code
1	0,8	9,5	400	B65496-B1000-T1

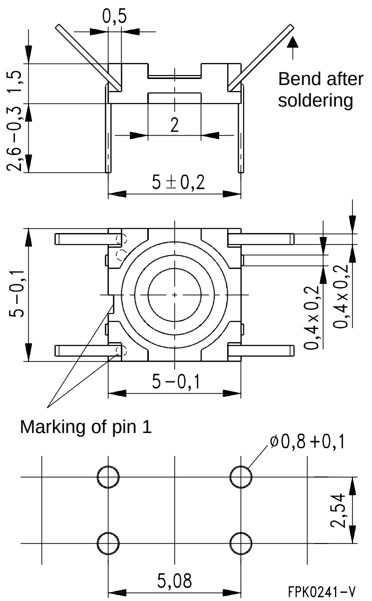


Terminal carrier

Material: GFR polyether ketone (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

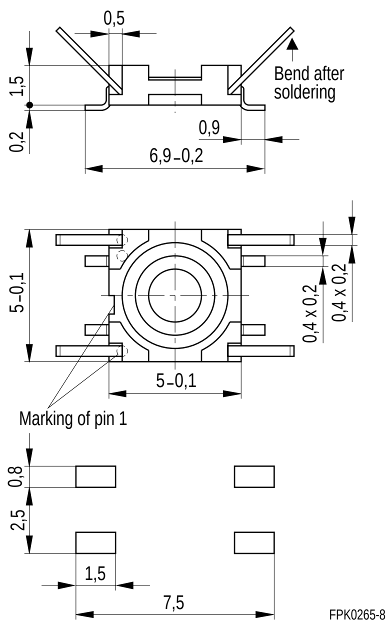
Terminal carrier	Ordering code
With 4 solder terminals for PCB through-hole assembly	B65496-B2002
With 4 solder terminals for SMT	B65496-B2003

For PCB through-hole assembly



Hole arrangement
View in mounting direction

For SMT



Recommended PCB layout

Adjusting screw

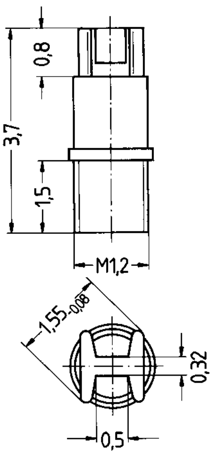
- Tube core with thread and core brake made of polyacetal

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Adjusting screw			Min. adjusting range	Ordering code
Tube core ∅ × length mm	Material	Color code	%	
1,25 × 1,2	K 1	blue	10	B65496-A3001-X1
Adjusting screwdriver				B63399-A1007
Handle				B63399-B5

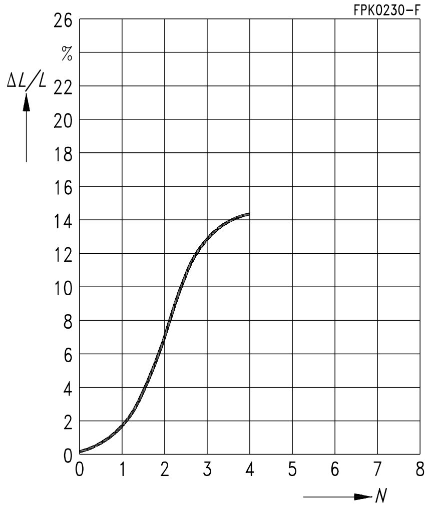
Adjusting screw



Inductance adjustment curves (nominal values)

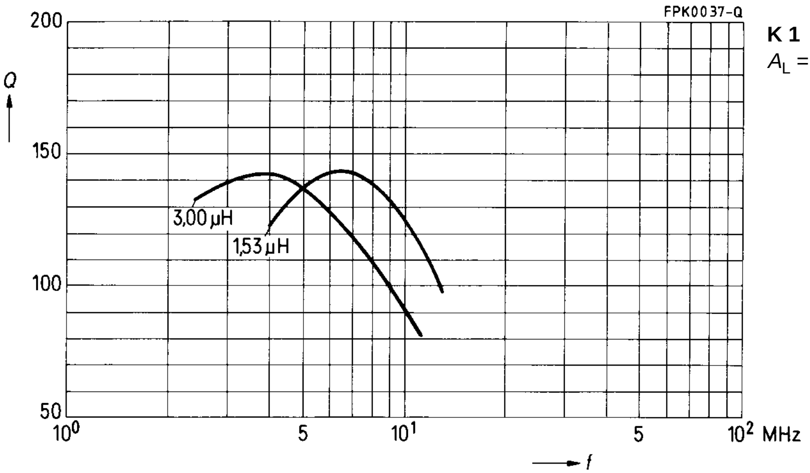
Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least $^1/_2$ to 1 turn engaged.

Adjusting screw B65496-A3001-X1
Color code blue



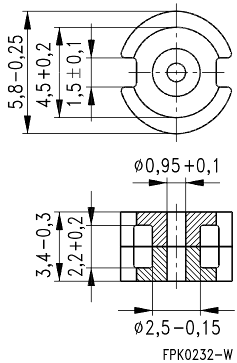
Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1 mT

Material	A_L (nH)	L (µH)	Turns	RF litz wire
K 1	16	1,53 3,00	9 13	32 × 0,025 CuLS 15 × 0,040 CuLS



K 1
A_L = 16 nH

- Pot cores are supplied in sets



Magnetic characteristics (per set)

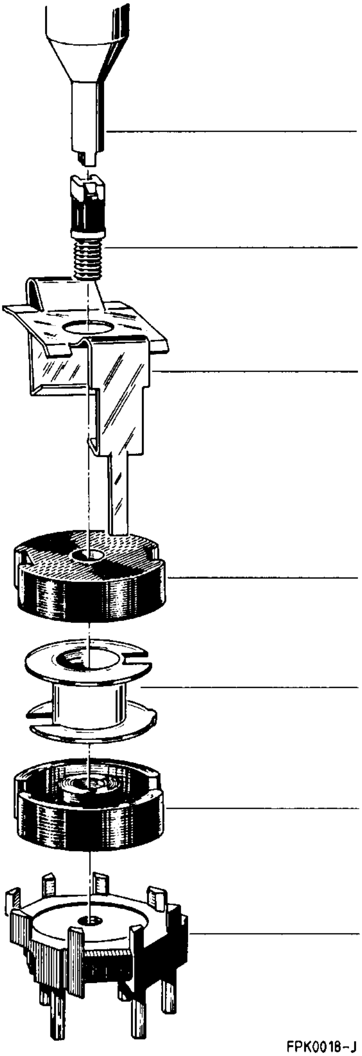
$\Sigma l/A$ = 1,68 mm^{-1}
l_e = 7,9 mm
A_e = 4,7 mm^2
V_e = 37 mm^3

Approx. weight 0,2 g/set

Ungapped 1)

Material	A_L value nH	μ_e	Ordering code -D with center hole
M33	350 + 30/– 20 %	470	B65501-D-R33
N26	800 + 40/– 30 %	1070	B65501-D-Y26

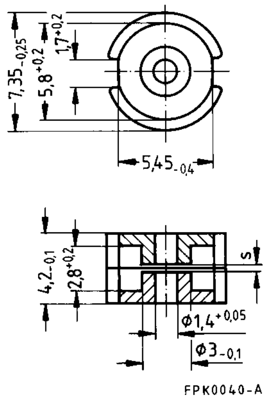
1) Gapped pot cores on request



Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	323
Matching handle	B63399	323
Adjusting screw	B65512	323
Yoke	B65512	322
Core	B65511	320
Coil former	B65512	321
Core	B65511	320
Terminal carrier with thread	B65812	322

- Pot cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,43 mm^{-1}
l_e = 10 mm
A_e = 7 mm^2
V_e = 70 mm^3

Approx. weight 0,5 g/set

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code -A with center hole
U17 1)	8 ± 3 %	0,80	9,1	B65511-A8-A17
K1	25 ± 3 %	0,32	28,5	B65511-A25-A1
M33	63 ± 3 %	0,13	72,0	B65511-A63-A33
N48	100 ± 3 %	0,10	114,0	B65511-A100-A48

Ungapped

Material	A_L value nH	μ_e	Ordering code -A with center hole
N30	2000 + 40/– 30 %	2280	B65511-A-Y30
N48	1000 + 40/– 30 %	1137	B65511-A-Y48

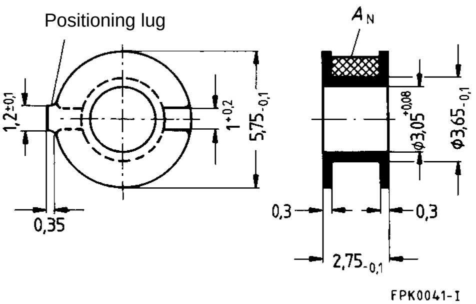
1) The dimensions may be up to approx. 10 % larger.

Coil former with positioning lug

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black

Winding: see page 154

Sections	A_N mm²	l_N mm	A_R value µΩ	Ordering code
1	2,2	14,6	240	B65512-C-T1



Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Coil former for nonlinear chokes

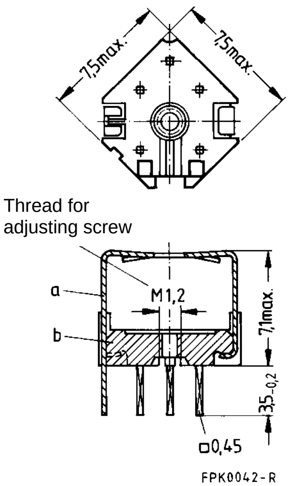
- With thread for the adjusting screw

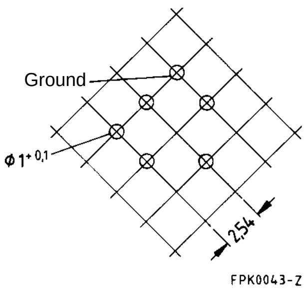
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

Yoke

Material: Spring yoke, made of tinned nickel silver (0,2 mm), with ground terminal

Complete mounting assembly (5 solder terminals)
Ordering code: B65512-C2001





a) Yoke
b) Terminal carrier with 5 solder terminals

Adjusting screw

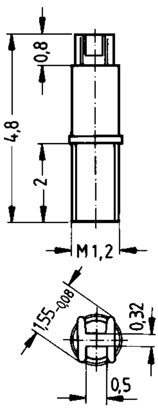
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 7 × 4		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Mate-rial	Color code	%	
U 17	8	1,25 × 1,8	U 17	white	14	B65512-A3001-X17
K 1	25	1,25 × 1,8	U 17	white	12	B65512-A3001-X17
M 33	63	1,25 × 1,8	U 17	white	8	B65512-A3001-X17
	63	1,25 × 1,8	K 1	yellow	15	B65512-A3001-X1
N 48	100	1,25 × 1,8	K 1	yellow	12	B65512-A3001-X1
Adjusting screwdriver						B63399-A1007
Handle						B63399-B5

Adjusting screw

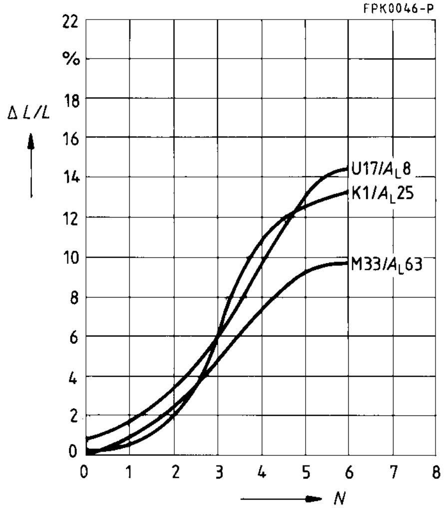


FPK0044-8

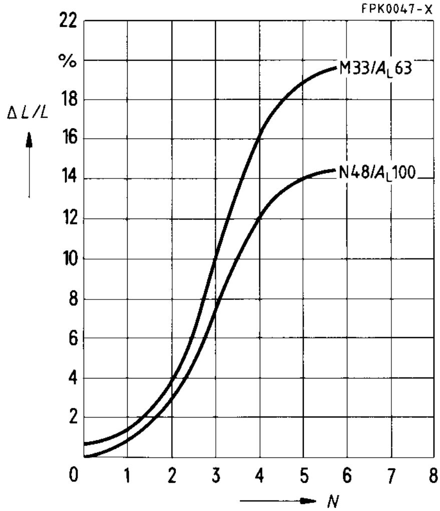
Inductance adjustment curves (nominal values)

Relative inductance change Δ L/L versus turns N of adjusting screw.
0 ≙ screw completely engaged.

Adjusting screw B65512-A3001-X17
Color code white

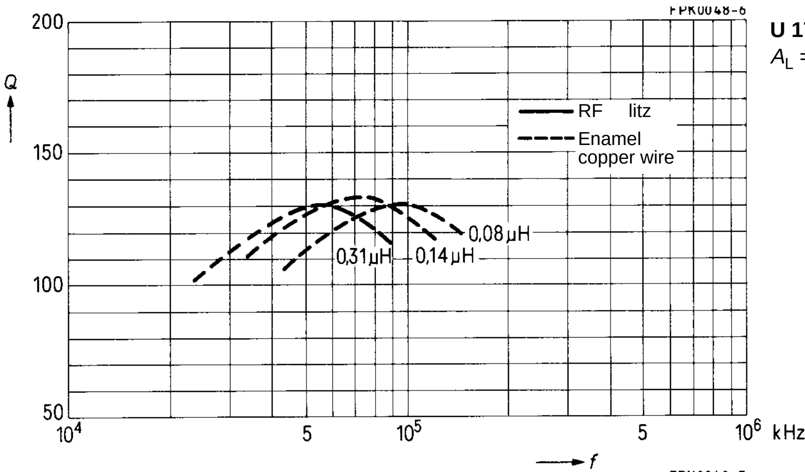


Adjusting screw B65512-A3001-X1
Color code yellow

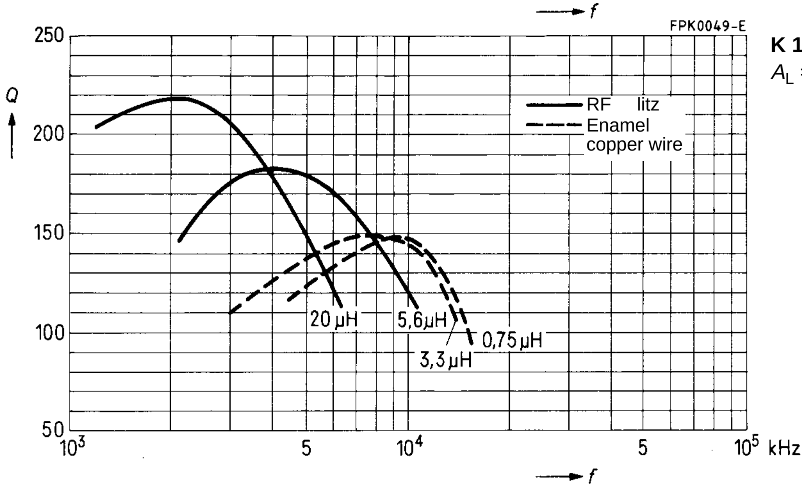


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Material	A_L value	L	Turns	Wire; RF litz wire	No. layers
U 17	8 nH	0,31 µH	6	0,25 CuL	1
		0,14 µH	4	0,30 CuL	1
		0,08 µH	3	0,30 CuL	1
K 1	25 nH	20 µH	28	15 × 0,04 CuLS	4
		5,6 µH	15	12 × 0,04 CuLS	2
		3,3 µH	11	0,3 CuL	2
		0,75 µH	5	0,4 CuL	1



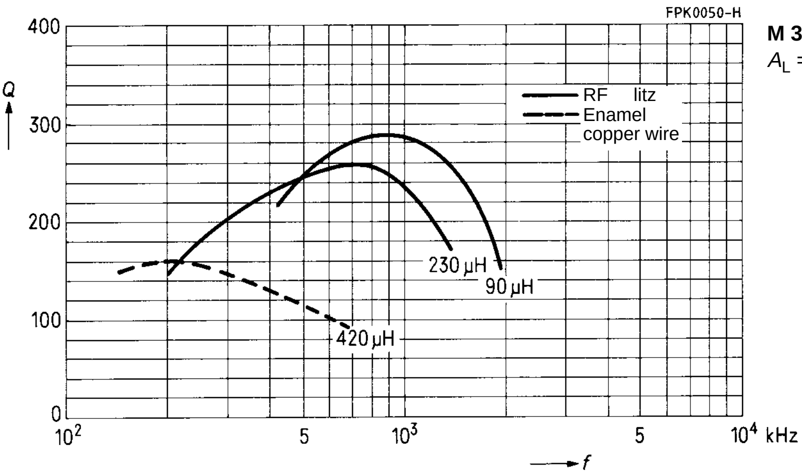
U 17
A_L = 8 nH



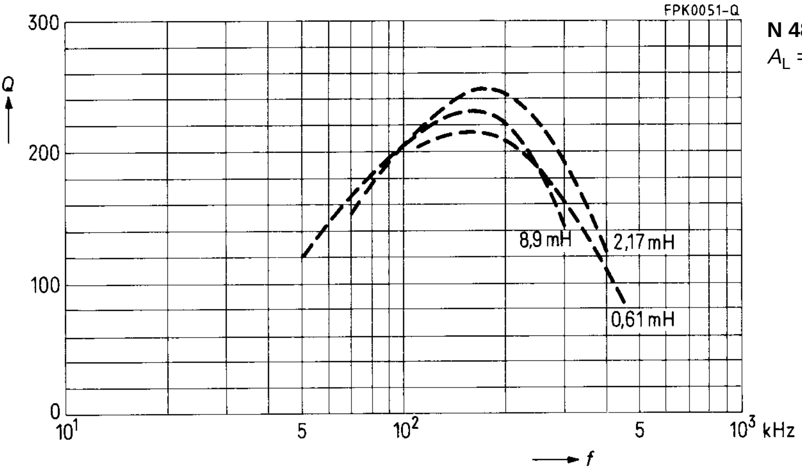
K 1
A_L = 25 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Material	A_L value	L	Turns	Wire; RF litz wire
M 33	63 nH	420 µH 230 µH 90 µH	80 60 37	0,14 CuL 3 × 0,07 CuLS 12 × 0,04 CuLS
N 48	100 nH	8,90 µH 2,17 µH 0,61 µH	300 150 80	0,07 CuL 0,10 CuL 0,15 CuL

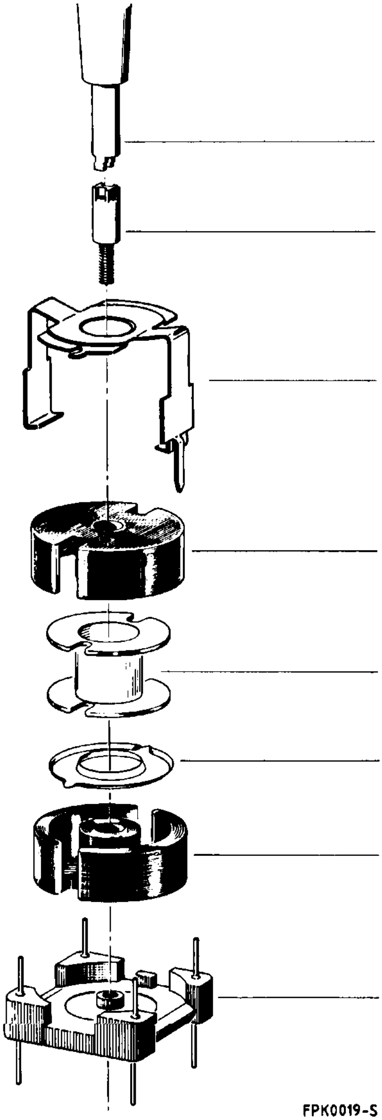


M 33
A_L = 63 nH



N 48
A_L = 100 nH

Core and Accessories

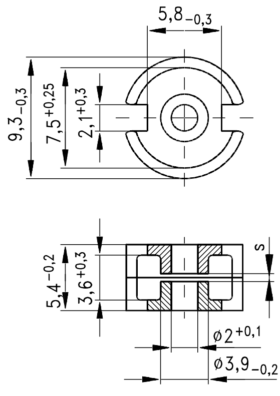


Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	332
Matching handle	B63399	332
Adjusting screw	B65518	332
Yoke	B65818	331
Core	B65817	328
Coil former	B65522	329
Insulating washer 1	B65522	329
Core	B65517	328
Terminal carrier with thread	B65518	331

Also available: SMD coil former B65524 330

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	1,25	1,13	mm^{-1}
l_e	12,2	13,4	mm
A_e	9,8	11,9	mm^2
A_{min}	—	9,3	mm^2
V_e	120	159	mm^3

Approx. weight (per set)

m	0,8	1,0	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code [1)] -D with center hole -T with threaded sleeve
K12	16 ± 3 %	0,80	15,9	B65517-+16-A12
K1	25 ± 3 %	0,45	24,9	B65517-+25-A1
	40 ± 3 %	0,26	39,8	B65517-+40-A1
M33	63 ± 3 %	0,20	63,0	B65517-D63-A33
N48	100 ± 3 %	0,10	100,0	B65517-+100-A48
	160 ± 3 %	0,06	159,0	B65517-+160-A48
	200 ± 3 %	0,04	200,0	B65517-D200-A48
N26	250 ± 10 %	0,03	249,0	B65517-D250-K26

Ungapped

Material	A_L value nH	μ_e	P_V W/set	Ordering code -D with center hole -W without center hole
N26	1300 + 30/– 20 %	1190		B65517-D-R26
N30	2500 + 30/– 20 %	2490		B65517-D-R30
T38	5500 + 40/– 30 %	4945		B65517-W-Y38

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

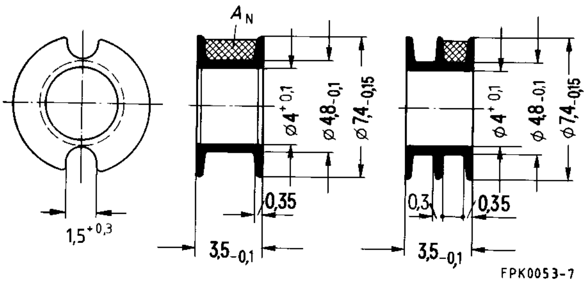
Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

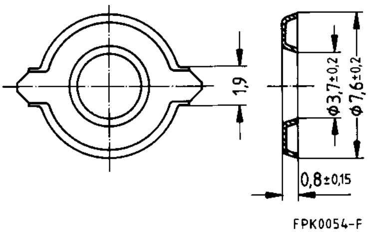
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120°C), 0,04 mm thick

Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	3,6	19,2	183	B65522-B-T1
2	3,2	19,2	206	B65522-B-T2
Insulating washer 1 (reel packing, PU = 1 reel)				B65522-A5000

Coil former



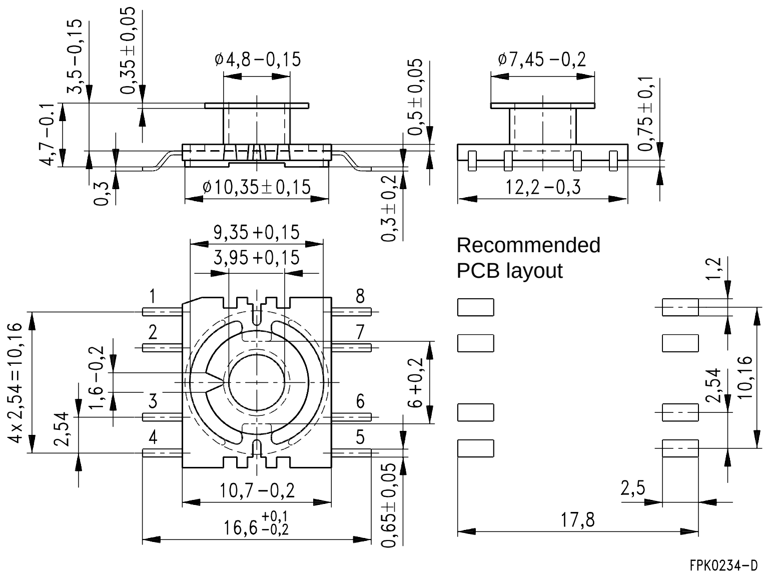
Insulating washer 1



SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400˚C, 1 s
Winding: see page 160

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	3,4	19,2	194	4	B65524-C1004-T1
	3,4	19,2	194	8	B65524-C1008-T1



In the 4-terminal version terminals 2, 3, 6 and 7 are omitted.

Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

- With thread for the adjusting screw (to be combined with core version ”D“)

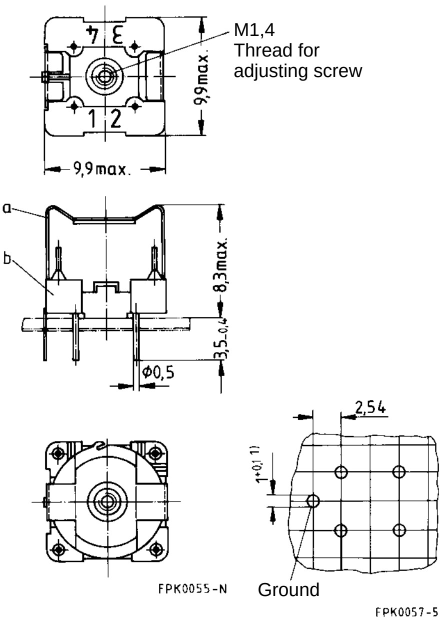
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Yoke

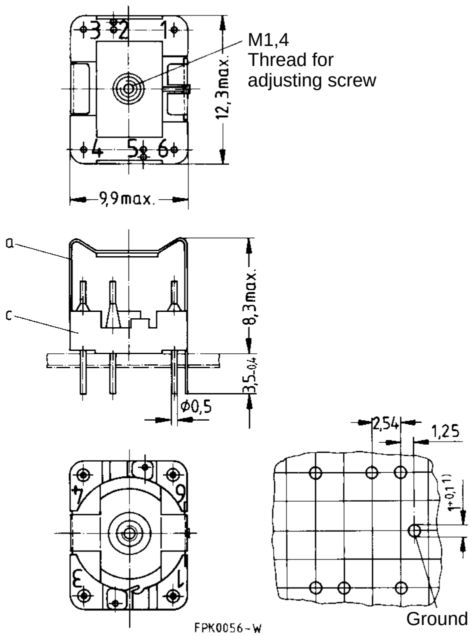
Material: Spring yoke, made of tinned nickel silver (0,25 mm), with ground terminal

Complete mounting assembly (4 solder terminals) Ordering code: B65518-D2001	Complete mounting assembly (6 solder terminals) Ordering code: B65518-D2002

4 solder terminals



6 solder terminals



1) 1,3 hole also permissible
a) Yoke
b) Terminal carrier with 4 solder terminals
c) Terminal carrier with 6 solder terminals

Adjusting screw

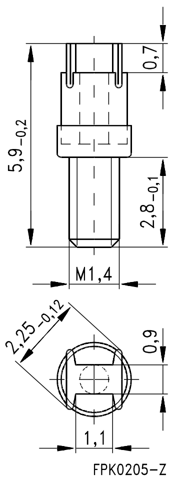
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 9 × 5		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Mate-rial	Color code	%	
U 17	10	1,81 × 2,0	Si 1	brown	6	B65518-C3000-X101
K 12	16	1,81 × 2,0	Si 1	brown	15	B65518-C3000-X101
K 1	25	1,81 × 2,0	Si 1	brown	17	B65518-C3000-X101
	40	1,81 × 2,0	K 1	blue	16	B65518-C3000-X1
M 33	40	1,81 × 2,0	Si 1	brown	16	B65518-C3000-X101
	63	1,81 × 2,0	K 1	blue	22	B65518-C3000-X1
N 48	100	1,81 × 2,0	K 1	blue	15	B65518-C3000-X1
Adjusting screwdriver						B63399-B4
Handle						B63399-B5

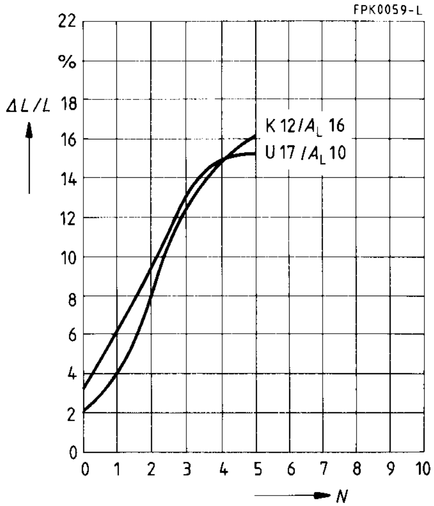
Adjusting screw



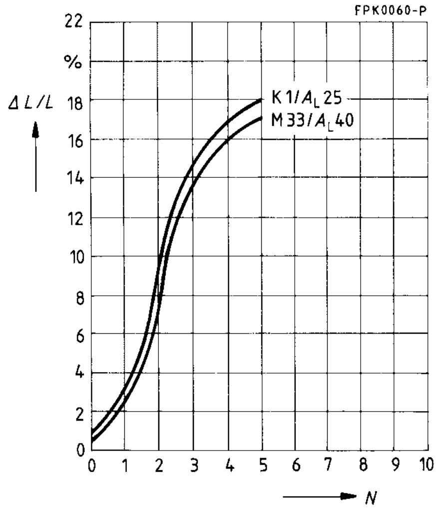
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

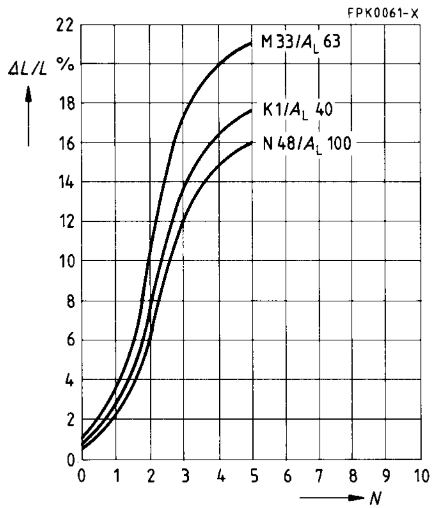
Adjusting screw B65518-C3000-X101
Color code brown



Adjusting screw B65518-C3000-X101
Color code brown

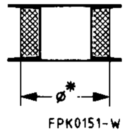


Adjusting screw B65518-C3000-X1
Color code blue

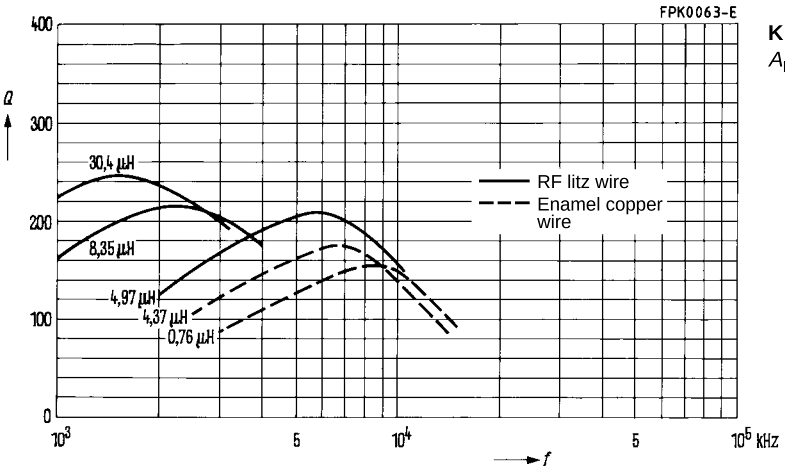


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 0,6 mT

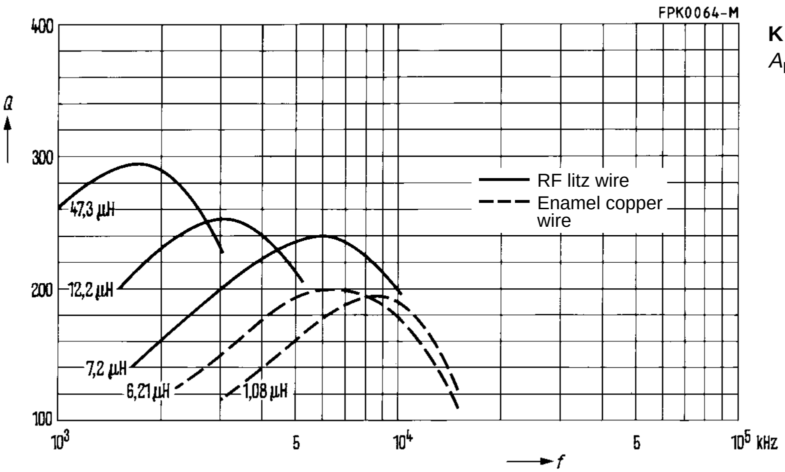
Mate-rial	L (µH) for A_L = 25 nH	A_L = 40 nH	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	4,37	6,21	12	0,20 CuL	1	6,7
	0,76	1,08	5	0,50 CuL	1	6,0
	30,40	47,3	35	1 × 20 × 0,04 CuLS	1	—
	8,35	12,2	18	1 × 20 × 0,04 CuLS	1	—
	4,97	7,2	13	1 × 12 × 0,04 CuLS	1	6,7



* Pad of polystyrene tape up to diameter ∅



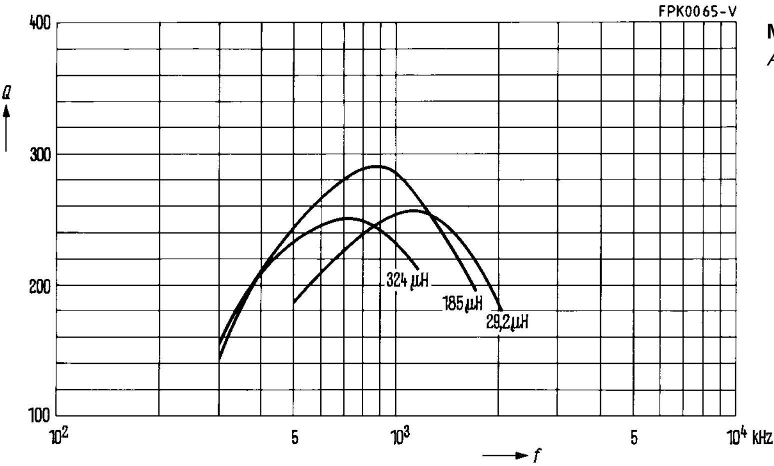
K 1
A_L = 25 nH



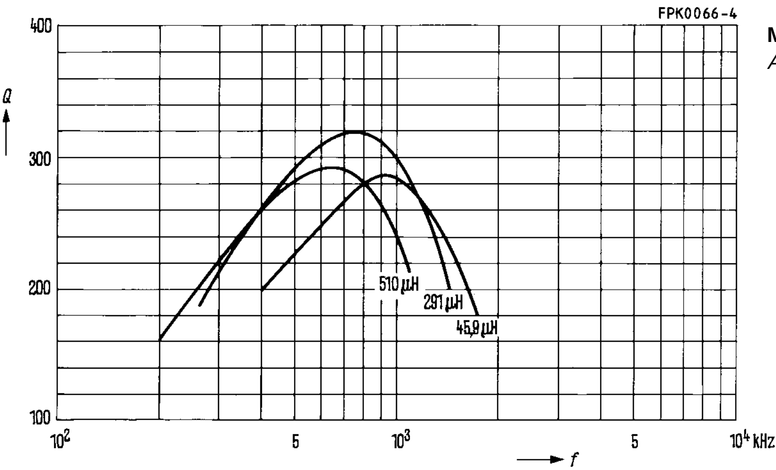
K 1
A_L = 40 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Mate-rial	L (µH) for A_L= 40 nH	A_L= 63 nH	Turns	RF litz wire	Sec-tions
M 33	324	510	90	1 × 5 × 0,05 CuLS	1
	185	291	68	1 × 12 × 0,04 CuLS	1
	29,2	45,9	27	1 × 30 × 0,04 CuLS	1



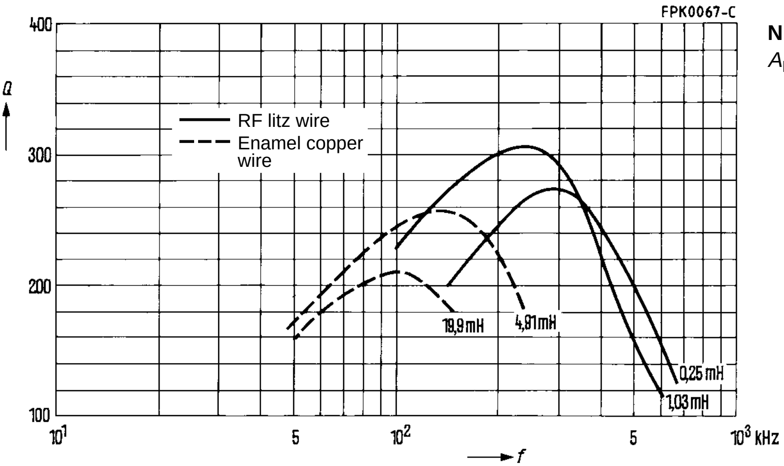
M 33
A_L = 40 nH



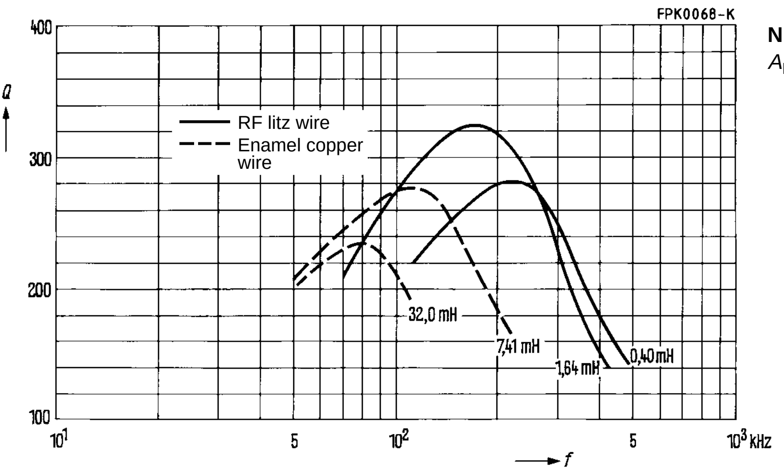
M 33
A_L = 63 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 3 mT

Material	L (µH) for A_L = 100 nH	L (µH) for A_L = 160 nH	Turns	RF litz wire	Sections
N 48	19,9	32,0	450	0,07 CuL	1
	4,91	7,41	250	0,1 CuL	1
	1,03	1,64	100	1 × 12 × 0,04 CuL	1
	0,25	0,40	50	1 × 15 × 0,04 CuLS	1

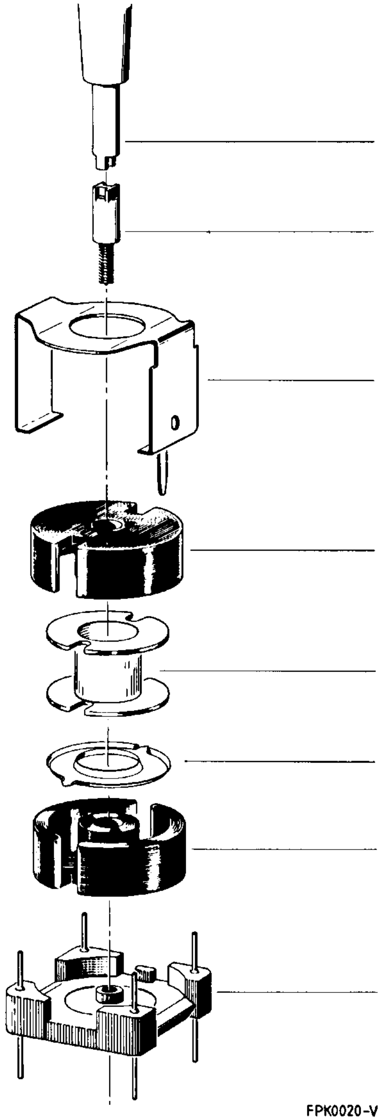


N 48
A_L = 100 nH



N 48
A_L = 160 nH

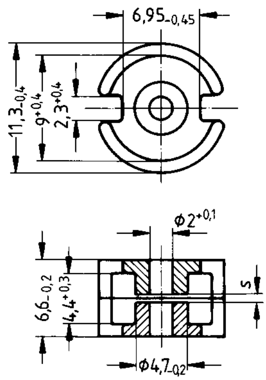
P 11 × 7
Core and Accessories



Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	341
Matching handle	B63399	341
Adjusting screw	B65539	341
Yoke	B65535	340
Core	B65531	338
Coil former	B65532	339
Insulating washer 1	B65532	339
Core	B65531	338
Terminal carrier with thread	B65535	340

- In accordance with IEC 60133
- Pot cores are supplied in sets



FPK0069-T

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	1,0	0,92	mm^{-1}
l_e	15,9	16,30	mm
A_e	15,9	17,70	mm^2
A_{min}	—	14,90	mm^2
V_e	252,0	289,00	mm^3

Approx. weight (per set)

m	1,7	1,8	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code [1] -D with center hole -T with threaded sleeve
K1	25 ± 3 %	1,00	19,1	B65531-D25-A1
	40 ± 3 %	0,41	31,8	B65531-D40-A1
M33	40 ± 3 %	0,64	31,8	B65531-D40-A33
	63 ± 3 %	0,38	50,0	B65531-D63-A33
N48	100 ± 3 %	0,20	80,0	B65531-D100-A48
	160 ± 3 %	0,10	127,0	B65531-+160-A48
	250 ± 3 %	0,06	199,0	B65531-+250-A48
N26	400 ± 10 %	0,03	318,0	B65531-D400-K26

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -W w/o center hole
M33	780 + 30/– 20 %	620			B65531-D-R33
N26	1800 + 30/– 20 %	1430			B65531-D-R26
N30	3500 + 30/– 20 %	2560			B65531-W-R30
T38	7000 + 40/– 30 %	5120			B65531-W-Y38
N67	2000 + 30/– 20 %	1460	1250	0,15 (200 mT, 100 kHz, 100 ˚C)	B65531-W-R67

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

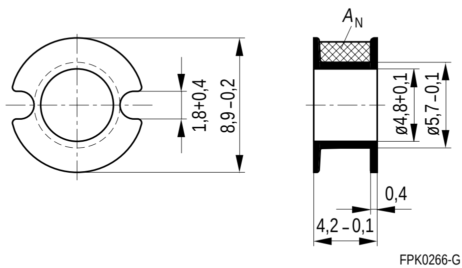
Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

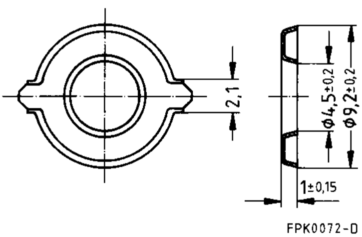
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120°C), 0,04 mm thick

Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	4,2	22	180	B65532-B-T1
Insulating washer 1 (reel packing, PU = 1 reel)				B65532-A5000

Coil former



Insulating washer 1



Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

- With thread for the adjusting screw (to be combined with core version ”D“)

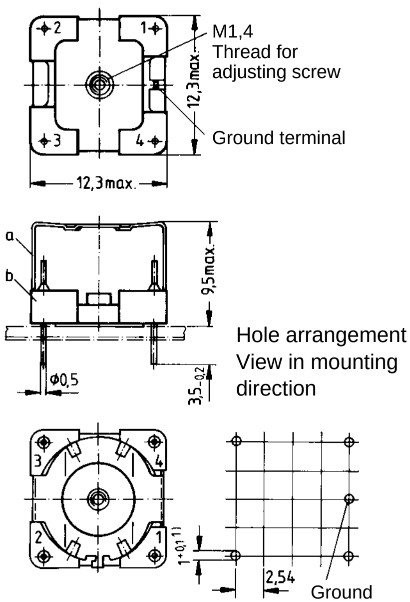
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Yoke

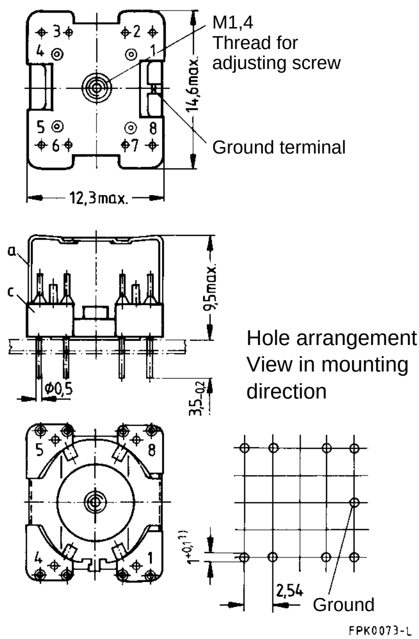
Material: Spring yoke, made of tinned nickel silver (0,25 mm), with ground terminal

Complete mounting assembly (4 solder terminals) Ordering code: B65535-B2	Complete mounting assembly (8 solder terminals) Ordering code: B65535-B3

4 solder terminals



8 solder terminals



1) 1,3 hole also permissible
a) Yoke
b) Terminal carrier with 4 solder terminals
c) Terminal carrier with 8 solder terminals

Adjusting screw

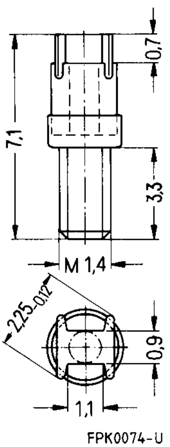
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 11 × 7		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Material	Color code	%	
K 12	16	1,81 × 2,0	Si 1	black	13	B65539-C1003-X101
K 1	25 40	1,81 × 2,0	K 1	yellow	30 12	B65539-C1003-X1
M 33	40 63	1,81 × 2,0	Si 1	black	17 11	B65539-C1003-X101
N 48	100	1,81 × 2,0	K 1	yellow	17	B65539-C1003-X1
	160 250	1,81 × 2,7	N 22	red	16 8	B65539-C1002-X22
Adjusting screwdriver						B63399-B4
Handle						B63399-B5

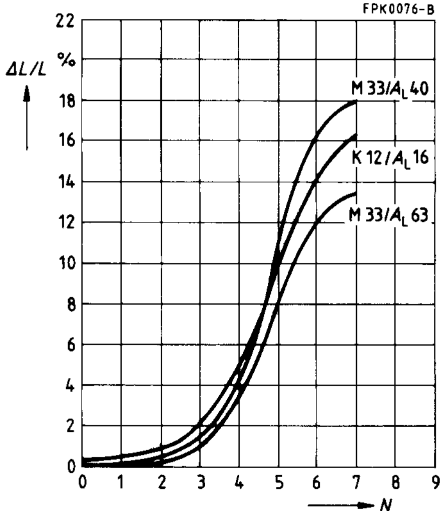
Adjusting screw



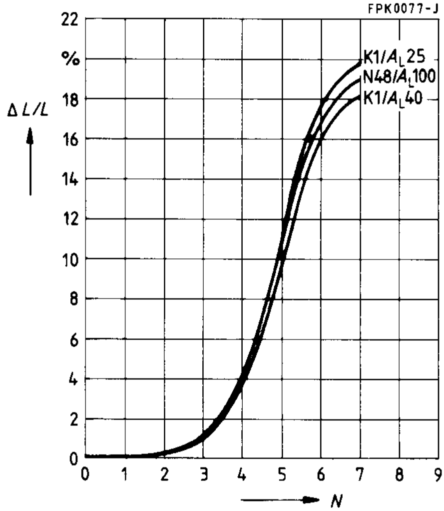
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

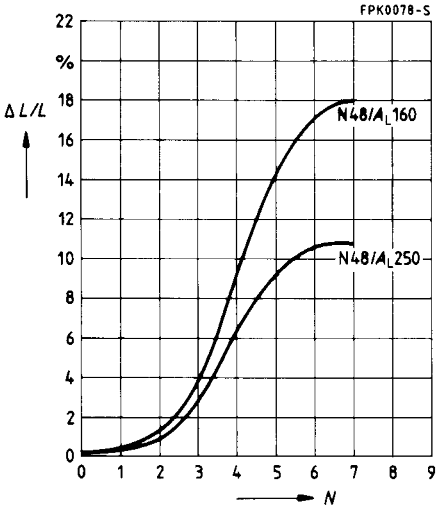
Adjusting screw B65539-C1003-X101
Color code black



Adjusting screw B65539-C1003-X1
Color code yellow

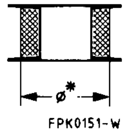


Adjusting screw B65539-C1002-X22
Color code red

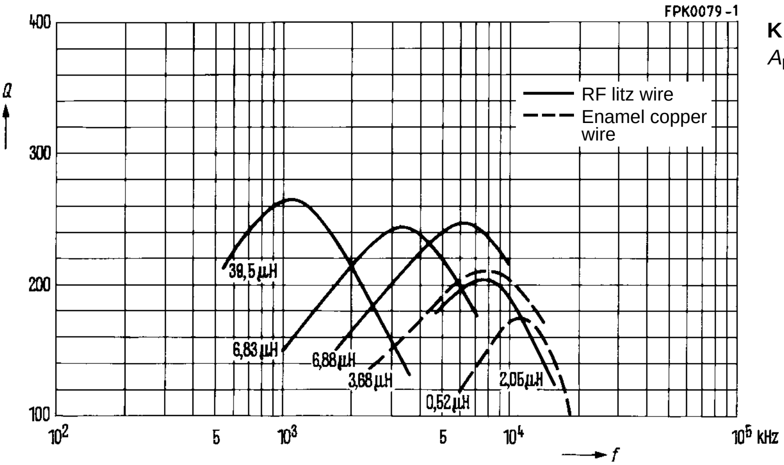


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 0,6 mT

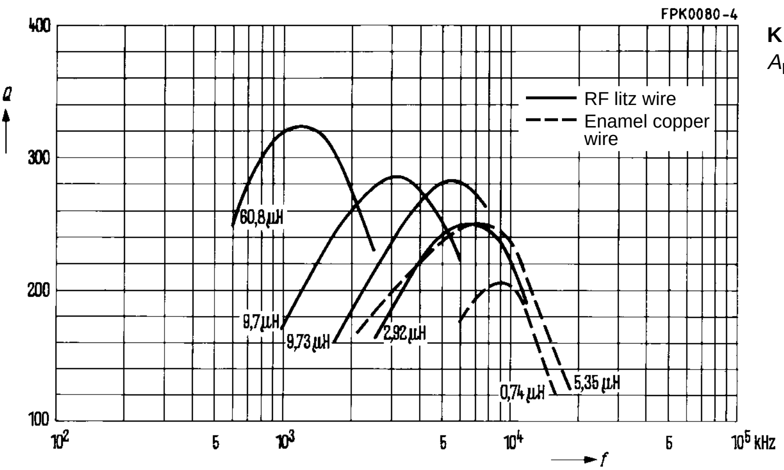
Mate-rial	L (µH) for A_L = 25 nH	L (µH) for A_L = 40 nH	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	3,68	5,35	11	0,25 CuL	1	8,1
	0,52	0,74	4	0,70 CuL	1	7,2
	39,50	60,80	40	1 × 30 × 0,04 CuLS	1	—
	6,88	9,73	15	1 × 12 × 0,04 CuLS	1	8,4
	6,83	9,70	15	1 × 30 × 0,04 CuLS	1	6,9
	2,05	2,92	8	1 × 30 × 0,04 CuLS	1	8,1



* Pad of polystyrene tape up to diameter ∅



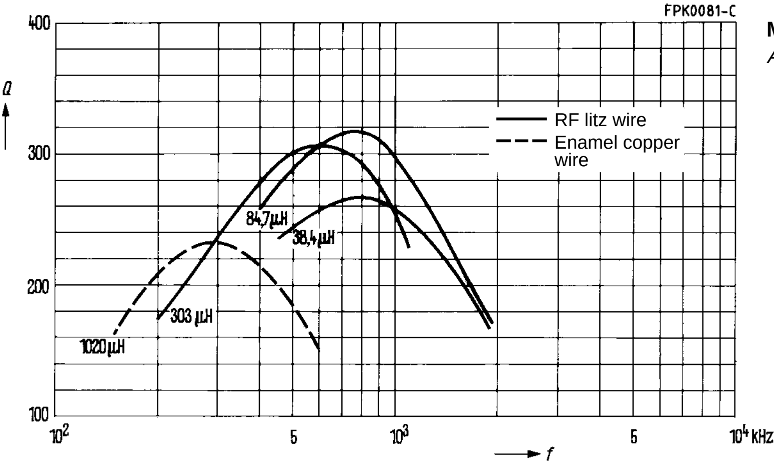
K 1
A_L = 25 nH



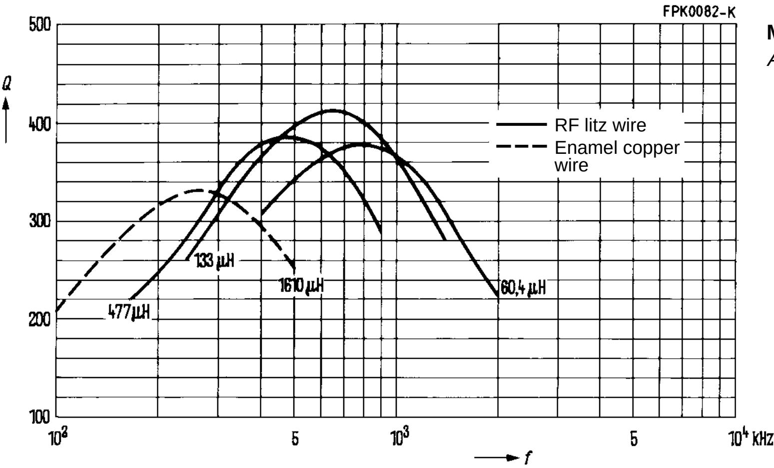
K 1
A_L = 40 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

Mate-rial	L (µH) for A_L= 40 nH	A_L= 63 nH	Turns	RF litz wire	Sec-tions
M 33	1020,0	1610,0	160	1 × 12 × 0,04 CuL	1
	303,0	477,0	87	1 × 15 × 0,04 CuLS	1
	84,7	133,0	46	1 × 30 × 0,04 CuLS	1
	38,4	60,4	31	1 × 45 × 0,04 CuLS	1



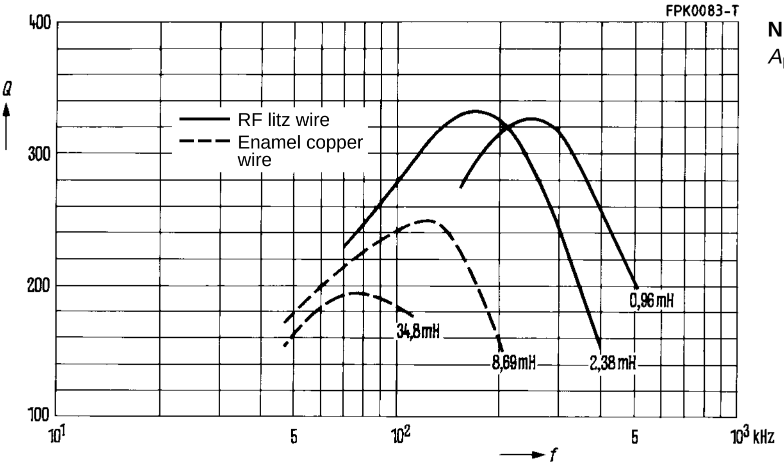
M 33
A_L = 40 nH



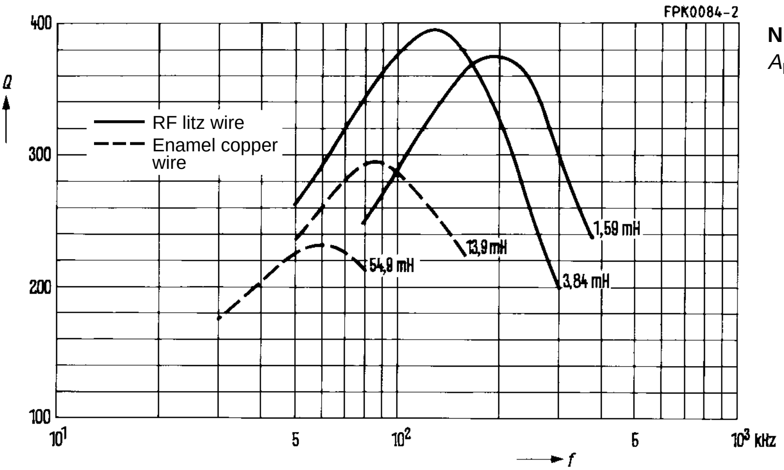
M 33
A_L = 63 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 3 mT

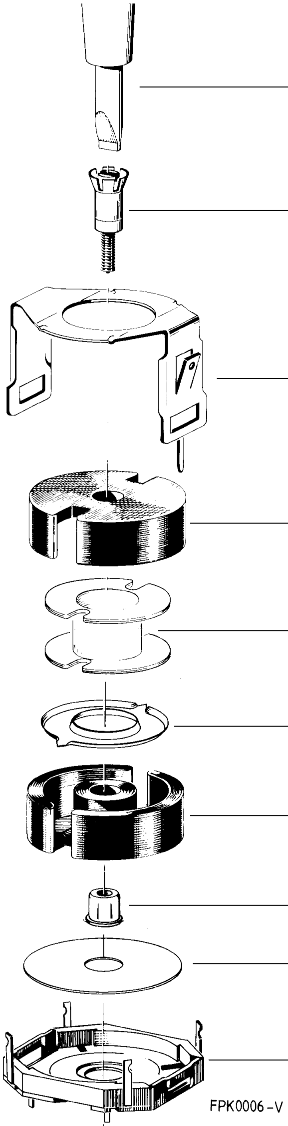
Mate-rial	L (µH) for A_L = 100 nH	A_L = 160 nH	Turns	RF litz wire	Sec-tions
N 48	34,80	54,90	600	0,07 CuL	1
	8,69	13,90	300	0,10 CuL	1
	2,38	3,84	160	1 × 12 × 0,04 CuLS	1
	0,96	1,59	100	1 × 12 × 0,04 CuLS	1



N 48
A_L = 100 nH



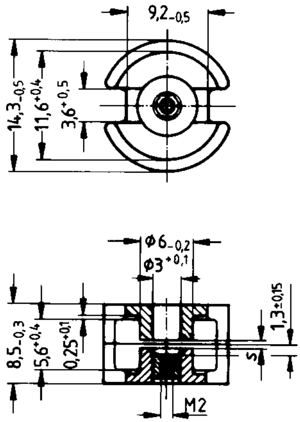
N 48
A_L = 160 nH



Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	350
Matching handle	B63399	350
Adjusting screw	B65549	350
Yoke	B65545	349
Core	B65541	347
Coil former	B65542	348
Insulating washer 1	B65542	348
Core	B65541	347
Threaded sleeve (glued-in)		
Insulating washer 2	B65542	348
Terminal carrier	B65545	349

- In accordance with IEC 60133
- Pot cores are supplied in sets



FPK0085-A

Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,8	0,73	mm^{-1}
l_e	20	21	mm
A_e	25	28,7	mm^2
A_{min}	20	23,6	mm^2
V_e	500	603	mm^3

Approx. weight (per set)

m	3,2	3,5	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code [1] -D with center hole -T with threaded sleeve
M33	100 ± 3 %	0,30	64,0	B65541-+100-A33
N48	160 ± 2 %	0,16	102,0	B65541-+160-G48
	250 ± 3 %	0,10	159,0	B65541-+250-A48
	315 ± 3 %	0,08	201,0	B65541-+315-A48
	400 ± 3 %	0,05	255,0	B65541-+400-A48

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -W w/o center hole
K1	140 + 30/– 20 %	89			B65541-D-R1
M33	970 + 30/– 20 %	617			B65541-D-R33
N26	2300 + 30/– 20 %	1460			B65541-D-R26
N30	4600 + 30/– 20 %	2670			B65541-W-R30
T38	9800 + 40/– 30 %	5690			B65541-W-Y38
N67	2800 + 30/– 20 %	1630	1550	0,33 (200 mT, 100 kHz, 100 °C)	B65541-W-R67
N41	2800 + 30/– 20 %	1780	1400	0,08 (200 mT, 25 kHz, 100 °C)	B65541-D-R41

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

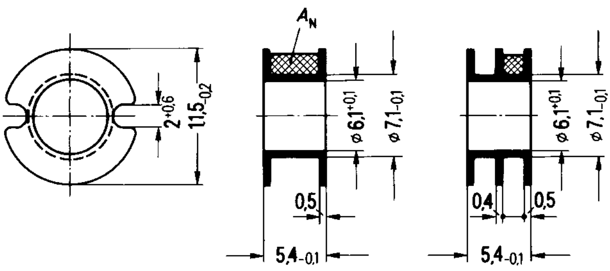
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 ˚C), 0,04 mm thick

Insulating washer 2 between core and terminal carrier

- For increased dielectric strength
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 ˚C), 0,08 mm thick

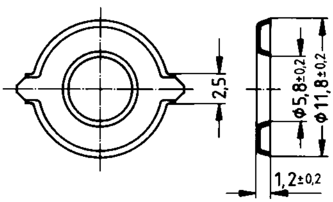
Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	8,4	28	115	B65542-B-T1
2	7,6	28	127	B65542-B-T2
Insulating washer 1 (reel packing, PU = 1 reel)				B65542-A5000
Insulating washer 2 (bulk)				B65542-A5002

Coil former



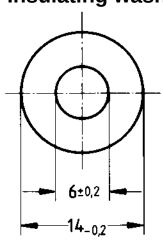
FPK0087-R

Insulating washer 1



FPK0088-Z

Insulating washer 2



FPK0089-8

Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

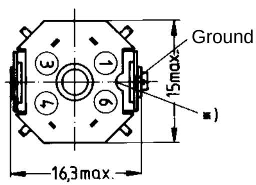
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

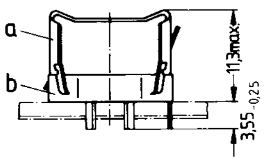
Yoke

Material: Spring yoke, made of tinned nickel silver (0,25 mm), with ground terminal

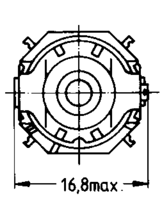
Complete mounting assembly (4 solder terminals) Ordering code: B65545-B9	Complete mounting assembly (6 solder terminals) Ordering code: B65545-B10

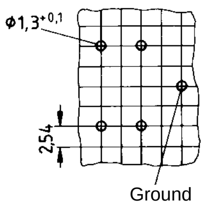
4 solder terminals



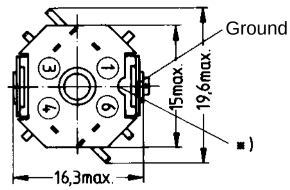


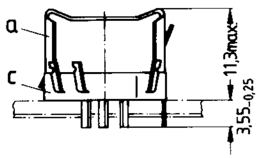
Hole arrangement
View in mounting direction



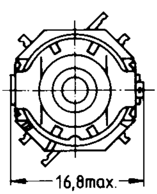


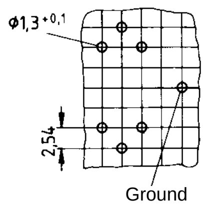
6 solder terminals





Hole arrangement
View in mounting direction





FPK0090-B

*) This recess must be on the side of the grounding pin to ensure that the yoke locks in position.
a) Yoke
b) Terminal carrier with 4 solder terminals
c) Terminal carrier with 6 solder terminals

Adjusting screw

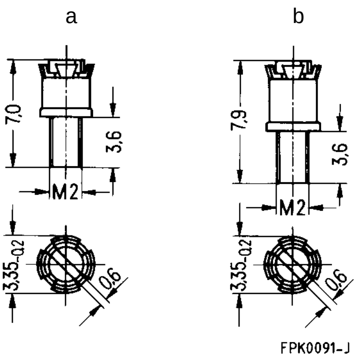
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 14 × 8		**Adjusting screw**				Min. adjusting range	Ordering code
		Tube core					
Material	A_L value nH	Fig.	∅ × length mm	Material	Color code	%	
K 12	20	a	2,6 × 2,0	Si 1	green	10	B65549-E3-X101
K 1	40	a	2,6 × 2,0	Si 1	green	10	B65549-E3-X101
M 33	40	a	2,6 × 2,0	Si 1	green	15	B65549-E3-X101
N 48	160 250 315 400	b	2,76 × 2,9	N 22	black	20 12 11 6	B65549-E4-X23
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

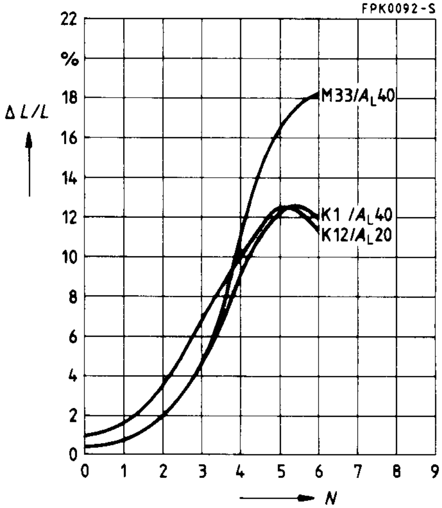
Adjusting screw



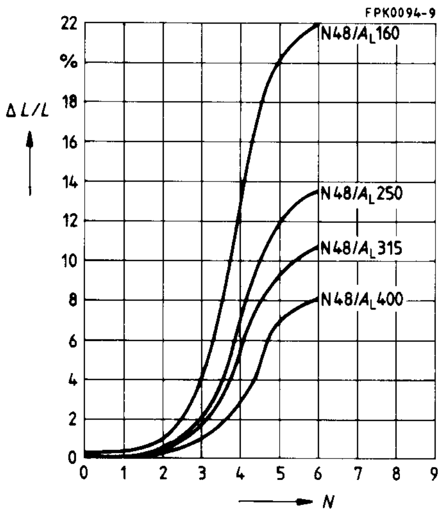
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

Adjusting screw B65549-E3-X101
Color code green

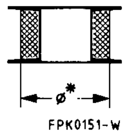


Adjusting screw B65549-E4-X23
Color code black

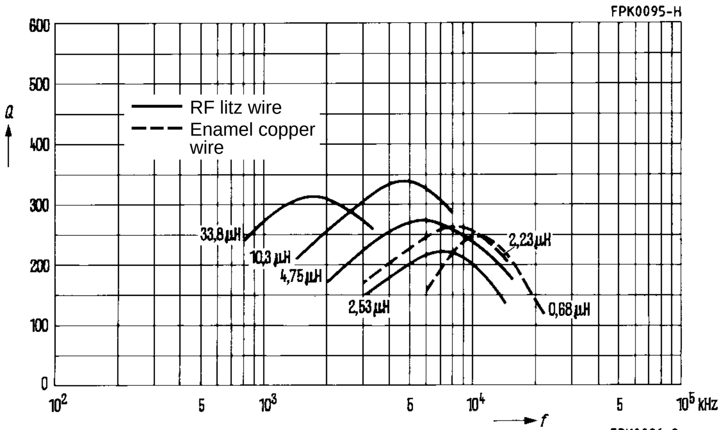


Q factor characteristics (typical values)

Material A_L value	L (µH)	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	2,23	7	0,55 CuL	1	10,1
A_L = 40 nH	0,68	4	1,0 CuL	1	9,2
	33,8	30	1 × 20 × 0,04 CuLS	1	9,5
	10,3	15	1 × 20 × 0,04 CuLS	1	10,8
	4,75	10	1 × 20 × 0,04 CuLS	1	10,8
	2,53	7	1 × 20 × 0,04 CuLS	1	10,8
M 33	1000	100	1 × 15 × 0,04 CuLS	1	—
A_L = 100 nH	325	57	1 × 30 × 0,05 CuLS	1	—
	250	50	1 × 30 × 0,05 CuLS	1	—
	193	22 + 22	1 × 45 × 0,04 CuLS	2	—
	90	15 + 15	1 × 45 × 0,04 CuLS	2	—

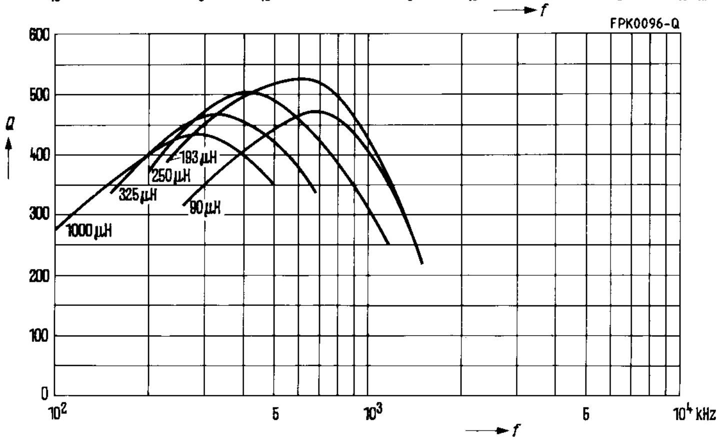


* Pad of polystyrene tape up to diameter ∅



K 1
A_L = 40 nH

Flux density in the core
$\hat{B}$ < 0,6 mT

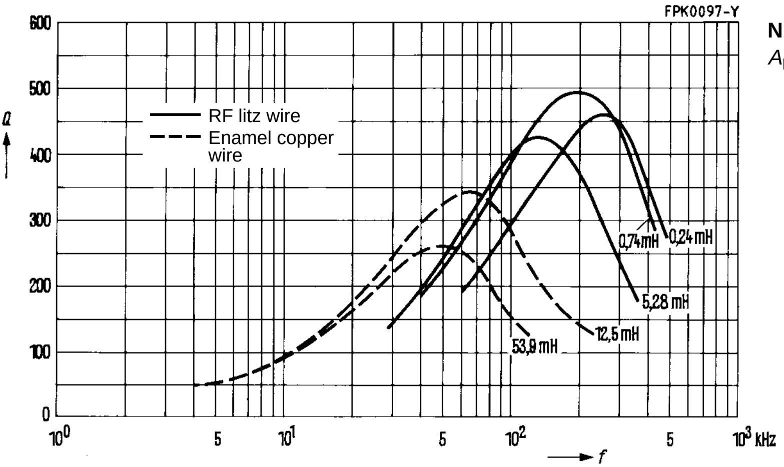


M 33
A_L = 100 nH

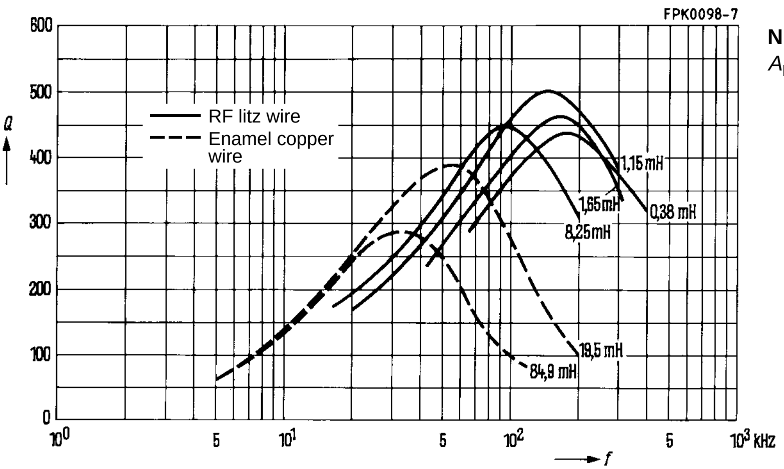
Flux density in the core
$\hat{B}$ < 2 mT

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 2 mT

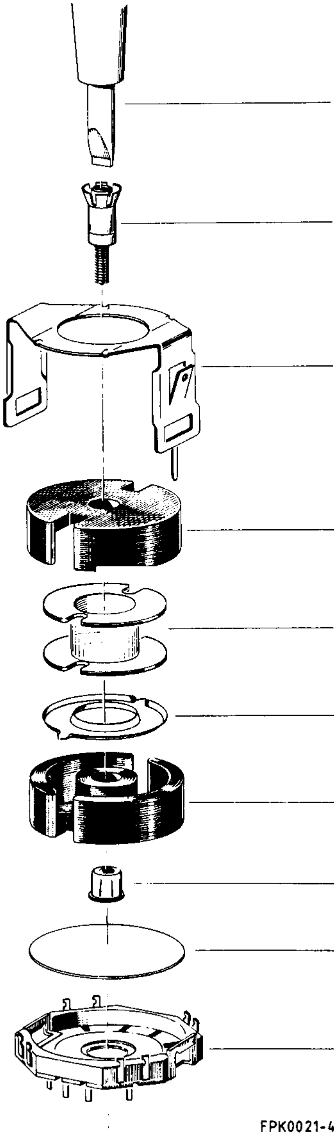
Material	L (mH) for A_L= 160 nH	L (mH) for A_L= 250 nH	Turns	Wire; RF litz wire	Sections
N 48	53,90	84,90	580	0,10 CuL	1
	12,50	19,50	280	0,15 CuL	1
	5,28	8,25	182	1 × 12 × 0,04 CuLS	1
	—	1,65	81	1 × 20 × 0,04 CuLS	2
	0,74	1,15	68	1 × 20 × 0,05 CuLS	2
	0,24	0,38	39	1 × 30 × 0,05 CuLS	2



N 48
A_L = 160 nH



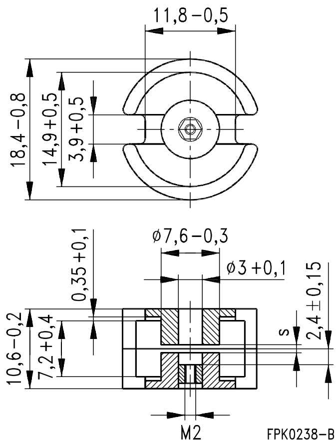
N 48
A_L = 250 nH



Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	358
Matching handle	B63399	358
Adjusting screw	B65659	358
Yoke	B65655	357
Core	B65651	355
Coil former	B65652	356
Insulating washer 1	B65652	356
Core	B65651	355
Threaded sleeve (glued-in)		
Insulating washer 2	B65652	356
Terminal carrier	B65655	357

Example of an assembly set
for printed circuit boards

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,6	0,57	mm^{-1}
l_e	25,9	26,6	mm
A_e	43	46,7	mm^2
A_{min}	—	33,9	mm^2
V_e	1 120	1 240	mm^3

Approx. weight (per set)

m	6,0	6,6	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code 1) -D with center hole -T w. threaded sleeve
K1	40 ± 3 %	1,60	19,2	B65651-+40-A1
M33	100 ± 3 %	0,60	47,9	B65651-+100-A33
N48	160 ± 2 %	0,32	77,0	B65651-+160-G48
	250 ± 3 %	0,20	120,0	B65651-+250-A48
	315 ± 3 %	0,15	151,0	B65651-+315-A48
	400 ± 3 %	0,10	192,0	B65651-+400-A48
	500 ± 3 %	0,07	240,0	B65651-+500-A48
N26	630 ± 10 %	0,05	302,0	B65651-D630-K26

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -W w/o center hole
N26	2900 + 30/– 20 %	1380			B65651-D-R26
N30	5900 + 30/– 20 %	2680			B65651-W-R30
T38	12600 + 40/– 30 %	5710			B65651-W-Y38
N67	3600 + 30/– 20 %	1630	2000	0,51 (200 mT, 100 kHz, 100 °C)	B65651-W-R67

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

Standard: to IEC 60133 and DIN 41 294
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

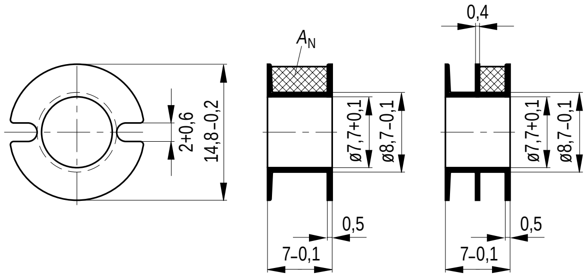
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,04 mm thick

Insulating washer 2 between core and terminal carrier

- For increased dielectric strength
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,08 mm thick

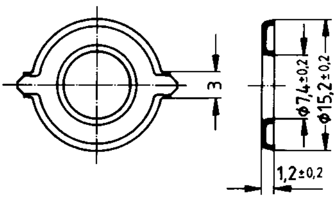
Coil former				Bestellnummer
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	16	35,6	87	B65652-B-T1
2	13	35,6	94	B65652-B-T2
Insulating washer 1 (reel packing, PU = 1 reel)				B65652-A5000
Insulating washer 2 (bulk)				B65652-A5002

Coil former



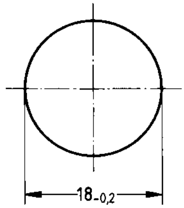
FPK0274-7

Insulating washer 1



FPK0101-V

Insulating washer 2



FPK0102-4

Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

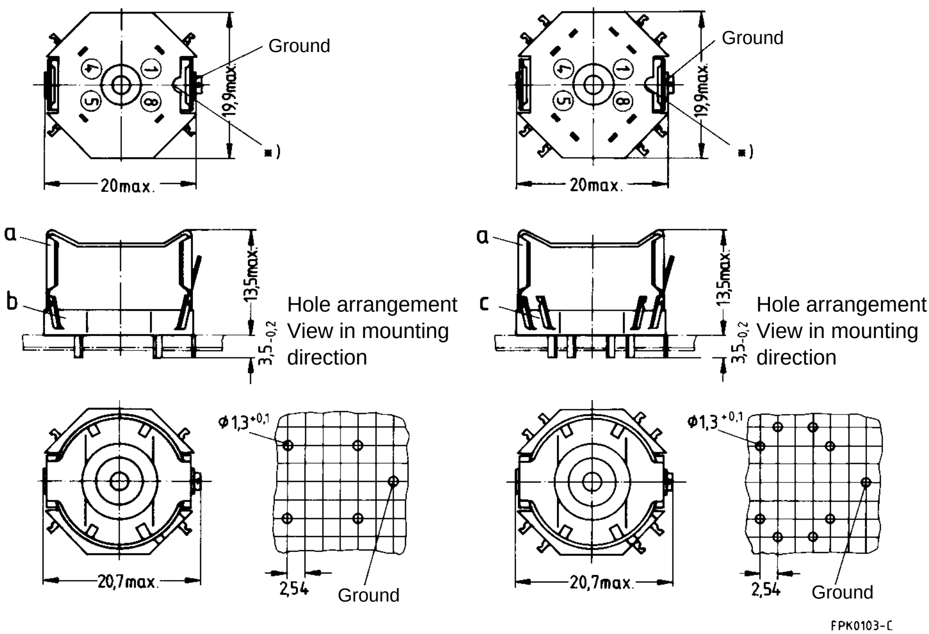
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code gray
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Yoke

Material: Spring yoke, made of tinned nickel silver (0,3 mm), with ground terminal

Complete mounting assembly (4 solder terminals) Ordering code: B65655-B9	Complete mounting assembly (8 solder terminals) Ordering code: B65655-B10

4 solder terminals | 8 solder terminals



*) This recess must be on the side of the grounding pin to ensure that the yoke locks in position.
a) Yoke
b) Terminal carrier with 4 solder terminals
c) Terminal carrier with 8 solder terminals

Adjusting screw

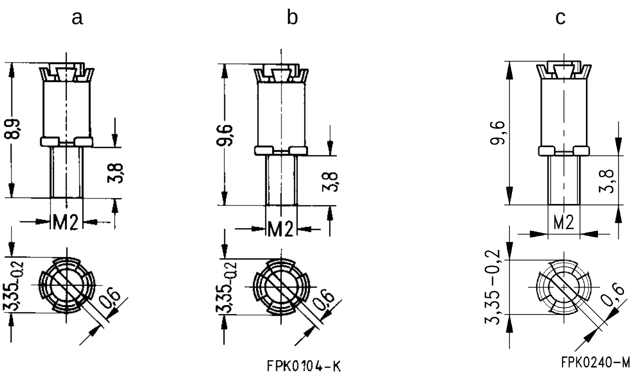
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 18 × 11		**Adjusting screw**				Min. adjusting range	Ordering code
		Tube core					
Material	A_L value nH	Fig.	∅ × length mm	Material	Color code	%	
K 1	40	a	2,62 × 3,6	Si 1	white	13	B65659-F1-X101
	63	a	2,62 × 3,6	K 1	green	17	B65659-F1-X1
M 33	63 100	a	2,62 × 3,6	Si 1	white	16 10	B65659-F1-X101
	160	a	2,62 × 3,6	Si 1	white	6	B65659-F1-X101
N 48	160	a	2,62 × 3,6	Si 1	white	7	B65659-F1-X101
	250	a	2,62 × 3,6	K 1	green	10	B65659-F1-X1
	315 400	b	2,75 × 4,4	N 22	black	16 12	B65659-F3-X23
	400 500	c	2,82 × 4,4	N 22	yellow	16 13	B65659-F4-X23
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

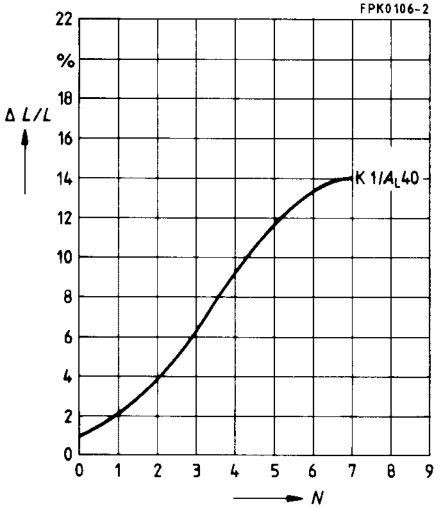
Adjusting screw



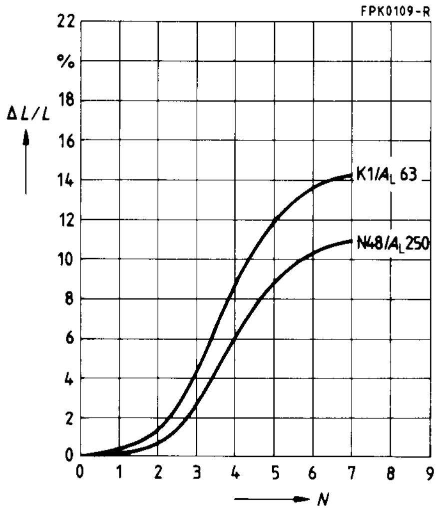
Inductance adjustment curves (nominal values)

Relative inductance change $\Delta L/L$ versus turns N of adjusting screw.
0 ≙ at least 1 turn engaged.

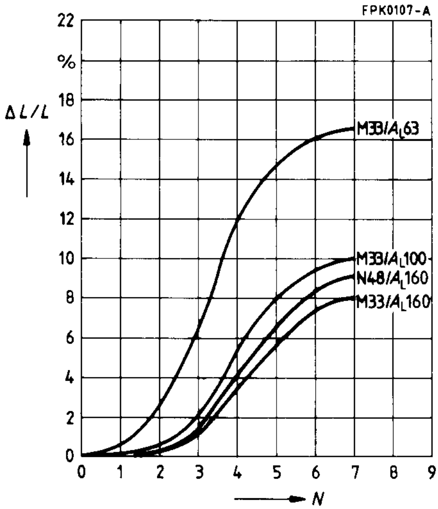
Adjusting screw B65659-F1-X101
Color code white



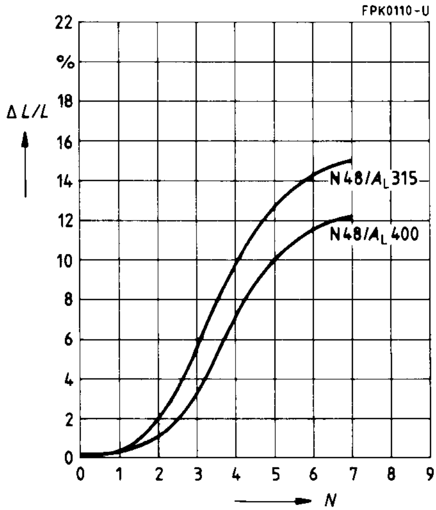
Adjusting screw B65659-F1-X1
Color code green



Adjusting screw B65659-F1-X101
Color code white



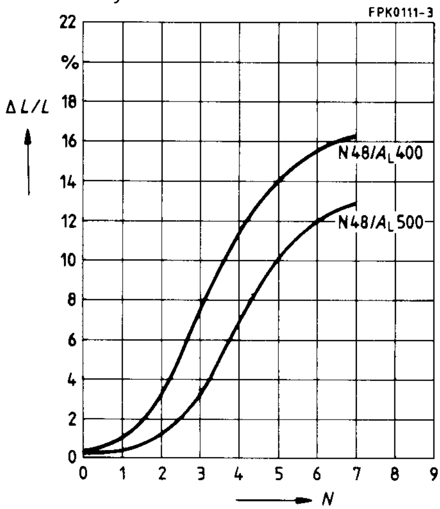
Adjusting screw B65659-F3-X23
Color code black



Inductance adjustment curves (nominal values)

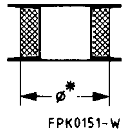
Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 1 turn engaged.

Adjusting screw B65659-F4-X23
Color code yellow

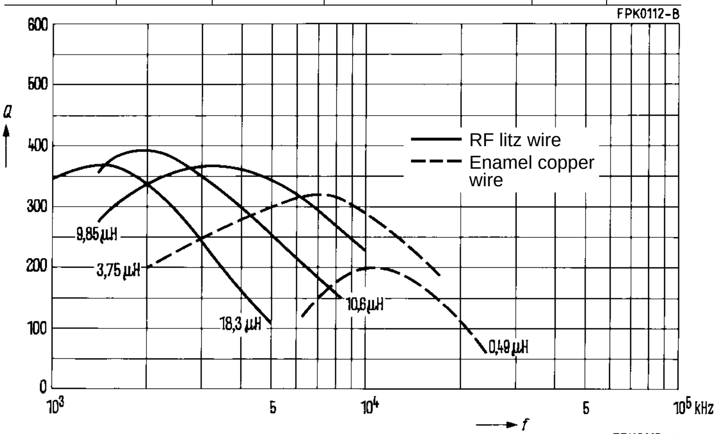


Q factor characteristics (typical values)

Material A_L value	L (µH)	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	3,75	9	0,6 CuL	1	13,0
A_L = 40 nH	0,49	3	1,0 CuL	1	12,2
	18,3	20	3 × 30 × 0,04 CuLS	1	12,8
	10,6	5+5+5	3 × 30 × 0,04 CuLS	3	12,8
	9,85	15	1 × 45 × 0,04 CuLS	1	13,5
M 33	1415	150	1 × 30 × 0,04 CuLS	1	—
A_L = 63 nH	630	100	1 × 45 × 0,04 CuLS	1	—
	403	40+40	1 × 45 × 0,04 CuLS	2	—
	198	25+6+25	1 × 45 × 0,04 CuLS	3	11,7
	72,8	15+4+15	1 × 45 × 0,04 CuLS	3	10,8
	49,4	12+4+12	1 × 45 × 0,04 CuLS	3	10,8

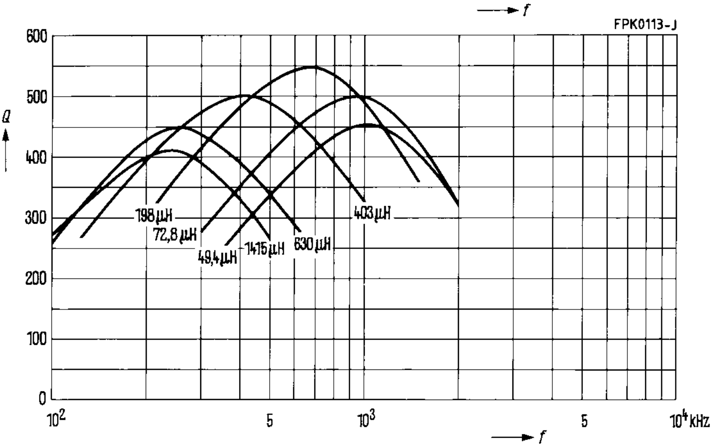


* Pad of polystyrene tape up to diameter ∅



K 1
A_L = 40 nH

Flux density in the core
$\hat{B}$ < 1,6 mT

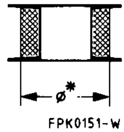


M 33
A_L = 63 nH

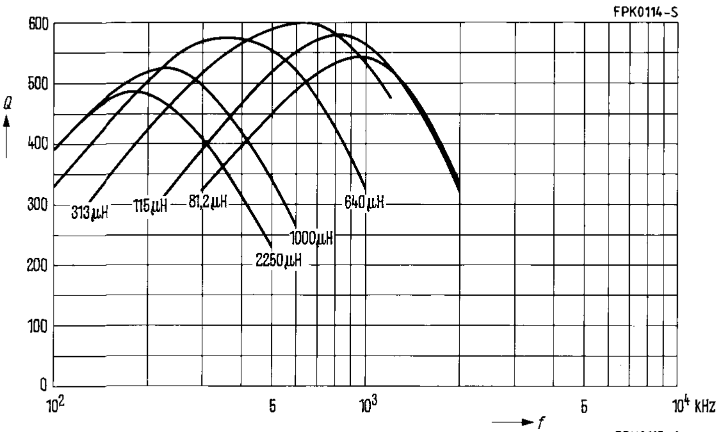
IFlux density in the core
$\hat{B}$ < 2 mT

Q factor characteristics (typical values)

Material A_L value	L	Turns	Wire; RF litz wire	Sections	∅* mm
M 33	2250 µH	150	1 × 30 × 0,04 CuLS	1	—
A_L = 100 nH	1000 µH	100	1 × 45 × 0,04 CuLS	1	—
	640 µH	40+40	1 × 45 × 0,04 CuLS	2	—
	313 µH	25+6+25	1 × 45 × 0,04 CuLS	3	11,7
	115 µH	15+4+15	1 × 45 × 0,04 CuLS	3	10,8
	81,2 µH	12+4+12	1 × 45 × 0,04 CuLS	3	10,8
N 48	504 mH	1790	0,07 CuL	1	—
A_L = 160 nH	31,9 mH	450	1,15 CuL	1	—
	3,0 mH	138	1 × 20 × 0,05 CuLS	1	—
	1,19 mH	8	1 × 45 × 0,04 CuLS	1	—
	0,53 mH	58	1 × 45 × 0,05 CuLS	1	—

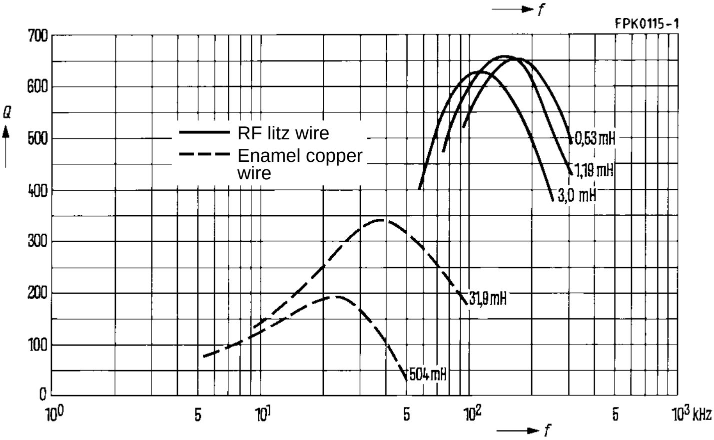


* Pad of polystyrene tape up to diameter ∅



M 33
A_L = 100 nH

Flux density in the core
$\hat{B}$ < 1,6 mT

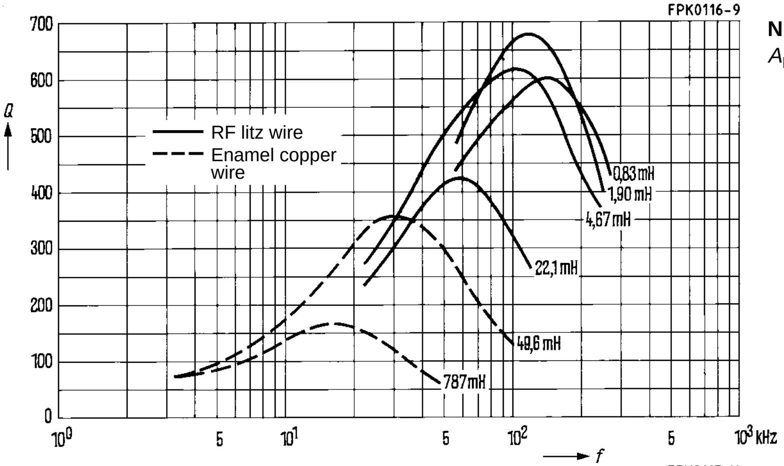


N 48
A_L = 160 nH

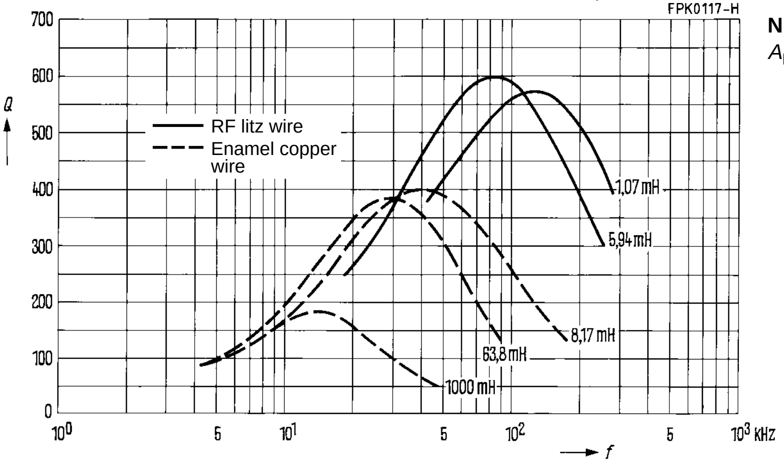
Flux density in the core
$\hat{B}$ < 1,5 mT

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1,5 mT

Material	L (mH) for A_L = 250 nH	L (mH) for A_L = 315 nH	Turns	Wire; RF litz wire	Sections
N 48	787	1000	1790	0,07 CuL	1
	49,6	63,8	450	0,15 CuL	1
	22,1	—	301	1 × 20 × 0,04 CuLS	1
	—	8,17	161	0,25 CuL	1
	4,67	5,94	138	1 × 20 × 0,05 CuLS	1
	1,90	—	87	1 × 45 × 0,04 CuLS	1
	0,83	1,07	58	1 × 45 × 0,05 CuLS	1

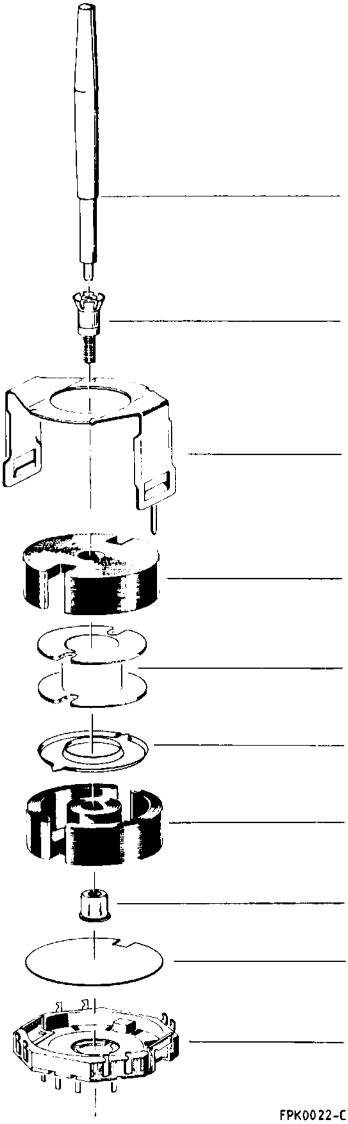


N 48
A_L = 250 nH



N 48
A_L = 315 nH

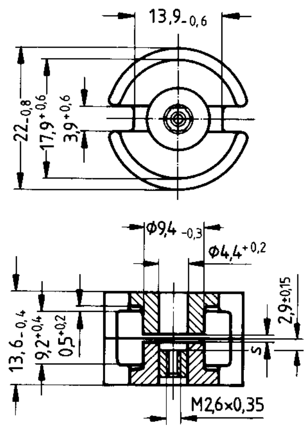
P 22 × 13
Core and Accessories



Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	368
Matching handle	B63399	368
Adjusting screw	B65669	368
Yoke	B65665	367
Core	B65661	365
Coil former	B65662	366
Insulating washer 1	B65662	366
Core	B65661	365
Threaded sleeve (glued-in)		
Insulating washer 2	B65662	366
Terminal carrier	B65665	367

Example of an assembly set
for printed circuit boards

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,5	0,46	mm^{-1}
l_e	31,6	33,2	mm
A_e	63	72,6	mm^2
A_{min}	—	58,1	mm^2
V_e	2 000	2 410	mm^3

Approx. weight (per set)

m	13	14	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code [1] -D with center hole -T w. threaded sleeve
N48	160 ± 2 %	0,50	64,0	B65661-+160-G48
	250 ± 2 %	0,26	100,0	B65661-+250-G48
	315 ± 3 %	0,22	125,0	B65661-+315-A48
	630 ± 3 %	0,10	250,0	B65661-+630-A48
N26	1250 ± 10 %	0,05	498,0	B65661-D1250-K26

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -W w/o center hole
K1	220 + 30/– 20 %	86			B65661-D-R1
N26	3800 + 30/– 20 %	1510			B65661-D-R26
N30	8300 + 30/– 20 %	2780			B65661-W-R30
T38	16000 + 40/– 30 %	6370			B65661-W-Y38
N67	4400 + 30/– 20 %	1600	2500	1,21 (200 mT, 100 kHz, 100 ˚C)	B65661-W-R67

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

Standard: to IEC 60133 and DIN 41 294
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

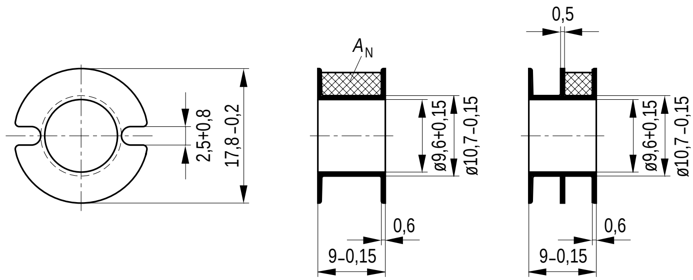
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 between core and terminal carrier

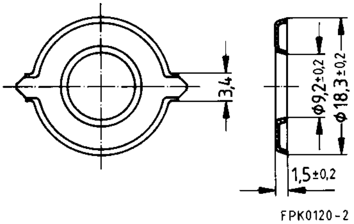
- For increased dielectric strength
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,08 mm thick

Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	23,4	44	67	B65662-B-T1
2	22,0	44	69	B65662-B-T2
Insulating washer 1 (reel packing, PU = 1 reel)				B65662-A5000
Insulating washer 2 (bulk)				B65662-A5002

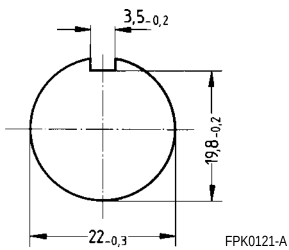
Coil former



Insulating washer 1



Insulating washer 2



Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

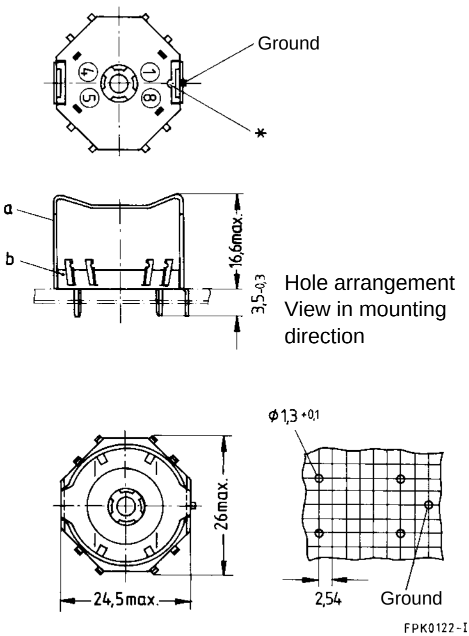
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code gray
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

Yoke

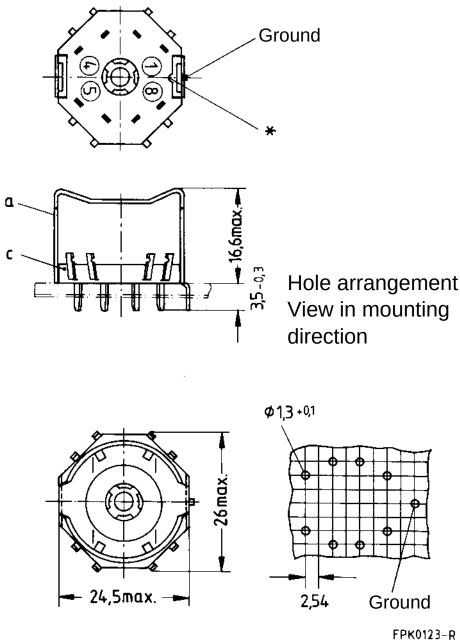
Material: Spring yoke, made of tinned nickel silver (0,4 mm), with ground terminal

Complete mounting assembly (4 solder terminals) Ordering code: B65665-C5	Complete mounting assembly (8 solder terminals) Ordering code: B65665-C4

4 solder terminals



8 solder terminals



*) This recess must be on the side of the grounding pin to ensure that the yoke locks in position.
a) Yoke
b) Terminal carrier with 4 solder terminals
c) Terminal carrier with 8 solder terminals

Adjusting screw

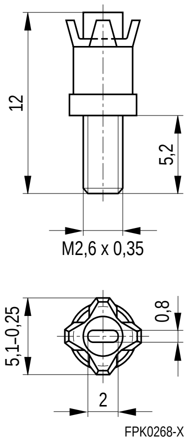
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 22 × 13		**Adjusting screw**			Min. adjusting range	Ordering code
		Tube core				
Material	A_L value nH	∅ × length mm	Material	Color code	%	
N48	400	4,1 × 4,3	N 22	red	12	B65669-D7-X22
Adjusting screwdriver						B63399-B4
Handle						B63399-B5

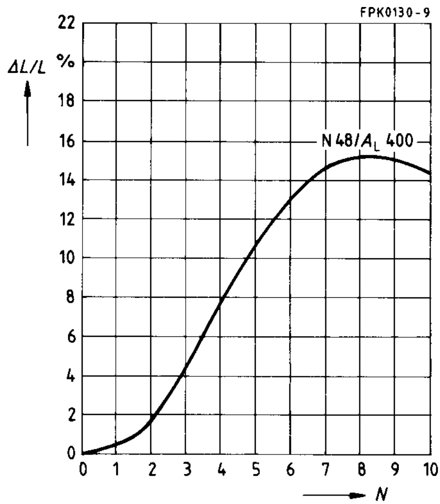
Adjusting screw



Inductance adjustment curves (nominal values)

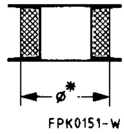
Relative inductance change Δ *L*/*L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

Adjusting screw B65669-D7-X22
Color code red

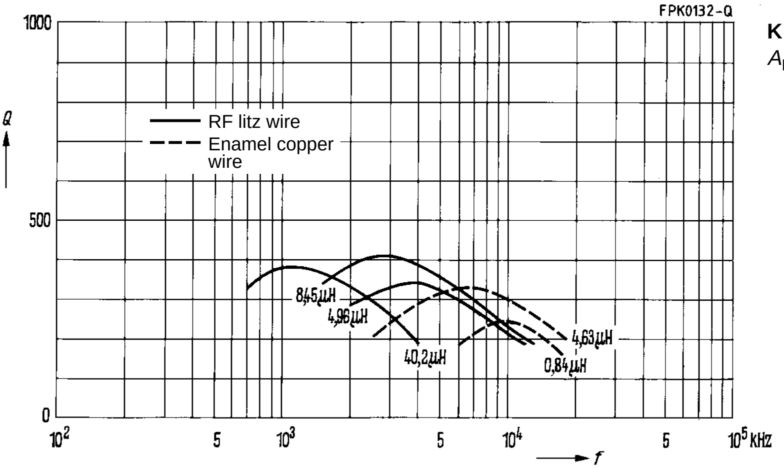


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 0,6 mT

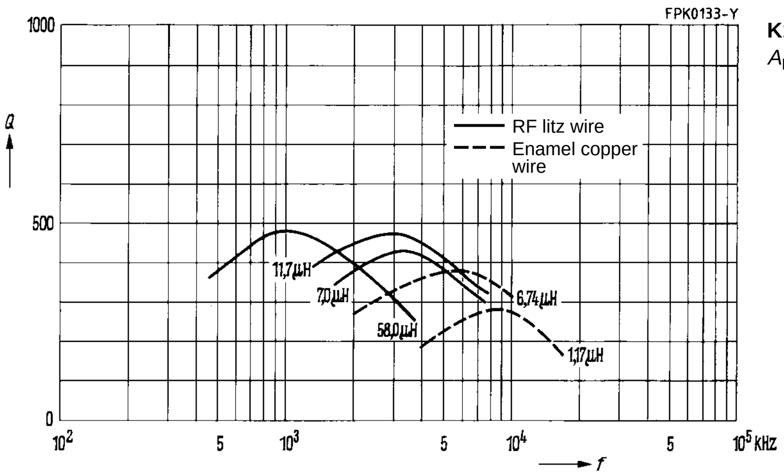
Material	L (µH) for A_L = 40 nH	L (µH) for A_L = 63 nH	Turns	Wire; RF litz wire	Sections	Ø* mm
K 1	4,63	6,74	10	0,7 CuL	1	16,1
	0,84	1,17	4	1,0 CuL	1	15,5
	40,20	58,0	10+10+10	1 × 45 × 0,04 CuLS	3	16,8
	8,45	11,7	13	3 × 30 × 0,04 CuLS	1	16,5
	4,96	7,0	10	3 × 30 × 0,04 CuLS	1	16,5



* Pad of polystyrene tape up to diameter Ø



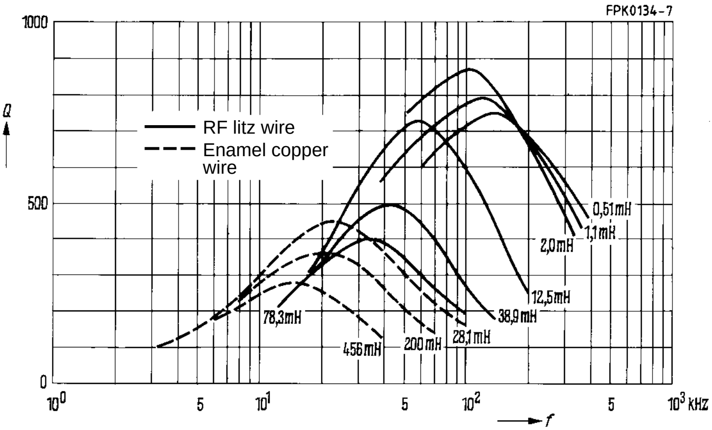
K 1
A_L = 40 nH



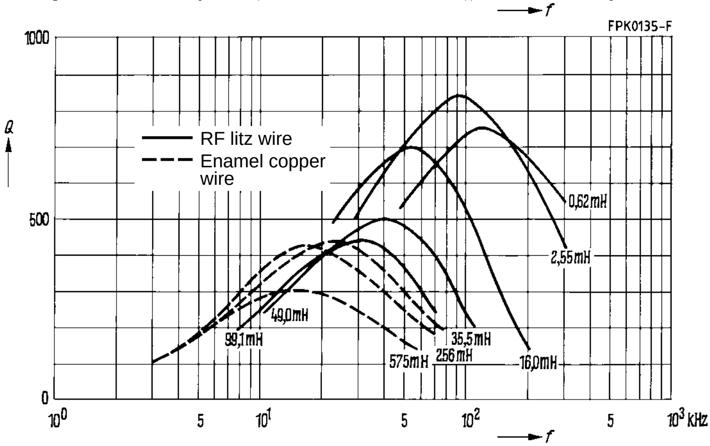
K1
A_L = 63 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1,5 mT

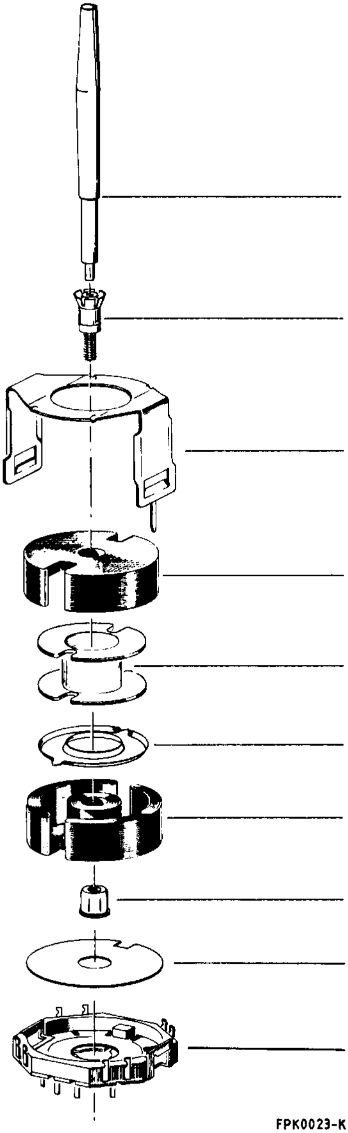
Material	L (mH) for A_L = 315 nH	L (mH) for A_L = 400 nH	Turns	Wire; RF litz wire	Sections
N 48	456	575	1200	0,12 CuL	1
	200	256	800	0,15 CuL	1
	28,1	35,5	300	0,27 CuL	1
	78,3	99,1	500	1 × 12 × 0,04 CuLS	1
	38,9	49,0	350	1 × 15 × 0,04 CuLS	1
	12,5	16,0	200	1 × 20 × 0,05 CuLS	1
	2,0	2,55	80	3 × 20 × 0,05 CuLS	2
	1,1	—	59	3 × 20 × 0,05 CuLS	3
	0,51	—	40	3 × 20 × 0,05 CuLS	2
	—	0,62	40	3 × 30 × 0,05 CuLS	2



N 48
A_L = 315 nH



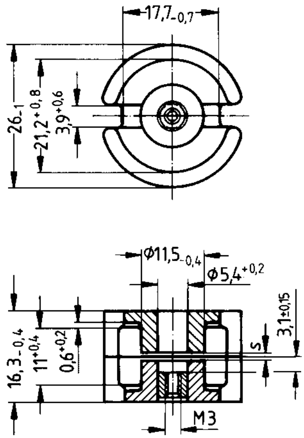
N 48
A_L = 400 nH



Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	376
Matching handle	B63399	376
Adjusting screw	B65679	376
Yoke	B65675	375
Core	B65671	373
Coil former	B65672	374
Insulating washer 1	B65672	374
Core	B65671	373
Threaded sleeve (glued-in)		
Insulating washer 2	B65672	374
Terminal carrier	B65675	375

Example of an assembly set
for printed circuit boards

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,4	0,37	mm^{-1}
l_e	37,2	40	mm
A_e	93	108	mm^2
A_{min}	76,5	87	mm^2
V_e	3 460	4 320	mm^3

Approx. weight (per set)

m	21	23	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code [1] -D with center hole -T with threaded sleeve
K1	100 ± 3 %	0,90	31,9	B65671-+100-A1
M33	100 ± 3 %	1,52	31,9	B65671-+100-A33
	160 ± 3 %	0,78	51,0	B65671-+160-A33
N48	160 ± 2 %	0,80	51,0	B65671-+160-G48
	250 ± 2 %	0,40	80,0	B65671-+250-G48
	315 ± 2 %	0,34	100,0	B65671-+315-G48
	400 ± 3 %	0,24	127,0	B65671-+400-A48
	630 ± 3 %	0,15	201,0	B65671-+630-A48
	800 ± 3 %	0,11	255,0	B65671-+800-A48
N26	1000 ± 5 %	0,10	319,0	B65671-D1000-J26

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code -D with center hole -W without center hole
N26	4900 + 30/– 20 %	1560			B65671-D-R26
N30	9700 + 30/– 20 %	2860			B65671-W-R30
T38	22000 + 40/– 30 %	6480			B65671-W-Y38
N67	5500 + 30/– 20 %	1620	3050	2,12 (200 mT, 100 kHz, 100 °C)	B65671-W-R67

1) Replace the + by the code letter "D" or "T" for the required version.

Coil former

Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

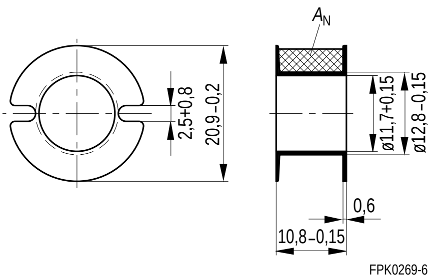
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,06 mm thick

Insulating washer 2 between core and terminal carrier

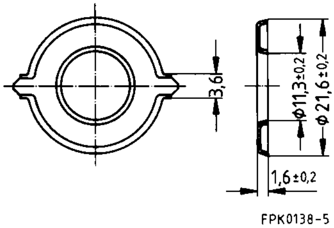
- For increased dielectric strength
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120 °C), 0,08 mm thick

Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	32,0	52	55	B65672-B-T1
Insulating washer 1 (reel packing, PU = 1 reel)				B65672-B5000
Insulating washer 2 (bulk)				B65672-A5002

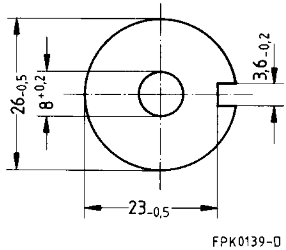
Coil former



Insulating washer 1



Insulating washer 2



Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

Terminal carrier

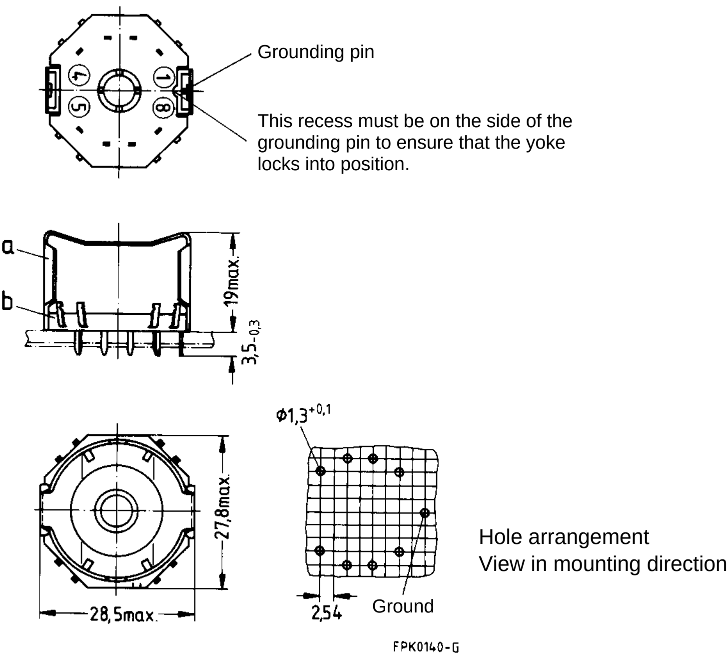
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code gray
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

Yoke

Material: Spring yoke, made of tinned nickel silver (0,4 mm), with ground terminal

---

Complete mounting assembly (8 solder terminals)
Ordering code: B65675-B5



a) Yoke
b) Terminal carrier with 8 solder terminals

Adjusting screw

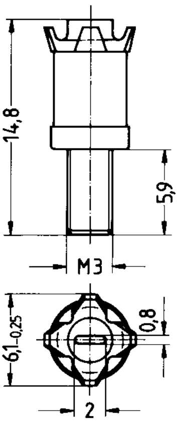
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 26 × 16		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Material	Color code	%	
N 48	250 315	4,55 × 6,3	N 22	red	16 13	B65679-E3-X22
	315 400	4,98 × 6,3	N 22	black	23 18	B65679-E2-X22
	630 800	5,15 × 6,3	N 22	white	16 14	B65679-E1-X22
Adjusting screw						B63399-B1
Handle						B63399-B5

Adjusting screw [1)]



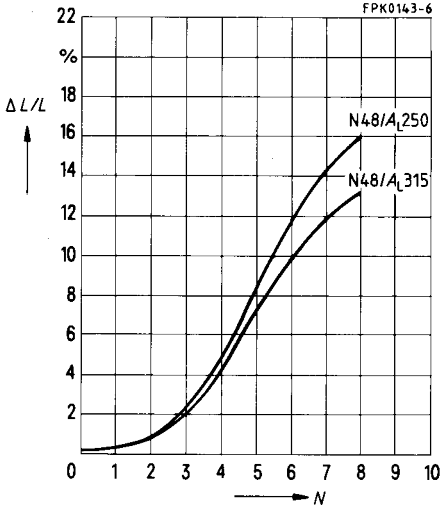
FPK0141-P

1) Due to the limited distance between adjusting screw and internal borehole, the entire assembly must be accurately centered.

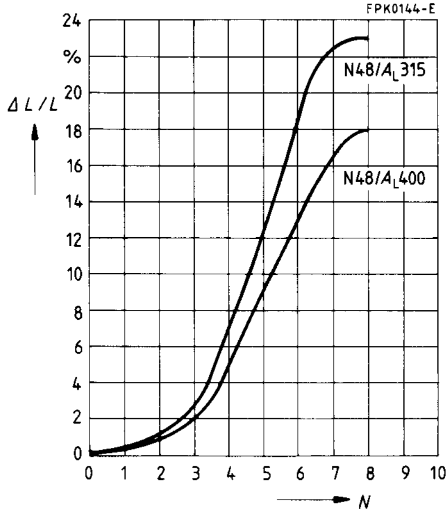
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged

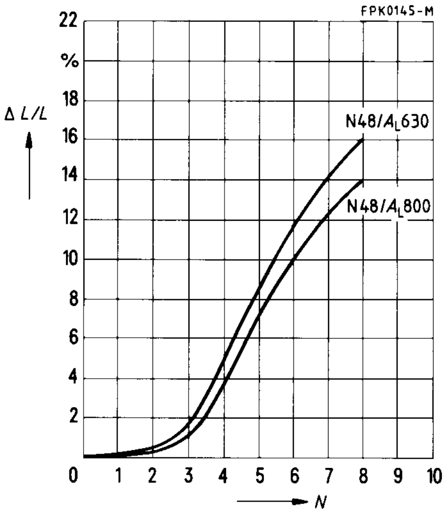
Adjusting screw B65679-E3-X22
Color code red



Adjusting screw B65679-E2-X22
Color code black

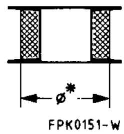


Adjusting screw B65679-E1-X22
Color code white

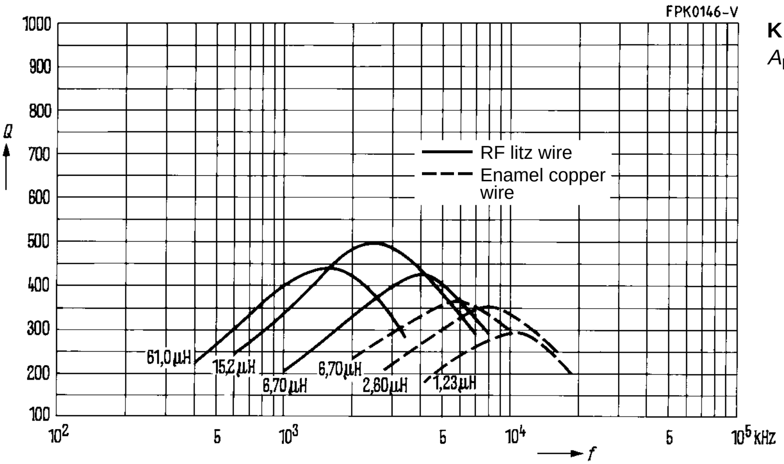


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 0,6 mT

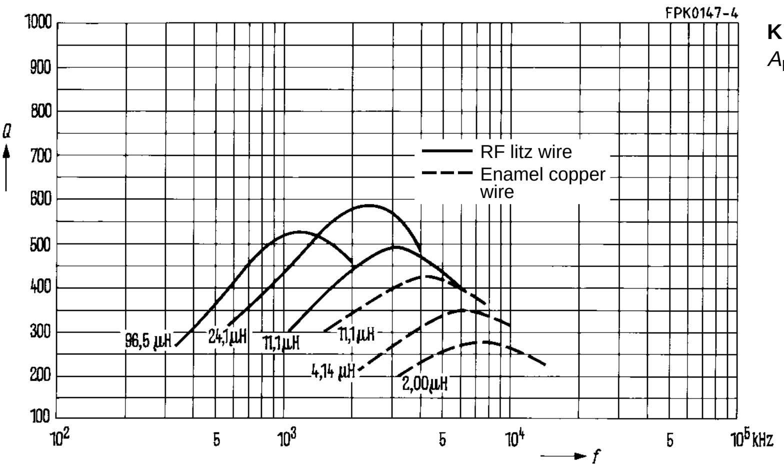
Mate-rial	L (µH) for A_L = 63 nH	L (µH) for A_L = 100 nH	Turns	Wire; RF litz wire	Sec-tions	∅* mm
K 1	6,70	11,10	10	0,7 CuL	1	18,0
	2,60	4,14	6	1,0 CuL	1	17,5
	1,23	2,0	4	1,0 CuL	1	17,5
	61,0	96,5	10+10+10	1 × 45 × 0,04 CuLS	3	18,5
	15,2	24,1	15	3 × 30 × 0,04 CuLS	1	18,0
	6,7	11,1	3+4+3	3 × 30 × 0,04 CuLS	3	18,0



* Pad of polystyrene tape up to diameter ∅



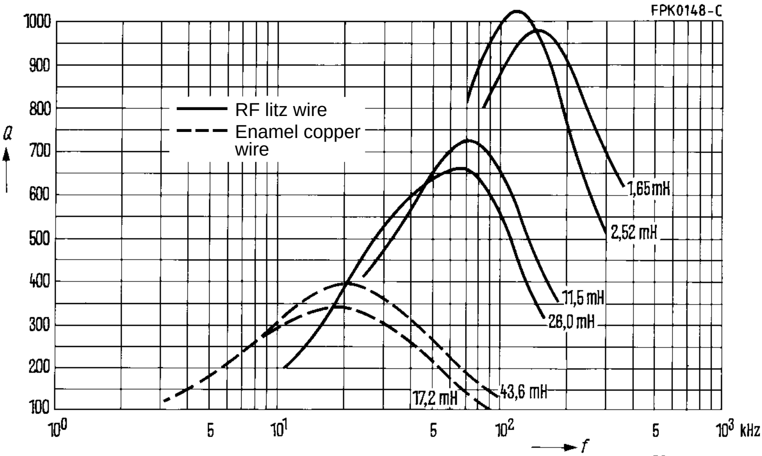
K 1
A_L = 63 nH



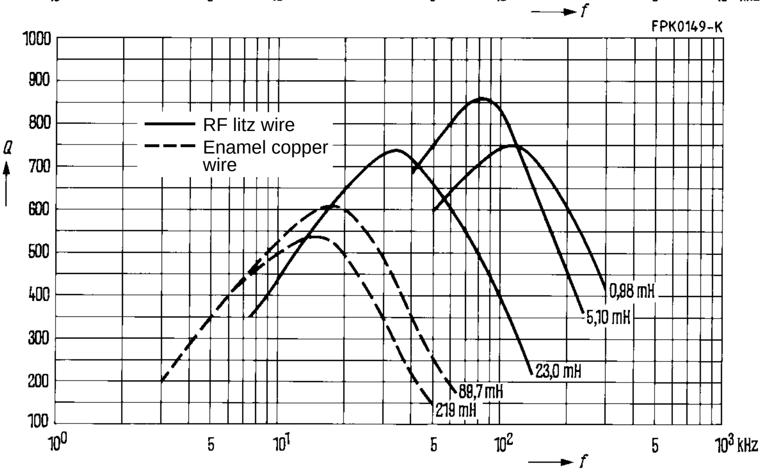
K 1
A_L = 100 nH

Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1,5 mT

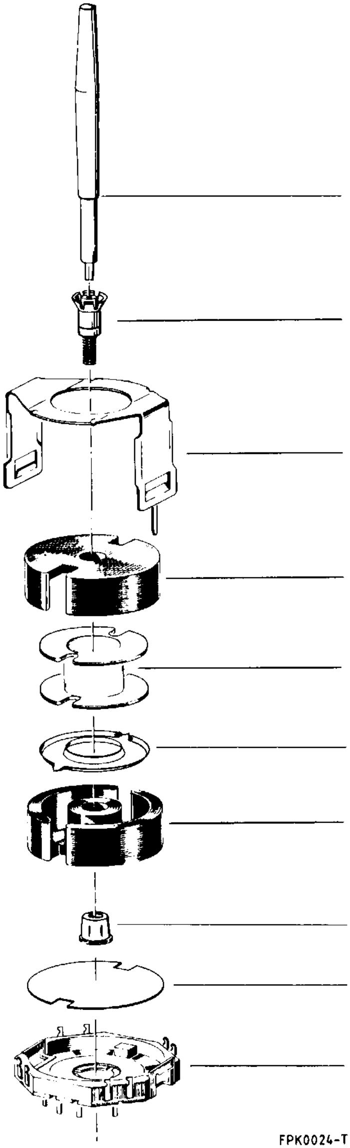
Mate-rial	*L* (mH) for A_L = 315 nH	*L* (mH) for A_L = 630 nH	Turns	RF litz wire	Sec-tions
N 48	—	219	600	0,20 CuL	1
	43,6	89,7	385	0,27 CuL	1
	17,2	—	235	0,35 CuL	1
	26,0	—	290	1 × 20 × 0,05 CuLS	1
	11,5	23,0	193	1 × 30 × 0,05 CuLS	1
	2,52	5,10	90	3 × 30 × 0,04 CuLS	2
	1,65	—	78	3 × 20 × 0,05 CuLS	3
	—	0,98	39	3 × 20 × 0,07 CuLS	3



N 48
A_L = 315 nH



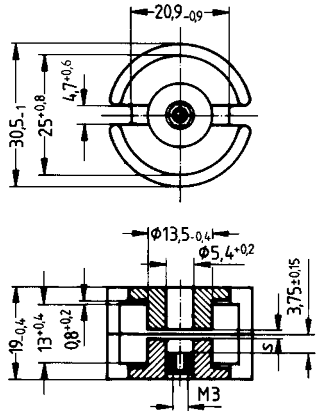
N 48
A_L = 630 nH



Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	384
Matching handle	B63399	384
Adjusting screw	B65679	384
Yoke	B65705	383
Core	B65701	381
Coil former	B65702	382
Insulating washer 1	B65702	382
Core	B65701	381
Threaded sleeve (glued-in)		
Insulating washer 2	B65702	382
Terminal carrier	B65705	383

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,33	0,32	mm^{-1}
l_e	45	46	mm
A_e	136	145	mm^2
A_{min}	—	117	mm^2
V_e	6100	6670	mm^3

Approx. weight (per set)

m	36	37	g

Gapped

Material	A_L value nH	*s* approx. mm	μ_e	Ordering code 1) -D with center hole -T with threaded sleeve
N48	250 ± 2 %	0,72	66	B65701-+250-G48
	400 ± 2 %	0,40	105	B65701-+400-A48
	630 ± 3 %	0,22	166	B65701-+630-A48
	1000 ± 3 %	0,12	263	B65701-+1000-A48
N26	2000 ± 10 %	0,05	525	B65701-D2000-K26

Ungapped

Material	A_L value nH	μ_e	P_V W/set	Ordering code -D with center hole -W without center hole
N26	6200 + 30/– 20 %	1630		B65701-D-R26
N30	11500 + 30/– 20 %	2930		B65701-W-R30
T38	28000 + 40/– 30 %	7130		B65701-W-Y38

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

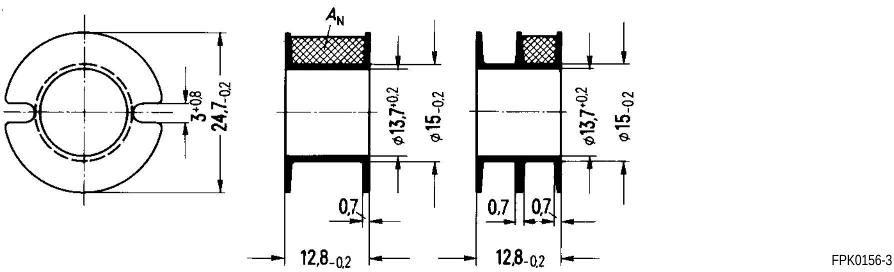
- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120˚C), 0,06 mm thick

Insulating washer 2 between core and terminal carrier

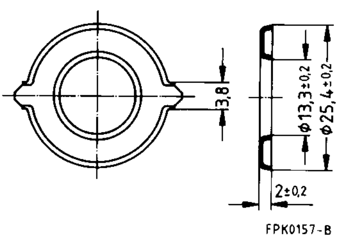
- For increased dielectric strength
- Made of polycarbonate (UL 94 V-0, insulation class to IEC 60085: E ≙ 120˚C), 0,08 mm thick

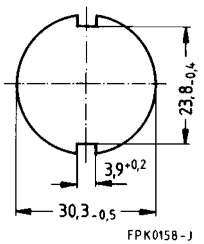
Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	48	60	46	B65702-B-T1
2	45	60	49	B65702-B-T2
Insulating washer 1 (reel packing, PU = 1 reel)				B65702-A5000
Insulating washer 2 (bulk)				B65702-A5002

Coil former



Insulating washer 1 **Insulating washer 2**





Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke
- For snap-in connection

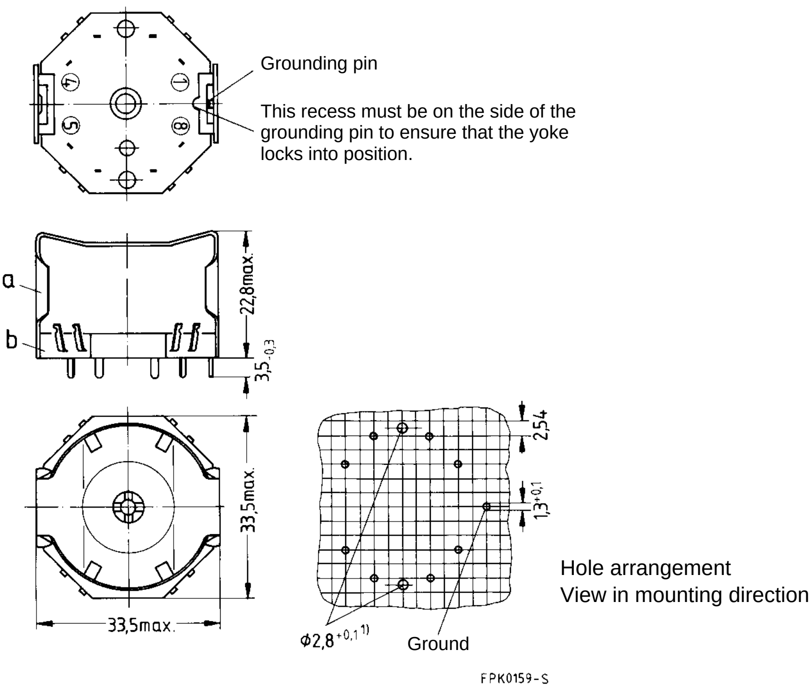
Terminal carrier

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 85: F ≙ max. operating temperature 155 ˚C), color code gray
Solderability: to IEC 68-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 68-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Yoke

Material: Spring yoke, made of tinned nickel silver (0,5 mm), with ground terminal

Complete mounting assembly (8 solder terminals)
Ordering code: B65705-B3



1) The 2,8 mm hole is only necessary for additional fixing with M 2,5 screw.
a) Yoke
b) Terminal carrier with 8 solder terminals

Adjusting screw

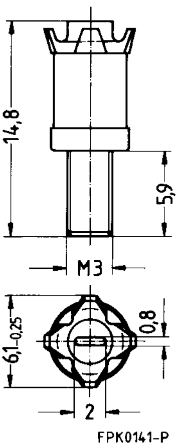
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 30 × 19		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Material	Color code	%	
N 48	250	4,55 × 6,3	N 22	red	16	B65679-E3-X22
	400 630	4,98 × 6,3	N 22	black	18 11	B65679-E2-X22
	630 1000	5,15 × 6,3	N 22	white	18 10	B65679-E1-X22
Adjusting screwdriver						B63399-B1
Handle						B63399-B5

Adjusting screw [1)]

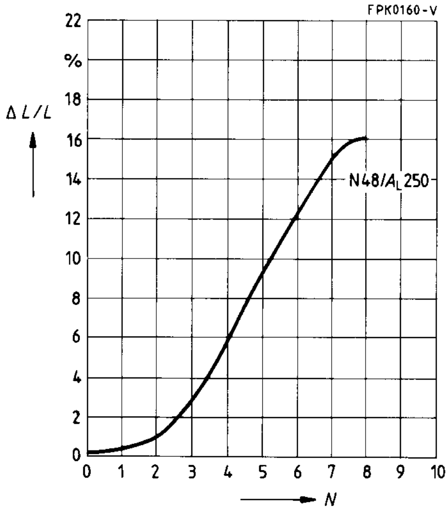


1) Due to the limited distance between adjusting screw and internal borehole, the entire assembly must be accurately centered.

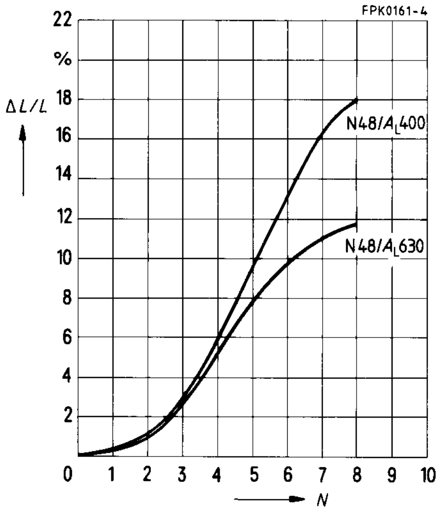
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

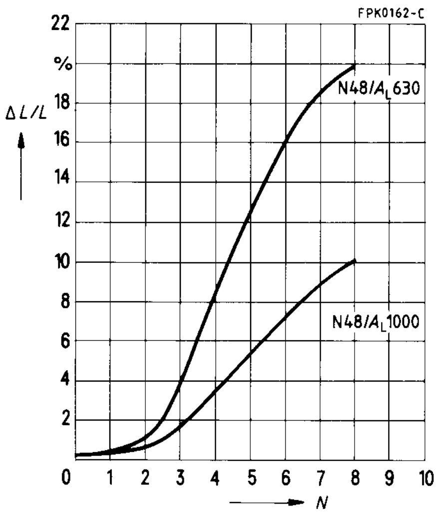
Adjusting screw B65679-E3-X22
Color code red



Adjusting screw B65679-E2-X22
Color code black

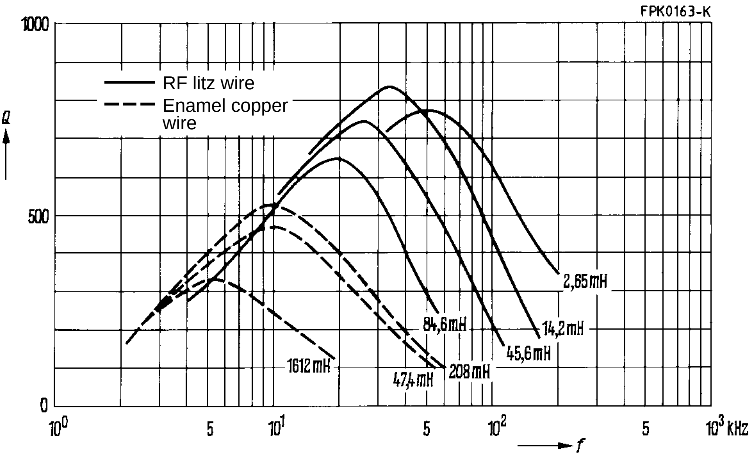


Adjusting screw B65679-E1-X22
Color code white

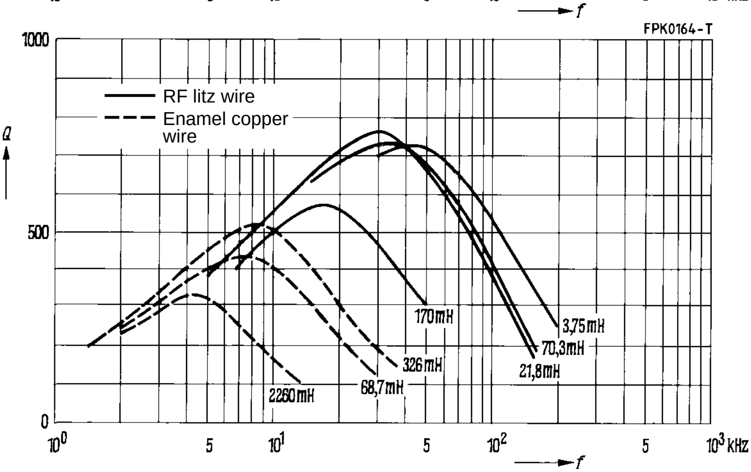


Q factor characteristics (typical values)
Flux density in the core $\hat{B}$ < 1,5 mT

Mate-rial	*L* (mH) for A_L= 630 nH	A_L= 1000 nH	Turns	Wire; RF litz wire	Sec-tions
N 48	1612	2260	1600	0,15 CuL	1
	208	326	570	0,25 CuL	1
	47,4	68,7	350	0,40 CuL	1
	—	170	420	1 × 12 × 0,04 CuLS	1
	84,6	—	420	1 × 20 × 0,05 CuLS	1
	45,6	70,3	270	1 × 30 × 0,05 CuLS	1
	14,2	21,8	150	3 × 20 × 0,05 CuLS	1
	2,65	3,75	65	3 × 20 × 0,07 CuLS	2

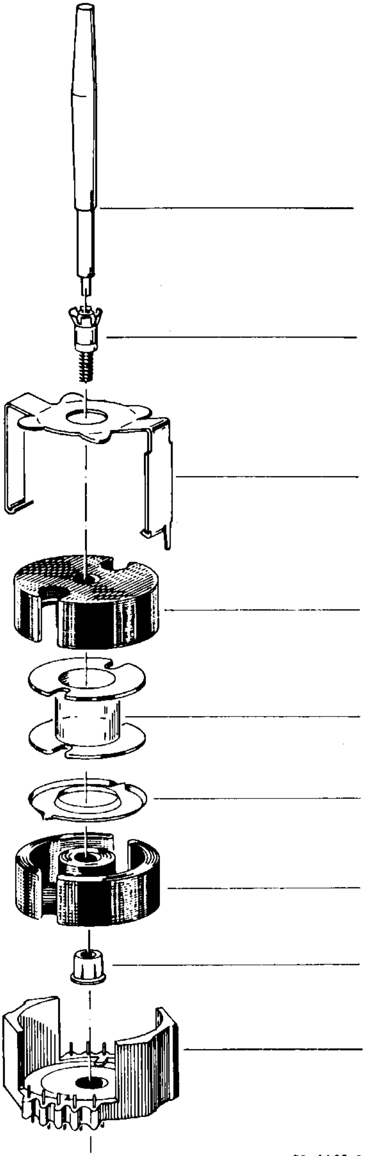


N 48
A_L = 630 nH



N 48
A_L = 1000 nH

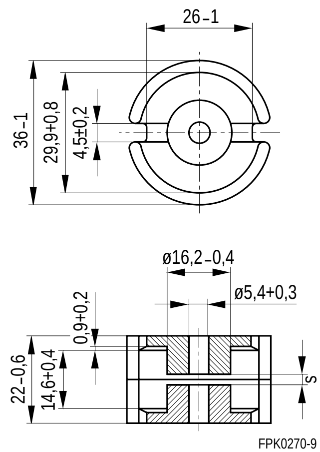
P 36 × 22
Core and Accessories



Example of an assembly set
for printed circuit boards

Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	391
Matching handle	B63399	391
Adjusting screw	B65679	391
Yoke	B65615	390
Core	B65611	388
Coil former	B65612	389
Insulating washer 1	B65612	389
Core	B65611	388
Threaded sleeve (glued-in)		
Terminal carrier	B65615	390

- In accordance with IEC 60133
- Pot cores are supplied in sets



Magnetic characteristics (per set)

	with center hole	without center hole	
$\Sigma l/A$	0,26	0,25	mm^{-1}
l_e	52	53,5	mm
A_e	202	213	mm^2
A_{min}	—	173	mm^2
V_e	10 600	11 400	mm^3

Approx. weight (per set)

m	57	59,5	g

Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code [1] -D with center hole -T with threaded sleeve
N48	250 ± 2 %	1,20	52	B65611-+250-G48
	400 ± 2 %	0,62	83	B65611-+400-G48
	630 ± 3 %	0,35	130	B65611-+630-A48
	1000 ± 3 %	0,22	207	B65611-+1000-A48

Ungapped

Material	A_L value nH	μ_e	P_V W/set	Ordering code -D with center hole -W without center hole
N26	7600 + 30/– 20 %	1570		B65611-D-R26
N30	15200 + 30/– 20 %	3020		B65611-W-R30

1) Replace the + by the code letter ”D“ or ”T“ for the required version.

Coil former

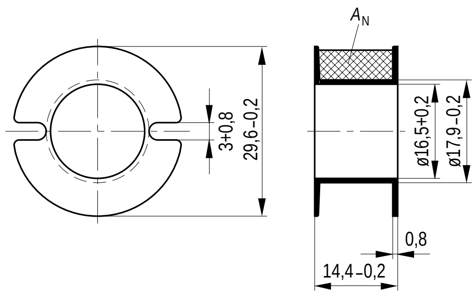
Standard: to IEC 60133
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Winding: see page 154

Insulating washer 1 between core and coil former

- For tolerance compensation and for insulation
- Polycarbonate spring washer (UL 94 V-0, insulation class to IEC 60085: E ≙ 120˚C), 0,06 mm thick

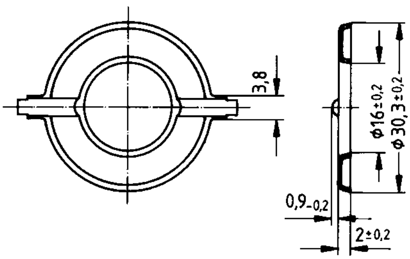
Coil former				Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	
1	63	73	39	B65612-B-T1
Insulating washer 1 (reel packing, PU = 1 reel)				B65612-A5000

Coil former



FPK0271-H

Insulating washer 1



FPK0167-I

Mounting assembly for printed circuit boards

- The set comprises a terminal carrier and a yoke

Terminal carrier

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code gray
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Yoke

Material: Spring yoke, made of nickel silver (0,5 mm), with ground terminal

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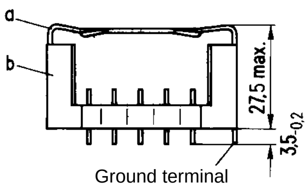
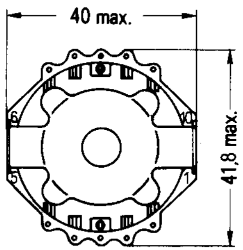
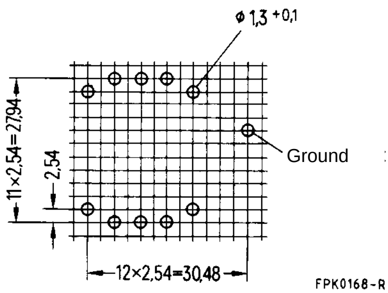
Complete mounting assembly (10 solder terminals)
Ordering code: B65615-B1





Hole arrangement
View in mounting direction



a) Yoke
b) Terminal carrier with 10 solder terminals

Adjusting screw

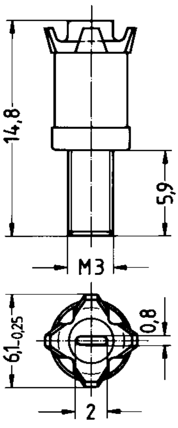
- Tube core with thread and core brake made of GFR polyterephthalate

Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 36 × 22		**Adjusting screw**			Min. adjusting range	Ordering code
Material	A_L value nH	Tube core ∅ × length mm	Material	Color code	%	
N 48	250 400	4,55 × 6,3	N 22	red	15 8	B65679-E3-X22
	400 630	4,98 × 6,3	N 22	black	15 10	B65679-E2-X22
	630 800 900 1000 1250	5,15 × 6,3	N 22	white	14 10 8 7 6	B65679-E1-X22
Adjusting screwdriver						B63399-B1
Handle						B63399-B5

Adjusting screw 1)

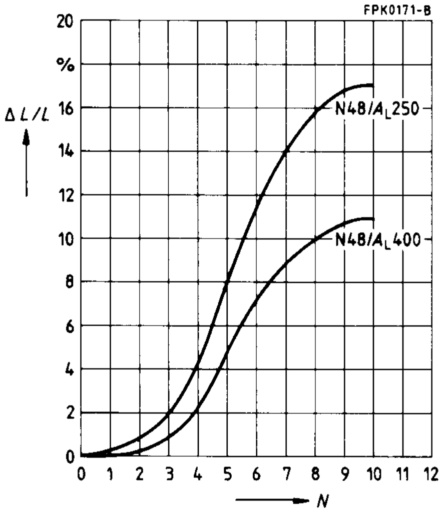


1) Due to the limited distance between adjusting screw and internal borehole, the entire assembly must be accurately centered.

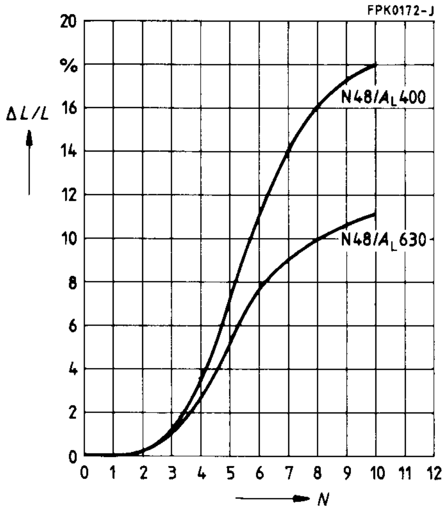
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
0 ≙ at least 2 turns engaged.

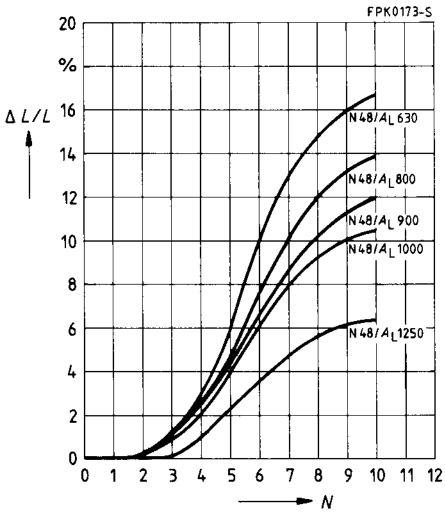
Adjusting screw B65679-E3-X22
Color code red



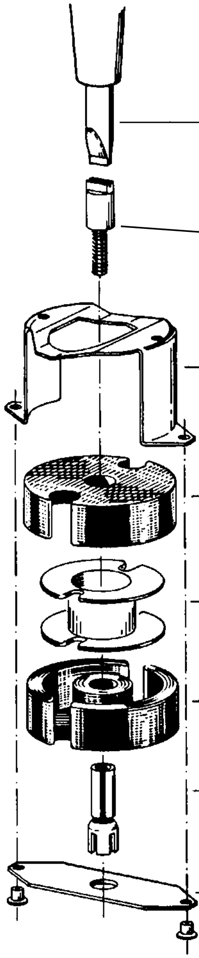
Adjusting screw B65679-E2-X22
Color code black



Adjusting screw B65679-E1-X22
Color code white



Assembly set for chassis mounting



Individual parts	Part no.	Page
Adjusting screwdriver (for assembly only)	B63399	397
Matching handle	B63399	397
Adjusting screw	B65579	397
Yoke	B65623	396
Core	B65621	394
Coil former	B65622	395
Core	B65621	394
Threaded sleeve	B65579	397
Base plate with 2 tubular rivets	B65623	396

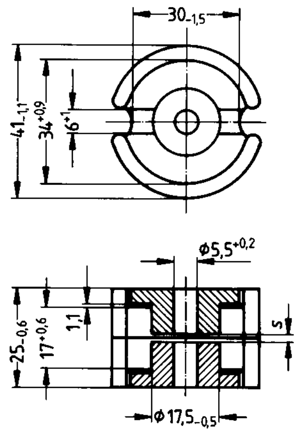
Example of an assembly set

- Pot cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,257 mm^{-1}
l_e = 62,1 mm
A_e = 242 mm^2
A_{min} = 200 mm^2
V_e = 15 000 mm^3

Approx. weight 82 g/set



Gapped

Material	A_L value nH	s approx. mm	μ_e	Ordering code -J with center hole
N48	250 ± 3 %	1,35	51	B65621-J250-A48
	630 ± 3 %	0,43	129	B65621-J630-A48
N26	3150 ± 10 %	0,05	642	B65621-J3150-K26

Ungapped

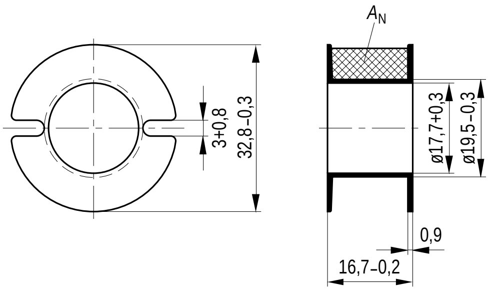
Material	A_L value nH	μ_e	Ordering code -J with center hole
N26	8400 + 30/– 20 %	1720	B65621-J-R26

Coil former

Material: GFR polycarbonate (UL 94 V-0, insulation class to IEC 60085:
E ≙ max. operating temperature 120 °C)

Winding: see page 154

Sections	A_N mm²	l_N mm	A_R value µΩ	Ordering code
1	80	81	33	B65622-A-M1



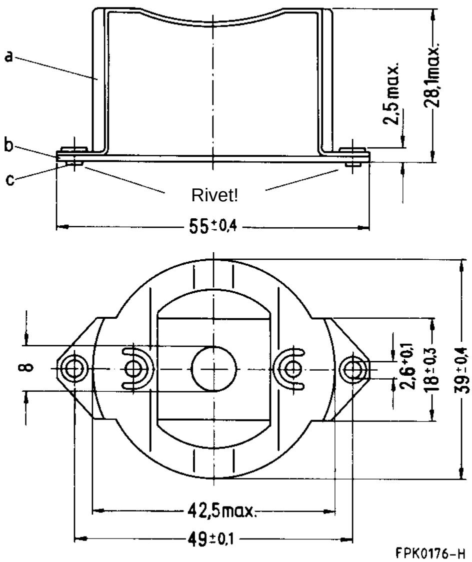
Mounting assembly for chassis mounting

- The set comprises a yoke and a metal base plate
- Fixing by screws or rivets

Yoke

Material: Spring yoke, made of nickel silver (0,5 mm)

Complete mounting assembly (with tubular rivets)
Ordering code: B65623-A1



a) Yoke
b) Base plate
c) Tubular rivets

Adjusting screw

- Tube core with thread made of GFR polyterephthalate

Threaded sleeve

- Made of GFR polyterephthalate
- The slotted shank serves as core brake

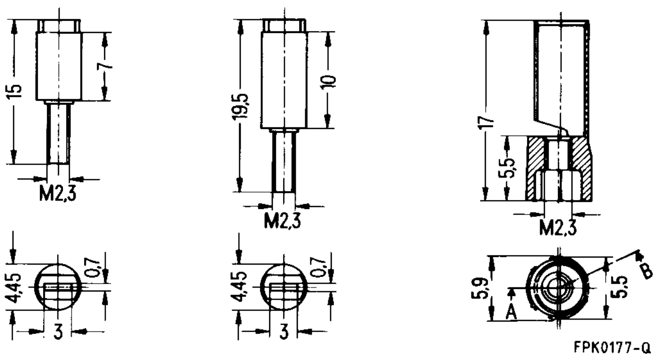
Plastic **adjusting screwdriver** (not shown)

Plastic **handle** for adjusting screwdriver (not shown)

Core P 41 × 25		**Adjusting screw**				Min. adjusting range	Ordering code
		Tube core					
Material	A_L value nH	Fig.	∅ × length mm	Material	Color code	%	
N 48	250	a	4,44 × 7	N 22	red	14	B65579-B1-X23
	400 630 1250	b	4,44 × 10	N 22	red	12 5 2	B65579-B3-X23
Threaded sleeve							B65579-K1
Adjusting screwdriver							B63399-B4
Handle							B63399-B5

Adjusting screw a b

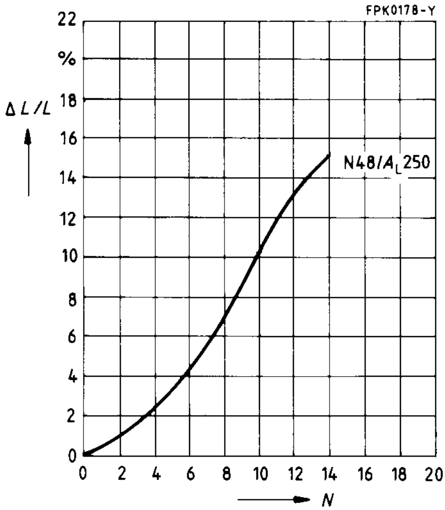
Threaded sleeve Section A-B



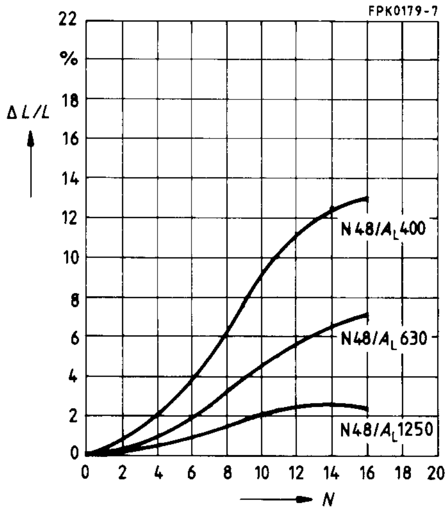
Inductance adjustment curves (nominal values)

Relative inductance change Δ *L/L* versus turns *N* of adjusting screw.
Immersion depth 3 mm. 0 ≙ at least 2 turns engaged.

Adjusting screw B65579-B1-X23
Color code red



Adjusting screw B65579-B3-X23
Color code red



P Core Halves for Proximity Switches (incl. PS Cores)
General Information

Inductive proximity switches can be used as noncontacting motion detectors and output indicators. Possible applications:

– Detection of the final position on conveyor belts
– Counters at rotating parts
– Contactless detection of pointer position of pointer-type measuring and control instruments

The advantages of proximity switches are bounceless switching, no mechanical wear, insensitivity to contamination and detection of metallic parts only.

We supply P cores with diameters ranging from 5,6 to 150 mm for inductive proximity switches. Their dimensions are matched to standardized switches. Maximum operating distances can thus be achieved for the individual P core sizes. The SIFERRIT material N22 is particularly suitable for the frequency range from 0,1 to 0,8 MHz. The material M33 is additionally available for higher frequencies (core types with 5,6 to 14,0 mm diameter).

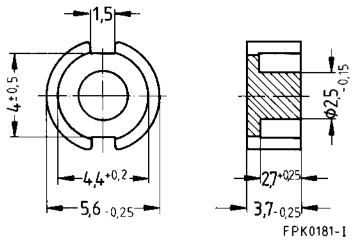
Thermoplastic coil formers can be supplied for most of the core types. This material permits an operating temperature range of – 60 to + 120 ˚C. Consequently, temperatures of up to + 120 ˚C are also permissible during encapsulation.

Standardization

Cores with the designation "PS" have been standardized in DIN 41001 (draft). These cores are recommended for new designs.

For sizes ∅11 mm and ∅14 mm the standard types correspond to one core half of P11×7 and P14×8, respectively.

- For inductive proximity switches
- Material N22 for the frequency range from about 80 to 800 kHz
- Material M33 for higher frequencies up to about 1,6 MHz



Material	Approx. weight g	Ordering code
N22	0,15	B65931-C-X22
M33	0,15	B65931-C-X33

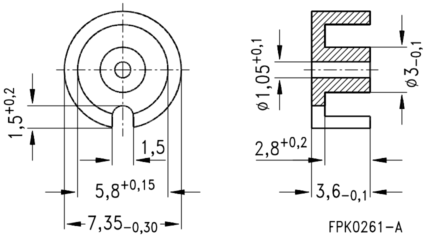
For these cores we recommend formerless winding, e.g. by using an enamel-insulated wire with thermoplastic coating.

Data for winding without coil former

A_N mm²	l_N mm	A_R value µΩ
approx. 1,1	9,7	160

Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 80 to 800 kHz
- Material M33 for higher frequencies up to about 1,6 MHz

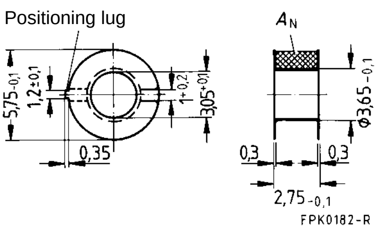


Material	Approx. weight g	Ordering code
N22	0,3	B65933-A-X22
M33	0,3	B65933-A-X33

Coil former with positioning lug

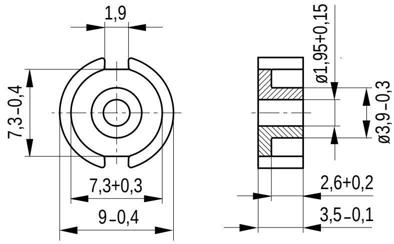
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
2,2	14,6	240	B65512-C-T1



Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 80 to 800 kHz
- Material M33 for higher frequencies up to about 1,6 MHz



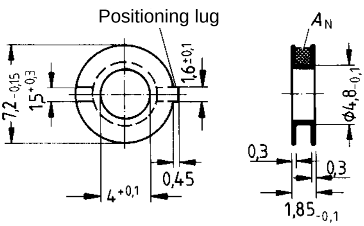
FPK0292-5

Material	Approx. weight g	Ordering code
N22	0,6	B65935-E-X22
M33	0,6	B65935-E-X33

Coil former with positioning lug

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

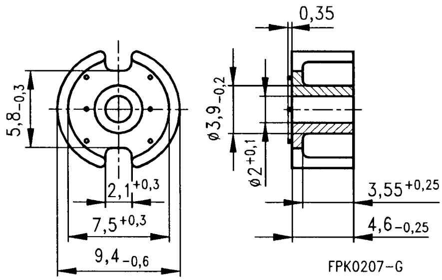
A_N mm²	l_N mm	A_R value µΩ	Ordering code
1,5	18,6	470	B65936-A-T1



FPK0185-G

Core

- For inductive proximity switches
- Material N22 for the frequency range from about 80 to 800 kHz
- Material M33 for higher frequencies up to about 1,6 MHz
- With pimples on the end surfaces (pimple height = 0,35 mm)

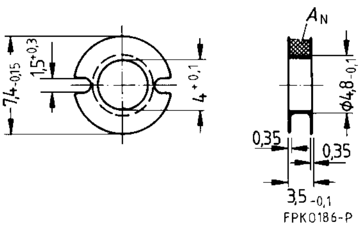


Material	Approx. weight g	Ordering code
N22	0,6	B65935-A-X22
M33	0,6	B65935-A-X33

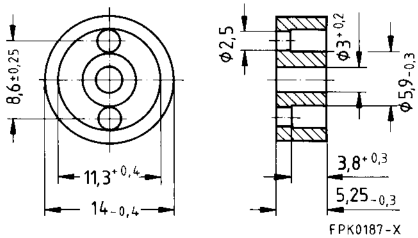
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
3,6	19,2	183	B65522-B-T1



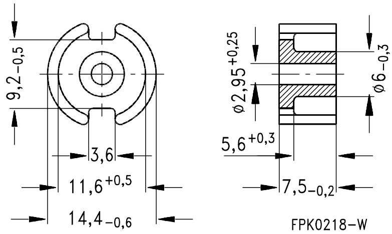
- For inductive proximity switches
- Material N22 for the frequency range from about 70 to 700 kHz
- Material M33 for higher frequencies up to about 1,6 MHz



Material	Approx. weight g	Ordering code
N22	1,8	B65926-A-X22
M33	1,8	B65926-A-X33

Core

- For inductive proximity switches
- Material N22 for the frequency range from about 70 to 700 kHz

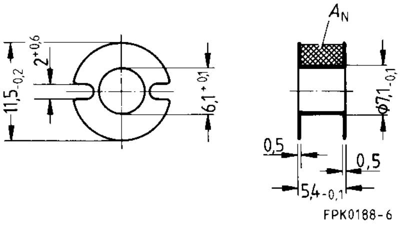


Material	Approx. weight g	Ordering code
N22	2,5	B65937-A-X22

Coil former

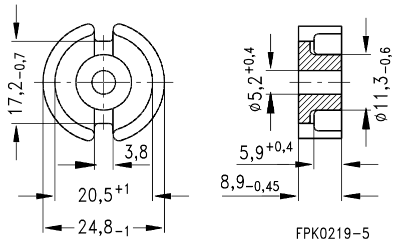
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
8,4	28	115	B65542-B-T1



Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 60 to 600 kHz

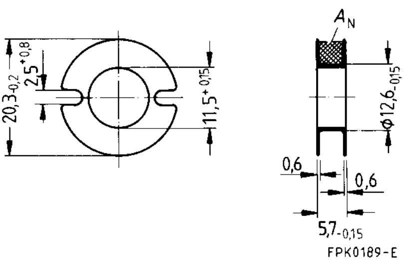


Material	Approx. weight g	Ordering code
N22	9	B65939-A-X22

Coil former

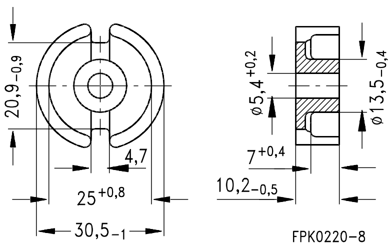
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
16,7	51	105	B65940-B-T1



Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 50 to 500 kHz

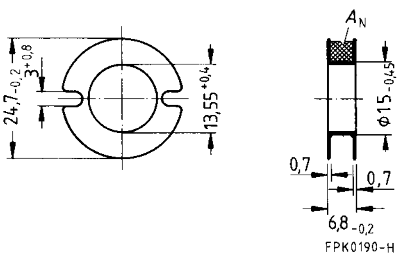


Material	Approx. weight g	Ordering code
N22	18	B65941-A-X22

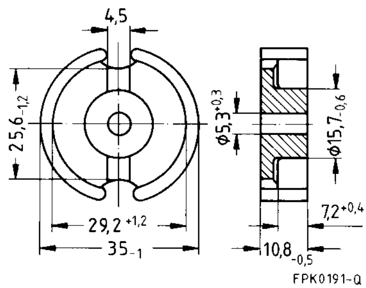
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
24,4	62	87	B65942-B-T1



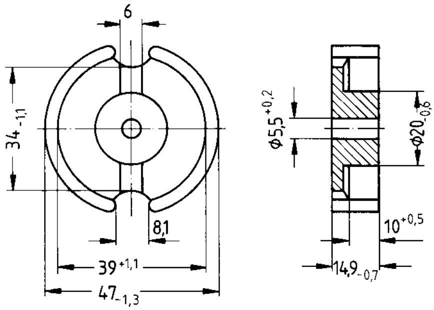
- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 40 to 400 kHz



Material	Approx. weight g	Ordering code
N22	28	B65947-A-X22

Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 30 to 300 kHz

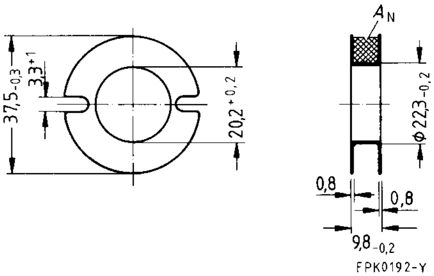


Material	Approx. weight g	Ordering code
N22	62	B65943-A-X22

Coil former

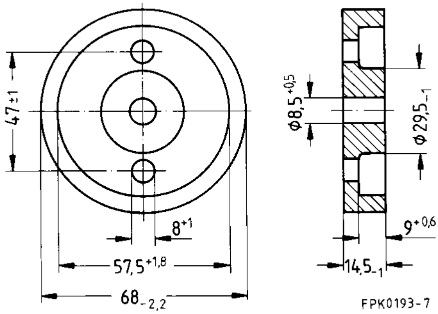
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value μΩ	Ordering code
62	95	52,5	B65944-B-T1



Core

- In accordance with DIN 41001
- Recommended for new designs
- For inductive proximity switches
- Material N22 for the frequency range from about 20 to 200 kHz

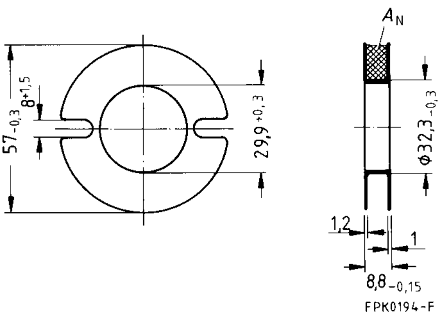


Material	Approx. weight g	Ordering code
N22	130	B65928-A-X22

Coil former

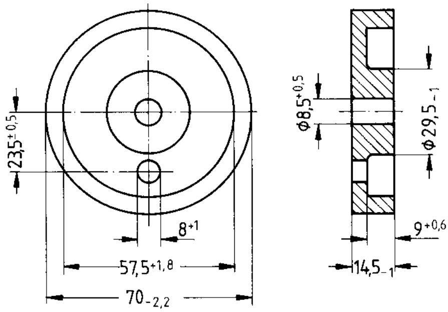
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value µΩ	Ordering code
77	140	62	B65946-B-T1



Core

- For inductive proximity switches
- Material N22 for the frequency range from about 20 to 200 kHz

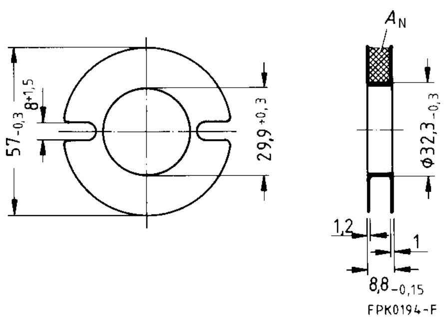


Material	Approx. weight g	Ordering code
N22	130	B65945-A-X22

Coil former

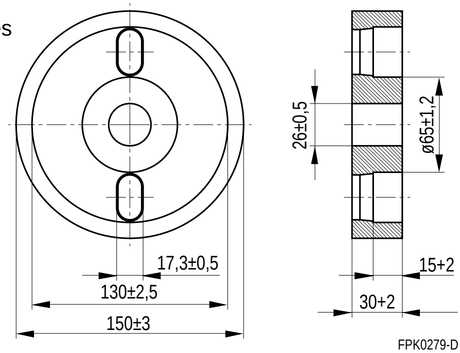
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C); color code black

A_N mm²	l_N mm	A_R value μΩ	Ordering code
77	140	62	B65946-B-T1



High-volume pot core

- Unground core for inductive proximity switches with wide operating distances
- Application examples:
  – Rotary transformers for non-contact power and information transmission
  – Inductive power transmission (non-contact charging of electric cars)
- Options:
  a) Ground version for transformers up to 30 kW
  b) Core height up to 45 mm for transformers up to 100 kW



FPK0279-D

Magnetic characteristics for option a)
(per set)

$\Sigma l/A$ = 0,044 mm^{-1}
l_e = 160 mm
A_e = 3 580 mm^2
A_{min} = 2 800 mm^2
V_e = 566 000 mm^3

Material	Approx. weight g	Ordering code
N27	1700	B65949-A-X27

1 General information

TT (**T**ouch **T**one) cores and PR (**P**ot **R**ectangular) cores are available in five sizes in the range 14 to 30 mm. All types are offered without center hole in order to provide maximum effective core cross section A_e. Cores with center hole are also available on request.

The **TT** core shape was originally used for push-button telephone sets. The round-slab core shape offers excellent shielding as well as enough space to bring out a higher number of parallel pin connections. The **PR** core (double-slab) core shape consists of two equal core halves having an evident advantage: PR cores offer as an alternative to TT cores the possibility of implementing a narrower component.

Gapped cores with tolerated A_L values are available on request. The air gap is ground by an efficient grinding technology into one of the slabbed core halves.

2 Applications

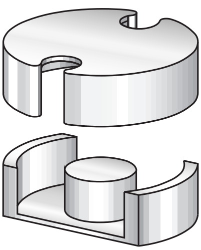
Both core shapes are suitable for:

- Telecommunication applications, mainly for impedance-matching transformers requiring low signal distortion. This is due to the balanced distribution of winding space and magnetic cross section (cf. core distortion factor, page 133.
- Power applications for transformers with low mounting height and compact winding design. These cores can also be used for planar applications and for this purpose lower heights can be produced on request.

3 Accessories

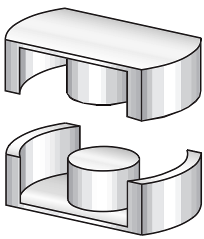
Coil formers for TT/PR cores are available on request.

Example: TT 18 × 11



FPK0290-N

PR 18 × 11



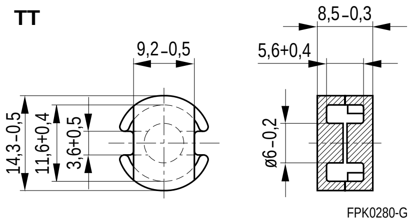
FPK0291-W

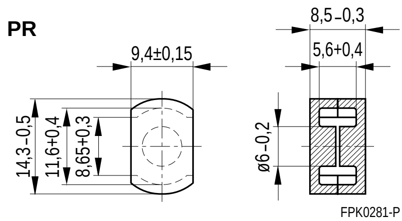
- Also available with center hole
- Types with special A_L value on request
- TT/PR cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l_e/A_e$ = 0,84 mm^{-1}
l_e = 25,3 mm
A_e = 25,3 mm^2
A_{min} = 22,1 mm^2
V_e = 539 mm^3

Approx. weight TT 3,5 g/set
PR 3,2 g/set





Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	Type
N87	2000 + 30/– 20 %	1340	1350	< 0,35 (200 mT, 100 kHz, 100 °C)	B65754-J-R87 B65755-J-R87	TT PR
N26	2000 + 30/– 20 %	1400			B65754-J-R26 B65755-J-R26	TT PR
N30	4000 + 30/– 20 %	2680			B65754-J-R30 B65755-J-R30	TT PR
T65	5200 + 30/– 20 %	3480			B65754-J-R65 B65755-J-R65	TT PR
T38	8500 + 40/– 30 %	5695			B65754-J-Y38 B65755-J-Y38	TT PR

1) Preliminary data

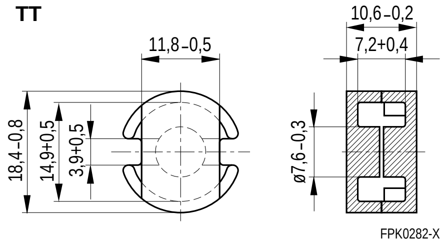
- Also available with center hole
- Types with special A_L value on request
- TT/PR cores are supplied in sets

Magnetic characteristics (per set)

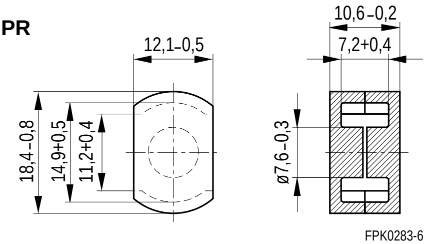
$\Sigma l_e/A_e$ = 0,68 mm^{-1}
l_e = 27,3 mm
A_e = 40,3 mm^2
A_{min} = 36,0 mm^2
V_e = 1100 mm^3

Approx. weight TT 6,4 g/set
PR 6,2 g/set

TT



PR



Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	Type
N87	2800 + 30/– 20 %	1510	1670	< 0,7 (200 mT, 100 kHz, 100 ˚C)	B65756-J-R87 B65757-J-R87	TT PR
N26	2600 + 30/– 20 %	1400			B65756-J-R26 B65757-J-R26	TT PR
N30	5000 + 30/– 20 %	2695			B65756-J-R30 B65757-J-R30	TT PR
T65	7200 + 30/– 20 %	3880			B65756-J-R65 B65757-J-R65	TT PR
T38	10800 + 40/– 30 %	5820			B65756-J-Y38 B65757-J-Y38	TT PR

1) Preliminary data

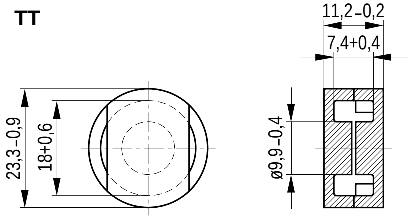
- Also available with center hole
- Types with special A_L value on request
- TT/PR cores are supplied in sets

Magnetic characteristics (per set)

$\Sigma l_e/A_e$ = 0,45 mm^{-1}
l_e = 31,2 mm
A_e = 68,8 mm^2
A_{min} = 62,8 mm^2
V_e = 2144 mm^3

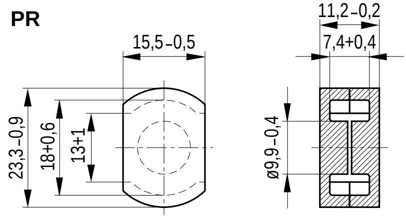
Approx. weight TT 13,8 g/set
PR 11,4 g/set

TT



FPK0284-E

PR



FPK0285-M

Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	Type
N87	4800 + 30/– 20 %	1730	2500	1,4 (200 mT, 100 kHz, 100 ˚C)	B65716-L-R87 B65738-L-R87	TT PR
N26	4400 + 30/– 20 %	1590			B65716-L-R26 B65738-L-R26	TT PR
N30	7900 + 30/– 20 %	2850			B65716-L-R30 B65738-L-R30	TT PR
T65	11800 + 30/– 20 %	3880			B65716-L-R65 B65738-L-R65	TT PR
T38	16400 + 40/– 30 %	5920			B65716-L-Y38 B65738-L-Y38	TT PR

1) Preliminary data

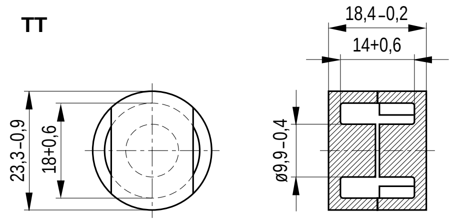
- Also available with center hole
- Types with special A_L value on request
- TT/PR cores are supplied in sets

Magnetic characteristics (per set)

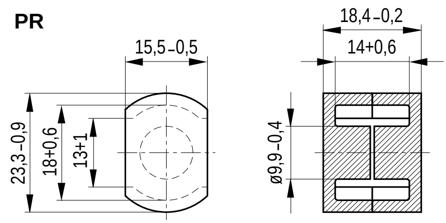
$\Sigma l_e/A_e$ = 0,62 mm^{-1}
l_e = 45,1 mm
A_e = 73,1 mm^2
A_{min} = 67,4 mm^2
V_e = 3293 mm^3

Approx. weight TT 20,6 g/set
PR 16,6 g/set

TT



PR



Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	Type
N87	3800 + 30/– 20 %	1870	1830	< 2,2 (200 mT, 100 kHz, 100 ˚C)	B65716-J-R87 B65738-J-R87	TT PR
N26	3600 + 30/– 20 %	1770			B65716-J-R26 B65738-J-R26	TT PR
N30	6500 + 30/– 20 %	3190			B65716-J-R30 B65738-J-R30	TT PR
T65	9200 + 30/– 20 %	4520			B65716-J-R65 B65738-J-R65	TT PR
T38	13800 + 40/– 30 %	6770			B65716-J-Y38 B65738-J-Y38	TT PR

1) Preliminary data

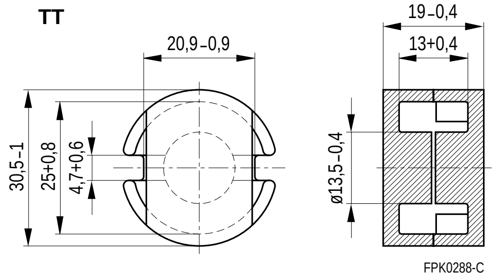
- Also available with center hole
- Types with special A_L value on request
- TT/PR cores are supplied in sets

Magnetic characteristics (per set)

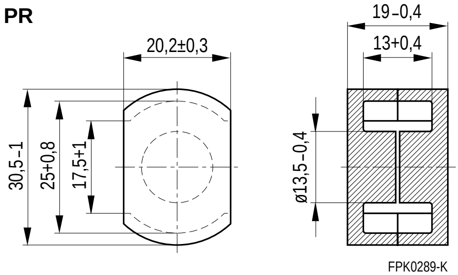
$\Sigma l_e/A_e$ = 0,39 mm^{-1}
l_e = 46,4 mm
A_e = 119 mm^2
A_{min} = 99,4 mm^2
V_e = 5534 mm^3

Approx. weight TT 33,3 g/set
PR 29,6 g/set

TT



PR



Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	Type
N87	5400 + 30/– 20 %	1680	2900	< 2,8 (200 mT, 100 kHz, 100 ˚C)	B65730-J-R87 B65735-J-R87	TT PR
N26	5900 + 30/– 20 %	1830			B65730-J-R26 B65735-J-R26	TT PR
N30	9400 + 30/– 20 %	2920			B65730-J-R30 B65735-J-R30	TT PR
T65	14000 + 30/– 20 %	4340			B65730-J-R65 B65735-J-R65	TT PR
T38	22800 + 40/– 30 %	7075			B65730-J-Y38 B65735-J-Y38	TT PR

1) Preliminary data

1 Core shapes and materials

The preferred materials for manufacture of E cores are the SIFERRIT materials N27, N67, N87, N49 and N30. N27 is recommended for power applications in the frequency range up to about 100 kHz, N67 for the frequency range from about 100 to 300 kHz and N87 for the frequency range up to 500 kHz; EFD cores made of N49 are particularly suitable for frequencies f > 500 kHz. These materials feature a high saturation flux density and low power loss.

Material N30 is particularly suitable for broadband small-signal applications and also for interference suppression chokes.

The E core spectrum contained in this data book comprises five basic core shapes, which can be used not only for transformers but also for chokes with a power capacity of up to 10 kW.

a) Types with round center leg

We offer the following types:

- ER cores
- ETD cores in accordance with IEC 61185 (Economic Transformer Design)
- EC cores in accordance with IEC 60647

E cores with round center leg offer the advantage of easy winding, particularly when thick winding wires are used, compact mounting dimensions and wide openings on each side. ETD cores have the additional benefit of an almost constant cross section along the magnetic path. A wide variety of optimized accessories is available. ER cores in sizes 9,5 and 11/5 are particularly suitable for designing transformers with low overall height and high inductance. They come in material T38 for broadband applications plus in N87 and N49 for power transformers for frequencies up to and over 500 kHz. SMD coil formers are available as accessory.

b) Double E cores (DE)

The DE cores are a type of E core with a closed magnetic path. Paired with the magnetic advantages of a ring core, automatic winding can be performed thanks to the accessories specially designed for automatic production. Material T37 can thus be used for the significantly more cost-effective production of current-compensated chokes.

c) Types with rectangular center leg

- E cores
- EFD cores (Economic Flat Transformer Design); EPF cores; EV cores

The conventional E cores with rectangular center leg are available in a wide variety of sizes.

EFD cores have an optimized cross section and enable the design of very flat and compacts transformers, even for high-frequency applications.

d) ELP cores (E Low Profile)

ELP cores enable the design of very flat transformers and feature excellent thermal performance due to the large core surface.

2 Ordering, marking, delivery

E cores are supplied as single units (except ER 9,5 and ER 11: in sets), with each packing unit (PU) exclusively containing cores with or without shortened center leg (air gap dimension „*g*“).

Gapped EFD cores are supplied with toleranced A_L value as specified in the data sheets. All other E cores are availble with toleranced A_L value on request.

There are two possibilites of air gap distribution, either symmetrical (each core of a set has the same air gap size) or unsymmetrical (a gapped core is combined with an ungapped core).

E and U cores are marked using the same system. Hence, the following description applies to both core shapes.

- **E5**, **E6,3** and **E8,8** cores are not marked.
- With **ER 9,5** and **ER 11** cores (packed in sets) only one core half carries the marking. Ungapped cores are stamped with the material and "o. L." (= without air gap). Gapped cores are stamped with the material and the A_L value. In case of unsymmetrical air gap distribution the gapped core half carries the marking.
- **E cores with short legs (up to E 16/6)** and **small U cores (up to U 17)** are stamped with rolls on the back (figure 1).

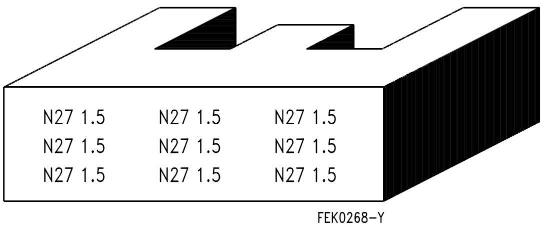


Figure 1
Roll stamping on back

Gapped cores:

with toleranced air gap: material and size of air gap, e.g.: N27 1,2

with toleranced A_L value:

symmetrical version: material, A_L value and code for A_L value tolerance, e.g.: N27 30 A

unsymmetrical version: material and size of air gap, e.g.: N27 1,2

Ungapped cores are only marked with the material, e.g. N27.

- **E 16/8 cores and larger** as well as **U 20 and larger** are marked by a ink-jet printer on the outside of the legs (figure 2).

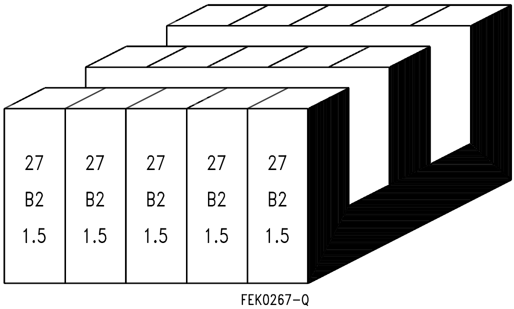


Figure 2
Marking by ink-jet printer

Gapped cores :

with toleranced air gap: material, date code and size of air gap,
e.g.: 27 B2 1,5
with toleranced A_L value:

symmetrical version: material, date code, A_L value and code for A_L value tolerance, e.g.: 27 B230A
unsymmetrical version: material, date code and size of air gap,
e.g.: 27 B2 1,5

Ungapped cores are marked with material and date code, e.g.: 27 B2.

Depending on their height and width, there is not enough space on all cores for complete marking, meaning that simplification is necessary. So only the material and the date code will be stated. This ensures that there is space for at least one complete marking (two characters per line) on the core. To avoid confusion of names like N27 and N72, the beginning of the material designation coincides with the position of the letter in the date code.

Example: ↓

727272
2B2B2B

means N27 (not N72)

Date code:

Date coding is based on a two-week period (see tables, counting by calendar weeks CW).

In the following year lines 1 and 2 will we swapped (material and date code). The position of letters and digits will not be swapped. Counting started in 1996.

Coding of two-week production periods

CW	Code	CW	Code	CW	Code
1 and 2	A	19 and 20	J	37 and 38	S
3 and 4	B	21 and 22	K	39 and 40	T
5 and 6	C	23 and 24	L	41 and 42	U
7 and 8	D	25 and 26	M	43 and 44	V
9 and 10	E	27 and 28	N	45 and 46	W
11 and 12	F	29 and 30	O	47 and 48	X
13 and 14	G	31 and 32	P	49 and 50	Y
15 and 16	H	33 and 34	Q	51 and 52	Z
17 and 18	I	35 and 36	R	53	@

Coding of week day

	Day	Code		Day	Code
CW_n	Monday	1	CW_{n+1}	Monday	6
	Tuesday	2		Tuesday	7
	Wednesday	3		Wednesday	8
	Thursday	4		Thursday	9
	Friday	5		Friday	0
	Saturday	5		Saturday	0
	Sunday	+		Sunday	–

The black ink is insoluble in water, but it will dissolve in fluids based on ketones. It will also dissolve if left for a long time in an ultrasonic bath. Different colored markings are not feasible.

3 Ungapped cores

Even with the best grinding methods available today, a certain degree of roughness (approx. 6 µm) cannot be avoided on the ground surface in the case of „ungapped“ cores.

The A_L value tolerance of E, ER, ETD, EC, EFD and EV cores is + 30/– 20 %. The small E cores E5, E6,3 and E8,8 made of T38, however, have a tolerance of + 40/– 30 %. E cores made of T42 (E13, E16) have a tolerance of ± 30%.

4 Cores with toleranced air gap

The following tolerances for dimension „*g*“ apply to all E cores:

Dimension *g* mm	Tolerance mm
$g < 0{,}10$ mm	± 0,01
$0{,}10 \text{ mm} \le g < 0{,}5$	± 0,02
$g \ge 0{,}5$	± 0,05

As is the case with ungapped cores, a certain degree of roughness cannot be avoided on the ground surfaces of the outer legs (see point 3).

5 Cores with toleranced A_L value

The tolerance of the A_L value depends on the magnitude of the A_L value and the core shape. Tolerance figures are therefore given only on a core-type-specific basis.

6 Calculation formulae

Calculation formulae a) and b) apply to the A_L value under the following measuring conditions:

Measuring flux density $\hat{B} \le 0{,}25$ mT, measuring frequency $f = 10$ kHz,
measuring temperature $T = 25 \pm 3$ ˚C, measuring coil: $N = 100$ turns, fully wound

a) Air gap and A_L value

The typical A_L value tabulated in the individual data sheets refers to a core set comprising a gapped core with dimension „*g*“ and an ungapped core with „*g*“ approx. 0.

By inserting the core-specific constants *K1* and *K2*, a nominal A_L value can be calculated for the materials N27, N67 and N87 within the relevant quoted air-gap validity range:

$$s = \left(\frac{A_L}{K1}\right)^{\frac{1}{K2}} \qquad s = [\text{mm}] \qquad A_L = [\text{nH}]$$

Production variations with regard to μ_i and grinding quality should be taken into account additionally.

b) DC magnetic bias I_{DC}

By using the core-shape-related factors *K3* and *K4*, nominal values can be determined for the DC magnetic biasing characteristic of E, ETD, EC and EFD cores made of N67, N27 and N87 and ELP cores made of N87 at temperature 25 ˚C and 100 ˚C.

The direct current I_{DC} at which the A_L value drops by 10 % compared to the A_L value without magnetic biasing ($I_{DC} = 0$ A) is determined for a coil with 100 turns.

Calculation of I_{DC} at $T = 25$ ˚C:
The factors *K3* and *K4* for $T = 25$ ˚C and the A_L value without magnetic biasing are inserted into the equation for the calculation.

Calculation of I_{DC} at T = 100 ˚C:
The factors $K3$ and $K4$ for T = 100 ˚C are inserted into the equation for the calculation. The value for T = 25 ˚C without magnetic biasing should be used here as the A_L value.

$$I_{DC} = \left(\frac{0{,}9 \cdot A_L}{K3}\right)^{\frac{1}{K4}} \qquad I_{DC} = [A] \qquad A_L = [nH] \quad \text{(without magnetic biasing)}$$

7 Magnetic characteristics

The set characteristics $\Sigma l/A$, l_e, A_e, A_{min} and V_e required for the calculation of field strength, flux density and hysteresis losses have been determined in accordance with IEC 60205 (A_{min} = minimum cross section relative to the nominal dimensions).

8 Core losses

The maximum power loss for each core type is specified in W/set together with the measurement parameters. The flux density has been calculated on the basis of a sinusoidal voltage and is referred to the minimum cross-sectional area A_{min}.

9 Accessories

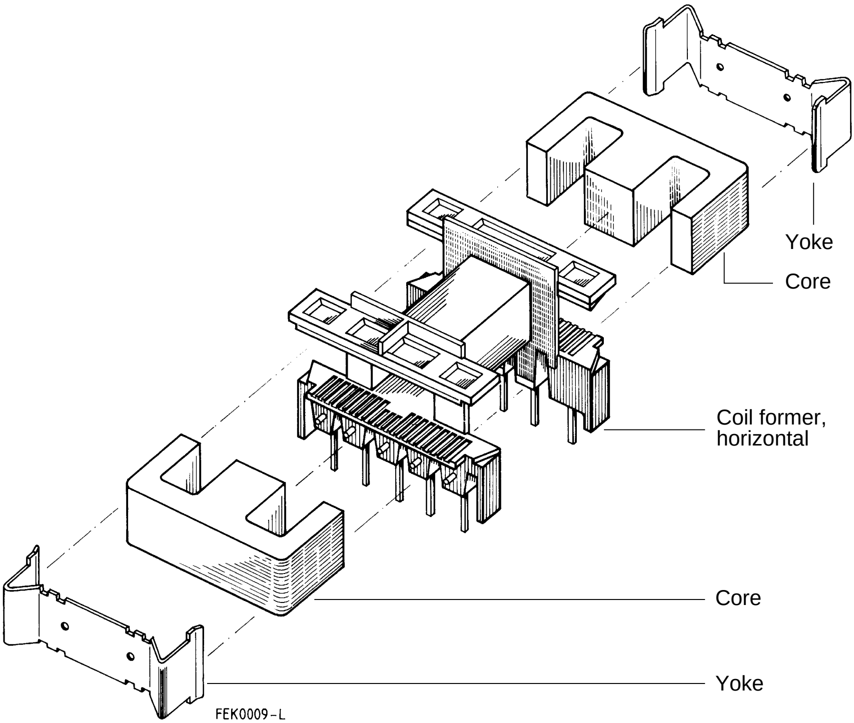
The coil formers for all ETD, EFD, EC and ER cores and most of the E cores are designed so that they can be wound fully automatically.

With the ETD cores and most E cores, each core half and its mounting assembly can be fitted to the coil former from the same side, thus permitting simple fully automatic assembly.

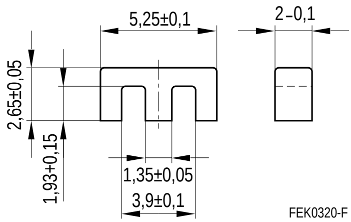
EC coil formers, cores and their mounting assemblies are fixed by means of screws.

If coil formers are used for cores with a rectangular cross section (E cores), the indication of the winding height represents only a theoretical value. The use of thicker wires or litz wires results in a gradual rounding of the winding from layer to layer. In such cases the planned winding design should be verified by means of a winding test.

Example of an assembly set using a coil former with horizontal magnetic axis (E 20/6)



- For small impedance-matching transformers in telecom applications
- For miniature transformers, e.g. DC/DC converters for surface mounting
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 4,86 mm^{-1}
l_e = 12,6 mm
A_e = 2,6 mm^2
A_{min} = 2,5 mm^2
V_e = 33 mm^3

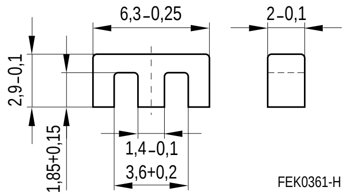
Approx. weight 0,16 g/set

Material	A_L value nH	μ_e	Ordering code
T38	1400 + 40/– 30 %	5190	B66303-G-X138
N87[1]	270 + 30/– 20 %	1000	B66303-G-X187

The A_L value in the table applies to a core set comprising two ungapped cores.

1) Preliminary data

- For miniature transformers, e.g. DC/DC converters for surface mounting
- Available with SMD coil former
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 3,7 mm^{-1}
l_e = 12,2 mm
A_e = 3,3 mm^2
A_{min} = 2,6 mm^2
V_e = 40,3 mm^3

Approx. weight 0,12 g/set

Material	A_L value nH	μ_e	A_{L1min} mH	Ordering code
N30	700 + 40/– 30 %	2059	—	B66300-G-X130
T38	1700 + 40/– 30 %	4990	—	B66300-G-X138
N67	380 + 30/– 20 %	1120	300	B66300-G-X167

The A_L value in the table applies to a core set comprising two ungapped cores.

SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black

Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235°C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s

Winding: see page 160

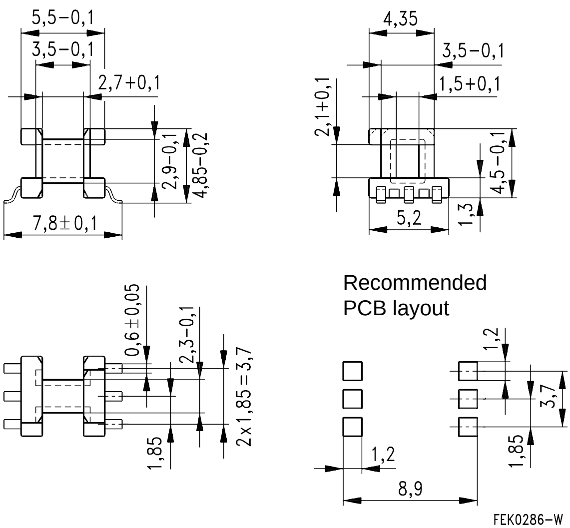
Plastic cover cap

Used to protect the transformer against external influences, for stamping and for improved processing on assembly machines

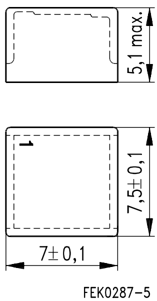
Material: see coil former, color code white

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	
1	1,62	12,8	489	6	B66296-B1006-T1
Plastic cover cap					B66301-C2000

Coil former



Plastic cover cap



SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black

Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s

Winding: see page 160

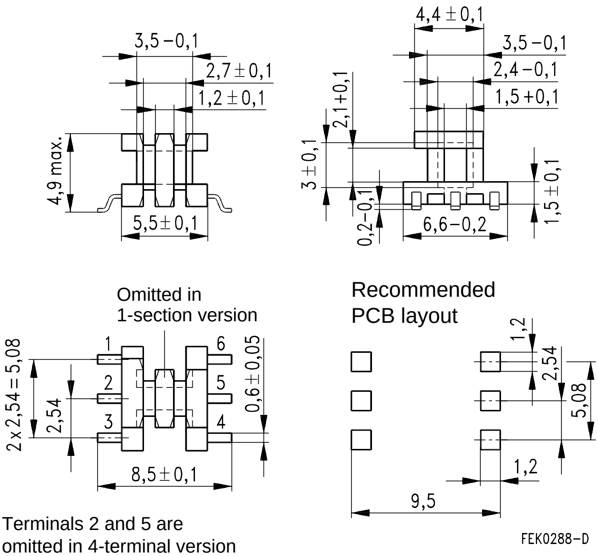
Plastic cover cap

Used to protect the transformer against external influences, for stamping and for improved processing on assembly machines

Material: see coil former, color code white

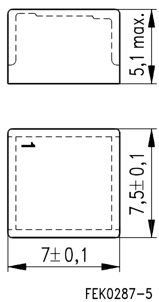
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	
1	1,62	12,8	272	4	B66301-B1004-T1
				6	B66301-B1006-T1
2	0,9	12,8	490	4	B66301-B1004-T2
				6	B66301-B1006-T2
Plastic cover cap					B66301-C2000

Coil former

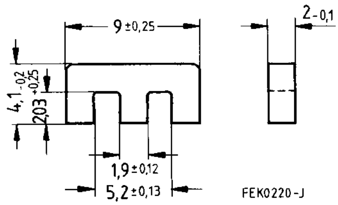


Terminals 2 and 5 are omitted in 4-terminal version

Plastic cover cap



- In accordance with IEC 61246
- For miniature transformers, e.g. DC/DC converters for surface mounting
- Available with SMD coil former
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 3,1 mm^{-1}
l_e = 15,5 mm
A_e = 5 mm^2
A_{min} = 3,6 mm^2
V_e = 78 mm^3

Approx. weight 0,50 g/set

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1000 + 30/– 20 %	2460			B66302-G-X130
T38	2100 + 40/– 30 %	5170			B66302-G-X138
N67	550 + 30/– 20 %	1350	400	0,04 (200 mT, 100 kHz, 100 ˚C)	B66302-G-X167

The A_L value in the table applies to a core set comprising two ungapped cores.

SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black

Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s

Winding: see page 160

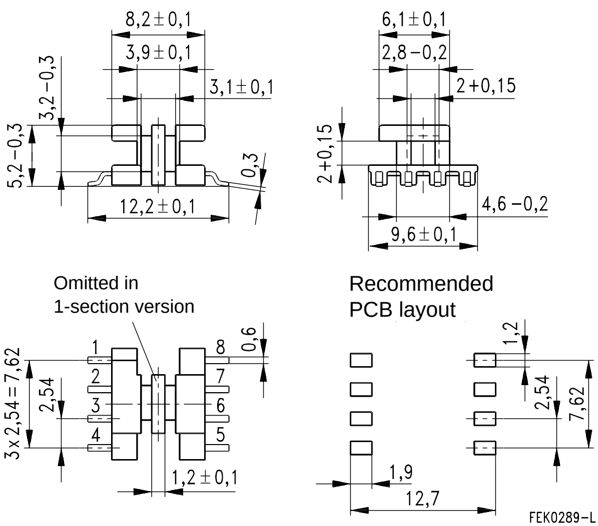
Plastic cover cap

Used to protect the transformer against external influences, for stamping and for improved processing on assembly machines

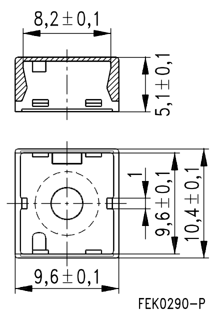
Material: GFR polyamide (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code white

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	2,7	14,9	190	8	B66302-D1008-T1
2	1,7	14,9	302	8	B66302-D1008-T2
Plastic cover cap					B66302-A2000

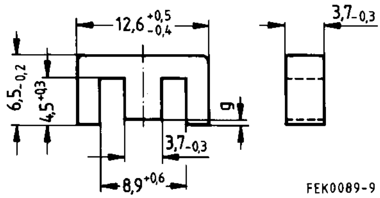
Coil former



Plastic cover cap



- In accordance with IEC 61246
- For miniature transformers
- Available with SMD coil former
- E cores with high permeability for common-mode chokes and broadband applications
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 2,39 mm^{-1}
l_e = 29,6 mm
A_e = 12,4 mm^2
A_{min} = 12,2 mm^2
V_e = 367 mm^3

Approx. weight 2 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1000 + 30/– 20 %	1900			B66305-G-X130
N27	800 + 30/– 20 %	1510	530	0,40 (200 mT, 100 kHz, 100 ˚C)	B66305-G-X127
N67	830 + 30/– 20 %	1570	530	0,25 (200 mT, 100 kHz, 100 ˚C)	B66305-G-X167
T42	3600 ± 30 %	6830			B66305-F-X142

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,04 ± 0,01	250	454	B66305-G40-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	28,4	– 0,676	36,5	– 0,847	33,2	– 0,865
N67	28,4	– 0,676	36,0	– 0,820	32,9	– 0,881

Validity range: *K1*, *K2*: 0,03 mm < s < 1,00 mm
K3, *K4*: 30 nH < A_L < 260 nH

Coil former (magnetic axis horizontal or vertical)

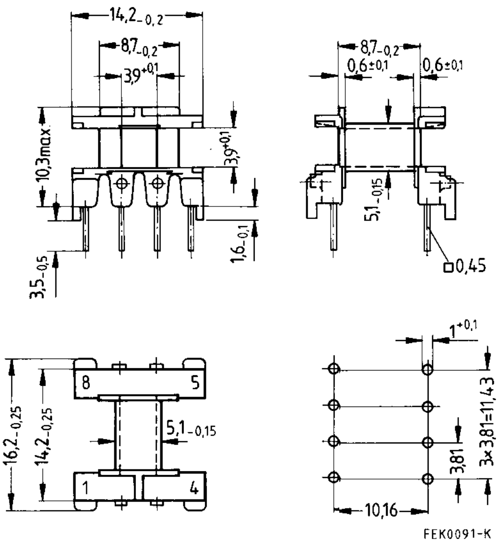
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159
Squared pins

Yoke

Material: Stainless spring steel (0,2 mm)

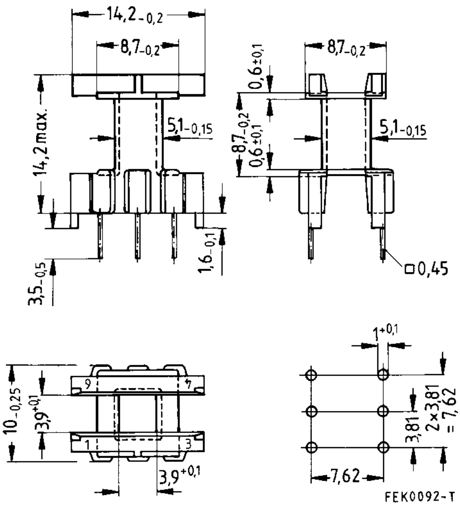
Coil former						Ordering code
Figure	Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	1	11,6	27,2	80,6	8	B66202-A1108-T1
2	1	11,6	27,2	80,6	6	B66202-J1106-T1
Yoke (ordering code per piece, 2 are required)						B66202-A2010

Figure 1, horizontal version



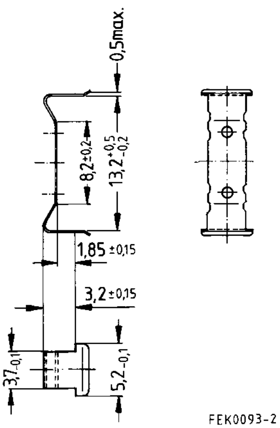
Hole arrangement
View in mounting direction

Figure 2, vertical version



Hole arrangement
View in mounting direction

Yoke



SMD coil former with gullwing terminals

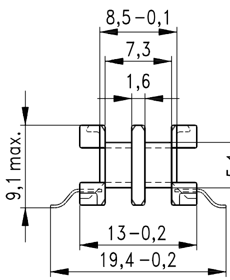
Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

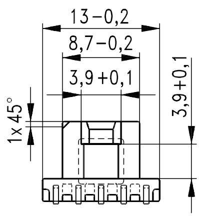
Cover plate

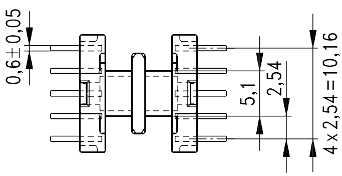
- For stamping and for improved processing on assembly machines
- See under coil former for material and resistance to soldering heat

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	13,0	27	71	10	B66306-C1010-T1
2	10,2	27	91	10	B66306-C1010-T2
Cover plate					B66414-A7000

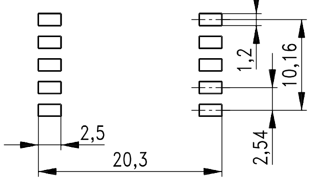
Coil former





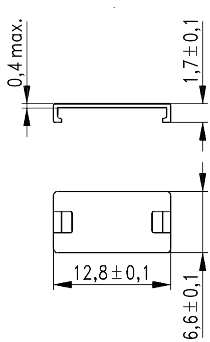


Recommended PCB layout

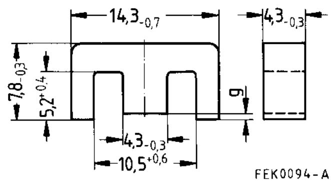


FEK0291-X

Cover plate



FEK0260-3



- E cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 2,19 mm^{-1}
l_e = 33,9 mm
A_e = 15,5 mm^2
A_{min} = 13,1 mm^2
V_e = 525 mm^3

Approx. weight 2,8 g/set

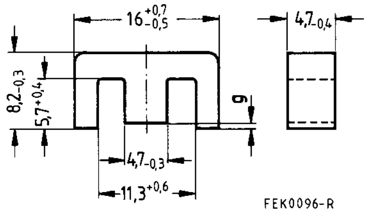
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1250 + 30/– 20 %	2170			B66219-G-X130
N27	860 + 30/– 20 %	1490	570	0,11 (200 mT, 25 kHz, 100 °C)	B66219-G-X127
N41	1050 + 30/– 20 %	1820	630	0,11 (200 mT, 25 kHz, 100 °C)	B66219-G-X141

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	36,8	– 0,712	44,6	– 0,847	40,8	– 0,865

Validity range: *K1*, *K2*: 0,03 mm < *s* < 1,00 mm
K3, *K4*: 30 nH < A_L < 260 nH



- In accordance with IEC 61246
- E cores with high permeability for common-mode chokes and broadband applications
- E cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,87 mm^{-1}
l_e = 37,6 mm
A_e = 20,1 mm^2
A_{min} = 19,4 mm^2
V_e = 756 mm^3

Approx. weight 3,6 g/set

Ungapped

Material	A_L-Wert nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1400 + 30/– 20 %	2080			B66307-G-X130
N27	950 + 30/– 20 %	1410	670	0,14 (200 mT, 25 kHz, 100 ˚C)	B66307-G-X127
N67	990 + 30/– 20 %	1470	670	0,45 (200 mT, 100 kHz, 100 ˚C)	B66307-G-X167
T42	5100 ± 30 %	7570			B66307-F-X142

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,06 ± 0,01	303	450	B66307-G60-X127
	0,10 ± 0,02	212	315	B66307-G100-X127
	0,50 ± 0,05	69	102	B66307-G500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	42,2	– 0,701	57,0	– 0,847	52,1	– 0,865
N67	42,2	– 0,701	55,9	– 0,820	51,8	– 0,881

Validity range: *K1*, *K2*: 0,05 mm < s < 1,50 mm
K3, *K4*: 30 nH < A_L < 330 nH

Coil former (magnetic axis horizontal or vertical)

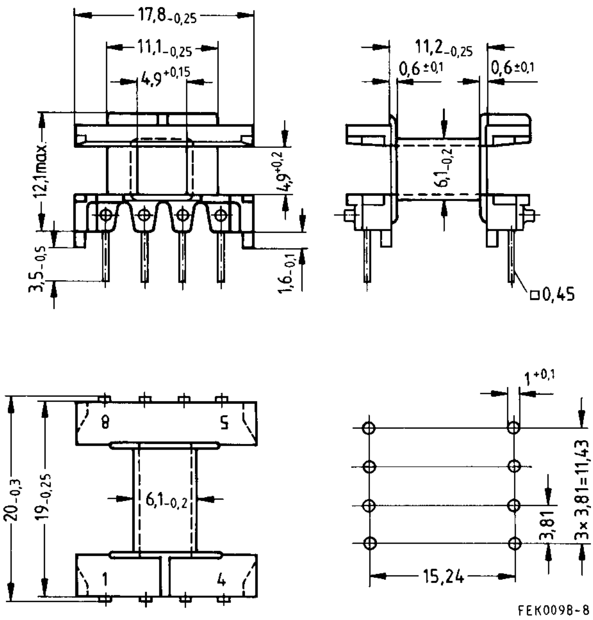
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 159
Squared pins

Yoke

Material: Stainless spring steel (0,2 mm)

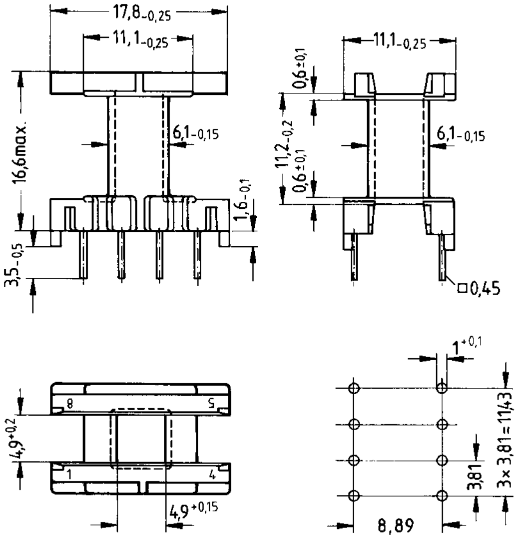
Coil former						Ordering code
Figure	Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	1	22,3	34	52,4	8	B66308-A1108-T1
2	1	22,3	34	52,4	8	B66308-J1108-T1
Yoke (ordering code per piece, 2 are required)						B66308-A2010

Figure 1, horizontal version



Hole arrangement
View in mounting direction

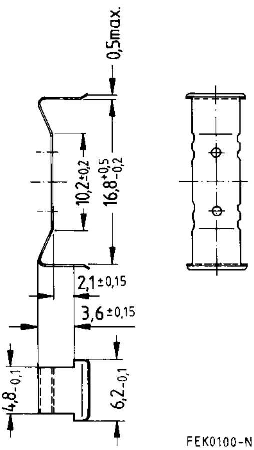
Figure 2, vertical version



Hole arrangement
View in mounting direction

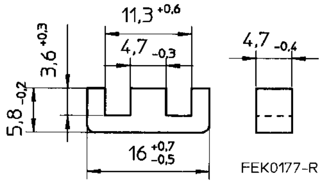
FEK0099-G

Yoke



FEK0100-N

- Shortened leg compared with E 16/8/5
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,49 mm^{-1}
l_e = 28,6 mm
A_e = 19,2 mm^2
A_{min} = 17,6 mm^2
V_e = 549 mm^3

Approx. weight 3 g/set

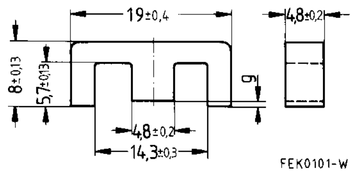
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	1100 + 30/– 20 %	1300	850	0,10 (200 mT, 25 kHz, 100 °C)	B66393-G-X127

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	42,0	– 0,764	56,7	– 0,847	51,7	– 0,865

Validity range: *K1*, *K2*: 0,05 mm < *s* < 1,50 mm
K3, *K4*: 40 nH < A_L < 430 nH



- Size based on US lam. size E cores
  US designation E 187
- E cores with high permeability for common-mode chokes and broadband applications
- E cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,76 mm^{-1}
l_e = 39,6 mm
A_e = 22,5 mm^2
A_{min} = 22,1 mm^2
V_e = 891 mm^3

Approx. weight 4,4 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1700 + 30/– 20 %	2380			B66379-G-X130
N27	1050 + 30/– 20 %	1470	720	0,18 (200 mT, 25 kHz, 100˚C)	B66379-G-X127
N67	1100 + 30/– 20 %	1540	720	0,55 (200 mT, 100 kHz, 100˚C)	B66379-G-X167
T42	5800 ± 30 %	8100			B66379-F-X142

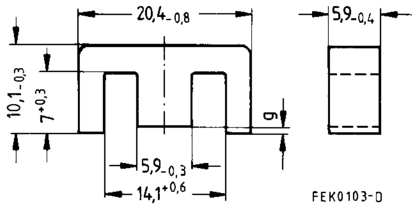
Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	46,4	– 0,697	63,3	– 0,847	57,9	– 0,865
N67	46,4	– 0,697	61,9	– 0,820	57,6	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 40 nH < A_L < 350 nH

E 20/10/6 (EF 20)
Core
B66311

- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,44 mm^{-1}
l_e = 46,3 mm
A_e = 32,1 mm^2
A_{min} = 31,9 mm^2
V_e = 1 490 mm^3

Approx. weight 7,3 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	2150 + 30/– 20 %	2460			B66311-G-X130
N27	1300 + 30/– 20 %	1490	1090	0,27 (200 mT, 25 kHz, 100 °C)	B66311-G-X127
N67	1350 + 30/– 20 %	1540	1090	0,92 (200 mT, 100 kHz, 100 °C)	B66311-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67)
N27,	0,09 ± 0,01	363	415	B66311-G90-X1**
N67	0,17 ± 0,02	227	259	B66311-G170-X1**
	0,25 ± 0,02	171	195	B66311-G250-X1**
	0,50 ± 0,05	103	118	B66311-G500-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	61,6	– 0,737	88,1	– 0,847	80,9	– 0,865
N67	61,6	– 0,737	85,9	– 0,820	80,9	– 0,881

Validity range: *K1*, *K2*: 0,05 mm < s < 1,50 mm
K3, *K4*: 50 nH < A_L < 430 nH

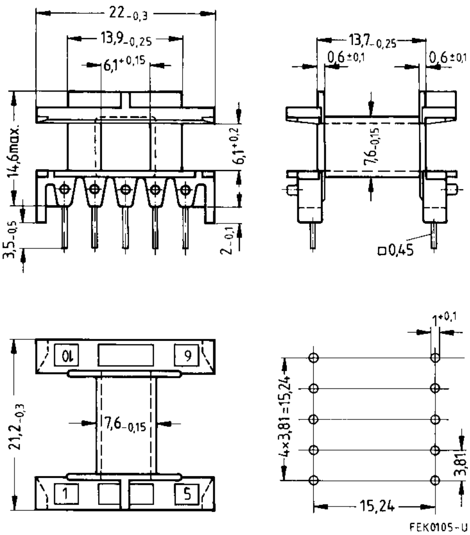
Coil former (magnetic axis horizontal or vertical)

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 159
Squared pins

For matching yoke see next page

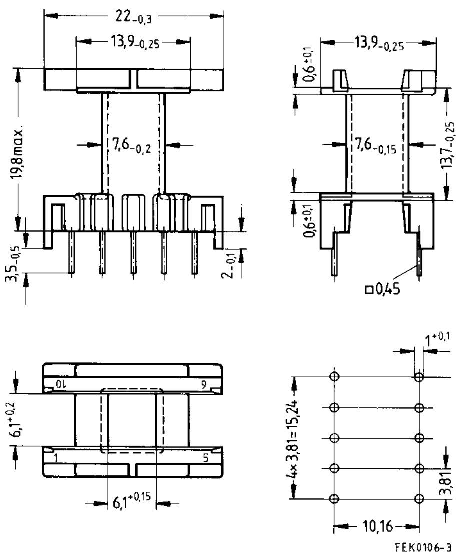
Figure	Sections	A_N mm²	l_N mm	A_R value μΩ	Pins	Ordering code
1	1	34	41,2	42	10	B66206-A1110-T1
2	1	34	41,2	42	10	B66206-J1110-T1

Figure 1, horizontal version



Hole arrangement
View in mounting
direction

Figure 2, vertical version



Hole arrangement
View in mounting
direction

Coil former (with right-angle pins)

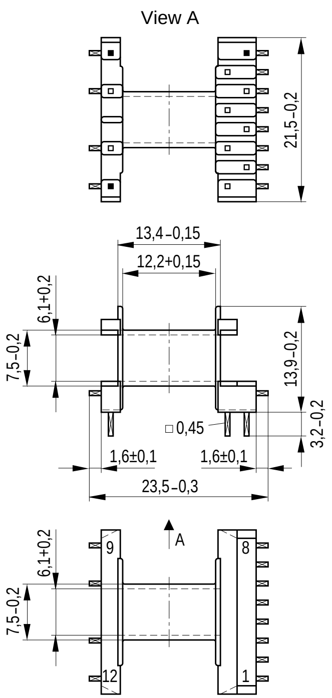
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235°C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 159
Squared pins

Yoke

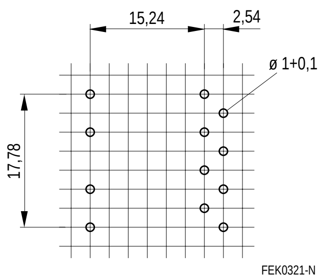
Material: Stainless spring steel (0,2 mm)

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	34	41,2	42	12	B66206-C1012-T1
1	34	41,2	42	14	on request
Yoke (ordering code per piece, 2 are required)					B66206-A2010

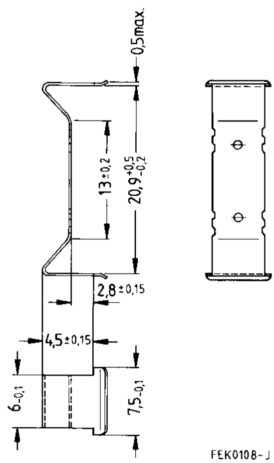
Coil former



Hole arrangement
View in
mounting direction



Yoke



Coil former for luminaires

- Also to be used without clamps

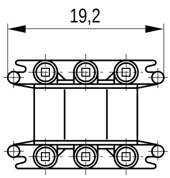
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159
Squared pins

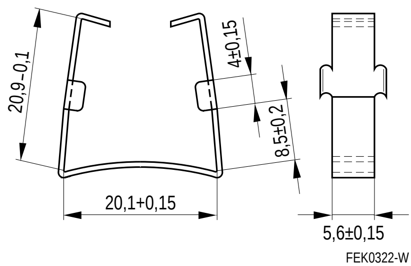
Yoke

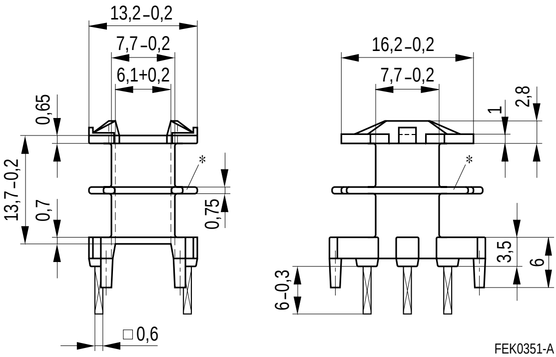
Material: Nickel silver (0,3 mm)

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	32,7	42,3	44,5	6	B66206-J1106-T1
2	30,7	42,3	34,4	6	B66206-J1106-T2
Yoke					B66206-A2001

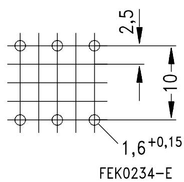
Coil former **Yoke**





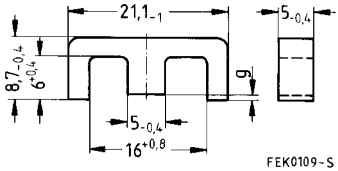


Hole arrangement
View in mounting direction



* Omitted for one-section version. Where nothing is specified the tolerances are ± 0,1 mm.

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 2,01 mm^{-1}
l_e = 43,4 mm
A_e = 21,6 mm^2
A_{min} = 20,2 mm^2
V_e = 937 mm^3

Approx. weight 4,8 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	1500 + 30/– 20 %	2390			B66314-G-X130
N27	900 + 30/– 20 %	1440	630	0,18 (200 mT, 25 kHz, 100 °C)	B66314-G-X127

Calculation factors (see page 423 for formulas)

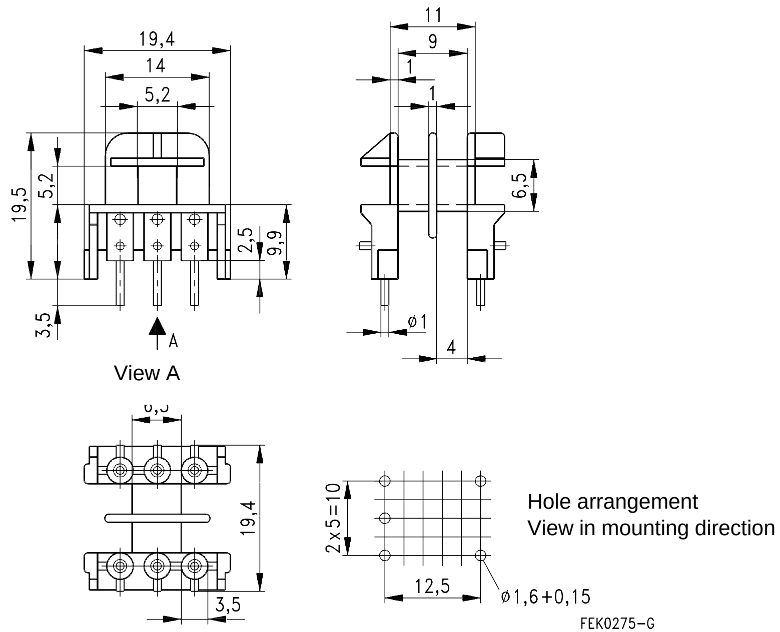
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	47,4	– 0,682	59,9	– 0,847	54,9	– 0,865

Validity range: *K1*, *K2*: 0,05 mm < *s* < 1,50 mm
K3, *K4*: 30 nH < A_L < 310 nH

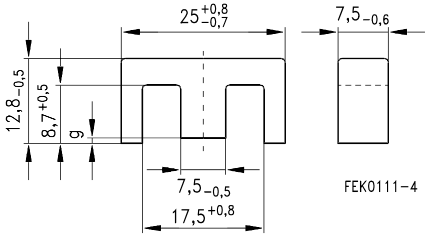
Coil former (magnetic axis horizontal)

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
2	30	41	47	5	B66314-Z1005-T2



- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,1 mm^{-1}
l_e = 57,5 mm
A_e = 52,5 mm^2
A_{min} = 51,5 mm^2
V_e = 3 020 mm^3

Approx. weight 16 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	2900 + 30/– 20 %	2530			B66317-G-X130
N27	1750 + 30/– 20 %	1520	1440	0,59 (200 mT, 25 kHz, 100 ˚C)	B66317-G-X127
N67	1800 + 30/– 20 %	1570	1440	2,00 (200 mT, 100 kHz, 100 ˚C)	B66317-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67)
N27,	0,10 ± 0,02	489	425	B66317-G100-X1**
N67	0,16 ± 0,02	347	302	B66317-G160-X1**
	0,25 ± 0,02	250	218	B66317-G250-X1**
	0,50 ± 0,05	151	131	B66317-G500-X1**
	1,00 ± 0,05	91	79	B66317-G1000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	90	– 0,731	139	– 0,847	129	– 0,865
N67	90	– 0,731	135	– 0,820	129	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,00 mm
K3, *K4*: 60 nH < A_L < 570 nH

Coil former (magnetic axis horizontal or vertical)

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 159
Squared pins
Material: Stainless spring steel (0,25 mm)

Coil former						Ordering code
Figure	Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	1	61	50	28	10	B66208-A1110-T1
2	1	61	50	28	10	B66208-J1110-T1
Yoke (ordering code per piece, 2 are required)						B66208-A2010

Figure 1, horizontal version

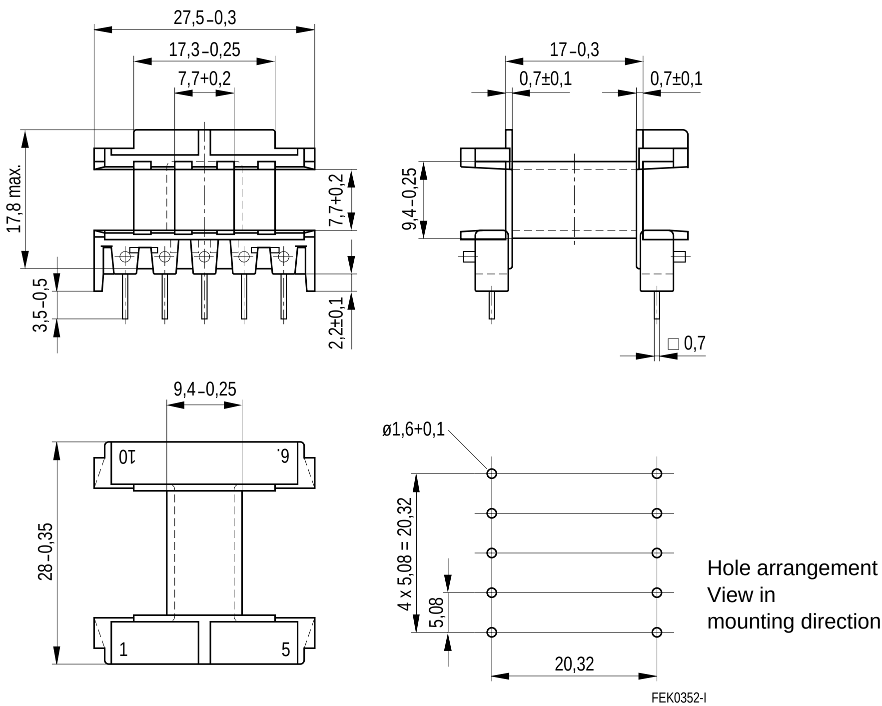
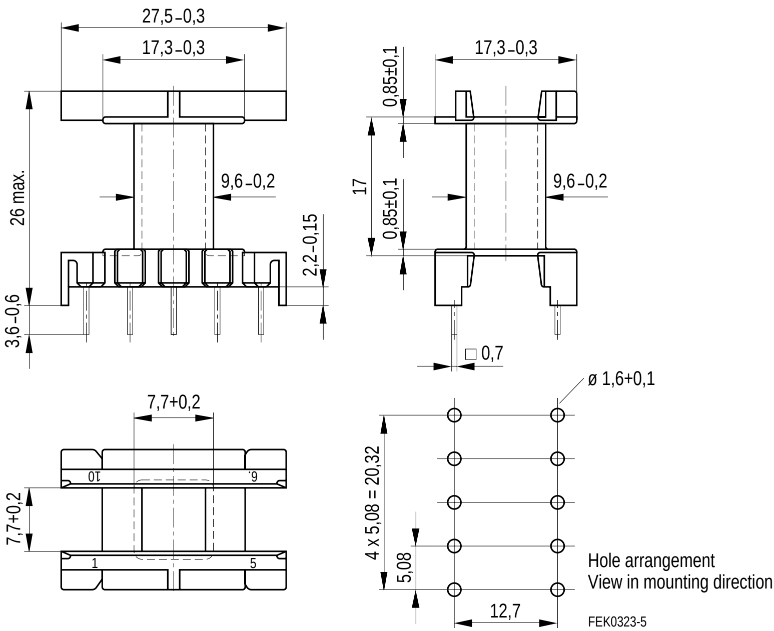
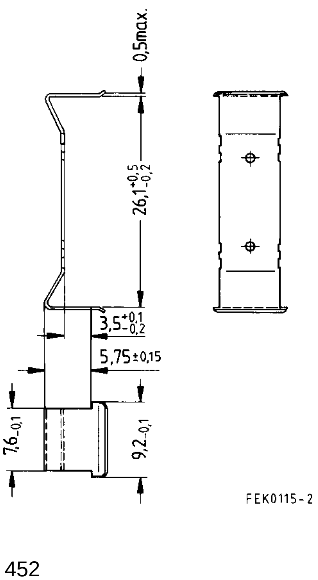


Figure 2, vertical version



Yoke



Coil former for SMPS transformers with line isolation

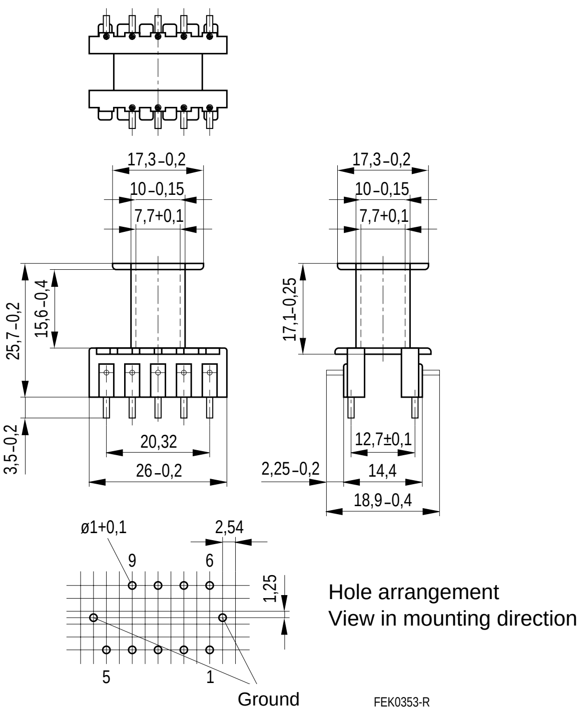
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 159
Squared pins

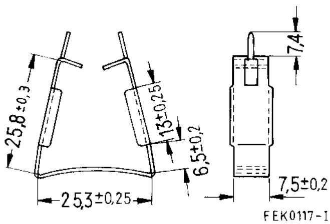
Yoke

Material: Nickel silver (0,3 mm) with ground terminal

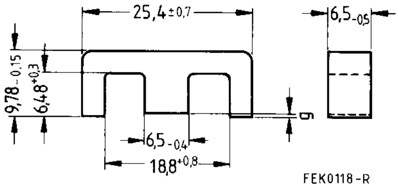
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	56	52	32	9	B66208-J1009-T1
Yoke (ordering code per piece, 2 piece required)					B66208-A2003

Coil former **Yoke**





- Size based on US lam. size E cores
  US designation E2425
- E cores with high permeability for common-mode chokes and broadband applications
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,27 mm^{-1}
l_e = 49,2 mm
A_e = 38,8 mm^2
A_{min} = 38,4 mm^2
V_e = 1 910 mm^3

Approx. weight 9,6 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	2700 + 30/– 20 %	2720			B66315-G-X130
N27	1500 + 30/– 20 %	1510	1240	0,36 (200 mT, 25 kHz, 100 ˚C)	B66315-G-X127
T42	8500 ± 30 %	8570			B66315-F-X142

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	122	123	B66315-G500-X127

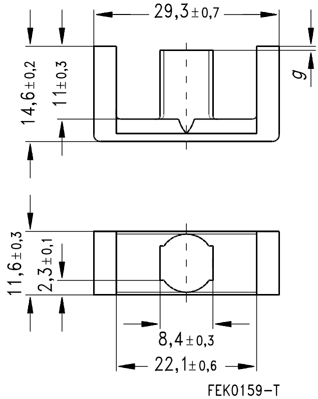
The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	75	– 0,707	106	– 0,847	97	– 0,865
N67	75	– 0,707	103	– 0,820	97	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,00 mm
K3, *K4*: 50 nH < A_L < 500 nH

- E core with flat, rounded center leg
- Compact winding design with low leakage inductance
- ED cores are supplied as pieces



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,84 mm^{-1}
l_e = 69,5 mm
A_e = 83 mm^2
A_{min} = 82,1 mm^2
V_e = 5 770 mm^3

Approx. weight 29 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code	PU Pcs
N27	2200 + 30/– 20 %	1460	1880	1,10 (200 mT, 25 kHz, 100 °C)	B66407-G-X127	585

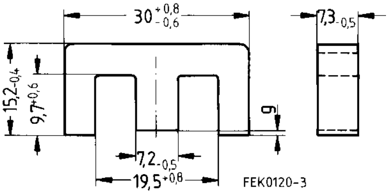
Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	138	– 0,731	214	– 0,847	198	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 80 nH < A_L < 750 nH

E 30/15/7
Core **B66319**

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,12 mm^{-1}
l_e = 67 mm
A_e = 60 mm^2
A_{min} = 49 mm^2
V_e = 4 000 mm^3

Approx. weight 22 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	3100 + 30/– 20 %	2760			B66319-G-X130
N27	1700 + 30/– 20 %	1510	1410	0,81 (200 mT, 25 kHz, 100˚C)	B66319-G-X127
N67	1850 + 30/– 20 %	1640	1410	2,75 (200 mT, 100 kHz, 100˚C)	B66319-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67)
N27,	0,10 ± 0,02	460	410	B66319-G100-X1**
N67	0,18 ± 0,02	300	265	B66319-G180-X1**
	0,34 ± 0,02	195	175	B66319-G340-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

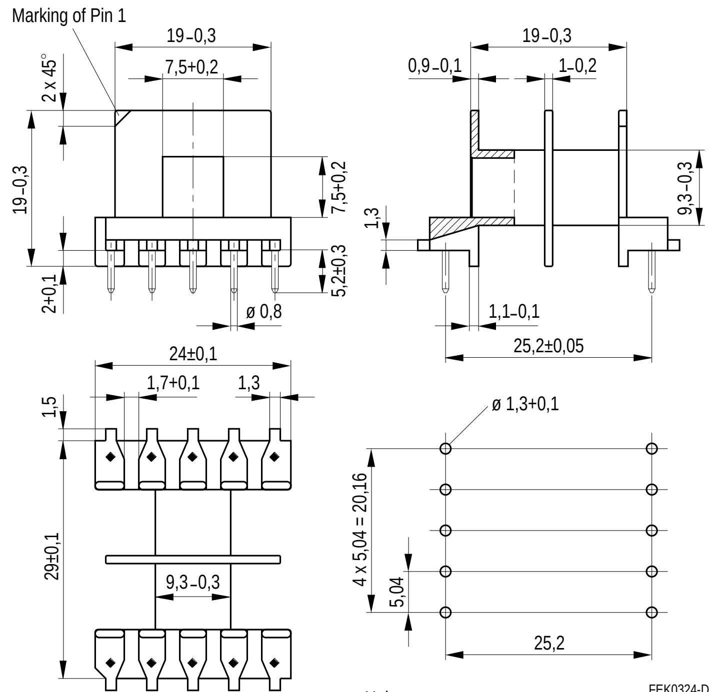
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	90	– 0,708	156	– 0,847	144	– 0,865
N67	90	– 0,708	150	– 0,820	144	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,00 mm
K3, *K4*: 560 nH < A_L < 60 nH

Coil former

Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5s
Winding: see page 159
Squared pins

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	83	56	23	10	B66232-B1010-D1
2	78	56	24	10	B66232-B1010-D2



Hole arrangement
View in mounting direction

Coil former (magnetic axis horizontal or vertical)

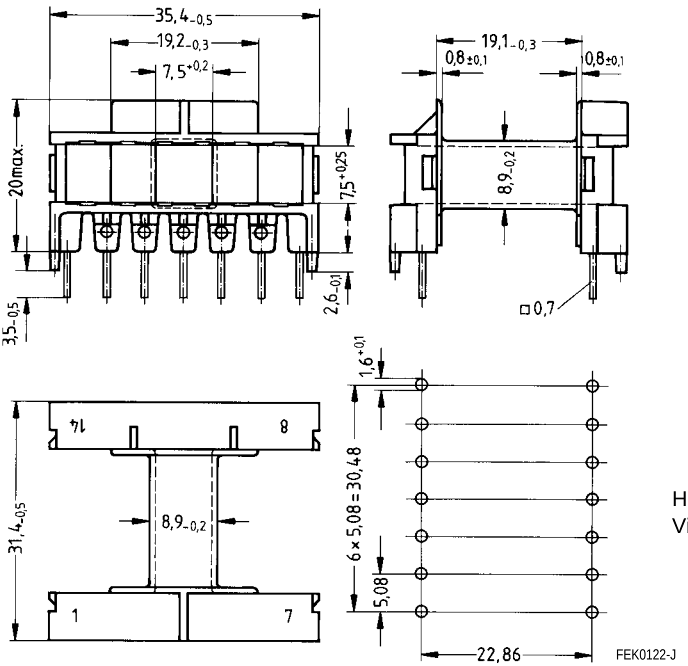
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5s
Winding: see page 159
Squared pins

Yoke

Material: Stainless spring steel (0,4 mm)

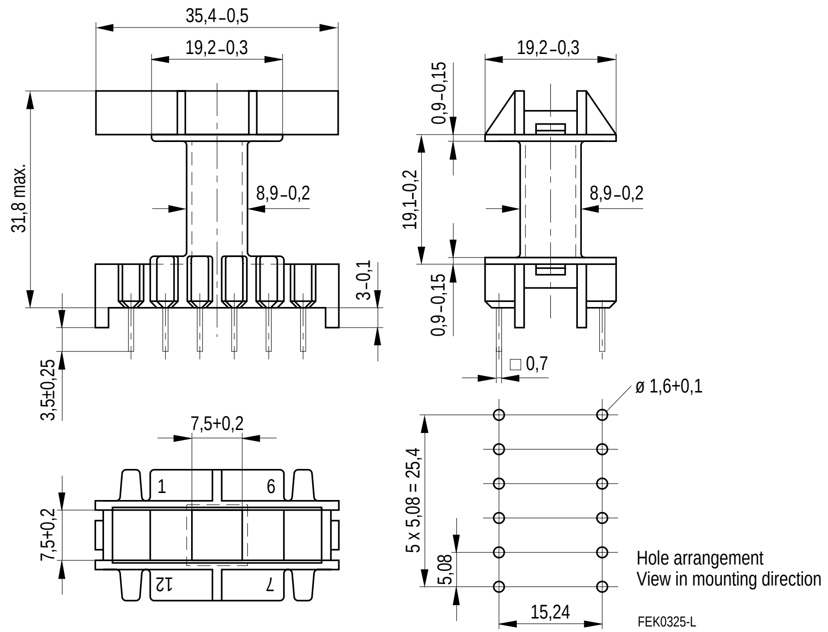
Coil former						Ordering code
Figure	Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	1	90	56	21	14	B66232-A1114-T1
2	1	90	56	21	12	B66232-J1112-T1
Yoke (ordering code per piece, 2 are required)						B66232-A2010

Figure 1, horizontal version

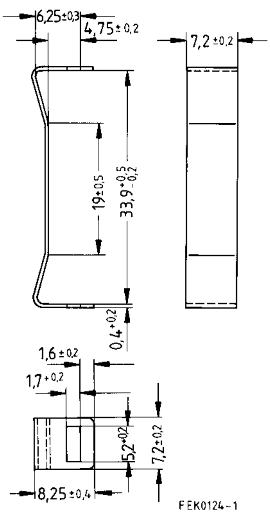


Hole arrangement
View in mounting direction

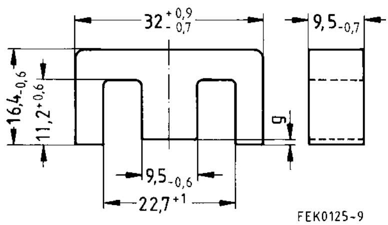
Figure 2, vertical version



Yoke



- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,89 mm^{-1}
l_e = 74 mm
A_e = 83 mm^2
A_{min} = 81,4 mm^2
V_e = 6 140 mm^3

Approx. weight 30 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N30	3800 + 30/– 20 %	2690			B66229-G-X130
N27	2100 + 30/– 20 %	1480	1770	1,10 (200 mT, 25 kHz, 100 ˚C)	B66229-G-X127
N67	2250 + 30/– 20 %	1590	1770	3,75 (200 mT, 100 kHz, 100 ˚C)	B66229-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67)
N27,	0,50 ± 0,05	244	172	B66229-G500-X1**
N67	1,00 ± 0,05	145	103	B66229-G1000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	145	– 0,748	212	– 0,847	196	– 0,865
N67	145	– 0,748	204	– 0,820	197	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 70 nH < A_L < 710 nH

Coil former

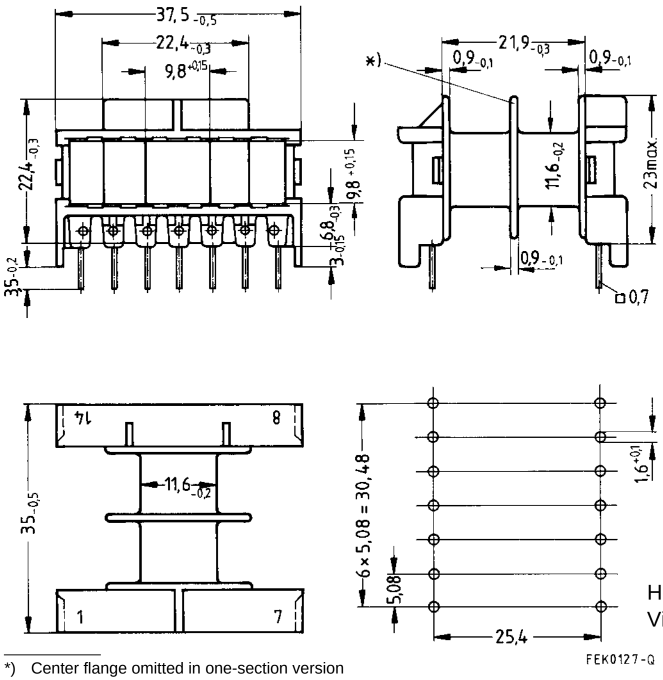
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159
Squared pins

Yoke

Material: Stainless spring steel (0,4 mm)

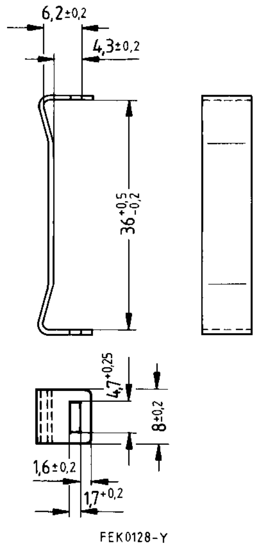
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	108,50	64,4	20,42	14	B66230-A1114-T1
2	103,64	64,4	21,38	14	B66230-A1114-T2
Yoke (ordering code per piece, 2 are required)					B66230-A2010

Coil former



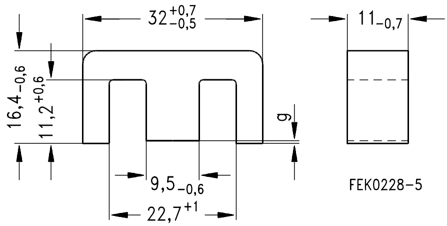
Hole arrangement
View in mounting direction

Yoke



*) Center flange omitted in one-section version

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,76 mm^{-1}
l_e = 74 mm
A_e = 97 mm^2
A_{min} = 95 mm^2
V_e = 7 187 mm^3

Approx. weight 37 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	2800 + 30/– 20 %	1690	2050	4,65 (200 mT, 100 kHz, 100 °C)	B66233-G-X167

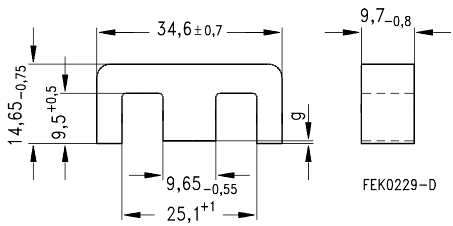
Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N67	165	– 0,711	239	– 0,820	231	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 90 nH < A_L < 800 nH

E 34/14/9
Core B66370

- Size based on US lam. size E cores
  US designation E375
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,82 mm^{-1}
l_e = 69,6 mm
A_e = 84,8 mm^2
A_{min} = 83,2 mm^2
V_e = 5 900 mm^3

Approx. weight 30 g/set

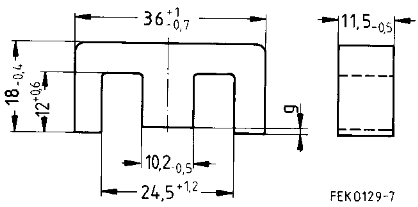
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2300 + 30/– 20 %	1498	1929	1,10 (200 mT, 25 kHz, 100 °C)	B66370-G-X127

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	146	– 0,719	219	– 0,847	202	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,50 mm
K3, *K4*: 80 nH < A_L < 770 nH



- E cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,68 mm^{-1}
l_e = 81 mm
A_e = 120 mm^2
A_{min} = 112 mm^2
V_e = 9 670 mm^3

Approx. weight 50 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2900 + 30/– 20 %	1550	2330	1,85 (200 mT, 25 kHz, 100 ˚C)	B66389-G-X127
N67	3000 + 30/– 20 %	1600	2330	6,25 (200 mT, 100 kHz, 100 ˚C)	B66389-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	1,00 ± 0,05	183	96	B66389-G1000-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

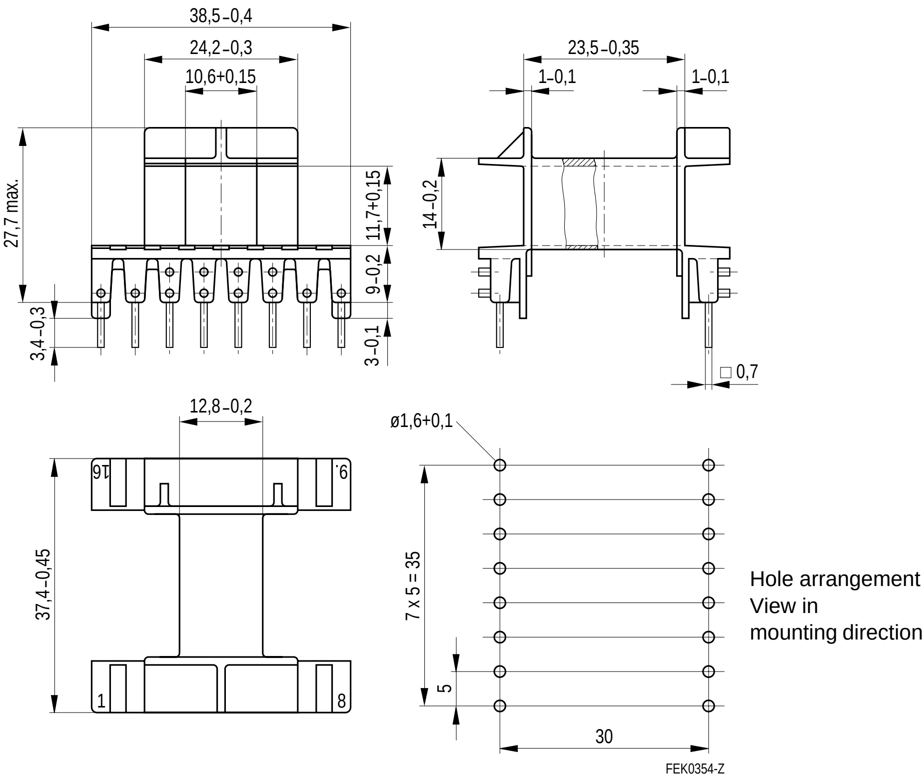
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	182	– 0,749	302	– 0,847	280	– 0,865
N67	182	– 0,749	290	– 0,820	282	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 100 nH < A_L < 930 nH

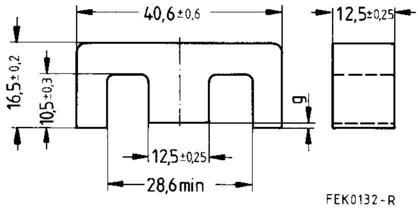
Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159
Squared pins

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	122,55	76,4	21,45	16	B66390-A1016-T1



- Size based on US lam. size E cores
  US designation E 21
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,52 mm^{-1}
l_e = 77 mm
A_e = 149 mm^2
A_{min} = 143 mm^2
V_e = 11 500 mm^3

Approx. weight 58 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3800 + 30/– 20 %	1560	3050	2,15 (200 mT, 25 kHz, 100 °C)	B66381-G-X127
N67	4000 + 30/– 20 %	1640	3050	7,25 (200 mT, 100 kHz, 100 °C)	B66381-G-X167
N72	4600 + 30/– 20 %	1900	3150	1,12 (200 mT, 25 kHz, 100 °C)	B66381-G-X172

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	411	166	B66381-G500-X127

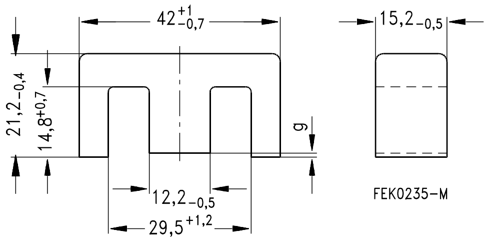
The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	239	– 0,782	378	– 0,847	351	– 0,865
N67	239	– 0,782	364	– 0,820	352	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 130 nH < A_L < 1200 nH

- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,54 mm^{-1}
l_e = 97 mm
A_e = 178 mm^2
A_{min} = 175 mm^2
V_e = 17 300 mm^3

Approx. weight 88 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3500 + 30/– 20 %	1510	2900	3,30 (200 mT, 25 kHz, 100˚C)	B66325-G-X127
N67	3800 + 30/– 20 %	1640	2900	11,00 (200 mT, 100 kHz, 100˚C)	B66325-G-X167
N87	3950 + 30/– 20 %	1690	2900	9,00 (200 mT, 100 kHz, 100˚C)	B66325-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,10 ± 0,02	1497	647	B66325-G100-X127
	0,25 ± 0,02	759	328	B66325-G250-X127
	0,50 ± 0,05	454	196	B66325-G500-X127
	0,64 ± 0,05	378	164	B66325-G640-X127
	1,00 ± 0,05	272	118	B66325-G1000-X127
	1,50 ± 0,05	201	87	B66325-G1500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

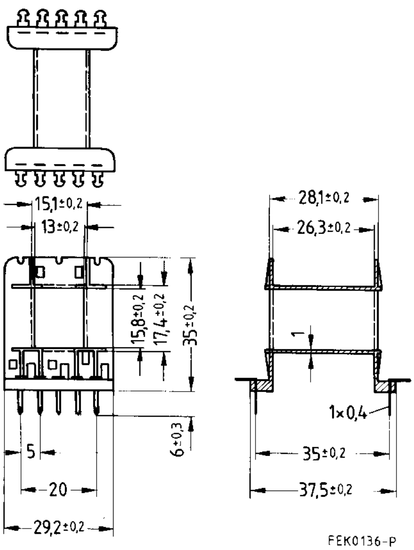
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	272	– 0,741	436	– 0,847	406	– 0,865
N67	272	– 0,741	417	– 0,820	410	– 0,881

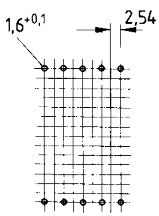
Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 1210 nH < A_L < 130 nH

Coil former

Material: GFR 6-polyamide (UL 94 HB, insulation class to IEC 60085:
B ≙ max. operating temperature 130 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159

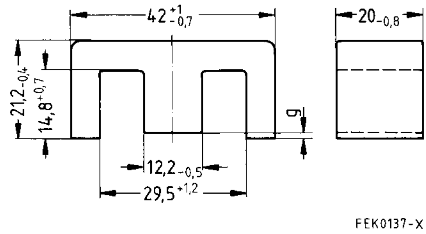
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	177	87	17	10	B66242-J1000-R1





Hole arrangement
View in mounting direction

- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,41 mm^{-1}
l_e = 97 mm
A_e = 234 mm^2
A_{min} = 229 mm^2
V_e = 22 700 mm^3

Approx. weight 116 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	4750 + 30/– 20 %	1560	3800	4,40 (200 mT, 25 kHz, 100 °C)	B66329-G-X127
N67	5100 + 30/– 20 %	1680	3800	14,50 (200 mT, 100 kHz, 100 °C)	B66329-G-X167
N87	5200 + 30/– 20 %	1690	3800	12,00 (200 mT, 100 kHz, 100 °C)	B66329-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,25 ± 0,02	1029	338	B66329-G250-X127
	0,50 ± 0,05	603	198	B66329-G500-X127
	1,00 ± 0,05	354	116	B66329-G1000-X127
	1,50 ± 0,05	259	85	B66329-G1500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

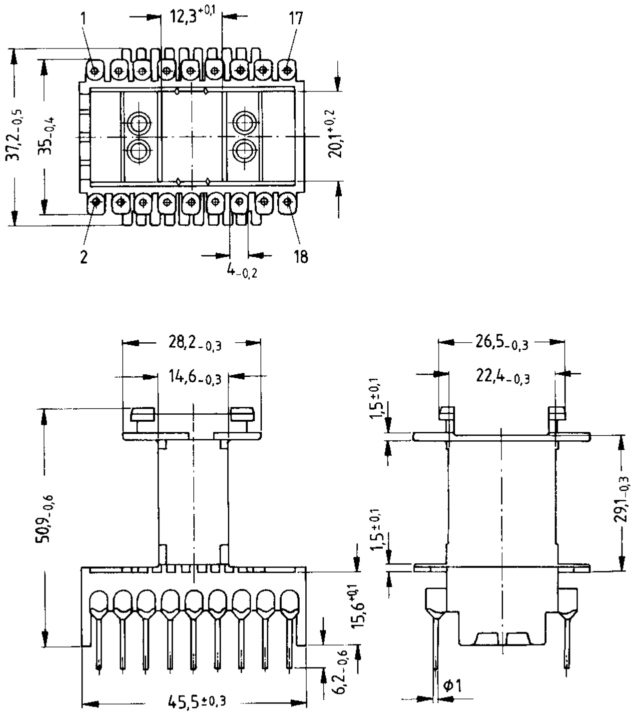
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	354	– 0,770	574	– 0,847	534	– 0,865
N67	354	– 0,770	548	– 0,820	538	– 0,881

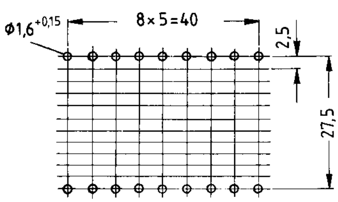
Validity range: *K1*, *K2*: 0,10 mm < s < 3,00 mm
K3, *K4*: 160 nH < A_L < 1500 nH

Coil former

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 159

Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	172	100	20	18	B66243-A1018-T1





Hole arrangement
View in mounting direction

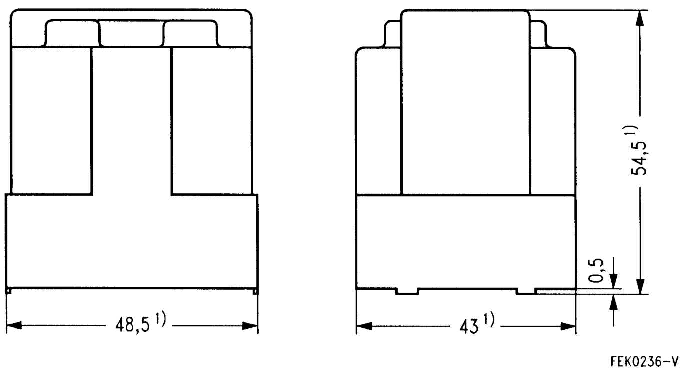
FEK0139-E

Case

- Used to protect the transformer against external influences, and for stamping

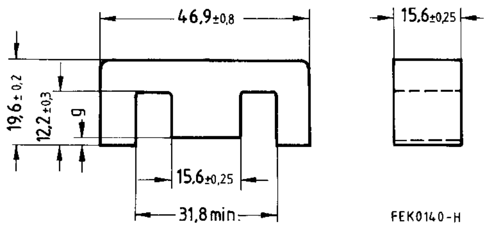
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code blue

	Ordering code
Case	B66243-A2001-T



1) Maximum dimension

- Size based on US lam. size E cores
  US designation E 625
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,38 mm^{-1}
l_e = 89 mm
A_e = 233 mm^2
A_{min} = 226 mm^2
V_e = 20 700 mm^3

Approx. weight 106 g/set

Ungapped

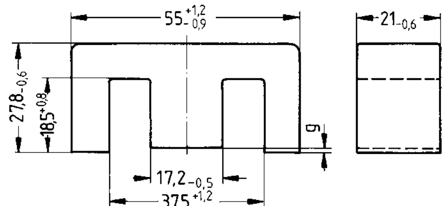
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	5100 + 30/– 20 %	1550	4120	3,95 (200 mT, 25 kHz, 100 ˚C)	B66383-G-X127
N67	5400 + 30/– 20 %	1640	4120	13,30 (200 mT, 100 kHz, 100 ˚C)	B66383-G-X167

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	364	– 0,773	579	– 0,847	538	– 0,865
N67	364	– 0,773	554	– 0,820	542	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < *s* < 3,00 mm
K3, *K4*: 170 nH < A_L < 1640 nH

- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,35 mm^{-1}
l_e = 124 mm
A_e = 354 mm^2
A_{min} = 351 mm^2
V_e = 43 900 mm^3

Approx. weight 215 g/set

Ungapped

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	5800 + 30/– 20 %	1610	4500	8,00 (200 mT, 25 kHz, 100°C)	B66335-G-X127
N67	6400 + 30/– 20 %	1780	4500	4,30 (100 mT, 100 kHz, 100°C)	B66335-G-X167
N87	6400 + 30/– 20 %	1780	4500	21,50 (200 mT, 100 kHz, 100°C)	B66335-G-X187

Gapped

Mate-rial	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,50 ± 0,05	843	234	B66335-G500-X1**
N67,	1,00 ± 0,05	496	138	B66335-G1000-X1**
N87	1,50 ± 0,05	364	101	B66335-G1500-X1**
	2,00 ± 0,05	292	81	B66335-G2000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

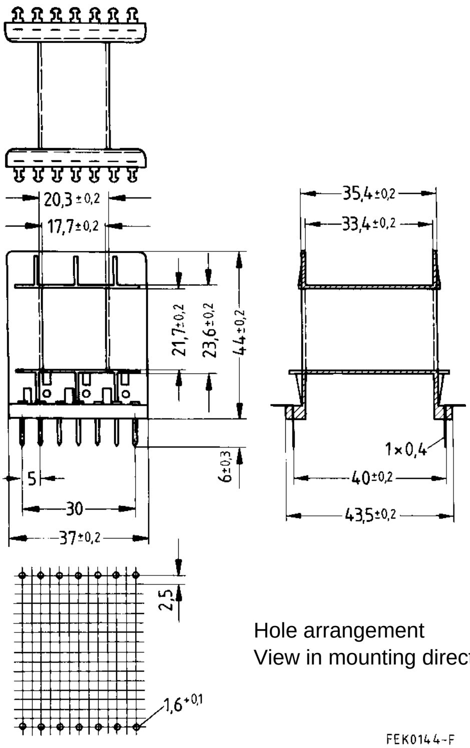
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	496	– 0,764	836	– 0,847	781	– 0,865
N67	496	– 0,764	794	– 0,82	791	– 0,881
N87	496	– 0,764	800	– 0,796	765	– 0,873

Validity range: *K1*, *K2*: 0,15 mm < s < 3,50 mm
K3, *K4*: 180 nH < A_L < 1799 nH

Coil former

Material: GFR 6-polyamide (UL 94 HB, insulation class to IEC 60085:
B ≙ max. operating temperature 130 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5s
Winding: see page 159

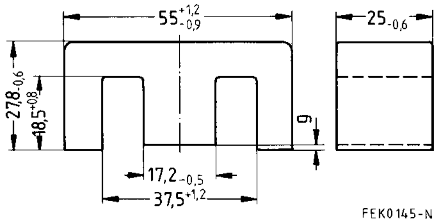
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	280	113	14	14	B66252-B-M1



Hole arrangement
View in mounting direction

FEK0144-F

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,3 mm^{-1}
l_e = 124 mm
A_e = 420 mm^2
A_{min} = 420 mm^2
V_e = 52 100 mm^3

Approx. weight 256 g

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	6800 + 30/– 20 %	1600	5340	9,50 (200 mT, 25 kHz, 100 °C)	B66344-G-X127
N87	7300 + 30/– 20 %	1740	5250	4,80 (100 mT, 100 kHz, 100 °C)	B66344-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	2,50 ± 0,05	295	70	B66344-G2500-X127

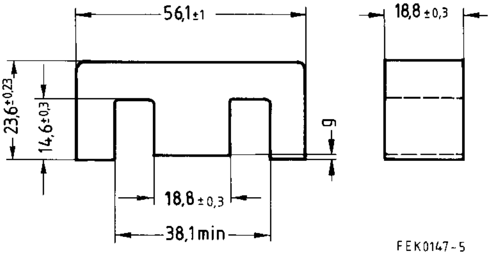
The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	$K1$ (25 °C)	$K2$ (25 °C)	$K3$ (25 °C)	$K4$ (25 °C)	$K3$ (100 °C)	$K4$ (100 °C)
N27	596	– 0,769	992	– 0,847	927	– 0,865

Validity range: $K1$, $K2$: 0,15 mm < s < 3,50 mm
$K3$, $K4$: 220 nH < A_L < 2130 nH

- Size based on US lam. size E cores
  US designation E 75
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,31 mm^{-1}
l_e = 107 mm
A_e = 340 mm^2
A_{min} = 327 mm^2
V_e = 36 400 mm^3

Approx. weight 184 g/set

Ungapped

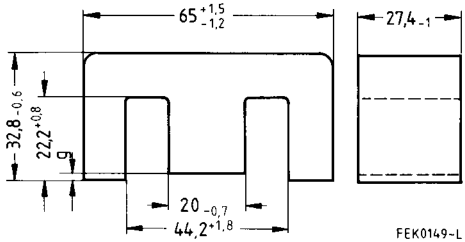
Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	6300 + 30/– 20 %	1570	5000	6,80 (200 mT, 25 kHz, 100 °C)	B66385-G-X127

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	500	– 0,784	821	– 0,847	765	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < s < 3,00 mm
K3, *K4*: 200 nH < A_L < 2000 nH

- In accordance with IEC 61246
- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,27 mm^{-1}
l_e = 147 mm
A_e = 535 mm^2
A_{min} = 529 mm^2
V_e = 78 600 mm^3

Approx. weight 394 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	7200 + 30/– 20 %	1570	5730	14,60 (200 mT, 25 kHz, 100 °C)	B66387-G-X127
N67	7900 + 30/– 20 %	1700	5730	7,90 (100 mT, 100 kHz, 100 °C)	B66387-G-X167
N87	7900 + 30/– 20 %	1700	5730	6,70 (100 mT, 100 kHz, 100 °C)	B66387-G-X187

Gapped

Material	*g* mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,50 ± 0,05	1214	265	B66387-G500-X1**
N67,	1,00 ± 0,05	716	156	B66387-G1000-X1**
N87	1,50 ± 0,05	526	115	B66387-G1500-X1**

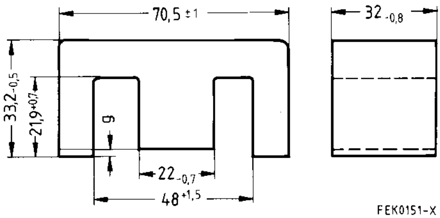
The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	716	– 0,762	1231	– 0,847	1154	– 0,865
N67	716	– 0,762	1163	– 0,82	1172	– 0,881
N87	716	– 0,762	1168	– 0,796	1131	– 0,873

Validity range: *K1*, *K2*: 0,20 mm < s < 5,00 mm
K3, *K4*: 230 nH < A_L < 2290 nH

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,22 mm^{-1}
l_e = 149 mm
A_e = 683 mm^2
A_{min} = 676 mm^2
V_e = 102 000 mm^3

Approx. weight 514 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	8850 + 30/– 20 %	1530	7200	19,00 (200 mT, 25 kHz, 100 ˚C)	B66371-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	1,50 ± 0,05	655	113	B66371-G1500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

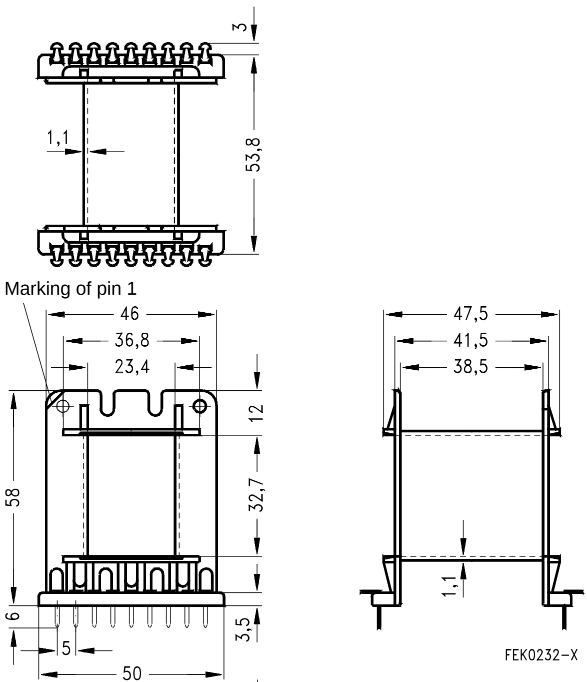
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	903	– 0,789	1568	– 0,847	1470	– 0,865

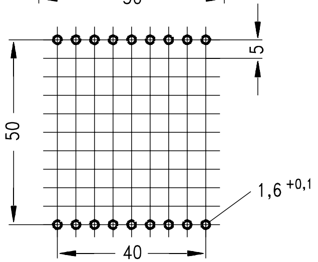
Validity range: *K1*, *K2*: 0,20 mm < s < 5,00 mm
K3, *K4*: 290 nH < A_L < 2880 nH

Coil former

Material: GFR 6-polyamide (UL 94 HB, insulation class to IEC 60085:
B ≙ max. operating temperature 130 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5s
Winding: see page 159

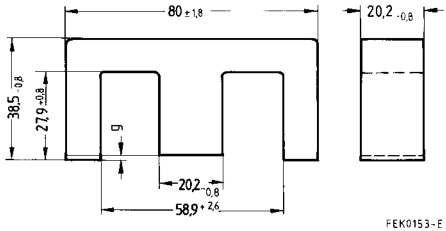
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	445	164	123	18	B66372-A1018-T1





Hole arrangement
View in
mounting direction

- E cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,47 mm^{-1}
l_e = 184 mm
A_e = 390 mm^2
A_{min} = 388 mm^2
V_e = 71 800 mm^3

Approx. weight 358 g/set

Ungapped

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	4150 + 30/– 20 %	1550	3340	13,30 (200 mT, 25 kHz, 100 °C)	B66375-G-X127
N87	4500 + 30/– 20 %	1680	3340	6,50 (100 mT, 100 kHz, 100 °C)	B66375-G-X187

Gapped

Mate-rial	*g* mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	882	329	B66375-G500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	539	– 0,710	867	– 0,847	816	– 0,865
N87	539	– 0,710	8,4	– 0,796	806	– 0,873

Validity range: *K1*, *K2*: 0,20 mm < *s* < 5,00 mm
K3, *K4*: 140 nH < A_L < 1330 nH

1 Low-profile cores for planar magnetics

The design of planar devices has attracted the attention of magnetic design engineers, since this type of devices has interesting advantages over conventional wound components (cf. Fig. 1):

- Low total height
- Outstanding reproducibility of electrical parameters
- Excellent thermal performance
- High degree of integration

a) Conventional magnetics b) Planar magnetics

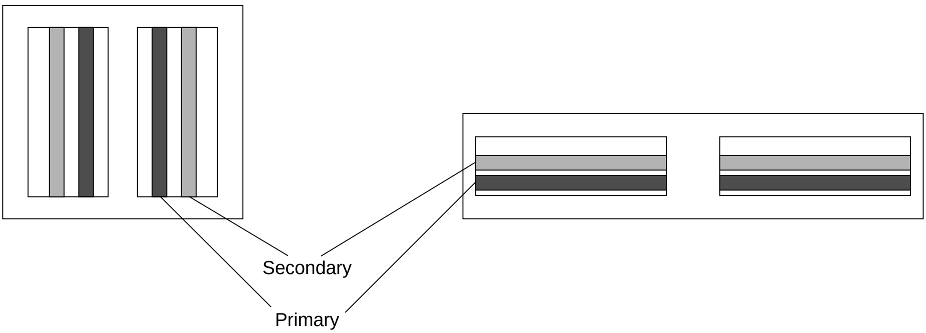


Fig. 1

In order to fulfill the requirements of this technology, suitable cores are needed. The most common designs of low-profile cores have been adopted in a new IEC standard (61860) to offer geometrically compatible cores for this application. These cores cover RM4 LP through RM14 LP, ER9,5, ER11 and the newly introduced ELP cores. A common denominator of these cores is that the length of the core is larger than both its total height and its width. The advantages of this core design are:

- High A_L values
- High core surface to volume ratio
- Large core surface to contact heat sink

The preferred materials used in combination with low-profile cores are N67, N87 and N49 for power applications as well as T38 and T42 for applications requiring high inductance values.

2 Extension of product range

In the fourth quarter 1998 the following types made of N87 and N49 will be included in the product range:

ELP 14/3,5/5	ELP 38/8/25
I 14/1,5/5	I 38/4/25

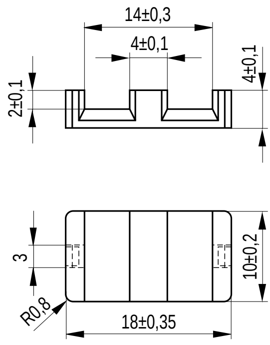
Combination: ELP 18/4/10 with ELP 18/4/10

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,62 mm^{-1}
l_e = 24,3 mm
A_e = 39,3 mm^2
A_{min} = 38,9 mm^2
V_e = 955 mm^3

Approx. weight 4,8 g/set

ELP 18/4/10



Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	1900 ± 25 %	930	1210	< 0,25 (50 mT, 500 kHz, 100 °C)	B66283-G-X149
N87	2600 ± 25 %	1270	1820	< 0,60 (200 mT, 100 kHz, 100 °C)	B66283-G-X187

Calculation factors (see page 423 for formulas)
ELP 18/4/10 + ELP 18/4/10:

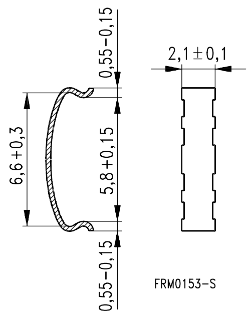
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	71,1	– 0,773	124	– 0,796	104	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,50 mm
K3, *K4*: 50 nH < A_L < 500 nH

Clamp

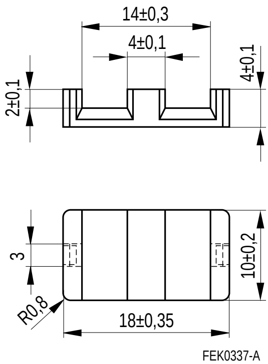
Ordering code per piece, 2 pieces required

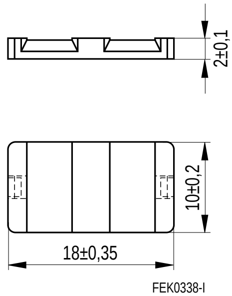
Ordering code: B65804-P2204



Combination: ELP 18/4/10 with I 18/2/10

ELP 18/4/10 **I 18/2/10**





Magnetic characteristics (per set)

$\Sigma l/A$ = 0,51 mm^{-1}
l_e = 20,3 mm
A_e = 39,5 mm^2
A_{min} = 38,9 mm^2
V_e = 802 mm^3

Approx. weight 4,1 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	2100 ± 25 %	860	1480	< 0,20 (50 mT, 500 kHz, 100 °C)	B66283-G-X149 (ELP core) B66283-P-X149 (I core)
N87	2900 ± 25 %	1180	2220	< 0,50 (200 mT, 100 kHz, 100 °C)	B66283-G-X187 (ELP core) B66283-P-X187 (I core)

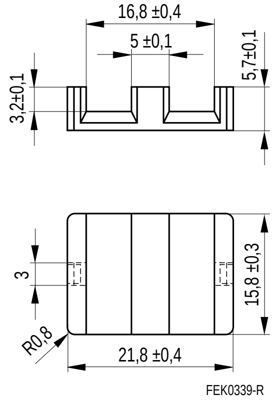
Calculation factors (see page 423 for formulas)
ELP 18/4/10 + I 18/2/10:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	77,4	– 0,774	129	– 0,796	107	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,50 mm
K3, *K4*: 50 nH < A_L < 500 nH

Combination: ELP 22/6/16 with ELP 22/6/16

ELP 22/6/16



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,41 mm^{-1}
l_e = 32,5 mm
A_e = 78,3 mm^2
A_{min} = 77,9 mm^2
V_e = 2540 mm^3

Approx. weight 13 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	3100 ± 25 %	1010	1840	< 0,65 (50 mT, 500 kHz, 100 ˚C)	B66285-G-X149
N87	4500 ± 25 %	1470	2760	< 1,50 (200 mT, 100 kHz, 100 ˚C)	B66285-G-X187

Calculation factors (see page 423 for formulas)
ELP 22/6/16 + ELP 22/6/16:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	126	– 0,814	232	– 0,796	200	– 0,873

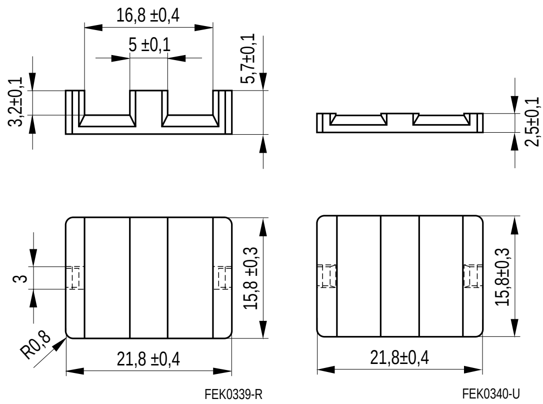
Validity range: *K1*, *K2*: 0,10 mm < s < 1,50 mm
K3, *K4*: 100 nH < A_L < 700 nH

Combination: ELP 22/6/16 with I 22/2,5/16 **ELP 22/6/16** **I 22/2,5/16**

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,33 mm^{-1}
l_e = 26,1 mm
A_e = 78,5 mm^2
A_{min} = 77,9 mm^2
V_e = 2050 mm^3

Approx. weight 10,5 g/set



Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	3700 ± 25 %	960	2290	< 0,50 (50 mT, 500 kHz, 100 ˚C)	B66285-G-X149 (ELP core) B66285-P-X149 (I core)
N87	5200 ± 25 %	1360	3430	< 1,25 (200 mT, 100 kHz, 100 ˚C)	B66285-G-X187 (ELP core) B66285-P-X187 (I core)

Calculation factors (see page 423 for formulas)
ELP 22/6/16 + I 22/2,5/16:

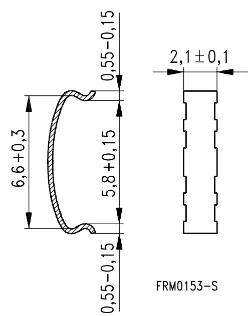
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	134	– 0,806	243	– 0,796	206	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,50 mm
K3, *K4*: 100 nH < A_L < 700 nH

Clamp

Ordering code per piece, 2 pieces required

Ordering code: B65804-P2204



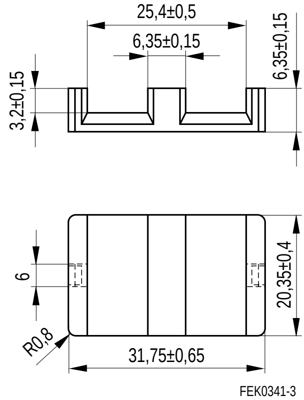
Combination: ELP 32/6/20 with ELP 32/6/20

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,32 mm^{-1}
l_e = 41,4 mm
A_e = 130 mm^2
A_{min} = 128 mm^2
V_e = 5390 mm^3

Approx. weight 28 g/set

ELP 32/6/20



Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	3900 ± 25 %	990	2360	< 1,40 (50 mT, 500 kHz, 100 °C)	B66287-G-X149
N87	5700 ± 25 %	1450	3540	< 3,40 (200 mT, 100 kHz, 100 °C)	B66287-G-X187

Calculation factors (see page 423 for formulas)
ELP 32/6/20 + ELP 32/6/20:

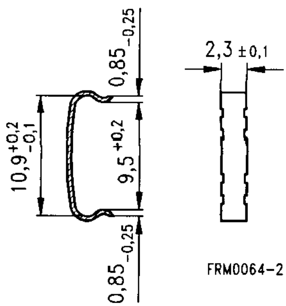
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	208	– 0,819	367	– 0,796	322	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,50 mm
K3, *K4*: 150 nH < A_L < 1000 nH

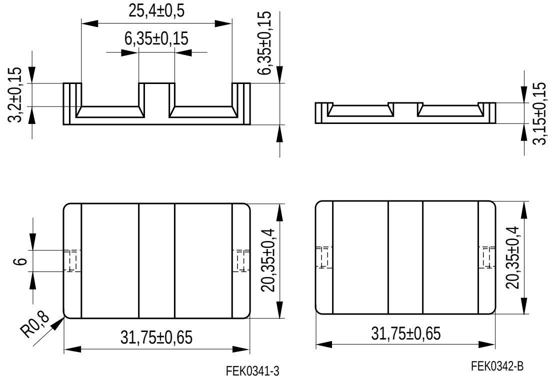
Clamp

Ordering code per piece, 2 pieces required

Ordering code: B65808-J2204



Combination: ELP 32/6/20 with I 32/3/20 **ELP 32/6/20** **I 32/3/20**



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,27 mm^{-1}
l_e = 35,1 mm
A_e = 130 mm^2
A_{min} = 128 mm^2
V_e = 4560 mm^3

Approx. weight 24 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	4400 ± 25 %	950	2800	< 1,20 (50 mT, 500 kHz, 100 °C)	B66287-G-X149 (ELP core) B66287-P-X149 (I core)
N87	6300 ± 25 %	1350	4200	< 2,90 (200 mT, 100 kHz, 100 °C)	B66287-G-X187 (ELP core) B66287-P-X187 (I core)

Calculation factors (see page 423 for formulas)
ELP 32/6/20 + I 32/3/20:

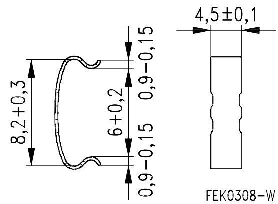
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	234	– 0,777	379	– 0,796	329	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,50 mm
K3, *K4*: 150 nH < A_L < 1000 nH

Clamp

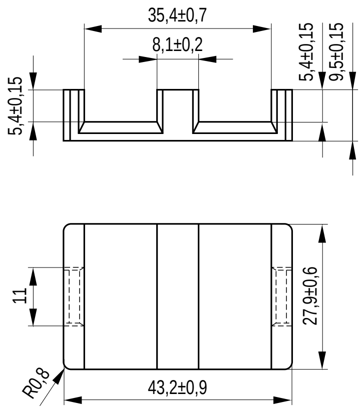
Ordering code per piece, 2 pieces required

Ordering code: B66288-F2204



Combination: ELP 43/10/28 with ELP 43/10/28

ELP 43/10/28



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,27 mm^{-1}
l_e = 61,1 mm
A_e = 229 mm^2
A_{min} = 225 mm^2
V_e = 14000 mm^3

Approx. weight 70 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	5000 ± 25 %	1070	2800	< 3,50 (50 mT, 500 kHz, 100 °C)	B66291-G-X149
N87	7300 ± 25 %	1560	4200	< 8,00 (200 mT, 100 kHz, 100 °C)	B66291-G-X187

Calculation factors (see page 423 for formulas)
ELP 43/10/28 + ELP 43/10/28:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	358	– 0,794	597	– 0,796	540	– 0,873

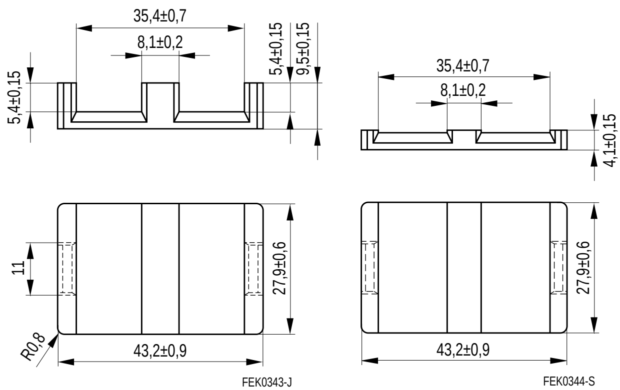
Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 200 nH < A_L < 2200 nH

Combination: ELP 43/10/28 with I 43/4/28

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,22 mm^{-1}
l_e = 50,4 mm
A_e = 229 mm^2
A_{min} = 225 mm^2
V_e = 11500 mm^3

Approx. weight 60 g/set



Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	5900 ± 25 %	1030	3430	< 3,00 (50 mT, 500 kHz, 100 ˚C)	B66291-G-X149 (ELP core) B66291-P-X149 (I core)
N87	8500 ± 25 %	1480	5150	< 7,00 (200 mT, 100 kHz, 100 ˚C)	B66291-G-X187 (ELP core) B66291-P-X187 (I core)

Calculation factors (see page 423 for formulas)
ELP 43/10/28 + I 43/4/28:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	390	– 0,784	621	– 0,796	553	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 200 nH < A_L < 2200 nH

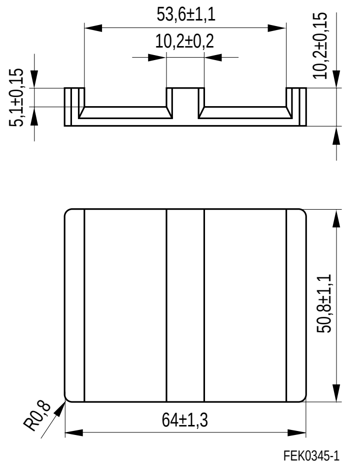
Combination: ELP 64/10/50 with ELP 64/10/50

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,15 mm^{-1}
l_e = 79,9 mm
A_e = 519 mm^2
A_{min} = 518 mm^2
V_e = 41500 mm^3

Approx. weight 210 g/set

ELP 64/10/50



Ungapped[1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	8000 ± 30 %	980	4300	< 10,7 (50 mT, 500 kHz, 100 °C)	B66295-G-X149
N87	12500 ± 25 %	1490	7560	< 26,00 (200 mT, 100 kHz, 100 °C)	B66295-G-X187

Calculation factors (see page 423 for formulas)
ELP 64/10/50 + ELP 64/10/50:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N87	820	– 0,767	1280	– 0,796	1182	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 480 nH < A_L < 4800 nH

1) Preliminary data

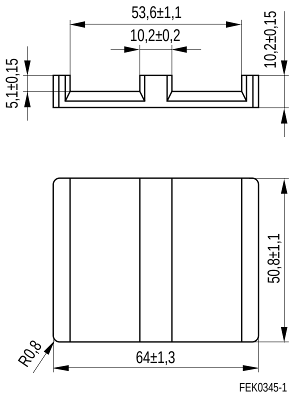
Combination: ELP 64/10/50 with I 64/5/50

Magnetic characteristics (per set)

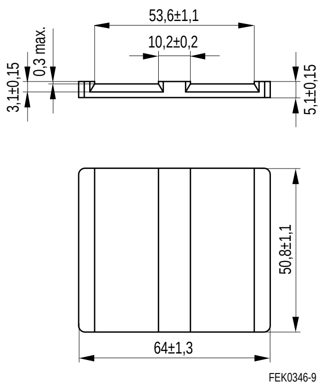
$\Sigma l/A$ = 0,13 mm^{-1}
l_e = 69,7 mm
A_e = 519 mm^2
A_{min} = 518 mm^2
V_e = 36200 mm^3

Approx. weight 185 g/set

ELP 64/10/50



I 64/5/50



Ungapped[1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code (per piece)
N49	8900 ± 30 %	950	4900	< 9,3 (50 mT, 500 kHz, 100 ˚C)	B66295-G-X149 (ELP core) B66295-P-X149 (I core)
N87	14000 ± 25 %	1450	8720	< 23,00 (200 mT, 100 kHz, 100 ˚C)	B66295-G-X187 (ELP core) B66295-P-X187 (I core)

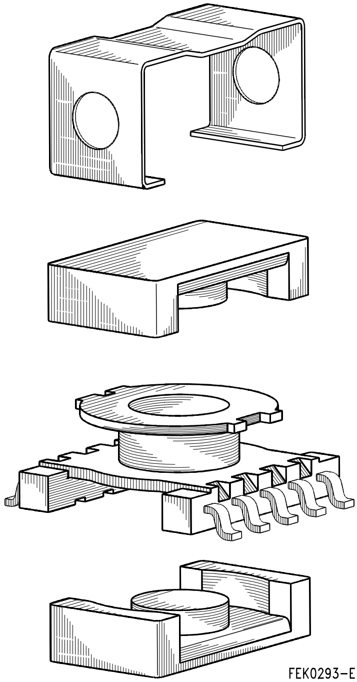
Calculation factors (see page 423 for formulas)
ELP 64/10/50 + I 64/5/50:

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	835	– 0,790	1316	– 0,796	1203	– 0,873

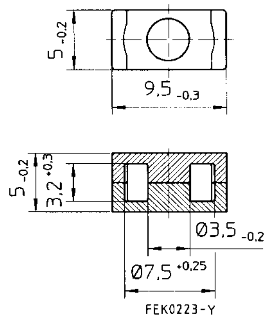
Validity range: *K1*, *K2*: 0,10 mm < *s* < 2,00 mm
K3, *K4*: 480 nH < A_L < 4800 nH

1) Preliminary data

Example of an assembly set ER 11/5


FEK0293-E

- For transformers featuring high inductance and low overall height
- ER9,5 cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,58 mm^{-1}
l_e = 13,3 mm
A_e = 8,41 mm^2
V_e = 120 mm^3

Approx. weight 0,6 g/set

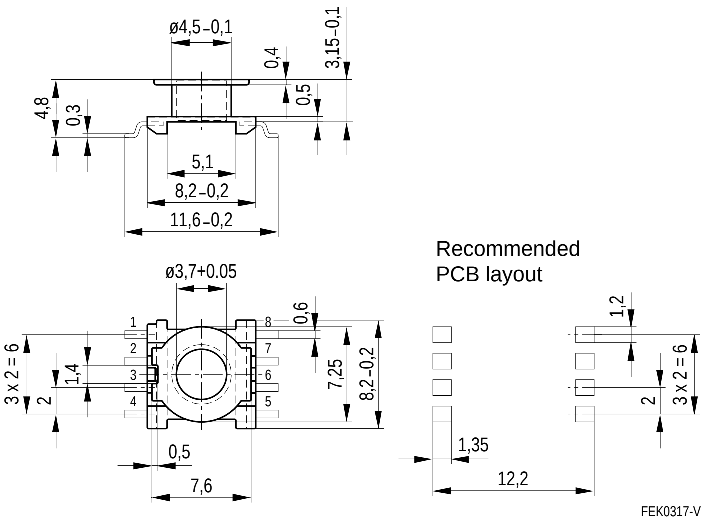
Ungapped

Material	A_L value nH	μ_e	Ordering code
T38	4500 + 40/– 30 %	5680	B65523-J-Y38
N87	800 + 30/– 20 %	1000	B65523-J-R87

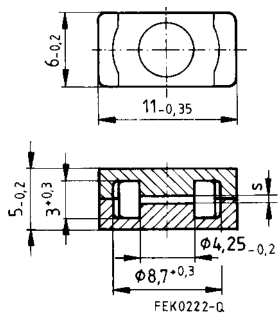
SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s
Winding: see page 160

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	3,23	18,4	196	8	B65527-B1008-T1



- For transformers featuring high inductance and low overall height
- ER11/5 cores are supplied in sets



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,1 mm^{-1}
l_e = 14 mm
A_e = 12,7 mm^2
V_e = 178 mm^3

Approx. weight 0,85 g/set

Ungapped

Material	A_L value nH	μ_e	Ordering code
T38	6400 + 40/– 30 %	5600	B65525-J-Y38
N49	800 + 30/– 20 %	715	B65525-J-R49
N87	1200 + 30/– 20 %	1050	B65525-J-R87

Gapped

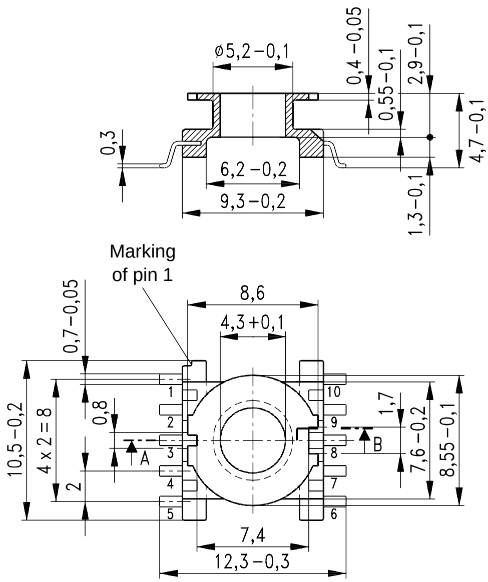
Material	A_L value nH	s approx. mm	μ_e	Ordering code
N87	160 ± 3 %	0,08	140	B65525-J160-A87

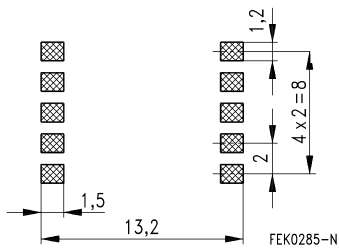
SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235°C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 °C, 1 s
Winding: see page 160

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	3,3	21,6	225	10	B65526-B1010-T1
Yoke					B65526-A2000

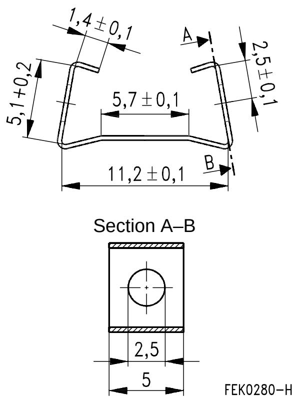
Coil former



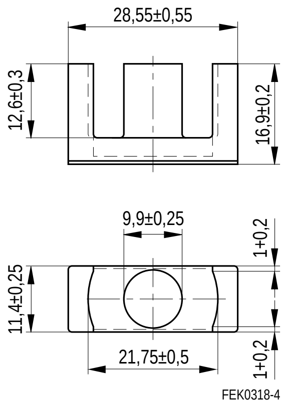


Recommended PCB layout

Yoke



- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

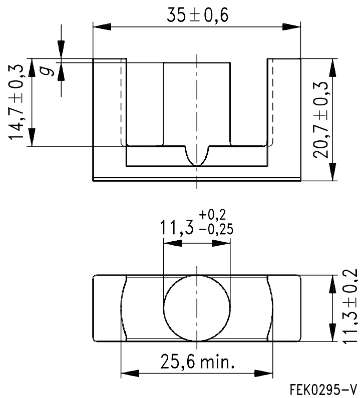
$\Sigma l/A$ = 0,88 mm^{-1}
l_e = 75,0 mm
A_e = 85,4 mm^2
A_{min} = 77,0 mm^2
V_e = 6 400 mm^3

Approx. weight 32 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N72	2700 + 30/– 20 %	1890	1780	0,80 (200 mT, 25 kHz, 100 ˚C)	B66433-G-X172

- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,81 mm^{-1}
l_e = 89,6 mm
A_e = 111 mm^2
A_{min} = 101 mm^2
V_e = 9 930 mm^3

Approx. weight 52 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2500 + 30/– 20 %	1610	1930	1,95 (200 mT, 25 kHz, 100 °C)	B66350-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	275	177	B66350-G500-X127
	1,00 ± 0,05	170	109	B66350-G1000-X127
	1,50 ± 0,05	125	80	B66350-G1500-X127

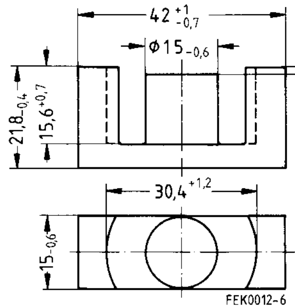
The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	169	– 0,706	275	– 0,847	256	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 90 nH < A_L < 600 nH

- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,58 mm^{-1}
l_e = 99 mm
A_e = 170 mm^2
A_{min} = 170 mm^2
V_e = 16 800 mm^3

Approx. weight 84 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3200 + 30/– 20 %	1480	2700	3,10 (200 mT, 25 kHz, 100 ˚C)	B66347-G-X127
N67	3500 + 30/– 20 %	1620	2700	10,50 (200 mT, 100 kHz, 100 ˚C)	B66347-G-X167

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	1,00 ± 0,05	257	119	B66347-G1000-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

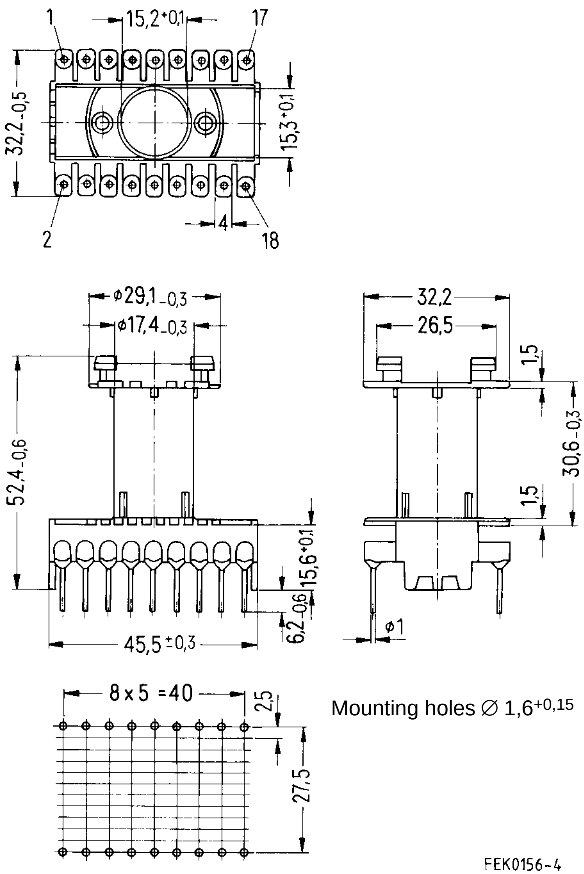
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	257	– 0,741	415	– 0,847	387	– 0,865
N67	257	– 0,741	396	– 0,820	390	– 0,881

Validity range: *K1*, *K2*: 0,10 mm < s < 3,00 mm
K3, *K4*: 110 nH < A_L < 1100 nH

Coil former

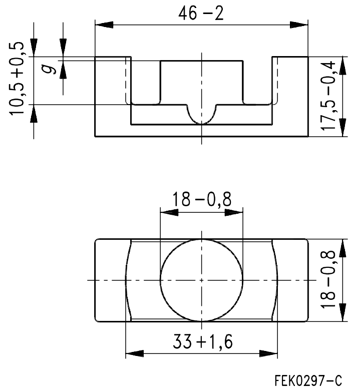
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 158

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	222	70,8	18,6	18	B66348-A1018-T1



FEK0156-4

- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,34 mm^{-1}
l_e = 79 mm
A_e = 233 mm^2
A_{min} = 226 mm^2
V_e = 18 400 mm^3

Approx. weight 98 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	5700 + 30/– 20 %	1550	4630	3,62 (200 mT, 25 kHz, 100 °C)	B66377-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	1,00 ± 0,05	343	93	B66377-G1000-X127

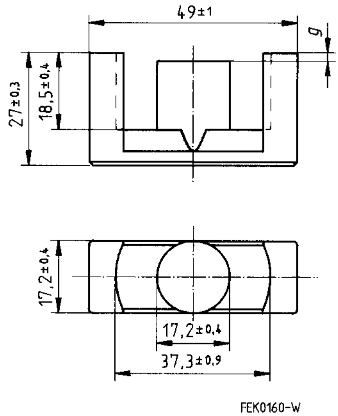
The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	343	– 0,826	589	– 0,847	546	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < s < 1,00 mm
K3, *K4*: 190 nH < A_L < 1850 nH

- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,49 mm^{-1}
l_e = 118 mm
A_e = 243 mm^2
A_{min} = 225 mm^2
V_e = 28 700 mm^3

Approx. weight 146 g/set

Ungapped

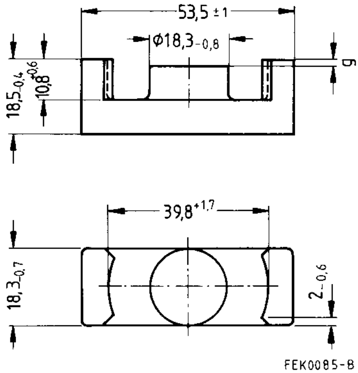
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3500 + 30/– 20 %	1350	3240	5,38 (200 mT, 25 kHz, 100 °C)	B66391-G-X127

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	342	– 0,750	578	– 0,847	540	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < *s* < 3,50 mm
K3, *K4*: 130 nH < A_L < 1300 nH

- Round center leg particularly suitable for use of thick winding wires or tapes
- For compact winding design with low leakage inductance
- ER cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,35 mm^{-1}
l_e = 90 mm
A_e = 256 mm^2
A_{min} = 252 mm^2
V_e = 23 000 mm^3

Approx. weight 119 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	5600 + 30/– 20 %	1560	4480	4,40 (200 mT, 25 kHz, 100 °C)	B66357-G-X127
N67	5750 + 30/– 20 %	1600	4480	14,90 (200 mT, 100 kHz, 100 °C)	B66357-G-X167

Gapped

Material	*g* mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	620	173	B66357-G500-X127

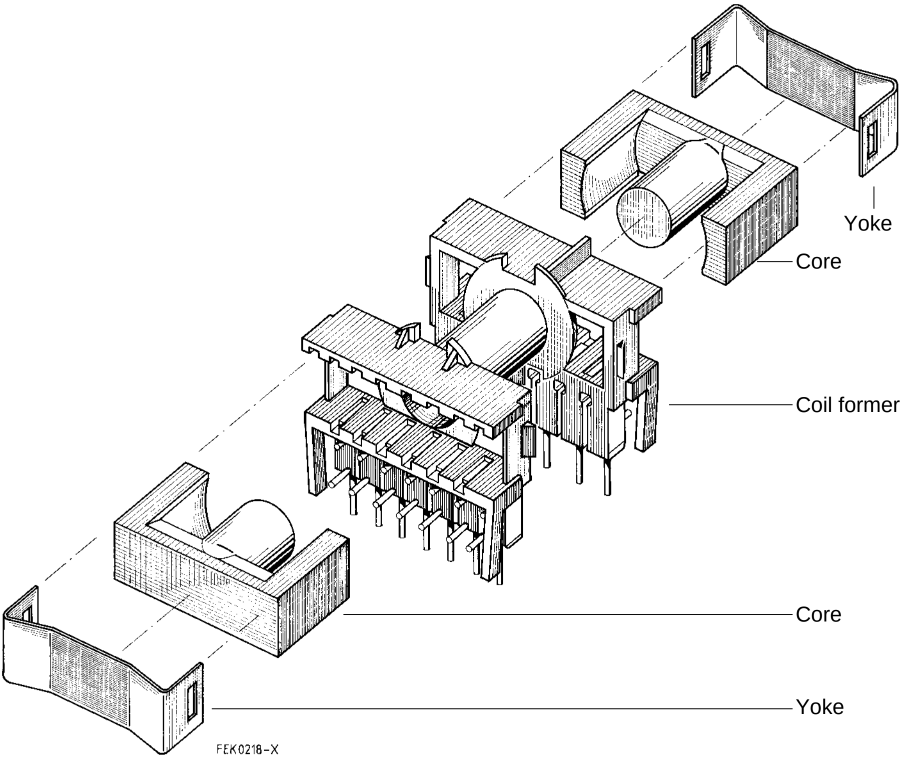
The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

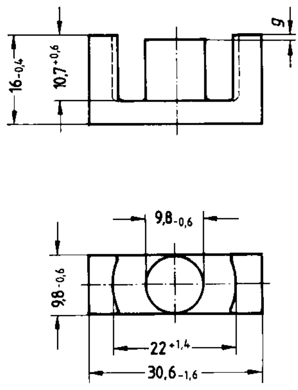
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	360	– 0,786	635	– 0,847	590	– 0,865
N67	360	– 0,786	608	– 0,820	594	– 0,881

Validity range: *K1*, *K2*: 0,15 mm < *s* < 3,50 mm
K3, *K4*: 180 nH < A_L < 1800 nH

Example of an assembly set (ETD 34)



- In accordance with IEC 61185
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0044-8

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,93 mm^{-1}
l_e = 70,4 mm
A_e = 76 mm^2
A_{min} = 71 mm^2
V_e = 5 350 mm^3

Approx. weight 28 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2000 + 30/– 20 %	1470	1700	1,04 (200 mT, 25 kHz, 100 ˚C)	B66358-G-X127
N67	2100 + 30/– 20 %	1530	1700	3,50 (200 mT, 100 kHz, 100 ˚C)	B66358-G-X167
N87	2200 + 30/– 20 %	1610	1700	2,80 (200 mT, 100 kHz, 100 ˚C)	B66358-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,10 ± 0,02	621	457	B66358-G100-X1**
N67,	0,20 ± 0,02	383	281	B66358-G200-X1**
N87	0,50 ± 0,05	201	148	B66358-G500-X1**
	1,00 ± 0,05	124	91	B66358-G1000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	124	– 0,7	195	– 0,847	181	– 0,865
N67	124	– 0,7	188	– 0,820	181	– 0,881
N87	124	– 0,7	192	– 0,796	176	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 2,00 mm
K3, *K4*: 70 nH < A_L < 680 nH

Coil former (magnetic axis horizontal)

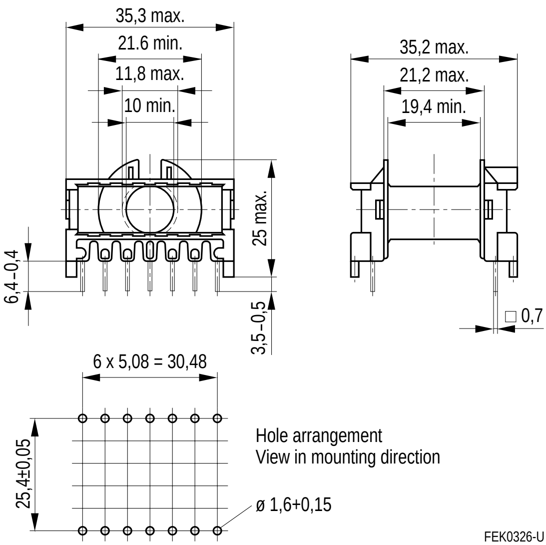
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 157
Squared pins

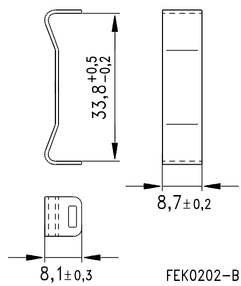
Yoke

Material: Stainless spring steel (0,4 mm)

Coil former					Ordering code
Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	97	52,8	18,7	13	B66359-B1013-T1
Yoke (ordering code per piece, 2 are required)					B66359-A2000

Coil former **Yoke**





Coil former (magnetic axis vertical)

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black

Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

Winding: see page 157

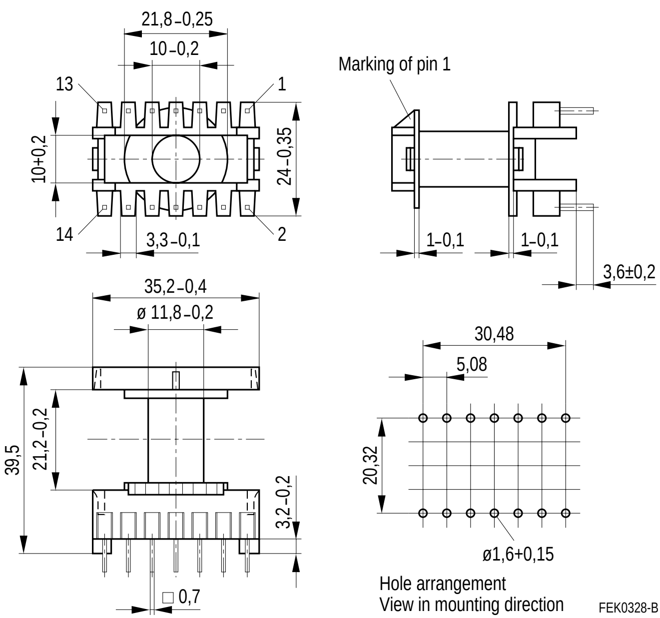
Squared pins

Yoke

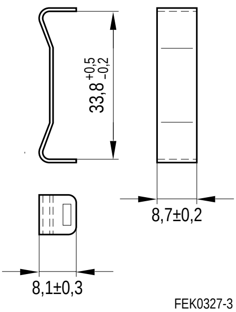
Material: Stainless spring steel (0,4 mm)

Coil former					Ordering code
Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	97	52,8	18,7	14	B66359-J1014-T1
Yoke (ordering code per piece, 2 are required)					B66359-A2000

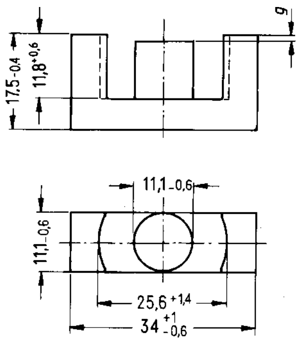
Coil former



Yoke



- In accordance with IEC 61185
- Quality assurance per UTE 83313-001/ CECC 25 301-001 (material N27)
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0048-F

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,81 mm^{-1}
l_e = 78,6 mm
A_e = 97,1 mm^2
A_{min} = 91,6 mm^2
V_e = 7 630 mm^3

Approx. weight 40 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2400 + 30/– 20 %	1540	1940	1,48 (200 mT, 25 kHz, 100 ˚C)	B66361-G-X127
N67	2450 + 30/– 20 %	1580	1940	5,00 (200 mT, 100 kHz, 100 ˚C)	B66361-G-X167
N87	2600 + 30/– 20 %	1670	1940	4,00 (200 mT, 100 kHz, 100 ˚C)	B66361-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,10 ± 0,02	790	508	B66361-G100-X1**
N67,	0,20 ± 0,02	482	310	B66361-G200-X1**
N87	0,50 ± 0,05	251	161	B66361-G500-X1**
	1,00 ± 0,05	153	98	B66361-G1000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	153	– 0,713	245	– 0,847	227	– 0,865
N67	153	– 0,713	236	– 0,820	229	– 0,881
N87	153	– 0,713	240	– 0,796	222	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 80 nH < A_L < 780 nH

Coil former (magnetic axis horizontal)

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black

Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s

Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s

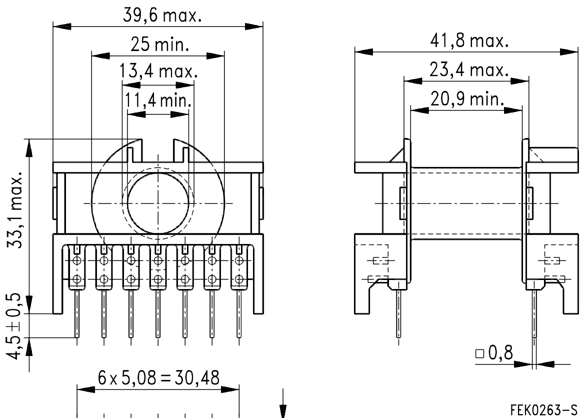
Winding: see page 157

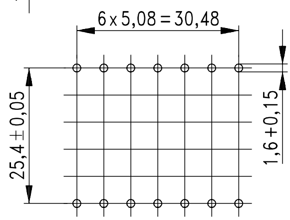
Yoke

Material: Stainless spring steel (0,4 mm)

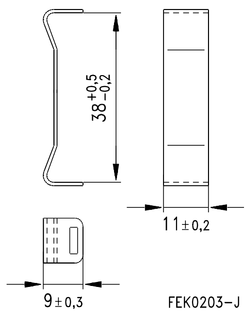
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value μΩ	Pins	
1	122	60,5	17	14	B66362-B1014-T1
Yoke (ordering code per piece, 2 are required)					B66362-A2000

Coil former **Yoke**





Hole arrangement
View in mounting direction



Coil former (magnetic axis vertical)

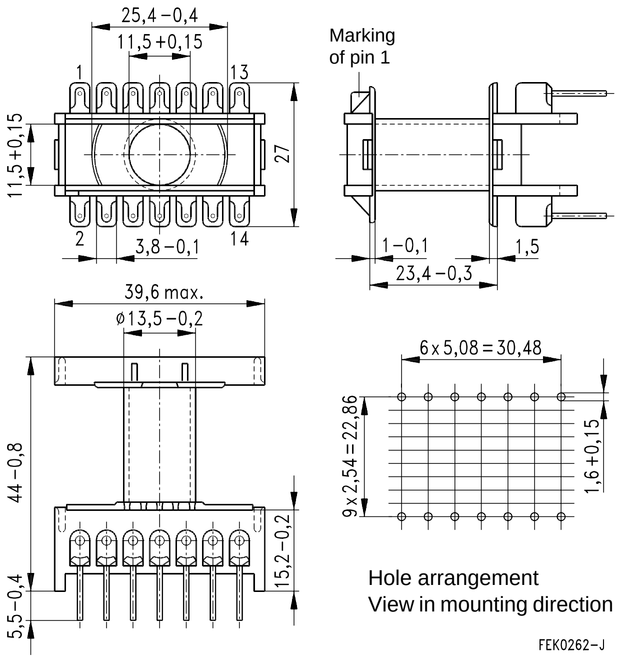
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 157

Yoke

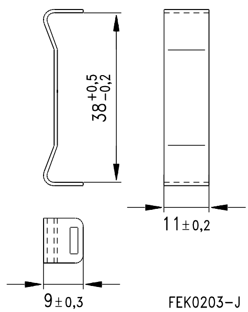
Material: Stainless spring steel (0,4 mm)

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	122	60,5	17	14	B66362-L1014-T1
Yoke (ordering code per piece, 2 are required)					B66362-A2000

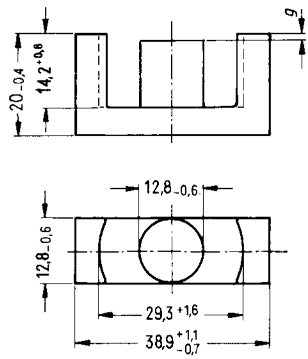
Coil former



Yoke



- In accordance with IEC 61185
- Quality assurance per UTE 83313-002/ CECC 25 301-002 (material N27)
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0053-8

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,74 mm^{-1}
l_e = 92,2 mm
A_e = 125 mm^2
A_{min} = 123 mm^2
V_e = 11 500 mm^3

Approx. weight 60 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2550 + 30/– 20 %	1500	2140	2,22 (200 mT, 25 kHz, 100 ˚C)	B66363-G-X127
N67	2600 + 30/– 20 %	1540	2140	7,50 (200 mT, 100 kHz, 100 ˚C)	B66363-G-X167
N87	2700 + 30/– 20 %	1600	2140	6,00 (200 mT, 100 kHz, 100 ˚C)	B66363-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,10 ± 0,02	1062	622	B66363-G100-X1**
N67,	0,20 ± 0,02	639	374	B66363-G200-X1**
N87	0,50 ± 0,05	326	191	B66363-G500-X1**
	1,00 ± 0,05	196	115	B66363-G1000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	196	– 0,734	308	– 0,847	287	– 0,865
N67	196	– 0,734	295	– 0,820	289	– 0,881
N87	196	– 0,734	300	– 0,796	280	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 3,00 mm
K3, *K4*: 90 nH < A_L < 850 nH

Coil former

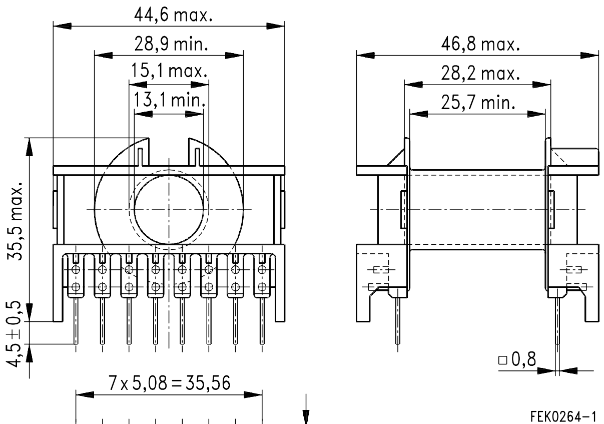
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 157

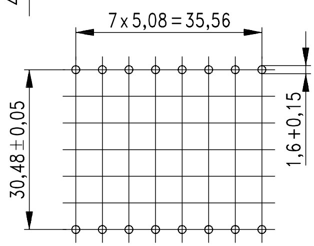
Yoke

Material: Stainless spring steel (0,4 mm)

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	178	69	13,3	16	B66364-B1016-T1
Yoke (ordering code per piece, 2 are required)					B66364-A2000

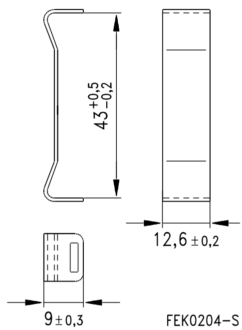
Coil former



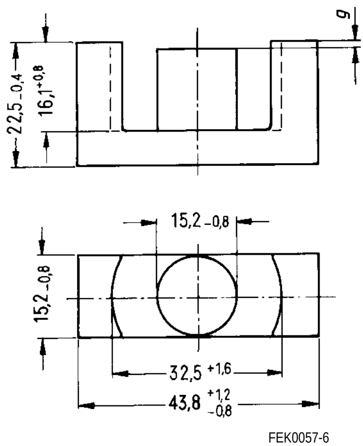


Hole arrangement
View in mounting direction

Yoke



- In accordance with IEC 61185
- Quality assurance per UTE 83313-003/ CECC 25 301-003 (material N27)
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,6 mm^{-1}
l_e = 103 mm
A_e = 173 mm^2
A_{min} = 172 mm^2
V_e = 17 800 mm^3

Approx. weight 94 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3300 + 30/– 20 %	1560	2640	3,48 (200 mT, 25 kHz, 100 °C)	B66365-G-X127
N67	3350 + 30/– 20 %	1600	2640	11,80 (200 mT, 100 kHz, 100 °C)	B66365-G-X167
N87	3500 + 30/– 20 %	1650	2640	9,40 (200 mT, 100 kHz, 100 °C)	B66365-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,20 ± 0,02	862	407	B66365-G200-X1**
N67,	0,50 ± 0,05	438	207	B66365-G500-X1**
N87	1,00 ± 0,05	262	124	B66365-G1000-X1**
	1,50 ± 0,05	194	92	B66365-G1500-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	262	– 0,74	420	– 0,847	391	– 0,865
N67	262	– 0,74	420	– 0,820	395	– 0,881
N87	262	– 0,74	420	– 0,796	382	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 3,50 mm
K3, *K4*: 110 nH < A_L < 1060 nH

Coil former

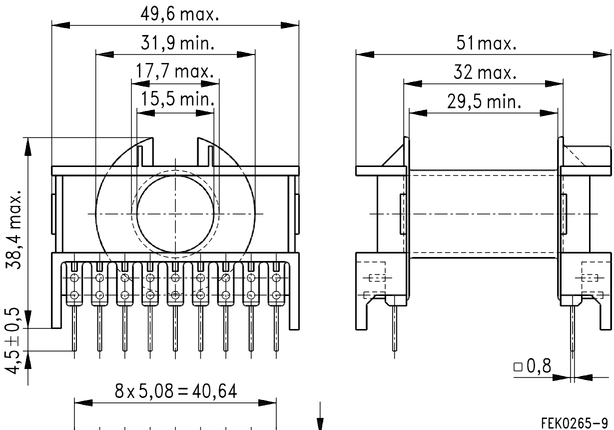
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 157

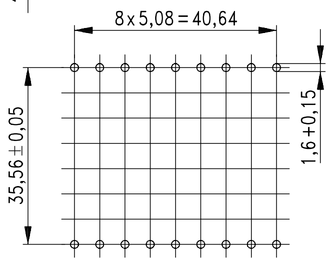
Yoke

Material: Stainless spring steel (0,4 mm)

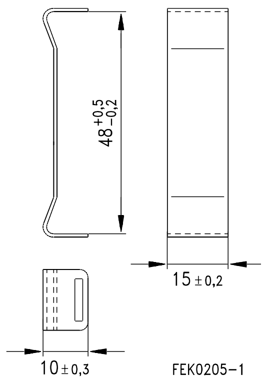
Coil former					Ordering code
Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	210	77,7	12,7	18	B66366-B1018-T1
Yoke (ordering code per piece, 2 are required)					B66366-A2000

Coil former **Yoke**

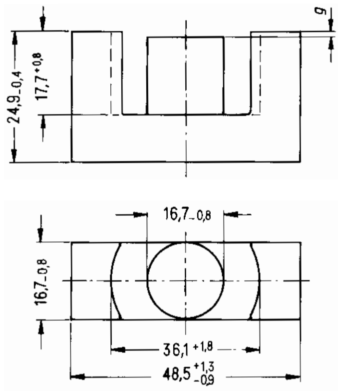




Hole arrangement
View in mounting direction



- In accordance with IEC 61185
- Quality assurance per UTE 83313-004/ CECC 25 301-004 (material N27)
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0061-Y

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,54 mm^{-1}
l_e = 114 mm
A_e = 211 mm^2
A_{min} = 209 mm^2
V_e = 24 100 mm^3

Approx. weight 124 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3700 + 30/– 20 %	1590	2910	4,59 (200 mT, 25 kHz, 100 °C)	B66367-G-X127
N67	3700 + 30/– 20 %	1590	2910	15,50 (200 mT, 100 kHz, 100 °C)	B66367-G-X167
N87	3800 + 30/– 20 %	1630	2910	12,40 (200 mT, 100 kHz, 100 °C)	B66367-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,20 ± 0,02	1035	444	B66367-G200-X1**
N67,	0,50 ± 0,05	525	225	B66367-G500-X1**
N87	1,00 ± 0,05	314	135	B66367-G1000-X1**
	2,00 ± 0,05	188	81	B66367-G2000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	314	– 0,741	504	– 0,847	470	– 0,865
N67	314	– 0,741	480	– 0,820	476	– 0,881
N87	314	– 0,741	485	– 0,796	460	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 3,50 mm
K3, *K4*: 120 nH < A_L < 1160 nH

Coil former

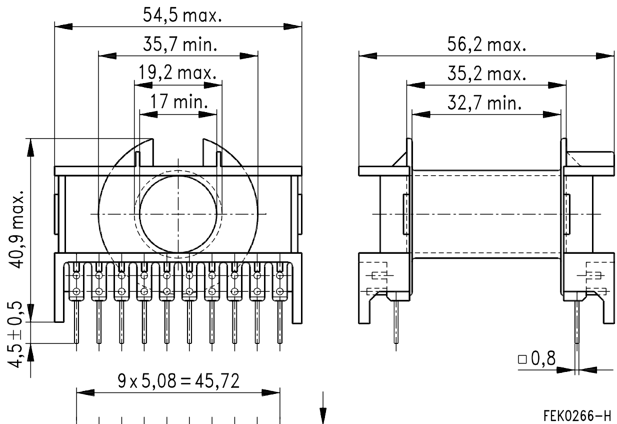
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 157

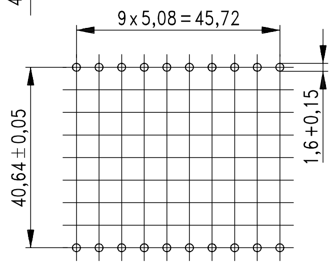
Yoke

Material: Stainless spring steel (0,4 mm)

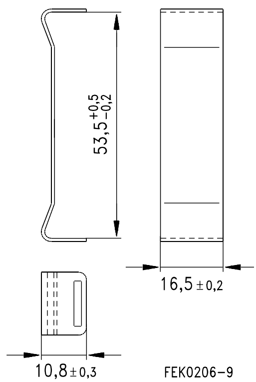
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	269,4	86	11	20	B66368-B1020-T1
Yoke (ordering code per piece, 2 are required)					B66368-A2000

Coil former **Yoke**



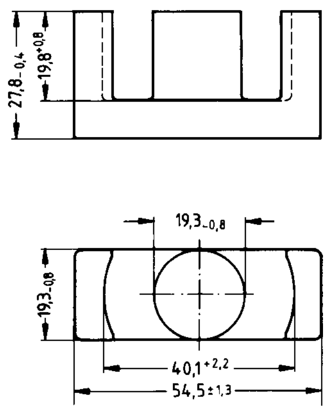


Hole arrangement
View in mounting direction



ETD 54/28/19
Core **B66395**

- In accordance with IEC 61185
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0065-W

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,45 mm^{-1}
l_e = 127 mm
A_e = 280 mm^2
A_{min} = 280 mm^2
V_e = 35 600 mm^3

Approx. weight 180 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	4200 + 30/– 20 %	1510	3470	6,66 (200 mT, 25 kHz, 100 °C)	B66395-G-X127
N67	4400 + 30/– 20 %	1570	3470	26,00 (200 mT, 100 kHz, 100 °C)	B66395-G-X167
N87	4450 + 30/– 20 %	1600	3470	21,00 (200 mT, 100 kHz, 100 °C)	B66395-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,20 ± 0,02	1377	496	B66395-G200-X1**
N67,	1,00 ± 0,05	393	141	B66395-G1000-X1**
N87	1,50 ± 0,05	287	103	B66395-G1500-X1**
	2,00 ± 0,05	229	82	B66395-G2000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	393	– 0,779	658	– 0,847	615	– 0,865
N67	393	– 0,779	624	– 0,820	623	– 0,881
N87	393	– 0,779	630	– 0,796	603	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 3,50 mm
K3, *K4*: 140 nH < A_L < 1390 nH

Coil former

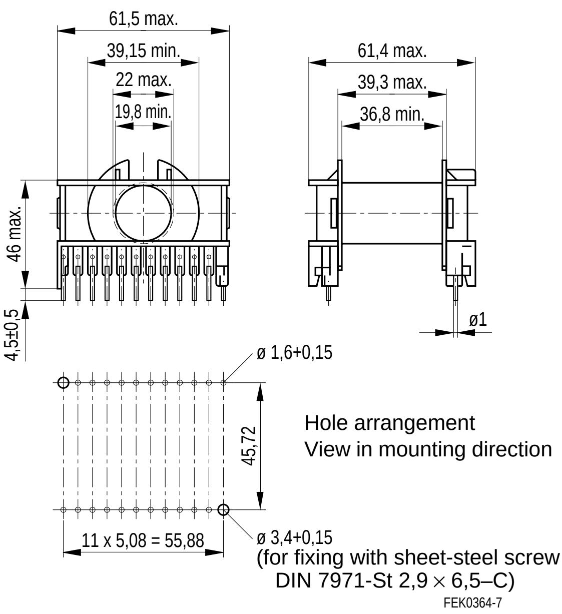
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 157

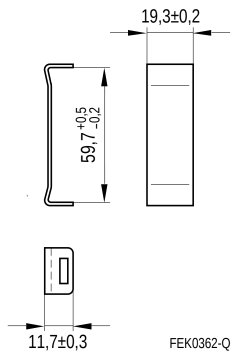
Yoke

Material: Stainless spring steel (0,4 mm)

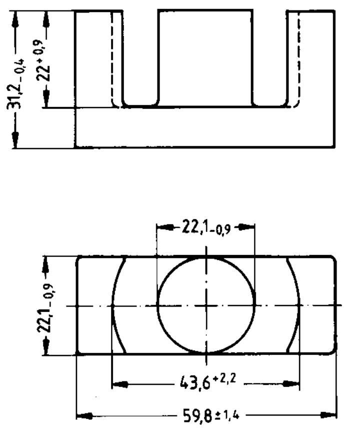
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	315,6	96	10,5	22	B66396-A1022-T1
Yoke (ordering code per piece, 2 are required)					B66396-A2000

Coil former **Yoke**





- In accordance with IEC 61185
- For SMPS transformers with optimum weight/performance ratio at small volume
- ETD cores are supplied as single units



FEK0066-5

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,38 mm^{-1}
l_e = 139 mm
A_e = 368 mm^2
A_{min} = 368 mm^2
V_e = 51 200 mm^3

Approx. weight 260 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	5000 + 30/– 20 %	1500	4170	9,62 (200 mT, 25 kHz, 100 °C)	B66397-G-X127
N67	5200 + 30/– 20 %	1570	4170	6,50 (100 mT, 100 kHz, 100 °C)	B66397-G-X167
N87	5300 + 30/– 20 %	1590	4170	5,20 (100 mT, 100 kHz, 100 °C)	B66397-G-X187

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code ** = 27 (N27) = 67 (N67) = 87 (N87)
N27,	0,20 ± 0,02	1588	476	B66397-G200-X1**
N67,	1,00 ± 0,05	508	152	B66397-G1000-X1**
N87	1,50 ± 0,05	381	114	B66397-G1500-X1**
	2,00 ± 0,05	311	93	B66397-G2000-X1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N27	508	– 0,708	853	– 0,847	799	– 0,865
N67	508	– 0,708	808	– 0,820	811	– 0,881
N87	508	– 0,708	812	– 0,796	783	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 3,50 mm
K3, *K4*: 170 nH < A_L < 1660 nH

Coil former

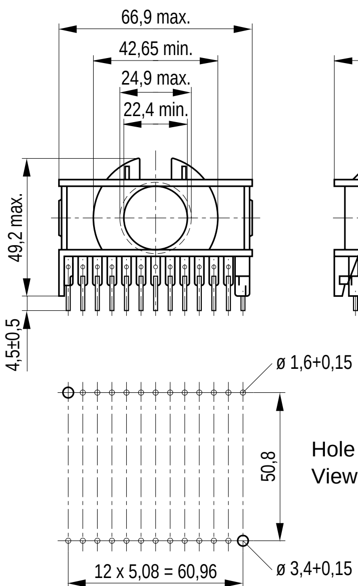
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 157

Yoke

Material: Stainless spring steel (0,4 mm)

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	365,6	106,1	10,0	24	B66398-A1024-T1
Yoke (ordering code per piece, 2 are required)					B66398-A2000

Coil former

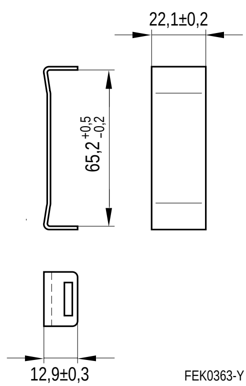


Hole arrangement
View in mounting direction

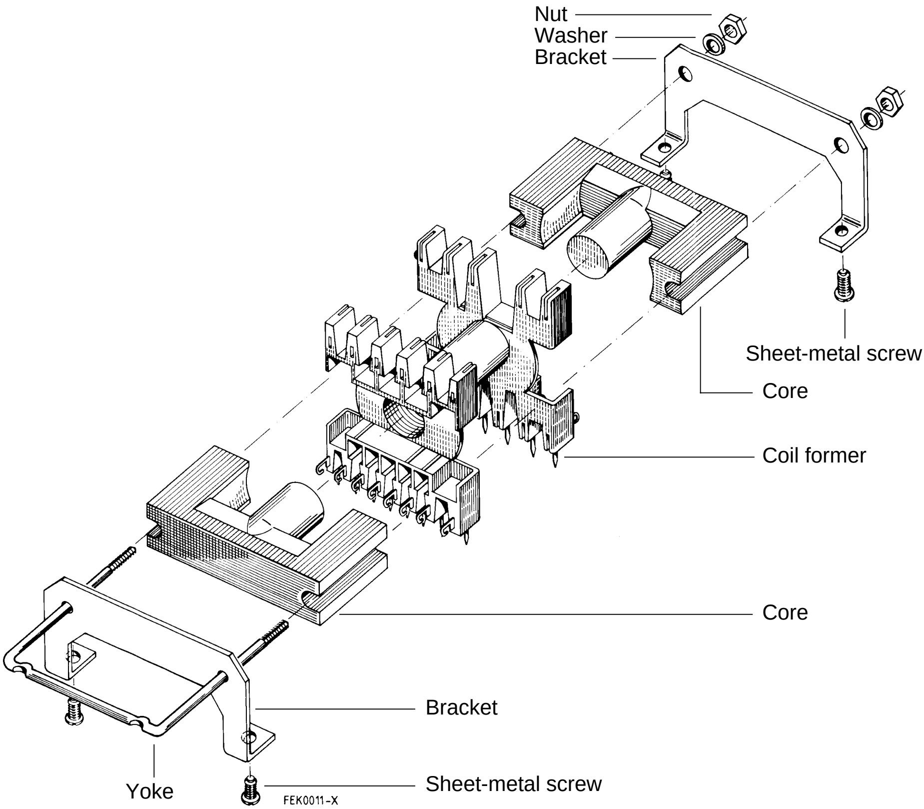
(for fixing with sheet-steel screw DIN 7971-St 2,9 × 6,5–C)

FEK0365-F

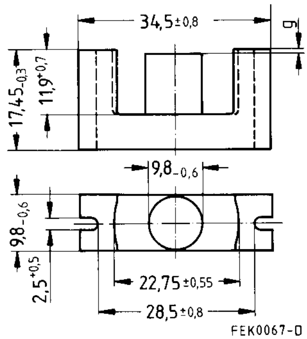
Yoke



Example of an assembly set



- In accordance with IEC 60647
- Compact E core with large winding window
- Round center leg particularly suitable for use of thick winding wires
- EC cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,92 mm^{-1}
l_e = 77,4 mm
A_e = 84,3 mm^2
A_{min} = 71 mm^2
V_e = 6 530 mm^3

Approx. weight 36 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2100 + 30/– 20 %	1530	1710	1,10 (200 mT, 25 kHz, 100 °C)	B66337-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,10 ± 0,02	651	475	B66337-G100-X127
	0,25 ± 0,02	336	245	B66337-G250-X127
	0,50 ± 0,05	203	148	B66337-G500-X127
	1,00 ± 0,05	123	90	B66337-G1000-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

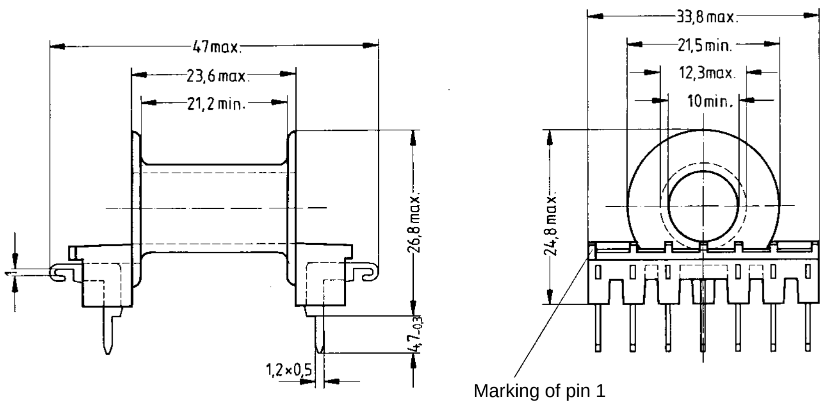
Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	123	– 0,724	214	– 0,847	198	– 0,865

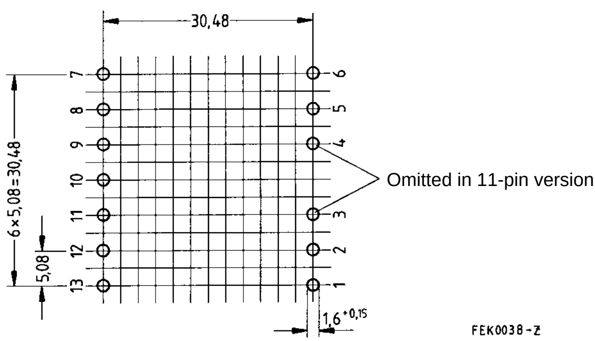
Validity range: *K1*, *K2*: 0,10 mm < s < 2,50 mm
K3, *K4*: 70 nH < A_L < 680 nH

Coil former with solder tags

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Solder tags hot-tin dipped
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 158
Also available without solder terminals

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	97	53	18,8	11	B66272-C1001-T1
				13	B66272-C1002-T1



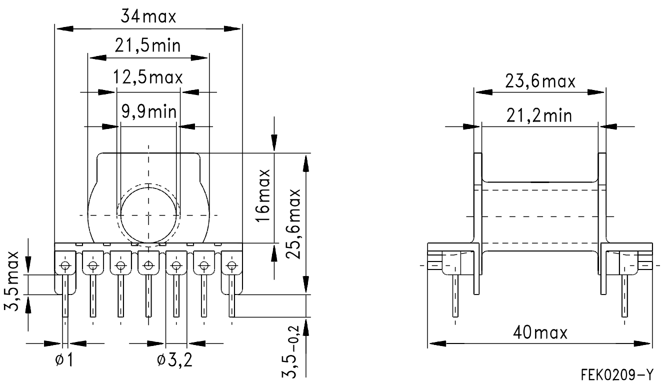


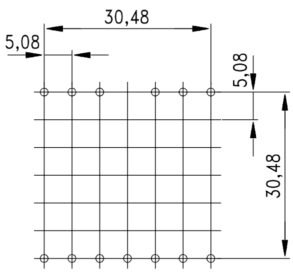
Hole arrangement
View in mounting direction

Coil former with solder pins

Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 158

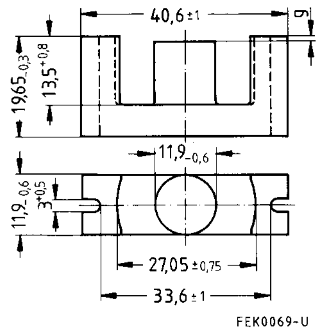
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	Ordering code
1	97	53	18,8	13	B66272-J1013-T1





Hole arrangement
View in mounting direction
Mounting holes ∅ $1{,}6^{+0,15}$

- In accordance with IEC 60647
- Compact E core with large winding window
- Round center leg particularly suitable for use of thick winding wires
- EC cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,74 mm^{-1}
l_e = 89,3 mm
A_e = 121 mm^2
A_{min} = 106 mm^2
V_e = 10 800 mm^3

Approx. weight 52 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2700 + 30/– 20 %	1580	2130	1,80 (200 mT, 25 kHz, 100 °C)	B66339-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,25 ± 0,02	470	275	B66339-G250-X127
	0,50 ± 0,05	281	165	B66339-G500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	$K1$ (25 °C)	$K2$ (25 °C)	$K3$ (25 °C)	$K4$ (25 °C)	$K3$ (100 °C)	$K4$ (100 °C)
N27	168	– 0,742	300	– 0,847	279	– 0,865

Validity range: $K1$, $K2$: 0,10 mm < s < 2,50 mm
$K3$, $K4$: 90 nH < A_L < 850 nH

Coil former (magnetic axis horizontal)

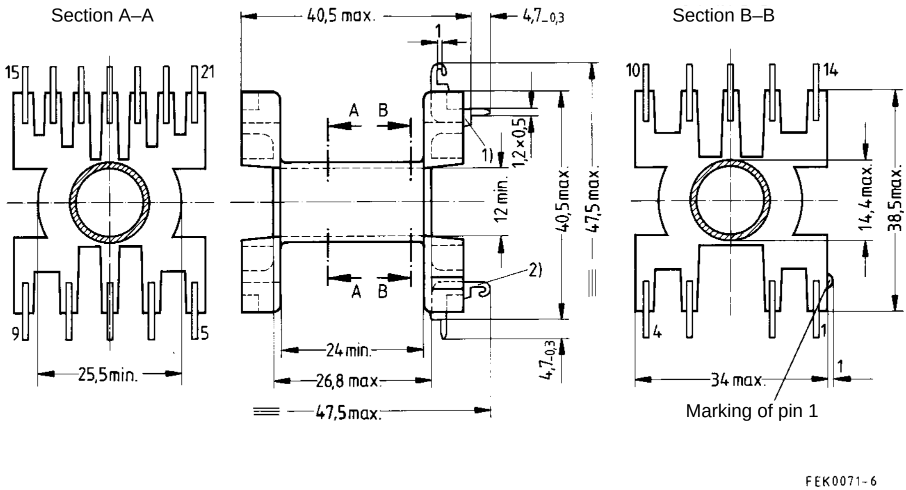
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Solder tags hot-tin dipped
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 158
Also available without solder terminals

Mounting assemblies

For vertical version: consisting of bracket and yoke
For horizontal version: consisting of yoke and metal strip
Max. torque for screwing the mounting assembly onto the PC board: 0,6 Nm per thread.

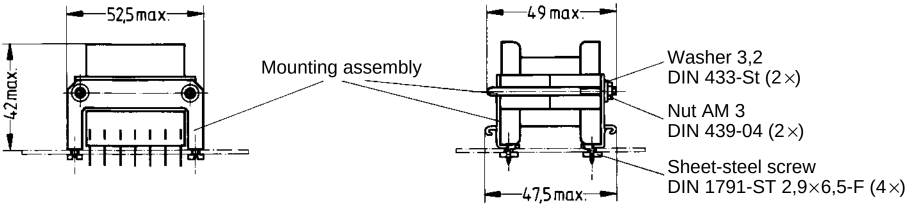
Coil former						Ordering code
Version	Sections	A_N mm^2	l_N mm	A_R value μΩ	Terminals	
Horizontal	1	134	62	15,9	9	B66274-B1001-T1
					12	B66274-B1002-T1
Mounting assembly (horizont.) complete with screws and nuts						B66274-B2001

Coil former

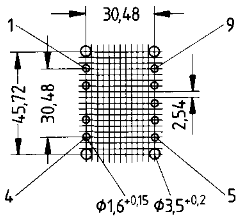


1) Position of solder tag in vertical version
2) Position of solder tag in horizontal version

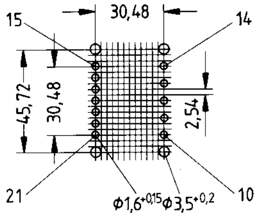
Horizontal version: core assembled with accessories



9 terminals



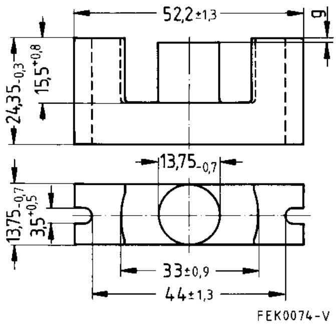
12 terminals



Hole arrangement
View in mounting direction

FEK0072-E

- In accordance with IEC 60647
- Compact E core with large winding window
- Round center leg particularly suitable for use of thick winding wires
- EC cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,58 mm^{-1}
l_e = 105 mm
A_e = 180 mm^2
A_{min} = 141 mm^2
V_e = 18 900 mm^3

Approx. weight 110 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3400 + 30/– 20 %	1570	2700	2,40 (200 mT, 25 kHz, 100 °C)	B66341-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,25 ± 0,02	621	288	B66341-G250-X127
	0,50 ± 0,05	372	173	B66341-G500-X127
	1,50 ± 0,05	165	77	B66341-G1500-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N27	223	– 0,739	435	– 0,847	406	– 0,865

Validity range: *K1*, *K2*: 0,10 mm < s < 3,00 mm
K3, *K4*: 110 nH < A_L < 1050 nH

Coil former (magnetic axis horizontal or vertical)

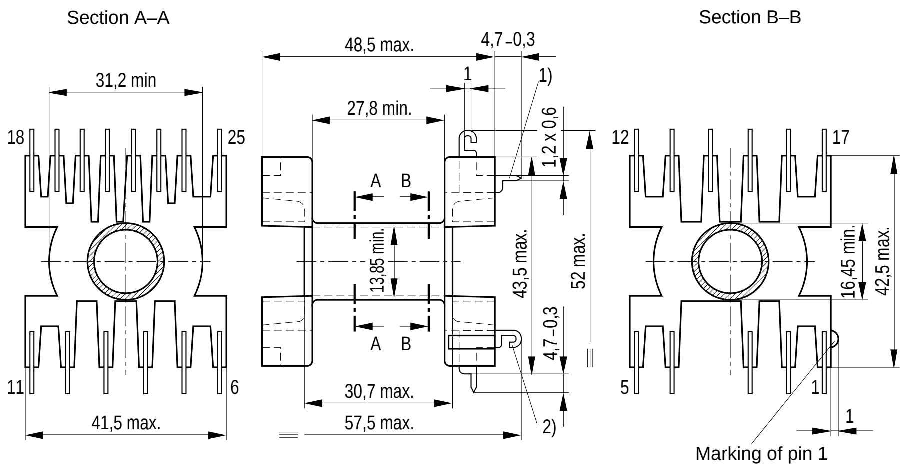
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 °C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Solder tags hot-tin dipped
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 158
Also available without solder terminals

Mounting assemblies

For vertical version: consisting of bracket and yoke
For horizontal version: consisting of yoke and metal strip
Max. torque for screwing the mounting assembly onto the PC board: 0,8 Nm per thread.

Coil former						Ordering code
Version	Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	
Horizontal	1	212	74	12	11	B66276-B1001-T1
					14	B66276-B1002-T1
Vertical	1	212	74	12	11	B66276-B1011-T1
Mounting assembly (horizont.) complete with screws and nuts						B66276-B2001
Mounting assembly (vertical) complete with screws and nuts						B66276-B2002

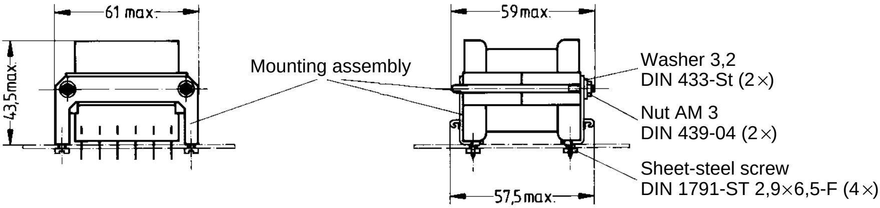
Coil former



1) Position of solder tag in vertical version
2) Position of solder tag in horizontal version

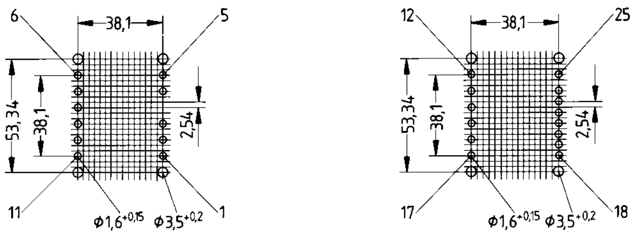
FEK0355-8

Horizontal version: core assembled with accessories



11 terminals

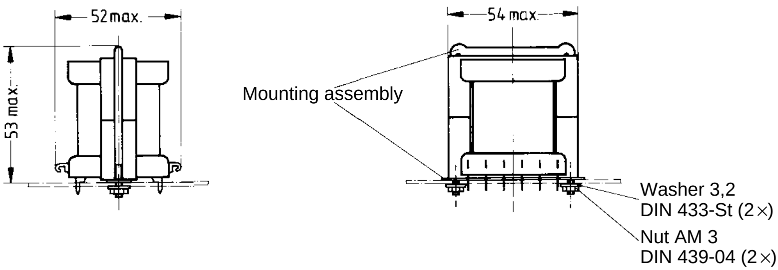
14 terminals



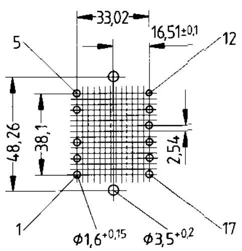
Hole arrangement
View in mounting
direction

FEK0077-K

Vertical version: core assembled with accessories



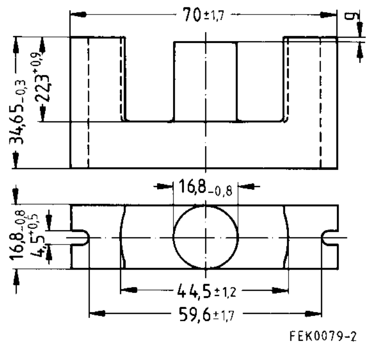
11 terminals



Hole arrangement
View in mounting
direction

FEK0078-T

- In accordance with IEC 60647
- Compact E core with large winding window
- Round center leg particularly suitable for use of thick winding wires
- EC cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,52 mm^{-1}
l_e = 144 mm
A_e = 279 mm^2
A_{min} = 211 mm^2
V_e = 40 200 mm^3

Approx. weight 252 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	3900 + 30/– 20 %	1600	3050	4,80 (200 mT, 25 kHz, 100 ˚C)	B66343-G-X127

Gapped

Material	g mm	A_L value approx. nH	μ_e	Ordering code
N27	0,50 ± 0,05	529	217	B66343-G500-X127
	1,00 ± 0,05	320	131	B66343-G1000-X127

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap - A_L value		Calculation of saturation current			
	$K1$ (25 ˚C)	$K2$ (25 ˚C)	$K3$ (25 ˚C)	$K4$ (25 ˚C)	$K3$ (100 ˚C)	$K4$ (100 ˚C)
N27	320	– 0,725	644	– 0,847	603	– 0,865

Validity range: $K1$, $K2$: 0,10 mm < s < 3,50 mm
$K3$, $K4$: 120 nH < A_L < 1200 nH

Coil former (magnetic axis horizontal or vertical)

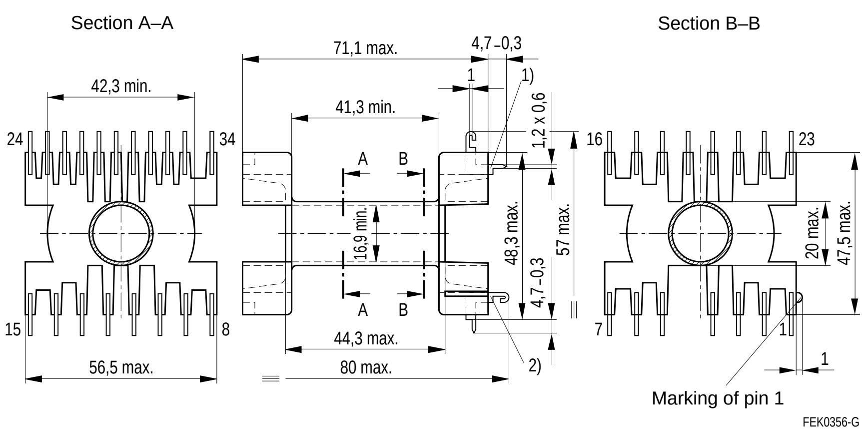
Material: GFR polyterephthalate (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Solder tags hot-tin dipped
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 158
Also available without solder terminals

Mounting assemblies

For vertical version: consisting of bracket and yoke
For horizontal version: consisting of yoke and metal strip
Max. torque for screwing the mounting assembly onto the PC board: 1,2 Nm per thread.

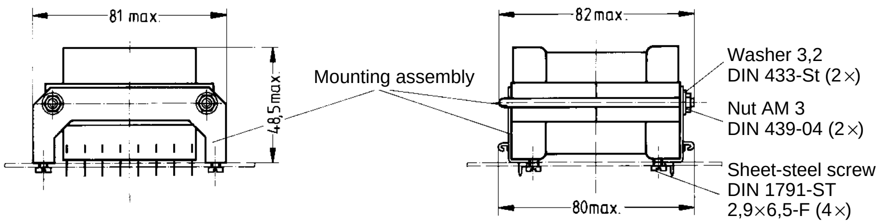
Coil former						Ordering code
Version	Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	
Horizontal	1	469	97	7,1	15	B66278-B1001-T1
					19	B66278-B1002-T1
Vertical	1	469	97	7,1	15	B66278-B1011-T1
Mounting assembly (horizont.) complete with screws and nuts						B66278-B2001
Mounting assembly (vertical) complete with screws and nuts						B66278-B2002

Coil former

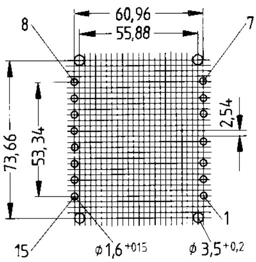


1) Position of solder tags in vertical version
2) Position of solder tag in horizontal version

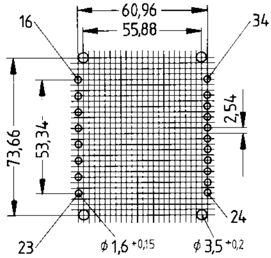
Horizontal version: Core assembled with accessories



15 terminals



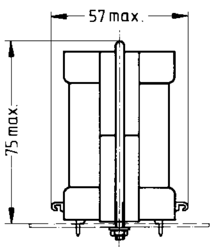
19 terminals

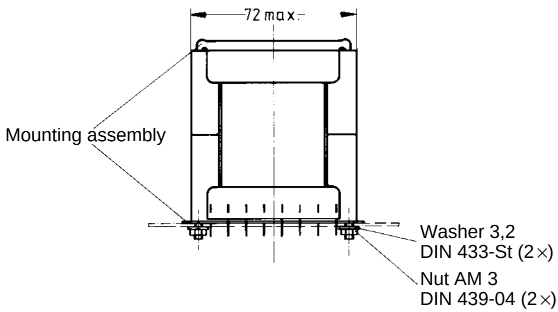


Hole arrangement
View in mounting
direction

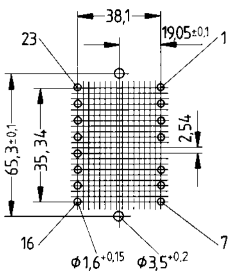
FEK0082-L

Vertical version: Core assembled with accessories





15 terminals



Hole arrangement
View in mounting
direction

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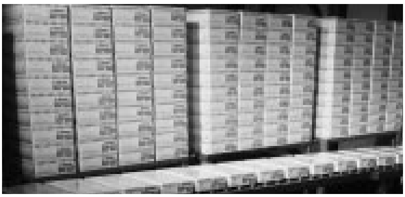

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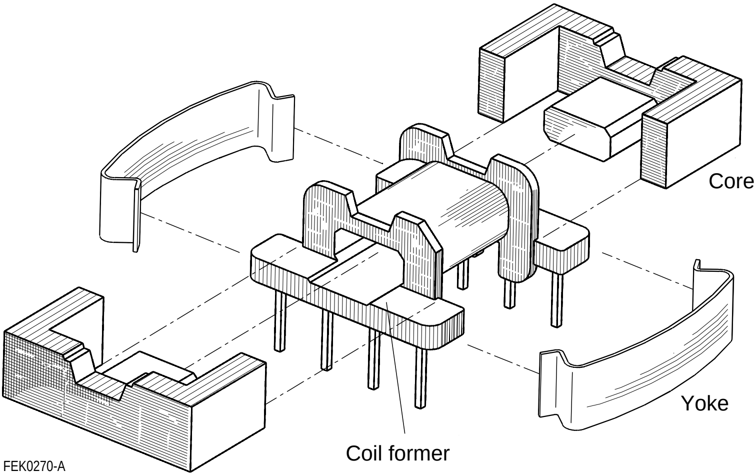
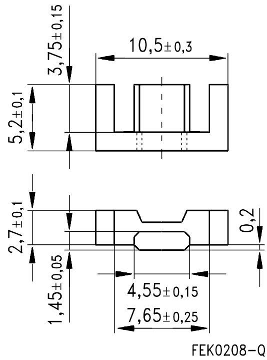
Example of an assembly set



- E core with flattened, lower center leg for especially flat transformer design
- For DC/DC converters
- EFD cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 3,21 mm^{-1}
l_e = 23,1 mm
A_e = 7,2 mm^2
A_{min} = 6,5 mm^2
V_e = 166 mm^3

Approx. weight 0,8 g/set

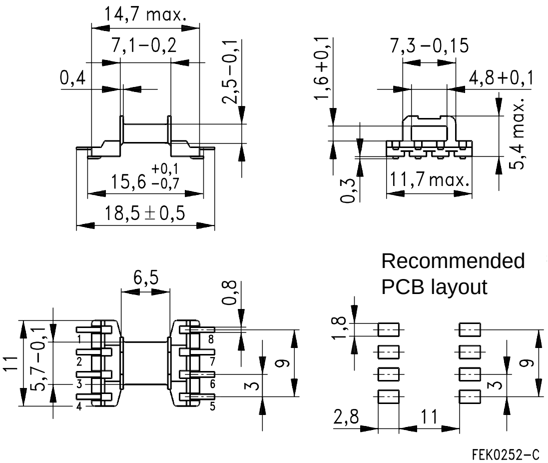
Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N59	260 + 30/– 20 %	660	200	0,037 (50 mT, 500 kHz, 100 °C)	B66411-G-X159
N49	370 + 30/– 20 %	940	100	0,032 (50 mT, 500 kHz, 100 °C)	B66411-G-X149
N87	450 + 30/– 20 %	1150	390	0,09 (200 mT, 100 kHz, 100 °C)	B66411-G-X187

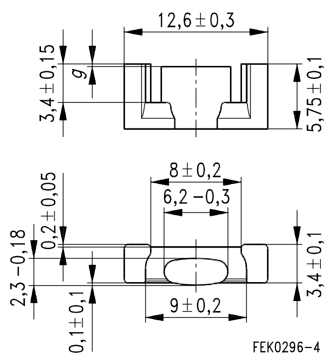
SMD coil former with gullwing terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s
Winding: see page 160

Sections	A_N mm²	l_N mm	A_R value µΩ	Terminals	Ordering code
1	4,6	19,6	147	8	B66412-A6008-T1



- E core with flattened, lower center leg for especially flat transformer design
- Optimized cross section of legs
- For DC/DC converters
- EPF cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,5 mm^{-1}
l_e = 21,5 mm
A_e = 14,5 mm^2
A_{min} = 12,6 mm^2
V_e = 310 mm^3

Approx. weight 1,5 g/set

Ungapped

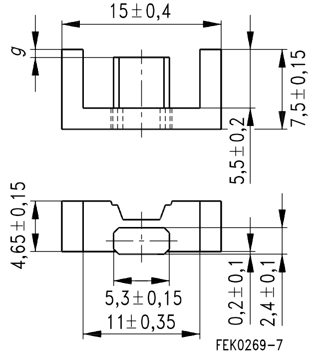
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N87	850 + 30/– 20 %	1010	670	0,20 (200 mT, 100 kHz, 100 ˚C)	B66427-G-X187

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	26,1	– 0,720	47	– 0,796	39	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < *s* < 1,00 mm
K3, *K4*: 50 nH < A_L < 410 nH

- E core with flattened, lower center leg for especially flat transformer design
- For DC/DC converters
- EFD cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 2,27 mm^{-1}
l_e = 34 mm
A_e = 15 mm^2
A_{min} = 12,2 mm^2
V_e = 510 mm^3

Approx. weight 2,8 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N49	600 + 30/– 20 %	1080	330	0,11 (50 mT, 500 kHz, 100 ˚C)	B66413-G-X149
N87	780 + 30/– 20 %	1400	560	0,28 (200 mT, 100 kHz, 100 ˚C)	B66413-G-X187

Gapped

Material	A_L value nH	μ_e	g approx. mm	Ordering code
N87	100 ± 10 %	180	0,17	B66413-U100-K187
	160 ± 15 %	288	0,08	B66413-U160-L187

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	29,7	– 0,676	44,2	– 0,796	33,2	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 1,00 mm
K3, *K4*: 30 nH < A_L < 280 nH

Coil former

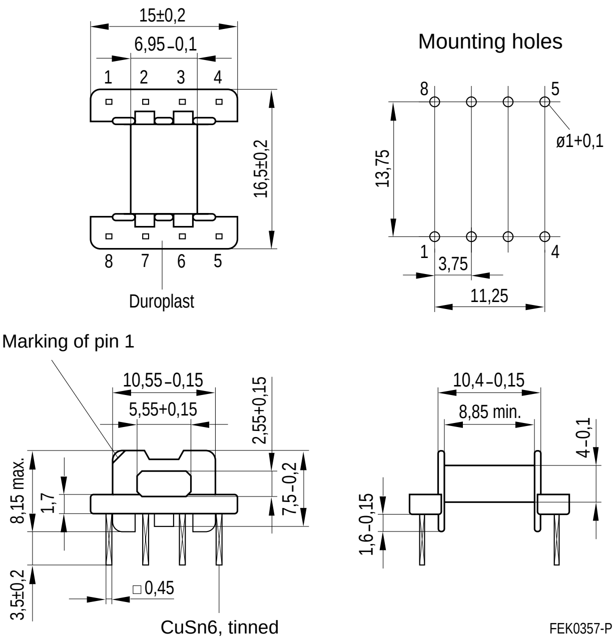
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max.operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 156
Squared pins

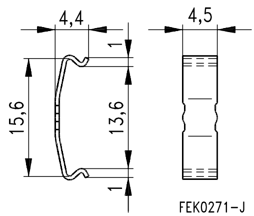
Yoke

- Material: Stainless spring steel (0,25 mm)

Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	15,8	29	63,1	8	B66414-B1008-D1
Yoke (ordering code per piece, 2 are required)					B66414-B2000

Coil former **Yoke**





SMD coil former with J terminals

Material: GFR liquid crystal polymer (UL 94 V-0, insulation class to IEC 60085:
F ≙ max. operating temperature 155 ˚C), color code black
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
permissible soldering temperature for wire-wrap connection on coil former: 400 ˚C, 1 s
Winding: see page 160

Yoke

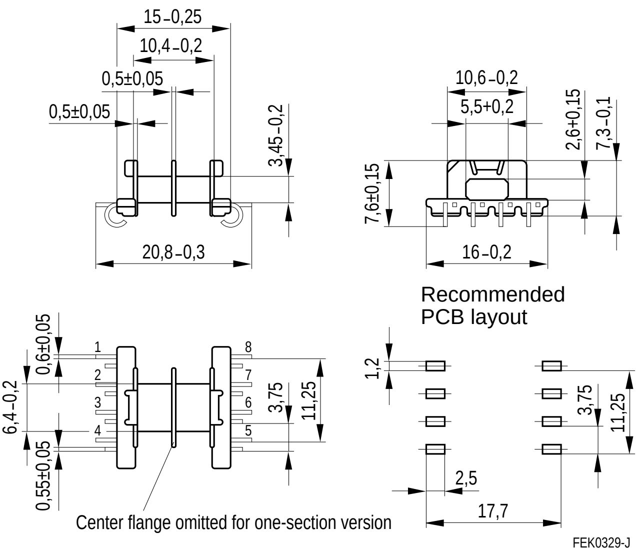
- Material: Stainless spring steel (0,25 mm)

Cover plate

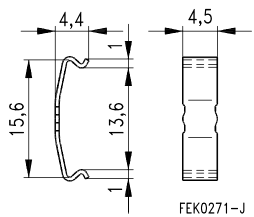
- For marking and improved processing on assembly machines
- See under coil former for material and resistance to soldering heat

Sections	A_N mm^2	l_N mm	A_R value µΩ	Terminals	Ordering code
1	20,4	36	60	8	B66414-B6008-T1
2	19,5	36	64	8	B66414-B6008-T2
Yoke (ordering code per piece, 2 are required)					B66414-B2000
Cover plate					B66414-A7000

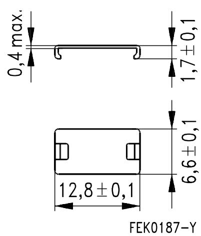
Coil former

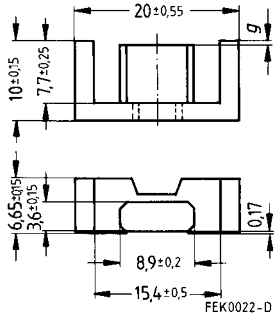


Yoke



Cover plate





- E core with flattened, lower center leg for especially flat transformer design
- For DC/DC converters
- EFD cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,52 mm^{-1}
l_e = 47 mm
A_e = 31 mm^2
A_{min} = 31 mm^2
V_e = 1 460 mm^3

Approx. weight 7,2 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N49	910 + 30/– 20 %	1100	750	0,29 (50 mT, 500 kHz, 100 ˚C)	B66417-G-X149
N87	1200 + 30/– 20 %	1440	660	1,05 (200 mT, 100 kHz, 100 ˚C)	B66417-G-X187

Gapped

Material	A_L value nH	μ_e	g approx. mm	Ordering code
N87	100 ± 10 %	120	0,49	B66417-U100-K187
	160 ± 10 %	193	0,25	B66417-U160-K187

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N87	61,1	– 0,699	85,4	– 0,796	75,7	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 1,40 mm
K3, *K4*: 50 nH < A_L < 410 nH

Coil former

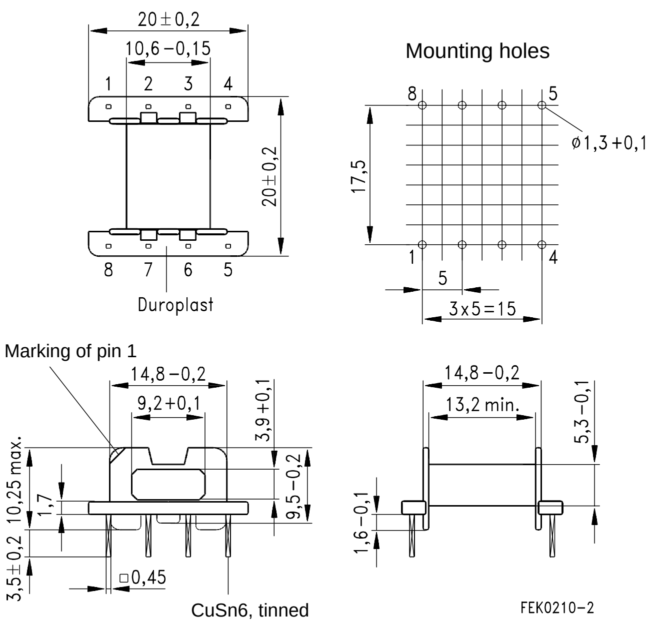
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max.operating temperature 155 °C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 °C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 °C, 3,5 s
Winding: see page 156
Squared pins

Yoke

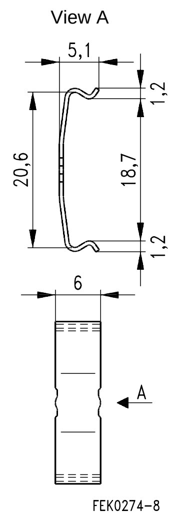
- Material: Stainless spring steel (0,3 mm)

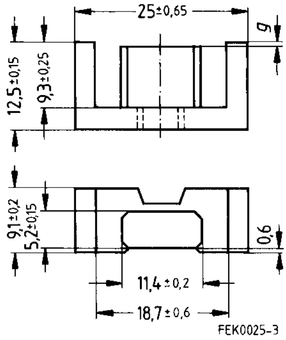
Coil former					Ordering code
Sections	A_N mm²	l_N mm	A_R value µΩ	Pins	
1	28,1	40,2	49,2	8	B66418-B1008-D1
Yoke (ordering code per piece, 2 are required)					B66418-B2000

Coil former



Yoke





- E core with flattened, lower center leg for especially flat transformer design
- For DC/DC converters
- EFD cores are supplied as single units

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,98 mm^{-1}
l_e = 57 mm
A_e = 58 mm^2
A_{min} = 57 mm^2
V_e = 3 310 mm^3

Approx. weight 16,6 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	2000 + 30/– 20 %	1560	1280	2,10 (200 mT, 100 kHz, 100 ˚C)	B66421-G-X167
N87	2000 + 30/– 20 %	1560	1280	1,80 (200 mT, 100 kHz, 100 ˚C)	B66421-G-X187

Gapped

Material	A_L value nH	μ_e	g approx. mm	Ordering code ** = 67 (N67) = 87 (N87)
N67,	160 ± 10 %	125	0,55	B66421-U160-K1**
N87	250 ± 10 %	195	0,30	B66421-U250-K1**
	315 ± 10 %	246	0,22	B66421-U315-K1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension $g = 0$) and one gapped core (dimension $g > 0$).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 ˚C)	*K2* (25 ˚C)	*K3* (25 ˚C)	*K4* (25 ˚C)	*K3* (100 ˚C)	*K4* (100 ˚C)
N67	103	– 0,734	150	– 0,820	142	– 0,881
N87	103	– 0,734	154	– 0,796	138	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 1,40 mm
K3, *K4*: 50 nH < A_L < 410 nH

Coil former

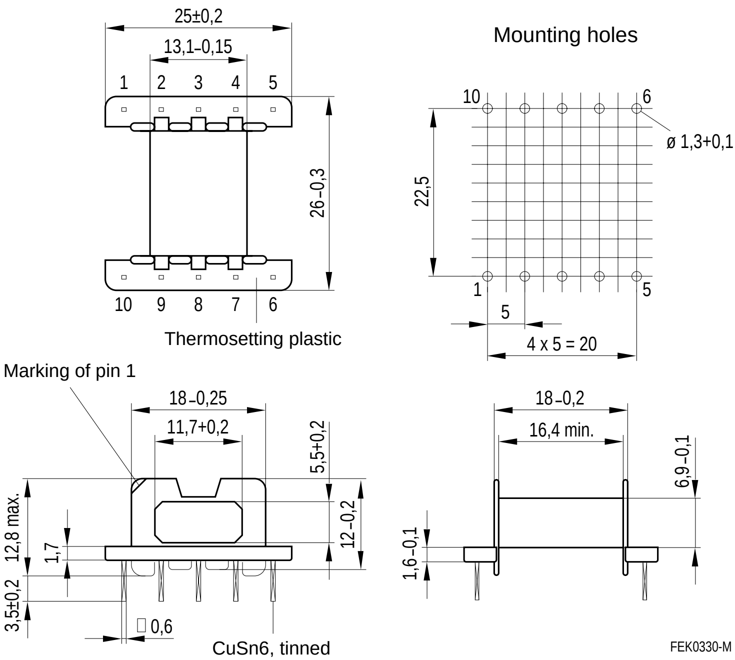
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085:
F ≙ max.operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 156
Squared pins

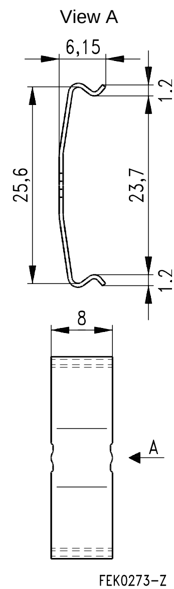
Yoke

- Material: Stainless spring steel (0,4 mm)

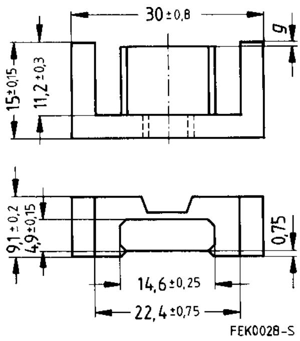
Coil former					Ordering code
Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	40,7	50	42,3	10	B66422-B1010-D1
Yoke (ordering code per piece, 2 are required)					B66422-B2000

Coil former **Yoke**





- E core with flattened, lower center leg for especially flat transformer design
- For DC/DC converters
- EFD cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,99 mm^{-1}
l_e = 68 mm
A_e = 69 mm^2
A_{min} = 69 mm^2
V_e = 4 690 mm^3

Approx. weight 24 g/set

Ungapped

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N67	2050 + 30/– 20 %	1610	1280	3,00 (200 mT, 100 kHz, 100 °C)	B66423-G-X167
N87	2050 + 30/– 20 %	1610	1280	2,60 (200 mT, 100 kHz, 100 °C)	B66423-G-X187

Gapped

Material	A_L value nH	μ_e	g approx. mm	Ordering code ** = 67 (N67) = 87 (N87)
N67,	160 ± 10 %	125	0,71	B66423-U160-K1**
N87	250 ± 10 %	196	0,38	B66423-U250-K1**
	315 ± 10 %	246	0,27	B66423-U315-K1**

The A_L value in the table applies to a core set comprising one ungapped core (dimension g = 0) and one gapped core (dimension g > 0).

Calculation factors (see page 423 for formulas)

Material	Relationship between air gap – A_L value		Calculation of saturation current			
	K1 (25 °C)	*K2* (25 °C)	*K3* (25 °C)	*K4* (25 °C)	*K3* (100 °C)	*K4* (100 °C)
N67	125	– 0,712	172	– 0,820	166	– 0,881
N87	125	– 0,712	176	– 0,796	161	– 0,873

Validity range: *K1*, *K2*: 0,10 mm < s < 2,00 mm
K3, *K4*: 70 nH < A_L < 630 nH

Coil former

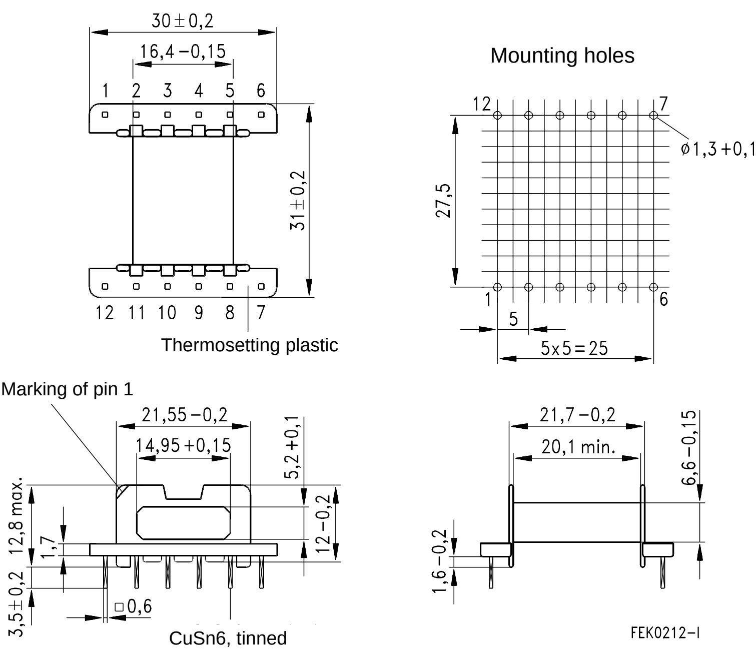
Material: GFR thermosetting plastic (UL 94 V-0, insulation class to IEC 60085: F ≙ max. operating temperature 155 ˚C), color code green
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s
Winding: see page 156
Square pins

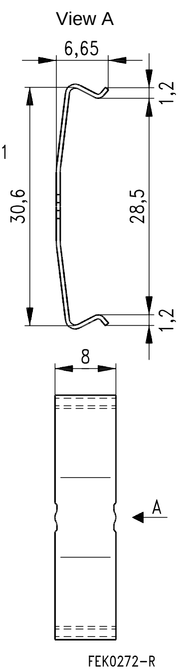
Yoke

- Material: Stainless spring steel (0,45 mm)

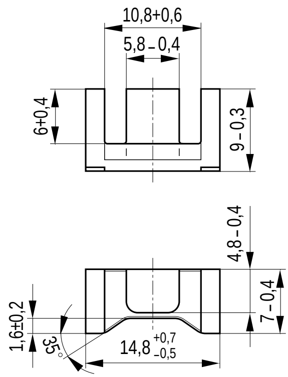
Coil former					Ordering code
Sections	A_N mm^2	l_N mm	A_R value µΩ	Pins	
1	52,3	56,7	37,3	12	B66424-B1012-D1
Yoke (ordering code per piece, 2 are required)					B66424-B2000

Coil former **Yoke**





- For DC/DC converters, storage chokes and EMI suppression chokes
- EV cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,4 mm^{-1}
l_e = 38,7 mm
A_e = 27,7 mm^2
A_{min} = 25,8 mm^2
V_e = 1070 mm^3

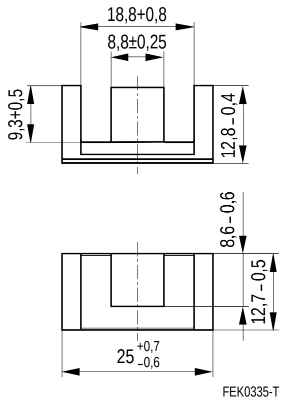
Approx. weight 5,7 g/set

Ungapped 1)

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	1150 ± 25 %	1280	1100	0,22 (200 mT, 25 kHz, 100 °C)	B66434-G-X127
N87	1250 ± 25 %	1390	1100	0,60 (200 mT, 100 kHz, 100 °C)	B66434-G-X187

1) Preliminary data

- For DC/DC converters, storage chokes and EMI suppression chokes
- EV cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,8 mm^{-1}
l_e = 59 mm
A_e = 74 mm^2
A_{min} = 73 mm^2
V_e = 4370 mm^3

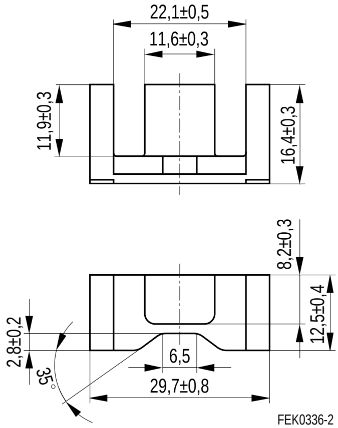
Approx. weight 22 g/set

Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2400 +30/–20 %	1520	1970	0,80 (200 mT, 25 kHz, 100 ˚C)	B66408-G-X127
N87	2500 +30/–20 %	1590	1970	2,20 (200 mT, 100 kHz, 100 ˚C)	B66408-G-X187

1) Preliminary data

- For DC/DC converters, storage chokes and EMI suppression chokes
- EV cores are supplied as single units



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,76 mm^{-1}
l_e = 74,8 mm
A_e = 99 mm^2
A_{min} = 95 mm^2
V_e = 7410 mm^3

Approx. weight 37 g/set

Ungapped [1)]

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2600 +30/–20 %	1570	2070	1,40 (200 mT, 25 kHz, 100 °C)	B66432-G-X127
N87	2800 +30/–20 %	1690	2070	3,70 (200 mT, 100 kHz, 100 °C)	B66432-G-X187

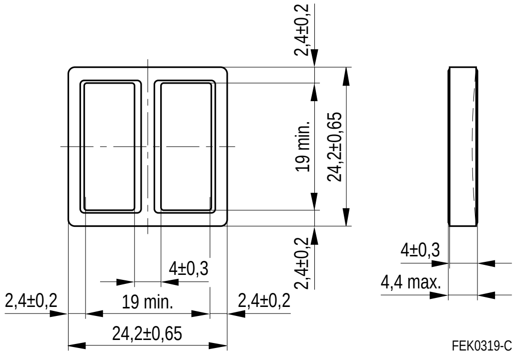
1) Preliminary data

- Closed E core shape (no gap)
- For broadband transformers and current-compensated chokes

Magnetic characteristics (per piece)

$\Sigma l/A$ = 3,45 mm^{-1}
l_e = 60,3 mm
A_e = 17,5 mm^2
A_{min} = 17,5 mm^2
V_e = 1060 mm^3

Approx. weight 5,4 g/set



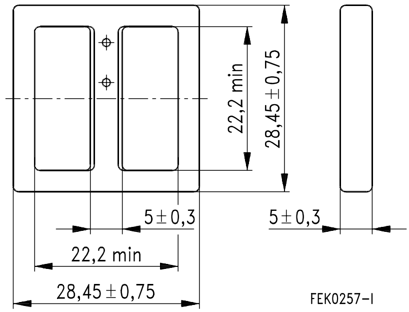
Material	A_L value nH	Ordering code
T37	2500 ± 30 %	B66426-A1-X37

- Closed E core shape (no gap)
- For broadband transformers and current-compensated chokes

Magnetic characteristics (per piece)

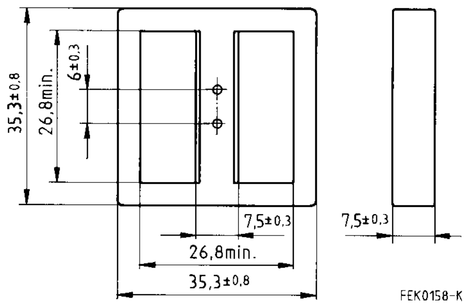
$\Sigma l/A$ = 2,59 mm^{-1}
l_e = 70 mm
A_e = 27 mm^2
A_{min} = 27 mm^2
V_e = 1 890 mm^3

Approx. weight 15 g/piece



Material	A_L value nH	Ordering code
T37	3200 ± 30 %	B66399-A1-X37

- Closed E core design guarantees material-specific properties
- For broadband transformers and current-compensated chokes



Magnetic characteristics (per piece)

$\Sigma l/A$ = 1,46 mm^{-1}
l_e = 85 mm
A_e = 58 mm^2
A_{min} = 58 mm^2
V_e = 4 970 mm^3

Approx. weight 26 g/piece

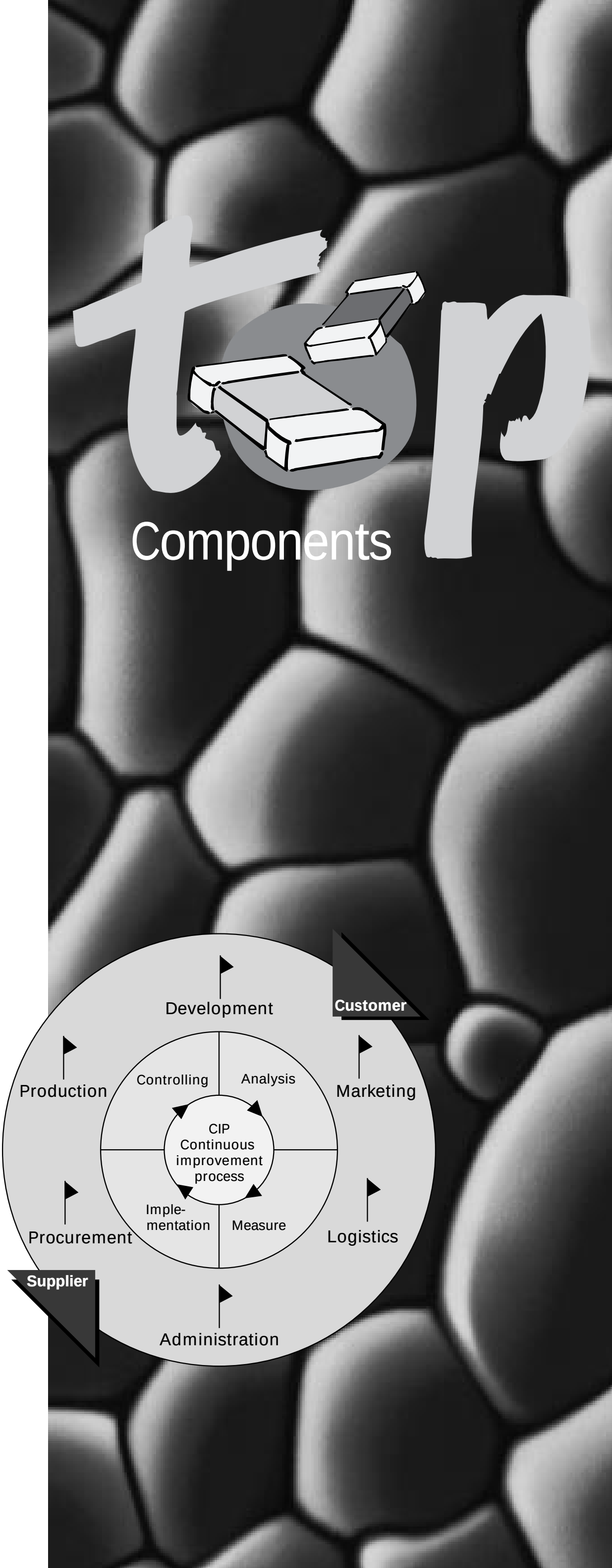
Material	A_L value nH	Ordering code
T37	5400 + 40/– 30 %	B66409-A1-X37

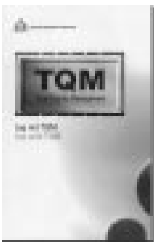
Siemens Matsushita Components

Quality without compromises

top with TQM

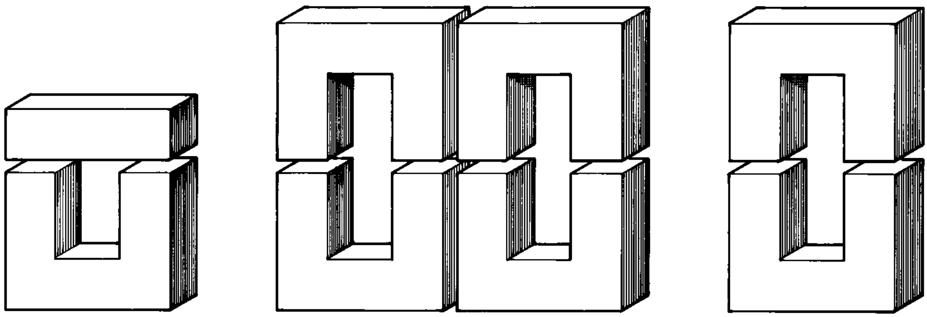
We’re not satisfied until you are. So our quality demands are quite tough. And they don’t start in production, they span the whole field from development to despatch. To watch over it all we implemented Total Quality Management, a system aimed at continuous improvement – in everything. That includes true-to-schedule delivery and service readiness, ISO 9000 for all plants, modern QA, commitment to the environment in manufacturing, materials and packing plus constant training of employees. All embedded in *top*, the worldwide quality campaign of the Siemens organization.





More about “top with TQM“ in this brochure!

SCS – dependable, fast and competent



1 Core shapes and materials

U and I cores are made of SIFERRIT materials N27, N53, N62, N67 and now new, of N82. Owing to their high saturation flux density, high Curie temperature and low dissipation losses, they are suitable for power, pulse and high-voltage transformers (in particular line deflection transformers and diode splitting transformers in TV sets, energy storage chokes, ignition transformers etc.). Typical core shapes are U cores with rectangular centerposts and UR cores with one round and one rectangular centerpost. UU and UI cores of rectangular cross section are preferred for power ratings > 1 kW, since they can be combined in various ways (see illustration above) to produce transformers in the kilowatt range.

2 Ordering, marking and delivery

U and I cores are supplied as single units, not as sets.

For marking see E cores, page 420.
U cores with one shortened leg (≙ air gap) are available only on request.

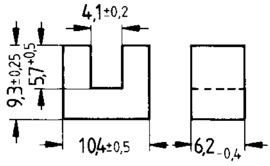
3 A_L and core loss specification

The corresponding test results are tabulated separately for each core shape.

a) A_L value (see also page 117)
The A_L value is measured with a fully wound 100-turn coil at a flux density of $\hat{B}$ = 0,25 mT and a frequency of f = 10 kHz. The temperature of the core is equal to room temperature.

b) Power loss P_V
The dissipation loss is specified in W/set. The data are maximum values under the specified measuring conditions. For material N67, the provisional limiting values at 200 mT/100 kHz/100 °C are also specified. The flux density has been calculated on the basis of a sinusoidal voltage and is referred to the minimum cross-sectional area A_{min} of the core.

Core (with rectangular cross section)



Magnetic characteristics (per set)

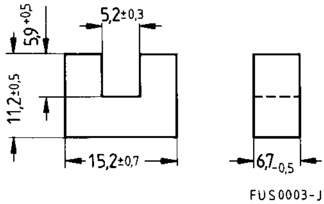
$\Sigma l/A$ = 2,11 mm^{-1}
l_e = 41,5 mm
A_e = 19,7 mm^2
A_{min} = 19,7 mm^2
V_e = 820 mm^3

Approx. weight 4,2 g/set

U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	800 + 30/– 20 %	1340	600	0,10 (200 mT, 16 kHz, 100 °C)	B67366-A1-X27

Core (with rectangular cross section)



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,5 mm^{-1}
l_e = 48 mm
A_e = 32 mm^2
A_{min} = 32 mm^2
V_e = 1 540 mm^3

Approx. weight 8,6 g/set

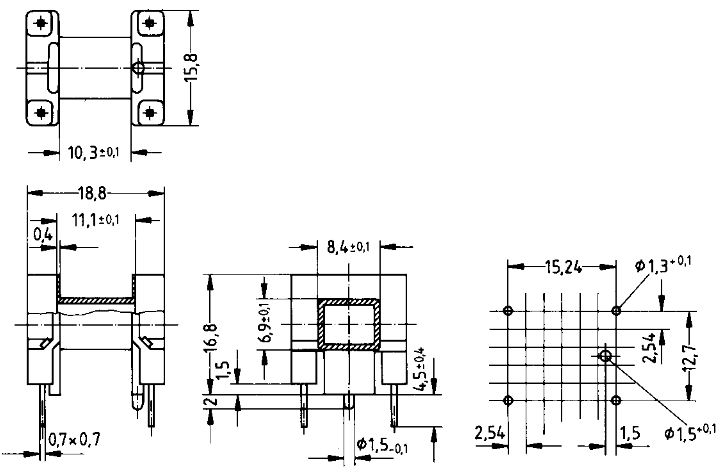
U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	1200 + 30/– 20 %	1430	840	0,19 (200 mT, 16 kHz, 100 ˚C)	B67350-A1-X27

Coil former with squared pins

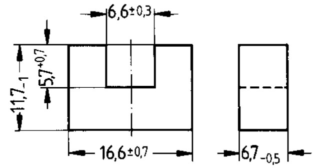
Material: GFR 6-polyamide (UL 94 V-0, insulation class to IEC 60085: E ≙ max. operating temperature 120 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

Sections	A_N mm^2	l_N mm	A_R µΩ	Pins	Ordering code
1	37	45	42	4	B67350-A1004-T1



Hole arrangement
View in
mounting direction

Core (with rectangular cross section)



Magnetic characteristics (per set)

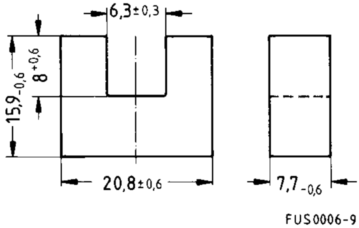
$\Sigma l/A$ = 1,66 mm^{-1}
l_e = 53 mm
A_e = 32 mm^2
A_{min} = 32 mm^2
V_e = 1 700 mm^3

Approx. weight 9,6 g/set

U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	1300 + 30/– 20 %	1510	760	0,21 (200 mT, 16 kHz, 100 °C)	B67364-G-X27

Core (with rectangular cross section)



Magnetic characteristics (per set)

$\Sigma l/A$ = 1,24 mm^{-1}
l_e = 68 mm
A_e = 55 mm^2
A_{min} = 55 mm^2
V_e = 3 740 mm^3

Approx. weight 18 g/set

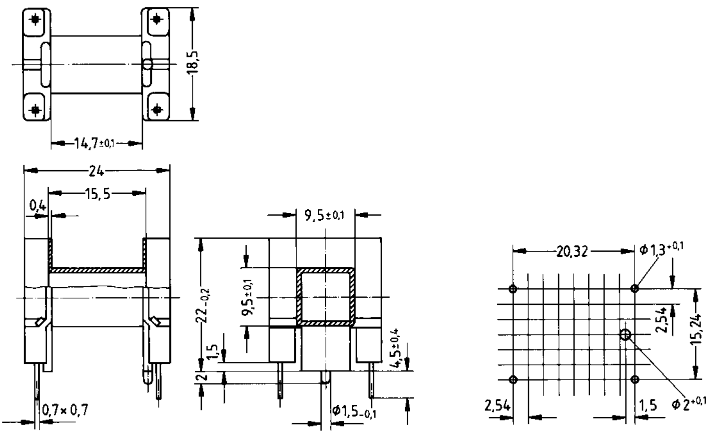
U cores are supplied as sinngle units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	1600 + 30/– 20 %	1570	1020	0,42 (200 mT, 16 kHz, 100 ˚C)	B67348-A1-X27

Coil former with squared pins

Material: GFR 6-polyamide (UL 94 V-0, insulation class to IEC 60085: E ≙ max. operating temperature 120 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

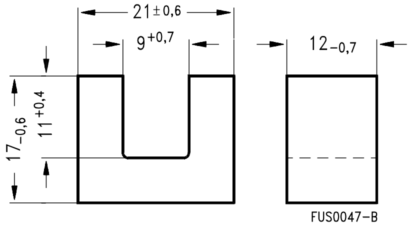
Sections	A_N mm^2	l_N mm	A_R μΩ	Pins	Ordering code
1	70	60	30	4	B67348-A1004-T1



Hole arrangement
View in
mounting direction

FUS0007-H

Core (with rectangular cross section)



Magnetic characteristics (per set)

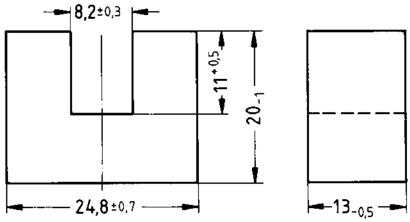
$\Sigma l/A$ = 1,22 mm^{-1}
l_e = 81 mm
A_e = 66,5 mm^2
A_{min} = 64,1 mm^2
V_e = 5 390 mm^3

Approx. weight 27 g/set

U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N62	1600 + 30/– 20 %	1550	1290	0,54 (200 mT, 25 kHz, 100 ˚C)	B67318-G-X162
N27	1650 + 30/– 20 %	1600	1030	0,59 (200 mT, 16 kHz, 100 ˚C)	B67318-G-X127

Core (with rectangular cross section)



FUS0008-Q

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,82 mm^{-1}
l_e = 86 mm
A_e = 105 mm^2
A_{min} = 105 mm^2
V_e = 9 030 mm^3

Approx. weight 46 g/set

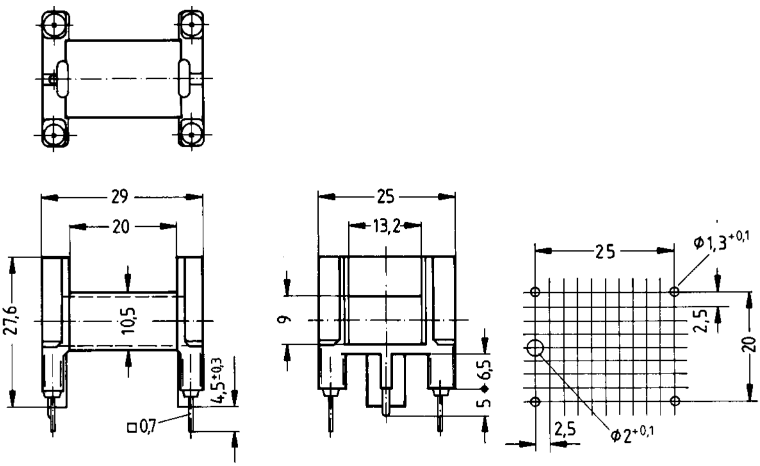
U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2500 + 30/– 20 %	1630	1540	1,00 (200 mT, 16 kHz, 100 ˚C)	B67352-A1-X27

Coil former with squared pins

Material: GFR 6-polyamide (UL 94 V-0, insulation class to IEC 60085: E ≙ max. operating temperature 120 ˚C), color code natural
Solderability: to IEC 60068-2-20, test Ta, method 1 (aging 3): 235 ˚C, 2 s
Resistance to soldering heat: to IEC 60068-2-20, test Tb, method 1B: 350 ˚C, 3,5 s

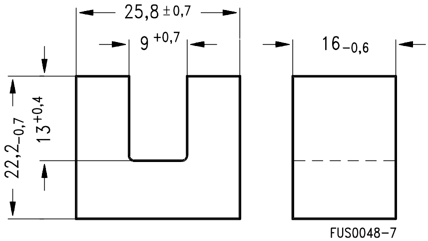
Sections	A_N mm^2	l_N mm	A_R μΩ	Pins	Ordering code
1	138	67	17	4	B67352-A1004-T1



Hole arrangement
View in mounting direction

FUS0009-Y

Core (with rectangular cross section)



Magnetic characteristics (per set)

$\Sigma l/A$ = 0,75 mm^{-1}
l_e = 98 mm
A_e = 131 mm^2
A_{min} = 129 mm^2
V_e = 12 800 mm^3

Approx. weight 65 g/set

U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

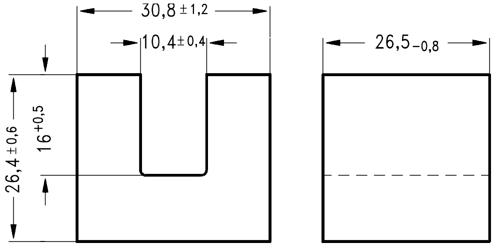
Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	2500 + 30/– 20 %	1480	1680	1,40 (200 mT, 16 kHz, 100 °C)	B67355-A1-X27

Core (with rectangular cross section)

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,45 mm^{-1}
l_e = 118 mm
A_e = 265 mm^2
A_{min} = 265 mm^2
V_e = 31 300 mm^3

Approx. weight 146 g/set



FUS0049-S

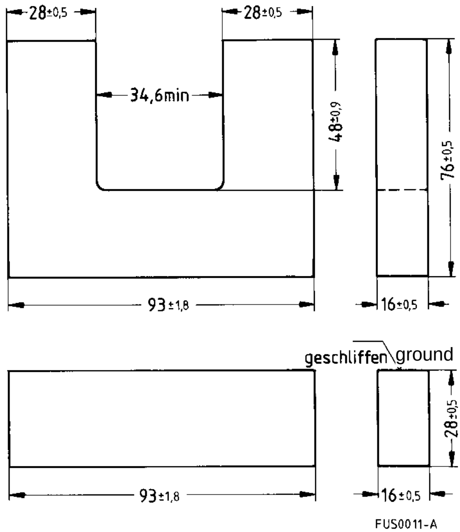
U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	4400 + 30/– 20 %	1560	2830	3,00 (200 mT, 16 kHz, 100 ˚C)	B67362-A1-X27

For power transformers
> 1 kW (20 kHz)

Magnetic characteristics (per set)

	UU 93/152/16	UI 93/104/16	
$\Sigma l/A$	0,79	0,58	mm^{-1}
l_e	354	258	mm
A_e	448	448	mm^2
A_{min}	448	448	mm^2
V_e	159 000	116 000	mm^3
m	800	600	g/set



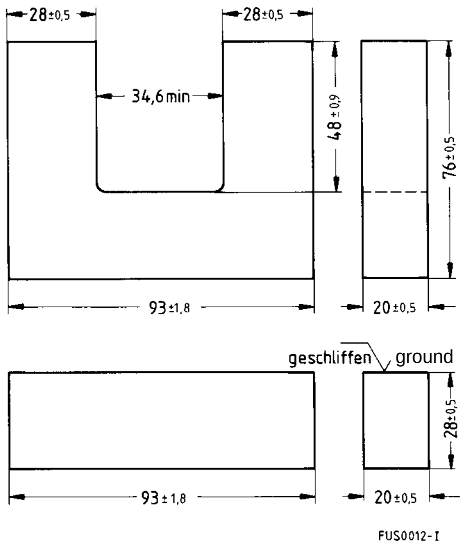
U and I cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
Combination UU 93/152/16					
N27	2900 + 30/– 20 %	1820	1990	< 32 (200 mT, 25 kHz, 100 °C)	B67345-B3-X27
Combination UI 93/104/16					
N27	3800 + 30/– 20 %	1740	2740	< 24 (100 mT, 25 kHz, 100 °C)	B67345-B3-X27 (U) B67345-B4-X27 (I)

For power transformers
> 1 kW (20 kHz)

Magnetic characteristics (per set)

	UU 93/152/20	UI 93/104/20	
$\Sigma l/A$	0,63	0,46	mm^{-1}
l_e	354	258	mm
A_e	560	560	mm^2
A_{min}	560	560	mm^2
V_e	198 000	144 000	mm^3
m	1 000	750	g/set



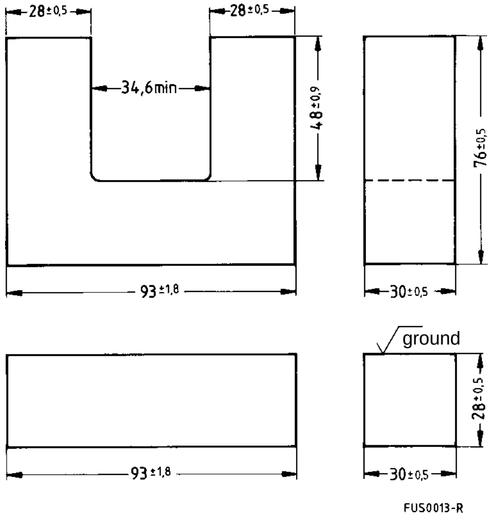
U and I cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
Combination UU 93/152/20					
N27	3600 + 30/– 20 %	1800	2490	<11 (100 mT, 25 kHz, 100 ˚C)	B67345-B10-X27
Combination UI 93/104/20					
N27	4900 + 30/– 20 %	1790	3420	< 8 (100 mT, 25 kHz, 100 ˚C)	B67345-B10-X27 (U) B67345-B11-X27 (I)

For power transformers
> 1 kW (20 kHz)

Magnetic characteristics (per set)

	UU 93/152/30	UI 93/104/30	
$\Sigma l/A$	0,42	0,31	mm^{-1}
l_e	354	258	mm
A_e	840	840	mm^2
A_{min}	840	840	mm^2
V_e	297 000	217 000	mm^3
m	1 500	1 100	g/set



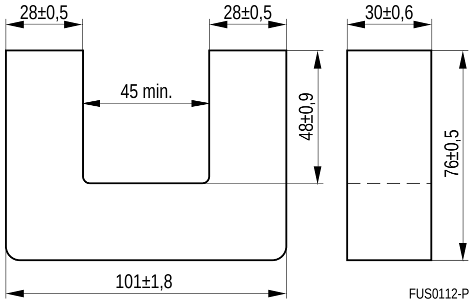
U and I cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
Combination UU 93/152/30					
N27	5400 + 30/– 20 %	1800	3740	< 16 (100 mT, 25 kHz, 100 °C)	B67345-B1-X27
N87	5700 + 30/– 20 %	1900	3740	< 7,5 (100 mT, 25 kHz, 100 °C)	B67345-B1-X87
Combination UI 93/104/30					
N27	7400 + 30/– 20 %	1850	5130	< 12 (100 mT, 25 kHz, 100 °C)	B67345-B1-X27 (U) B67345-B2-X27 (I)
N87	7900 + 30/– 20 %	1930	5130	< 5,5 (100 mT, 25 kHz, 100 °C)	B67345-B1-X87 (U) B67345-B2-X87 (I)

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,45 mm^{-1}
l_e = 368 mm
A_e = 825 mm^2
A_{min} = 825 mm^2
V_e = 303 600 mm^3

Approx. weight 1500 g/set



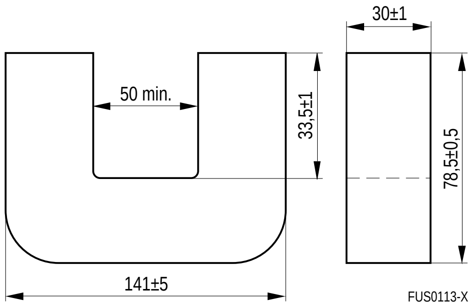
U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	4600 + 30/– 20 %	1580	3520	16,5 (100 mT, 25 kHz, 100 °C)	B67370-A2-X27

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,28 mm^{-1}
l_e = 377 mm
A_e = 1350 mm^2
A_{min} = 1350 mm^2
V_e = 508 950 mm^3

Approx. weight 2500 g/set



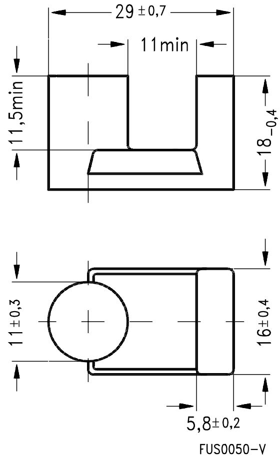
U cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N27	7500 ± 30 %	1670	4300	22,0 (100 mT, 25 kHz, 100 °C)	B67374-G-X127

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,01 mm^{-1}
l_e = 95 mm
A_e = 94 mm^2
A_{min} = 94 mm^2
V_e = 8 930 mm^3

Approx. weight 44 g/set



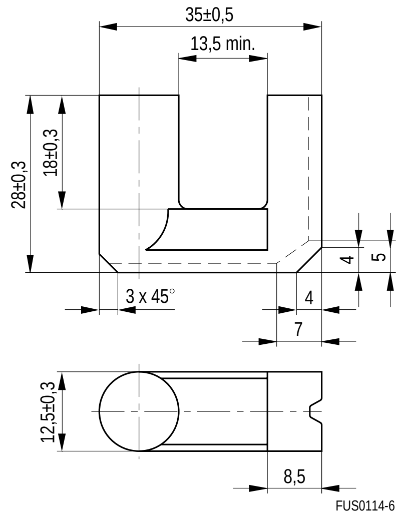
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1750 + 30/– 20 %	1400	1250	7,50 (200 mT, 100 kHz, 100 ˚C)	B67354-A1-X53
N62	1900 + 30/– 20 %	1520	1500	1,00 (200 mT, 25 kHz, 100 ˚C)	B67354-A1-X62
N82	1900 + 30/– 20 %	1520	1500	5,25 (200 mT, 100 kHz, 100 ˚C)	B67354-A1-X82
N27	2000 + 30/– 20 %	1600	1250	0,95 (200 mT, 16 kHz, 100 ˚C)	B67354-A1-X27
N67	2100 + 30/– 20 %	1680	1250	5,50 (200 mT, 100 kHz, 100 ˚C)	B67354-A1-X67

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,12 mm^{-1}
l_e = 132 mm
A_e = 117 mm^2
A_{min} = 106 mm^2
V_e = 15 400 mm^3

Approx. weight 78 g/set



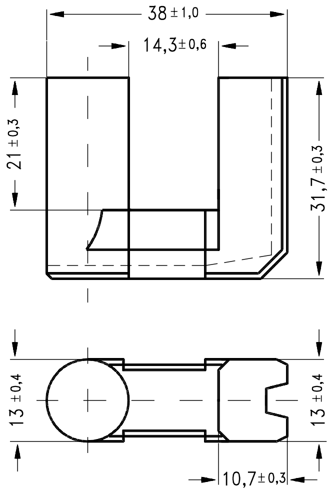
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1600 + 30/– 20 %	1420	1180	13,30 (200 mT, 100 kHz, 100 °C)	B67327-G-X153
N62	1750 + 30/– 20 %	1560	1350	1,75 (200 mT, 25 kHz, 100 °C)	B67327-G-X162
N82	1750 + 30/– 20 %	1560	1350	8,1 (200 mT, 100 kHz, 100 °C)	B67327-G-X182
N27	1800 + 30/– 20 %	1600	1180	2,90 (200 mT, 25 kHz, 100 °C)	B67327-G-X127
N67	1900 + 30/– 20 %	1690	1180	9,80 (200 mT, 100 kHz, 100 °C)	B67327-G-X167

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,08 mm^{-1}
l_e = 148 mm
A_e = 137 mm^2
A_{min} = 133 mm^2
V_e = 20 300 mm^3

Approx. weight 97,5 g/set



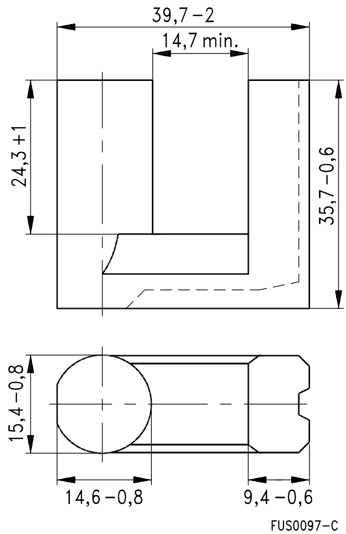
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1650 + 30/– 20 %	1420	1280	16,60 (200 mT, 100 kHz, 100 ˚C)	B67313-G-X153
N62	1850 + 30/– 20 %	1590	1460	2,15 (200 mT, 25 kHz, 100 ˚C)	B67313-G-X162
N82	1850 + 30/– 20 %	1590	1460	10,2 (200 mT, 100 kHz, 100 ˚C)	B67313-G-X182
N27	1950 + 30/– 20 %	1670	1280	3,40 (200 mT, 25 kHz, 100 ˚C)	B67313-G-X127
N67	2000 + 30/– 20 %	1720	1280	12,20 (200 mT, 100 kHz, 100 ˚C)	B67313-G-X167

Magnetic characteristics (per set)

$\Sigma l/A$ = 1,09 mm^{-1}
l_e = 163 mm
A_e = 150 mm^2
A_{min} = 133 mm^2
V_e = 24 500 mm^3

Approx. weight 125 g/set



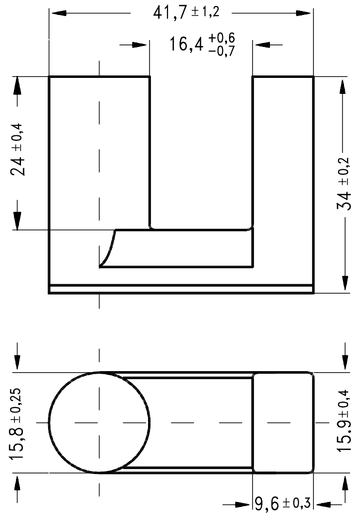
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate- rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1700 + 30/– 20 %	1470	1210	21,30 (200 mT, 100 kHz, 100 °C)	B67317-G-X153
N62	1850 + 30/– 20 %	1600	1370	2,75 (200 mT, 25 kHz, 100 °C)	B67317-G-X162
N82	1850 + 30/– 20 %	1600	1370	13,1 (200 mT, 100 kHz, 100 °C)	B67317-G-X182
N27	1950 + 30/– 20 %	1690	1210	4,60 (200 mT, 25 kHz, 100 °C)	B67317-G-X127
N67	2050 + 30/– 20 %	1780	1210	15,60 (200 mT, 100 kHz, 100 °C)	B67317-G-X167

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,98 mm^{-1}
l_e = 163 mm
A_e = 166 mm^2
A_{min} = 153 mm^2
V_e = 27 100 mm^3

Approx. weight 140 g/set



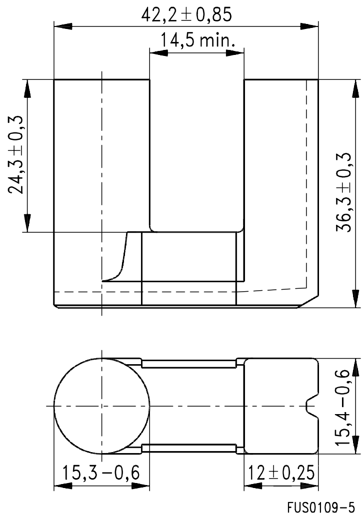
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1950 + 30/– 20 %	1520	1410	23,80 (200 mT, 100 kHz, 100 ˚C)	B67368-G-X153
N62	2150 + 30/– 20 %	1680	1600	3,10 (200 mT, 25 kHz, 100 ˚C)	B67368-G-X162
N82	2150 + 30/– 20 %	1680	1600	14,7 (200 mT, 100 kHz, 100 ˚C)	B67368-G-X182
N27	2250 + 30/– 20 %	1750	1410	5,20 (200 mT, 25 kHz, 100 ˚C)	B67386-G-X127
N67	2350 + 30/– 20 %	1830	1410	17,50 (200 mT, 100 kHz, 100 ˚C)	B67368-G-X167

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,94 mm^{-1}
l_e = 168 mm
A_e = 179 mm^2
A_{min} = 177 mm^2
V_e = 30 100 mm^3

Approx. weight 144 g/set



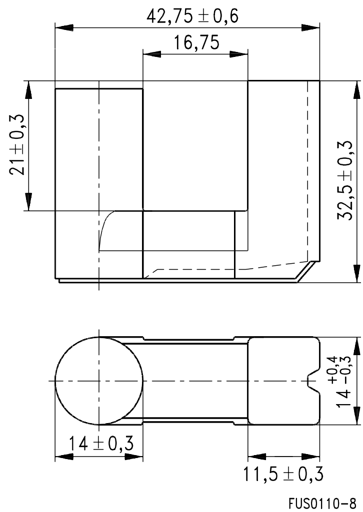
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1980 + 30/– 20 %	1480	1410	24,50 (200 mT, 100 kHz, 100 ˚C)	B67320-G-X153
N62	2100 + 30/– 20 %	1570	1660	3,20 (200 mT, 25 kHz, 100 ˚C)	B67320-G-X162
N82	2100 + 30/– 20 %	1570	1660	15,2 (200 mT, 100 kHz, 100 ˚C)	B67320-G-X182
N27	2150 + 30/– 20 %	1610	1410	5,40 (200 mT, 25 kHz, 100 ˚C)	B67320-G-X127
N67	2250 + 30/– 20 %	1680	1410	18,00 (200 mT, 100 kHz, 100 ˚C)	B67320-G-X167
N87	2300 + 30/– 20 %	1720	1410	14,50 (200 mT, 100 kHz, 100 ˚C)	B67320-G-X187

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,99 mm^{-1}
l_e = 157 mm
A_e = 159 mm^2
A_{min} = 154 mm^2
V_e = 24 850 mm^3

Approx. weight 127 g/set



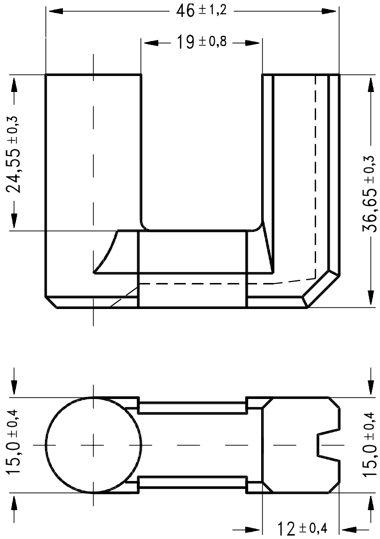
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Material	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1850 + 30/– 20 %	1480	1380	21,60 (200 mT, 100 kHz, 100 ˚C)	B67322-G-X153
N62	2050 + 30/– 20 %	1610	1560	2,80 (200 mT, 25 kHz, 100 ˚C)	B67322-G-X162
N82	2050 + 30/– 20 %	1610	1560	13,4 (200 mT, 100 kHz, 100 ˚C)	B67322-G-X182
N27	2150 + 30/– 20 %	1690	1380	4,70 (200 mT, 25 kHz, 100 ˚C)	B67322-G-X127
N87	2300 + 30/– 20 %	1810	1380	15,00 (200 mT, 100 kHz, 100 ˚C)	B67322-G-X187

Magnetic characteristics (per set)

$\Sigma l/A$ = 0,98 mm^{-1}
l_e = 176 mm
A_e = 180 mm^2
A_{min} = 177 mm^2
V_e = 31 700 mm^3

Approx. weight 145,5 g/set



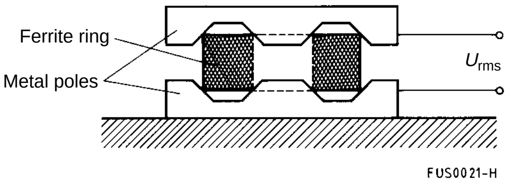
UR cores are supplied as single units. The A_L value in the table applies to a core set comprising two ungapped cores.

Mate-rial	A_L value nH	μ_e	A_{L1min} nH	P_V W/set	Ordering code
N53	1900 + 30/– 20 %	1480	1420	24,80 (200 mT, 100 kHz, 100 ˚C)	B67314-G-X153
N62	2050 + 30/– 20 %	1590	1610	3,30 (200 mT, 25 kHz, 100 ˚C)	B67314-G-X162
N82	2050 + 30/– 20 %	1590	1610	15,8 (200 mT, 100 kHz, 100 ˚C)	B67314-G-X182
N27	2100 + 30/– 20 %	1630	1420	5,40 (200 mT, 25 kHz, 100 ˚C)	B67314-G-X127
N67	2300 + 30/– 20 %	1790	1420	18,20 (200 mT, 100 kHz, 100 ˚C)	B67314-G-X167

- Our product line includes a wide range of ring cores with finely graded diameters ranging from 2,5 to 200 mm (see overview of available types). Other core heights can be supplied on request. All cores are available in the usual materials.

  Ring cores are available in different coating versions, thus offering the appropriate solution for every application. The coating not only offers protection for the edges but also provides an insulation function.

  The following test setup is used to test the dielectric strength of the insulating coating: A copper ring is pressed to the top edge of the ring. It touches the ferrite ring at the edges (see diagram). The test duration is 2 seconds; the test voltages specified in the table are minimum values for epoxy- and Rilsan-coated cores:



Core size	U_{rms}
R 4 thru R 10	1,0 kV
R 12,5 thru R 20	1,5 kV
> R 20	2,0 kV

For cores with high permeability, increased spread of the A_L values of several percent must be expected according to the specifications due to the Polyamid coating process. This effect can be avoided by using an epoxy resin coating (L version).

For small ring cores, we have introduced a parylene coating (Galxyl) which features a low coating thickness and high dielectric strength.

- Ring cores are used primarily for pulse and broadband transformers, baluns and chokes. Owing to the magnetically closed circuit, high flux densities can be achieved at small volume. Magnetic leakage is negligible.
- Ring cores are also increasingly used for power applications. Here, the typical values for amplitude permeability and power loss, as summarized in the section on SIFERRIT materials (page 33), are applicable to the special power materials.
- Characteristic data for cores not included among the preferred types are available on request.

Coatings of ring cores

Version	Rilsan (Polyamid11)	Epoxy (blue)	Galxyl (Parylene)
Layer thickness	< 0,4 mm	< 0,4 mm	0,012 or 0,025 mm
Breakdown voltage	> 2 kV (> R20)	> 2 kV (> R20)	> 1 kV (standard value)
Mechanical quality	Rough surface	High firmness	Smooth surface
Maximum temperature (short-time)	approx. 115 °C	approx. 200 °C	approx. 115 °C
Advantage	Low cost for small and medium sizes	No influence on A_L value	Very low thickness
Main application	Medium sizes (> R6,3 and < R29)	Big sizes (≥ R29) and high-perm. materials	Small sizes (≤ R10)
UL rating	UL 94V-2	UL 94V-0	UL 94V-0
Ordering code	B64290-**K**…	B64290-**L**…	B64290-**P**…

Application: Ring cores to suppress line interference

With the ever-increasing use of electrical and electronic equipment, it becomes increasingly important to be able to ensure that all facilities will operate simultaneously in the context of electromagnetic compatibility (EMC) without interfering with each others' respective functions. The EMC legislation which came into force at the beginning of 1996 applies to all electrical and electronic products marketed in the EU, both new and existing ones. So the latter may have to be modified so that they are neither susceptible to electromagnetic interference, nor emit spurious radiation. Ferrite cores are ideally suited for this purpose since they are able to suppress interference over a wide frequency range.

At frequencies above 1 MHz, ferrite rings slipped over a conductor lead to an increase in the impedance of this conductor. The real component of this impedance absorbs the interference energy.

A ferrite material´s suitability for suppressing interference within a specific frequency spectrum depends on its magnetic properties, which vary with frequency. Before the right material can be selected, the impedance lZl must be known as a function of frequency.

The curve of impedance as a function of frequency is characterized by the sharp increase in loss at resonance frequency.

<u>Measurement results:</u>

The measurements shown here were made at room temperature (25 ± 3 ˚C) using an HP 4191A RF impedance analyzer with a flux density of B ≤ 1 mT.

The maximum of the impedance curve shifts to lower frequencies as the number of turns increases; this is due to the capacitive effect of the turns (figure 1, using R25/15 as an example).

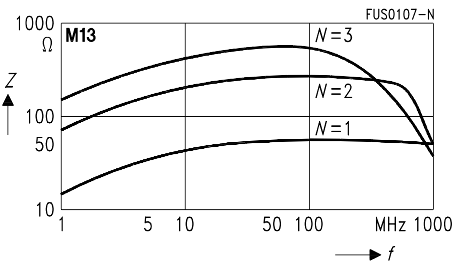


Figure 1

For direct comparison of the typical suppression characteristics of differenct ferrite materials, the impedance curves were normalized using the equation $|Z|_n = |Z| / N^2 \times \Sigma (l_e / A_e)$; the geometry factor was calculated on the basis of the core dimensions (figure 2).

These normalized impedance curves are guide values, mostly measured using ring core R 10 with a number of turns N = 1 (wire diameter 0,7 mm); they may vary slightly, depending on the geometry.

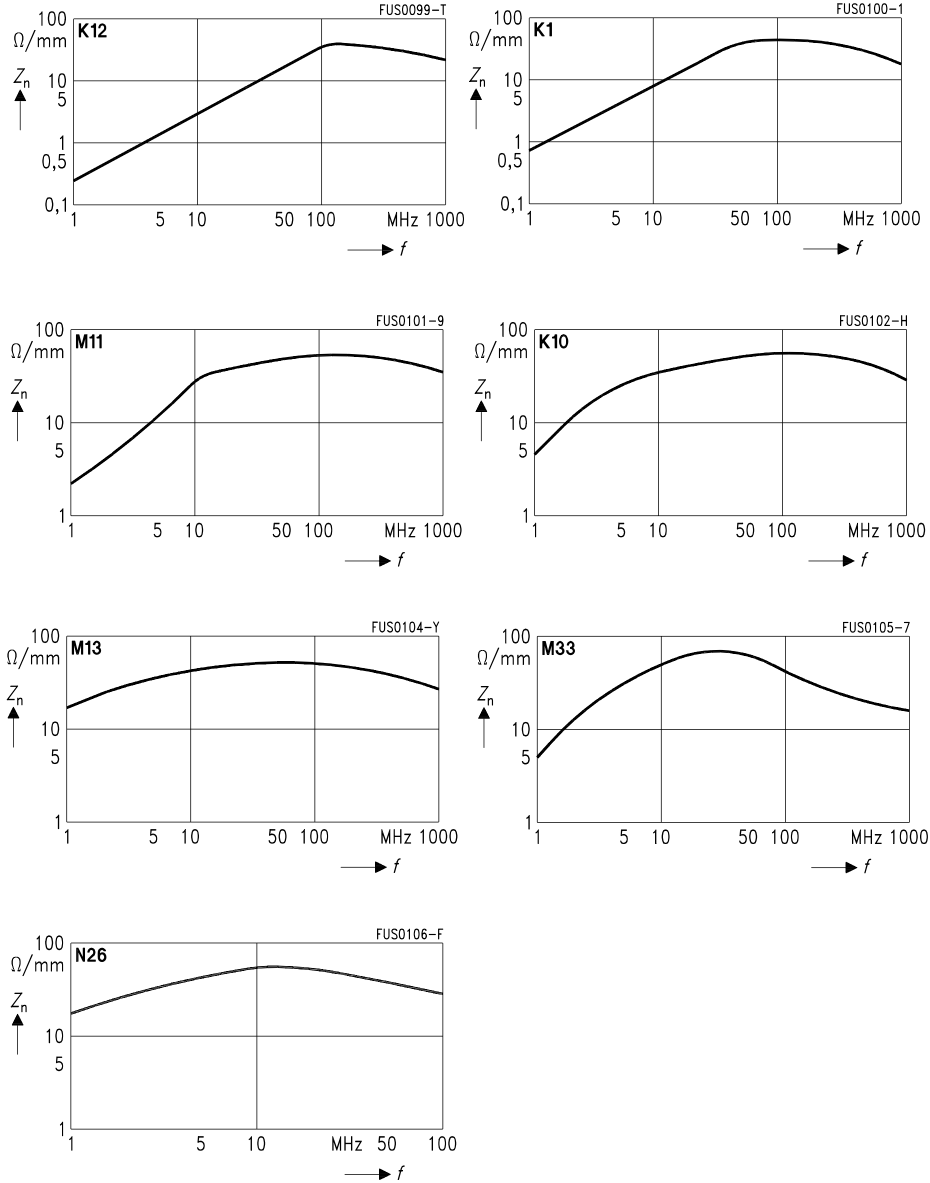
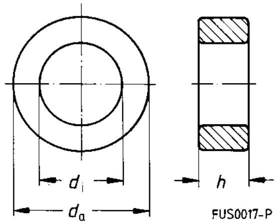

FUS0099-T
K12
100
Ω/mm
Z_n
10
5
1
0,5
0,1
1
5
10
50
100
MHz 1000
f
FUS0100-1
K1
FUS0101-9
M11
FUS0102-H
K10
FUS0104-Y
M13
FUS0105-7
M33
FUS0106-F
N26
MHz 50

Figure 2



Overview of available types

Type	Dimensions					
	d_a 1) mm	d_i 1) mm	h 1) mm	d_a inch	d_i inch	h inch
R 2,5	2,5 ± 0,12	1,5 ± 0,1	1,0 ± 0,1	0,098 ± 0,005	0,059 ± 0,004	0,039 ± 0,004
R 3,0	3,05 ± 0,2	1,27 ± 0,2	1,27 ± 0,2	0,120 ± 0,008	0,050 ± 0,008	0,050 ± 0,008
R 3,4	3,43 ± 0,20	1,78 ± 0,20	2,08 ± 0,20	0,135 ± 0,008	0,070 ± 0,008	0,082 ± 0,008
R 3,9	3,94 ± 0,12	2,24 ± 0,12	1,3 ± 0,12	0,155 ± 0,005	0,088 ± 0,005	0,051 ± 0,005
R 4,0	4,0 ± 0,12 (4,5 max)	2,4 ± 0,12 (1,9 min)	1,6 ± 0,1 (2,1 max)	0,157 ± 0,005 (0,177 max)	0,094 ± 0,005 (0,075 max)	0,063 ± 0,004 (0,083 max)
R 5,8/3	5,84 ± 0,12 (6,36 max)	3,05 ±0,12 (2,53 min)	3,0 ± 0,12 (3,55 max)	0,230 ± 0,005 (0,250 max)	0,120 ± 0,005 (0,100 max)	0,118 ± 0,005 (0,140 max)
R 6,3	6,3 ± 0,15 (7,25 max)	3,8 ± 0,12 (2,85 min)	2,5 ± 0,12 (3,4 max)	0,248 ± 0,006 (0,285 max)	0,150 ± 0,005 (0,112 max)	0,098 ± 0,005 (0,134 max)
R 9,5	9,53 ± 0,19 (10,5 max)	4,75 ±0,12 (3,8 min)	3,17 ±0,15 (4,1 max)	0,375 ± 0,007 (0,413 max)	0,187 ± 0,005 (0,130 max)	0,125 ± 0,006 (0,161 max)
R 10	10,0 ± 0,2 (11,0 max)	6,0 ± 0,15 (5,05 min)	4,0 ± 0,15 (4,95 max)	0,394 ± 0,008 (0,433 max)	0,236 ± 0,006 (0,199 max)	0,157 ± 0,006 (0,195 max)
R 12,5	12,5 ± 0,3 (13,6 max)	7,5 ± 0,2 (6,5 min)	5,0 ± 0,15 (5,95 max)	0,492 ± 0,012 (0,535 max)	0,295 ± 0,008 (0,256 max)	0,197 ± 0,005 (0,234 max)
R 13,3	13,3 ± 0,3 (14,4 max)	8,3 ± 0,3 (7,2 min)	5,0 ± 0,15 (5,95 max)	0,524 ± 0,012 (0,567 max)	0,327 ± 0,012 (0,283 max)	0,197 ± 0,005 (0,234 max)
R 14	14,0 ± 0,3 (15,1 max)	9,0 ± 0,25 (7,95 min)	5,0 ± 0,2 (6,0 max)	0,551 ± 0,012 (0,594 max)	0,354 ± 0,012 (0,313 max)	0,197 ± 0,008 (0,236 max)
R 15	15,0 ± 0,5 (16,3 max)	10,4 ± 0,4 (9,2 min)	5,3 ± 0,3 (6,4 max)	0,591 ± 0,020 (0,642 max)	0,409 ± 0,016 (0,362 max)	0,209 ± 0,012 (0,252 max)
R 16	16,0 ± 0,4 (17,2 max)	9,6 ± 0,3 (8,5 min)	6,3 ± 0,2 (7,3 max)	0,630 ± 0,016 (0,677 max)	0,378 ± 0,012 (0,335 max)	0,248 ± 0,008 (0,287 max)
R 17	17,0 ± 0,4 (18,2 max)	10,7 ± 0,3 (9,6 min)	6,8 ± 0,2 (7,8 max)	0,669 ± 0,016 (0,717 max)	0,421 ± 0,012 (0,378 max)	0,268 ± 0,008 (0,307 max)
R 20/7	20,0 ± 0,4 (21,2 max)	10,0 ±0,25 (8,75 min)	7,0 ± 0,4 (8,1 max)	0,787 ± 0,016 (0,835 max)	0,394 ± 0,010 (0,344 max)	0,276 ± 0,016 (0,319 max)

1) Values in parentheses apply to coated cores, ring cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %

Type	Dimensions					
	d_a[1)] mm	d_i[1)] mm	h[1)] mm	d_a inch	d_i inch	h inch
R 22	22,1 ± 0,4 (23,3 max)	13,7 ± 0,3 (12,6 min)	6,35 ±0,3 (7,4 max)	0,870 ± 0,016 (0,917 max)	0,539 ± 0,012 (0,496 max)	0,250 ± 0,012 (0,291 max)
R23/9	22,6 ± 0,4 (23,8 max)	14,7 ± 0,2 (13,7 min)	9,2 ± 0,2 (10,2 max)	0,890 ± 0,016 (0,937 max)	0,579 ± 0,008 (0,539 max)	0,362 ± 0,008 (0,402 max)
R 25/10	25,3 ± 0,7 (26,8 max)	14,8 ± 0,5 (13,5 min)	10,0 ± 0,2 (11,0 max)	0.996 ± 0,028 (1,043 max)	0,583 ± 0,020 (0,531 max)	0,394 ± 0,008 (0,433 max)
R 25/20	25,3 ± 0,7 (26,8 max)	14,8 ± 0,5 (13,5 min)	20,0 ± 0,5 (21,3 max)	0.996 ± 0,028 (1,043 max)	0,583 ± 0,020 (0,531 max)	0,787 ± 0,020 (0,839 max)
R 29	29,5 ± 0,7 (31,0 max)	19,0 ± 0,5 17,7 min	14,9 ± 0,4 (16,1 max)	1,142 ± 0,028 (1,220 max)	0,748 ± 0,020 (0,697 max)	0,587 ± 0,016 (0,634 max)
R 30	30,5 ± 1,0 (32,3 max)	20,0 ± 0,6 (18,2 min)	12,5 ± 0,4 (13,7 max)	1,201 ± 0,039 (1,272 max)	0,787 ± 0,024 (0,717 max)	0,492 ± 0,016 (0,539 max)
R 34/10	34,0 ± 0,7 (35,5 max)	20,5 ± 0,5 (19,2 min)	10,0 ± 0,3 (11,1 max)	1,339 ± 0,028 (1,398 max)	0,807 ± 0,020 (0,756 max)	0,394 ± 0,012 (0,437 max)
R 34/12,5	34,0 ± 0,7 (35,5 max)	20,5 ± 0,5 (19,2 min)	12,5 ± 0,3 (13,6 max)	1,339 ± 0,028 (1,398 max)	0,807 ± 0,020 (0,756 max)	0,492 ± 0,012 (0,535 max)
R 36	36,0 ± 0,7 (37,5 max)	23,0 ± 0,5 (21,7 min)	15,0 ± 0,4 (16,2 max)	1,417 ± 0,028 (1,476 max)	0,906 ± 0,020 (0,854 max)	0,591 ± 0,016 (0,638 max)
R 40	40,0 ± 1,0 (41,8 max)	24,0 ± 0,7 (22,5 min)	16,0 ± 0,4 (17,2 max)	1,575 ± 0,039 (1,646 max)	0,945 ± 0,028 (0,886 max)	0,630 ± 0,016 (0,677 max)
R 42	41,8 ± 1,0 (43,6 max)	26,2 ± 0,6 (24,8 min)	12,5 ± 0,3 (13,6 max)	1,646 ± 0,039 (1,717 max)	1,031 ± 0,024 (0,976 max)	0,492 ± 0,012 (0,535 max)
R 50	50,0 ± 1,0 (51,8 max)	30,0 ± 0,7 (28,5 min)	20,0 ± 0,5 (21,3 max)	1,969 ± 0,039 (2,039 max)	1,181 ± 0,028 (1,122 max)	0,787 ± 0,020 (0,839 max)
R 58	58,3 ± 1,0 (60,1 max)	40,8 ± 0,8 (39,2 min)	17,6 ± 0,4 (18,8 max)	2,283 ± 0,039 (2,366 max)	1,606 ± 0,031 (1,543 max)	0,693 ± 0,016 (0,740 max)
R 63	63,0 ± 1,5 (65,3 max)	38,0 ± 1,2 (36,0 min)	25,0 ± 0,8 (26,6 max)	2,480 ± 0,059 (2,571 max)	1,496 ± 0,047 (1,417 max)	0,984 ± 0,031 (1,047 max)
R 68	68,0 ± 1,2 (60,1 max)	48,0 ± 1,0 (46,2 min)	13,0 ± 0,4 (14,2 max)	2,677 ± 0,047 (2,756 max)	1,890 ± 0,039 (1,819 max)	0,512 ± 0,015 (0,559 max)
R 100	102,0 ± 2,0 (104,8 max)	65,8 ± 1,3 (63,7 min)	15,0 ± 0,5 (16,3 max)	4,016 ± 0,079 (4,126 max)	2,591 ± 0,051 (2,508 max)	0,591 ± 0,020 (0,642 max)
R 140	140,0 ± 3,0 (143,8 max)	103,0 ± 2,0 (100,2 min)	25,0 ± 1,0 (26,8 max)	5,512 ± 0,118 (5,661 max)	4,055 ± 0,079 (3,945 max)	0,984 ± 0,039 (1,055 max)
R 200	202,0 ± 4,0 (206,8 max)	153,0 ± 3,0 (149,2 min)	25,0 ± 1,0 (26,8 max)	7,953 ± 0,157 (8,142 max)	6,024 ± 0,118 (5,874 max)	0,984 ± 0,039 (1,055 max)

1) Values in parentheses apply to coated cores, ring cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %

Magnetic characteristics R 2,5

$\Sigma l/A$ = 12,30 mm^{-1}
l_e = 6,02 mm
A_e = 0,49 mm^2
V_e = 3,00 mm^3

Approx. weight 0,02 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	440 ± 25 %	B64290-P35-X830
T38	1020 ± 30 %	B64290-A35-X38
T46	1530 + 30/– 40 %	B64290-P35-X46

Magnetic characteristics R 3,0

$\Sigma l/A$ = 5,65 mm^{-1}
l_e = 5,99 mm
A_e = 1,06 mm^2
V_e = 6,40 mm^3

Approx. weight 0,04 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	960 ± 25 %	B64290-P683-X830
T38	2200 + 30/– 40 %	B64290-P683-X38
T46	3340 + 30/– 40 %	B64290-P683-X46

Magnetic characteristics R 3,4

$\Sigma l/A$ = 4,61 mm^{-1}
l_e = 7,63 mm
A_e = 1,66 mm^2
V_e = 12,6 mm^3

Approx. weight 0,07 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	1170 ± 25 %	B64290-P709-X830
T38	2730 + 30/– 40 %	B64290-P709-X38
T46	4090 + 30/– 40 %	B64290-P709-X46

1) Uncoated cores are available on request.

Magnetic characteristics

R 3,9

$\Sigma l/A$ = 8,56 mm^{-1}
l_e = 9,21 mm
A_e = 1,08 mm^2
V_e = 9,90 mm^3

Approx. weight 0,05 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	630 ± 25 %	B64290-P61-X830
T38	1470 + 30/– 40 %	B64290-P61-X38
T46	2200 + 30/– 40 %	B64290-P61-X46

Magnetic characteristics

R 4,0

$\Sigma l/A$ = 7,69 mm^{-1}
l_e = 9,63 mm
A_e = 1,25 mm^2
V_e = 12,0 mm^3

Approx. weight 0,05 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
K1	13 ± 25 %	B64290-A36-X1
M33	125 ± 25 %	B64290-A36-X33
N30	700 ± 25 %	B64290-K36-X830
T38	1630 + 30/– 40 %	B64290-P36-X38
T46	2450 + 30/– 40 %	B64290-P36-X46

1) Uncoated cores are available on request.

Magnetic characteristics **R 5,8/3**

$\Sigma l/A$ = 3,22 mm^{-1}
l_e = 13,03 mm
A_e = 4,04 mm^2
V_e = 52,60 mm^3

Approx. weight 0,3 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	1680 ± 25 %	B64290-P687-X830
T38	3900 + 30/– 40 %	B64290-P687-X38
T46	5850 + 30/– 40 %	B64290-P687-X46

Magnetic characteristics **R 6,3**

$\Sigma l/A$ = 4,97 mm^{-1}
l_e = 15,21 mm
A_e = 3,06 mm^2
V_e = 46,50 mm^3

Approx. weight 0,2 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	Ordering code
K1	20 ± 25 %		B64290-A37-X1
M33	190 ± 25 %		B64290-K37-X33
N49	330 ± 25%	250	B64290-K37-X49
N30	1090 ± 25 %		B64290-P37-X830
T38	2530 + 30/– 40 %		B64290-P37-X38
T46	3600 + 30/– 40 %		B64290-P37-X46

1) Uncoated cores are available on request.

Magnetic characteristics **R 9,5**

$\Sigma l/A$ = 2,85 mm^{-1}
l_e = 20,72 mm
A_e = 7,28 mm^2
V_e = 151 mm^3

Approx. weight 0,8 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	1900 ± 25 %	B64290-K62-X830
T35	2650 + 25/– 30 %	B64290-K62-X35
T38	4410 + 30/– 40 %	B64290-K62-X38

Magnetic characteristics **R 10**

$\Sigma l/A$ = 3,07 mm^{-1}
l_e = 24,07 mm
A_e = 7,83 mm^2
V_e = 188 mm^3

Approx. weight 0,9 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code
K1	33 ± 25 %			B64290-A38-X1
M33	308 ± 25 %			B64290-K38-X33
N49	530 ± 25%	410	< 36 mW (50 mT/500 kHz/100 ˚C)	B64290-K38-X49
N30	1760 ± 25 %			B64290-K38-X830
T37	2660 + 25/– 30 %			B64290-K38-X37
T38	4090 + 30/– 40 %			B64290-K38-X38

1) Uncoated cores are available on request.

Magnetic characteristics R 12,5

$\Sigma l/A$ = 2,46 mm^{-1}
l_e = 30,09 mm
A_e = 12,23 mm^2
V_e = 368 mm^3

Approx. weight 1,8 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code
N49	660 ± 25%	510	< 72 mW (50 mT/500 kHz/100 ˚C)	B64290-K44-X49
N27	1020 ± 25%	460	< 70 mW (200 mT/25 kHz/100 ˚C)	B64290-K44-X27
N67	1070 ± 25%	460	< 280 mW (200 mT/100 kHz/100 ˚C)	B64290-K44-X67
N30	2200 ± 25 %			B64290-A44-X830
N30	2200 ± 25 %			B64290-K44-X830
T35	3060 + 25/– 30 %			B64290-K38-X35
T37	3320 + 25/– 30 %			B64290-K44-X37
T38	5110 + 30/– 40 %			B64290-K44-X38

Magnetic characteristics R 13,3

$\Sigma l/A$ = 2,67 mm^{-1}
l_e = 32,70 mm
A_e = 12,27 mm^2
V_e = 401 mm^3

Approx. weight 1,8 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	2020 ± 25 %	B64290-K644-X830
T35	2830 + 25/– 30 %	B64290-K644-X35
T37	3060 + 25/– 30 %	B64290-K644-X37
T38	4700 + 30/– 40 %	B64290-K644-X38

1) Uncoated cores are available on request.

Magnetic characteristics

R 14

$\Sigma l/A$ = 2,84 mm^{-1}
l_e = 34,98 mm
A_e = 12,30 mm^2
V_e = 430 mm^3

Approx. weight 2 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	1900 ± 25 %	B64290-K658-X830
T35	2650 + 25/– 30 %	B64290-K658-X35
T37	2880 + 25/– 30 %	B64290-K658-X37
T38	4420 + 30/– 40 %	B64290-K658-X38

Magnetic characteristics

R 15

$\Sigma l/A$ = 3,24 mm^{-1}
l_e = 39,02 mm
A_e = 12,05 mm^2
V_e = 470 mm^3

Approx. weight 2,4 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	1670 ± 25 %	B64290-K623-X830
T35	2330 + 25/– 30 %	B64290-K623-X35
T37	2520 + 25/– 30 %	B64290-K623-X37
T38	3880 + 30/– 40 %	B64290-K623-X38

1) Uncoated cores are available on request.

Magnetic characteristics **R 16**

$\Sigma l/A$ = 1,95 mm^{-1}
l_e = 38,52 mm
A_e = 19,73 mm^2
V_e = 760 mm^3

Approx. weight 3,7 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code[1)]
N49	840 ± 25%	640	< 130 mW (50 mT/500 kHz/100 ˚C)	B64290-K45-X49
N27	1290 ± 25%	580	< 140 mW (200 mT/25 kHz/100 ˚C)	B64290-K45-X27
N67	1350 ± 25%	580	< 500 mW (200 mT/100 kHz/100 ˚C)	B64290-K45-X67
N30	2770 ± 25 %			B64290-K45-X830
T35	3870 + 25/– 30 %			B64290-K45-X35
T37	4190 + 25/– 30 %			B64290-K45-X37
T38	6440 + 30/– 40 %			B64290-K45-X38

Magnetic characteristics **R 17**

$\Sigma l/A$ = 2,00 mm^{-1}
l_e = 42,00 mm
A_e = 21,04 mm^2
V_e = 884 mm^3

Approx. weight 4,4 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	2710 ± 25 %	B64290-K652-X830
T35	3770 + 25/– 30 %	B64290-K652-X35
T37	4080 + 25/– 30 %	B64290-K652-X37
T38	5700 + 30/– 40 %	B64290-K652-X38

1) Uncoated cores are available on request.

Magnetic characteristics R 20/7

$\Sigma l/A$ = 1,30 mm^{-1}
l_e = 43,55 mm
A_e = 33,63 mm^2
V_e = 1465 mm^3

Approx. weight 7,6 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	4160 ± 25 %	B64290-K632-X830
T35	5000 + 25/– 30 %	B64290-K632-X35
T37	6280 + 25/– 30 %	B64290-K632-X37
T38	8500 + 30/– 40 %	B64290-K632-X38

Magnetic characteristics R 22

$\Sigma l/A$ = 2,07 mm^{-1}
l_e = 54,15 mm
A_e = 26,17 mm^2
V_e = 1417 mm^3

Approx. weight 6,8 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code[1)]
N27	1210 ± 25%	550	< 250 mW (200 mT/25 kHz/100 ˚C)	B64290-K638-X27
N30	2610 ± 25 %			B64290-K638-X830
T35	3200 + 25/– 30 %			B64290-K638-X35
T37	3950 + 25/– 30 %			B64290-K638-X37
T38	5400 + 30/– 40 %			B64290-K638-X38

1) Uncoated cores are available on request.

Magnetic characteristics

R 23/9

$\Sigma l/A$ = 1,59 mm^{-1}
l_e = 56,82 mm
A_e = 35,78 mm^2
V_e = 2033 mm^3

Approx. weight 9,8 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1]
N30	3420 ± 25 %	B64290-K626-X830
T35	4200 + 25/– 30 %	B64290-K626-X35
T37	5170 + 25/– 30 %	B64290-K626-X37
T38[2]	6700 + 30/– 40 %	B64290-K626-X38

Magnetic characteristics

R 25/10

$\Sigma l/A$ = 1,17 mm^{-1}
l_e = 60,07 mm
A_e = 51,26 mm^2
V_e = 3079 mm^3

Approx. weight 16 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code[1]
N27	2150 ± 25%	970	< 580 mW (200 mT/25 kHz/100 ˚C)	B64290-K618-X27
N30	4620 ± 25 %			B64290-K618-X830
T35	5400 + 25/– 30 %			B64290-K618-X35
T37	6970 + 25/– 30 %			B64290-K618-X37
T38	9100 + 30/– 40 %			B64290-K618-X38

1) Uncoated cores are available on request.
2) Preliminary data

Magnetic characteristics R 25/20

$\Sigma l/A$ = 0,59 mm^{-1}
l_e = 60,07 mm
A_e = 102,5 mm^2
V_e = 6157 mm^3

Approx. weight 33 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	9160 ± 25 %	B64290-K616-X830
T35	11700 + 25/– 30 %	B64290-K616-X35
T65	11000 + 30/– 40 %	B64290-K616-X65
T37[2)]	13800 + 25/– 30 %	B64290-K616-X37
T38[2)]	18000 + 30/– 40 %	B64290-K616-X38

Magnetic characteristics R 29

$\Sigma l/A$ = 0,96 mm^{-1}
l_e = 73,78 mm
A_e = 76,98 mm^2
V_e = 5680 mm^3

Approx. weight 27 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	5630 ± 25 %	B64290-L647-X830
T65[2)]	6800 ± 30 %	B64290-L647-X65
T37[2)]	8500 ± 25 %	B64290-L647-X37

1) Uncoated cores are available on request.
2) Preliminary data

Magnetic characteristics

R 30

$\Sigma l/A$ = 1,19 mm^{-1}
l_e = 77,02 mm
A_e = 64,66 mm^2
V_e = 4980 mm^3

Approx. weight 25 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	4540 ± 25 %	B64290-L657-X830
T65	5400 ± 30 %	B64290-L657-X65
T37[2)]	6400 ± 25 %	B64290-L657-X37

Magnetic characteristics

R 34/10

$\Sigma l/A$ = 1,24 mm^{-1}
l_e = 82,06 mm
A_e = 66,08 mm^2
V_e = 5423 mm^3

Approx. weight 27 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	4360 ± 25 %	B64290-L58-X830
T65[2)]	5100 ± 30 %	B64290-L58-X65
T37[2)]	6100 ± 25 %	B64290-L58-X37

Magnetic characteristics

R 34/12,5

$\Sigma l/A$ = 0,99 mm^{-1}
l_e = 82,06 mm
A_e = 82,60 mm^2
V_e = 6778 mm^3

Approx. weight 33 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code[1)]
N30	5460 ± 25 %	B64290-L48-X830
T65[2)]	6400 ± 30 %	B64290-L48-X65
T37[2)]	7600 ± 25 %	B64290-L48-X37

1) Uncoated cores are available on request. 2) Preliminary data

Magnetic characteristics

R 36

$\Sigma l/A$ = 0,94 mm^{-1}
l_e = 89,65 mm
A_e = 95,89 mm^2
V_e = 8597 mm^3

Approx. weight 43 g

Material	A_L value nH (1 mT, 10 kHz, 25 °C)	A_{L1min} nH (320 mT, 10 kHz, 100 °C)	P_V W/core (Measuring conditions)	Ordering code[1]
N67	2810 ± 25%	1200	< 5,9 W (200 mT/100 kHz/100 °C)	B64290-L674-X67
N30	5750 ± 25 %			B64290-L674-X830
T65[2]	6700 ± 30 %			B64290-L674-X65
T37[2]	8000 ± 25 %			B64290-L674-X37

Magnetic characteristics

R 40

$\Sigma l/A$ = 0,77 mm^{-1}
l_e = 96,29 mm
A_e = 125,30 mm^2
V_e = 12070 mm^3

Approx. weight 61 g

Material	A_L value nH (1 mT, 10 kHz, 25 °C)	Ordering code[1]
N30	7000 ± 25 %	B64290-L659-X830
T65[2]	8200 ± 30 %	B64290-L659-X65
T37[2]	9800 ± 25 %	B64290-L659-X37

1) Uncoated cores are available on request.
2) Preliminary data

Magnetic characteristics **R 42**

$\Sigma l/A$ = 1,08 mm^{-1}
l_e = 103,0 mm
A_e = 95,75 mm^2
V_e = 9862 mm^3

Approx. weight 48 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	5000 ± 25 %	B64290-A22-X830
N30	5000 ± 25 %	B64290-L22-X830
T65	5800 ± 30 %	B64290-L22-X65
T37	7000 ± 25 %	B64290-L22-X37

Magnetic characteristics **R 50**

$\Sigma l/A$ = 0,62 mm^{-1}
l_e = 120,4 mm
A_e = 195,7 mm^2
V_e = 23560 mm^3

Approx. weight 118 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	8700 ± 25 %	B64290-A82-X830
N30	8700 ± 25 %	B64290-L82-X830
T65	10000 ± 30 %	B64290-L82-X65
T37	12000 ± 25 %	B64290-L82-X37

Magnetic characteristics **R 58**

$\Sigma l/A$ = 1,00 mm^{-1}
l_e = 152,4 mm
A_e = 152,4 mm^2
V_e = 23230 mm^3

Approx. weight 115 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	5400 ± 25 %	B64290-A40-X830
T65	6250 ± 30 %	B64290-L40-X65
T37	7160 ± 25 %	B64290-L40-X37

Magnetic characteristics **R 63**

$\Sigma l/A$ = 0,5 mm^{-1}
l_e = 152,1 mm
A_e = 305,9 mm^2
V_e = 46530 mm^3

Approx. weight 238 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	10800 ± 25 %	B64290-L699-X830
N30	10800 ± 30 %	B64290-A699-X830
T37[1)]	14500 ± 25 %	B64290-L699-X37

Magnetic characteristics **R 68**

$\Sigma l/A$ = 1,39 mm^{-1}
l_e = 178,6 mm
A_e = 128,7 mm^2
V_e = 22980 mm^3

Approx. weight 114 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	3890 ± 25 %	B64290-L696-X830
N30	3890 ± 25 %	B64290-A696-X830

1) Preliminary data

Magnetic characteristics — R 100

$\Sigma l/A$ = 0,96 mm^{-1}
l_e = 255,3 mm
A_e = 267,2 mm^2
V_e = 68220 mm^3

Approx. weight 330 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	A_{L1min} nH (320 mT, 10 kHz, 100 ˚C)	P_V W/core (Measuring conditions)	Ordering code
N87	2880 ± 25%	1600	< 14 W (100 mT/100 kHz/100 ˚C)	B64290-L84-X87
N30	5500 ± 25 %			B64290-L84-X830

Magnetic characteristics — R 140

$\Sigma l/A$ = 0,82 mm^{-1}
l_e = 375,8 mm
A_e = 458,9 mm^2
V_e = 172440 mm^3

Approx. weight 860 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	6200 ± 25 %	B64290-A705-X830

Magnetic characteristics — R 200

$\Sigma l/A$ = 0,90 mm^{-1}
l_e = 550,5 mm
A_e = 608,6 mm^2
V_e = 335030 mm^3

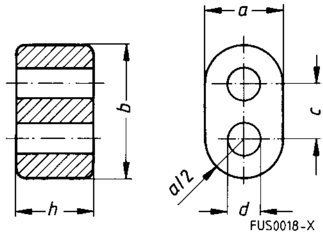
Approx. weight 1600 g

Material	A_L value nH (1 mT, 10 kHz, 25 ˚C)	Ordering code
N30	5500 ± 30 %	B64290-A711-X830

Primarily used for broadband transformers up to high frequencies

Application examples

- SIFERRIT material N30 for low frequencies and for pulse applications
- SIFERRIT material K1 for matching transformers and baluns up to about 250 MHz in antenna feeders or in input circuits of VHF and TV receivers
- SIFERRIT material U17 for the same applications up to 500 MHz



Dimensions 1)					Magnetic characteristics				Weight
h (mm)	*b* (mm)	*a* (mm)	*c* (mm)	*d* (mm)	$\Sigma l/A$ 3) mm^{-1}	l_e 3) mm	A_e 3) mm^2	V_e 3) mm^3	g
14,5 – 1,0	14,50 – 1,0	8,5 – 0,5	5,85 ± 0,25	3,4 + 0,80	0,310	15,3	49,7	760	4,0
8,3 – 0,6	14,50 – 1,0	8,5 – 0,5	5,85 ± 0,25	3,4 + 0,60	0,540	15,3	28,4	435	2,5
6,2 – 0,5	7,25 – 0,5	4,2 – 0,4	2,90 ± 0,15	1,7 + 0,30	0,745	7,6	10,2	78	0,4
2,5 – 0,3	3,60 – 0,3	2,1 – 0,3	1,45 ± 0,10	0,8 + 0,15	1,780	3,7	2,1	7,8	0,1

Overview of available types

Core height *h* (mm)	Material	A_L value 3) nH (Tol. ± 30 %)	Ordering code 4)
14,5 – 1,0 2)	K1	330	B62152-A1-X1
8,3 – 0,6 2)	K1 N30	190 10000	B62152-A4-X1 B62152-A4-X30
6,2 – 0,5 2)	K1 N30	140 7300	B62152-A7-X1 B62152-A7-X30
2,5 – 0,3	K1 N30	60 3000	B62152-A8-X1 B62152-A8-X30

1) Cores made of NiZn ferrite may exceed the specified dimensions by up to 5 %.
2) In accordance with DIN 41279, shape G.
3) Magnetic characteristics and A_L value are based on winding of center leg.
4) Double-aperture cores are available with parylene coating on request. In this case the thickness of the coating is approx. 10 to 15 µm. Ordering code for coated version: B62152-P...

Ferrite Polymer Composites

Ferrite cores are familiar as brittle, rigid and bulky components for high-inductance coils and transformers. The performance of such ferrites depends very much on external influences such as temperature, pressure, electromagnetic fields and frequency.

FPC is a homogeneous mixture of ferrite powder and plastic with outstanding mechanical and magnetic properties. This rugged material can be processed into injection-molded parts or thin, flexible film to open up innovative applications.

The new C351 film is suitable for high-temperature applications up to 200 °C and is UL 94-V0-listed. It is also available with copper coatings of 35 to 75 µm and in various thicknesses from 0,2 to 0,4 mm. FPC film of materials C350 and C351 can also be supplied in self-adhesive versions.

FPC film is ideal for EMC applications, e.g. to shield coils against metals or absorb interference at frequencies of 500 MHz and higher. It opens up many other applications, such as implementation of low-profile coils for identification systems and electronic article surveillance in retailing and logistics, for sensors or contactless smart cards. FPC can also be used for compensation of deflection yoke coils in TV picture tubes and computer monitors. This innovative material is also suitable as spacing between ferrite cores – instead of air gaps or non-magnetic films – to suppress leakage fields, for instance, or to adjust the biasing curve.

Basic features

- Composite material of polymer and ferrite
- Minor influence of temperature
- High dc magnetic bias capability
- Suitable for a wide frequency range
- High electrical resistance

Technical benefits

- High mechanical stability
- Excellent dimensional stability
- Manufacturing technique: injection molding
  → production of any core shape possible
- Distributed air gap → low winding losses

Applications

- Inductive proximity switches
- Identification systems, e.g. immobilizer in automobiles
- Non-contact power transmission
- Resonance inductors for DC/DC converters

Core shapes on request

Physical properties

Material	Symbol	Unit	C302
Initial permeability; f = 1 MHz	μ_i		17 ± 20 %
Flux density (near saturation) H = 25 kA/m; f = 10 kHz	B_S (25 °C)	mT	330
Remanent flux density H = 25 kA/m; f = 10 kHz	B_r (25 °C)	mT	15
Coercive field strength H = 25 kA/m; f = 10 kHz	H_C (25 °C)	A/m	770
Relative loss factor f = 1 MHz f = 100 MHz	$\tan\delta/\mu_i$		 < 0,0004 < 0,03
Hysteresis material constant	η_B	10^{-3}/mT	< 0,25
Temperature coefficient	$\alpha = \Delta\mu/\mu\Delta T$	1/K	< 0,0002
Density		kg/m³	3500
Resistivity f = 10 kHz f = 10 MHz	ρ	Ωm	 21 13
Dielectric constant f = 10 kHz f = 10 MHz	ε_r		 280 100
Max. operating temperature	T_{max}	°C	180

Basic features

- FPC is a composite material of polymer and ferrite
- FPC film is a thin, mechanically flexible film

Technical benefits

- Stable magnetic characteristics
- Low weight: FPC film is 40% lower in density than ferrite
- High mechanical strength
- Shaping as required: customer-specific solutions possible
- Economy: easy transport and storage,
  simple, rationalized processing, low mounting volume
- C351 film suitable for high-temperature applications (up to 200 °C)
- Material C351 approved to UL 94-V0 (E 140 693)
- Various film thickness (from 0,2 to 0,4 mm)
- Self-adhesive versions
- C351 film with optional copper coatings 35 to 75 µm thick

Applications

- Implementation of low-profile coils, e. g. for
  – identification systems
  – security tags for electronic article surveillance
  – sensors
  – inductive reading of smart cards
- Electromagnetic shielding of coils from metals to prevent interference
- EMC: absorption of radiated emissions at frequencies ≥ 500 MHz
- Compensation of deflection yokes to correct distortion at the corners of TV screens and monitors
- Spacing between ferrite cores (as a substitute for air gaps or non-magnetic films) for
  – suppression of the leakage field
  – adjustment of the biasing curve

Ordering details

The ordering codes are structured as follows:

1st group Design	2nd group Film thickness/width		3rd group Copper coating/material		4th group Packing unit
B68450: Film on reel B68451: Film on reel, self-adhesive B68452: Film on reel, copper-coated (only in combination with C351!)	A: 0,2 mm B: 0,3 mm C: 0,4 mm	0080: 80 mm	X: Default letter A: 35 µm B: 50 µm C: 75 µm D: 100 µm	350 351	M9: 5 m length M1: 10 m length M2: 25 m length M3: 50 m length

Material	Thickness (mm)	Extra features	Ordering code	Packing unit (m)
C350	0,2		B68450-A0080-X350-M9	5
C350	0,2		B68450-A0080-X350-M1	10
C350	0,2		B68450-A0080-X350-M3	50
C351	0,2		B68450-A0080-X351-M9	5
C351	0,2		B68450-A0080-X351-M1	10
C351	0,2		B68450-A0080-X351-M3	50
C350	0,2	self-adhesive	B68451-A0080-X350-M9	5
C350	0,2		B68451-A0080-X350-M3	50
C351	0,3	self-adhesive	B68451-B0080-X351-M1	10
C351	0,3		B68451-B0080-X351-M3	50
C351	0,2	copper-coated	B68452-A0080-X351-M1	10
C351	0,2		B68452-A0080-X351-M3	50

Quantities of FPC film products should be ordered in *meters*, not in units or reels.

Physical properties (material values defined on 0,2 mm thick film)

Material	Symbol	Unit	C350	C351[3]
Initial permeability [1] f = 1 MHz	μ_i		9 ± 20 %	9 ± 20 %
Flux density (near saturation) [1] H = 25 kA/m f = 10 kHz	B_S	mT	255	255
Remanent flux density [1] H = 25 kA/m f = 10 kHz	B_r	mT	9	9
Coercive field strength [1] H = 25 kA/m f = 10 kHz	H_C	A/m	600	600
Relative loss factor [1] f = 10 MHz f = 1 GHz	$\tan\delta/\mu_i$		 < 0,005 < 0,400	 < 0,005 < 0,400
Hysteresis material constant	η_B	10^{-3}/mT	< 2	< 2
Temperature coefficient[1]	$\alpha = \Delta\mu/\mu\Delta T$	1/K	$< 5 \cdot 10^{-5}$	$< 5 \cdot 10^{-5}$
Density		kg/m^3	2930	2930
Resistivity [1] f = 1 kHz f = 10 MHz	ρ	Ωm	 500 100	 500 100
Dielectric constant [1] f = 1 kHz f = 10 MHz	ε_r		 700 21	 700 21
Dielectric strength		kV/mm	1	0,8
Max. operating temperature	T_{max}	°C	120	200
Tensile strength [2]	σ_Z	N/mm^2	1,5	2,5
Tearing resistance [2]		%	25	25
Compressibility [2]	κ	N/mm^2	70	70

1) T = 25 °C in accordance with IEC 51 (CO) 282
2) T = 23 °C and 50 % r.h.
3) UL 94, flame class V0 (listed E 140 693)

Subject Index

Q

R

S

T

U

V

W

Symbol	Meaning	Unit
A	Cross section of coil	mm^2
A_e	Effective magnetic cross section	mm^2
A_L	Inductance factor; $A_L = L/N^2$	nH
A_{L1}	Minimum inductance at defined high saturation ($\triangleq \mu_a$)	nH
A_{min}	Minimum core cross section	mm^2
A_N	Winding cross section	mm^2
A_R	Resistance factor; $A_R = R_{Cu}/N^2$	$\mu\Omega = 10^{-6}\ \Omega$
B	RMS value of magnetic flux density	Vs/m^2, mT
ΔB	Flux density deviation	Vs/m^2, mT
$\hat{B}$	Peak value of magnetic flux density	Vs/m^2, mT
$\Delta\hat{B}$	Peak value of flux density deviation	Vs/m^2, mT
$B\_$	DC magnetic flux density	Vs/m^2, mT
B_R	Remanent flux density	Vs/m^2, mT
B_S	Saturation magnetization	Vs/m^2, mT
C_0	Winding capacitance	F = As/V
CDF	Core distortion factor	$mm^{-4,5}$
DF	Relative disaccommodation coefficient $DF = d/\mu_i$	
d	Disaccommodation coefficient	
E_a	Activation energy	J
f	Frequency	s^{-1}, Hz
f_{cutoff}	Cut-off frequency	s^{-1}, Hz
f_{max}	Upper frequency limit	s^{-1}, Hz
f_{min}	Lower frequency limit	s^{-1}, Hz
f_r	Resonance frequency	s^{-1}, Hz
f_{Cu}	Copper filling factor	
g	Air gap	mm
H	RMS value of magnetic field strength	A/m
$\hat{H}$	Peak value of magnetic field strength	A/m
$H\_$	DC field strength	A/m
H_c	Coercive field strength	A/m
h	Hysteresis coefficient of material	10^{-6} cm/A
$h/\mu_i^{\ 2}$	Relative hysteresis coefficient	10^{-6} cm/A
I	RMS value of current	A
$I\_$	Direct current	A
$\hat{I}$	Peak value of current	A
J	Polarization	Vs/m^2
k	Boltzmann constant	J/K
k_3	Third harmonic distortion	
k_{3c}	Circuit third harmonic distortion	
L	Inductance	H = Vs/A
$\Delta L/L$	Relative inductance change	

Symbol	Meaning	Unit
L_0	Inductance of coil without core	H
L_H	Main inductance	H
L_p	Parallel inductance	H
L_{rev}	Reversible inductance	H
L_s	Series inductance	H
l_e	Effective magnetic path length	mm
l_N	Average length of turn	mm
N	Number of turns	
P_{Cu}	Copper (winding) losses	W
P_{trans}	Transferrable power	W
P_V	Relative core losses	mW/g
PF	Performance factor	
Q	Quality factor ($Q = \omega L/R_s = 1/\tan \delta_L$)	
R	Resistance	Ω
R_{Cu}	Copper (winding) resistance ($f = 0$)	Ω
R_h	Hysteresis loss resistance of a core	Ω
ΔR_h	R_h change	Ω
R_i	Internal resistance	Ω
R_p	Parallel loss resistance of a core	Ω
R_s	Series loss resistance of a core	Ω
R_{th}	Thermal resistance	K/W
R_V	Effective loss resistance of a core	Ω
s	Total air gap	mm
T	Temperature	˚C
ΔT	Temperature difference	K
T_C	Curie temperature	˚C
t	Time	s
t_v	Pulse duty factor	
$\tan \delta$	Loss factor	
$\tan \delta_L$	Loss factor of coil	
$\tan \delta_r$	(Residual) loss factor at $H \to 0$	
$\tan \delta_e$	Relative loss factor	
$\tan \delta_h$	Hysteresis loss factor	
$\tan \delta/\mu_i$	Relative loss factor of material at $H \to 0$	
U	RMS value of voltage	V
$\hat{U}$	Peak value of voltage	V
V_e	Effective magnetic volume	mm^3
Z	Complex impedance	Ω
α	Temperature coefficient (TK)	1/K
α_F	Relative temperature coefficient of material	1/K
α_e	Temperature coefficient of effective permeability	1/K

Symbols and Terms

Symbol	Meaning		Unit
ε_r	Relative dielectric constant		
Φ	Magnetic flux		Vs
η	Efficiency of a transformer		
η_B	Hysteresis material constant		mT^{-1}
η_i	Hysteresis core constant		$A^{-1}H^{-1/2}$
λ_s	Magnetostriction at saturation magnetization		
μ	Relative complex permeability		
μ_0	Magnetic field constant		Vs/Am
μ_a	Relative amplitude permeability		
μ_{app}	Relative apparent permeability		
μ_e	Relative effective permeability	for series components	Ωm^{-1}
μ_i	Relative initial permeability		mm^{-1}
μ'_p	Relative real (inductive) component of $\bar{\mu}$		s
μ''_p	Relative imaginary (loss) component of $\bar{\mu}$		s^{-1}
μ_r	Relative permeability	for parallel components	
μ_{rev}	Relative reversible permeability		
μ'_s	Relative real (inductive) component of $\bar{\mu}$		
μ''_s	Relative imaginary (loss) component of $\bar{\mu}$		
μ_{tot}	Relative total permeability derived from the static magnetization curve		
ρ	Resistivity		
$\Sigma l/A$	Magnetic form factor		
τ_{Cu}	DC time constant $\tau_{Cu} = L/R_{Cu} = A_L/A_R$		
ω	Angular frequency; $\omega = 2\,\Pi f$		

The commas used in numerical values denote decimal points.

All dimensions are given in mm.

SMD Surface-mount device

Ordering code structure

1 RM, P, TT/PR, EP, ER9,5, ER11 cores
(Example here RM 4)

B65803 – N 160 – A 48

Part number

Code letter for revision status and version

A_L value in nH
Given only for gapped cores.
Not specified for ungapped cores
(e.g. B65803-J-R30)

Short designation for the SIFERRIT material
(48 ≙ N48,
1 ≙ K1,
33 ≙ M33 etc.)

Letter giving A_L value tolerance
A ≙ ± 3 %
G ≙ ± 2 %
J ≙ ± 5 %
E ≙ ± 7 %
K ≙ ± 10 %
L ≙ ± 15 %
R ≙ + 30/– 20 %
U ≙ + 80/– 0 %
Y ≙ + 40/– 30 %
X ≙ Filling letter

2 E, ELP, ER, ETD, EC, EFD, EV cores
These cores are supplied as single units; each packing unit contains only cores either with or without shortened center leg (gap dimension »*g*«). The typical value given in the tables for the A_L value applies to a core set consisting of one core with a shortened center leg and one core without a shortened center leg (dimension »*g*« approx. 0). E cores with a toleranced A_L value are available on request. We then prefer a symmetrical air gap distribution.

Ordering example (here ETD 29)

B66358 – G 1000 – X 1 27

Part number

See table "Code letters of E cores"

See table "Code letters of E cores"

Short designation for the SIFERRIT material
(27 ≙ N27, 67 ≙ N67 etc.)

Code letter for A_L tolerance (see table)

Versions (code letters) of RM, P and E cores

Type	with center hole (without threaded sleeve)	with center hole (with threaded sleeve)	without center hole	with tapered center post	low-profile version
RM 3	—	—	J	—	P
RM 4	A	N	J	—	P
RM 5	C	N	J	—	P
RM 6	C	N	J	—	P
RM 6-R	A	F	—	—	—
RM 7	A	N	J	—	P
RM 8	D	F	J	H	P
RM 10	—	N	J	H	P
RM 12	—	—	E	H	P
RM 14	—	—	E	H	P

Type	with center hole (without threaded sleeve)	with center hole (with threaded sleeve)	without center hole
P 3,3 × 2,6	—	—	C
P 4,6 × 4,1	B	K (with thread)	W
P 5,8 × 3,3	D	—	—
P 7 × 4	A	—	—
P 9 × 5	D	T	—
P 11 × 7	D	T	W
P 14 × 8	D	T	W
P 18 × 11	D	T	W
P 22 × 13	D	T	W
P 26 × 16	D	T	W
P 30 × 19	D	T	W
P 36 × 22	D	T	W
P 41 × 25	J	—	—

Code letter	Pairing	Code number	Tolerance
G	E - E	Air gap dimensions in µm Not specified f. ungapped cores	Air gap toleranced
U	E - E	A_L value in nH	A_L value, asymmetric air gap
A	E - E	A_L value in nH	A_L value, symmetric air gap
W	E - I (ELP cores)	A_L value in nH	A_L value
P	I core (plate f. ELP cores)	—	—