Projet 11 - H2Q / Hacheur 2 quadrants 60V/10A

11.1 H2Q version A - Hacheur 2 quadrants 60V/10A

Projet : IUT3

Info : [DIV414]

Révision : H2Qa – rev. 1 du 15 octobre 2003

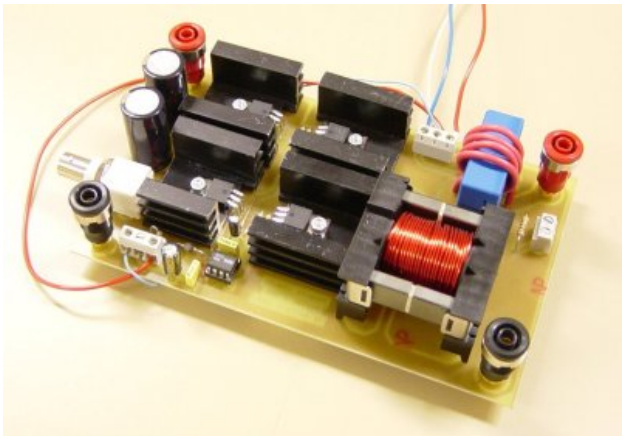


Fig. 11.1. Maquette H2Qa (images-maquettes\h2qa-22.jpg).

11.1.1 Désignation des composants H2Qa

Tableau 11.1. Liste de composants (projets-iut3.xls / H2Qa).

N°	Quantité	Référence	Désignation	Empreinte
1	2	B1,B3	HEADER 1	EMBASE
2	1	B2	OUT	EMBASE
3	1	B4	MASSE	EMBASE
4	2	C4,C1	330uF 100V	RADIAL16
5	3	C2,C7,C8	100nF	CK06
6	1	C5	120uF 25V	RADIAL06L
7	1	C6	10uF 25V	RADIAL06L
8	2	D1,D2	MBR20100CTP	TO220-KL224-38
9	1	D3	BYV95A	DO41
10	1	JP1	COURANT	03PL2
11	1	JP3	CDE	03PL2
12	1	JP4	CDE	BNC1
13	1	LEM1	LTS25-NP	LTS25
14	1	L1	500uH 10A	RM14
15	2	Q1,Q2	IRF540N	TO220-KL224-38
16	2	R1,R3	75	RC04
17	2	R2,R4	1k	RC04
18	1	R6	4.7k	RC02
19	1	U1	IR2111	08DIP300L

11.1.2 Chronogrammes H2Qa - ETD39 – e = 1mm

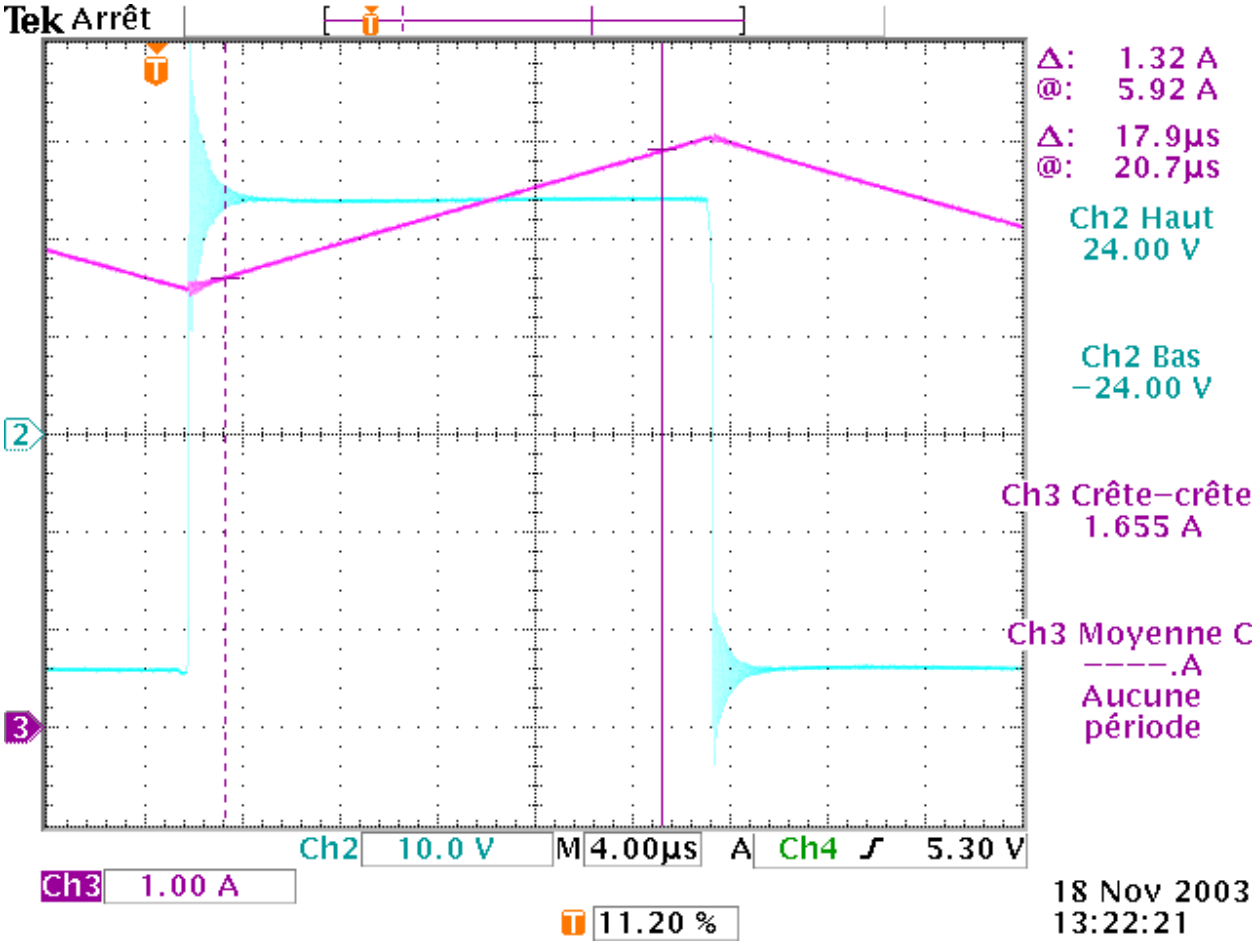


Fig. 11.2. Courant et tension de l'inductance (tektronix\h2qa\0VL-IL-ETD39-1mm.pcx).

Essais **: hacheur de type BUCK**

Tension d'entrée : E = 50 V

Rapport cyclique : α = 50 %

Courant d'entrée : Ie = 2,5 A

Courant de sortie : Is = 5 A

Tension inductance : V_{Lmax} = +24 V pendant ΔT = 17,9 µs

Variation du courant : ΔI_L = 1,32 A

Inductance : $v = L\frac{di}{dt}$ soit $L = \frac{V_L \times \Delta T}{\Delta I_L}$ = 325 µH.

Circuit ETD39 – Matériaux 3C90 – Entrefer e = 1 mm (FR4) – N = 57 spires – Fils 2 x AWG19 (ϕ 1 mm)

μ_e = 1900 – Ae = 125 mm² – Le = 92,2 mm – $\mu_0 = 4 \cdot \pi \cdot 10^{-7}$

$$L = N^2 \cdot \frac{\mu_0 \cdot \mu_e \cdot Ae}{Le} \cdot \frac{1}{1 + \frac{2 \cdot e \cdot \mu_e}{Le}} = 249\ \mu H$$

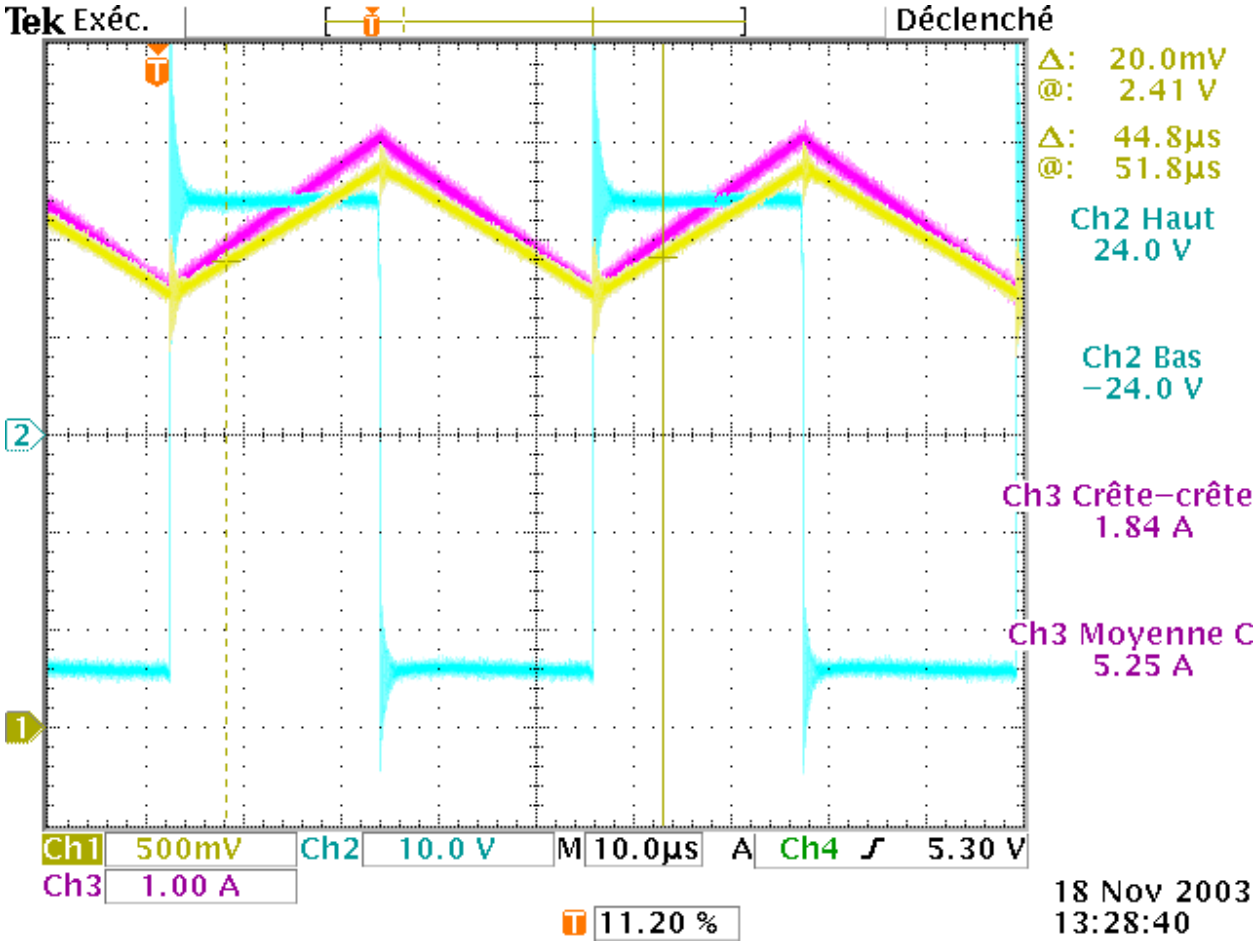


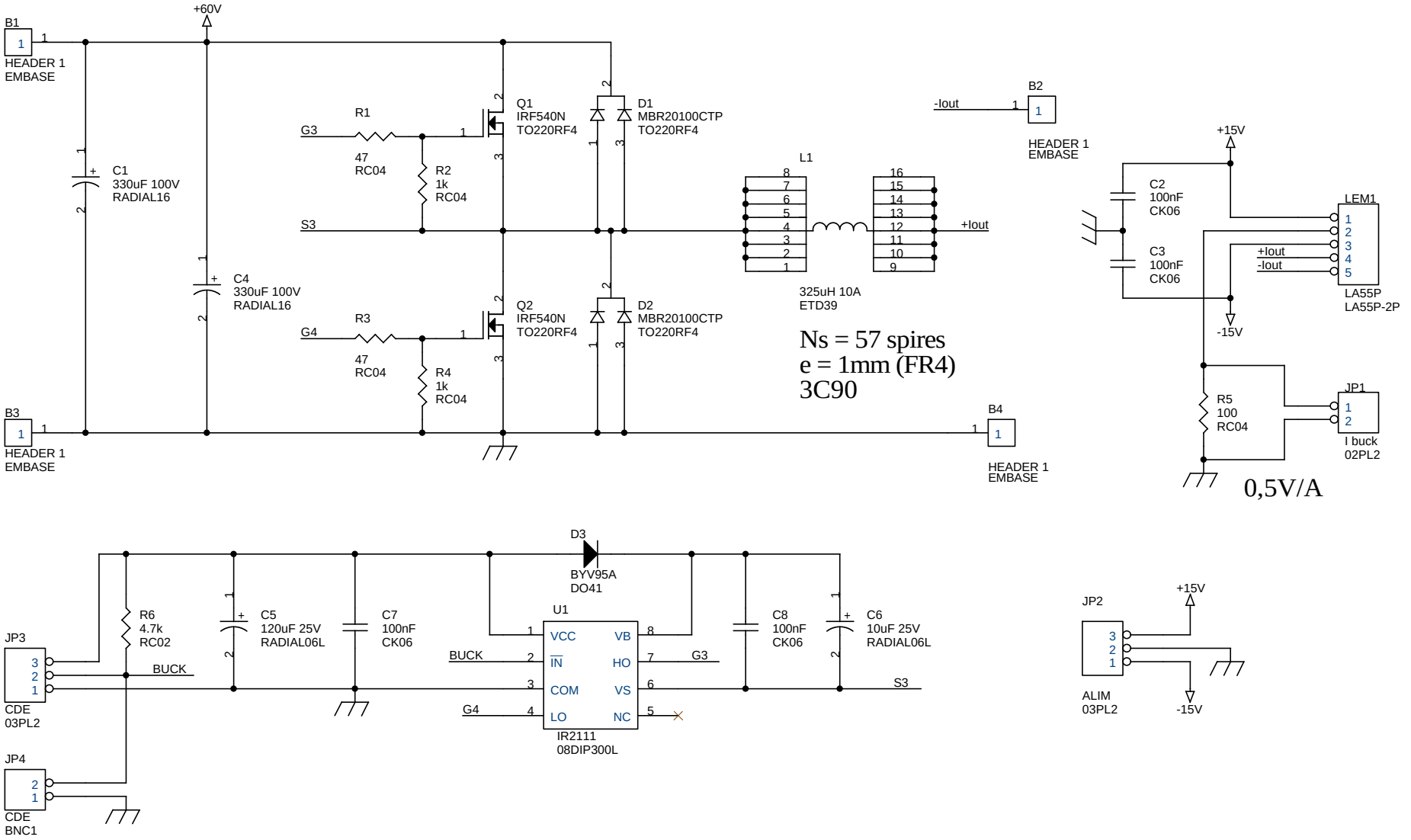
Fig. 11.3. Tension de sortie du capteur de courant (tektronix\h2qa\VL-IL-LA55-100.pcx).

Capteur LEM LA55-P – 5 tours – R_{mesure} = 100 Ω.

$$\Delta I_L = 1{,}4\ A - \Delta V_{Imes} = 700\ mV - \frac{\Delta V}{\Delta I} = \frac{700\ mV}{1{,}4A} = 0{,}5$$

$$V_{OUT} = \frac{Ns \cdot i_P}{1000} \times R_{mes} = \frac{i_P}{200} \times 100\Omega - \frac{\Delta V}{\Delta I} = \frac{100\Omega}{200} = 0{,}5$$

$$V_{OUT} = \frac{Ns \cdot i_P}{1000} \times R_{mes} = i_p \frac{5}{1000} \times 100\Omega \Rightarrow 0{,}5\ {}^{V}\!/_{A}$$



Title: Hacheur 2 qudarants 60V 10A		
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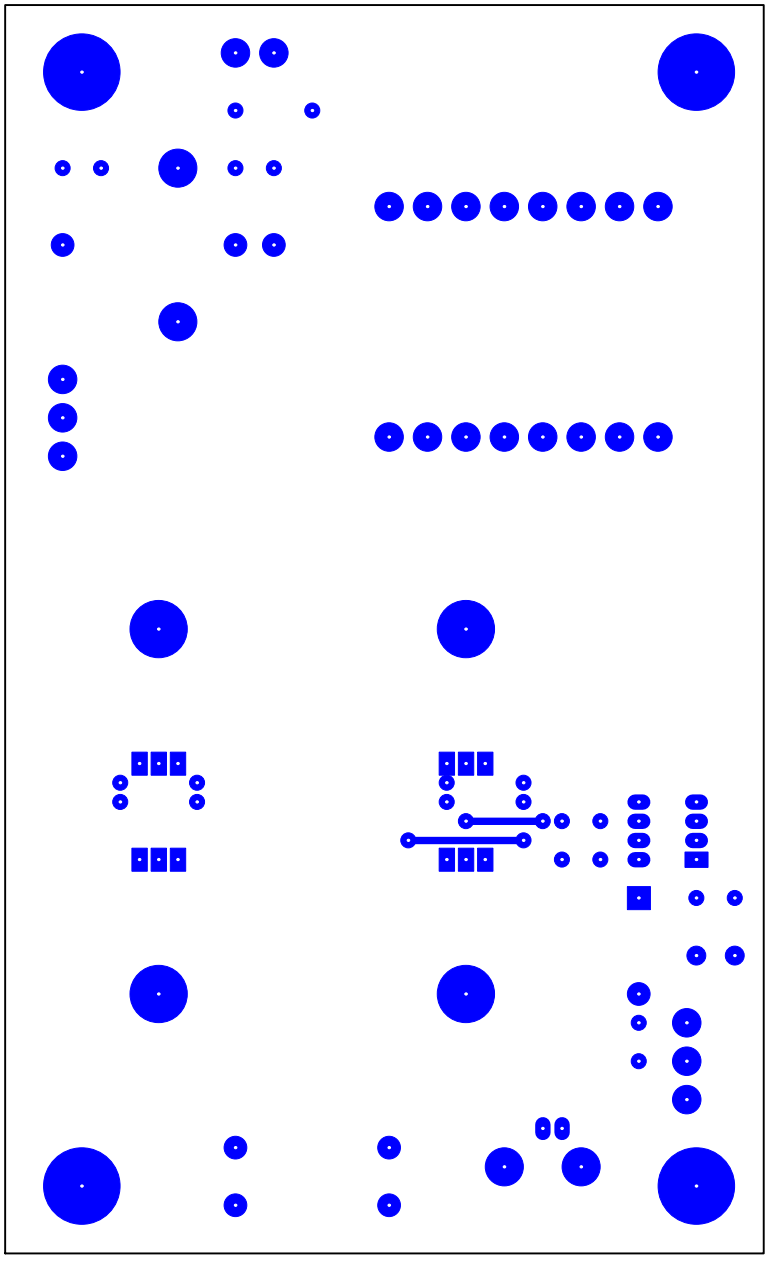
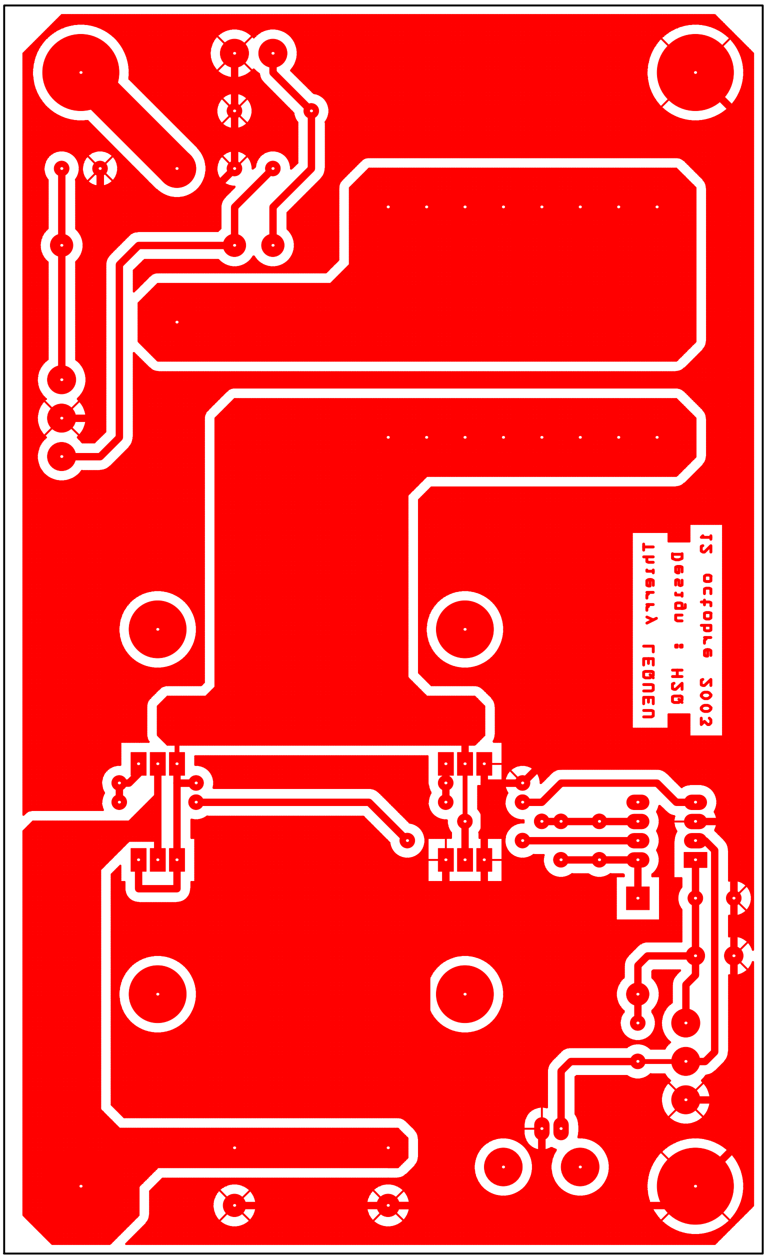
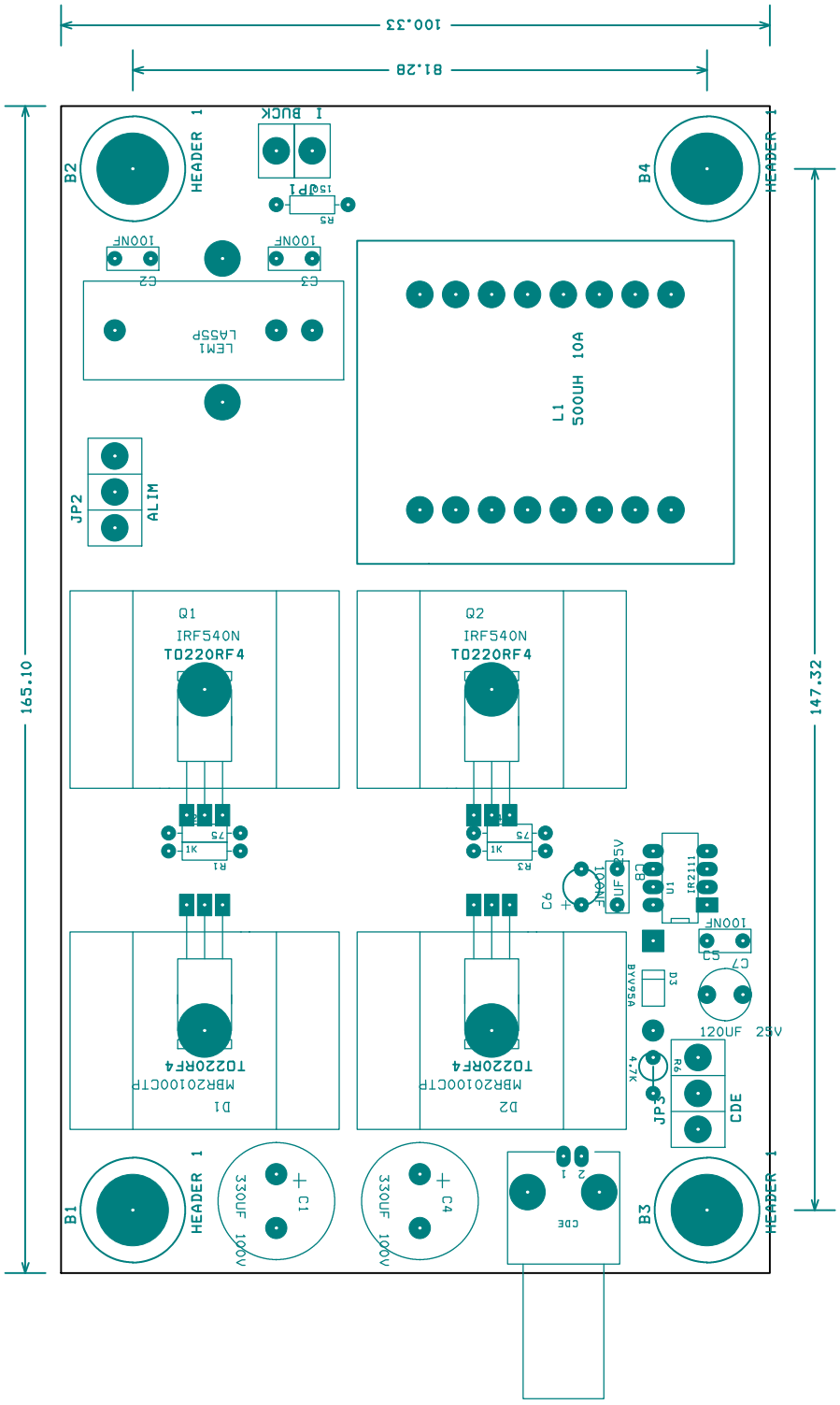
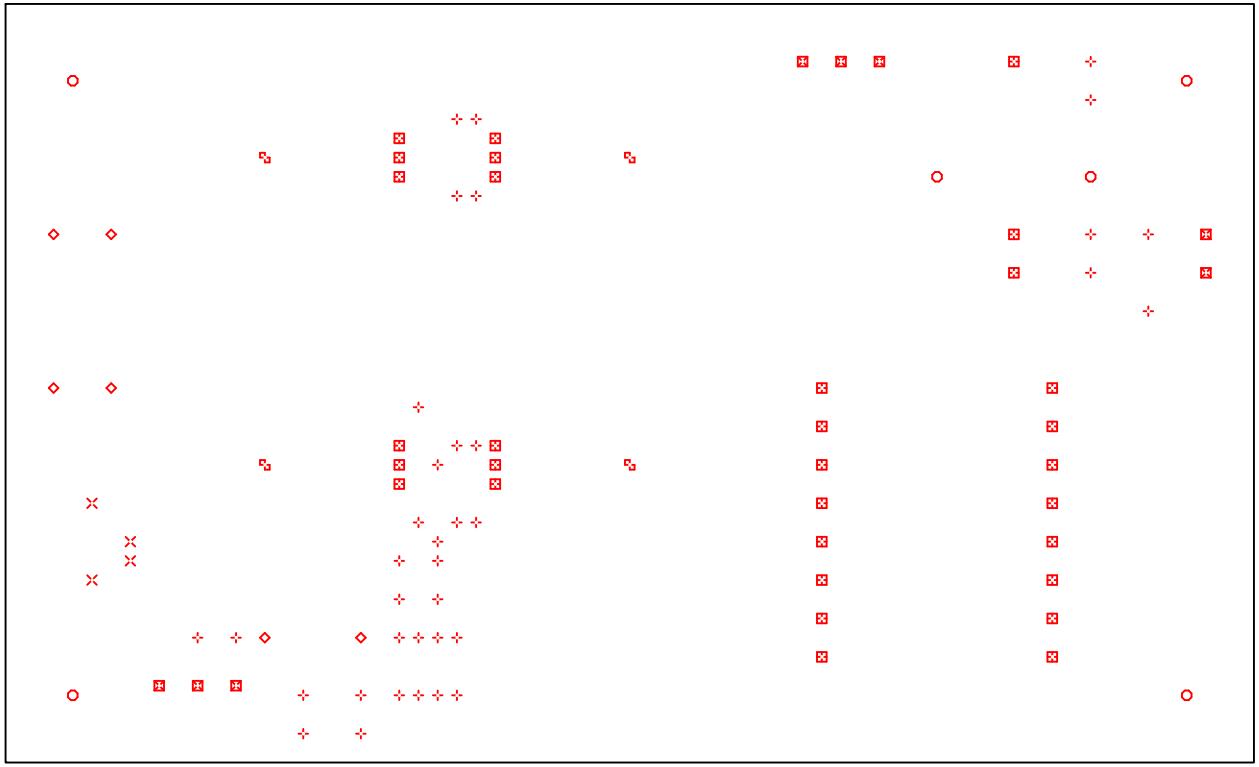





100.33
81.28
165.10
147.32
B2
HEADER 1
I BUCK
B4
HEADER 1
100NF
C2
100NF
C3
LEM1
LA55P
L1
500UH 10A
JP2
ALIM
Q1
IRF540N
TO220RF4
Q2
IRF540N
TO220RF4
R1
75
1K
R3
75
1K
C6
100NF
C8
1UF 25V
U1
IR2111
100NF
C5
C7
120UF 25V
BYV95A
D3
4,7K
R6
JP3
CDE
D1
MBR20100CTR
TO220RF4
D2
MBR20100CTR
TO220RF4
B1
HEADER 1
330UF 100V
C1
330UF 100V
C4
CDE
B3
HEADER 1

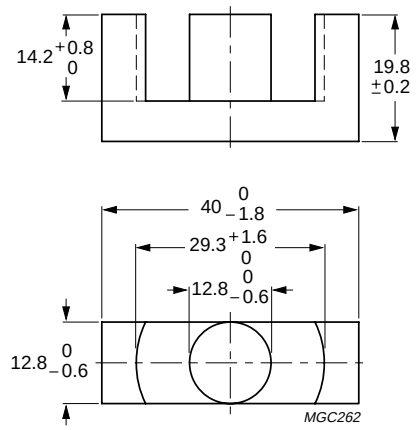


DRILL CHART				
SYM	DIAM	TOL	QTY	NOTE
×	0.508 mm		4	
+	0.787 mm		36	
◇	0.991 mm		6	
⊠	1.000 mm		8	
⊞	1.194 mm		31	
○	1.499 mm		2	
⧉	3.200 mm		4	
○	4.191 mm		4	
TOTAL			95	

CORE SETS

Effective core parameters

SYMBOL	PARAMETER	VALUE	UNIT
Σ(l/A)	core factor (C1)	0.737	mm^{-1}
V_e	effective volume	11500	mm^3
l_e	effective length	92.2	mm
A_e	effective area	125	mm^2
A_{min}	minimum area	123	mm^2
m	mass of core half	≈30	g



Dimensions in mm.

Fig.1 ETD39 core half.

Core halves

Clamping force for A_L measurements, 40 ±20 N. Gapped cores are available on request.

GRADE	A_L (nH)	μ_e	AIR GAP (μm)	TYPE NUMBER
3C90	3000 ±25%	≈1900	≈0	ETD39-3C90
3F3	2800 ±25%	≈1750	≈0	ETD39-3F3

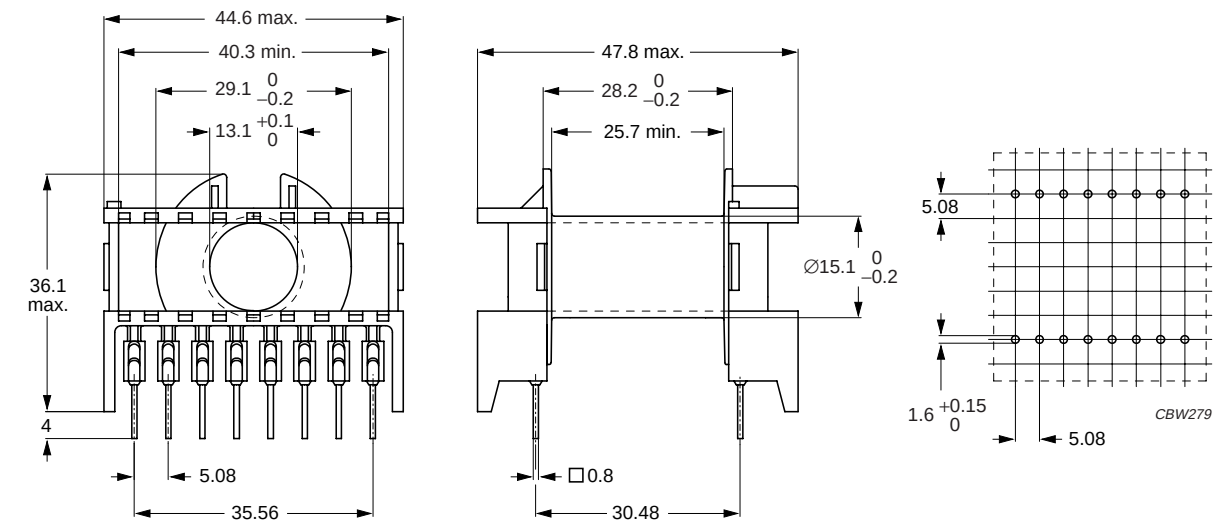
Properties of core sets under power conditions

GRADE	B (mT) at	CORE LOSS (W) at		
	H = 250 A/m; f = 25 kHz; T = 100 °C	f = 25 kHz; $\hat{B}$ = 200 mT; T = 100 °C	f = 100 kHz; $\hat{B}$ = 100 mT; T = 100 °C	f = 400 kHz; $\hat{B}$ = 50 mT; T = 100 °C
3C90	≥330	≤1.4	≤1.5	–
3F3	≥320	–	≤1.4	≤2.5

COIL FORMER

General data 16-pins ETD39 coil former

PARAMETER	SPECIFICATION
Coil former material	polybutyleneterephtalate (PBT), glass-reinforced, flame retardant in accordance with *"UL 94V-0"*; UL file number E45329(R)
Pin material	copper-tin alloy (CuSn), tin-lead alloy (SnPb) plated
Maximum operating temperature	155 °C, *"IEC 60085"*, class F
Resistance to soldering heat	*"IEC 60068-2-20"*, Part 2, Test Tb, method 1B, 350 °C, 3.5 s
Solderability	*"IEC 60068-2-20"*, Part 2, Test Ta, method 1



Dimensions in mm.

Fig.2 ETD39 coil former; 16-pins.

Winding data for 16-pins ETD39 coil former

NUMBER OF SECTIONS	WINDING AREA (mm^2)	MINIMUM WINDING WIDTH (mm)	AVERAGE LENGTH OF TURN (mm)	TYPE NUMBER
1	177	25.7	69	CPH-ETD39-1S-16P(1)

Note

1. Also available with ∅1.0 mm pins.