

Projet 4 - VAR24V / Variateur 24V-300W pour petit véhicule électrique.

Projet : IUT5
Info : [DIV513]
Révision : 1 du 2 juillet 2007
Révision : 2 du 19 juillet 2007

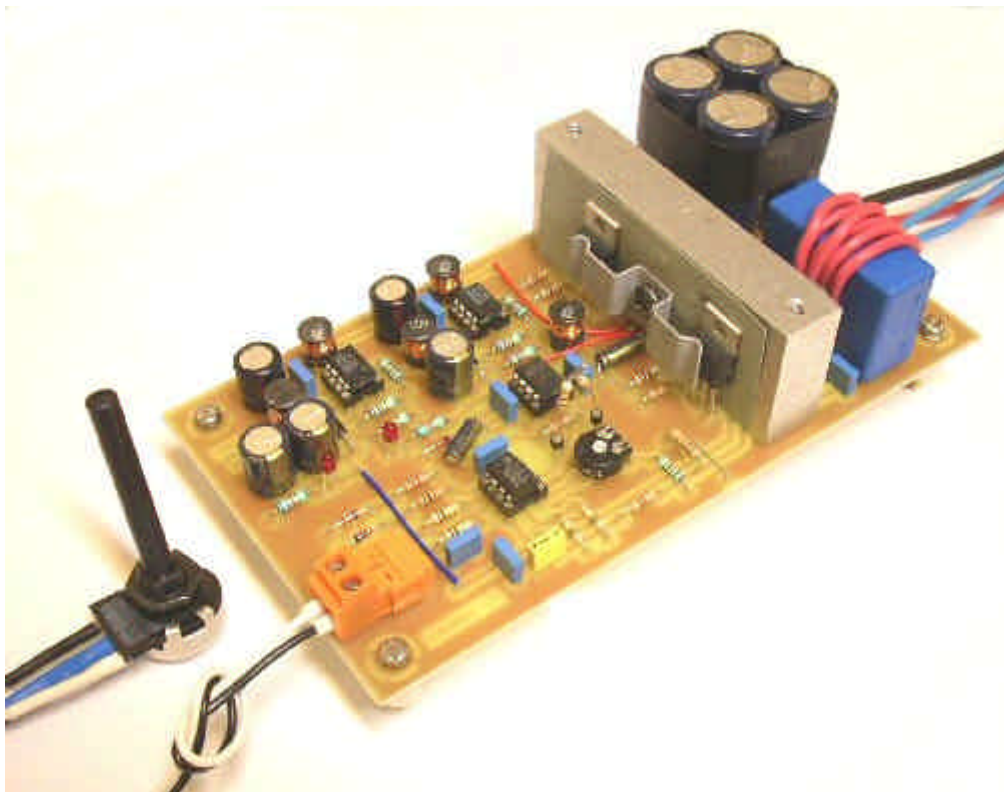


Figure 4.1. Vue de carte électronique (images-maquettes\VAR24V-42.jpg).

4.1 Liste des documents

- Désignation des composants
- Prix du montage.
- Schéma électronique.
- Circuit imprimé coté cuivre.
- Circuit imprimé coté composants.
- Implantation des composants.
- Documentations des composants.

4.2 Désignation des composants

Tableau 4.1. Liste de composants (projets-iut5.xls / VAR24V).

N°	Quantité	Référence	Désignation	Empreinte
1	4	C1,C2,C3,C21	2200uF 50V FC	RADIAL18
2	7	C4,C5,C11,C14,C18,C19,C20	100nF	CK06
3	2	C7,C6	10uF 50V FC	RADIAL04L
4	2	C9,C8	100nF	CK06L
5	2	C10,C13	100uF 63V	RADIAL10
6	3	C12,C15,C16	330uF 25V	RADIAL10
7	1	C17	10nF	CK06
8	2	D8,D1	43CTQ100	TO220
9	2	D5,D2	2mA	LED3
10	2	D3,D4	11DQ06	DO41
11	2	D9,D6	4.7V	DO35L
12	1	D7	1N4148	DO35
13	1	JP1	24V	02PL2
14	1	JP3	MOTEUR	02PL2
15	1	JP4	10k	WEID2
16	1	LEM1	LA55P	LA55P-2P
17	1	L1	10uH	RADIAL08
18	2	L2,L4	10uH 0.5A	RADIAL08
19	1	L3	330uH 0.5A	RADIAL08
20	1	L5	68uH 0.5A	RADIAL08
21	1	RAD1	Radiateur	DISSIP-00
22	1	R1	100	RC04
23	2	R2,R22	100	RC04L
24	3	R3,R14,R21	10k	RC04L
25	4	R4,R5,R8,R9	27k	RC04L
26	3	R6,R11,R20	1.2k	RC04L
27	2	R10,R7	6.8k	RC04L
28	5	R12,R13,R16,R17,R18	100k	RC04L
29	2	R23,R15	2.7k	RC04L
30	1	R19	10k	RAJ1
31	1	R24	4.7k	RC04L
32	2	T2,T1	HUF75639P3	TO220
33	1	U1	TC4422	08DIP300L
34	1	U2	LM2574N-ADJ	08DIP300L
35	1	U3	LM2574HVN-ADJ	08DIP300L
36	1	U4	TL082	08DIP300L
37	4	VIS1,VIS2,VIS3,VIS4	VISSERIE	M3L

4.3 Composants annexes



Figure 4.2. Vue de carte électronique (images-maquettes\VAR24V-22.jpg).

4.4 Calculs des composants

4.4.1 Le moteur à courant continu

Puissance 300 W – Tension 24 V – Courant 12,5 A.

Capteur de courant : LA55P 50 A RMS, +/- 70A – 5 tours de câble de 1,5 mm².

4.4.2 Les batteries

2 batteries au plomb de 12V – Tension entre 20V et 30V – Tension nominale = 2 x 13,6 = 27,2 V.

Alimentation +15V : LM2575N-ADJ – 40V 500 mA DIP 8.

Alimentation -15V : LM2575HVN-ADJ – 30V – (-15V) = 45V donc un 60V 500mA DIP 8.

4.4.3 Le transistor MOSFET et la diode de roue libre

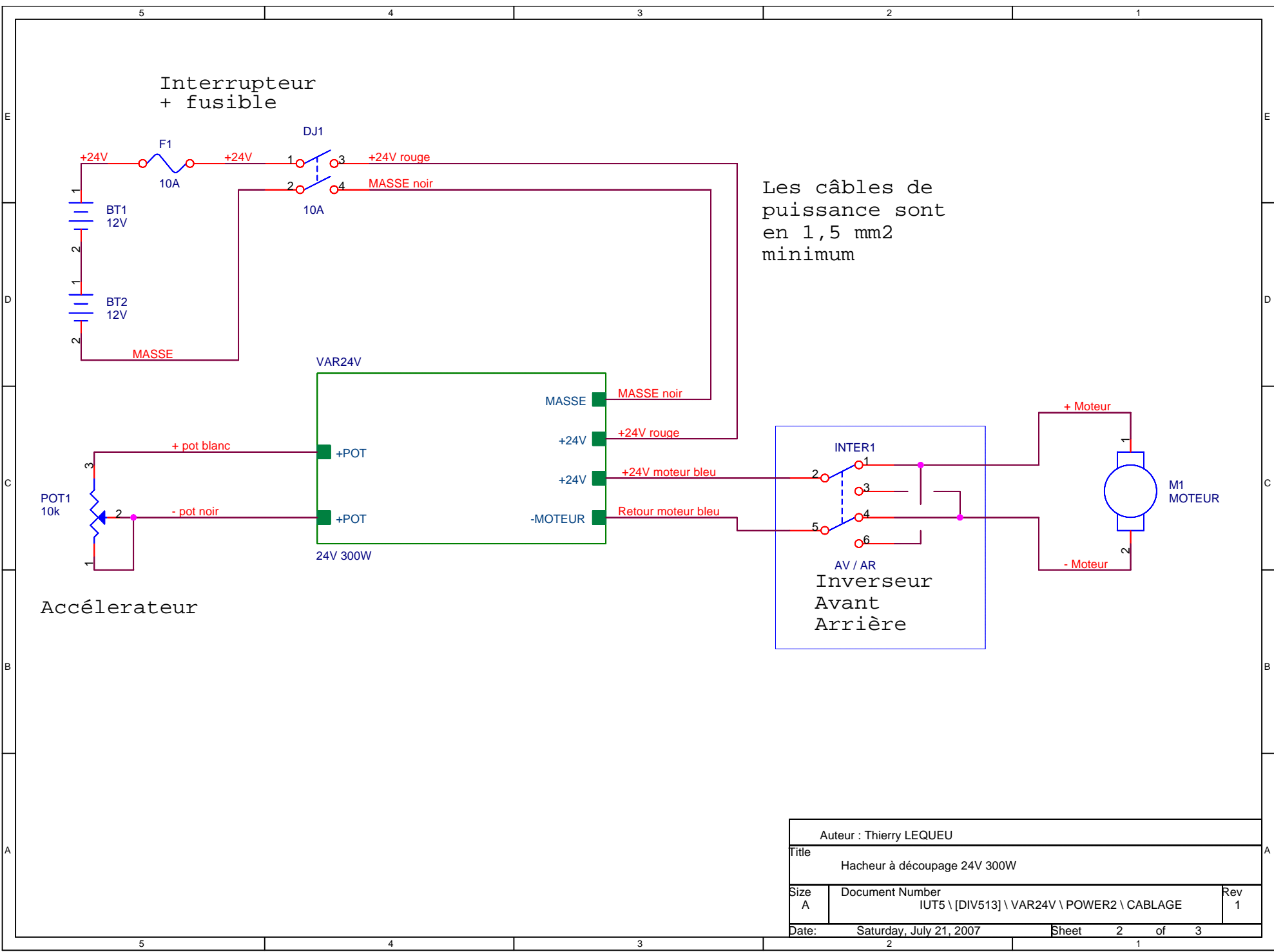
Coefficient de sécurité de 2 en tension et en courant : $V_{max} > 60$ V et $I_{max} > 25$ A

En stock : 2 x MOSFET HUF75639P3 boîtier TO220, 100V 56A, 25 mΩ. $R_{DS(on)} = 50$ mΩ à $T_j = 120^\circ\text{C}$.

Puissance dissipée $P = \frac{R_{DS(on)}}{2} \times I_{DS}^2 = 0,025 \times 12,5 \times 12,5 = 3,9$ W : il faut un dissipateur.

En stock : 2 x Diode Scotky 43CTQ100, TO 220, 100V, 40 A, 0,67 V.

Puissance dissipée $P = V_{AK} \times \frac{I_{AK}}{2} = 0,67 \times 6,25 = 4,2$ W : il faut un dissipateur.



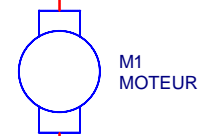
Interrupteur
+ fusible

Les câbles de
puissance sont
en 1,5 mm²
minimum

Accélérateur

INTER1

AV / AR
Inverseur
Avant
Arrière

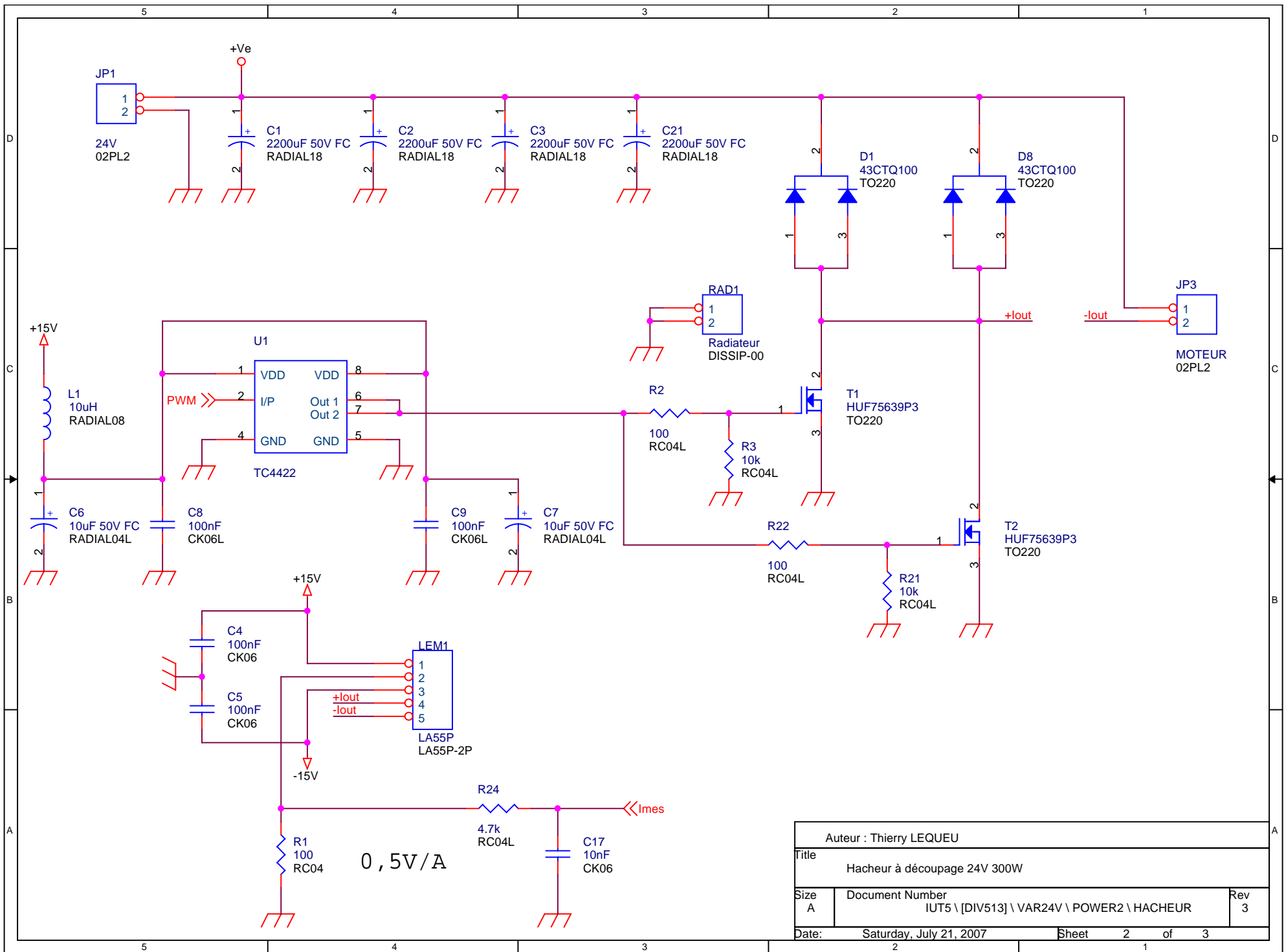


Auteur : Thierry LEQUEU		
Title Hacheur à découpage 24V 300W		
Size A	Document Number IUT5 \ [DIV513] \ VAR24V \ POWER2 \ CABLAGE	Rev 1
Date:	Saturday, July 21, 2007	Sheet 2 of 3

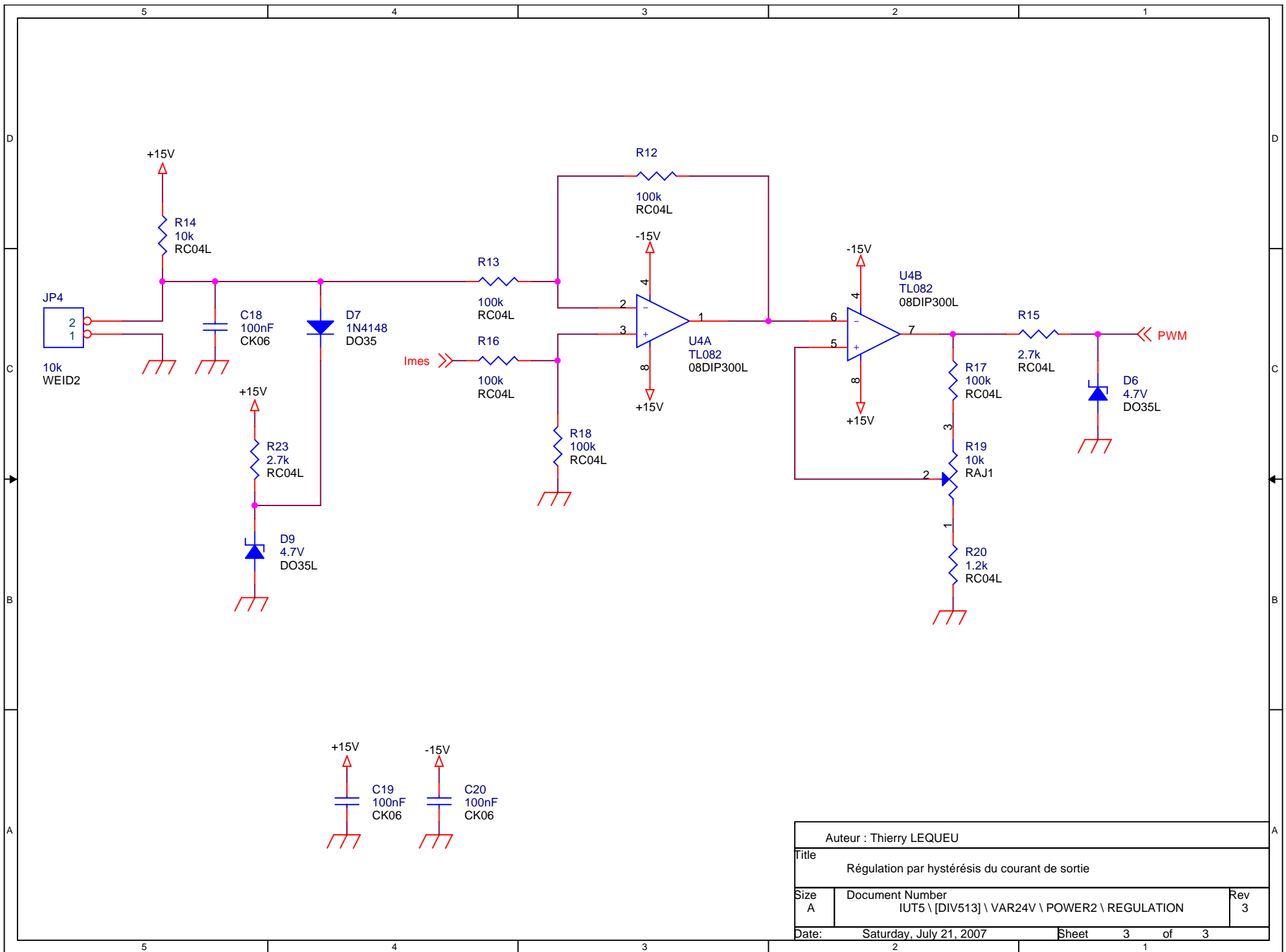
Régulation par hystérésis du courant de sortie**Revised: Saturday, July 21, 2007****IUT4 \ [DIV513] \ VAR24V \ POWER2 \ REGULATION Revision: 3**

Référence	Qu.	Désignation	Fournisseur	Code Cde.	U.d.V.	Prix U.	Prix T.
C1,C2,C3,C21	4	2200uF 50V FC	Radiospares	315-0928	5	12,95 €	10,360 €
C4,C5,C11,C14,C18,C19,C20	7	100nF	Radiospares	537-3044	10	1,33 €	0,931 €
C7,C6	2	10uF 50V FC	Radiospares	315-0805	5	0,95 €	0,380 €
C9,C8	2	100nF	Radiospares	537-3044	10	1,33 €	0,266 €
C10,C13	2	100uF 63V FC	Radiospares	315-0962	5	2,00 €	0,800 €
C12,C15,C16	3	330uF 25V FC	Radiospares	315-0568	5	2,00 €	1,200 €
C17	1	10nF	Radiospares	315-0619	5	4,10 €	0,820 €
D8,D1	2	43CTQ100	Radiospares	544-6142	5	5,86 €	2,344 €
D5,D2	2	LED verte 3mm 2mA	Radiospares	180-8451	10	3,32 €	0,664 €
D3,D4	2	11DQ06	Radiospares	544-4994	5	1,10 €	0,440 €
D9,D6	2	Zener 4.7V BZX79C4V7	Radiospares	446-8652	20	2,56 €	0,256 €
D7	1	1N4148	Radiospares	544-3480	20	0,44 €	0,022 €
JP1	1	Connecteur 2 points	Radiospares	131-8920	10	2,61 €	0,261 €
JP3	1	Connecteur 2 points	Radiospares	131-8920	10	2,61 €	0,261 €
JP4	1	Connecteur 2 points	Radiospares	131-8920	10	2,61 €	0,261 €
LEM1	1	LA55P	Radiospares	1807357	1	24,67 €	24,670 €
L1	1	10uH 0.5A	Radiospares	540-8500	5	1,80 €	0,360 €
L2,L4	2	10uH 0.5A	Radiospares	540-8500	5	1,80 €	0,720 €
L3	1	330uH 0.5A	Radiospares	540-8702	5	1,80 €	0,360 €
L5	1	68uH 0.5A	Radiospares	540-8639	5	1,80 €	0,360 €
RAD1	1	Radiateur	LMP		1	0,00 €	0,000 €
R1	1	100	IUT GEII		10	0,30 €	0,030 €
R2,R22	2	100	IUT GEII		10	0,30 €	0,060 €
R3,R14,R21	3	10k	IUT GEII		10	0,30 €	0,090 €
R4,R5,R8,R9	4	27k	IUT GEII		10	0,30 €	0,120 €
R6,R11,R20	3	1.2k	IUT GEII		10	0,30 €	0,090 €
R10,R7	2	6.8k	IUT GEII		10	0,30 €	0,060 €
R12,R13,R16,R17,R18	5	100k	IUT GEII		10	0,30 €	0,150 €
R23,R15	2	2.7k	IUT GEII		10	0,30 €	0,060 €
R19	1	10k	IUT GEII		10	0,30 €	0,030 €
R24	1	4.7k	IUT GEII		10	0,30 €	0,030 €
T2,T1	2	HUF75639P3	Radiospares	329-1013	1	3,80 €	7,600 €
U1	1	TC4422	Radiospares	207-0168	1	4,90 €	4,900 €
U2	1	LM2574N-ADJ	Radiospares		1	1,79 €	1,790 €
U3	1	LM2574HVN-ADJ	Radiospares		1	3,59 €	3,590 €
U4	1	TL082	Radiospares	536-1120	20	6,76 €	0,338 €
Divers	4	Support tulipe 8 broches	Radiospares	100-9935	10	4,31 €	1,724 €
Divers	4	Visserie M3	IUT GEII		1	0,00 €	0,000 €
Divers	140	Circuit imprimé SF 160x87 mm	Radiospares	159-6120	600	14,21 €	3,316 €
Divers					1		0,000 €

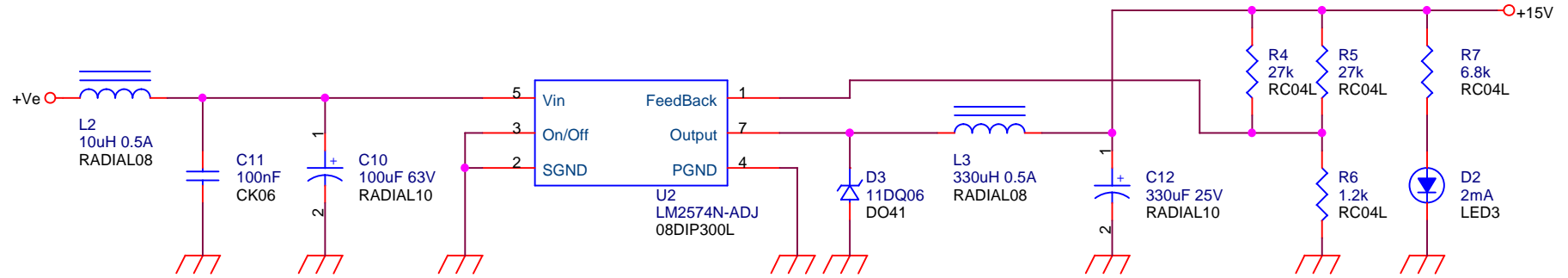
TOTAL H.T. :	69,71 €
dont TVA : 19,60%	13,66 €
TOTAL T.T.C. :	83,38 €



Auteur : Thierry LEQUEU		
Title Hacheur à découpage 24V 300W		
Size A	Document Number IUT5 \ [DIV513] \ VAR24V \ POWER2 \ HACHEUR	Rev 3
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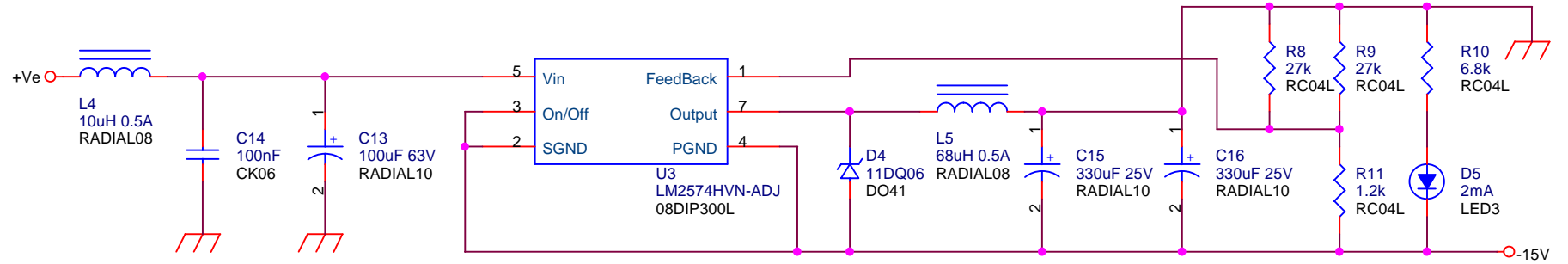


Auteur : Thierry LEQUEU		
Titre Régulation par hystérésis du courant de sortie		
Size A	Document Number IUT5 \ [DIV513] \ VAR24V \ POWER2 \ REGULATION	Rev 3
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Cin = 22 uF

Cout = 220 uF

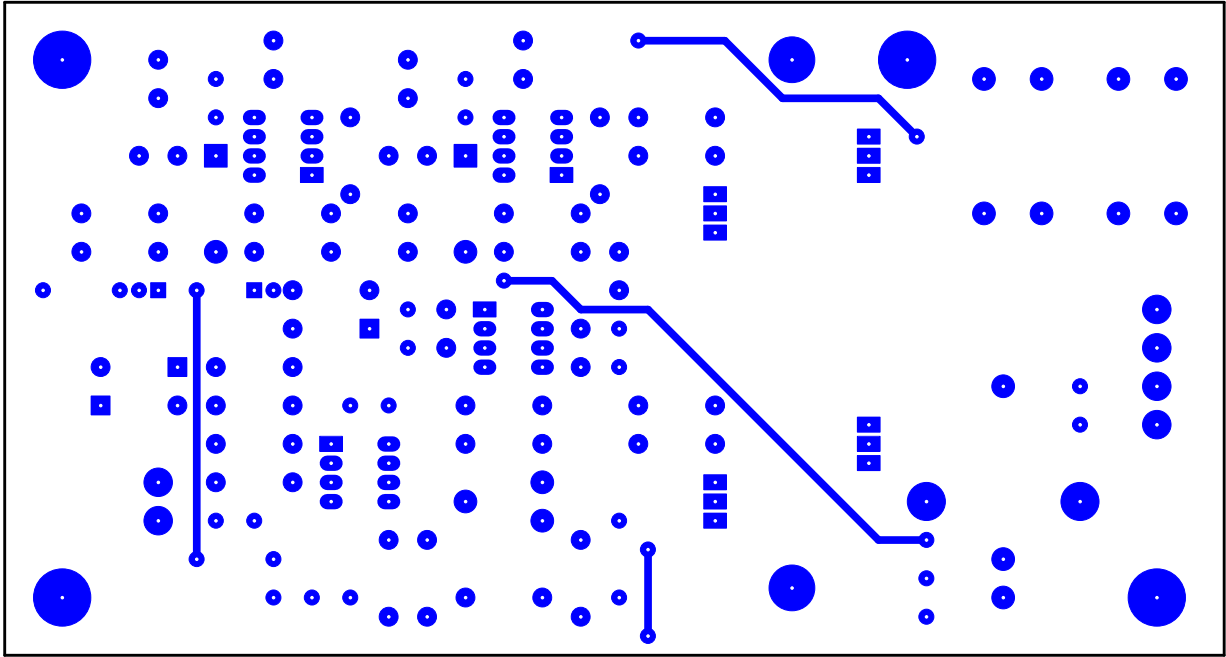


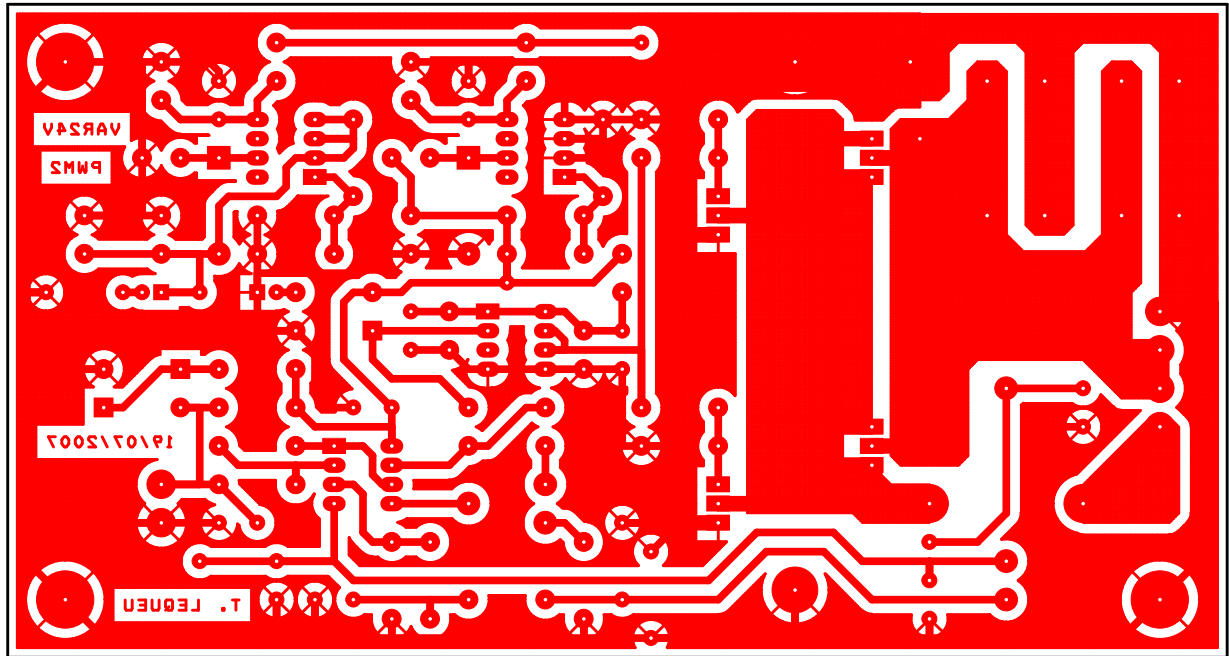
Cin = 22 uF

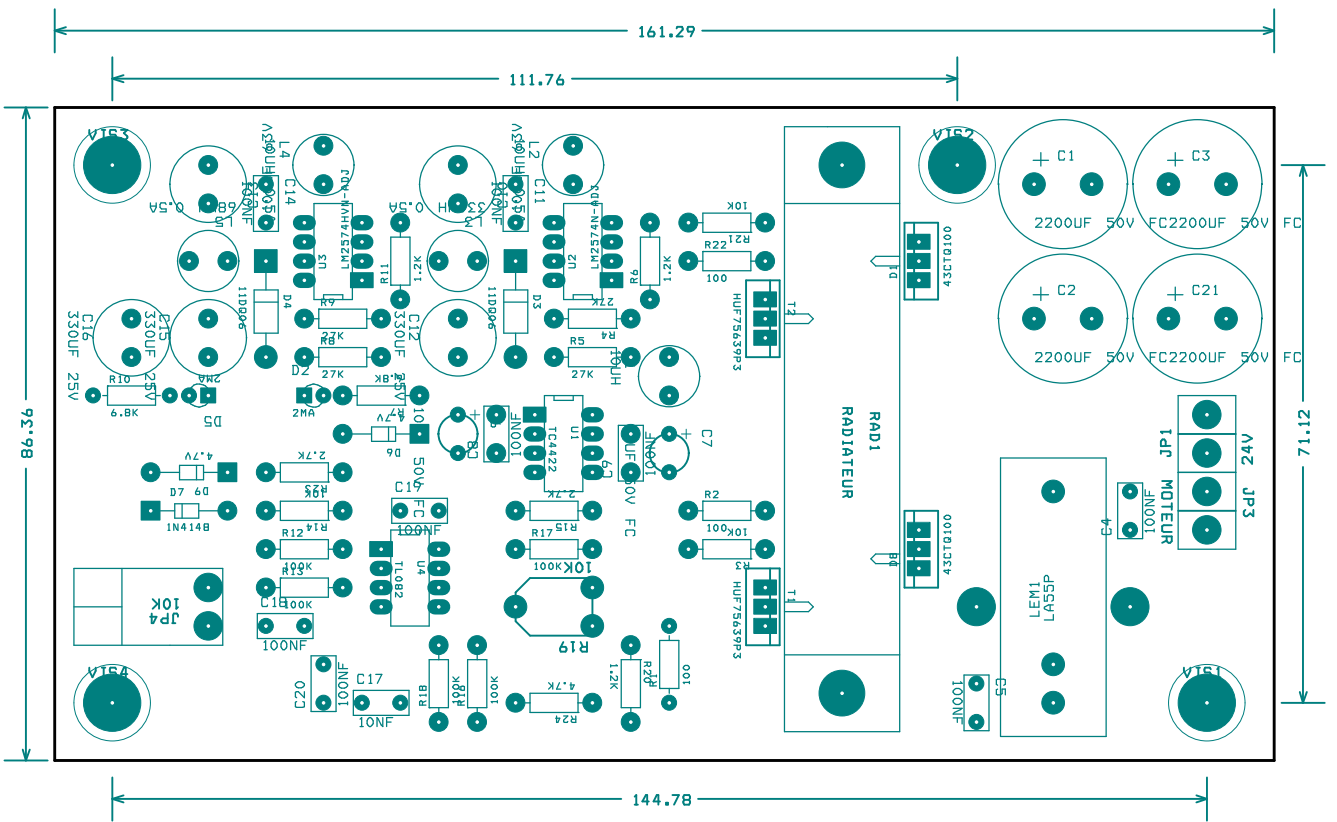
Cout = 680 uF

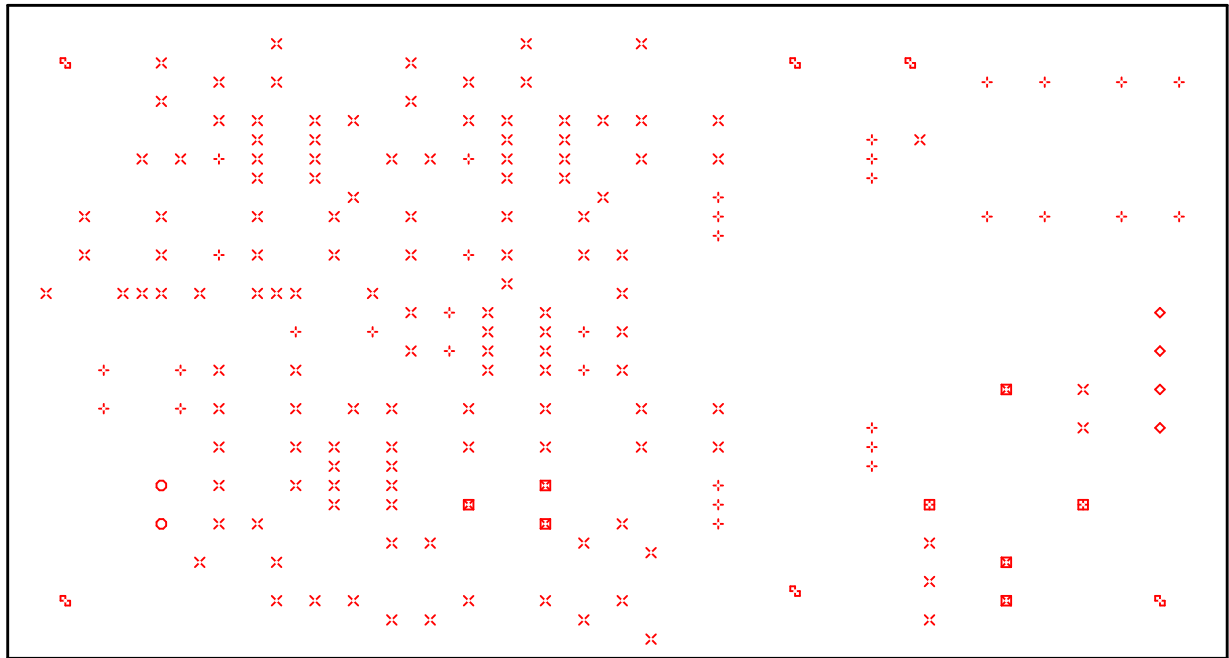


Auteur : Thierry LEQUEU		
Titre Alimentations à découpage 24V vers +15V / -15V		
Size A	Document Number IUT5 \ [DIV513] \ VAR24V \ POWER2 \ ALIM	Rev 3
Date: Saturday, July 21, 2007	Sheet 1	of 3









DRILL CHART				
SYM	DIAM	TOL	QTY	NOTE
x	0.031		130	
+	0.039		34	
◇	0.039		4	
⊞	0.047		6	
⊞	0.059		2	
o	0.059		2	
⊞	0.126		6	
TOTAL			184	

**56A, 100V, 0.025 Ohm, N-Channel
UltraFET Power MOSFETs**



These N-Channel power MOSFETs are manufactured using the innovative UltraFET® process. This advanced process technology

achieves the lowest possible on-resistance per silicon area, resulting in outstanding performance. This device is capable of withstanding high energy in the avalanche mode and the diode exhibits very low reverse recovery time and stored charge. It was designed for use in applications where power efficiency is important, such as switching regulators, switching converters, motor drivers, relay drivers, low-voltage bus switches, and power management in portable and battery-operated products.

Formerly developmental type TA75639.

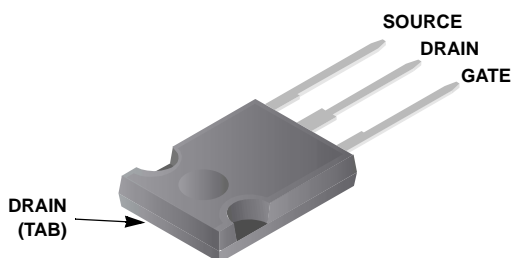
Ordering Information

PART NUMBER	PACKAGE	BRAND
HUF75639G3	TO-247	75639G
HUF75639P3	TO-220AB	75639P
HUF75639S3S	TO-263AB	75639S
HUF75639S3	TO-262AA	75639S

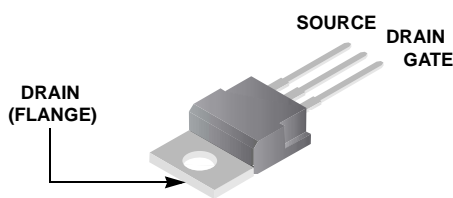
NOTE: When ordering, use the entire part number. Add the suffix T to obtain the TO-263AB variant in tape and reel, e.g., HUF75639S3ST.

Packaging

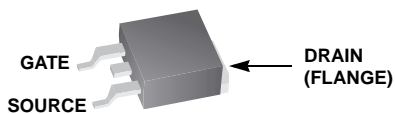
JEDEC STYLE TO-247



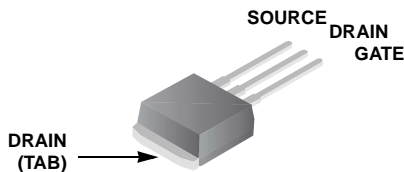
JEDEC TO-220AB



JEDEC TO-263AB



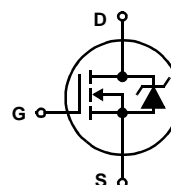
TO-262AA



Features

- 56A, 100V
- Simulation Models
 - Temperature Compensated PSPICE® and SABER™ Electrical Models
 - Spice and Saber Thermal Impedance Models
 - www.fairchildsemi.com
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
 - TB334, "Guidelines for Soldering Surface Mount Components to PC Boards"

Symbol



Product reliability information can be found at <http://www.fairchildsemi.com/products/discrete/reliability/index.html>

For severe environments, see our Automotive HUFA series.

All Fairchild semiconductor products are manufactured, assembled and tested under ISO9000 and QS9000 quality systems certification.

HUF75639G3, HUF75639P3, HUF75639S3S, HUF75639S3

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, Unless Otherwise Specified

			UNITS
Drain to Source Voltage (Note 1)	V_{DSS}	100	V
Drain to Gate Voltage ($R_{GS} = 20k\Omega$) (Note 1)	V_{DGR}	100	V
Gate to Source Voltage	V_{GS}	± 20	V
Drain Current			
Continuous (Figure 2)	I_D	56	A
Pulsed Drain Current	I_{DM}	Figure 4	
Pulsed Avalanche Rating	E_{AS}	Figures 6, 14, 15	
Power Dissipation	P_D	200	W
Derate Above 25°C		1.35	W/ $^\circ\text{C}$
Operating and Storage Temperature	T_J, T_{STG}	-55 to 175	$^\circ\text{C}$
Maximum Temperature for Soldering			
Leads at 0.063in (1.6mm) from Case for 10s	T_L	300	$^\circ\text{C}$
Package Body for 10s, See Techbrief 334	T_{pkg}	260	$^\circ\text{C}$

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

- $T_J = 25^\circ\text{C}$ to 150°C .

Electrical Specifications $T_C = 25^\circ\text{C}$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
OFF STATE SPECIFICATIONS							
Drain to Source Breakdown Voltage	BV_{DSS}	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$ (Figure 11)	100	-	-	V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 95\text{V}, V_{GS} = 0\text{V}$	-	-	1	μA	
		$V_{DS} = 90\text{V}, V_{GS} = 0\text{V}, T_C = 150^\circ\text{C}$	-	-	250	μA	
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{V}$	-	-	± 100	nA	
ON STATE SPECIFICATIONS							
Gate to Source Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ (Figure 10)	2	-	4	V	
Drain to Source On Resistance	$r_{DS(ON)}$	$I_D = 56\text{A}, V_{GS} = 10\text{V}$ (Figure 9)	-	0.021	0.025	Ω	
THERMAL SPECIFICATIONS							
Thermal Resistance Junction to Case	$R_{\theta JC}$	(Figure 3)	-	-	0.74	$^\circ\text{C/W}$	
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	TO-247	-	-	30	$^\circ\text{C/W}$	
		TO-220, TO-263	-	-	62	$^\circ\text{C/W}$	
SWITCHING SPECIFICATIONS ($V_{GS} = 10\text{V}$)							
Turn-On Time	t_{ON}	$V_{DD} = 50\text{V}, I_D \cong 56\text{A}, R_L = 0.89\Omega, V_{GS} = 10\text{V}, R_{GS} = 5.1\Omega$	-	-	110	ns	
Turn-On Delay Time	$t_{d(ON)}$		-	15	-	ns	
Rise Time	t_r		-	60	-	ns	
Turn-Off Delay Time	$t_{d(OFF)}$		-	20	-	ns	
Fall Time	t_f		-	25	-	ns	
Turn-Off Time	t_{OFF}		-	-	70	ns	
GATE CHARGE SPECIFICATIONS							
Total Gate Charge	$Q_{g(TOT)}$	$V_{GS} = 0\text{V}$ to 20V	$V_{DD} = 50\text{V}, I_D \cong 56\text{A}, R_L = 0.89\Omega, I_g(\text{REF}) = 1.0\text{mA}$ (Figure 13)	-	110	130	nC
Gate Charge at 10V	$Q_{g(10)}$	$V_{GS} = 0\text{V}$ to 10V		-	57	75	nC
Threshold Gate Charge	$Q_{g(TH)}$	$V_{GS} = 0\text{V}$ to 2V		-	3.7	4.5	nC
Gate to Source Gate Charge	Q_{gs}			-	9.8	-	nC
Gate to Drain "Miller" Charge	Q_{gd}			-	24	-	nC

MBR2060CT, MBR2080CT, MBR2090CT, MBR20100CT

MBR2060CT and MBR20100CT are Preferred Devices

SWITCHMODE™ Power Rectifiers

... using the Schottky Barrier principle with a platinum barrier metal. These state-of-the-art devices have the following features:

- 20 Amps Total (10 Amps Per Diode Leg)
- Guard-Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8"
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2060, B2080, B2090, B20100

MAXIMUM RATINGS

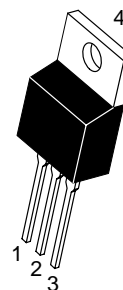
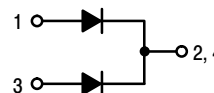
Please See the Table on the Following Page



ON Semiconductor™

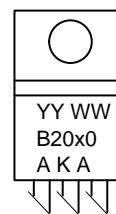
<http://onsemi.com>

SCHOTTKY BARRIER RECTIFIERS 20 AMPERES 60-100 VOLTS



TO-220AB
CASE 221A
PLASTIC

MARKING DIAGRAM



YY = Year
WW = Work Week
B20x0 = Device Code
x = 6, 8, 9 or 10
AKA = Polarity Designator

ORDERING INFORMATION

Device	Package	Shipping
MBR2060CT	TO-220	50 Units/Rail
MBR2080CT	TO-220	50 Units/Rail
MBR2090CT	TO-220	50 Units/Rail
MBR20100CT	TO-220	50 Units/Rail

Preferred devices are recommended choices for future use and best overall value.

MBR2060CT, MBR2080CT, MBR2090CT, MBR20100CT

MAXIMUM RATINGS (Per Diode Leg)

Rating	Symbol	MBR				Unit
		2060CT	2080CT	2090CT	20100CT	
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	60	80	90	100	Volts
Average Rectified Forward Current (Rated V_R) $T_C = 133^\circ\text{C}$	$I_{F(AV)}$	10				Amps
Peak Repetitive Forward Current (Rated V_R , Square Wave, 20 kHz) $T_C = 133^\circ\text{C}$	I_{FRM}	20				Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz)	I_{FSM}	150				Amps
Peak Repetitive Reverse Surge Current (2.0 μs , 1.0 kHz)	I_{RRM}	0.5				Amp
Operating Junction Temperature	T_J	-65 to +150				$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +175				$^\circ\text{C}$
Voltage Rate of Change (Rated V_R)	dv/dt	10,000				$\text{V}/\mu\text{s}$

THERMAL CHARACTERISTICS

Maximum Thermal Resistance — Junction to Case — Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.0 60	$^\circ\text{C}/\text{W}$
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ELECTRICAL CHARACTERISTICS (Per Diode Leg)

Maximum Instantaneous Forward Voltage (Note 1.) ($i_F = 10$ Amps, $T_C = 125^\circ\text{C}$) ($i_F = 10$ Amps, $T_C = 25^\circ\text{C}$) ($i_F = 20$ Amps, $T_C = 125^\circ\text{C}$) ($i_F = 20$ Amps, $T_C = 25^\circ\text{C}$)	v_F	0.75 0.85 0.85 0.95	Volts
Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, $T_C = 125^\circ\text{C}$) (Rated dc Voltage, $T_C = 25^\circ\text{C}$)	i_R	6.0 0.1	mA

1. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$.