tyco Electronics

final datasheet

fastPIM 1H, 600V, 30A

V23990-P386-A11-01-14

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition		Symbol	Datasheet values	Unit
				max.	
Input Rectifier Bridge **Gleichrichter**					
Repetitive peak reverse voltage Periodische Rückw. Spitzensperrspannung			V_{RRM}	1600	V
Forward current per diode Dauergrenzstrom	DC current	T_h=80°C;	I_{FAV}	40	A
Surge forward current Stoßstrom Grenzwert	t_p=10ms	T_j=25°C	I_{FSM}	250	A
I^2t-value Grenzlastintegral	t_p=10ms	T_j=25°C	I^2t	310	A^2s
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	77	W
Transistor Inverter **Transistor Wechselrichter**					
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung			V_{CE}	600	V
DC collector current Kollektor-Dauergleichstrom	T_j=150°C	T_h=80°C,	I_C	40	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	80	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C	P_{tot}	103	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj=125°C Vce=390V	V_{GE}=15V	t_{SC}	5	us
Diode Inverter **Diode Wechselrichter**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C,	I_F	28	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	56	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	40	W
Thermal properties **Thermische Eigenschaften**					
max. Chip temperature max. Chiptemperatur			T_{jmax}	150	°C
Storage temperature Lagertemperatur			T_{stg}	-40…+125	°C
Operation temperature Betriebstemperatur			T_{op}	-40…+125	°C
Insulation properties **Modulisolation**					
Insulation voltage Isolationsspannung		t=1min	V_{is}	4000	Vdc
Creepage distance Kriechstrecke				min 12,7	mm
Clearance Luftstrecke				min 12,7	mm

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Input Rectifier Bridge **Gleichrichter**										
Forward voltage Durchlaßpannung	V_F	Tj=25°C Tj=125°C				50		1,29 1,28	1,36	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V_{to}	Tj=25°C Tj=125°C				50		0,93 0,81		V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r_t	Tj=25°C Tj=125°C				50		0,007 0,009		Ohm
Reverse current Sperrstrom	I_r	Tj=25°C Tj=150°C			1200			2	0,01 3	mA
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,91		K/W
Transistor Inverter, inductive load **Transistor Wechselrichter**										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			0,00025	4,5	5,2	7	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		30		2,14 1,68	2,7	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	600				0,25 4	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		20	0				300	nA
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		33		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		11		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		146		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		29		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		0,328		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=6 Ohm Rgoff=1 Ohm	15	300	30		0,459		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			4		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,4		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,2		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		15	300	30		225	270	nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,68		K/W

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Diode Inverter **Diode Wechselrichter**										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				30		1,88 1,54	2,35	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	30		 52		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	30		 51		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	30		 1,57		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	30		 0,321		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,74		K/W
NTC-Thermistor **NTC-Widerstand**										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				9,5	10	10,5	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=809Ohm					2,8		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	Tj=25°C							210	mW
B-value B-Wert	$B_{(25/100)}$	Tj=25°C	Tol. ±3%					3730		K

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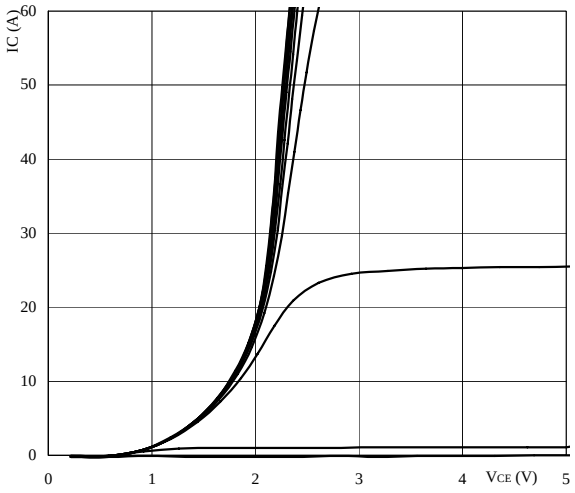
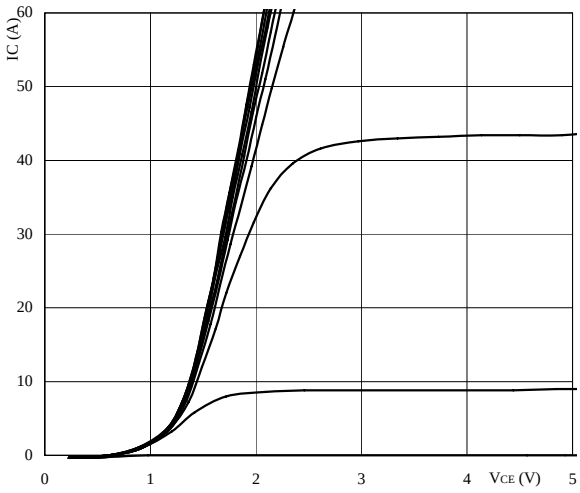
Output inverter

Figure 1. Typical output characteristics
Output inverter IGBT
Ic= f(VCE)



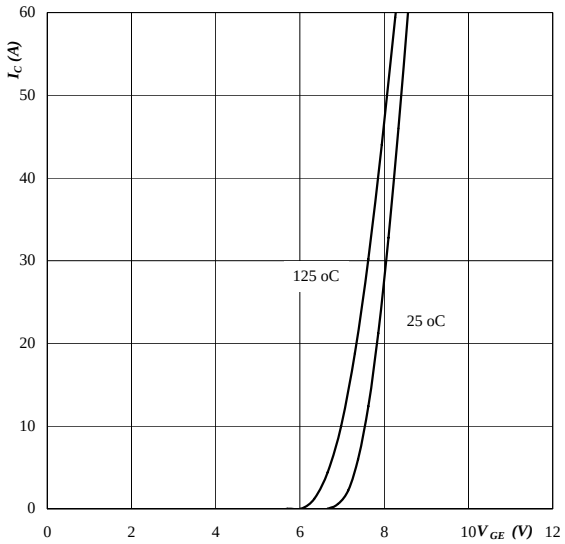
parameter: tp = 250 µs Tj = 25 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

Figure 2. Typical output characteristics
Output inverter IGBT
Ic= f(VCE)



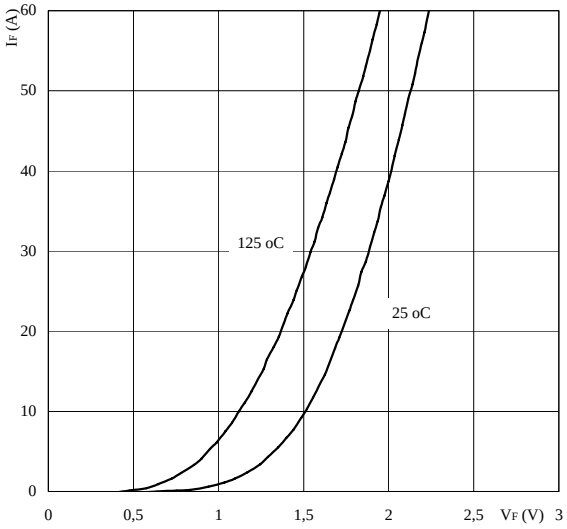
parameter: tp = 250 µs Tj = 125 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

Figure 3. Typical transfer characteristics
Output inverter IGBT
Ic= f(VGE)



parameter: tp = 250 µs VCE = 8 V

Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



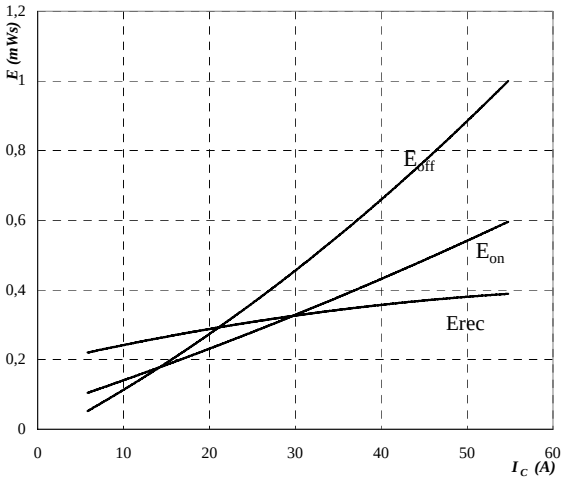
parameter: tp = 250 µs

Output inverter

Figure 5. Typical switching energy losses as a function of collector current

Output inverter IGBT

E = f (Ic)



inductive load, Tj = 125 °C

V_{CE} = 300 V

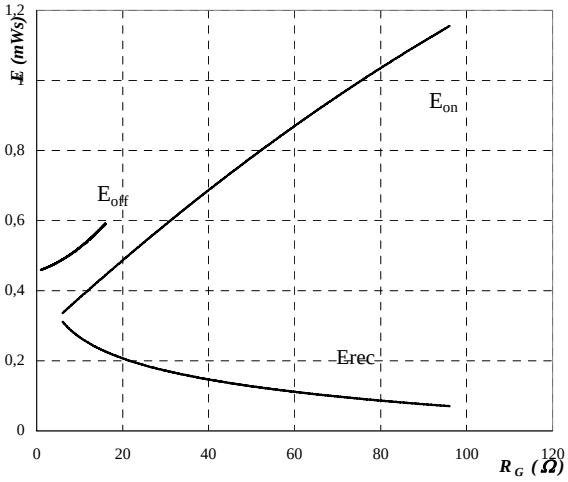
V_{GE} = 15 V

R_{Gon} =6* R_{Goff} = 6 Ω

Figure 6. Typical switching energy losses as a function of gate resistor

Output inverter IGBT

E = f (R_G)



inductive load, Tj = 125 °C

V_{CE} = 300 V

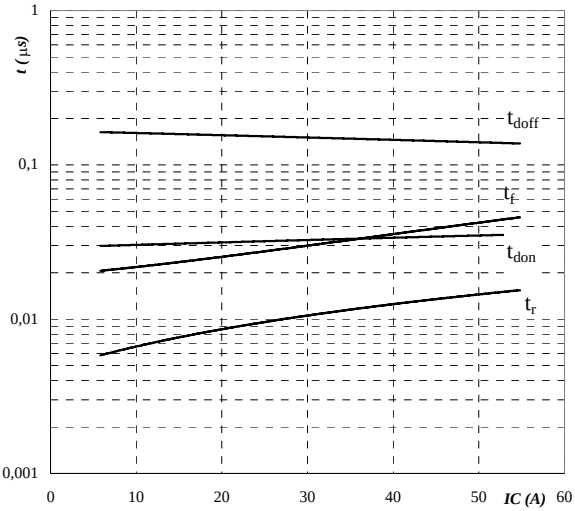
V_{GE} = 15 V

Ic = 30 A

Figure 7. Typical switching times as a function of collector current

Output inverter IGBT

t = f (Ic)



inductive load, Tj = 125 °C

V_{CE} = 300 V

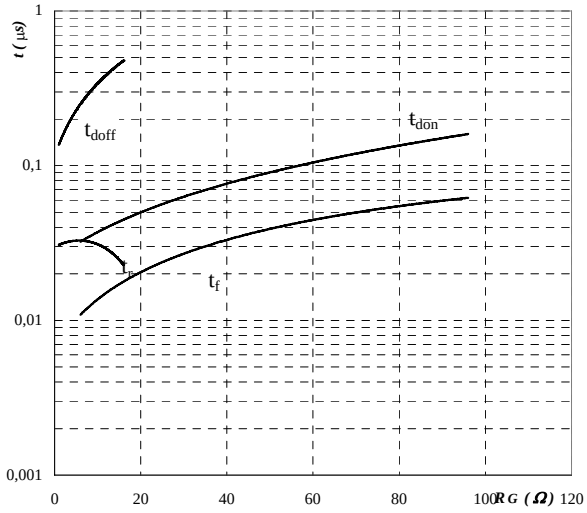
V_{GE} = 15 V

R_{Gon} =6* R_{Goff} = 6 Ω

Figure 8. Typical switching times as a function of gate resistor

Output inverter IGBT

t = f (R_G)



inductive load, Tj = 125 °C

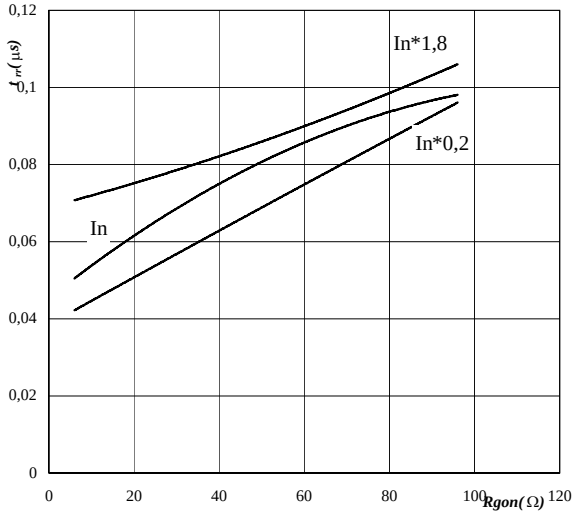
V_{CE} = 300 V

V_{GE} = 15 V

Ic = 30 A

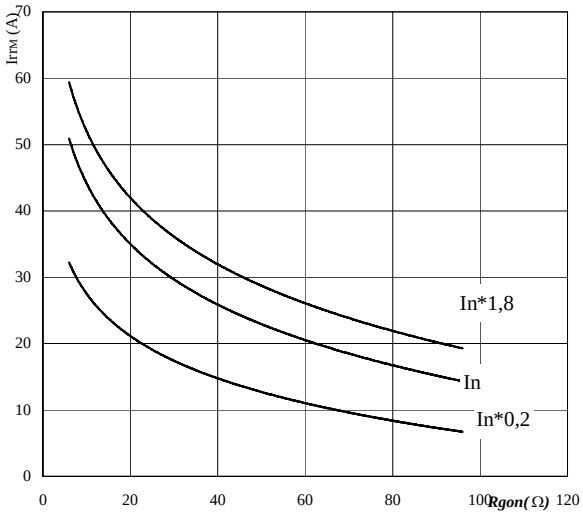
Output inverter

Figure 9. Typical reverse recovery time as a function of gate resistor
Output inverter FRED diode
t_{rr} = f (Rgon)



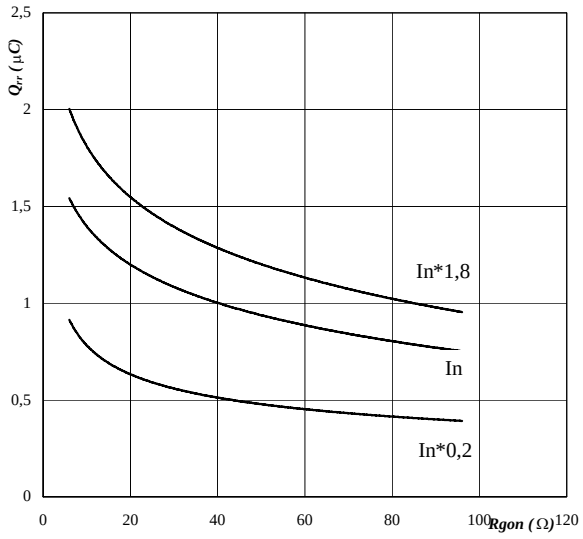
Tj = 125 °C
V_R = 300 V
In= 30 A

Figure 10. Typical reverse recovery current as a function of gate resistor
Output inverter FRED diode
I_{RRM} = f (Rgon)



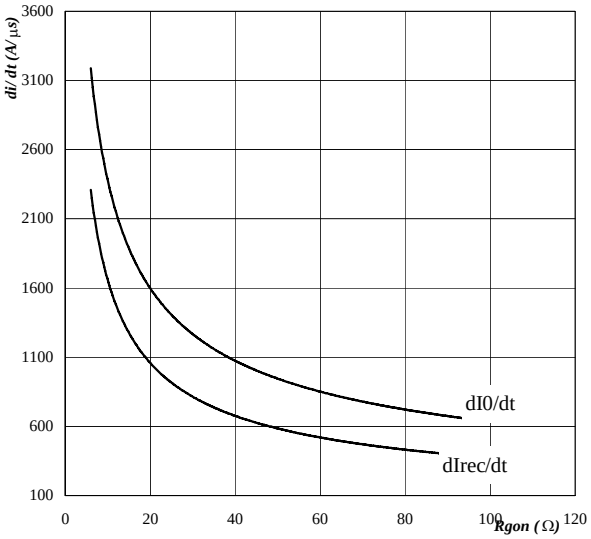
Tj = 125 °C
V_R = 300 V
In= 30 A

Figure 11. Typical reverse recovery charge as a function of gate resistor
Output inverter FRED diode
Q_{rr} = f (Rgon)



Tj = 125 °C
V_R = 300 V
In= 30 A

Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)

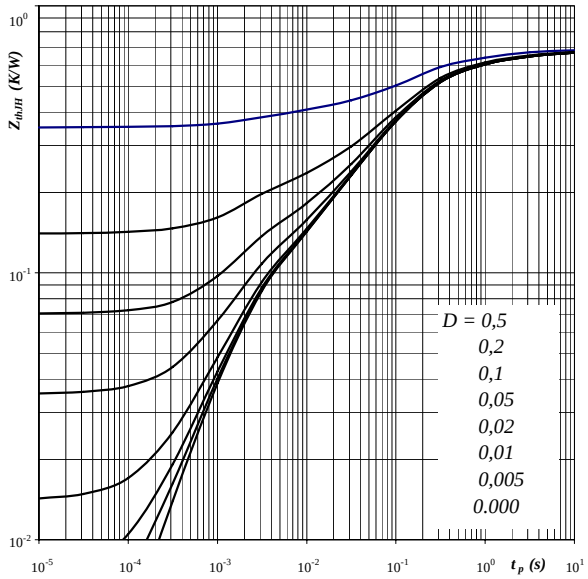


Tj = 125 °C
V_R = 300 V
I_F = 30 A

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$



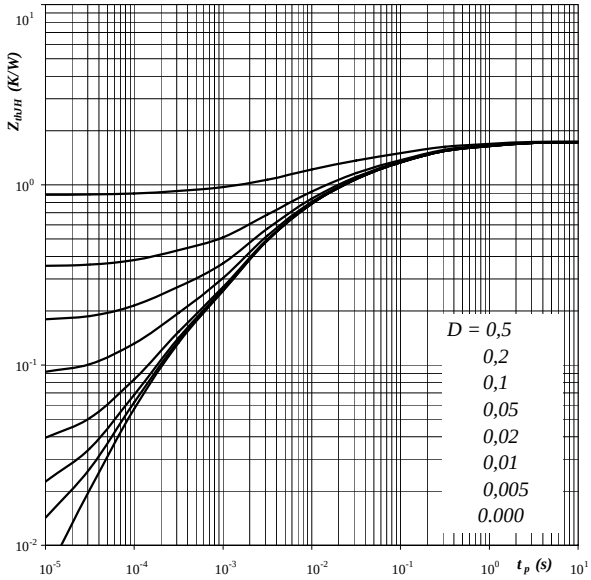
Parameter: D = tp / T RthJH 0,68 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	1,2E+02
0,05	6,8E+00
0,15	6,5E-01
0,31	1,1E-01

Figure 14. FRED transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$



Parameter: D = tp / T RthJH 1,74 K/W

FRED thermal model values

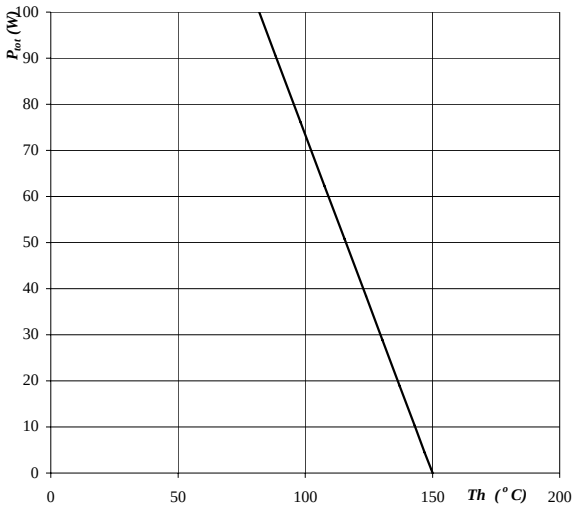
R (C/W)	Tau (s)
0,04	5,5E+01
0,18	1,1E+00
0,51	1,2E-01
0,51	1,6E-02

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

$P_{tot} = f(Th)$

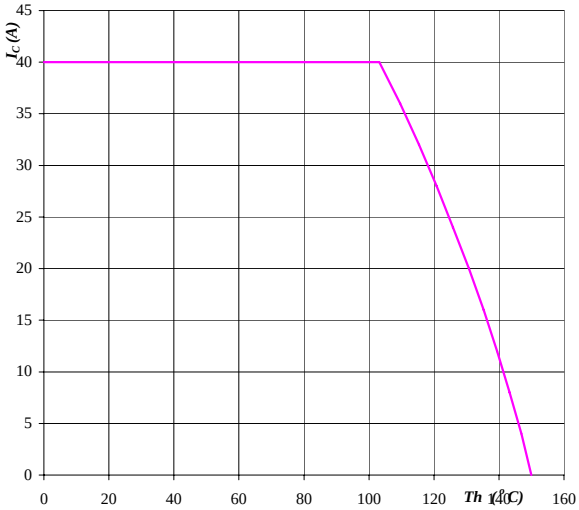


parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

$I_C = f(Th)$



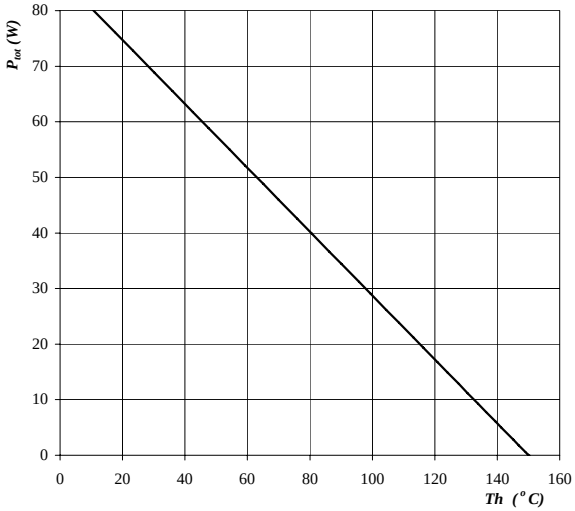
parameter: Tj = 150°C

V_{GE}= 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

$P_{tot} = f(Th)$

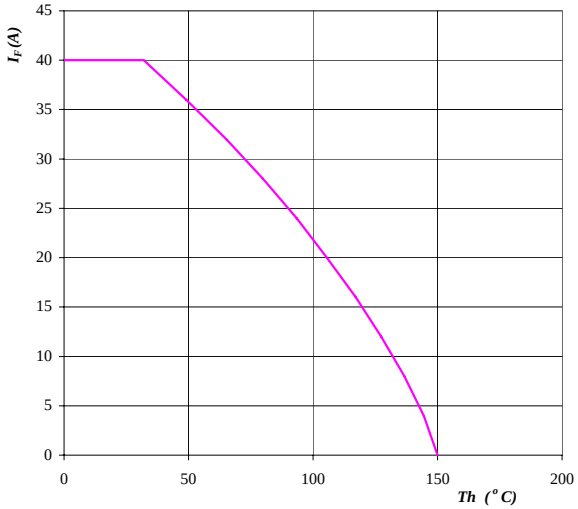


parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

$I_F = f(Th)$

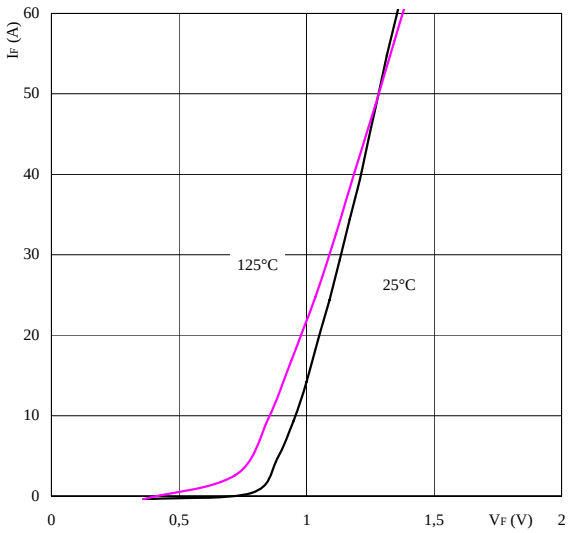


parameter: Tj = 150°C

Input rectifier bridge

Figure 19. Typical diode forward current as a function of forward voltage

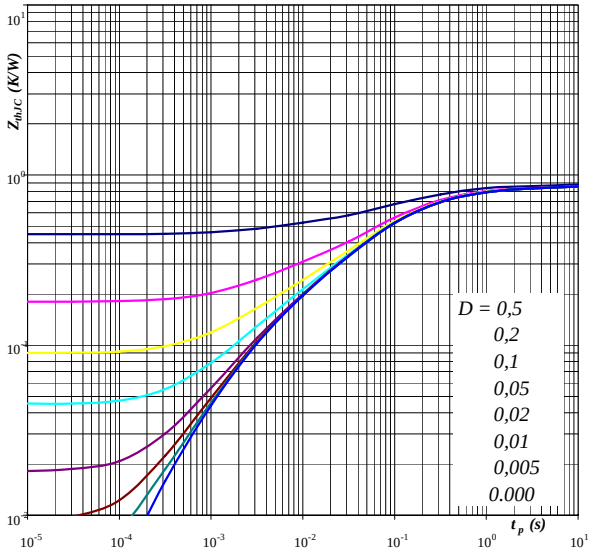
Rectifier diode $I_F=f(V_F)$



parameter: tp = 250 µs

Figure 20. Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$

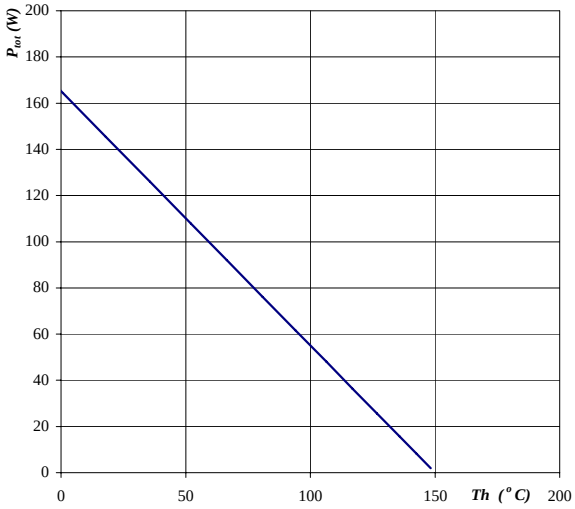


Parameter: D = tp / T RthJH 0,91 K/W

Figure 21. Power dissipation as a function of heatsink temperature

Rectifier diode

$P_{tot} = f(Th)$

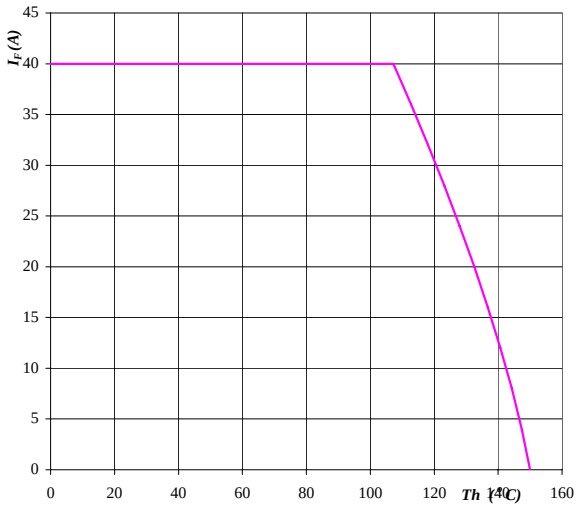


parameter: Tj = 150°C

Figure 22. Forward current as a function of heatsink temperature

Rectifier diode

$I_F = f(Th)$



parameter: Tj = 150°C

Thermistor

Figure 23. Typical NTC characteristic as a function of temperature

NTC

$R_T / R_{25} = f(T)$