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}	35	A
Surge forward current Stoßstrom Grenzwert	t_p=10ms	T_j=25°C	I_{FSM}	200	A
I^2t-value Grenzlastintegral	t_p=10ms	T_j=25°C	I^2t	200	A^2s
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	44	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	22	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	44	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C	P_{tot}	42	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}	3	us
Diode Inverter **Diode Wechselrichter**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C,	I_F	15,5	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	31	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	24	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

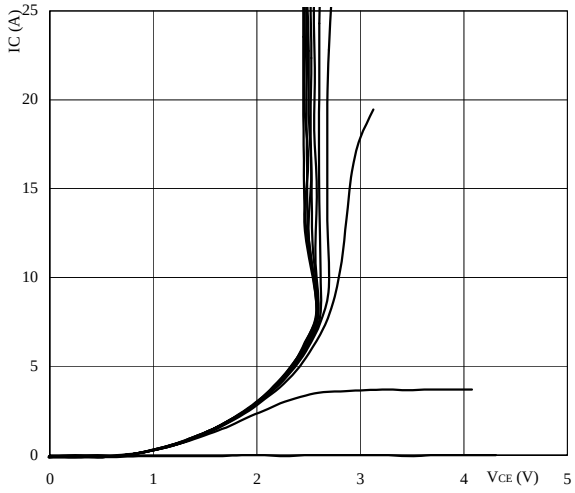
Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Input Rectifier Bridge										
Gleichrichter										
Forward voltage	V_F	Tj=25°C				30		1,21	1,35	V
Durchlaßpannung		Tj=125°C						1,19		
Threshold voltage (for power loss calc. only)	V_{to}	Tj=25°C				30		0,92		V
Schleusenspannung		Tj=125°C						0,81	0,85	
Slope resistance (for power loss calc. only)	r_t	Tj=25°C				30		0,01		Ohm
Ersatzwiderstand		Tj=125°C						0,013		
Reverse current	I_r	Tj=25°C			1200				0,01	mA
Sperrstrom		Tj=150°C						2	3	
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal grease thikness≤50um Warmeleitpaste Dicke≤50um					1,6		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip			λ = 0,61 W/mK							
Transistor Inverter, inductive load										
Transistor Wechselrichter										
Gate emitter threshold voltage	$V_{GE(th)}$	Tj=25°C	VCE=VGE			0,00025		5,6		V
Gate-Schwellenspannung		Tj=125°C								
Collector-emitter saturation voltage	$V_{CE(sat)}$	Tj=25°C		15		12		2,5	2,75	V
Kollektor-Emitter Sättigungsspannung		Tj=125°C						1,8		
Collector-emitter cut-off	I_{CES}	Tj=25°C		0	600				0,25	mA
Kollektor-Emitter Reststrom		Tj=125°C							2	
Gate-emitter leakage current	I_{GES}	Tj=25°C		25	0				300	nA
Gate-Emitter Reststrom		Tj=125°C								
Turn-on delay time	$t_{d(on)}$	Tj=25°C	Rgon=12 Ohm	15	300	12				ns
Einschaltverzögerungszeit		Tj=125°C	Rgoff=2 Ohm					17		
Rise time	t_r	Tj=25°C	Rgon=12 Ohm	15	300	12				ns
Anstiegszeit		Tj=125°C	Rgoff=2 Ohm					8		
Turn-off delay time	$t_{d(off)}$	Tj=25°C	Rgon=12 Ohm	15	300	12				ns
Abschaltverzögerungszeit		Tj=125°C	Rgoff=2 Ohm					80		
Fall time	t_f	Tj=25°C	Rgon=12 Ohm	15	300	12				ns
Fallzeit		Tj=125°C	Rgoff=2 Ohm					29		
Turn-on energy loss per pulse	E_{on}	Tj=25°C	Rgon=12 Ohm	15	300	12				mWs
Einschaltverlustenergie pro Puls		Tj=125°C	Rgoff=2 Ohm					0,155		
Turn-off energy loss per pulse	E_{off}	Tj=25°C	Rgon=12 Ohm	15	300	12				mWs
Abschaltverlustenergie pro Puls		Tj=125°C	Rgoff=2 Ohm					0,133		
Input capacitance	C_{ies}	Tj=25°C	f=1MHz	0	25			1,2		nF
Eingangskapazität		Tj=125°C								
Output capacitance	C_{oss}	Tj=25°C	f=1MHz	0	25			0,15		nF
Ausgangskapazität		Tj=125°C								
Reverse transfer capacitance	C_{rss}	Tj=25°C	f=1MHz	0	25			0,05		nF
Rückwirkungskapazität		Tj=125°C								
Gate charge	Q_{Gate}	Tj=25°C		15	300	12		78	96	nC
Gate Ladung		Tj=125°C								
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um					1,69		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip			λ = 0,61 W/mK							

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				12		1,92 1,48	2,3	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=12Ohm	15	300	12		 22,7		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=12Ohm	15	300	12		 50		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=12Ohm	15	300	12		 0,55		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=12Ohm	15	300	12		 0,089		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					2,95		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

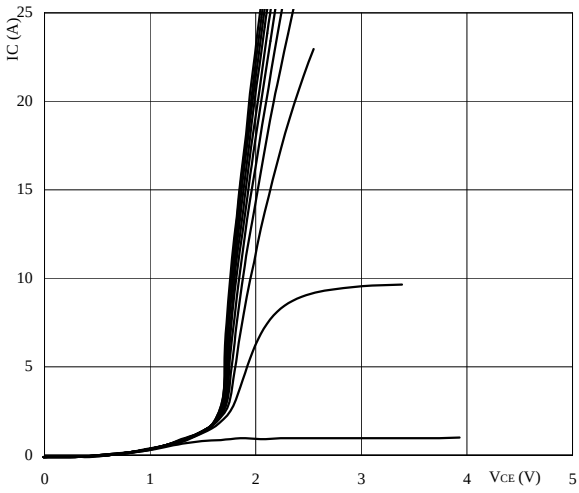
Output inverter

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



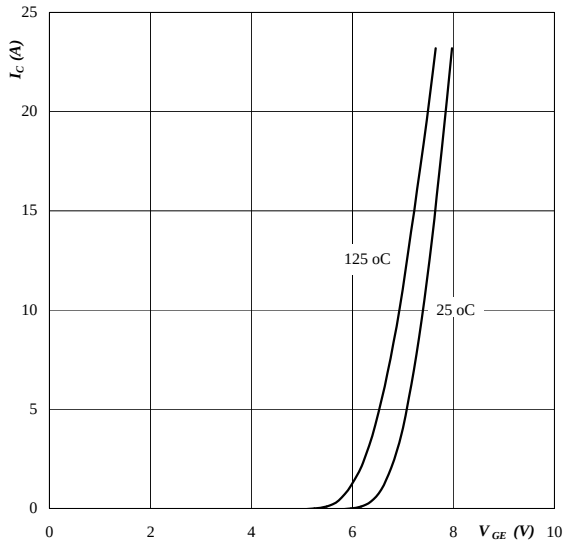
parameter: tp = 250 µs Tj = 25 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



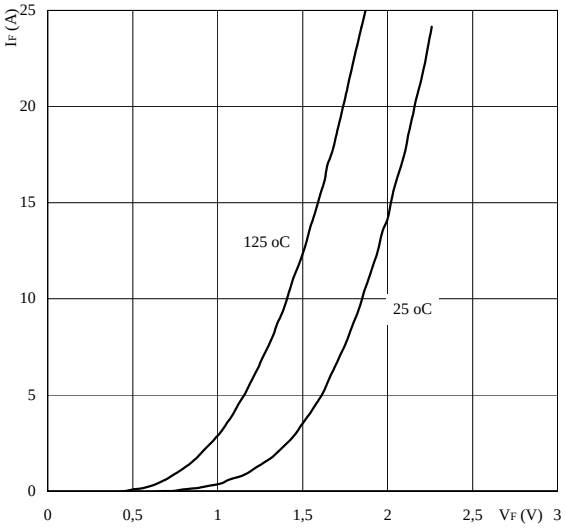
parameter: tp = 250 µs Tj = 125 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



parameter: tp = 250 µs VCE = 4 V

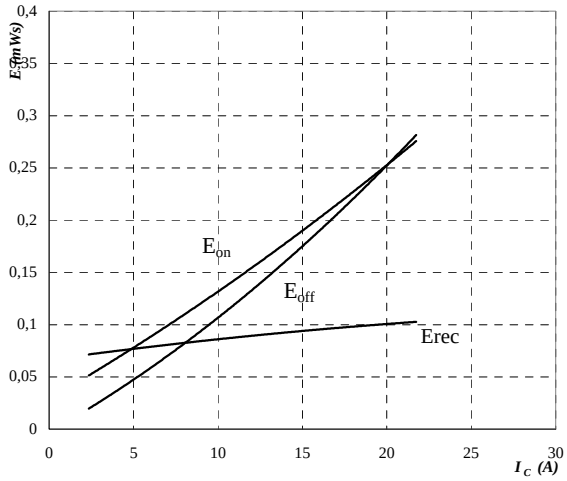
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 µs

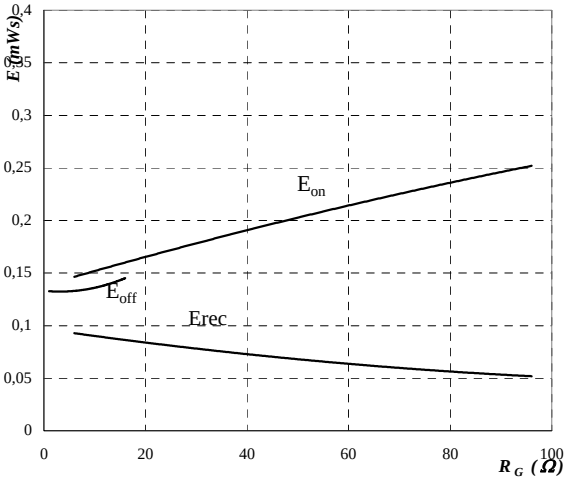
Output inverter

Figure 5. **Typical switching energy losses as a function of collector current**
Output inverter IGBT
E = f (Ic)



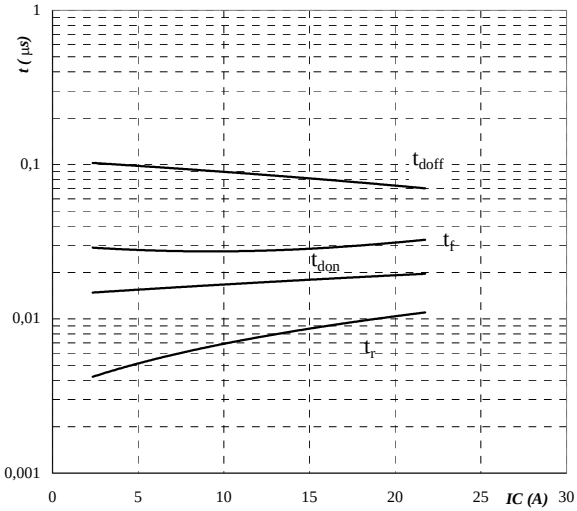
inductive load, Tj = 125 °C
V_{CE} = 300 V
V_{GE} = 15 V
$R_{Gon} = 6*R_{Goff}$ = 12 Ω

Figure 6. **Typical switching energy losses as a function of gate resistor**
Output inverter IGBT
E = f (R_G)



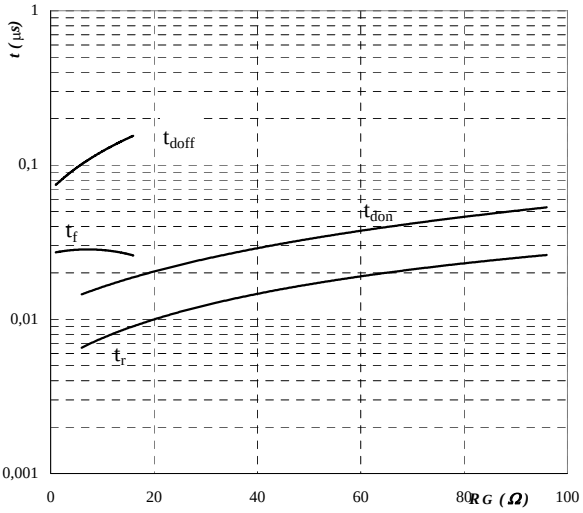
inductive load, Tj = 125 °C
V_{CE} = 300 V
V_{GE} = 15 V
Ic = 12 A

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
$R_{Gon} = 6* R_{Goff}$ = 12 Ω

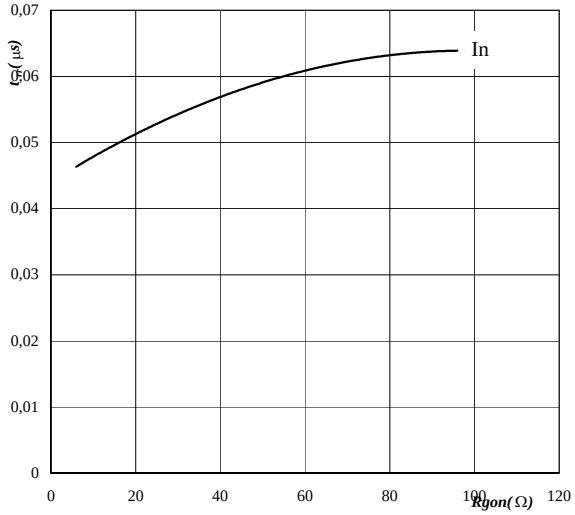
Figure 8. **Typical switching times as a function of gate resistor**
Output inverter IGBT
t = f (R_G)



inductive load, Tj = 125 °C
V_{CE} = 300 V
V_{GE} = 15 V
Ic = 12 A

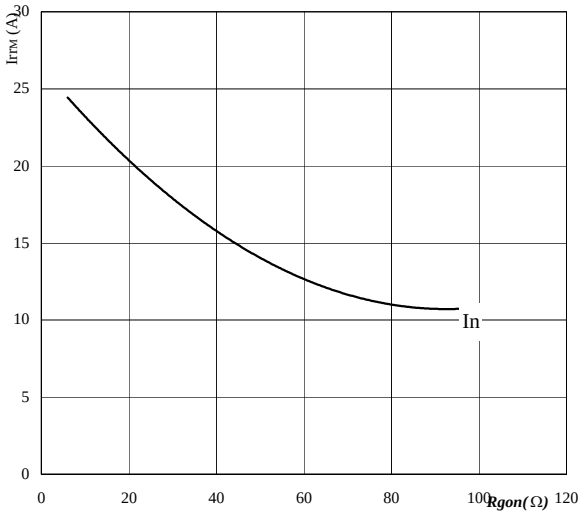
Output inverter

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



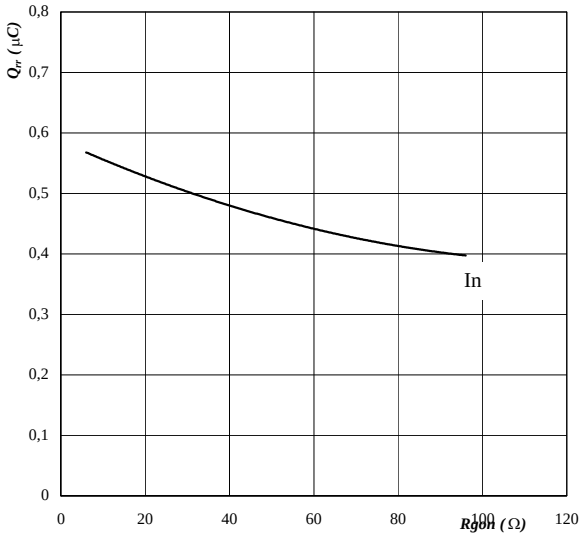
Tj = 125 °C
V_R = 300 V
In= 12 A

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



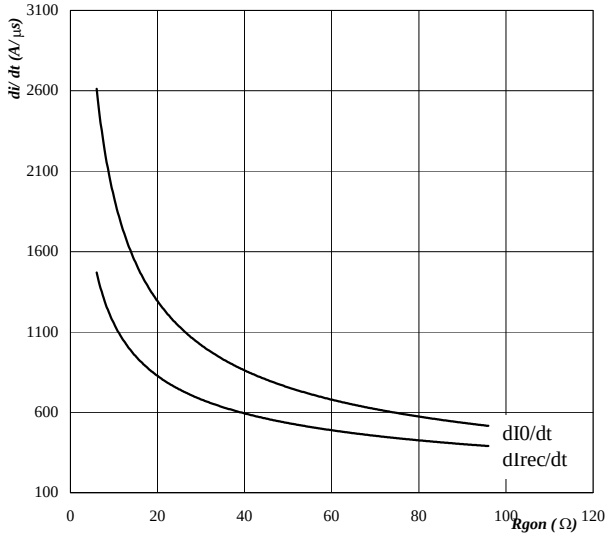
Tj = 125 °C
V_R = 300 V
In= 12 A

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= 12 A

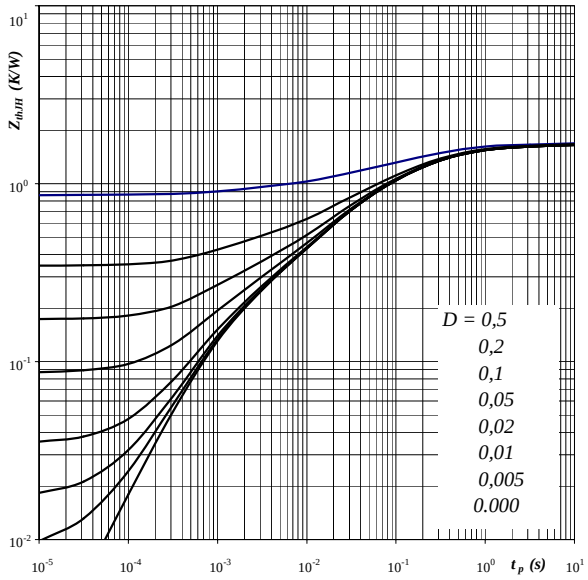
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 300 V
I_F = 12 A

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width
ZthJH = f(tp)

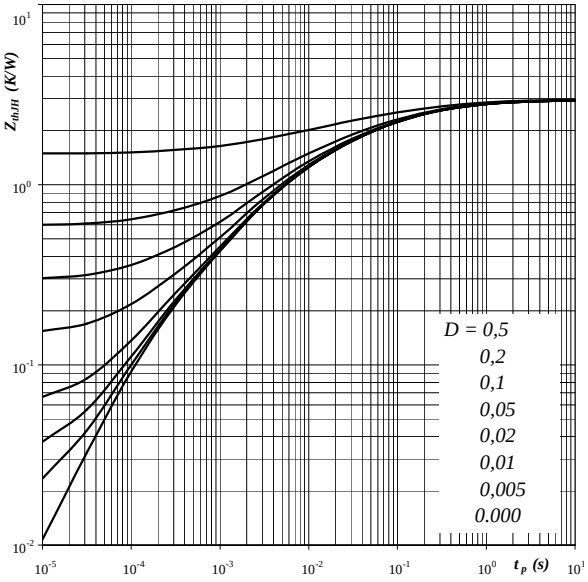


Parameter: D = tp / T RthJH 1,69 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,08	1,3E+02
0,15	2,1E+00
0,55	2,6E-01
0,50	5,7E-02

Figure 14. FRED transient thermal impedance as a function of pulse width
ZthJH = f(tp)



Parameter: D = tp / T RthJH 2,95 K/W

FRED thermal model values

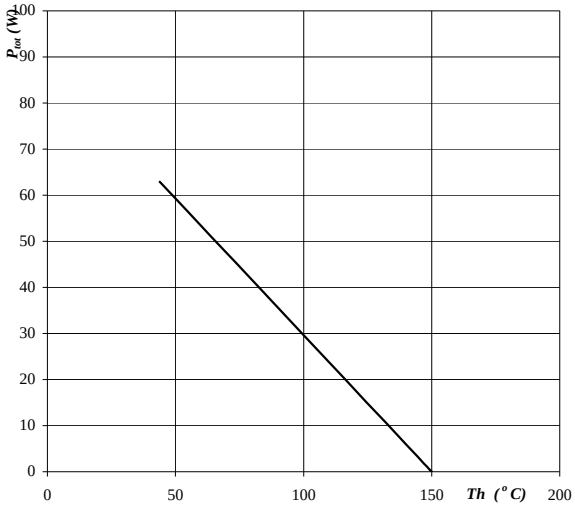
R (C/W)	Tau (s)
0,06	5,0E+01
0,25	1,3E+00
0,69	1,9E-01
0,75	3,7E-02
0,73	7,3E-03

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

P_{tot} = f (Th)

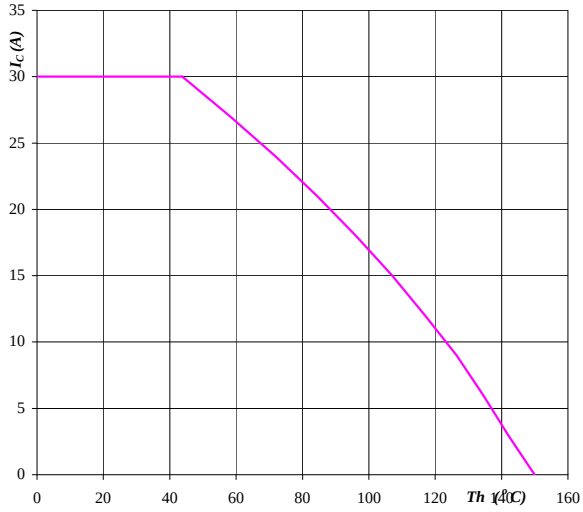


parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

I_C = f (Th)



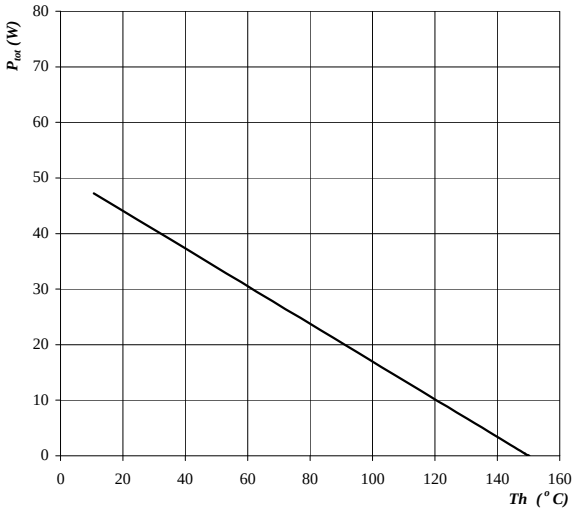
parameter: Tj = 150°C

V_{GE}= 0 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

P_{tot} = f (Th)

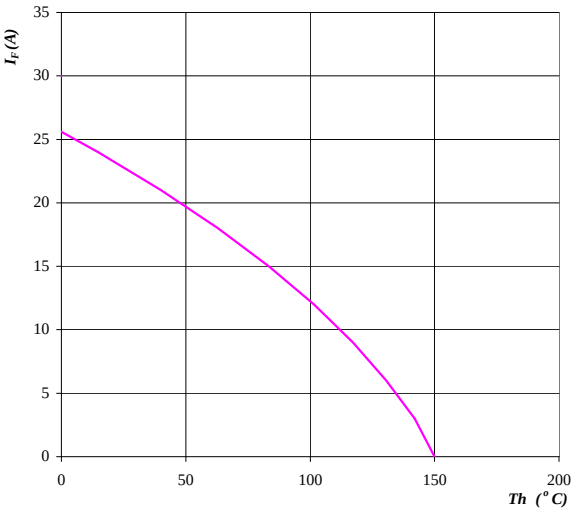


parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

I_F = f (Th)

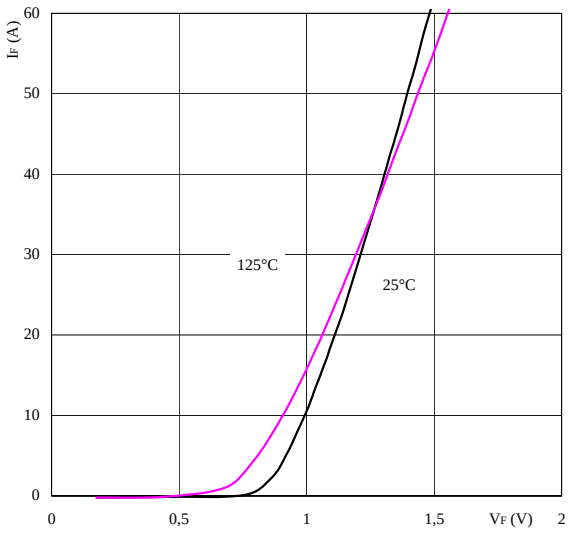


parameter: Tj = 150°C

Input rectifier bridge

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

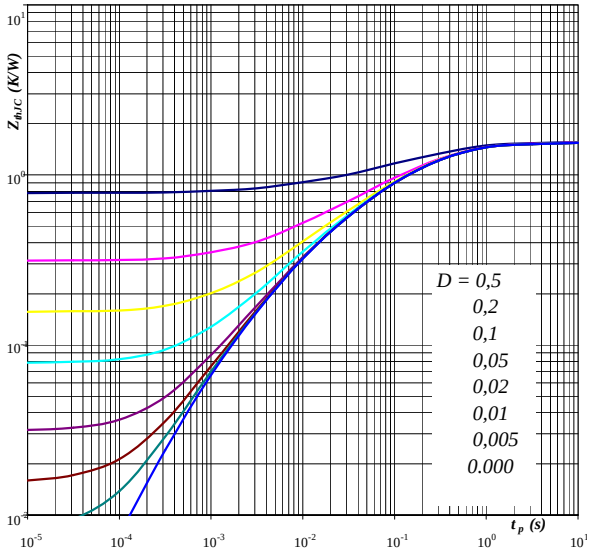
Rectifier diode $I_F=f(V_F)$



parameter: tp = 250 µs

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

$Z_{thJH} = f(tp)$

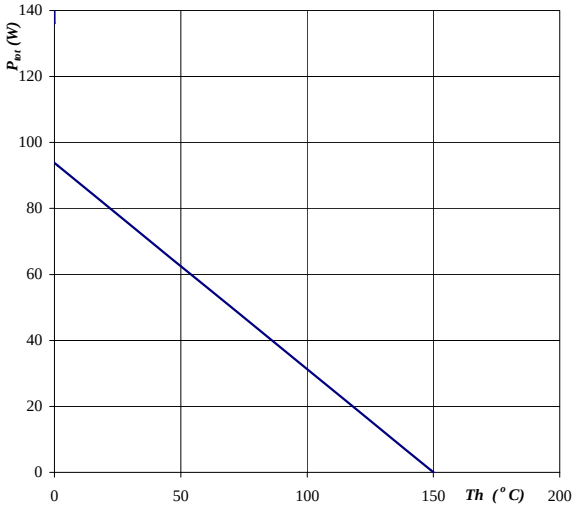


Parameter: D = tp / T RthJH 1,60 K/W

Figure 21. Power dissipation as a function of heatsink temperature

Rectifier diode

$P_{tot} = f(Th)$

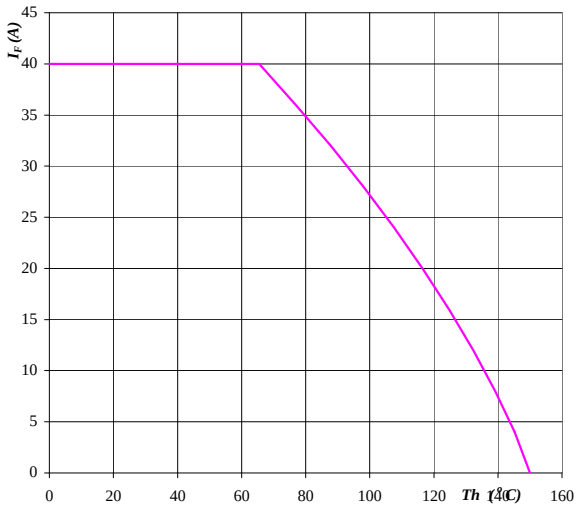


parameter: Tj = 150°C

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

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