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; Tc=80°C	I_{FAV}	30 40-limited by wires	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 T_c=80°C	P_{tot}	36 54	W
Transistor Inverter **Transistor Wechselrichter**					
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung			V_{CE}	1200	V
DC collector current Kollektor-Dauergleichstrom	T_j=150°C	T_h=80°C, T_c=80°C	I_C	6 8	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	12	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	28 42	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤150°C V_{CE}=V_{CEBR}	V_{GE}=15V	t_{SC}	8 (125°C,840V)	us
Diode Inverter **Diode Wechselrichter**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C, T_c=80°C	I_F	12 16	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	23	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	21 32	W

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*flow*PIM® 0, 1200V

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition		Symbol	Datasheet values	Unit
				max.	
Transistor BRC **Transistor Wechselrichter**					
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung			V_{CE}	1200	V
DC collector current Kollektor-Dauergleichstrom	T_j=150°C	T_h=80°C T_c=80°C	I_C	6 8	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	12	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	28 42	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤150°C VCE=600/1200 V	VGE=15V	t_{SC}	8 (125°C,840V)	us
Diode BRC **Diode BRC**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C T_c=80°C	I_F	7 10	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	14	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	13 20	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

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Characteristic values

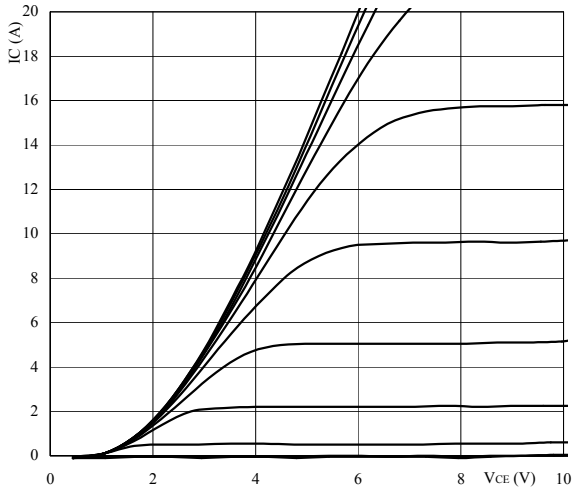
Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Input Rectifier Bridge **Gleichrichter**										
Forward voltage Durchlaßpannung	V_F	Tj=25°C Tj=125°C				30		1,23 1,22	1,4	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V_{to}	Tj=25°C Tj=125°C				30		0,92 0,81		V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r_t	Tj=25°C Tj=125°C				30		0,01 0,014		Ohm
Reverse current Sperrstrom	I_r	Tj=25°C Tj=150°C			1500				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					1,9 1,25		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			4,5E-05	6	6,7	9,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		5		3,05 3,98	3,5	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	1200			0,1	0,1	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		20	0				250	nA
Integrated Gate resistor Integrirter Gate Widerstand	R_{gint}							-		Ohm
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		26		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		16		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		106		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		39		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		0,71		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		0,28		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,1		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,05		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,025		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		15	600	2,6		30	36	nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					2,53 1,6698		K/W
Diode Inverter **Diode Wechselrichter**										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				5		2 1,5	2,6	V
Peak reverse recovery current Rückstromspitze	I_{RRM}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		10		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		391		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		1,53		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		0,60		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					3,27 2,16		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	
Transistor BRC										
Transistor BRC										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			4,5E-05	6	6,7	9,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		5		3,05 3,98	3,5	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	1200			0,1	0,1	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		20	0				250	nA
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		uWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=52Ohm Rgoff=26Ohm	15	600	5		TBD		uWs
Input capacitance Eingangskapazität	C_{iss}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,1		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,05		nF
Reverse transfer capacitance Rückwirkungskapazität	Cies	Tj=25°C Tj=125°C	f=1MHz	0	25			0,025		nF
Gate charge Gate Ladung	Qgate	Tj=25°C Tj=125°C		15	600	2,6		30	36	nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					2,53 1,6698		K/W
Diode BRC										
Diode BRC										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				5		1,8 1,85	2,35	V
Reverse current Sperrstrom	I_r	Tj=25°C Tj=150°C			1200				250 350	uA
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		TBD		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		TBD		uC
Reverse recovery energy Sperrverzögerungsenergie	E_{rec}	Tj=25°C Tj=125°C	Rgon=52Ohm	15	600	5		TBD		uWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					TBD ######		K/W
NTC-Thermistor										
NTC-Widerstand										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				20,9	22	23,1	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=1503Ohm					2,9		%/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%					3980		K

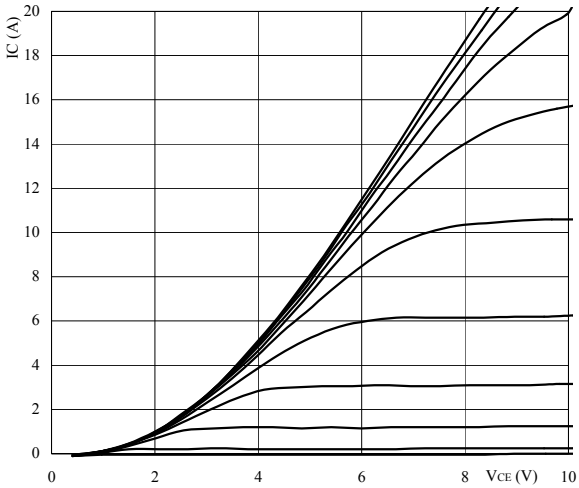
Output inverter

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



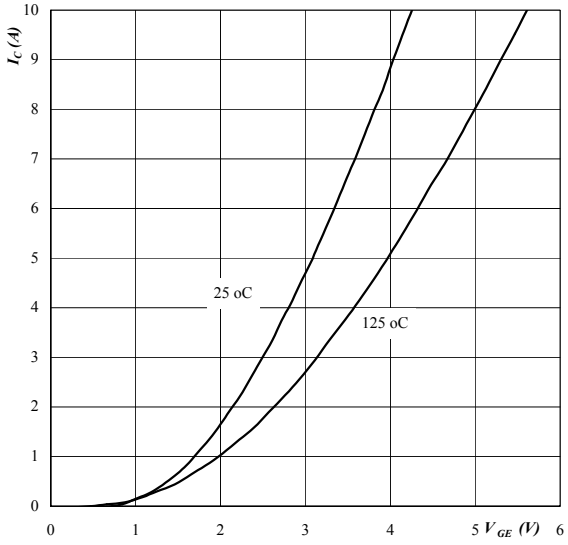
parameter: tp = 250 µs Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



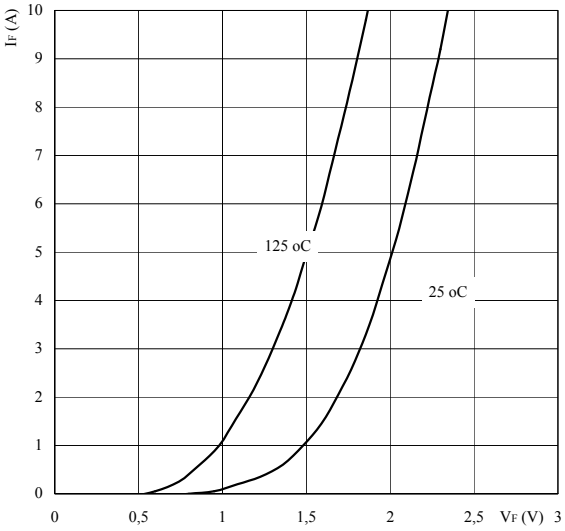
parameter: tp = 250 µs Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: tp = 250 µs VCE = 13 V

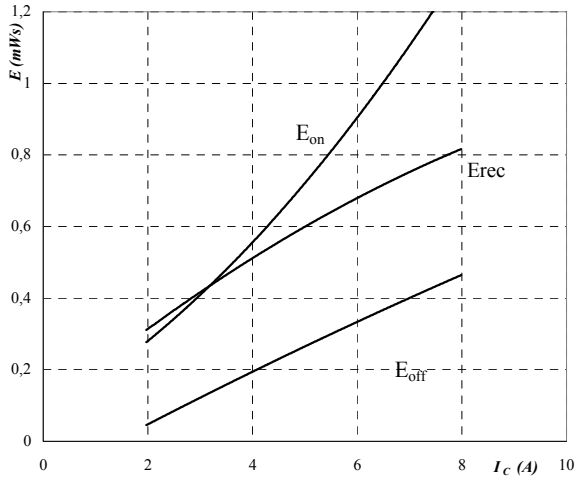
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 µs

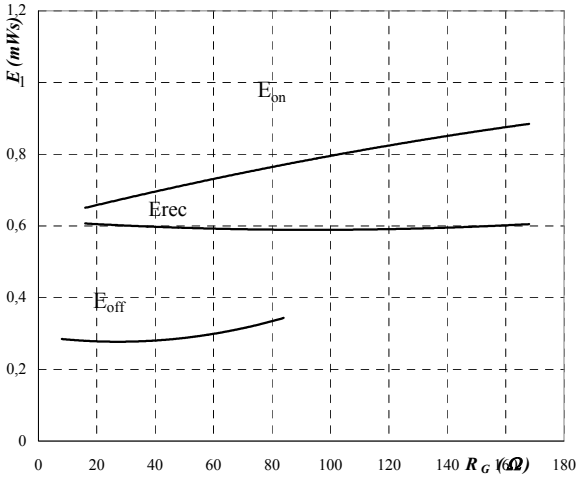
Output inverter

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



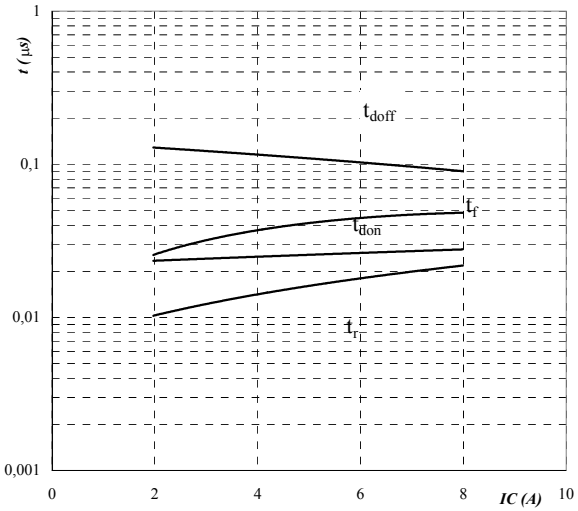
inductive load, Tj = 125 °C
V_{CE} = 600 V
V_{GE} = 15 V
$R_{Gon} = 2*R_{Goff}$ = 52 Ω

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



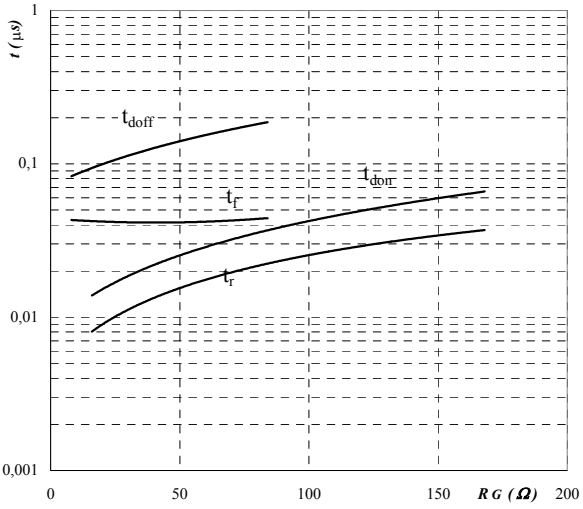
inductive load, Tj = 125 °C
V_{CE} = 600 V
V_{GE} = 15 V
Ic = 4,97 A

Figure 7. Typical switching times as a function of collector current
Output inverter IGBT
t = f (Ic)



inductive load, Tj = 125 °C
V_{CE} = 600 V
V_{GE} = 15 V
$R_{Gon} = 2*R_{Goff}$ = 52 Ω

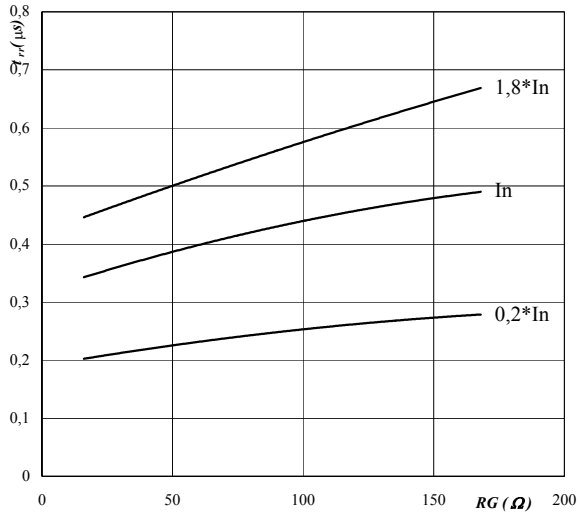
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (R_G)



inductive load, Tj = 125 °C
V_{CE} = 600 V
V_{GE} = 15 V
Ic = 4,97 A

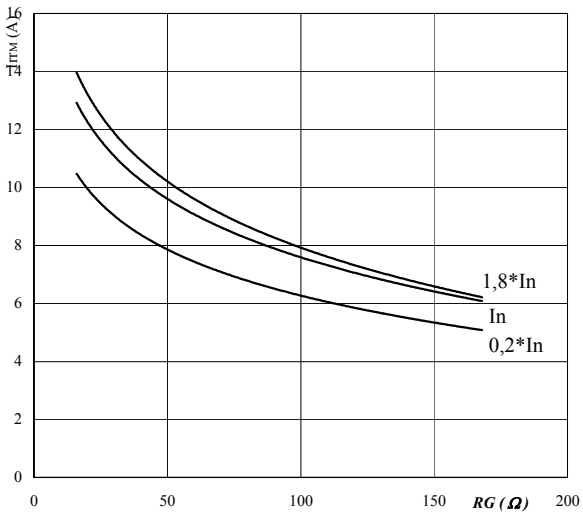
Output inverter

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



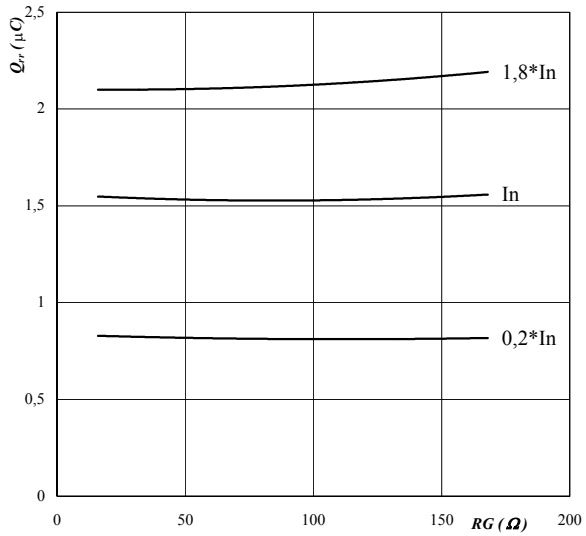
Tj = 125 °C
V_R = 600 V
In= 5 A

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



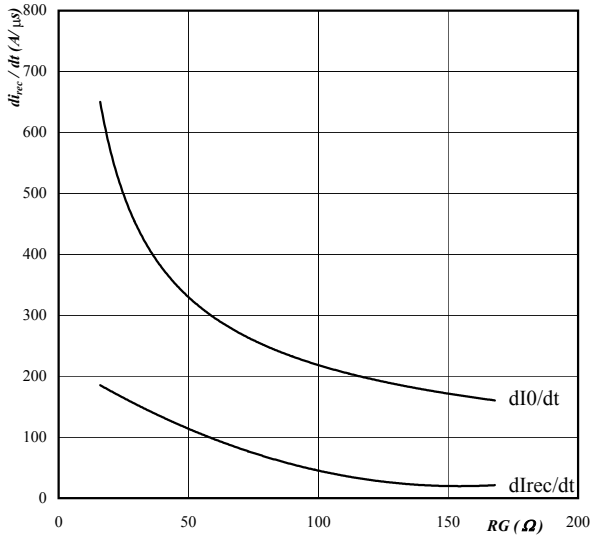
Tj = 125 °C
V_R = 600 V
In= 5 A

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 = 600 V
In= 5 A

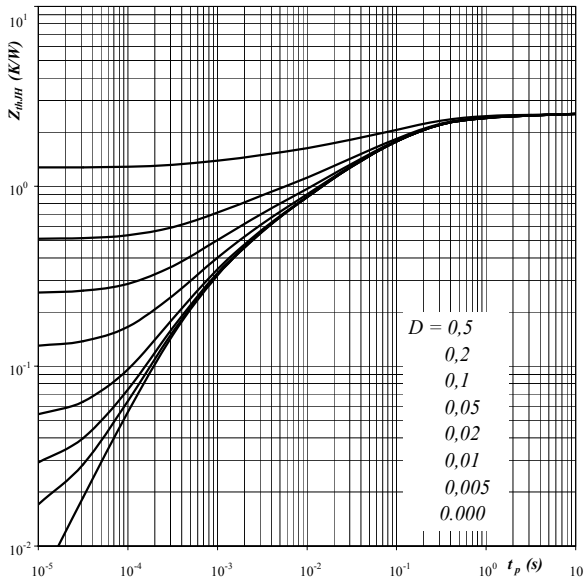
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 600 V
I_F= 5 A

Output inverter

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

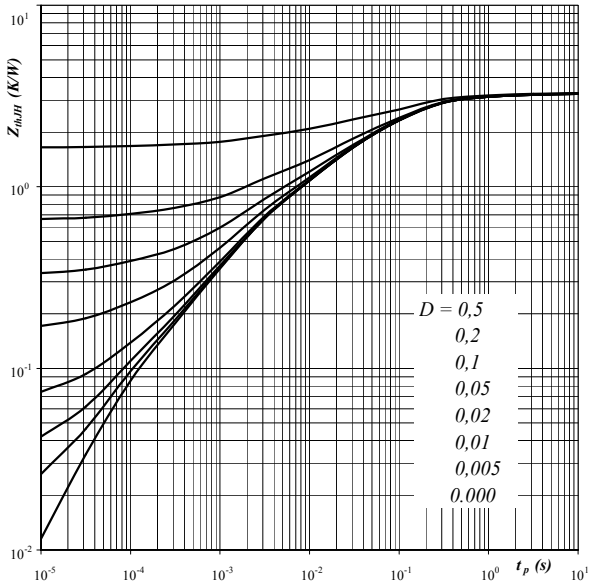


Parameter: D = tp / T RthJH 2,53 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	6,1E+01
0,17	2,6E+00
0,65	2,3E-01
0,75	6,6E-02
0,48	1,2E-02
0,31	2,0E-03

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



Parameter: D = tp / T RthJH 3,27 K/W

FRED thermal model values

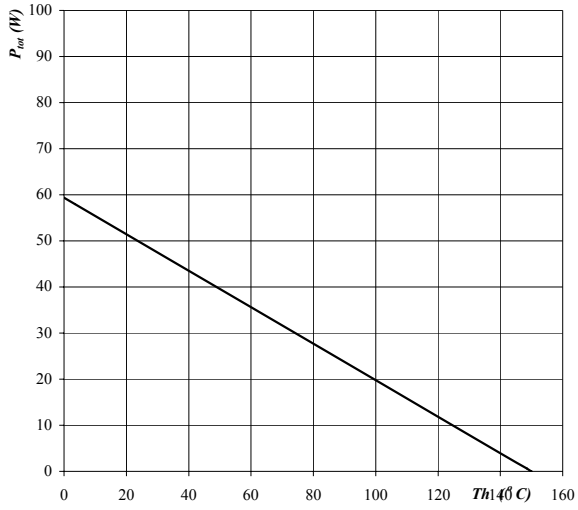
R (C/W)	Tau (s)
0,05	4,3E+01
0,12	2,5E+00
0,41	4,1E-01
1,43	9,3E-02
0,78	1,3E-02
0,43	1,6E-03

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

$P_{tot} = f(Th)$

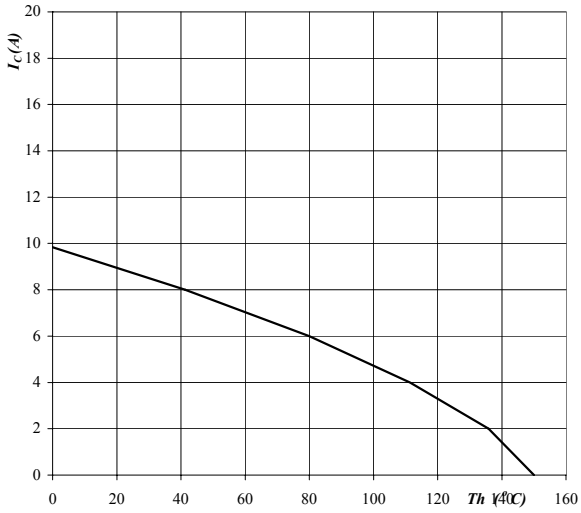


parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

$I_C = f(Th)$



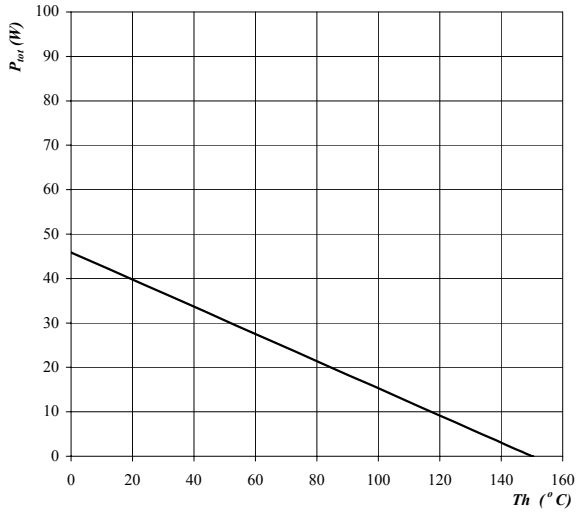
parameter: Tj = 150°C

V_{GE}= 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

$P_{tot} = f(Th)$

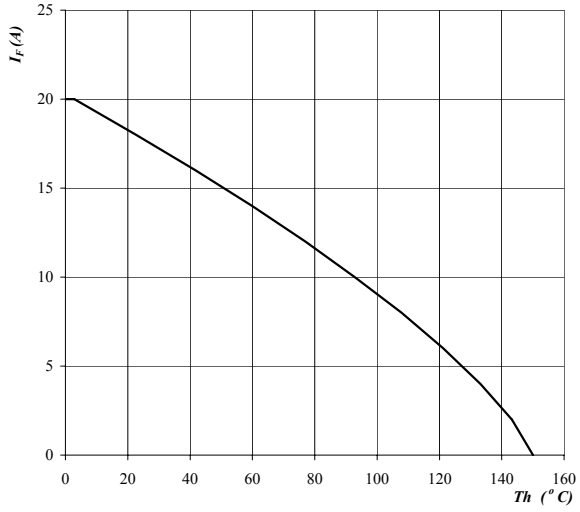


parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

$I_F = f(Th)$

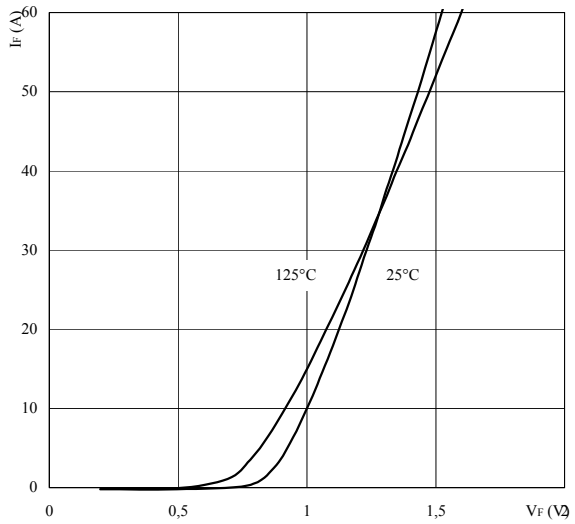


parameter: Tj = 150°C

Input rectifier bridge

Figure 37. Typical diode forward current as a function of forward voltage

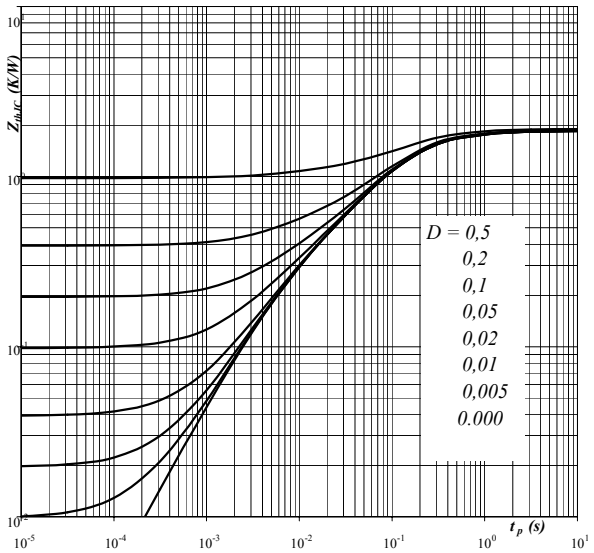
Rectifier diode $I_F=f(V_F)$



parameter: tp = 250 µs

Figure 38. Diode transient thermal impedance as a function of pulse width

$Z_{thJH} = f(tp)$

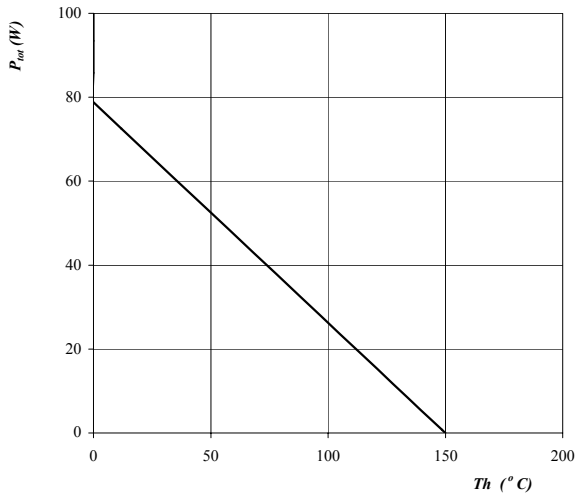


Parameter: D = tp / T RthJH 1,90 K/W

Figure 39. Power dissipation as a function of heatsink temperature

Rectifier diode

$P_{tot} = f(Th)$

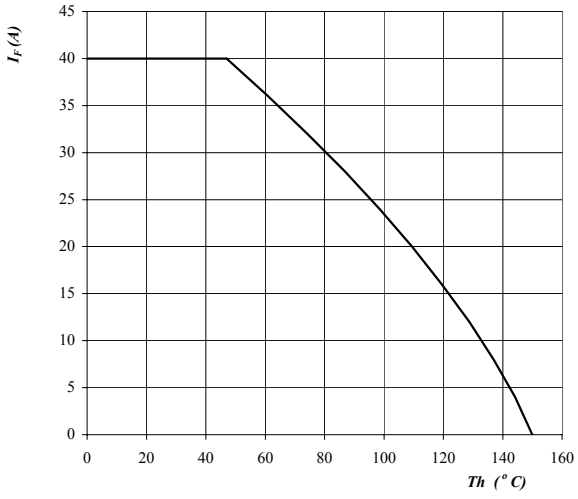


parameter: Tj = 150°C

Figure 40. Forward current as a function of heatsink temperature

Rectifier diode

$I_F = f(Th)$



parameter: Tj = 150°C

Thermistor

Figure 41. Typical NTC characteristic as a function of temperature

NTC

$R_T = f(T)$