

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 $T_h=80^\circ\text{C}$;	I_{FAV}	40	A
Surge forward current Stoßstrom Grenzwert	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I_{FSM}	200	A
I^2t -value Grenzlastintegral	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I^2t	200	A^2s
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	65	W

**Transistor Inverter
Transistor Wechselrichter**

Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung		V_{CE}	600	V
DC collector current Kollektor-Dauergleichstrom	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$,	I_C	38	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{cpuls}	75	A
Power dissipation per IGBT Verlustleistung pro IGBT	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	78	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time Kurzschlußverhalten	$T_j=125^\circ\text{C}$ $V_{GE}=15\text{V}$ $V_{ce}=390\text{V}$	t_{SC}	3,2	us

**Diode Inverter
Diode Wechselrichter**

DC forward current Dauergleichstrom	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$,	I_F	20	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{FRM}	40	A
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	31	W

**Thermal properties
Thermische Eigenschaften**

max. Chip temperature max. Chiptemperatur		T_{jmax}	150	$^\circ\text{C}$
Storage temperature Lagertemperatur		T_{stg}	-40...+125	$^\circ\text{C}$
Operation temperature Betriebstemperatur		T_{op}	-40...+125	$^\circ\text{C}$

**Insulation properties
Modulisolation**

Insulation voltage Isolationsspannung	$t=1\text{min}$	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			min 12,7	mm

fastPIM 1H, 600V, 20A

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 Durchlaßspannung	V_F	T _J =25°C T _J =125°C				30		1,21 1,19	1,35	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V_{to}	T _J =25°C T _J =125°C				30		0,92 0,81	0,85	V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r_t	T _J =25°C T _J =125°C				30		0,01 0,013		Ohm
Reverse current Sperrstrom	I_r	T _J =25°C T _J =150°C					1200		0,01 3	mA
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61$ W/mK					1,08		K/W

**Transistor Inverter, inductive load
Transistor Wechselrichter**

Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	T _J =25°C T _J =125°C	VCE=VGE				0,00025	4,5	5,5	7	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	T _J =25°C T _J =125°C		15		20		2,13 1,75	2,75		V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	T _J =25°C T _J =125°C		0	600				0,25 2		mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	T _J =25°C T _J =125°C		25	0				300		nA
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			23		ns
Rise time Anstiegszeit	t_r	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			9		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			106		ns
Fall time Fallzeit	t_f	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			42		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			0,238		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	T _J =25°C T _J =125°C	Rgon=6 Ohm Rgof=1 Ohm	15	300	20			0,306		mWs
Input capacitance Eingangskapazität	C_{ies}	T _J =25°C T _J =125°C	f=1MHz	0	25				2,2		nF
Output capacitance Ausgangskapazität	C_{oss}	T _J =25°C T _J =125°C	f=1MHz	0	25				0,2		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	T _J =25°C T _J =125°C	f=1MHz	0	25				0,1		nF
Gate charge Gate Ladung	Q_{Gate}	T _J =25°C T _J =125°C		15	300	20			142 162		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61$ W/mK						0,9		K/W

fastPIM 1H, 600V, 20A

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				20		1,82 1,54	2,4	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	20		40		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	20		66		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	20		1,16		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=6 Ohm	15	300	20		0,228		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61 \text{ W/mK}$					2,25		K/W

NTC-Thermistor

NTC-Widerstand

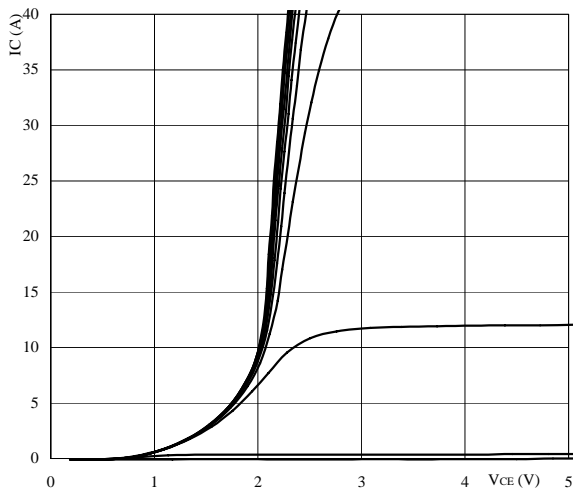
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				9,5	10	10,5	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=809Ohm					2,8		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	Tj=25°C							210	mW
B-value B-Wert	$B_{(25/100)}$	Tj=25°C	Tol. ±3%					3730		K

Output inverter

Figure 1. Typical output characteristics

Output inverter IGBT

$I_C = f(V_{CE})$

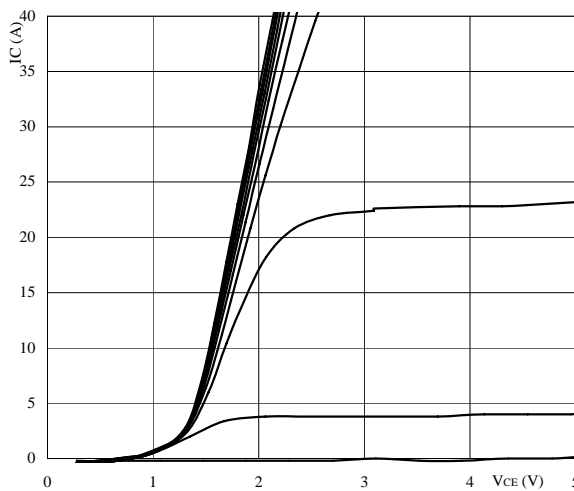


parameter: $t_p = 250 \mu s$ $T_j = 25 \text{ }^\circ C$
 VGE parameter: from: 6 V to 16 V
 in 1 V steps

Figure 2. Typical output characteristics

Output inverter IGBT

$I_C = f(V_{CE})$

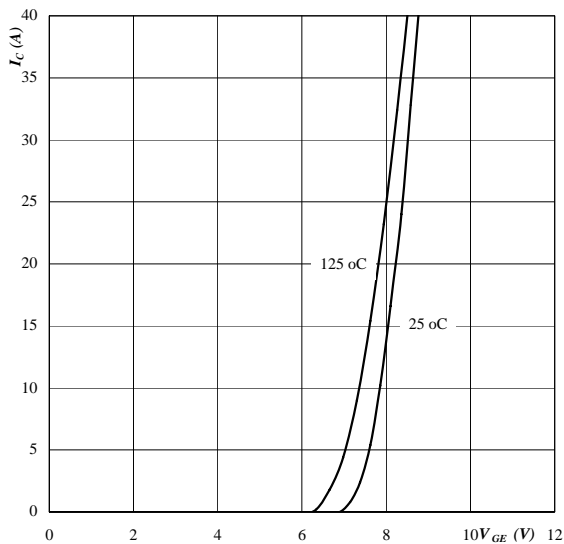


parameter: $t_p = 250 \mu s$ $T_j = 125 \text{ }^\circ C$
 VGE parameter: from: 6 V to 16 V
 in 1 V steps

Figure 3. Typical transfer characteristics

Output inverter IGBT

$I_C = f(V_{GE})$

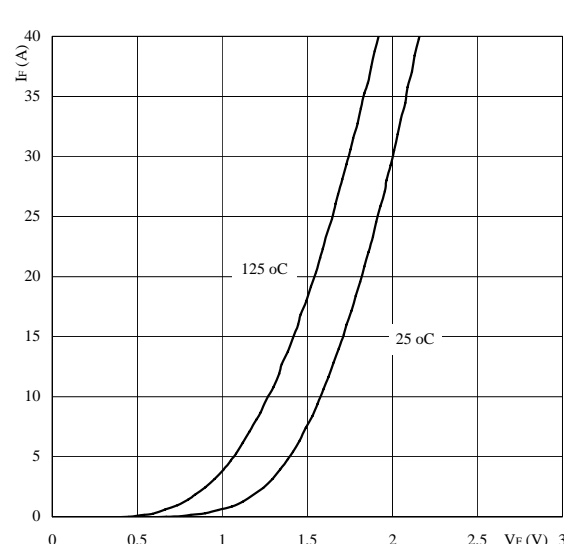


parameter: $t_p = 250 \mu s$ $V_{CE} = 7 \text{ V}$

Figure 4. Typical diode forward current as a function of forward voltage

Output inverter FRED

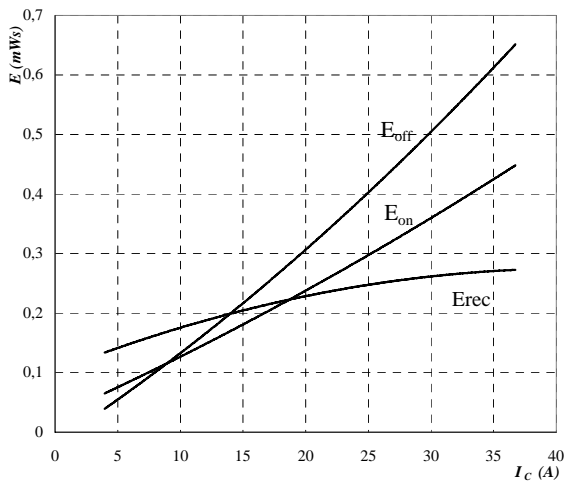
$I_F = f(V_F)$



parameter: $t_p = 250 \mu s$

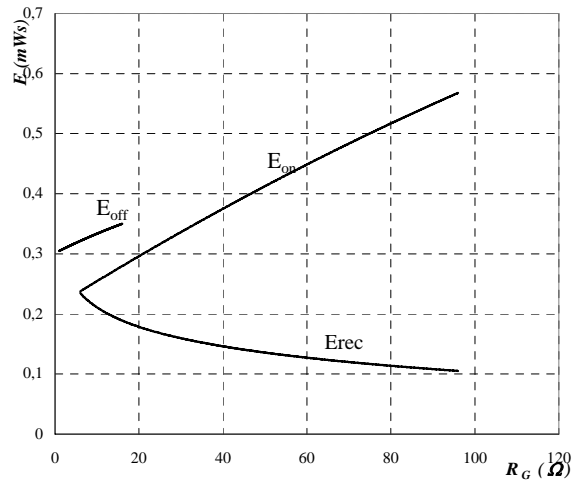
Output inverter

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



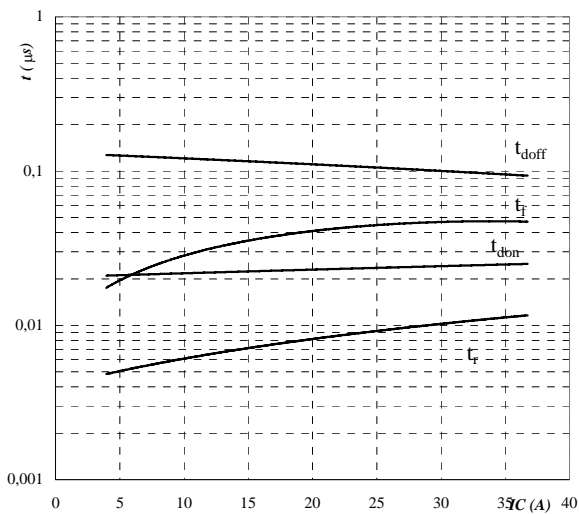
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 6 * R_{Goff} = 6\text{ }\Omega$

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



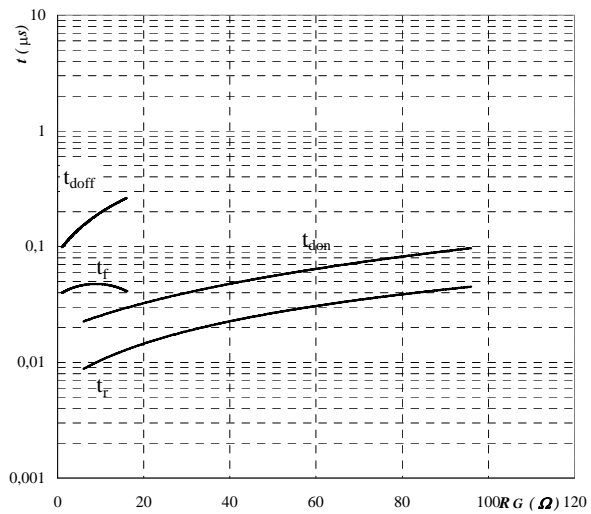
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 20\text{ A}$

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



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 6 * R_{Goff} = 6\text{ }\Omega$

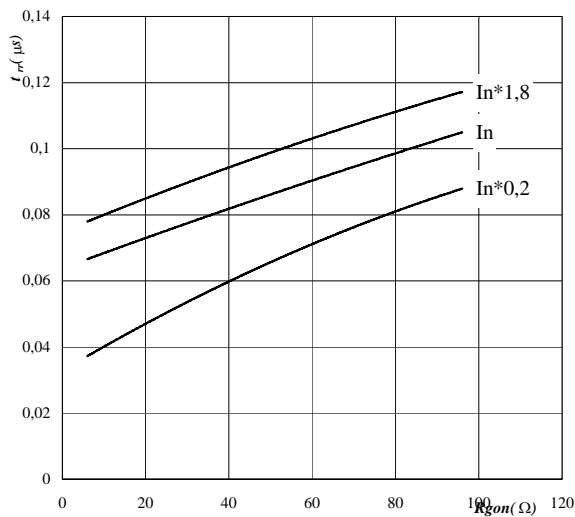
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
 $t = f(R_G)$



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 20\text{ A}$

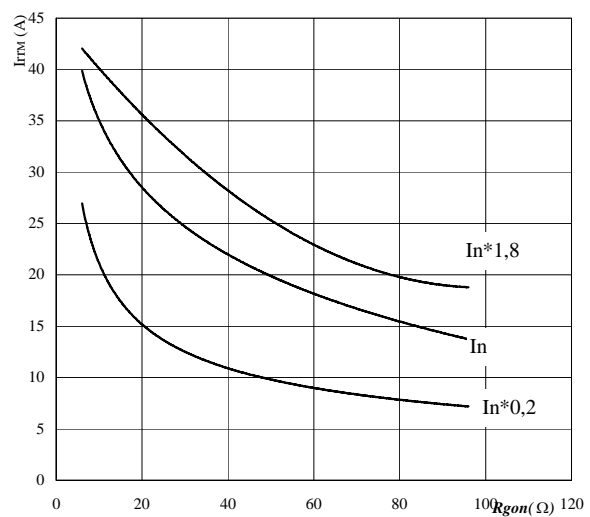
Output inverter

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



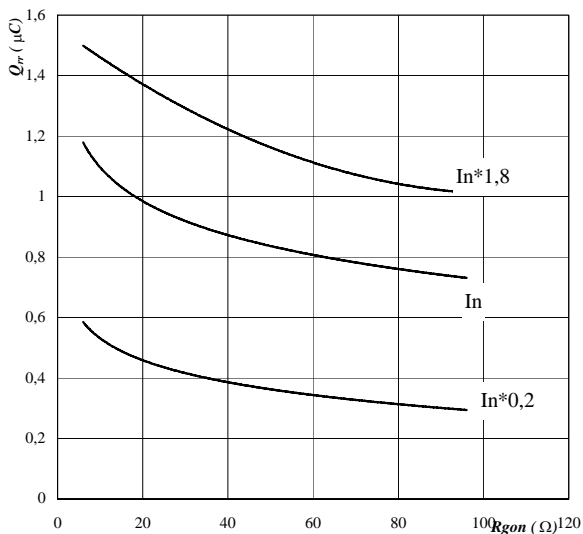
$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 20\text{ A}$

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



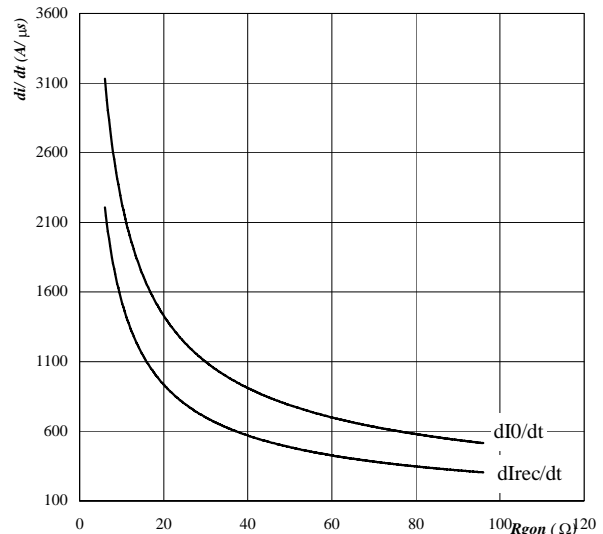
$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 20\text{ A}$

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



$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 20\text{ A}$

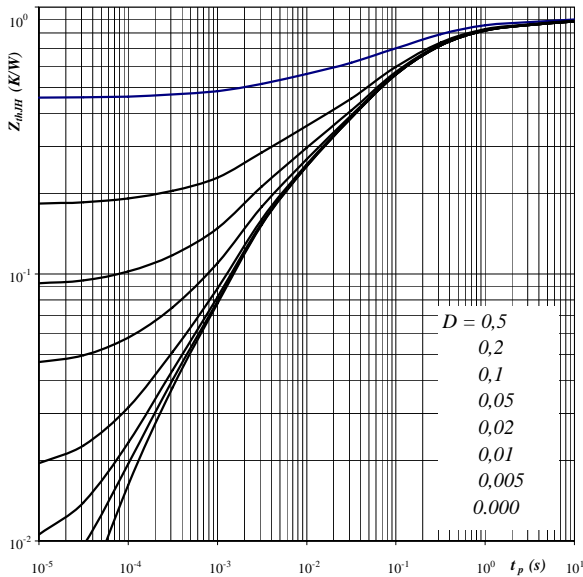
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
 $di_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_F = 20\text{ A}$

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$

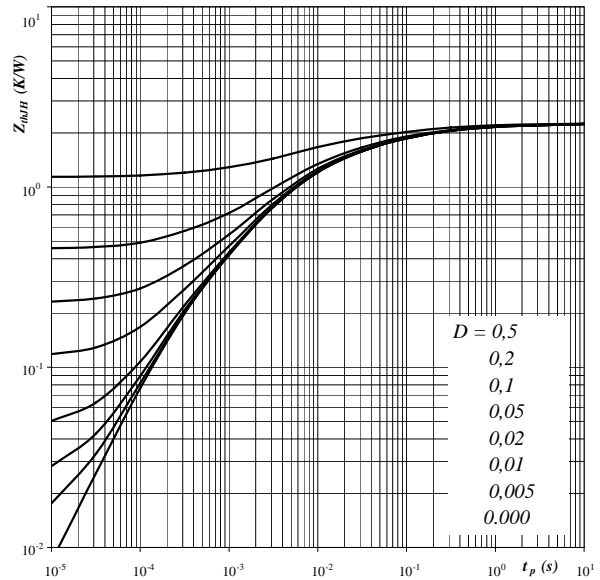


Parameter: $D = t_p / T$ $R_{thJH} \ 0,90 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,03	9,5E+01
0,08	3,0E+00
0,25	3,2E-01
0,31	6,5E-02
0,12	1,0E-02

Figure 14. FRED transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$



Parameter: $D = t_p / T$ $R_{thJH} \ 2,25 \text{ K/W}$

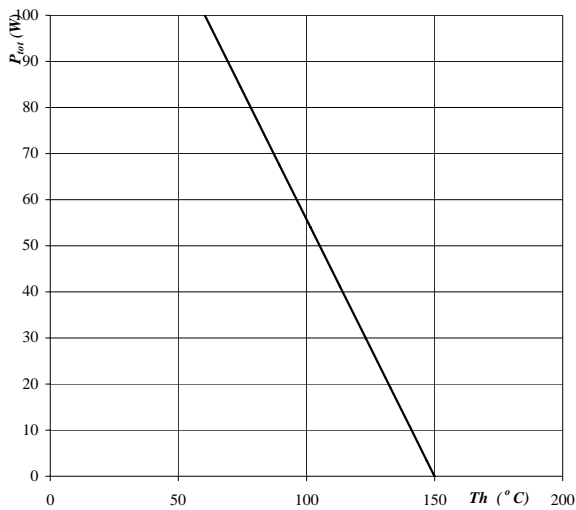
FRED thermal model values

R (C/W)	Tau (s)
0,03	2,9E+02
0,08	4,6E+00
0,26	3,9E-01
0,52	6,2E-02
0,63	1,1E-02

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

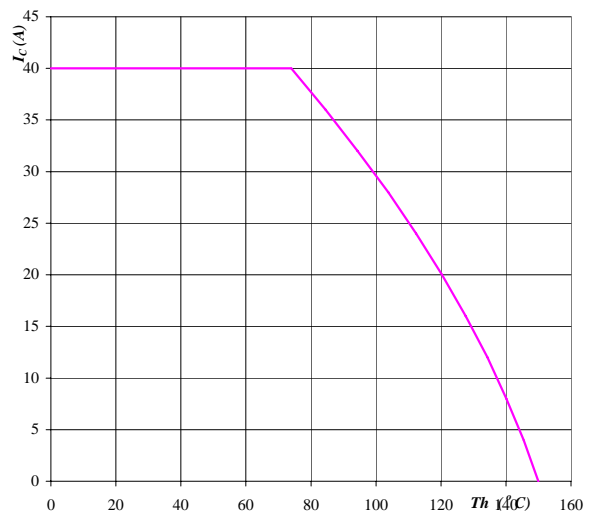
Output inverter IGBT
 $P_{tot} = f(T_h)$



parameter: T_j = 150°C

Figure 16. Collector current as a function of heatsink temperature

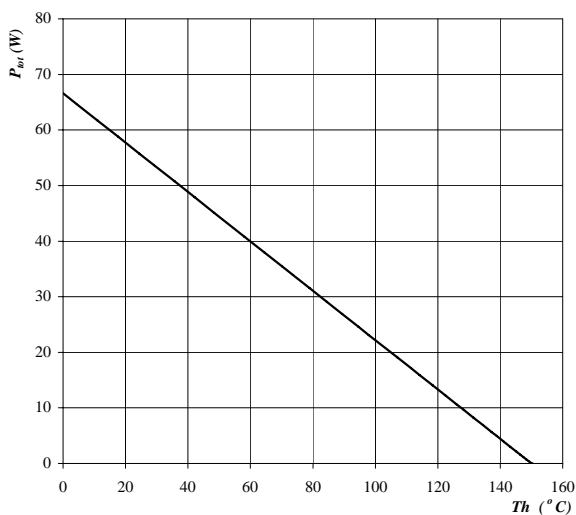
Output inverter IGBT
 $I_c = f(T_h)$



parameter: T_j = 150°C
V_{GE} = 15 V

Figure 17. Power dissipation as a function of heatsink temperature

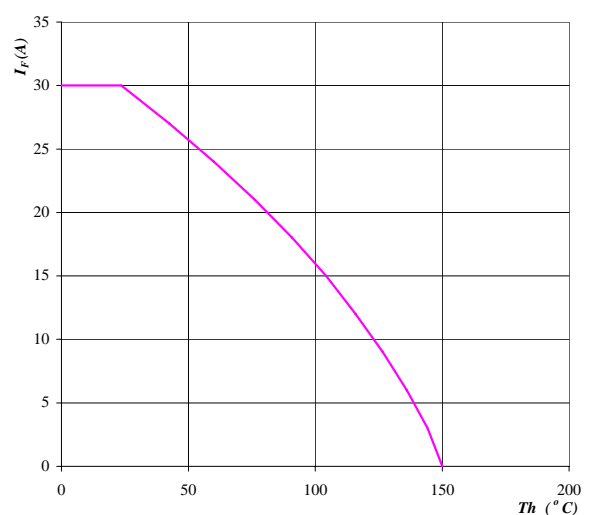
Output inverter FRED
 $P_{tot} = f(T_h)$



parameter: T_j = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED
 $I_F = f(T_h)$



parameter: T_j = 150°C

Input rectifier bridge

Figure 19. Typical diode forward current as a function of forward voltage
Rectifier diode $I_F = f(V_F)$

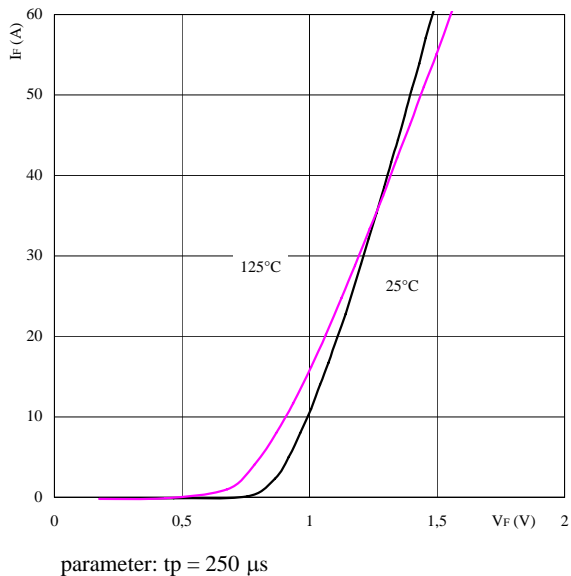


Figure 20. Diode transient thermal impedance as a function of pulse width
 $Z_{thJC} = f(t_p)$

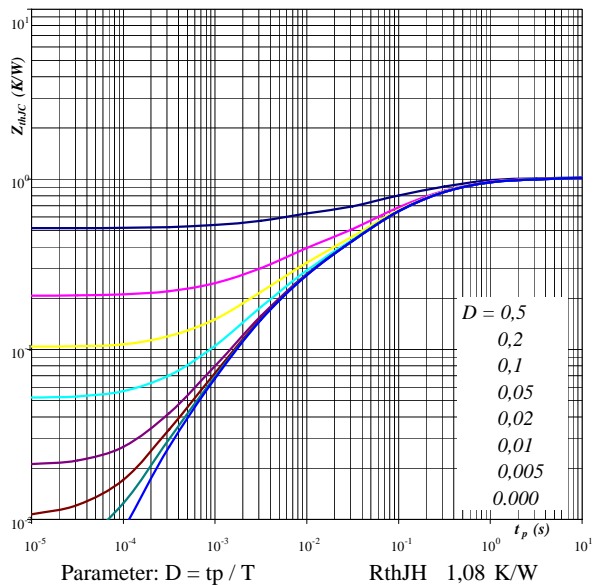


Figure 21. Power dissipation as a function of heatsink temperature
Rectifier diode $P_{tot} = f(T_h)$

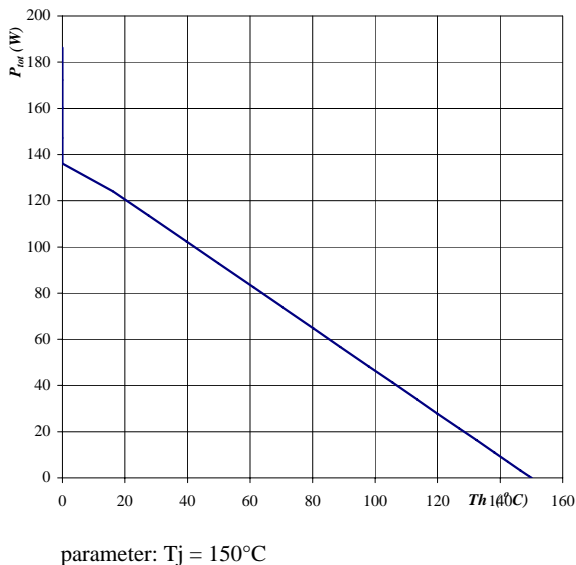
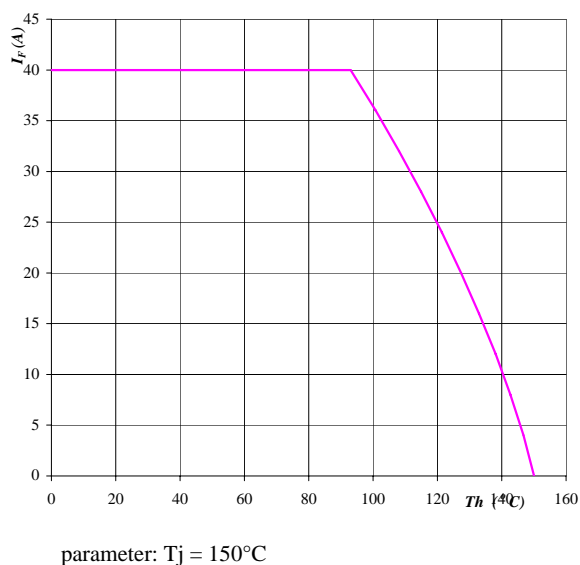


Figure 22. Forward current as a function of heatsink temperature
Rectifier diode $I_F = f(T_h)$



Thermistor

**Figure 23. Typical NTC characteristic
as a function of temperature**
NTC
 $R_T / R_{25} = f(T)$

