

fastPIM 1H, 600V, 30A

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}	50	A
Surge forward current Stoßstrom Grenzwert	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I_{FSM}	300	A
I^2t -value Grenzlastintegral	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I^2t	450	A^2s
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	56	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	40	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{cpuls}	80	A
Power dissipation per IGBT Verlustleistung pro IGBT	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	75	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}	5	us

Diode Inverter
Diode Wechselrichter

DC forward current Dauergleichstrom	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$,	I_F	38	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{FRM}	77	A
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^\circ\text{C}$ $T_h=80^\circ\text{C}$	P_{tot}	46	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

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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 Durchlaßspannung	V_F	Tj=25°C Tj=125°C				80	1,32 1,33	1,5	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V_{to}	Tj=25°C Tj=125°C				80	0,94 0,82		V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r_t	Tj=25°C Tj=125°C				80	0,005 0,006		Ohm
Reverse current Sperrstrom	I_r	Tj=25°C Tj=150°C			1200		3	0,01 4	mA
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61 \text{ W/mK}$				1,26		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	1,87 1,55	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=4 Ohm Rgoff=1 Ohm	15	300	30		33		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	15	300	30		10		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	15	300	30		153		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	15	300	30		39		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	15	300	30		0,486		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=4 Ohm Rgoff=1 Ohm	15	300	30		0,503		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 Wärmeleitpaste Dicke≤50um $\lambda = 0,61 \text{ W/mK}$					0,94		K/W

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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	

Diode Inverter

Diode Wechselrichter

Diode forward voltage Durchlaßspannung	V_F	T _J =25°C T _J =125°C				30		1,4 1,16	2,15	V
Peak reverse recovery current Rückstromspitze	I_{RM}	T _J =25°C T _J =125°C	Rgon=4 Ohm	15	300	30		82,2		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	T _J =25°C T _J =125°C	Rgon=4 Ohm	15	300	30		51		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	T _J =25°C T _J =125°C	Rgon=4 Ohm	15	300	30		2,6		uC
Reverse recovered energy Sperrverzögerungsenergie	E _{rec}	T _J =25°C T _J =125°C	Rgon=4 Ohm	15	300	30		0,485		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	$R_{th,CH}$		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,53		K/W

NTC-Thermistor

NTC-Widerstand

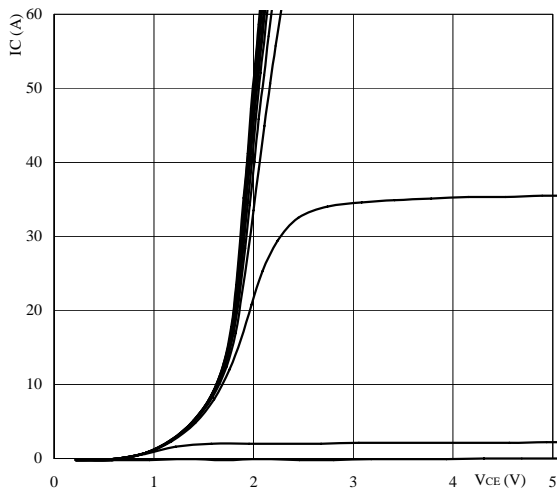
Rated resistance Nennwiderstand	R_{25}	T _J =25°C	Tol. ±5%				9,5	10	10,5	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	T _c =100°C	R100=809Ohm					2,8		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	T _J =25°C							210	mW
B-value B-Wert	$B_{(25/100)}$	T _J =25°C	Tol.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

Output inverter

Figure 1. Typical output characteristics

Output inverter IGBT

$I_C = f(V_{CE})$

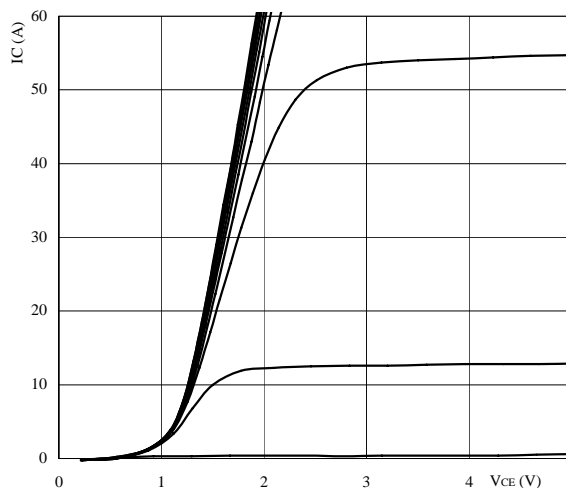


parameter: $t_p = 250 \mu s$ $T_j = 25 \text{ }^\circ C$
 VGE parameter: from: 6 V to 16 V
 in 1 V steps

Figure 2. Typical output characteristics

Output inverter IGBT

$I_C = f(V_{CE})$

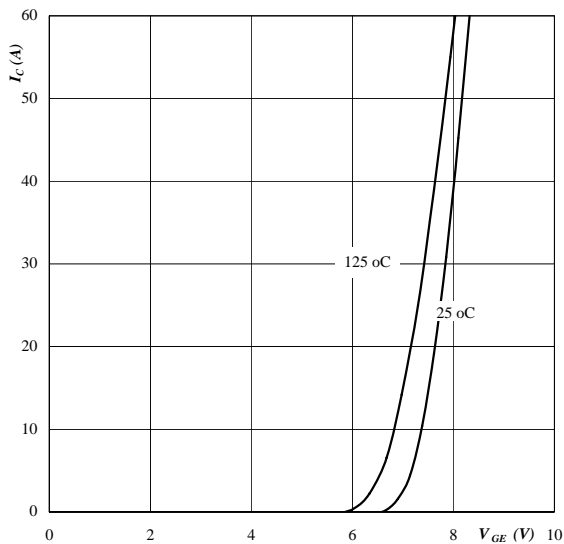


parameter: $t_p = 250 \mu s$ $T_j = 125 \text{ }^\circ C$
 VGE parameter: from: 6 V to 16 V
 in 1 V steps

Figure 3. Typical transfer characteristics

Output inverter IGBT

$I_C = f(V_{GE})$

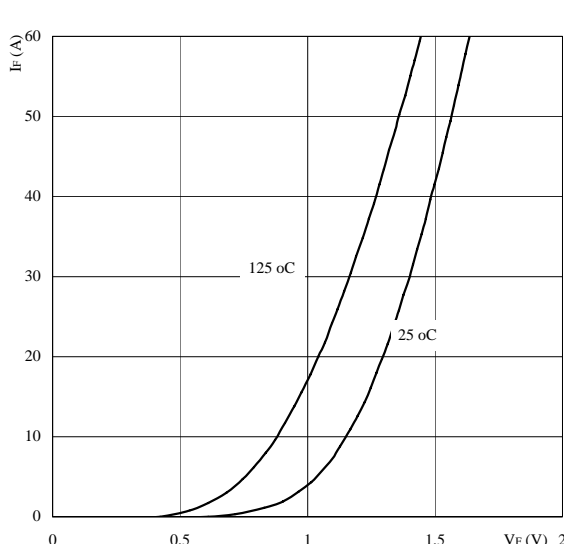


parameter: $t_p = 250 \mu s$ $V_{CE} = 8 \text{ V}$

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

Output inverter FRED

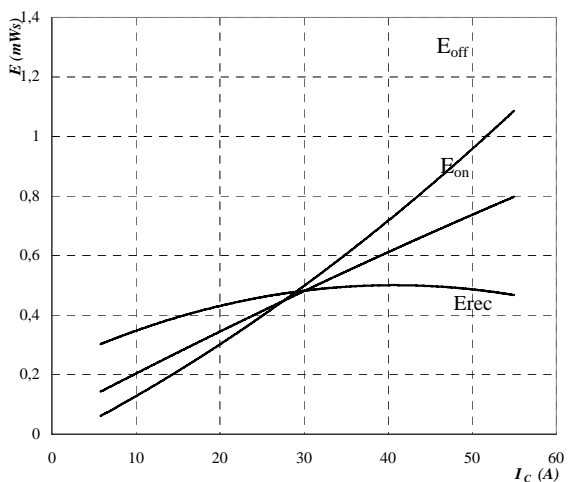
$I_F = f(V_F)$



parameter: $t_p = 250 \mu s$

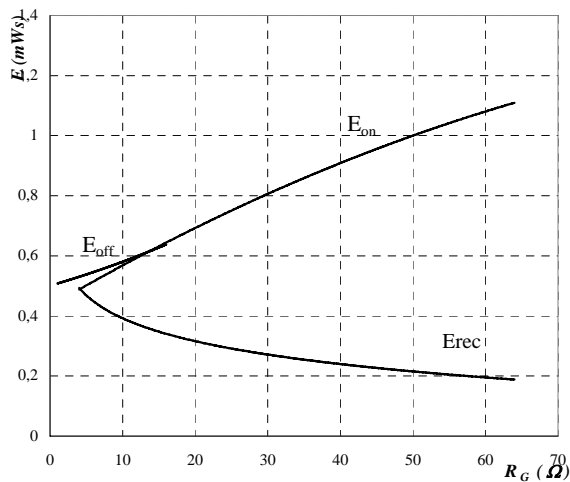
Output inverter

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



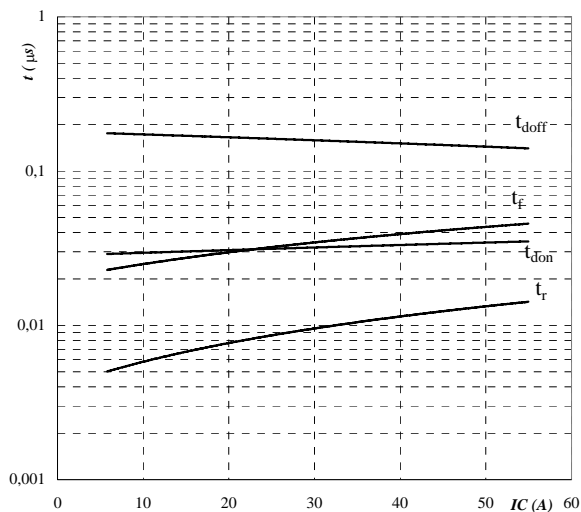
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 4 * R_{Goff} = 4\ \Omega$

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



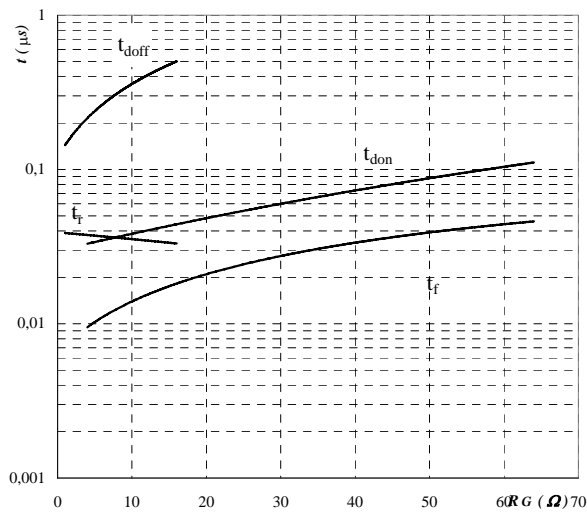
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 30\text{ A}$

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



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 4 * R_{Goff} = 4\ \Omega$

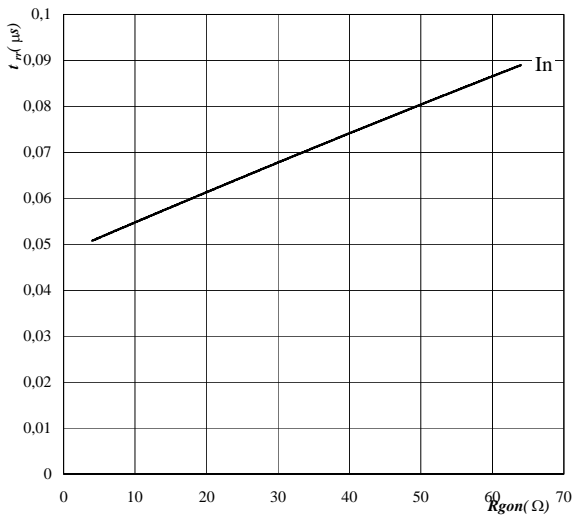
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
 $t = f(R_G)$



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 30\text{ A}$

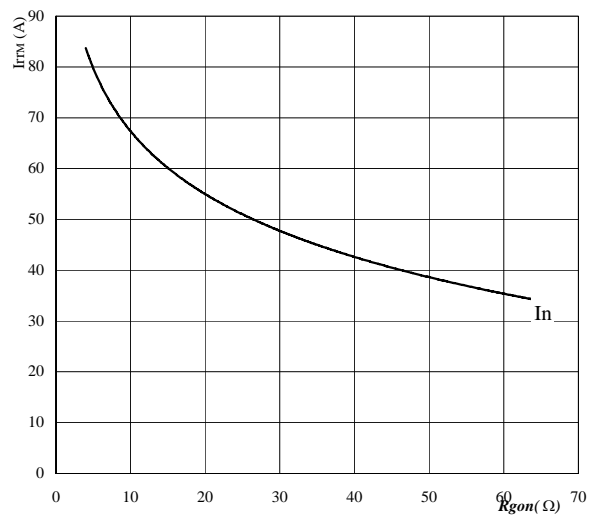
Output inverter

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



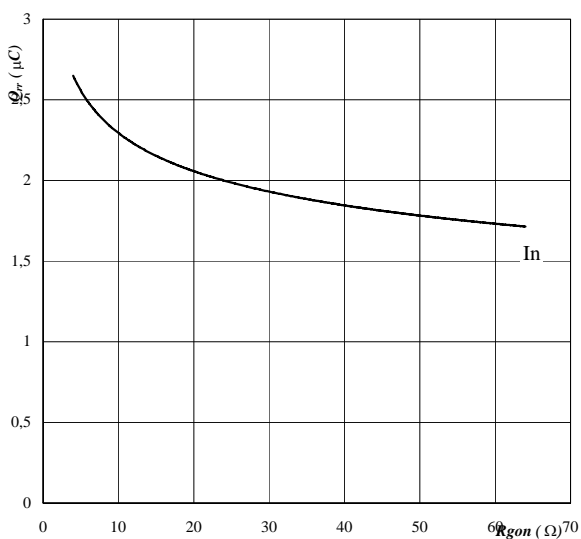
$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 30\text{ A}$

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



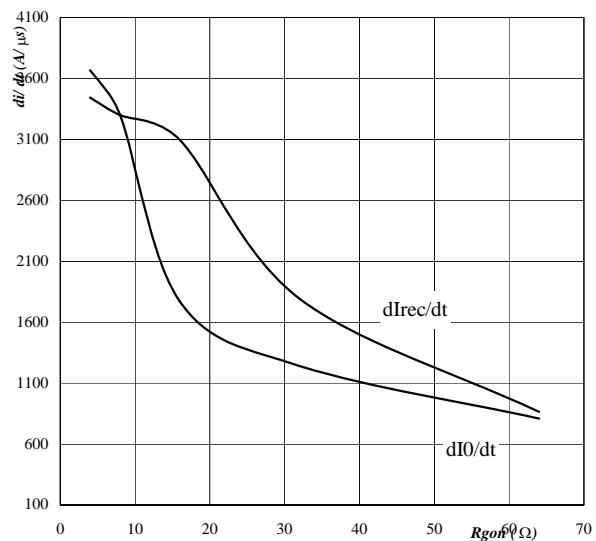
$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 30\text{ A}$

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



$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_n = 30\text{ A}$

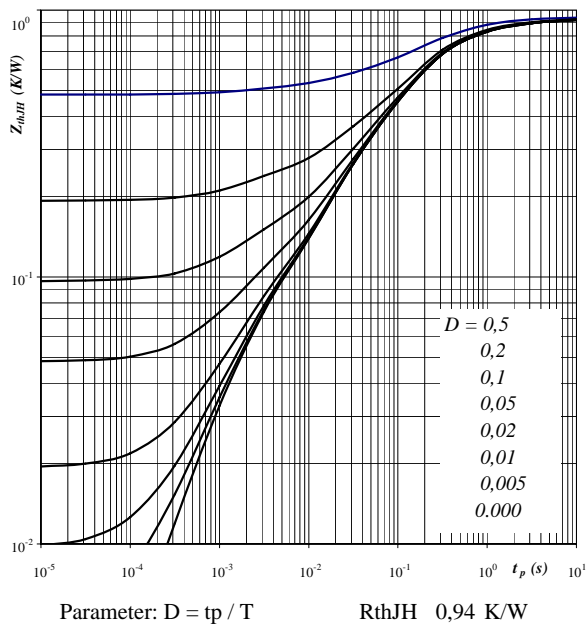
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
 $di_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125\text{ }^\circ\text{C}$
 $V_R = 300\text{ V}$
 $I_r = 30\text{ A}$

Output inverter

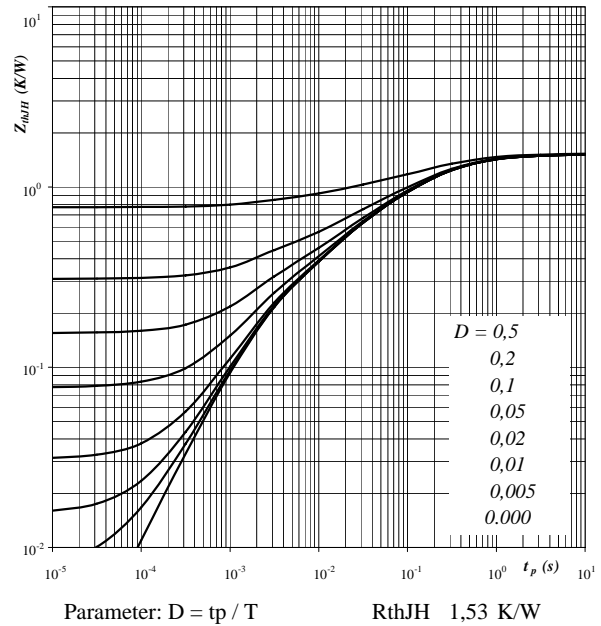
Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$



IGBT thermal model values

R (C/W)	Tau (s)
0,04	1,5E+02
0,05	6,0E+00
0,19	7,6E-01
0,47	1,6E-01

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



FRED thermal model values

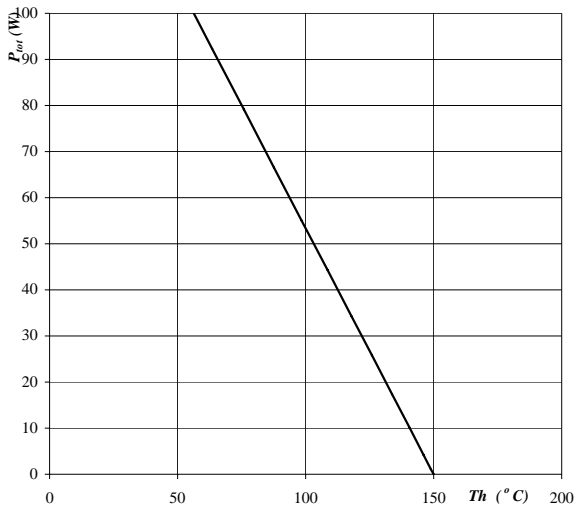
R (C/W)	Tau (s)
0,02	3,6E+02
0,08	3,3E+00
0,38	4,1E-01
0,52	1,0E-01

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Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

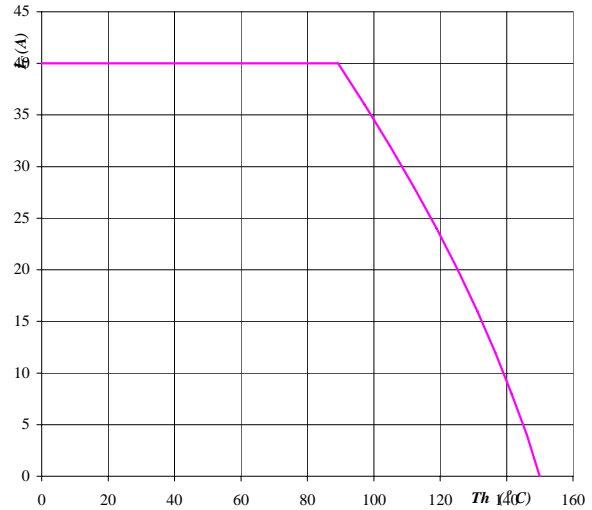
Output inverter IGBT
 $P_{tot} = f(T_h)$



parameter: T_j = 150°C

Figure 16. Collector current as a function of heatsink temperature

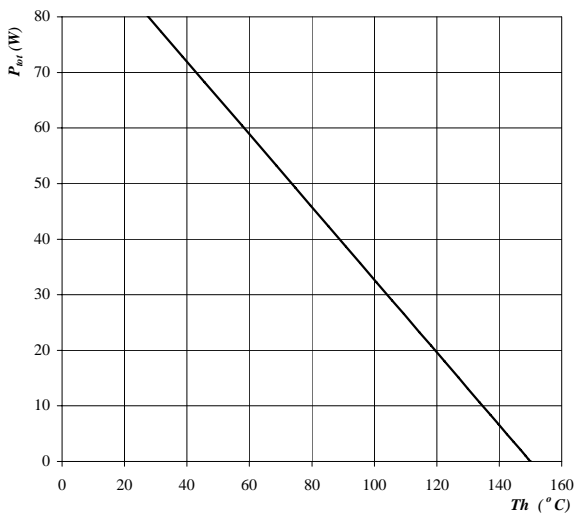
Output inverter IGBT
 $I_c = f(T_h)$



parameter: T_j = 150°C
V_{GE} = 15 V

Figure 17. Power dissipation as a function of heatsink temperature

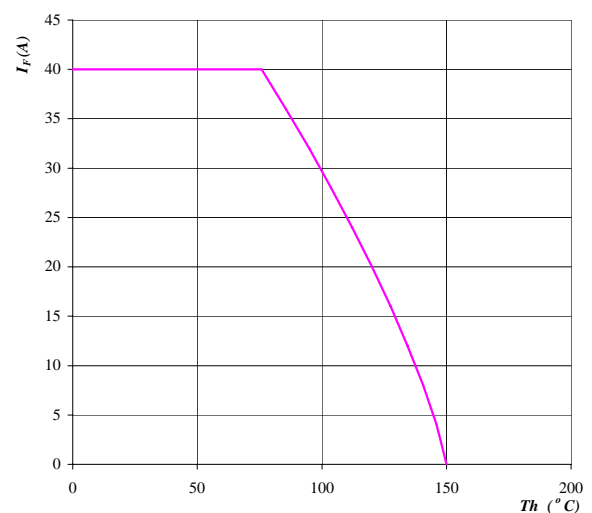
Output inverter FRED
 $P_{tot} = f(T_h)$



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 $I_F = f(V_F)$

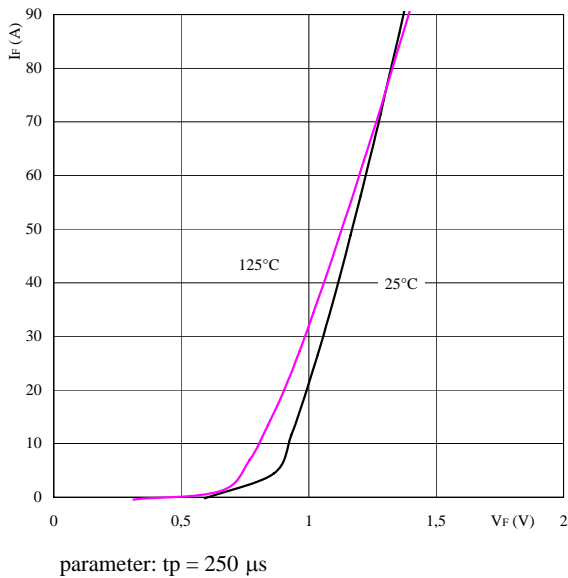


Figure 20. Diode transient thermal impedance as a function of pulse width
 $Z_{thJC} = f(t_p)$

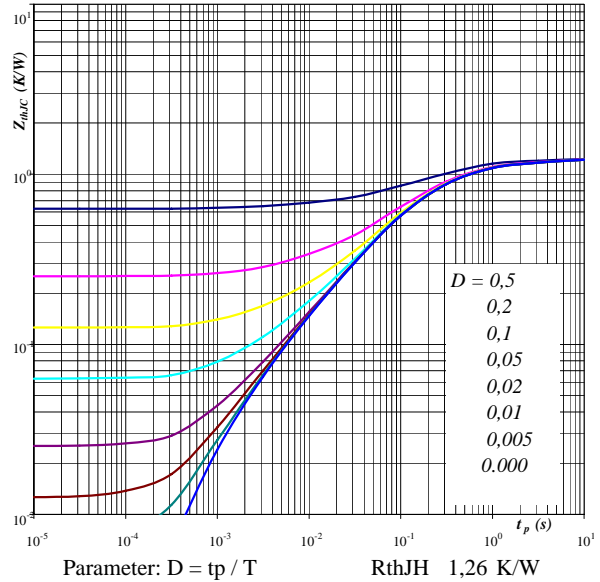


Figure 21. Power dissipation as a function of heatsink temperature
Rectifier diode $P_{tot} = f(T_h)$

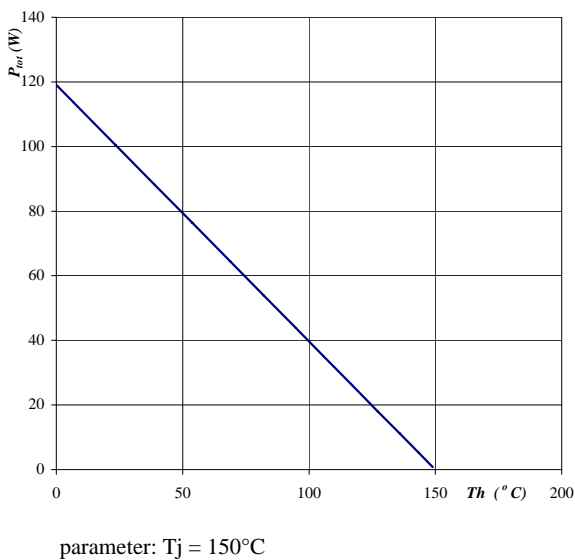
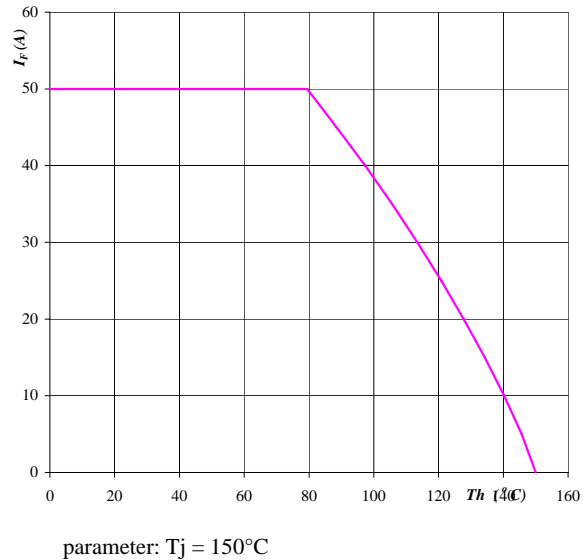


Figure 22. Forward current as a function of heatsink temperature
Rectifier diode $I_F = f(T_h)$



Thermistor

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

