Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values	Unit
			max.	
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, T_c=80°C	I_C	14 19	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms T_h=80°C	I_{cpuls}	28	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C T_h=80°C T_c=80°C	P_{tot}	39 59	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤125°C V_{GE}=15V V_{CE}=400V/900V	t_{SC}	10 @400V	us
Diode Inverter Diode Wechselrichter				
DC forward current Dauergleichstrom	T_j=150°C T_h=80°C, T_c=80°C	I_F	16 20-limited by wires	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 T_c=80°C	P_{tot}	22 34	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

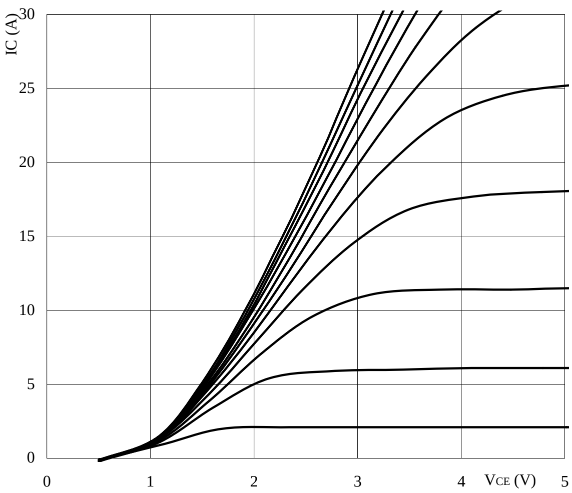
Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Transistor Inverter, inductive load										
Transistor Wechselrichter										
Gate emitter threshold voltage	$V_{GE(th)}$	Tj=25°C	VCE=VGE			0,0004	3	4	5	V
Gate-Schwellenspannung		Tj=125°C								
Collector-emitter saturation voltage	$V_{CE(sat)}$	Tj=25°C		15		10		1,92	2,6	V
Kollektor-Emitter Sättigungsspannung		Tj=125°C						2,15		
Collector-emitter cut-off	I_{CES}	Tj=25°C		0	600				0,06	mA
Kollektor-Emitter Reststrom		Tj=125°C							1,5	
Gate-emitter leakage current	I_{GES}	Tj=25°C		25	0				200	nA
Gate-Emitter Reststrom		Tj=125°C								
Integrated Gate resistor	R_{gint}							-		Ohm
Integrirter Gate Widerstand										
Turn-on delay time	$t_{d(on)}$	Tj=25°C	Rgon=48 Ohm	15	300	10				ns
Einschaltverzögerungszeit		Tj=125°C	Rgoff=24 Ohm					16		
Rise time	t_r	Tj=25°C	Rgon=48 Ohm	15	300	10				ns
Anstiegszeit		Tj=125°C	Rgoff=24 Ohm					16		
Turn-off delay time	$t_{d(off)}$	Tj=25°C	Rgon=48 Ohm	15	300	10				ns
Abschaltverzögerungszeit		Tj=125°C	Rgoff=24 Ohm					256		
Fall time	t_f	Tj=25°C	Rgon=48 Ohm	15	300	10				ns
Fallzeit		Tj=125°C	Rgoff=24 Ohm					37		
Turn-on energy loss per pulse	E_{on}	Tj=25°C	Rgon=48 Ohm	15	300	10				mWs
Einschaltverlustenergie pro Puls		Tj=125°C	Rgoff=24 Ohm					0,221		
Turn-off energy loss per pulse	E_{off}	Tj=25°C	Rgon=48 Ohm	15	300	10				mWs
Abschaltverlustenergie pro Puls		Tj=125°C	Rgoff=24 Ohm					0,248		
Input capacitance	C_{ies}	Tj=25°C	f=1MHz	0	25			0,58	0,7	nF
Eingangskapazität		Tj=125°C								
Output capacitance	C_{oss}	Tj=25°C	f=1MHz	0	25			0,07	0,08	nF
Ausgangskapazität		Tj=125°C								
Reverse transfer capacitance	C_{rss}	Tj=25°C	f=1MHz	0	25			0,05	0,06	nF
Rückwirkungskapazität		Tj=125°C								
Gate charge	Q_{Gate}	Tj=25°C		15	480	10		64	83	nC
Gate Ladung		Tj=125°C								
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					1,81		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,1946		K/W
Coupled thermal resistance inverter diode-transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					TBD		K/W
Diode Inverter										
Diode Wechselrichter										
Diode forward voltage	V_F	Tj=25°C				10		1,59	2,2	V
Durchlaßspannung		Tj=125°C						1,31		
Peak reverse recovery current	I_{RRM}	Tj=25°C	Rgon=48 Ohm	15	300	10				A
Rückstromspitze		Tj=125°C						20,8		
Reverse recovery time	t_{rr}	Tj=25°C	Rgon=48 Ohm	15	300	10				ns
Sperreverzögerungszeit		Tj=125°C						64		
Reverse recovered charge	Q_{rr}	Tj=25°C	Rgon=48 Ohm	15	300	10				uC
Sperrverzögerungsladung		Tj=125°C						0,69		
Reverse recovered energy	Erec	Tj=25°C	Rgon=48 Ohm	15	300	10				mWs
Sperrverzögerungsenergie		Tj=125°C						0,106		
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					3,12		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					2,0592		K/W
Coupled thermal resistance inverter transistor-diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					TBD		K/W

Characteristic values

Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
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

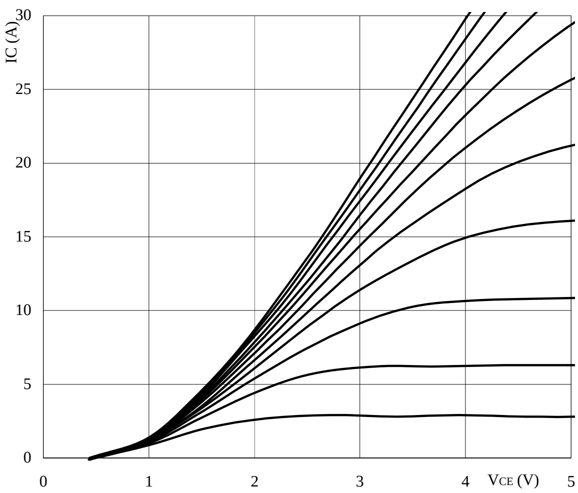
Output inverter

Figure 1. Typical output characteristics
Output inverter IGBT
$I_C = f(V_{CE})$



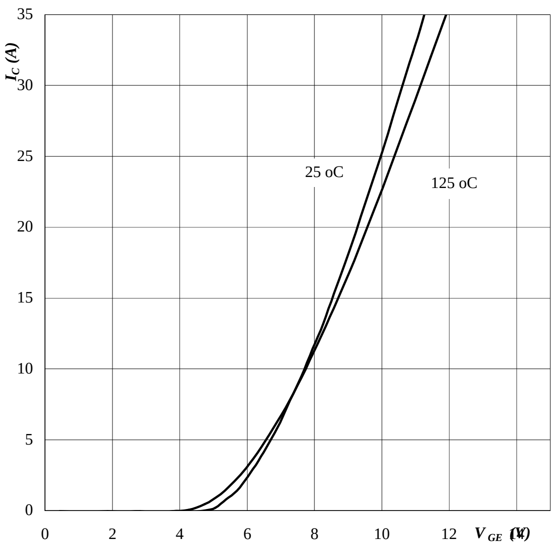
parameter: tp = 250 µs Tj = 25 °C
V_{GE} parameter: from: 6 V to 16 V
in 1 V steps

Figure 2. Typical output characteristics
Output inverter IGBT
$I_C = f(V_{CE})$



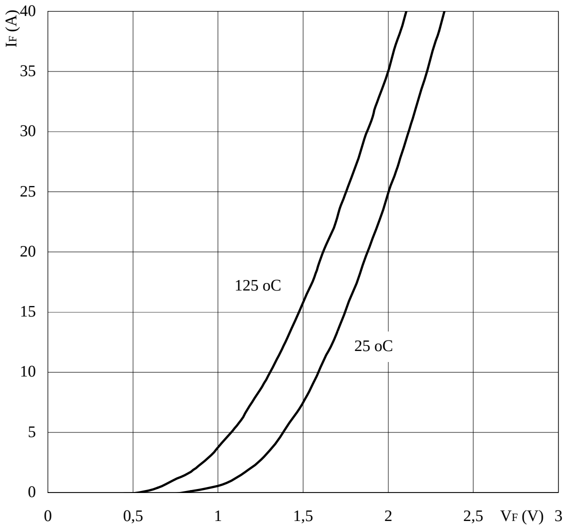
parameter: tp = 250 µs Tj = 125 °C
V_{GE} parameter: from: 6 V to 16 V
in 1 V steps

Figure 3. Typical transfer characteristics
Output inverter IGBT
$I_C = f(V_{GE})$



parameter: tp = 250 µs V_{CE} = 14 V

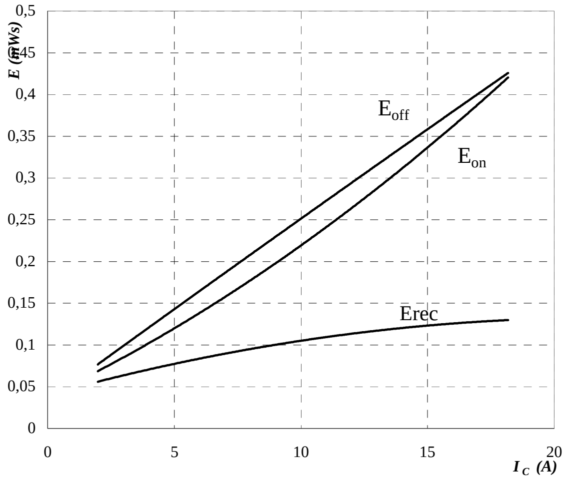
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED $I_F = f(V_F)$



parameter: tp = 250 µs

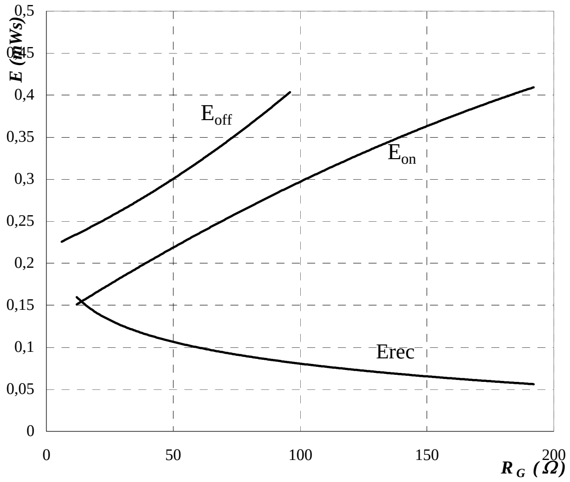
Output inverter

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



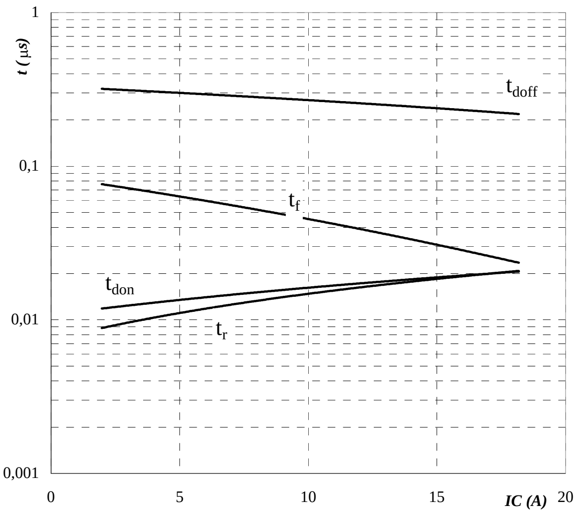
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 48 Ω

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



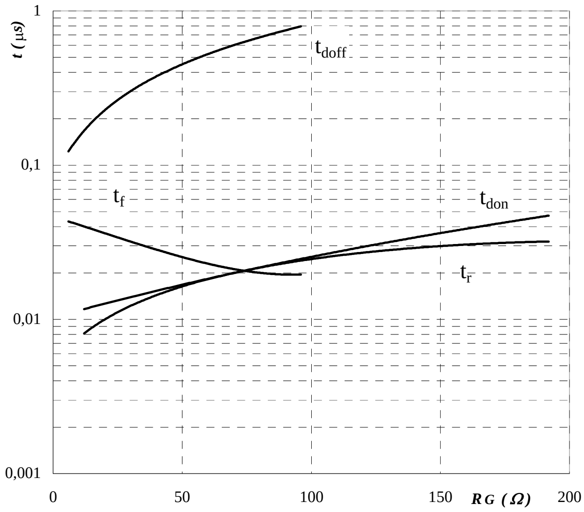
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 10 A

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



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 48 Ω

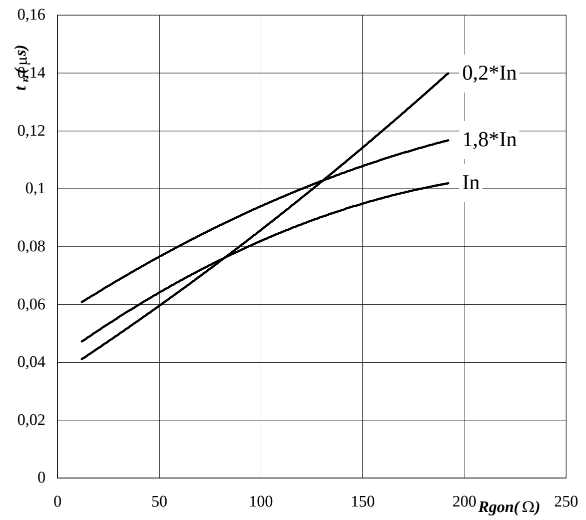
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 10 A

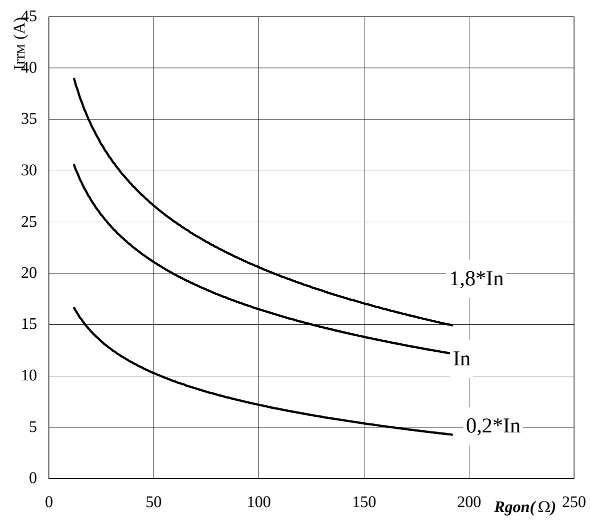
Output inverter

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



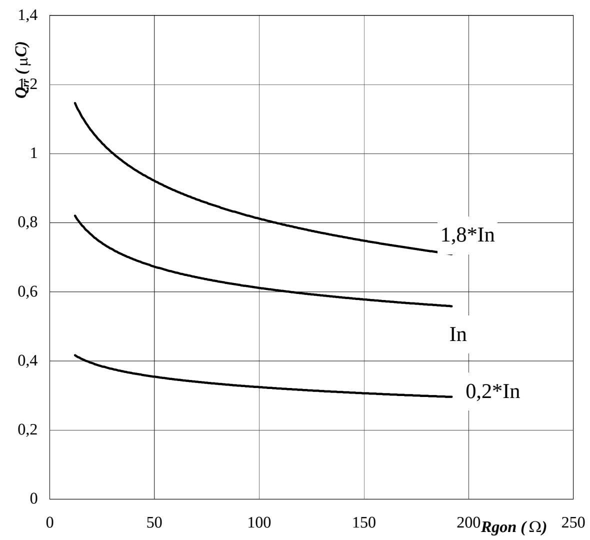
Tj = 125 °C
V_R = 300 V
In= 10 A

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



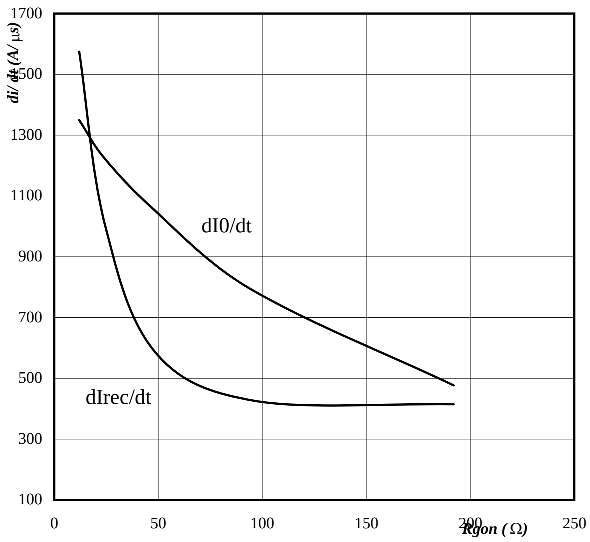
Tj = 125 °C
V_R = 300 V
In= 10 A

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= 10 A

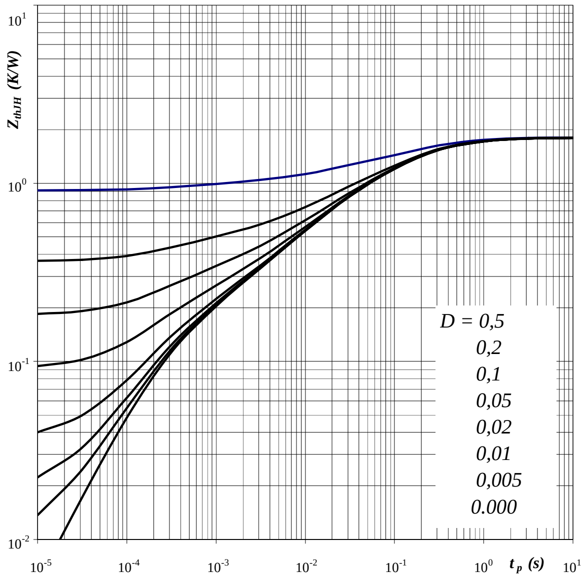
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 300 V
I_F= 10 A

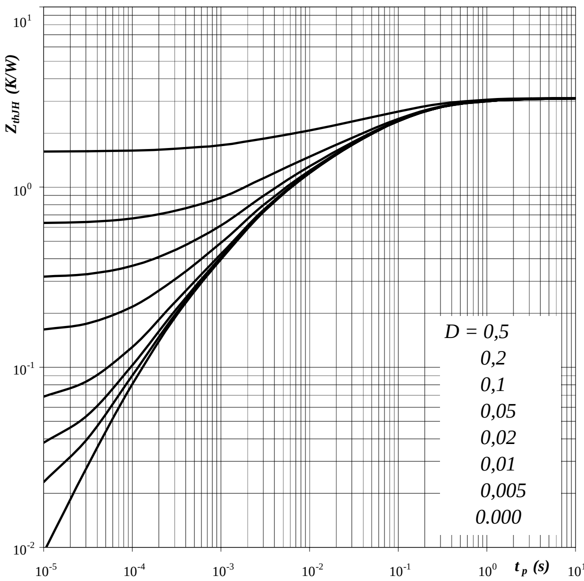
Output inverter

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



Parameter: D = tp / T RthJH 1,81 K/W

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



Parameter: D = tp / T RthJH 3,12 K/W

IGBT thermal model values

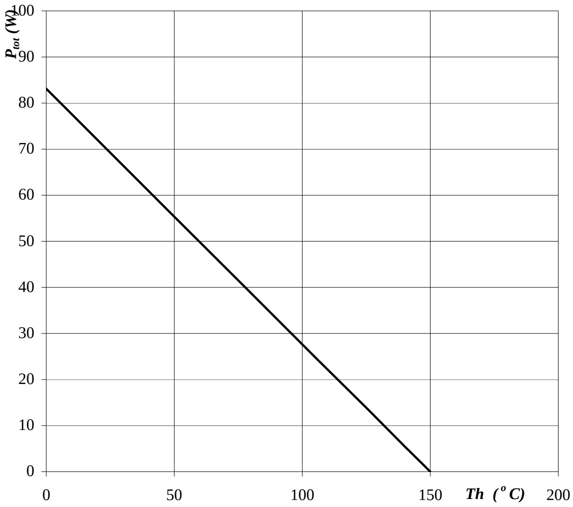
R (C/W)	Tau (s)
0,04	2,2E+01
0,20	9,3E-01
0,68	1,7E-01
0,40	4,0E-02
0,31	8,9E-03

FRED thermal model values

R (C/W)	Tau (s)
0,05	6,3E+01
0,19	1,4E+00
0,90	1,8E-01
0,86	4,3E-02
0,66	7,5E-03

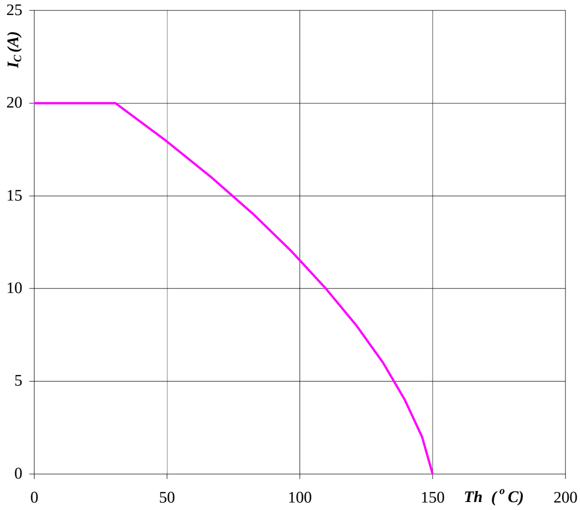
Output inverter

Figure 15. Power dissipation as a function of heatsink temperature
Output inverter IGBT
Ptot = f (Th)



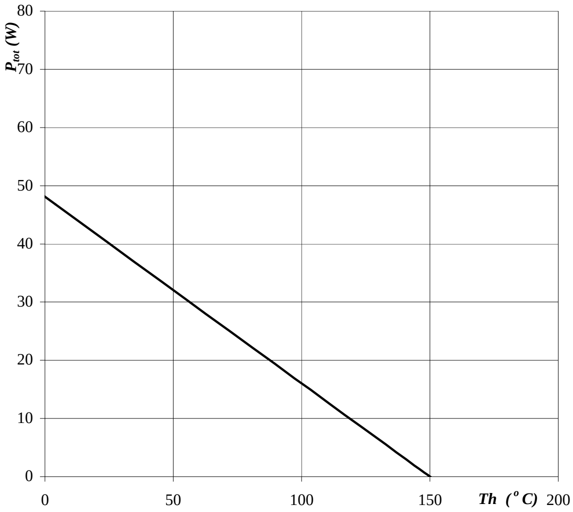
parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature
Output inverter IGBT
Ic = f (Th)



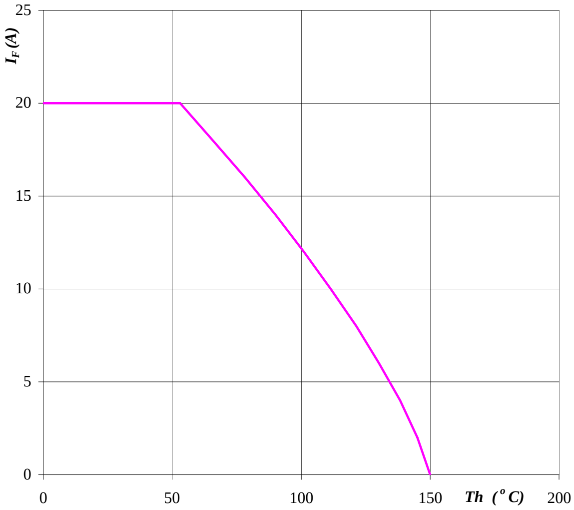
parameter: Tj = 150°C
VGE= 15 V

Figure 17. Power dissipation as a function of heatsink temperature
Output inverter FRED
Ptot = f (Th)



parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature
Output inverter FRED
IF = f (Th)



parameter: Tj = 150°C

Thermistor

Figure 23. **Typical NTC characteristic as a function of temperature**
NTC
$R_T = f(T)$