Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values max.	Unit
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	18 / 24	A
Repetitive peak collector current / Periodischer Kollektorspitzenstrom	t_p=1ms T_h=80°C	I_{cpuls}	36	A
Power dissipation per IGBT / Verlustleistung pro IGBT	T_j=150°C T_h=80°C T_c=80°C	P_{tot}	44 / 66	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	20 / 26	A
Repetitive peak forward current / Periodischer Spitzenstrom	t_p=1ms T_h=80°C	I_{FRM}	39	A
Power dissipation per Diode / Verlustleistung pro Diode	T_j=150°C T_h=80°C T_c=80°C	P_{tot}	29 / 44	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

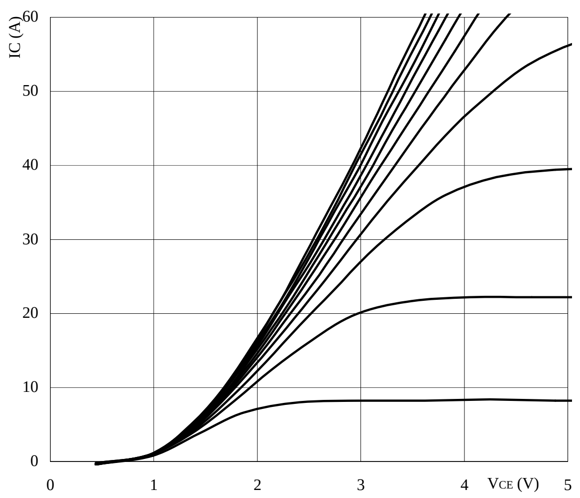
Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Transistor Inverter, inductive load **Transistor Wechselrichter**										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			0,0005	3	4	5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		20		2,15 2,46	2,6	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	600				0,1 2,5	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		25	0				200	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=32 Ohm Rgoff=16 Ohm	15	300	20		 23		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=32 Ohm Rgoff=16 Ohm	15	300	20		 16		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=32 Ohm Rgoff=16 Ohm	15	300	20		 276		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=32 Ohm Rgoff=16 Ohm	15	300	20		 20		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=32 Ohm Rgoff=16 Ohm	15	300	20		 0,321		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=32 Ohm Rgoff=16 Ohm	15	300	20		 0,44		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,1	1,32	nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,107	0,128	nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,063	0,076	nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		15	480	20		100	130	nC
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					1,60		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}							1,056		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 Durchlaßspannung	V_F	Tj=25°C Tj=125°C				20		1,83 1,55	2,4	V
Peak reverse recovery current Rückstromspitze	I_{RRM}	Tj=25°C Tj=125°C	Rgon=32 Ohm	15	300	20		 33		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=32 Ohm	15	300	20		 52		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=32 Ohm	15	300	20		 0,93		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=32 Ohm	15	300	20		 0,152		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					2,39		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}							1,5774		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

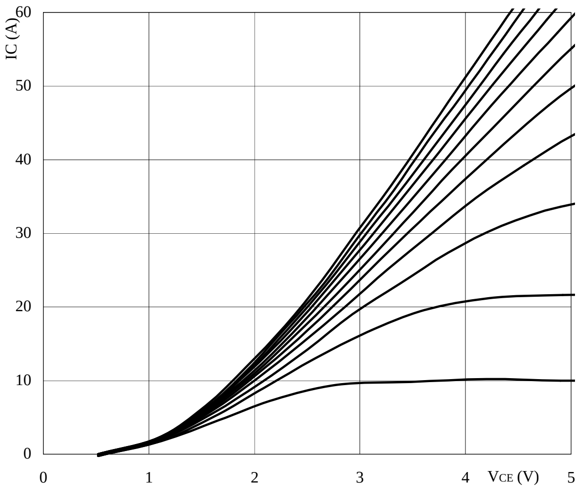
Output inverter

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



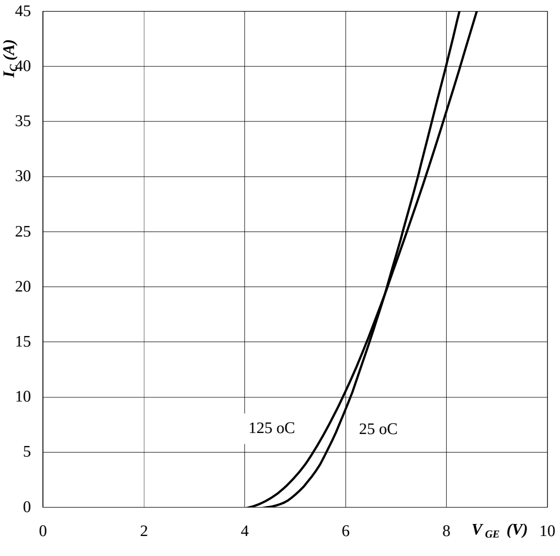
parameter: tp = 250 μs Tj = 25 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



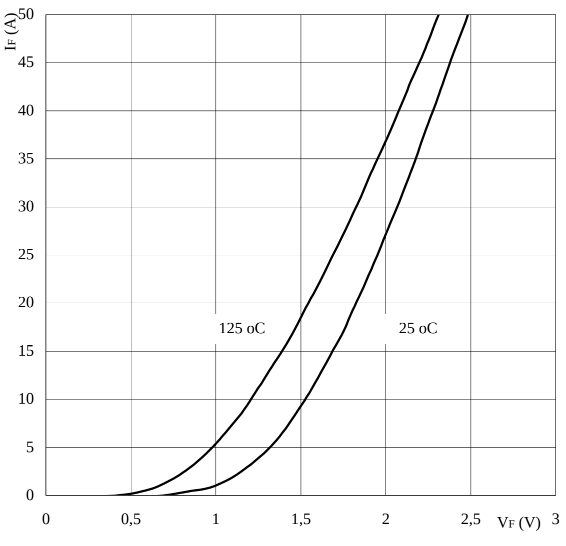
parameter: tp = 250 μs Tj = 125 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



parameter: tp = 250 μs VCE = 13 V

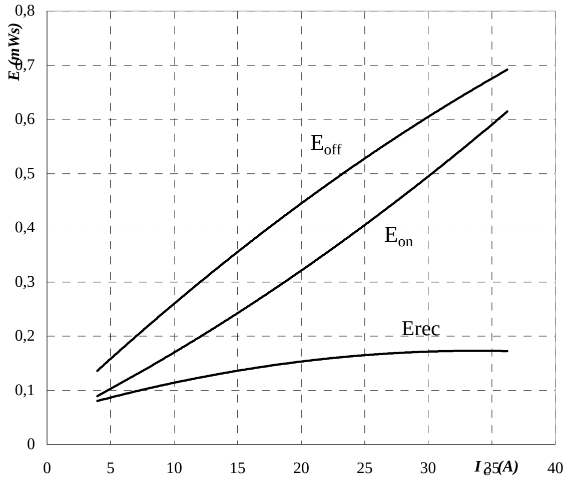
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 μs

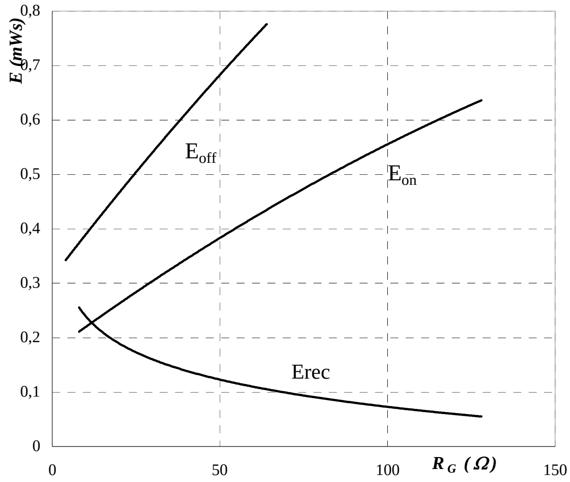
Output inverter

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



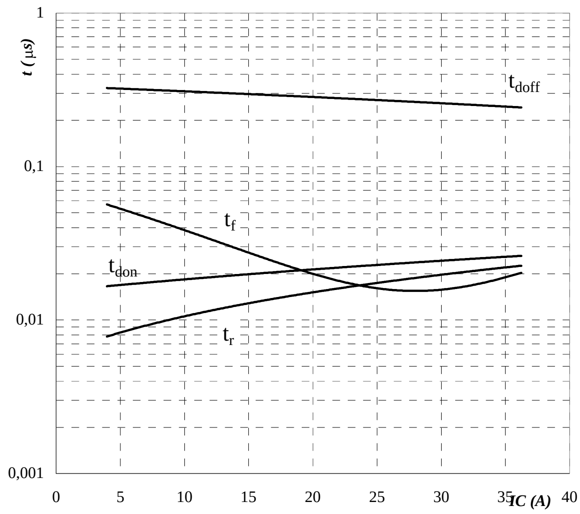
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 32 Ω

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



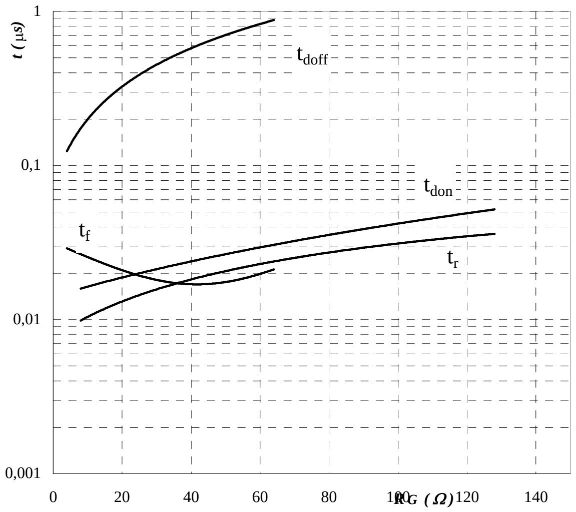
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 20 A

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 = 32 Ω

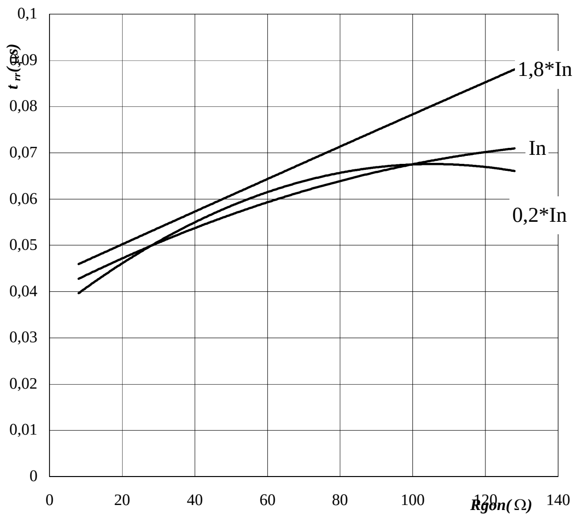
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 20 A

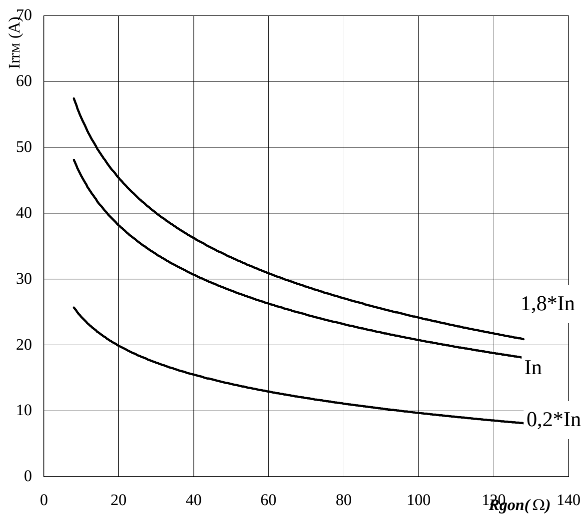
Output inverter

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



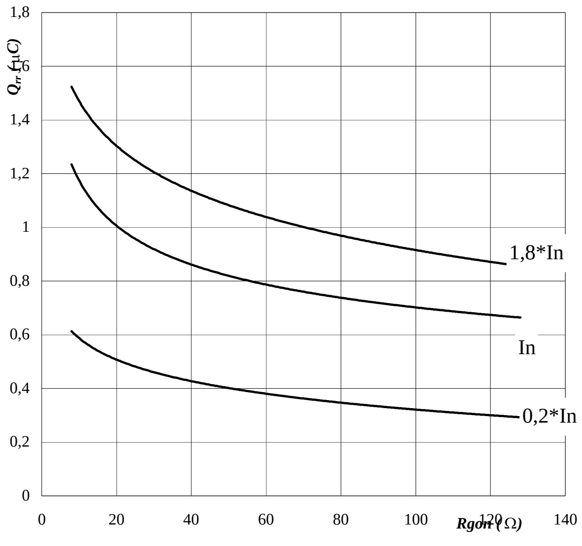
Tj = 125 °C
V_R = 300 V
In= 20 A

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



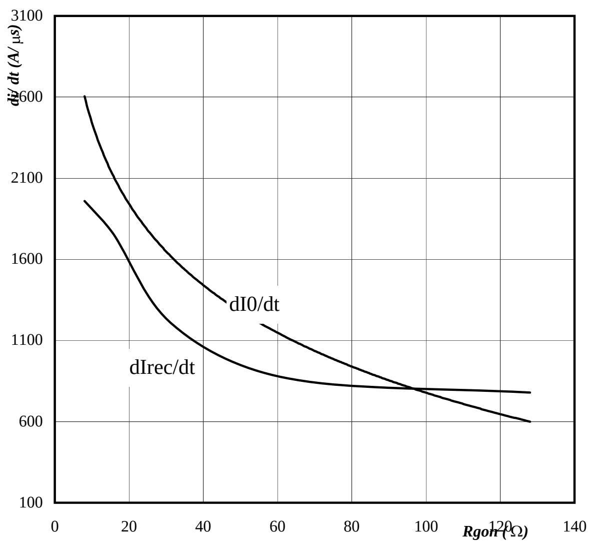
Tj = 125 °C
V_R = 300 V
In= 20 A

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= 20 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)

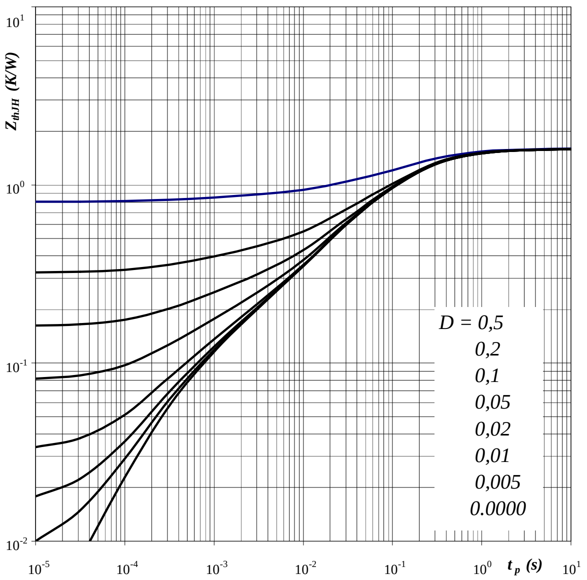


Tj = 125 °C
V_R = 300 V
I_F= 20 A

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width

$Z_{th}JH = f(tp)$



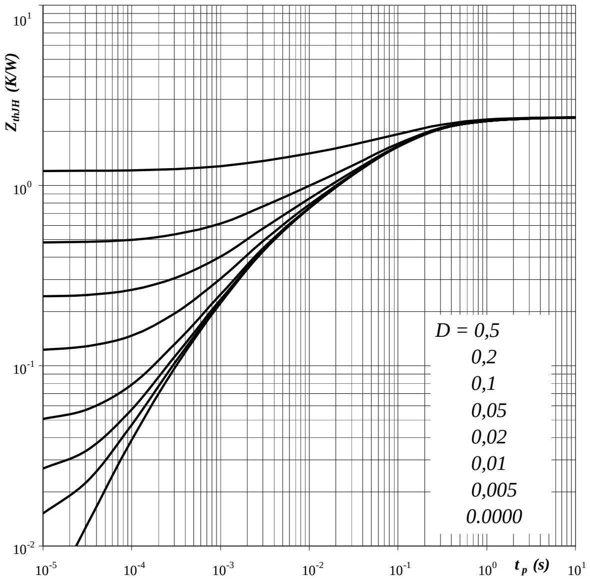
Parameter: D = tp / T RthJH 1,60 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,02	4,3E+01
0,10	2,0E+00
0,45	3,2E-01
0,63	8,9E-02
0,28	1,5E-02

Figure 14. FRED transient thermal impedance as a function of pulse width

$Z_{th}JH = f(tp)$



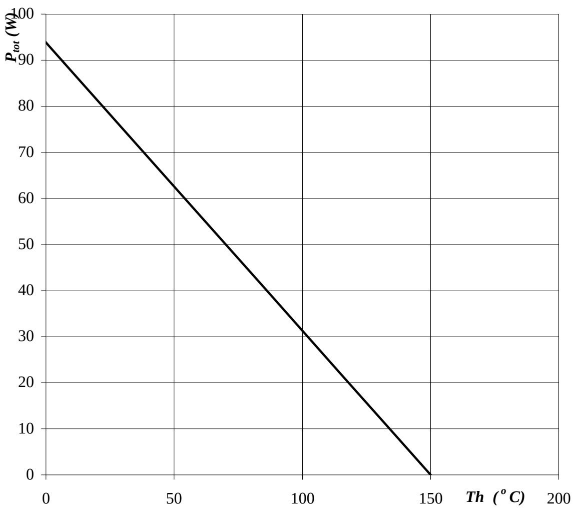
Parameter: D = tp / T RthJH 2,39 K/W

FRED thermal model values

R (C/W)	Tau (s)
0,04	3,6E+01
0,19	1,3E+00
0,85	1,8E-01
0,64	4,4E-02
0,40	8,4E-03

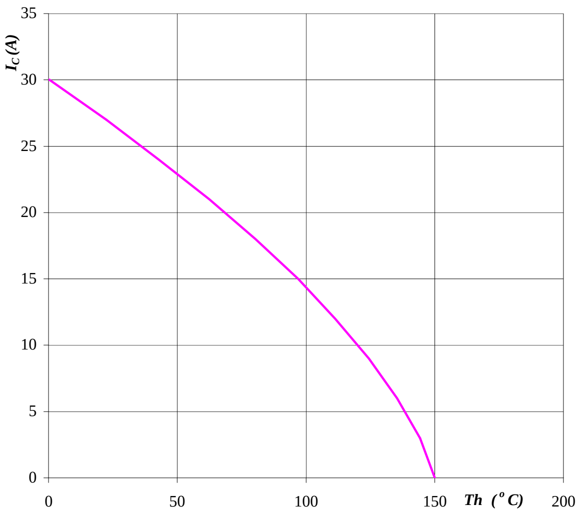
Output inverter

Figure 15. Power dissipation as a function of heatsink temperature
Output inverter IGBT
$P_{tot} = f\ (Th)$



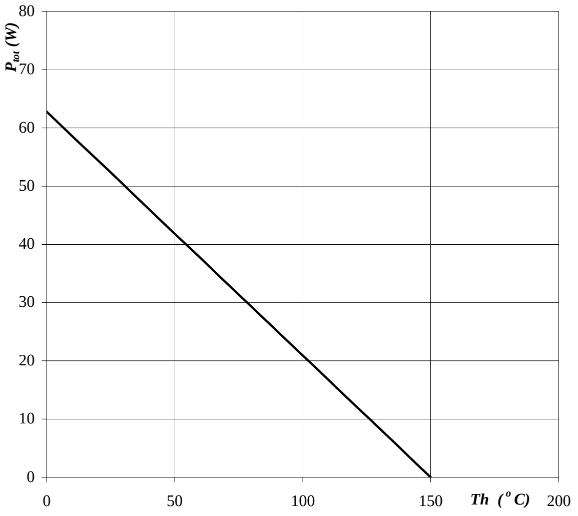
parameter: Tj = 150°C

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



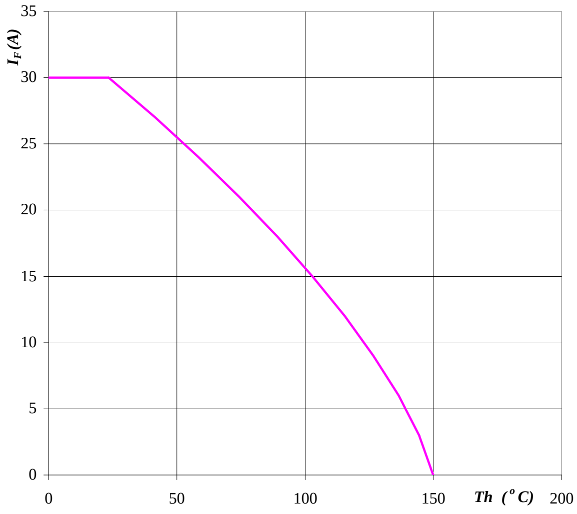
parameter: Tj = 150°C
V_{GE}= 15 V

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

Thermistor

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