flow **PACK 1, 600V**

Maximum Ratings / Höchstzulässige Werte

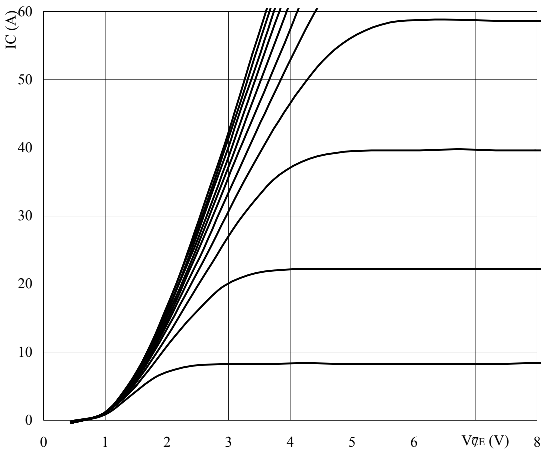
Parameter	Condition		Symbol	Datasheet values max.	Unit
Transistor Inverter Transistor Wechselrichter					
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung			V_{CE}	600	V
DC collector current Kollektor-Dauergleichstrom	T_j=150°C	T_h=80°C, T_c=80°C	I_C	22 29	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	44	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	49 74	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}	10	us
Diode Inverter Diode Wechselrichter					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C, T_c=80°C	I_F	31 40 *	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	62	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	41 62	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)	V_R(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Transistor Inverter Transistor Wechselrichter										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	V_{CE}=V_{GE}			0,0007	3	4	5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		30		2,21 2,49	2,65	V
Collector-emitter cut-off current incl. Diode Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	600				0,04 3	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=24 Ohm Rgoff=12 Ohm	15	300	30		 30		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgon=24 Ohm Rgoff=12 Ohm	15	300	30		 20		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgon=24 Ohm Rgoff=12 Ohm	15	300	30		 333		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgon=24 Ohm Rgoff=12 Ohm	15	300	30		 21		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgon=24 Ohm Rgoff=12 Ohm	15	300	30		 0,677		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgon=24 Ohm Rgoff=12 Ohm	15	300	30		 0,695		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,6	1,92	nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,15	0,18	nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,092	0,110	nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		15	480	20		140	182	nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					1,43		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,94		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				30		1,52 1,34	1,75	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=24 Ohm	15	300	30		 60		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=24 Ohm	15	300	30		 66		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=24 Ohm	15	300	30		 2,29		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=24 Ohm	15	300	30		 0,376		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					1,70		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,12		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
NTC-Thermistor NTC-Widerstand										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				4,46	4,7	4,94	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=226Ohm					3		%/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%					4500		K

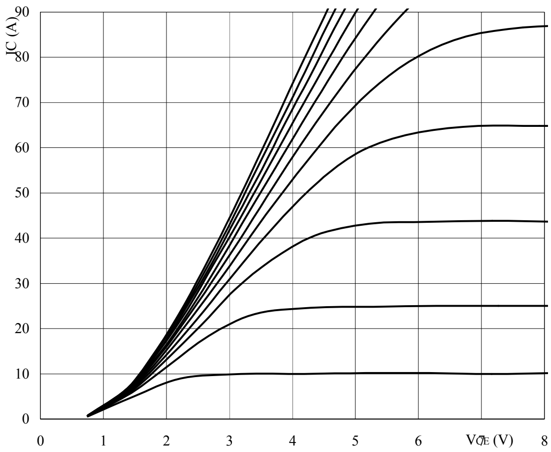
Output inverter

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



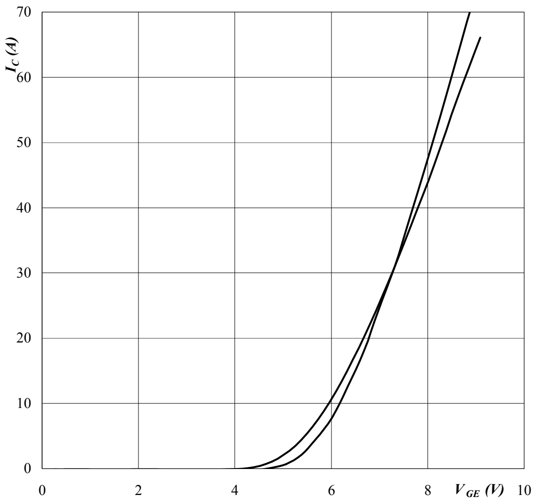
parameter: tp = 250 µs Tj = 25 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



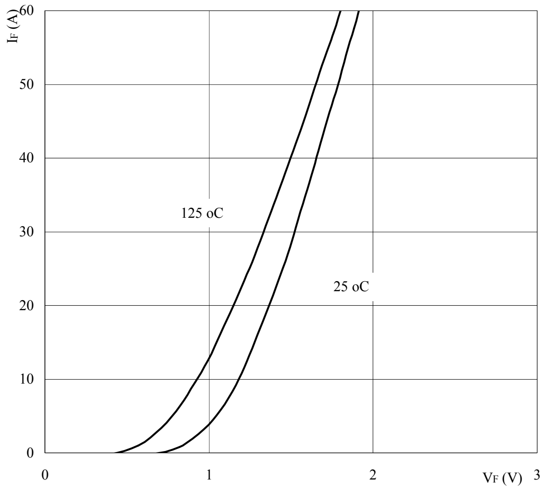
parameter: tp = 250 µs Tj = 125 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



parameter: tp = 250 µs VCE = 16 V

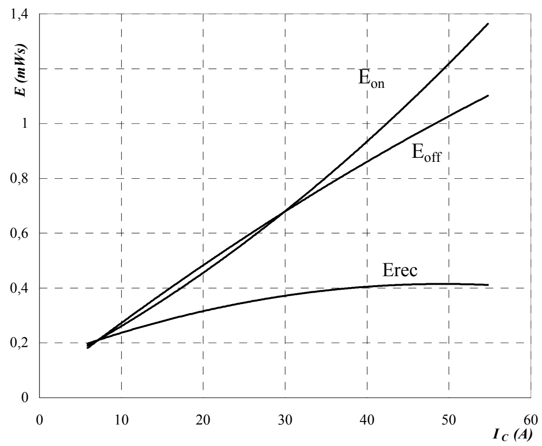
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 µs

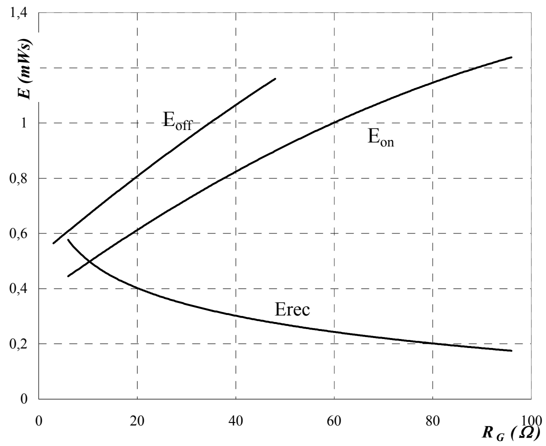
Output inverter

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



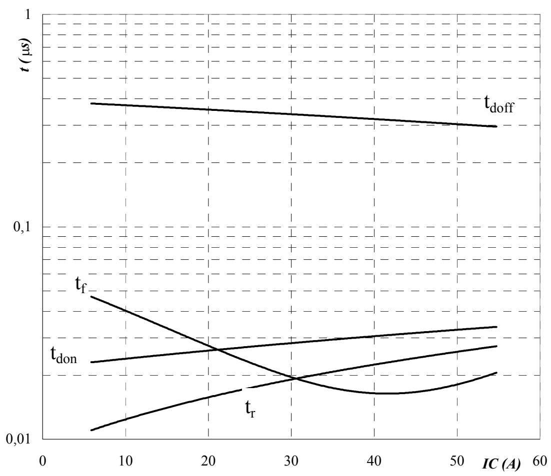
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff= 24 Ω

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



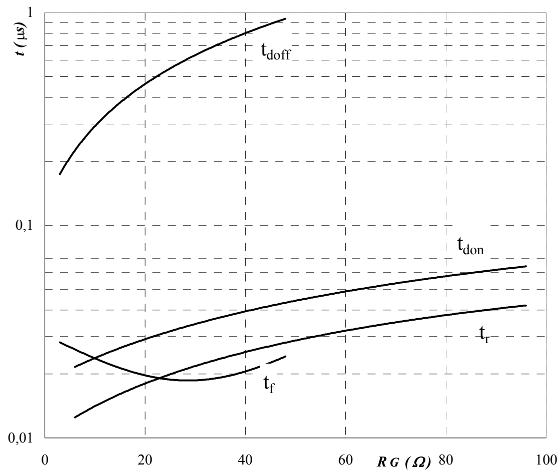
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 30 A

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= 24 Ω

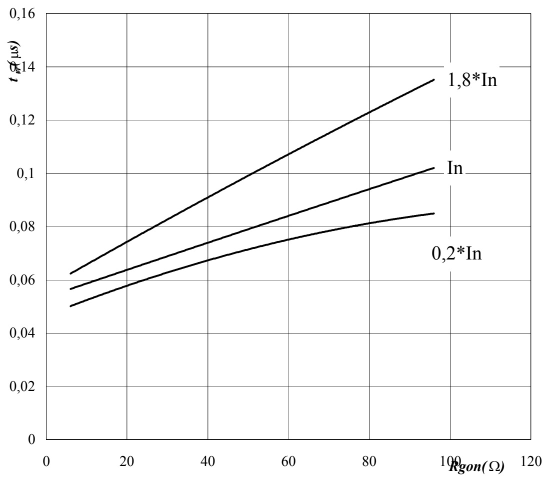
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 30 A

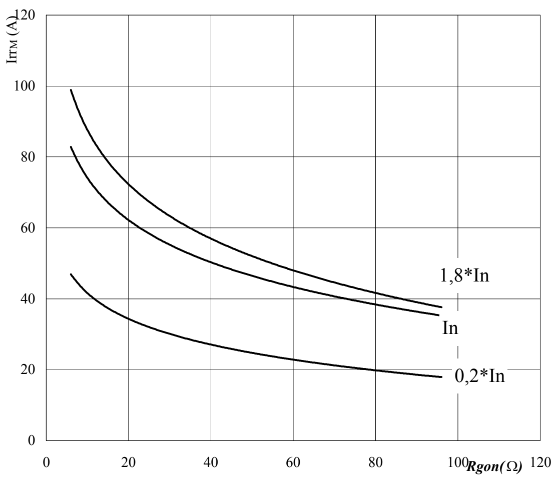
Output inverter

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



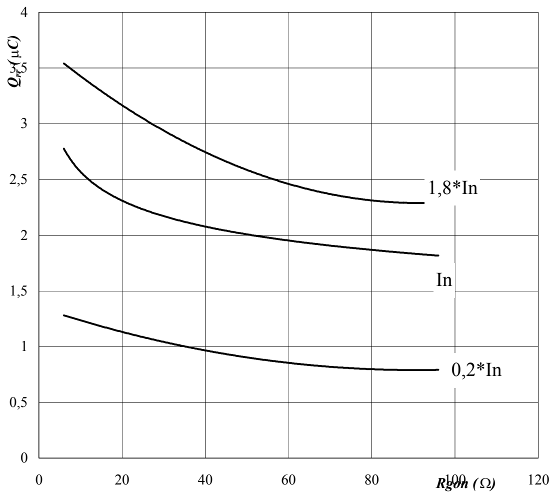
Tj = 125 °C
V_R = 300 V
In= 30 A

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



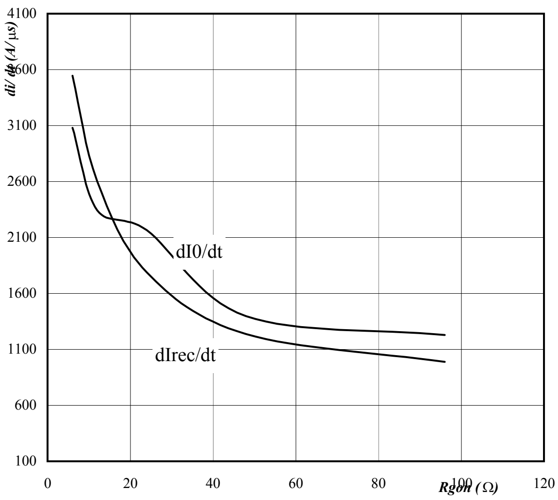
Tj = 125 °C
V_R = 300 V
In= 30 A

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= 30 A

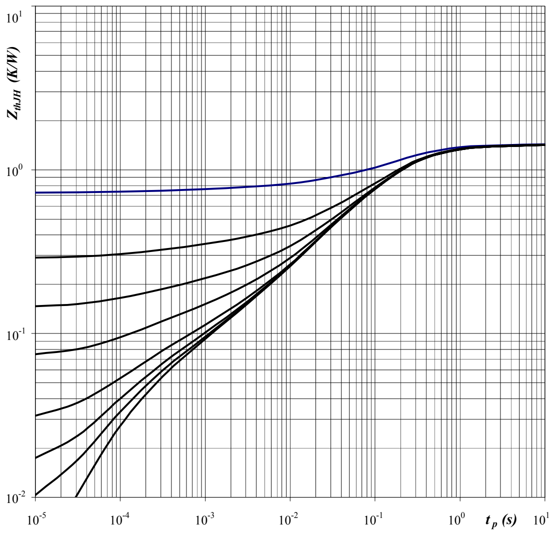
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 300 V
I_F= 30 A

Output inverter

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

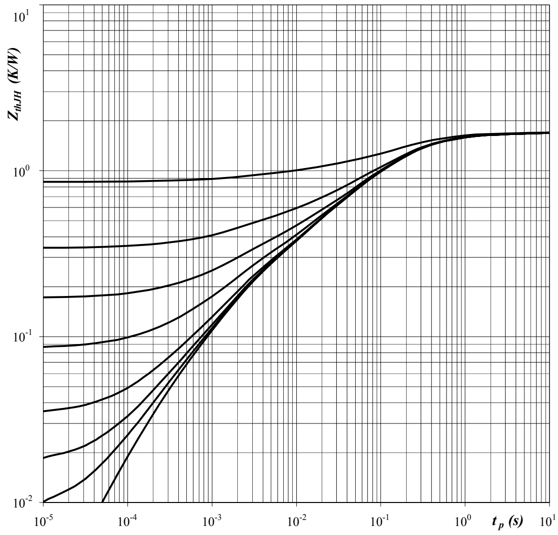


Parameter: D = tp / T RthJH 1,43 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,03	6,1E+01
0,10	2,2E+00
0,48	3,3E-01
0,56	9,8E-02

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



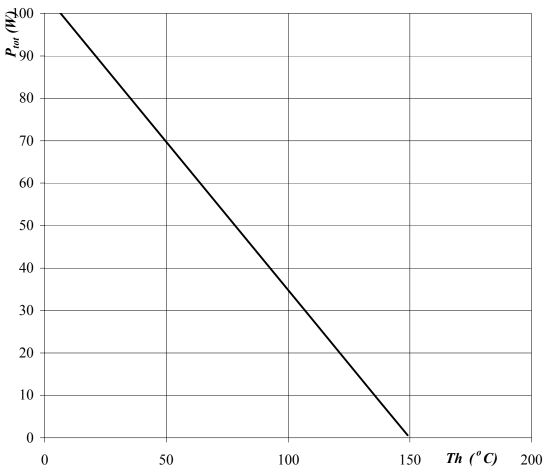
Parameter: D = tp / T RthJH 1,70 K/W

FRED thermal model values

R (C/W)	Tau (s)
0,03	3,5E+01
0,12	1,9E+00
0,57	3,0E-01
0,60	8,1E-02

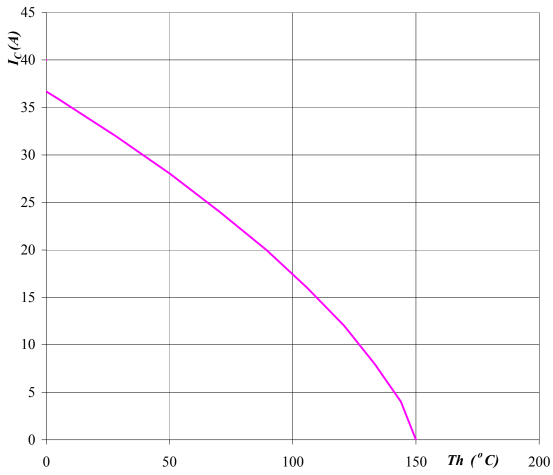
Output inverter

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



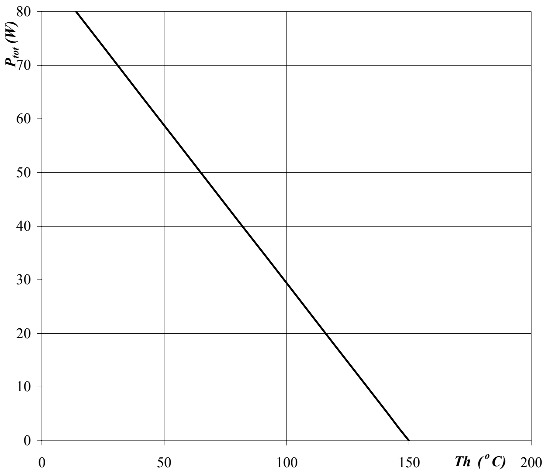
parameter: Tj = 150°C

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



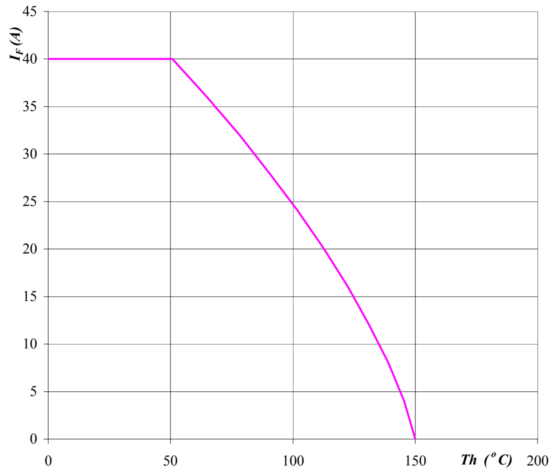
parameter: Tj = 150°C
VGE= 15 V

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