Maximum Ratings / Höchstzulässige Werte

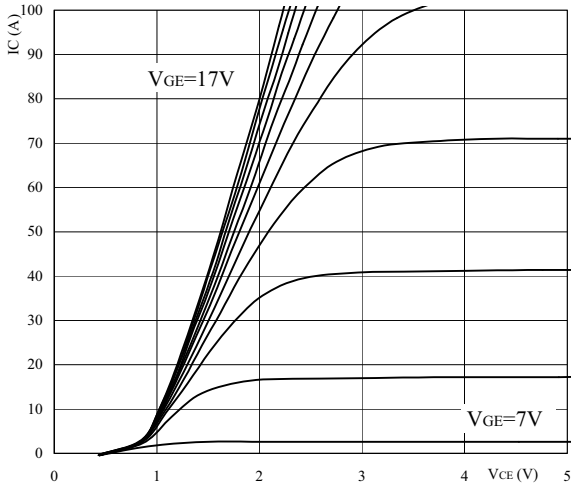
Parameter	Condition		Symbol	Values	Unit
				max.	
Transistor Inverter **Transistor Wechselrichter**					
Collector-emitter break down voltage Kollektor-Emitter-Sperrspannung			V_{CE}	1200	V
DC collector current Kollektor-Dauergleichstrom	T_j=150°C	T_h=80°C, T_c=80°C	I_C	42 55	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	83	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	74 113	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤125°C V_{CC}=900V	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	34 45	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	67	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C T_c=80°C	P_{tot}	47 71	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					Values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	V_{GE}(V) V_{GS}(V)	V_R(V) V_{CE}(V) V_{DS}(V)	Ic(A) IF(A) Id(A)	Min	Typ	Max	
Transistor Inverter **Transistor Wechselrichter**										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=150°C	VCE=VGE			0,002	5	5,8	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15 15		50 50	1,35	1,67 1,89	2,15	V
Collector-emitter cut-off current incl. Diode Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	1224		0		0,1	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=125°C		±25	0		0		400	nA
Integrated Gate resistor Integrirter Gate Widerstand	R_{gint}							4		Ohm
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		70		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		22		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		492		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		211		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		5,475		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgoff= 18 Ohm Rgon= 18 Ohm	±15	600	50		5,422		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			3,7		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,8		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,7		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		±15				360		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					0,94		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,62		K/W
Diode Inverter **Diode Wechselrichter**										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				50 50	1,3	1,55 1,59	1,9	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon= 18 Ohm diF/dt = 2344 A/us	0	600	50 50		88,6		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon= 18 Ohm diF/dt = 2344 A/us	0	600	50 50		444		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon= 18 Ohm diF/dt = 2344 A/us	0	600	50 50		12,11		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon= 18 Ohm diF/dt = 2344 A/us	0	600	50 50		4,896		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					1,5		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,00		K/W
PTC-Thermistor **PTC-Widerstand**										
Nominal resistance Nominaler Widerstand	R_{25} R_{100}	Tj=25°C Tj=100°C	tolerance = 3% tolerance = 2%				0,97 1,637	1 1,67	1,03 1,703	kOhm kOhm
Typical temperature coefficient Tipischer Temperaturkoeffizient	α	Tj=25°C Tj=125°C						0,76		%/K
Recommended measuring current Empfohlener Messstrom	I_m	Tj=25°C Tj=125°C					1		3	mA
Measured values Gemessene Werte	V_{PTC}	Tj=25°C	Im = 1mA Im = 3mA				0,93 2,84		1,03 3,4	V

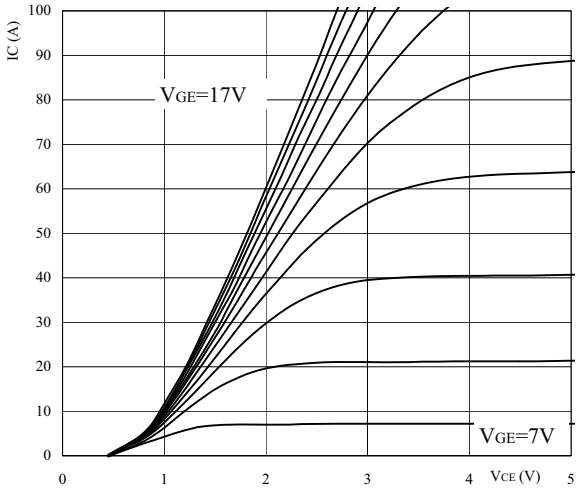
Output inverter

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



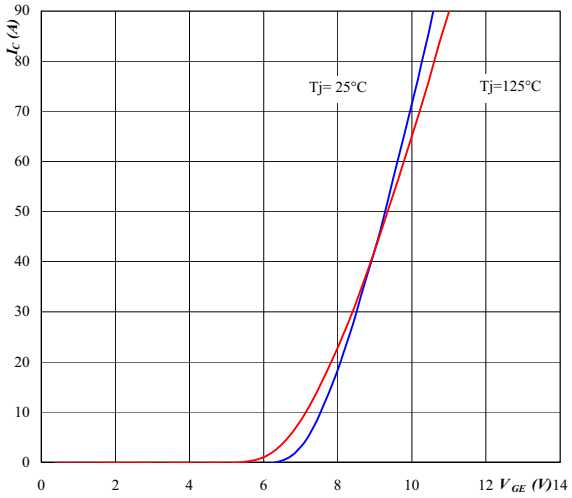
parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



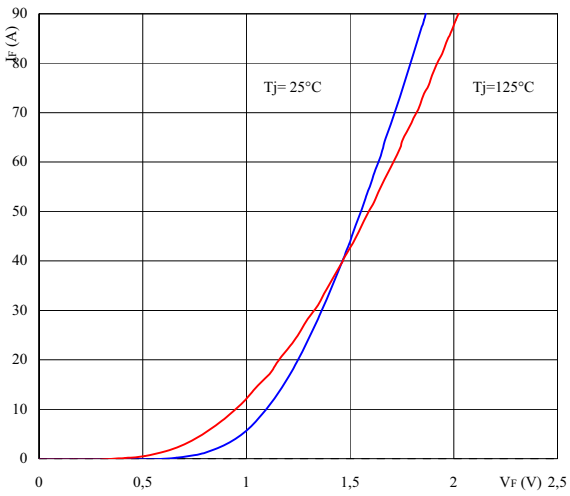
parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: tp = 250 us VCE = 10 V

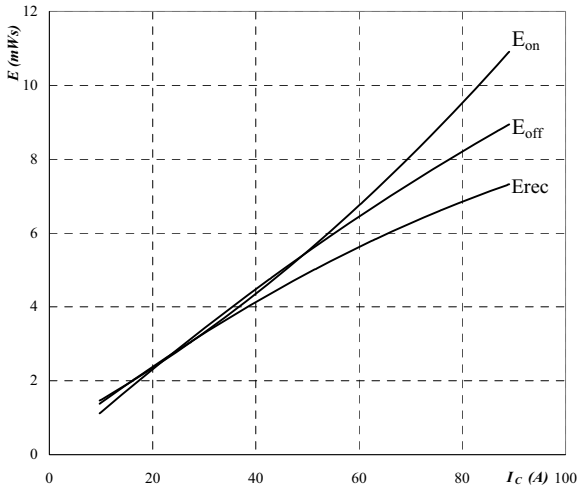
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 us

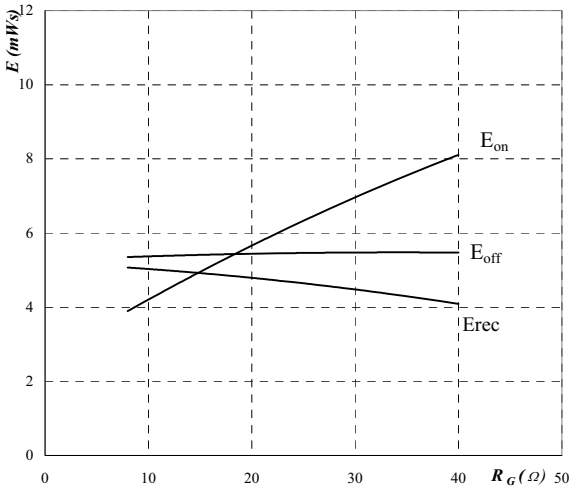
Output inverter

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



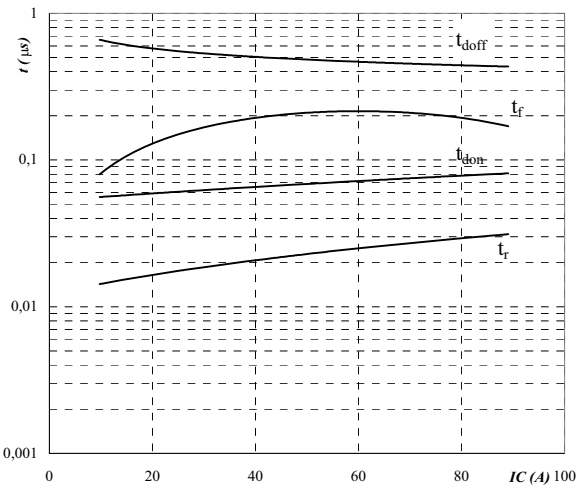
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Rgon= 18 Ω
Rgoff= 18 Ω

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



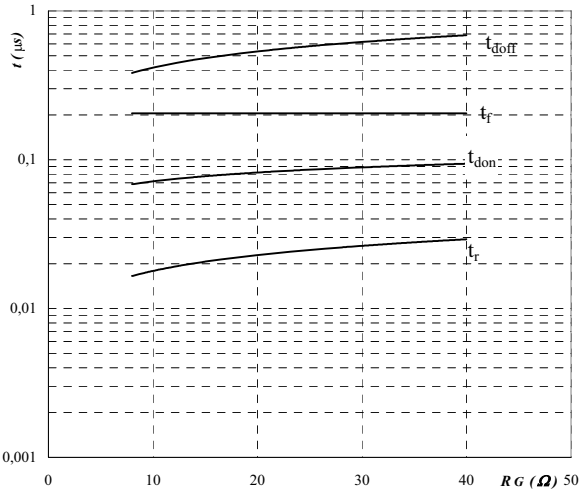
inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Ic = 50 A

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



inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Rgon= 18 Ω
Rgoff= 18 Ω

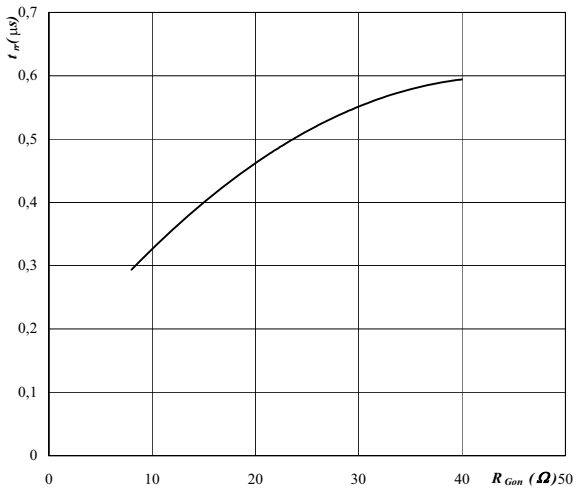
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 600 V
VGE= ±15 V
Ic = 50 A

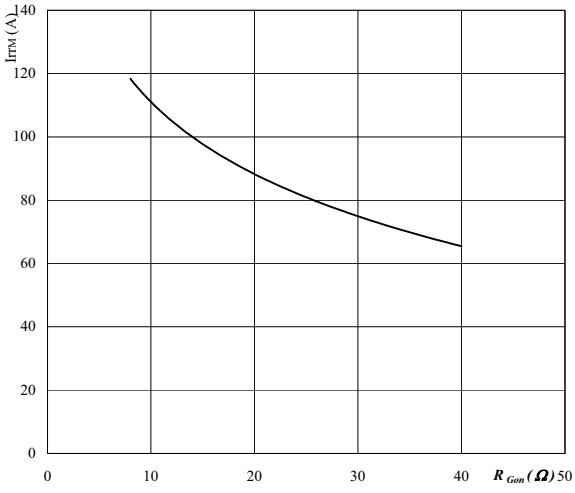
Output inverter

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



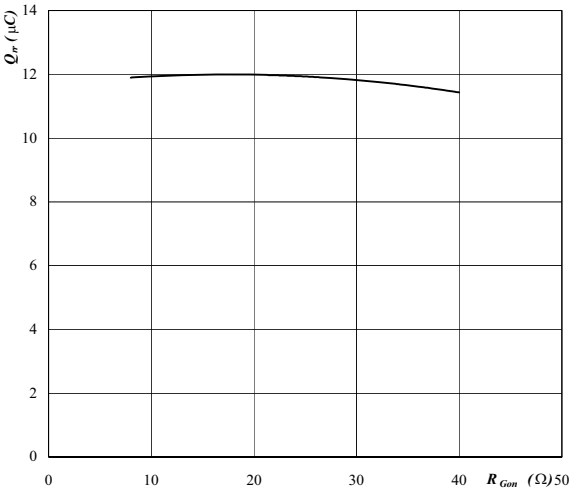
Tj = 125 °C
V_R = 600 V
I_F = 50 A
V_{GE} = ±15 V

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



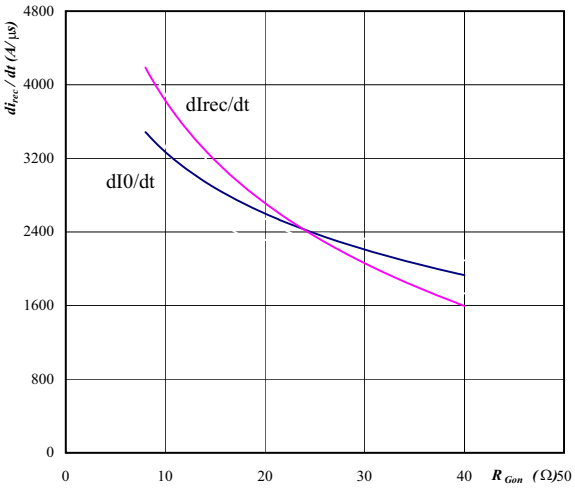
Tj = 125 °C
V_R = 600 V
I_F = 50 A
V_{GE} = ±15 V

Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor
Output inverter FRED diode
Q_{rr} = f (Rgon)



Tj = 125 °C
V_R = 600 V
I_F = 50 A
V_{GE} = ±15 V

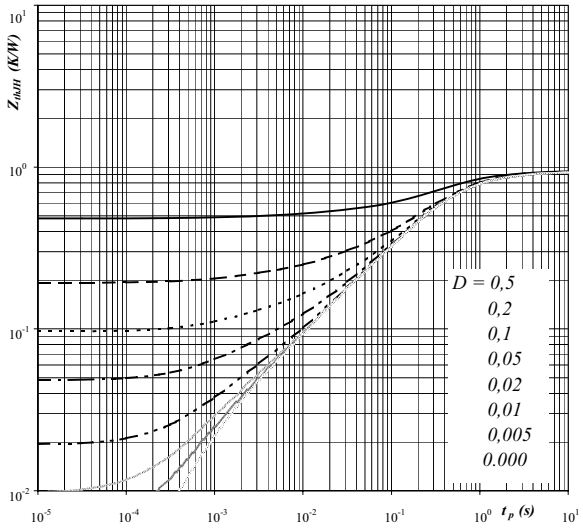
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
dI0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 600 V
I_F = 50 A
V_{GE} = ±15 V

Output inverter

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

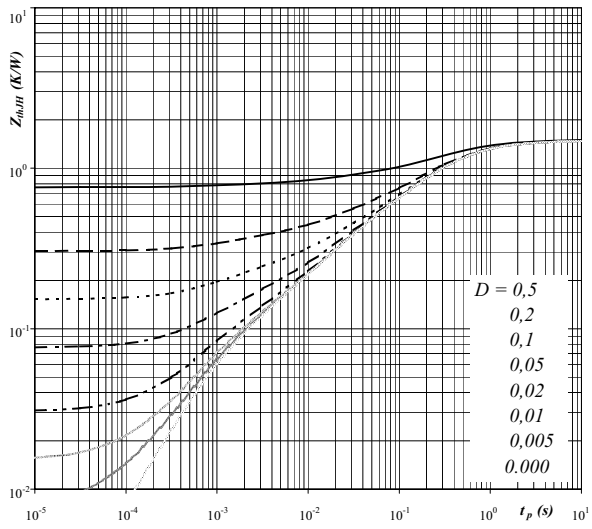


Parameter: D = tp / T RthJH= 0,94 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,04	2,7E+01
0,11	2,6E+00
0,46	4,9E-01
0,25	1,3E-01
0,08	1,3E-02
0,02	1,3E-03
0,00	0,0E+00
0,00	0,0E+00

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



Parameter: D = tp / T RthJH= 1,50 K/W

FRED thermal model values

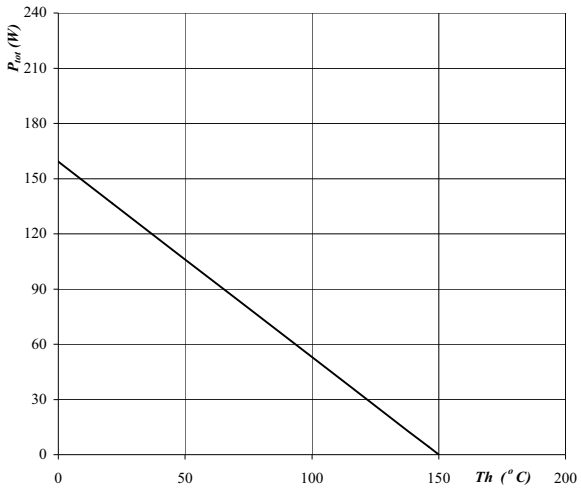
R (C/W)	Tau (s)
0,06	3,0E+01
0,18	1,9E+00
0,65	3,8E-01
0,40	9,4E-02
0,16	1,3E-02
0,07	1,1E-03
0,00	0,0E+00
0,00	0,0E+00

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

$P_{tot} = f(Th)$

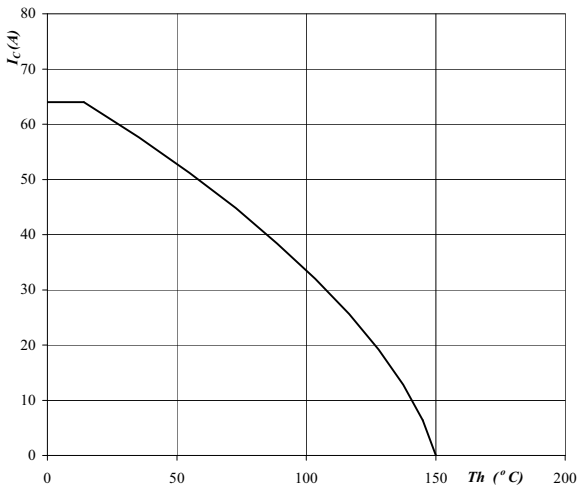


parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

$I_C = f(Th)$

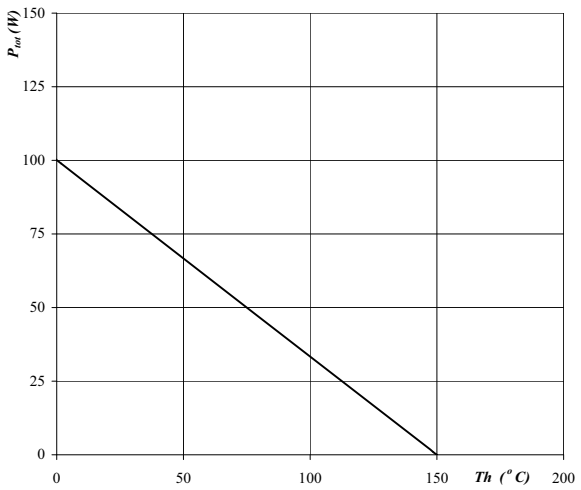


parameter: Tj = 150°C
V_{GE}= 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

$P_{tot} = f(Th)$

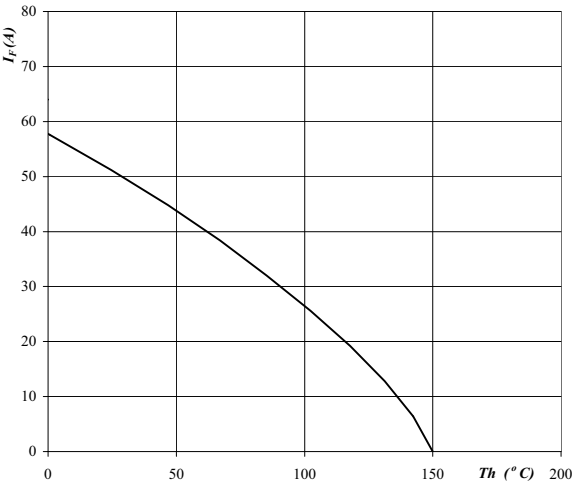


parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

$I_F = f(Th)$



parameter: Tj = 150°C

Thermistor

Figure 37. Typical PTC characteristic as afunction of temperature

$R_T = f(T)$