

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}	1200	V
DC collector current Kollektor-Dauergleichstrom	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	I_C	27 32 limited by bond	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	54	A
Power dissipation per IGBT Verlustleistung pro IGBT	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	P_{tot}	55 83	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time Kurzschlußverhalten	$T_j \leq 125^{\circ}\text{C}$ $V_{GE}=15\text{V}$	t_{SC} V_{CC}	10 900	us V

Diode Inverter

Diode Wechselrichter

DC forward current Dauergleichstrom	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	I_F	27,5 32 limited by bond	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	55	A
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	P_{tot}	43 65	W

Thermal properties

Thermische Eigenschaften

max. Chip temperature max. Chiptemperatur		T_{jmax}	150	$^{\circ}\text{C}$
Storage temperature Lagertemperatur		T_{stg}	$-40 \dots +125$	$^{\circ}\text{C}$
Operation temperature Betriebstemperatur		T_{op}	$-40 \dots +125$	$^{\circ}\text{C}$

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

flowPACK 1, 1200V 25A

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	
Transistor Inverter, inductive load										
Transistor Wechselrichter										
Gate emitter threshold voltage Gate-Schwellenspannung	V _{GE(th)}	T _J =25°C T _J =125°C	VCE=VGE			0,001	5	5,8	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	V _{CE(sat)}	T _J =25°C T _J =125°C		15		25		1,67 1,87	2,2	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I _{CES}	T _J =25°C T _J =125°C		0	1200				0,25 2,5	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I _{GES}	T _J =25°C T _J =125°C		30	0				650	nA
Integrated Gate resistor Integrierter Gate Widerstand	R _{gint}							8		Ohm
Turn-on delay time Einschaltverzögerungszeit	t _{d(on)}	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		79		ns
Rise time Anstiegszeit	t _r	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		20		ns
Turn-off delay time Abschaltverzögerungszeit	t _{d(off)}	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		511		ns
Fall time Fallzeit	t _f	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		197		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E _{on}	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		3,44		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E _{off}	T _J =25°C T _J =125°C	Rgon=36 Ohm Rgoff=36 Ohm	±15	600	25		2,63		mWs
Input capacitance Eingangskapazität	C _{ies}	T _J =25°C T _J =125°C	f=1MHz		0	25		1,8		nF
Output capacitance Ausgangskapazität	C _{oss}	T _J =25°C T _J =125°C	f=1MHz		0	25		0,095		nF
Reverse transfer capacitance Rückwirkungskapazität	C _{rss}	T _J =25°C T _J =125°C	f=1MHz		0	25		0,082		nF
Gate charge Gate Ladung	Q _{Gate}	T _J =25°C T _J =125°C		15	960	25		155		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,28 0,8448		K/W
Coupled thermal resistance inverter diode-transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R _{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,24		K/W

Diode Inverter
Diode Wechselrichter

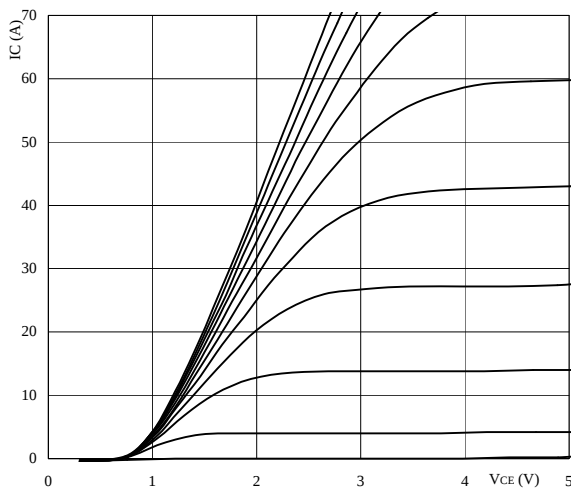
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				25		2,05 1,61	2,8	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=36 Ohm	±15	600	25		61		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=36 Ohm	±15	600	25		67		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=36 Ohm	±15	600	25		4,9		uC
Reverse recovered energy Sperrverzögerungsenergie	E_{rec}	Tj=25°C Tj=125°C	Rgon=36 Ohm	±15	600	25		1,44		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61$ W/mK					1,63 1,0758		K/W
Coupled thermal resistance inverter transistor-diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61$ W/mK					0,25		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=435Ohm					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%					3530		K

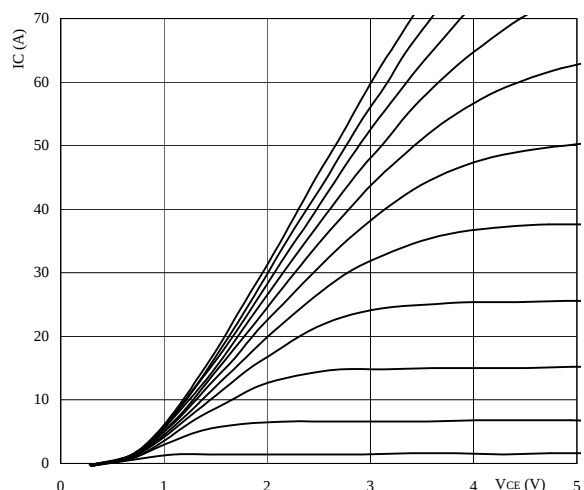
flowPACK 1, 1200V, 25A
Output inverter

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



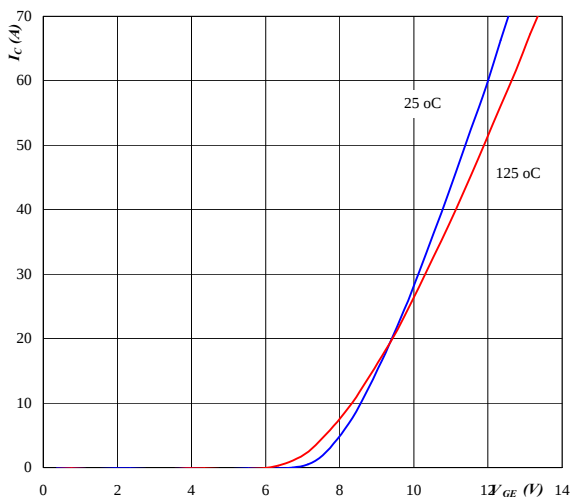
parameter: $t_p = 250 \text{ us}$ $T_j = 25 \text{ }^\circ\text{C}$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



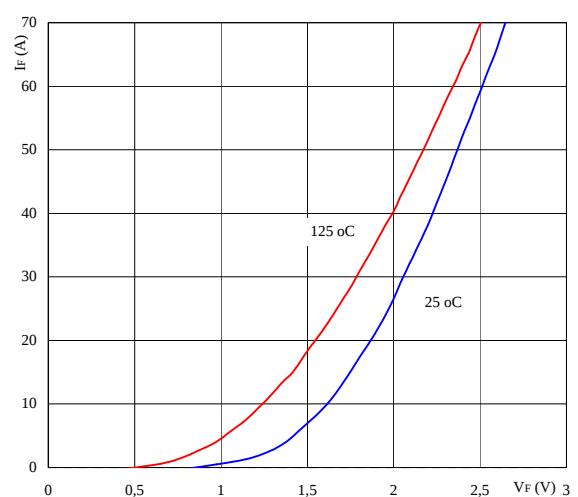
parameter: $t_p = 250 \text{ us}$ $T_j = 125 \text{ }^\circ\text{C}$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: $t_p = 250 \text{ us}$ $V_{CE} = 10 \text{ V}$

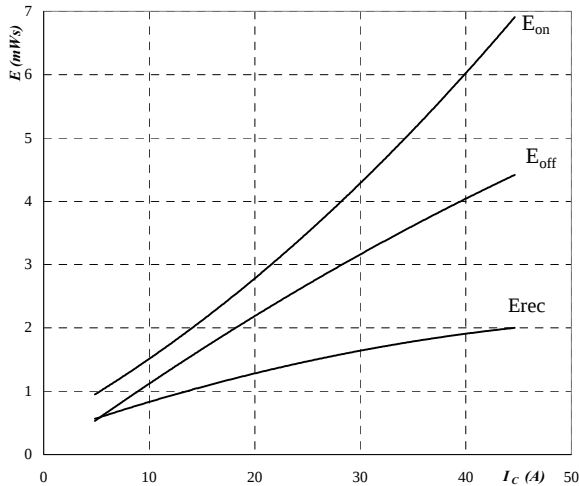
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED $I_F = f(V_F)$



parameter: $t_p = 250 \text{ us}$

Output inverter

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



inductive load, $T_j = 125^\circ\text{C}$

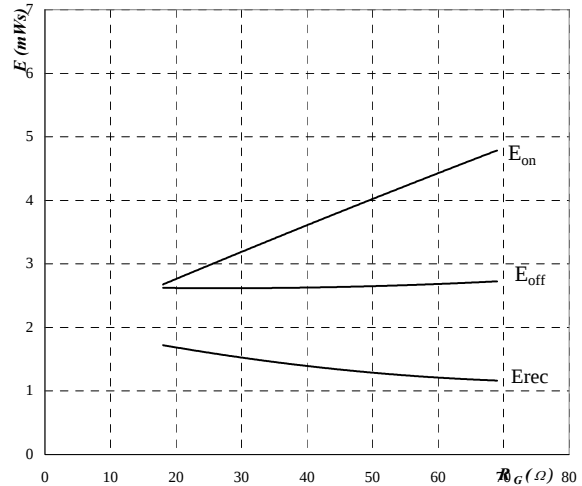
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$R_{gon} = 36\ \Omega$

$R_{goff} = 36\ \Omega$

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



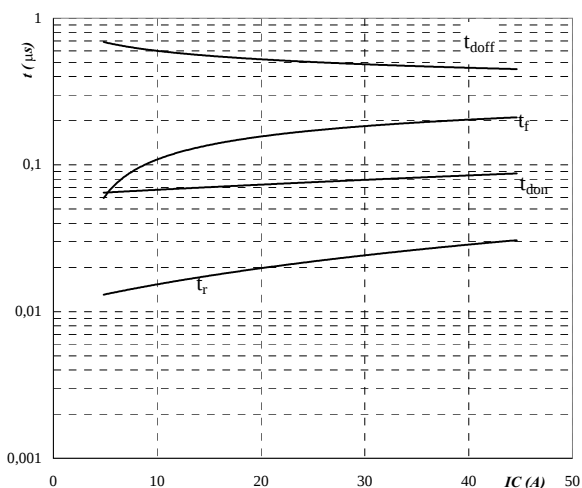
inductive load, $T_j = 125^\circ\text{C}$

$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$I_C = 25\text{ A}$

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



inductive load, $T_j = 125^\circ\text{C}$

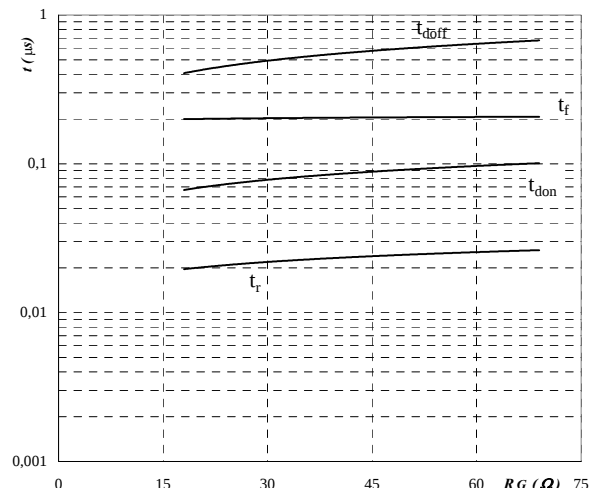
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$R_{gon} = 36\ \Omega$

$R_{goff} = 36\ \Omega$

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



inductive load, $T_j = 125^\circ\text{C}$

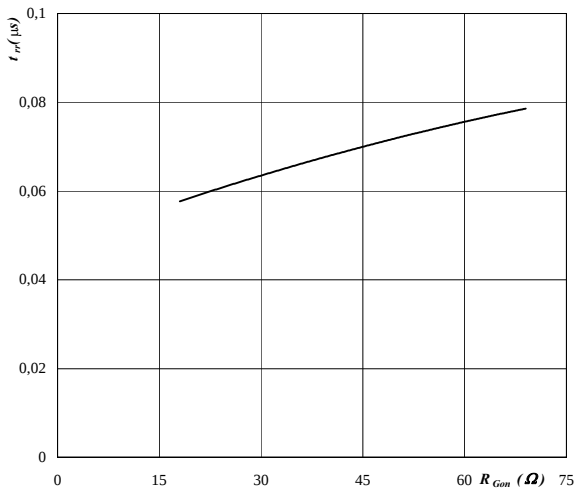
$V_{CE} = 600\text{ V}$

$V_{GE} = \pm 15\text{ V}$

$I_C = 25\text{ A}$

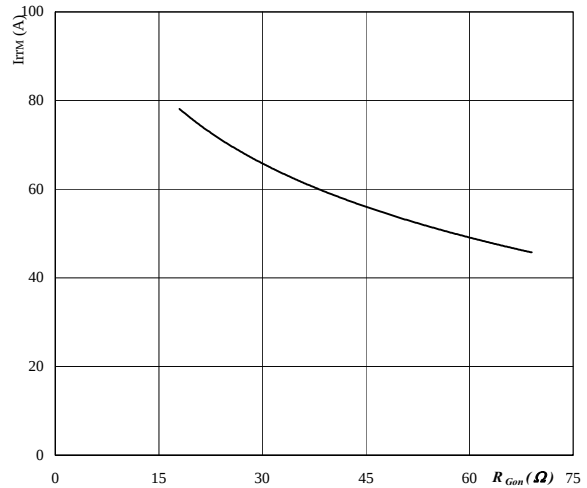
Output inverter

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



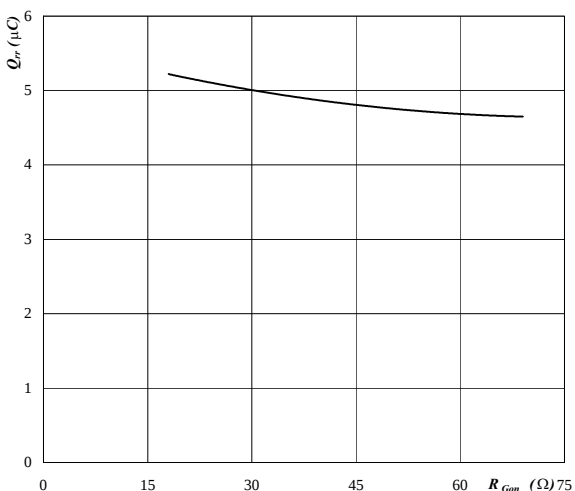
$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 25 A$
 $V_{GE} = \pm 15 V$

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



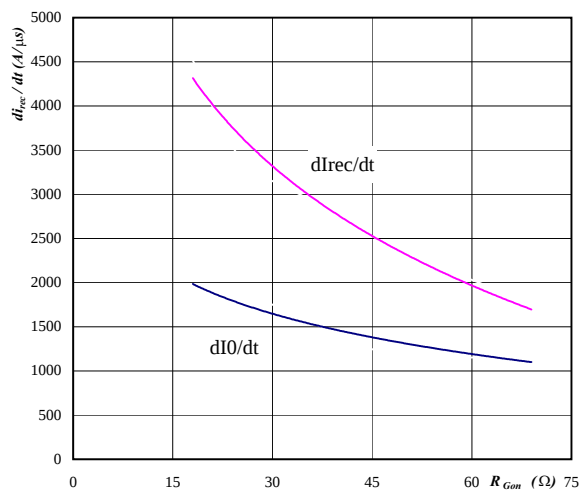
$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 25 A$
 $V_{GE} = \pm 15 V$

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



$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 25 A$
 $V_{GE} = \pm 15 V$

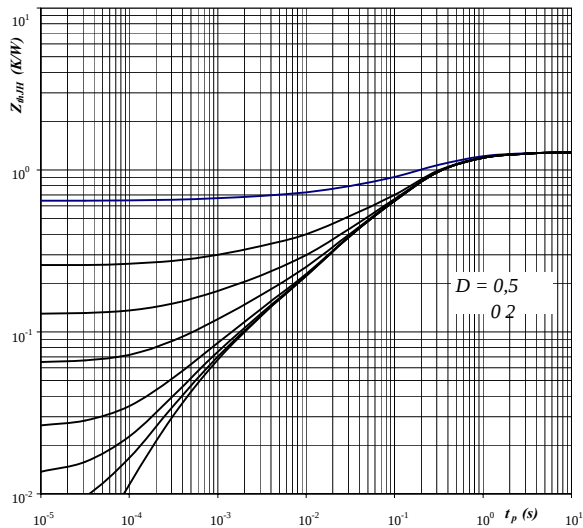
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 25 A$
 $V_{GE} = \pm 15 V$

Output inverter

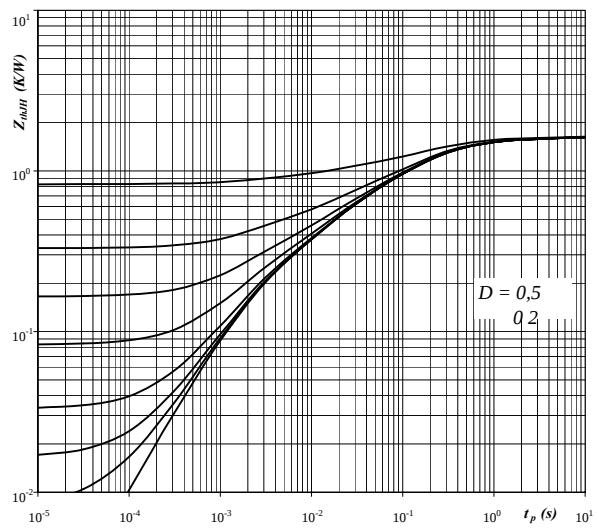
Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$


Parameter: $D = t_p / T$
 $R_{thJH} = 1,28 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,06	4,0E+00
0,32	5,5E-01
0,62	1,5E-01
0,20	1,8E-02

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


Parameter: $D = t_p / T$
 $R_{thJH} = 1,63 \text{ K/W}$

FRED thermal model values

R (C/W)	Tau (s)
0,04	4,0E+01
0,14	2,0E+00
0,51	2,9E-01
0,51	8,2E-02

Output inverter

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

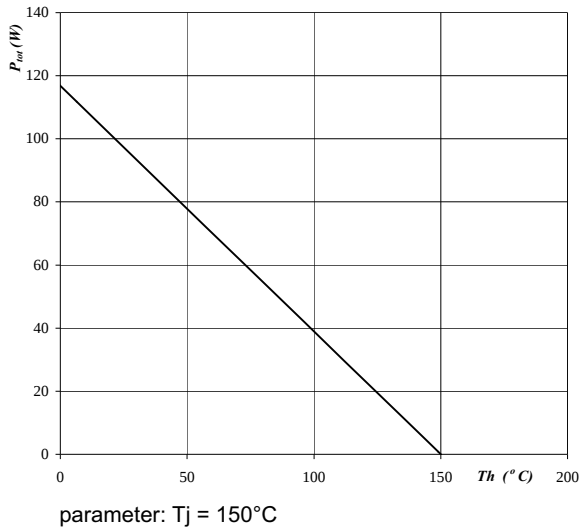


Figure 16. Collector current as a function of heatsink temperature
Output inverter IGBT
 $I_c = f(T_h)$

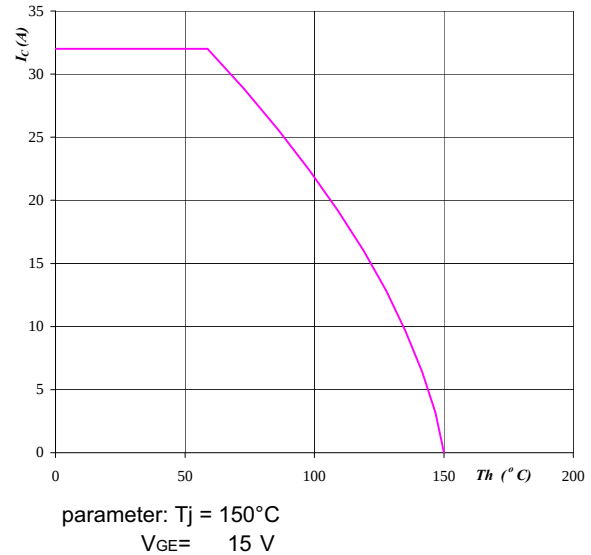


Figure 17. Power dissipation as a function of heatsink temperature
Output inverter FRED
 $P_{tot} = f(T_h)$

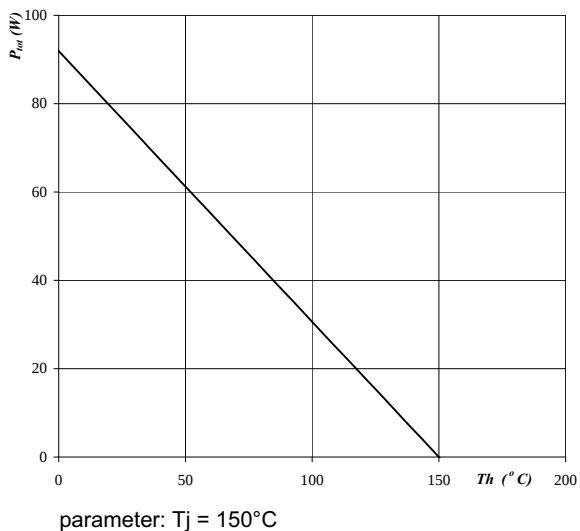
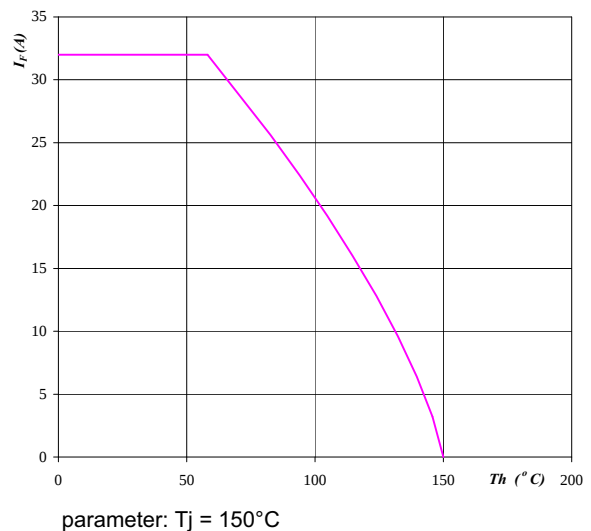


Figure 18. Forward current as a function of heatsink temperature
Output inverter FRED
 $I_F = f(T_h)$



Thermistor

**Figure 37. Typical NTC characteristic
as a function of temperature**

$$R_T = f(T)$$

