

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	$T_j=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$, $T_c=80^{\circ}\text{C}$	I_C	33 44	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	66	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}	64 97	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}	10 400	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	36 50	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	72	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}	41 63	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, 600V 50A

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	3	4	5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	V _{CE(sat)}	T _J =25°C T _J =125°C		15		50		2,09	2,7	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I _{CES}	T _J =25°C T _J =125°C		0	600				0,25 2,5	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I _{GES}	T _J =25°C T _J =125°C		30	0				200	nA
Integrated Gate resistor Integrierter Gate Widerstand	R _{gint}									Ohm
Turn-on delay time Einschaltverzögerungszeit	t _{d(on)}	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		29		ns
Rise time Anstiegszeit	t _r	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		24		ns
Turn-off delay time Abschaltverzögerungszeit	t _{d(off)}	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		435		ns
Fall time Fallzeit	t _f	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		16		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E _{on}	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		1,23		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E _{off}	T _J =25°C T _J =125°C	Rgon=16 Ohm Rgoff=8 Ohm	15	300	50		1,2		mWs
Input capacitance Eingangskapazität	C _{ies}	T _J =25°C T _J =125°C	f=1MHz					tbd		nF
Output capacitance Ausgangskapazität	C _{oss}	T _J =25°C T _J =125°C	f=1MHz					tbd		nF
Reverse transfer capacitance Rückwirkungskapazität	C _{rss}	T _J =25°C T _J =125°C	f=1MHz					tbd		nF
Gate charge Gate Ladung	Q _{Gate}	T _J =25°C T _J =125°C						tbd		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{th,JH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,09 0,7194		K/W
Coupled thermal resistance inverter diode-transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R _{th,JH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,3		K/W

Diode Inverter
Diode Wechselrichter

Diode forward voltage Durchlaßspannung	V _F	T _J =25°C T _J =125°C				50		1,48	2,05	V
Peak reverse recovery current Rückstromspitze	I _{RM}	T _J =25°C T _J =125°C	Rgon=16 Ohm	15	300	50		76		A
Reverse recovery time Sperrverzögerungszeit	t _{rr}	T _J =25°C T _J =125°C	Rgon=16 Ohm	15	300	50		91		ns
Reverse recovered charge Sperrverzögerungsladung	Q _{rr}	T _J =25°C T _J =125°C	Rgon=16 Ohm	15	300	50		3,17		uC
Reverse recovered energy Sperrverzögerungsenergie	E _{rec}	T _J =25°C T _J =125°C	Rgon=16 Ohm	15	300	50		0,36		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{th,JH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,69		K/W
Coupled thermal resistance inverter transistor-diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R _{th,JH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,29		K/W

NTC-Thermistor
NTC-Widerstand

Rated resistance Nennwiderstand	R ₂₅	T _J =25°C	Tol. ±5%				4,46	4,7	4,94	kOhm
Deviation of R100 Abweichung von R100	D _{R/R}	T _C =100°C	R100=435Ohm					3		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	T _J =25°C						210		mW
B-value B-Wert	B _(25/100)	T _J =25°C	Tol. ±3%					3530		K

flowPACK 1, 600V, 50A
Output inverter

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

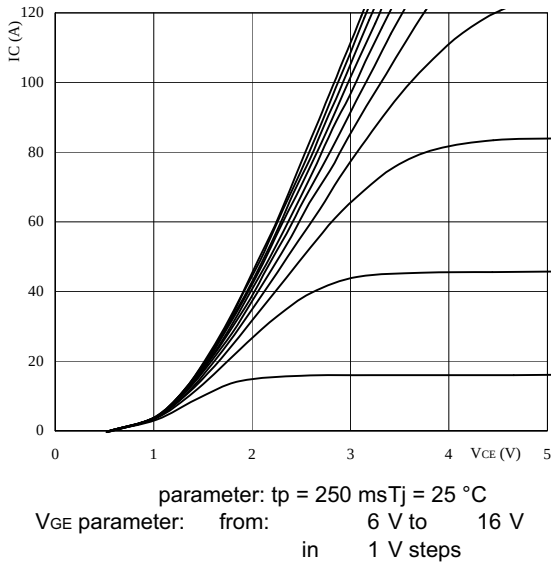


Figure 2. Typical output characteristics
Output inverter IGBT
 $I_C = f(V_{CE})$

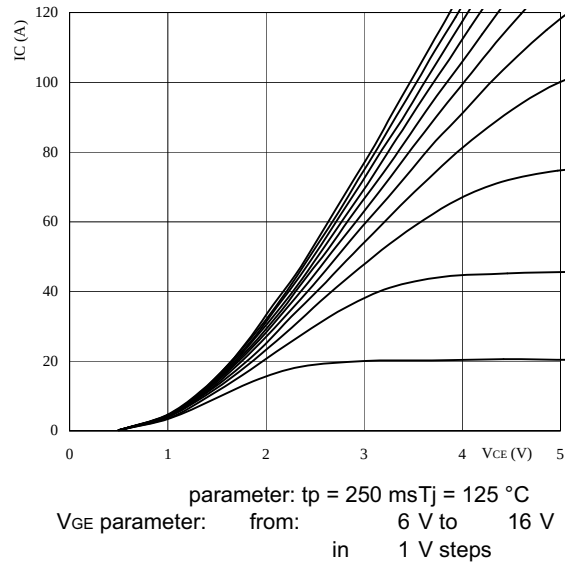


Figure 3. Typical transfer characteristics
Output inverter IGBT
 $I_C = f(V_{GE})$

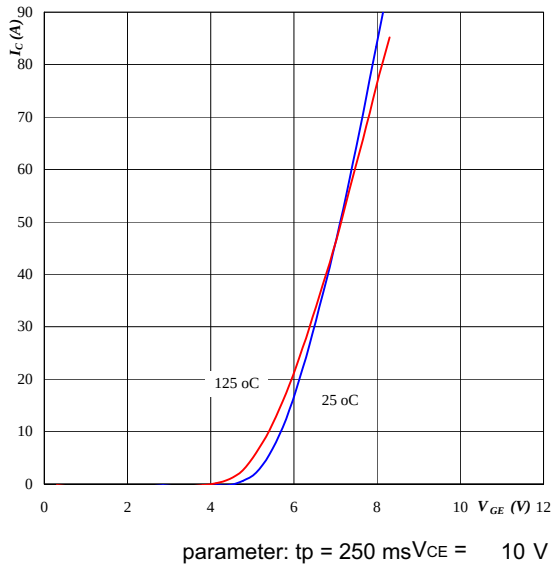
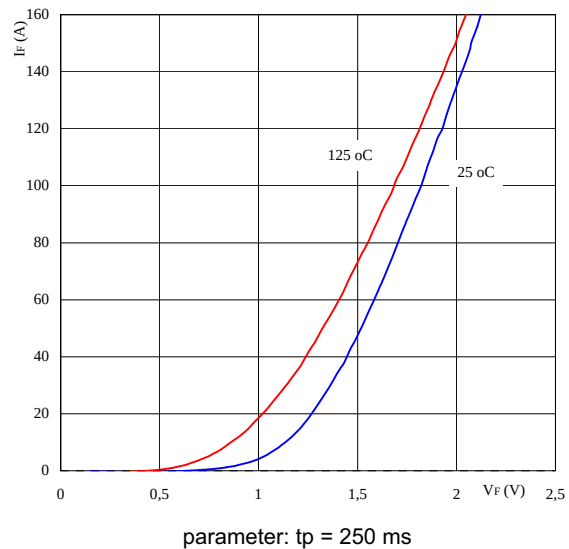
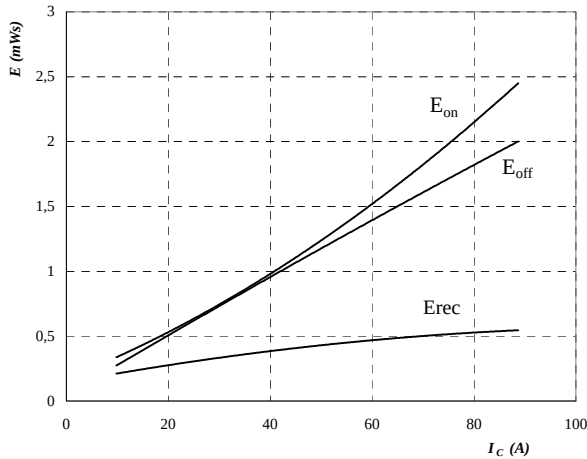


Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED $I_F = f(V_F)$



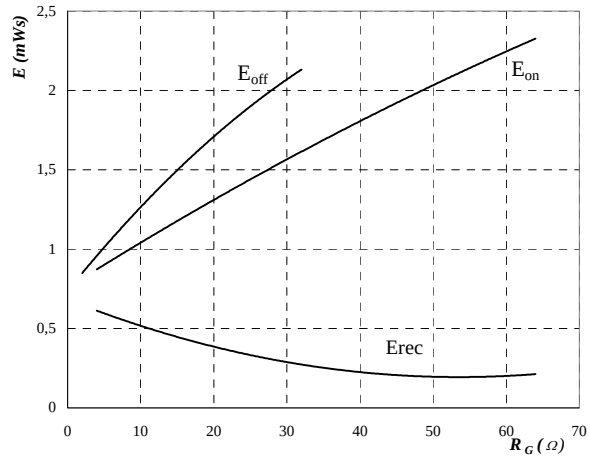
Output inverter

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



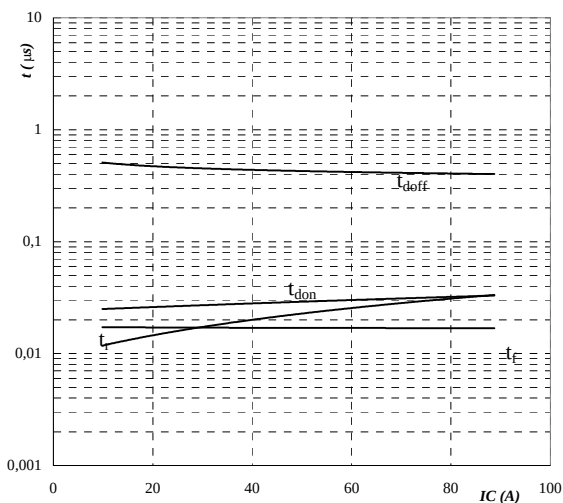
inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 2 \cdot R_{Goff} = 16\ \Omega$

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



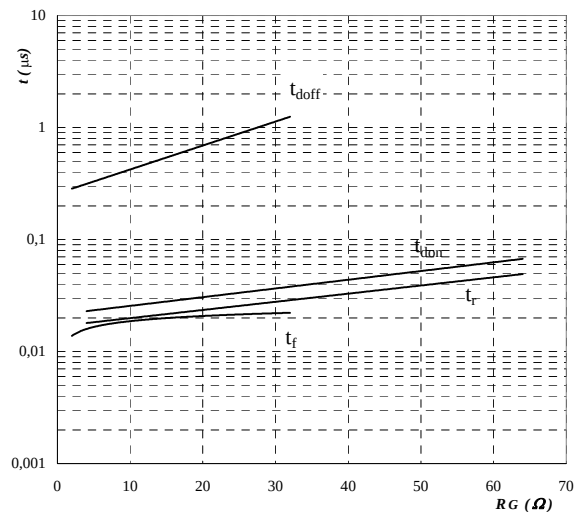
inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_C = 50\text{ A}$

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



inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 2 \cdot R_{Goff} = 16\ \Omega$

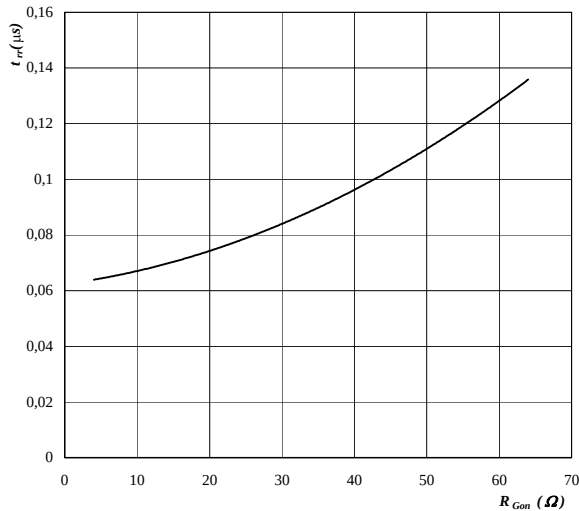
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
 $t = f(R_G)$



inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 300\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_C = 50\text{ A}$

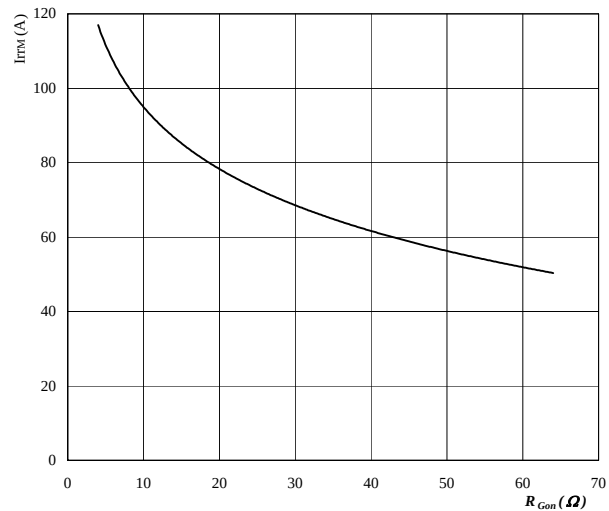
Output inverter

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



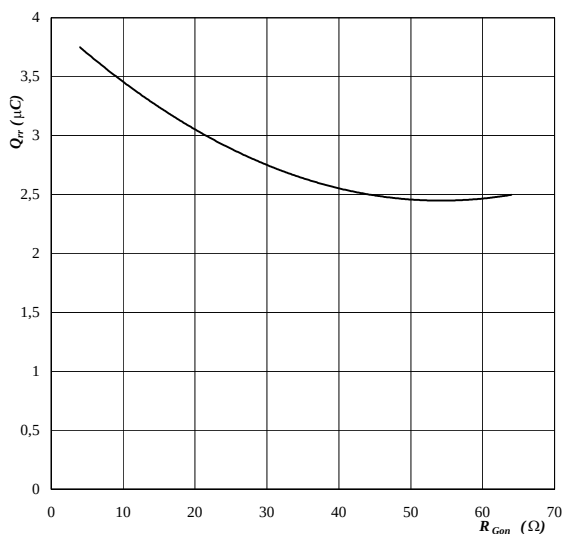
$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 300\text{ V}$
 $I_F = 50\text{ A}$

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



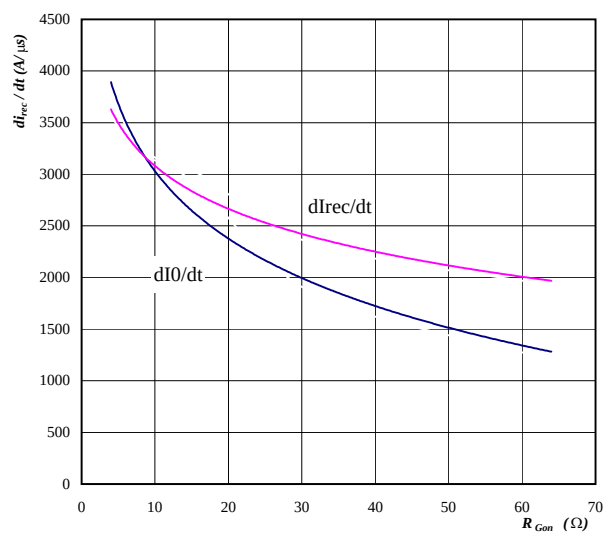
$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 300\text{ V}$
 $I_F = 50\text{ A}$

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



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 300\text{ V}$
 $I_F = 50\text{ A}$

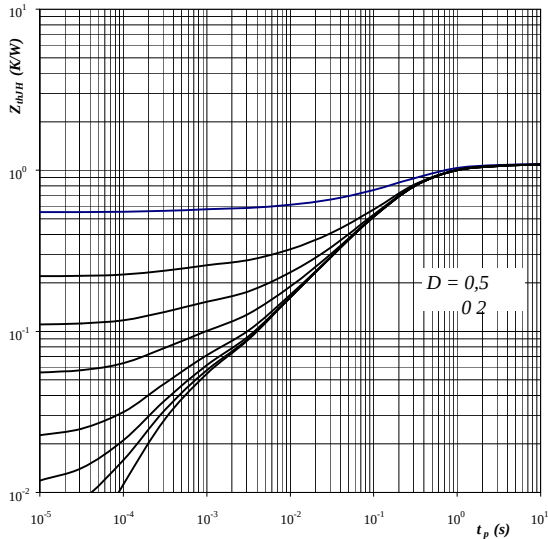
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 300\text{ V}$
 $I_F = 50\text{ A}$

Output inverter

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

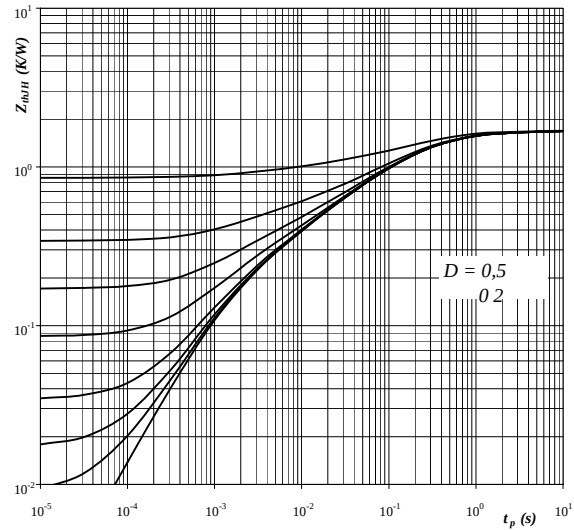


Parameter: $D = t_p / T$ $R_{thJH} \ 1,09 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,02	2,2E+01
0,14	1,4E+00
0,63	2,3E-01
0,18	4,6E-02

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



Parameter: $D = t_p / T$ $R_{thJH} \ 1,69 \text{ K/W}$

FRED thermal model values

R (C/W)	Tau (s)
0,04	3,5E+01
0,16	1,7E+00
0,70	2,5E-01
0,44	5,3E-02

flowPACK 1, 600V, 50A
Output inverter

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

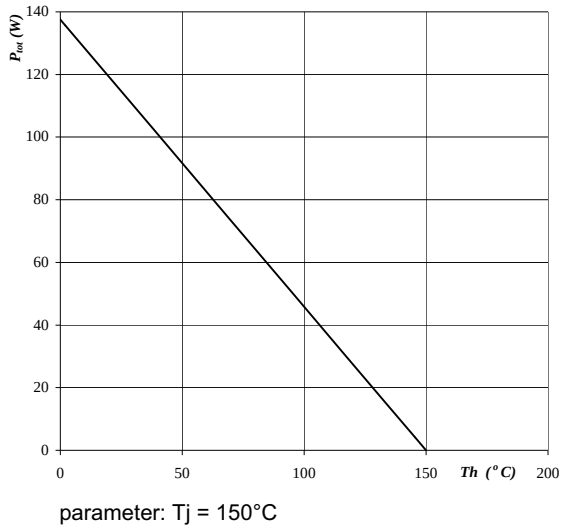


Figure 16. Collector current as a function of heatsink temperature
Output inverter IGBT
 $I_c = f(T_h)$

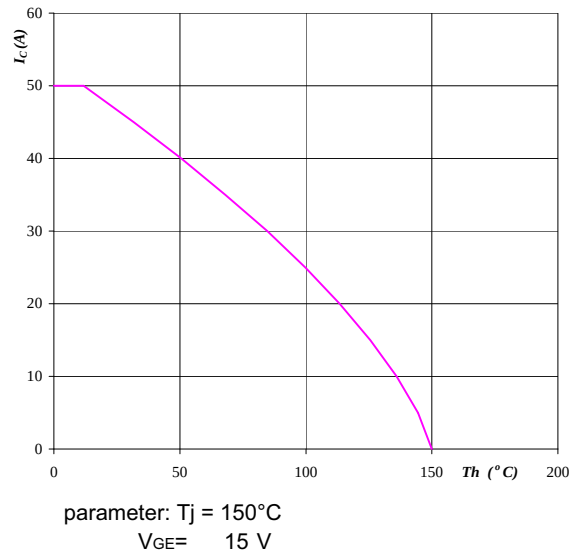


Figure 17. Power dissipation as a function of heatsink temperature
Output inverter FRED
 $P_{tot} = f(T_h)$

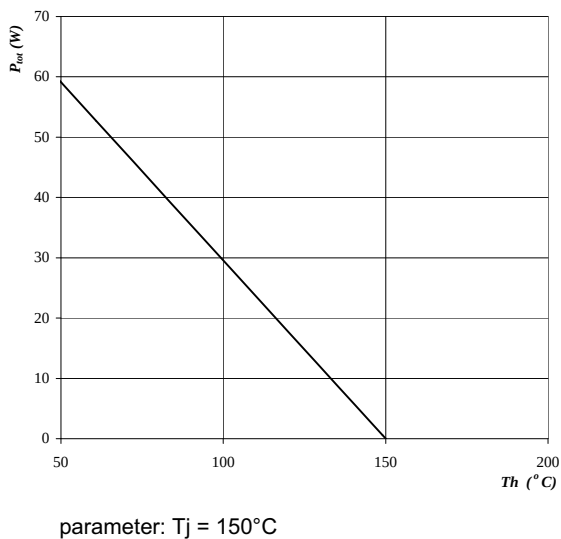
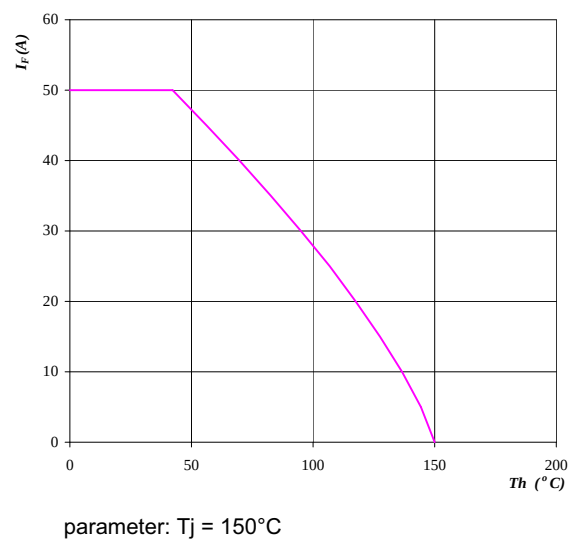
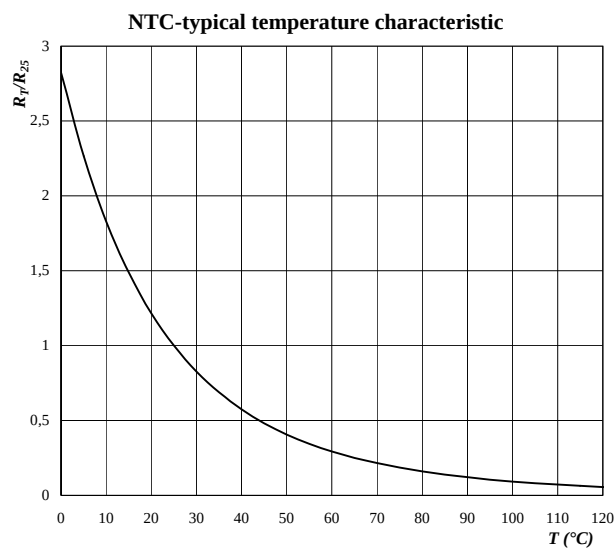


Figure 18. Forward current as a function of heatsink temperature
Output inverter FRED
 $I_F = f(T_h)$



Thermistor

**Figure 19. Typical NTC characteristic
as a function of temperature**



$$B_{25/100} = 3530$$