

flowPACK 0, 1200V, 15A

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	19 25	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	38	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}	41 63	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 900V	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	16 22	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	32	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}	29 43	W

Thermal properties
Thermische Eigenschaften

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

Insulation properties
Modulisolation

Insulation voltage Isolationsspannung	$t=2\text{sec}$	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			min 12,7	mm

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(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			0,0006	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		15	1,35	1,68 1,83	2,15	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I _{CES}	T _j =25°C T _j =125°C		0	1200				0,2 2	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 Integritrter Gate Widerstand	R _{gint}							-		Ohm
Turn-on delay time Einschaltverzögerungszeit	t _{d(on)}	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		38		ns
Rise time Anstiegszeit	t _r	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		24		ns
Turn-off delay time Abschaltverzögerungszeit	t _{d(off)}	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		434		ns
Fall time Fallzeit	t _f	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		203		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E _{on}	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		1,649		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E _{off}	T _j =25°C T _j =125°C	Rgon=54 Ohm Rgoff=54 Ohm	±15	600	15		1,634		mWs
Input capacitance Eingangskapazität	C _{ies}	T _j =25°C T _j =125°C	f=1MHz	0	25			1,1		nF
Output capacitance Ausgangskapazität	C _{oss}	T _j =25°C T _j =125°C	f=1MHz	0	25			0,1		nF
Reverse transfer capacitance Rückwirkungskapazität	C _{rss}	T _j =25°C T _j =125°C	f=1MHz	0	25			0,05		nF
Gate charge Gate Ladung	Q _{Gate}	T _j =25°C T _j =125°C		15	960	15		85		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um					1,69		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R _{thJC}		λ = 0,61 W/mK					1,12		K/W
Coupled thermal resistance inverter diode-transistor	R _{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um					0,38		K/W
Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor			λ = 0,61 W/mK							

Diode Inverter
Diode Wechselrichter

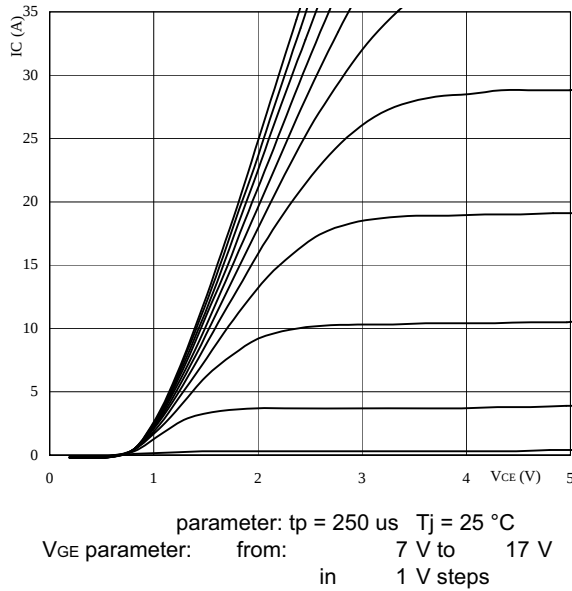
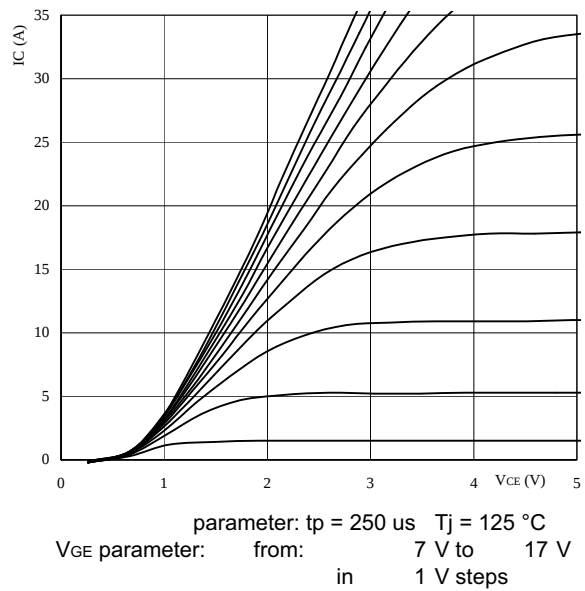
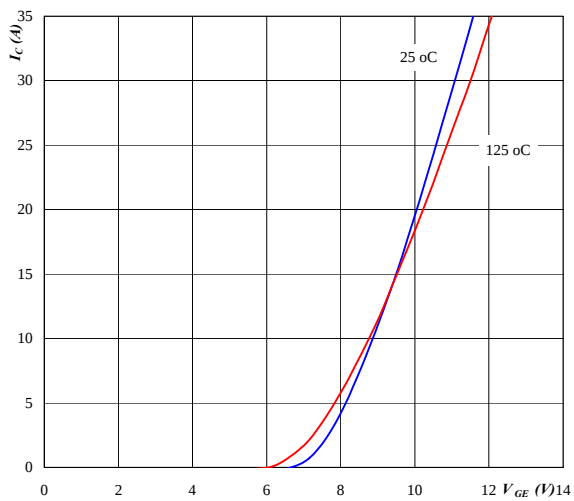
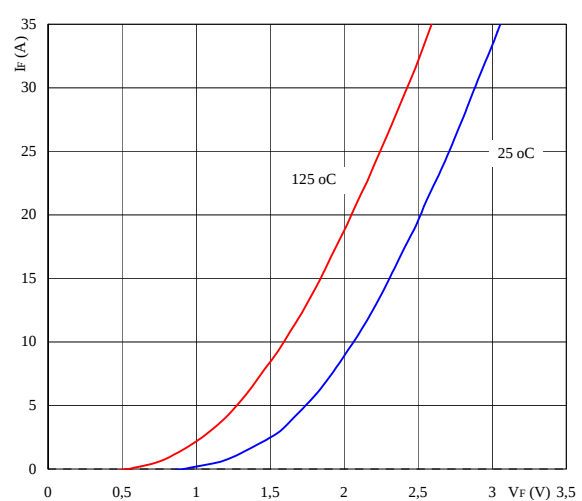
Diode forward voltage Durchlaßspannung	V_F	TJ=25°C TJ=125°C				15		2,3 1,84	2,85	V
Peak reverse recovery current Rückstromspitze	I_{RRM}	TJ=25°C TJ=125°C	Rgon=54 Ohm dI0/dt=766 A/us	±15	600	15		29,7		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	TJ=25°C TJ=125°C	Rgon=54 Ohm dI0/dt=766 A/us	±15	600	15		312		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	TJ=25°C TJ=125°C	Rgon=54 Ohm dI0/dt=766 A/us	±15	600	15		2,649		uC
Reverse recovered energy Sperrverzögerungsenergie	E_{rec}	TJ=25°C TJ=125°C	Rgon=54 Ohm dI0/dt=766 A/us	±15	600	15		0,853		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um					2,45		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R_{thJC}		λ = 0,61 W/mK					1,6		K/W
Coupled thermal resistance inverter transistor-diode	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um					0,44		K/W
Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode			λ = 0,61 W/mK							

Characteristic values

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	VR(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Min	Typ	Max	

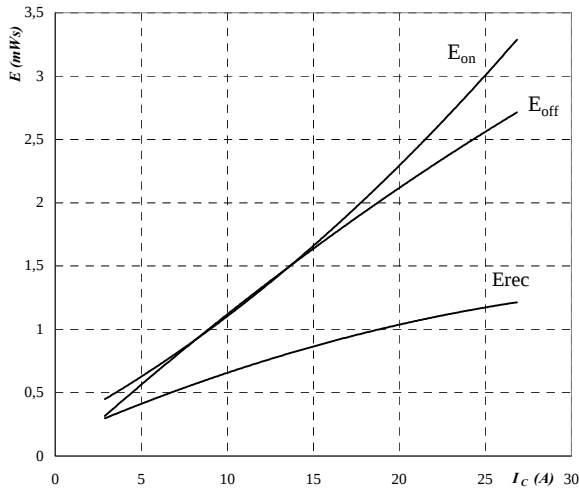
NTC-Thermistor
NTC-Widerstand

Rated resistance Nennwiderstand	R ₂₅	T _j =25°C					17,5	22	29	kOhm
Deviation of R100 Abweichung von R100	D _{R/R}	T _c =100°C	R100=1486Ohm					2,9		%/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%					4000		K

flowPACK 0, 1200A, 15A
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, $T_j = 125^\circ\text{C}$

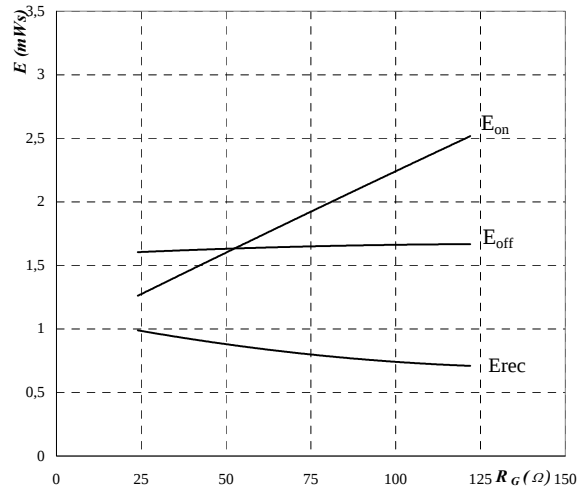
$V_{CE} = 600\text{ V}$

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

$R_{gon} = 54\ \Omega$

$R_{goff} = 54\ \Omega$

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



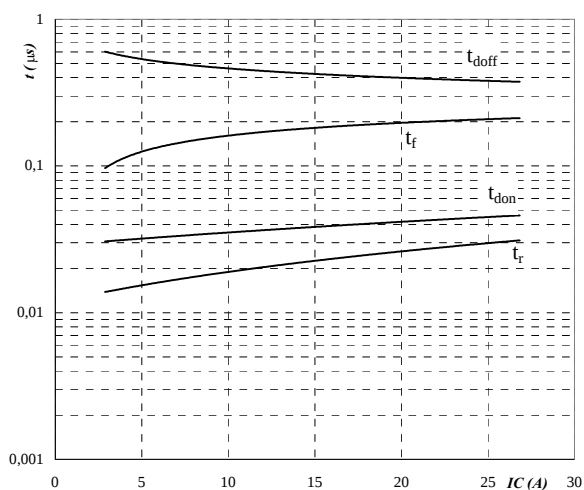
inductive load, $T_j = 125^\circ\text{C}$

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

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

$I_c = 15\text{ A}$

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



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

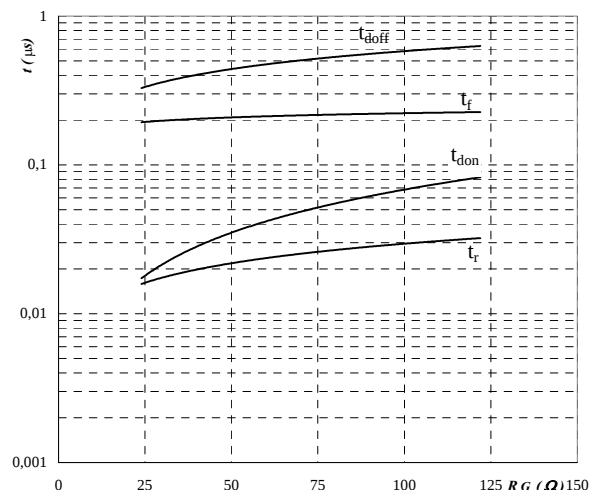
$V_{CE} = 600\text{ V}$

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

$R_{gon} = 54\ \Omega$

$R_{goff} = 54\ \Omega$

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



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

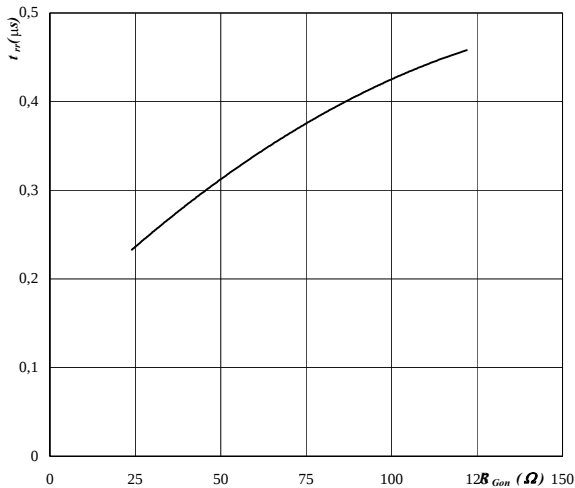
$V_{CE} = 600\text{ V}$

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

$I_c = 15\text{ A}$

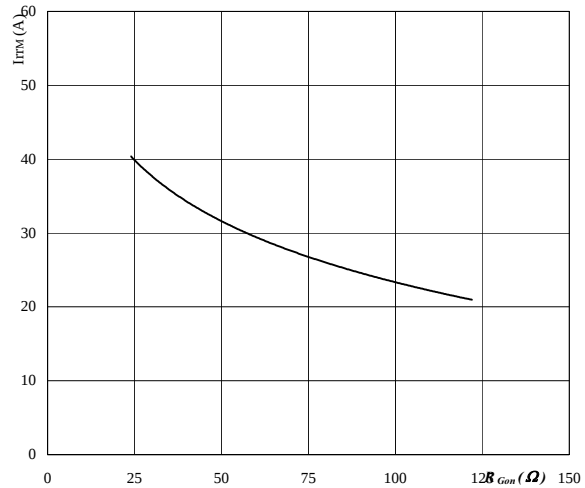
Output inverter

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



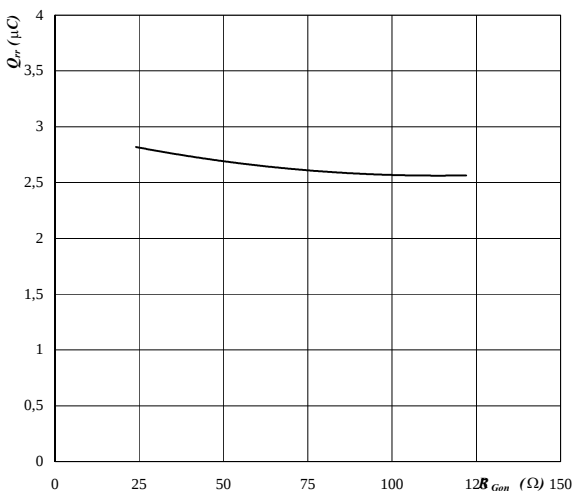
$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 15 A$
 $V_{GE} = \pm 15 V$

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



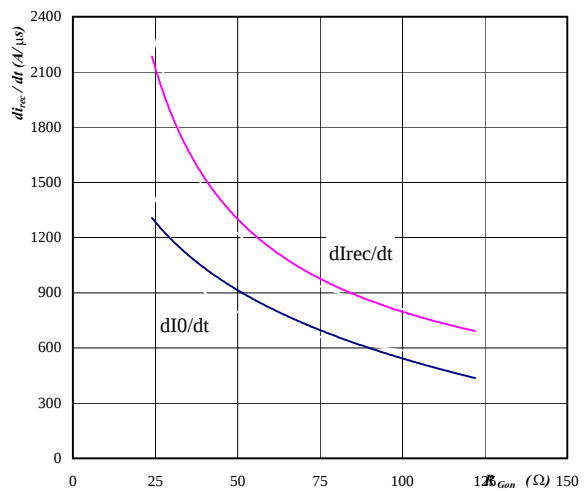
$T_j = 125^\circ C$
 $V_R = 600 V$
 $I_F = 15 A$
 $V_{GE} = \pm 15 V$

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



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

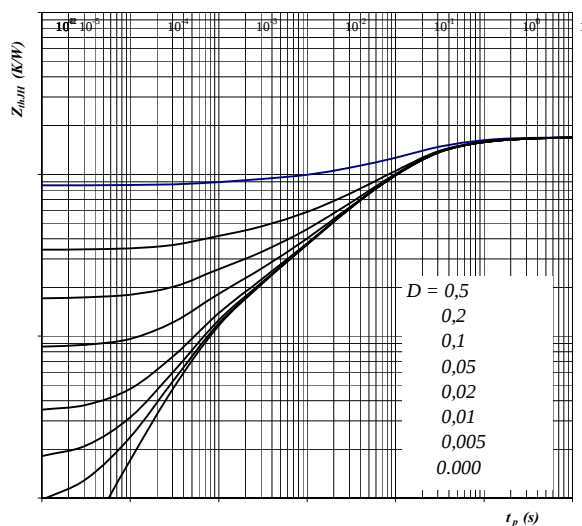
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



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

Output inverter

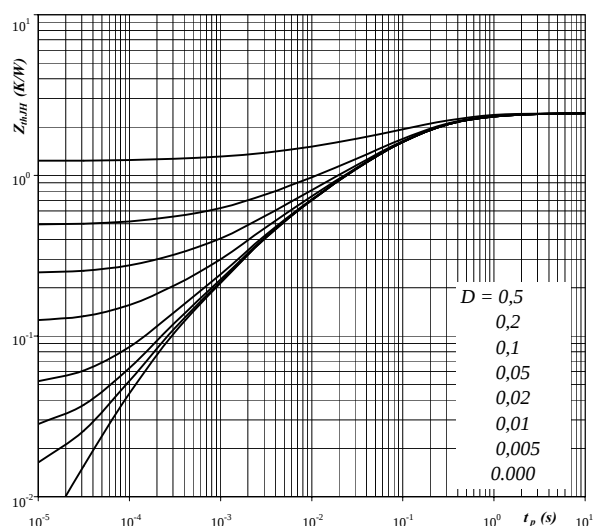
Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$


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

IGBT thermal model values

R (C/W)	Tau (s)
0,05	1,2E+01
0,22	9,4E-01
0,78	1,8E-01
0,35	4,4E-02

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


Parameter: $D = t_p / T$
 $R_{thJH} = 2,45 \text{ K/W}$

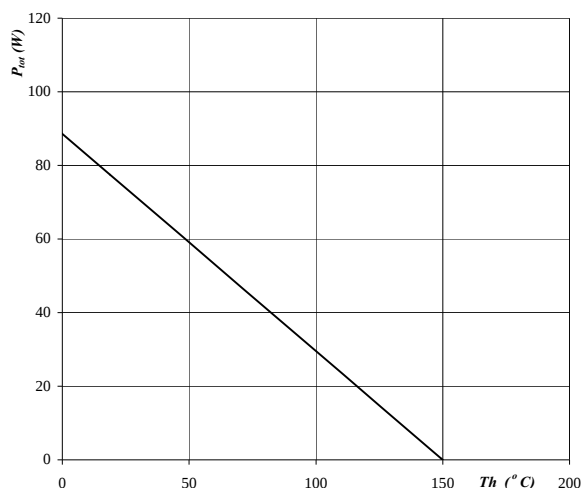
FRED thermal model values

R (C/W)	Tau (s)
0,04	3,0E+01
0,21	1,3E+00
0,93	1,9E-01
0,64	4,4E-02
0,38	8,5E-03

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

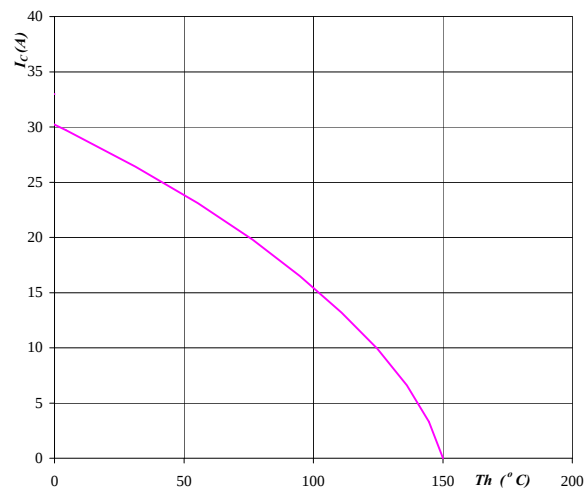
Output inverter IGBT
 $P_{tot} = f(T_h)$



parameter: $T_j = 150^\circ\text{C}$

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT
 $I_c = f(T_h)$

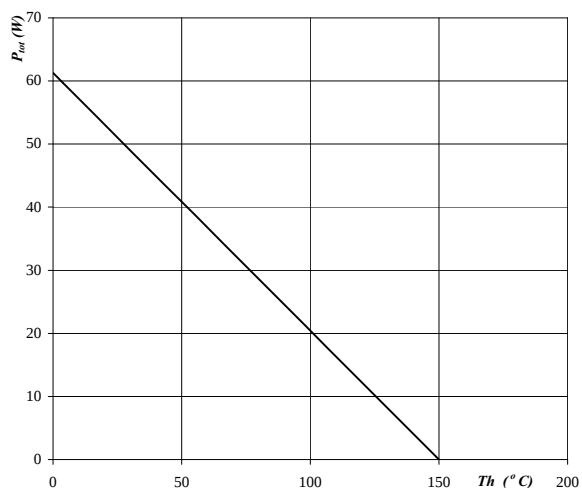


parameter: $T_j = 150^\circ\text{C}$

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

Figure 17. Power dissipation as a function of heatsink temperature

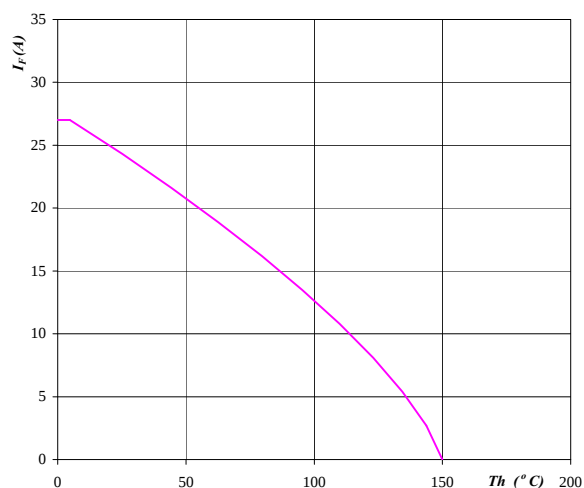
Output inverter FRED
 $P_{tot} = f(T_h)$



parameter: $T_j = 150^\circ\text{C}$

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED
 $I_F = f(T_h)$



parameter: $T_j = 150^\circ\text{C}$

Thermistor

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

$$R_T = f(T)$$

