flowPIM®1, 600V

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition		Symbol	Datasheet values max.	Unit
Input Rectifier Bridge **Gleichrichter**					
Repetitive peak reverse voltage Periodische Rückw. Spitzensperrspannung			V_{RRM}	1600	V
Forward current per diode Dauergrenzstrom	DC current	T_h=80°C Tc=80°C	I_{FAV}	29 40,limited by nr. of wires	A
Surge forward current Stoßstrom Grenzwert	t_p=10ms	T_j=25°C	I_{FSM}	200	A
I^2t-value Grenzlastintegral	t_p=10ms	T_j=25°C	I^2t	200	A^2s
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C Tc=80°C	P_{tot}	35 53	W
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 Tc=80°C	I_C	14,5 16,limited by nr. of wires	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	29	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C Tc=80°C	P_{tot}	35 53	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤150°C V_{CE}=600V	V_{GE}=15V	t_{SC}	10	us
Diode Inverter **Diode Wechselrichter**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C Tc=80°C	I_F	16,limited by nr. of wires 16,limited by nr. of wires	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	34	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C Tc=80°C	P_{tot}	23	W
Transistor BRC **Transistor BRC**					
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 Tc=80°C	I_C	9,6 12,6	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	19,2	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C Tc=80°C	P_{tot}	28 43	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj≤150°C VCE=600/1200 V	VGE=15V	t_{SC}	10	us

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition		Symbol	Datasheet values max.	Unit
Diode BRC **Diode BRC**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C Tc=80°C	I_F	8,limited by nr. of wires 8,limited by nr. of wires	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	24	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C Tc=80°C	P_{tot}	21	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/ Charakteristische Werte P84-A20

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	V_{GE}(V) V_{GS}(V)	V_R(V) V_{CE}(V) V_{DS}(V)	I_C(A) IF(A) I_d(A)	Min	Typ	Max	
Input Rectifier Bridge **Gleichrichter**										
Forward voltage Durchlaßpannung	V_F	Tj=25°C				30	0,8	1,24	1,4	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V_{to}	Tj=25°C				30		0,92		V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r_t	Tj=25°C				30		10		mOhm
Reverse current Sperrstrom	I_r	Tj=25°C			1200				0,01	mA
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thikness≤50um					2		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,3		K/W
Transistor Inverter, inductive load **Transistor Wechselrichter**										
Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	Tj=25°C Tj=125°C	VCE=VGE			0,0004	4,5	5,5	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		15	1,7	2,01 2,3	2,65	V
Collector-emitter cut-off incl.FRED Kollektor-Emitter Reststrom inkl.FRED	I_{CES}	Tj=25°C Tj=125°C		0	600				0,1	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=150°C		25	0				120	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=40 Ohm	15	300	15		 27		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	 Rgon=40 Ohm	15	300	15		 23		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	 Rgoff=20 Ohm	15	300	15		 158		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	 Rgoff=20 Ohm	15	300	15		 49		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	 Rgon=40 Ohm	15	300	15		 0,42		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	 Rgoff=20 Ohm	15	300	15		 0,433		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,8		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25					nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			0,06		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C		15	300			58		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thikness≤50um					1,8		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,2		K/W

flowPIM®1, 600V

Characteristic values/ Charakteristische Werte P84-A20

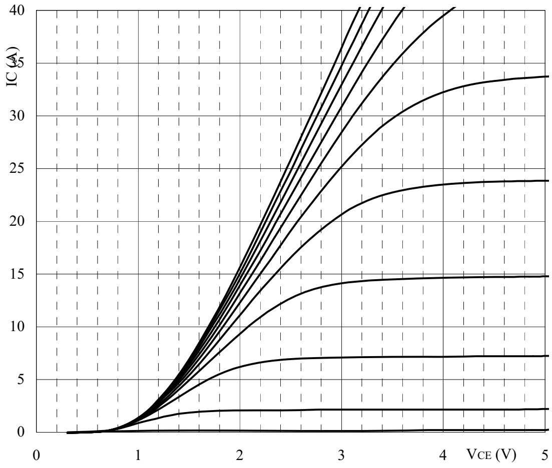
Description	Symbol	Conditions T(C°)	Other conditions (Rgon-Rgoff)	VGE(V) VGS(V)	V_R(V) VCE(V) VDS(V)	IC(A) IF(A) Id(A)	Datasheet values Min	Typ	Max	Unit
Diode Inverter										
Diode Wechselrichter										
Diode forward voltage	V_F	Tj=25°C				15	1	1,61	2,2	V
Durchlaßspannung		Tj=125°C						1,32		
Peak reverse recovery current	I_{RM}	Tj=25°C		15	300	15				A
Rückstromspitze		Tj=125°C	Rgon=40 Ohm					15		
Reverse recovery time	t_{rr}	Tj=25°C		15	300	15				ns
Sperreverzögerungszeit		Tj=125°C	Rgon=40 Ohm					85		
Reverse recovered charge	Q_{rr}	Tj=25°C		15	300	15				uC
Sperrverzögerungsladung		Tj=125°C	Rgon=40 Ohm					0,67		
Reverse recovered energy	E_{rec}	Tj=25°C		15	300	15				mWs
Sperrverzögerungsenergie		Tj=125°C	Rgon=40 Ohm					0,075		
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thikness≤50um					3		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					2		K/W
Transistor BRC										
Transistor BRC										
Gate emitter threshold voltage	$V_{GE(th)}$	Tj=25°C	VCE=VGE			0,0002	3	4	5	V
Gate-Schwellenspannung		Tj=125°C								
Collector-emitter saturation voltage	$V_{CE(sat)}$	Tj=25°C		15		8	1,5	2,3	3	V
Kollektor-Emitter Sättigungsspannung		Tj=125°C						2,6		
Collector-emitter cut-off	I_{CES}	Tj=25°C		0	600				0,03	mA
Kollektor-Emitter Reststrom		Tj=125°C								
Gate-emitter leakage current	I_{GES}	Tj=25°C		25	0				100	nA
Gate-Emitter Reststrom		Tj=150°C								
Integrated Gate resistor	R_{gint}									Ohm
Integrirter Gate Widerstand										
Turn-on delay time	$t_{d(on)}$	Tj=25°C		15	300	8				ns
Einschaltverzögerungszeit		Tj=125°C	Rgon=48 Ohm					13		
Rise time	t_r	Tj=25°C		15	300	8				ns
Anstiegszeit		Tj=125°C	Rgon=48 Ohm					15		
Turn-off delay time	$t_{d(off)}$	Tj=25°C		15	300	8				ns
Abschaltverzögerungszeit		Tj=125°C	Rgoff=24 Ohm					130		
Fall time	t_f	Tj=25°C		15	300	8				ns
Fallzeit		Tj=125°C	Rgoff=24 Ohm					34		
Turn-on energy loss per pulse	E_{on}	Tj=25°C		15	300	8				mWs
Einschaltverlustenergie pro Puls		Tj=125°C	Rgon=48 Ohm					0,159		
Turn-off energy loss per pulse	E_{off}	Tj=25°C		15	300	8				mWs
Abschaltverlustenergie pro Puls		Tj=125°C	Rgoff=24 Ohm					0,161		
Input capacitance	C_{iss}	Tj=25°C	f=1MHz	0	25			0,35	0,42	nF
Eingangskapazität		Tj=125°C								
Output capacitance	C_{oss}	Tj=25°C	f=1MHz	0	25			0,038	0,046	nF
Ausgangskapazität		Tj=125°C								
Reverse transfer capacitance	C_{rss}	Tj=25°C	f=1MHz	0	25			0,023	0,028	nF
Rückwirkungskapazität		Tj=125°C								
Gate charge	Q_{Gate}	Tj=25°C		15	480	6		32	42	nC
Gate Ladung		Tj=125°C								
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thikness≤50um					2,5		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,65		K/W

Characteristic values/ Charakteristische Werte P84-A20

Description	Symbol	Conditions					Datasheet values			Unit
		T(C°)	Other conditions (Rgon-Rgoff)	V_{GE}(V) V_{GS}(V)	V_R(V) V_{CE}(V) V_{DS}(V)	I_C(A) I_F(A) I_d(A)	Min	Typ	Max	
Diode BRC										
Diode BRC										
Diode forward voltage	V_F	Tj=25°C				8	1	1,7	2,2	V
Durchlaßspannung		Tj=125°C						1,35		
Reverse current	I_r	Tj=25°C			600				0,06	uA
Sperrstrom										
Peak reverse recovery current	IRM	Tj=25°C		15	300	8				A
Rückstromspitze		Tj=125°C	Rgon=48 Ohm					13,2		
Reverse recovery time	trr	Tj=25°C		15	300	8				ns
Sperreverzögerungszeit		Tj=125°C	Rgon=48 Ohm					73		
Reverse recovered charge	Qrr	Tj=25°C		15	300	8				uC
Sperrverzögerungsladung		Tj=125°C	Rgon=48 Ohm					0,46		
Reverse recovered energy	Erec	Tj=25°C		15	300	8				mWs
Sperrverzögerungsenergie		Tj=125°C	Rgon=48 Ohm					0,07		
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thikness≤50um					3,4		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehause pro Chip	R_{thJC}		Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					2,25		K/W
NTC-Thermistor										
NTC-Widerstand										
Rated resistance	R_{25}	TC=25°C	Tol. ±5%				4,2	4,7	5,3	kOhm
Nennwiderstand										
Deviation of R100	$D_{R/R}$	TC=100°C						2,56		%/K
Abweichung von R100										
Power dissipation given Epcos-Typ	P	TC=25°C						210		mW
Verlustleistung Epcos-Typ angeben										
B-value	$B_{(25/100)}$		Tol. ±3%					3530		K
B-Wert										

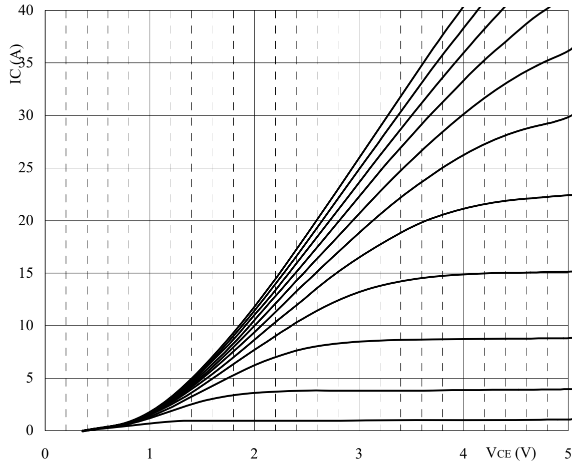
Output inverter

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



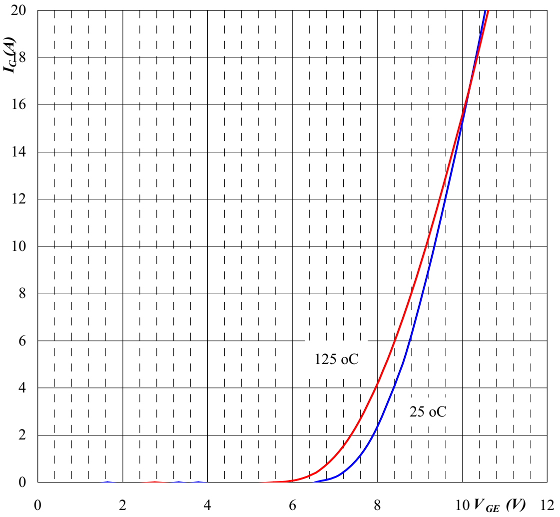
parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



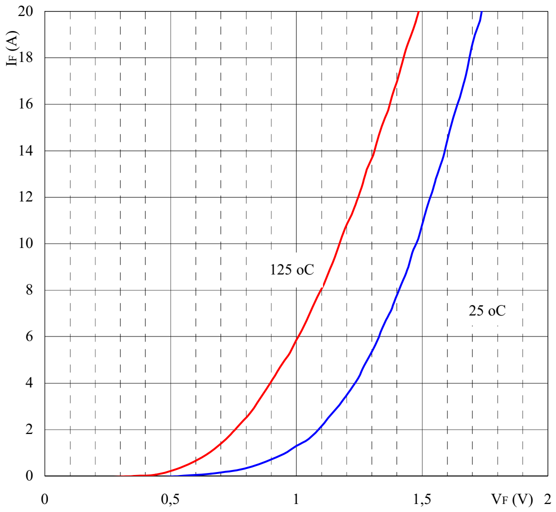
parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: tp = 250 us VCE = 10 V

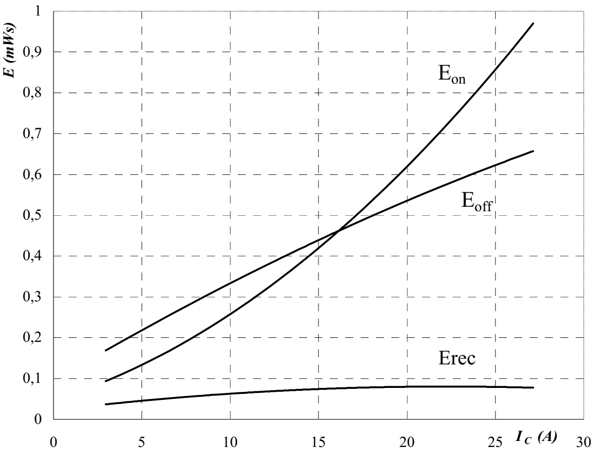
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED IF=f(VF)



parameter: tp = 250 us

Output inverter

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

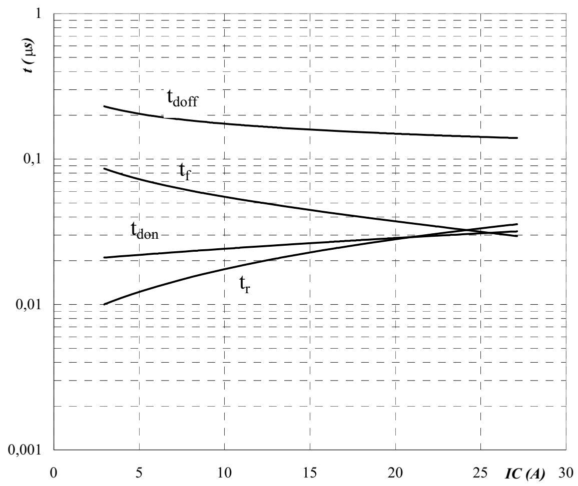


inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 40 W

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

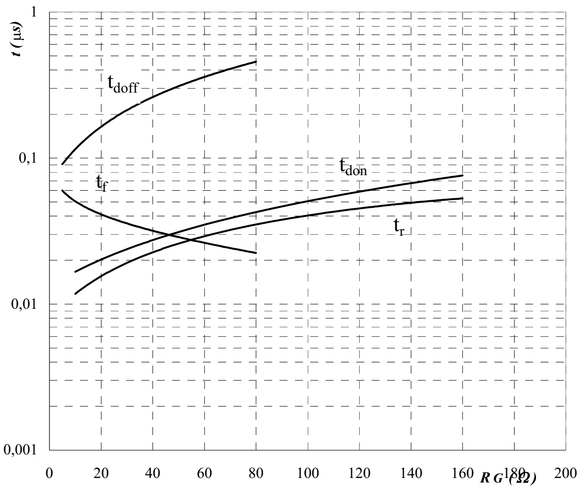
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 15 A

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 = 40 W

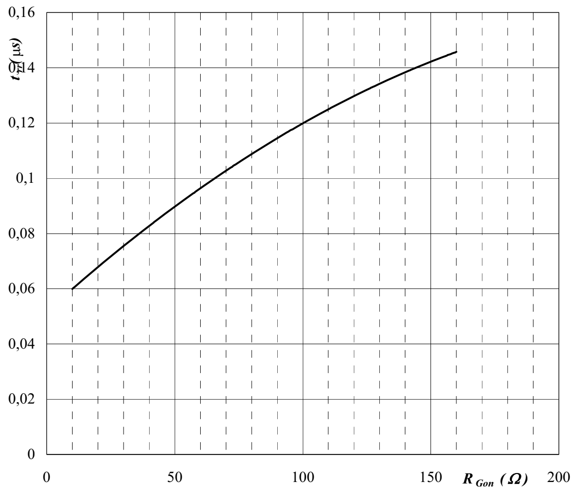
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
t = f (RG)



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

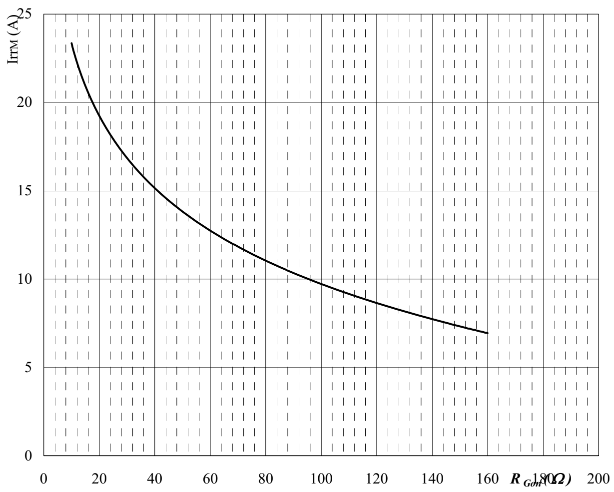
Output inverter

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



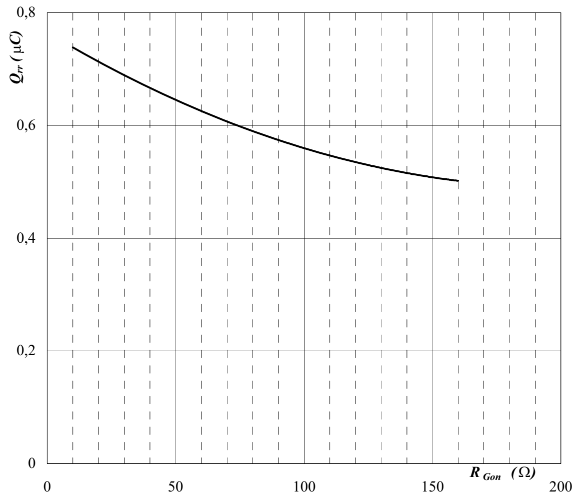
Tj = 125 °C
VR = 300 V
IF= 15 A

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



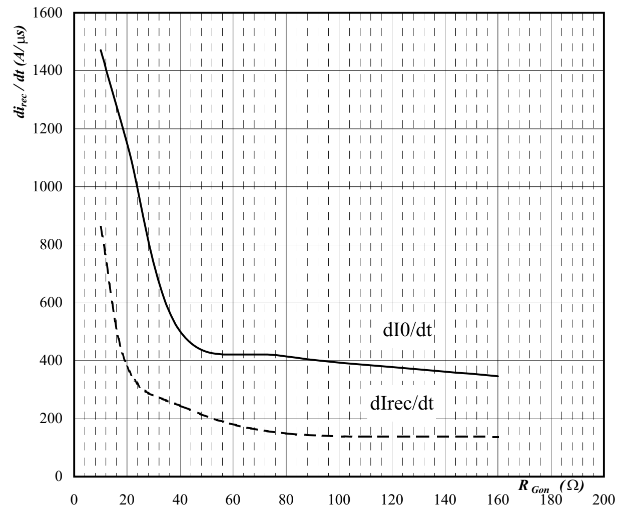
Tj = 125 °C
VR = 300 V
IF= 15 A

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



Tj = 125 °C
VR = 300 V
IF= 15 A

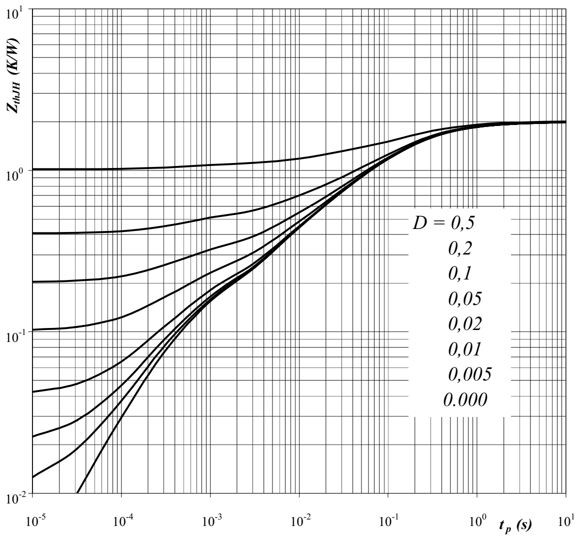
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
dI0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
VR = 300 V
IF= 15 A

Output inverter

Figure 13. IGBT transient thermal impedance as a function of pulse width
ZthJH = f(tp)

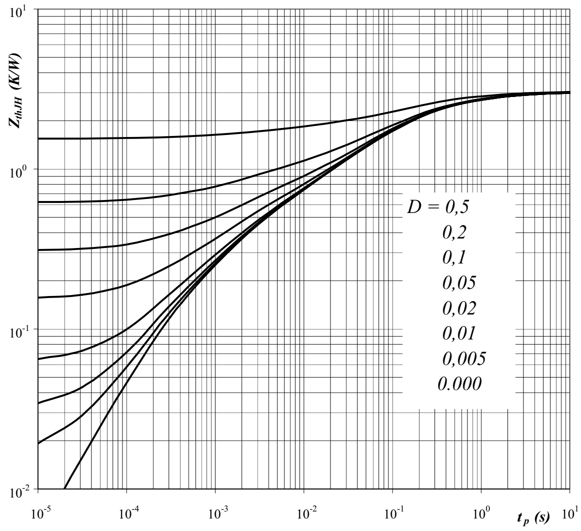


Parameter: D = tp / T RthJH 2,0 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,04	6,6E+01
0,15	2,4E+00
0,56	3,6E-01
0,84	8,2E-02
0,32	9,5E-03
0,12	4,4E-04

Figure 14. FRED transient thermal impedance as a function of pulse width
ZthJH = f(tp)



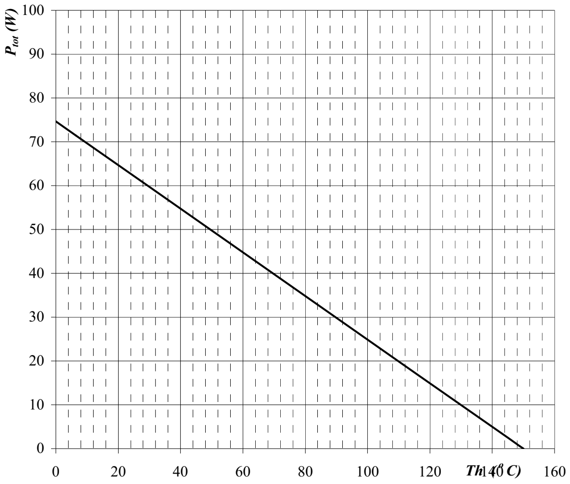
Parameter: D = tp / T RthJH= 3,0 K/W

FRED thermal model values

R (C/W)	Tau (s)
0,09	8,0E+01
0,19	4,7E+00
0,81	5,8E-01
1,20	9,2E-02
0,41	1,4E-02
0,29	2,1E-03
0,10	3,1E-04

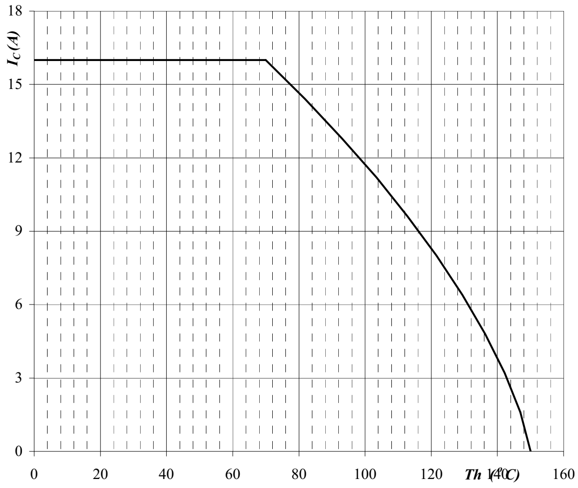
Output inverter

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



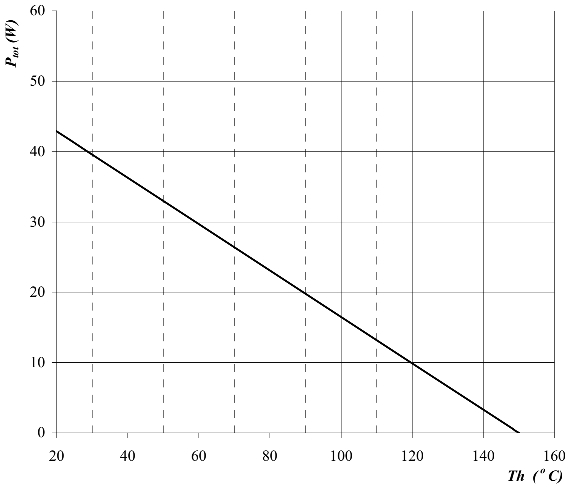
parameter: Tj = 150°C

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



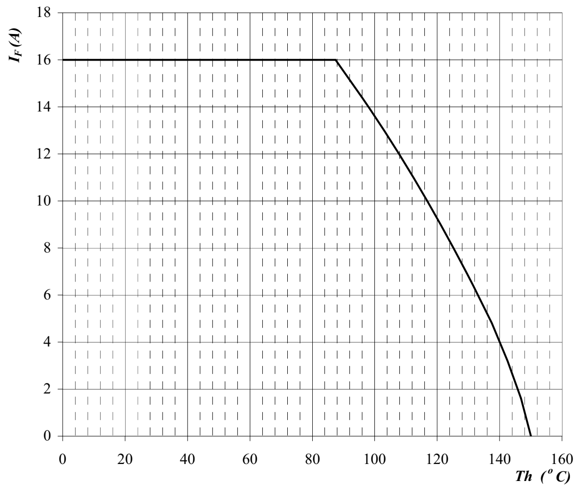
parameter: Tj = 150°C
VGE= 15 V

Figure 17. Power dissipation as a function of heatsink temperature
Output inverter FRED
Ptot = f (Th)



parameter: Tj = 150°C

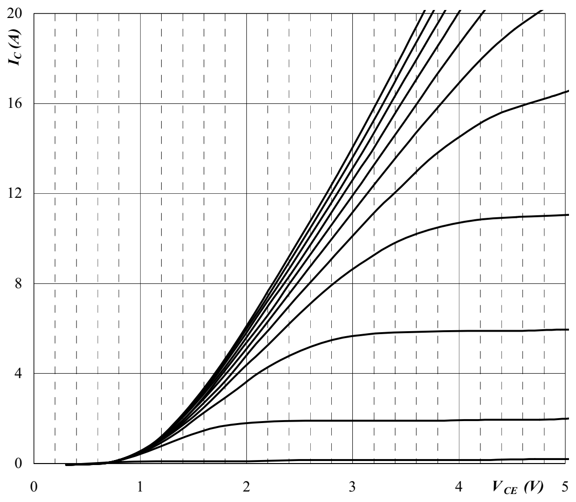
Figure 18. Forward current as a function of heatsink temperature
Output inverter FRED
IF = f (Th)



parameter: Tj = 150°C

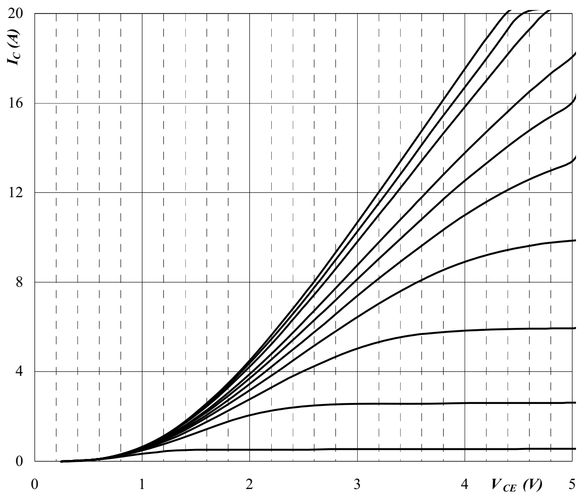
Brake

Figure 19. Typical output characteristics
Brake IGBT
Ic= f(VCE)



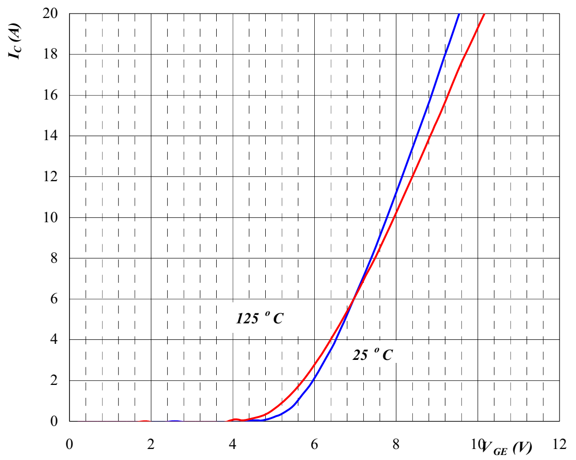
parameter: tp = 250 us Tj = 25 °C
VGE parameter: from: 5 V to 15 V
in 1 V steps

Figure 20. Typical output characteristics
Brake IGBT
Ic= f(VCE)



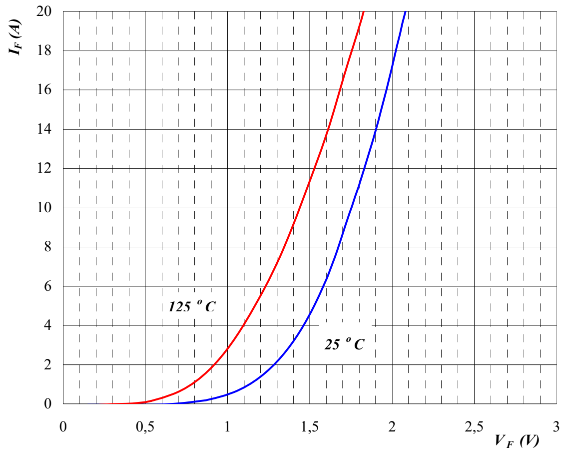
parameter: tp = 250 us Tj = 125 °C
VGE parameter: from: 5 V to 15 V
in 1 V steps

Figure 21. Typical transfer characteristics
Brake IGBT
Ic= f(VGE)



parameter: tp = 250 us VCE = 10 V

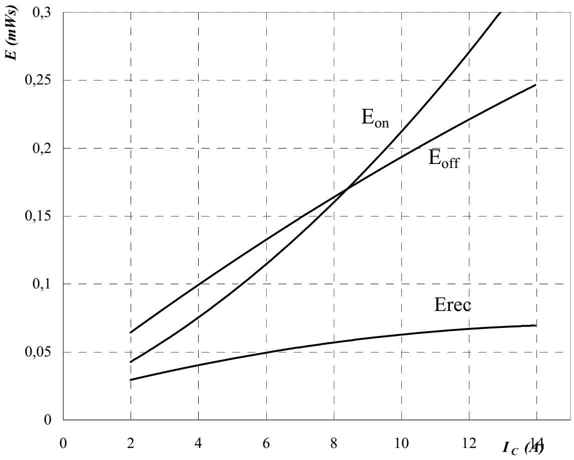
Figure 22. Typical diode forward current as a function of forward voltage
Brake FRED IF=f(VF)



parameter: tp = 250 us

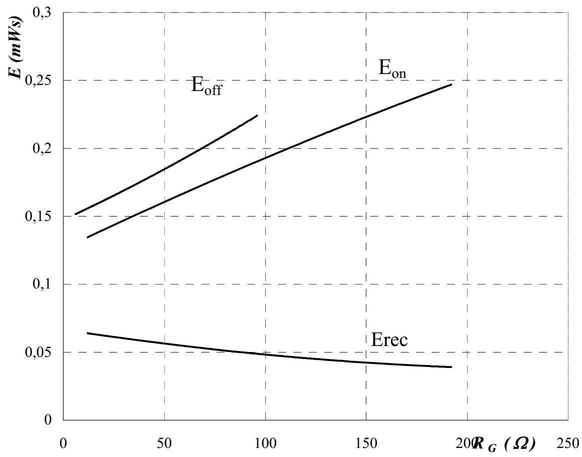
Brake

Figure 23. Typical switching energy losses as a function of collector current
Brake IGBT
E = f (Ic)



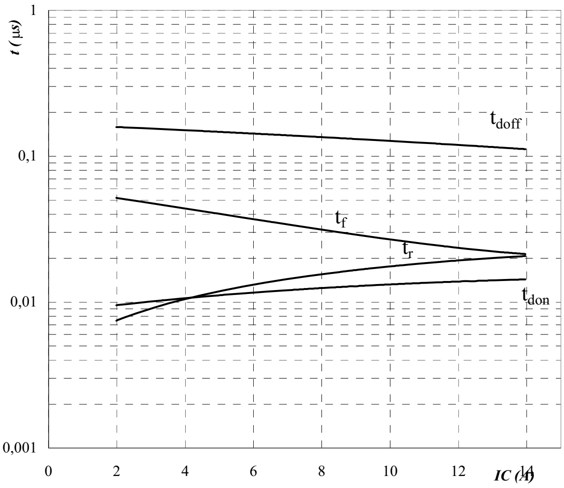
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 48 W

Figure 24. Typical switching energy losses as a function of gate resistor
Brake IGBT
E = f (RG)



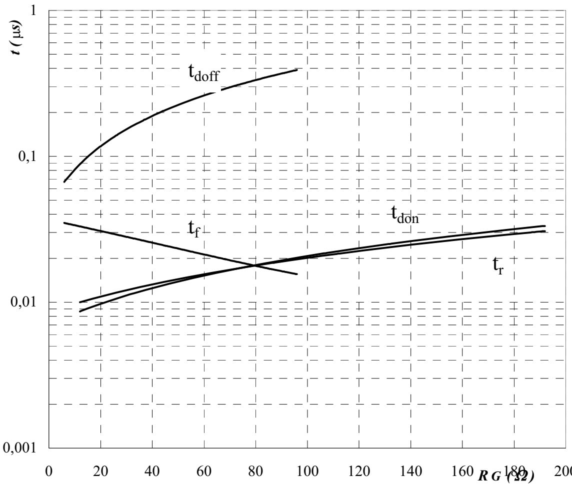
inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 8 A

Figure 25. Typical switching times as a function of collector current
Brake IGBT
t = f (Ic)



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
RGon = 2*RGoff = 48 W

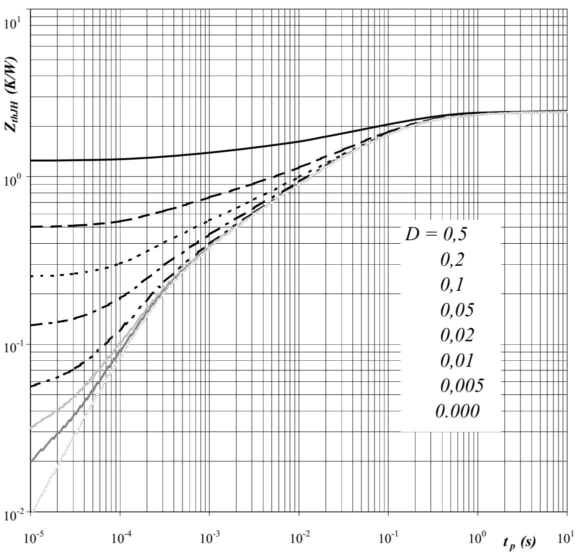
Figure 26. Typical switching times as a function of gate resistor
Brake IGBT
t = f (RG)



inductive load, Tj = 125 °C
VCE = 300 V
VGE= 15 V
Ic = 8 A

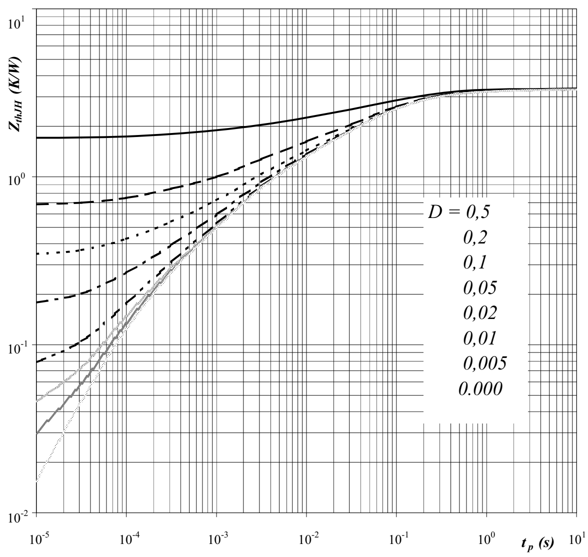
Brake

Figure 27. IGBT transient thermal impedance as a function of pulse width
ZthJH = f(tp)



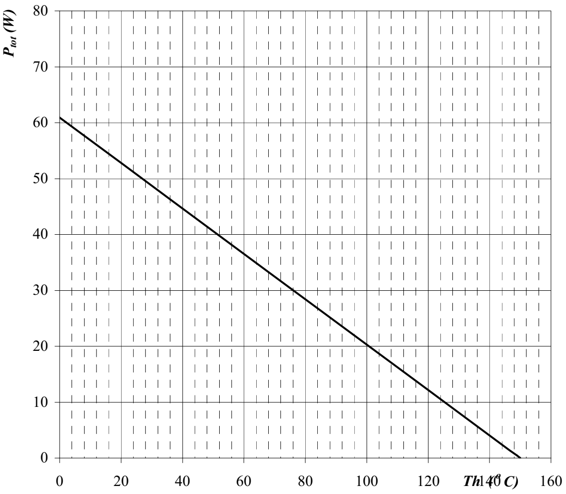
Parameter: D = tp / T RthJH= 2,5 K/W

Figure 28. FRED transient thermal impedance as a function of pulse width
ZthJH = f(tp)



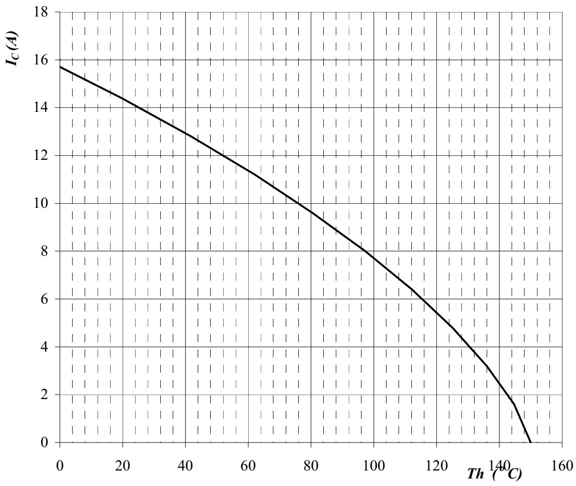
Parameter: D = tp / T RthJH= 3,4 K/W

Figure 29. Power dissipation as a function of heatsink temperature
Brake IGBT
Ptot = f (Th)



parameter: Tj = 150°C

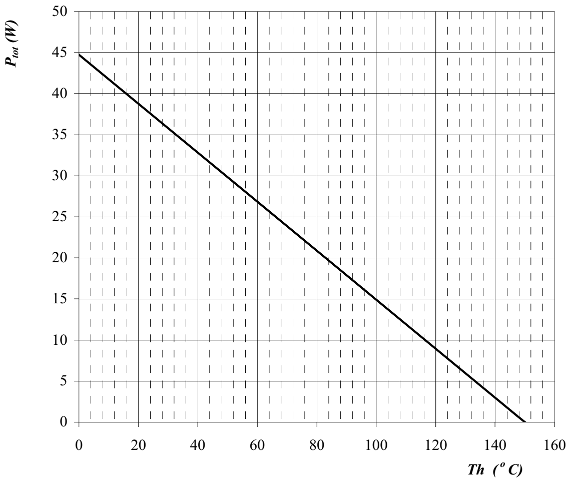
Figure 30. Collector current as a function of heatsink temperature
Brake IGBT
Ic = f (Th)



parameter: Tj = 150°C
VGE= 15 V

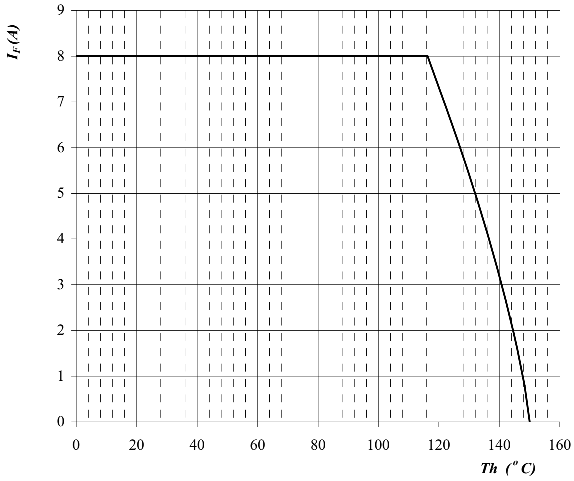
Brake

Figure 31. Power dissipation as a function of heatsink temperature
Brake FRED
Ptot = f (Th)



parameter: Tj = 150°C

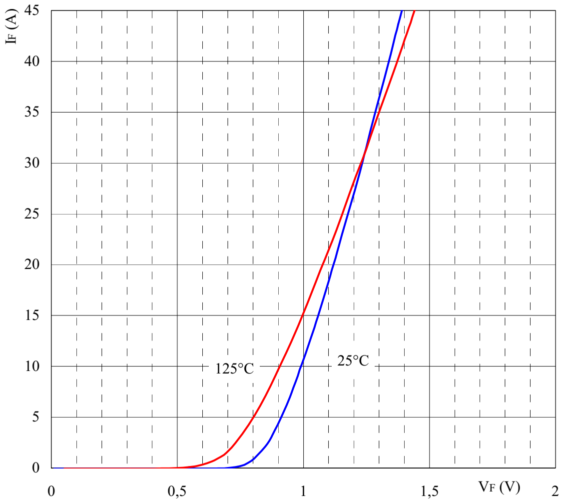
Figure 32. Forward current as a function of heatsink temperature
Brake FRED
IF = f (Th)



parameter: Tj = 150°C

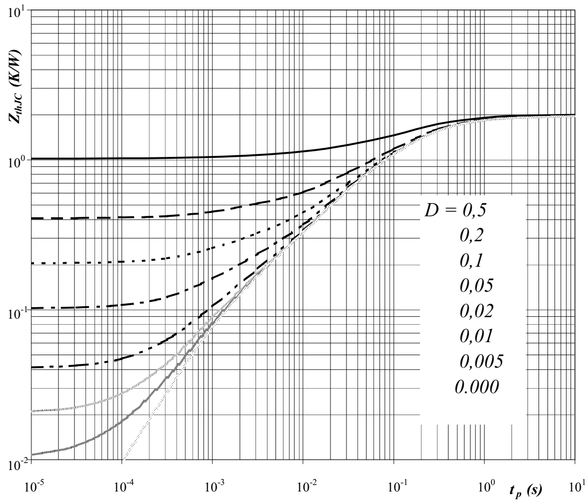
Input rectifier bridge

Figure 33. Typical diode forward current as a function of forward voltage
Rectifier diode IF=f(VF)



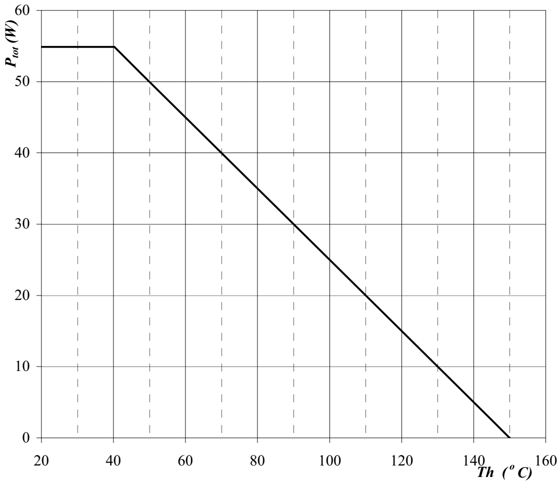
parameter: tp = 250 us

Figure 34. Diode transient thermal impedance as a function of pulse width
ZthJH = f(tp)



Parameter: D = tp / T RthJH= 2,0 K/W

Figure 35. Power dissipation as a function of heatsink temperature
Rectifier diode
Ptot = f (Th)



parameter: Tj = 150°C

Figure 36. Forward current as a function of heatsink temperature
Rectifier diode
IF = f (Th)

parameter: Tj = 150°C

Thermistor

Figure 37. Typical NTC characteristic as afunction of temperature

RT = f (T)