

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values	Unit
			max.	

Input Rectifier Bridge
Gleichrichter

Repetitive peak reverse voltage Periodische Rückw. Spitzensperrspannung		V_{RRM}	1600	V
Forward current per diode Dauergrenzstrom	DC current $T_h=80^\circ\text{C};$ $T_c=80^\circ\text{C}$	I_{FAV}	30 40-limited by wires	A
Surge forward current Stoßstrom Grenzwert	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I_{FSM}	200	A
I^2t -value Grenzlastintegral	$t_p=10\text{ms}$ $T_j=25^\circ\text{C}$	I^2t	200	A ² s
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}	37 54	W

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	16 20-limited by wires	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{cpuls}	32	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}	39 59	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	$T_j \leq 150^\circ\text{C}$ $V_{GE}=15\text{V}$ $V_{CE}=V_{CEBR}$	t_{SC}	10	us

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 20-limited by wires	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^\circ\text{C}$	I_{FRM}	31	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}	27 40	W

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values	Unit
			max.	

Transistor BRC
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	11 14	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	22	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}	27 41	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time Kurzschlußverhalten	$T_J \leq 150^{\circ}\text{C}$ $V_{GE}=15\text{V}$ $V_{CE}=600/1200\text{ V}$	t_{SC}	10	us

Diode BRC
Diode BRC

DC forward current Dauergleichstrom	$T_J=150^{\circ}\text{C}$ $T_h=80^{\circ}\text{C}$ $T_c=80^{\circ}\text{C}$	I_F	12 16	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	24	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}	23 35	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	$t=1\text{min}$	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			min 12,7	mm

flow PIM® 0, 1200V

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	

Input Rectifier Bridge

Gleichrichter

Forward voltage Durchlaßspannung	V _F	T _J =25°C T _J =125°C				30		1,22 1,21	1,45	V
Threshold voltage (for power loss calc. only) Schleusenspannung	V _{to}	T _J =25°C T _J =125°C				30		0,91 0,81		V
Slope resistance (for power loss calc. only) Ersatzwiderstand	r _t	T _J =25°C T _J =125°C				30		0,01 0,013		Ohm
Reverse current Sperrstrom	I _r	T _J =25°C T _J =150°C			1500				0,01 4	mA
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					1,95 1,29		K/W

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		1,89 2,19	2,35	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I _{CEs}	T _J =25°C T _J =125°C		0	1200				0,1 2	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I _{GES}	T _J =25°C T _J =125°C		20	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=40Ohm Rgoff=20Ohm	15	600	15		32		ns
Rise time Anstiegszeit	t _r	T _J =25°C T _J =125°C	Rgon=40Ohm Rgoff=20Ohm	15	600	15		20		ns
Turn-off delay time Abschaltverzögerungszeit	t _{d(off)}	T _J =25°C T _J =125°C	Rgon=40Ohm Rgoff=20Ohm	15	600	15		451		ns
Fall time Fallzeit	t _f	T _J =25°C T _J =125°C	Rgon=40Ohm Rgoff=20Ohm	15	600	15		276		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E _{on}	T _J =25°C T _J =125°C	Rgon=40Ohm Rgoff=20Ohm	15	600	15		1,61		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E _{off}	T _J =25°C T _J =125°C	Rgon=40Ohm Rgoff=20Ohm	15	600	15		2,19		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			0,058		nF
Reverse transfer capacitance Rückwirkungskapazität	C _{rss}	T _J =25°C T _J =125°C	f=1MHz	0	25			0,048		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 _{th,JH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,81 1,19		K/W

Diode Inverter

Diode Wechselrichter

Diode forward voltage Durchlaßspannung	V _F	T _J =25°C T _J =125°C				15		2,32 1,78	3	V
Peak reverse recovery current Rückstromspitze	I _{RRM}	T _J =25°C T _J =125°C	Rgon=40Ohm	15	600	15		31		A
Reverse recovery time Sperrverzögerungszeit	t _{rr}	T _J =25°C T _J =125°C	Rgon=40Ohm	15	600	15		355		ns
Reverse recovered charge Sperrverzögerungsladung	Q _{rr}	T _J =25°C T _J =125°C	Rgon=40Ohm	15	600	15		3,5		uC
Reverse recovered energy Sperrverzögerungsenergie	E _{rec}		Rgon=40Ohm	15	600	15		1,32		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					2,64 1,74		K/W

flow PIM® 0, 1200V

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 BRC

Transistor BRC

Gate emitter threshold voltage Gate-Schwellenspannung	$V_{GE(th)}$	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$V_{CE}=V_{GE}$			0,0003	5	5,8	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		15		10		1,87 2,19	2,7	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		0	1200				0,05 2	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		20	0				200	nA
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		34		ns
Rise time Anstiegszeit	t_r	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		20		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		442		ns
Fall time Fallzeit	t_f	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		284		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		0,92		uWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$ $R_{goff}=40\Omega$	15	600	10		1,47		uWs
Input capacitance Eingangskapazität	C_{iss}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$f=1\text{MHz}$	0	25			0,6		nF
Output capacitance Ausgangskapazität	C_{oss}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$f=1\text{MHz}$	0	25			0,037		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{ies}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$f=1\text{MHz}$	0	25			0,029		nF
Gate charge Gate Ladung	Q_{gate}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$		15	960	10		53		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61 \text{ W/mK}$					2,56		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip								1,69		

Diode BRC

Diode BRC

Diode forward voltage Durchlaßspannung	V_F	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$				10		1,8 1,79	2,5	V
Reverse current Sperrstrom	I_r	$T_j=25^{\circ}C$ $T_j=150^{\circ}C$			1200				250 700	uA
Reverse recovery time Sperreverzögerungszeit	t_{rr}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$	15	600	10		423		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$	15	600	10		2,1		uC
Reverse recovery energy Sperrverzögerungsenergie	E_{rec}	$T_j=25^{\circ}C$ $T_j=125^{\circ}C$	$R_{gon}=80\Omega$	15	600	10		0,88		uWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Wärmeleitpaste Dicke≤50um $\lambda = 0,61 \text{ W/mK}$					3,05		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip								2,01		

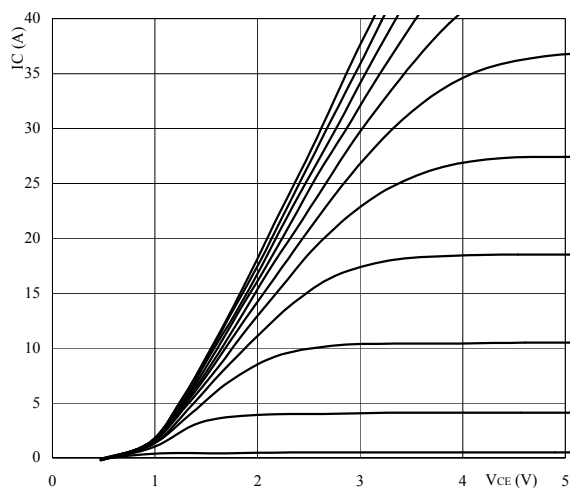
NTC-Thermistor

NTC-Widerstand

Rated resistance Nennwiderstand	R_{25}	$T_j=25^{\circ}C$	Tol. ±5%				20,9	22	23,1	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	$T_c=100^{\circ}C$	$R_{100}=1503\Omega$					2,9		%/K
Power dissipation given Epcos-Typ Verlustleistung Epcos-Typ angeben	P	$T_j=25^{\circ}C$						210		mW
B-value B-Wert	$B_{(25/100)}$	$T_j=25^{\circ}C$	Tol. ±3%					3980		K

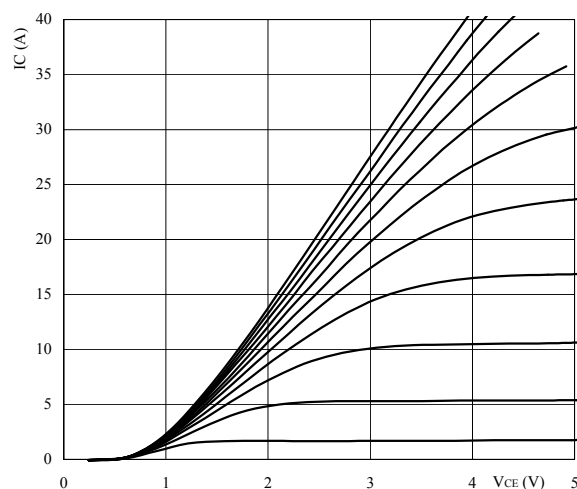
Output inverter

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



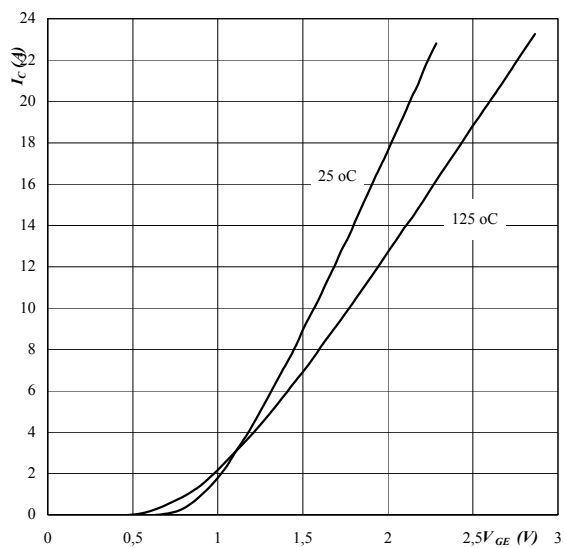
parameter: $t_p = 250 \mu s$ $T_j = 25^\circ C$
V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



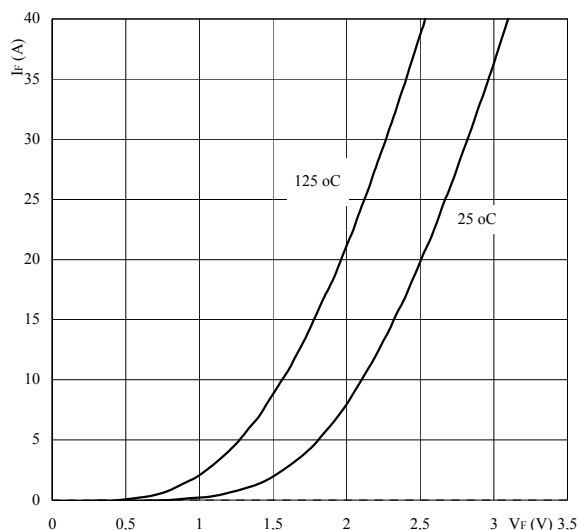
parameter: $t_p = 250 \mu s$ $T_j = 125^\circ C$
V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



parameter: $t_p = 250 \mu s$ $V_{CE} = 13 V$

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

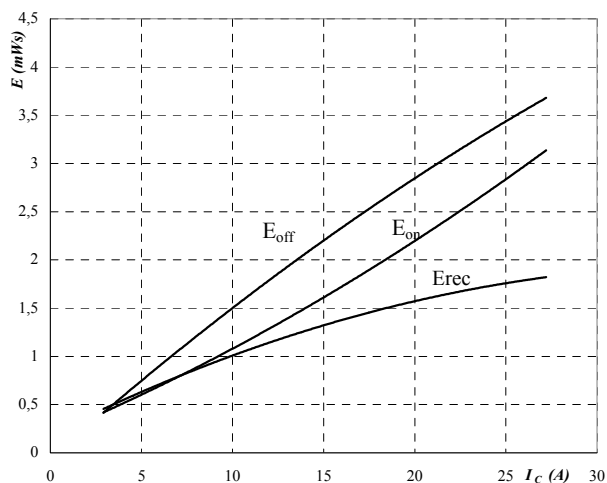


parameter: $t_p = 250 \mu s$

Output inverter

Figure 5. Typical switching energy losses as a function of collector current
Output inverter IGBT

$E = f(I_c)$



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

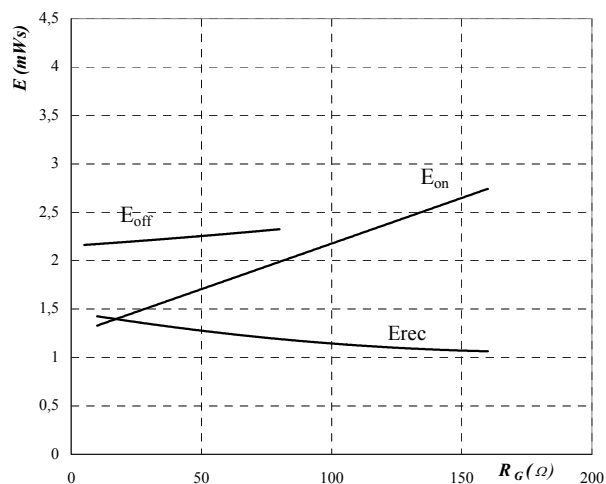
$V_{CE} = 600\text{ V}$

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

$R_{Gon} = 2 \cdot R_{Goff} = 40\ \Omega$

Figure 6. Typical switching energy losses as a function of gate resistor
Output inverter IGBT

$E = f(R_G)$



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

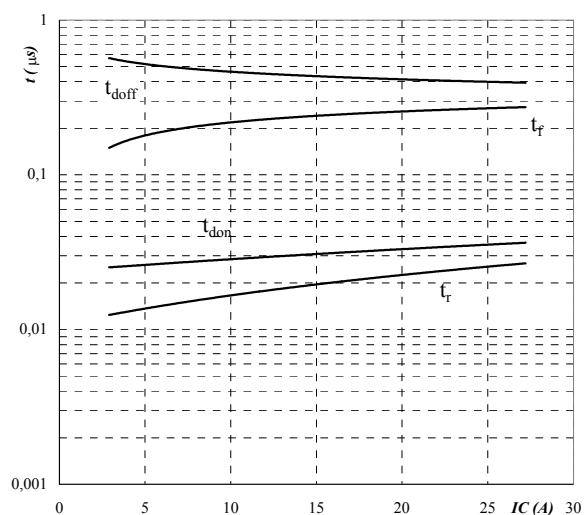
$V_{CE} = 600\text{ V}$

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

$I_c = 15\text{ A}$

Figure 7. Typical switching times as a function of collector current
Output inverter IGBT

$t = f(I_c)$



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

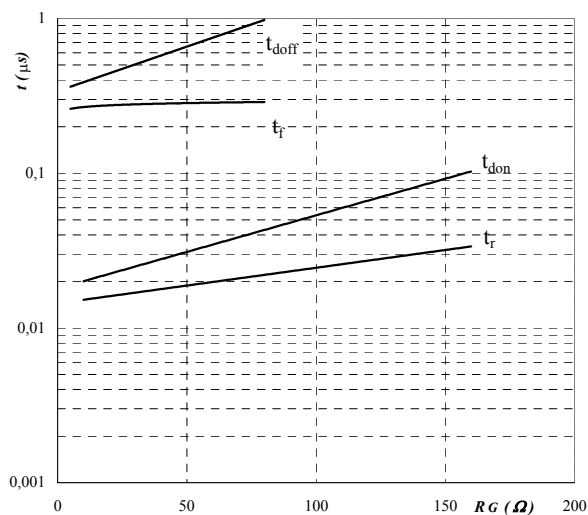
$V_{CE} = 600\text{ V}$

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

$R_{Gon} = 2 \cdot R_{Goff} = 40\ \Omega$

Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT

$t = f(R_G)$



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

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

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

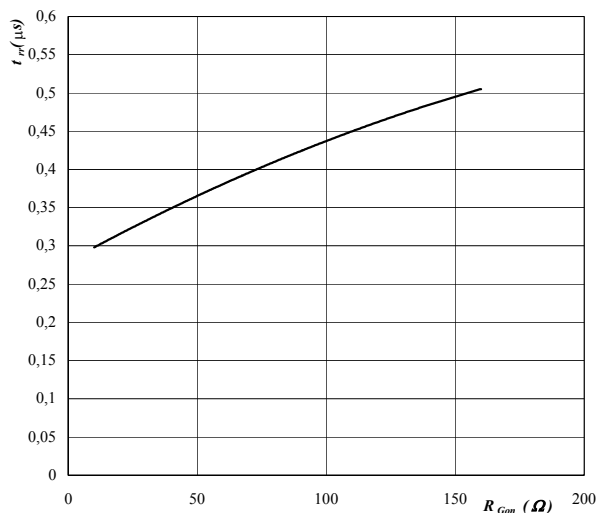
$I_c = 15\text{ A}$

Output inverter

Figure 9. Typical reverse recovery time as a function of IGBT turn on gate resistor

Output inverter FRED diode

$$t_{rr} = f(R_{gon})$$

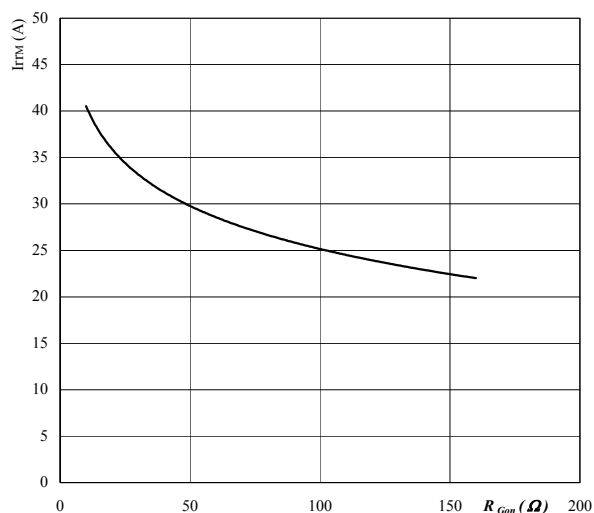


$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 15\text{ A}$

Figure 10. Typical reverse recovery current as a function of IGBT turn on gate resistor

Output inverter FRED diode

$$I_{RRM} = f(R_{gon})$$

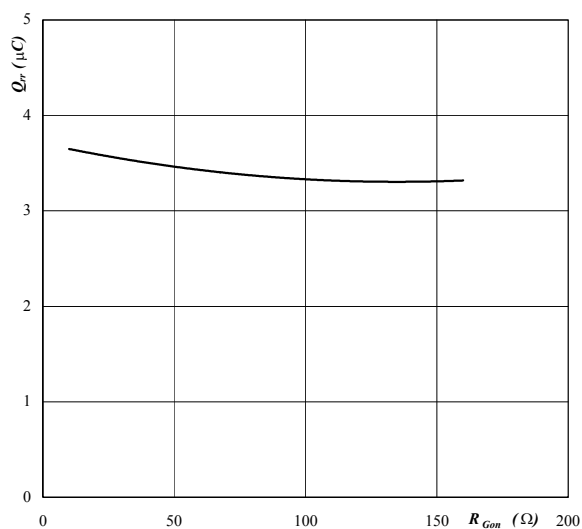


$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 15\text{ A}$

Figure 11. Typical reverse recovery charge as a function of IGBT turn on gate resistor

Output inverter FRED diode

$$Q_{rr} = f(R_{gon})$$

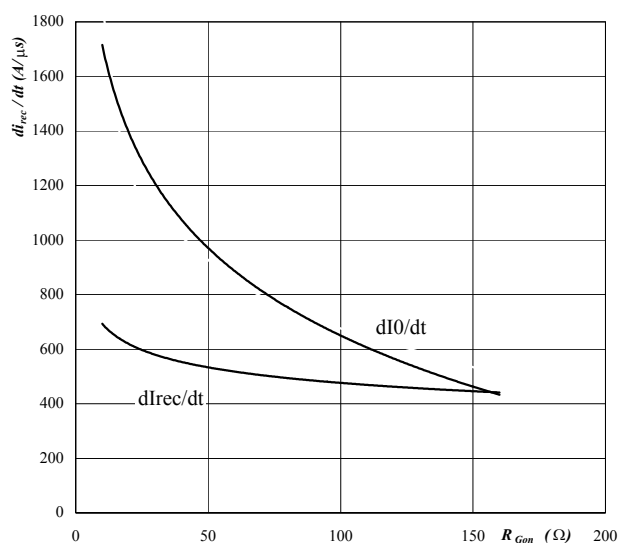


$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 15\text{ A}$

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

$$dI_0/dt, dI_{rec}/dt = f(R_{gon})$$

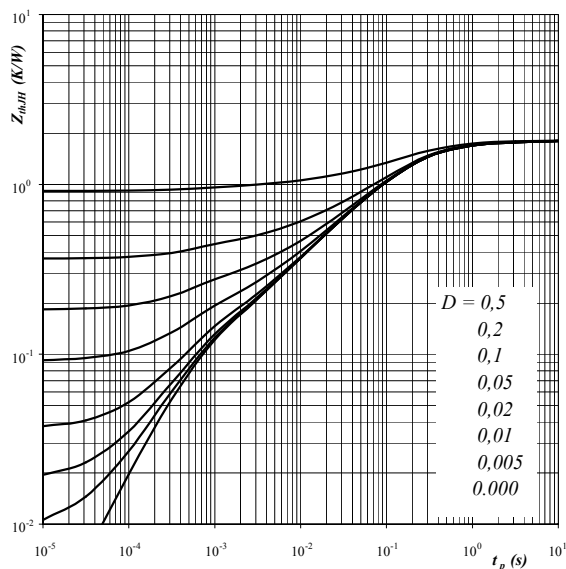


$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 15\text{ A}$

Output inverter

**Figure 13. IGBT transient thermal impedance
as a function of pulse width**

$$Z_{thJH} = f(t_p)$$

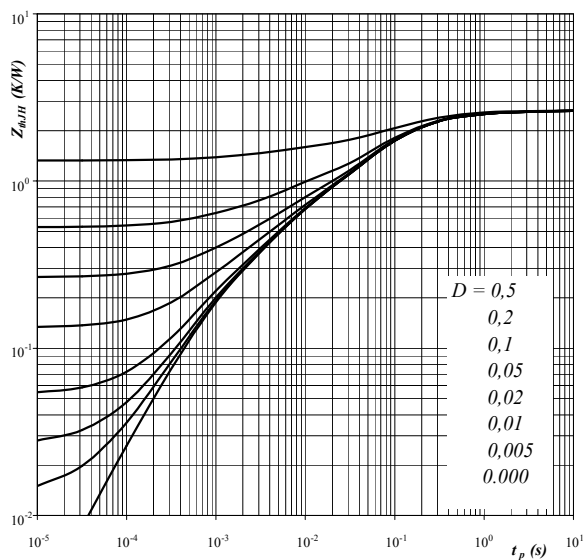


Parameter: $D = t_p / T$

$R_{thJH} \ 1,81 \text{ K/W}$

**Figure 14. FRED transient thermal impedance
as a function of pulse width**

$$Z_{thJH} = f(t_p)$$



Parameter: $D = t_p / T$

$R_{thJH} \ 2,64 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,03	5,5E+01
0,09	2,7E+00
0,32	4,6E-01
0,82	1,4E-01
0,34	2,8E-02
0,12	5,5E-03
0,10	6,2E-04
0,00	0,0E+00

FRED thermal model values

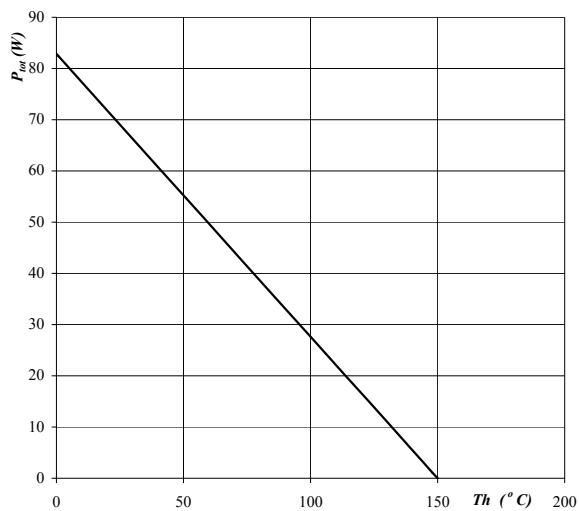
R (C/W)	Tau (s)
0,04	5,2E+01
0,16	1,8E+00
0,74	2,4E-01
1,17	6,3E-02
0,41	5,8E-03
0,14	7,8E-04
0,34	2,8E-04

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

$$P_{\text{tot}} = f(T_h)$$

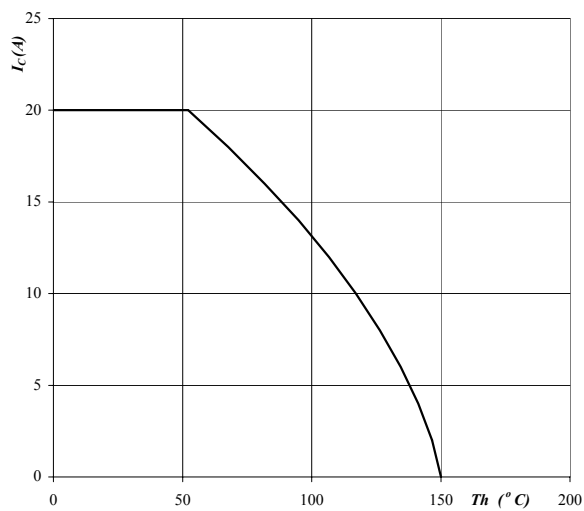


parameter: T_j = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

$$I_c = f(T_h)$$



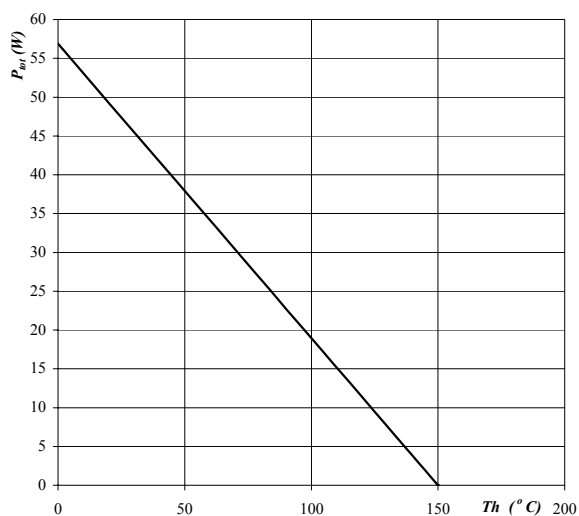
parameter: T_j = 150°C

V_{GE} = 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

$$P_{\text{tot}} = f(T_h)$$

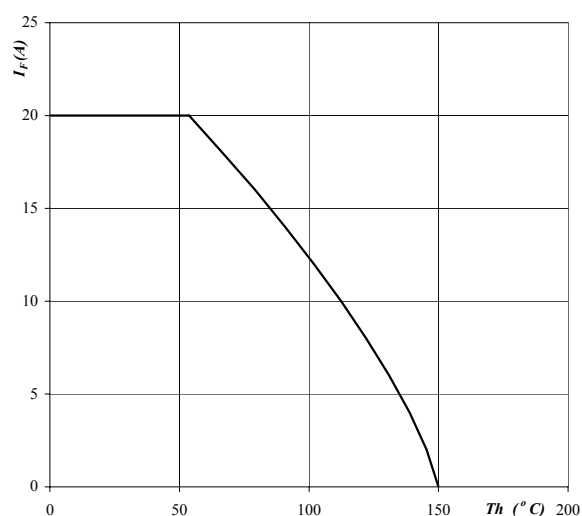


parameter: T_j = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

$$I_F = f(T_h)$$



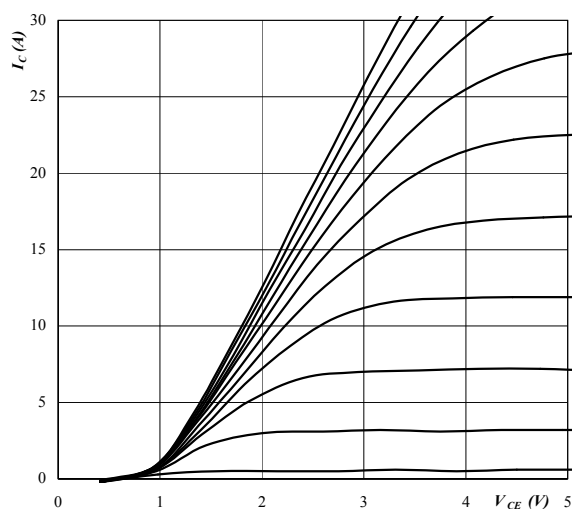
parameter: T_j = 150°C

Brake

Figure 19. Typical output characteristics

Brake IGBT

$I_C = f(V_{CE})$

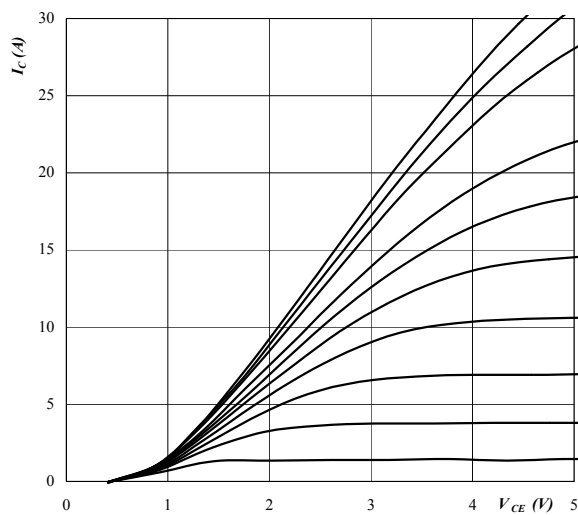


parameter: $t_p = 250 \mu s$ $T_j = 25 \text{ }^\circ C$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

Figure 20. Typical output characteristics

Brake IGBT

$I_C = f(V_{CE})$

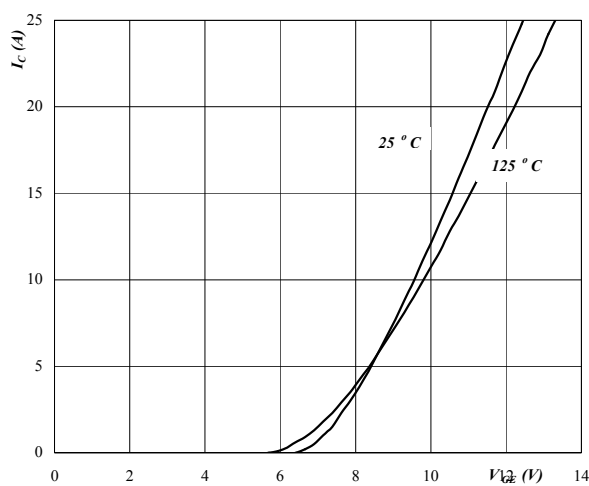


parameter: $t_p = 250 \mu s$ $T_j = 125 \text{ }^\circ C$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

Figure 21. Typical transfer characteristics

Brake IGBT

$I_C = f(V_{GE})$

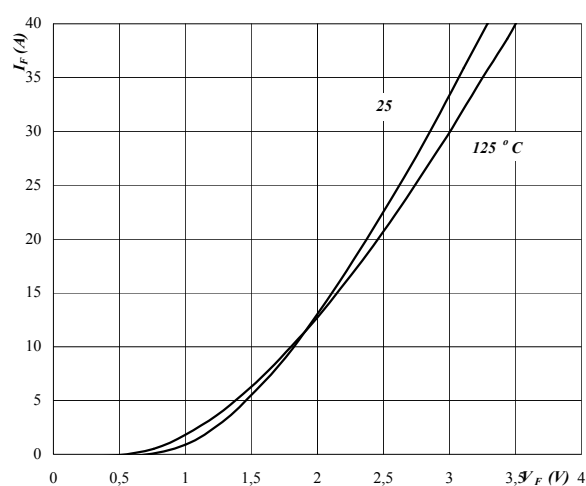


parameter: $t_p = 250 \mu s$ $V_{CE} = 10 \text{ V}$

Figure 22. Typical diode forward current as a function of forward voltage

Brake FRED

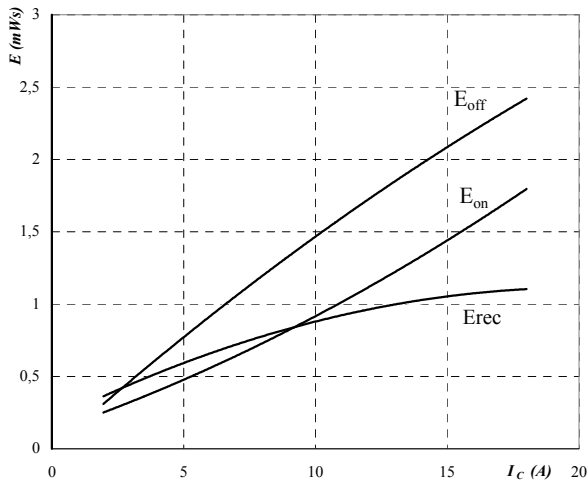
$I_F = f(V_F)$



parameter: $t_p = 250 \mu s$

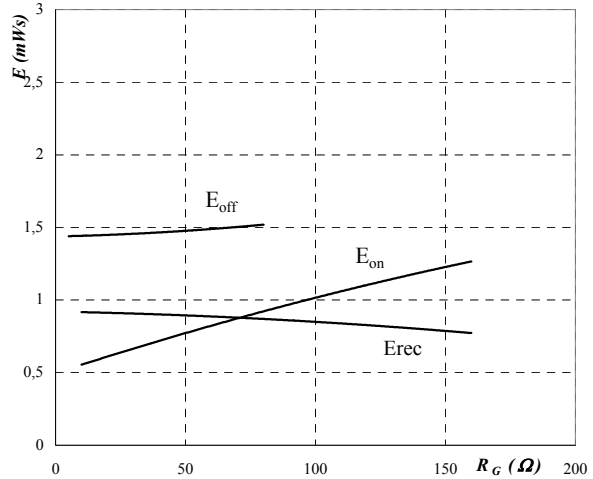
Brake

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



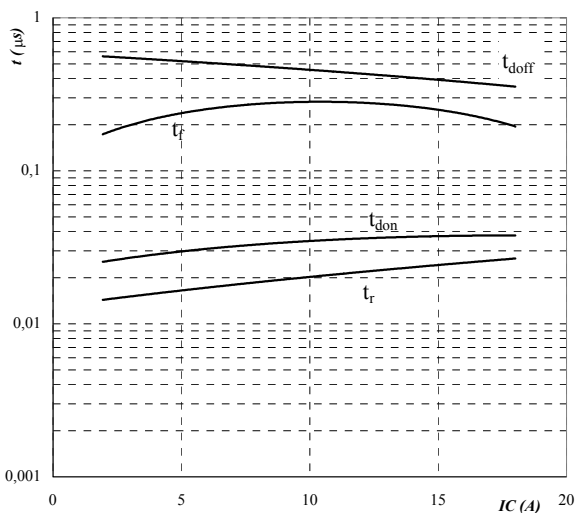
inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 2 \cdot R_{Goff} = 80\ \Omega$

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



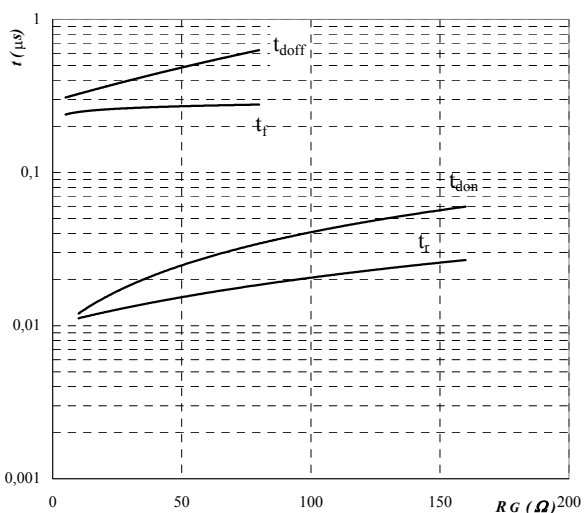
inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 10\text{ A}$

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



inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = 15\text{ V}$
 $R_{Gon} = 2 \cdot R_{Goff} = 80\ \Omega$

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



inductive load, $T_j = 125^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = 15\text{ V}$
 $I_c = 10\text{ A}$

Brake

Figure 27. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$

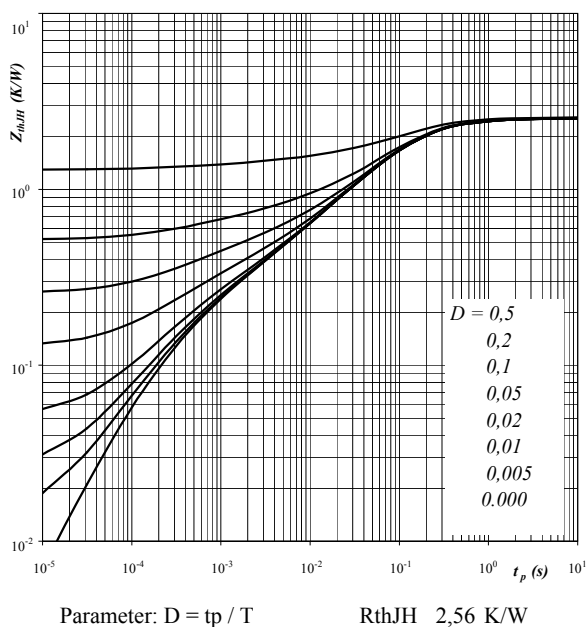


Figure 28. FRED transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$

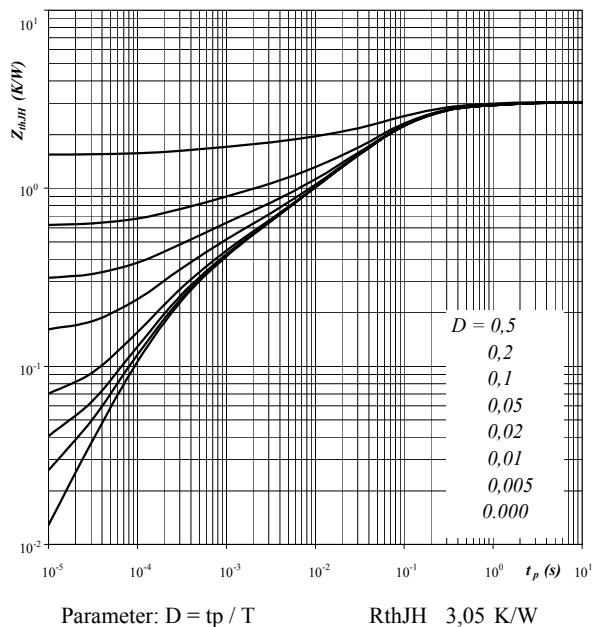


Figure 29. Power dissipation as a function of heatsink temperature
Brake IGBT
 $P_{tot} = f(T_h)$

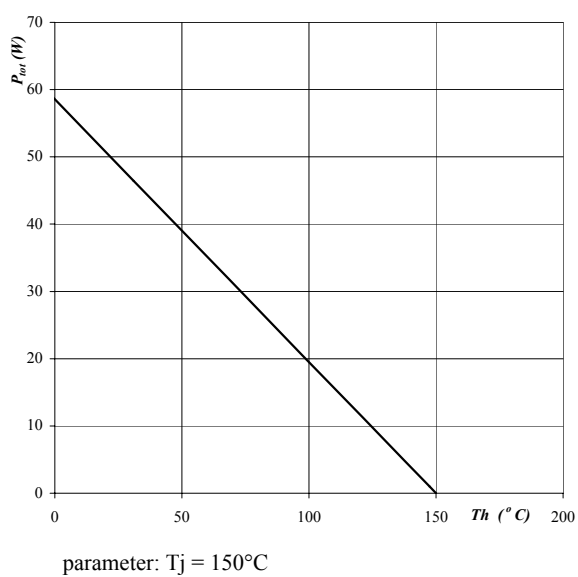
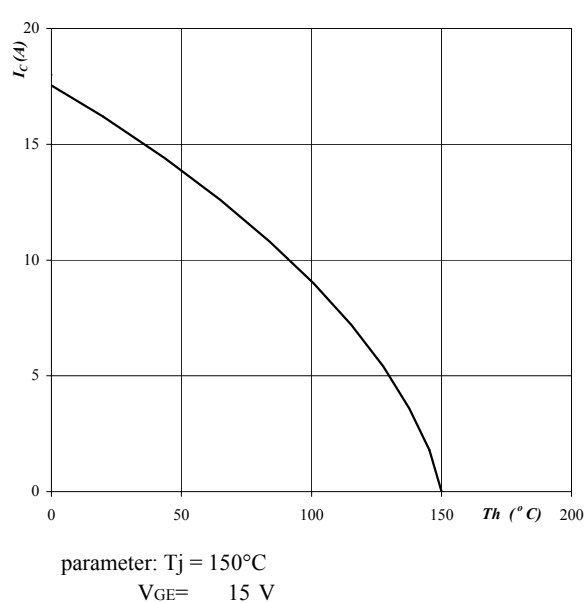
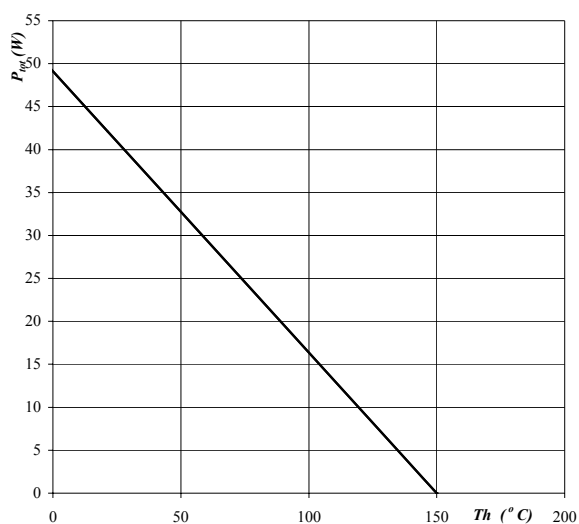


Figure 30. Collector current as a function of heatsink temperature
Brake IGBT
 $I_c = f(T_h)$



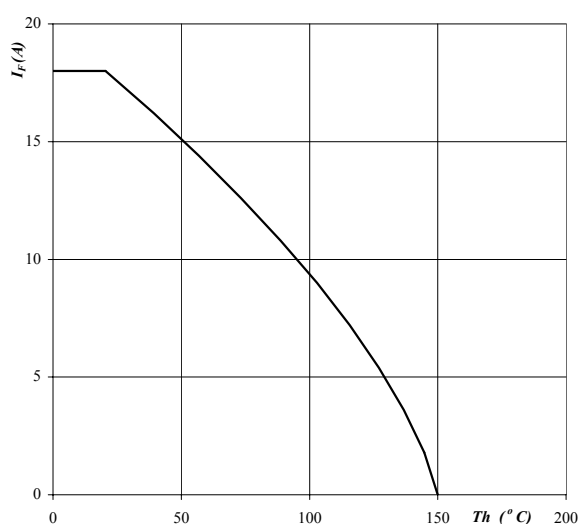
Brake

Figure 31. Power dissipation as a function of heatsink temperature
Brake FRED
 $P_{\text{tot}} = f(T_h)$



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

Figure 32. Forward current as a function of heatsink temperature
Brake FRED
 $I_F = f(T_h)$



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

Input rectifier bridge

Figure 33. Typical diode forward current as a function of forward voltage
Rectifier diode
 $I_F = f(V_F)$

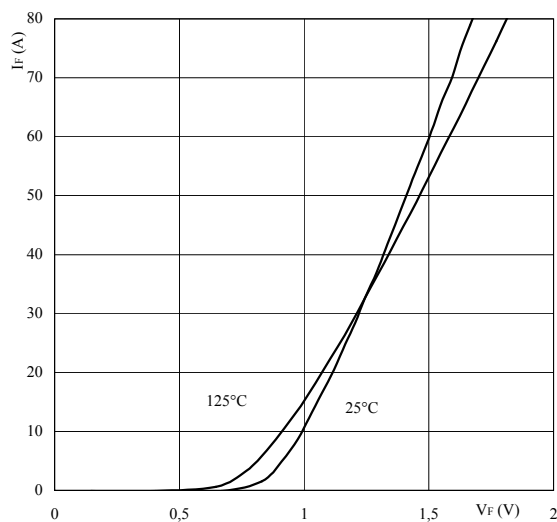


Figure 34. Diode transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$

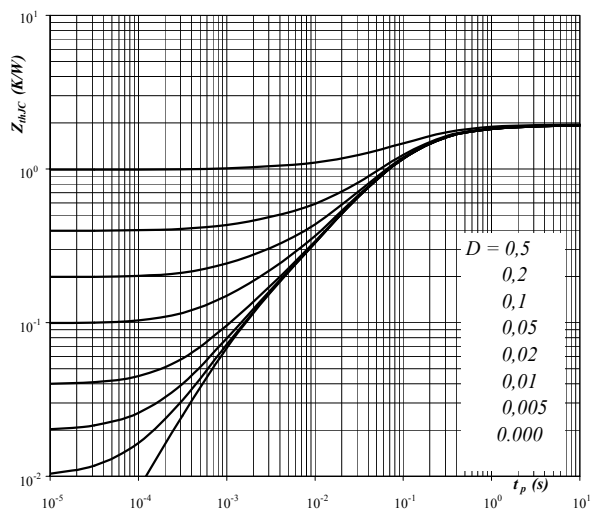


Figure 35. Power dissipation as a function of heatsink temperature
Rectifier diode
 $P_{tot} = f(T_h)$

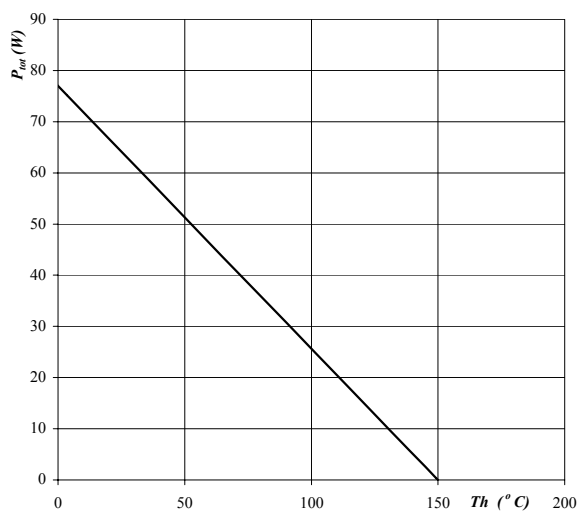
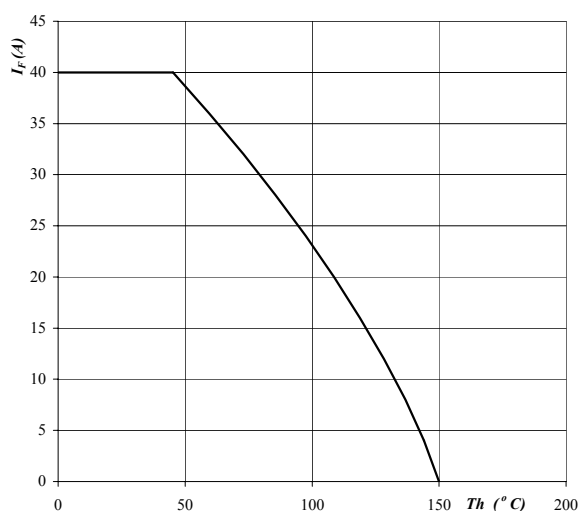


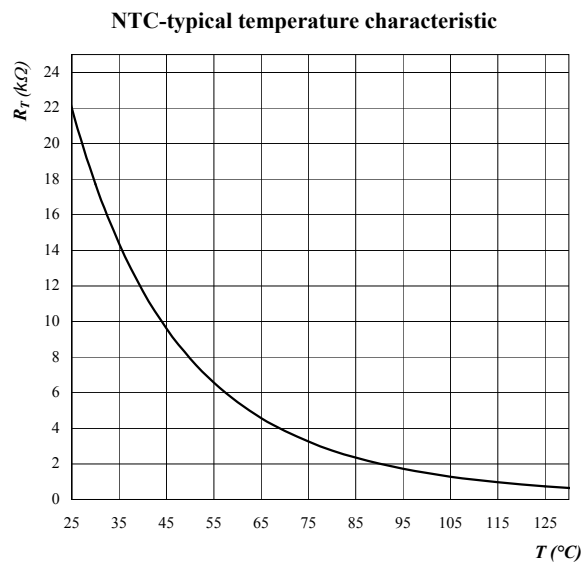
Figure 36. Forward current as a function of heatsink temperature
Rectifier diode
 $I_F = f(T_h)$



Thermistor

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

$$R_T = f(T)$$



Output inverter application

General conditions: 3 phase SPWM, $V_{geon} = 15 \text{ V}$ $V_{geoff} = 0 \text{ V}$ $R_{gon} = 40 \text{ ohms}$ $R_{goff} = 20 \text{ ohms}$

Figure 1. Typical average static loss as a function of output current
IGBT $P_{loss} = f(I_{out})$

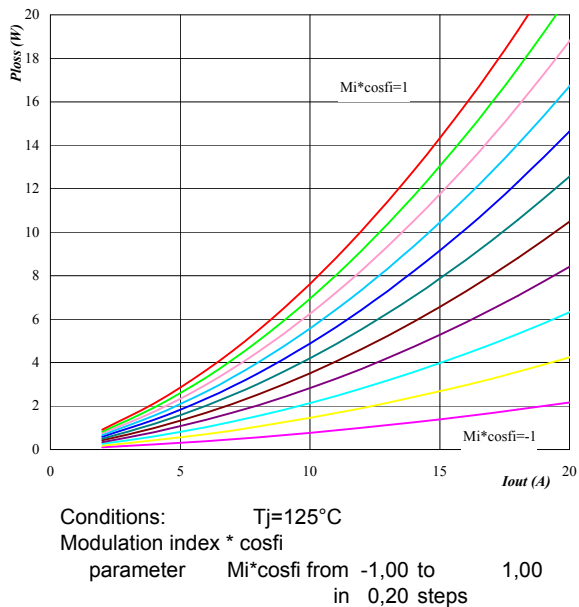


Figure 2. Typical average static loss as a function of output current
FRED $P_{loss} = f(I_{out})$

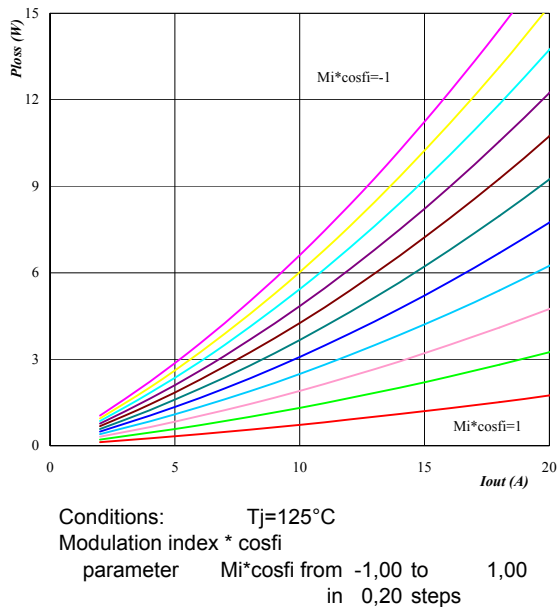


Figure 3. Typical average switching loss as a function of output current
IGBT $P_{loss} = f(I_{out})$

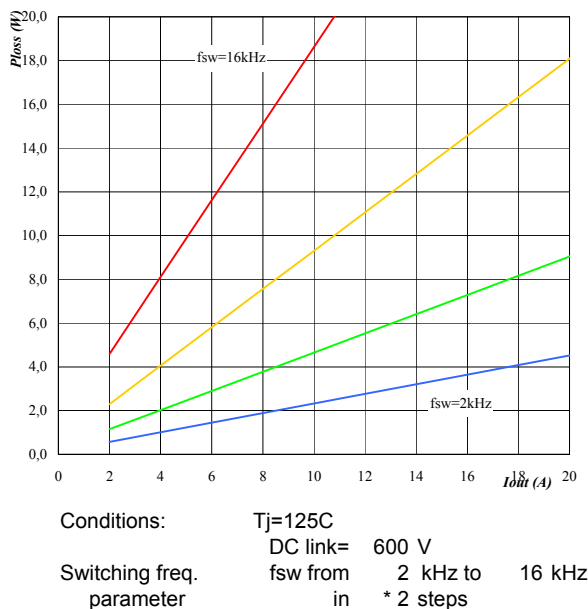
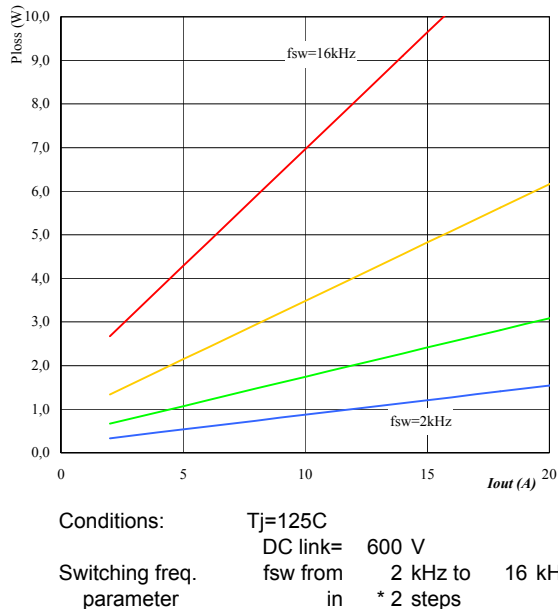


Figure 4. Typical average switching loss as a function of output current
FRED $P_{loss} = f(I_{out})$

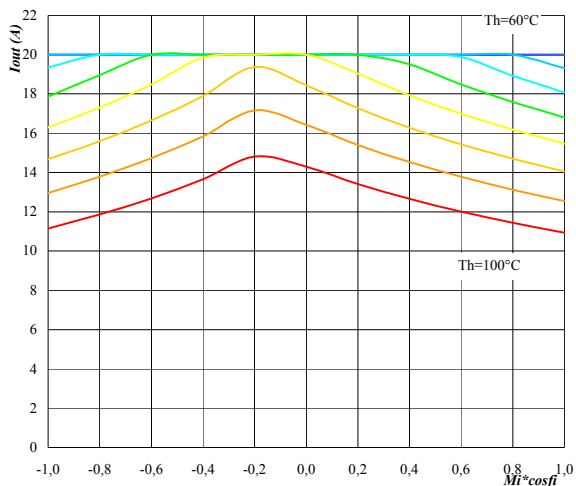


Output inverter application

General conditions: 3 phase SPWM, $V_{geon} = 15 \text{ V}$ $V_{geoff} = 0 \text{ V}$ $R_{gon} = 40 \text{ ohms}$ $R_{goff} = 20 \text{ ohms}$

Figure 5. Typical available 50Hz output current as a function of $Mi \cdot \cos \phi_i$

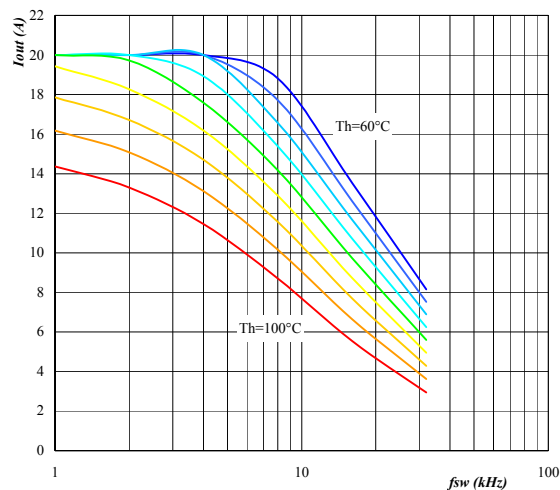
Phase $I_{out} = f(Mi \cdot \cos \phi_i)$



Conditions: $T_j = 125^\circ\text{C}$
DC link= 600 V
fsw= 4 kHz
Heatsink temp. T_h from 60 °C to 100 °C
parameter in 5 °C steps

Figure 6. Typical available 50Hz output current as a function of switching frequency

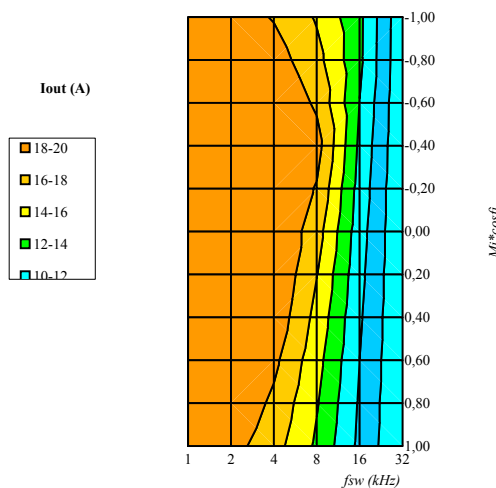
Phase $I_{out} = f(f_{sw})$



Conditions: $T_j = 125^\circ\text{C}$
DC link= 600 V
 $Mi \cdot \cos \phi_i = 0.8$
Heatsink temp. T_h from 60 °C to 100 °C
parameter in 5 °C steps

Figure 7. Typical available 50Hz output current as a function of $Mi \cdot \cos \phi_i$ and fsw

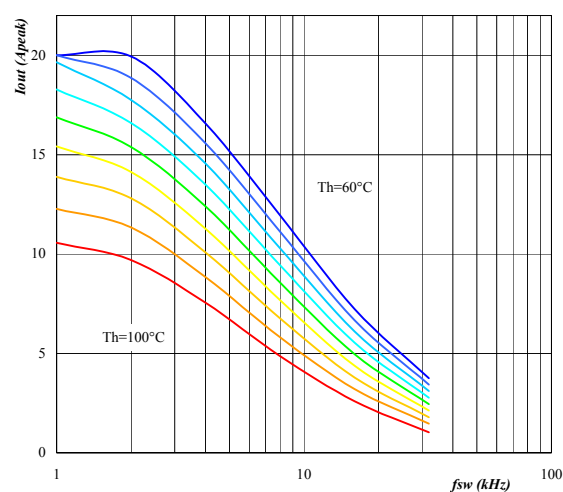
Phase $I_{out} = f(f_{sw}, Mi \cdot \cos \phi_i)$



Conditions: $T_j = 125^\circ\text{C}$
DC link= 600 V
 $T_h = 80^\circ\text{C}$

Figure 8. Typical available 0Hz output current as a function of switching frequency

Phase $I_{outpeak} = f(f_{sw})$



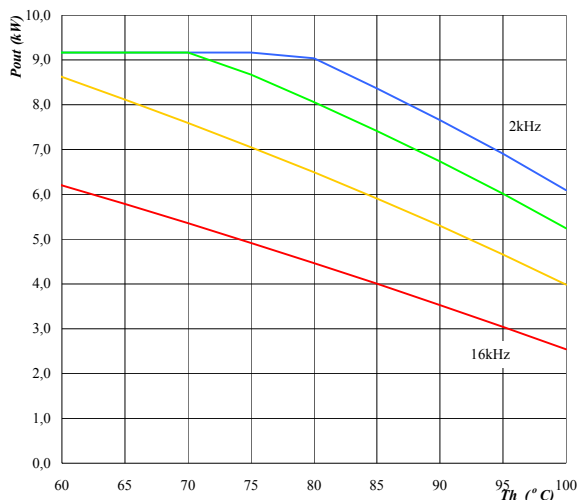
Conditions: $T_j = 125^\circ\text{C}$
DC link= 600 V
Heatsink temp. T_h from 60 °C to 100 °C
parameter in 5 °C steps

Output inverter application

General conditions: 3 phase SPWM, $V_{geon} = 15 \text{ V}$ $V_{geoff} = 0 \text{ V}$ $R_{gon} = 40 \text{ ohms}$ $R_{goff} = 20 \text{ ohms}$

Figure 9. Typical available electric peak output power as a function of heatsink temperature

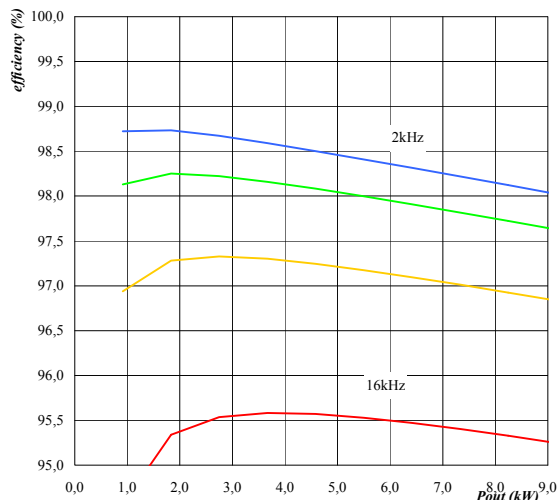
Inverter $P_{out} = f(T_h)$



Conditions: $T_j = 125^\circ\text{C}$
 DC link = 600 V
 Modulation index $M_i = 1$
 $\cos\phi = 0,80$
 Switching freq. parameter fsw from 2 kHz to 16 kHz in * 2 steps

Figure 10. Typical efficiency as a function of output power

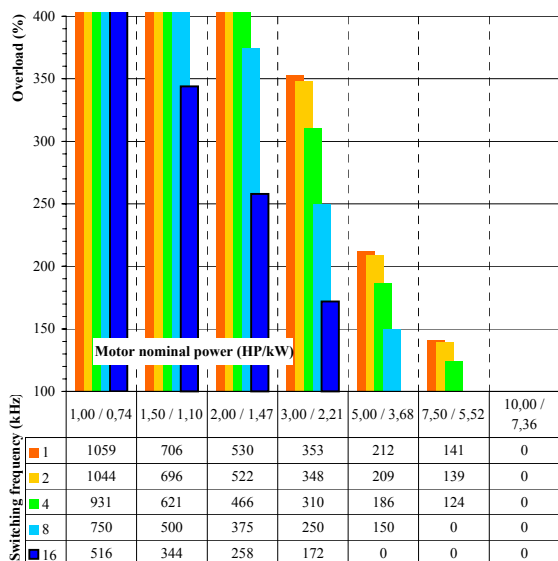
Inverter $\text{efficiency} = f(P_{out})$



Conditions: $T_j = 125^\circ\text{C}$
 DC link = 600 V
 Modulation index $M_i = 1$
 $\cos\phi = 0,80$
 Switching freq. parameter fsw from 2 kHz to 16 kHz in * 2 steps

Figure 11. Typical available overload factor as a function of motor power and switching frequency

Inverter $P_{peak}/P_{nom} = f(P_{nom}, f_{sw})$



Conditions: $T_j = 125^\circ\text{C}$
 DC link = 600 V
 Modulation index $M_i = 1$
 $\cos\phi = 0,8$
 Switching freq. parameter fsw from 1 kHz to 16 kHz in * 2 steps
 Heatsink temperature = 80 °C
 Motor efficiency = 0,85