tyco Electronics

***fast* PIM 1 H, 600V** version 0403

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;	I_{FAV}	50	A
Surge forward current Stoßstrom Grenzwert	t_p=10ms	T_j=25°C	I_{FSM}	300	A
I^2t-value Grenzlastintegral	t_p=10ms	T_j=25°C	I^2t	450	A^2s
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	56	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,	I_C	40	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	t_p=1ms	T_h=80°C	I_{cpuls}	80	A
Power dissipation per IGBT Verlustleistung pro IGBT	T_j=150°C	T_h=80°C	P_{tot}	75	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung			V_{GE}	±20	V
SC withstand time Kurzschlußverhalten	Tj=125°C Vce=390V	V_{GE}=15V	t_{SC}	5	us
Diode Inverter **Diode Wechselrichter**					
DC forward current Dauergleichstrom	T_j=150°C	T_h=80°C,	I_F	38	A
Repetitive peak forward current Periodischer Spitzenstrom	t_p=1ms	T_h=80°C	I_{FRM}	77	A
Power dissipation per Diode Verlustleistung pro Diode	T_j=150°C	T_h=80°C	P_{tot}	46	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

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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	
Input Rectifier Bridge										
Gleichrichter										
Forward voltage	V_F	Tj=25°C				80		1,32	1,5	V
Durchlaßpannung		Tj=125°C						1,33		
Threshold voltage (for power loss calc. only)	V_{to}	Tj=25°C				80		0,94		V
Schleusenspannung		Tj=125°C						0,82		
Slope resistance (for power loss calc. only)	r_t	Tj=25°C				80		0,005		Ohm
Ersatzwiderstand		Tj=125°C						0,006		
Reverse current	I_r	Tj=25°C			1200				0,01	mA
Sperrstrom		Tj=150°C						3	4	
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,26		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip										
Transistor Inverter, inductive load										
Transistor Wechselrichter										
Gate emitter threshold voltage	$V_{GE(th)}$	Tj=25°C	VCE=VGE			0,00025	4,5	5,2	7	V
Gate-Schwellenspannung		Tj=125°C								
Collector-emitter saturation voltage	$V_{CE(sat)}$	Tj=25°C		15		30		1,87	2,7	V
Kollektor-Emitter Sättigungsspannung		Tj=125°C						1,55		
Collector-emitter cut-off	I_{CES}	Tj=25°C		0	600				0,25	mA
Kollektor-Emitter Reststrom		Tj=125°C							4	
Gate-emitter leakage current	I_{GES}	Tj=25°C		20	0				300	nA
Gate-Emitter Reststrom		Tj=125°C								
Turn-on delay time	$t_{d(on)}$	Tj=25°C	Rgon=4 Ohm	15	300	30				ns
Einschaltverzögerungszeit		Tj=125°C	Rgoff=1 Ohm					33		
Rise time	t_r	Tj=25°C	Rgon=4 Ohm	15	300	30				ns
Anstiegszeit		Tj=125°C	Rgoff=1 Ohm					10		
Turn-off delay time	$t_{d(off)}$	Tj=25°C	Rgon=4 Ohm	15	300	30				ns
Abschaltverzögerungszeit		Tj=125°C	Rgoff=1 Ohm					153		
Fall time	t_f	Tj=25°C	Rgon=4 Ohm	15	300	30				ns
Fallzeit		Tj=125°C	Rgoff=1 Ohm					39		
Turn-on energy loss per pulse	E_{on}	Tj=25°C	Rgon=4 Ohm	15	300	30				mWs
Einschaltverlustenergie pro Puls		Tj=125°C	Rgoff=1 Ohm					0,486		
Turn-off energy loss per pulse	E_{off}	Tj=25°C	Rgon=4 Ohm	15	300	30				mWs
Abschaltverlustenergie pro Puls		Tj=125°C	Rgoff=1 Ohm					0,503		
Input capacitance	C_{ies}	Tj=25°C	f=1MHz	0	25			4		nF
Eingangskapazität		Tj=125°C								
Output capacitance	C_{oss}	Tj=25°C	f=1MHz	0	25			0,4		nF
Ausgangskapazität		Tj=125°C								
Reverse transfer capacitance	C_{rss}	Tj=25°C	f=1MHz	0	25			0,2		nF
Rückwirkungskapazität		Tj=125°C								
Gate charge	Q_{Gate}	Tj=25°C		15	300	30		225	270	nC
Gate Ladung		Tj=125°C								
Thermal resistance chip to heatsink per chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,94		K/W
Wärmewiderstand Chip-Kühlkörper pro Chip										

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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	
Diode Inverter **Diode Wechselrichter**										
Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				30		1,4 1,16	2,15	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=4 Ohm	15	300	30		 82,2		A
Reverse recovery time Sperreverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=4 Ohm	15	300	30		 51		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=4 Ohm	15	300	30		 2,6		uC
Reverse recovered energy Sperrverzögerungsenergie	Erec	Tj=25°C Tj=125°C	Rgon=4 Ohm	15	300	30		 0,485		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um Warmeleitpaste Dicke≤50um λ = 0,61 W/mK					1,53		K/W
NTC-Thermistor **NTC-Widerstand**										
Rated resistance Nennwiderstand	R_{25}	Tj=25°C	Tol. ±5%				9,5	10	10,5	kOhm
Deviation of R100 Abweichung von R100	$D_{R/R}$	Tc=100°C	R100=1503W					3,4		%/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%					4500		K

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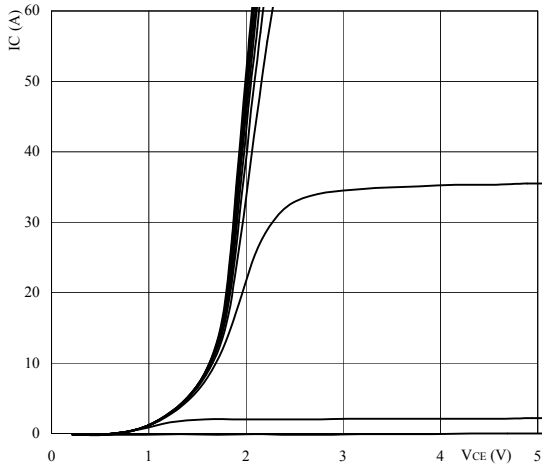
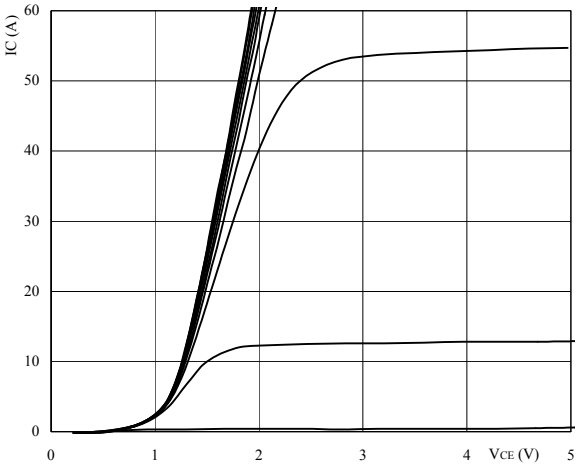
Output inverter

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



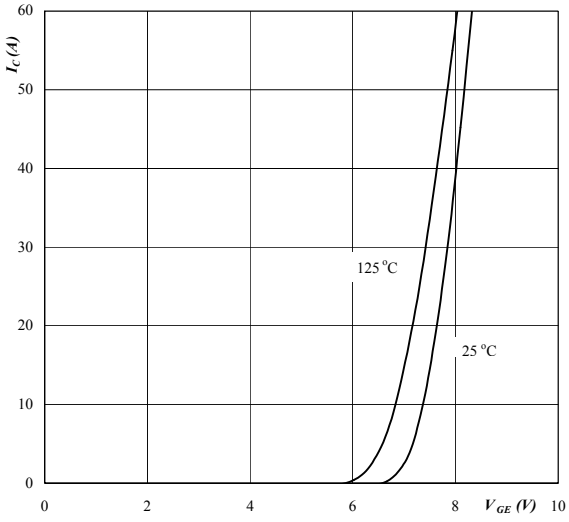
parameter: tp = 250 ms Tj = 25 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



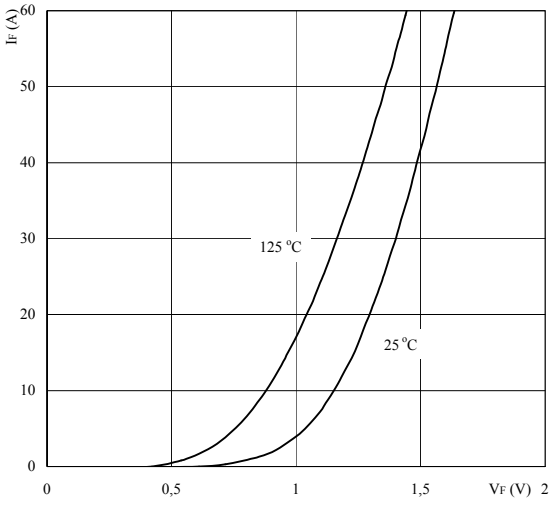
parameter: tp = 250 ms Tj = 125 °C
VGE parameter: from: 6 V to 16 V
in 1 V steps

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



parameter: tp = 250 ms VCE = 8 V

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



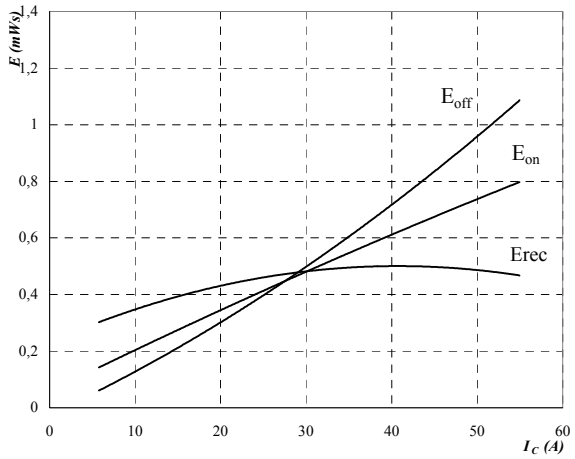
parameter: tp = 250 ms

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

V_{CE} = 300 V

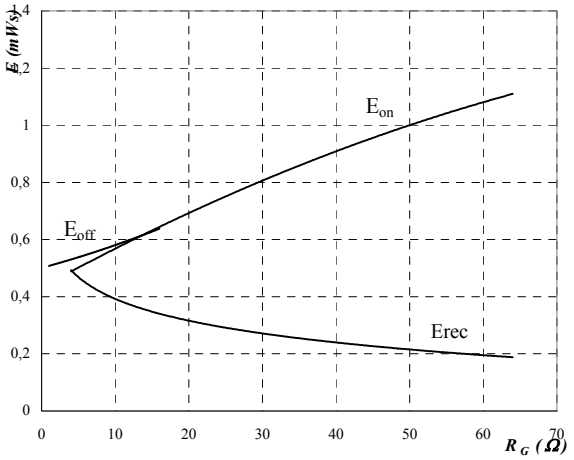
V_{GE} = 15 V

$R_{Gon} = 4*R_{Goff}$ = 4 Ohm

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

Output inverter IGBT

E = f (RG)



inductive load, Tj = 125 °C

V_{CE} = 300 V

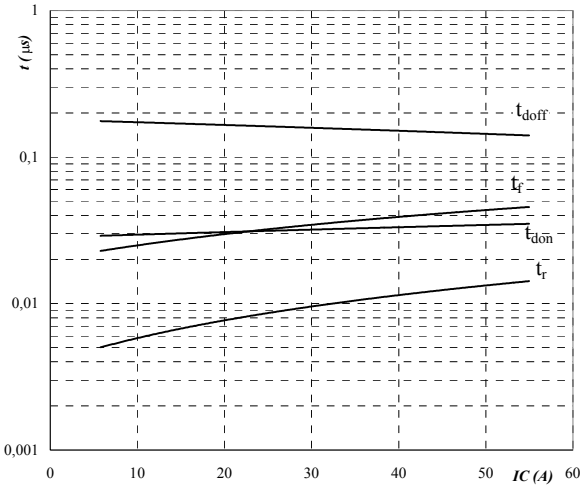
V_{GE} = 15 V

Ic = 30 A

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

Output inverter IGBT

t = f (Ic)



inductive load, Tj = 125 °C

V_{CE} = 300 V

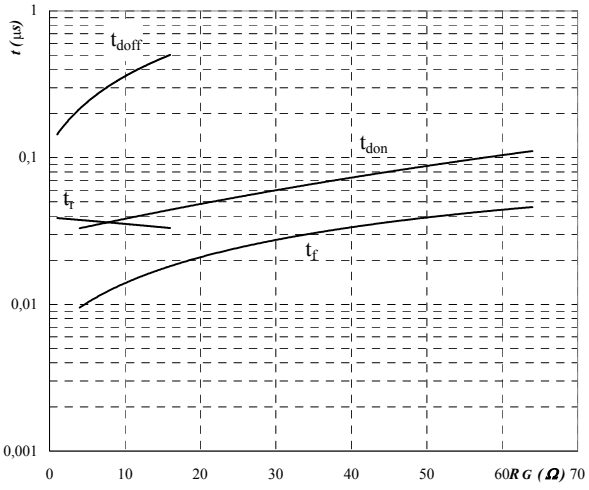
V_{GE} = 15 V

$R_{Gon} = 4*R_{Goff}$ = 4 Ohm

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

Output inverter IGBT

t = f (RG)



inductive load, Tj = 125 °C

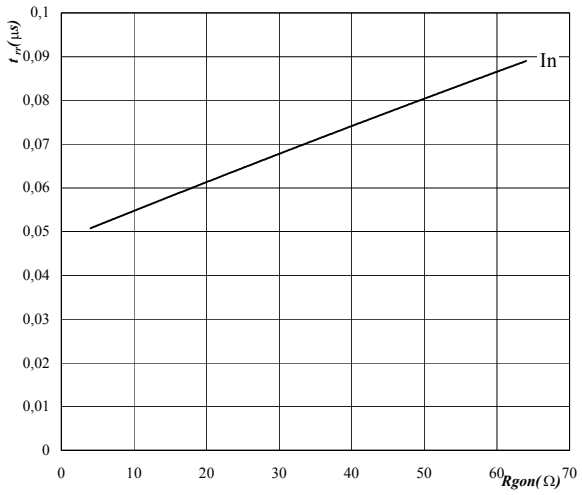
V_{CE} = 300 V

V_{GE} = 15 V

Ic = 30 A

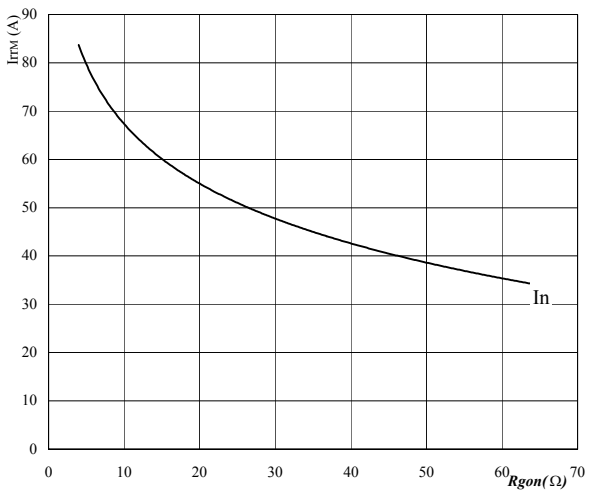
Output inverter

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



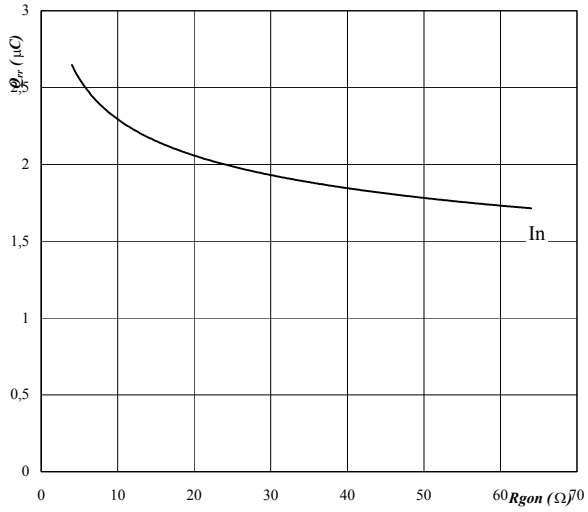
Tj = 125 °C
V_R = 300 V
In= 30 A

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



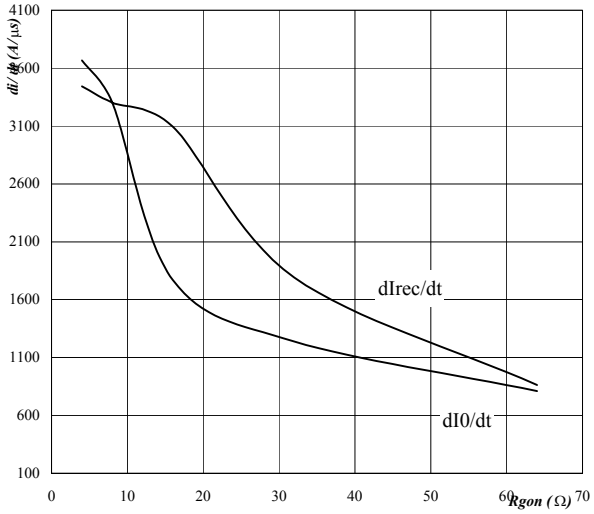
Tj = 125 °C
V_R = 300 V
In= 30 A

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



Tj = 125 °C
V_R = 300 V
In= 30 A

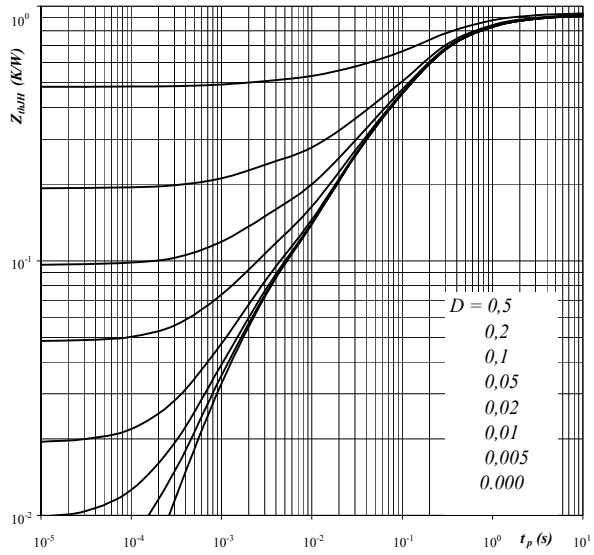
Figure 12. Typical diode peak rate of fall of forward and reverse recovery current as a function of gate resistor
Output inverter FRED diode
di0/dt,dIrec/dt= f (Rgon)



Tj = 125 °C
V_R = 300 V
I_F = 30 A

Output inverter

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

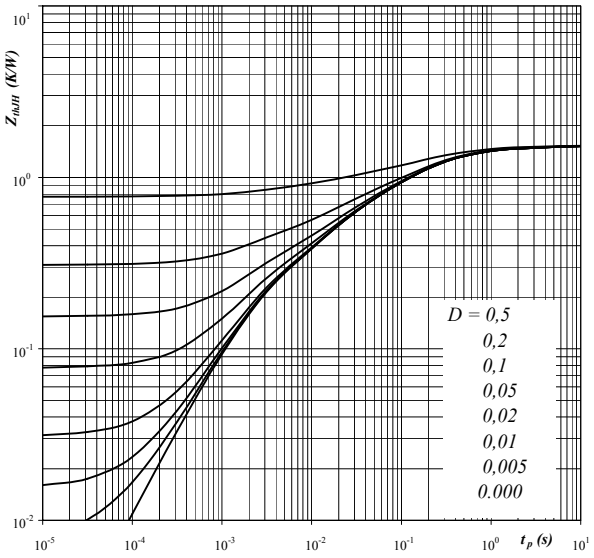


Parameter: D = tp / T RthJH= 0,94 K/W

IGBT thermal model values

R (C/W)	Tau (s)
0,04	1,5E+02
0,05	6,0E+00
0,19	7,6E-01
0,47	1,6E-01

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



Parameter: D = tp / T RthJH= 1,53 K/W

FRED thermal model values

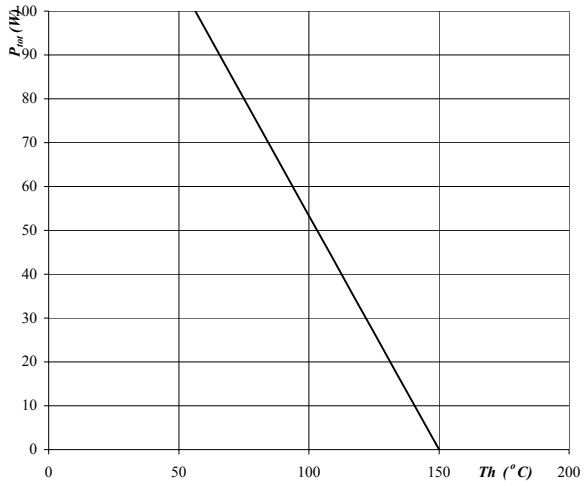
R (C/W)	Tau (s)
0,02	3,6E+02
0,08	3,3E+00
0,38	4,1E-01
0,52	1,0E-01

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

Output inverter IGBT

Ptot = f (Th)

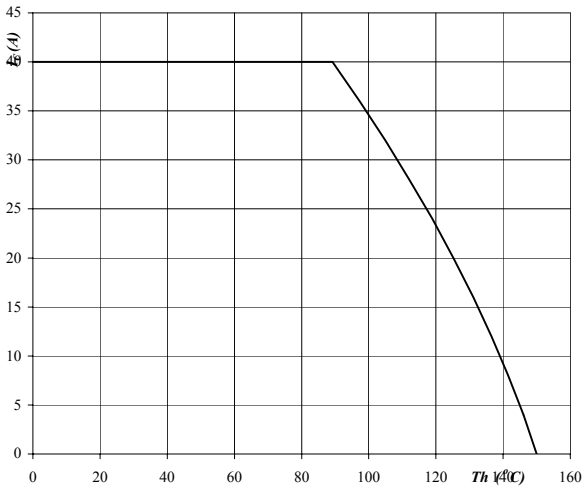


parameter: Tj = 150°C

Figure 16. Collector current as a function of heatsink temperature

Output inverter IGBT

Ic = f (Th)



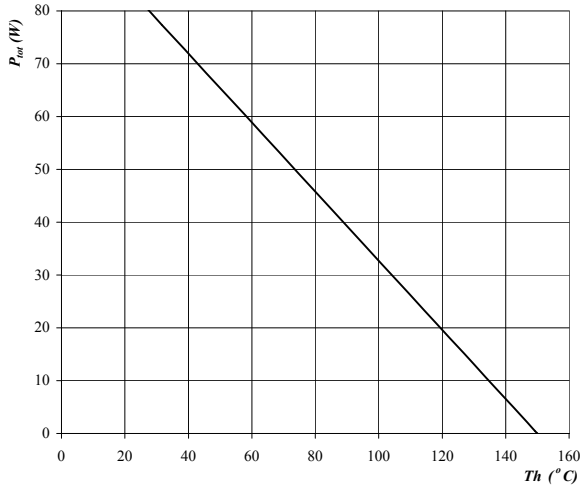
parameter: Tj = 150°C

V_{GE}= 15 V

Figure 17. Power dissipation as a function of heatsink temperature

Output inverter FRED

Ptot = f (Th)

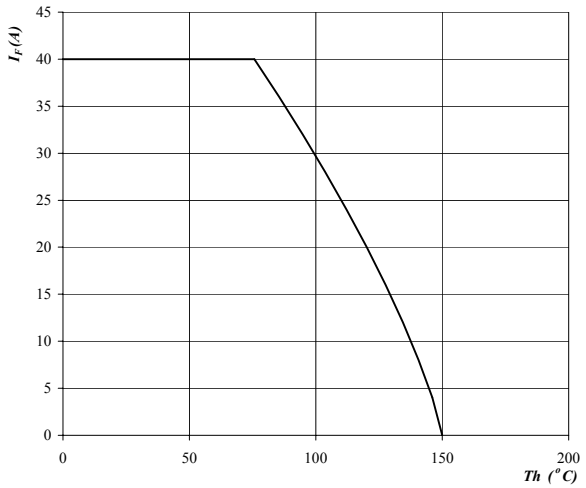


parameter: Tj = 150°C

Figure 18. Forward current as a function of heatsink temperature

Output inverter FRED

IF = f (Th)

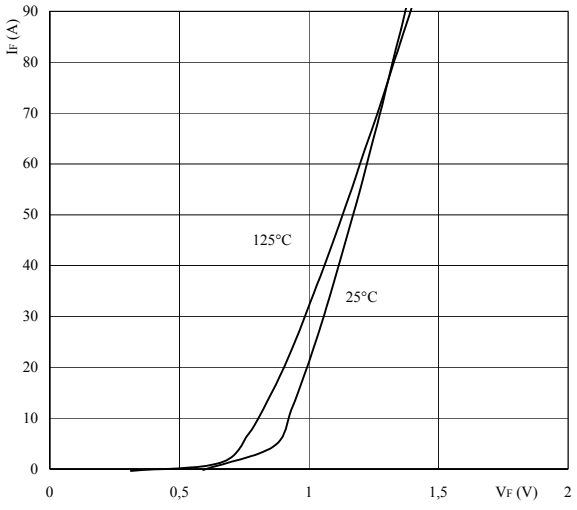


parameter: Tj = 150°C

Input rectifier bridge

Figure 19. Typical diode forward current as a function of forward voltage

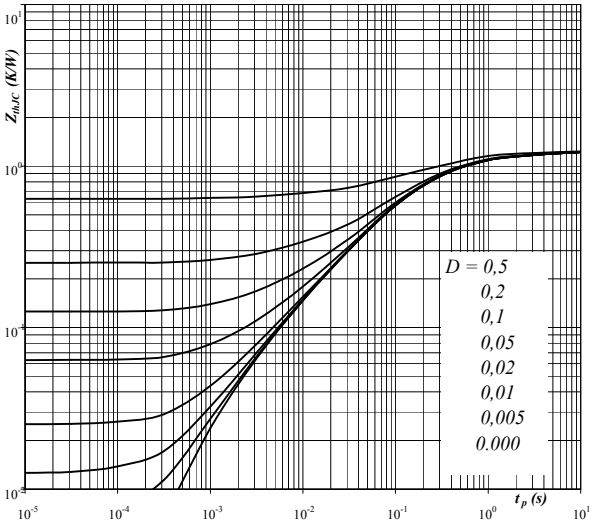
Rectifier diode IF=f(VF)



parameter: tp = 250 ms

Figure 20. Diode transient thermal impedance as a function of pulse width

ZthJH = f(tp)

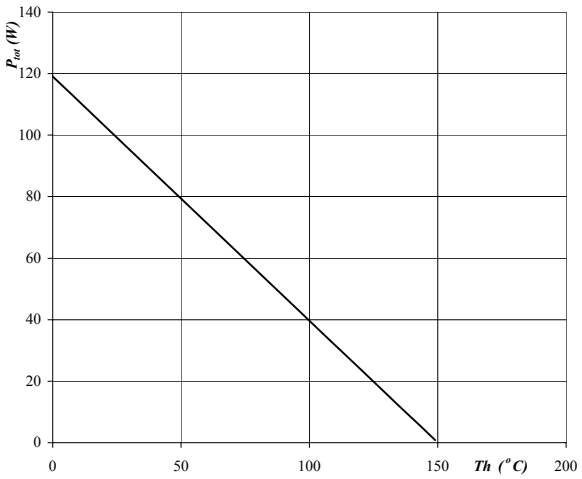


Parameter: D = tp / T RthJH= 1,26 K/W

Figure 21. Power dissipation as a function of heatsink temperature

Rectifier diode

Ptot = f (Th)

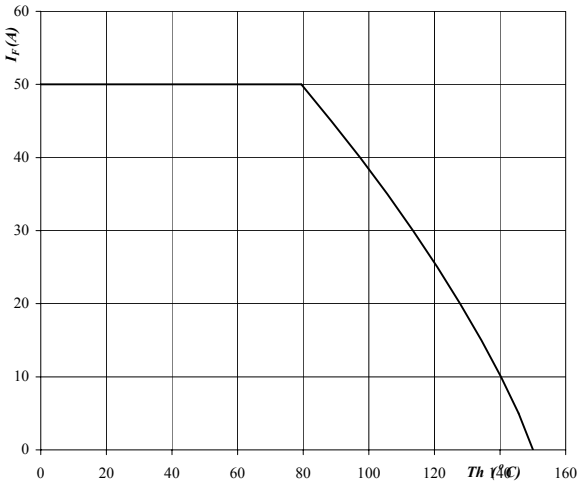


parameter: Tj = 150°C

Figure 22. Forward current as a function of heatsink temperature

Rectifier diode

IF = f (Th)



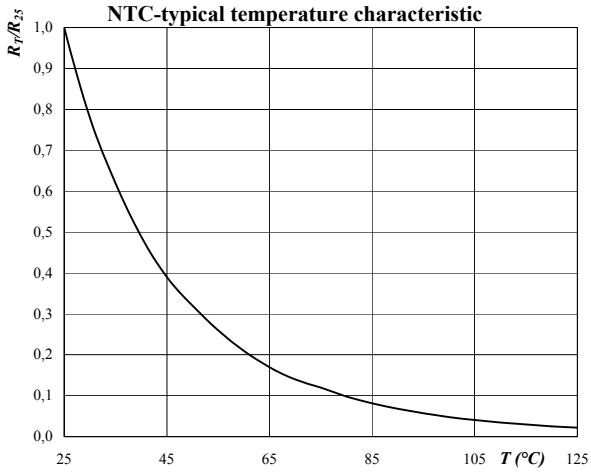
parameter: Tj = 150°C

Thermistor

Figure 23. Typical NTC characteristic as a function of temperature

NTC

RT / R25 = f (T)

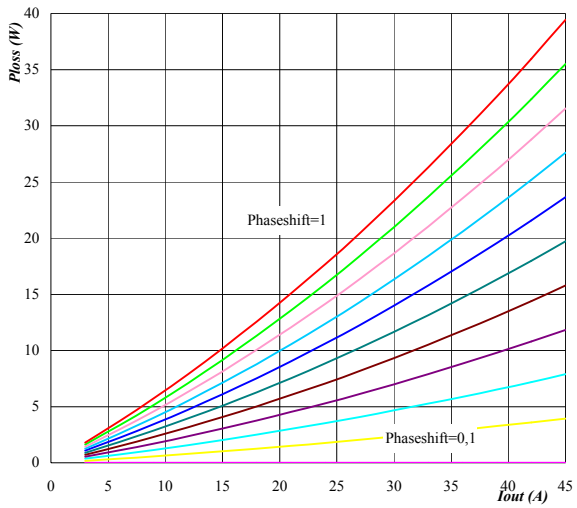


Output inverter application

Phase shifted ZVS, Vgeon= 15 V Vgeoff=0V Rgon= 4 ohms Rgoff= 1 ohms

Figure 1. Typical static loss of shifted switch as a function of output current

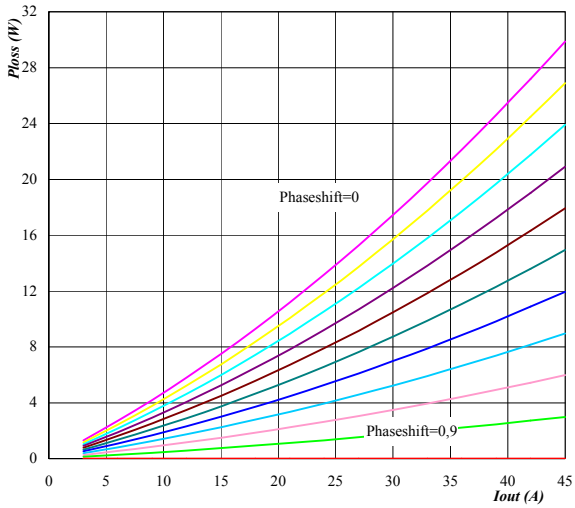
IGBT Ploss=f(Iout)



Conditions: Tj=125°C
Phaseshift parameter Phaseshift from 0,10 to 1,00 in 0,10 steps

Figure 2. Typical static loss of shifted switch as a function of output current

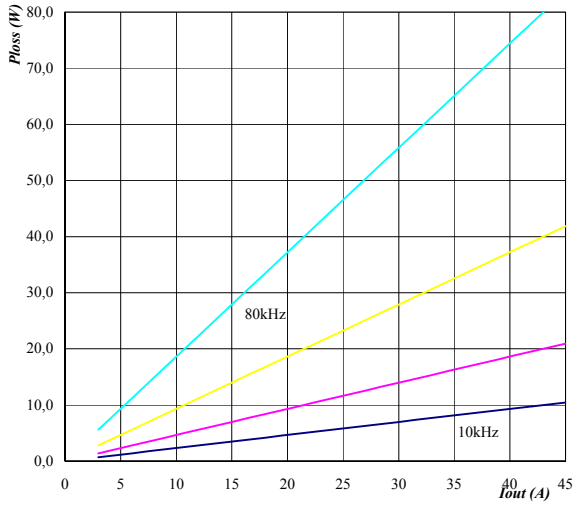
FRED Ploss=f(Iout)



Conditions: Tj=125°C
Phaseshift parameter Phaseshift from 0,00 to 0,90 in 0,10 steps

Figure 3. Typical switching loss as a function of output current

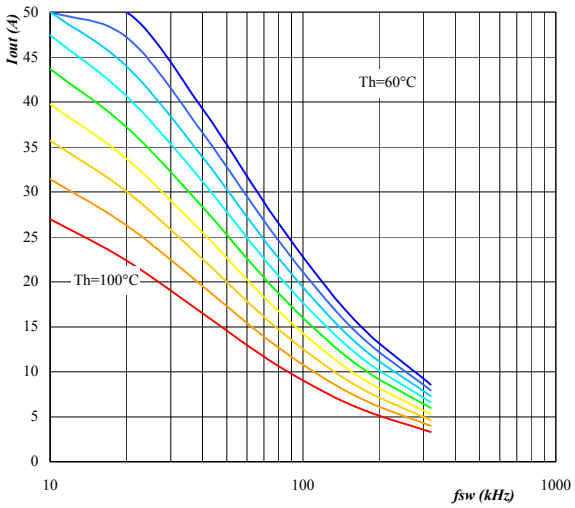
IGBT Ploss=f(Iout)



Conditions: Tj=125C
Ioutpk/Iout= 1,3 DC link= 320 V
Phaseshift= 1
Switching freq. parameter fsw from 10 kHz to 80 kHz in * 2 steps

Figure 4. Typical available output current as a function of switching frequency

Phase Iout=f(fsw)



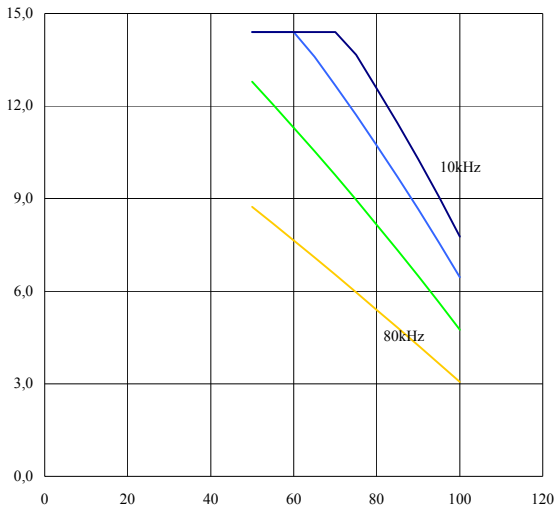
Conditions: Tj=125C
Ioutpk/Iout= 1,3 DC link= 320 V
Phaseshift= 1
Heatsink temp. parameter Th from 60 °C to 100 °C in 5 °C steps

Output inverter application

Phase shifted ZVS, Vgeon= 15 V Vgeoff=0V Rgon= 4 ohms Rgoff= 1 ohms

Figure 5. Typical available electric peak output power as a function of heatsink temperature

Inverter Pout=f(Th)

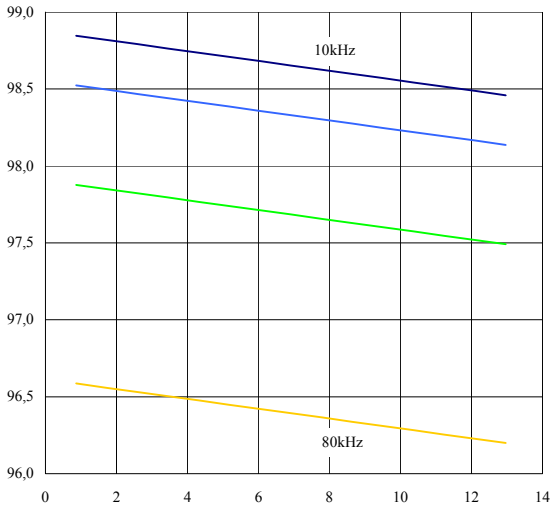


Conditions: Tj=125C
Ioutpk/Iout= 1,3 DC link= 320 V
Phaseshift= 1

Switching freq. parameter fsw from 10 kHz to 80 kHz in * 2 steps

Figure 6. Typical efficiency as a function of output power

Inverter efficiency=f(Pout)



Conditions: Tj=125C
Ioutpk/Iout= 1,3 DC link= 320 V
Phaseshift= 1

Switching freq. parameter fsw from 10 kHz to 80 kHz in * 2 steps