

Maximum Ratings / Höchstzulässige Werte

Parameter	Condition	Symbol	Datasheet values max.	Unit
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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	73 96	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{cpuls}	146	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}	122 185	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time Kurzschlußverhalten	$T_J \leq 125^{\circ}\text{C}$ $V_{GE}=15\text{V}$ $V_{CC}=900\text{V}$	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	57 77	A
Repetitive peak forward current Periodischer Spitzenstrom	$t_p=1\text{ms}$ $T_h=80^{\circ}\text{C}$	I_{FRM}	114 154	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}	85 129,2	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

flow PHASE 0 1200V/ 100A
Characteristic values/ Charakteristische Werte

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	$V_{GE(th)}$	Tj=25°C Tj=150°C	VCE=VGE			0,004	5	5,8	6,5	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	$V_{CE(sat)}$	Tj=25°C Tj=125°C		15		100		1,7 1,9	2,2	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I_{CES}	Tj=25°C Tj=125°C		0	1200				0,65	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I_{GES}	Tj=25°C Tj=150°C		30	0				700	nA
Integrated Gate resistor Integrierter Gate Widerstand	R_{gint}							7,5		Ohm
Turn-on delay time Einschaltverzögerungszeit	$t_{d(on)}$	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		311		ns
Rise time Anstiegszeit	t_r	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		36		ns
Turn-off delay time Abschaltverzögerungszeit	$t_{d(off)}$	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		520		ns
Fall time Fallzeit	t_f	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		180		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E_{on}	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		11,9		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E_{off}	Tj=25°C Tj=125°C	Rgoff=6 Ohm Rgon=6 Ohm	±15	600	100		10,2		mWs
Input capacitance Eingangskapazität	C_{ies}	Tj=25°C Tj=125°C	f=1MHz	0	25			7,21		nF
Output capacitance Ausgangskapazität	C_{oss}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,5		nF
Reverse transfer capacitance Rückwirkungskapazität	C_{rss}	Tj=25°C Tj=125°C	f=1MHz	0	25			1,3		nF
Gate charge Gate Ladung	Q_{Gate}	Tj=25°C Tj=125°C						900		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					0,57		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R_{thJC}		Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,38		K/W
Coupled thermal resistance inverter diode-transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R_{thJH}		Thermal grease thickness≤50um					0,08		K/W
Coupled thermal resistance inverter transistor-transistor Gekoppelte Wärmewiderstand Wechselrichter Transistor-Transistor	R_{thJH}		Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,06		K/W

Diode Inverter
Diode Wechselrichter

Diode forward voltage Durchlaßspannung	V_F	Tj=25°C Tj=125°C				100		1,6 1,8	2,4	V
Peak reverse recovery current Rückstromspitze	I_{RM}	Tj=25°C Tj=125°C	Rgon=6 Ohm di0/dt = 3125 A/us	0	600	100		151		A
Reverse recovery time Sperrverzögerungszeit	t_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm di0/dt = 3125 A/us	0	600	100		546		ns
Reverse recovered charge Sperrverzögerungsladung	Q_{rr}	Tj=25°C Tj=125°C	Rgon=6 Ohm di0/dt = 3125 A/us	0	600	100		25		uC
Reverse recovered energy Sperrverzögerungsenergie	E_{rec}	Tj=25°C Tj=125°C	Rgon=6 Ohm di0/dt = 3125 A/us	0	600	100		10		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R_{thJH}		Thermal grease thickness≤50um					0,82		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R_{thJC}		Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,54		K/W
Coupled thermal resistance inverter transistor-diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R_{thJH}		Thermal grease thickness≤50um					0,07		K/W
Coupled thermal resistance inverter diode-diode Gekoppelte Wärmewiderstand Wechselrichter Diode-Diode	R_{thJH}		Wärmeleitpaste Dicke≤50um λ = 0,61 W/mK					0,05		K/W

Output inverter

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

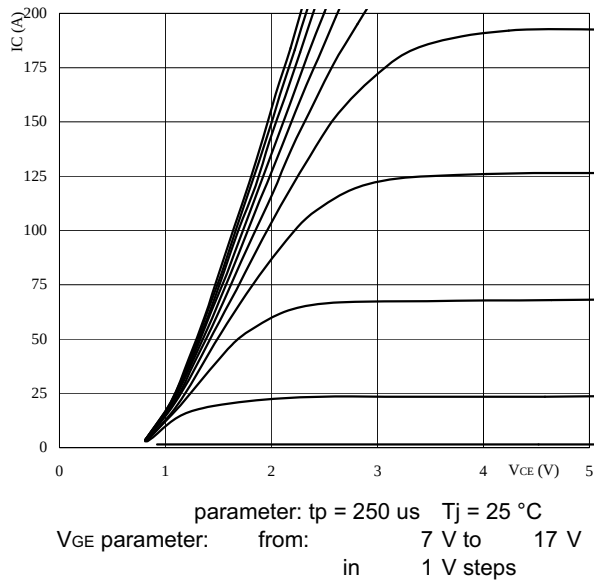


Figure 2. Typical output characteristics
 Output inverter IGBT
 $I_C = f(V_{CE})$

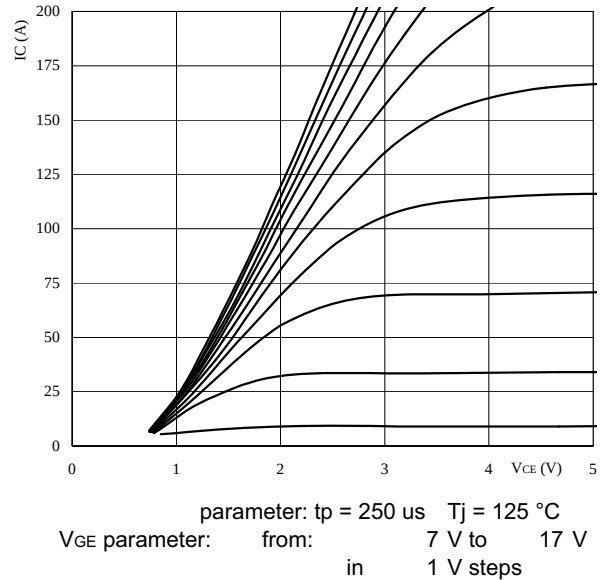


Figure 3. Typical transfer characteristics
 Output inverter IGBT
 $I_C = f(V_{GE})$

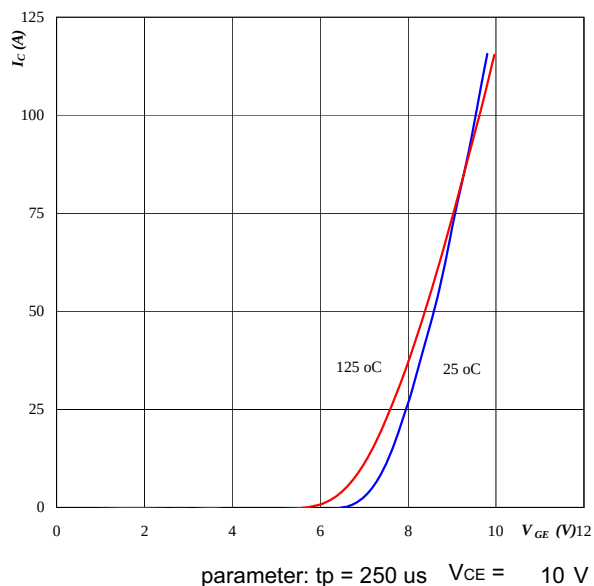
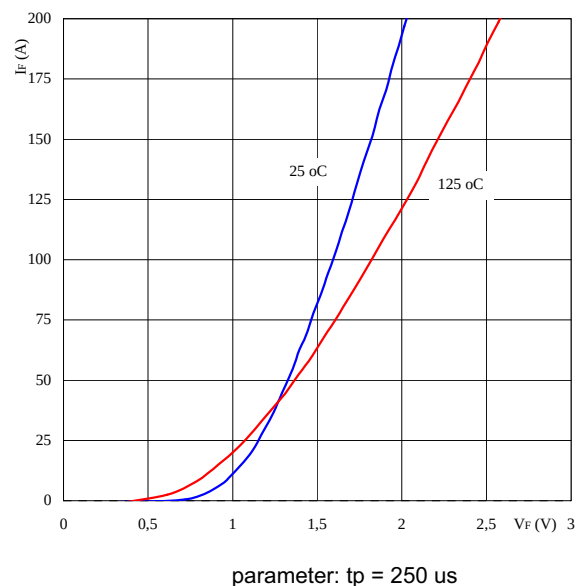


Figure 4. Typical diode forward current as a function of forward voltage
 Output inverter FRED $I_F = f(V_F)$

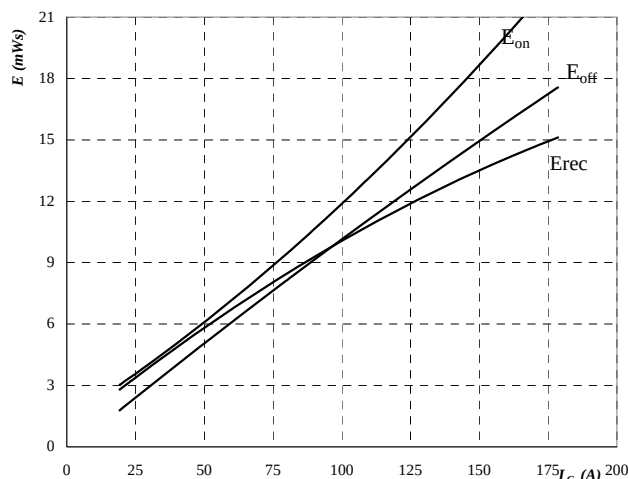


Output inverter

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

Output inverter IGBT

$$E = f(I_C)$$



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

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

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

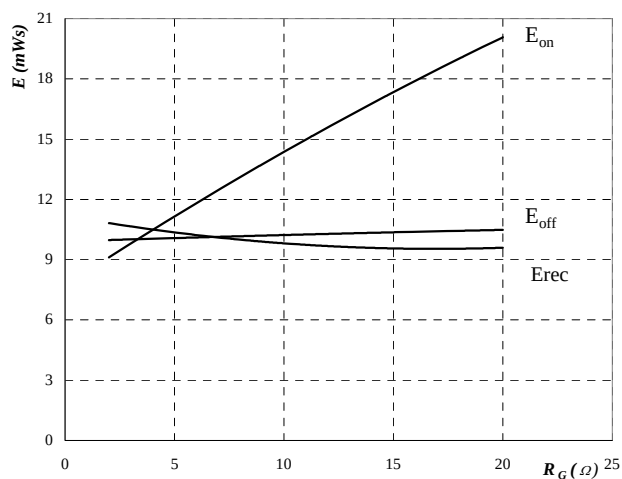
$R_{gon} = 6\ \Omega$

$R_{goff} = 6\ \Omega$

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

Output inverter IGBT

$$E = f(R_G)$$



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

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

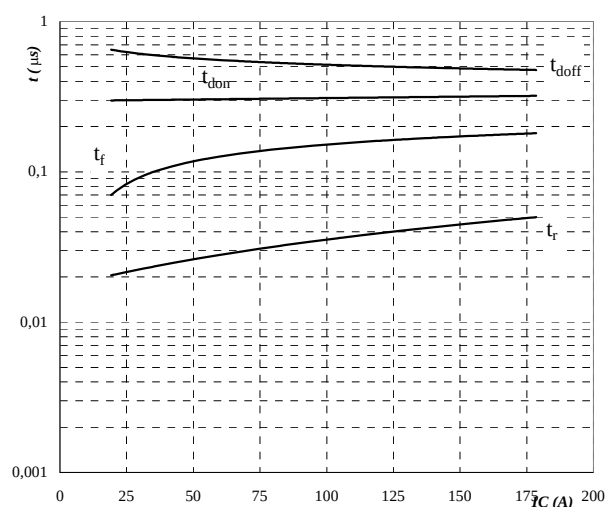
$V_{GE} = \pm 15\text{ V}$

$I_C = 100\text{ A}$

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

Output inverter IGBT

$$t = f(I_C)$$



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

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

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

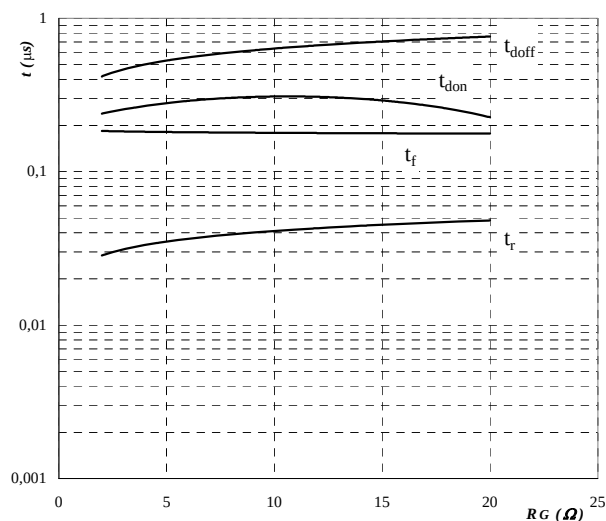
$R_{gon} = 6\ \Omega$

$R_{goff} = 6\ \Omega$

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

Output inverter IGBT

$$t = f(R_G)$$



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

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

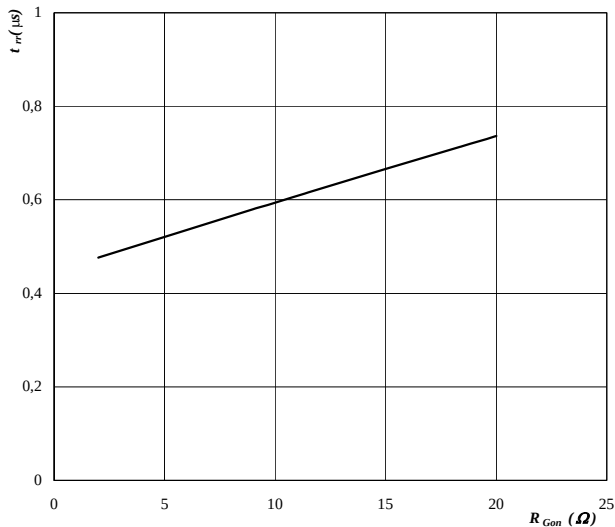
$V_{GE} = \pm 15\text{ V}$

$I_C = 100\text{ A}$

Output inverter

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

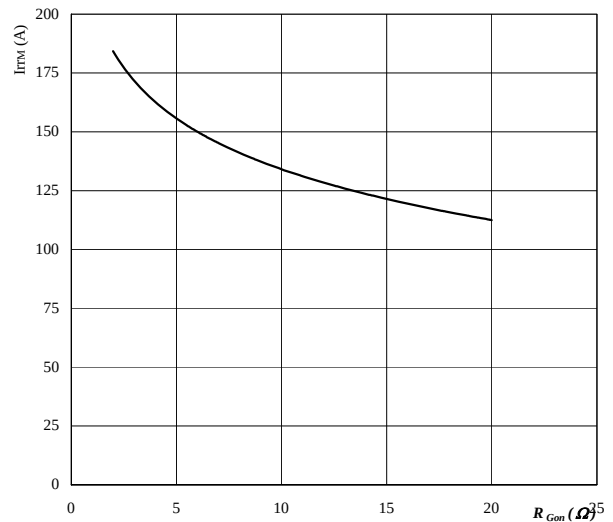
Output inverter FRED diode
 $t_{rr} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 100\text{ A}$

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

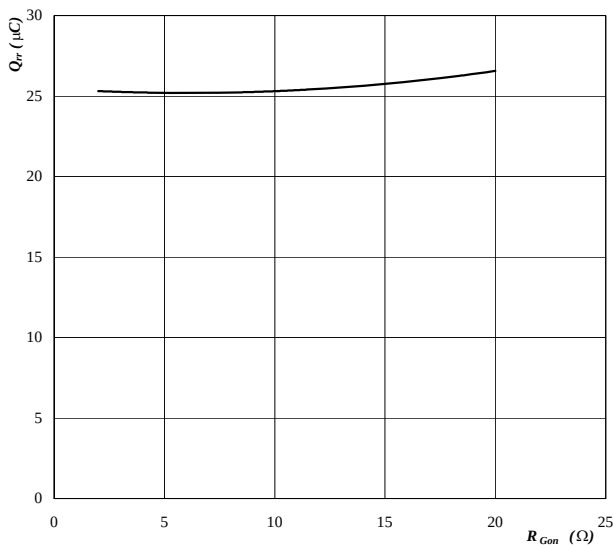
Output inverter FRED diode
 $I_{RRM} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 100\text{ A}$

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

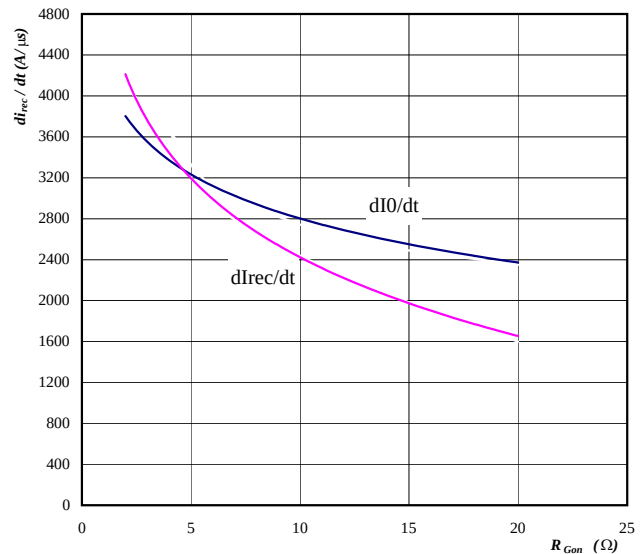
Output inverter FRED diode
 $Q_{rr} = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 100\text{ A}$

Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor

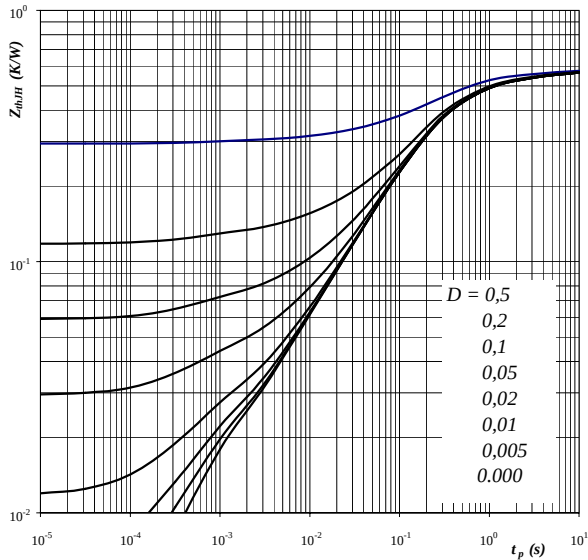
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



$T_j = 125\text{ }^{\circ}\text{C}$
 $V_R = 600\text{ V}$
 $I_F = 100\text{ A}$

Output inverter

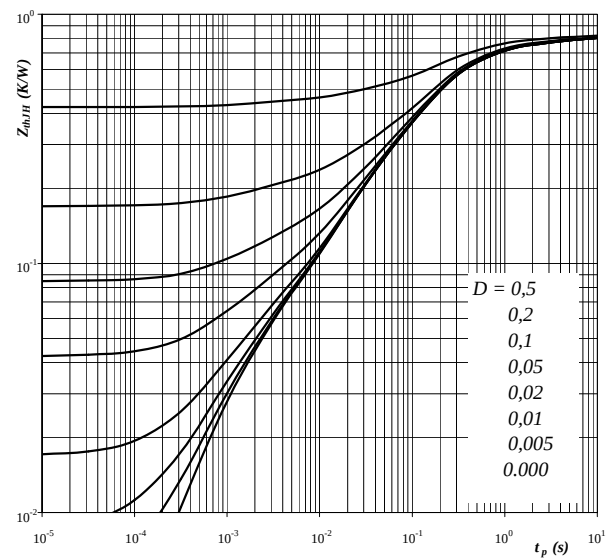
Figure 13. IGBT transient thermal impedance as a function of pulse width
 $Z_{thJH} = f(t_p)$


 Parameter: $D = t_p / T$
 $R_{thJH} = 0,57 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,05	1,2E+01
0,10	1,3E+00
0,32	2,3E-01
0,07	4,5E-02
0,03	7,6E-03
0,01	5,2E-04

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


 Parameter: $D = t_p / T$
 $R_{thJH} = 0,82 \text{ K/W}$

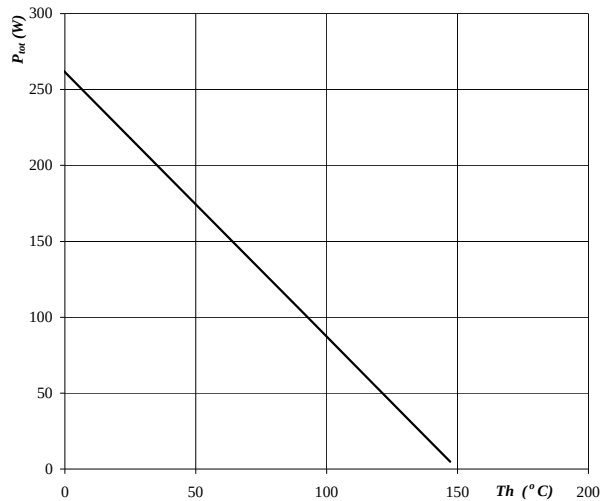
FRED thermal model values

R (C/W)	Tau (s)
0,06	3,5E+01
0,07	2,8E+00
0,26	4,4E-01
0,33	1,2E-01
0,09	1,6E-02
0,04	1,3E-03

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

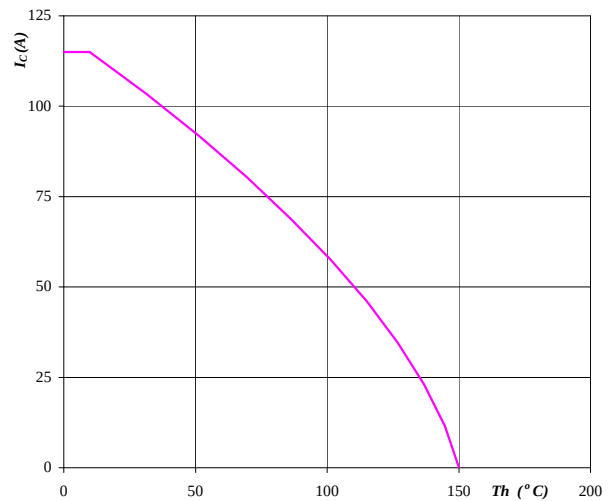
Output inverter IGBT
 $P_{tot} = f(T_h)$



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

Figure 16. Collector current as a function of heatsink temperature

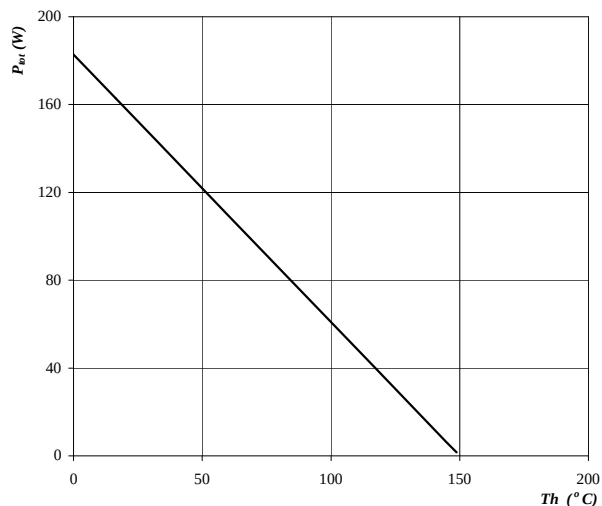
Output inverter IGBT
 $I_c = f(T_h)$



parameter: $T_j = 150^\circ\text{C}$
 $V_{GE} = 15\text{ V}$

Figure 17. Power dissipation as a function of heatsink temperature

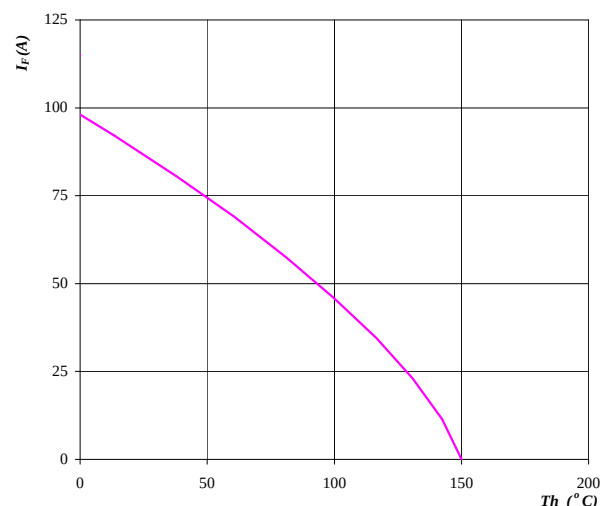
Output inverter FRED
 $P_{tot} = f(T_h)$



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