

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	$T_j=150^{\circ}C$ $T_h=80^{\circ}C$, $T_c=80^{\circ}C$	I_C	104 164	A
Repetitive peak collector current Periodischer Kollektorspitzenstrom	tp limited by T_j max	I_{cpuls}	300	A
Power dissipation per IGBT Verlustleistung pro IGBT	$T_j=150^{\circ}C$ $T_h=80^{\circ}C$ $T_c=80^{\circ}C$	P_{tot}	249 498	W
Gate-emitter peak voltage Gate-Emitter-Spitzenspannung		V_{GE}	± 20	V
SC withstand time* Kurzschlußverhalten*	$T_j \leq 125^{\circ}C$ $V_{GE}=15V$ $V_{CC}=900V$	t_{SC}	tbd	us

Diode Inverter

Diode Wechselrichter

DC forward current Dauergleichstrom	$T_j=150^{\circ}C$ $T_h=80^{\circ}C$, $T_c=80^{\circ}C$	I_F	80 115, limited by wires	A
Repetitive peak forward current Periodischer Spitzenstrom	tp limited by T_j max	I_{FRM}	200	A
Power dissipation per Diode Verlustleistung pro Diode	$T_j=150^{\circ}C$ $T_h=80^{\circ}C$ $T_c=80^{\circ}C$	P_{tot}	134 268	W

Thermal properties

Thermische Eigenschaften

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

Insulation properties

Modulisolation

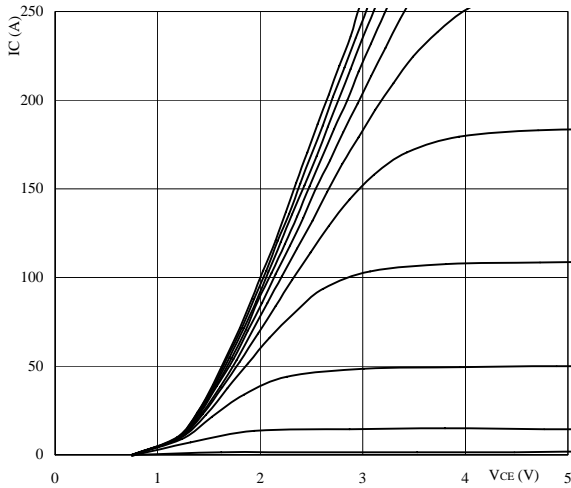
Insulation voltage Isolationsspannung	t=1min	V_{is}	4000	Vdc
Creepage distance Kriechstrecke			min 12,7	mm
Clearance Luftstrecke			min 12,7	mm

Characteristic values

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			0,004	4	5,5	8	V
Collector-emitter saturation voltage Kollektor-Emitter Sättigungsspannung	V _{CE(sat)}	T _J =25°C T _J =125°C			15	100	1,3	2,1 2,3	2,8	V
Collector-emitter cut-off Kollektor-Emitter Reststrom	I _{CES}	T _J =25°C T _J =125°C			0	1200			0,25	mA
Gate-emitter leakage current Gate-Emitter Reststrom	I _{GES}	T _J =25°C T _J =125°C			30	0			700	nA
Integrated Gate resistor Integrierter Gate Widerstand	R _{gint}							5		Ohm
Turn-on delay time Einschaltverzögerungszeit	t _{d(on)}	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	190		ns
Rise time Anstiegszeit	t _r	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	28		ns
Turn-off delay time Abschaltverzögerungszeit	t _{d(off)}	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	357		ns
Fall time Fallzeit	t _f	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	90		ns
Turn-on energy loss per pulse Einschaltverlustenergie pro Puls	E _{on}	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	8,34		mWs
Turn-off energy loss per pulse Abschaltverlustenergie pro Puls	E _{off}	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	7,01		mWs
Input capacitance Eingangskapazität	C _{ies}	T _J =25°C T _J =125°C	f=1MHz		0	25		7,85		nF
Output capacitance Ausgangskapazität	C _{oss}	T _J =25°C T _J =125°C	f=1MHz		0	25		0,65		nF
Reverse transfer capacitance Rückwirkungskapazität	C _{rss}	T _J =25°C T _J =125°C	f=1MHz		0	25		0,275		nF
Gate charge Gate Ladung	Q _{Gate}	T _J =25°C T _J =125°C	Rgoff=4 Ohm Rgon=4 Ohm		±15	600	100	1206		nC
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{thJH}		Thermal foil thickness=76um Wärmeleitfolie Dicke=76um					0,28		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R _{thJC}		Kunze Folien KU- ALC5F					0,14		K/W
Coupled thermal resistance inverter diode- transistor Gekoppelte Wärmewiderstand Wechselrichter Diode-Transistor	R _{thJH}		Thermal foil thickness=76um Wärmeleitfolie Dicke=76um					0,06		K/W
Coupled thermal resistance inverter transistor- transistor Gekoppelte Wärmewiderstand Wechselrichter Transistor-Transistor	R _{thJH}		Kunze Folien KU- ALC5F					0,03		K/W
Diode Inverter										
Diode Wechselrichter										
Diode forward voltage Durchlaßspannung	V _F	T _J =25°C T _J =125°C				100	1	1,8 1,8	2,4	V
Peak reverse recovery current Rückstromspitze	I _{RM}	T _J =25°C T _J =125°C	Rgon=4 Ohm di0/dt = 4817 A/us		-15	600	100	178,9		A
Reverse recovery time Sperrverzögerungszeit	t _{rr}	T _J =25°C T _J =125°C	Rgon=4 Ohm di0/dt = 4817 A/us		-15	600	100	312		ns
Reverse recovered charge Sperrverzögerungsladung	Q _{rr}	T _J =25°C T _J =125°C	Rgon=4 Ohm di0/dt = 4817 A/us		-15	600	100	17,9		uC
Reverse recovered energy Sperrverzögerungsenergie	E _{rec}	T _J =25°C T _J =125°C	Rgon=4 Ohm di0/dt = 4817 A/us		-15	600	100	7,14		mWs
Thermal resistance chip to heatsink per chip Wärmewiderstand Chip-Kühlkörper pro Chip	R _{thJH}		Thermal foil thickness=76um Wärmeleitfolie Dicke=76um					0,52		K/W
Thermal resistance chip to case per chip Wärmewiderstand Chip-Gehäuse pro Chip	R _{thJC}		Kunze Folien KU- ALC5F					0,26		K/W
Coupled thermal resistance inverter transistor- diode Gekoppelte Wärmewiderstand Wechselrichter Transistor-Diode	R _{thJH}		Thermal foil thickness=76um Wärmeleitfolie Dicke=76um					0,07		K/W
Coupled thermal resistance inverter diode-diode Gekoppelte Wärmewiderstand Wechselrichter Diode-Diode	R _{thJH}		Kunze Folien KU- ALC5F					0,03		K/W

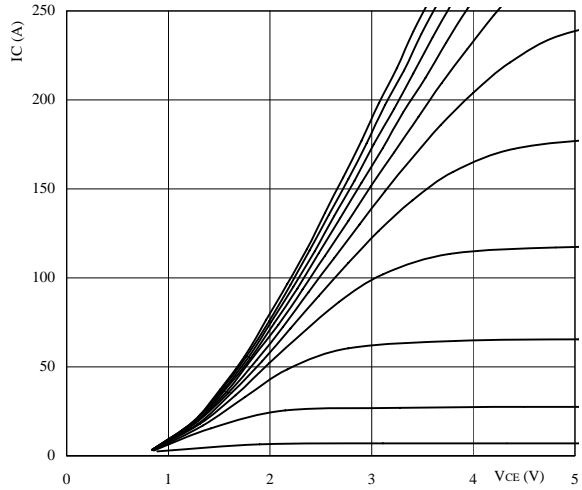
Output inverter

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



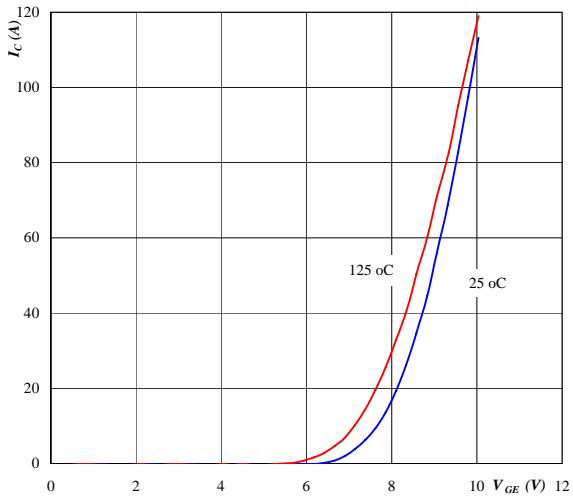
parameter: $t_p = 250 \mu s$ $T_j = 25 \text{ }^\circ\text{C}$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



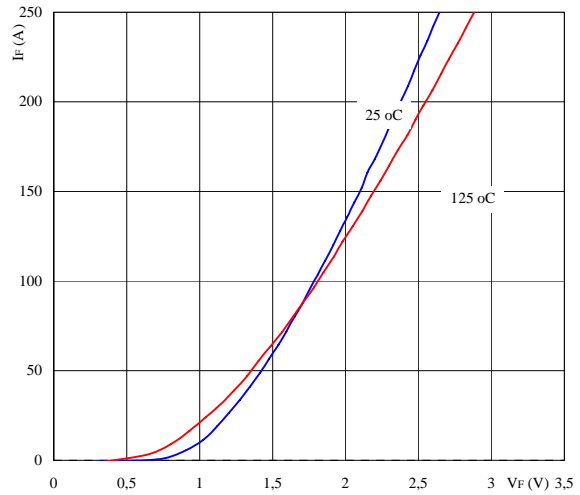
parameter: $t_p = 250 \mu s$ $T_j = 125 \text{ }^\circ\text{C}$
 V_{GE} parameter: from: 7 V to 17 V
in 1 V steps

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



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

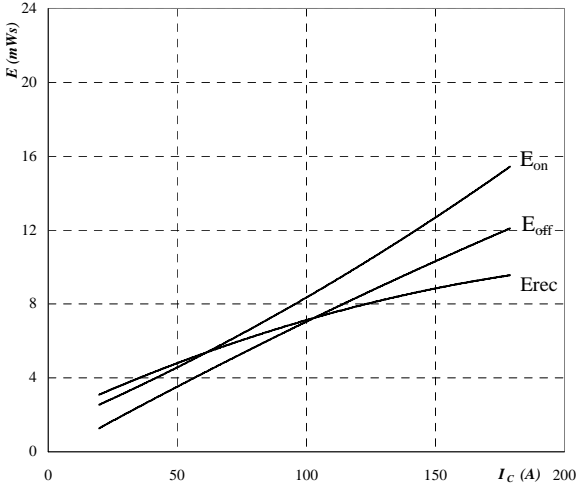
Figure 4. Typical diode forward current as a function of forward voltage
Output inverter FRED $I_F = f(V_F)$



parameter: $t_p = 250 \mu s$

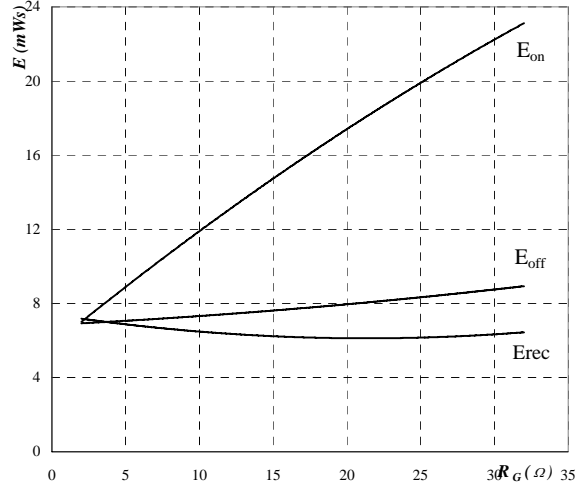
Output inverter

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



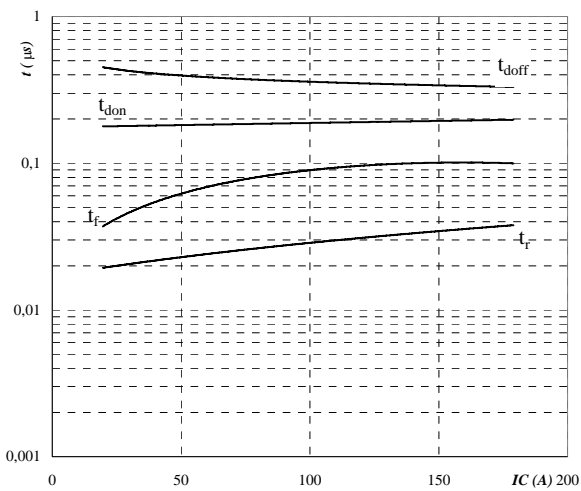
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_{gon} = 4\ \Omega$
 $R_{goff} = 4\ \Omega$

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



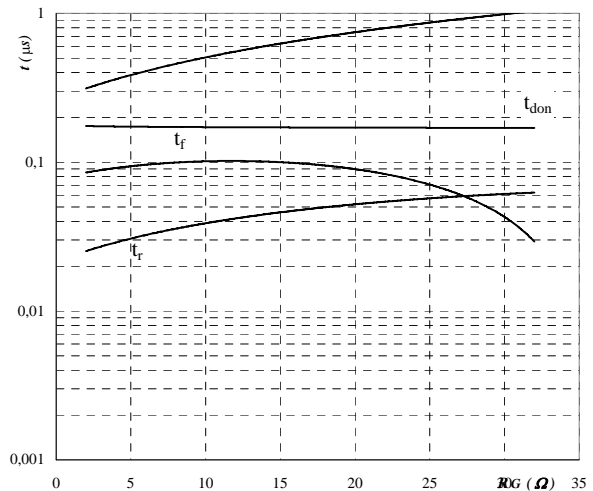
inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_c = 100\text{ A}$

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



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $R_{gon} = 4\ \Omega$
 $R_{goff} = 4\ \Omega$

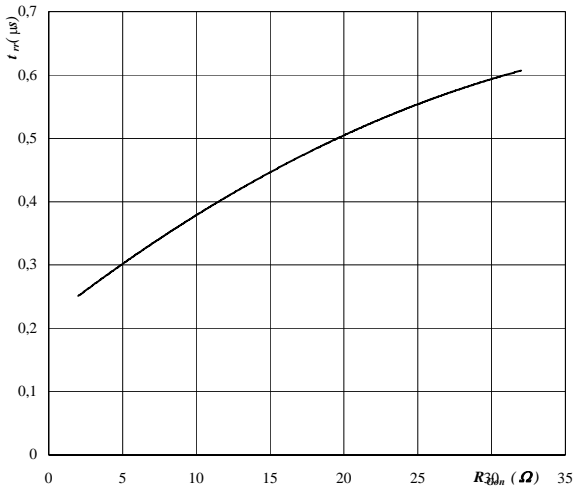
Figure 8. Typical switching times as a function of gate resistor
Output inverter IGBT
 $t = f(R_G)$



inductive load, $T_j = 125\text{ }^\circ\text{C}$
 $V_{CE} = 600\text{ V}$
 $V_{GE} = \pm 15\text{ V}$
 $I_c = 100\text{ A}$

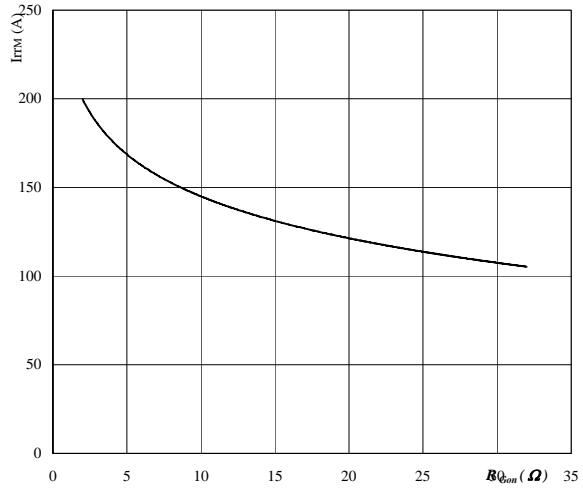
Output inverter

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



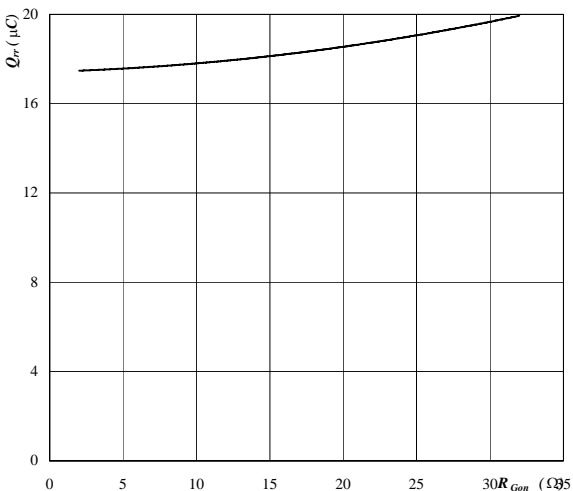
T_j = 125 °C
V_R = 600 V
I_F = 100 A
V_{GE} = ±15 V

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



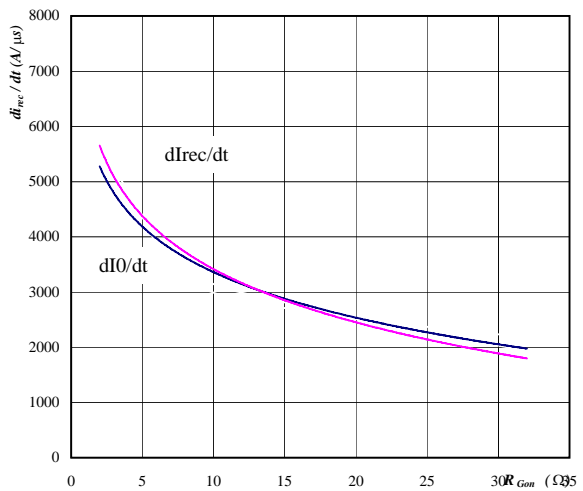
T_j = 125 °C
V_R = 600 V
I_F = 100 A
V_{GE} = ±15 V

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 °C
V_R = 600 V
I_F = 100 A
V_{GE} = ±15 V

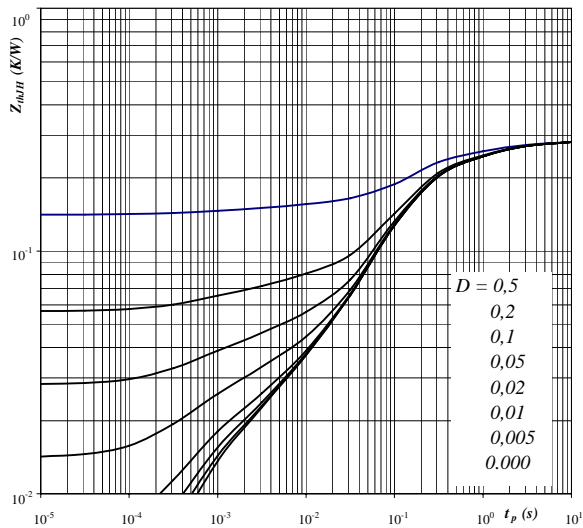
Figure 12. Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor
Output inverter FRED diode
 $dI_0/dt, dI_{rec}/dt = f(R_{gon})$



T_j = 125 °C
V_R = 600 V
I_F = 100 A
V_{GE} = ±15 V

Output inverter

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

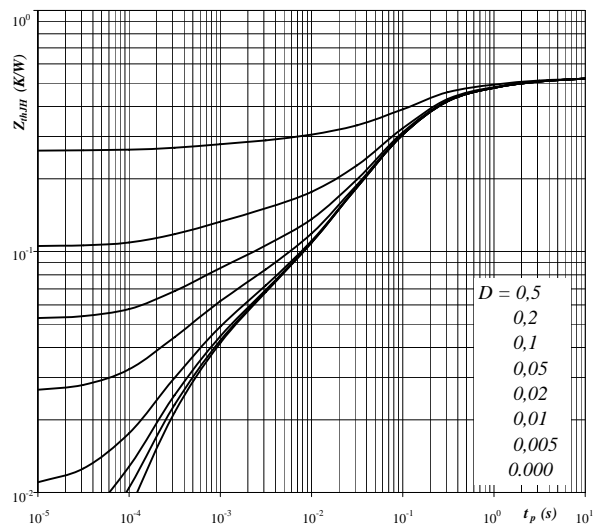


Parameter: $D = t_p / T$ $R_{thJH} = 0,28 \text{ K/W}$

IGBT thermal model values

R (C/W)	Tau (s)
0,03	2,7E+00
0,06	6,4E-01
0,16	1,2E-01

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



Parameter: $D = t_p / T$ $R_{thJH} = 0,52 \text{ K/W}$

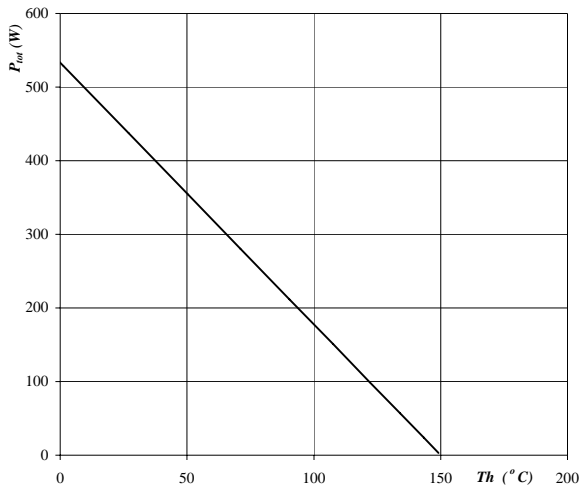
FRED thermal model values

R (C/W)	Tau (s)
0,04	3,5E+00
0,09	6,2E-01
0,26	1,1E-01
0,08	2,5E-02

Output inverter

Figure 15. Power dissipation as a function of heatsink temperature

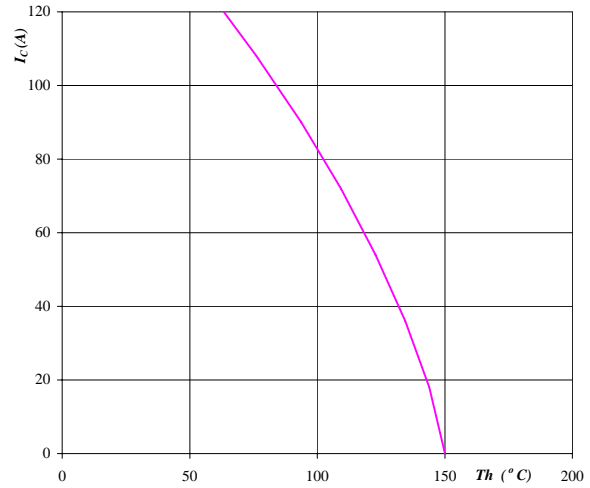
Output inverter IGBT
 $P_{tot} = f(T_h)$



parameter: T_j = 150°C

Figure 16. Collector current as a function of heatsink temperature

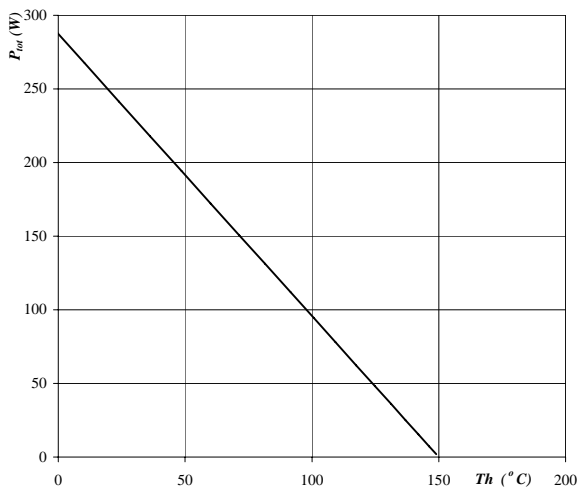
Output inverter IGBT
 $I_c = f(T_h)$



parameter: T_j = 150°C
V_{GE} = 15 V

Figure 17. Power dissipation as a function of heatsink temperature

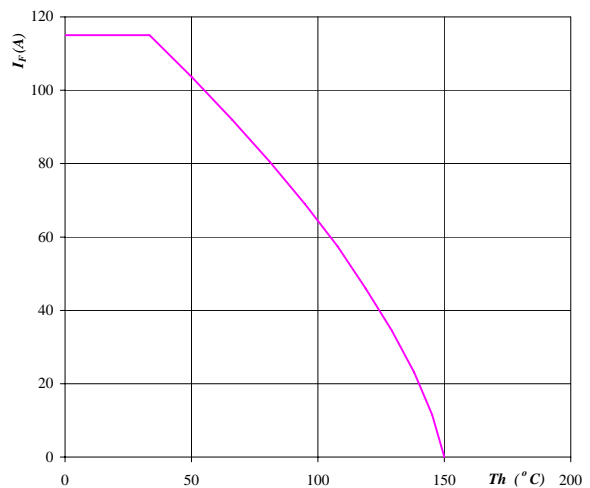
Output inverter FRED
 $P_{tot} = f(T_h)$



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