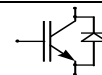


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Elektrische Eigenschaften / Electrical properties

Höchstzulässige Werte / Maximum rated values

Diode Gleichrichter/ Diode Rectifier

Periodische Rückw. Spitzensperrspannung repetitive peak reverse voltage		V_{RRM}	1600	V
Durchlaßstrom Grenzeffektivwert RMS forward current per chip		I_{FRMSM}	40	A
Dauergleichstrom DC forward current	$T_C = 80^\circ\text{C}$	I_d	10	A
Stoßstrom Grenzwert surge forward current	$t_p = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^\circ\text{C}$	I_{FSM}	300 230	A A
Grenzlastintegral I^2t - value	$t_p = 10\text{ ms}, T_{vj} = 25^\circ\text{C}$ $t_p = 10\text{ ms}, T_{vj} = 150^\circ\text{C}$	I^2t	450 260	A^2s A^2s

Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ I_C	10 20	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	20	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	80	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current	$T_C = 80^\circ\text{C}$	I_F	10	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	20	A
Grenzlastintegral I^2t - value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	I^2t	50	A^2s

Transistor Brems-Chopper/ Transistor Brake-Chopper

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ I_C	10 20	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	20	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	80	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current	$T_C = 80^\circ\text{C}$	I_F	10	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	20	A

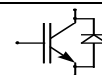
prepared by: Andreas Schulz	date of publication: 17.09.1999
approved by: MN.Hierholzer	revision: 4

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Modul Isolation/ Module Isolation

Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min. NTC connected to Baseplate	V _{ISOL}	2,5	kV
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Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

Diode Gleichrichter/ Diode Rectifier		min.	typ.	max.	
Durchlaßspannung forward voltage	T _{vj} = 150°C, I _F = 10 A	V _F	-	0,9	0,95 V
Schleusenspannung threshold voltage	T _{vj} = 150°C	V _(TO)	-	-	0,8 V
Ersatzwiderstand slope resistance	T _{vj} = 150°C	r _T	-	-	10,5 mΩ
Sperrstrom reverse current	T _{vj} = 150°C, V _R = 1600 V	I _R	-	1	- mA
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T _C = 25°C	R _{AA'+CC'}	-	8	- mΩ

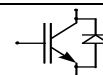
Transistor Wechselrichter/ Transistor Inverter		min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	V _{GE} = 15V, T _{vj} = 25°C, I _C = 10 A	V _{CE sat}	-	1,95	2,35 V
	V _{GE} = 15V, T _{vj} = 125°C, I _C = 10 A		-	2,2	- V
Gate-Schwellenspannung gate threshold voltage	V _{CE} = V _{GE} , T _{vj} = 25°C, I _C = 0,35 mA	V _{GE(TO)}	4,5	5,5	6,5 V
Eingangskapazität input capacitance	f = 1MHz, T _{vj} = 25°C V _{CE} = 25 V, V _{GE} = 0 V	C _{ies}	-	0,6	- nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V _{GE} = 0V, T _{vj} = 25°C, V _{CE} = 600 V	I _{CES}	-	0,5	500 μA
	V _{GE} = 0V, T _{vj} = 125°C, V _{CE} = 600 V		-	0,8	- mA
Gate-Emitter Reststrom gate-emitter leakage current	V _{CE} = 0V, V _{GE} = 20V, T _{vj} = 25°C	I _{GES}	-	-	300 nA
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	I _C = I _{Nenn} , V _{CC} = 300 V	t _{d,on}	-	35	- ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 82 Ohm				
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
Anstiegszeit (induktive Last) rise time (inductive load)	I _C = I _{Nenn} , V _{CC} = 300 V	t _r	-	30	- ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 82 Ohm				
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	I _C = I _{Nenn} , V _{CC} = 300 V	t _{d,off}	-	220	- ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 82 Ohm				
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
Fallzeit (induktive Last) fall time (inductive load)	I _C = I _{Nenn} , V _{CC} = 300 V	t _f	-	18	- ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 82 Ohm				
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I _C = I _{Nenn} , V _{CC} = 300 V	E _{on}	-	0,4	- mWs
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
	L _S = 75 nH				
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I _C = I _{Nenn} , V _{CC} = 300 V	E _{off}	-	0,3	- mWs
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 82 Ohm				
	L _S = 75 nH				
Kurzschlußverhalten SC Data	t _p ≤ 10μs, V _{GE} ≤ 15V, R _G = 82 Ohm T _{vj} ≤ 125°C, V _{CC} = 360 V dI/dt = 600 A/μs	I _{SC}	-	45	- A

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Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

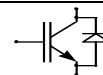
			min.	typ.	max.	
Modulinduktivität stray inductance module		L_{GCE}	-	-	100	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^\circ\text{C}$	$R_{\text{CC}'+\text{EE}'}$	-	11	-	mΩ
Diode Wechselrichter/ Diode Inverter						
			min.	typ.	max.	
Durchlaßspannung forward voltage	$V_{\text{GE}} = 0\text{V}, T_{\text{vj}} = 25^\circ\text{C}, I_{\text{F}} = 10\text{ A}$ $V_{\text{GE}} = 0\text{V}, T_{\text{vj}} = 125^\circ\text{C}, I_{\text{F}} = 10\text{ A}$	V_{F}	-	1,25 1,2	1,7 -	V V
Rückstromspitze peak reverse recovery current	$I_{\text{F}}=I_{\text{Nenn}}, -di_{\text{F}}/dt = 400\text{A}/\mu\text{s}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 25^\circ\text{C}, V_{\text{R}} = 300\text{ V}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 125^\circ\text{C}, V_{\text{R}} = 300\text{ V}$	I_{RM}	-	12 15	- -	A A
Sperrverzögerungsladung recovered charge	$I_{\text{F}}=I_{\text{Nenn}}, -di_{\text{F}}/dt = 400\text{A}/\mu\text{s}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 25^\circ\text{C}, V_{\text{R}} = 300\text{ V}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 125^\circ\text{C}, V_{\text{R}} = 300\text{ V}$	Q_{r}	-	0,85 1,35	- -	μAs μAs
Abschaltenergie pro Puls reverse recovery energy	$I_{\text{F}}=I_{\text{Nenn}}, -di_{\text{F}}/dt = 400\text{A}/\mu\text{s}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 25^\circ\text{C}, V_{\text{R}} = 300\text{ V}$ $V_{\text{GE}} = -10\text{V}, T_{\text{vj}} = 125^\circ\text{C}, V_{\text{R}} = 300\text{ V}$	E_{RQ}	-	0,16 0,26	- -	mWs mWs
Transistor Brems-Chopper/ Transistor Brake-Chopper						
			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, T_{\text{vj}} = 25^\circ\text{C}, I_{\text{C}} = 10,0\text{ A}$ $V_{\text{GE}} = 15\text{V}, T_{\text{vj}} = 125^\circ\text{C}, I_{\text{C}} = 10,0\text{ A}$	$V_{\text{CE sat}}$	-	1,95 2,2	2,35 -	V V
Gate-Schwellenspannung gate threshold voltage	$V_{\text{CE}} = V_{\text{GE}}, T_{\text{vj}} = 25^\circ\text{C}, I_{\text{C}} = 0,35\text{mA}$	$V_{\text{GE(TO)}}$	4,5	5,5	6,5	V
Eingangskapazität input capacitance	$f = 1\text{MHz}, T_{\text{vj}} = 25^\circ\text{C}$ $V_{\text{CE}} = 25\text{ V}, V_{\text{GE}} = 0\text{ V}$	C_{ies}	-	0,6	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{\text{GE}} = 0\text{V}, T_{\text{vj}} = 25^\circ\text{C}, V_{\text{CE}} = 600\text{ V}$ $V_{\text{GE}} = 0\text{V}, T_{\text{vj}} = 125^\circ\text{C}, V_{\text{CE}} = 600\text{ V}$	I_{CES}	-	0,5 0,8	500 -	μA mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{\text{CE}} = 0\text{V}, V_{\text{GE}} = 20\text{V}, T_{\text{vj}} = 25^\circ\text{C}$	I_{GES}	-	-	300	nA
Diode Brems-Chopper/ Diode Brake-Chopper						
			min.	typ.	max.	
Durchlaßspannung forward voltage	$T_{\text{vj}} = 25^\circ\text{C}, I_{\text{F}} = 10,0\text{ A}$ $T_{\text{vj}} = 125^\circ\text{C}, I_{\text{F}} = 10,0\text{ A}$	V_{F}	-	1,25 1,2	1,7 -	V V
NTC-Widerstand/ NTC-Thermistor						
			min.	typ.	max.	
Nennwiderstand rated resistance	$T_C = 25^\circ\text{C}$	R_{25}	-	5	-	kΩ
Abweichung von R_{100} deviation of R_{100}	$T_C = 100^\circ\text{C}, R_{100} = 493\text{ Ω}$	$\Delta R/R$	-5		5	%
Verlustleistung power dissipation	$T_C = 25^\circ\text{C}$	P_{25}			20	mW
B-Wert B-value	$R_2 = R_1 \exp [B(1/T_2 - 1/T_1)]$	$B_{25/50}$		3375		K

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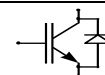


Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode	R_{thJC}	-	-	1	K/W
	Trans. Wechr./ Trans. Inverter		-	-	1,5	K/W
	Diode Wechr./ Diode Inverter		-	-	2,3	K/W
	Trans. Bremse/ Trans. Brake		-	-	1,5	K/W
	Diode Bremse/ Diode Brake		-	-	2,3	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleichr. Diode/ Rectif. Diode	R_{thCK}	-	0,08	-	K/W
	Trans. Wechr./ Trans. Inverter		-	0,04	-	K/W
	Diode Wechr./ Diode Inverter		-	0,08	-	K/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		T_{vj}	-	-	150	°C
Betriebstemperatur operation temperature		T_{op}	-40	-	125	°C
Lagertemperatur storage temperature		T_{stg}	-40	-	125	°C

Mechanische Eigenschaften / Mechanical properties

Innere Isolation internal insulation			Al_2O_3	
CTI comperative tracking index			225	
Anzugsdrehmoment f. mech. Befestigung mounting torque		M	3 ±10%	Nm
Gewicht weight		G	180	g

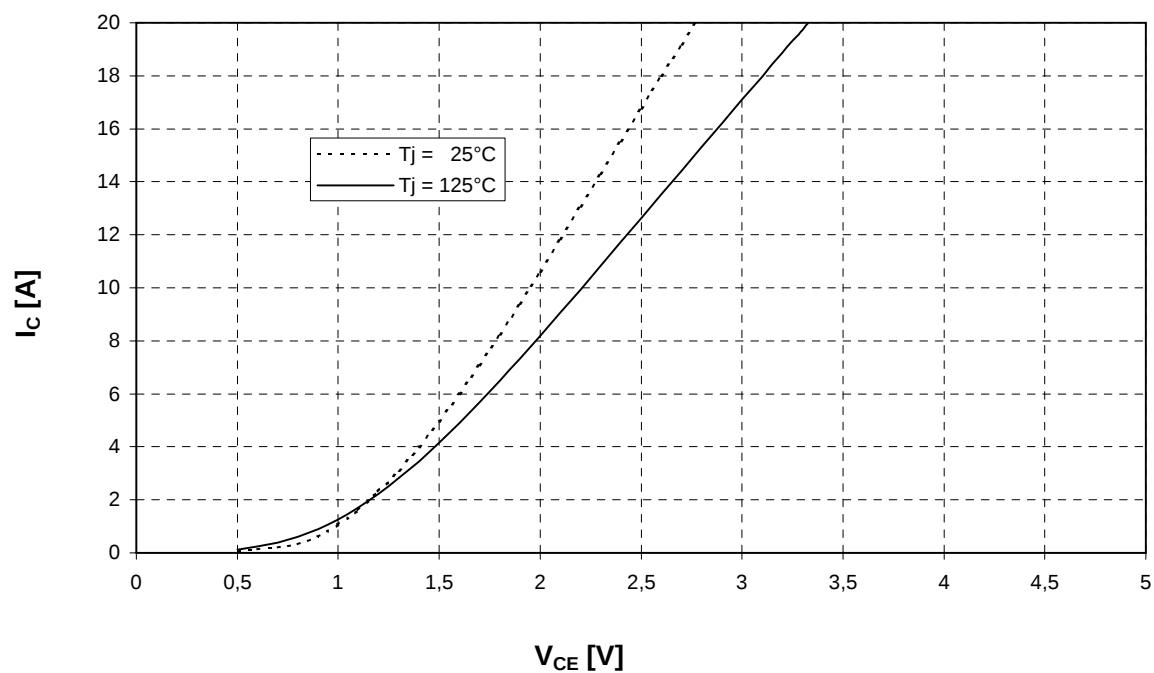


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

$$I_c = f(V_{CE})$$

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

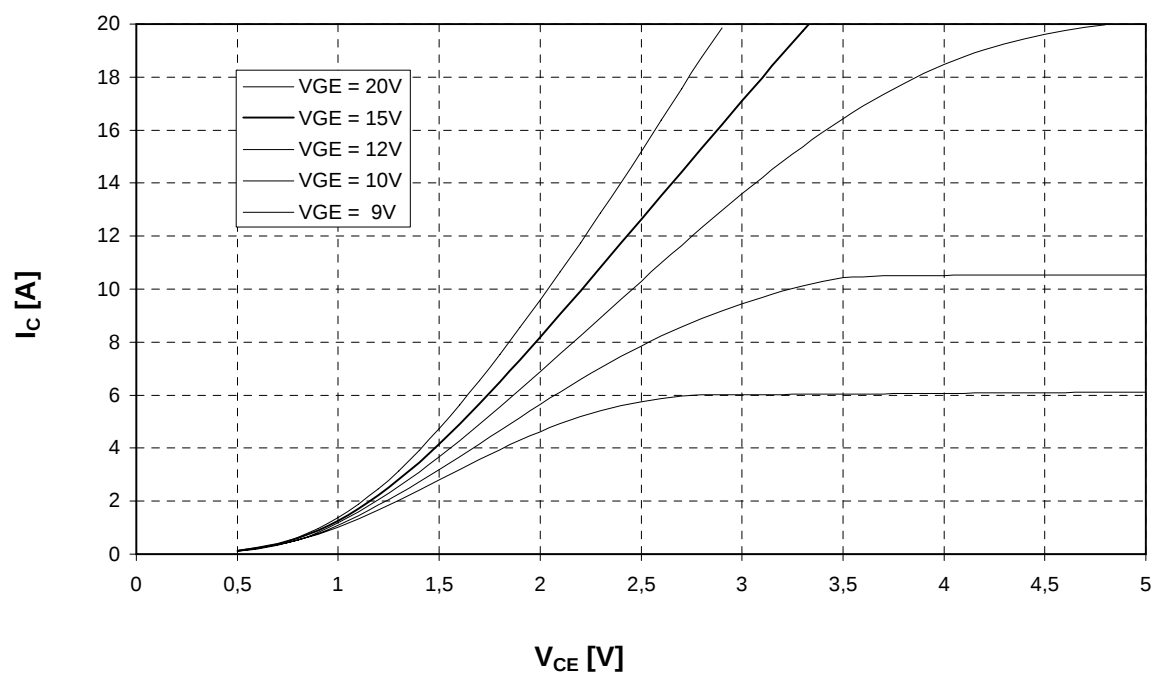


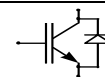
Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

$$I_c = f(V_{CE})$$

$$T_{vj} = 125^\circ\text{C}$$



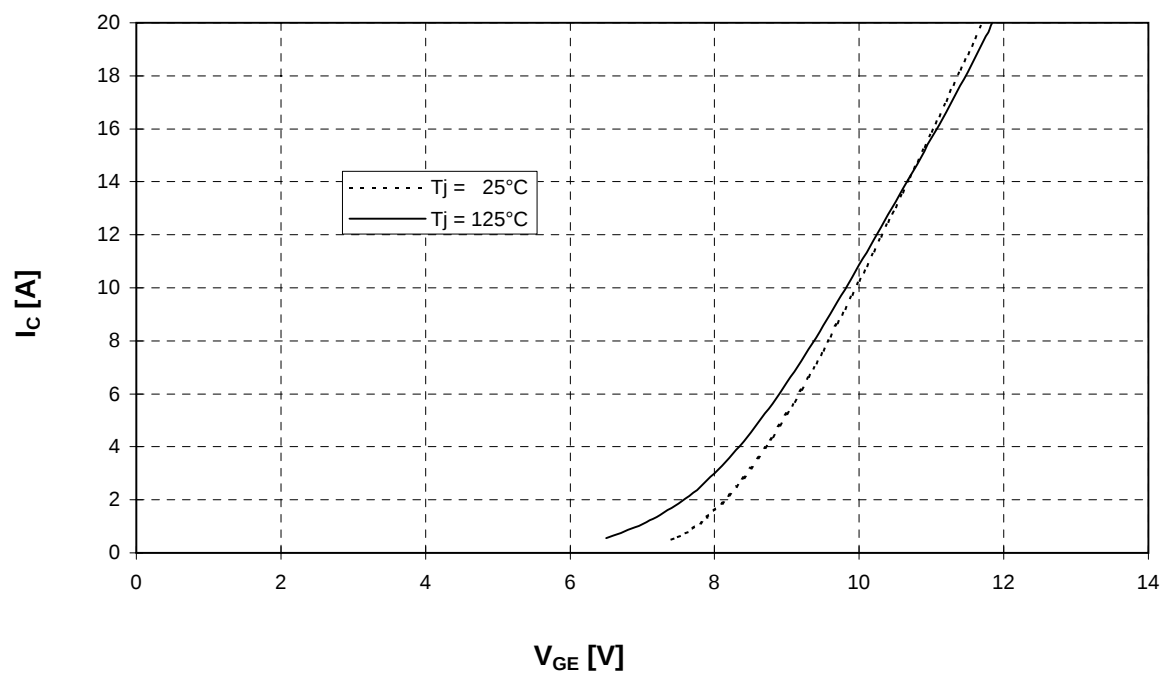


Übertragungscharakteristik Wechselr. (typisch)

Transfer characteristic Inverter (typical)

$$I_c = f(V_{GE})$$

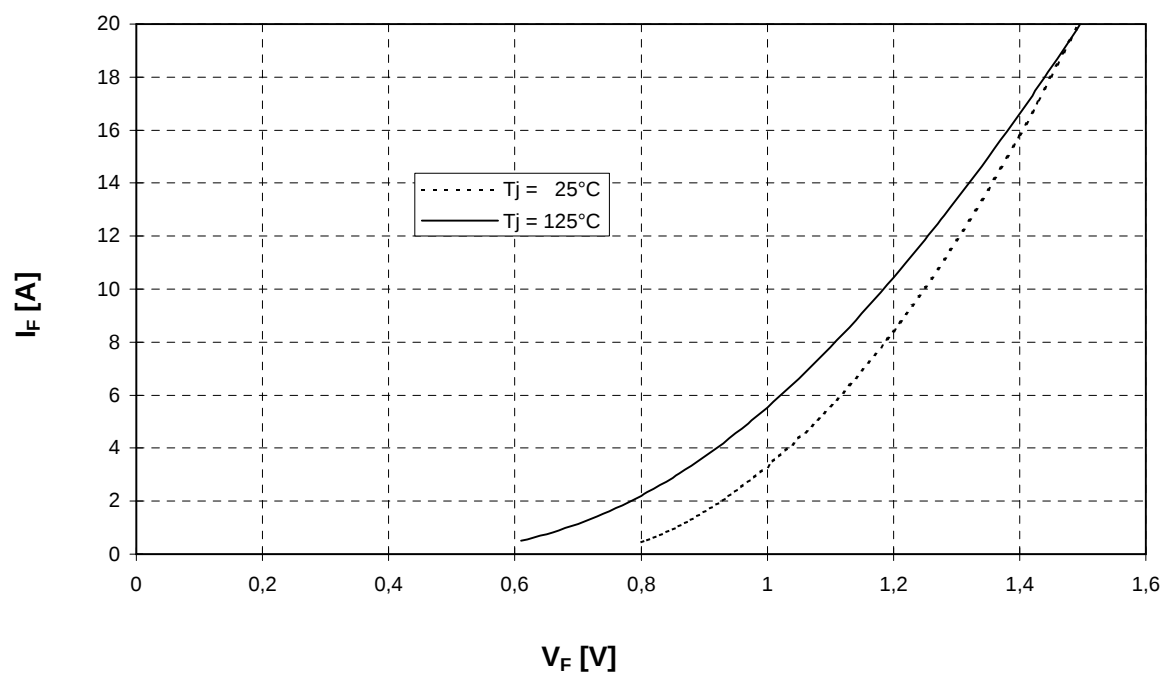
$$V_{CE} = 20 \text{ V}$$

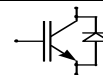


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)

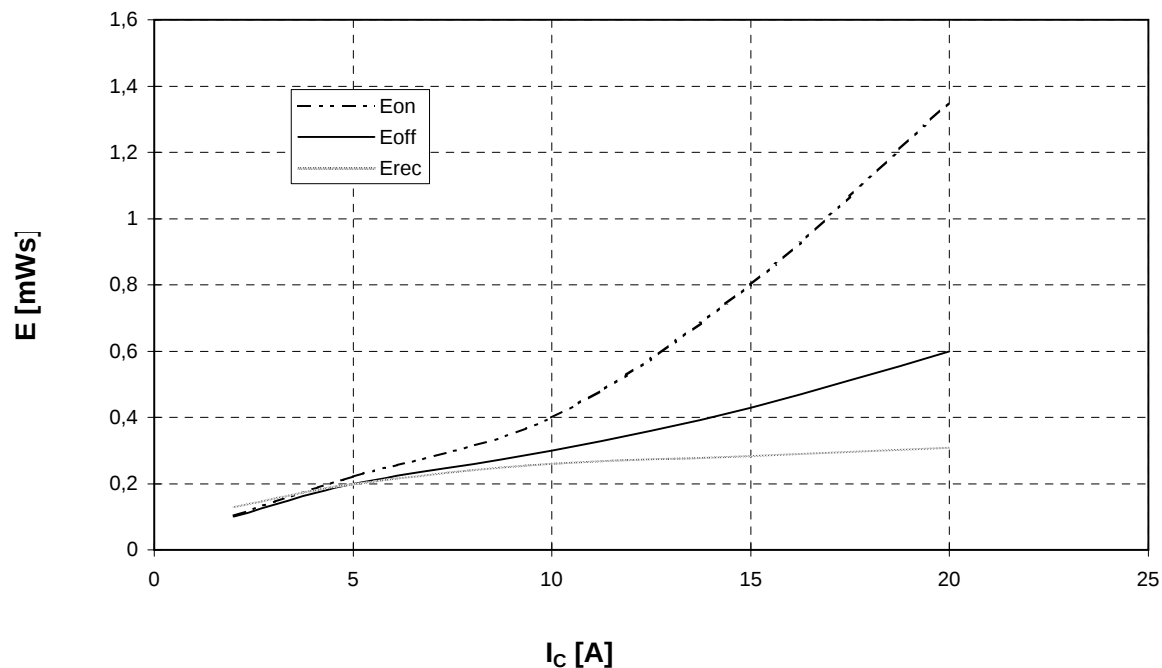
Forward characteristic of FWD Inverter (typical)

$$I_F = f(V_F)$$

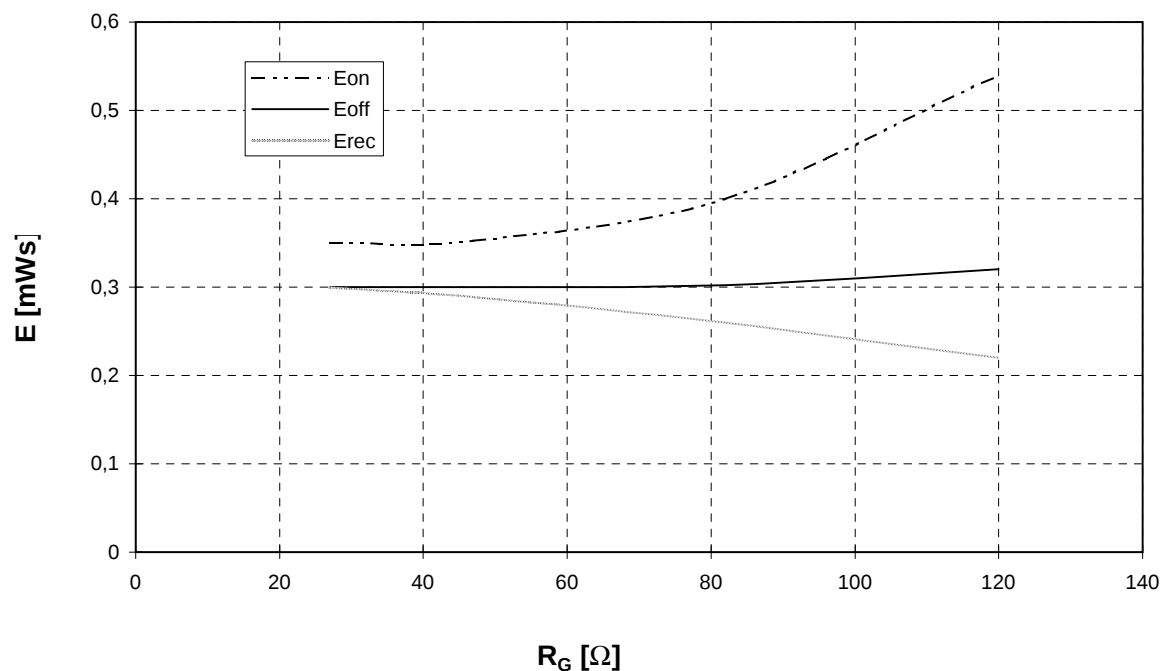


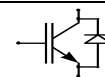


Schaltverluste Wechselr. (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$ $V_{CC} = 300\text{ V}$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = R_{Goff} = 82\text{ Ohm}$



Schaltverluste Wechselr. (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{ V}$, $I_C = I_{nenn}$, $V_{CC} = 300\text{ V}$

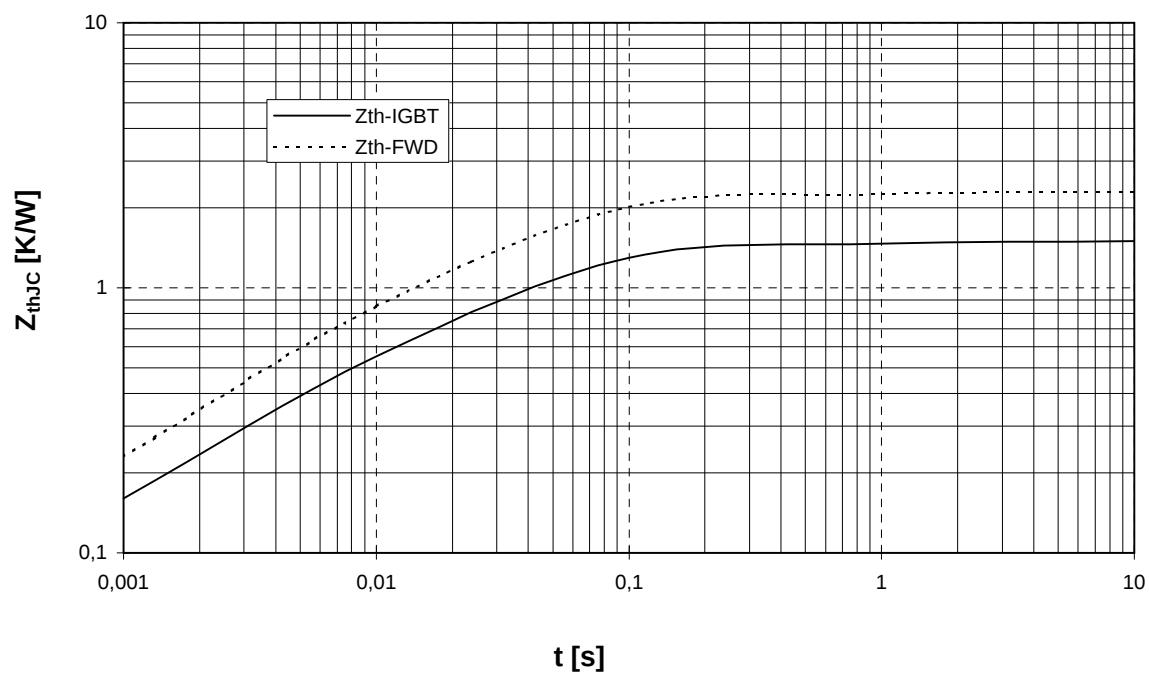




Transienter Wärmewiderstand Wechslr.

$$Z_{thJC} = f(t)$$

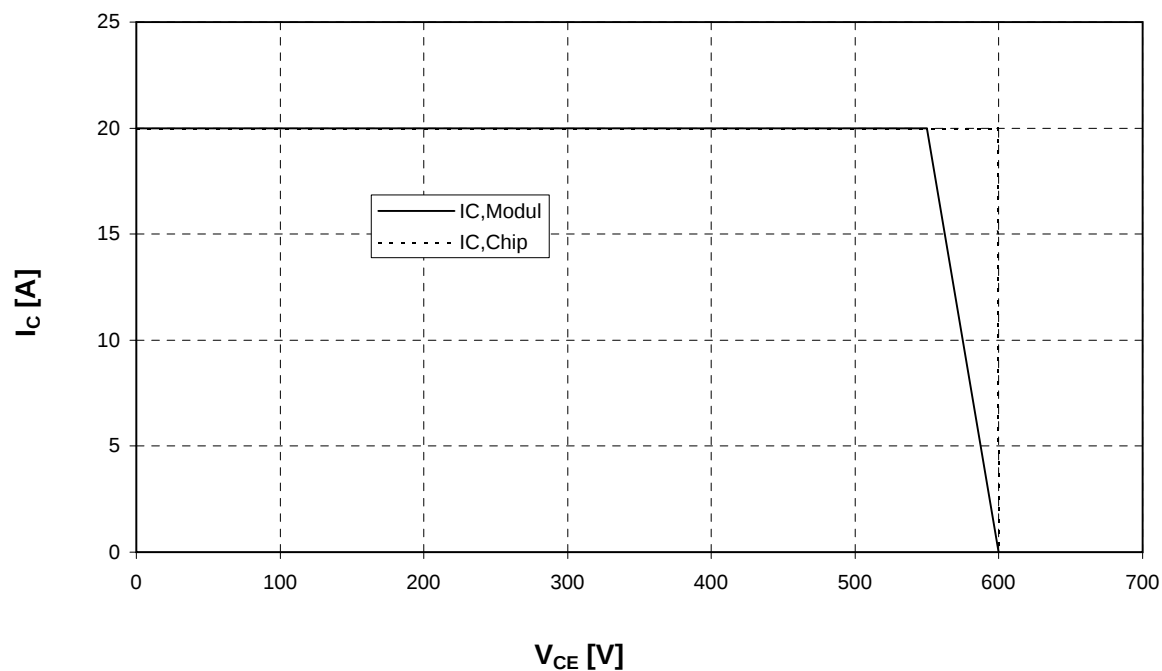
Transient thermal impedance Inverter

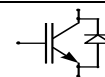


Sicherer Arbeitsbereich Wechslr. (RBSOA)

$$I_c = f(V_{CE})$$

Reverse bias safe operating area Inverter (RBSOA) $T_{vj} = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{V}$, $R_G = 82\ \Omega$



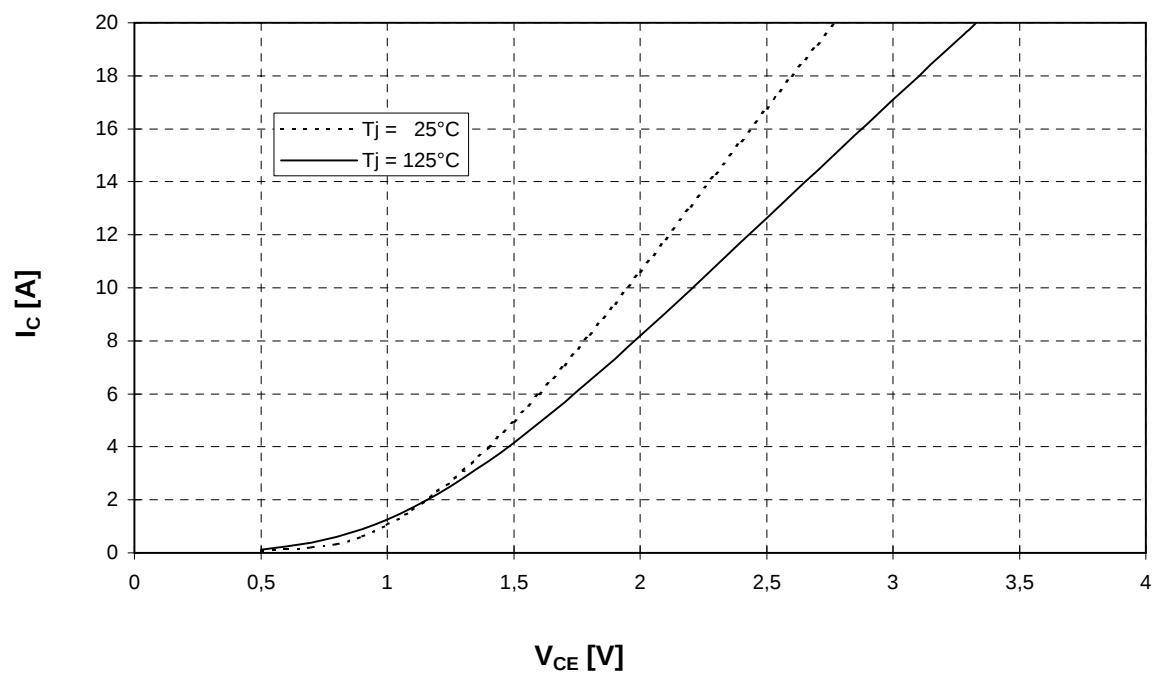


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

$d = f(V_{CE})$

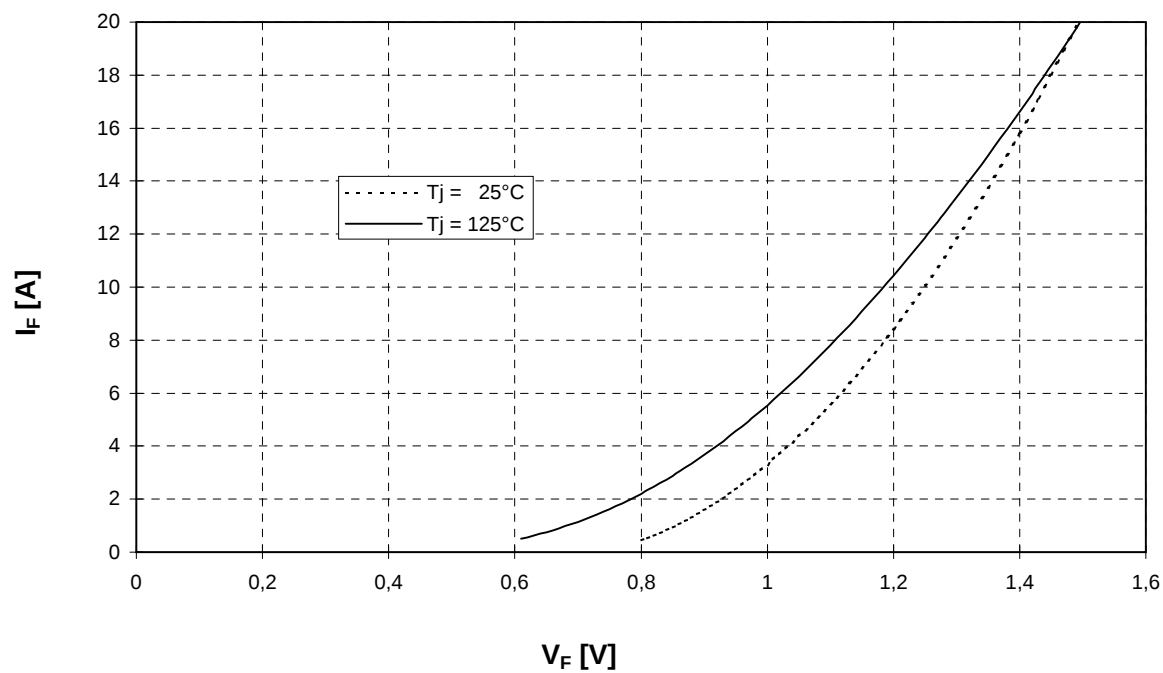
Output characteristic brake-chopper-IGBT (typical)

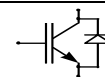
$V_{GE} = 15 \text{ V}$



Durchlaßkennlinie der Brems-Chopper-Diode (typisch) $d = f(V_F)$

Forward characteristic of brake-chopper-FWD (typical)

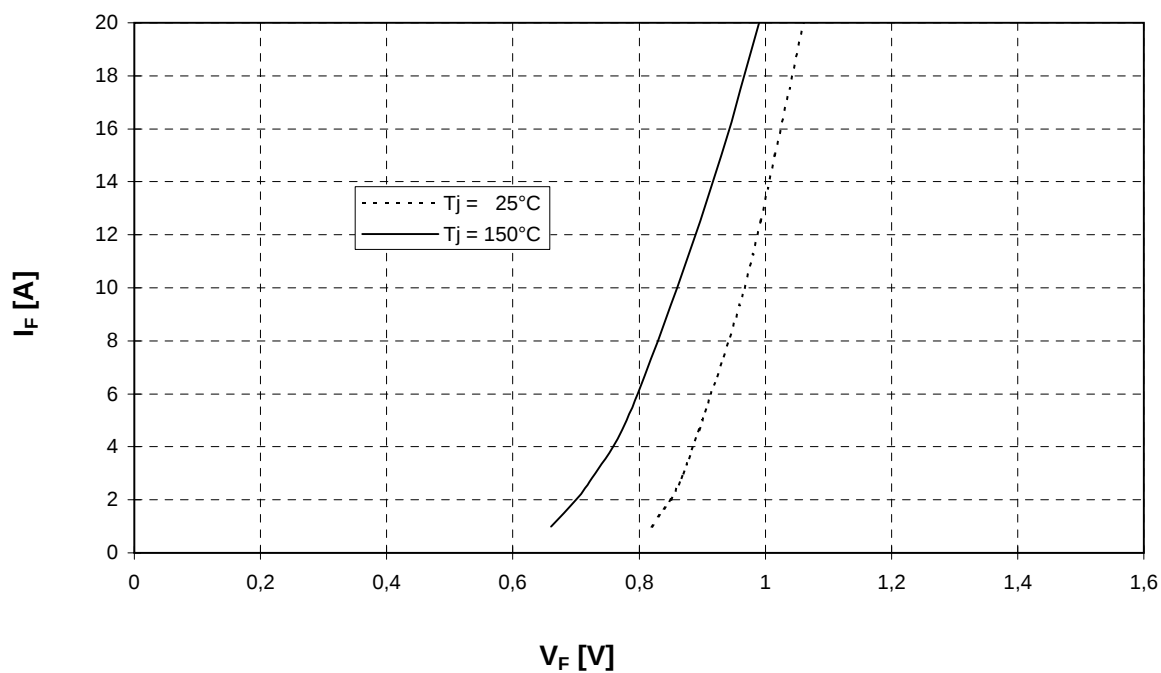




Durchlaßkennlinie der Gleichrichterdiode (typisch)

$$I_F = f(V_F)$$

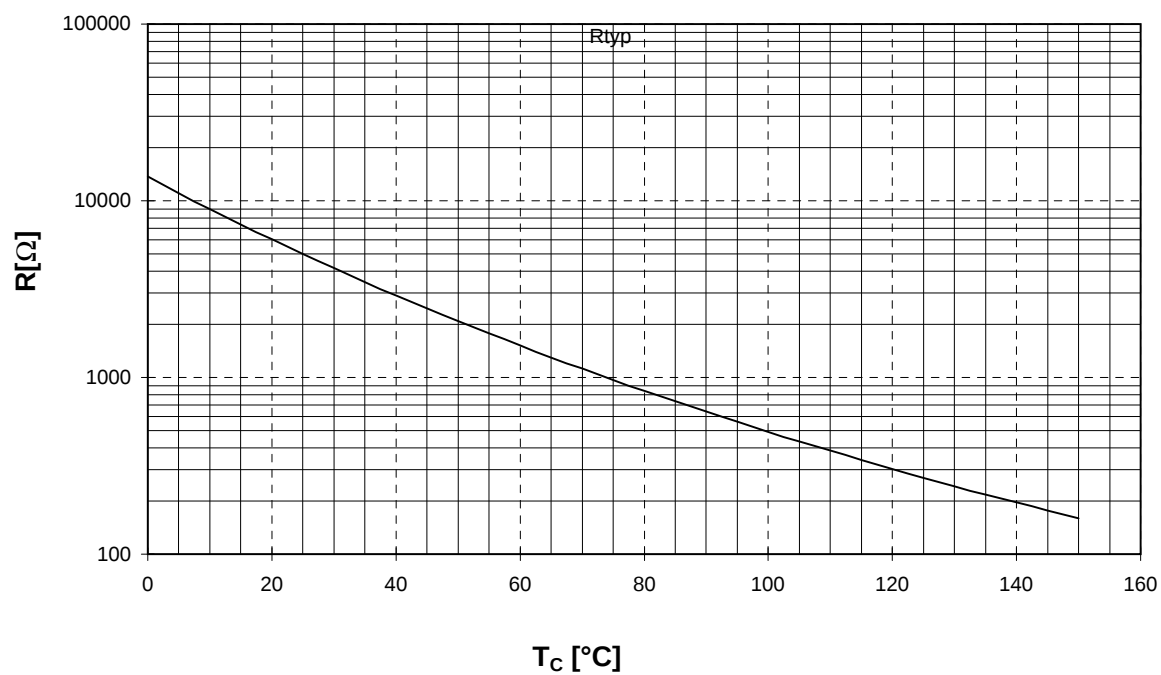
Forward characteristic of Rectifier Diode (typical)

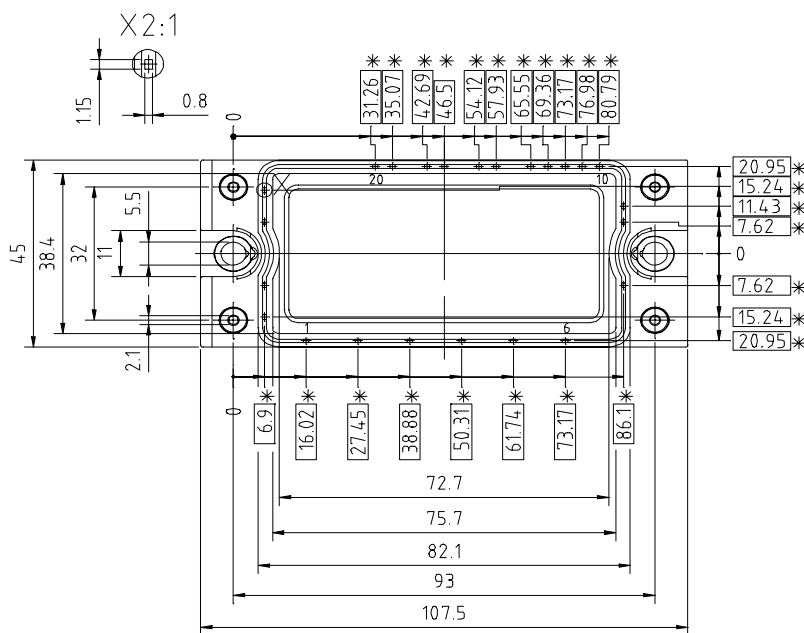
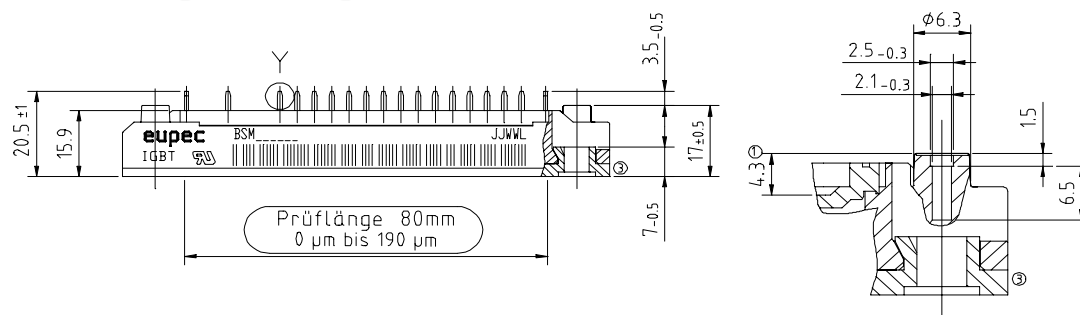
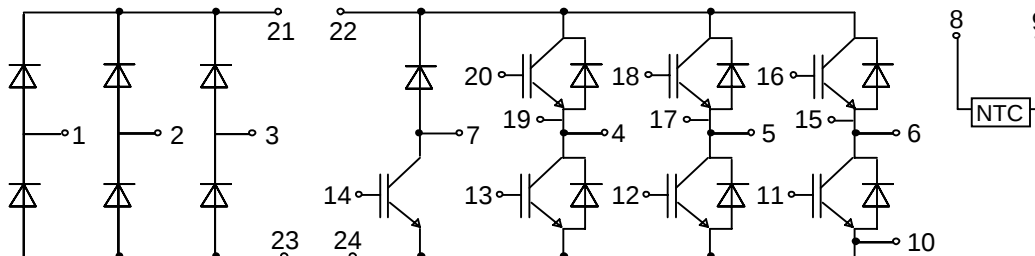
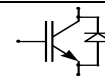


NTC- Temperaturkennlinie (typisch)

$$R = f(T)$$

NTC- temperature characteristic (typical)





* = alle Maße mit einer Toleranz von $\begin{array}{|c|} \hline \oplus \\ \hline \end{array} \varnothing 0.4$

Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

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