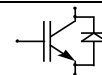


Technische Information / Technical Information

IGBT-Module
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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	15	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	15 25	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	30	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	100	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	15	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	30	A
Grenzlastintegral I^2t - value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	I^2t	70	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

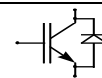
prepared by: Andreas Schulz	date of publication: 17.09.1999
approved by: M. Hierholzer	revision: 3

Technische Information / Technical Information

IGBT-Module
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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	$T_{vj} = 150^{\circ}\text{C}$, $I_F = 15\text{ A}$	V_F	-	0,95	1	V	
Schleusenspannung threshold voltage	$T_{vj} = 150^{\circ}\text{C}$	$V_{(TO)}$	-	-	0,8	V	
Ersatzwiderstand slope resistance	$T_{vj} = 150^{\circ}\text{C}$	r_T	-	-	10,5	mΩ	
Sperrstrom reverse current	$T_{vj} = 150^{\circ}\text{C}$, $V_R = 1600\text{ V}$	I_R	-	2	-	mA	
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^{\circ}\text{C}$	$R_{AA'+CC'}$	-	8	-	mΩ	

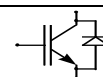
Transistor Wechselrichter/ Transistor Inverter		min.		typ.		max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = 15\text{ A}$	$V_{CE\text{ sat}}$	-	1,95	2,45	V	
	$V_{GE} = 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $I_C = 15\text{ A}$		-	2,2	-	V	
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = 0,4\text{ mA}$	$V_{GE(TO)}$	4,5	5,5	6,5	V	
Eingangskapazität input capacitance	f = 1MHz, $T_{vj} = 25^{\circ}\text{C}$ $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$	C_{ies}	-	0,8	-	nF	
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 600\text{ V}$	I_{CES}	-	0,5	500	μA	
	$V_{GE} = 0\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $V_{CE} = 600\text{ V}$		-	0,8	-	mA	
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{GES}	-	-	300	nA	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	$t_{d,on}$	-	50	-	ns	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	t_r	-	50	-	ns	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	$t_{d,off}$	-	250	-	ns	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
Fallzeit (induktive Last) fall time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	t_f	-	30	-	ns	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	E_{on}	-	0,7	-	mWs	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$L_S = 75\text{ nH}$						
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	E_{off}	-	0,5	-	mWs	
	$V_{GE} = \pm 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 67\text{ Ohm}$						
	$L_S = 75\text{ nH}$						
Kurzschlußverhalten SC Data	$t_p \leq 10\mu\text{s}$, $V_{GE} \leq 15\text{ V}$, $R_G = 67\text{ Ohm}$ $T_{vj} \leq 125^{\circ}\text{C}$, $V_{CC} = 360\text{ V}$ $dI/dt = 900\text{ A}/\mu\text{s}$	I_{SC}	-	65	-	A	

Technische Information / Technical Information

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Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

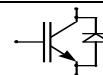
			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	100	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^\circ\text{C}$	$R_{CC'+EE'}$	-	11	-	mΩ
Diode Wechselrichter/ Diode Inverter						
			min.	typ.	max.	
Durchlaßspannung forward voltage	$V_{GE} = 0\text{V}, T_{vj} = 25^\circ\text{C}, I_F = 15\text{A}$ $V_{GE} = 0\text{V}, T_{vj} = 125^\circ\text{C}, I_F = 15\text{A}$	V_F	-	1,25 1,2	1,7 -	V V
Rückstromspitze peak reverse recovery current	$I_F = I_{Nenn}, -di_F/dt = 550\text{A}/\mu\text{s}$ $V_{GE} = -10\text{V}, T_{vj} = 25^\circ\text{C}, V_R = 300\text{V}$ $V_{GE} = -10\text{V}, T_{vj} = 125^\circ\text{C}, V_R = 300\text{V}$	I_{RM}	-	16 20	- -	A A
Sperrverzögerungsladung recovered charge	$I_F = I_{Nenn}, -di_F/dt = 550\text{A}/\mu\text{s}$ $V_{GE} = -10\text{V}, T_{vj} = 25^\circ\text{C}, V_R = 300\text{V}$ $V_{GE} = -10\text{V}, T_{vj} = 125^\circ\text{C}, V_R = 300\text{V}$	Q_r	-	1,2 2	- -	μAs μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = I_{Nenn}, -di_F/dt = 550\text{A}/\mu\text{s}$ $V_{GE} = -10\text{V}, T_{vj} = 25^\circ\text{C}, V_R = 300\text{V}$ $V_{GE} = -10\text{V}, T_{vj} = 125^\circ\text{C}, V_R = 300\text{V}$	E_{RQ}	-	0,25 0,4	- -	mWs mWs
Transistor Brems-Chopper/ Transistor Brake-Chopper						
			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15\text{V}, T_{vj} = 25^\circ\text{C}, I_C = 10,0\text{A}$ $V_{GE} = 15\text{V}, T_{vj} = 125^\circ\text{C}, I_C = 10,0\text{A}$	$V_{CE sat}$	-	1,95 2,2	2,35 -	V V
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^\circ\text{C}, I_C = 0,35\text{mA}$	$V_{GE(TO)}$	4,5	5,5	6,5	V
Eingangskapazität input capacitance	$f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}$ $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{ies}	-	0,6	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0\text{V}, T_{vj} = 25^\circ\text{C}, V_{CE} = 600\text{V}$ $V_{GE} = 0\text{V}, T_{vj} = 125^\circ\text{C}, V_{CE} = 600\text{V}$	I_{CES}	-	0,5 0,8	500 -	μA mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^\circ\text{C}$	I_{GES}	-	-	300	nA
Diode Brems-Chopper/ Diode Brake-Chopper						
			min.	typ.	max.	
Durchlaßspannung forward voltage	$T_{vj} = 25^\circ\text{C}, I_F = 10,0\text{A}$ $T_{vj} = 125^\circ\text{C}, I_F = 10,0\text{A}$	V_F	-	1,25 1,2	1,75 -	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}	$T_C = 100^\circ\text{C}, R_{100} = 493\Omega$	$\Delta R/R$	-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

Technische Information / Technical Information

IGBT-Module
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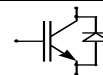


Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode	R_{thJC}	-	-	1	K/W
	Trans. Wechsr./ Trans. Inverter		-	-	1,3	K/W
	Diode Wechsr./ Diode Inverter		-	-	1,8	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 $\lambda_{paste}=1W/m^2K$	R_{thCK}	-	0,08	-	K/W
	Trans. Wechsr./ Trans. Inverter $\lambda_{grease}=1W/m^2K$		-	0,04	-	K/W
	Diode Wechsr./ 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

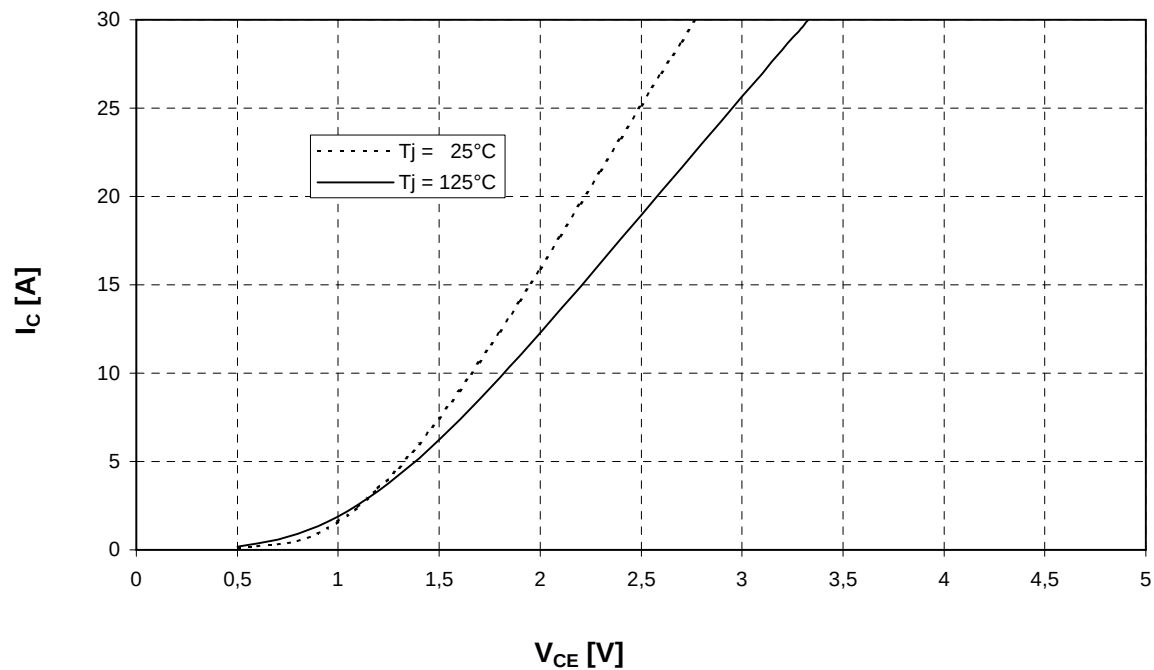


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

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

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

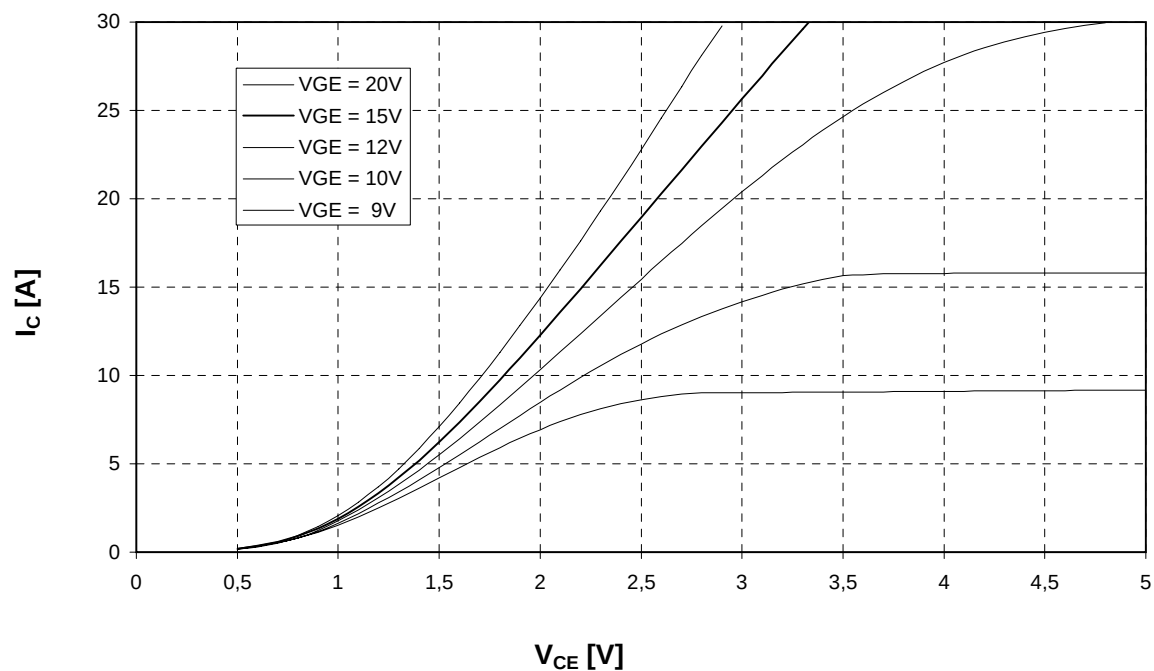


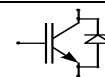
Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

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

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



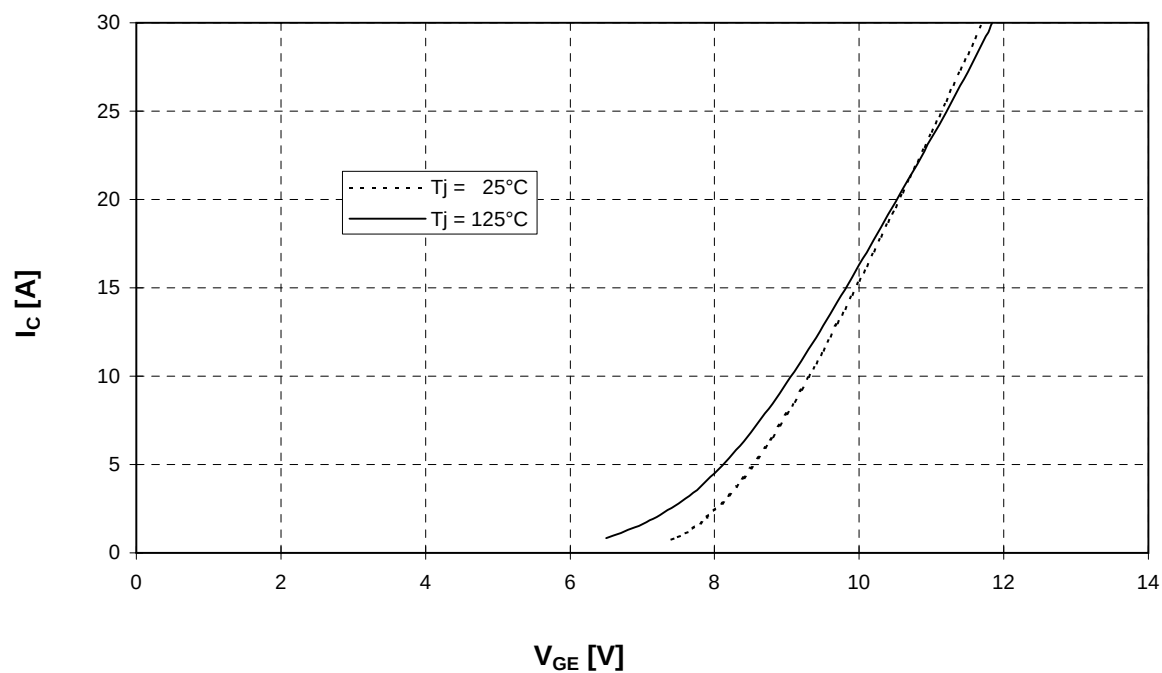


Übertragungscharakteristik Wechselr. (typisch)

Transfer characteristic Inverter (typical)

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

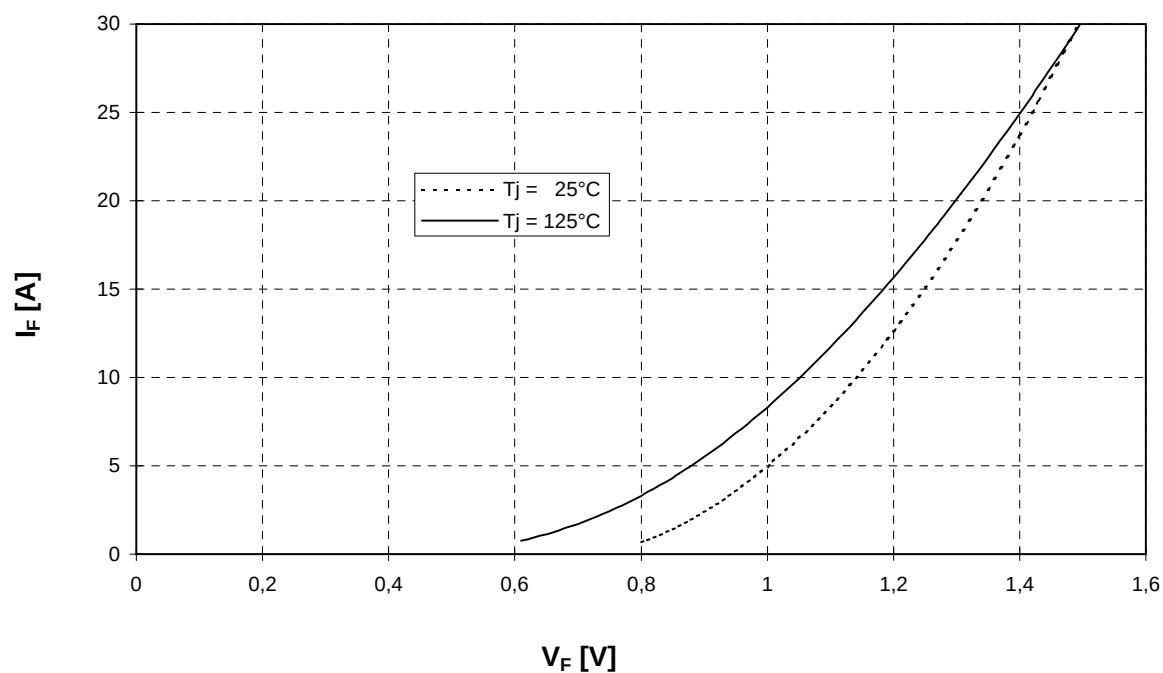
$$V_{CE} = 20 \text{ V}$$

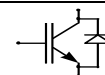


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)

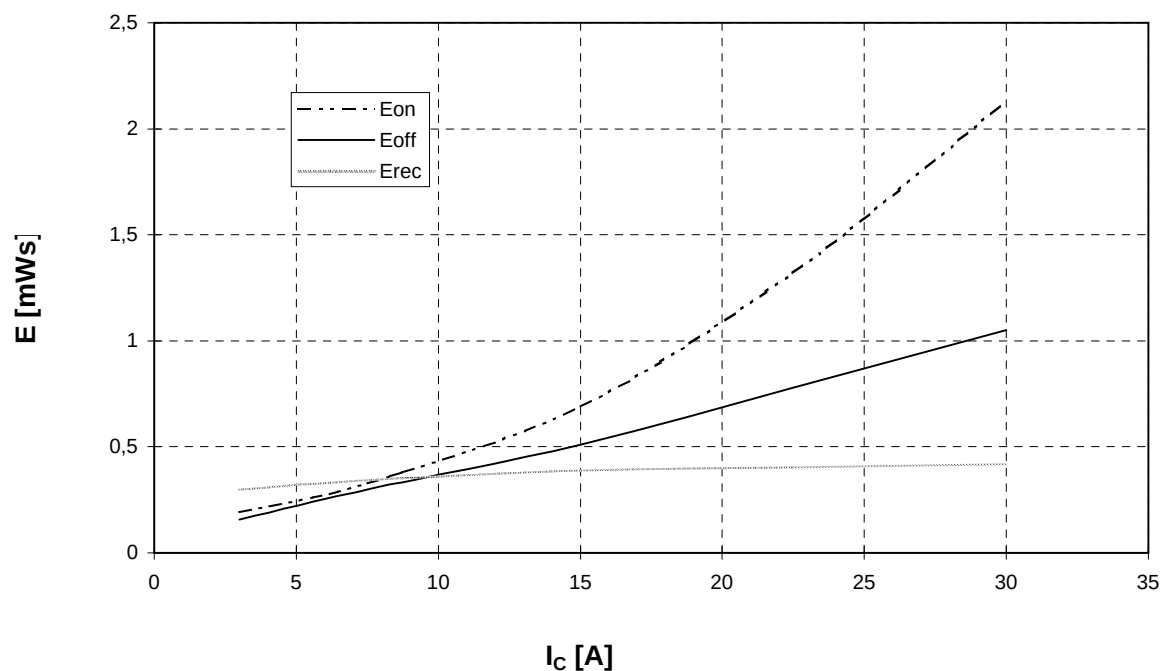
Forward characteristic of FWD Inverter (typical)

$$I_F = f(V_F)$$

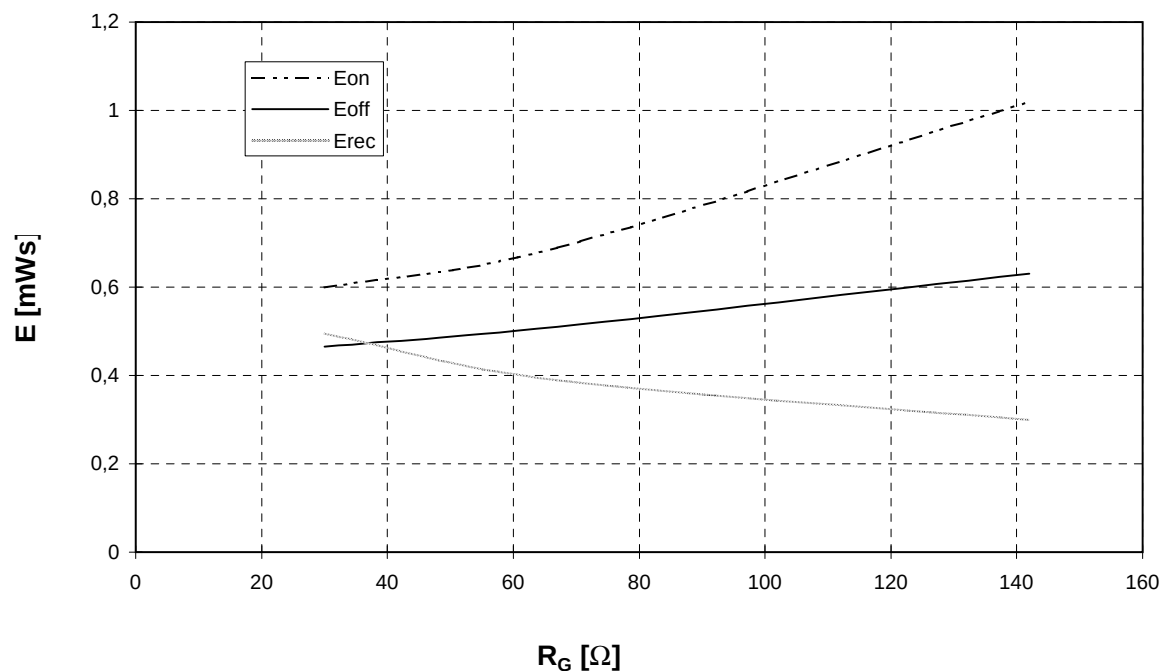


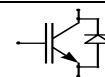


Schaltverluste Wechselr. (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$ $V_{CC} = 300\text{ V}$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = R_{Goff} = 67\text{ Ohm}$



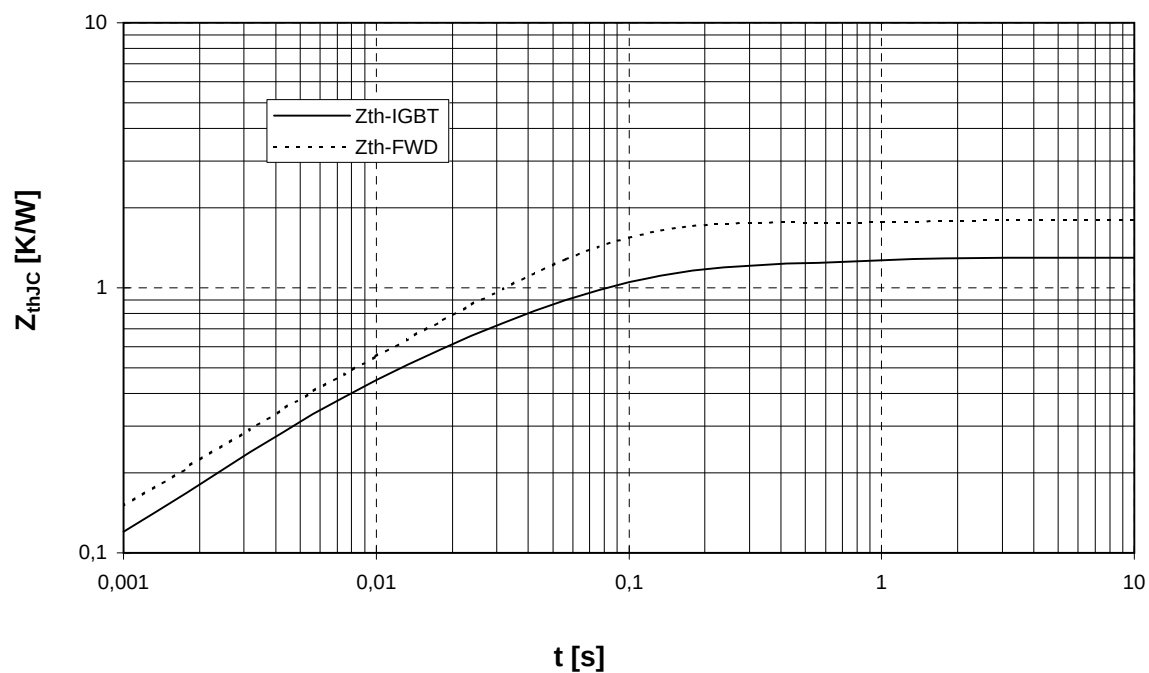
Schaltverluste Wechselr. (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{ V}$, $I_C = I_{nenn}$, $V_{CC} = 300\text{ V}$





Transienter Wärmewiderstand Wechsell.
Transient thermal impedance Inverter

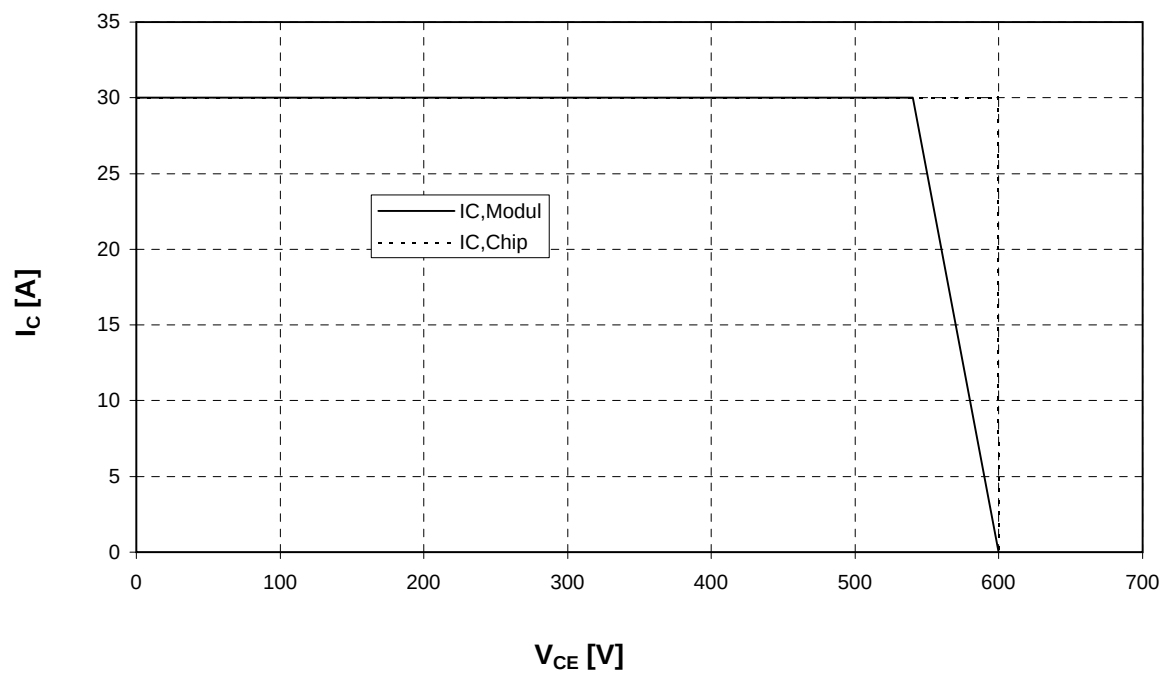
$Z_{thJC} = f(t)$

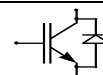


Sicherer Arbeitsbereich Wechsell. (RBSOA)

$I_c = f(V_{CE})$

Reverse bias safe operating area Inverter (RBSOA) $T_{vj} = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{V}$, $R_G = 67\ \Omega$



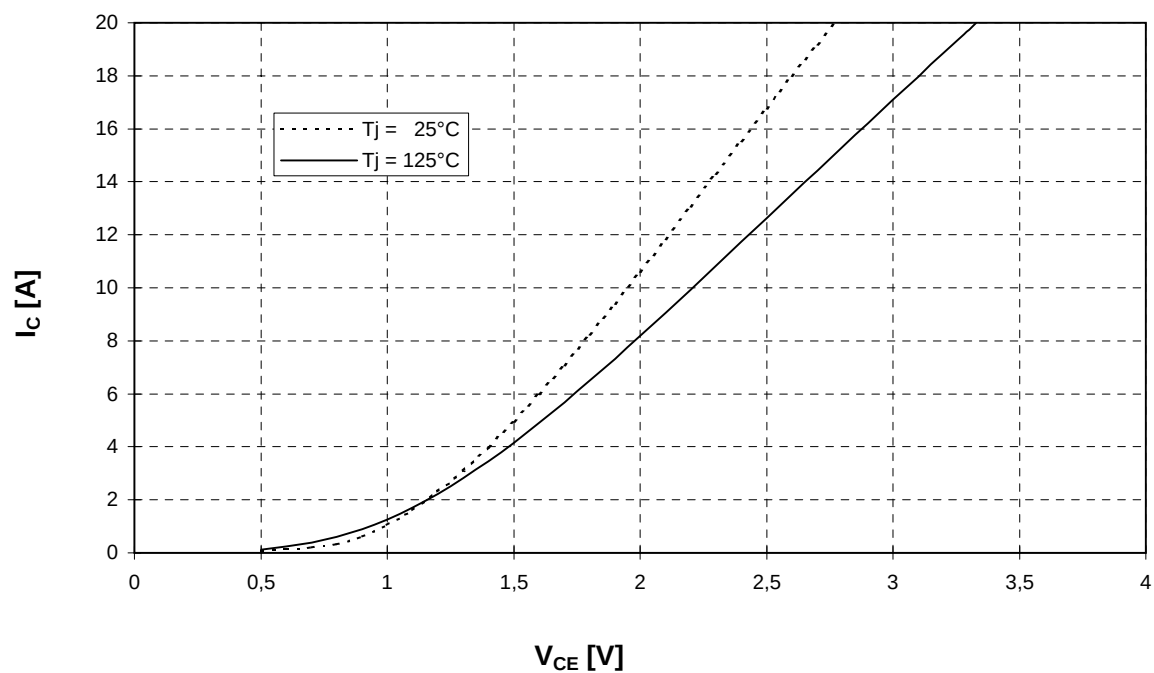


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

$d = f(V_{CE})$

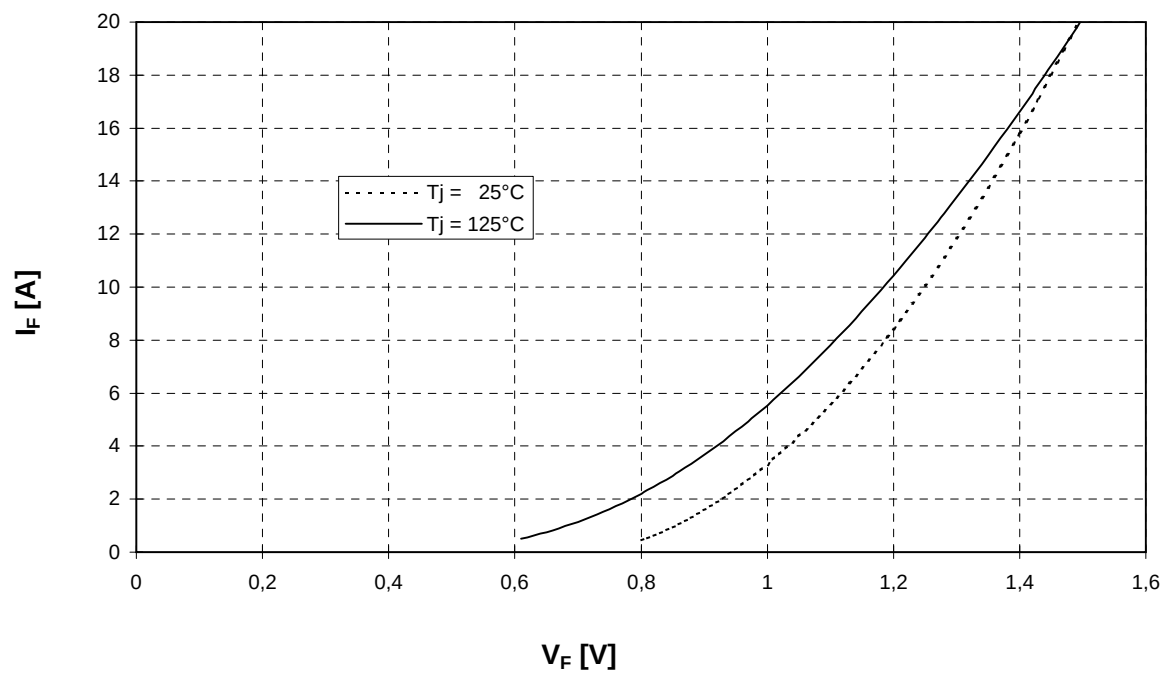
Output characteristic brake-chopper-IGBT (typical)

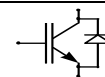
$V_{GE} = 15 \text{ V}$



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

Forward characteristic of brake-chopper-FWD (typical)

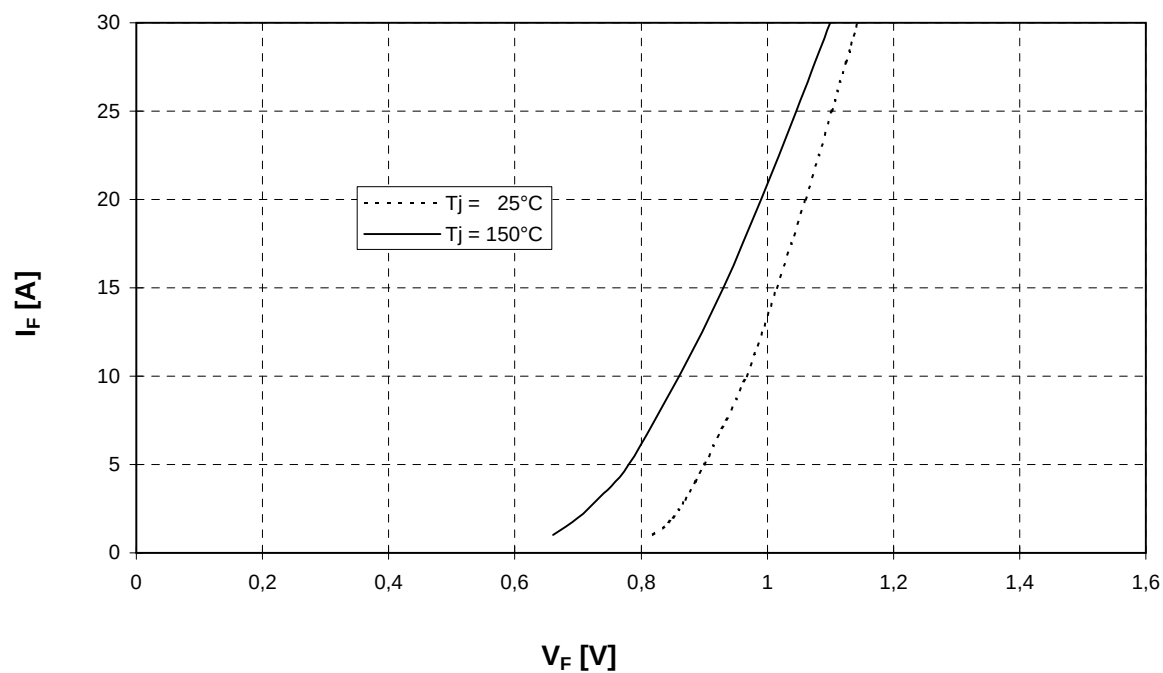




Durchlaßkennlinie der Gleichrichterdiode (typisch)

$$I_F = f(V_F)$$

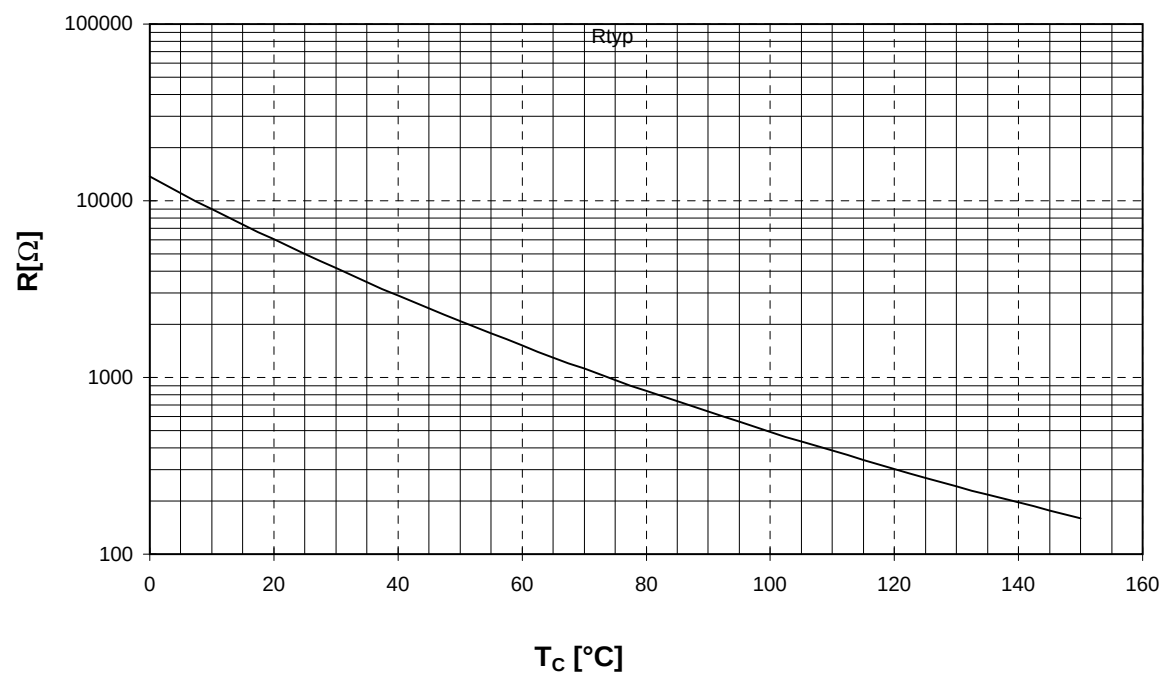
Forward characteristic of Rectifier Diode (typical)

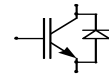


NTC- Temperaturkennlinie (typisch)

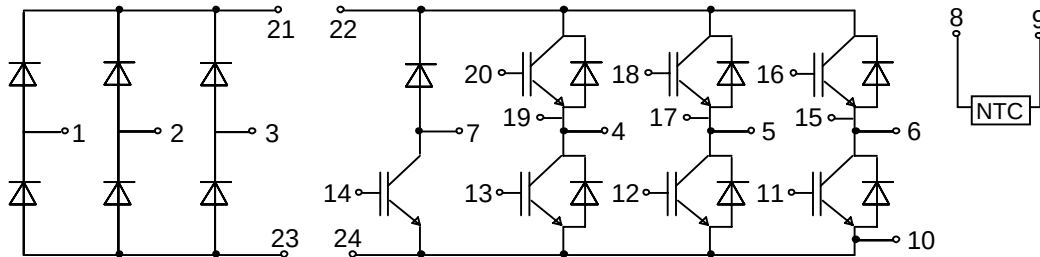
$$R = f(T)$$

NTC- temperature characteristic (typical)

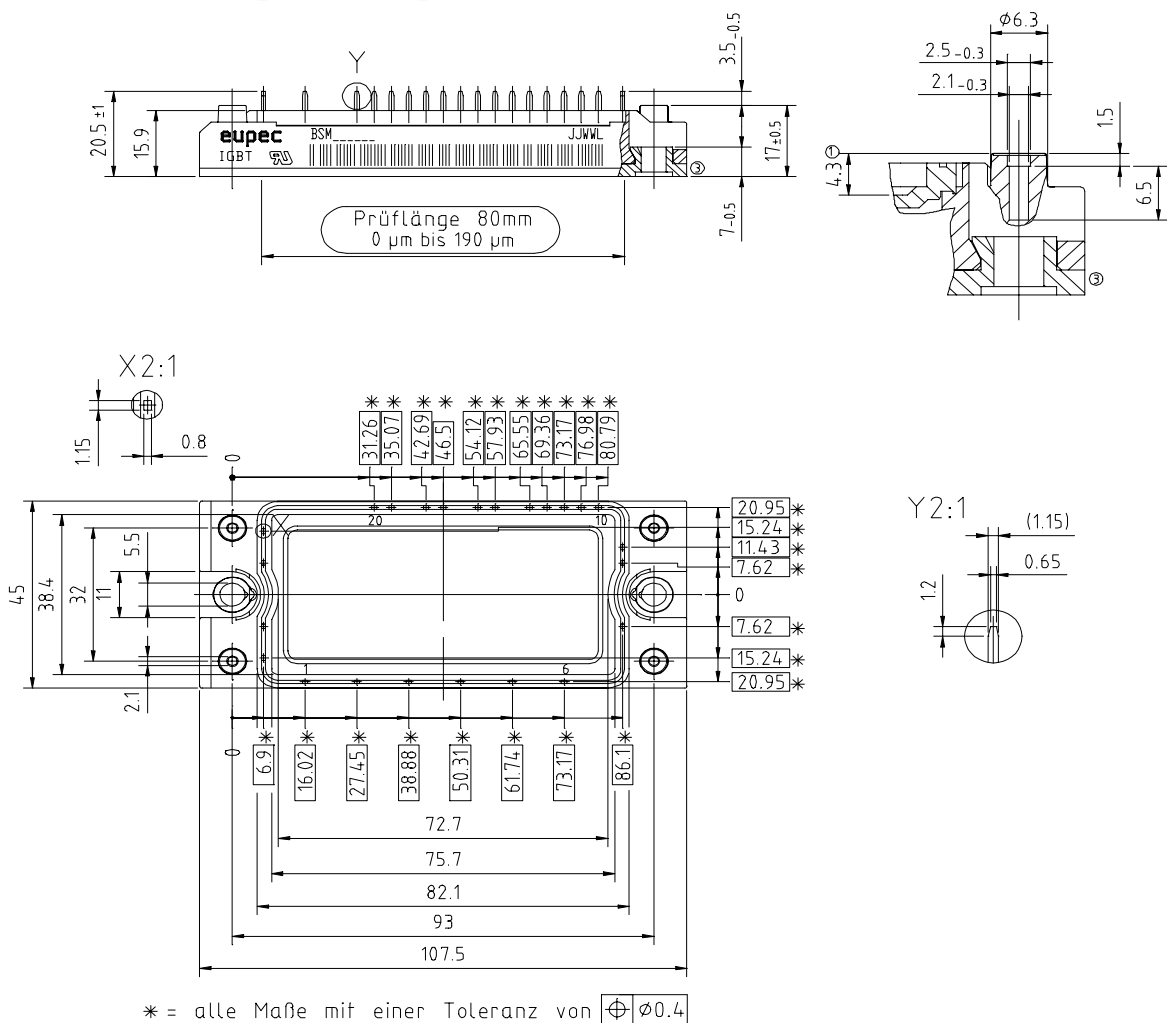




Schaltplan/ Circuit diagram



Gehäuseabmessungen/ Package outlines



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