

Elektrische Eigenschaften / Electrical properties

Höchstzulässige Werte / Maximum rated values

Diode Gleichrichter/ Diode Rectifier

Periodische Rückw. Spitzenspernung repetitive peak reverse voltage		V_{RRM}	1600	V
Durchlaßstrom Grenzeffektivwert RMS forward current per chip		I_{FRMSM}	40	A
Dauergleichstrom DC forward current	$T_C = 80^\circ C$	I_d	50	A
Stoßstrom Grenzwert surge forward current	$t_p = 10 \text{ ms}, T_{vj} = 25^\circ C$ $t_p = 10 \text{ ms}, T_{vj} = 150^\circ C$	I_{FSM}	315 260	A A
Grenzlastintegral I^2t - value	$t_p = 10 \text{ ms}, T_{vj} = 25^\circ C$ $t_p = 10 \text{ ms}, T_{vj} = 150^\circ C$	I^2t	500 340	A^2s A^2s

Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Spernung collector-emitter voltage		V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ C$ $T_C = 25^\circ C$	$I_{C,nom.}$ I_C	50 70	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1 \text{ ms}, T_C = 80^\circ C$	I_{CRM}	100	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ C$	P_{tot}	250	W
Gate-Emitter-Spitzenspernung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current	$T_C = 80^\circ C$	I_F	50	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1 \text{ ms}$	I_{FRM}	100	A
Grenzlastintegral I^2t - value	$V_R = 0V, t_p = 10\text{ms}, T_{vj} = 125^\circ C$	I^2t	760	A^2s

Transistor Brems-Chopper/ Transistor Brake-Chopper

Kollektor-Emitter-Spernung collector-emitter voltage		V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ C$ $T_C = 25^\circ C$	$I_{C,nom.}$ I_C	25 35	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1 \text{ ms}, T_C = 80^\circ C$	I_{CRM}	50	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ C$	P_{tot}	130	W
Gate-Emitter-Spitzenspernung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current	$T_C = 80^\circ C$	I_F	12,5	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1 \text{ ms}$	I_{FRM}	25	A

prepared by: Andreas Schulz	date of publication:29.03.2001
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Technische Information / Technical Information

IGBT-Module
IGBT-Modules

BSM50GP60G

eupec



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

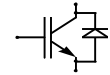
Charakteristische Werte / Characteristic values

Diode Gleichrichter/ Diode Rectifier

				min.	typ.	max.	
Durchlaßspannung forward voltage	$T_{vj} = 150^{\circ}\text{C}$, $I_F = 50\text{ A}$	V_F	-	1,3	-	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	m Ω	
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}	-	4	-	m Ω	

Transistor Wechselrichter/ Transistor Inverter

				min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = 50\text{ A}$	$V_{CE\text{ sat}}$	-	1,95	2,55	V	
	$V_{GE} = 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $I_C = 50\text{ A}$		-	2,2	-	V	
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = 1,0\text{ mA}$	$V_{GE(TO)}$	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}	-	2,8	-	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}	-	1,5	500	μA	
	$V_{GE} = 0\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $V_{CE} = 600\text{ V}$		-	2,0	-	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	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	50	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	50	-	ns	
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	t_r	-	55	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	55	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	55	-	ns	
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	$t_{d,off}$	-	260	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	275	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	275	-	ns	
Fallzeit (induktive Last) fall time (inductive load)	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$	t_f	-	30	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	40	-	ns	
	$V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$		-	40	-	ns	
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$ $L_S = 75\text{ nH}$	E_{on}	-	2,3	-	mWs	
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = I_{Nenn}$, $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $R_G = 22\text{ Ohm}$ $L_S = 75\text{ nH}$	E_{off}	-	1,7	-	mWs	
Kurzschlußverhalten SC Data	$t_P \leq 10\mu\text{s}$, $V_{GE} \leq 15\text{V}$, $R_G = 22\text{ Ohm}$ $T_{vj} \leq 125^{\circ}\text{C}$, $V_{CC} = 360\text{ V}$ $di/dt = 3000\text{ A}/\mu\text{s}$	I_{SC}	-	200	-	A	



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	$T_C = 25^\circ C$	$R_{CC'+EE'}$	-	7	mΩ		
Diode Wechselrichter/ Diode Inverter		min.		typ.		max.	
Durchlaßspannung forward voltage	$V_{GE} = 0V, T_{vj} = 25^\circ C, I_F = 50 A$ $V_{GE} = 0V, T_{vj} = 125^\circ C, I_F = 50 A$	V_F	-	1,25	1,7	V	
Rückstromspitze peak reverse recovery current	$I_F = I_{Nenn}, - di_F/dt = 1150A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	I_{RM}	-	35	-	A	
Sperrverzögerungsladung recovered charge	$I_F = I_{Nenn}, - di_F/dt = 1150A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	Q_r	-	3,4	-	μAs	
Abschaltenergie pro Puls reverse recovery energy	$I_F = I_{Nenn}, - di_F/dt = 1150A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	E_{RO}	-	0,8	-	mWs	
			-	1,3	-	mWs	
Transistor Brems-Chopper/ Transistor Brake-Chopper		min.		typ.		max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15V, T_{vj} = 25^\circ C, I_C = 25,0 A$ $V_{GE} = 15V, T_{vj} = 125^\circ C, I_C = 25,0 A$	$V_{CE sat}$	-	2,2	2,75	V	
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^\circ C, I_C = 0,5 mA$	$V_{GE(TO)}$	4,5	5,5	6,5	V	
Eingangskapazität input capacitance	$f = 1MHz, T_{vj} = 25^\circ C$ $V_{CE} = 25 V, V_{GE} = 0 V$	C_{ies}	-	1,1	-	nF	
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0V, T_{vj} = 25^\circ C, V_{CE} = 600 V$ $V_{GE} = 0V, T_{vj} = 125^\circ C, V_{CE} = 600 V$	I_{CES}	-	0,7	500	μA	
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$	I_{GES}	-	-	300	nA	
Diode Brems-Chopper/ Diode Brake-Chopper		min.		typ.		max.	
Durchlaßspannung forward voltage	$T_{vj} = 25^\circ C, I_F = 25,0 A$ $T_{vj} = 125^\circ C, I_F = 25,0 A$	V_F	-	1,6	2,05	V	
			-	1,65	-	V	
NTC-Widerstand/ NTC-Thermistor		min.		typ.		max.	
Nennwiderstand rated resistance	$T_C = 25^\circ C$	R_{25}	-	5	-	kΩ	
Abweichung von R_{100} deviation of R_{100}	$T_C = 100^\circ C, R_{100} = 493 \Omega$	$\Delta R/R$	-5		5	%	
Verlustleistung power dissipation	$T_C = 25^\circ C$	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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BSM50GP60G

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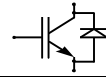


Thermische Eigenschaften / Thermal properties

		min.	typ.	max.		
Innerer Wärmewiderstand thermal resistance, junction to case	Gleicher. Diode/ Rectif. Diode	R_{thJC}	-	-	1	K/W
	Trans. Wechr./ Trans. Inverter		-	-	0,5	K/W
	Diode Wechr./ Diode Inverter		-	-	0,8	K/W
	Trans. Bremse/ Trans. Brake		-	-	1	K/W
	Diode Bremse/ Diode Brake		-	-	2,3	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleicher. Diode/ Rectif. Diode	R_{thCK}	-	0,04	-	K/W
	Trans. Wechr./ Trans. Inverter	$\lambda_{paste}=1W/m^2K$	-	0,02	-	K/W
	Diode Wechr./ Diode Inverter	$\lambda_{grease}=1W/m^2K$	-	0,04	-	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 $\pm 10\%$	Nm
Gewicht weight		G		300	g

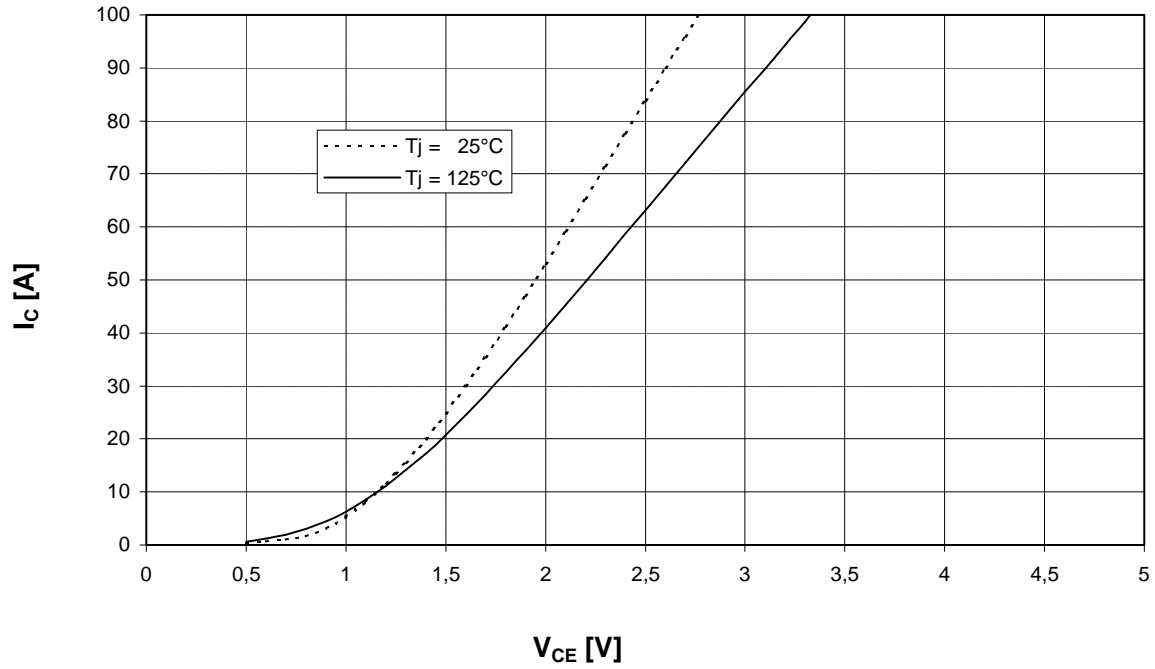


Ausgangskennlinienfeld Wechselr. (typisch)

$I_C = f(V_{CE})$

Output characteristic Inverter (typical)

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

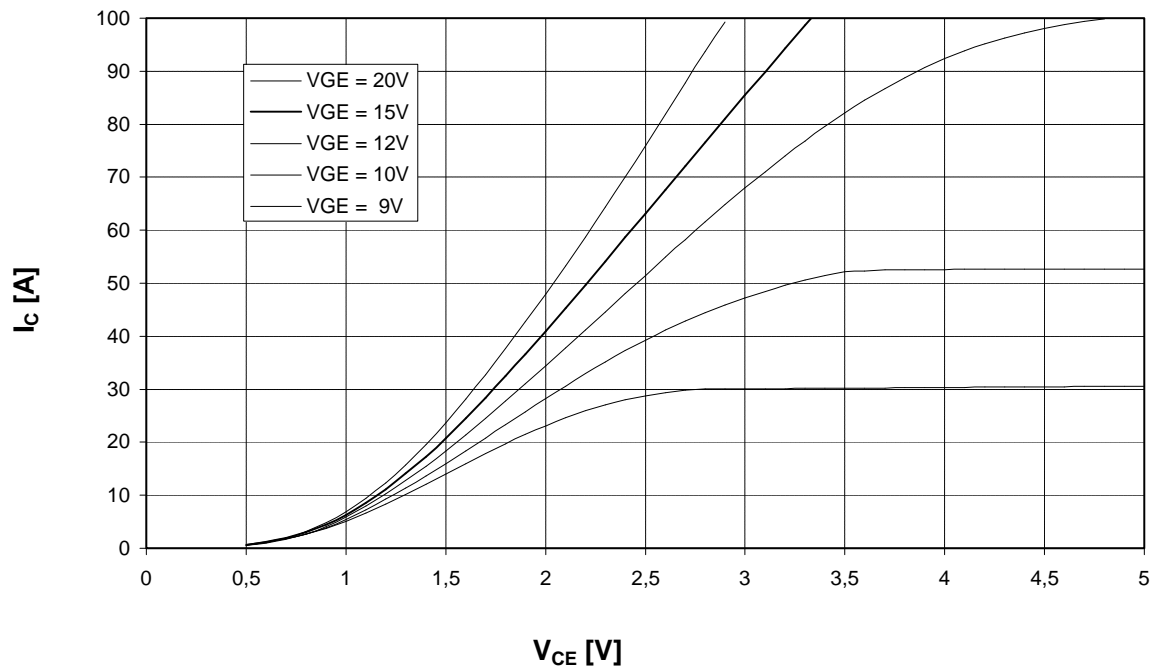


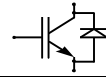
Ausgangskennlinienfeld Wechselr. (typisch)

$I_C = f(V_{CE})$

Output characteristic Inverter (typical)

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



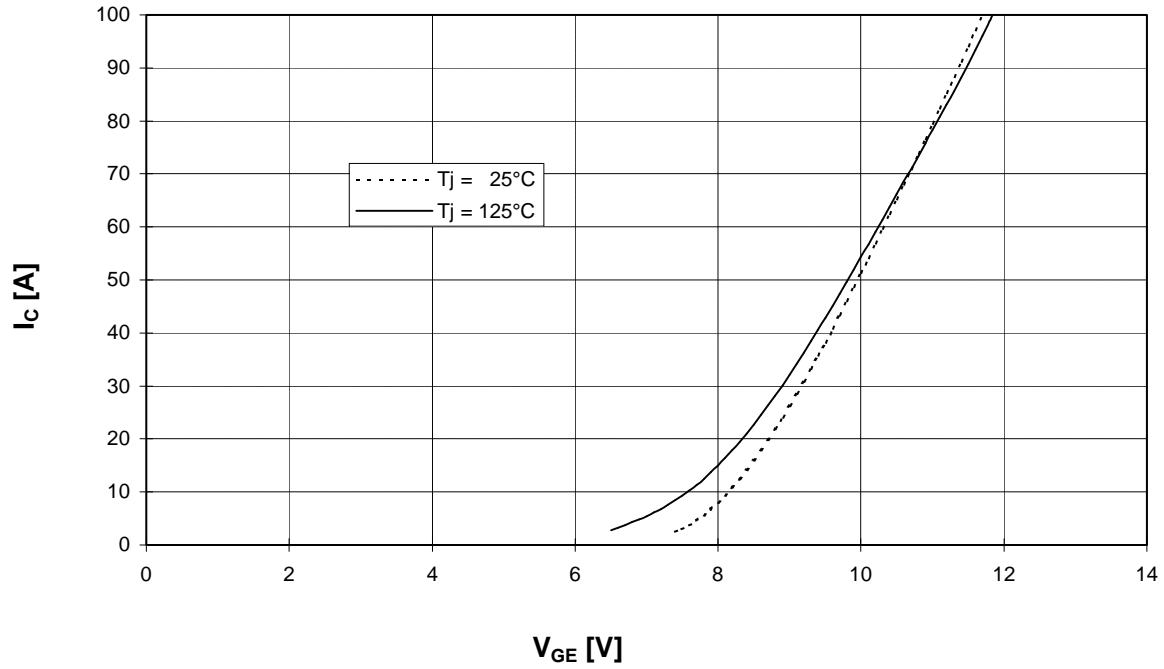


Übertragungscharakteristik Wechselr. (typisch)

$I_C = f(V_{GE})$

Transfer characteristic Inverter (typical)

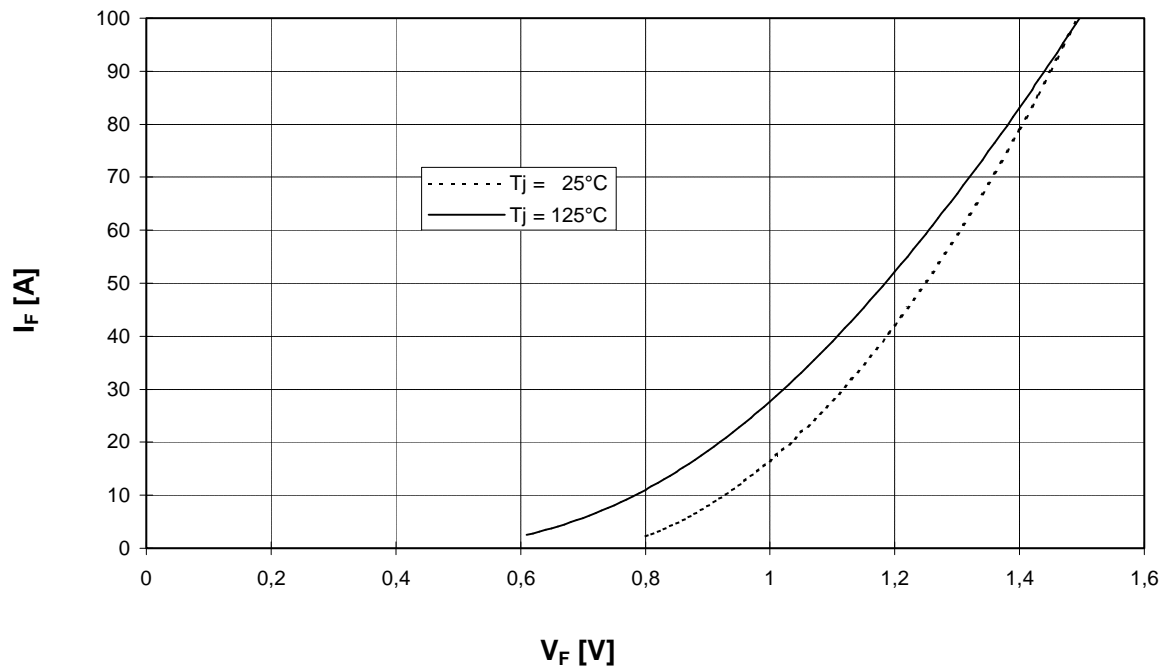
$V_{CE} = 20\text{ V}$

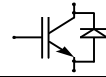


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)

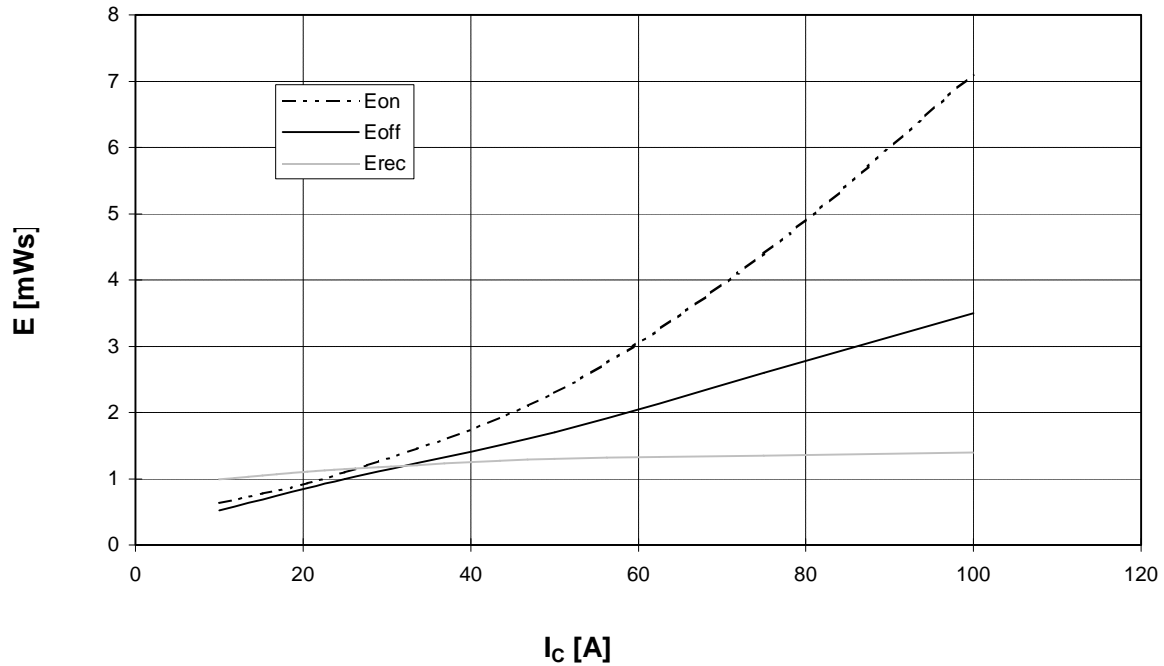
$I_F = f(V_F)$

Forward characteristic of FWD Inverter (typical)

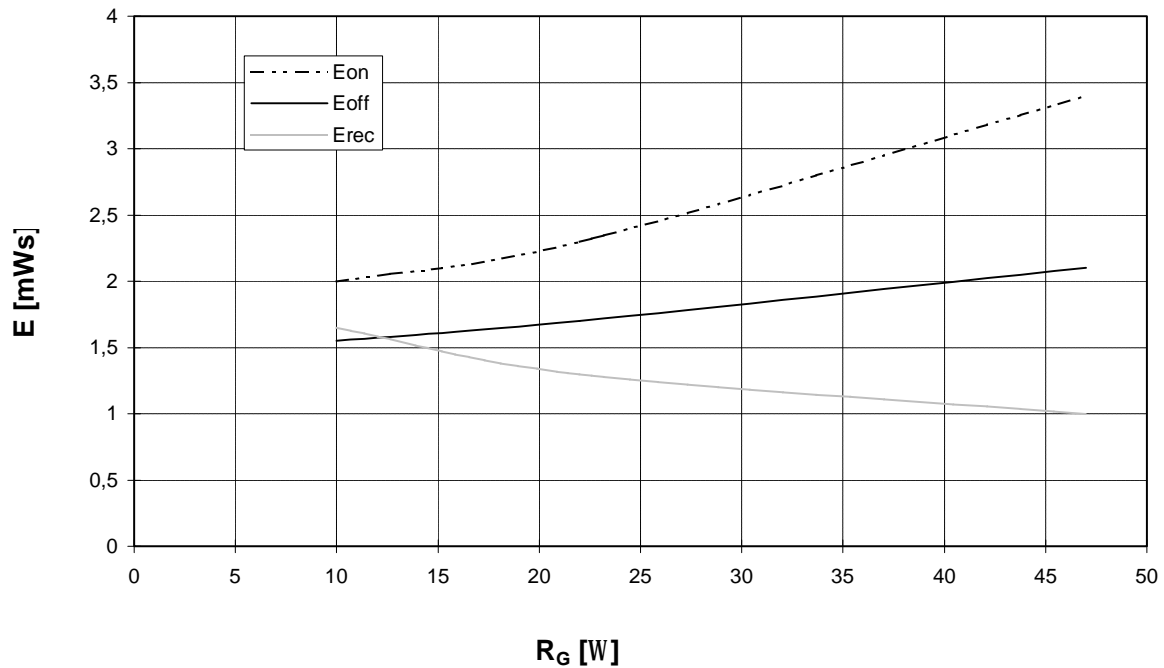


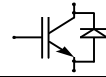


Schaltverluste Wechselr. (typisch) $E_{on} = f(I_c), E_{off} = f(I_c), E_{rec} = f(I_c)$ $V_{CC} = 300\text{ V}$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}, V_{GE} = \pm 15\text{ V}, R_{Gon} = R_{Goff} = 22\text{ Ohm}$



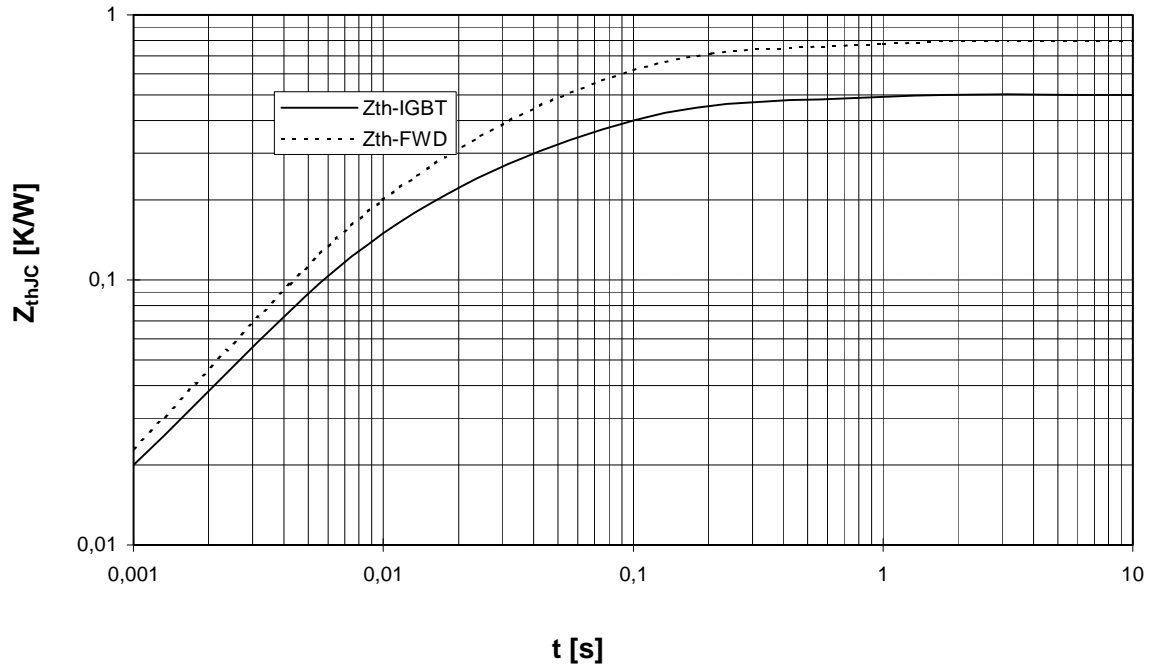
Schaltverluste Wechselr. (typisch) $E_{on} = f(R_G), E_{off} = f(R_G), E_{rec} = f(R_G)$
Switching losses Inverter (typical) $T_j = 125^\circ\text{C}, V_{GE} = \pm 15\text{ V}, I_c = I_{nenn}, V_{CC} = 300\text{ V}$





Transienter Wärmewiderstand Wechslr.
Transient thermal impedance Inverter

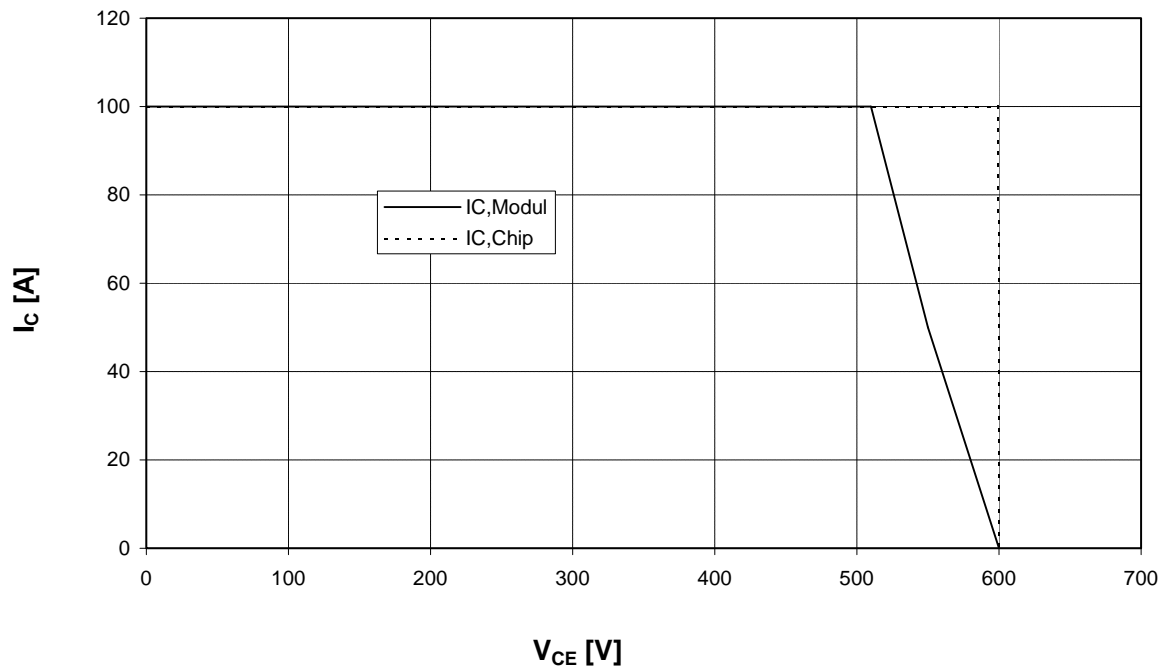
$Z_{thJC} = f(t)$



Sicherer Arbeitsbereich Wechslr. (RBSOA)

$I_C = f(V_{CE})$

Reverse bias safe operating area Inverter (RBSOA) $T_{vj} = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{V}$, $R_G = 22 \text{ Ohm}$



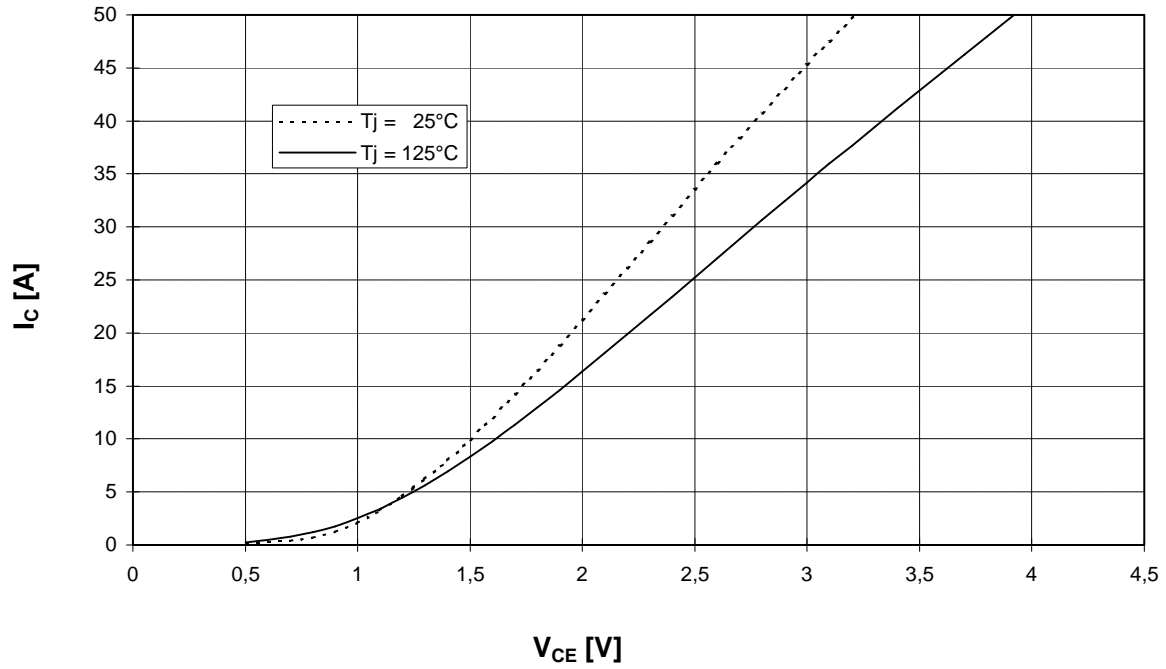


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

Output characteristic brake-chopper-IGBT (typical)

$I_C = f(V_{CE})$

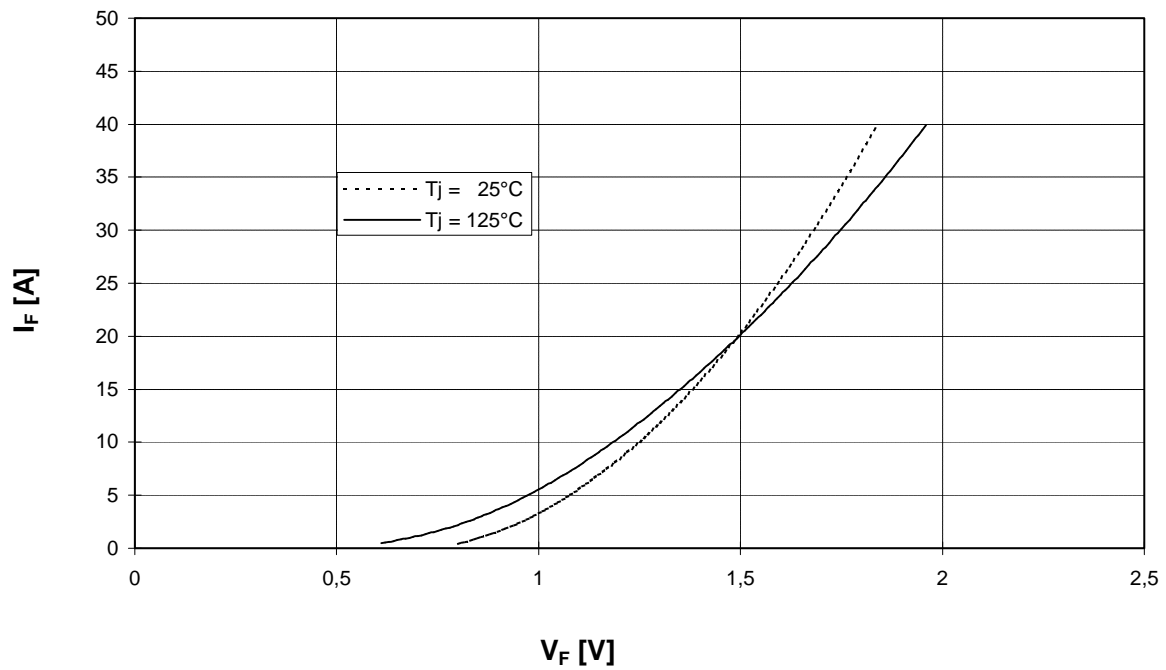
$V_{GE} = 15\text{ V}$

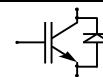


Durchlaßkennlinie der Brems-Chopper-Diode (typisch)

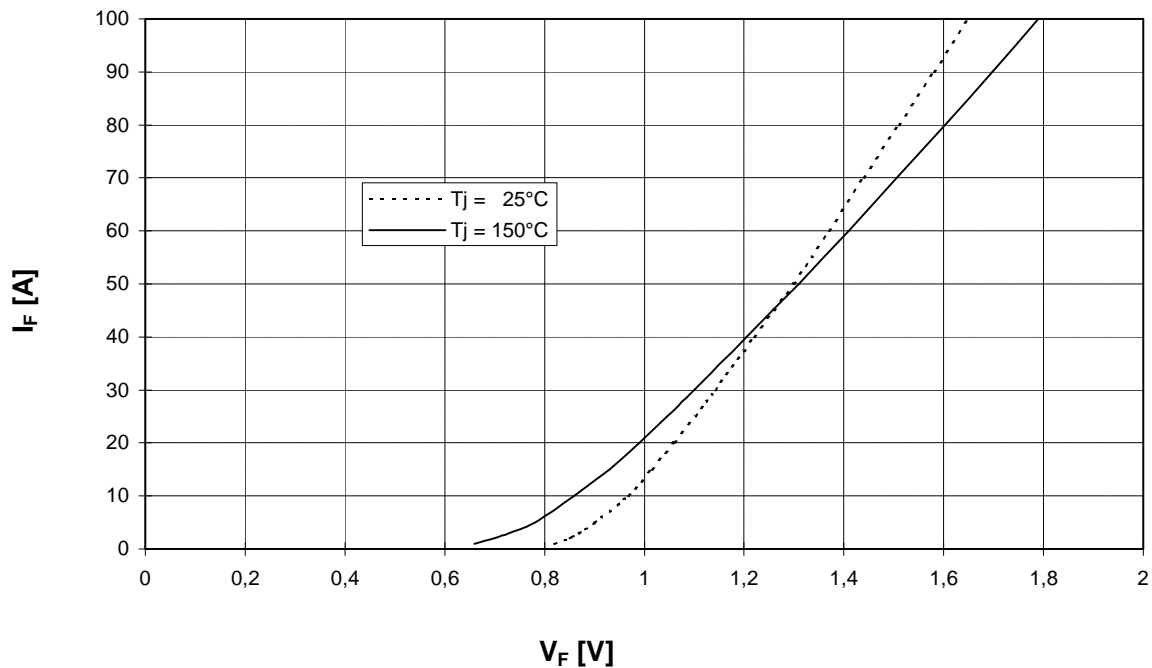
Forward characteristic of brake-chopper-FWD (typical)

$I_F = f(V_F)$

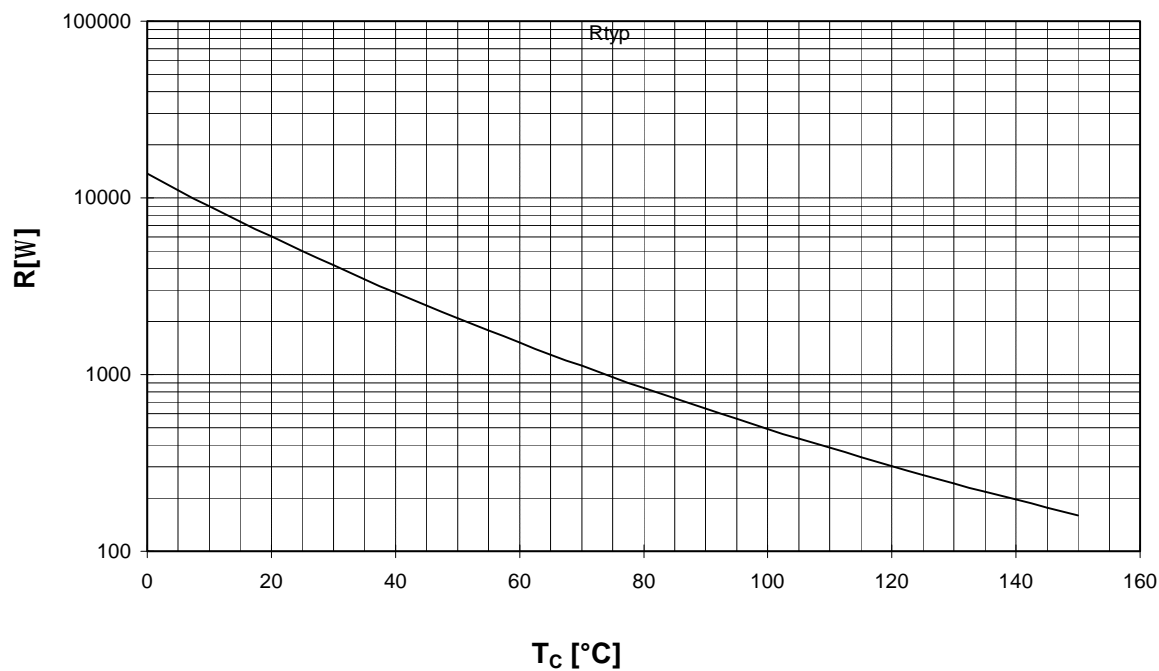


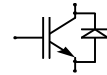


Durchlaßkennlinie der Gleichrichterdiode (typisch) $I_F = f(V_F)$
Forward characteristic of Rectifier Diode (typical)

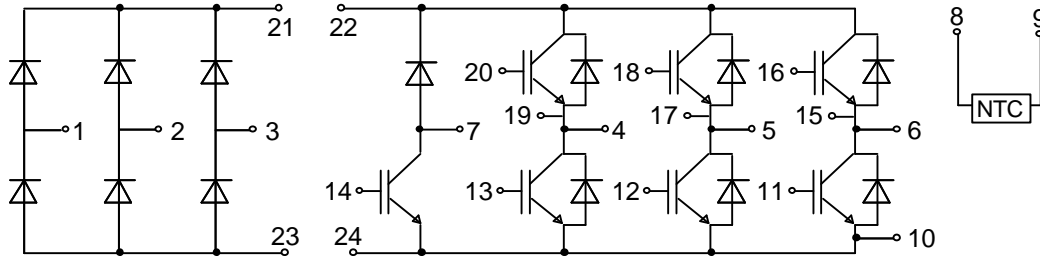


NTC- Temperaturkennlinie (typisch) $R = f(T)$
NTC- temperature characteristic (typical)

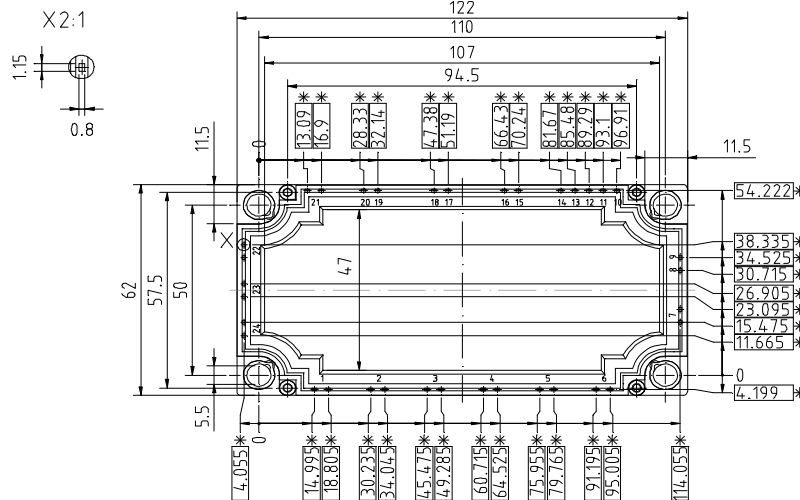
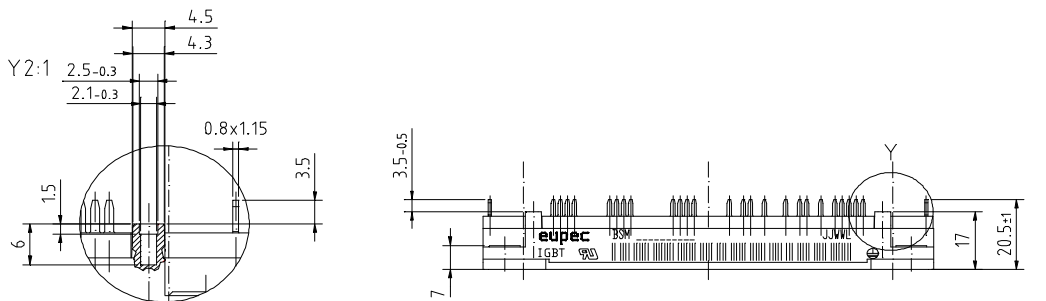




Schaltplan/ Circuit diagram



Gehäuseabmessungen/ Package outlines



* = alle Maße mit einer Toleranz von ± 0.5

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This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.

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