

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FP50R12KS4C

eupec



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	50	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}	500 400	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	1250 800	A^2s A^2s

Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ I_C	50 70	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	100	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	360	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	50	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	100	A
Grenzlastintegral I^2t - value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	I^2t	1.200	A^2s

Transistor Brems-Chopper/ Transistor Brake-Chopper

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ I_C	25 45	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	50	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	230	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	15	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	30	A

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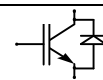
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Modul Isolation/ Module Isolation

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

Diode Gleichrichter/ Diode Rectifier				min.	typ.	max.	
Durchlaßspannung forward voltage	$T_{vj} = 150^{\circ}\text{C},$	$I_F = 50\text{ A}$	V_F	-	1,05	-	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	-	-	6,5	mΩ
Sperrstrom reverse current	$T_{vj} = 150^{\circ}\text{C},$	$V_R = 1600\text{ V}$	I_R	-	3	-	mA
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^{\circ}\text{C}$		$R_{AA'+CC'}$	-	4	-	mΩ

Transistor Wechselrichter/ Transistor Inverter

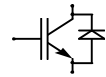
Transistor Wechselrichter/ Transistor Inverter				min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15V, T_{vj} = 25^{\circ}C, I_C = 50 A$ $V_{GE} = 15V, T_{vj} = 125^{\circ}C, I_C = 50 A$	$V_{CE sat}$	- -	3,2 3,85	3,7 -	V V	
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^{\circ}C, I_C = 2 mA$	$V_{GE(TO)}$	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}	-	3,3	-	nF	
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0V, T_{vj} = 25^{\circ}C, V_{CE} = 1200 V$	I_{CES}	-	-	5	mA	
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^{\circ}C$	I_{GES}	-	-	400	nA	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = I_{Nenn}, V_{CC} = 600 V$	$t_{d,on}$	-	60	-	ns	
	$V_{GE} = \pm 15V, T_{vj} = 25^{\circ}C, R_G = 15 \text{ Ohm}$						
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = I_{Nenn}, V_{CC} = 600 V$	t_r	-	50	-	ns	
	$V_{GE} = \pm 15V, T_{vj} = 25^{\circ}C, R_G = 15 \text{ Ohm}$						
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = I_{Nenn}, V_{CC} = 600 V$	$t_{d,off}$	-	340	-	ns	
	$V_{GE} = \pm 15V, T_{vj} = 25^{\circ}C, R_G = 15 \text{ Ohm}$						
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
Fallzeit (induktive Last) fall time (inductive load)	$I_C = I_{Nenn}, V_{CC} = 600 V$	t_f	-	50	-	ns	
	$V_{GE} = \pm 15V, T_{vj} = 25^{\circ}C, R_G = 15 \text{ Ohm}$						
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = I_{Nenn}, V_{CC} = 600 V$	E_{on}	-	6,5	-	mWs	
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
	$L_S = 50 \text{ nH}$						
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = I_{Nenn}, V_{CC} = 600 V$	E_{off}	-	3,4	-	mWs	
	$V_{GE} = \pm 15V, T_{vj} = 125^{\circ}C, R_G = 15 \text{ Ohm}$						
	$L_S = 50 \text{ nH}$						
Kurzschlußverhalten SC Data	$t_p \leq 10\mu s, V_{GE} \leq 15V, R_G = 15 \text{ Ohm}$ $T_{vj} \leq 125^{\circ}C, V_{CC} = 720 V$ $dI/dt = 4000 A/\mu s$	I_{SC}	-	300	-	A	

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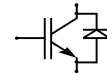
			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	100	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^\circ C$	$R_{CC'+EE'}$	-	7	-	mΩ
Diode Wechselrichter/ Diode Inverter			min.	typ.	max.	
Durchlaßspannung forward voltage	$V_{GE} = 0V, T_{vj} = 25^\circ C, I_F = 50 A$ $V_{GE} = 0V, T_{vj} = 125^\circ C, I_F = 50 A$	V_F	-	1,75 1,7	2,15 -	V V
Rückstromspitze peak reverse recovery current	$I_F = I_{Nenn}, -di_F/dt = 1600A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	I_{RM}	-	75 85	- -	A A
Sperrverzögerungsladung recovered charge	$I_F = I_{Nenn}, -di_F/dt = 1600A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	Q_r	-	5,5 12	- -	μAs μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = I_{Nenn}, -di_F/dt = 1600A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	E_{RQ}	-	1,6 4	- -	mWs 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 2,5	2,55 -	V V
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^\circ C, I_C = 1mA$	$V_{GE(TO)}$	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}	-	1,5	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0V, T_{vj} = 25^\circ C, V_{CE} = 1200 V$ $V_{GE} = 0V, T_{vj} = 125^\circ C, V_{CE} = 1200 V$	I_{CES}	-	1,5 2,0	500 -	μA mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$	I_{GES}	-	-	300	nA
Schaltverluste und -bedingungen Switching losses and conditions	siehe Datenblatt (Wechselrichter) see datasheet (inverter)	BSM25GP120				
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	-	2,1 2	2,4 -	V V
Schaltverluste und -bedingungen Switching losses and conditions	siehe Datenblatt (Wechselrichter) see datasheet (inverter)	BSM15GP120				
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

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Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode	R_{thJC}	-	-	0,65	K/W
	Trans. Wechr./ Trans. Inverter		-	-	0,35	K/W
	Diode Wechr./ Diode Inverter		-	-	0,55	K/W
	Trans. Bremse/ Trans. Brake		-	-	0,55	K/W
	Diode Bremse/ Diode Brake		-	-	1,2	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleichr. 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		$T_{vj\ max}$	-	-	150	°C
Betriebstemperatur operation temperature		$T_{vj\ op}$	-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	300	g

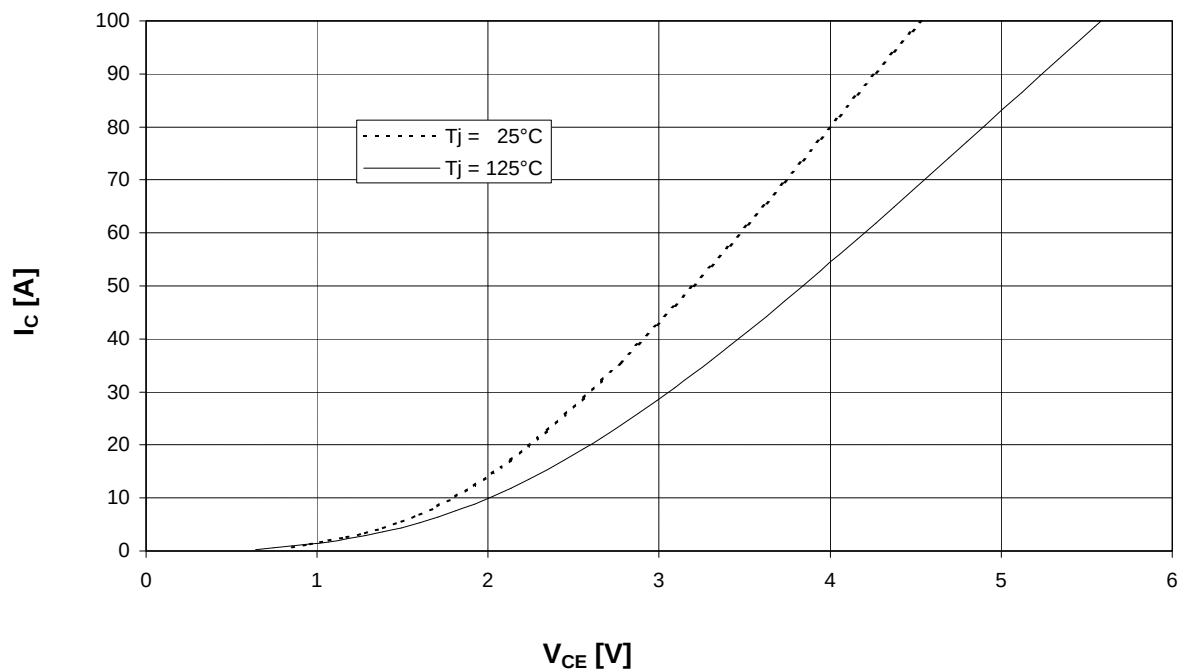


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

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

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

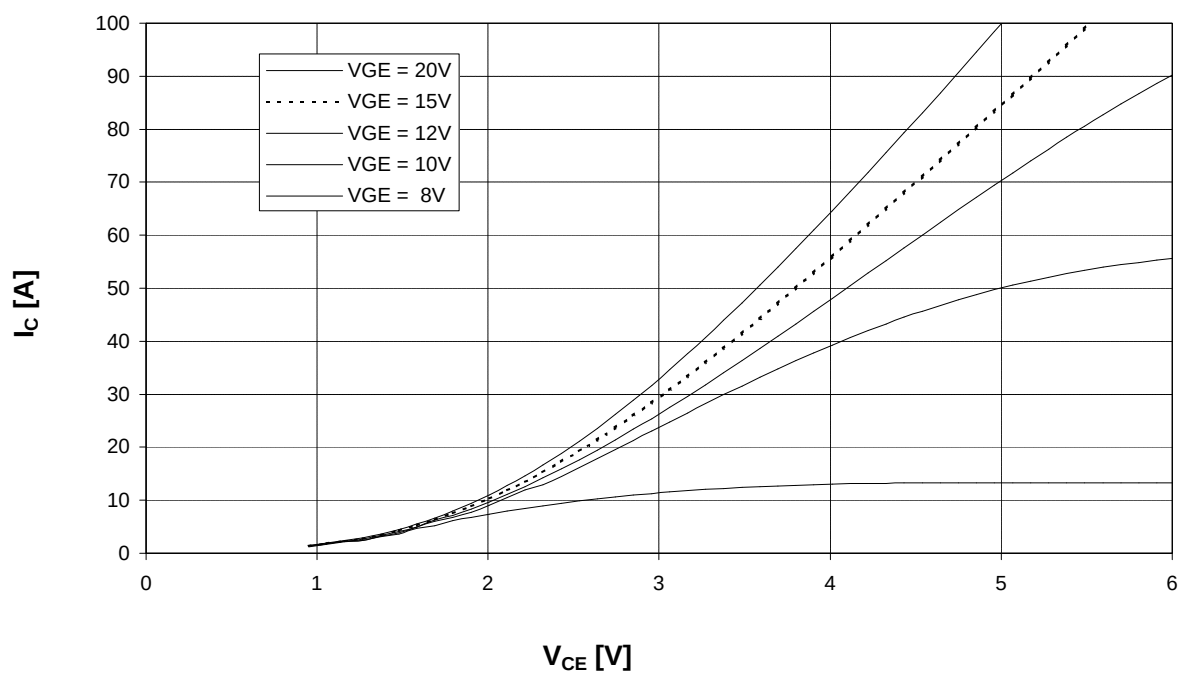


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

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

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



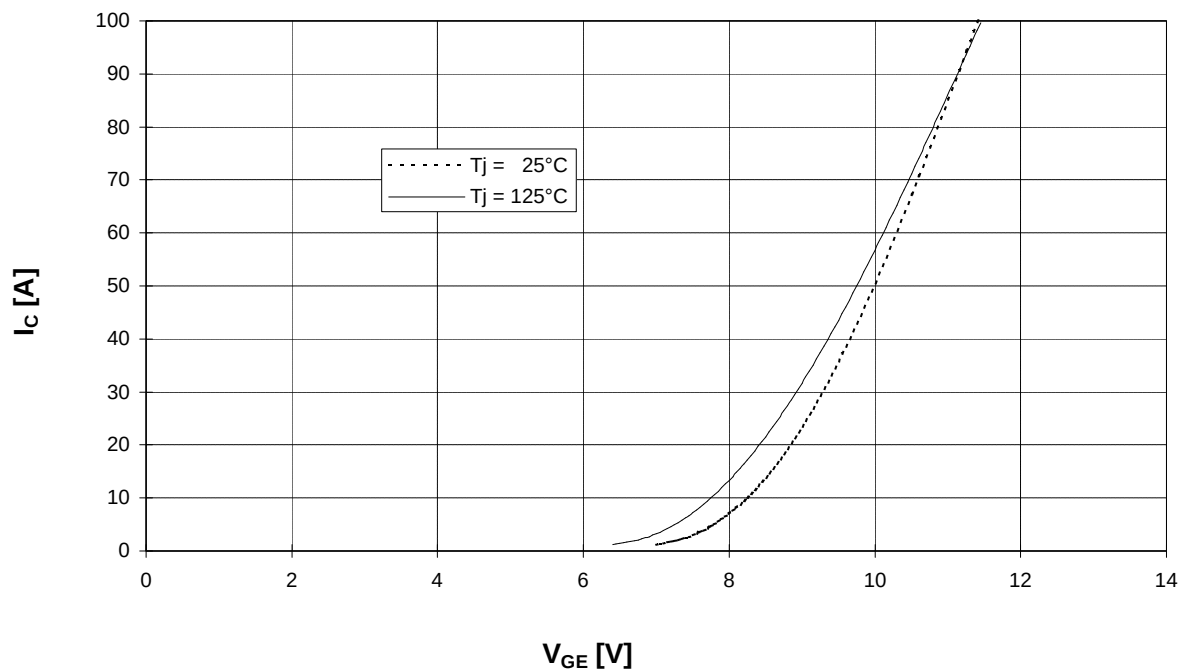


Übertragungscharakteristik Wechselr. (typisch)

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

Transfer characteristic Inverter (typical)

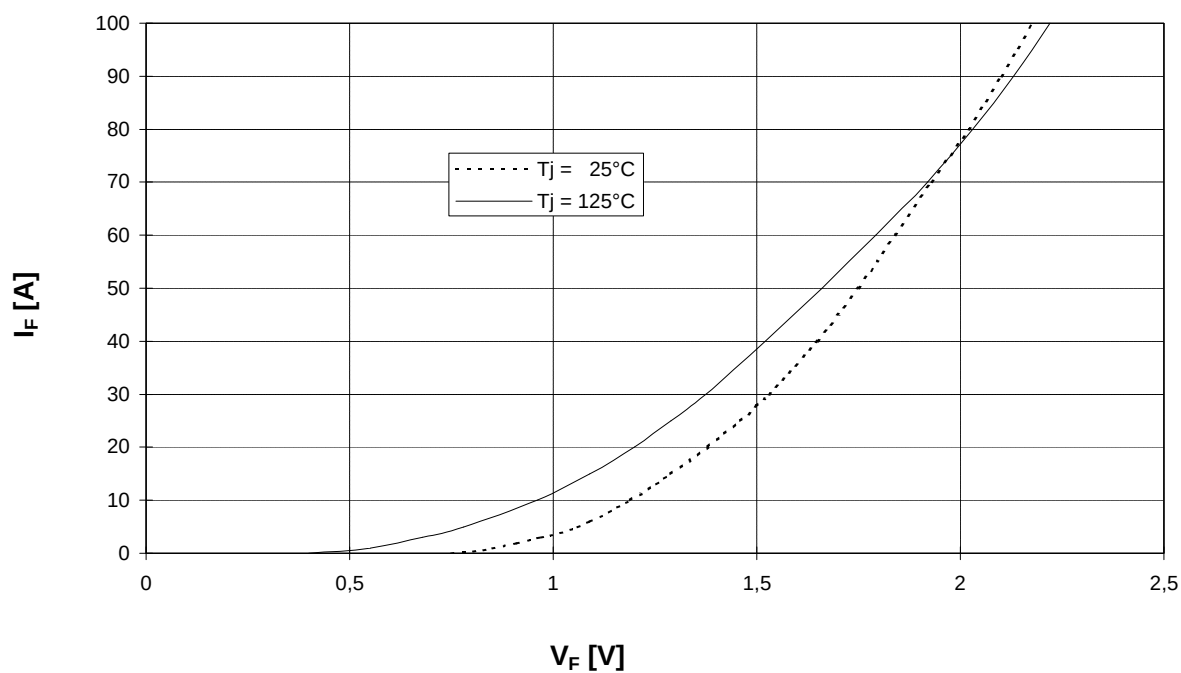
$$V_{CE} = 20 \text{ V}$$

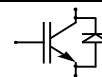


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)

$$I_F = f(V_F)$$

Forward characteristic of FWD Inverter (typical)





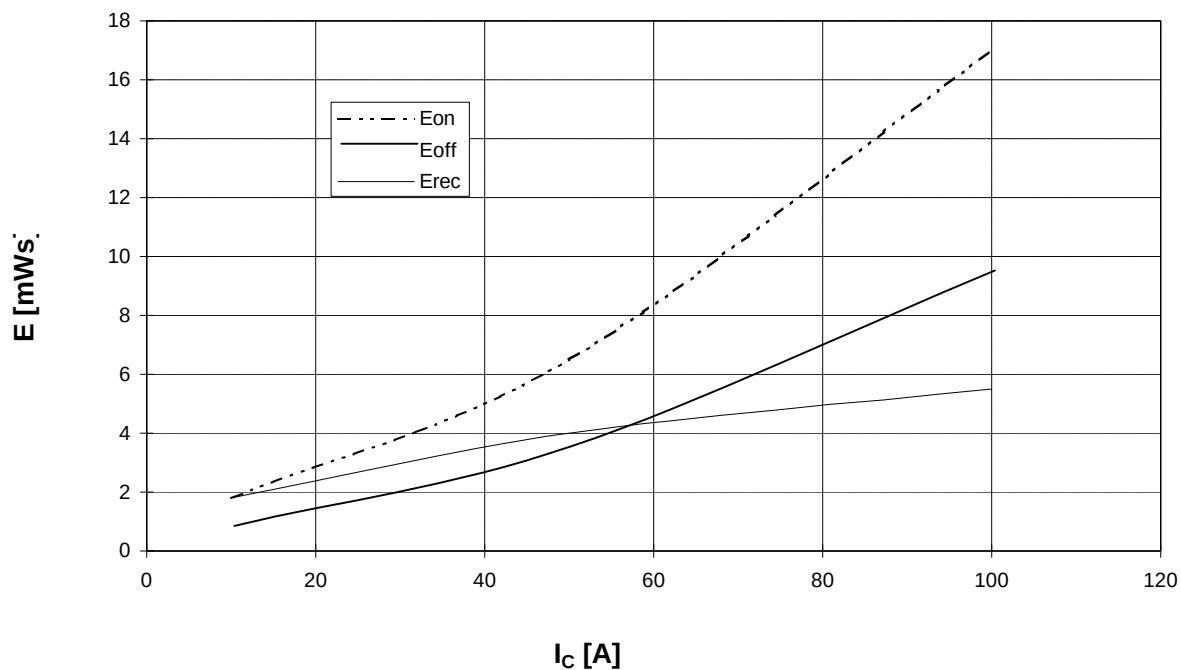
Schaltverluste Wechselr. (typisch)

Switching losses Inverter (typical)

 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$
 $T_j = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = R_{Goff} =$

600 V

150hm

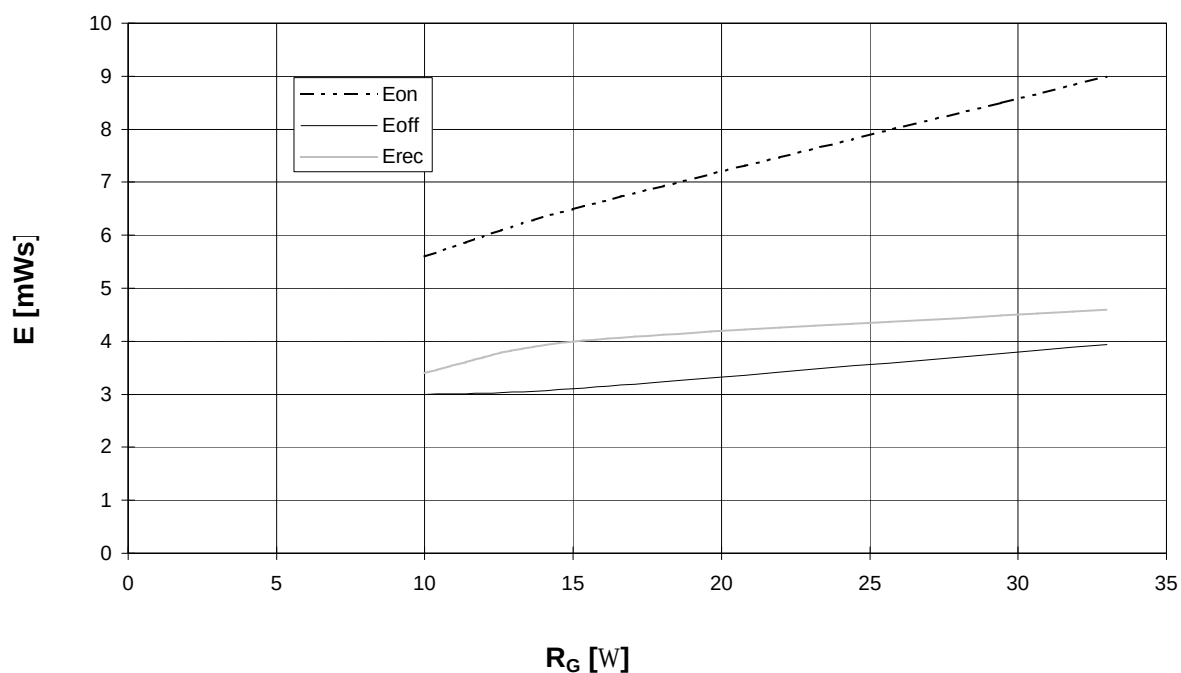


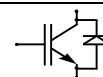
Schaltverluste Wechselr. (typisch)

Switching losses Inverter (typical)

 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
 $T_j = 125^\circ\text{C}$, $V_{GE} = +15\text{ V}$, $I_C = I_{nenn}$, $V_{CC} =$

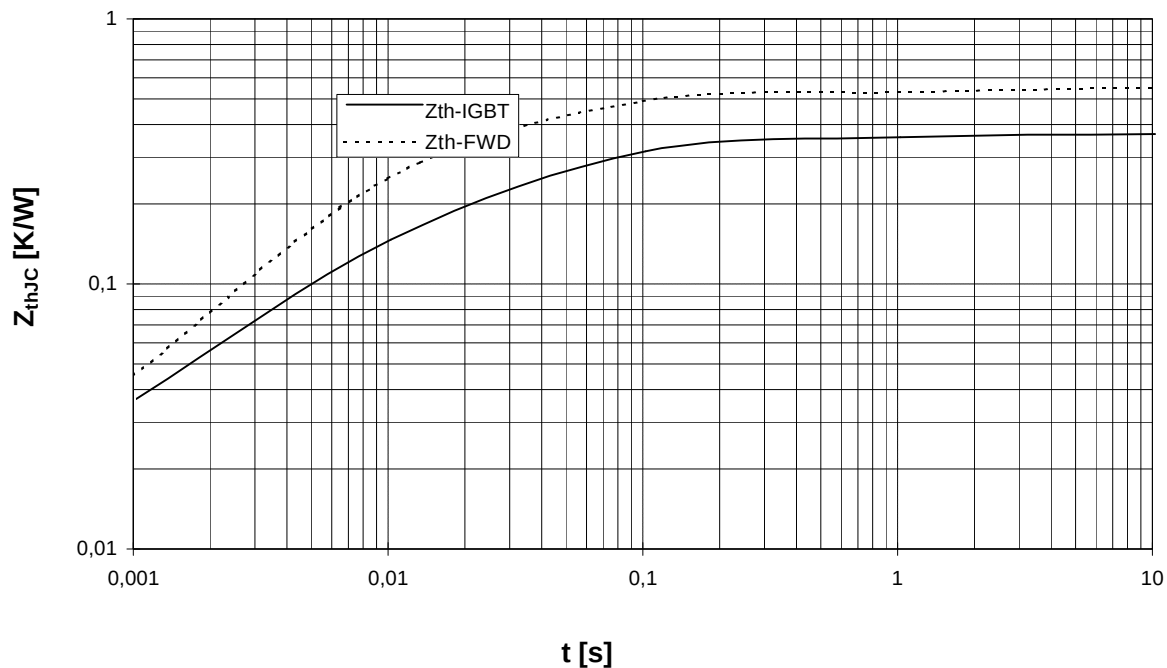
600 V





Transienter Wärmewiderstand Wechselr.
Transient thermal impedance Inverter

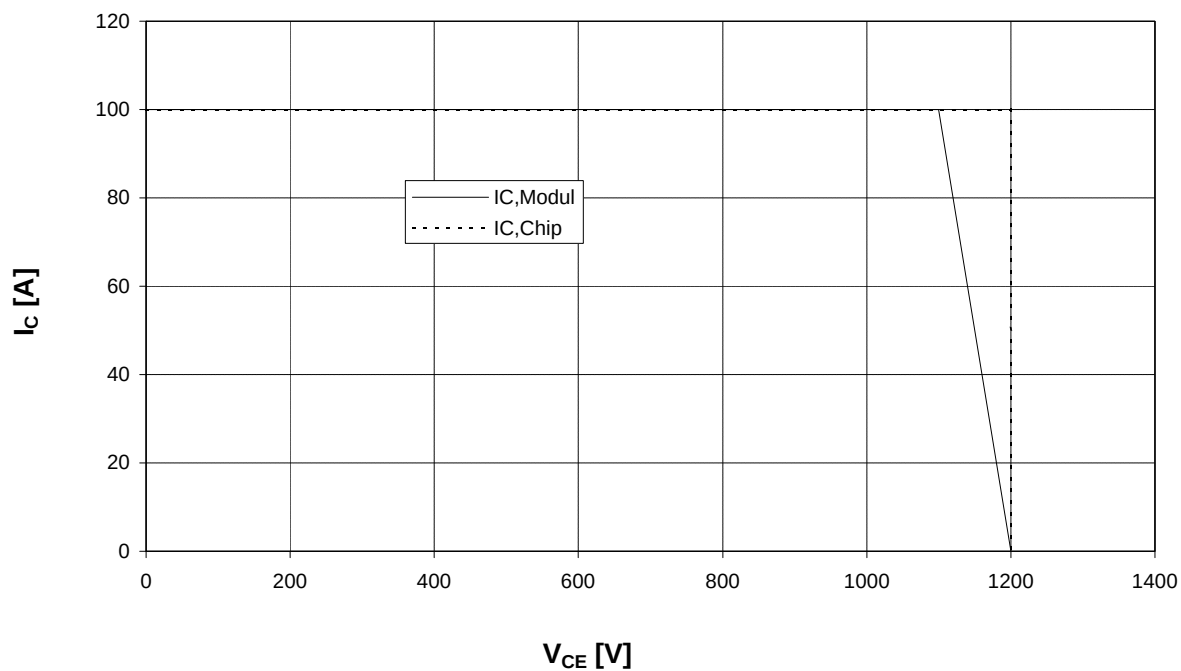
$$Z_{thJC} = f(t)$$



Sicherer Arbeitsbereich Wechselr. (RBSOA)

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

Reverse bias safe operating area Inverter (RBSOA) $T_{VI} = 125^\circ\text{C}$, $V_{GE} = \pm 15\text{V}$, $R_G = 150\text{hm}$



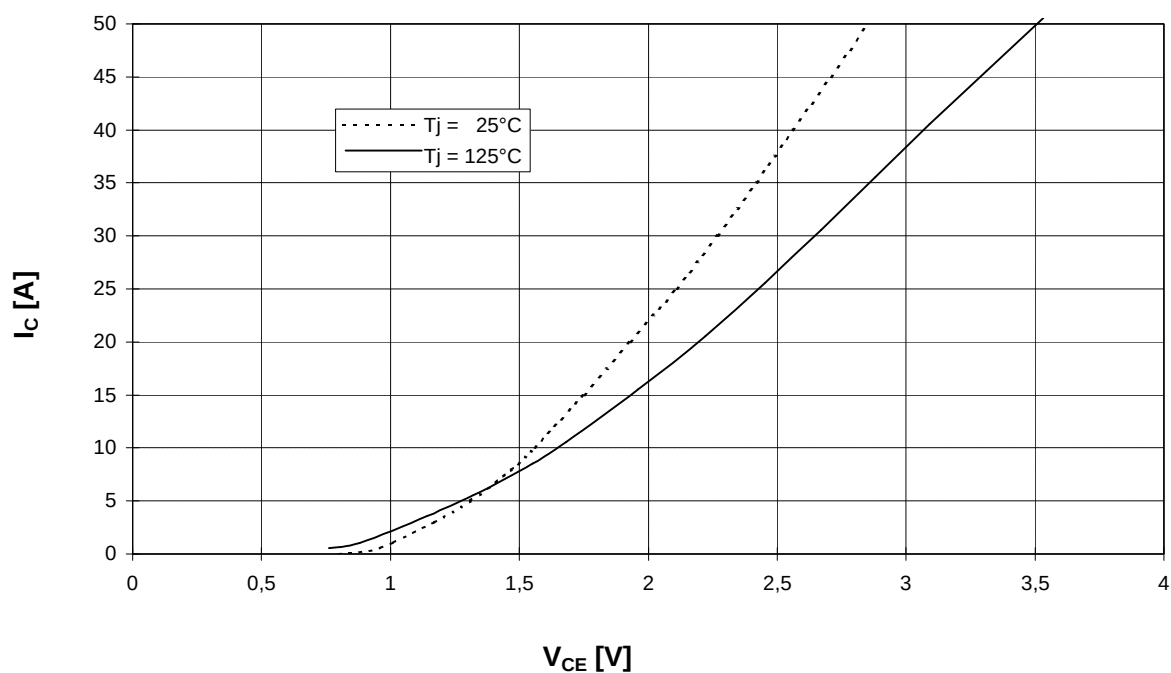


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

Output characteristic brake-chopper-IGBT (typical)

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

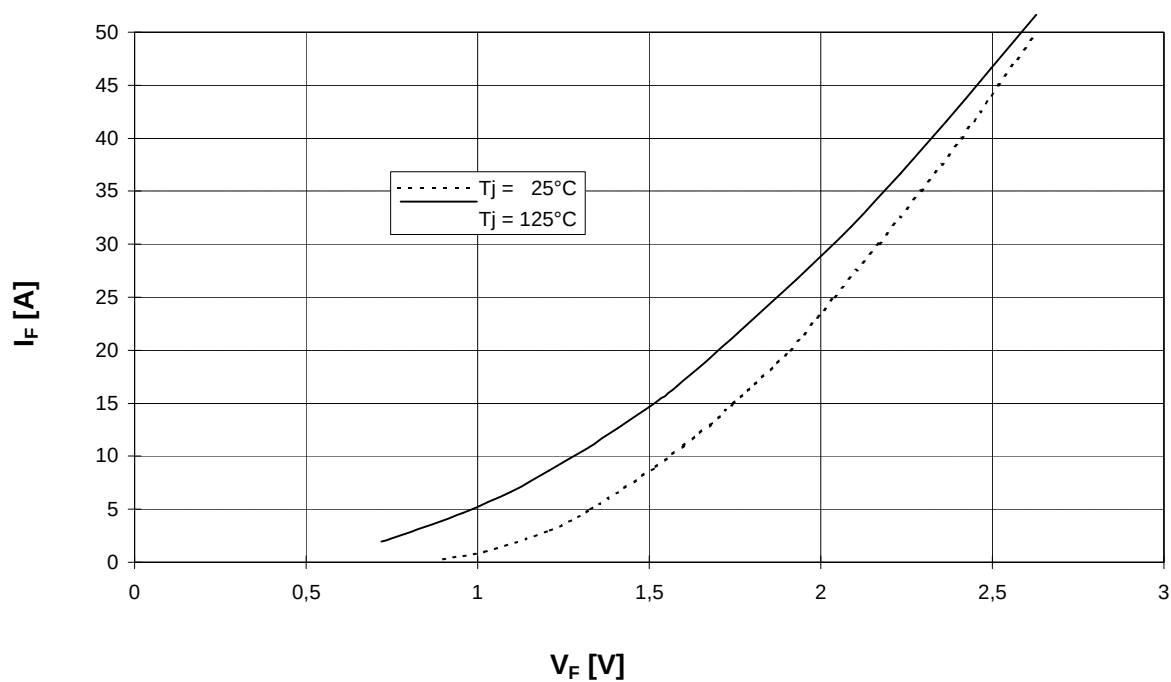
$$V_{GE} = 15 \text{ V}$$



Durchlaßkennlinie der Brems-Chopper-Diode (typisch)

Forward characteristic of brake-chopper-FWD (typical)

$$I_F = f(V_F)$$

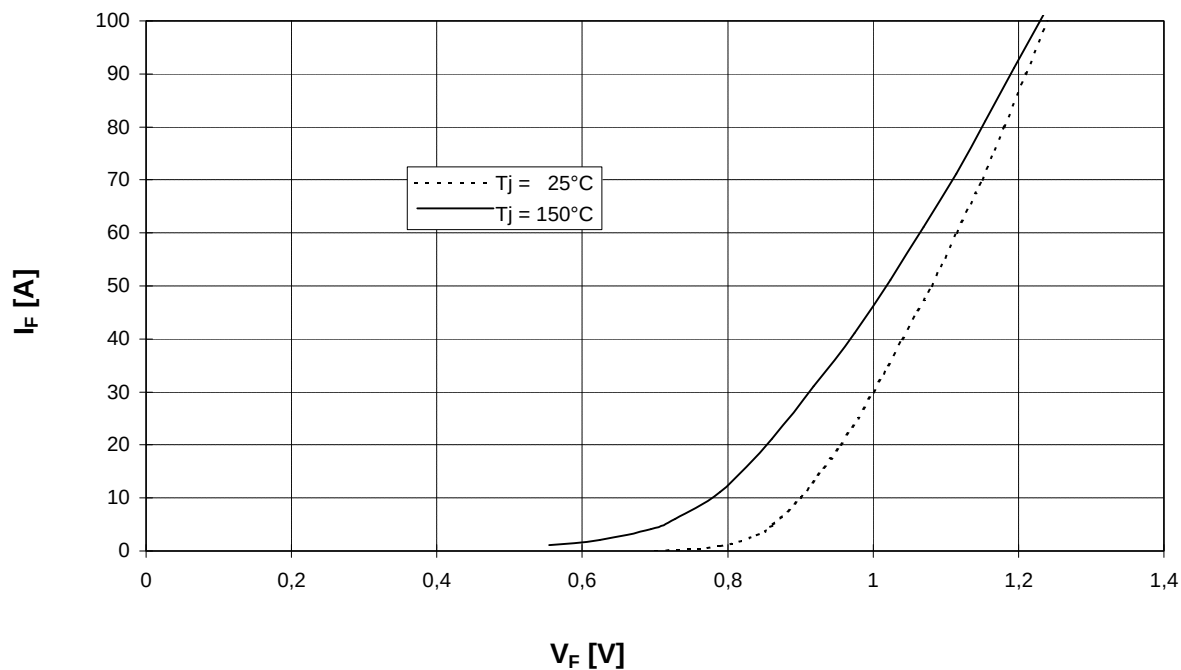




Durchlaßkennlinie der Gleichrichterdiode (typisch)

$$I_F = f(V_F)$$

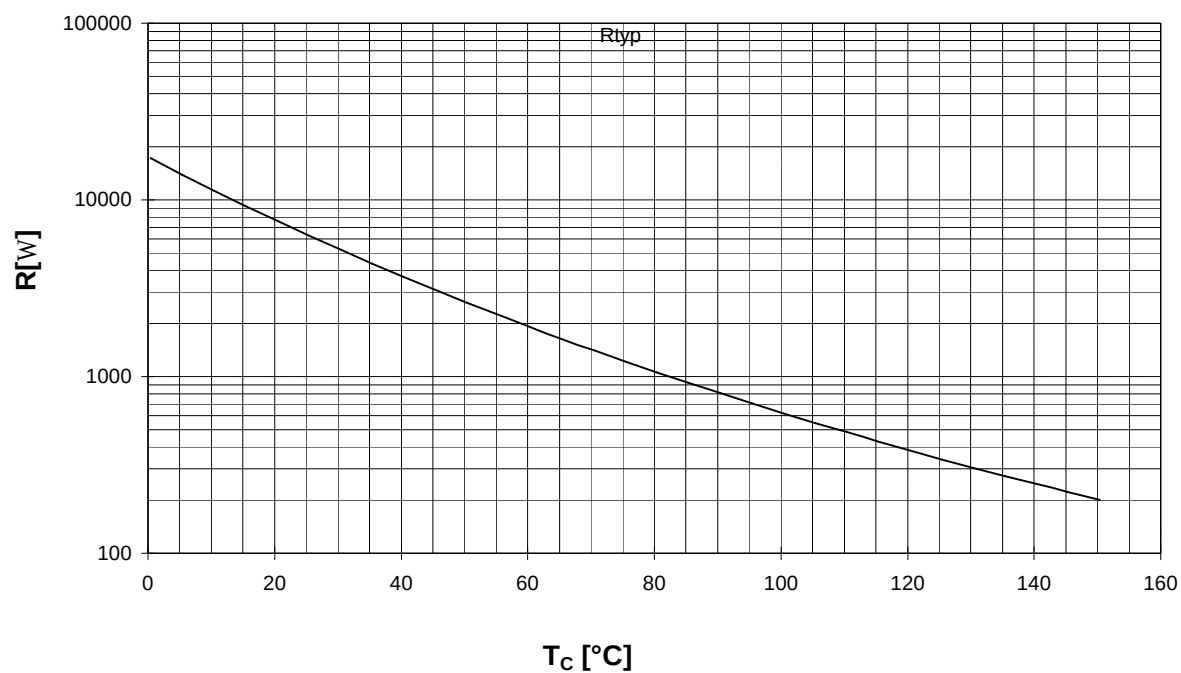
Forward characteristic of Rectifier Diode (typical)

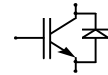


NTC- Temperaturkennlinie (typisch)

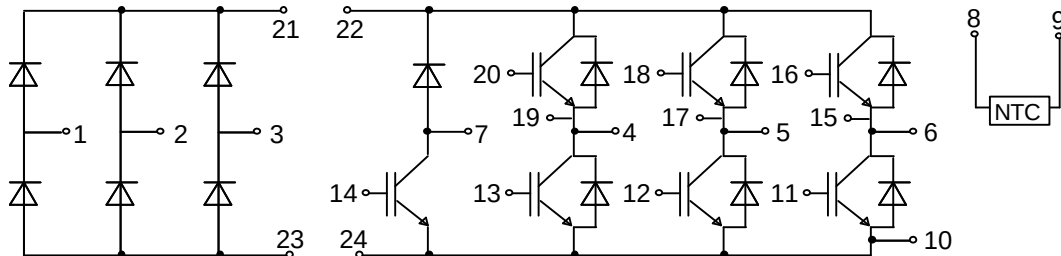
$$R = f(T)$$

NTC- temperature characteristic (typical)

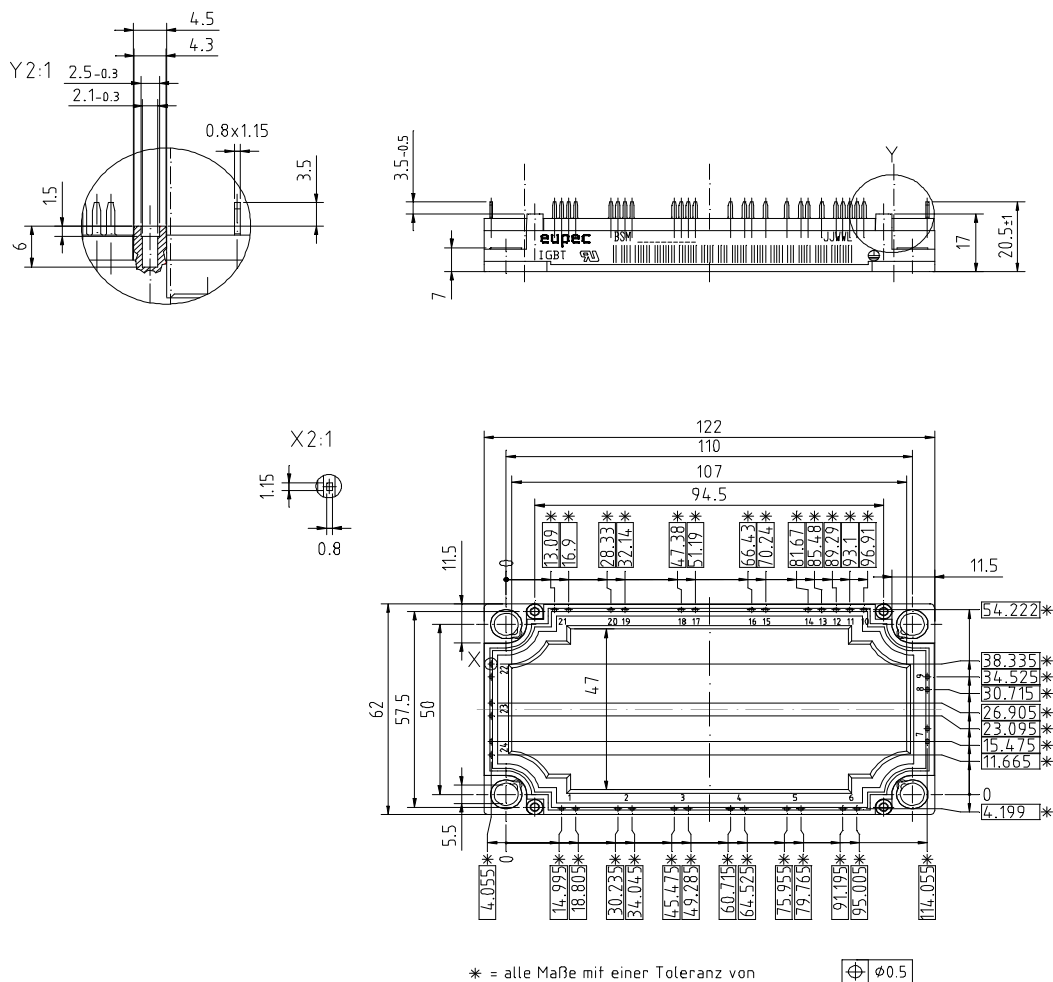




Schaltplan/ Circuit diagram



Gehäuseabmessungen/ Package outlines



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