**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	35	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}	315 260	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	500 340	A^2s A^2s

Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 55^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ I_C	35 40	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 55^\circ\text{C}$	I_{CRM}	70	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 Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current	$T_C = 55^\circ\text{C}$	I_F	35	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	70	A
Grenzlastintegral I^2t - value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	I^2t	310	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	17,5 35	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	I_{CRM}	35	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}$	P_{tot}	180	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current	$T_C = 55^\circ\text{C}$	I_F	10	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	20	A

prepared by: A.Schulz

date of publication: 2001-11-28

approved by: M.Hierholzer

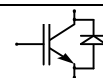
revision: 2

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

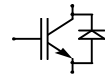
Diode Gleichrichter/ Diode Rectifier				min.	typ.	max.	
Durchlaßspannung forward voltage	T _{vj} = 150°C, I _F = 35 A		V _F	-	1,15	-	V
Schleusenspannung threshold voltage	T _{vj} = 150°C		V _(TO)	-	-	0,8	V
Ersatzwiderstand slope resistance	T _{vj} = 150°C		r _T	-	-	10,5	mΩ
Sperrstrom reverse current	T _{vj} = 150°C, V _R = 1600 V		I _R	-	2	-	mA
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T _C = 25°C		R _{AA'+CC'}	-	4	-	mΩ
Transistor Wechselrichter/ Transistor Inverter				min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	V _{GE} = 15V, T _{vj} = 25°C, I _C = 35 A		V _{CE sat}	-	3,75	4,35	V
	V _{GE} = 15V, T _{vj} = 125°C, I _C = 35 A			-	4,5	-	V
Gate-Schwellenspannung gate threshold voltage	V _{CE} = V _{GE} , T _{vj} = 25°C, I _C = 1 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}	-	1,5	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V _{GE} = 0V, T _{vj} = 25°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°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} = ±15V, T _{vj} = 25°C, R _G = 22 Ohm						
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 Ohm						
Anstiegszeit (induktive Last) rise time (inductive load)	I _C = I _{Nenn} , V _{CC} = 600 V		t _r	-	50	-	ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 22 Ohm						
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 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} = ±15V, T _{vj} = 25°C, R _G = 22 Ohm						
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 Ohm						
Fallzeit (induktive Last) fall time (inductive load)	I _C = I _{Nenn} , V _{CC} = 600 V		t _f	-	50	-	ns
	V _{GE} = ±15V, T _{vj} = 25°C, R _G = 22 Ohm						
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 Ohm						
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I _C = I _{Nenn} , V _{CC} = 600 V		E _{on}	-	4,5	-	mWs
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 Ohm						
	L _S = 50 nH						
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I _C = I _{Nenn} , V _{CC} = 600 V		E _{off}	-	2,3	-	mWs
	V _{GE} = ±15V, T _{vj} = 125°C, R _G = 22 Ohm						
	L _S = 50 nH						
Kurzschlußverhalten SC Data	t _p ≤ 10μs, V _{GE} ≤ 15V, R _G = 22 Ohm T _{vj} ≤125°C, V _{CC} = 720 V di/dt = 2800 A/μs		I _{SC}	-	160	-	A

Technische Information / Technical Information

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Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

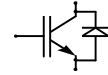
			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	100	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^\circ C$	$R_{CC'+EE'}$	-	7	-	mΩ
Diode Wechselrichter/ Diode Inverter			min.	typ.	max.	
Durchlaßspannung forward voltage	$V_{GE} = 0V, T_{vj} = 25^\circ C, I_F = 35 A$ $V_{GE} = 0V, T_{vj} = 125^\circ C, I_F = 35 A$	V_F	-	1,95 1,8	2,35 -	V V
Rückstromspitze peak reverse recovery current	$I_F = I_{Nenn}, -di_F/dt = 1400A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	I_{RM}	-	40 45	- -	A A
Sperrverzögerungsladung recovered charge	$I_F = I_{Nenn}, -di_F/dt = 1400A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	Q_r	-	3,5 7,5	- -	μAs μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = I_{Nenn}, -di_F/dt = 1400A/\mu s$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 600 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 600 V$	E_{RQ}	-	1,3 2,5	- -	mWs mWs
Transistor Brems-Chopper/ Transistor Brake-Chopper			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15V, T_{vj} = 25^\circ C, I_C = 17,5 A$ $V_{GE} = 15V, T_{vj} = 125^\circ C, I_C = 17,5 A$	$V_{CE sat}$	-	2,3 2,7	2,75 -	V V
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^\circ C, I_C = 0,6mA$	$V_{GE(TO)}$	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}	-	1,0	-	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}	-	1,0 1,2	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)	BSM15GP120				
Diode Brems-Chopper/ Diode Brake-Chopper			min.	typ.	max.	
Durchlaßspannung forward voltage	$T_{vj} = 25^\circ C, I_F = 17,5 A$ $T_{vj} = 125^\circ C, I_F = 17,5 A$	V_F	-	2,7 2,6	3,05 -	V V
Schaltverluste und -bedingungen Switching losses and conditions	siehe Datenblatt (Wechselrichter) see datasheet (inverter)	BSM10GP120				
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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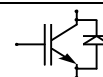


Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode	R_{thJC}	-	-	1	K/W
	Trans. Wechr./ Trans. Inverter		-	-	0,55	K/W
	Diode Wechr./ Diode Inverter		-	-	0,8	K/W
	Trans. Bremse/ Trans. Brake		-	-	0,7	K/W
	Diode Bremse/ Diode Brake		-	-	2,3	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

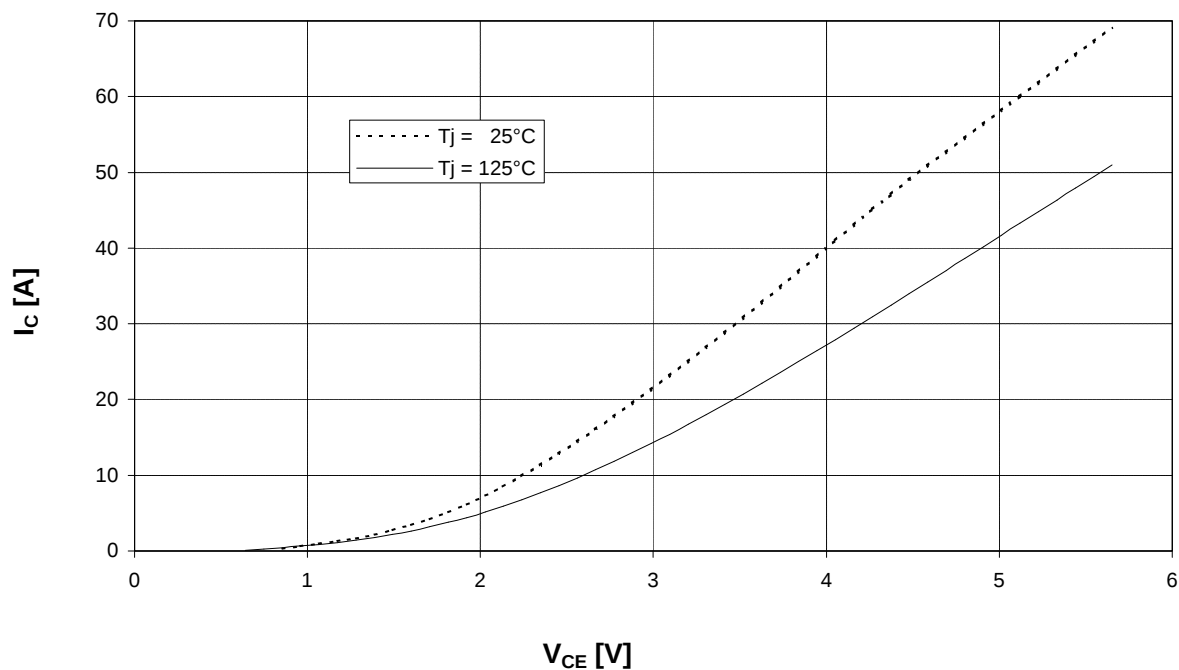


Ausgangskennlinienfeld Wechselr. (typisch)

Output characteristic Inverter (typical)

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

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

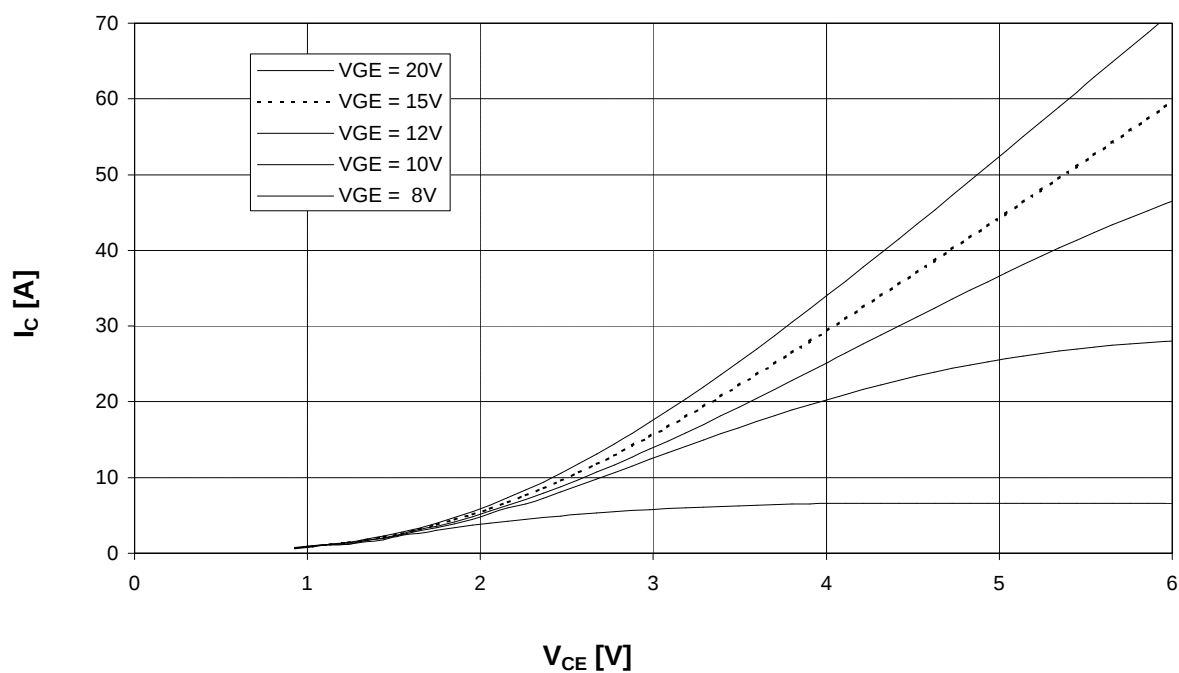


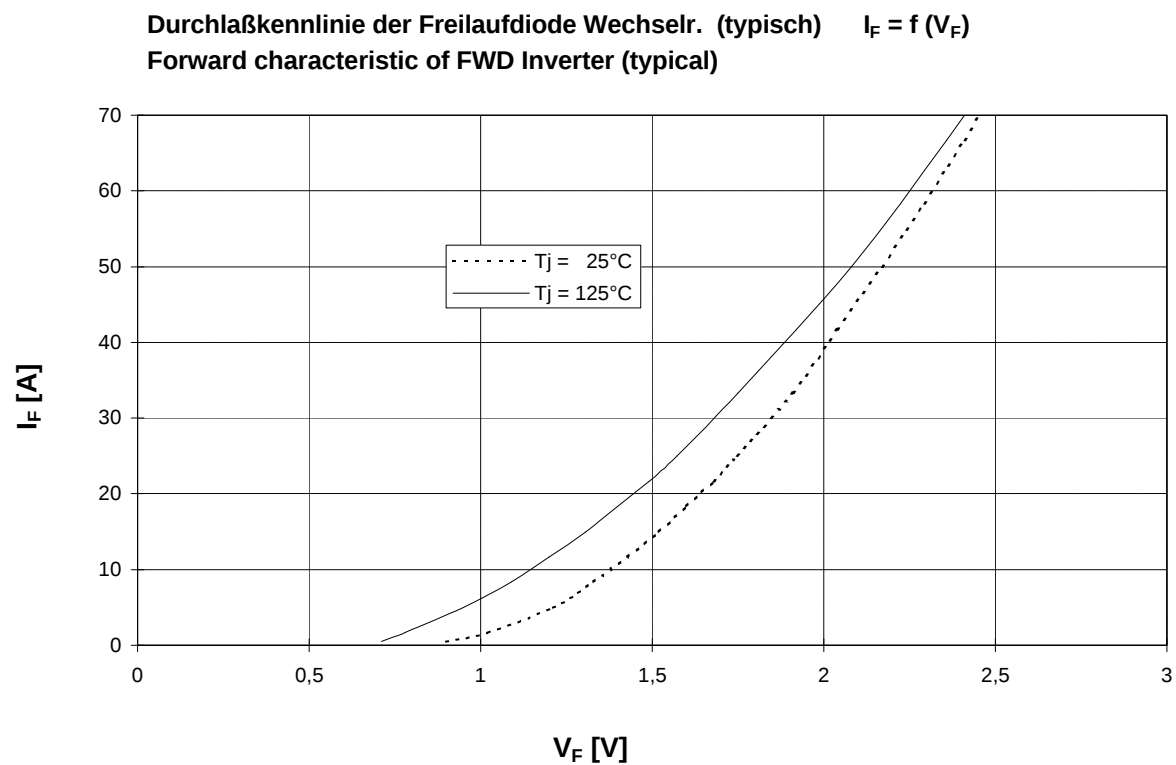
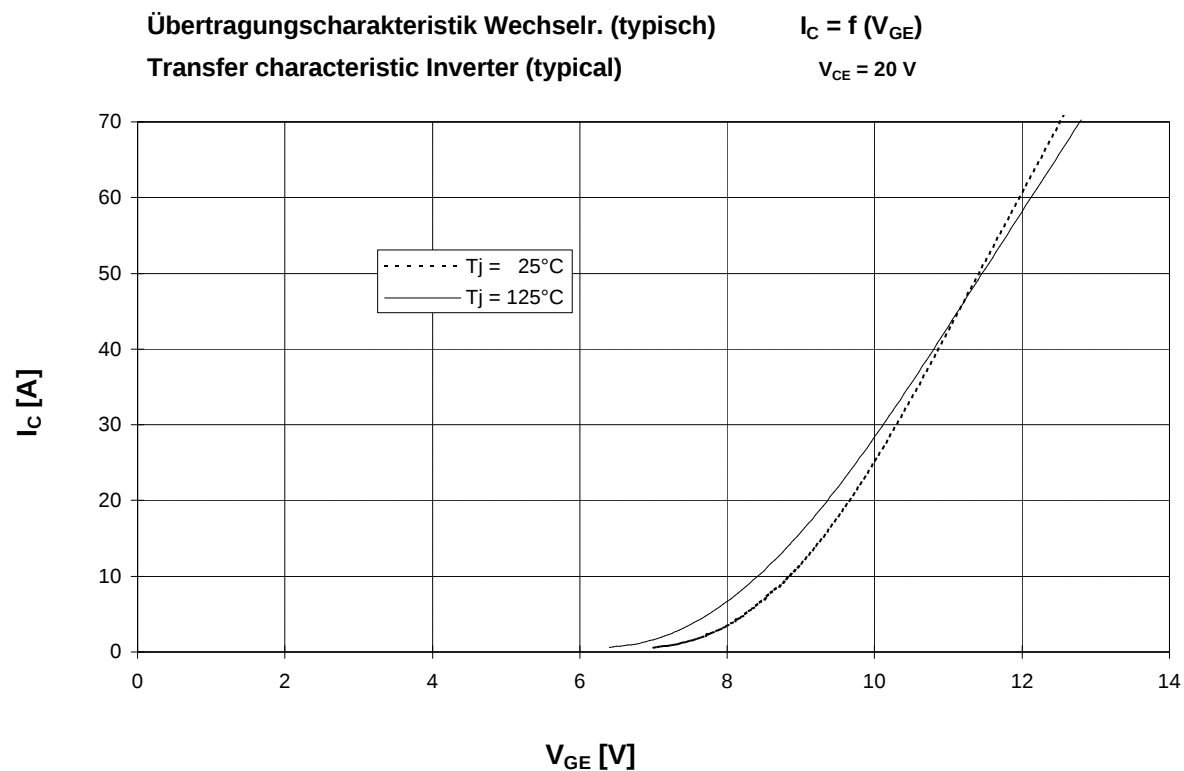
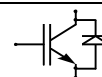
Ausgangskennlinienfeld Wechselr. (typisch)

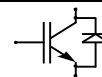
Output characteristic Inverter (typical)

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

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







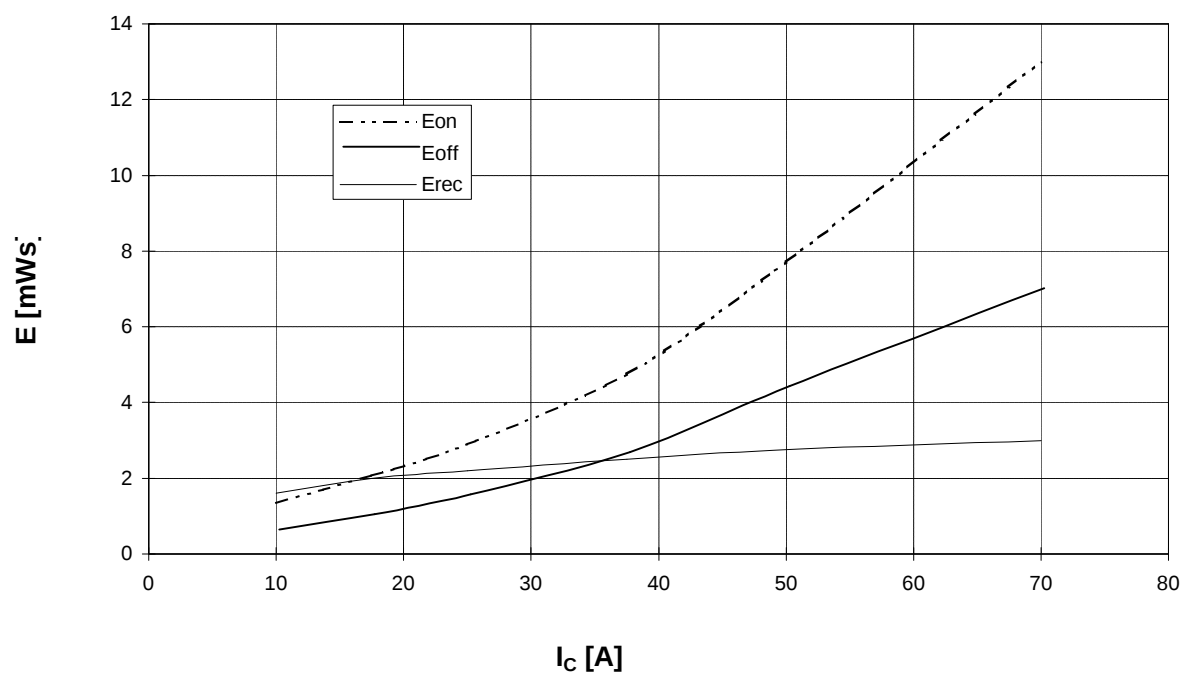
Schaltverluste Wechselr. (typisch)

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

22 Ohm

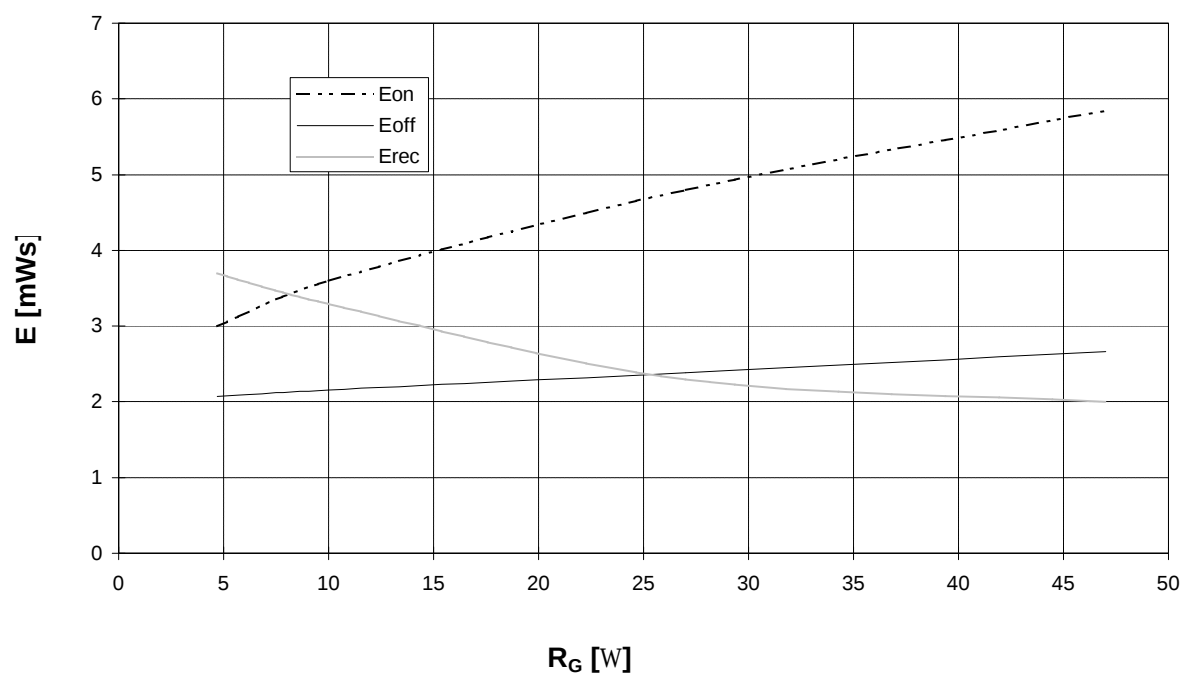


Schaltverluste Wechselr. (typisch)

Switching losses Inverter (typical)

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

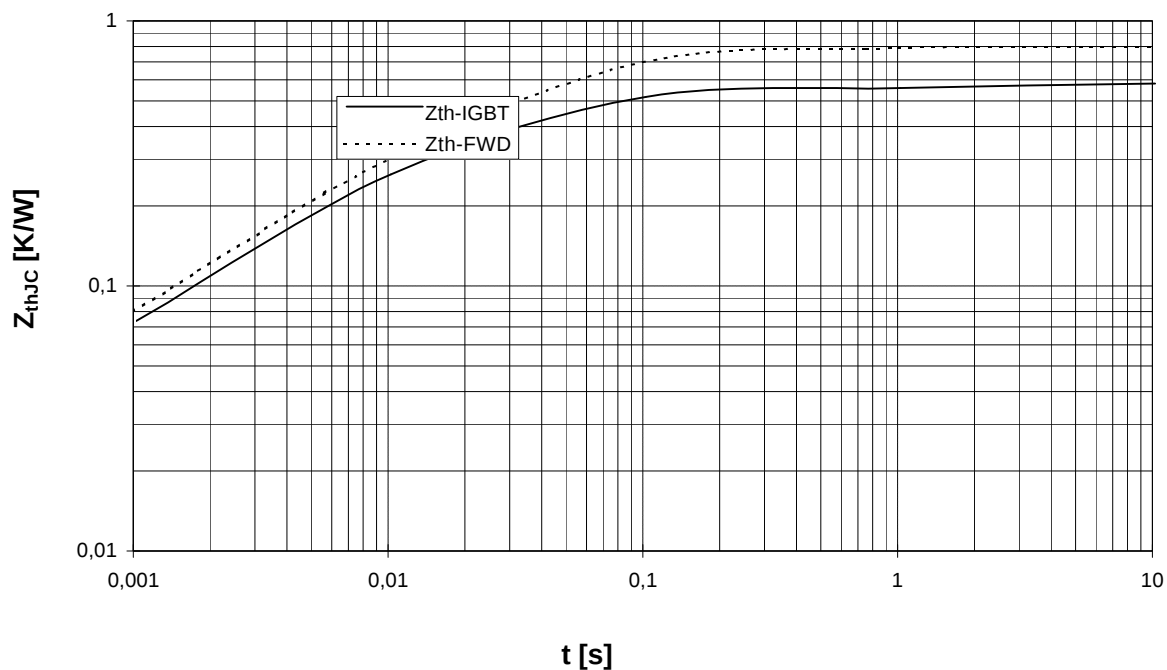
600 V





Transienter Wärmewiderstand Wechselr.
Transient thermal impedance Inverter

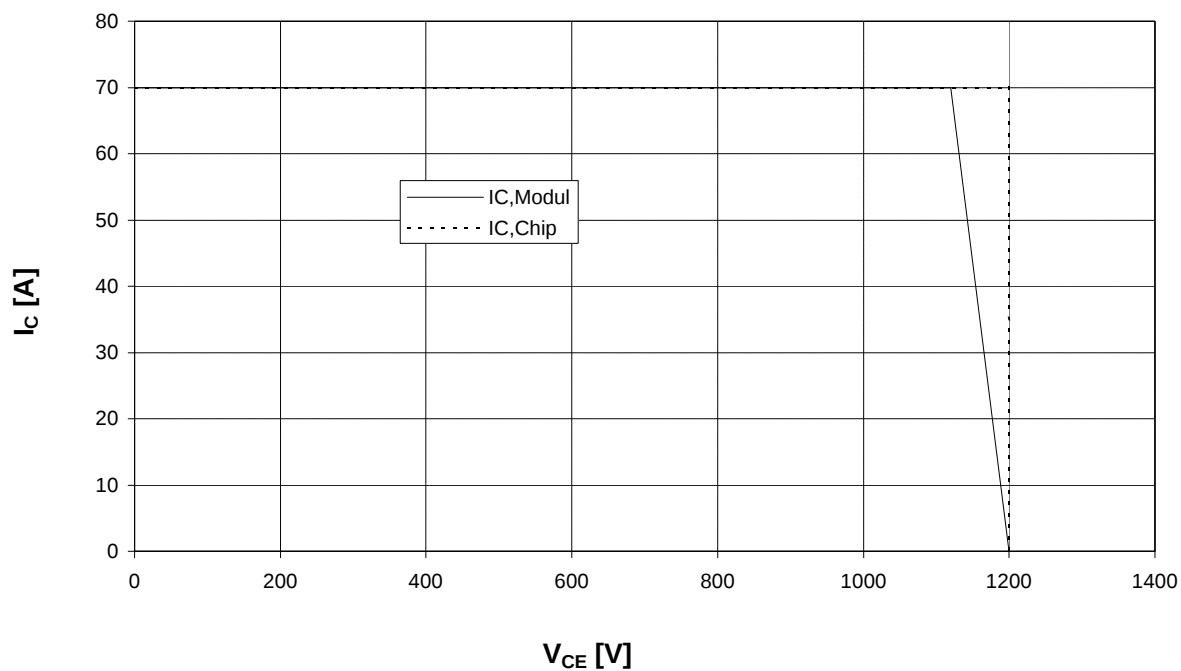
$$Z_{thJC} = f(t)$$

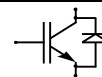


Sicherer Arbeitsbereich Wechselr. (RBSOA)

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

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



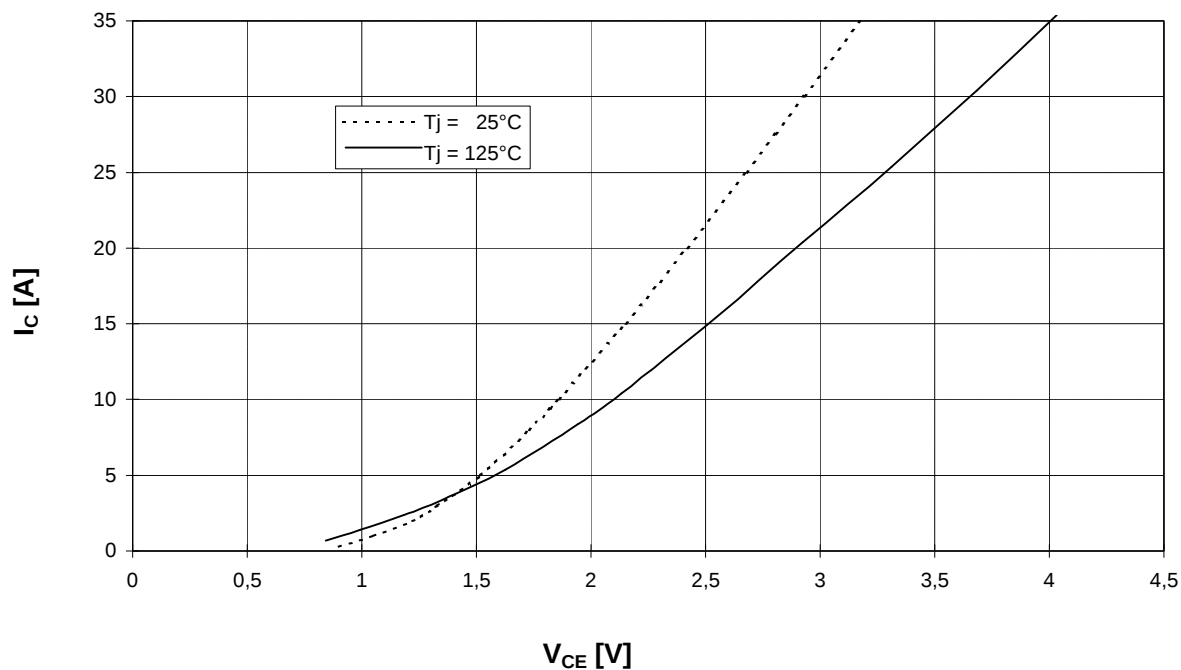


Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

Output characteristic brake-chopper-IGBT (typical)

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

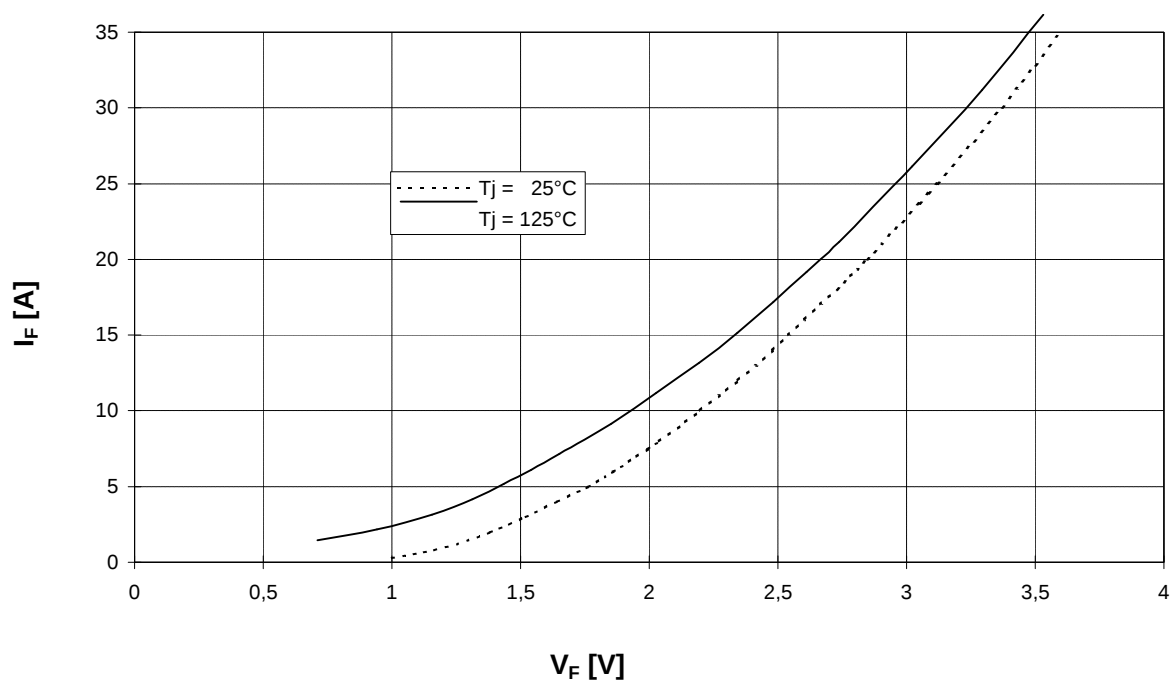
$$V_{GE} = 15 \text{ V}$$

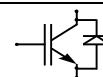


Durchlaßkennlinie der Brems-Chopper-Diode (typisch)

Forward characteristic of brake-chopper-FWD (typical)

$$I_F = f(V_F)$$

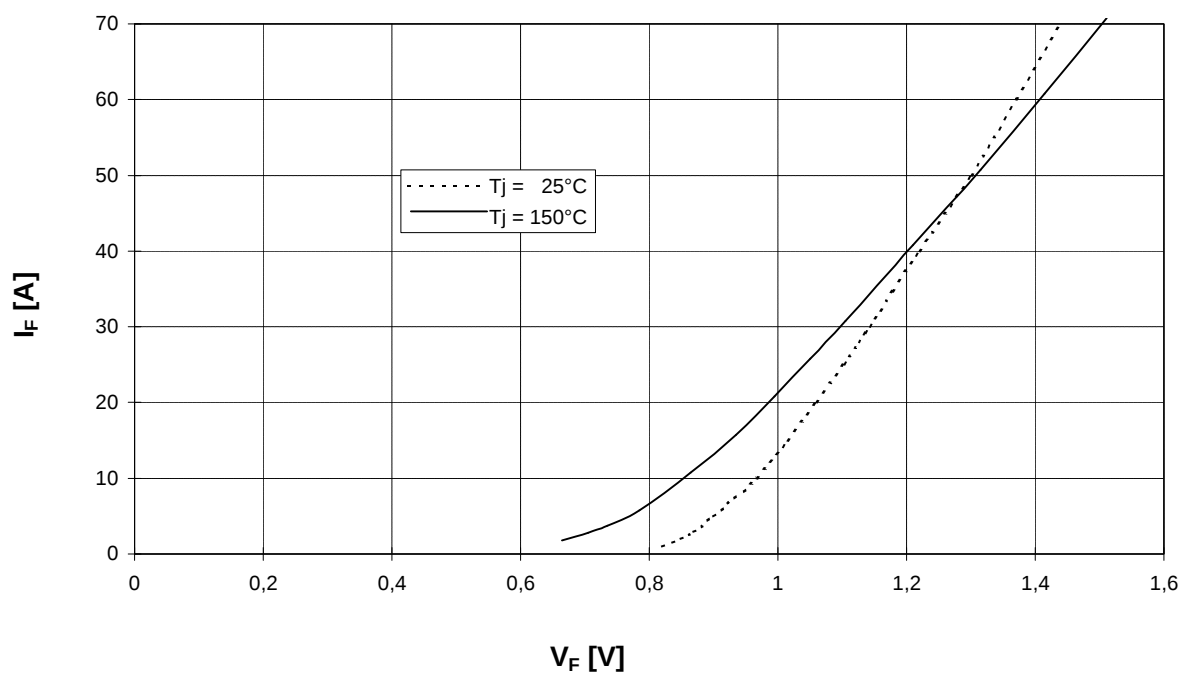




Durchlaßkennlinie der Gleichrichterdiode (typisch)

$$I_F = f(V_F)$$

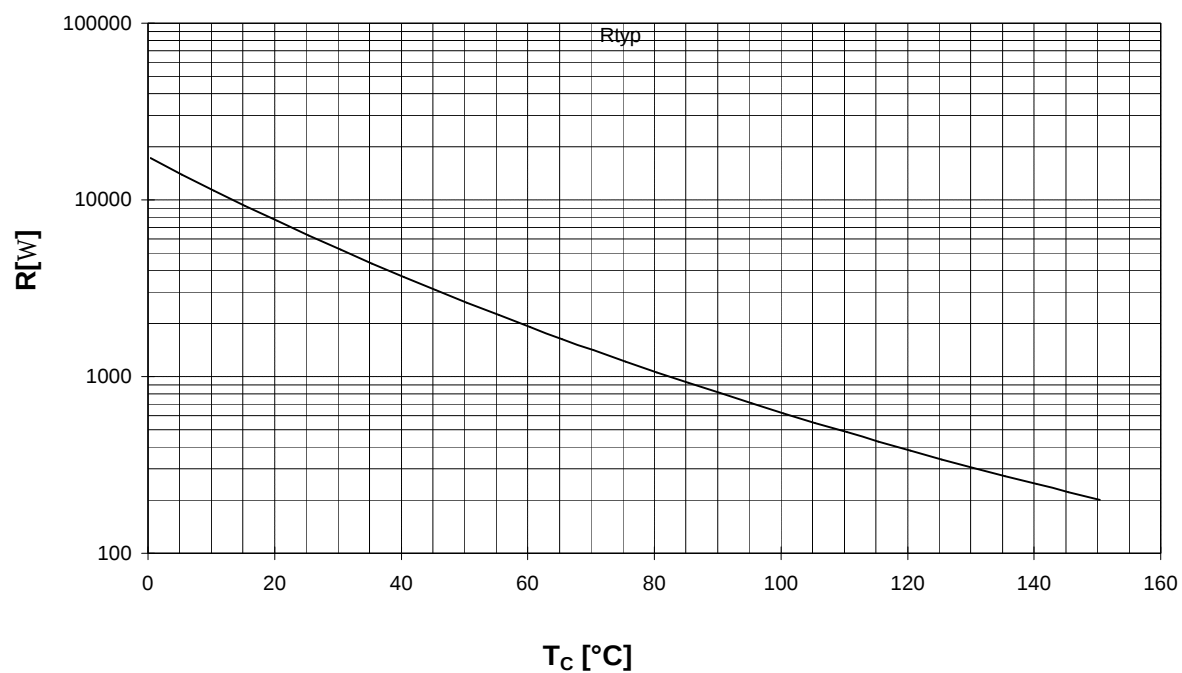
Forward characteristic of Rectifier Diode (typical)

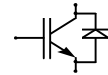


NTC- Temperaturkennlinie (typisch)

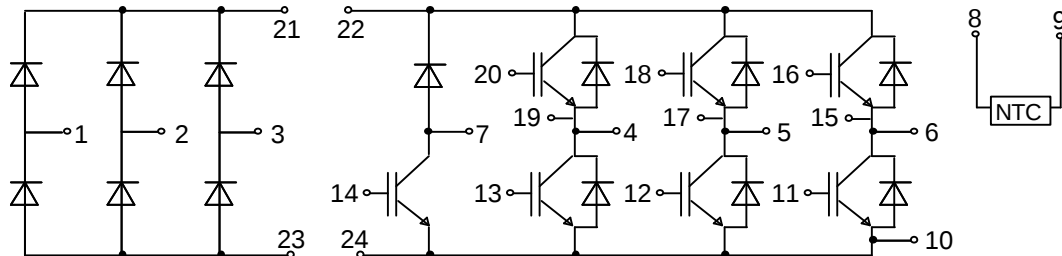
$$R = f(T)$$

NTC- temperature characteristic (typical)

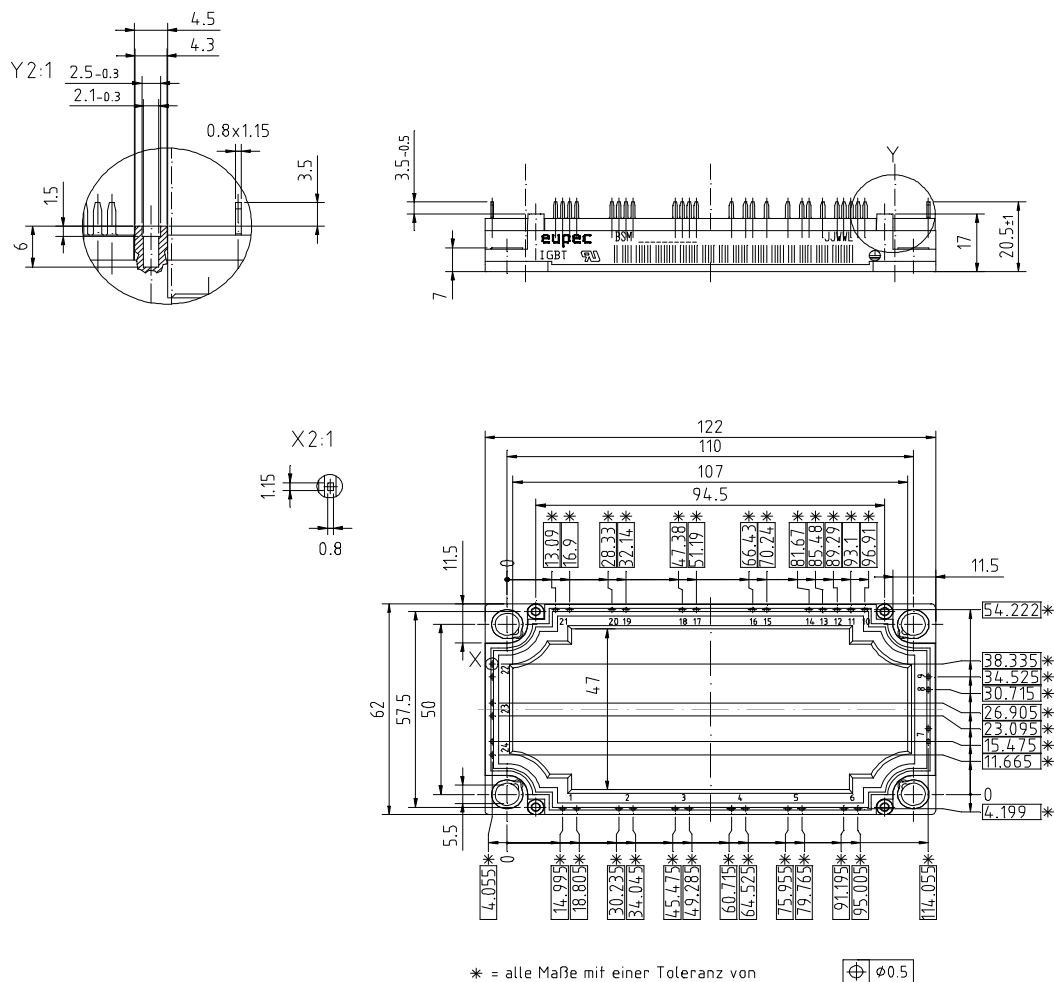




Schaltplan/ Circuit diagram



Gehäuseabmessungen/ Package outlines



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

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