Elektrische Eigenschaften / Electrical properties

Höchstzulässige Werte / Maximum rated values

Diode Gleichrichter/ Diode Rectifier

Periodische Rückw. Spitzensperrspannung repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1600	V
Gleichrichter Ausgang Grenzeffektivstrom maximum RMS current at Rectifier output	T_C = 80°C	I_{RMSmax}	115	A
Durchlaßstrom Grenzeffektivwert proChip Forward current RMS maximum per Chip	T_C = 80°C	I_{FRMSM}	80	A
Stoßstrom Grenzwert surge forward current	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I_{FSM}	500 400	A A
Grenzlastintegral I^2t - value	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I^2t	1250 800	A^2s A^2s

Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	Tc = 80 °C T_C = 25 °C	$I_{C,nom.}$ I_C	75 105	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C = 80 °C	I_{CRM}	150	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	350	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current		I_F	75	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	150	A
Grenzlastintegral I^2t - value	V_R = 0V, t_p = 10ms, T_{vj} = 125°C	I^2t	1.190	A^2s

Transistor Brems-Chopper/ Transistor Brake-Chopper

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	T_C = 80 °C T_C = 25 °C	$I_{C,nom.}$ I_C	40 55	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C = 80°C	I_{CRM}	80	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	200	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current		I_F	25	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	50	A

prepared by: Andreas Schulz	date of publication:23.04.2002
approved by: Robert Severin	revision: 2

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

Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

Diode Gleichrichter/ Diode Rectifier			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	T_{vj} = 150°C, I_F = 75 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	-	-	6,5	mΩ
Sperrstrom reverse current	T_{vj} = 150°C, V_R = 1600 V	I_R	-	3	-	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 = 75 A V_{GE} = 15V, T_{vj} = 125°C, I_C = 75 A	$V_{CE\ sat}$	- -	1,7 2	2,15 -	V V
Gate-Schwellenspannung gate threshold voltage	V_{CE} = V_{GE}, T_{vj} = 25°C, I_C = 3,0 mA	$V_{GE(TO)}$	5,0	5,8	6,5	V
Eingangskapazität input capacitance	f = 1MHz, T_{vj} = 25°C V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}	-	5,3	-	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 V_{GE} = ±15V, T_{vj} = 25°C, R_G = 5 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm	$t_{d,on}$	- -	260 285	- -	ns ns
Anstiegszeit (induktive Last) rise time (inductive load)	I_C = I_{Nenn}, V_{CC} = 600 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 5 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm	t_r	- -	30 45	- -	ns ns
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	I_C = I_{Nenn}, V_{CC} = 600 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 5 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm	$t_{d,off}$	- -	420 520	- -	ns ns
Fallzeit (induktive Last) fall time (inductive load)	I_C = I_{Nenn}, V_{CC} = 600 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 5 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm	t_f	- -	65 90	- -	ns ns
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I_C = I_{Nenn}, V_{CC} = 600 V V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm Lσ = 45 nH	E_{on}	-	9,4	-	mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I_C = I_{Nenn}, V_{CC} = 600 V V_{GE} = ±15V, T_{vj} = 125°C, R_G = 5 Ohm Lσ = 45 nH	E_{off}	-	9,4	-	mWs
Kurzschlußverhalten SC Data	t_P ≤ 10µs, V_{GE} ≤ 15V, R_G = 5 Ohm T_{vj}≤125°C, V_{CC} = 720 V	I_{SC}	-	300	-	A

Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	60	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T_C = 25°C	$R_{CC'+EE'}$	-	7	-	mΩ
Diode Wechselrichter/ Diode Inverter			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	V_{GE} = 0V, T_{vj} = 25°C, I_F = 75 A	V_F	-	1,65	2,15	V
	V_{GE} = 0V, T_{vj} = 125°C, I_F = 75 A		-	1,65	-	V
Rückstromspitze peak reverse recovery current	I_F=I_{Nenn}, - di_F/dt = 2000 A/µs					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V	I_{RM}	-	80	-	A
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V		-	86	-	A
Sperrverzögerungsladung recovered charge	I_F=I_{Nenn}, - di_F/dt = 2000 A/µs					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V	Q_r	-	9,3	-	µAs
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V		-	16,3	-	µAs
Abschaltenergie pro Puls reverse recovery energy	I_F=I_{Nenn}, - di_F/dt = 2000 A/µs					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V	E_{rec}	-	3,2	-	mWs
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V		-	6,5	-	mWs
Transistor Brems-Chopper/ Transistor Brake-Chopper			**min.**	**typ.**	**max.**	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	V_{GE} = 15V, T_{vj} = 25°C, I_C = 40 A	$V_{CE\,sat}$	-	1,8	2,3	V
	V_{GE} = 15V, T_{vj} = 125°C, I_C = 40 A		-	2,15	-	V
Gate-Schwellenspannung gate threshold voltage	V_{CE} = V_{GE}, T_{vj} = 25°C, I_C = 1,5 mA	$V_{GE(TO)}$	5,0	5,8	6,5	V
Eingangskapazität input capacitance	f = 1MHz, T_{vj} = 25°C V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}	-	2,5	-	nF
Kollektor-Emitter Reststrom collector-emitter cut off current	V_{GE} = 0V, T_{vj} = 25°C, V_{CE} = 1200 V	I_{CES}	-	5,0	500	mA
Gate-Emitter Reststrom gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25°C	I_{GES}	-	-	400	nA
Schaltverluste und -bedingungen Switching losses and conditions	siehe Wechselrichter in Dbl FP40R12KE3 see inverter in datasheet FP40R12KE3					
Diode Brems-Chopper/ Diode Brake-Chopper			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	T_{vj} = 25°C, I_F = 40 A	V_F	-	1,95	2,5	V
	T_{vj} = 125°C, I_F = 40 A		-	2,05	-	V
Schaltverluste und -bedingungen Switching losses and conditions	siehe Wechselrichter in Dbl FP25R12KE3 see inverter in datasheet FP25R12KE3					
NTC-Widerstand/ NTC-Thermistor			**min.**	**typ.**	**max.**	
Nennwiderstand rated resistance	T_C = 25°C	R_{25}	-	5	-	kΩ
Abweichung von R_{100} deviation of R_{100}	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung power dissipation	T_C = 25°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

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. Wechsr./ Trans. Inverter			-	-	0,35	K/W
	Diode Wechsr./ Diode Inverter			-	-	0,58	K/W
	Trans. Bremse/ Trans. Brake			-	-	0,6	K/W
	Diode Bremse/ Diode Brake			-	-	1,2	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleichr. Diode/ Rectif. Diode	λ_{Paste}=1W/m*K	R_{thCK}	-	0,04	-	K/W
	Trans. Wechsr./ Trans. Inverter	λ_{grease}=1W/m*K		-	0,02	-	K/W
	Diode Wechsr./ Diode Inverter			-	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

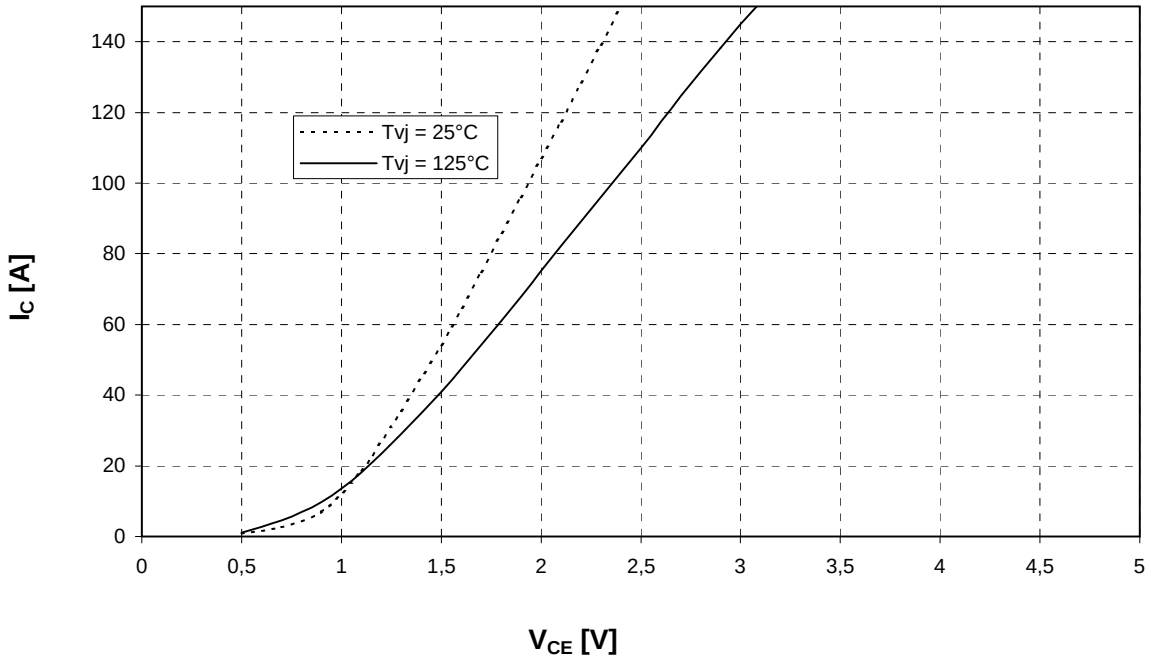
Mechanische Eigenschaften / Mechanical properties

Innere Isolation internal insulation			Al_2O_3				
CTI comperative tracking index			225				
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube M 5 screw M 5	M	3	-	6	Nm	
Gewicht weight		G	300			g	
Luftstrecke clearance	Pin-Erde Pin-GND		7,5			mm	
Kriechstrecke creeping distance	Pin-Erde Pin-GND		10			mm	

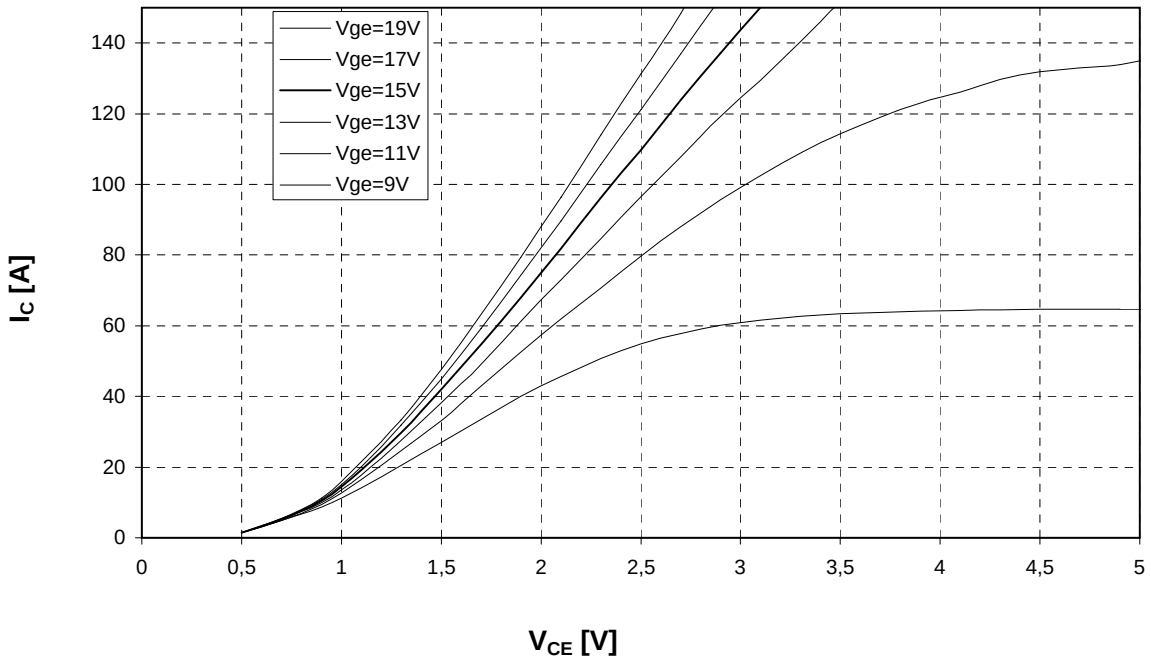
Transiente Thermische Eigenschaften / Transient Thermal properties

	IGBT-Wechselrichter IGBT-Inverter		Diode-Wechselrichter Diode-Inverter	
	r_i [K/W]	τ_i [s]	r_i [K/W]	τ_i [s]
1	3,949E-02	2,345E-03	5,906E-02	3,333E-03
2	6,139E-02	2,820E-01	3,815E-01	3,429E-02
3	1,580E-01	2,820E-02	1,099E-01	1,294E-01
4	8,884E-02	1,128E-01	3,480E-02	7,662E-01

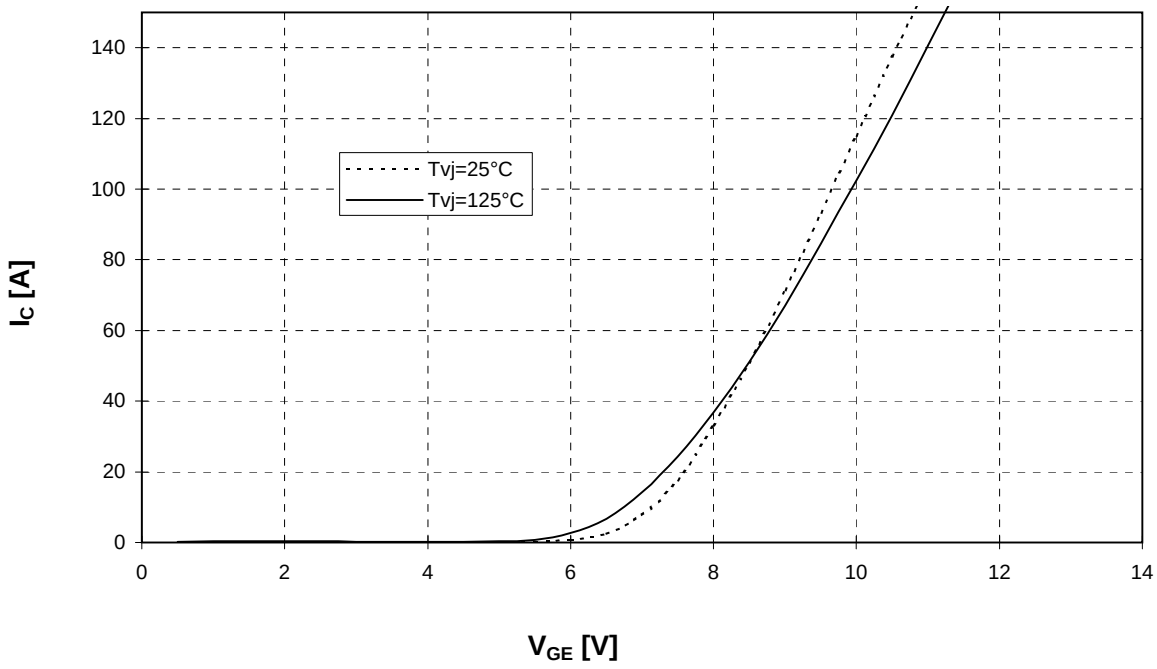
Ausgangskennlinienfeld Wechselr. (typisch) $I_C = f(V_{CE})$
Output characteristic Inverter (typical) $V_{GE} = 15\ V$



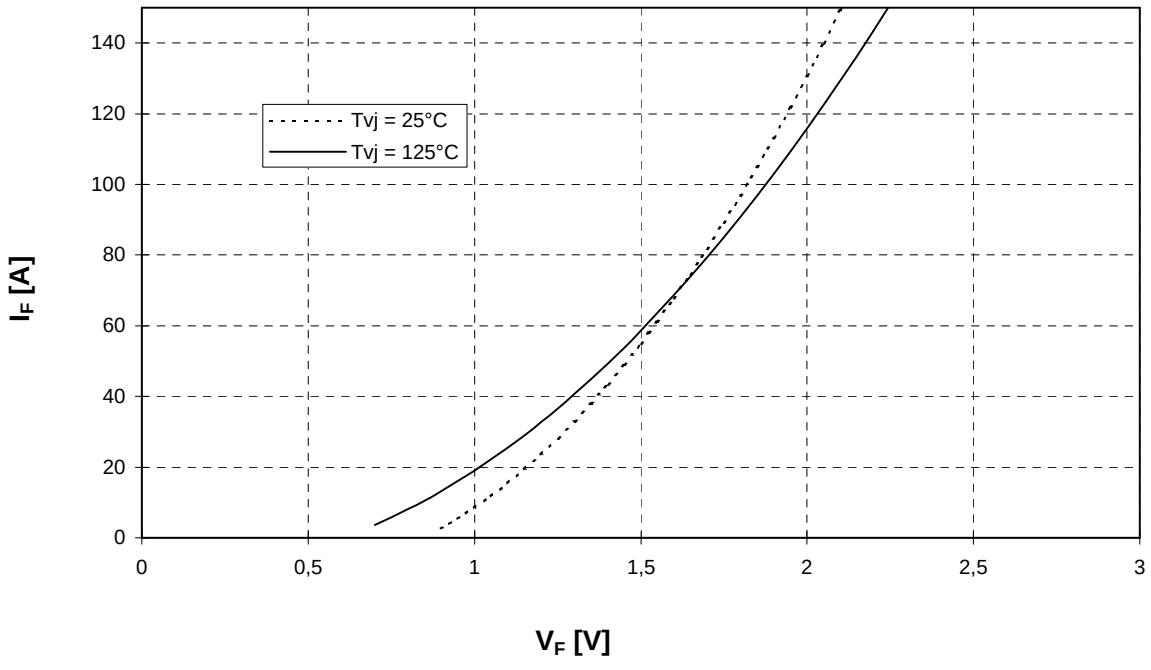
Ausgangskennlinienfeld Wechselr. (typisch) $I_C = f(V_{CE})$
Output characteristic Inverter (typical) $T_{vj} = 125°C$



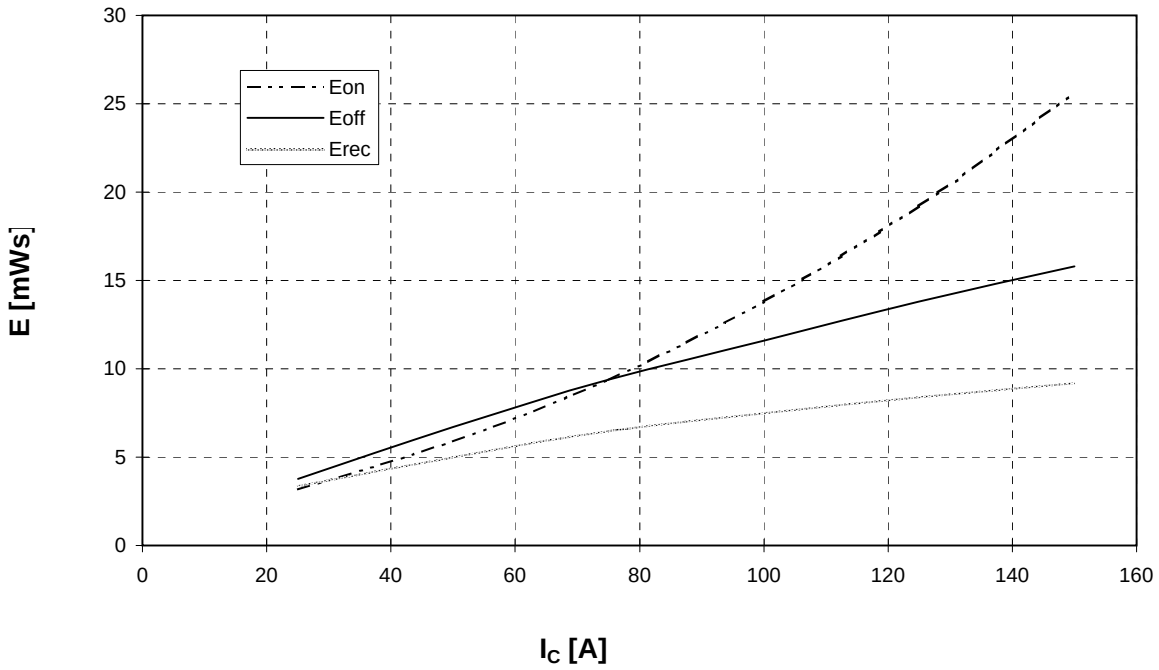
Übertragungscharakteristik Wechselr. (typisch) $I_C = f(V_{GE})$
Transfer characteristic Inverter (typical) $V_{CE} = 20\ V$



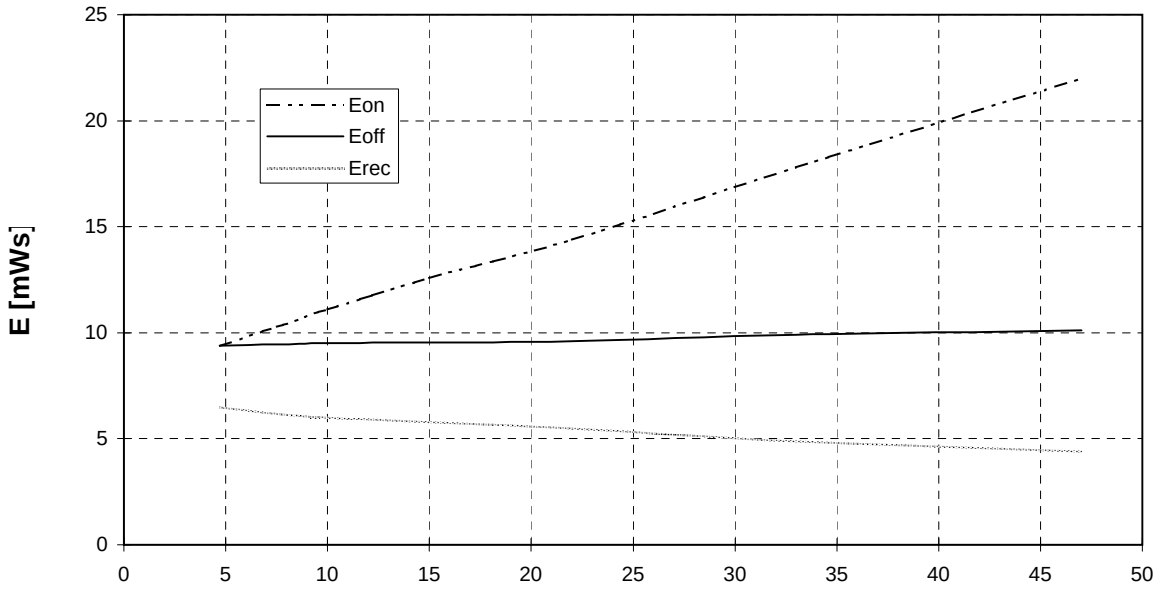
Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch) $I_F = f(V_F)$
Forward characteristic of FWD Inverter (typical)



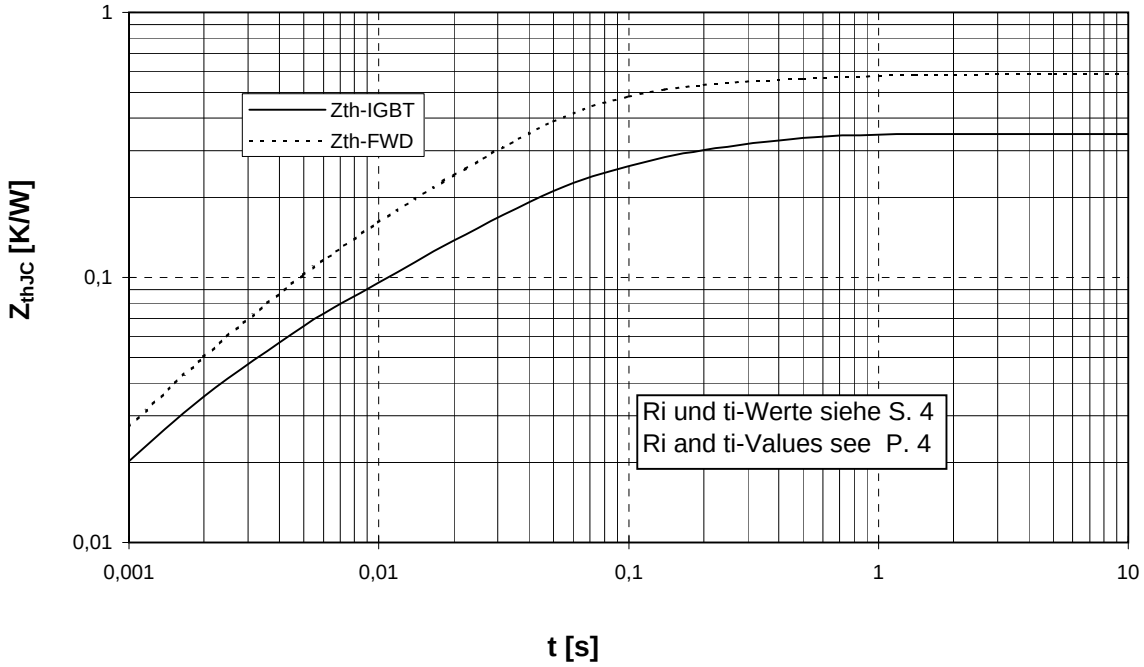
Schaltverluste Wechselr. (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$ V_{CC} = **600 V**
Switching losses Inverter (typical) T_j = 125°C, V_{GE} = ±15 V, R_{Gon} = R_{Goff} = **4,7 Ohm**



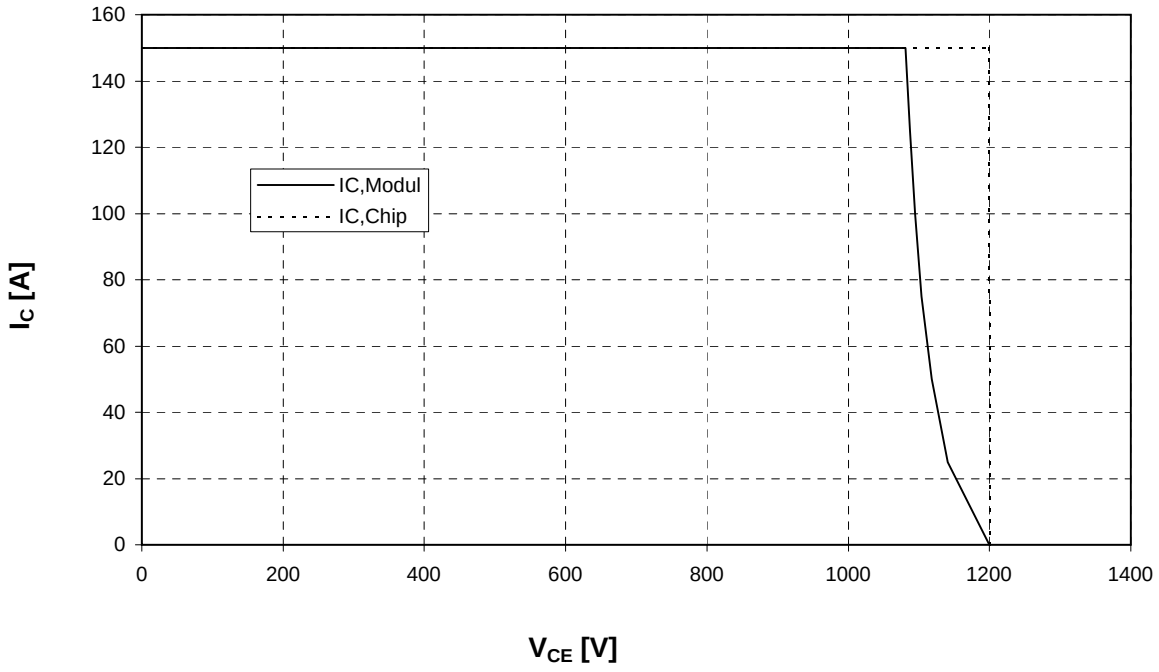
Schaltverluste Wechselr. (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
Switching losses Inverter (typical) T_j = 125°C, V_{GE} = +-15 V , $I_c = I_{nenn}$, V_{CC} = **600 V**



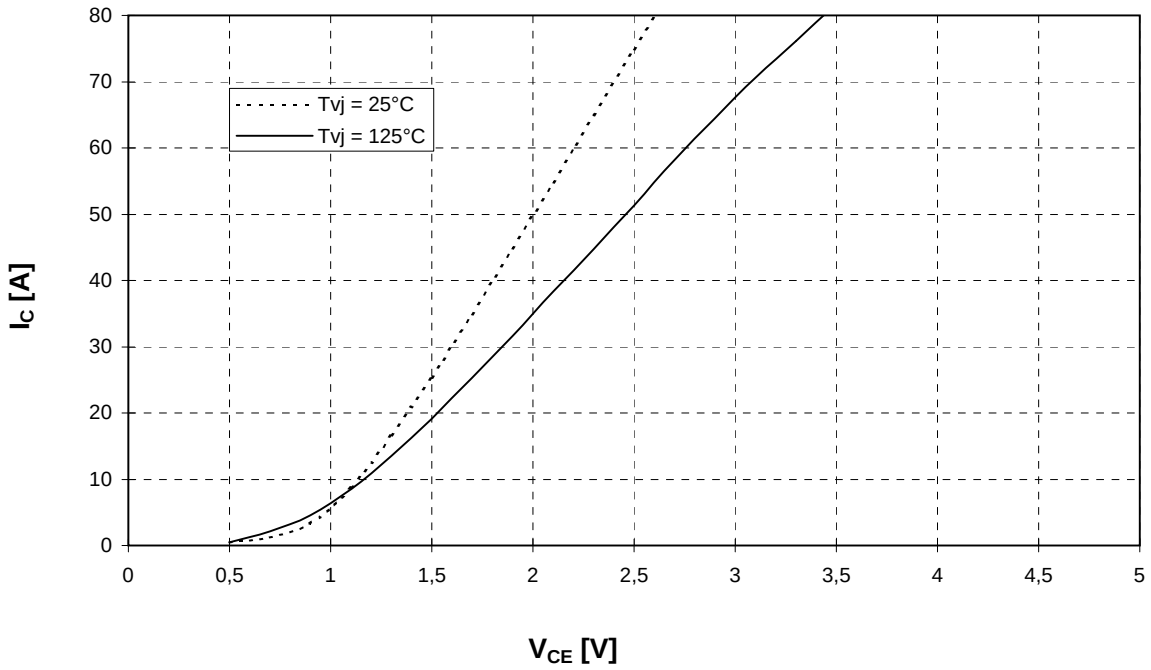
Transienter Wärmewiderstand Wechselr. $Z_{thJC} = f(t)$
Transient thermal impedance Inverter



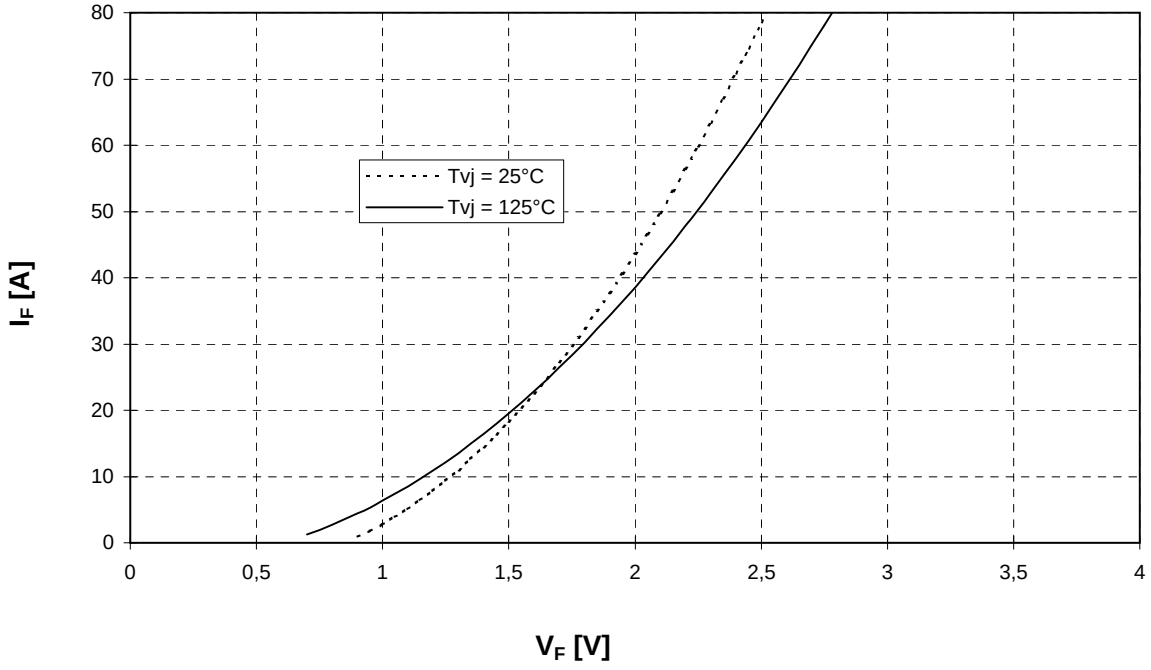
Sicherer Arbeitsbereich IGBT-Wechselr. (RBSOA)
Reverse bias save operating area (RBSOA) $V_{GE} = 15V,\ T_j = 125°C$



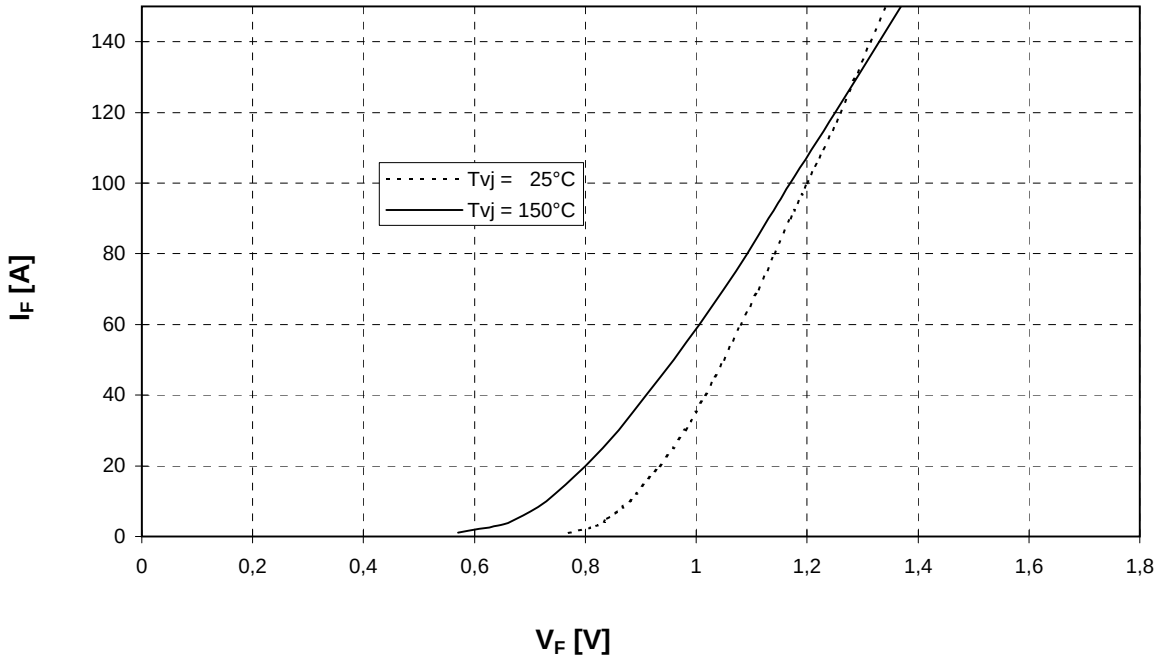
Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch) $I_C = f(V_{CE})$
Output characteristic brake-chopper-IGBT (typical) $V_{GE} = 15$ V



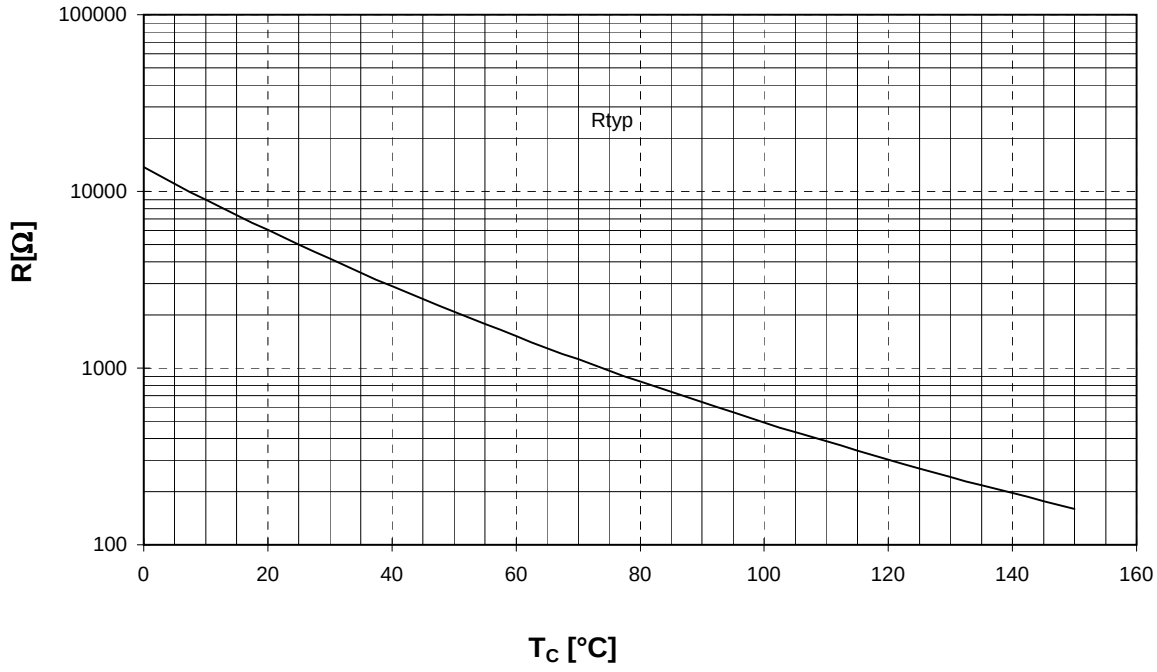
Durchlaßkennlinie der Brems-Chopper-Diode (typisch) $I_F = f(V_F)$
Forward characteristic of brake-chopper-FWD (typical)



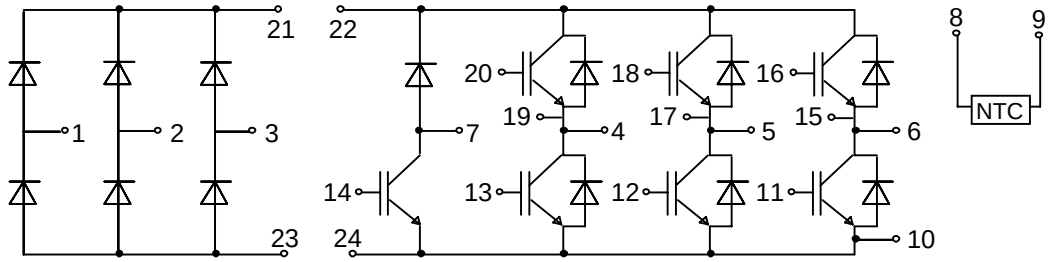
Durchlaßkennlinie der Gleichrichterdiode (typisch) $I_F = f(V_F)$
Forward characteristic of Rectifier Diode (typical)



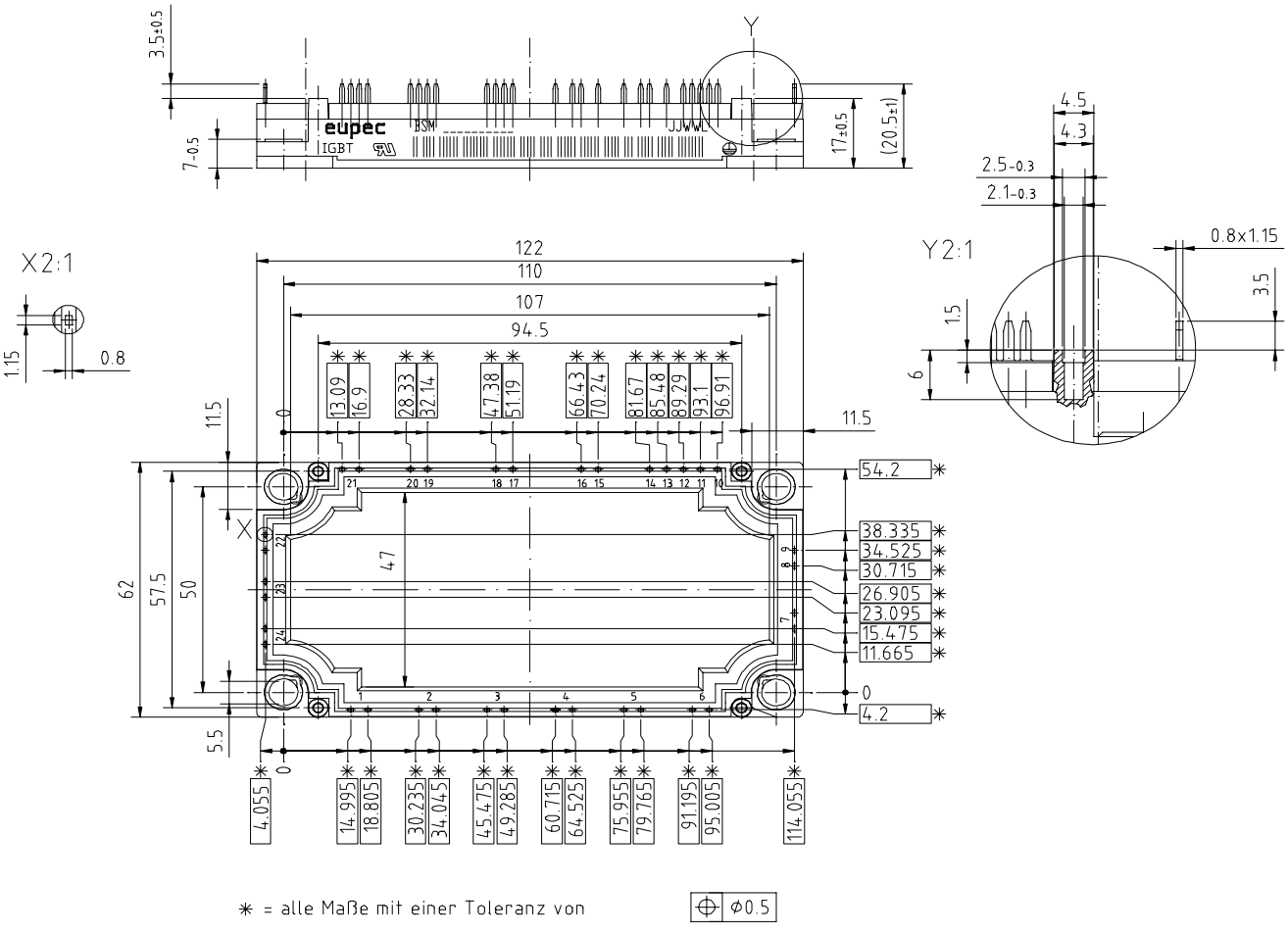
NTC- Temperaturkennlinie (typisch) **R = f (T)**
NTC- temperature characteristic (typical)



Schaltplan/ Circuit diagram



Gehäuseabmessungen/ Package outlines



✳ = alle Maße mit einer Toleranz von ⌖ ⌀0.5

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