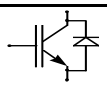


Vorläufig
preliminary

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}	800	V
Durchlaßstrom Grenzeffektivwert pro Chip RMS forward current per chip	T_C =80°C	I_{FRMSM}	23	A
Gleichrichter Ausgang Grenzeffektivstrom maximum RMS current at Rectifier output	T_C =80°C	I_{RMSmax}	25	A
Stoßstrom Grenzwert surge forward current	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I_{FSM}	197 158	A A
Grenzlastintegral I^2t - value	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I^2t	194 125	A^2s A^2s

Transistor Wechselrichter / transistor inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} =25°C	V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	T_C =80°C T_C = 25 °C	$I_{C,nom.}$ I_C	10 15	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C =80°C	I_{CRM}	20	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	55	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter / diode inverter

Dauergleichstrom DC forward current		I_F	10	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	20	A
Grenzlastintegral I^2t - value	V_R = 0V, t_p = 10ms, T_{vj} = 125°C	I^2t	12	A^2s

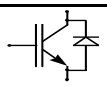
Transistor Brems-Chopper / transistor brake-chopper

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} =25°C	V_{CES}	600	V
Kollektor-Dauergleichstrom DC-collector current	T_C =80 °C T_C = 25 °C	$I_{C,nom.}$ I_C	10 15	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_c=80°C	I_{CRM}	20	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	55	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper / diode brake-chopper

Dauergleichstrom DC forward current		I_F	10	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	20	A

prepared by: Thomas Passe	date of publication: 2003-03-26
approved by: R. Keggenhoff	revision: 2.1



Vorläufig
preliminary

Modul Isolation / module isolation

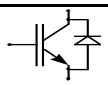
Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min. NTC connected to baseplate	V_{ISOL}	2,5		kV

Elektrische Eigenschaften / electrical properties

Charakteristische Werte / characteristic values

Diode Gleichrichter / diode rectifier			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	T_{vj} = 150°C, I_F = 10 A	V_F	-	0,9	-	V
Schleusenspannung threshold voltage	T_{vj} = 150°C	$V_{(TO)}$	-	0,67	-	V
Ersatzwiderstand slope resistance	T_{vj} = 150°C	r_T	-	21	-	mΩ
Sperrstrom reverse current	T_{vj} = 150°C, V_R = 800 V	I_R	-	5	-	mA
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T_C = 25°C	$R_{AA'+CC'}$	-	11	-	mΩ

Transistor Wechselrichter / transistor inverter			**min.**	**typ.**	**max.**	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	V_{GE} = 15V, T_{vj} = 25°C, I_C = 10 A V_{GE} = 15V, T_{vj} = 125°C, I_C = 10 A	$V_{CE\ sat}$	- -	1,95 2,2	2,55 -	V V
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}$, T_{vj} = 25°C, I_C = 0,35mA	$V_{GE(TO)}$	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}	-	0,8	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{GE} = 0V, T_{vj} =25°C, V_{CE} = 600V	I_{CES}	-	-	5,0	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} = 300 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 82 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm	$t_{d,on}$	- -	32 30	- -	ns ns
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = I_{Nenn}$, V_{CC} = 300 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 82 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm	t_r	- -	26 28	- -	ns ns
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = I_{Nenn}$, V_{CC} = 300 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 82 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm	$t_{d,off}$	- -	234 230	- -	ns ns
Fallzeit (induktive Last) fall time (inductive load)	$I_C = I_{Nenn}$, V_{CC} = 300 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 82 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm	t_f	- -	10 30	- -	ns ns
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = I_{Nenn}$, V_{CC} = 300 V V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm L_S = 80 nH	E_{on}	-	0,36	-	mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = I_{Nenn}$, V_{CC} = 300 V V_{GE} = ±15V, T_{vj} = 125°C, R_G = 82 Ohm L_S = 80 nH	E_{off}	-	0,44	-	mJ
Kurzschlußverhalten SC Data	$t_P \leq$ 10µs, $V_{GE} \leq$ 15V, R_G = 82 Ohm $T_{vj} \leq$125°C, V_{CC} = 360 V dI/dt = 400 A/µs	I_{SC}	-	40	-	A



Vorläufig
preliminary

Elektrische Eigenschaften / electrical properties

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	40	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T_C = 25°C	$R_{CC'+EE'}$	-	10	-	mΩ
Diode Wechselrichter / diode inverter			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	V_{GE} = 0V, T_{vj} = 25°C, I_F = 10 A	V_F	-	1,85	2,25	V
	V_{GE} = 0V, T_{vj} = 125°C, I_F = 10 A		-	1,9	-	V
Rückstromspitze peak reverse recovery current	I_F=I_{Nenn}, - di_F/dt = 600 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	I_{RM}	-	11	-	A
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	12	-	A
Sperrverzögerungsladung recovered charge	I_F=I_{Nenn}, - di_F/dt = 600 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	Q_r	-	0,35	-	µAs
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	0,71	-	µAs
Abschaltenergie pro Puls reverse recovery energy	I_F=I_{Nenn}, - di_F/dt = 600 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	E_{rec}	-	0,05	-	mJ
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	0,12	-	mJ
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 = 10,0 A	$V_{CE\ sat}$	-	1,95	2,55	V
	V_{GE} = 15V, T_{vj} = 125°C, I_C = 10,0 A		-	2,2	-	V
Gate-Schwellenspannung gate threshold voltage	V_{CE} = V_{GE}, T_{vj} = 25°C, I_C = 0,35mA	$V_{GE(TO)}$	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}	-	0,8	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{GE} = 0V, T_{vj} = 25°C, V_{CE} = 600V		-	-	5,0	mA
Gate-Emitter Reststrom gate-emitter leakage current	V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25°C	I_{GES}	-	-	400	nA
Diode Brems-Chopper / diode brake-chopper			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	T_{vj} = 25°C, I_F = 10,0 A	V_F	-	1,85	2,25	V
	T_{vj} = 125°C, I_F = 10,0 A		-	1,9	-	V
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

Vorläufig
preliminary

Thermische Eigenschaften / thermal properties

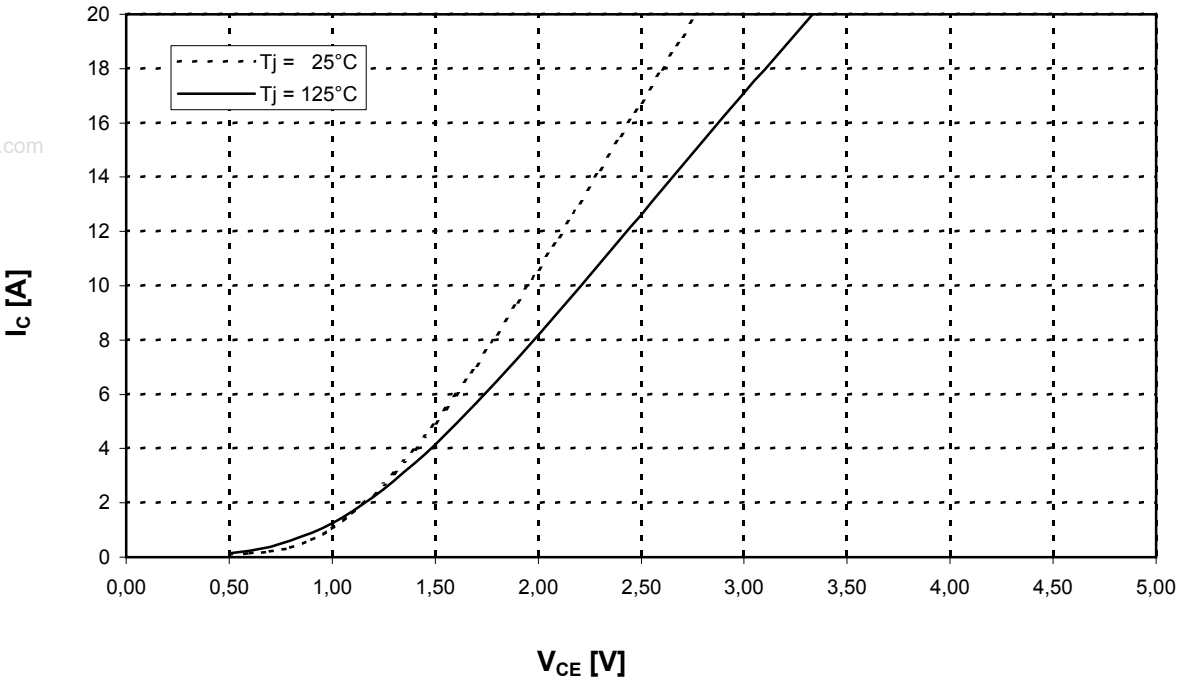
				min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to heatsink	Gleichr. Diode/ rectif. diode	λ_{Paste}=1W/m*K	R_{thJH}	-	2,6	-	K/W
	Trans. Wechselr./ trans. inverter	λ_{grease}=1W/m*K		-	2,8	-	K/W
	Diode Wechselr./ diode inverter			-	4,3	-	K/W
	Trans. Bremse/ trans. brake			-	2,8	-	K/W
	Diode Bremse/ diode brake			-	4,3	-	K/W
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ rectif. diode		R_{thJC}	-	-	2,4	K/W
	Trans. Wechselr./ trans.inverter			-	-	2,2	K/W
	Diode Wechselr./ diode inverter			-	-	3,1	K/W
	Trans. Bremse/ trans. brake			-	-	2,2	K/W
	Diode Bremse/ diode brake			-	-	3,1	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleichr. Diode/ rectif. diode	λ_{Paste}=1W/m*K	R_{thCH}	-	0,4	-	K/W
	Trans. Wechselr./ trans. inverter	λ_{grease}=1W/m*K		-	0,8	-	K/W
	Diode Wechselr./ diode inverter			-	1,5	-	K/W
	Trans. Bremse/ trans. brake			-	0,8	-	K/W
	Diode Bremse/ diode brake			-	1,5	-	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

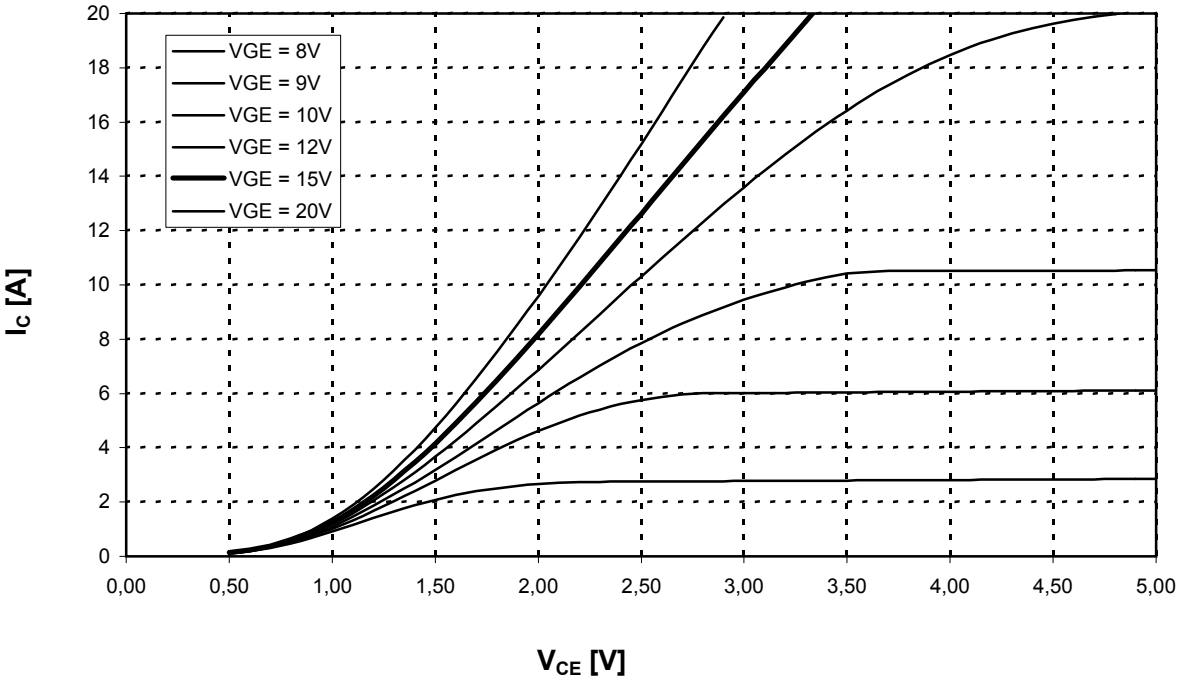
Innere Isolation internal insulation			Al_2O_3		
CTI comperative tracking index			225		
Anpreßkraft f. mech. Befestigung pro Feder mounting force per clamp		F	40...80		N
Gewicht weight		G	36		g
Kontakt - Kühlkörper terminal to heatsink	Kriechstrecke creepage distance		13,5		mm
	Luftstrecke clearance distance		12		mm
Terminal - Terminal terminal to terminal	Kriechstrecke creepage distance		7,5		mm
	Luftstrecke clearance distance		7,5		mm

Vorläufig
preliminary

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

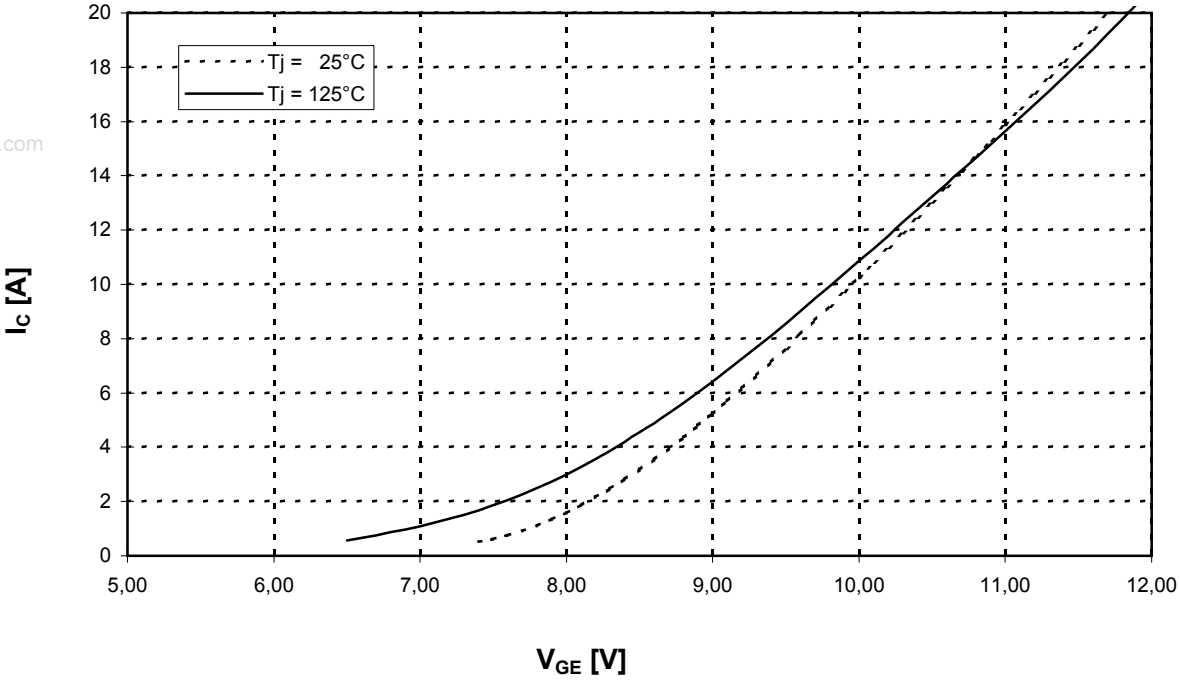


Ausgangskennlinienfeld Wechselr. (typisch) $I_C = f(V_{CE})$
output characteristicinverter (typical) $T_{vj} = 125°C$

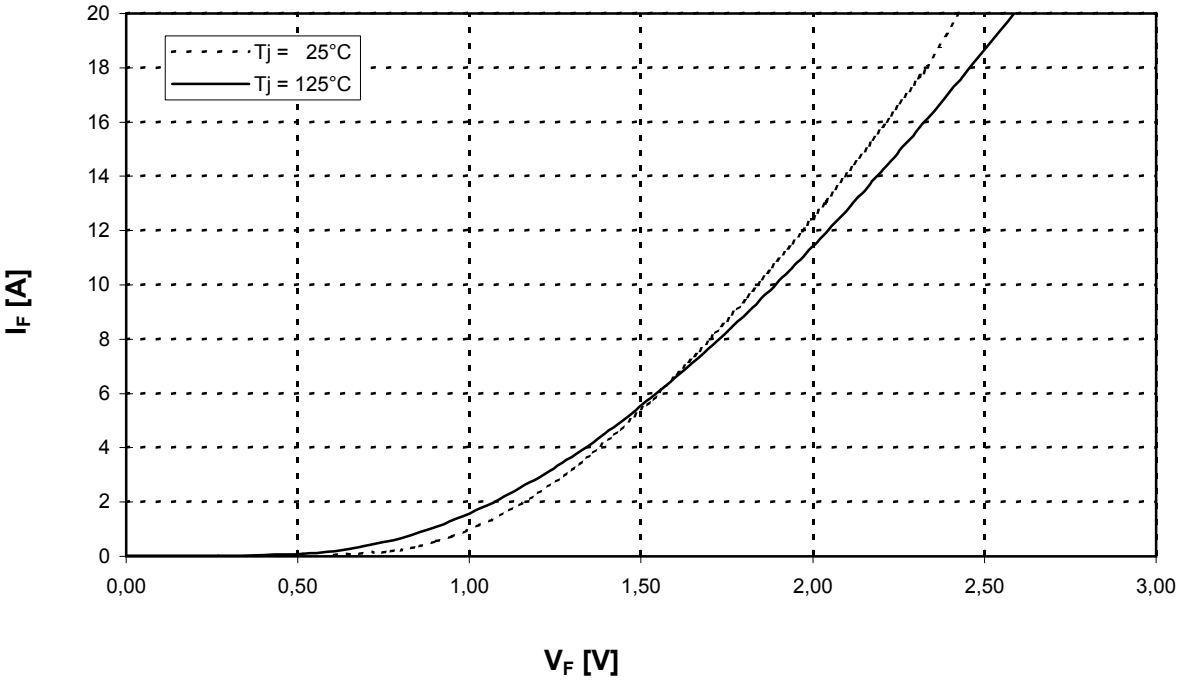


Vorläufig
preliminary

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

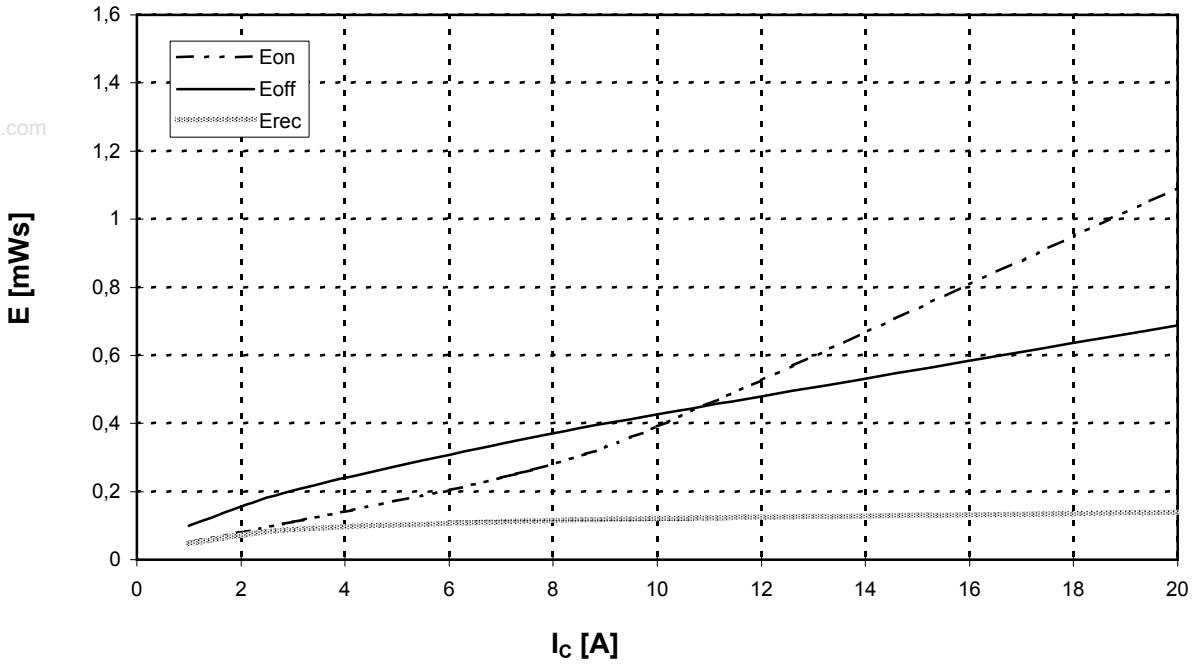


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch) $I_F = f(V_F)$
forward characteristic of FWD inverter (typical)

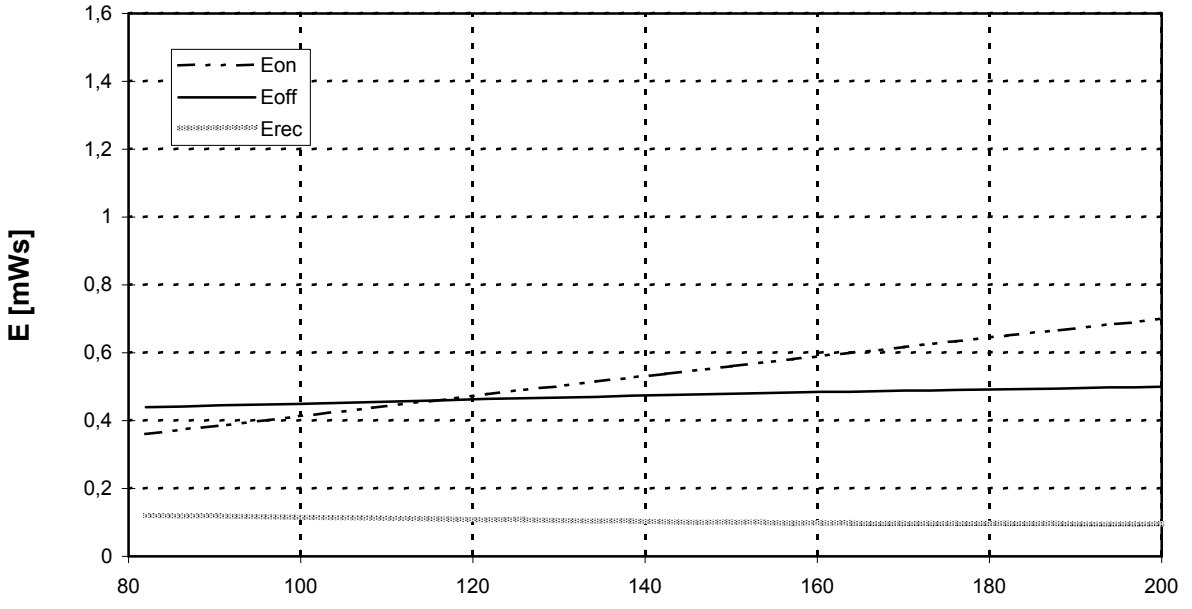


Vorläufig
preliminary

Schaltverluste Wechselr. (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$ V_{CC} = **300 V**
switching losses inverter (typical) T_j = 125°C, V_{GE} = ±15 V, $R_{Gon} = R_{Goff}$ = **82 Ohm**

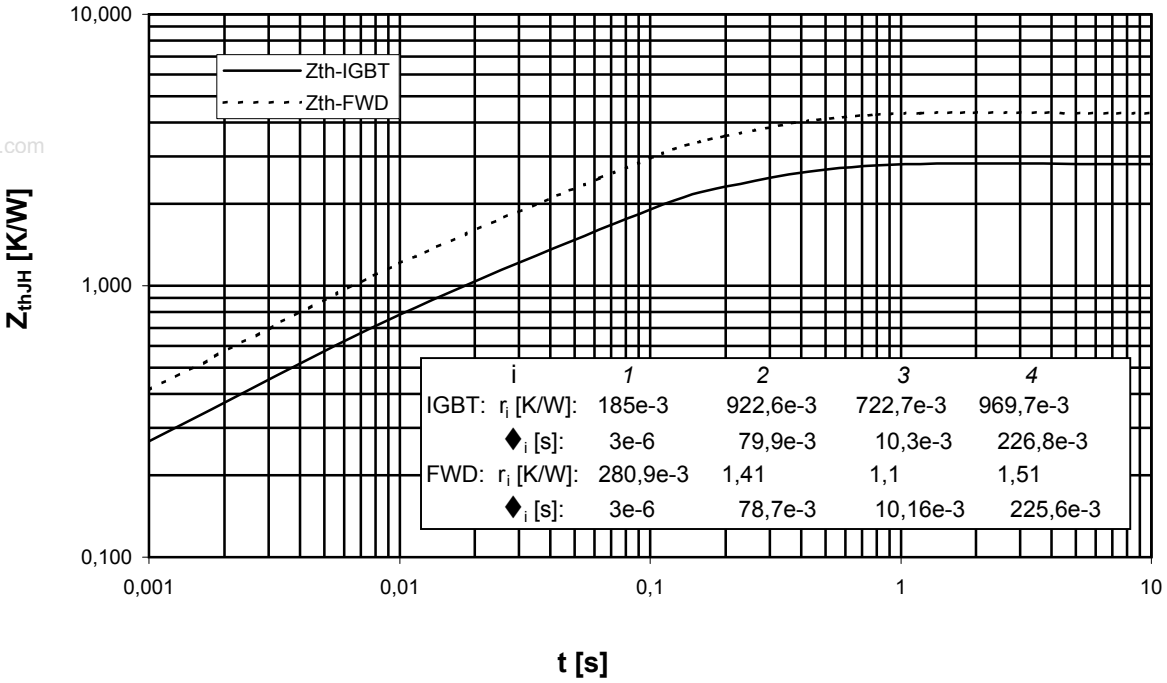


Schaltverluste Wechselr. (typisch) $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
switching losses inverter (typical) T_j = 125°C, V_{GE} = +-15 V, $I_c = I_{nenn}$, V_{CC} = **300 V**



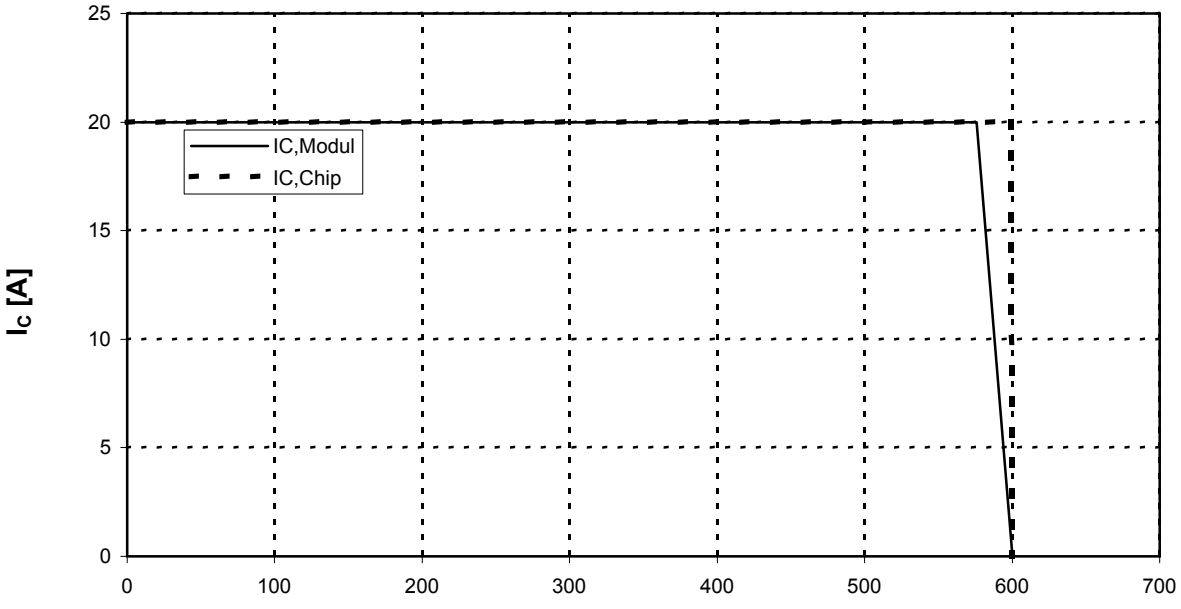
Vorläufig
preliminary

Transienter Wärmewiderstand Wechselr. $Z_{thJH} = f(t)$
transient thermal impedance inverter



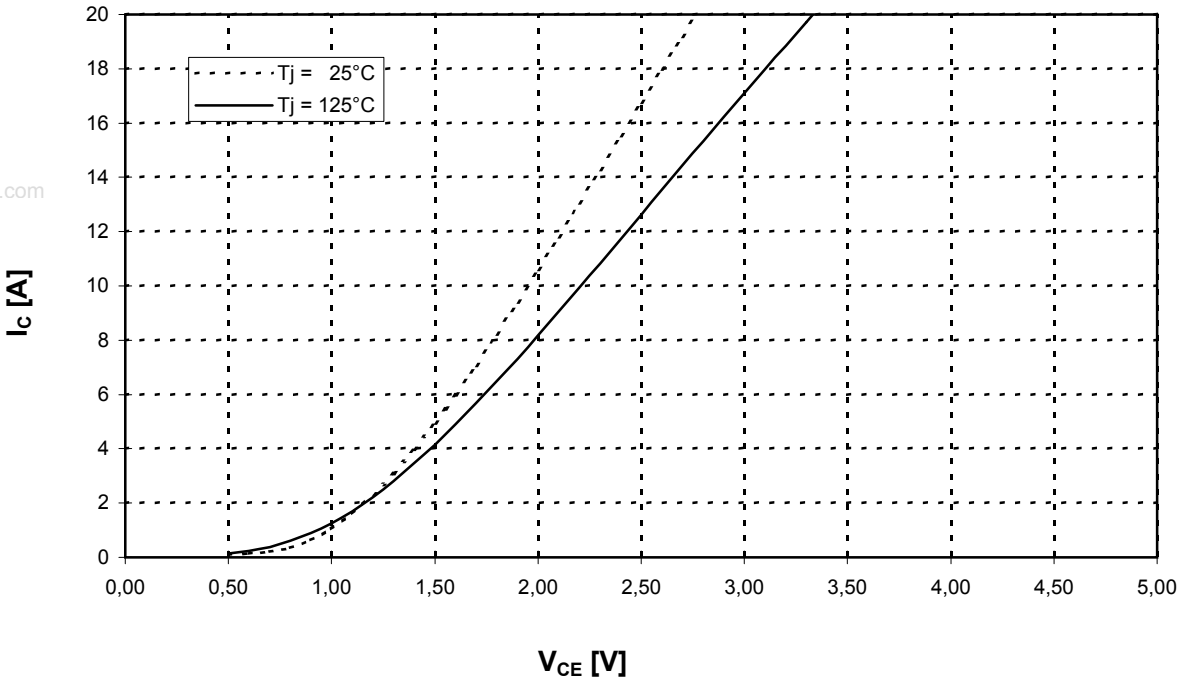
i	1	2	3	4
IGBT: r_i [K/W]:	185e-3	922,6e-3	722,7e-3	969,7e-3
τ_i [s]:	3e-6	79,9e-3	10,3e-3	226,8e-3
FWD: r_i [K/W]:	280,9e-3	1,41	1,1	1,51
τ_i [s]:	3e-6	78,7e-3	10,16e-3	225,6e-3

Sicherer Arbeitsbereich Wechselr. (RBSOA) $I_C = f(V_{CE})$
reverse bias save operating area inverter (RBSOA) T_{vj} **= 125°C,** V_{GE} **= ±15V,** R_G **= 82 Ohm**

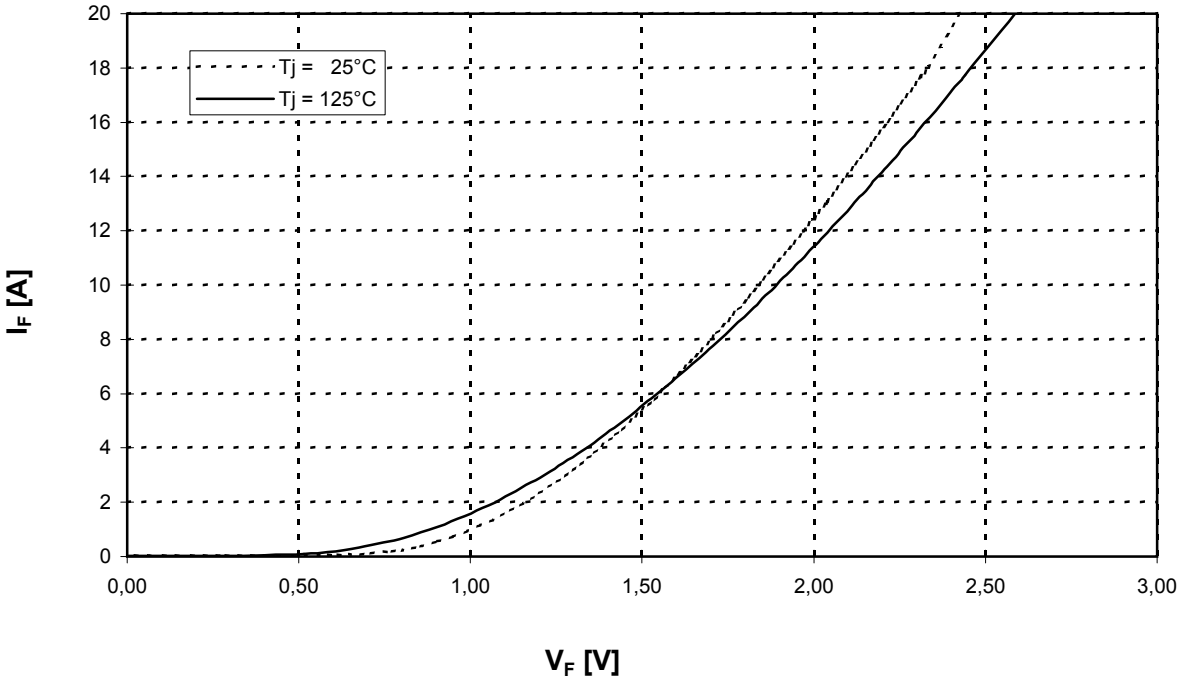


Vorläufig
preliminary

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

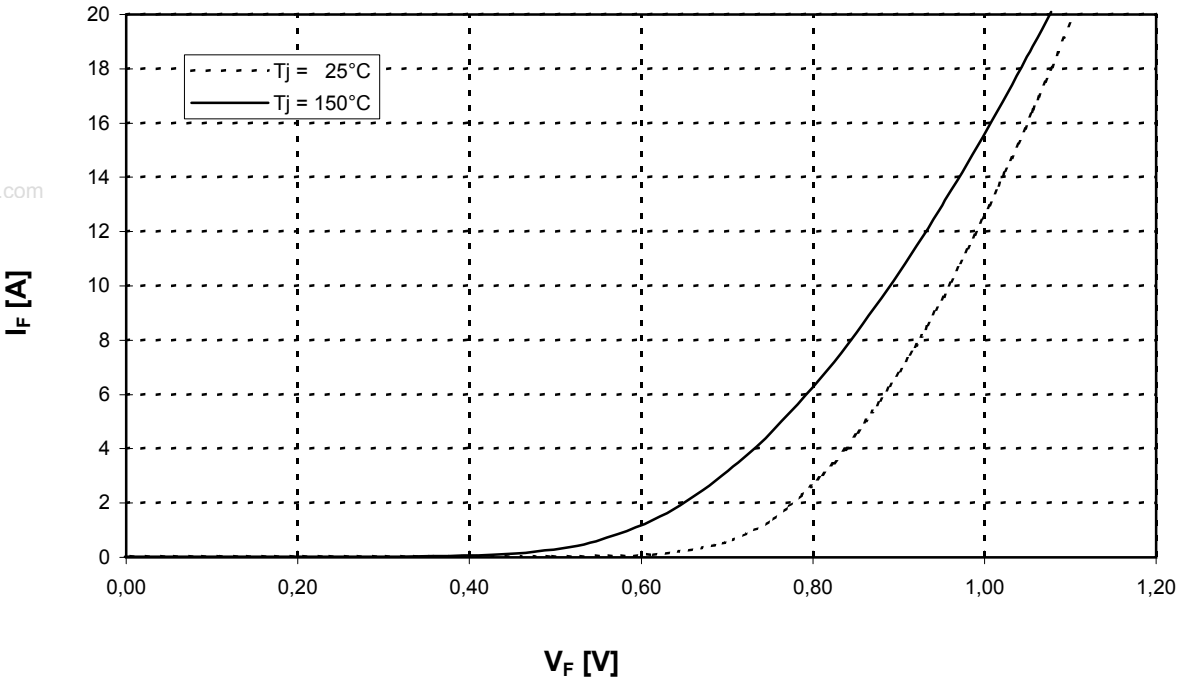


Durchlaßkennlinie der Brems-Chopper-Diode (typisch) $I_F = f(V_F)$
forward characteristic of brake-chopper-FWD (typical)

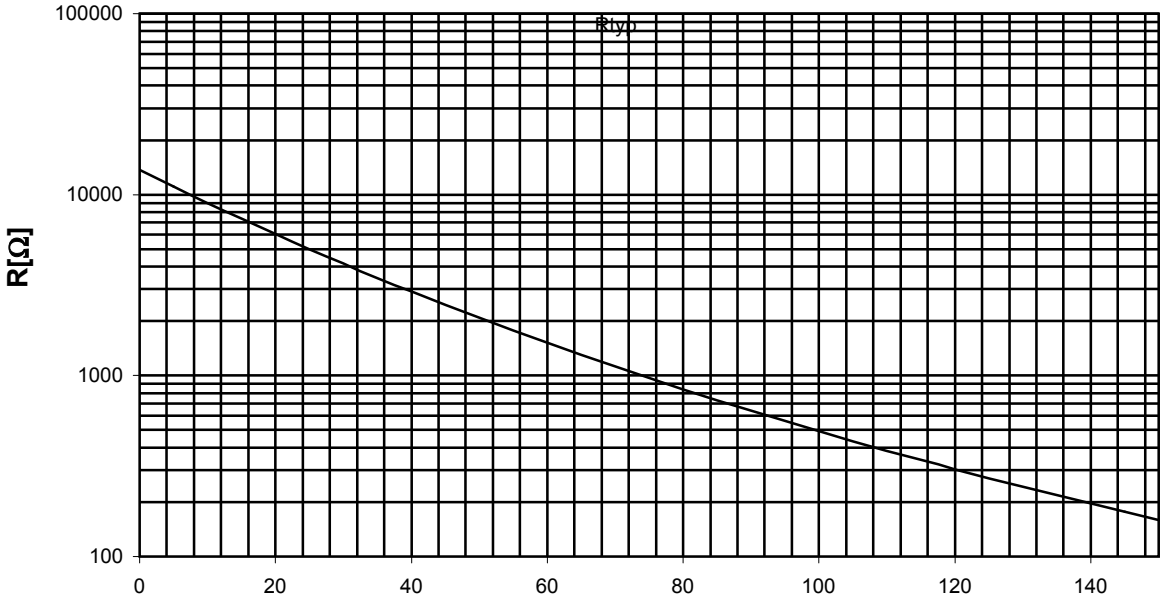


Vorläufig
preliminary

Durchlaßkennlinie der Gleichrichterdiode (typisch) $I_F = f(V_F)$
forward characteristic of rectifier diode (typical)

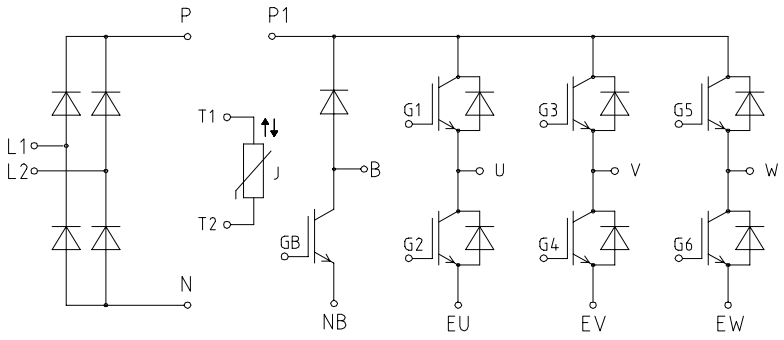


NTC- Temperaturkennlinie (typisch) $R = f(T)$
NTC- temperature characteristic (typical)

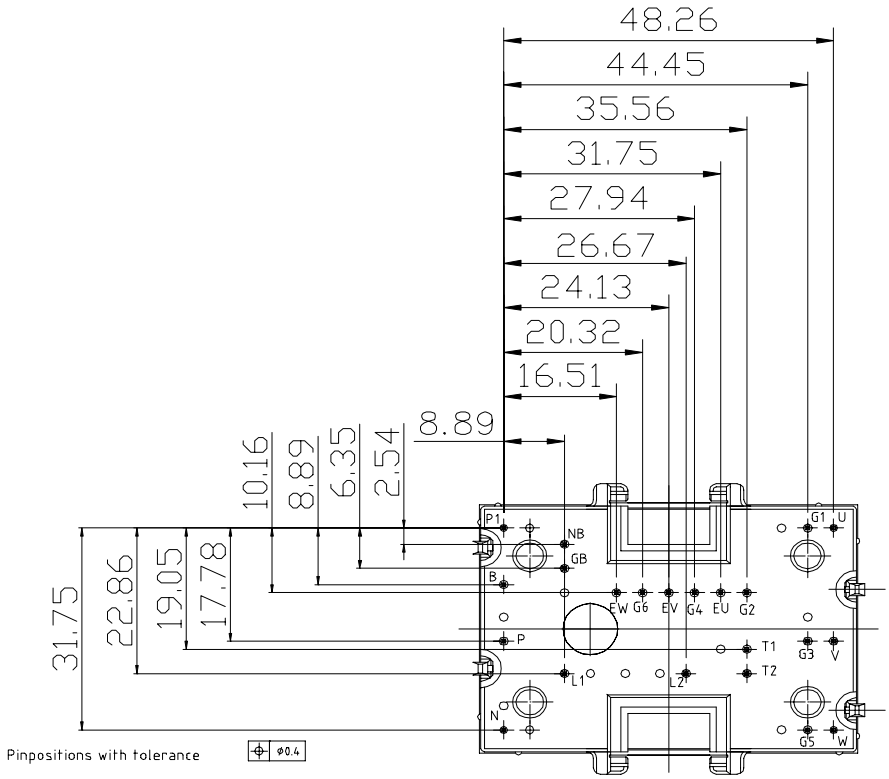


Vorläufig
preliminary

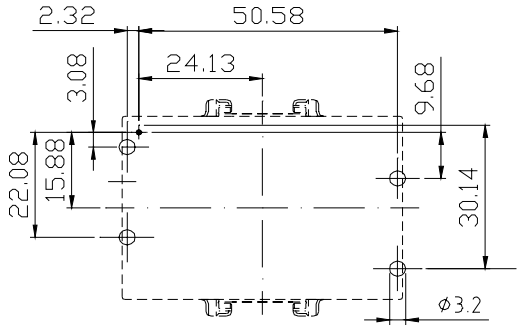
Schaltplan/ circuit diagram



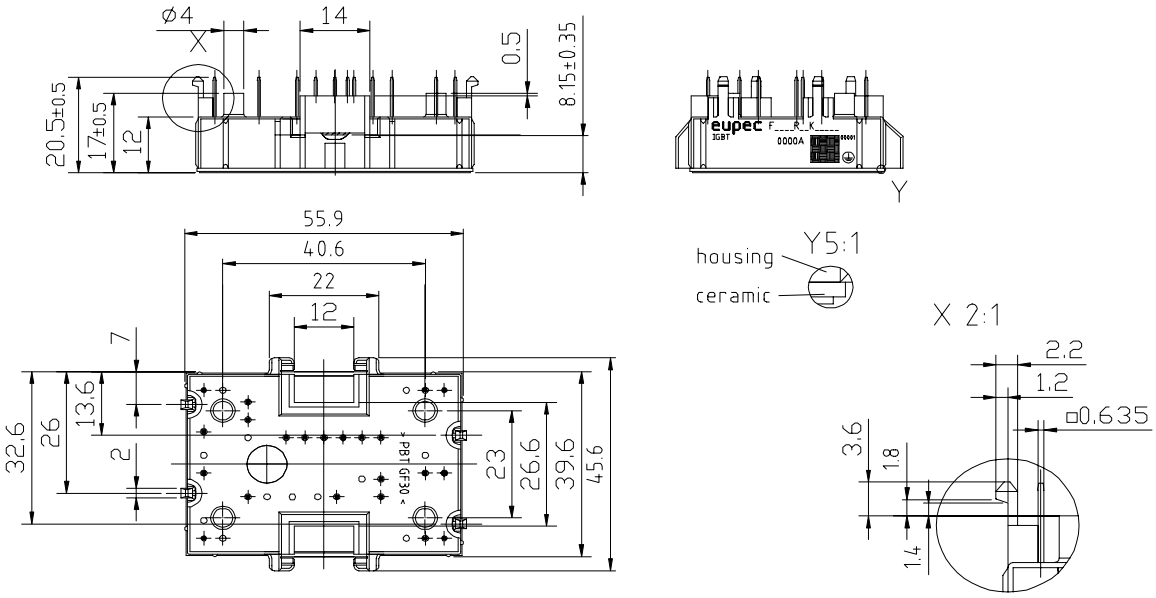
Gehäuseabmessungen/ package outlines



Bohrplan /
drilling layout



Gehäuseabmessungen Forts. / package outlines contd.



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