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}	29	A
Gleichrichter Ausgang Grenzeffektivstrom maximum RMS current at Rectifier output	T_C =80°C	I_{RMSmax}	36	A
Stoßstrom Grenzwert surge forward current	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I_{FSM}	262 215	A A
Grenzlastintegral I^2t - value	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I^2t	344 231	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 = 65°C T_C = 25 °C	$I_{C,nom.}$ I_C	20 25	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_c=65°C	I_{CRM}	40	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	78	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current		I_F	20	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	40	A
Grenzlastintegral I^2t - value	V_R = 0V, t_p = 10ms, T_{vj} = 125°C	I^2t	62	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 = 65 °C T_C = 25 °C	$I_{C,nom.}$ I_C	20 25	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_c=65°C	I_{CRM}	40	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	78	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current		I_F	20	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	40	A

prepared by: Thomas Passe	date of publication: 2002-02-14
approved by: Ingo Graf	revision: 4

Vorläufig
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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

Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

Diode Gleichrichter/ Diode Rectifier			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	T_{vj} = 150°C, I_F = 20 A	V_F	-	0,95	-	V
Schleusenspannung threshold voltage	T_{vj} = 150°C	$V_{(TO)}$	-	0,71	-	V
Ersatzwiderstand slope resistance	T_{vj} = 150°C	r_T	-	12	-	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 = 20 A V_{GE} = 15V, T_{vj} = 125°C, I_C = 20 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 = 0,5mA	$V_{GE(TO)}$	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}	-	1,1	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{GE} = 0V, T_{vj} =125°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 = 47 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 47 Ohm	$t_{d,on}$	- -	22 31	- -	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 = 47 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 47 Ohm	t_r	- -	23 37	- -	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 = 47 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 47 Ohm	$t_{d,off}$	- -	143 154	- -	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 = 47 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 47 Ohm	t_f	- -	22 38	- -	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 = 47 Ohm L_S = 80 nH	E_{on}	-	0,7	-	mWs
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 = 47 Ohm L_S = 80 nH	E_{off}	-	0,6	-	mWs
Kurzschlußverhalten SC Data	$t_P \leq$ 10µs, $V_{GE} \leq$ 15V, R_G = 47 Ohm $T_{vj} \leq$125°C, V_{CC} = 360 V	I_{SC}	-	90	-	A

Vorläufig
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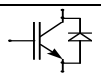
Elektrische Eigenschaften / Electrical properties

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	$R_{CC'+EE'}$	-	13	-	mΩ
Diode Wechselrichter/ Diode Inverter			**min.**	**typ.**	**max.**	
Durchlaßspannung forward voltage	V_{GE} = 0V, T_{vj} = 25°C, I_F = 20 A	V_F	-	1,7	2,15	V
	V_{GE} = 0V, T_{vj} = 125°C, I_F = 20 A		-	1,7	-	V
Rückstromspitze peak reverse recovery current	I_F=I_{Nenn}, - di_F/dt = 1000 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	I_{RM}	-	20	-	A
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	23	-	A
Sperrverzögerungsladung recovered charge	I_F=I_{Nenn}, - di_F/dt = 1000 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	Q_r	-	1	-	µAs
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	1,7	-	µAs
Abschaltenergie pro Puls reverse recovery energy	I_F=I_{Nenn}, - di_F/dt = 1000 A/us					
	V_{GE} = -10V, T_{vj} = 25°C, V_R = 300 V	E_{rec}	-	0,2	-	mWs
	V_{GE} = -10V, T_{vj} = 125°C, V_R = 300 V		-	0,35	-	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 = 20,0 A	$V_{CE\,sat}$	-	1,95	2,55	V
	V_{GE} = 15V, T_{vj} = 125°C, I_C = 20,0 A		-	2,2	-	V
Gate-Schwellenspannung gate threshold voltage	V_{CE} = V_{GE}, T_{vj} = 25°C, I_C = 0,5mA	$V_{GE(TO)}$	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}	-	1,1	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{GE} = 0V, T_{vj} = 125°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 = 20A	V_F	-	2,45	2,9	V
	T_{vj} = 125°C, I_F = 20A		-	2,55	-	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

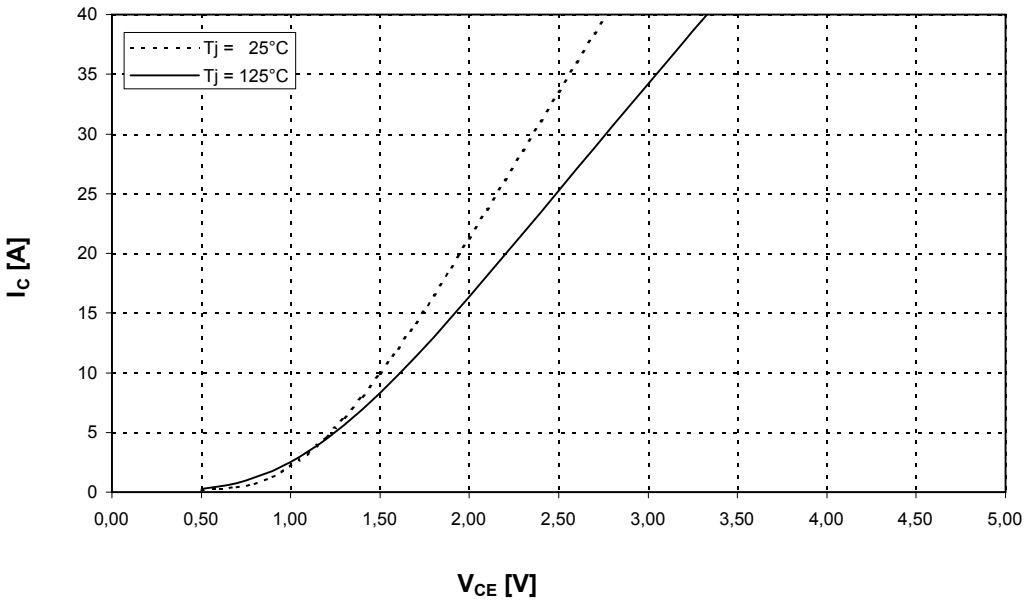
				min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to heatsink	Gleichr. Diode/ Rectif. Diode	λ_{Paste}=1W/m*K	R_{thJH}	-	2,1	-	K/W
	Trans. Wechsr./ Trans. Inverter	λ_{grease}=1W/m*K		-	1,8	-	K/W
	Diode Wechsr./ Diode Inverter			-	3,7	-	K/W
	Trans. Bremse/ Trans. Brake			-	1,8	-	K/W
	Diode Bremse/ Diode Brake			-	4,3	-	K/W
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode		R_{thJC}	-	-	2	K/W
	Trans. Wechsr./ Trans. Inverter			-	-	1,6	K/W
	Diode Wechsr./ Diode Inverter			-	-	2,7	K/W
	Trans. Bremse/ Trans. Brake			-	-	1,6	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}	-	0,3	-	K/W
	Trans. Wechsr./ Trans. Inverter	λ_{grease}=1W/m*K		-	0,4	-	K/W
	Diode Wechsr./ Diode Inverter			-	1,3	-	K/W
	Trans. Bremse/ Trans. Brake			-	0,4	-	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

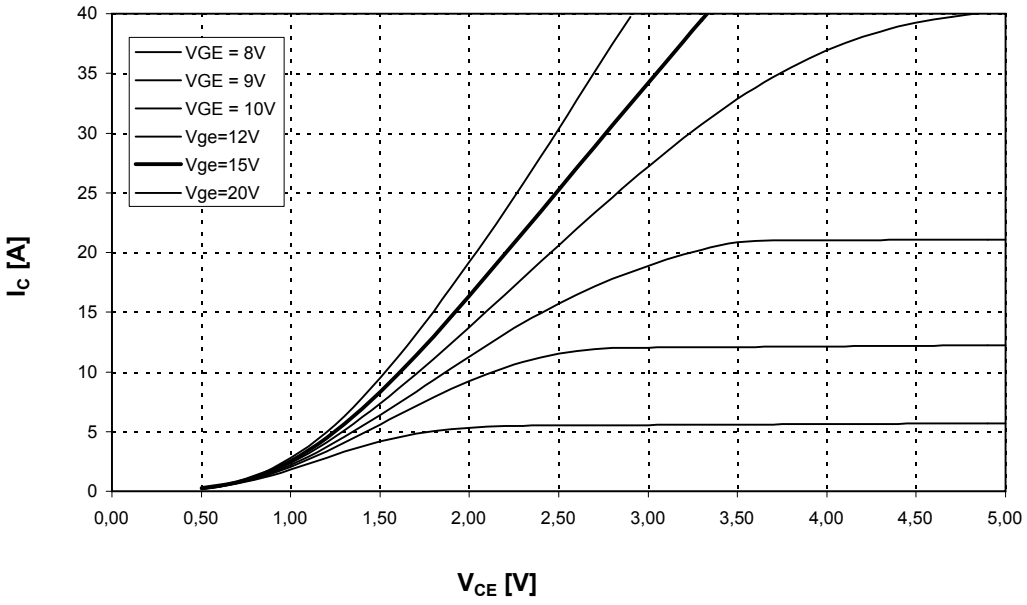
Innere Isolation internal insulation			Al_2O_3		
CTI comperative tracking index			225		
Anpreßkraft f. mech. Befestigung mounting force		F	40...80		N
Gewicht weight		G	36		g
Kontakt - Kühlkörper terminal to heatsink	Kriechstrecke creeping distance		13,5		mm
	Luftstrecke clearance		12		mm
Terminal - Terminal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

Vorläufig
Preliminary

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

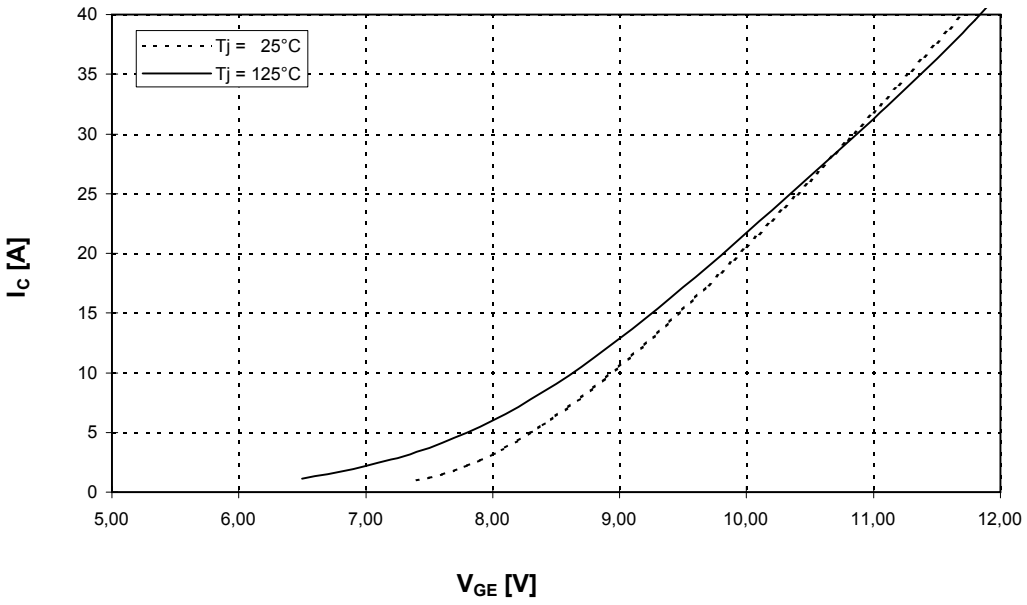


Ausgangskennlinienfeld Wechselr. (typisch) $I_C = f(V_{CE})$
Output characteristic Inverter (typical) $T_{vj} = 125°C$

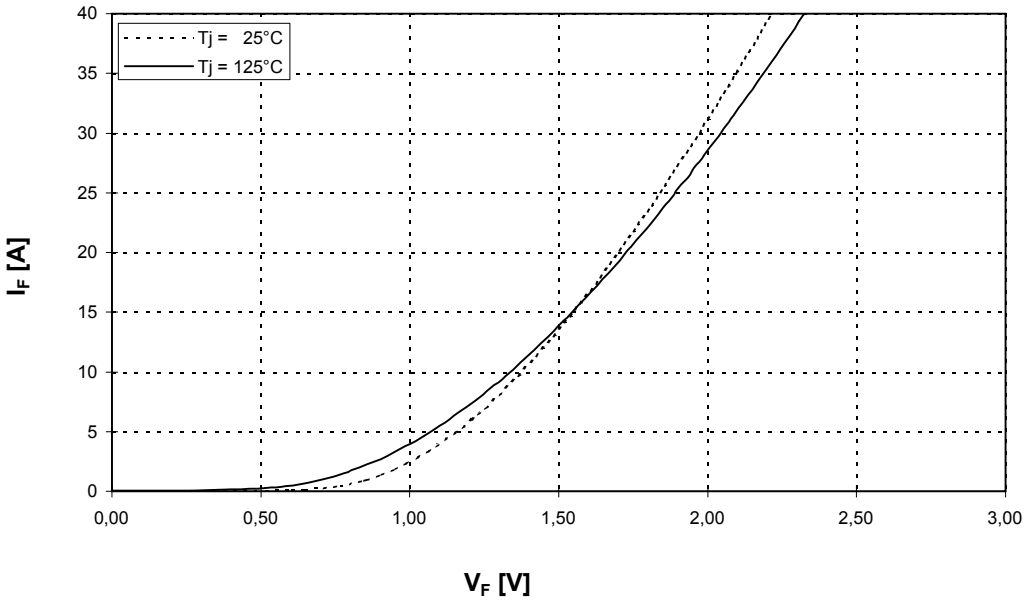


Vorläufig
Preliminary

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

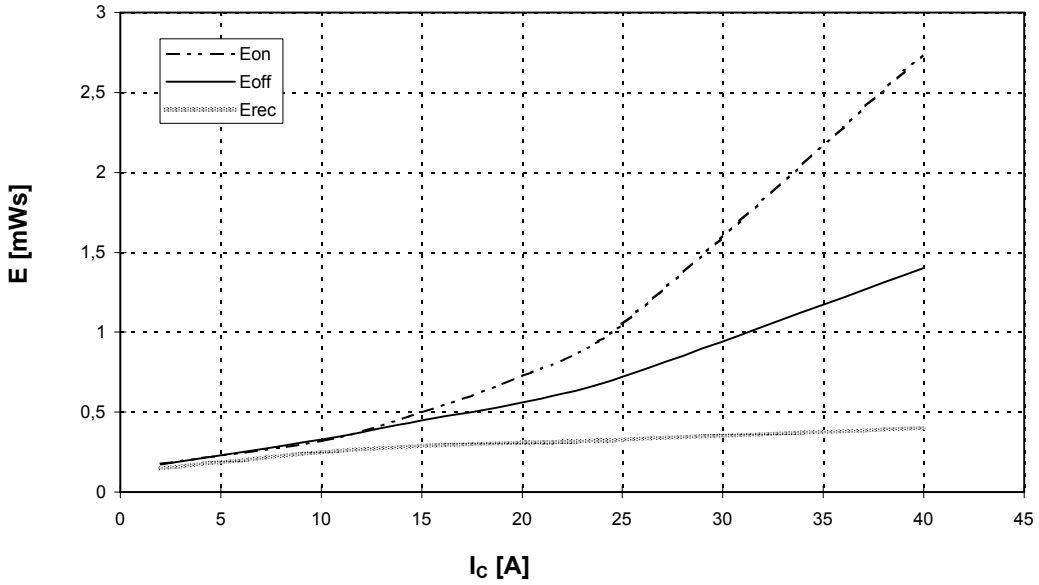


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch) $I_F = f(V_F)$
Forward characteristic of FWD Inverter (typical)

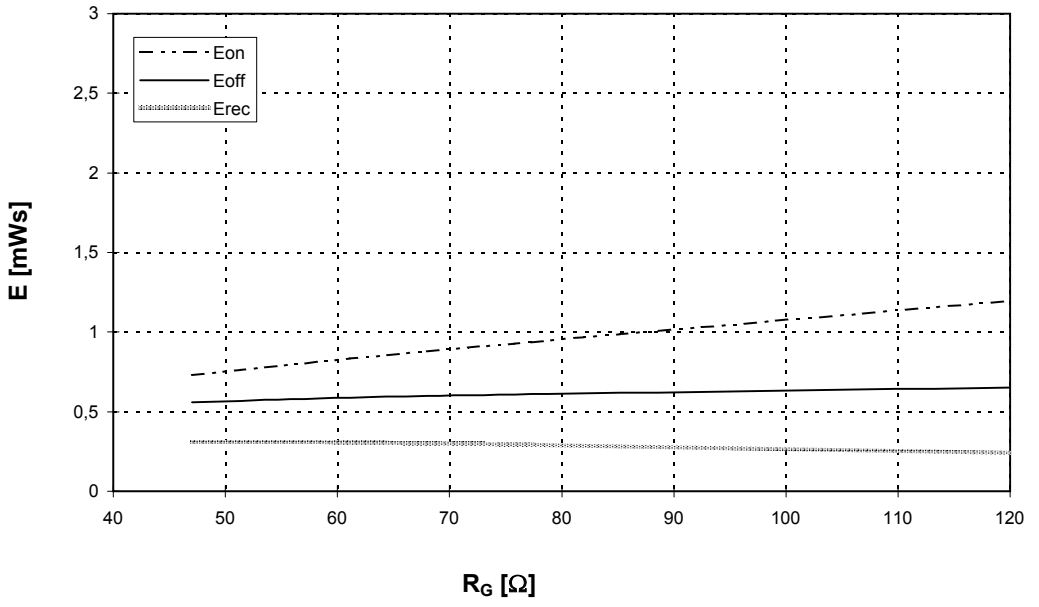


Vorläufig
Preliminary

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, $R_{Gon} = R_{Goff}$ = **47 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
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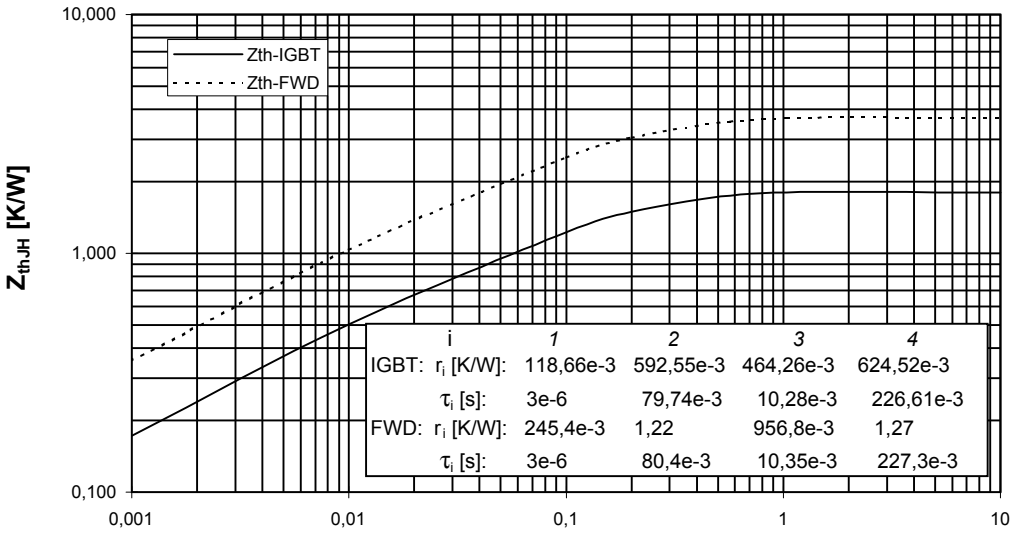
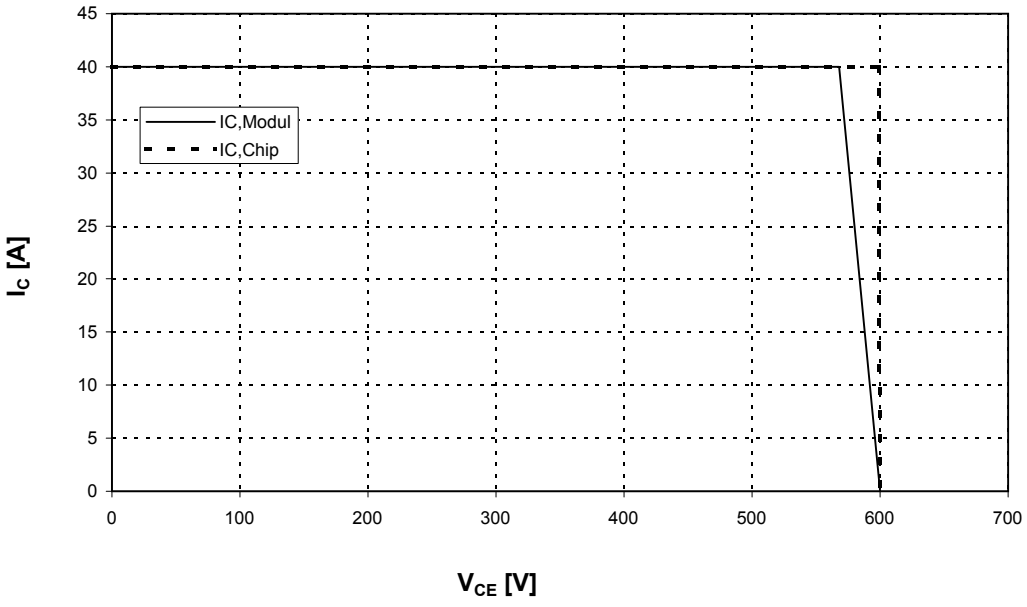
Transienter Wärmewiderstand Wechselr. $Z_{thJH} = f(t)$
Transient thermal impedance Inverter



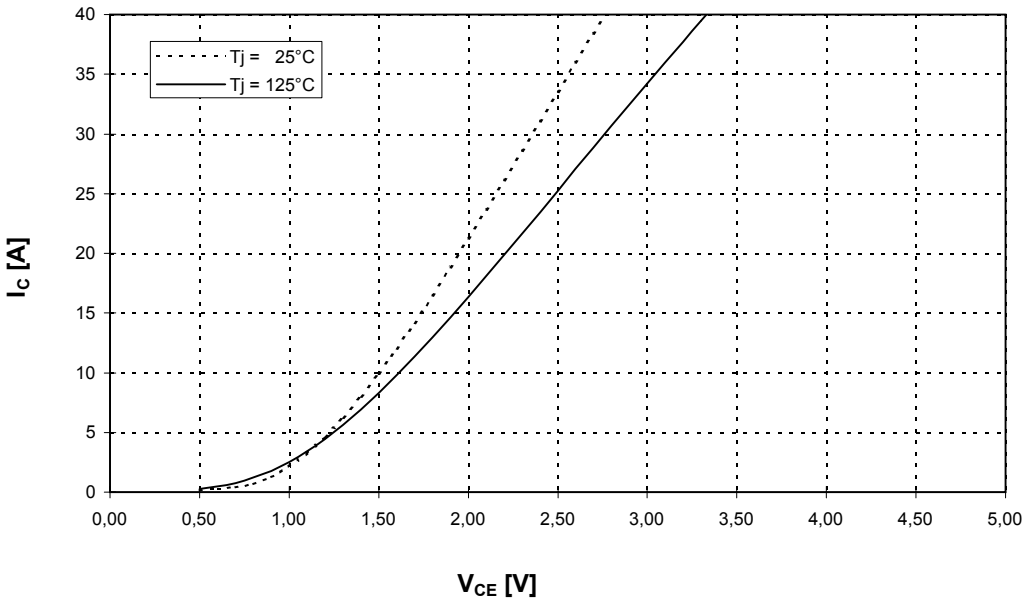
i		1	2	3	4
IGBT:	r_i [K/W]:	118,66e-3	592,55e-3	464,26e-3	624,52e-3
	τ_i [s]:	3e-6	79,74e-3	10,28e-3	226,61e-3
FWD:	r_i [K/W]:	245,4e-3	1,22	956,8e-3	1,27
	τ_i [s]:	3e-6	80,4e-3	10,35e-3	227,3e-3

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 = 47 Ohm

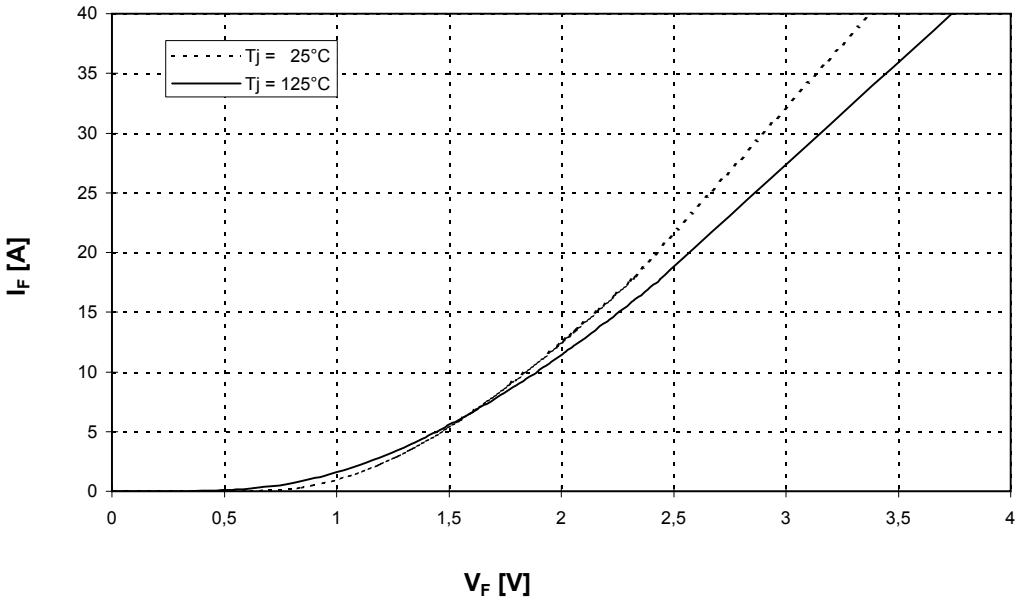


Vorläufig
Preliminary

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

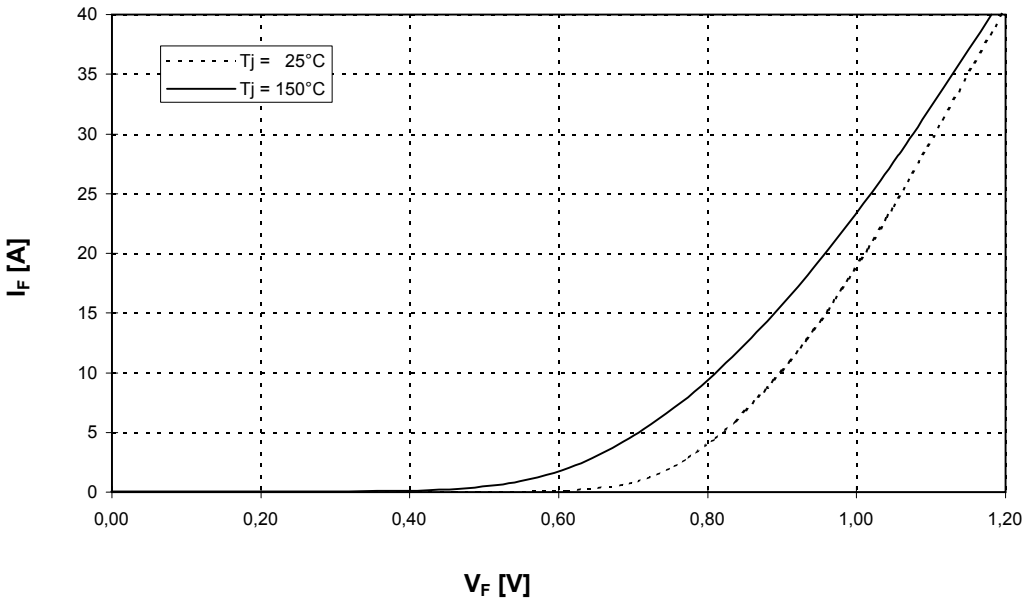


Durchlaßkennlinie der Brems-Chopper-Diode (typisch) $I_F = f(V_F)$
Forward characteristic of brake-chopper-FWD (typical)

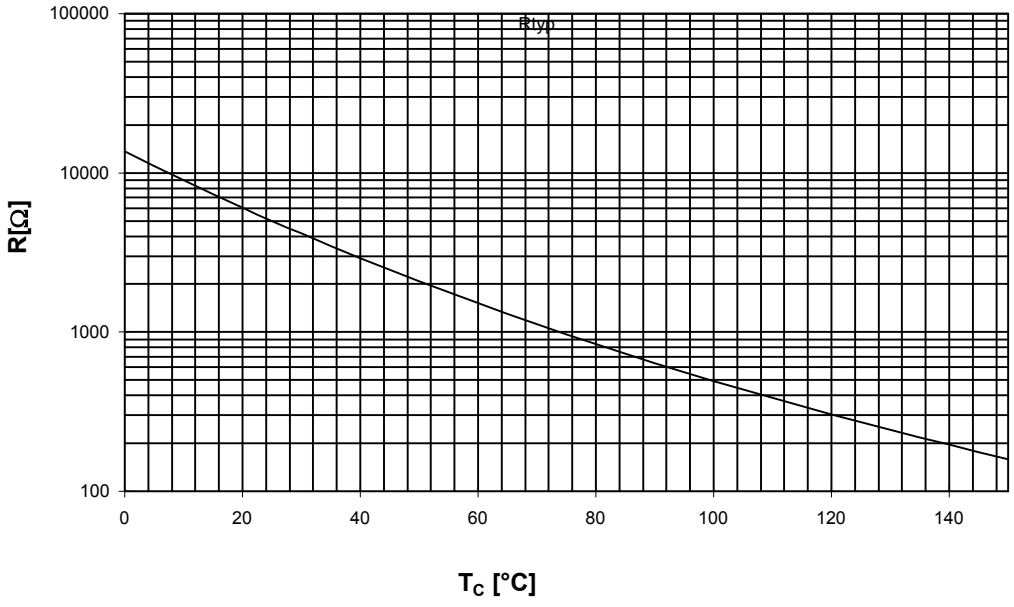


Vorläufig
Preliminary

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
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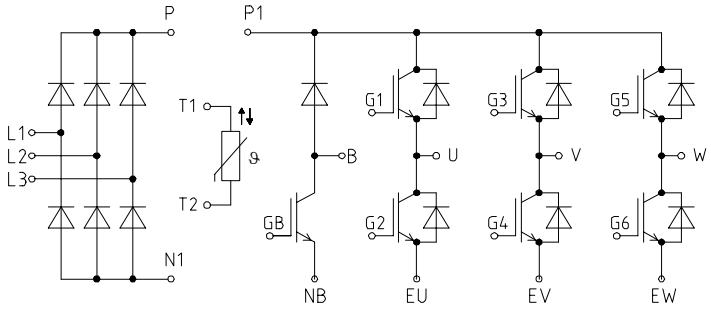
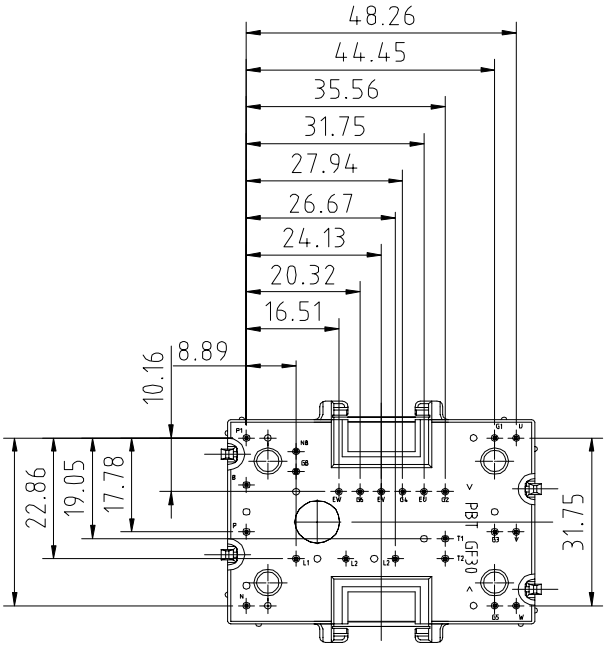
Schaltplan/ Circuit diagram



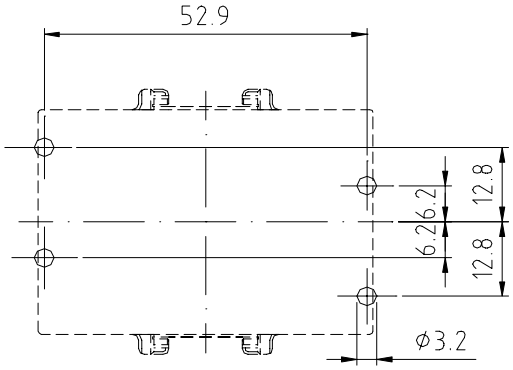
Gehäuseabmessungen/ Package outlines

Modul only designed for mounting on PCB's with 1.6 ±0.2 mm thickness

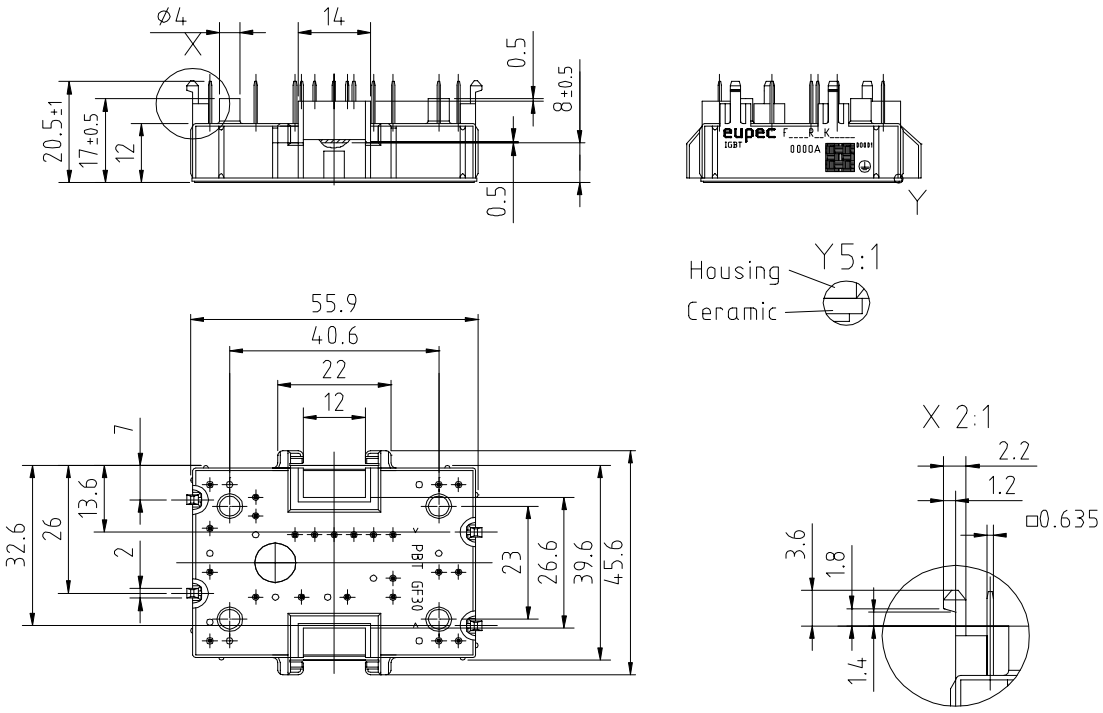
Pinpositions with tolerance ⌖ ø0.4



Bohrplan /
drilling layout



Gehäuseabmessungen Forts. / Package outlines contd.



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