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}	1600	V
Durchlaßstrom Grenzeffektivwert pro Chip RMS forward current per chip	T_C =80°C	I_{FRMSM}	25	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}	196 158	A A
Grenzlastintegral I^2t - value	t_P = 10 ms, T_{vj} = 25°C t_P = 10 ms, T_{vj} = 150°C	I^2t	192 125	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	T_C = 80°C T_C = 25 °C	$I_{C,nom.}$ I_C	15 27	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C =80°C	I_{CRM}	30	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	89	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Wechselrichter/ Diode Inverter

Dauergleichstrom DC forward current		I_F	15	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	30	A
Grenzlastintegral I^2t - value	V_R = 0V, t_p = 10ms, T_{vj} = 125°C	I^2t	44	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	15 27	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C = 80°C	I_{CRM}	30	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	89	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V

Diode Brems-Chopper/ Diode Brake-Chopper

Dauergleichstrom DC forward current		I_F	15	A
Periodischer Spitzenstrom repetitive peak forw. current	t_P = 1 ms	I_{FRM}	30	A

prepared by: Thomas Passe	date of publication: 2002-02-13
approved by: Ingo Graf	revision: 6

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 = 15 A	V_F	-	1,05	-	V
Schleusenspannung threshold voltage	T_{vj} = 150°C	$V_{(TO)}$	-	0,80	-	V
Ersatzwiderstand slope resistance	T_{vj} = 150°C	r_T	-	15	-	mΩ
Sperrstrom reverse current	T_{vj} = 150°C, V_R = 1600 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 = 15 A V_{GE} = 15V, T_{vj} = 125°C, I_C = 15 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 = 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}	-	1,0	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{GE} = 0V, T_{vj} =125°C, V_{CE} = 1200V	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} = 600 V V_{GE} = ±15V, T_{vj} = 25°C, R_G = 68 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 68 Ohm	$t_{d,on}$	- -	56 57	- -	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 = 68 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 68 Ohm	t_r	- -	30 40	- -	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 = 68 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 68 Ohm	$t_{d,off}$	- -	337 421	- -	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 = 68 Ohm V_{GE} = ±15V, T_{vj} = 125°C, R_G = 68 Ohm	t_f	- -	66 87	- -	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 = 68 Ohm L_S = 80 nH	E_{on}	-	2,2	-	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 = 68 Ohm L_S = 80 nH	E_{off}	-	1,6	-	mWs
Kurzschlußverhalten SC Data	$t_P \leq$ 10µs, $V_{GE} \leq$ 15V, R_G = 68 Ohm $T_{vj} \leq$125°C, V_{CC} = 720 V	I_{SC}	-	68	-	A

Vorläufig
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Elektrische Eigenschaften / Electrical properties

Charakteristische Werte / Characteristic values

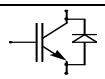
			min.	typ.	max.	
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	-	40	nH
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	T_C = 25°C	$R_{CC'+EE'}$	-	14	-	mΩ

Diode Wechselrichter/ Diode Inverter			min.	typ.	max.	
Durchlaßspannung forward voltage	V_{GE} = 0V, T_{vj} = 25°C, I_F = 15 A V_{GE} = 0V, T_{vj} = 125°C, I_F = 15 A	V_F	- -	1,7 1,7	2,1 -	V V
Rückstromspitze peak reverse recovery current	I_F=I_{Nenn}, - di_F/dt = 500 A/us V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V	I_{RM}	 - -	 18 16	 - -	 A A
Sperrverzögerungsladung recovered charge	I_F=I_{Nenn}, - di_F/dt = 500 A/us V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V	Q_r	 - -	 1,6 2,8	 - -	 µAs µAs
Abschaltenergie pro Puls reverse recovery energy	I_F=I_{Nenn}, - di_F/dt = 500 A/us V_{GE} = -10V, T_{vj} = 25°C, V_R = 600 V V_{GE} = -10V, T_{vj} = 125°C, V_R = 600 V	E_{rec}	 - -	 0,5 1	 - -	 mWs 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 = 15,0 A V_{GE} = 15V, T_{vj} = 125°C, I_C = 15,0 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 = 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} = 1200V		-	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 = 15A T_{vj} = 125°C, I_F = 15A	V_F	- -	2,05 2,15	2,65 -	V 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

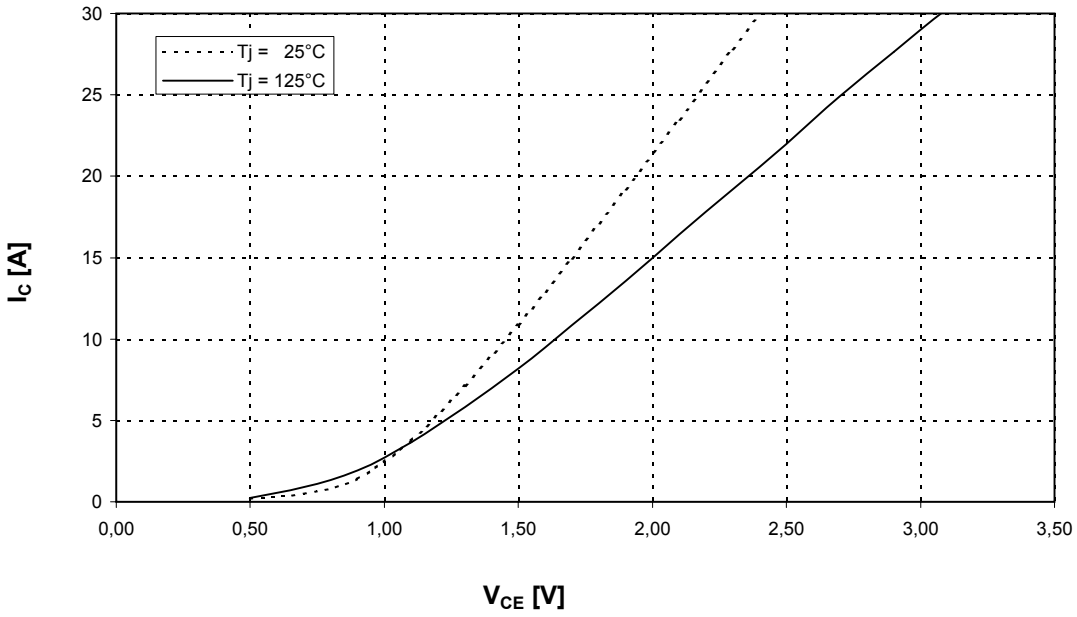
				min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to heatsink	Gleichr. Diode/ Rectif. Diode	λ_{Paste}=1W/m*K	R_{thJH}	-	1,9	-	K/W
	Trans. Wechsr./ Trans. Inverter	λ_{grease}=1W/m*K		-	1,6	-	K/W
	Diode Wechsr./ Diode Inverter			-	3,2	-	K/W
	Trans. Bremse/ Trans. Brake			-	1,6	-	K/W
	Diode Bremse/ Diode Brake			-	4,0	-	K/W
Innerer Wärmewiderstand thermal resistance, junction to case	Gleichr. Diode/ Rectif. Diode		R_{thJC}	-	-	1,9	K/W
	Trans. Wechsr./ Trans. Inverter			-	-	1,4	K/W
	Diode Wechsr./ Diode Inverter			-	-	2,4	K/W
	Trans. Bremse/ Trans. Brake			-	-	1,4	K/W
	Diode Bremse/ Diode Brake			-	-	2,9	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	Gleichr. Diode/ Rectif. Diode	λ_{Paste}=1W/m*K	R_{thCH}	-	0,2	-	K/W
	Trans. Wechsr./ Trans. Inverter	λ_{grease}=1W/m*K		-	0,3	-	K/W
	Diode Wechsr./ Diode Inverter			-	1	-	K/W
	Trans. Bremse/ Trans. Brake			-	0,3	-	K/W
	Diode Bremse/ Diode Brake			-	1,4	-	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

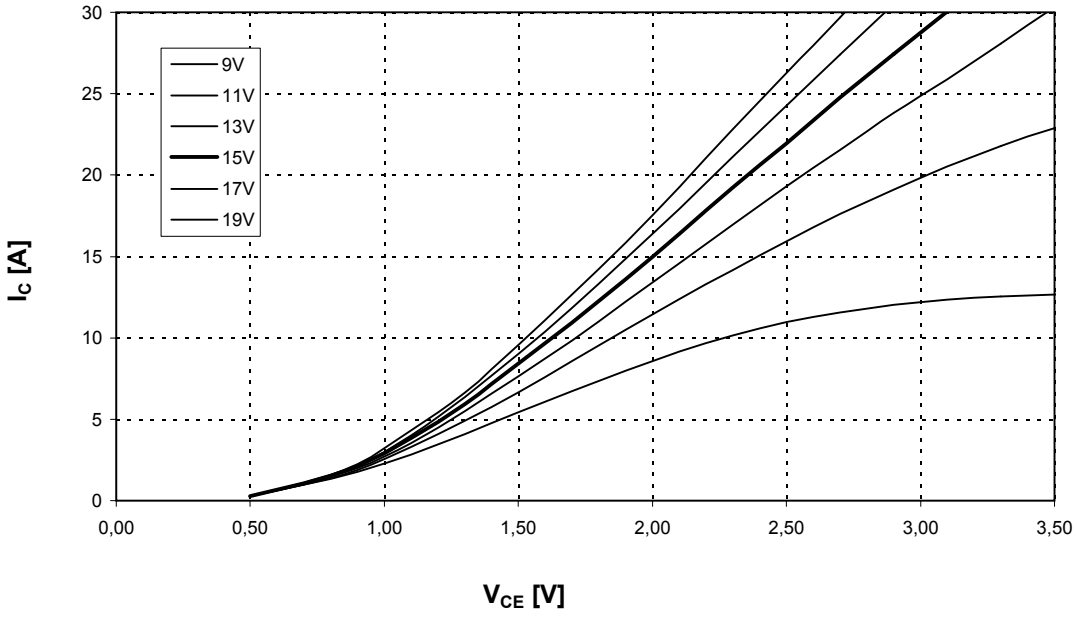
Innere Isolation internal insulation			Al_2O_3		
CTI comperative tracking index			225		
Anpreßkraft f. mech. Befestigung mounting force		F	40...80		N
Gewicht weight		G	36		g
Kontakt - Kühlkörper terminal to heatsink	Kriechstrecke creeping distance		13,5		mm
	Luftstrecke clearance		12		mm
Terminal - Terminal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

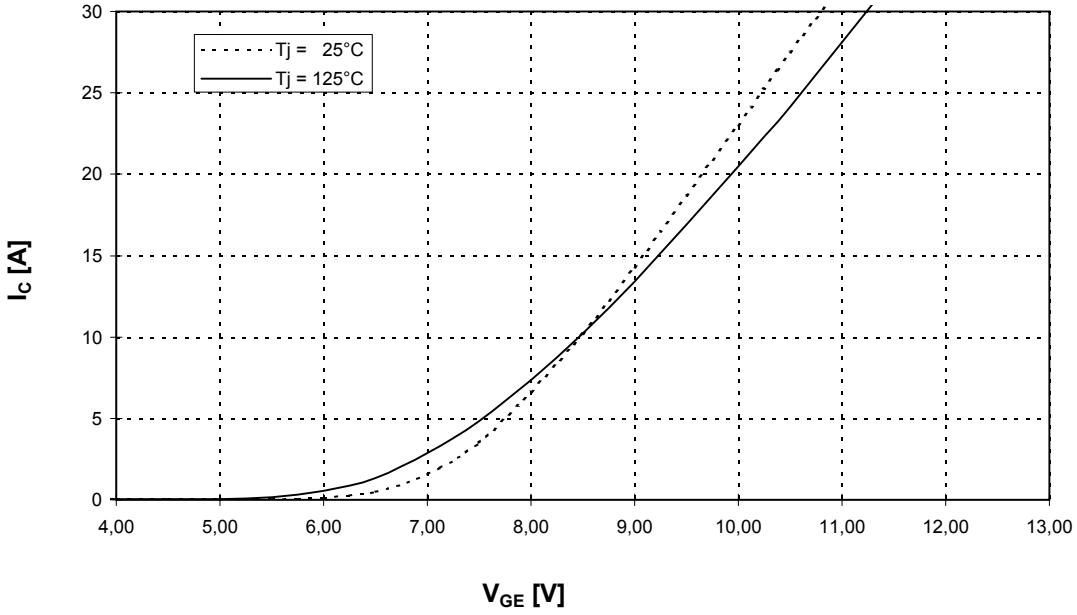


Ausgangskennlinienfeld Wechselr. (typisch) $I_C = f(V_{CE})$
Output characteristic Inverter (typical) $T_{vj} = 125°C$

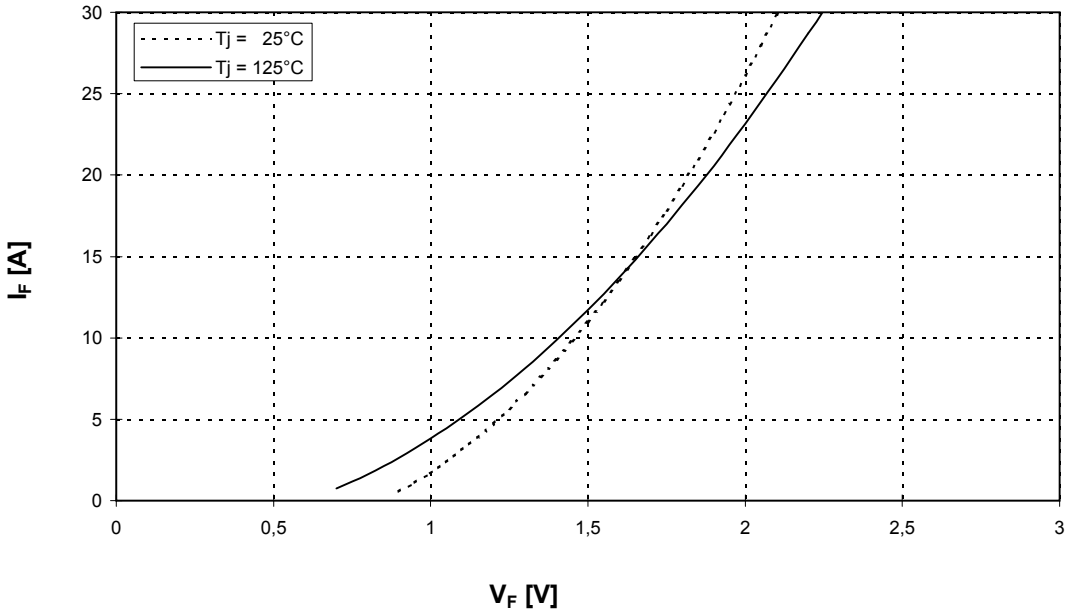


Vorläufig
Preliminary

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

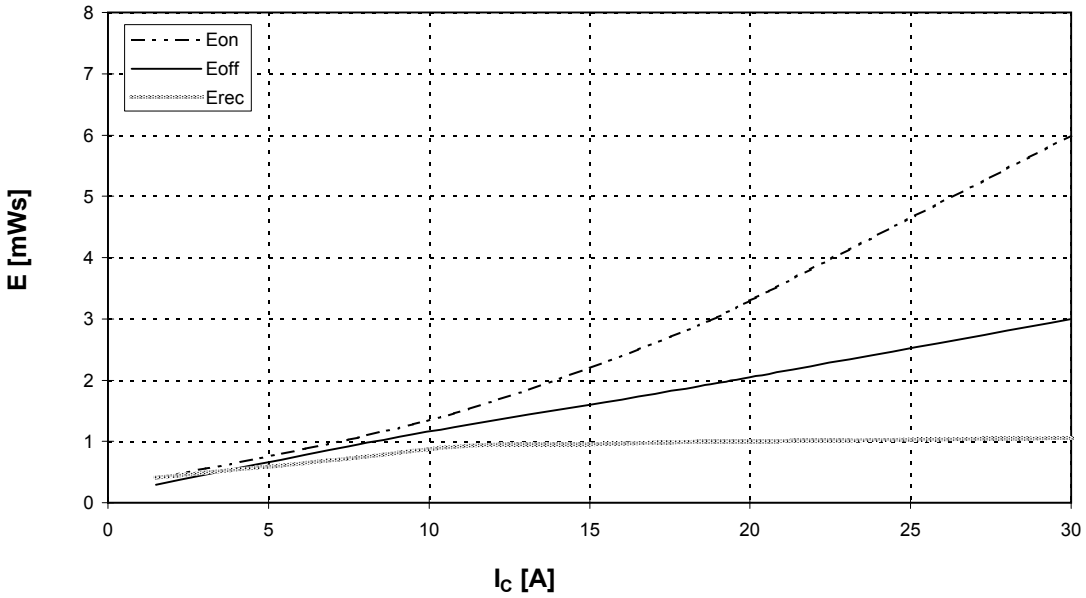


Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch) $I_F = f(V_F)$
Forward characteristic of FWD Inverter (typical)

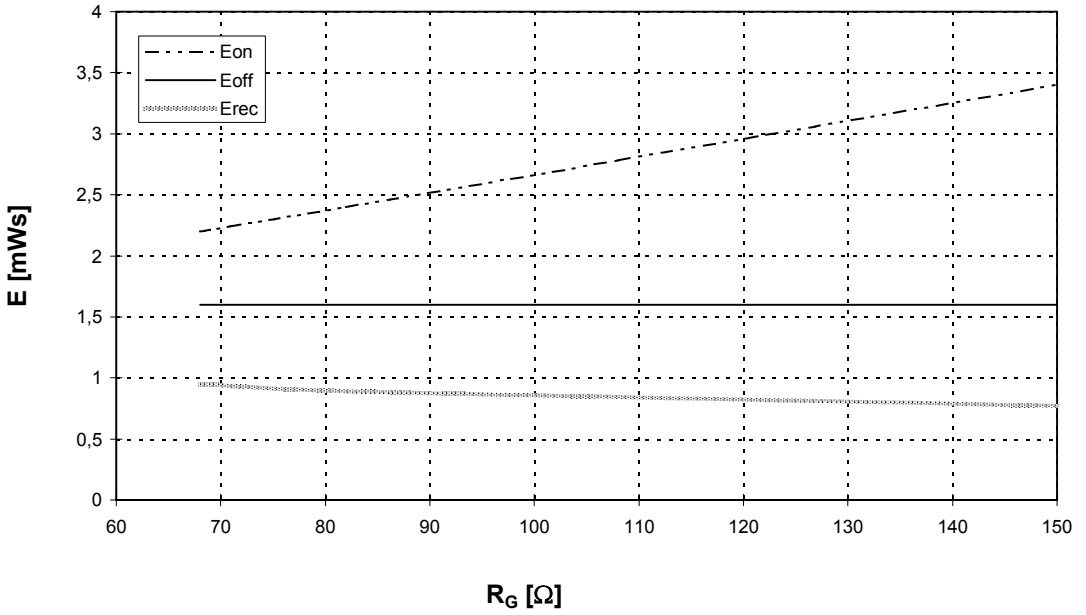


Vorläufig
Preliminary

Schaltverluste Wechselr. (typisch) $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$ V_{CC} = **600 V**
Switching losses Inverter (typical) T_j = 125°C, V_{GE} = ±15 V, $R_{Gon} = R_{Goff}$ = **68 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**



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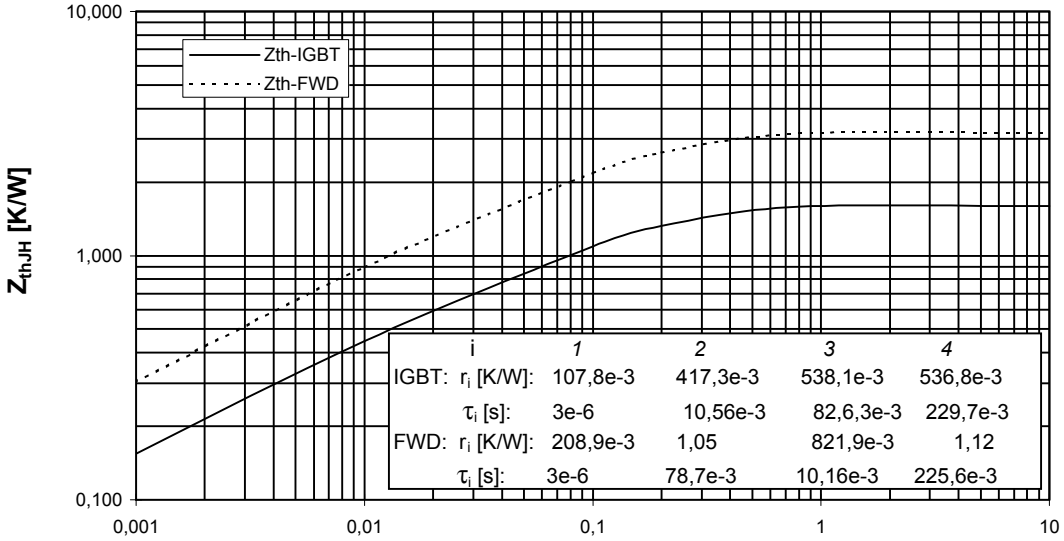
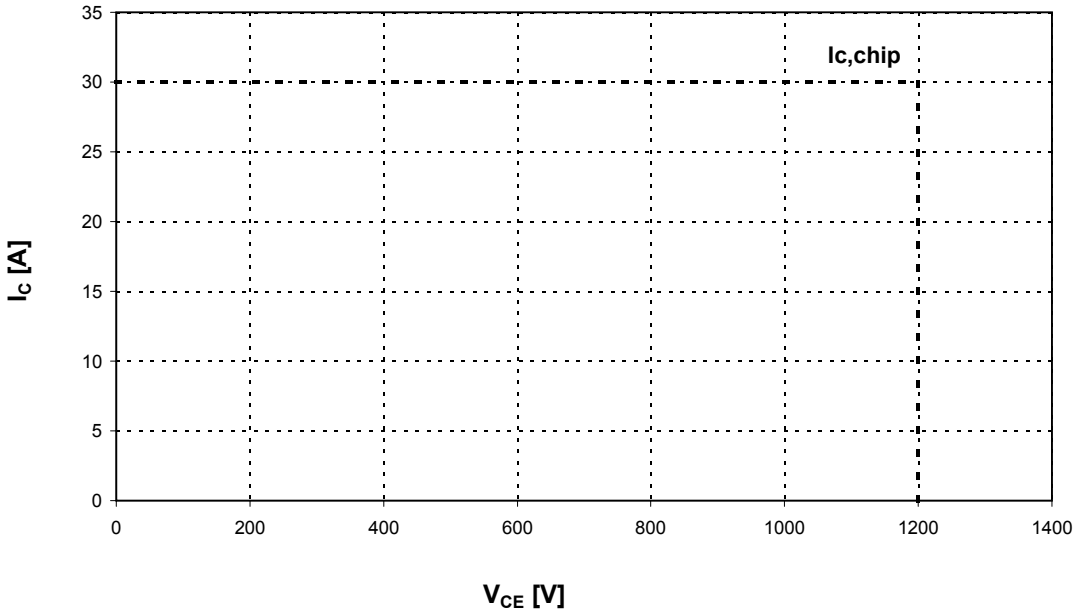
Transienter Wärmewiderstand Wechselr. $Z_{thJH} = f(t)$
Transient thermal impedance Inverter



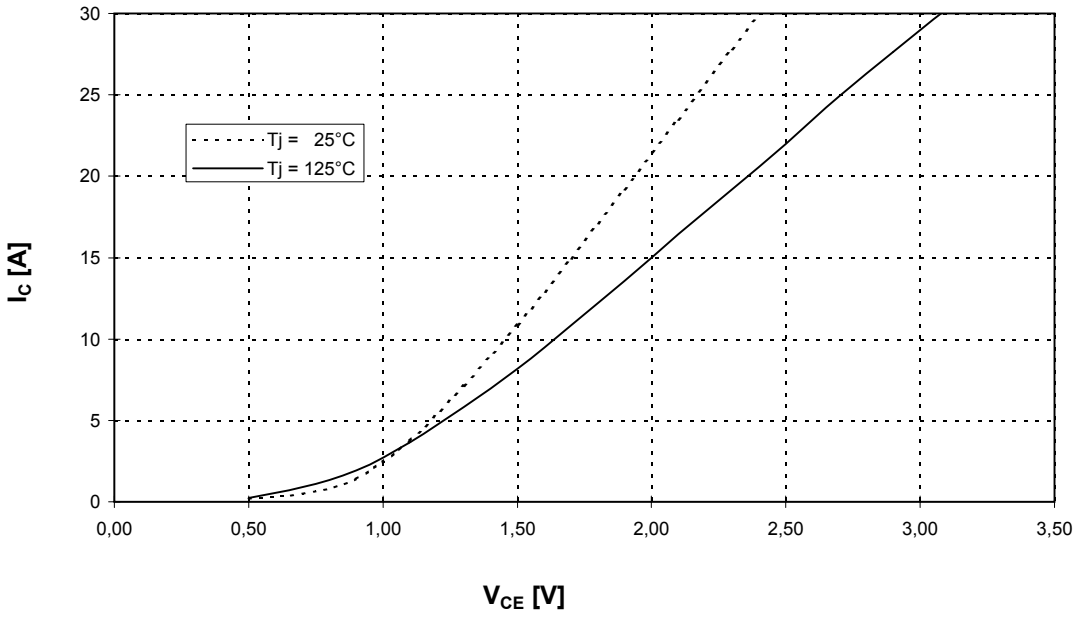
i	1	2	3	4
IGBT: r_i [K/W]:	107,8e-3	417,3e-3	538,1e-3	536,8e-3
τ_i [s]:	3e-6	10,56e-3	82,6,3e-3	229,7e-3
FWD: r_i [K/W]:	208,9e-3	1,05	821,9e-3	1,12
τ_i [s]:	3e-6	78,7e-3	10,16e-3	225,6e-3

Sicherer Arbeitsbereich Wechselr. (RBSOA) $I_C = f(V_{CE})$
Reverse bias save operating area Inverter (RBSOA) $T_{vj} = 125°C$, $V_{GE} = \pm 15V$, $R_G =$ **68 Ohm**

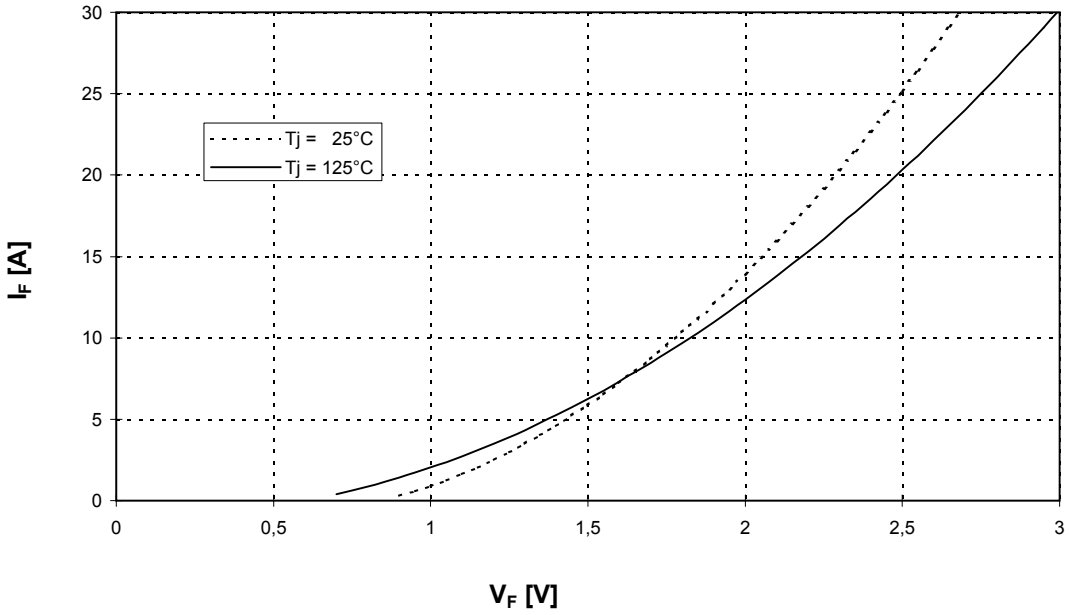


Vorläufig
Preliminary

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

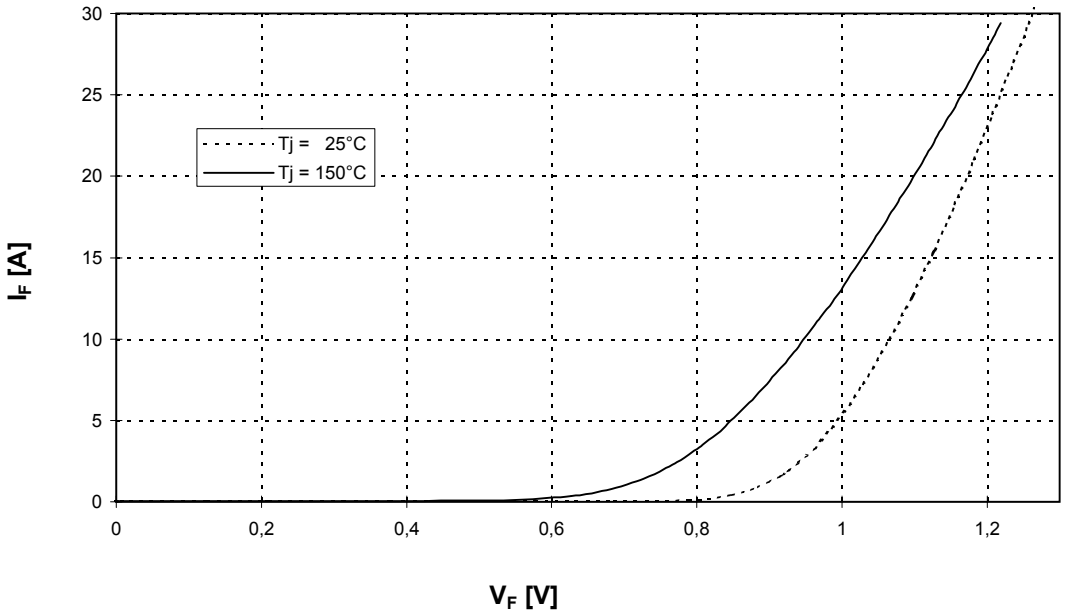


Durchlaßkennlinie der Brems-Chopper-Diode (typisch) $I_F = f(V_F)$
Forward characteristic of brake-chopper-FWD (typical)

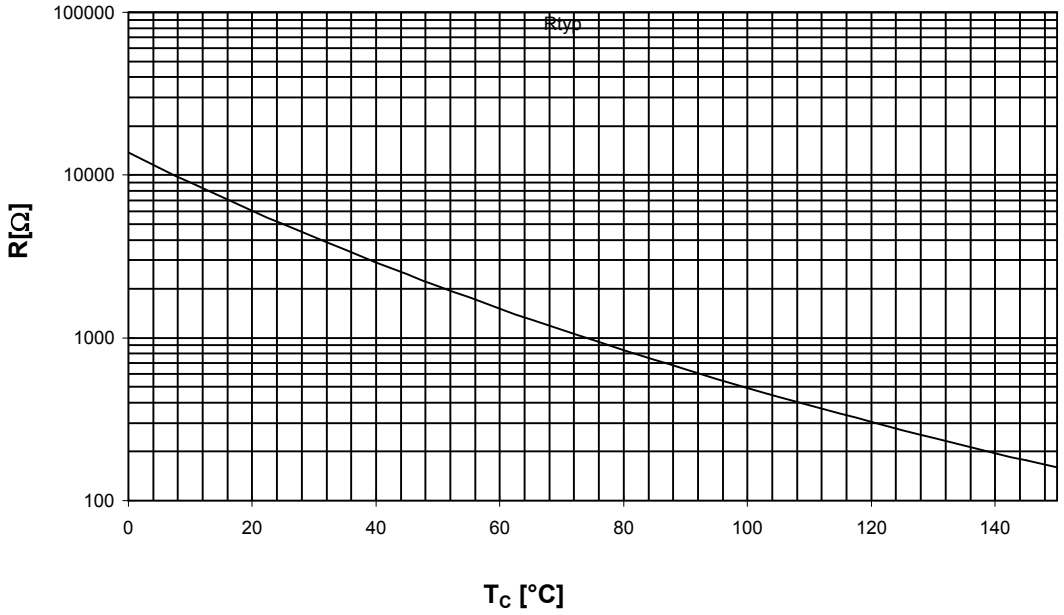


Vorläufig
Preliminary

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

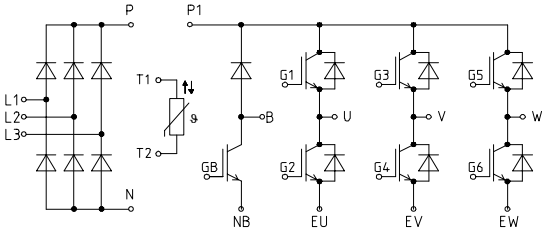


NTC- Temperaturkennlinie (typisch) $R = f(T)$
NTC- temperature characteristic (typical)



Vorläufig
Preliminary

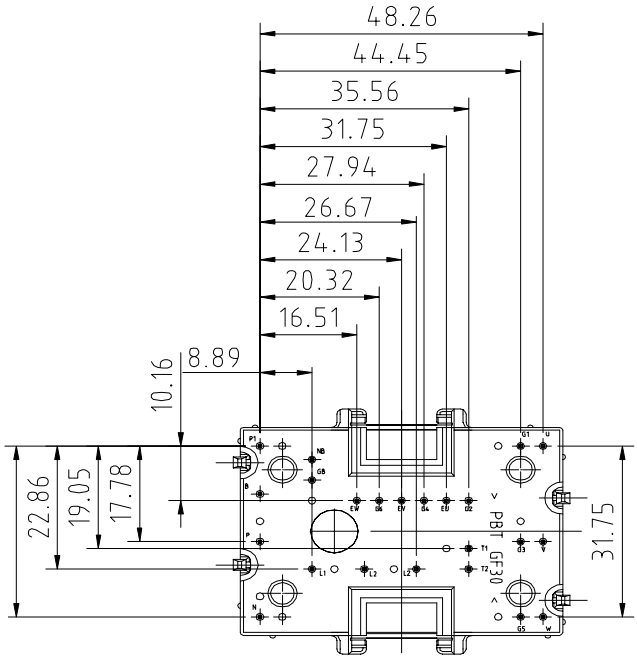
Schaltplan/ Circuit diagram



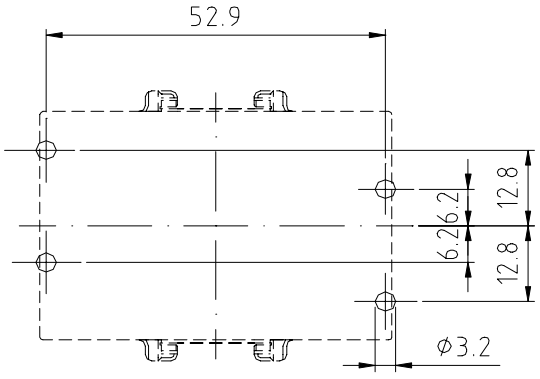
Gehäuseabmessungen/ Package outlines

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

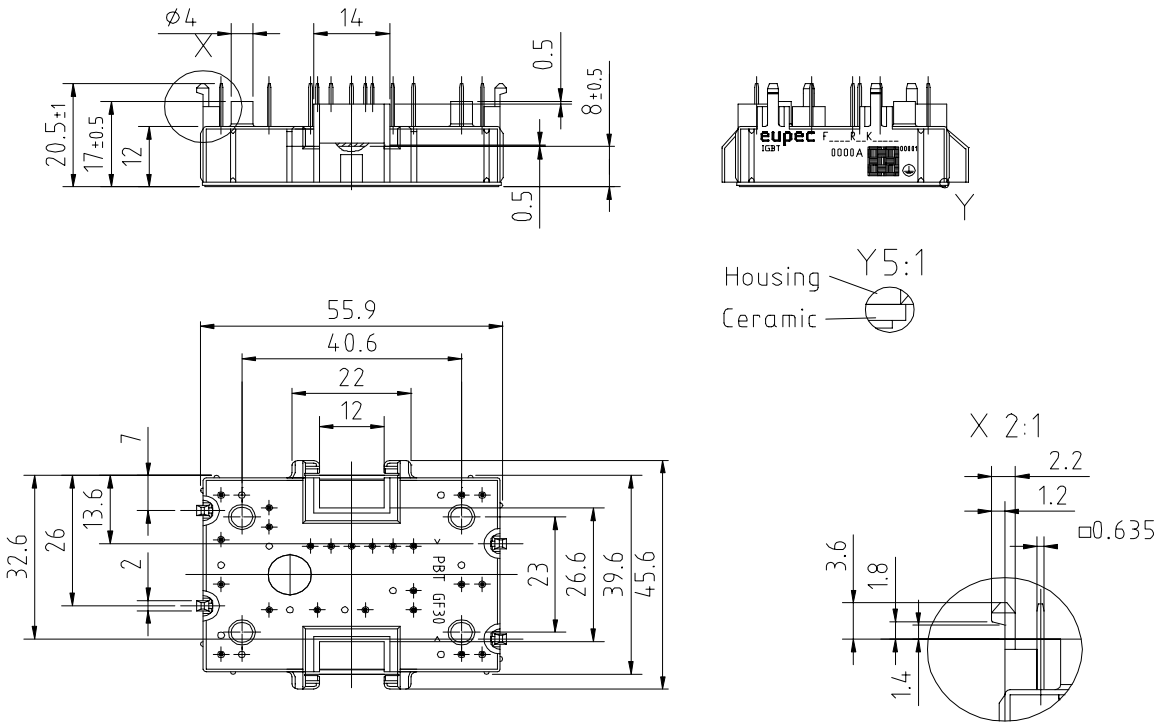
Pinpositions with tolerance ⌖ ø0.4



Bohrplan /
drilling layout



Gehäuseabmessungen Forts. / Package outlines contd.



Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Diese 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.