

# Technische Information / Technical Information

IGBT-Module  
IGBT-Modules

## FP20R06KL4

eupec



Vorläufig  
Preliminary

### Elektrische Eigenschaften / Electrical properties

#### Höchstzulässige Werte / Maximum rated values

##### Diode Gleichrichter/ Diode Rectifier

Periodische Rückw. Spitzensperrspannung repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	800	V
Durchlaßstrom Grenzeffektivwert pro Chip RMS forward current per chip	$T_C = 80^{\circ}\text{C}$	$I_{FRMSM}$	29	A
Gleichrichter Ausgang Grenzeffektivstrom maximum RMS current at Rectifier output	$T_C = 80^{\circ}\text{C}$	$I_{RMSmax}$	36	A
Stoßstrom Grenzwert surge forward current	$t_p = 10 \text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I_{FSM}$	262 215	A A
Grenzlastintegral $I^2t$ - value	$t_p = 10 \text{ ms}, T_{vj} = 25^{\circ}\text{C}$ $t_p = 10 \text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	344 231	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

##### Transistor Wechselrichter/ Transistor Inverter

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 65^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C,nom.}$ $I_C$	20 25	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1 \text{ ms}, T_c = 65^{\circ}\text{C}$	$I_{CRM}$	40	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	$P_{tot}$	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	$t_p = 1 \text{ ms}$	$I_{FRM}$	40	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^{\circ}\text{C}$	$I^2t$	62	$\text{A}^2\text{s}$

##### Transistor Brems-Chopper/ Transistor Brake-Chopper

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 65^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C,nom.}$ $I_C$	20 25	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1 \text{ ms}, T_c = 65^{\circ}\text{C}$	$I_{CRM}$	40	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	$P_{tot}$	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	$t_p = 1 \text{ ms}$	$I_{FRM}$	40	A

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

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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

		min.	typ.	max.			
<b>Diode Gleichrichter/ Diode Rectifier</b>							
Durchlaßspannung forward voltage	$T_{vj} = 150^{\circ}\text{C}$ , $I_F = 20\text{ A}$	$V_F$	-	0,95	-	V	
Schleusenspannung threshold voltage	$T_{vj} = 150^{\circ}\text{C}$	$V_{(TO)}$	-	0,71	-	V	
Ersatzwiderstand slope resistance	$T_{vj} = 150^{\circ}\text{C}$	$r_T$	-	12	-	m $\Omega$	
Sperrstrom reverse current	$T_{vj} = 150^{\circ}\text{C}$ , $V_R = 800\text{ V}$	$I_R$	-	5	-	mA	
Modul Leitungswiderstand, Anschlüsse-Chip lead resistance, terminals-chip	$T_C = 25^{\circ}\text{C}$	$R_{AA+CC}$	-	11	-	m $\Omega$	
<b>Transistor Wechselrichter/ Transistor Inverter</b>							
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ , $I_C = 20\text{ A}$ $V_{GE} = 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $I_C = 20\text{ A}$	$V_{CE\text{ sat}}$	-	1,95	2,55	V	
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}$ , $T_{vj} = 25^{\circ}\text{C}$ , $I_C = 0,5\text{mA}$	$V_{GE(TO)}$	4,5	5,5	6,5	V	
Eingangskapazität input capacitance	f = 1MHz, $T_{vj} = 25^{\circ}\text{C}$ $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$	$C_{ies}$	-	1,1	-	nF	
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $V_{CE} = 600\text{V}$	$I_{CES}$	-	5,0	-	mA	
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0\text{V}$ , $V_{GE} = 20\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$	$I_{GES}$	-	-	400	nA	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$	$t_{d,on}$	-	22	-	ns	
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$	$t_r$	-	23	-	ns	
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$	$t_{d,off}$	-	143	-	ns	
Fallzeit (induktive Last) fall time (inductive load)	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 25^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$	$t_f$	-	22	-	ns	
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $L_S = 80\text{ nH}$	$E_{on}$	-	0,7	-	mWs	
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = I_{Nenn}$ , $V_{CC} = 300\text{ V}$ $V_{GE} = \pm 15\text{V}$ , $T_{vj} = 125^{\circ}\text{C}$ , $R_G = 47\text{ Ohm}$ $L_S = 80\text{ nH}$	$E_{off}$	-	0,6	-	mWs	
Kurzschlußverhalten SC Data	$t_p \leq 10\mu\text{s}$ , $V_{GE} \leq 15\text{V}$ , $R_G = 47\text{ Ohm}$ $T_{vj} \leq 125^{\circ}\text{C}$ , $V_{CC} = 360\text{ V}$	$I_{SC}$	-	90	-	A	

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**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	$T_C = 25^\circ C$	$R_{CC+EE}$	-	13	-	m $\Omega$
<b>Diode Wechselrichter/ Diode Inverter</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>
Durchlaßspannung forward voltage	$V_{GE} = 0V, T_{vj} = 25^\circ C, I_F = 20 A$ $V_{GE} = 0V, T_{vj} = 125^\circ C, I_F = 20 A$	$V_F$	-	1,7	2,15	V
Rückstromspitze peak reverse recovery current	$I_F = I_{Nenn}, -di_F/dt = 1000 A/us$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	$I_{RM}$	-	20	-	A
Sperrverzögerungsladung recovered charge	$I_F = I_{Nenn}, -di_F/dt = 1000 A/us$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	$Q_r$	-	1	-	$\mu As$
Abschaltenergie pro Puls reverse recovery energy	$I_F = I_{Nenn}, -di_F/dt = 1000 A/us$ $V_{GE} = -10V, T_{vj} = 25^\circ C, V_R = 300 V$ $V_{GE} = -10V, T_{vj} = 125^\circ C, V_R = 300 V$	$E_{rec}$	-	0,2	-	mWs
<b>Transistor Brems-Chopper/ Transistor Brake-Chopper</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$V_{GE} = 15V, T_{vj} = 25^\circ C, I_C = 20,0 A$ $V_{GE} = 15V, T_{vj} = 125^\circ C, I_C = 20,0 A$	$V_{CE sat}$	-	1,95	2,55	V
Gate-Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25^\circ C, I_C = 0,5mA$	$V_{GE(TO)}$	4,5	5,5	6,5	V
Eingangskapazität input capacitance	$f = 1MHz, T_{vj} = 25^\circ C$ $V_{CE} = 25 V, V_{GE} = 0 V$	$C_{ies}$	-	1,1	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{GE} = 0V, T_{vj} = 125^\circ C, V_{CE} = 600V$		-	5,0	-	mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25^\circ C$	$I_{GES}$	-	-	400	nA
<b>Diode Brems-Chopper/ Diode Brake-Chopper</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>
Durchlaßspannung forward voltage	$T_{vj} = 25^\circ C, I_F = 20A$ $T_{vj} = 125^\circ C, I_F = 20A$	$V_F$	-	2,45	2,9	V
<b>NTC-Widerstand/ NTC-Thermistor</b>				<b>min.</b>	<b>typ.</b>	<b>max.</b>
Nennwiderstand rated resistance	$T_C = 25^\circ C$	$R_{25}$	-	5	-	k $\Omega$
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

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**Vorläufig  
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### Thermische Eigenschaften / Thermal properties

				min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to heatsink	Gleichr. Diode/ Rectif. Diode $\lambda_{\text{paste}}=1\text{W/m}^2\text{K}$	$R_{\text{thJH}}$	-	2,1	-	K/W	
	Trans. Wechs./ Trans. Inverter $\lambda_{\text{grease}}=1\text{W/m}^2\text{K}$		-	1,8	-	K/W	
	Diode Wechs./ 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	$R_{\text{thJC}}$	-	-	2	K/W	
	Trans. Wechs./ Trans. Inverter		-	-	1,6	K/W	
	Diode Wechs./ 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 $\lambda_{\text{paste}}=1\text{W/m}^2\text{K}$	$R_{\text{thCH}}$	-	0,3	-	K/W	
	Trans. Wechs./ Trans. Inverter $\lambda_{\text{grease}}=1\text{W/m}^2\text{K}$		-	0,4	-	K/W	
	Diode Wechs./ 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		$T_{\text{vj}}$	-	-	150	°C	
Betriebstemperatur operation temperature		$T_{\text{op}}$	-40	-	125	°C	
Lagertemperatur storage temperature		$T_{\text{stg}}$	-40	-	125	°C	

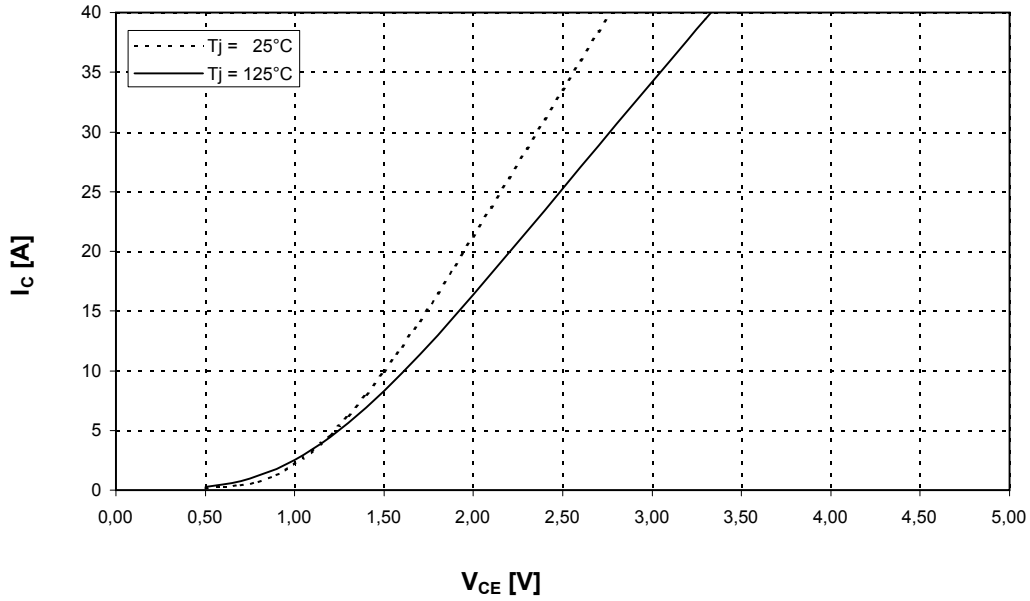
### Mechanische Eigenschaften / Mechanical properties

Innere Isolation internal insulation			$\text{Al}_2\text{O}_3$	
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

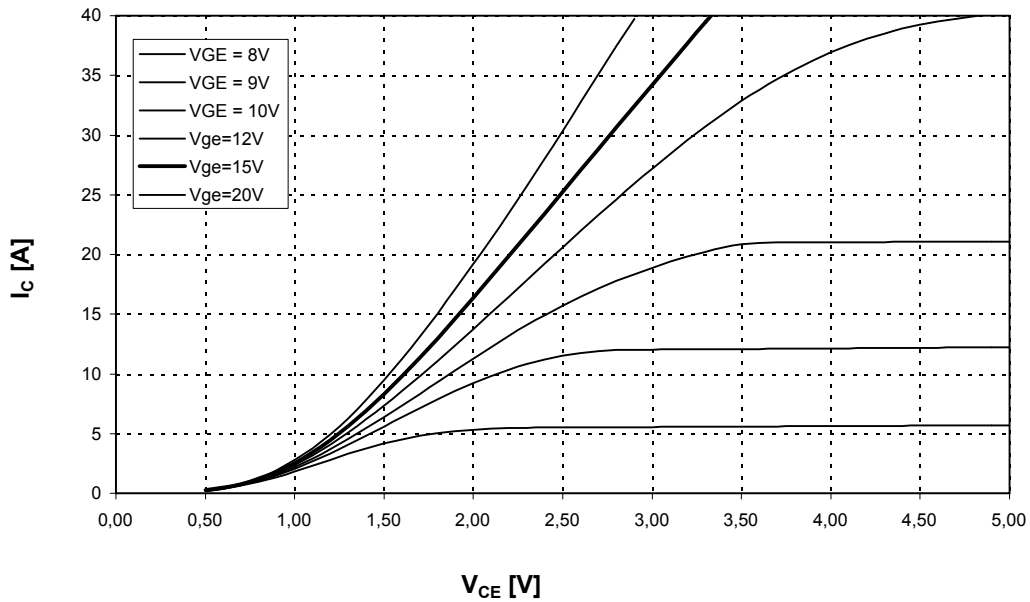


Vorläufig  
Preliminary

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



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

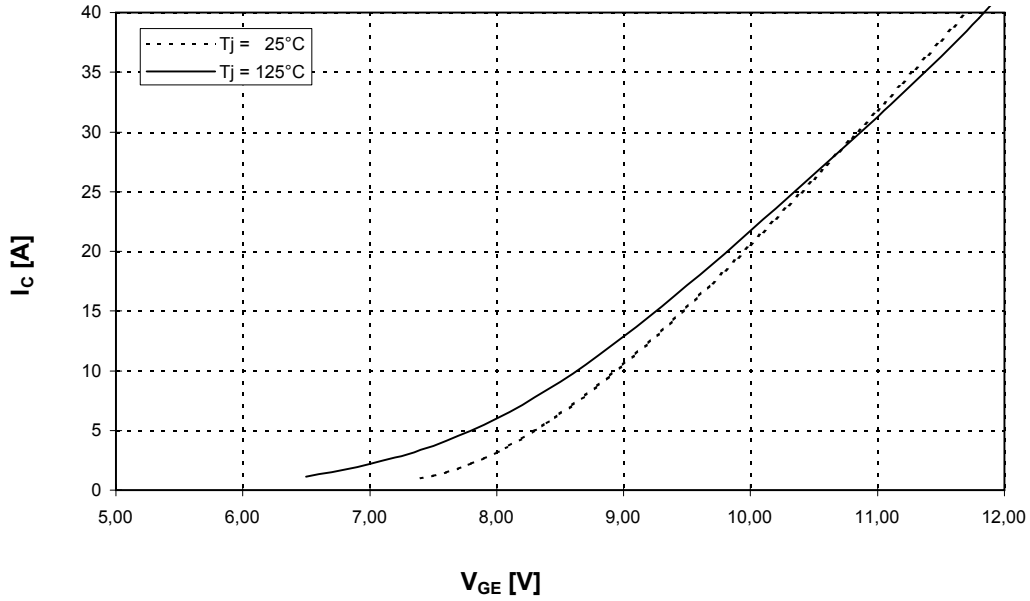




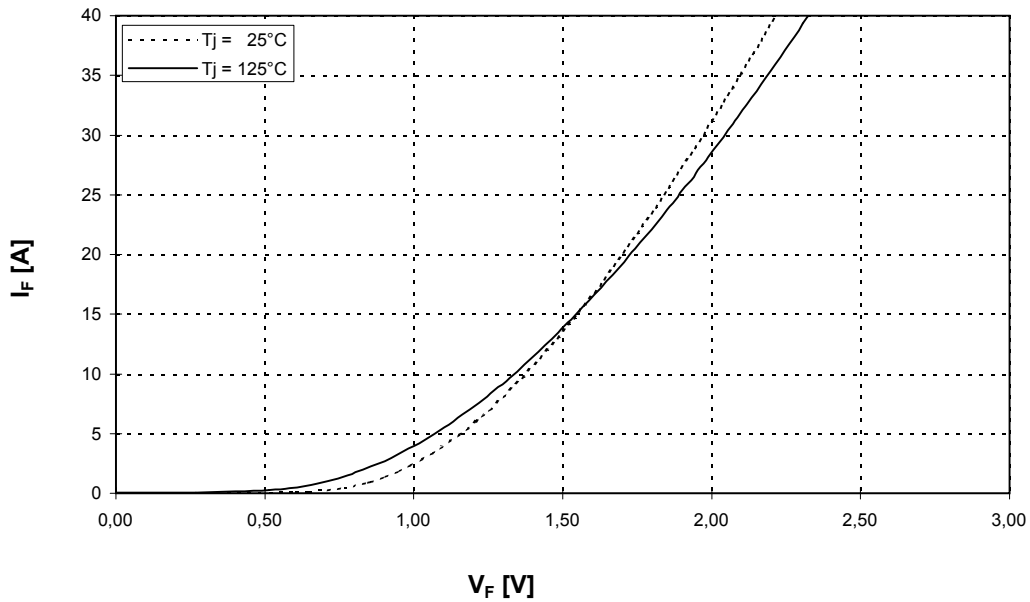
Vorläufig  
Preliminary

Übertragungscharakteristik Wechselr. (typisch)  
Transfer characteristic Inverter (typical)

$I_C = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



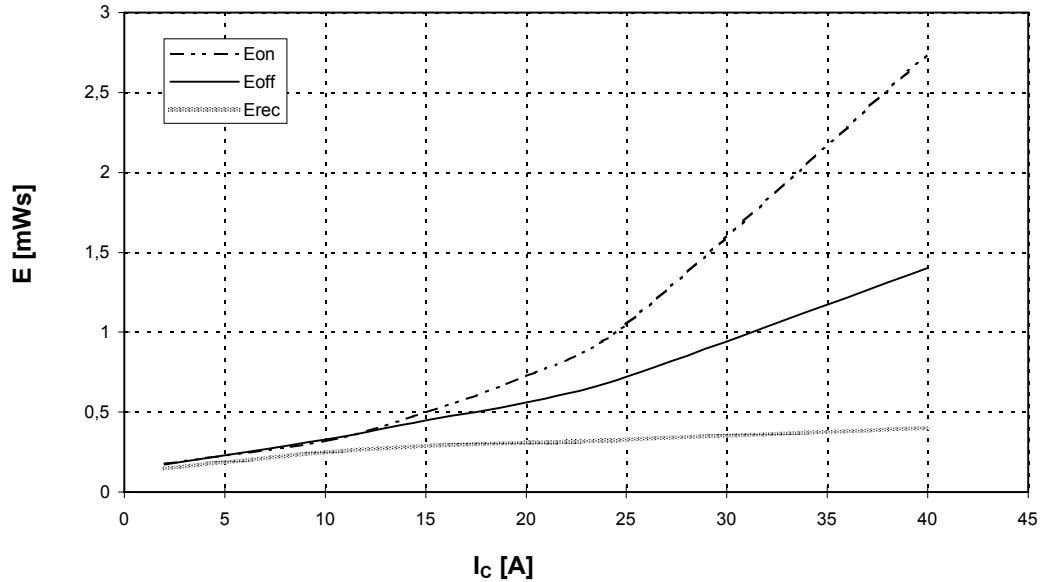
Durchlaßkennlinie der Freilaufdiode Wechselr. (typisch)  $I_F = f(V_F)$   
Forward characteristic of FWD Inverter (typical)



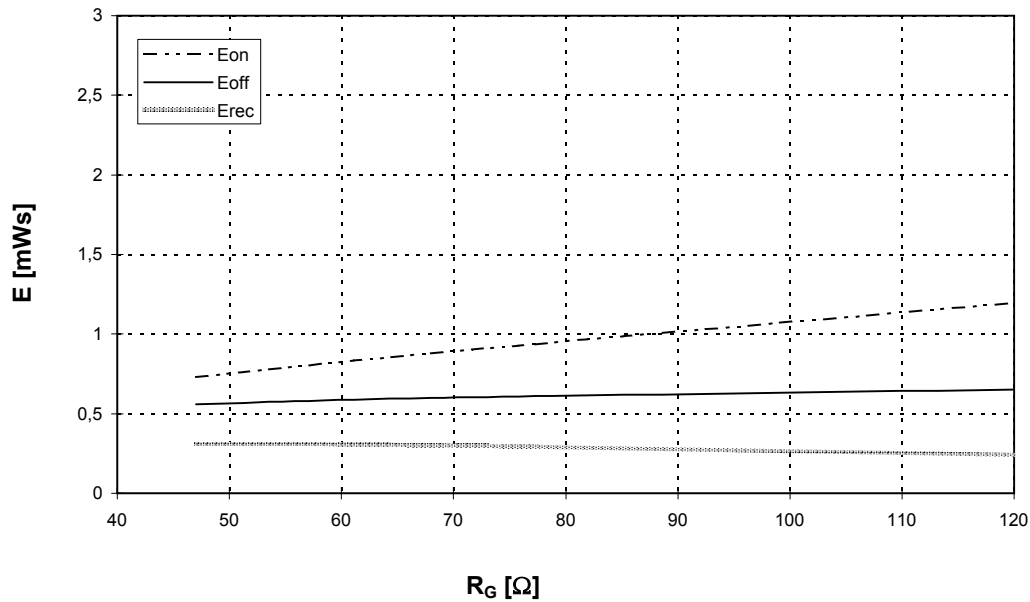


Vorläufig  
Preliminary

Schaltverluste Wechselr. (typisch)  $E_{on} = f(I_C), E_{off} = f(I_C), E_{rec} = f(I_C)$   $V_{CC} = 300\text{ V}$   
 Switching losses Inverter (typical)  $T_J = 125^\circ\text{C}, V_{GE} = \pm 15\text{ V}, R_{Gon} = R_{Goff} = 47\text{ Ohm}$



Schaltverluste Wechselr. (typisch)  $E_{on} = f(R_G), E_{off} = f(R_G), E_{rec} = f(R_G)$   
 Switching losses Inverter (typical)  $T_J = 125^\circ\text{C}, V_{GE} = \pm 15\text{ V}, I_C = I_{nenn}, V_{CC} = 300\text{ V}$

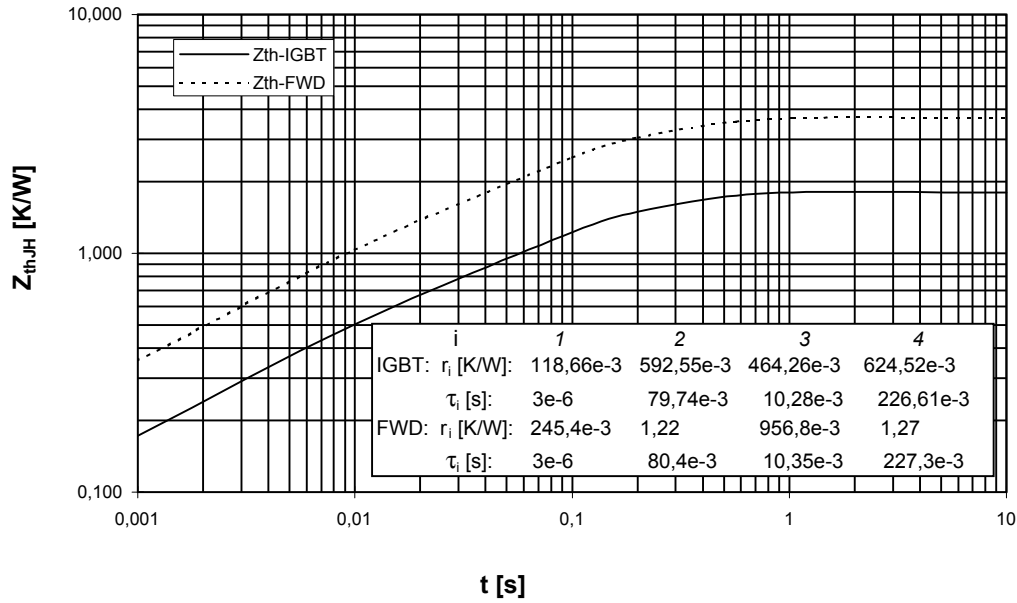




Vorläufig  
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Transienter Wärmewiderstand Wechsler.  
Transient thermal impedance Inverter

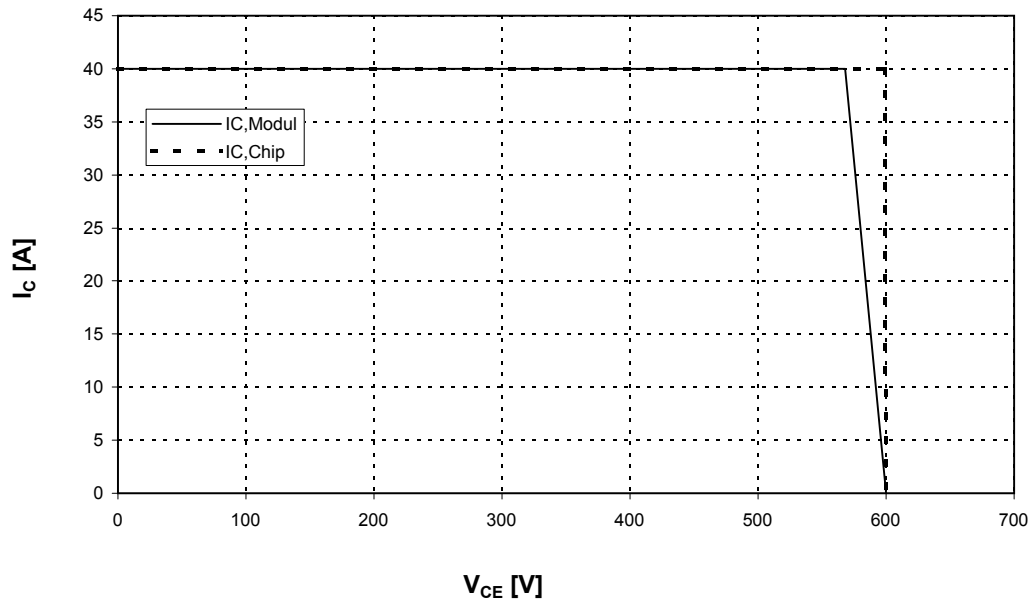
$$Z_{thJH} = f(t)$$



Sicherer Arbeitsbereich Wechsler. (RBSOA)

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

Reverse bias safe operating area Inverter (RBSOA)  $T_{vj} = 125^\circ\text{C}$ ,  $V_{GE} = \pm 15\text{V}$ ,  $R_G = 47 \text{ Ohm}$







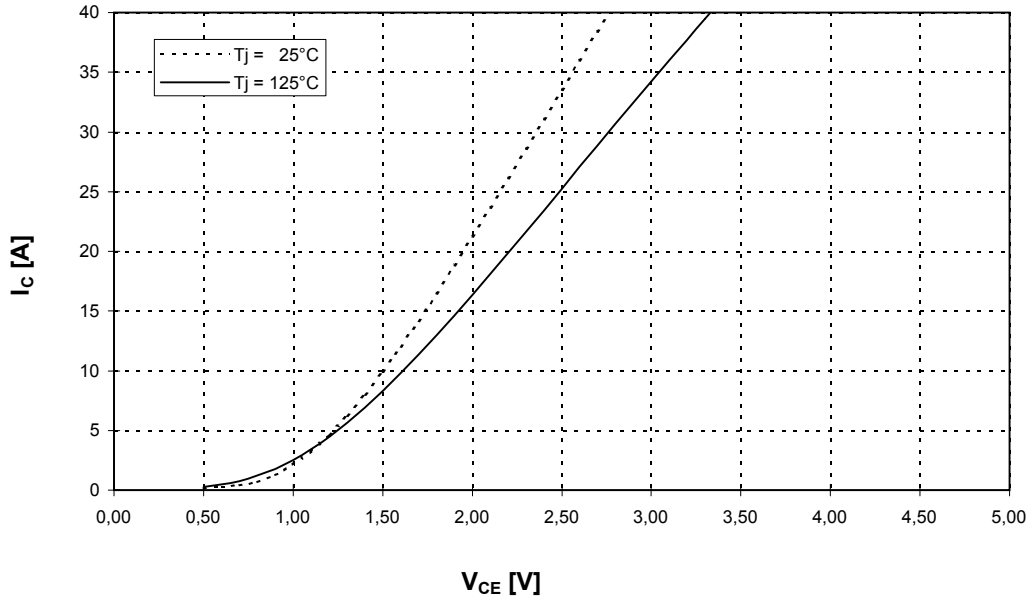
Vorläufig  
Preliminary

Ausgangskennlinienfeld Brems-Chopper-IGBT (typisch)

$I_C = f(V_{CE})$

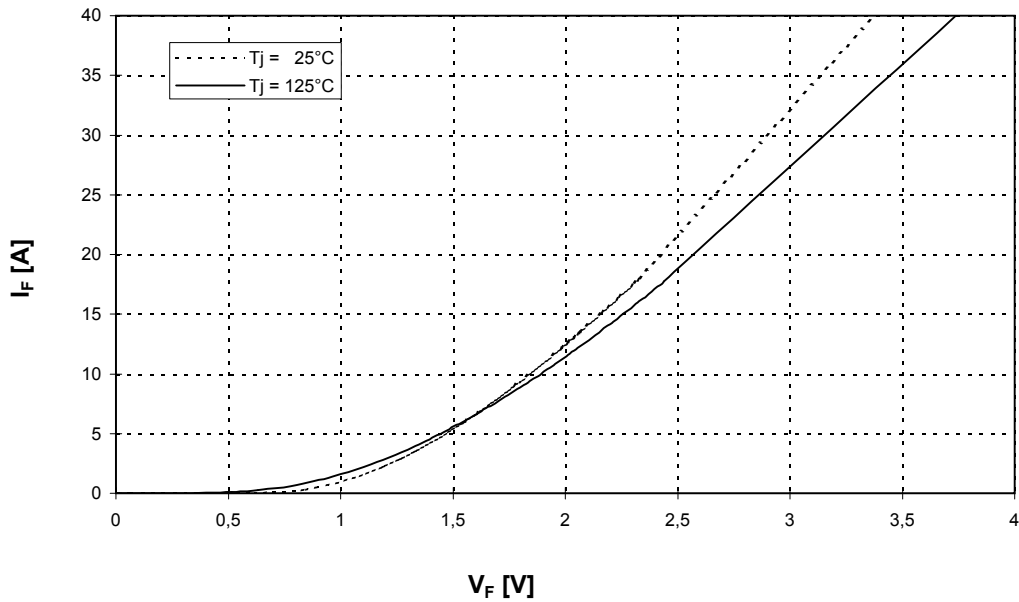
Output characteristic brake-chopper-IGBT (typical)

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



Durchlaßkennlinie der Brems-Chopper-Diode (typisch)  $I_F = f(V_F)$

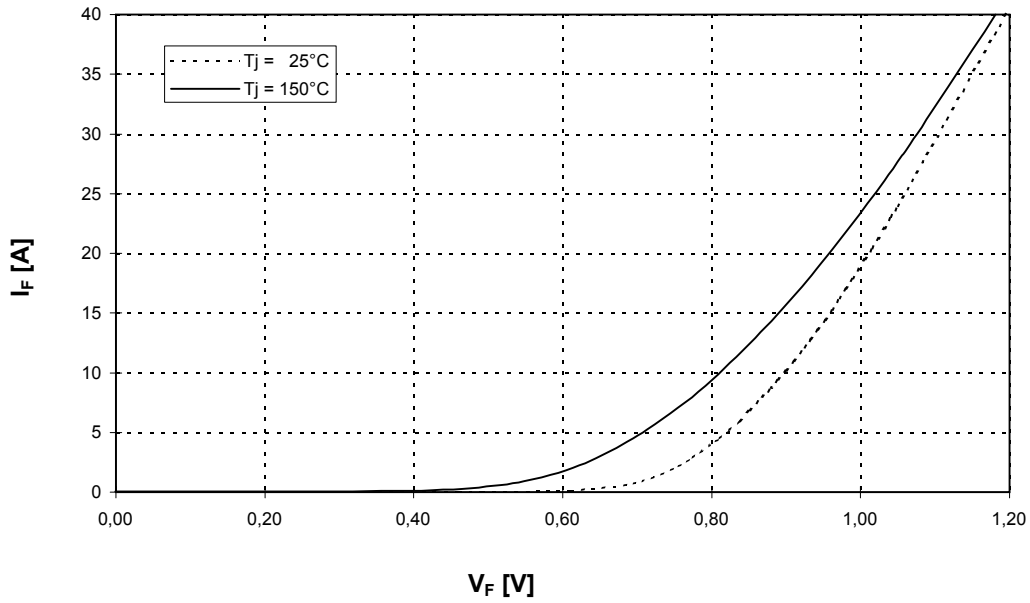
Forward characteristic of brake-chopper-FWD (typical)



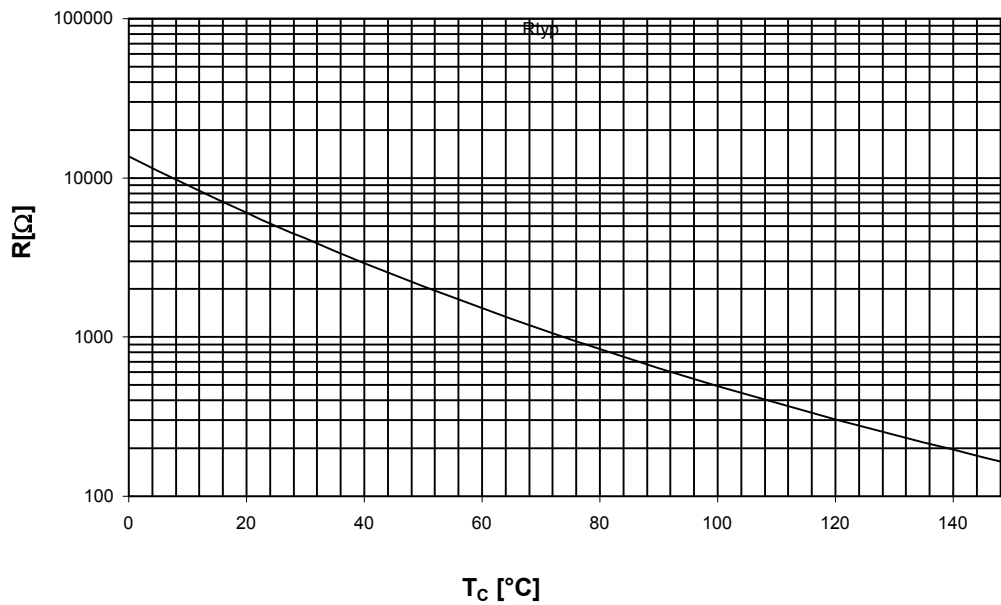


Vorläufig  
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Durchlaßkennlinie der Gleichrichterdiode (typisch)  $I_F = f(V_F)$   
Forward characteristic of Rectifier Diode (typical)



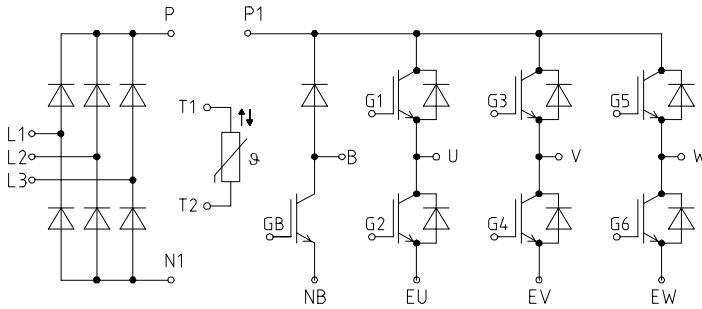
NTC- Temperaturkennlinie (typisch)  $R = f(T)$   
NTC- temperature characteristic (typical)





**Vorläufig**  
**Preliminary**

**Schaltplan/ Circuit diagram**

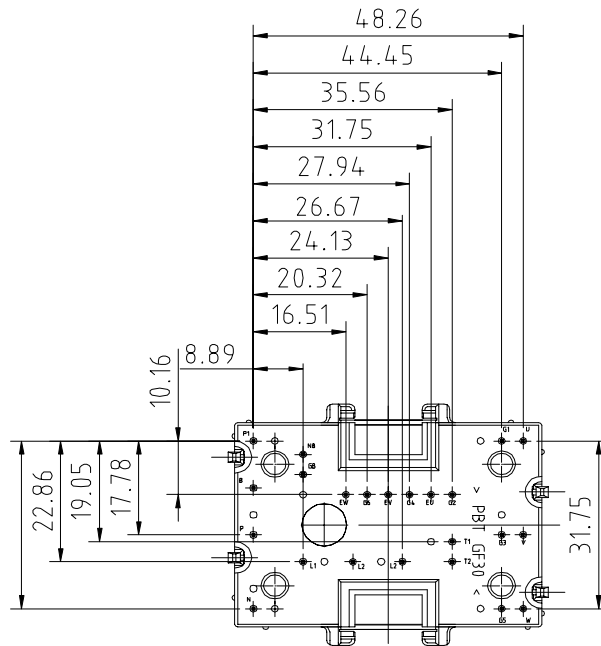
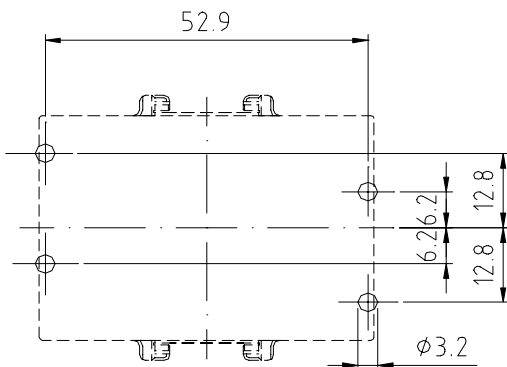


**Gehäuseabmessungen/ Package outlines**

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

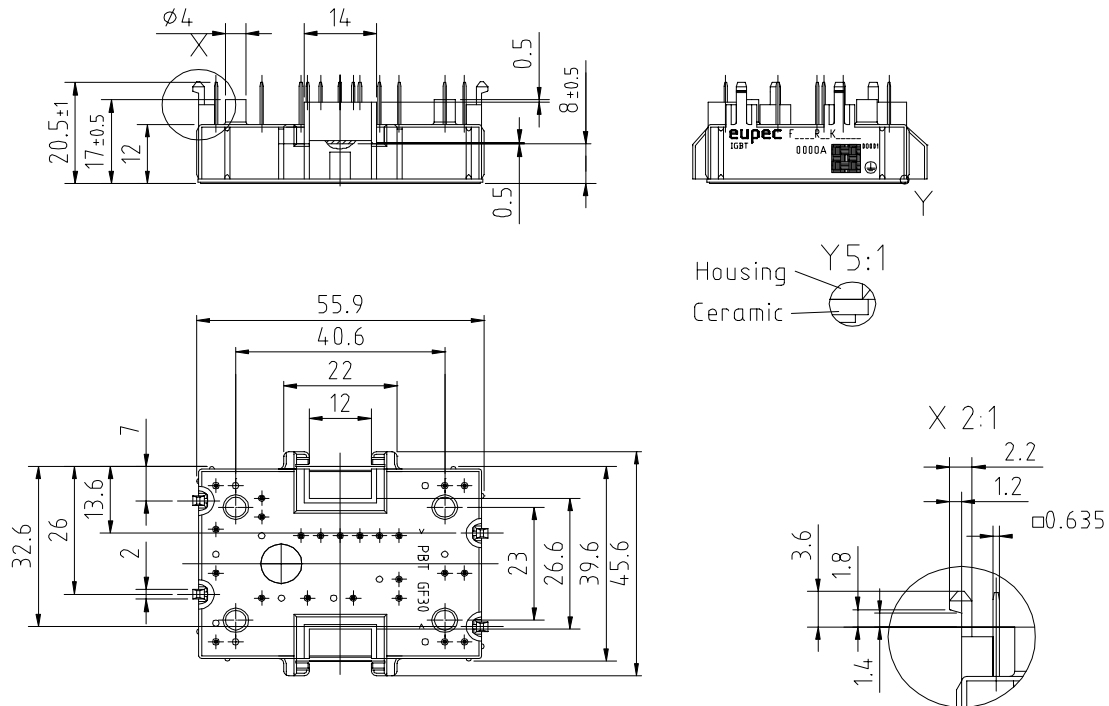
Pinpositions with tolerance  $\pm 0.4$

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.

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