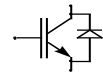


# Technische Information / Technical Information

IGBT-Module  
IGBT-Modules

## FZ 1200 R 12 KL4C

eupec



vorläufige Daten  
preliminary data

### Höchstzulässige Werte / Maximum rated values

#### Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage		$V_{CES}$	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$	$I_{C,nom.}$	1200	A
	$T_C = 25^\circ\text{C}$	$I_C$	1900	A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^\circ\text{C}$	$I_{CRM}$	2400	A
Gesamt-Verlustleistung total power dissipation	$T_C=25^\circ\text{C}$ , Transistor	$P_{tot}$	7,8	kW
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		$V_{GES}$	+/- 20V	V
Dauergleichstrom DC forward current		$I_F$	1200	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	$I_{FRM}$	2400	A
Grenzlastintegral der Diode $I^2t$ - value, Diode	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	$I^2t$	300	$\text{kA}^2\text{s}$
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$	$V_{ISOL}$	2,5	kV

### Charakteristische Werte / Characteristic values

#### Transistor / Transistor

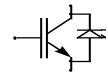
			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_C = 1200\text{A}, V_{GE} = 15\text{V}, T_{vj} = 25^\circ\text{C}$	$V_{CE\text{ sat}}$	-	2,1	2,6	V
	$I_C = 1200\text{A}, V_{GE} = 15\text{V}, T_{vj} = 125^\circ\text{C}$		-	2,4		V
Gate-Schwellenspannung gate threshold voltage	$I_C = 48\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^\circ\text{C}$	$V_{GE(th)}$	4,5	5,5	6,5	V
Eingangskapazität input capacitance	$f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	$C_{ies}$	-	90	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^\circ\text{C}$	$I_{CES}$	-	0,03	1	mA
	$V_{CE} = 1200\text{V}, V_{GE} = 0\text{V}, T_{vj} = 125^\circ\text{C}$		-	2,5		mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25^\circ\text{C}$	$I_{GES}$	-	-	600	nA

prepared by: Mark Münzer

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approved by: H.Ludwig

revision: 1b



vorläufige Daten  
preliminary data

Charakteristische Werte / Characteristic values

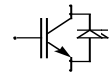
Transistor / Transistor

			min.	typ.	max.	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 1200A, V_{CE} = 600V$	$t_{d,on}$	-	0,54	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 0,82\Omega, T_{vj} = 25^\circ C$		-	0,57	-	$\mu s$
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 1200A, V_{CE} = 600V$	$t_r$	-	0,18	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 0,82\Omega, T_{vj} = 125^\circ C$		-	0,18	-	$\mu s$
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 1200A, V_{CE} = 600V$	$t_{d,off}$	-	1,03	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 0,82\Omega, T_{vj} = 125^\circ C$		-	1,14	-	$\mu s$
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 1200A, V_{CE} = 600V$	$t_f$	-	0,13	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 0,82\Omega, T_{vj} = 125^\circ C$		-	0,14	-	$\mu s$
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 1200A, V_{CE} = 600V, V_{GE} = 15V$ $R_G = 0,82\Omega, T_{vj} = 125^\circ C, L_S = 70nH$	$E_{on}$	-	165	-	mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 1200A, V_{CE} = 600V, V_{GE} = 15V$ $R_G = 0,82\Omega, T_{vj} = 125^\circ C, L_S = 70nH$	$E_{off}$	-	195	-	mWs
Kurzschlußverhalten SC Data	$t_p \leq 10\mu sec, V_{GE} \leq 15V, R_G = 0,82\Omega$ $T_{vj} \leq 125^\circ C, V_{CC} = 900V, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$I_{SC}$	-	9000	-	A
Modulinduktivität stray inductance module		$L_{sCE}$	-	15	-	nH
Modul Leitungswiderstand, Anschlüsse – Chip module lead resistance, terminals – chip	$T_C = 25^\circ C$	$R_{CC+EE}$	-	0,10	-	m $\Omega$

Charakteristische Werte / Characteristic values

Diode / Diode

			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 1200A, V_{GE} = 0V, T_{vj} = 25^\circ C$	$V_F$	-	1,8	2,3	V
	$I_F = 1200A, V_{GE} = 0V, T_{vj} = 125^\circ C$		-	1,7		V
Rückstromspitze peak reverse recovery current	$I_F = 1200A, -di_F/dt = 6800A/\mu sec$	$I_{RM}$	-	740	-	A
	$V_R = 600V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 600V, V_{GE} = -15V, T_{vj} = 125^\circ C$		-	980	-	A
Sperrverzögerungsladung recovered charge	$I_F = 1200A, -di_F/dt = 6800A/\mu sec$	$Q_r$	-	105	-	$\mu As$
	$V_R = 600V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 600V, V_{GE} = -15V, T_{vj} = 125^\circ C$		-	215	-	$\mu As$
Abschaltenergie pro Puls reverse recovery energy	$I_F = 1200A, -di_F/dt = 6800A/\mu sec$	$E_{rec}$	-	45	-	mWs
	$V_R = 600V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 600V, V_{GE} = -15V, T_{vj} = 125^\circ C$		-	80	-	mWs



**vorläufige Daten**  
**preliminary data**

**Thermische Eigenschaften / Thermal properties**

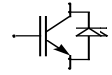
			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	$R_{thJC}$	-	-	0,016	K/W
	Diode/Diode, DC		-	-	0,032	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $d_{paste} \leq 100\mu m / d_{grease} \leq 100\mu m$	$R_{thCK}$	-	-	0,008	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**

Gehäuse, siehe Anlage case, see appendix						
Innere Isolation internal insulation				$Al_2O_3$		
Kriechstrecke creepage distance				17		mm
Luftstrecke clearance				10		mm
CTI comperative tracking index				275		
Anzugsdrehmoment f. mech. Befestigung mounting torque		M1	4,25	5	5,75	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	terminals M4	M2	1,7	2	2,3	Nm
	terminals M8		8		10	Nm
Gewicht weight		G		1500		g

Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

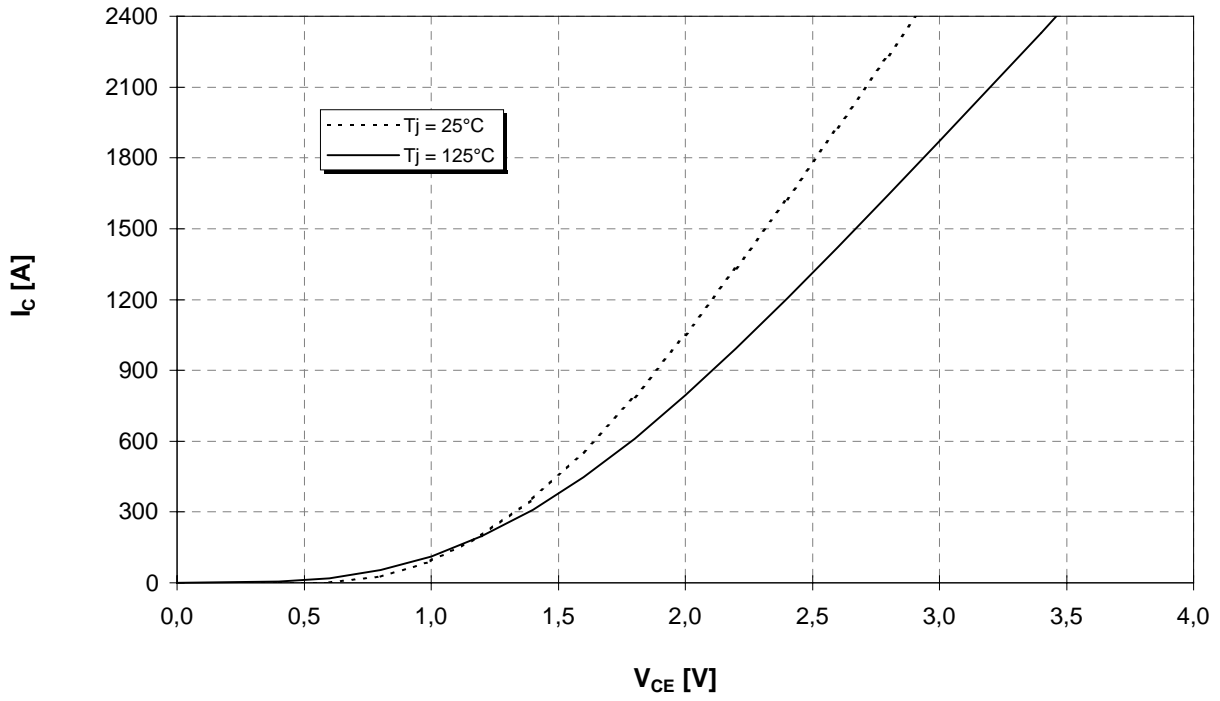
This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.



**Ausgangskennlinie (typisch)**  
**Output characteristic (typical)**

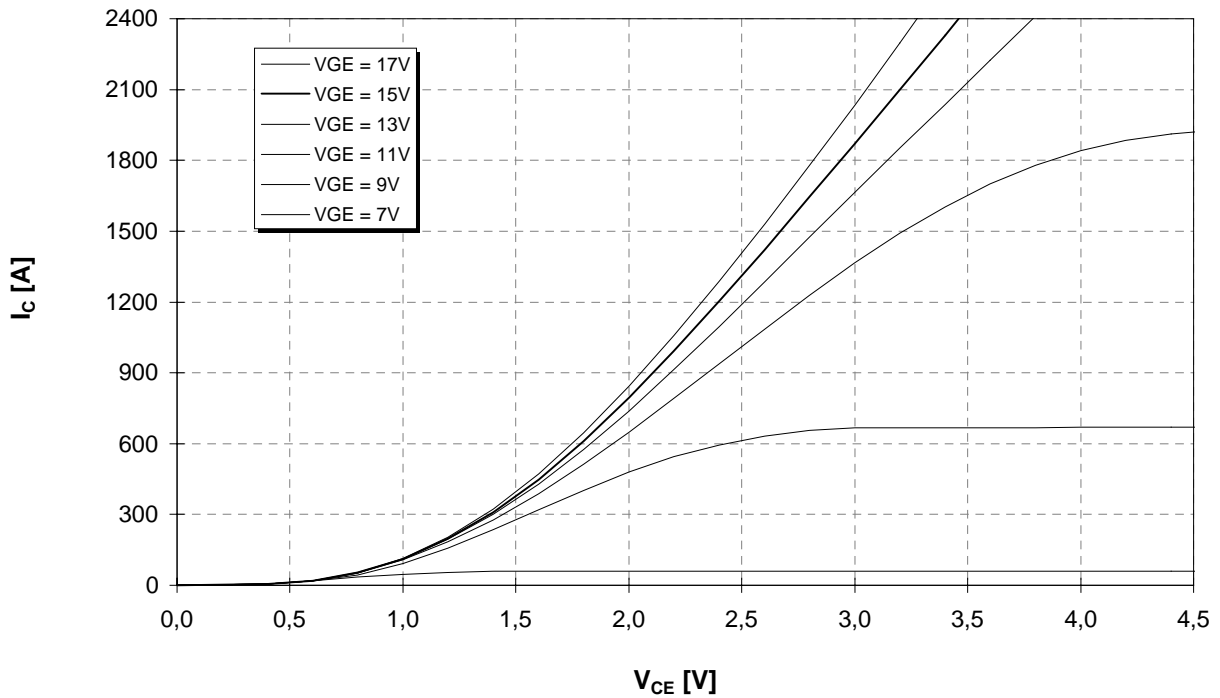
$I_C = f(V_{CE})$   
 $V_{GE} = 15V$

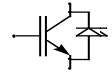
**vorläufige Daten**  
**preliminary data**



**Ausgangskennlinienfeld (typisch)**  
**Output characteristic (typical)**

$I_C = f(V_{CE})$   
 $T_{vj} = 125°C$

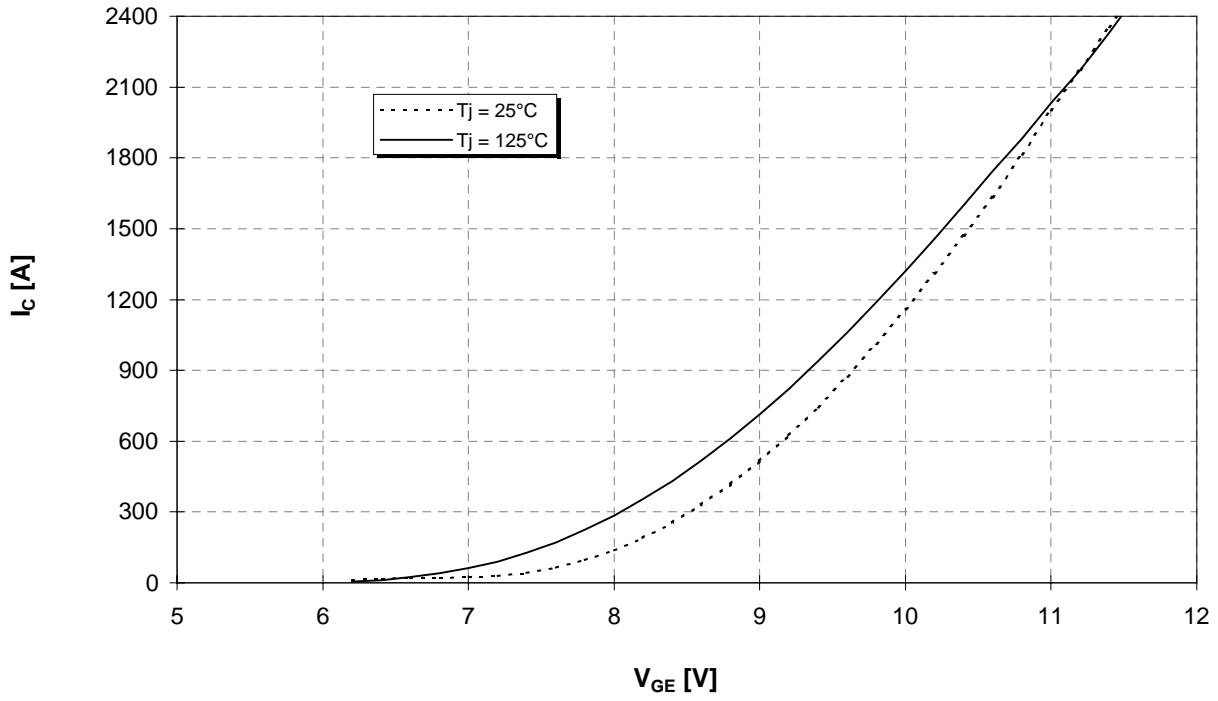




vorläufige Daten  
preliminary data

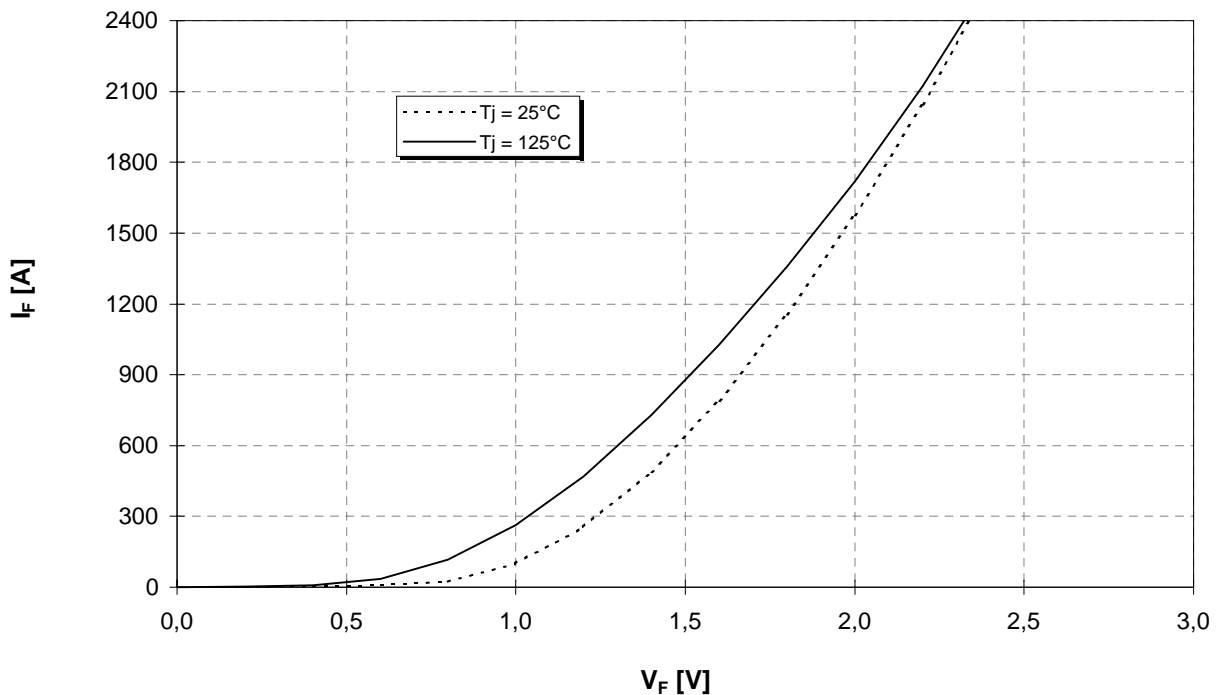
Übertragungscharakteristik (typisch)  
Transfer characteristic (typical)

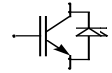
$I_C = f(V_{GE})$   
 $V_{CE} = 20V$



Durchlaßkennlinie der Inversdiode (typisch)  
Forward characteristic of inverse diode (typical)

$I_F = f(V_F)$

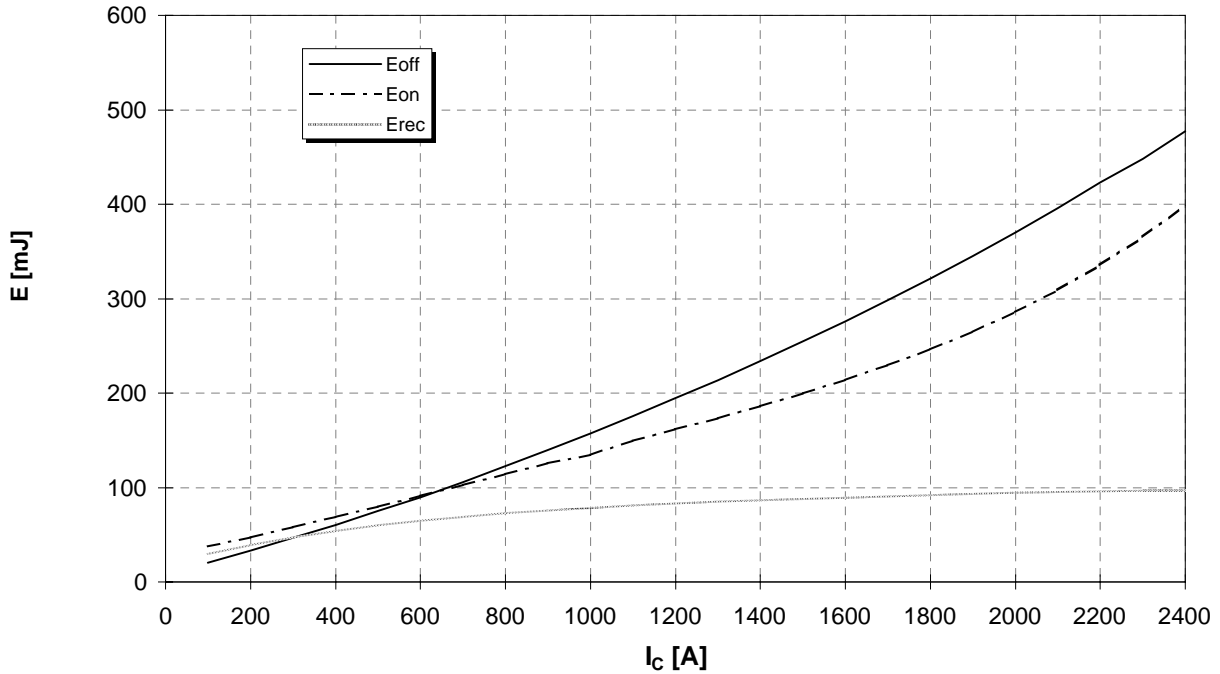




vorläufige Daten  
preliminary data

Schaltverluste (typisch)  $E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$ ,  $E_{rec} = f(I_C)$   
Switching losses (typical)

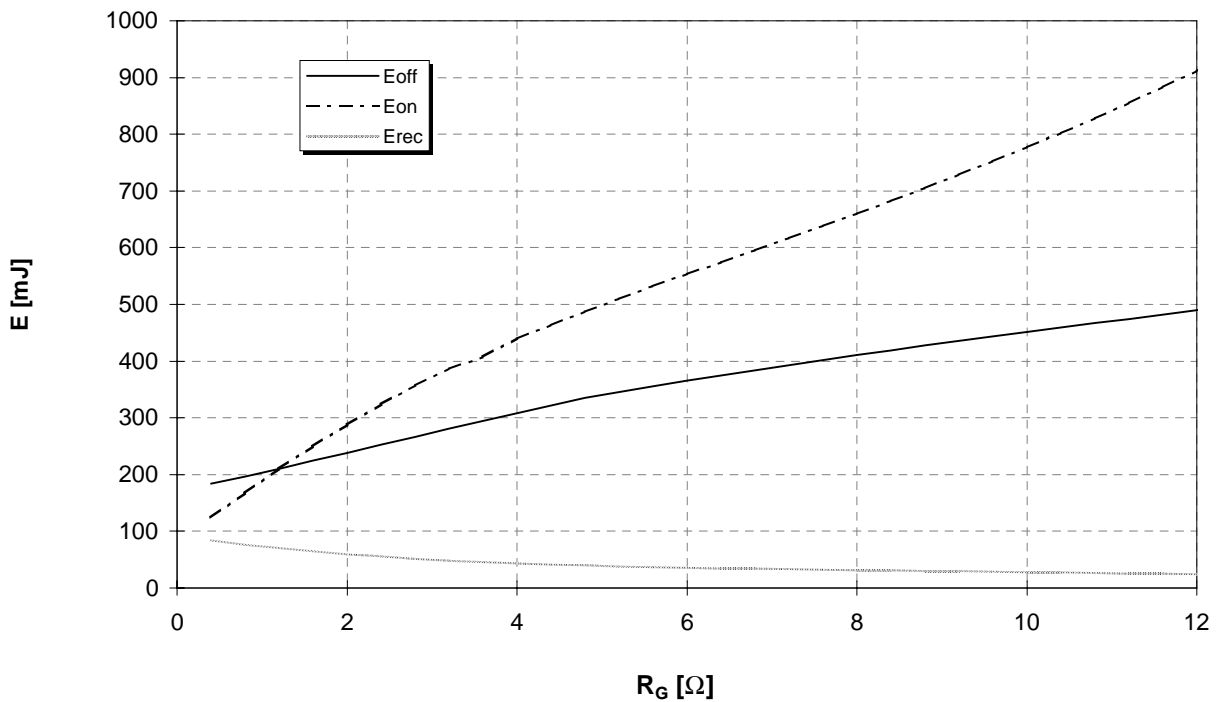
$V_{GE} = \pm 15V$ ,  $R_{gon} = R_{goff} = 0,82 \Omega$ ,  $V_{CE} = 600V$ ,  $T_j = 125^\circ C$

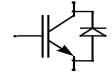


Schaltverluste (typisch)  $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$ ,  $E_{rec} = f(R_G)$   
Switching losses (typical)

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$ ,  $E_{rec} = f(R_G)$

$V_{GE} = \pm 15V$ ,  $I_C = 1200A$ ,  $V_{CE} = 600V$ ,  $T_j = 125^\circ C$



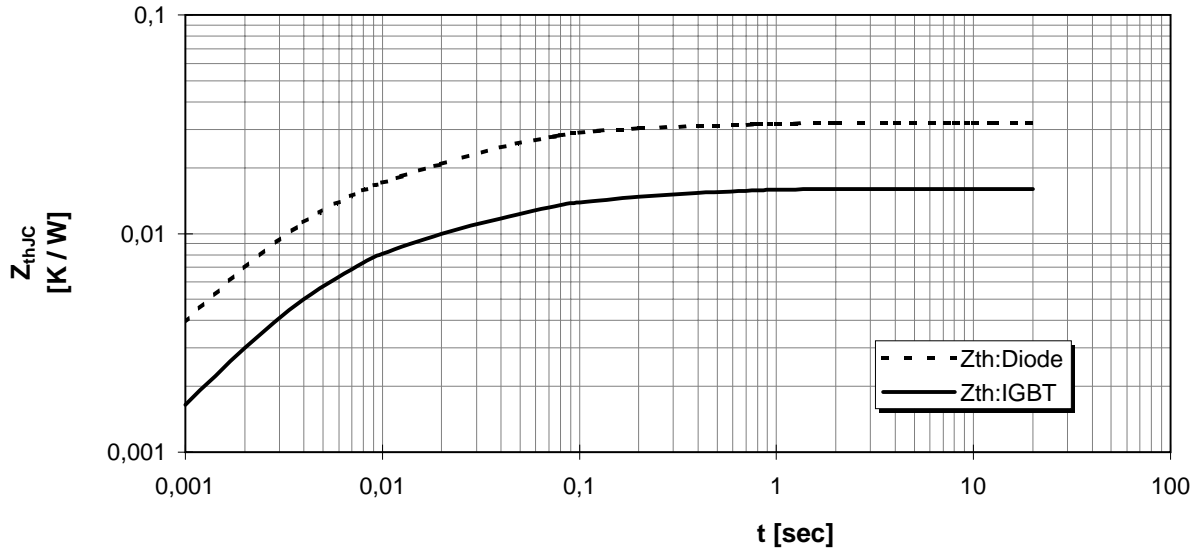


vorläufige Daten

preliminary data

Transienter Wärmewiderstand  
Transient thermal impedance

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

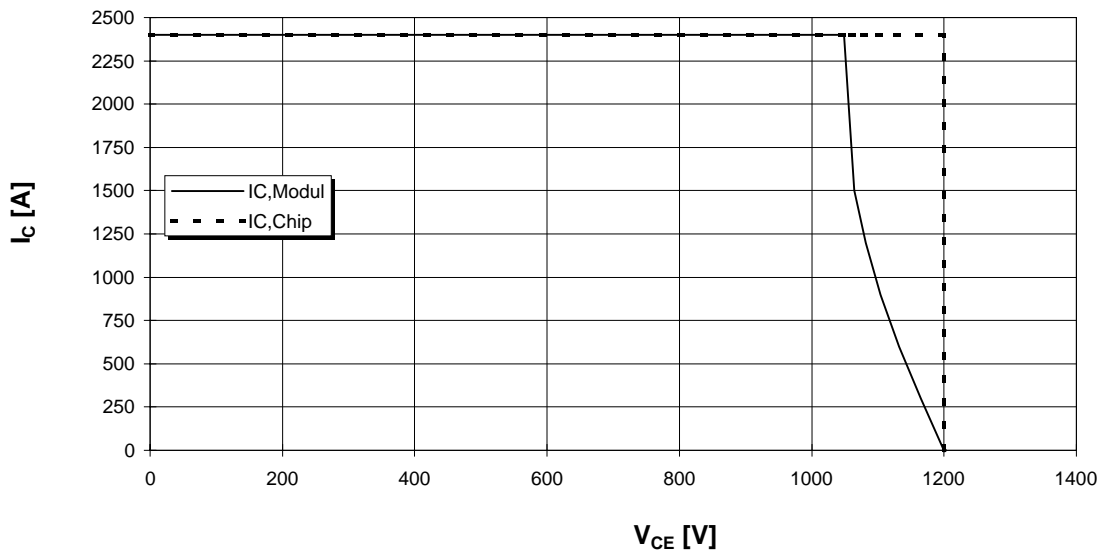


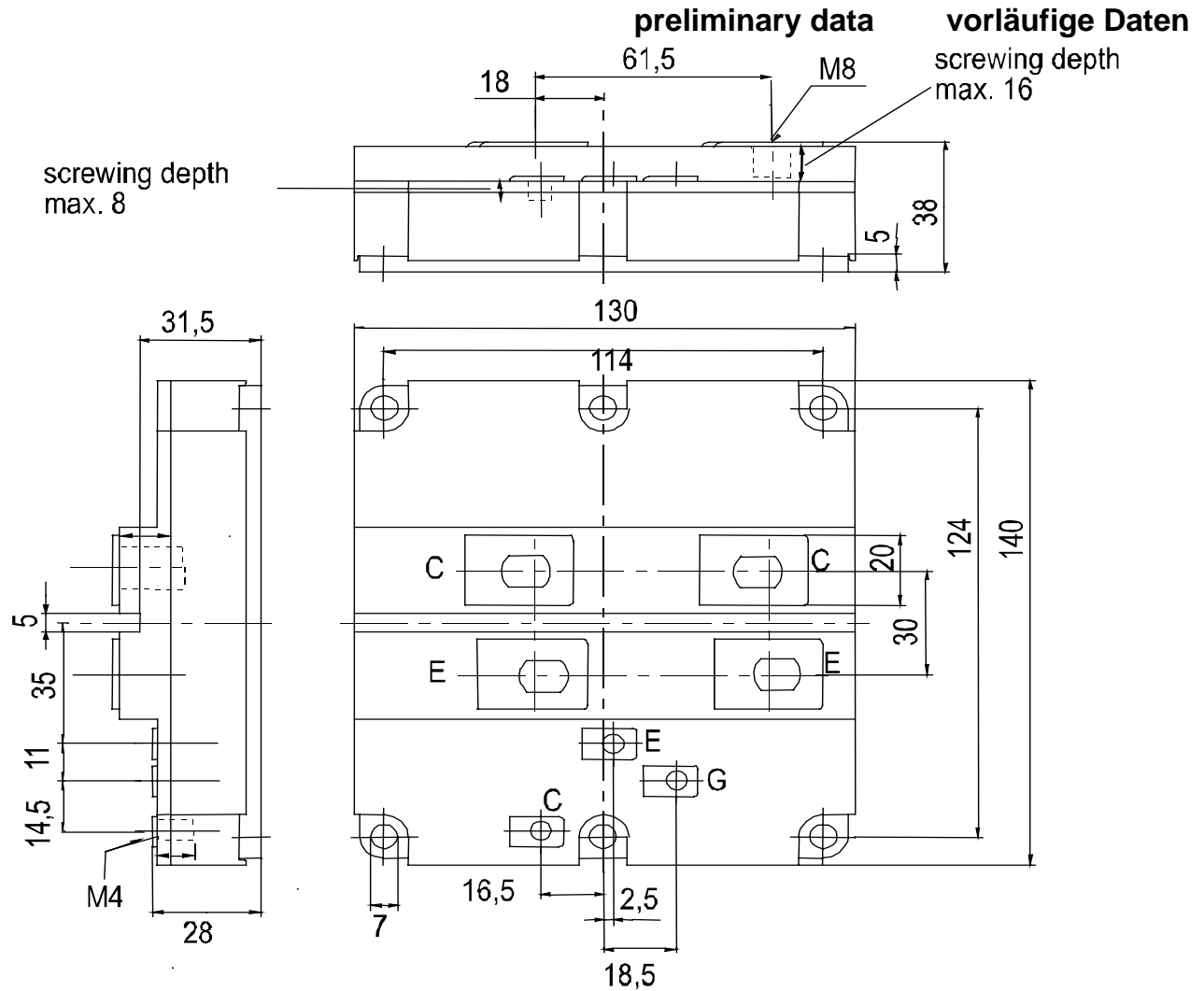
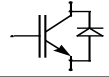
i	1	2	3	4
$r_i$ [K/kW] : IGBT	7,3	6,3	1,1	1,2
$\tau_i$ [sec] : IGBT	0,004	0,04	0,19	0,5
$r_i$ [K/kW] : Diode	13,6	7,5	8,6	2,3
$\tau_i$ [sec] : Diode	0,003	0,03	0,05	0,5

Sicherer Arbeitsbereich (RBSOA)

Reverse bias safe operation area (RBSOA)

$$R_g = 0,82\Omega, T_{vj} = 125^\circ\text{C}$$





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external connections ( to be done)

