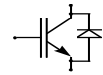


# Technische Information / Technical Information

IGBT-Module  
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## FS 150 R17 KE3 G

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### Höchstzulässige Werte / Maximum rated values

#### Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1700	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^{\circ}\text{C}$	$I_{C,nom.}$	150	A
	$T_C = 25^{\circ}\text{C}$	$I_C$	240	A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^{\circ}\text{C}$	$I_{CRM}$	300	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$ , Transistor	$P_{tot}$	1040	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		$V_{GES}$	+/- 20V	V
Dauergleichstrom DC forward current		$I_F$	150	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	$I_{FRM}$	300	A
Grenzlastintegral der Diode $I^2t$ - value, Diode	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^{\circ}\text{C}$	$I^2t$	t.b.d	$\text{k A}^2\text{s}$
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$	$V_{ISOL}$	3,4	kV

### Charakteristische Werte / Characteristic values

#### Transistor / Transistor

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_C = 150\text{A}, V_{GE} = 15\text{V}, T_{vj} = 25^{\circ}\text{C}$	$V_{CE\text{ sat}}$	-	2,0	2,45	V
	$I_C = 150\text{A}, V_{GE} = 15\text{V}, T_{vj} = 125^{\circ}\text{C}$		-	2,4	-	V
Gate-Schwellenspannung gate threshold voltage	$I_C = 6\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE(th)}$	5,2	5,8	6,4	V
Gateladung gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	$Q_G$	-	1,7	-	$\mu\text{C}$
Eingangskapazität input capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	$C_{ies}$	-	12	-	nF
Rückwirkungskapazität reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	$C_{res}$	-	0,45	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 1700\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$	-	-	5	mA
	$V_{CE} = 1700\text{V}, V_{GE} = 0\text{V}, T_{vj} = 125^{\circ}\text{C}$		-	-	-	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

prepared by: Alfons Wiesenthal

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approved by: Christoph Lübke

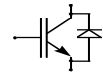
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### Charakteristische Werte / Characteristic values

#### Transistor / Transistor

			min.	typ.	max.	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 150A, V_{CE} = 900V$	$t_{d,on}$	-	0,20	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 9,1\Omega, T_{vj} = 25^\circ C$			0,22		$\mu s$
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 150A, V_{CE} = 900V$	$t_r$	-	0,10	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 9,1\Omega, T_{vj} = 125^\circ C$			0,10		$\mu s$
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 150A, V_{CE} = 900V$	$t_{d,off}$	-	0,72	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 9,1\Omega, T_{vj} = 125^\circ C$			0,88		$\mu s$
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 150A, V_{CE} = 900V$	$t_f$	-	0,10	-	$\mu s$
	$V_{GE} = \pm 15V, R_G = 9,1\Omega, T_{vj} = 125^\circ C$			0,20		$\mu s$
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 150A, V_{CE} = 900V, V_{GE} = \pm 15V$ $R_G = 9,1\Omega, T_{vj} = 125^\circ C, L_\sigma = 80nH$	$E_{on}$	-	60	-	mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 150A, V_{CE} = 900V, V_{GE} = \pm 15V$ $R_G = 9,1\Omega, T_{vj} = 125^\circ C, L_\sigma = 80nH$	$E_{off}$	-	50	-	mJ
Kurzschlußverhalten SC Data	$t_p \leq 10\mu sec, V_{GE} \leq 15V$ $T_{vj} \leq 125^\circ C, V_{CC} = 1000V, V_{CEmax} = V_{CES} - L_{\sigma CE} \cdot di/dt$	$I_{SC}$	-	560	-	A
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	20	-	nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	pro Zweig / per arm, $T_C = 25^\circ C$	$R_{CC+EE}$	-	1,1	-	m $\Omega$

### Charakteristische Werte / Characteristic values

#### Diode / Diode

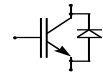
			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 150A, V_{GE} = 0V, T_{vj} = 25^\circ C$	$V_F$	-	1,8	2,2	V
	$I_F = 150A, V_{GE} = 0V, T_{vj} = 125^\circ C$			1,9	t.b.d.	V
Rückstromspitze peak reverse recovery current	$I_F = 150A, -di_F/dt = 2200A/\mu s$	$I_{RM}$	-	185	-	A
	$V_R = 900V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 900V, V_{GE} = -15V, T_{vj} = 125^\circ C$			200	-	A
Sperrverzögerungsladung recovered charge	$I_F = 150A, -di_F/dt = 2200A/\mu s$	$Q_r$	-	40	-	$\mu C$
	$V_R = 900V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 900V, V_{GE} = -15V, T_{vj} = 125^\circ C$			65	-	$\mu C$
Abschaltenergie pro Puls reverse recovery energy	$I_F = 150A, -di_F/dt = 2200A/\mu s$	$E_{rec}$	-	20	-	mJ
	$V_R = 900V, V_{GE} = -15V, T_{vj} = 25^\circ C$ $V_R = 900V, V_{GE} = -15V, T_{vj} = 125^\circ C$			35	-	mJ

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### Charakteristische Werte / Characteristic values

			min.	typ.	max.	
NTC - Widerstand / NTC - thermistor						
Nennwiderstand rated resistance	$T_C = 25^\circ\text{C}$	$R_{25}$	-	5	-	k $\Omega$
Abweichung von $R_{100}$ deviation of $R_{100}$	$T_C = 100^\circ\text{C}; R_{100} = 493\Omega$	$\Delta R/R$	-5	-	5	%
Verlustleistung Power dissipation	$T_C = 25^\circ\text{C}$	$P_{25}$	-	-	20	mW
B - Wert B - value	$R_2 = R_1 \exp[B(1/T_2 - 1/T_1)]$	$B_{25/50}$	-	3375	-	K

### Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	$R_{thJC}$	-	-	0,120	K/W
	Diode/Diode, DC	$R_{thJC}$	-	-	0,210	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $\lambda_{\text{Paste}} = 1 \text{ W/m}^2\text{K} / \lambda_{\text{grease}} = 1 \text{ W/m}^2\text{K}$	$R_{thCK}$	-	0,005	-	K/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj \text{ max}}$	-	-	150	$^\circ\text{C}$
Betriebstemperatur operation temperature		$T_{vj \text{ op}}$	-40	-	125	$^\circ\text{C}$
Lagertemperatur storage temperature		$T_{stg}$	-40	-	125	$^\circ\text{C}$

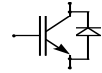
### Mechanische Eigenschaften / Mechanical properties

Gehäuse, siehe Anlage case, see appendix						
Innere Isolation internal insulation				$\text{Al}_2\text{O}_3$		
Kriechstrecke creepage distance				14		mm
Luftstrecke clearance				10		mm
CTI comperative tracking index				225		
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube / screw M5	M	3	-	6	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	Anschlüsse / terminals M6	M	3	-	6	Nm
Gewicht weight		G		916		g

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

Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

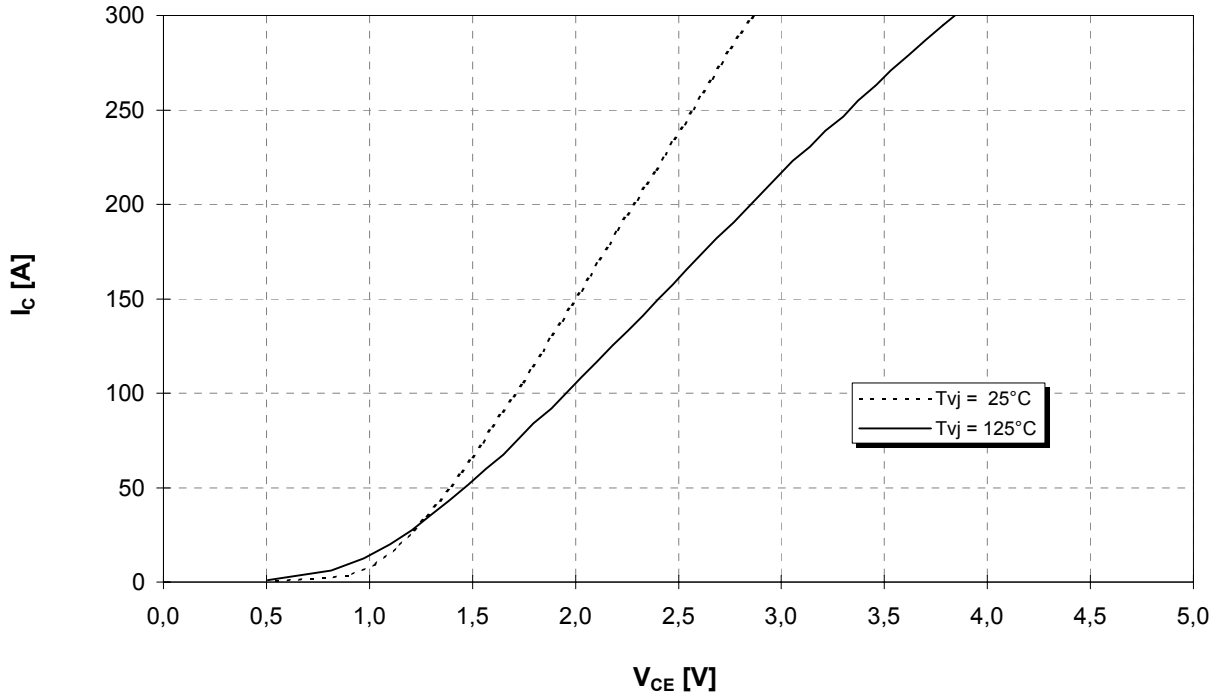
This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.



vorläufige Daten  
preliminary data

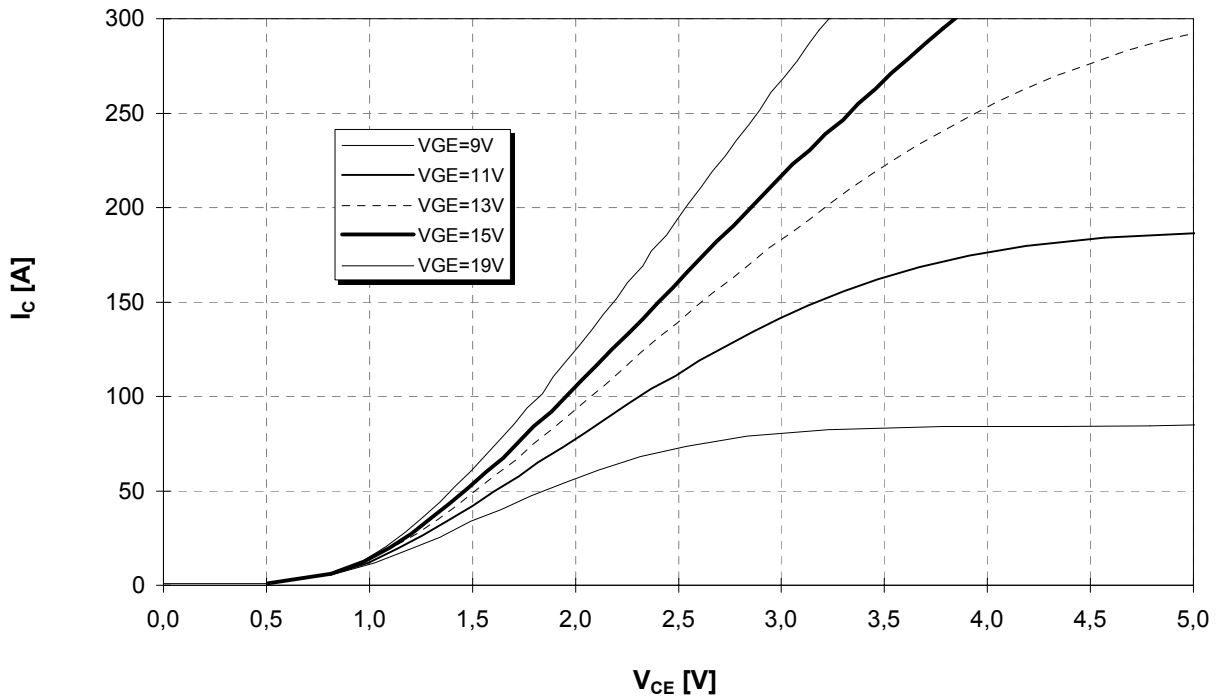
Ausgangskennlinie (typisch)  
Output characteristic (typical)

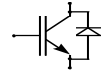
$I_C = f(V_{CE})$   
 $V_{GE} = 15V$



Ausgangskennlinienfeld (typisch)  
Output characteristic (typical)

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



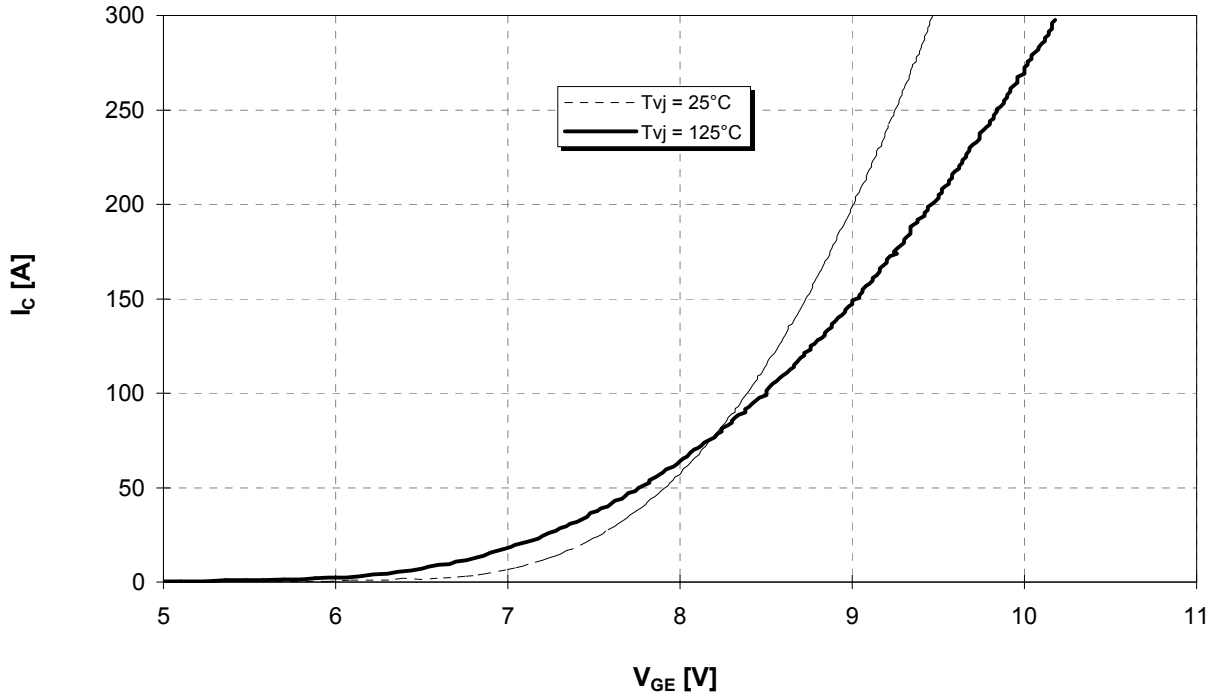


vorläufige Daten  
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Übertragungscharakteristik (typisch)  
Transfer characteristic (typical)

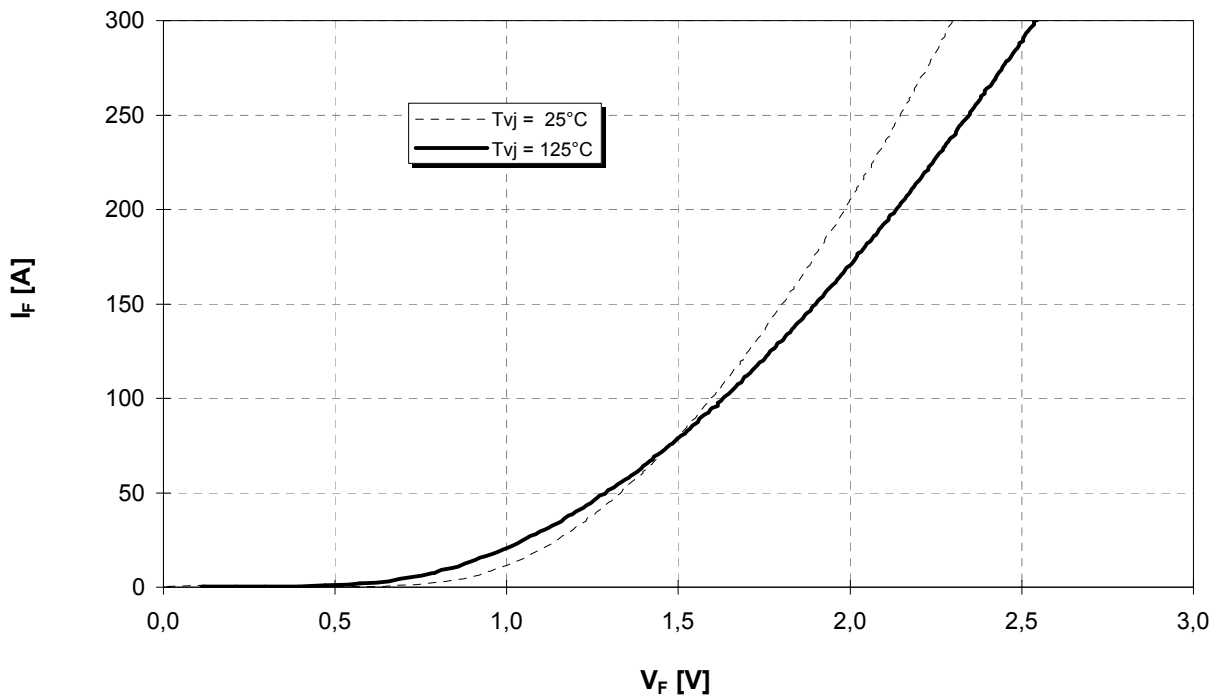
$$I_C = f(V_{GE})$$

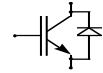
$V_{CE} = 20V$



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

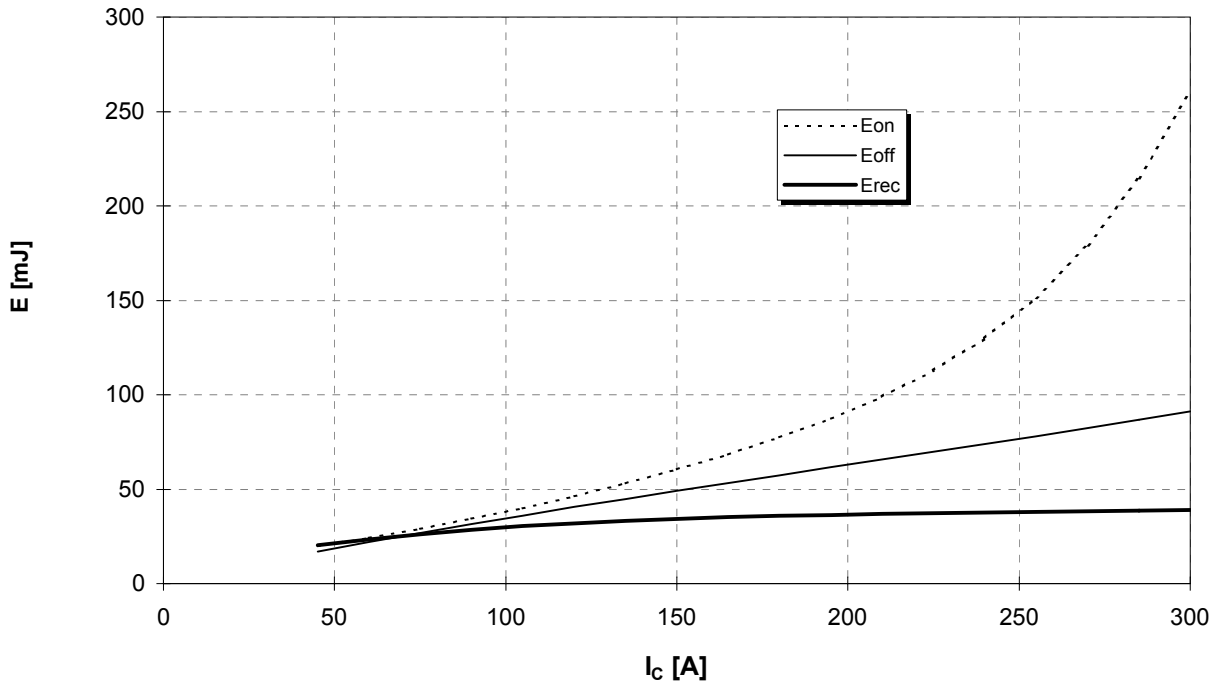
$$I_F = f(V_F)$$



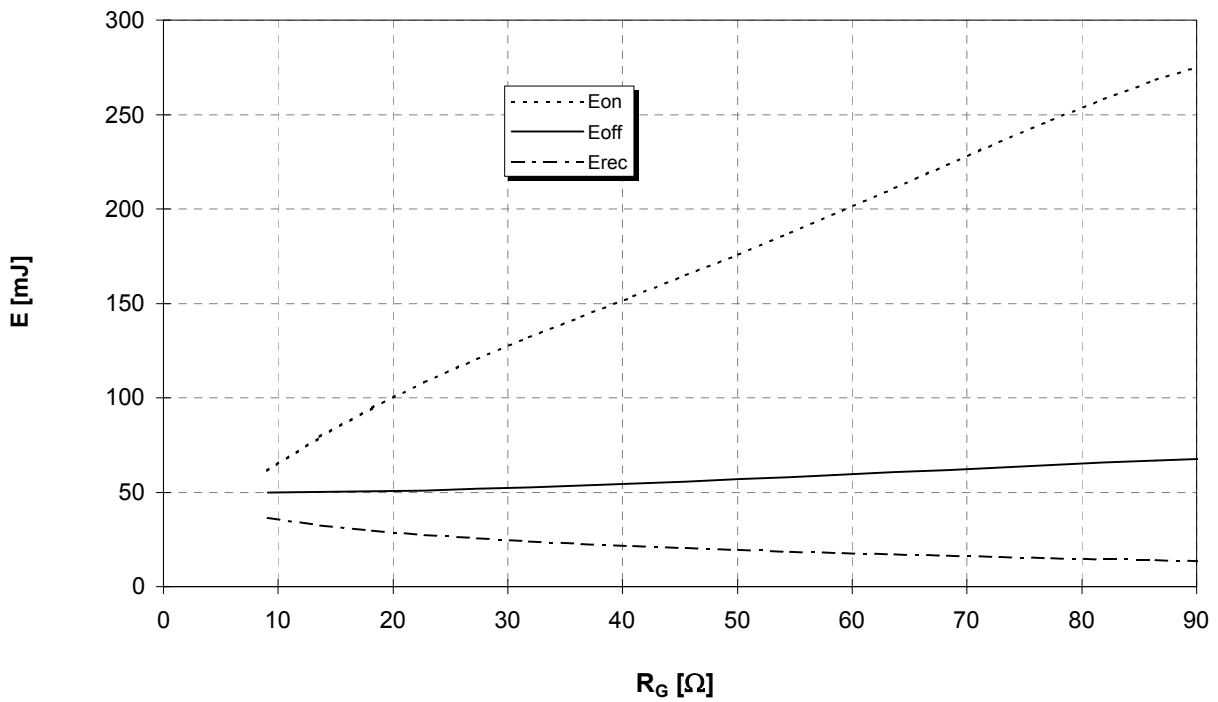


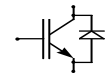
vorläufige Daten  
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Schaltverluste (typisch)  $E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$ ,  $E_{rec} = f(I_C)$   
 Switching losses (typical)  $V_{GE} = \pm 15V$ ,  $R_{Gon} = R_{Goff} = 9,1\Omega$ ,  $V_{CE} = 900V$ ,  $T_{vj} = 125^\circ C$



Schaltverluste (typisch)  $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$ ,  $E_{rec} = f(R_G)$   
 Switching losses (typical)  $V_{GE} = \pm 15V$ ,  $I_C = 150A$ ,  $V_{CE} = 900V$ ,  $T_{vj} = 125^\circ C$

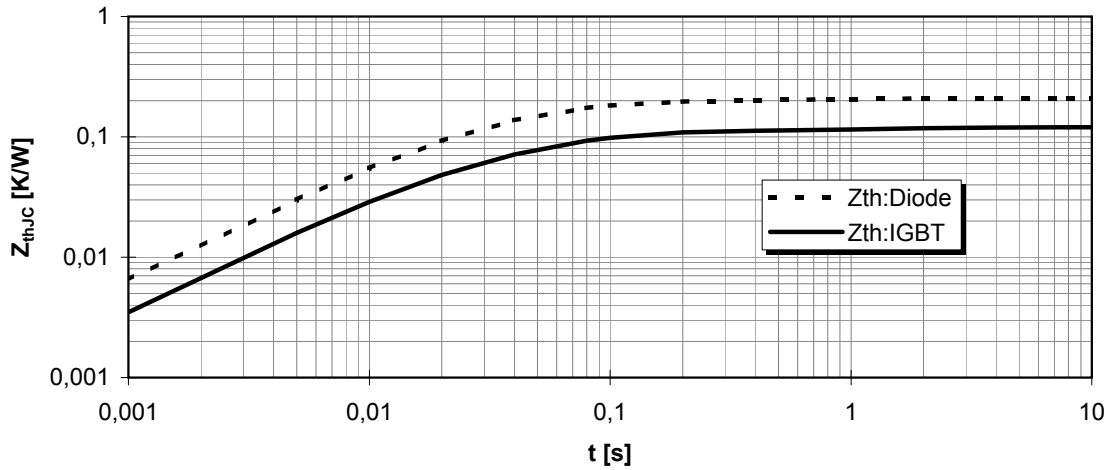




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Transienter Wärmewiderstand  
Transient thermal impedance

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

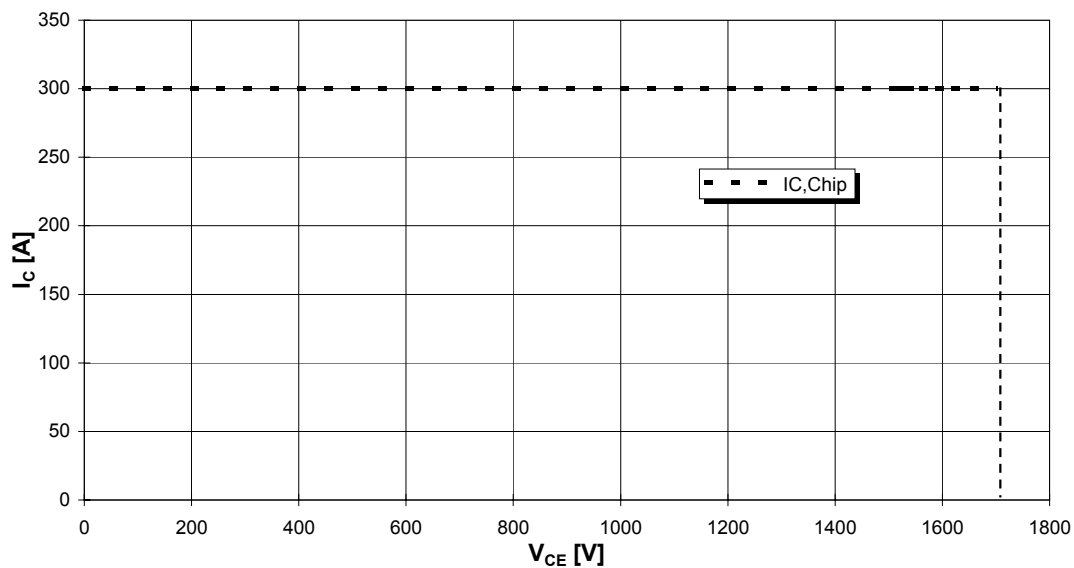


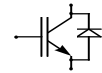
i		1	2	3	4
$r_i$ [K/kW]	: IGBT	30,54	45,13	34,85	9,479
$\tau_i$ [s]	: IGBT	0,01565	0,03977	0,07521	1,443
$r_i$ [K/kW]	: Diode	71,17	78,97	50,01	9,856
$\tau_i$ [s]	: Diode	0,02103	0,03011	0,08672	1,1583

Sicherer Arbeitsbereich (RBSOA)

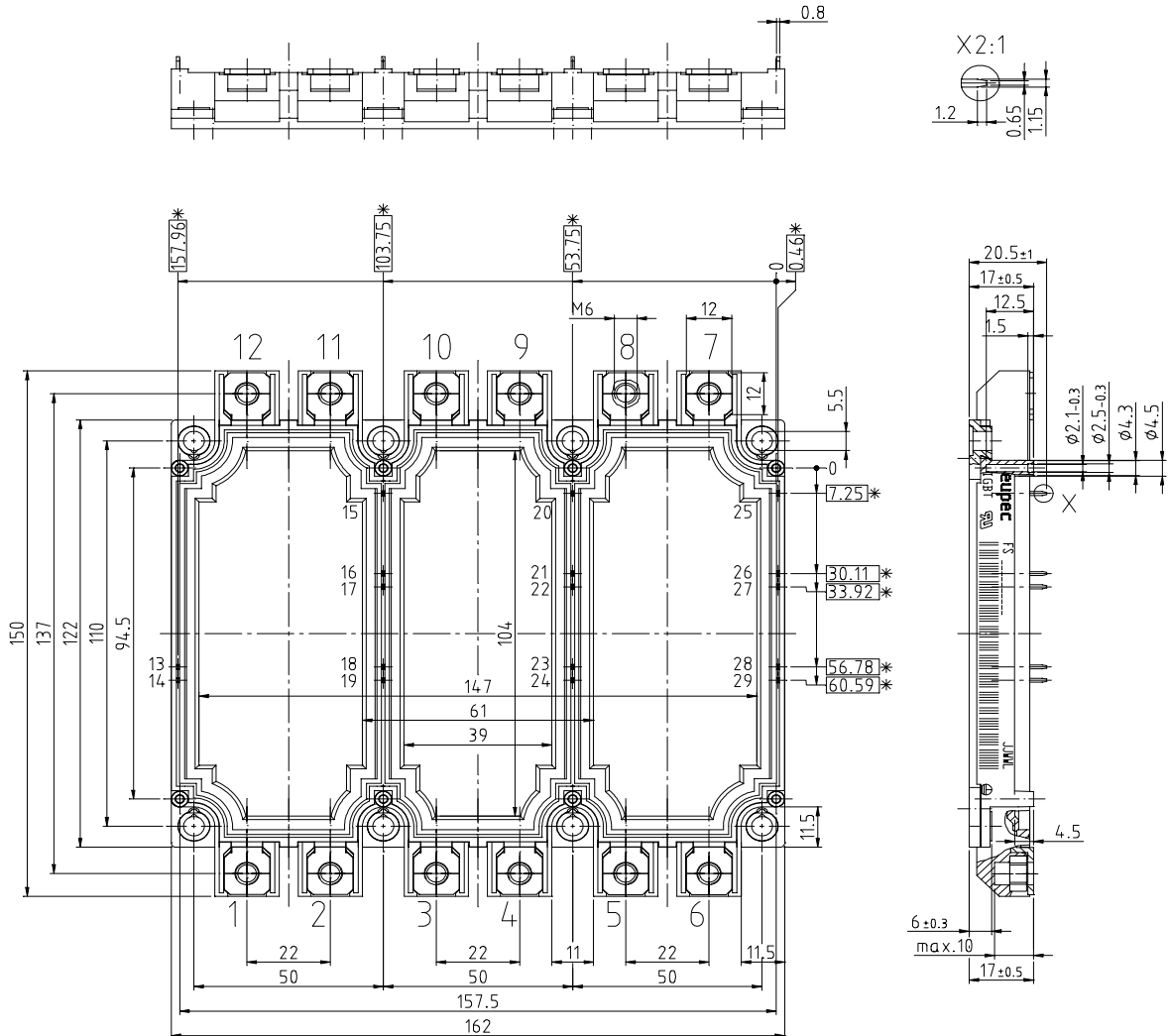
Reverse bias safe operation area (RBSOA)

$V_{GE} = \pm 15V$ ,  $R_G = 9,1 \text{ Ohm}$ ,  $T_V = 125^\circ C$





vorläufige Daten  
preliminary data



\* = alle Maße mit einer Toleranz von  $\pm 0.5$

