

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FF300R12KS4

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vorläufige Daten
preliminary data

Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 60^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C,nom.}$ I_C	300 370	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}$, $T_C = 60^{\circ}\text{C}$	I_{CRM}	600	A
Gesamt Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$; Transistor	P_{tot}	1950	W
Gate Emitter Spitzenspannung gate emitter peak voltage		V_{GES}	+/- 20V	V
Dauergleichstrom DC forward current		I_F	300	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1\text{ ms}$	I_{FRM}	600	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	18	$\text{k A}^2\text{s}$
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50\text{ Hz}$, $t = 1\text{ min.}$	V_{ISOL}	2.500	V

Charakteristische Werte / Characteristic values

Transistor / Transistor

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector emitter saturation voltage	$I_C = 300\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$ $I_C = 300\text{A}$, $V_{GE} = 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$	$V_{CE\text{ sat}}$	-	3,20 3,85	3,75 -	V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 12\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$	$V_{GE(th)}$	4,5	5,50	6,50	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}	-	20	-	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}	-	1,4	-	nF
Gateladung gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$; $V_{CE} = \dots\text{V}$	Q_G	-	3,2	-	μC
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}	-	-	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}	-	-	400	nA

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Charakteristische Werte / Characteristic values

Transistor / Transistor			min.	typ.	max.	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}$	$t_{d,on}$	-	0,10	-	μs
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}$					
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}$	t_r	-	0,09	-	μs
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}$					
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}$	$t_{d,off}$	-	0,53	-	μs
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}$					
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}$	t_f	-	0,06	-	μs
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}$					
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}$ $R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}, L_\sigma = 60\text{ nH}$	E_{on}	-	25	-	mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 300\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = 15\text{ V}$ $R_G = 3,0\ \Omega, T_{vj} = 125^\circ\text{C}, L_\sigma = 60\text{ nH}$	E_{off}	-	15	-	mJ
Kurzschlußverhalten SC Data	$t_p \leq 10\mu\text{s}, V_{GE} \leq 15\text{ V}$ $T_{vj} \leq 125^\circ\text{C}, V_{CC} = 900\text{ V}, V_{CEmax} = V_{CES} - L_{\sigma CE} \cdot di/dt$	I_{SC}	-	1950	-	A
Modulinduktivität stray inductance module	Anschlüsse / terminals 2-3	$L_{\sigma CE}$	-	20	-	nH
Modul-Leitungswiderstand, Anschlüsse - Chip lead resistance, terminals - chip	pro Zweig / per arm, $T_C = 25^\circ\text{C}$	R_{CC+EE}	-	0,7	-	m Ω

Charakteristische Werte / Characteristic values

Diode / Diode			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 300\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 25^\circ\text{C}$	V_F	-	2,00	2,55	V
	$I_F = 300\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 125^\circ\text{C}$					
Rückstromspitze peak reverse recovery current	$I_F = 300\text{ A}, -di_F/dt = 4500\text{ A}/\mu\text{s}$	I_{RM}	-	230	-	A
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^\circ\text{C}$					
Sperrverzögerungsladung recovered charge	$I_F = 300\text{ A}, -di_F/dt = 4500\text{ A}/\mu\text{s}$	Q_r	-	18	-	μC
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^\circ\text{C}$					
Abschaltenergie pro Puls reverse recovery energy	$I_F = 300\text{ A}, -di_F/dt = 4500\text{ A}/\mu\text{s}$	E_{rec}	-	7	-	mJ
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^\circ\text{C}$					

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Thermische Eigenschaften / Thermal properties						
			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor,DC , pro Modul / per module	R_{thJC}	-	-	0,032	K/W
	Transistor / transistor,DC , pro Zweig / per arm		-	-	0,064	K/W
	Diode / Diode, DC, pro Modul / per module		-	-	0,050	K/W
	Diode / Diode, DC, pro Zweig / per arm		-	-	0,100	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $\lambda_{Paste} = 1 \text{ W/m}^2\text{K} / \lambda_{grease} = 1 \text{ W/m}^2\text{K}$	R_{thCK}	-	0,010	-	K/W
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj \text{ max}}$	-	-	150	°C
Betriebstemperatur operation temperature		$T_{vj \text{ op}}$	-40	-	125	°C
Lagertemperatur storage temperature		T_{stg}	-40	-	125	°C
Mechanische Eigenschaften / Mechanical properties						
Gehäuse, siehe Anlage case, see appendix						
Material Modulgrundplatte material of module baseplate				Cu		
Innere Isolation internal insulation				Al_2O_3		
Kriechstrecke creepage distance				20		mm
Luftstrecke clearance distance				11		mm
CTI comperative tracking index				425		
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube / screw M6	M	3,0	-	6,0	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	Anschlüsse / terminals M6	M	2,5	-	5,0	Nm
Gewicht weight		G		340		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 belongina technical notes.						

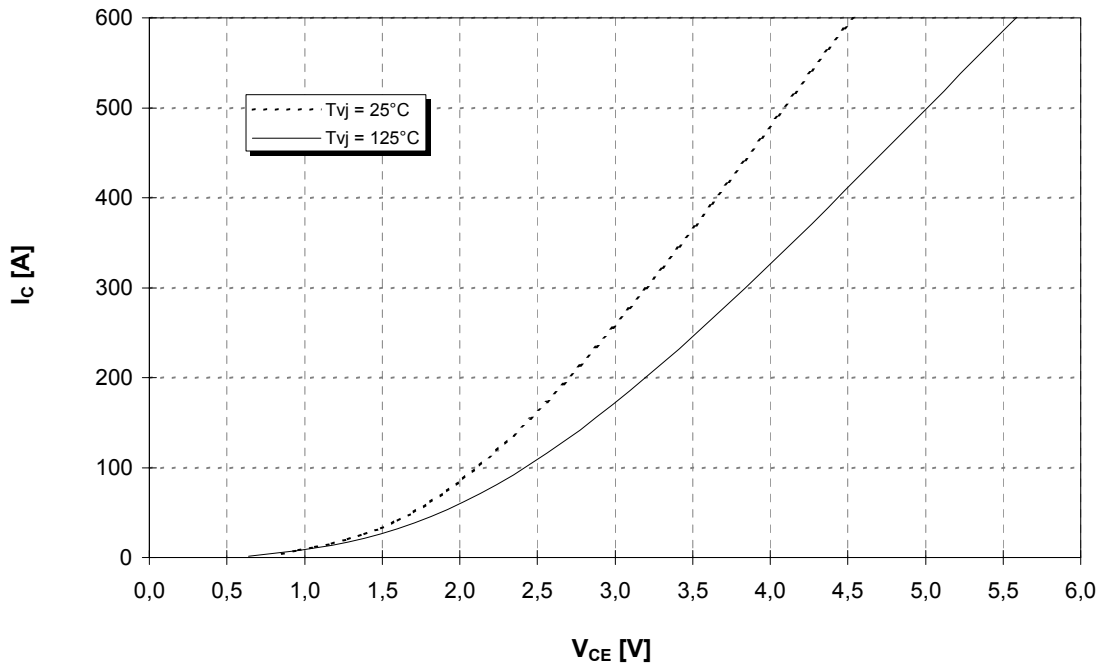


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Ausgangskennlinie (typisch)
Output characteristic (typical)

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

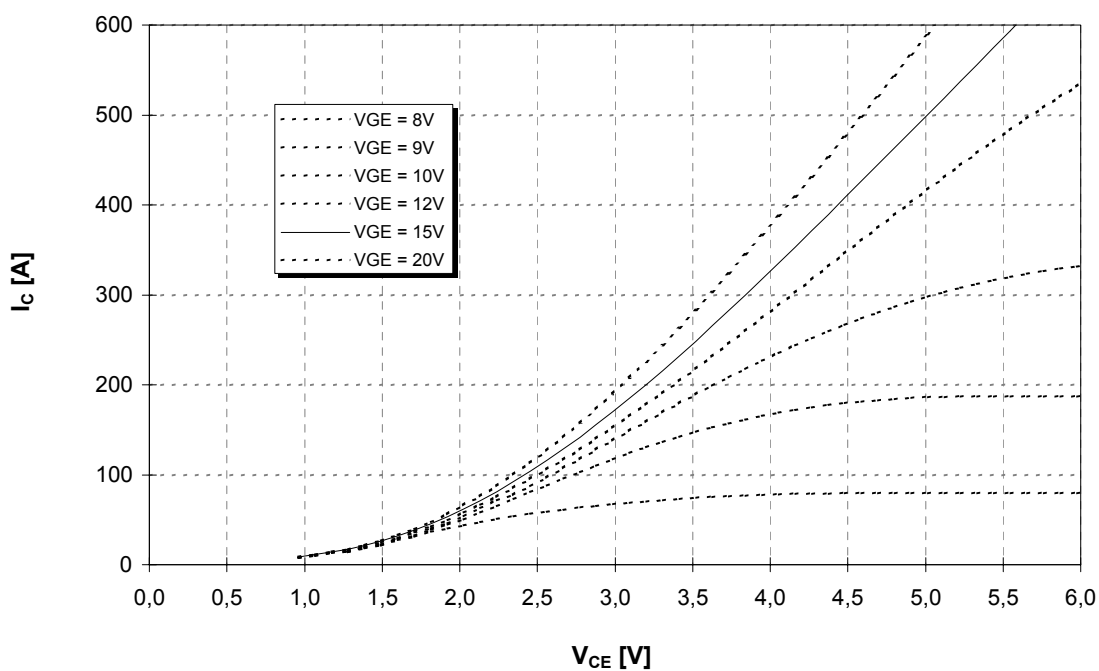
$$V_{GE} = 15V$$



Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

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

$$T_{vj} = 125^\circ C$$



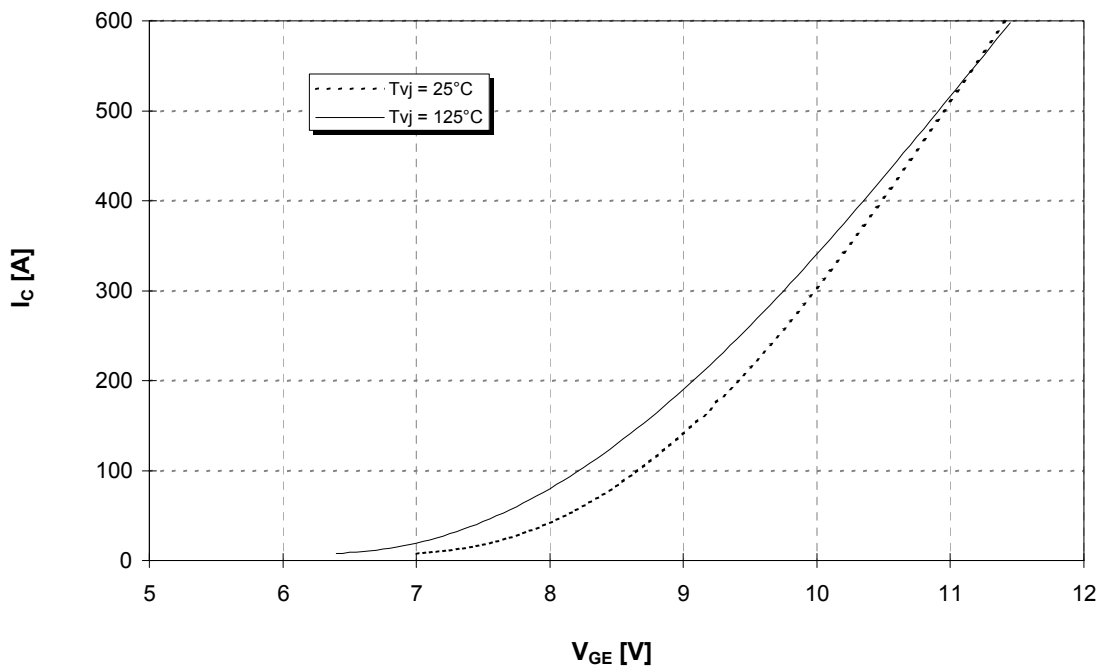


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Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

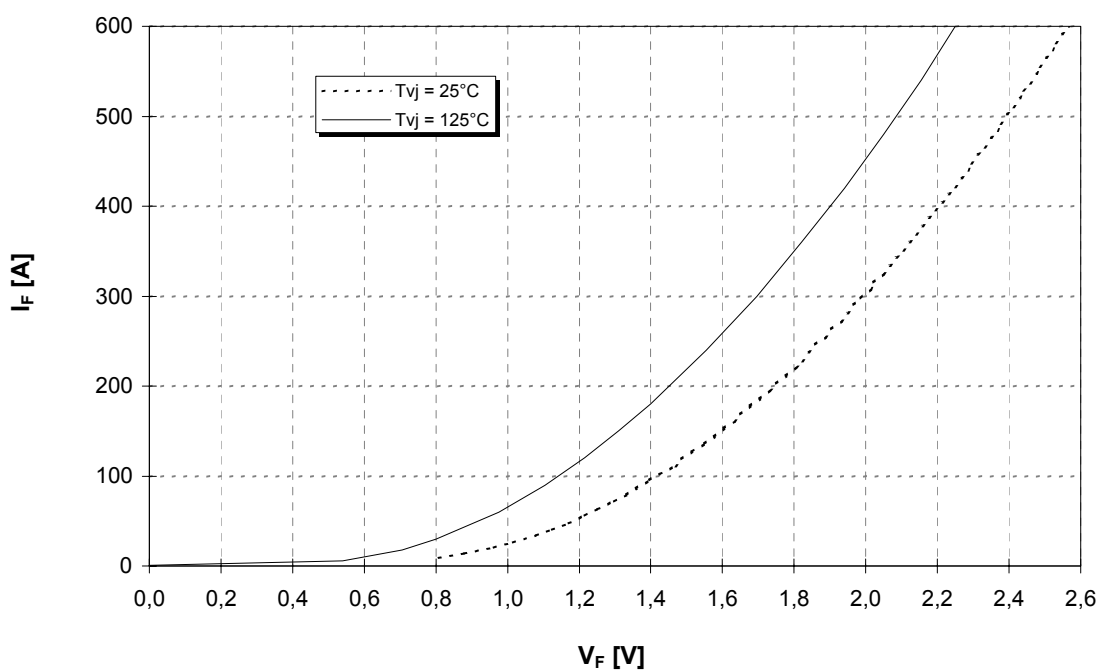
$$I_C = f(V_{GE})$$

$$V_{CE} = 20V$$



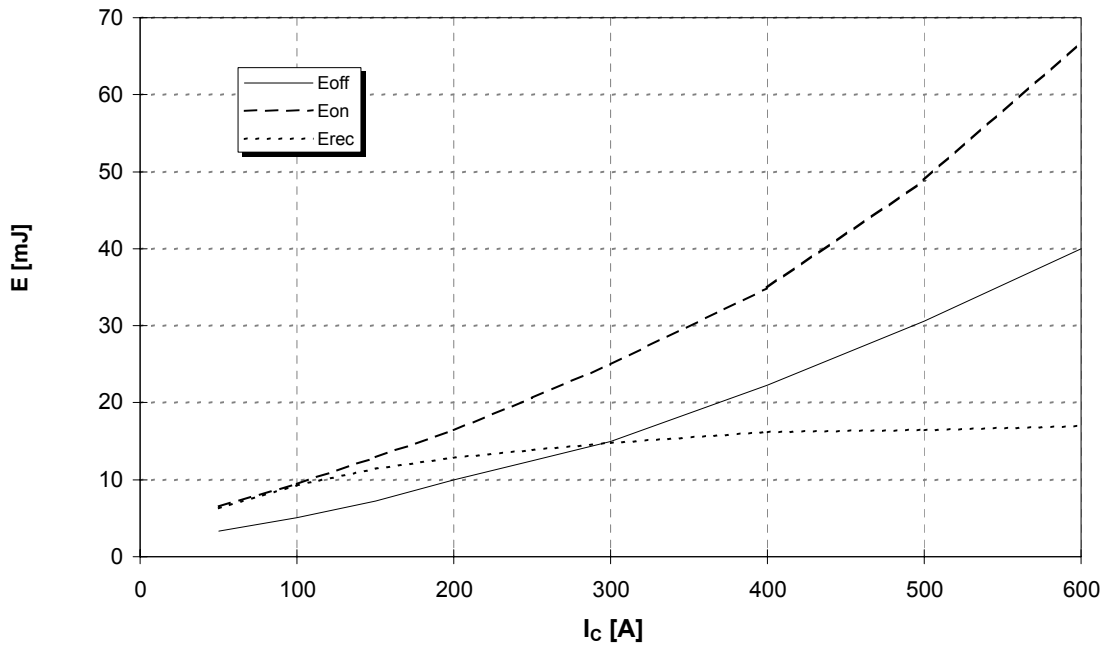
Durchlaßkennlinie der Inversdiode (typisch)
Forward characteristic of inverse diode (typical)

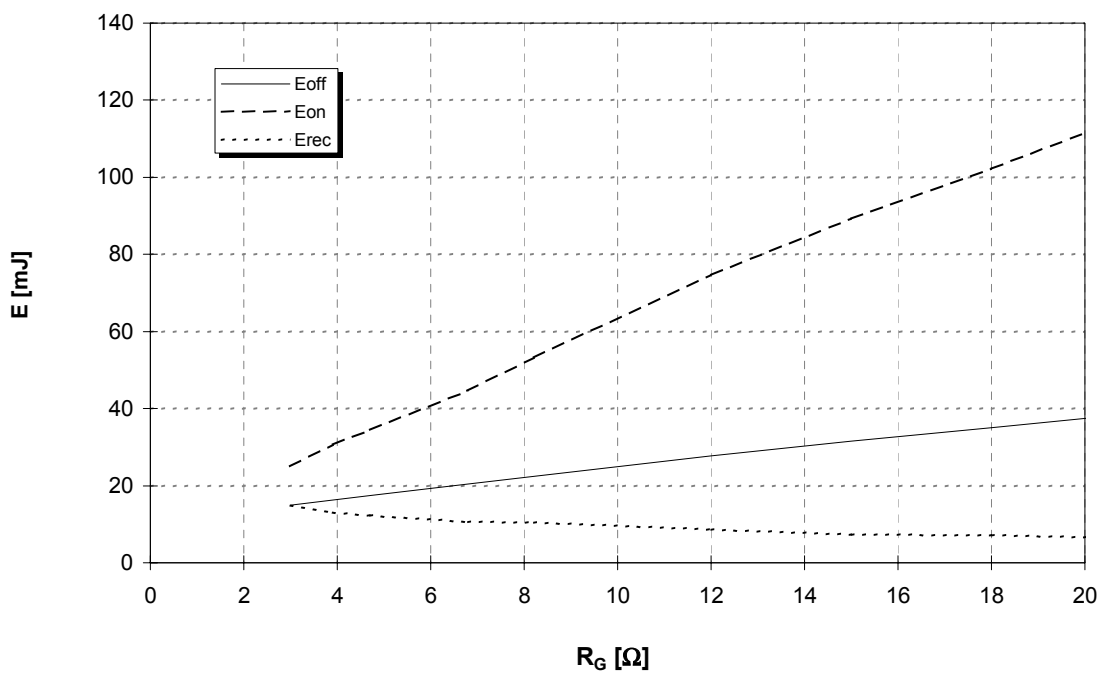
$$I_F = f(V_F)$$




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Schaltverluste (typisch)
Switching losses (typical)

 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$
 $V_{GE} = \pm 15V$, $R_G = 3,0 \Omega$, $V_{CE} = 600V$, $T_{vj} = 125^\circ C$

Schaltverluste (typisch)
Switching losses (typical)

 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
 $V_{GE} = \pm 15V$, $I_C = 300 A$, $V_{CE} = 600V$, $T_{vj} = 125^\circ C$


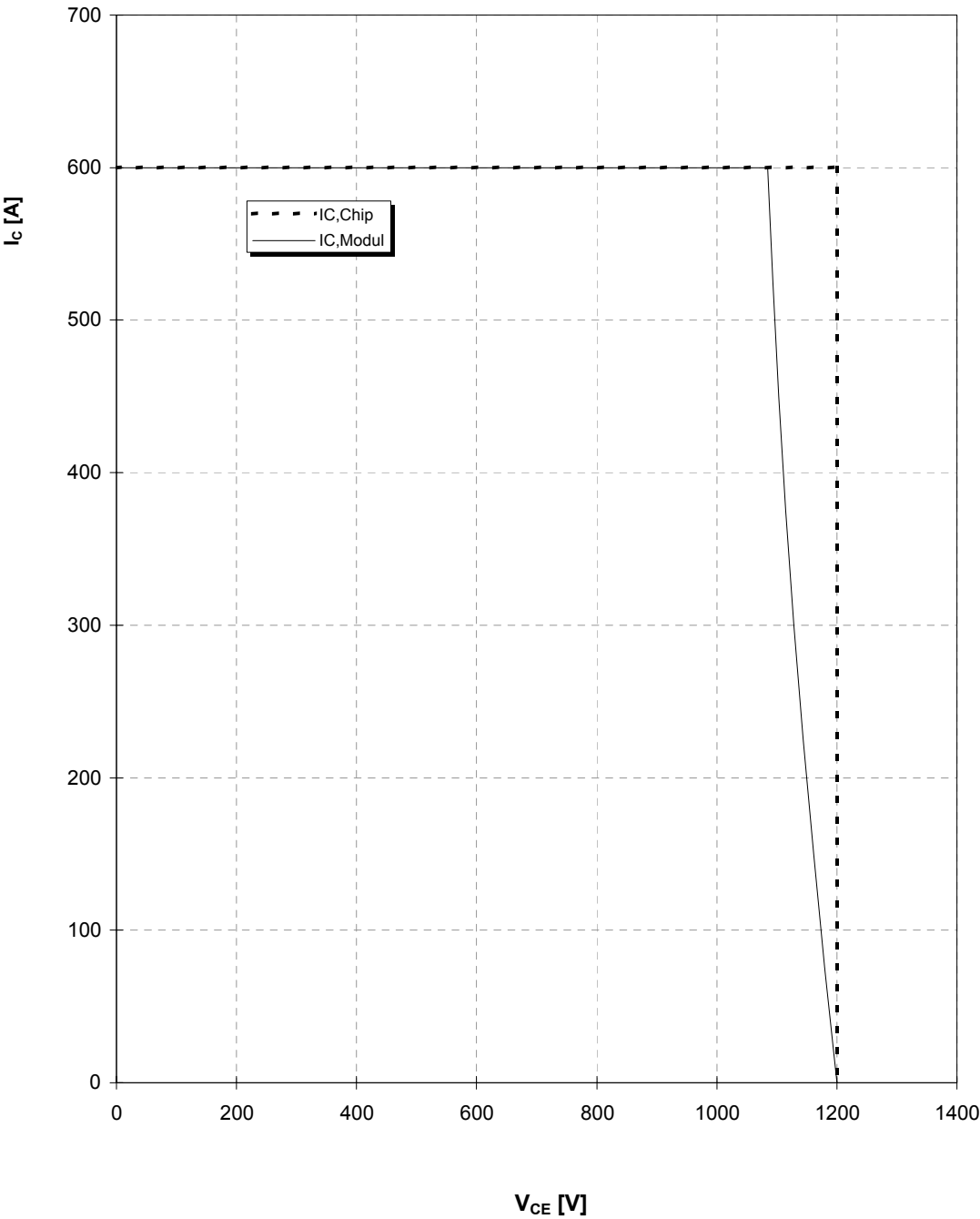


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Sicherer Arbeitsbereich IGBT (RBSOA)

$V_{GE} = \pm 15V$, $T_{vj} = 125^{\circ}C$

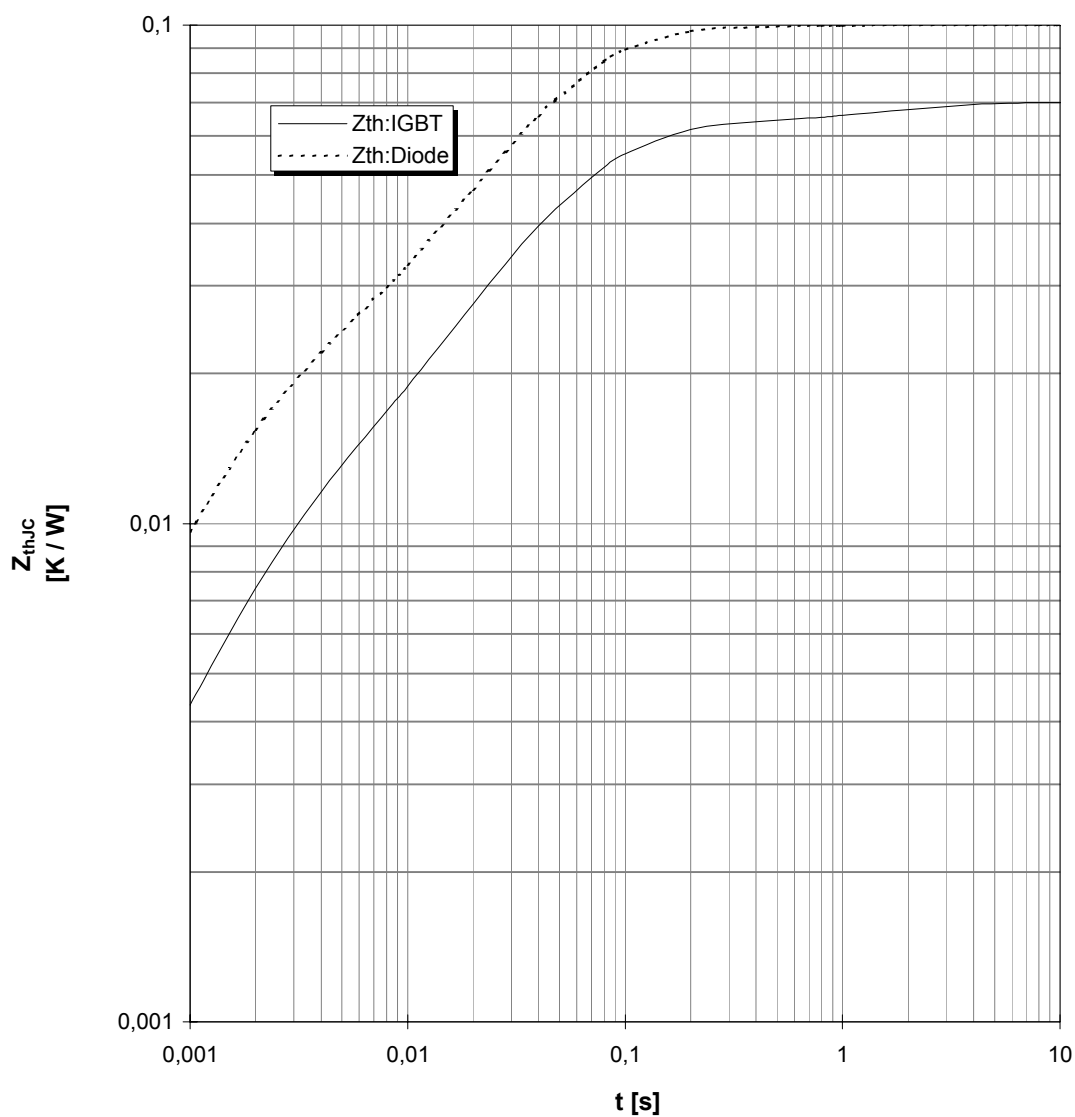
Reverse bias safe operation area IGBT (RBSOA)



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Transienter Wärmewiderstand
Transient thermal impedance

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

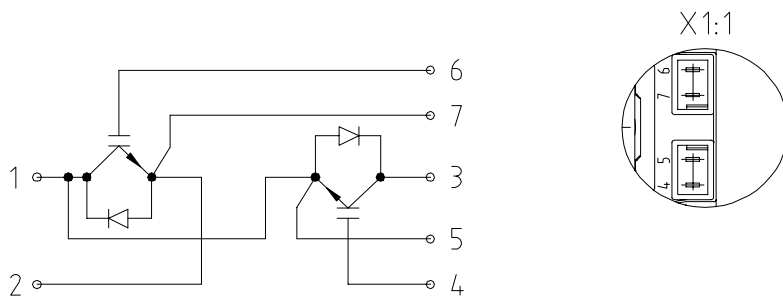
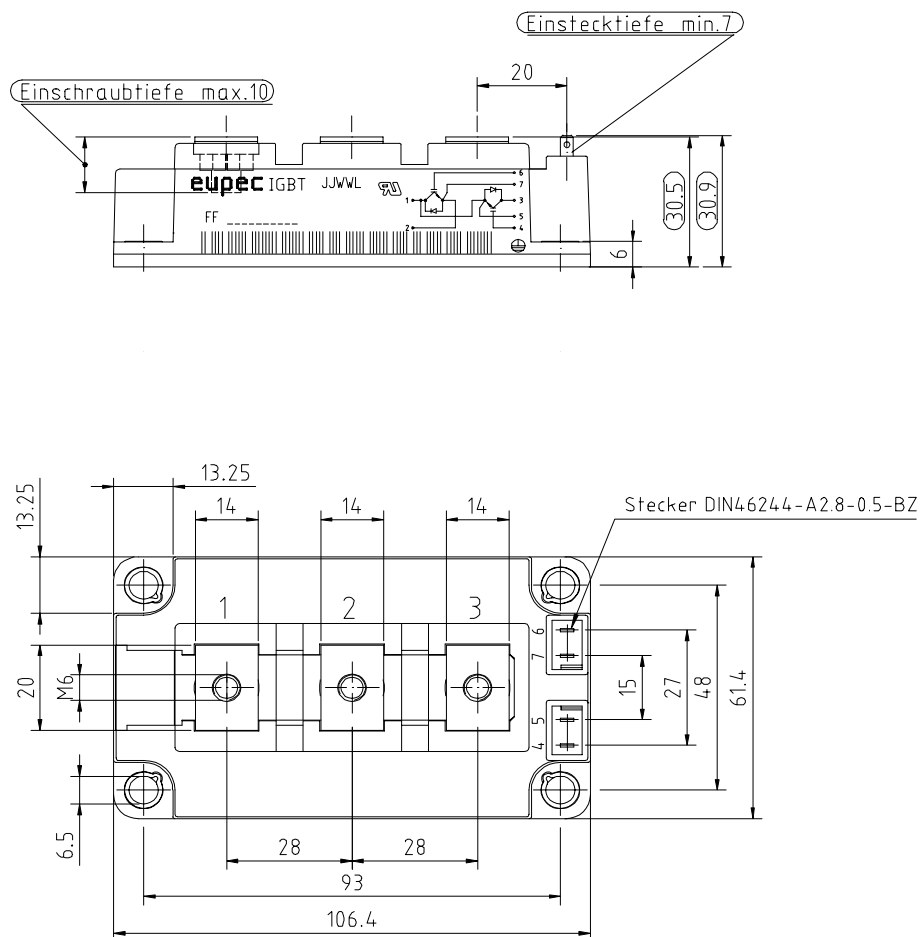


i	1	2	3	4
r_i [K/kW] : IGBT	7,16	21,67	28,23	6,94
τ_i [s] : IGBT	0,0020	0,0300	0,0660	1,6550
r_i [K/kW] : Diode	15,47	40,66	41,90	1,97
τ_i [s] : Diode	0,0015	0,0327	0,0561	0,3872



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Gehäusemaße / Schaltbild
Package outline / Circuit diagram



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