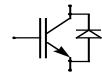


Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FZ 1200 R 33 KF2

eupec



Datenblatt data sheet

Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_J = 25^{\circ}\text{C}$ $T_J = -25^{\circ}\text{C}$	V_{CES}	3300 3300	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{\text{C,nom.}}$ I_{C}	1200 2000	A 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}	14,7	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	$V_R = 0\text{V}$, $t_p = 10\text{ms}$, $T_{\text{vj}} = 125^{\circ}\text{C}$	I^2t	500.000	A^2s
Spitzenverlustleistung der Diode maximum power dissipation diode	$T_J = 125^{\circ}\text{C}$	P_{RQM}	1.200	kW
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min.}$	V_{ISOL}	6.000	V
Teilentladungs-Aussetzspannung partial discharge extinction voltage	RMS, $f = 50 \text{ Hz}$, $Q_{\text{PD}} \leq 10 \text{ pC}$ (acc. to IEC 1287)	V_{ISOL}	2.600	V

Charakteristische Werte / Characteristic values

Transistor / Transistor

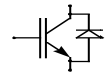
			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_{\text{C}} = 1200\text{A}$, $V_{\text{GE}} = 15\text{V}$, $T_{\text{vj}} = 25^{\circ}\text{C}$	$V_{\text{CE sat}}$	-	3,40	4,25	V
	$I_{\text{C}} = 1200\text{A}$, $V_{\text{GE}} = 15\text{V}$, $T_{\text{vj}} = 125^{\circ}\text{C}$		-	4,30	5,00	V
Gate-Schwellenspannung gate threshold voltage	$I_{\text{C}} = 120 \text{ mA}$, $V_{\text{CE}} = V_{\text{GE}}$, $T_{\text{vj}} = 25^{\circ}\text{C}$	$V_{\text{GE(th)}}$	4,2	5,1	6,0	V
Eingangskapazität input capacitance	$f = 1\text{MHz}$, $T_{\text{vj}} = 25^{\circ}\text{C}$, $V_{\text{CE}} = 25\text{V}$, $V_{\text{GE}} = 0\text{V}$	C_{ies}	-	150	-	nF
Rückwirkungskapazität reverse transfer capacitance	$f = 1\text{MHz}$, $T_{\text{vj}} = 25^{\circ}\text{C}$, $V_{\text{CE}} = 25\text{V}$, $V_{\text{GE}} = 0\text{V}$	C_{res}	-	8	-	nF
Gateladung gate charge	$V_{\text{GE}} = -15\text{V} \dots +15\text{V}$, $V_{\text{CE}} = 1800\text{V}$	Q_{G}	-	22	-	μC
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{\text{CE}} = 3300\text{V}$, $V_{\text{GE}} = 0\text{V}$, $T_{\text{vj}} = 25^{\circ}\text{C}$	I_{CES}	-	0,15	12	mA
	$V_{\text{CE}} = 3300\text{V}$, $V_{\text{GE}} = 0\text{V}$, $T_{\text{vj}} = 125^{\circ}\text{C}$		-	60	150	mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{\text{CE}} = 0\text{V}$, $V_{\text{GE}} = 20\text{V}$, $T_{\text{vj}} = 25^{\circ}\text{C}$	I_{GES}	-	-	400	nA

prepared by: Jürgen Göttert

date of publication : 08.06.99

approved by: Chr. Lübke; 20.07.99

revision: 3

Datenblatt
data sheet

Charakteristische Werte / Characteristic values

Transistor / Transistor

min. typ. max.

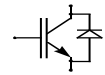
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}$	$t_{d,on}$	-	370	-	ns
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}$					ns
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}$	t_r	-	250	-	ns
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}$					ns
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}$	$t_{d,off}$	-	1550	-	ns
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}$					ns
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}$	t_f	-	200	-	ns
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 25^\circ\text{C}$					
	$V_{GE} = \pm 15\text{ V}, R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}$					ns
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}, V_{GE} = 15\text{ V}$	E_{on}	-	2880	-	mWs
	$R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}, L_S = 40\text{ nH}$					
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 1200\text{ A}, V_{CC} = 1800\text{ V}, V_{GE} = 15\text{ V}$	E_{off}	-	1530	-	mWs
	$R_G = 1,2\ \Omega, C_{GE} = 220\text{ nF}, T_{vj} = 125^\circ\text{C}, L_S = 40\text{ nH}$					
Kurzschlußverhalten SC Data	$t_p \leq 10\ \mu\text{sec}, V_{GE} \leq 15\text{ V}$	I_{SC}	-	6000	-	A
	$T_{vj} \leq 125^\circ\text{C}, V_{CC} = 2500\text{ V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$					
Modulinduktivität stray inductance module		L_{sCE}	-	10	-	nH
Modul-Leitungswiderstand, Anschlüsse - Chip lead resistance, terminals - chip	$T = 25^\circ\text{C}$	$R_{CC'+EE'}$	-	0,12	-	mΩ

Charakteristische Werte / Characteristic values

Diode / Diode

min. typ. max.

Durchlaßspannung forward voltage	$I_F = 1200\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 25^\circ\text{C}$	V_F	-	2,80	3,50	V
	$I_F = 1200\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 125^\circ\text{C}$					
Rückstromspitze peak reverse recovery current	$I_F = 1200\text{ A}, -di_F/dt = 3800\text{ A}/\mu\text{sec}$	I_{RM}	-	1025	-	A
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 125^\circ\text{C}$					A
Sperrverzögerungsladung recovered charge	$I_F = 1200\text{ A}, -di_F/dt = 3800\text{ A}/\mu\text{sec}$	Q_r	-	710	-	μAs
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 125^\circ\text{C}$					μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = 1200\text{ A}, -di_F/dt = 3800\text{ A}/\mu\text{sec}$	E_{rec}	-	730	-	mWs
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 25^\circ\text{C}$					
	$V_R = 1800\text{ V}, V_{GE} = -10\text{ V}, T_{vj} = 125^\circ\text{C}$					mWs

Datenblatt
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Thermische Eigenschaften / Thermal properties

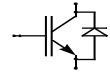
			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	R_{thJC}	-	-	0,0085	K/W
	Diode/Diode, DC		-	-	0,0170	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $\lambda_{paste} = 1 \text{ W/m}^2\text{K} / \lambda_{grease} = 1 \text{ W/m}^2\text{K}$	R_{thCK}	-	0,004	-	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				
Material Modulgrundplatte material of module baseplate			AlSiC	
Innere Isolation internal insulation			AlN	
Kriechstrecke creepage distance			32,2	mm
Luftstrecke clearance			19,1	mm
CTI comperative tracking index			> 400	
Anzugsdrehmoment f. mech. Befestigung mounting torque		M1	5	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	terminals M4	M2	2	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.

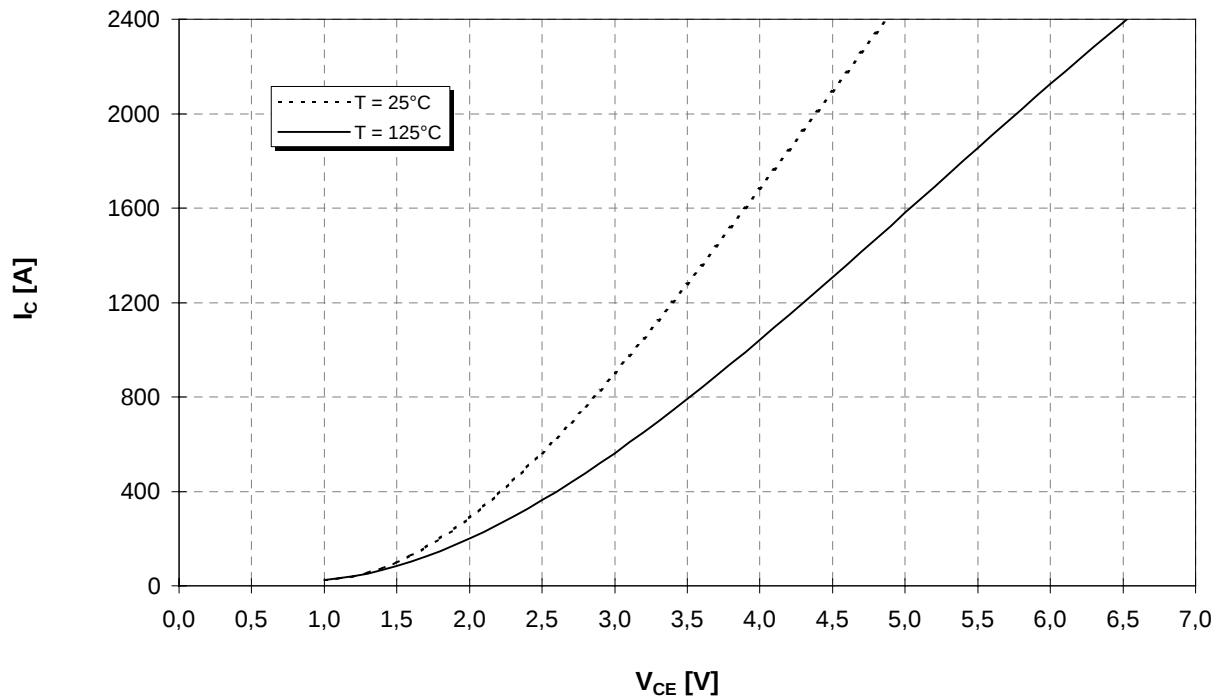


Datenblatt
data sheet

Ausgangskennlinie (typisch)
Output characteristic (typical)

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

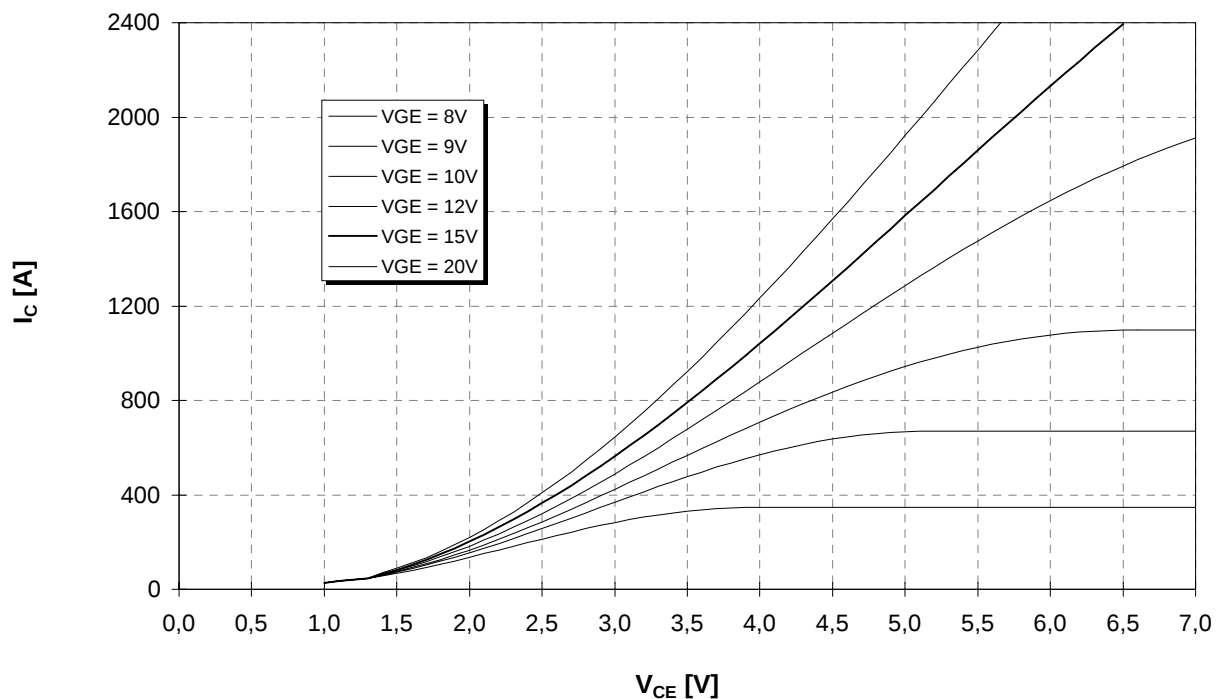
$V_{GE} = 15V$

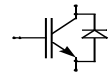


Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

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

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



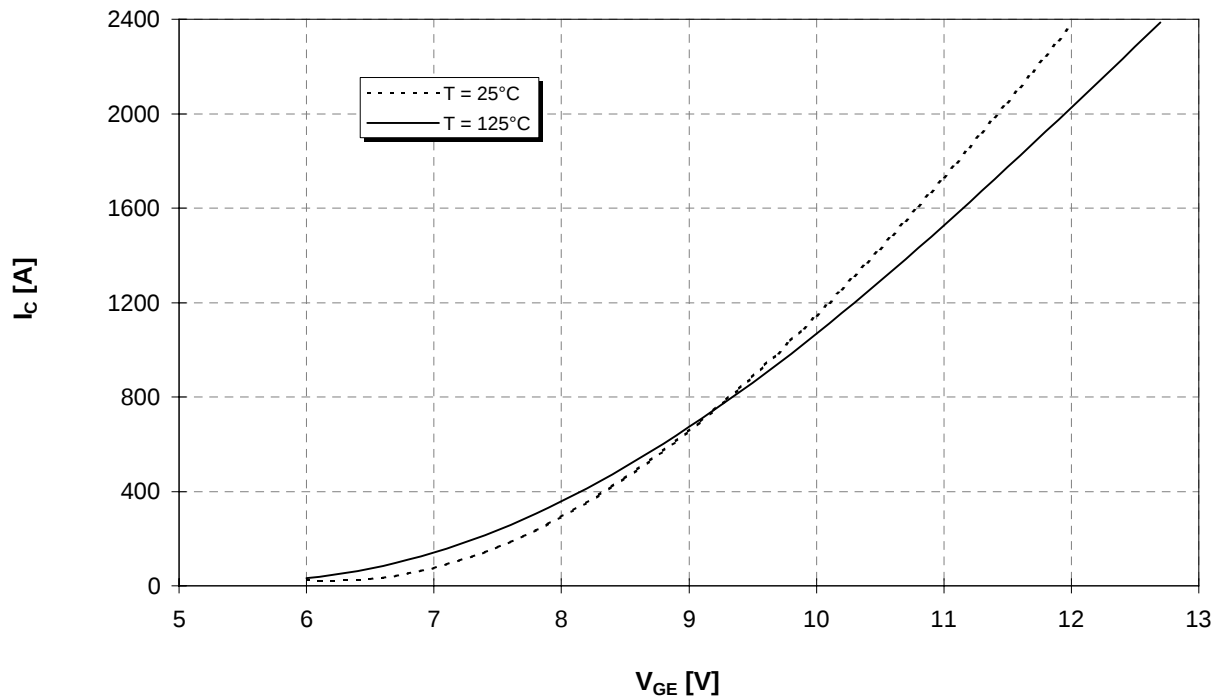


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Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

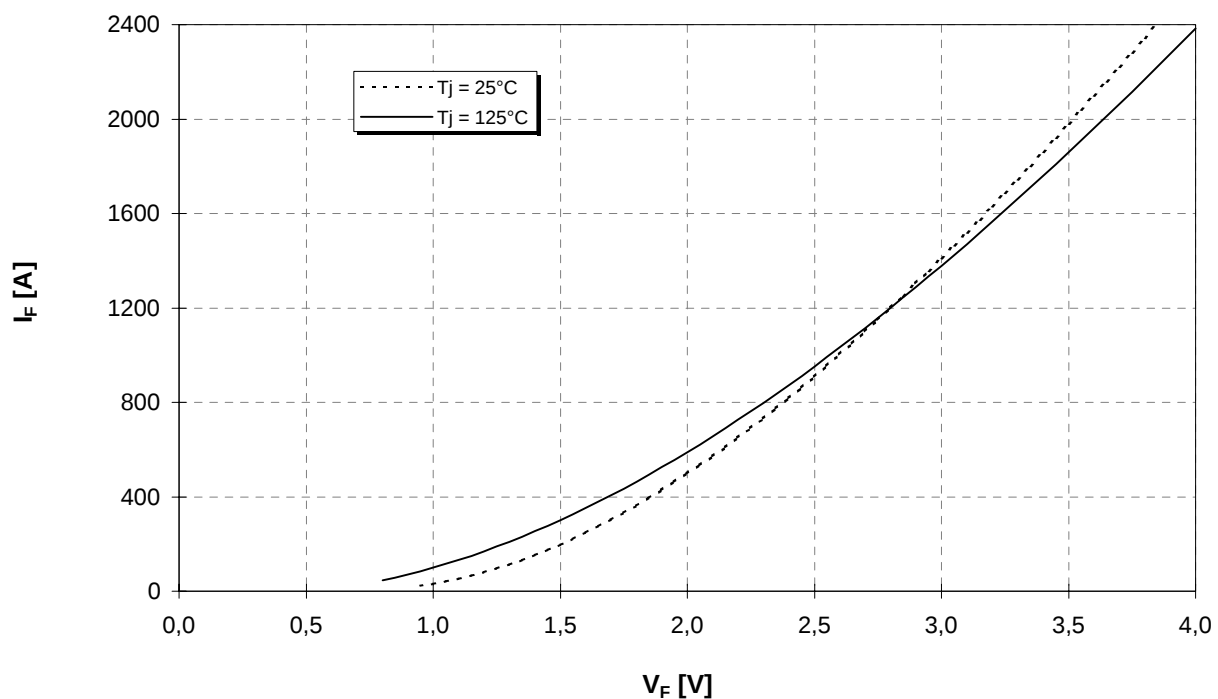
$$I_C = f(V_{GE})$$

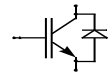
$$V_{CE} = 20V$$



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

$$I_F = f(V_F)$$

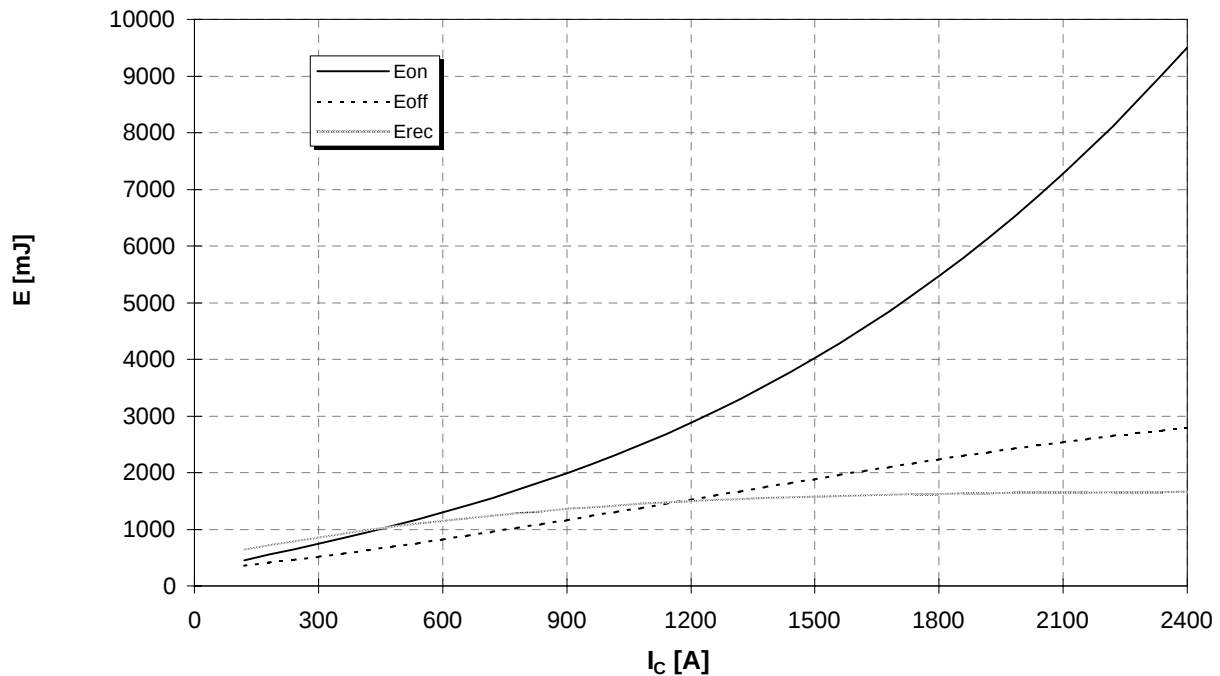



Datenblatt
data sheet

Schaltverluste (typisch)
Switching losses (typical)

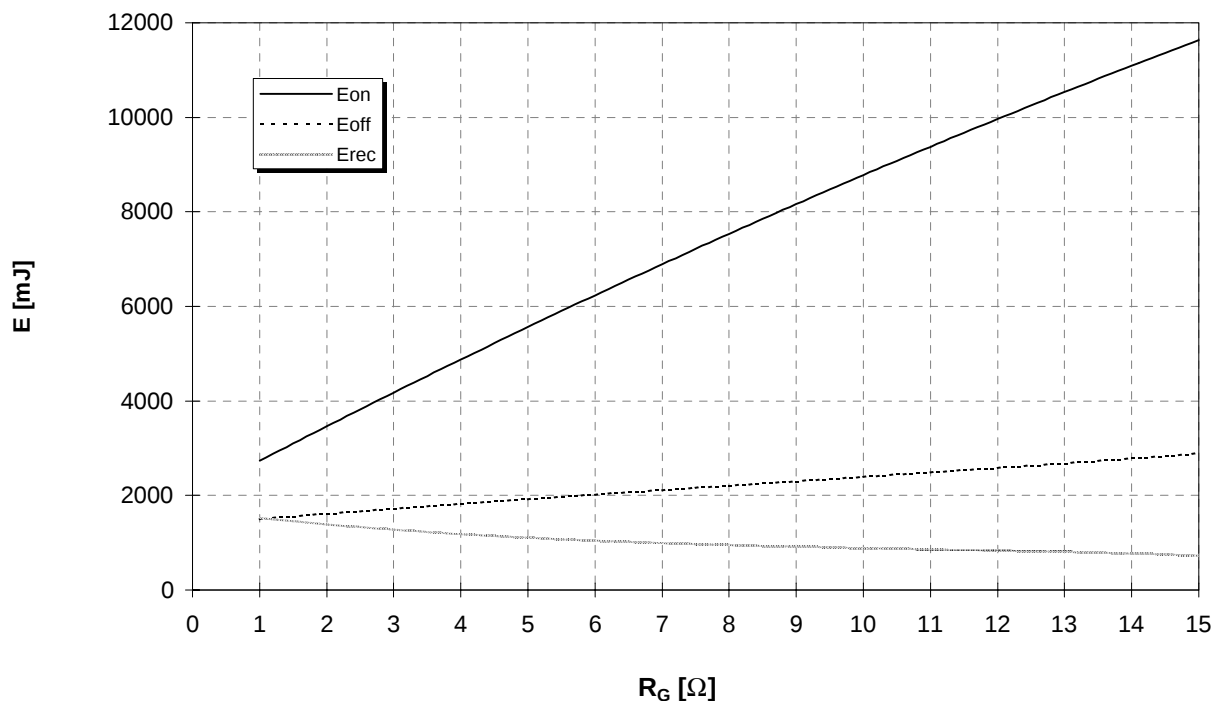
$$E_{on} = f(I_C), E_{off} = f(I_C), E_{rec} = f(I_C)$$

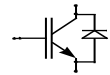
$$R_{G,on} = 1,2 \, \Omega, R_{G,off} = 1,2 \, \Omega, C_{GE} = 220 \, \text{nF}, V_{CE} = 1800 \, \text{V}, T_J = 125^\circ\text{C}$$


Schaltverluste (typisch)
Switching losses (typical)

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

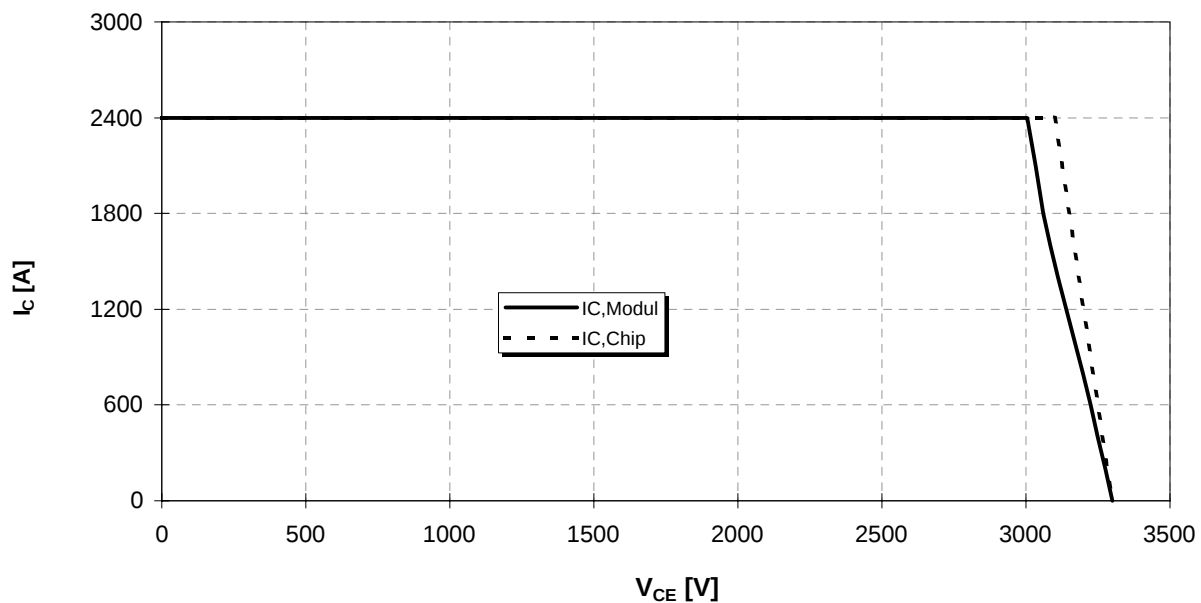
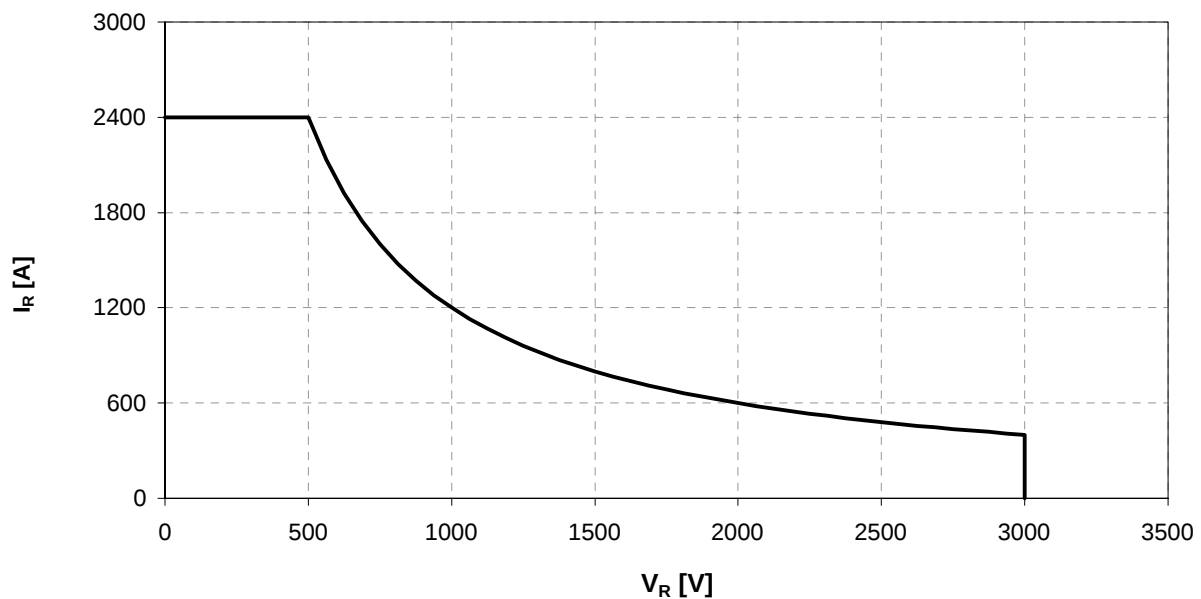
$$I_C = 1200 \, \text{A}, C_{GE} = 220 \, \text{nF}, V_{CE} = 1800 \, \text{V}, T_J = 125^\circ\text{C}$$

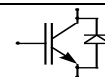


Datenblatt
data sheet

Sicherer Arbeitsbereich IGBT (RBSOA)

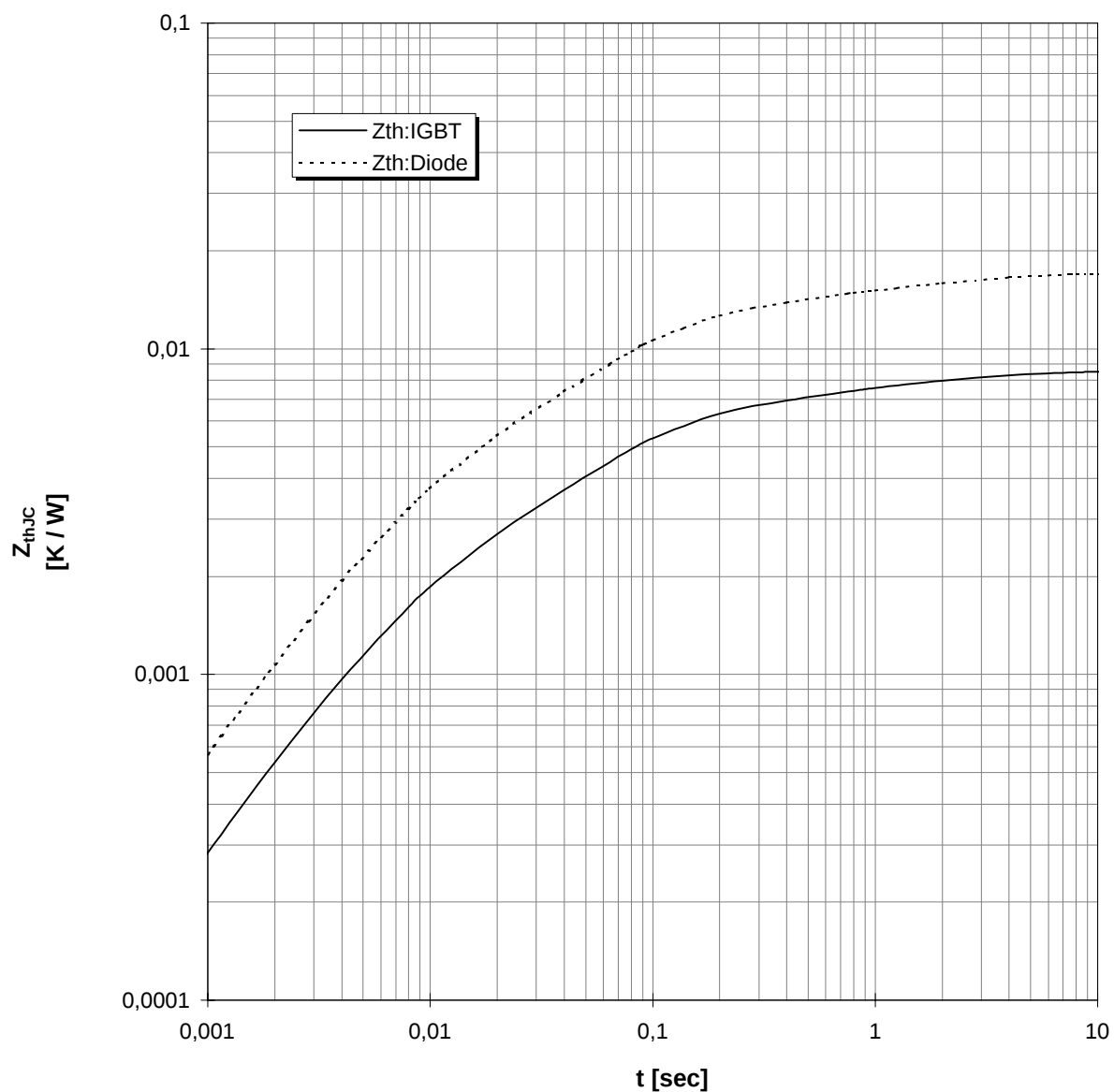
Reverse bias safe operation area IGBT (RBSOA)

 $R_{G,off} = 1,2 \, \Omega$, $C_{GE} = 220 \, \text{nF}$ $T_{vj} = 125^\circ\text{C}$ Sicherer Arbeitsbereich Diode (SOA)
safe operation area Diode (SOA) $T_{vj} = 125^\circ\text{C}$ 

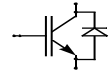


Transienter Wärmewiderstand
Transient thermal impedance

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



i	1	2	3	4
r_i [K/kW] : IGBT	1,56	4,25	1,26	1,44
τ_i [sec] : IGBT	0,0068	0,0642	0,3209	2,0212
r_i [K/kW] : Diode	3,11	8,49	2,52	2,88
τ_i [sec] : Diode	0,0068	0,0642	0,3209	2,0212



Gehäusemaße / Schaltbild
Package outline / Circuit diagram

