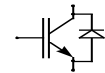


Technische Information / Technical Information

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_{ROM}	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

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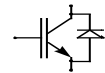
revision: 3

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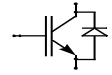
Datenblatt data sheet

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
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 25^\circ \text{ C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}$					
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 1200 \text{ A}, V_{CC} = 1800 \text{ V}$	t_r	-	250	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 25^\circ \text{ C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}$					
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 1200 \text{ A}, V_{CC} = 1800 \text{ V}$	$t_{d,off}$	-	1550	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 25^\circ \text{ C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}$					
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 1200 \text{ A}, V_{CC} = 1800 \text{ V}$	t_f	-	200	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 25^\circ \text{ C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}$					
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 1200 \text{ A}, V_{CC} = 1800 \text{ V}, V_{GE} = 15 \text{ V}$ $R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}, L_S = 40 \text{ nH}$	E_{on}	-	2880	-	mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 1200 \text{ A}, V_{CC} = 1800 \text{ V}, V_{GE} = 15 \text{ V}$ $R_G = 1,2 \Omega, C_{GE} = 220 \text{ nF}, T_{vj} = 125^\circ \text{ C}, L_S = 40 \text{ nH}$	E_{off}	-	1530	-	mWs
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

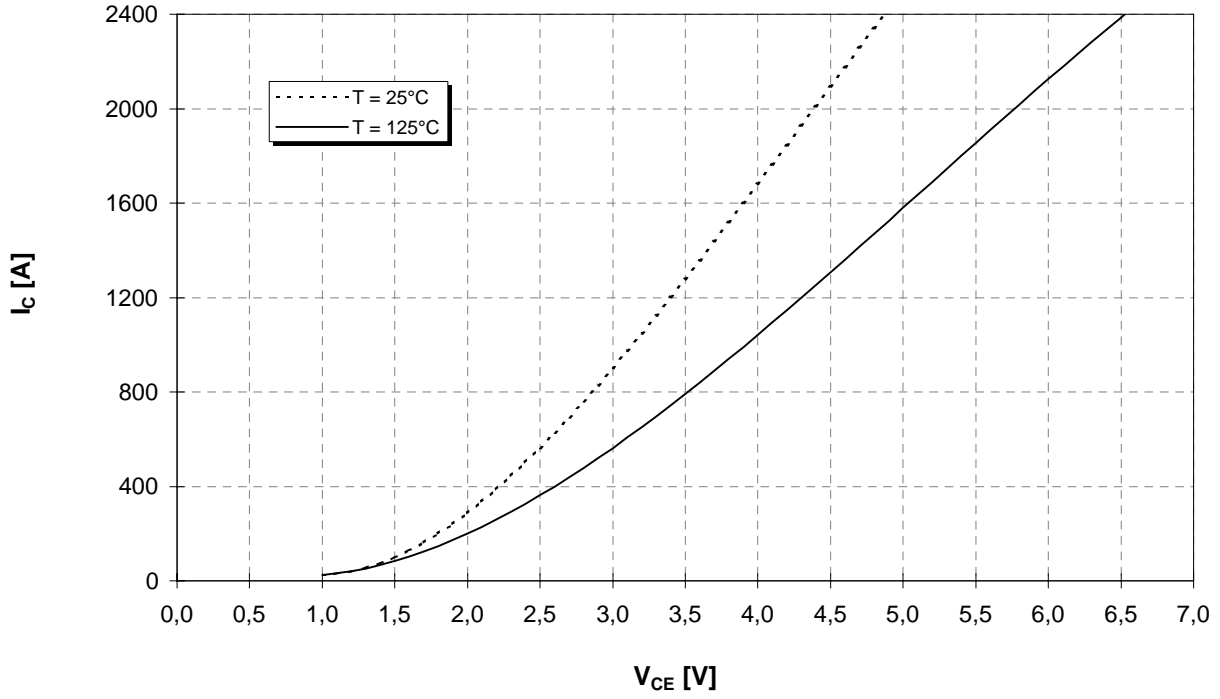
Diode / Diode			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 1200 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^\circ \text{ C}$	V_F	-	2,80	3,50	V
	$I_F = 1200 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^\circ \text{ C}$					
Rückstromspitze peak reverse recovery current	$I_F = 1200 \text{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



Datenblatt
data sheet

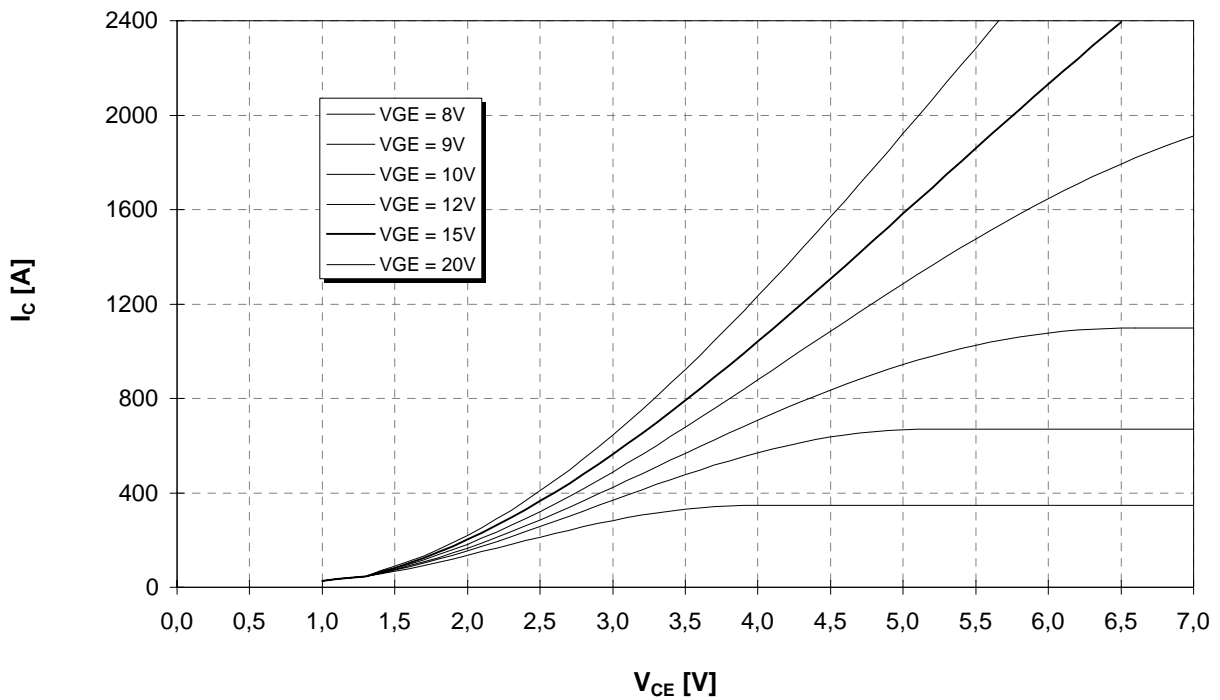
Ausgangskennlinie (typisch)
Output characteristic (typical)

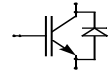
$I_C = f(V_{CE})$
 $V_{GE} = 15V$



Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 125^\circ C$

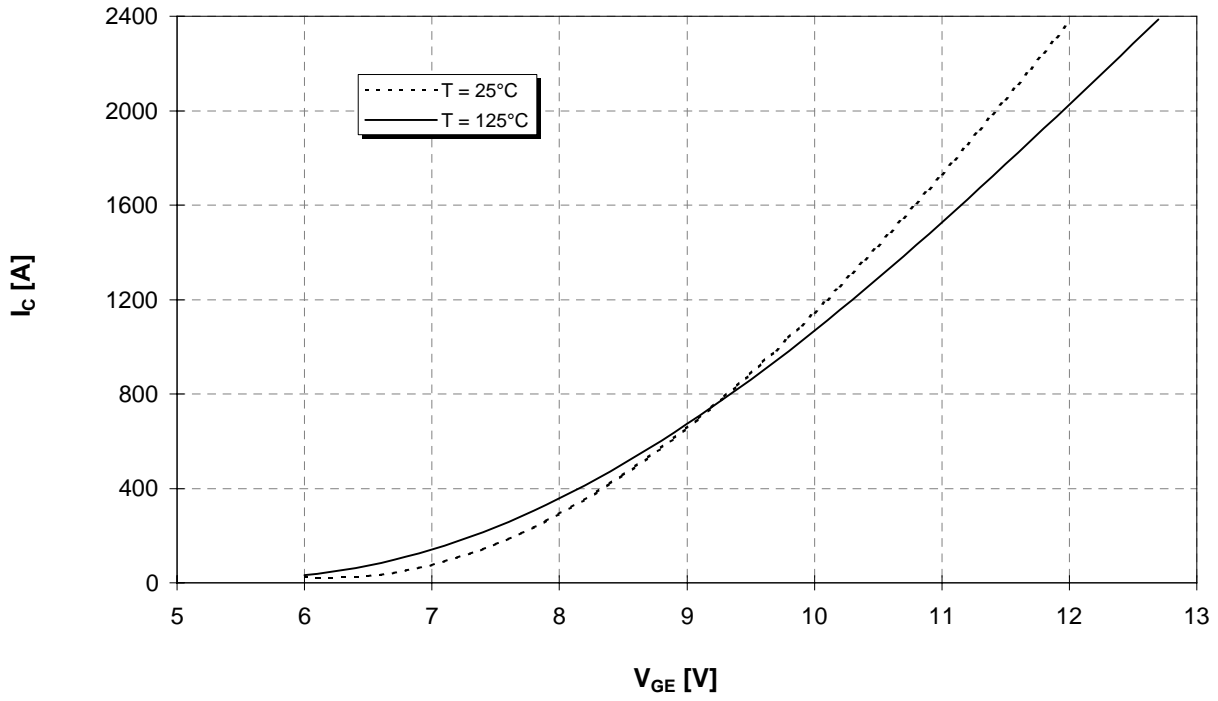




Datenblatt
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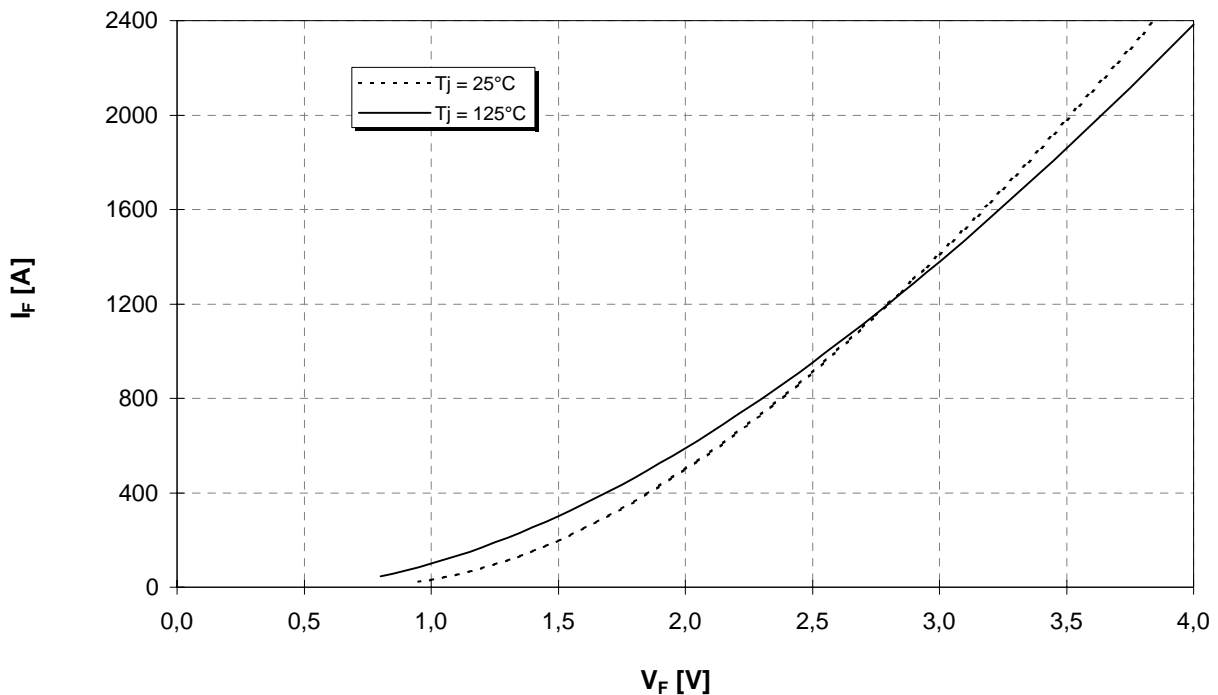
Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

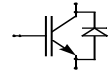
$I_C = f(V_{GE})$
 $V_{CE} = 20V$



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

$I_F = f(V_F)$

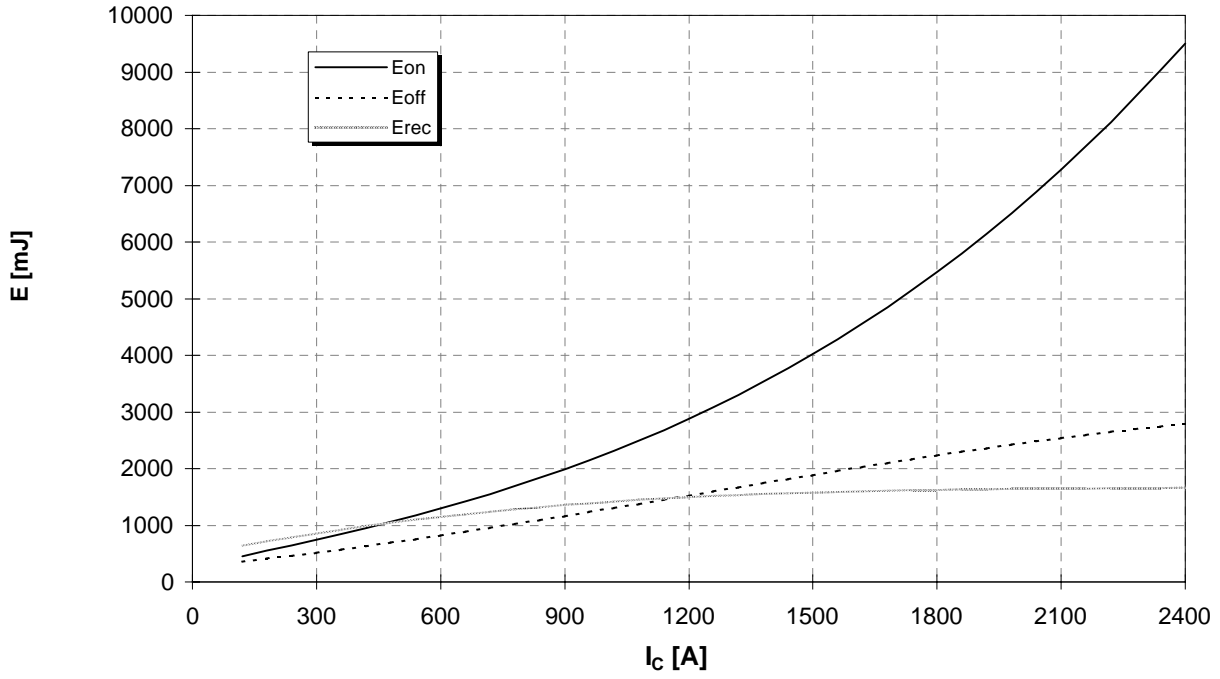




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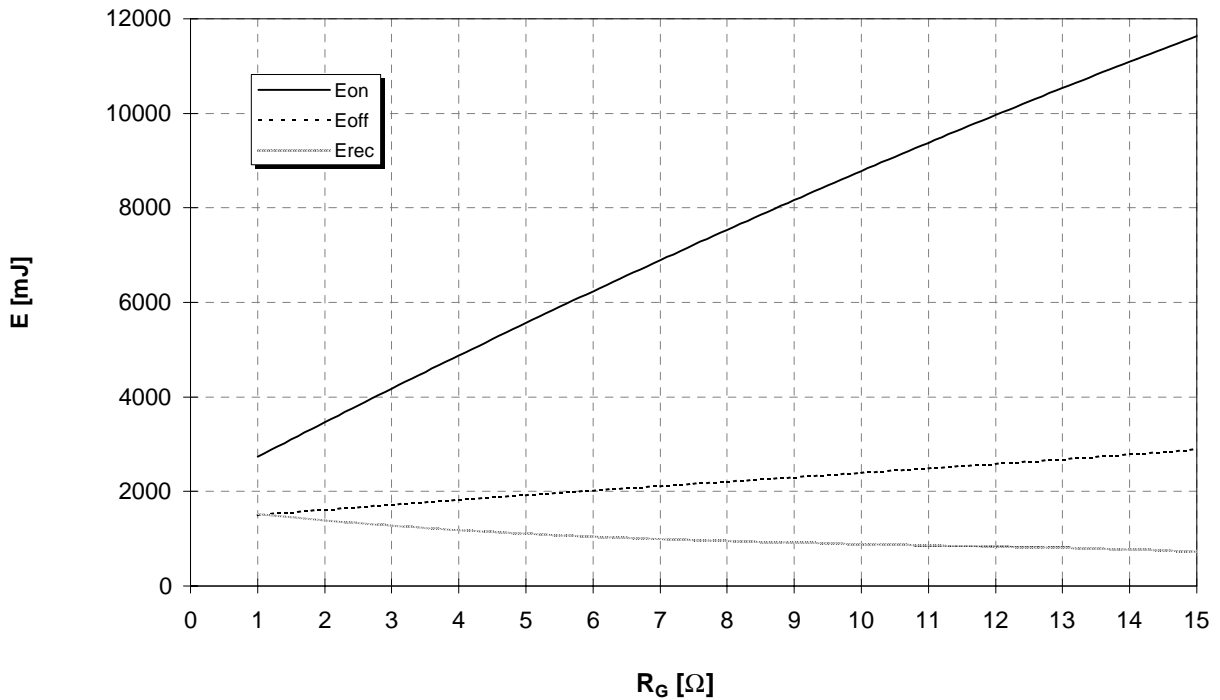
Schaltverluste (typisch)
Switching losses (typical)

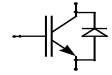
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$, $E_{rec} = f(I_C)$
 $R_{G,on} = 1,2 \Omega$, $R_{G,off} = 1,2 \Omega$, $C_{GE} = 220 \text{ nF}$, $V_{CE} = 1800\text{V}$, $T_J = 125^\circ\text{C}$



Schaltverluste (typisch)
Switching losses (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$, $E_{rec} = f(R_G)$
 $I_C = 1200 \text{ A}$, $C_{GE} = 220 \text{ nF}$, $V_{CE} = 1800\text{V}$, $T_J = 125^\circ\text{C}$



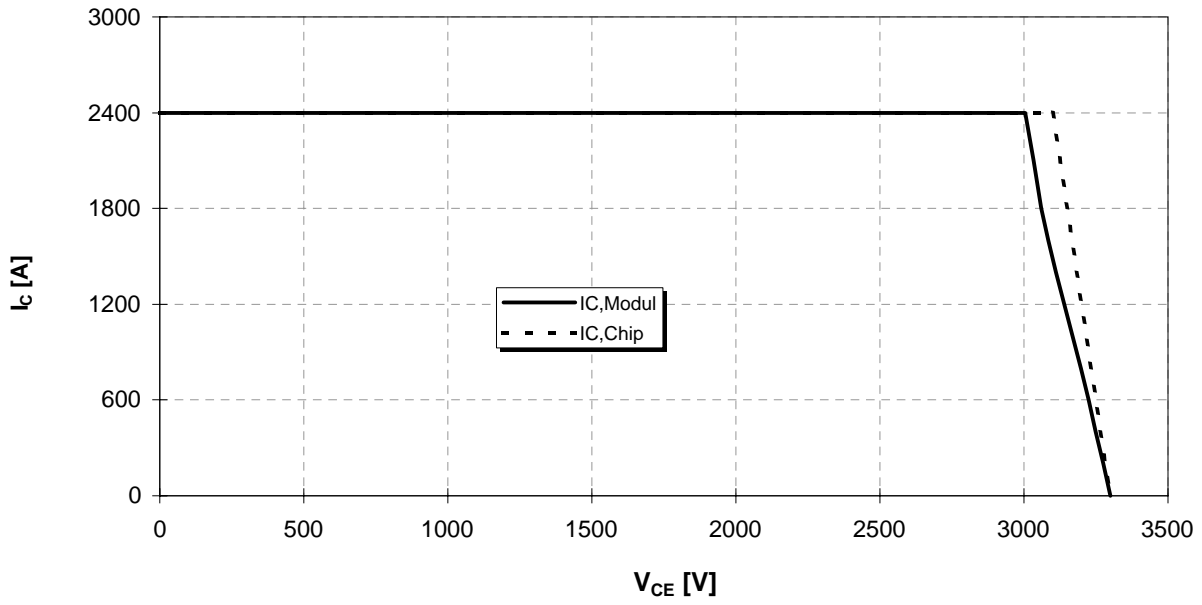


Sicherer Arbeitsbereich IGBT (RBSOA)

Reverse bias safe operation area IGBT (RBSOA)

$R_{G,off} = 1,2 \Omega$, $C_{GE} = 220 \text{ nF}$

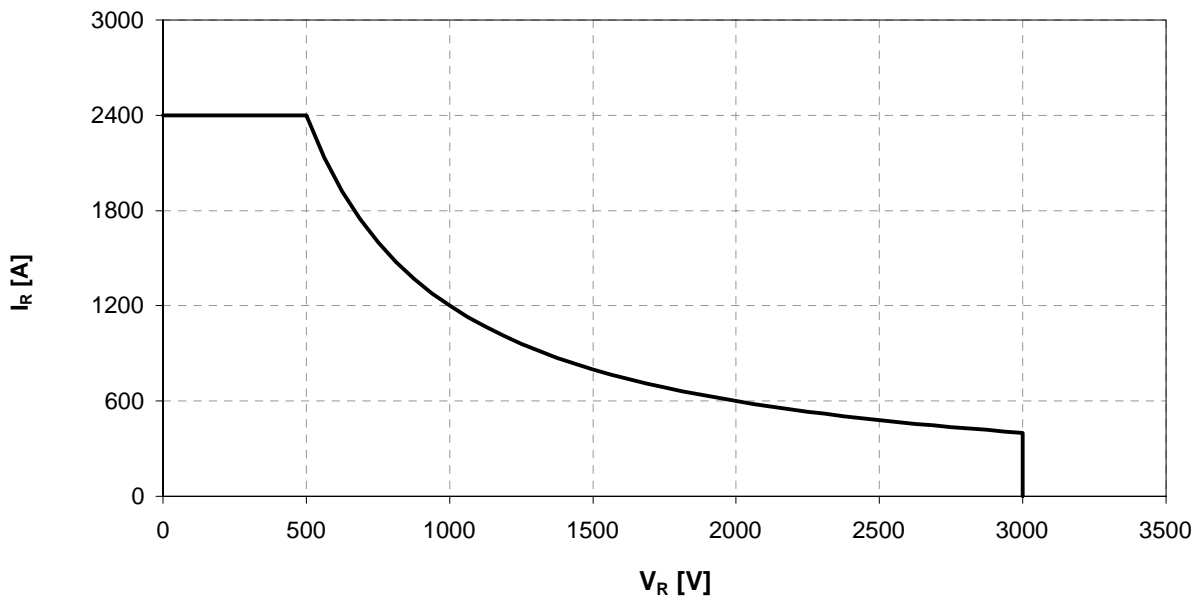
$T_{vj} = 125^\circ\text{C}$

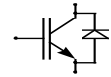


Sicherer Arbeitsbereich Diode (SOA)

safe operation area Diode (SOA)

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

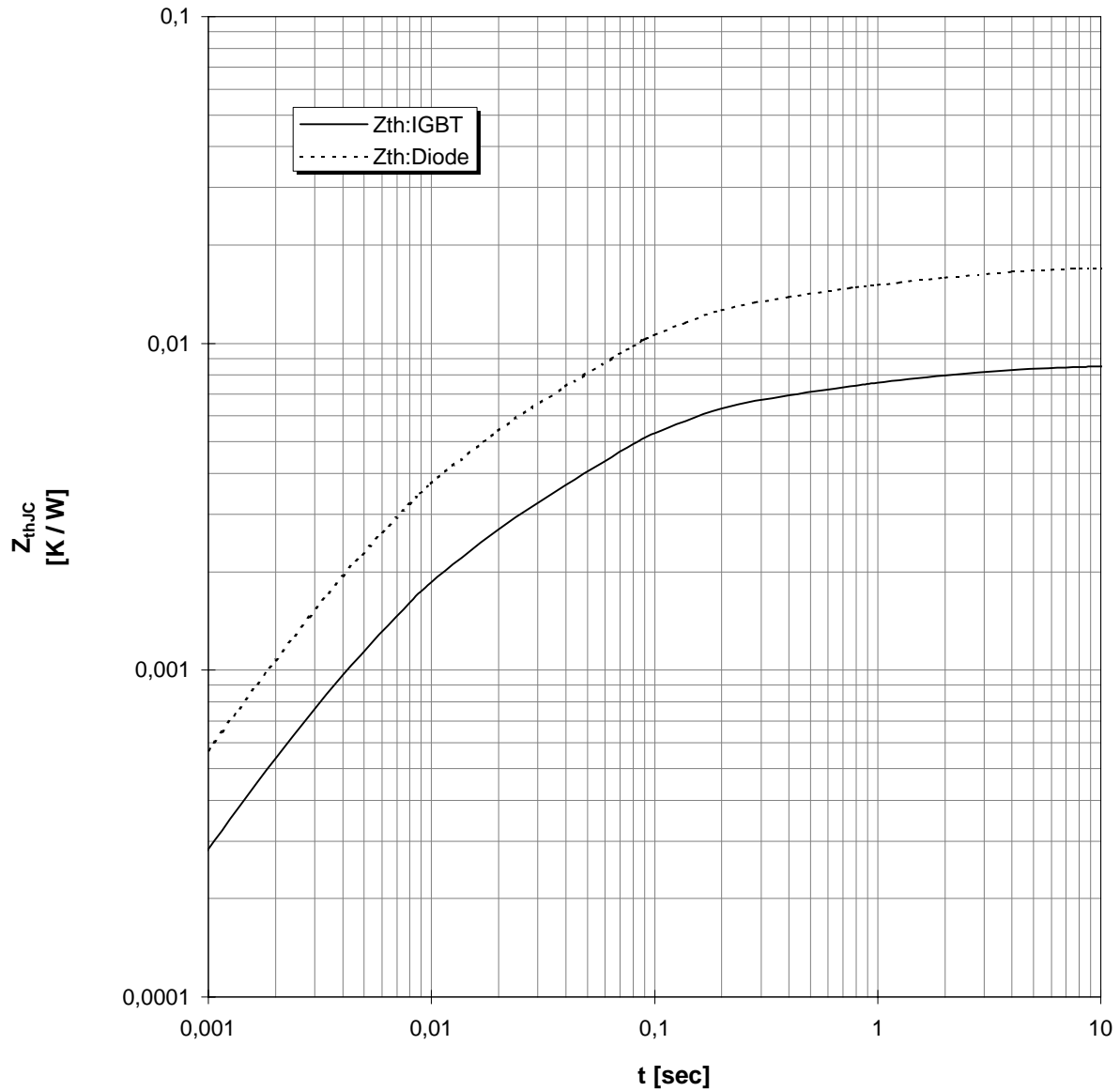




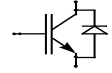
Datenblatt
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Transienter Wärmewiderstand
Transient thermal impedance

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



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

