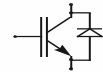


Technische Information / Technical Information

IGBT-Module  
IGBT-Modules

FD 800 R 33 KF2

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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 V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^\circ\text{C}$ $T_C = 25^\circ\text{C}$	$I_{C,nom.}$ $I_C$	800 1300	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1 \text{ ms}, T_C = 80^\circ\text{C}$	$I_{CRM}$	1600	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^\circ\text{C}, \text{ Transistor}$	$P_{tot}$	9,6	kW
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		$V_{GES}$	+/- 20V	V
Dauergleichstrom DC forward current		$I_F$	800	A
Periodischer Spitzenstrom repetitive peak forw. Current	$t_p = 1 \text{ ms}$	$I_{FRM}$	1600	A
Grenzlastintegral der Diode I2t - value, Diode	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125^\circ\text{C}$	$I^2t$	222.200	A <sup>2</sup> s
Spitzenverlustleistung der Diode maximum power dissipation diode	$T_j = 125^\circ\text{C}$	$P_{RQM}$	800	kW
Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	$V_{ISOL}$	6.000	V
Teilentladungs-Aussetzspannung partial discharge extinction voltage	RMS, f = 50 Hz, $Q_{pD} \leq 10 \text{ pC}$ (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	$I_C = 800 \text{ A}, V_{GE} = 15\text{V}, T_{vj} = 25^\circ\text{C}$ $I_C = 800 \text{ A}, V_{GE} = 15\text{V}, T_{vj} = 125^\circ\text{C}$	$V_{CE \text{ sat}}$	-	3,40 4,30	4,25 5,00	V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 80 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^\circ\text{C}$	$V_{GE(th)}$	4,2	5,1	6,0	V
Eingangskapazität input capacitance	f = 1MHz, $T_{vj} = 25^\circ\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	$C_{ies}$	-	100	-	nF
Rückwirkungskapazität reverse transfer capacitance	f = 1MHz, $T_{vj} = 25^\circ\text{C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	$C_{res}$	-	5,4	-	nF
Gateladung gate charge	$V_{GE} = -15\text{V} \dots + 15\text{V}, V_{CE} = 1800\text{V}$	$Q_G$	-	15	-	$\mu\text{C}$
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 3300\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^\circ\text{C}$ $V_{CE} = 3300\text{V}, V_{GE} = 0\text{V}, T_{vj} = 125^\circ\text{C}$	$I_{CES}$	-	0,1 40	8 100	mA 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: Jürgen Göttert	date of publication : 08.06.99
approved by: Chr. Lübke; 20.07.99	revision: 2

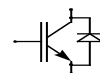


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IGBT-Module  
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### Datenblatt data sheet

#### Charakteristische Werte / Characteristic values

##### Transistor / Transistor

min. typ. max.

			min.	typ.	max.	
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}$	$t_{d,on}$	-	370	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 25^\circ \text{ C}$		-	350	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}$		-	350	-	ns
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}$	$t_r$	-	250	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 25^\circ \text{ C}$		-	270	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}$		-	270	-	ns
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}$	$t_{d,off}$	-	1550	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 25^\circ \text{ C}$		-	1700	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}$		-	1700	-	ns
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}$	$t_f$	-	200	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 25^\circ \text{ C}$		-	200	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}$		-	200	-	ns
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}, V_{GE} = 15 \text{ V}$ $R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}, L_S = 40 \text{ nH}$	$E_{on}$	-	1920	-	mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 800 \text{ A}, V_{CC} = 1800 \text{ V}, V_{GE} = 15 \text{ V}$ $R_G = 1,8 \Omega, C_{GE} = 150 \text{ nF}, T_{vj} = 125^\circ \text{ C}, L_S = 40 \text{ nH}$	$E_{off}$	-	1020	-	mWs
Kurzschlußverhalten SC Data	$t_p \leq 10 \mu\text{sec}, V_{GE} \leq 15 \text{ V}$	$I_{SC}$	-	4000	-	A
	$T_{vj} \leq 125^\circ \text{ C}, V_{CC} = 2500 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		-	4000	-	A
Modulinduktivität stray inductance module	IGBT (Zweig / arm 1+2 parallel)	$L_{sCE}$	-	12	-	nH
	Diode (Zweig / arm 3)		-	25	-	nH
Modul-Leitungswiderstand, Anschlüsse - Chip lead resistance, terminals - chip	$T = 25^\circ \text{ C}, \text{IGBT (Zweig / arm 1+2 parallel)}$	$R_{CC+EE}$	-	0,19	-	mΩ
	$T = 25^\circ \text{ C}, \text{Diode (Zweig / arm 3)}$		-	0,34	-	mΩ

#### Charakteristische Werte / Characteristic values

##### Diode / Diode

min. typ. max.

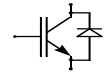
			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 800 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^\circ \text{ C}$	$V_F$	-	2,80	3,50	V
	$I_F = 800 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^\circ \text{ C}$		-	2,80	3,50	V
Sperrstrom reverse current	$V_{CE} = 3300 \text{ V}, T_{vj} = 25^\circ \text{ C}, \text{Zweig / arm 3}$	$I_R$	-	0,01	1,6	mA
	$V_{CE} = 3300 \text{ V}, T_{vj} = 125^\circ \text{ C}, \text{Zweig / arm 3}$		-	4	20	mA
Rückstromspitze peak reverse recovery current	$I_F = 800 \text{ A}, -di_F/dt = 2500 \text{ A}/\mu\text{sec}$	$I_{RM}$	-	650	-	A
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{ C}$		-	700	-	A
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{ C}$		-	700	-	A
Sperrverzögerungsladung recovered charge	$I_F = 800 \text{ A}, -di_F/dt = 2500 \text{ A}/\mu\text{sec}$	$Q_r$	-	500	-	μAs
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{ C}$		-	900	-	μAs
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{ C}$		-	900	-	μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = 800 \text{ A}, -di_F/dt = 2500 \text{ A}/\mu\text{sec}$	$E_{rec}$	-	490	-	mWs
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{ C}$		-	1000	-	mWs
	$V_R = 1800 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{ C}$		-	1000	-	mWs

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IGBT-Module  
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### Datenblatt data sheet

#### Thermische Eigenschaften / Thermal properties

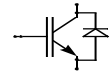
			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	$R_{thJC}$	-	-	0,013	K/W
	Diode/Diode, DC, Zweig / arm 1+2		-	-	0,026	K/W
	Diode/Diode, DC, Zweig / arm 3		-	-	0,026	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / 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				AISiC	
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.

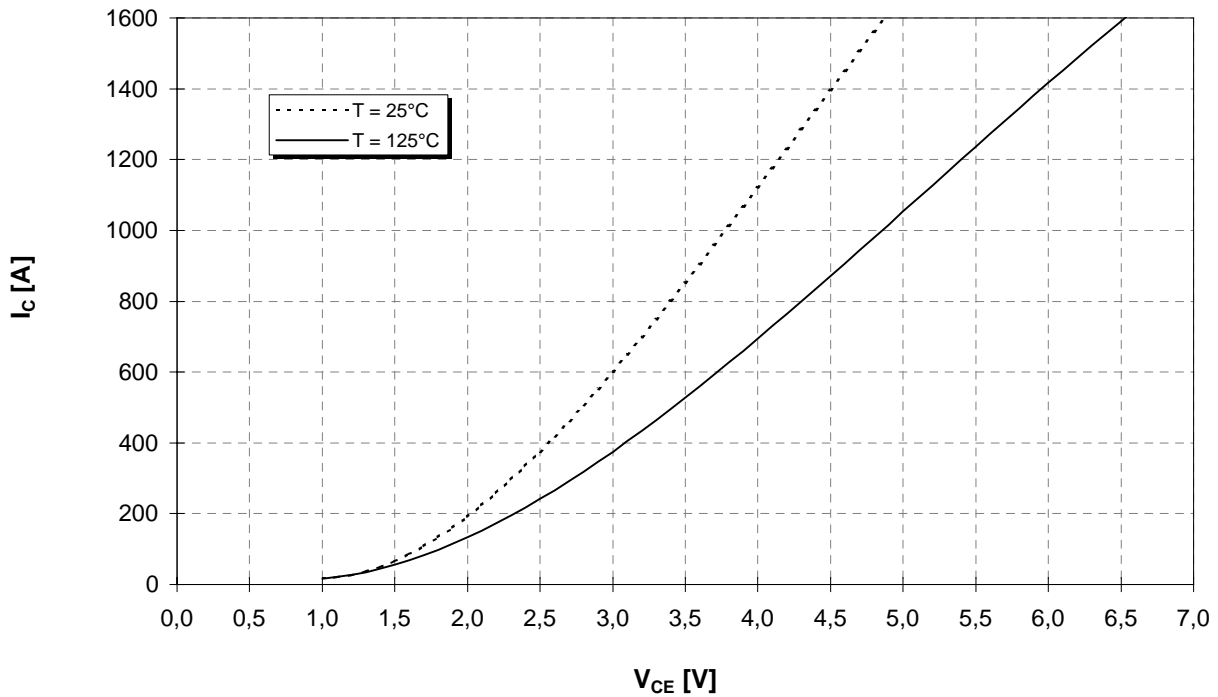
This technical information specifies semiconductor devices but promises no characteristics. It is valid in combination with the belonging technical notes.



Datenblatt  
data sheet

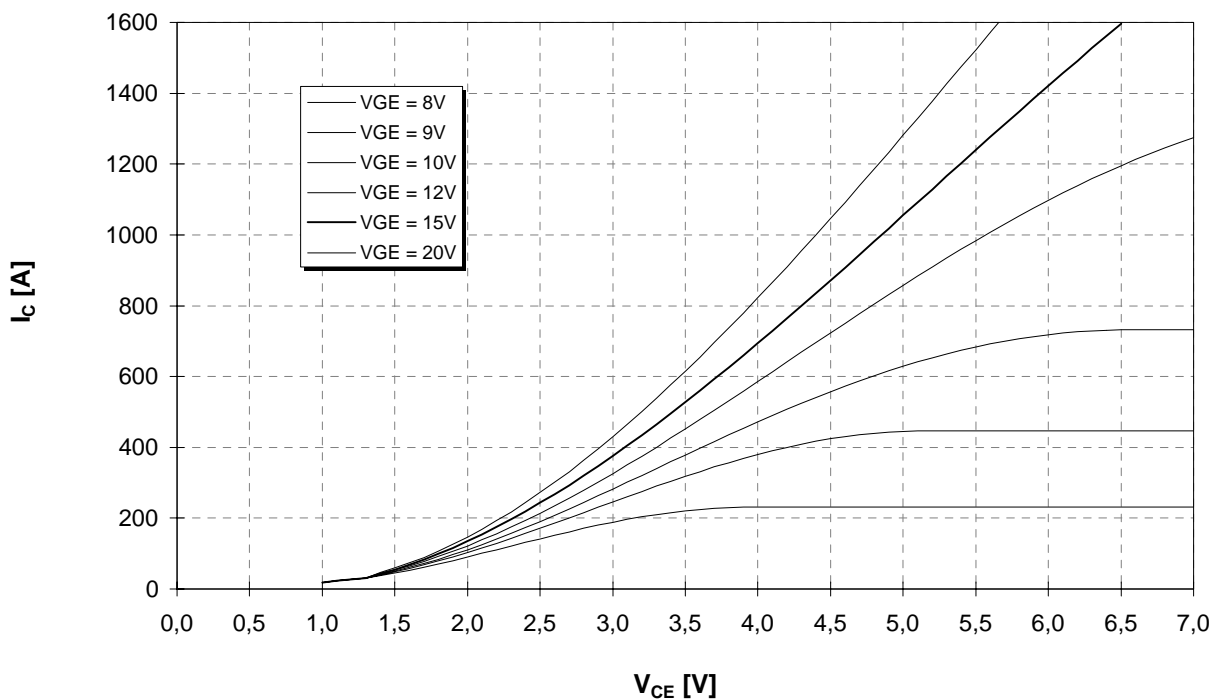
Ausgangskennlinie (typisch)  
Output characteristic (typical)

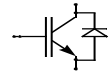
$I_C = f(V_{CE})$   
 $V_{GE} = 15V$



Ausgangskennlinienfeld (typisch)  
Output characteristic (typical)

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

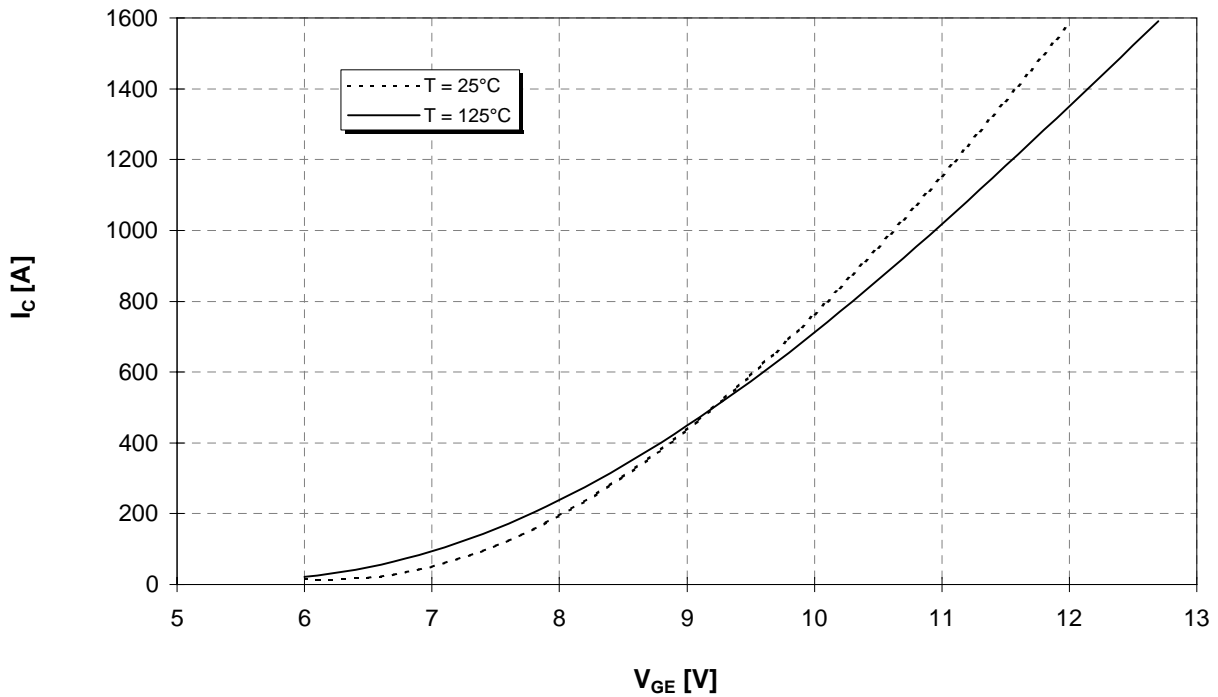




Datenblatt  
data sheet

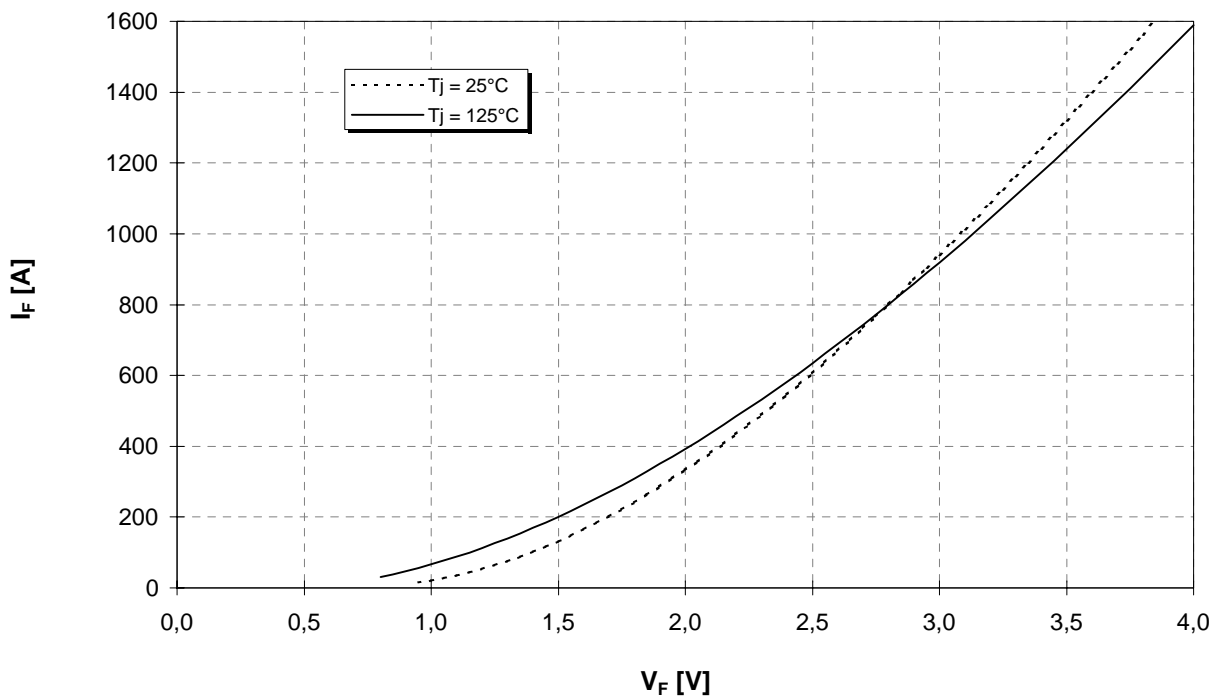
Übertragungscharakteristik (typisch)  
Transfer characteristic (typical)

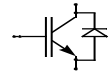
$I_C = f(V_{GE})$   
 $V_{CE} = 20V$



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

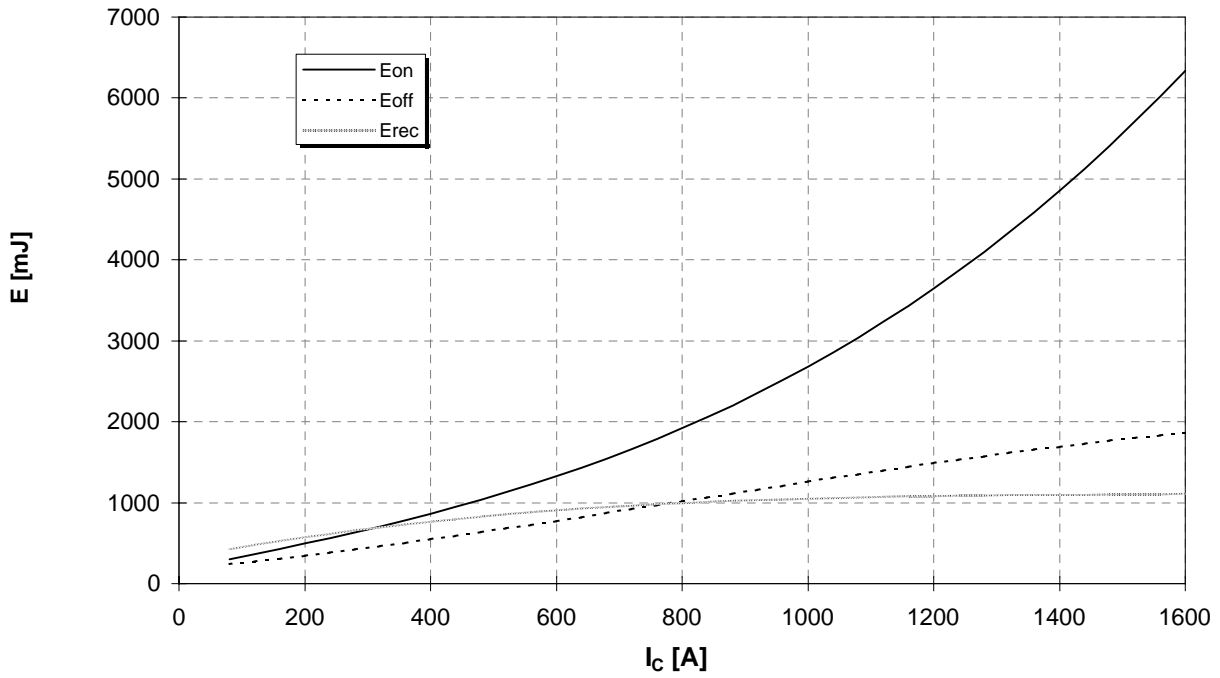
$I_F = f(V_F)$





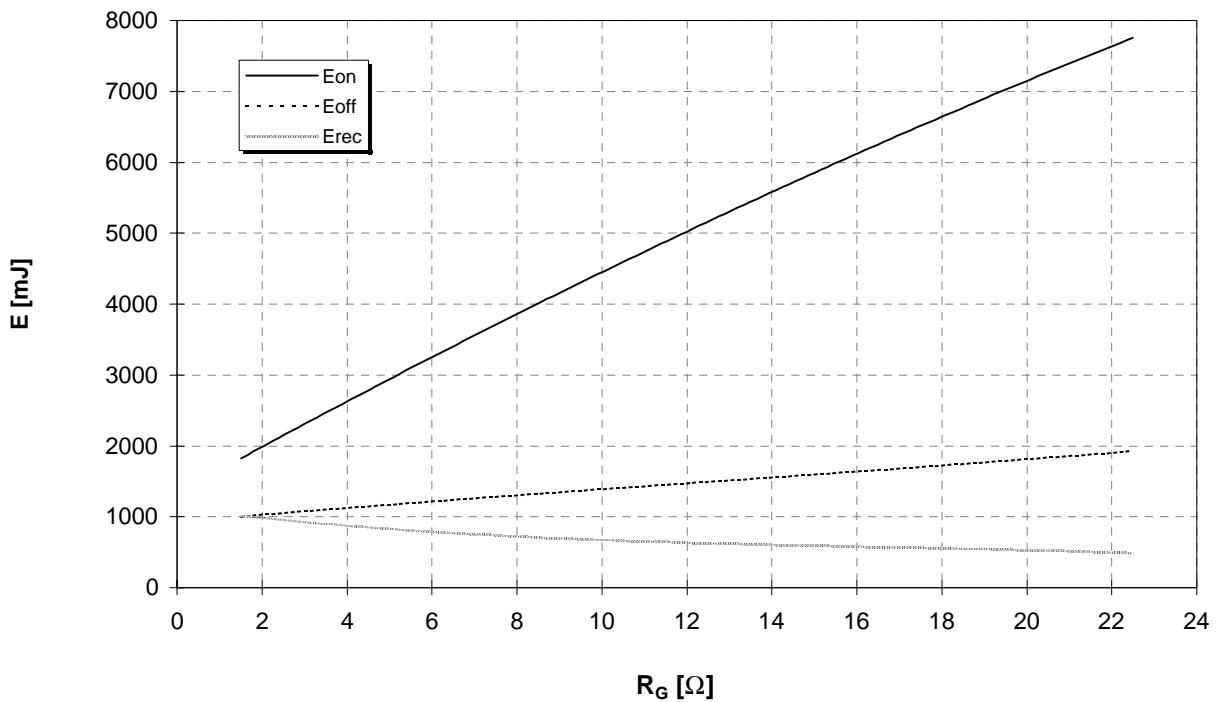
Schaltverluste (typisch)  
Switching losses (typical)

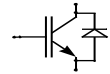
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$ ,  $E_{rec} = f(I_C)$   
 $R_{G,on} = 1,8 \Omega$ ,  $R_{G,off} = 1,8 \Omega$ ,  $C_{GE} = 150 \text{ nF}$ ,  $V_{CE} = 1800\text{V}$ ,  $T_J = 125^\circ\text{C}$



Schaltverluste (typisch)  
Switching losses (typical)

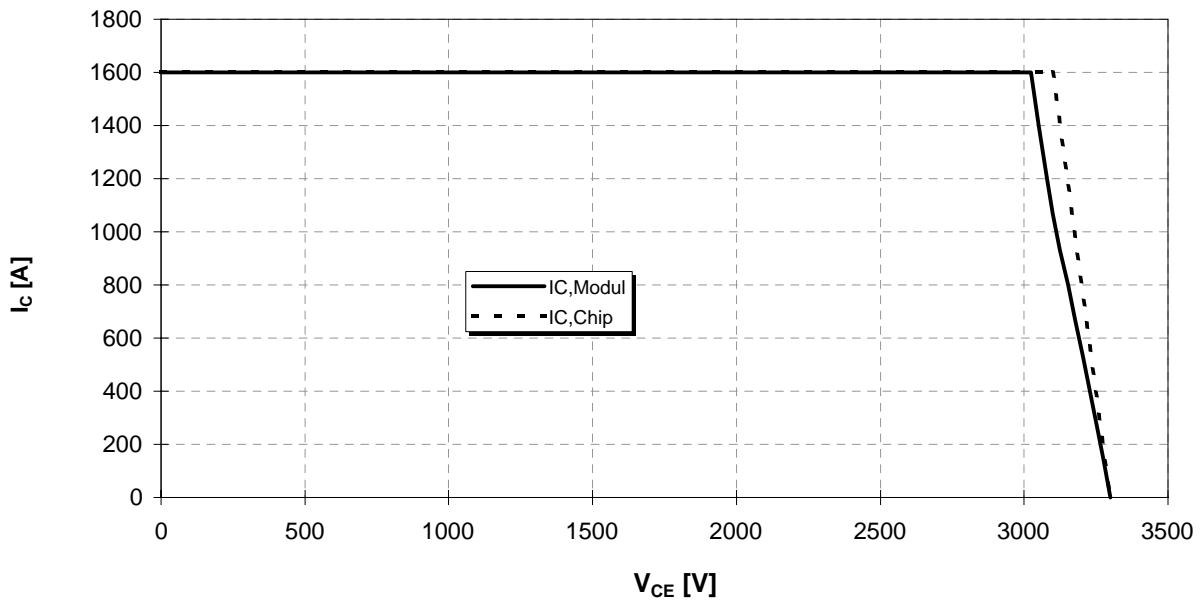
$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$ ,  $E_{rec} = f(R_G)$   
 $I_C = 800 \text{ A}$ ,  $C_{GE} = 150 \text{ nF}$ ,  $V_{CE} = 1800\text{V}$ ,  $T_J = 125^\circ\text{C}$





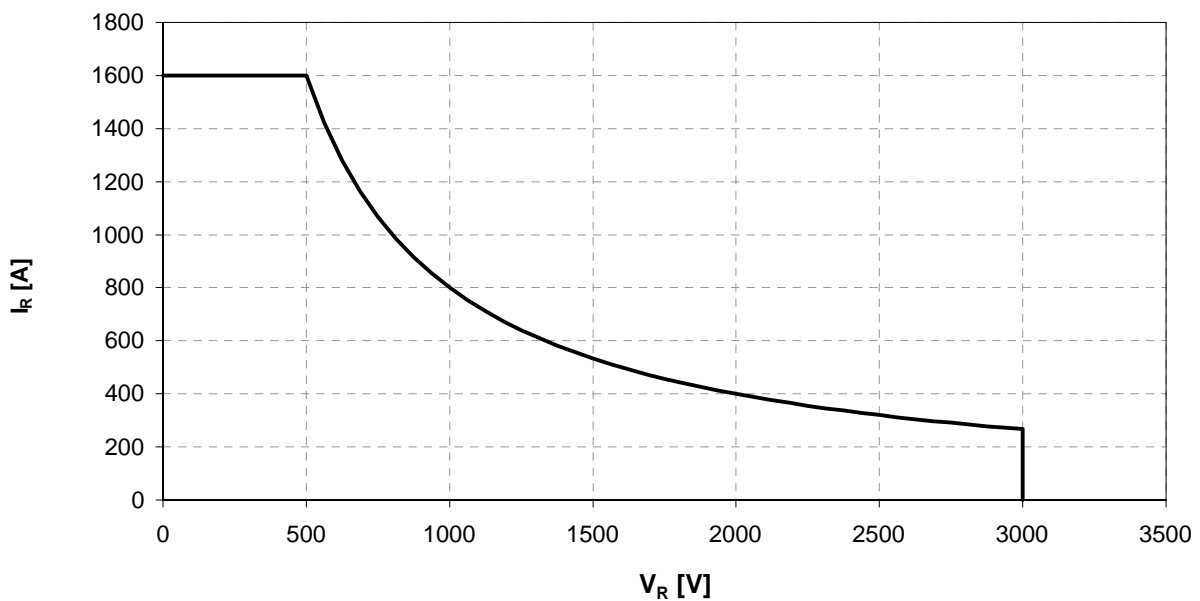
**Sicherer Arbeitsbereich IGBT (RBSOA)**  
**Reverse bias safe operation area IGBT (RBSOA)**

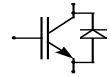
$R_{G,off} = 1,8 \Omega$ ,  $C_{GE} = 150 \text{ nF}$   
 $T_{vj} = 125^\circ\text{C}$



**Sicherer Arbeitsbereich Diode (SOA)**  
**safe operation area Diode (SOA)**

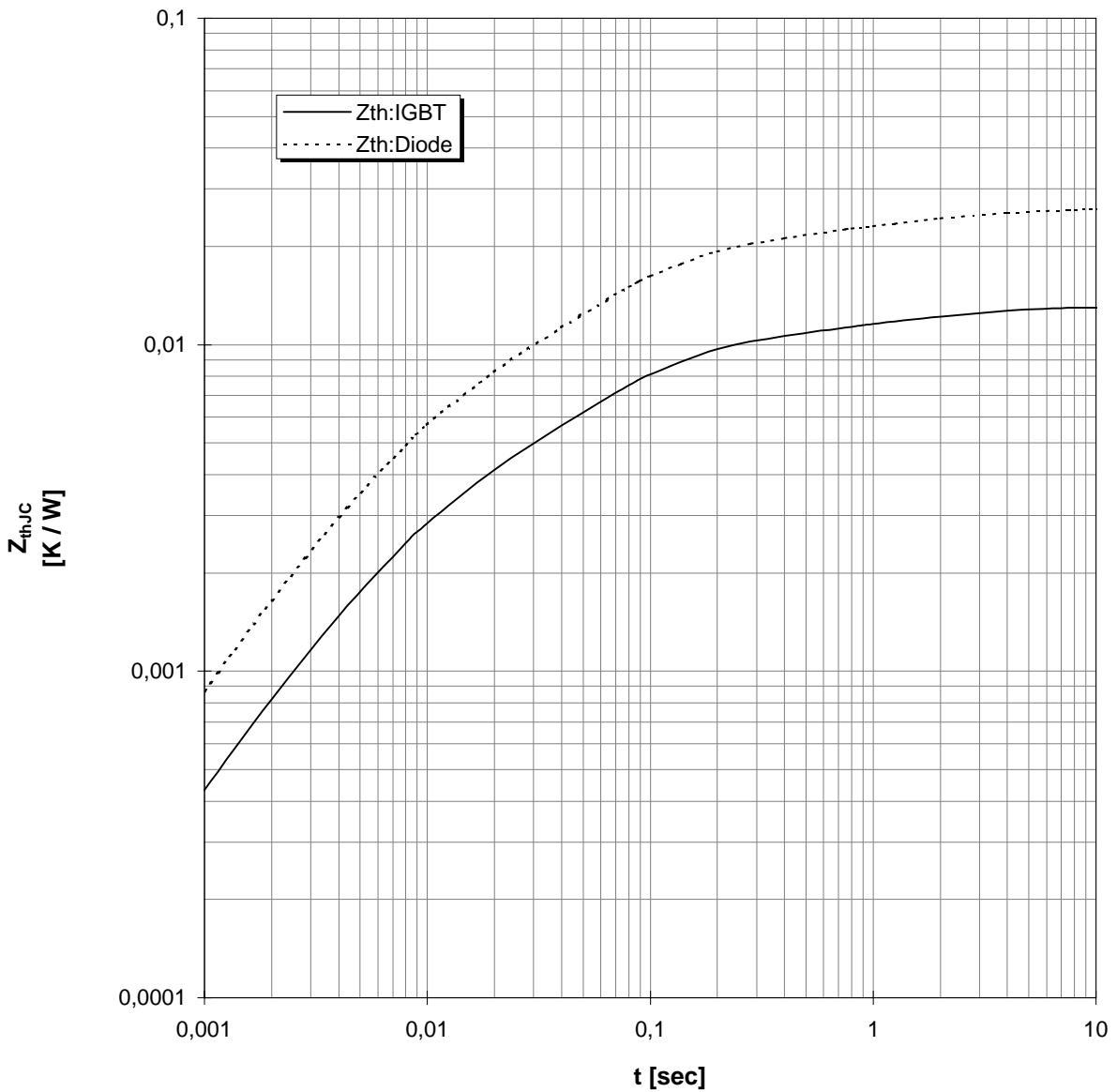
$T_{vj} = 125^\circ\text{C}$





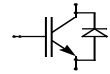
**Transienter Wärmewiderstand**  
**Transient thermal impedance**

$Z_{thJC} = f(t)$



i	1	2	3	4
$r_i$ [K/kW] : IGBT	2,38	6,49	1,93	2,20
$\tau_i$ [sec] : IGBT	0,0068	0,0642	0,3209	2,0212
$r_i$ [K/kW] : Diode	4,76	12,98	3,86	4,40
$\tau_i$ [sec] : Diode	0,0068	0,0642	0,3209	2,0212





Gehäusemaße / Schaltbild  
Package outline / Circuit diagram

