

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FZ 2400 R 17 KF6 B2

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Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage		V_{CES}	1700	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80\text{ °C}$	$I_{C,nom.}$	2400	A
	$T_C = 25\text{ °C}$	I_C	4800	A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80\text{ °C}$	I_{CRM}	4800	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25\text{ °C}, \text{ Transistor}$	P_{tot}	19,2	kW
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V
Dauergleichstrom DC forward current		I_F	2400	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	4800	A
Grenzlastintegral der Diode I^2t - value, Diode	$V_R = 0V, t_p = 10ms, T_{vj} = 125\text{ °C}$	I^2t	2200	KA^2s
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$	V_{ISOL}	4	kV

Charakteristische Werte / Characteristic values

Transistor / Transistor

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_C = 2400A, V_{GE} = 15V, T_{vj} = 25\text{ °C}$	$V_{CE\ sat}$		2,6	3,1	V
	$I_C = 2400A, V_{GE} = 15V, T_{vj} = 125\text{ °C}$			3,1	3,6	V
Gate-Schwellenspannung gate threshold voltage	$I_C = 190mA, V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}$	$V_{GE(th)}$	4,5	5,5	6,5	V
Gateladung gate charge	$V_{GE} = -15V \dots +15V$	Q_G		29		μC
Eingangskapazität input capacitance	$f = 1MHz, T_{vj} = 25\text{ °C}, V_{CE} = 25V, V_{GE} = 0V$	C_{res}		160		nF
Rückwirkungskapazität reverse transfer capacitance	$f = 1MHz, T_{vj} = 25\text{ °C}, V_{CE} = 25V, V_{GE} = 0V$	C_{res}		8		nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 1700V, V_{GE} = 0V, T_{vj} = 25\text{ °C}$	I_{CES}		0,06	4,5	mA
	$V_{CE} = 1700V, V_{GE} = 0V, T_{vj} = 125\text{ °C}$			30	240	mA
Gate-Emitter Reststrom gate-emitter leakage current	$V_{CE} = 0V, V_{GE} = 20V, T_{vj} = 25\text{ °C}$	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)	$I_C = 2400, V_{CE} = 900V$	$t_{d,on}$		0,3		μs
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 25^\circ C$					
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 125^\circ C$			0,3		μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 2400, V_{CE} = 900V$	t_r		0,23		μs
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 25^\circ C$					
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 125^\circ C$			0,23		μs
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 2400, V_{CE} = 900V$	$t_{d,off}$		1,5		μs
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 25^\circ C$					
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 125^\circ C$			1,5		μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 2400, V_{CE} = 900V$	t_f		0,18		μs
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 25^\circ C$					
	$V_{GE} = \pm 15V, R_G = 0,6\Omega, T_{vj} = 125^\circ C$			0,19		μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 2400A, V_{CE} = 900V, V_{GE} = 15V$ $R_G = 0,6\Omega, T_{vj} = 125^\circ C, L_S = 50nH$	E_{on}		750		mWs
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 2400A, V_{CE} = 900V, V_{GE} = 15V$ $R_G = 0,6\Omega, T_{vj} = 125^\circ C, L_S = 50nH$	E_{off}		1060		mWs
Kurzschlußverhalten SC Data	$t_p \leq 10\mu sec, V_{GE} \leq 15V$ $T_{vj} \leq 125^\circ C, V_{CC} = 1000V, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	I_{SC}		9600		A
Modulinduktivität stray inductance module		L_{sCE}		10		nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	pro Zweig / per arm	R_{CC+EE}		0,06		m Ω

Charakteristische Werte / Characteristic values

Diode / Diode

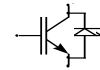
			min.	typ.	max.	
Durchlaßspannung forward voltage	$I_F = 2400A, V_{GE} = 0V, T_{vj} = 25^\circ C$	V_F		2,1	2,5	V
	$I_F = 2400A, V_{GE} = 0V, T_{vj} = 125^\circ C$					
				1,95	2,3	V
Rückstromspitze peak reverse recovery current	$I_F = 2400A, -di_F/dt = 14400A/\mu sec$	I_{RM}		1350		A
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 25^\circ C$					
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 125^\circ C$			2000		A
Sperrverzögerungsladung recovered charge	$I_F = 2400A, -di_F/dt = 14400A/\mu sec$	Q_r		330		μAs
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 25^\circ C$					
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 125^\circ C$			690		μAs
Abschaltenergie pro Puls reverse recovery energy	$I_F = 2400A, -di_F/dt = 14400A/\mu sec$	E_{rec}		180		mWs
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 25^\circ C$					
	$V_R = 900V, V_{GE} = -10V, T_{vj} = 125^\circ C$			360		mWs

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Thermische Eigenschaften / Thermal properties

			min.	typ.	max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	R_{thJC}			0,007	K/W
	Diode/Diode, DC				0,012	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}		0,006		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					
Innere Isolation internal insulation				AlN	
Kriechstrecke creepage distance				32	mm
Luftstrecke clearance				20	mm
CTI comperative tracking index			min.	>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

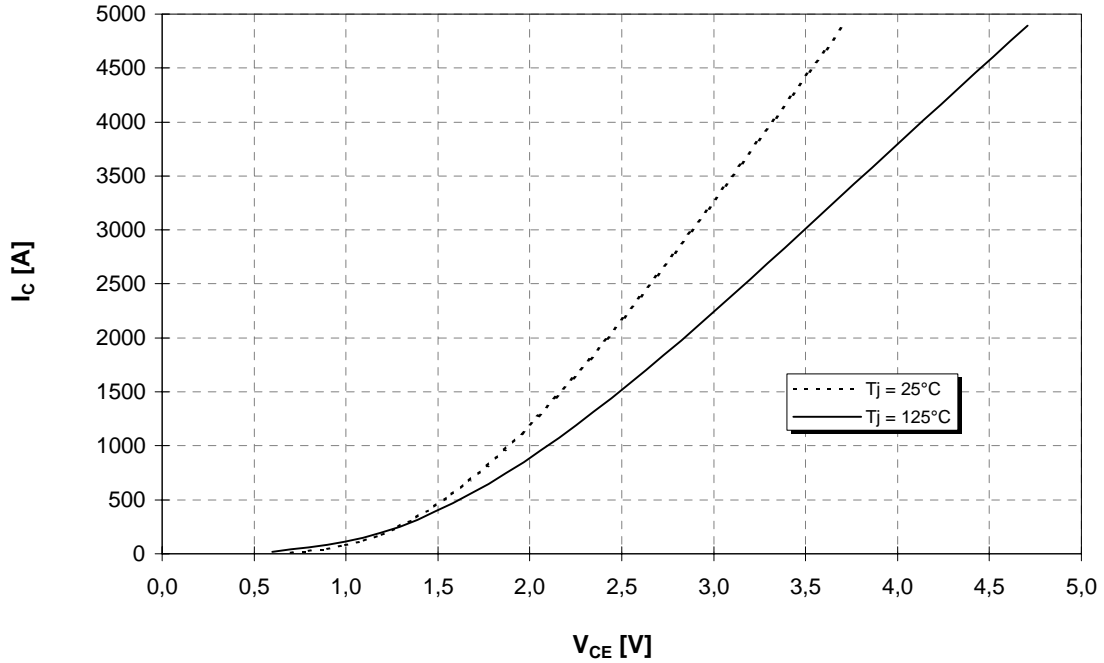
Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

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



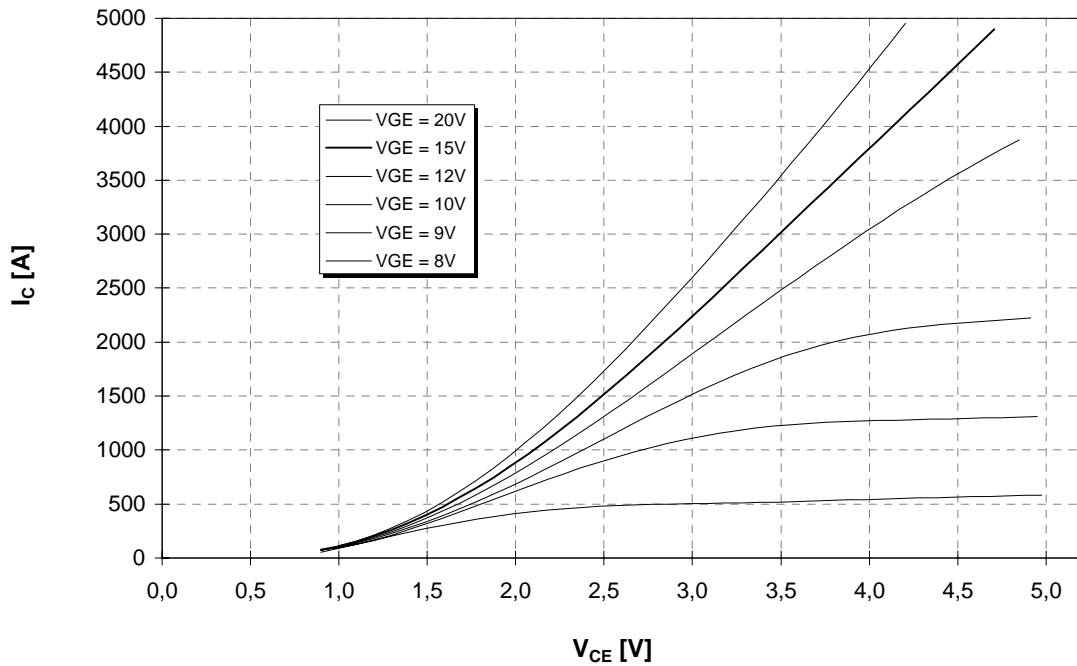
Ausgangskennlinie (typisch)
Output characteristic (typical)

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



Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 125°C$

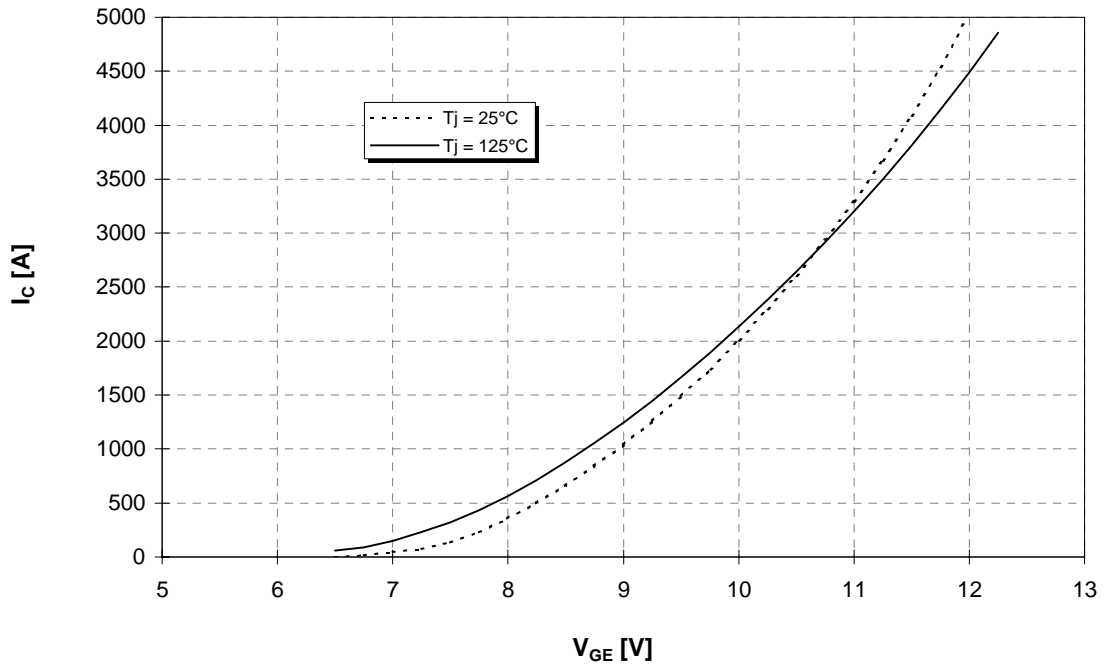




Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

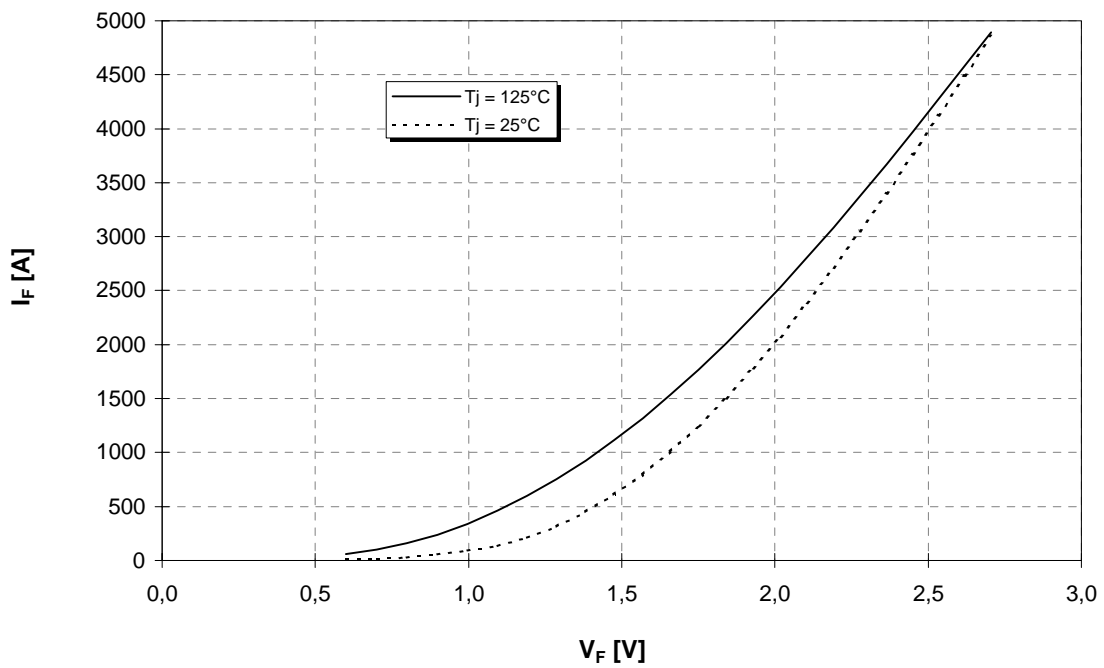
$$I_C = f(V_{GE})$$

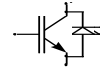
$V_{CE} = 20V$



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

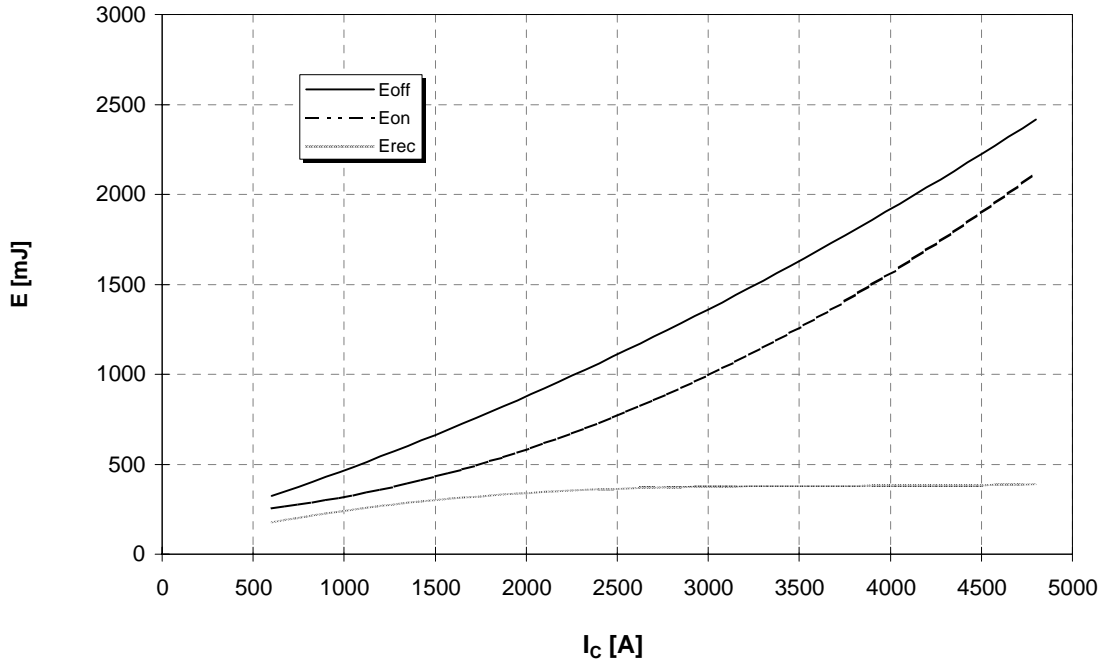
$$I_F = f(V_F)$$





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

Switching losses (typical) $R_{gon} = R_{goff} = 0,6 \Omega$, $V_{CE} = 900V$, $T_j = 125^\circ C$, $V_{GE} = \pm 15V$

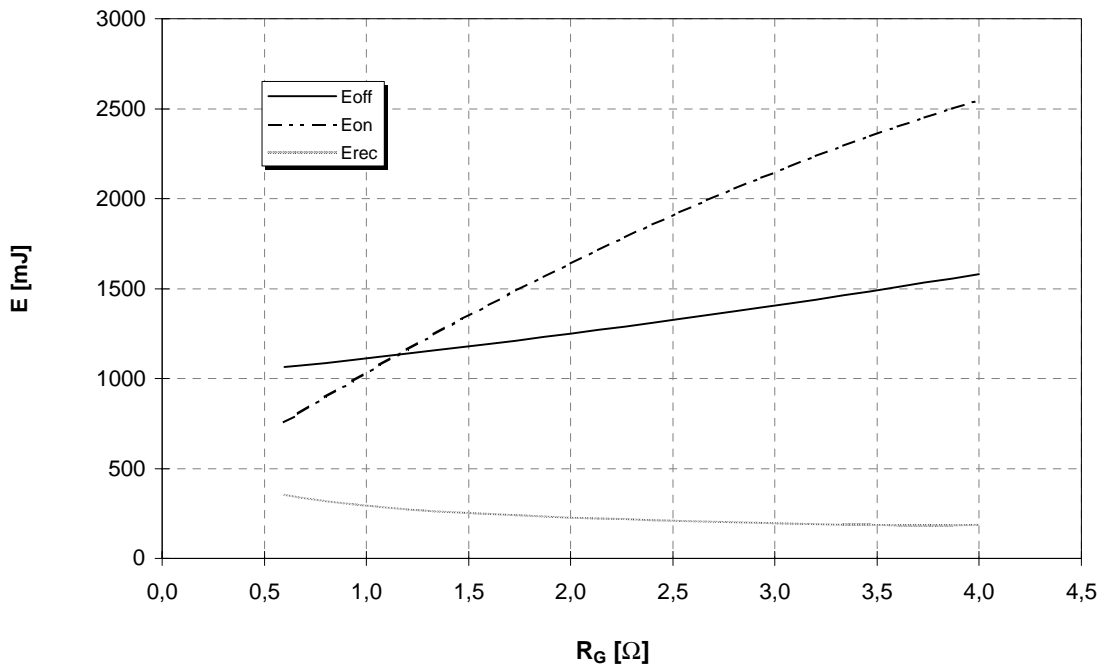


Schaltverluste (typisch)

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

Switching losses (typical)

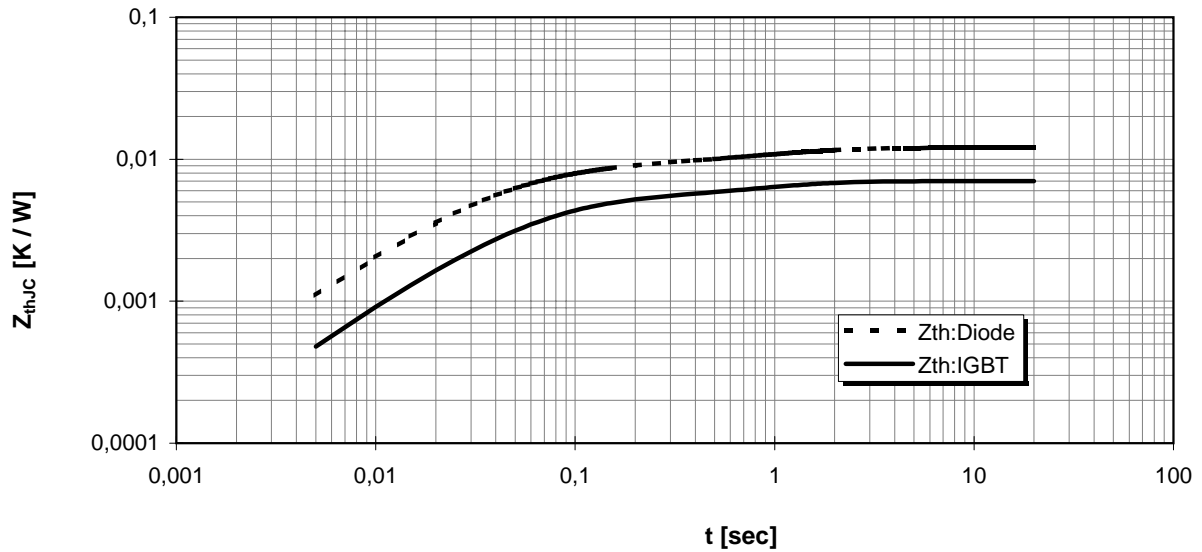
$I_C = 2400A$, $V_{CE} = 900V$, $T_j = 125^\circ C$, $V_{GE} = \pm 15V$





Transienter Wärmewiderstand
Transient thermal impedance

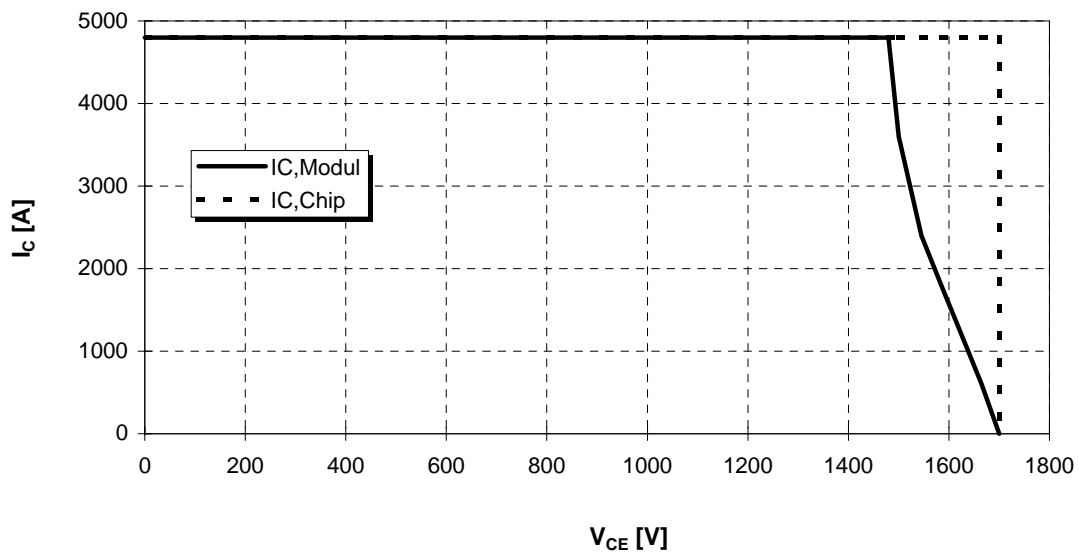
$Z_{thJC} = f(t)$

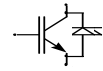


i	1	2	3	4
r_i [K/kW] : IGBT	0,658	3,3	0,997	2,04
τ_i [sec] : IGBT	0,027	0,052	0,09	0,838
r_i [K/kW] : Diode	5,54	2,48	0,79	3,19
τ_i [sec] : Diode	0,0287	0,0705	0,153	0,988

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

$R_g = 0,6 \text{ Ohm}, T_{vj} = 125^\circ\text{C}$





Äußere Abmessungen / external dimensions

