

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FD 400 R 65 KF1-K

eupec



Höchstzulässige Werte / Maximum rated values

Elektrische Eigenschaften / Electrical properties

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj}=125^{\circ}\text{C}$ $T_{vj}=25^{\circ}\text{C}$ $T_{vj}=40^{\circ}\text{C}$	V_{CES}	6500 6300 5800	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C,nom.}$ I_C	400 800	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 80^{\circ}\text{C}$	I_{CRM}	800	A
Gesamt-Verlustleistung total power dissipation	$T_C=25^{\circ}\text{C}, \text{ Transistor}$	P_{tot}	7,4	kW
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/- 20V	V
Dauergleichstrom DC forward current		I_F	400	A
Periodischer Spitzenstrom repetitive peak forw. current	$t_p = 1\text{ ms}$	I_{FRM}	800	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	87	$\text{k A}^2\text{s}$
Isolations-Prüfspannung insulation test voltage	RMS, $f = 50\text{ Hz}, t = 1\text{ min.}$	V_{ISOL}	10,2	kV
Teilentladungs Aussetzspannung partial discharge extinction voltage	RMS, $f = 50\text{ Hz}, Q_{PD} \text{ typ. } 10\text{pC (acc. To IEC 1287)}$	V_{ISOL}	5,1	kV

Charakteristische Werte / Characteristic values

Transistor / Transistor

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_C = 400\text{A}, V_{GE} = 15\text{V}, T_{vj} = 25^{\circ}\text{C}$	$V_{CE\text{ sat}}$	-	4,3	4,9	V
	$I_C = 400\text{A}, V_{GE} = 15\text{V}, T_{vj} = 125^{\circ}\text{C}$		-	5,3	5,9	V
Gate-Schwellenspannung gate threshold voltage	$I_C = 70\text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	$V_{GE(th)}$	6,4	7,0	8,1	V
Gateladung gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	Q_G	-	5,6	-	μC
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}	-	56	-	nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 6300\text{V}, V_{GE} = 0\text{V}, T_{vj} = 25^{\circ}\text{C}$	I_{CES}	-	0,4	-	mA
	$V_{CE} = 6500\text{V}, V_{GE} = 0\text{V}, T_{vj} = 125^{\circ}\text{C}$			40		
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: Dr. Oliver Schilling

date of publication: 2002-08-30

approved by: Dr. Schütze 2002-08-30

revision/Status: Series 1

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FD 400 R 65 KF1-K

eupec



Charakteristische Werte / Characteristic values

Transistor / Transistor		min.	typ.	max.		
Einschaltverzögerungszeit (ind. Last) turn on delay time (inductive load)	$I_C = 400A, V_{CE} = 3600V$ $V_{GE} = \pm 15V, R_{Gon} = 6,2\Omega, C_{GE}=44nF, T_{vj} = 25^\circ C,$	$t_{d,on}$	-	0,75	-	μs
	$V_{GE} = \pm 15V, R_{Gon} = 6,2\Omega, C_{GE}=44nF, T_{vj} = 125^\circ C,$		-	0,72	-	μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 400A, V_{CE} = 3600V$ $V_{GE} = \pm 15V, R_{Gon} = 6,2\Omega, C_{GE}=44nF, T_{vj} = 25^\circ C,$	t_r	-	0,37	-	μs
	$V_{GE} = \pm 15V, R_{Gon} = 6,2\Omega, C_{GE}=44nF, T_{vj} = 125^\circ C,$		-	0,40	-	μs
Abschaltverzögerungszeit (ind. Last) turn off delay time (inductive load)	$I_C = 400A, V_{CE} = 3600V$ $V_{GE} = \pm 15V, R_{Goff} = 36\Omega, C_{GE}=44nF, T_{vj} = 25^\circ C,$	$t_{d,off}$	-	5,50	-	μs
	$V_{GE} = \pm 15V, R_{Goff} = 36\Omega, C_{GE}=44F, T_{vj} = 125^\circ C,$		-	6,00	-	μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 400A, V_{CE} = 3600V$ $V_{GE} = \pm 15V, R_{Goff} = 36\Omega, C_{GE}=44nF, T_{vj} = 25^\circ C,$	t_f	-	0,40	-	μs
	$V_{GE} = \pm 15V, R_{Goff} = 36\Omega, C_{GE}=44F, T_{vj} = 125^\circ C,$		-	0,50	-	μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 400A, V_{CE} = 3600V, V_{GE} = \pm 15V$ $R_{Gon} = 6,2\Omega, C_{GE}=44nF, T_{vj} = 125^\circ C, L_\sigma = 280nH$	E_{on}	-	4000	-	mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 400A, V_{CE} = 3600V, V_{GE} = \pm 15V$ $R_{Goff} = 36\Omega, C_{GE}=44nF, T_{vj} = 125^\circ C, L_\sigma = 280nH$	E_{off}	-	2300	-	mJ
Kurzschlußverhalten SC Data	$t_p \leq 10\mu sec, V_{GE} \leq 15V, acc\ to\ appl.note\ 2002/05$ $T_{vj} \leq 125^\circ C, V_{CC} = 4400V, V_{CEmax} = V_{CES} - L_{\sigma CE} \cdot di/dt$	I_{SC}	-	2000	-	A
Modulinduktivität stray inductance module	Zweig 1+2 / arm 1+2	L_{SCE}	-	20	-	nH
	Zweig 3 / arm 3		-	25	-	nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	Zweig 1+2 / arm 1+2	R_{CC+EE}	-	0,18	-	m Ω
	Zweig 3 / arm 3		-	0,37	-	m Ω

Diode / Diode		min.	typ.	max.		
Durchlaßspannung forward voltage	$I_F = 400A, V_{GE} = 0V, T_{vj} = 25^\circ C$	V_F	3,0	3,8	4,6	V
	$I_F = 400A, V_{GE} = 0V, T_{vj} = 125^\circ C$			3,9	4,7	V
Rückstromspitze peak reverse recovery current	$I_F = 400A, -di_F/dt = 1400A/\mu s$ $V_R = 3600V, V_{GE} = -10V, T_{vj} = 25^\circ C$	I_{RM}	-	540	-	A
	$V_R = 3600V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	660	-	A
Sperrverzögerungsladung recovered charge	$I_F = 400A, -di_F/dt = 1400A/\mu s$ $V_R = 3600V, V_{GE} = -10V, T_{vj} = 25^\circ C$	Q_r	-	360	-	μC
	$V_R = 3600V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	700	-	μC
Abschaltenergie pro Puls reverse recovery energy	$I_F = 400A, -di_F/dt = 1400A/\mu s$ $V_R = 3600V, V_{GE} = -10V, T_{vj} = 25^\circ C$	E_{rec}	-	440	-	mJ
	$V_R = 3600V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	1050	-	mJ

Technische Information / Technical Information

IGBT-Module
IGBT-Modules

FD 400 R 65 KF1-K

eupec



Thermische Eigenschaften / Thermal properties

		min.		typ.		max.	
Innerer Wärmewiderstand thermal resistance, junction to case	Transistor / transistor, DC	R_{thJC}	-	-	0,017	K/W	
	Diode/Diode, DC		-	-	0,032	K/W	
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per Module $\lambda_{Paste} \leq 1 \text{ W/m}^2\text{K} / \lambda_{grease} \leq 1 \text{ W/m}^2\text{K}$	R_{thCK}	-	0,006	-	K/W	
Höchstzulässige Sperrschichttemperatur maximum junction temperature		$T_{vj, max}$	-	-	150	°C	
Betriebstemperatur Sperrschicht junction operation temperature	Schaltvorgänge IGBT(RBSOA);Diode(SOA) switching operation IGBT(RBSOA);Diode(SOA)	$T_{vj, op}$	-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			AIN		
Kriechstrecke creepage distance			56		mm
Luftstrecke clearance			26		mm
CTI comperative tracking index			>600		
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube /screw M6	M		5	Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	Anschlüsse / terminals M4	M		2	Nm
	Anschlüsse / terminals M8			8 - 10	Nm
Gewicht weight		G		1400	g

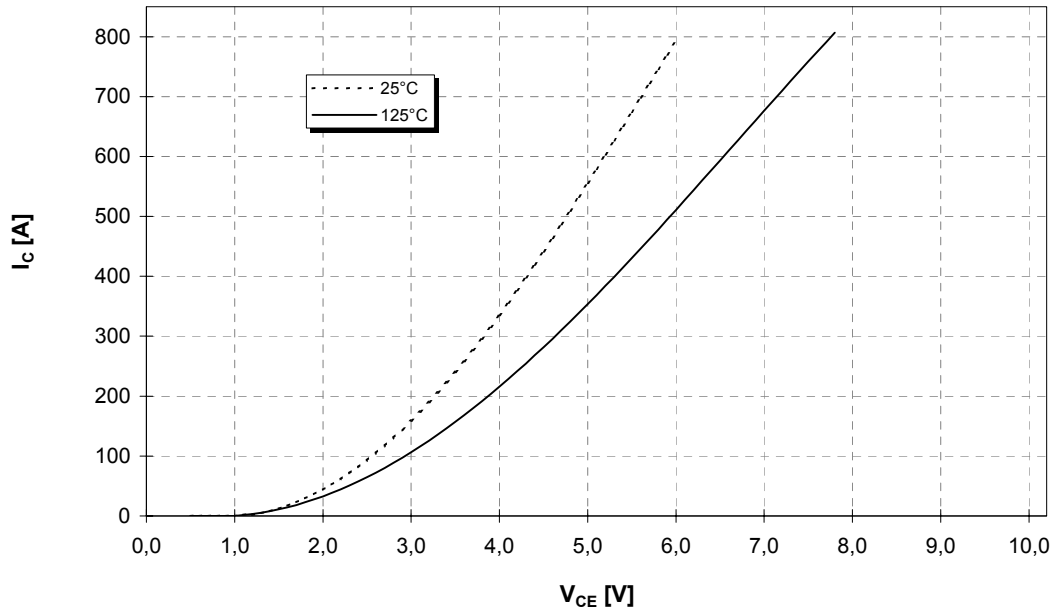
Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen Technischen Erläuterungen.

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



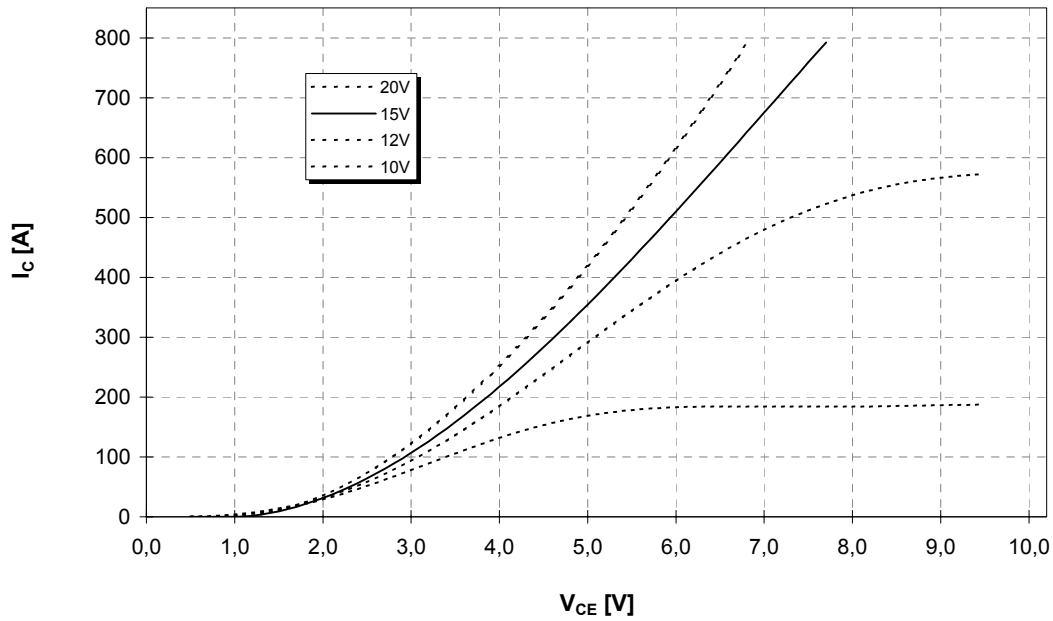
Ausgangskennlinie (typisch)
Output characteristic (typical)

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



Ausgangskennlinienfeld (typisch)
Output characteristic (typical)

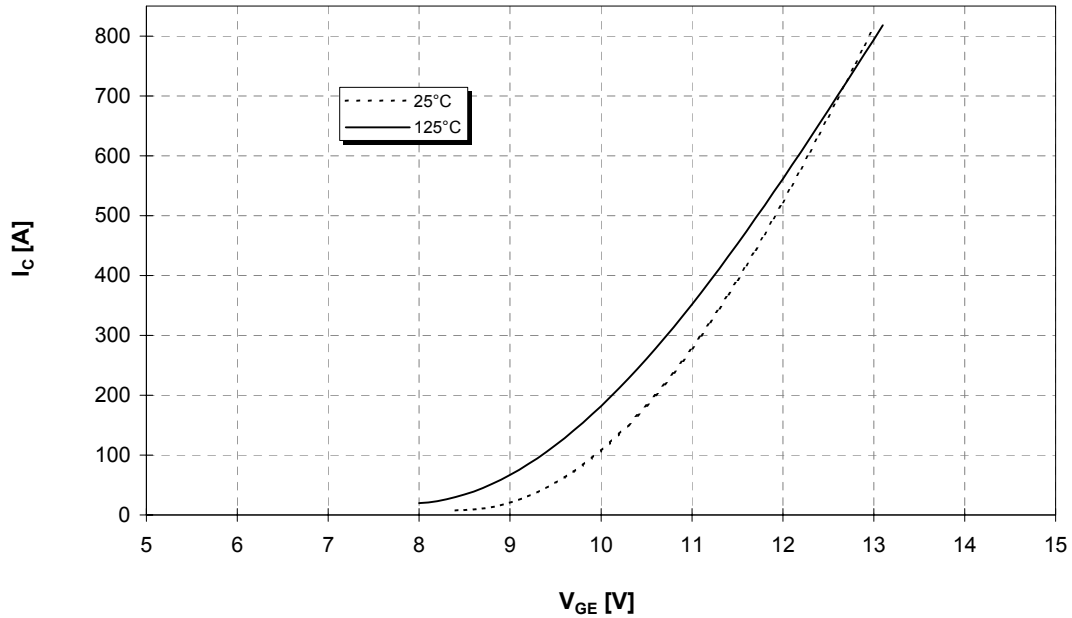
$I_c = f(V_{CE}), V_{GE} = < \text{see inset} >$
 $T_{vj} = 125^\circ C$





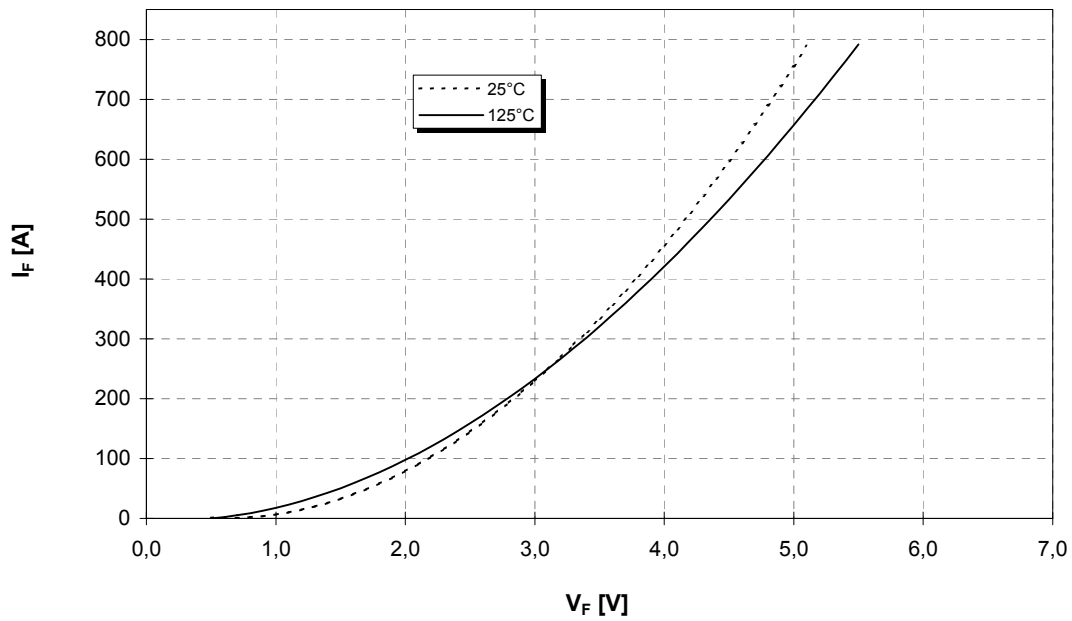
Übertragungscharakteristik (typisch)
Transfer characteristic (typical)

$I_C = f(V_{GE})$
 $V_{CE} = 10V$



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

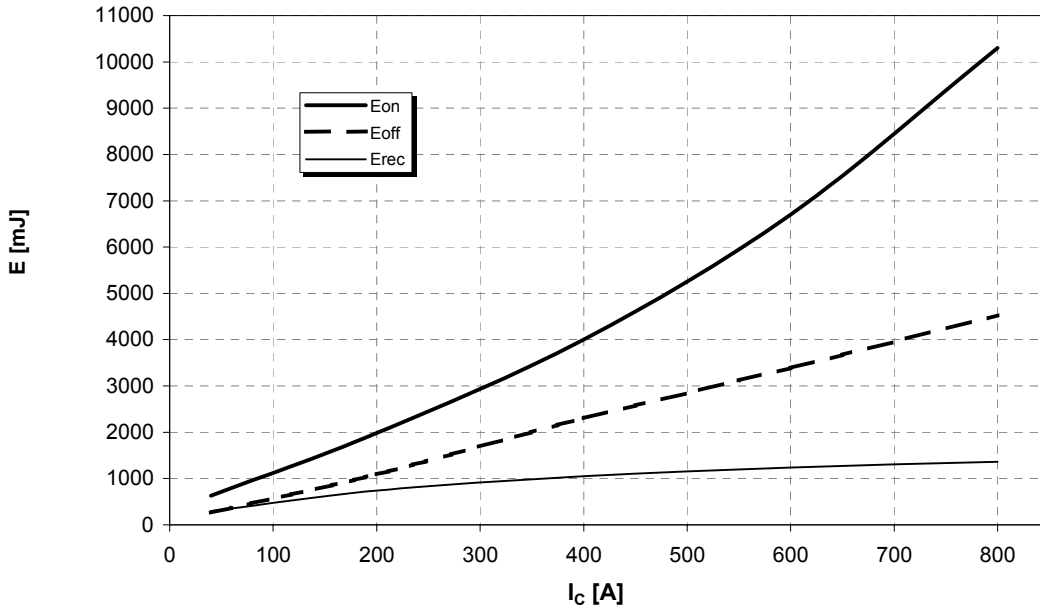
$I_F = f(V_F)$





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

Switching losses (typical) $R_{Gon}=6,2\Omega$, $R_{Goff}=36\Omega$, $C_{GE} = 44nF$, $V_{GE}=\pm 15V$, $V_{CE} = 3600V$, $T_{vj} = 125^\circ C$,

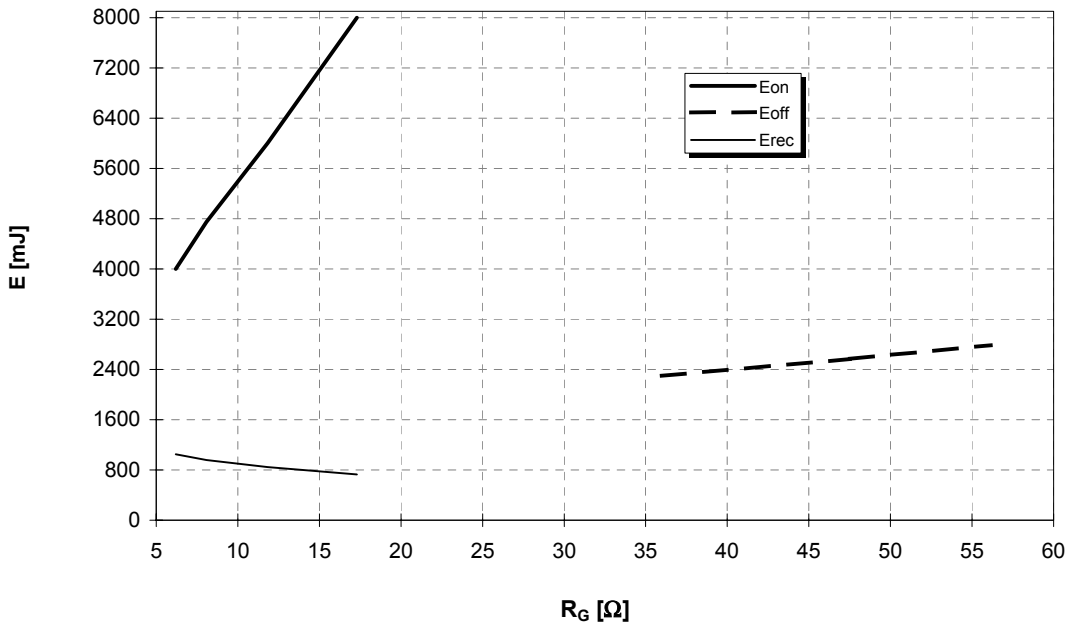


Schaltverluste (typisch)

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

Switching losses (typical)

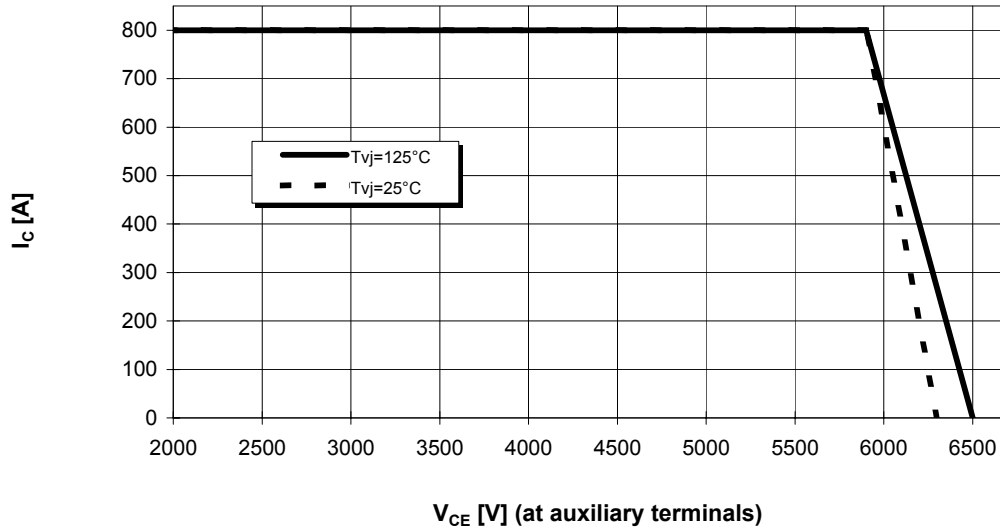
$I_C = 400A$, $V_{CE} = 3600V$, $V_{GE}=\pm 15V$, $C_{GE}=44nF$, $T_{vj} = 125^\circ C$





Sicherer Arbeitsbereich (RBSOA)

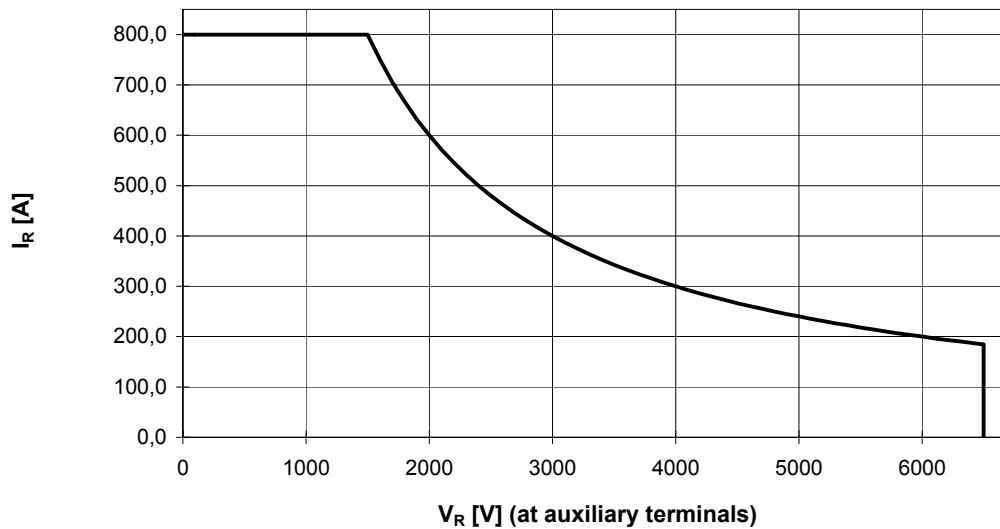
Reverse bias safe operation area (RBSOA) $R_{G,off} = 36\Omega$, $C_{GE}=44nF$, $V_{GE}=\pm 15V$, $T_{vj} = <see inset>$, $V_{CC} \leq 4400V$



Sicherer Arbeitsbereich Diode (SOA)

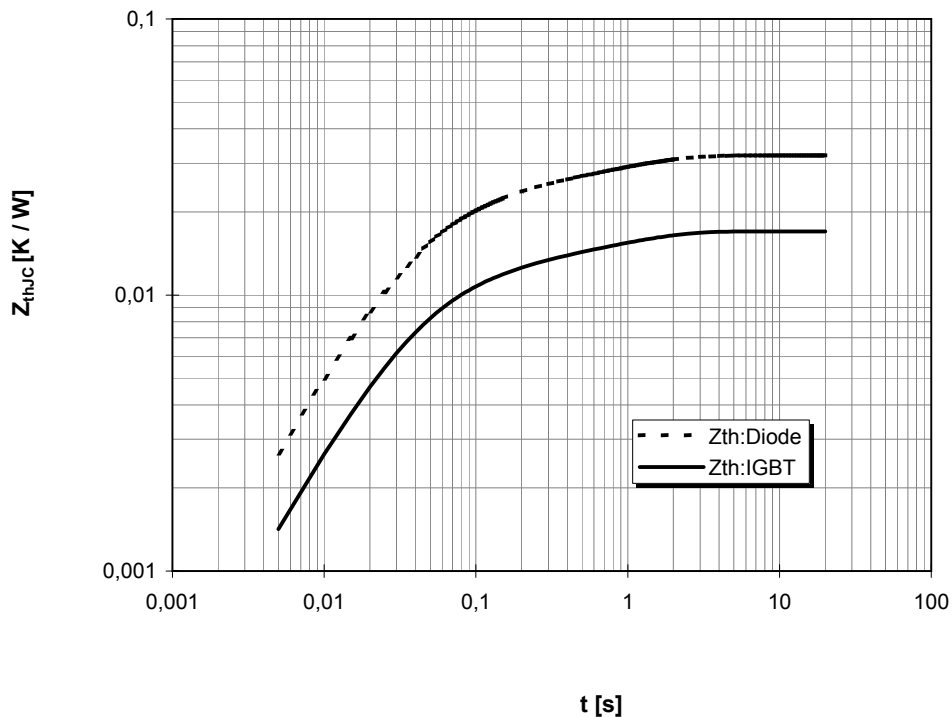
safe operation area Diode (SOA)

$P_{max} = 1200kW$; $T_{vj} = 125^\circ C$





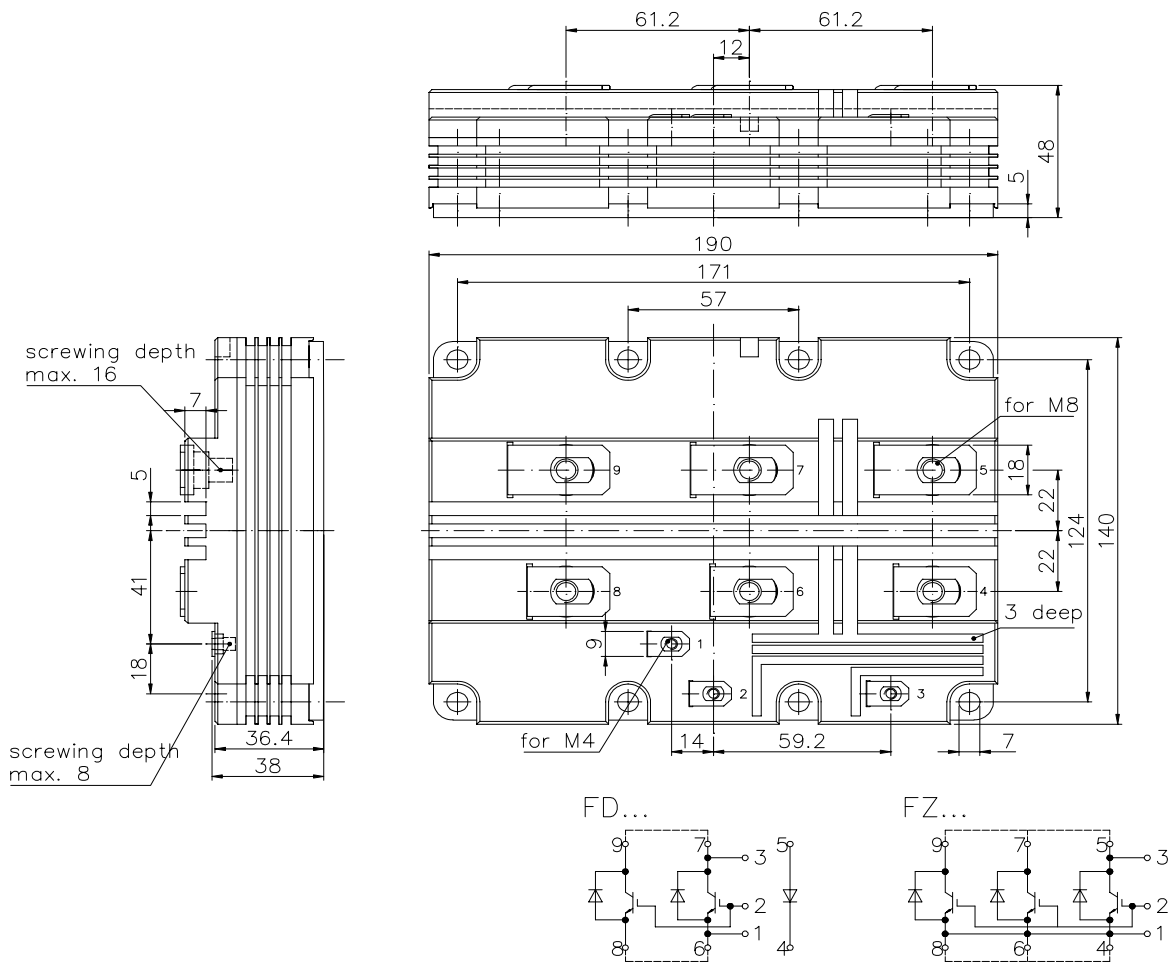
Transienter Wärmewiderstand $Z_{thJC} = f(t)$
Transient thermal impedance



i		1	2	3	4
r_i [K/kW]	: IGBT	7,65	4,25	1,02	4,08
τ_i [s]	: IGBT	0,030	0,10	0,30	1,0
r_i [K/kW]	: Diode	14,40	8,00	1,92	7,68
τ_i [s]	: Diode	0,030	0,10	0,30	1,0



Äußere Abmessungen /
external dimensions



Anschlüsse / Terminals

siehe Anschlussschaltbild oben / see circuit diagram above

Terms & Conditions of Usage

Attention

The present product data is exclusively subscribed to technically experienced staff. This Data Sheet is describing the specification of the products for which a warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its specifications. Changes to the Data Sheet are reserved.

You and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application. Should you require product information in excess of the data given in the Data Sheet, please contact your local Sales Office via "www.eupec.com / sales & contact".

Warning

Due to technical requirements the products may contain dangerous substances. For information on the types in question please contact your local Sales Office via "www.eupec.com / sales & contact".