

Technische Information / technical information

eupec

IGBT-Module
IGBT-Modules

FS15R06XL4



vorläufige Daten
preliminary data

Höchstzulässige Werte / maximum rated values

Elektrische Eigenschaften / electrical properties

Kollektor Emitter Sperrspannung collector emitter voltage	$T_{vj} = 25\text{ °C}$	V_{CES}	600	V
Kollektor Dauergleichstrom DC collector current	$T_C = 75\text{ °C}$	$I_{C,nom.}$	15	A
	$T_C = 25\text{ °C}$	I_C	20	A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ms}, T_C = 75\text{ °C}$	I_{CRM}	30	A
Gesamt Verlustleistung total power dissipation	$T_c = 25\text{ °C}, \text{ Transistor}$	P_{tot}	81	W
Gate Emitter Spitzenspannung gate emitter peak voltage		V_{GES}	± 20	V
Dauergleichstrom DC forward current		I_F	15	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1\text{ms}$	I_{FRM}	30	A
Grenzlastintegral I^2t value	$V_R = 0\text{V}, t_p = 10\text{ms}, T_{vj} = 125\text{ °C}$	I^2t	34	A ² s
Isolations Prüfspannung insulation test voltage	RMS, $f = 50\text{Hz}, t = 1\text{min}$	V_{ISOL}	2,5	kV

Charakteristische Werte / characteristic values

Transistor Wechselrichter / transistor inverter

			min.	typ.	max.	
Kollektor Emitter Sättigungsspannung collector emitter saturation voltage	$V_{GE} = 15\text{V}, T_{vj} = 25\text{ °C}, I_C = I_{C,nom.}$	V_{CESat}	-	1,95	2,55	V
	$V_{GE} = 15\text{V}, T_{vj} = 125\text{ °C}, I_C = I_{C,nom.}$		-	2,20	-	V
Gate Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}, I_C = 0,4\text{ mA}$	$V_{GE(th)}$	4,5	5,5	6,5	V
Gateladung gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	Q_G	-	0,08	-	μC
Eingangskapazität input capacitance	$f = 1\text{MHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{ies}	-	0,675	-	nF
Rückwirkungskapazität reverse transfer capacitance	$f = 1\text{MHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{V}, V_{GE} = 0\text{V}$	C_{res}	-	0,06	-	nF
Kollektor Emitter Reststrom collector emitter cut off current	$V_{CE} = 600\text{ V}, V_{GE} = 0\text{V}, T_{vj} = 25\text{ °C}$	I_{CES}	-	-	5	mA
Gate Emitter Reststrom gate emitter leakage current	$V_{CE} = 0\text{V}, V_{GE} = 20\text{V}, T_{vj} = 25\text{ °C}$	I_{GES}	-	-	400	nA

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Charakteristische Werte / characteristic values

Transistor Wechselrichter / transistor inverter

			min.	typ.	max.	
Einschaltverzögerungszeit (induktive Last) turn on delay time (inductive load)	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$	$t_{d,on}$	-	20	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 25^\circ \text{C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}$					
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$	t_r	-	7	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 25^\circ \text{C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}$					
Abschaltverzögerungszeit (induktive Last) turn off delay time (inductive load)	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$	$t_{d,off}$	-	80	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 25^\circ \text{C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}$					
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$	t_f	-	18	-	ns
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 25^\circ \text{C}$					
	$V_{GE} = \pm 15 \text{ V}, R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}$					
Einschaltverlustenergie pro Puls turn on energy loss per pulse	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$ $R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}, L_\sigma = 15 \text{ nH}$	E_{on}	-	0,45	-	mJ
Ausschaltverlustenergie pro Puls turn off energy loss per pulse	$I_C = 15 \text{ A}, V_{CC} = 300 \text{ V}$ $R_G = 18 \ \Omega, T_{vj} = 125^\circ \text{C}, L_\sigma = 15 \text{ nH}$	E_{off}	-	0,30	-	mJ
Kurzschlussverhalten SC data	$t_p \leq 10 \mu\text{sec}, V_{GE} \leq 15 \text{ V}, T_{vj} = 125^\circ \text{C},$ $V_{CC} = 360 \text{ V}, V_{CEmax} = V_{CES} - L_{\sigma CE} \cdot di/dt $	I_{SC}	-	68	-	A
Modulinduktivität stray inductance module		$L_{\sigma CE}$	-	25	-	nH
Leitungswiderstand, Anschluss-Chip lead resistance, terminal-chip	$T_c = 25^\circ \text{C}$	$R_{CC/EE}$	-	8	-	m Ω

Charakteristische Werte / characteristic values

Diode Wechselrichter / diode inverter

Durchlassspannung forward voltage	$I_F = 15 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^\circ \text{C}$	V_F	-	1,4	2	V
	$I_F = 15 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^\circ \text{C}$					
Rückstromspitze peak reverse recovery current	$I_F = 15 \text{ A}, -di_F/dt = 2000 \text{ A}/\mu\text{s}$	I_{RM}	-	36	-	A
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{C}$					
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{C}$					
Sperrverzögerungsladung recovered charge	$I_F = 15 \text{ A}, -di_F/dt = 2000 \text{ A}/\mu\text{s}$	Q_r	-	0,9	-	μC
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{C}$					
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{C}$					
Ausschaltenergie pro Puls reverse recovery energy	$I_F = 15 \text{ A}, -di_F/dt = 2000 \text{ A}/\mu\text{s}$	E_{rec}	-	0,25	-	mJ
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 25^\circ \text{C}$					
	$V_R = 300 \text{ V}, V_{GE} = -10 \text{ V}, T_{vj} = 125^\circ \text{C}$					

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NTC-Widerstand / NTC-thermistor

			min.	typ.	max.	
Nennwiderstand rated resistance	$T_c = 25^\circ\text{C}$	R_{25}	-	5	-	k Ω
Abweichung von R_{100} deviation of R_{100}	$T_c = 100^\circ\text{C}$, $R_{100} = 493\Omega$	$\Delta R/R$	-5	-	5	%
Verlustleistung power dissipation	$T_c = 25^\circ\text{C}$	P_{25}	-	-	20	mW
B-Wert B-value	$R_2 = R_1 \exp[B(1/T_2 - 1/T_1)]$	$B_{25/50}$	-	3375	-	K

Thermische Eigenschaften / thermal properties

Innerer Wärmewiderstand; DC thermal resistance, junction to case; DC	Transistor Wechselr. / transistor inverter	R_{thJC}	-	-	1,55	K/W
	Diode Wechselrichter / diode inverter		-	-	2,70	K/W
Wärmewiderstand; DC thermal resistance, junction to heatsink; DC	Transistor Wechselr. / transistor inverter	R_{thJH}	-	1,90	-	K/W
	Diode Wechselrichter / diode inverter		-	3,20	-	K/W
	$\lambda_{\text{Paste}} = 1 \text{ W/m}^2\text{K}$ / $\lambda_{\text{grease}} = 1 \text{ W/m}^2\text{K}$					
Übergangs-Wärmewiderstand, DC thermal resistance, case to heatsink, DC	Transistor Wechselr. / transistor inverter	R_{thCH}	-	0,65	-	K/W
	Diode Wechselrichter / diode inverter		-	0,85	-	K/W
	$\lambda_{\text{Paste}} = 1 \text{ W/m}^2\text{K}$ / $\lambda_{\text{grease}} = 1 \text{ W/m}^2\text{K}$					
Höchstzulässige Sperrschichttemp. maximum junction temperature		T_{vjmax}	-	-	150	$^\circ\text{C}$
Betriebstemperatur operation temperature		T_{op}	-40	-	125	$^\circ\text{C}$
Lagertemperatur storage temperature		T_{stg}	-40	-	125	$^\circ\text{C}$

Mechanische Eigenschaften / mechanical properties

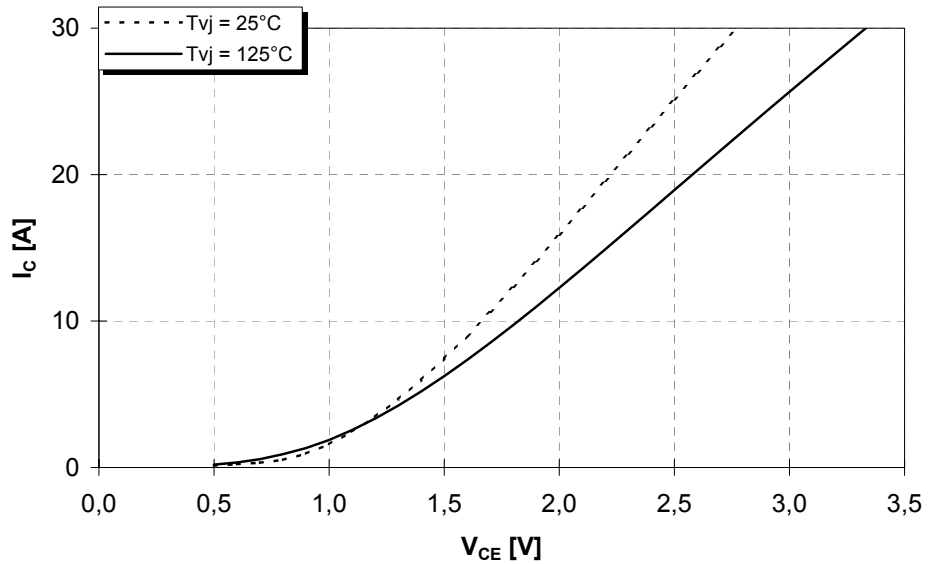
Innere Isolation internal insulation				Al_2O_3	
CTI comperative tracking index				225	
Anpresskraft pro Feder mounting force per clamp		F		20..50	N
Gewicht weight		G		25	g
Kriechstrecke creepage distance	Anschluss - Kühlkörper terminal to heatsink			10,5	mm
	Anschluss - Anschluss terminal to terminal			5	mm
Luftstrecke clearance distance	Anschluss - Kühlkörper terminal to heatsink			9	mm
	Anschluss - Anschluss terminal to terminal			5	mm



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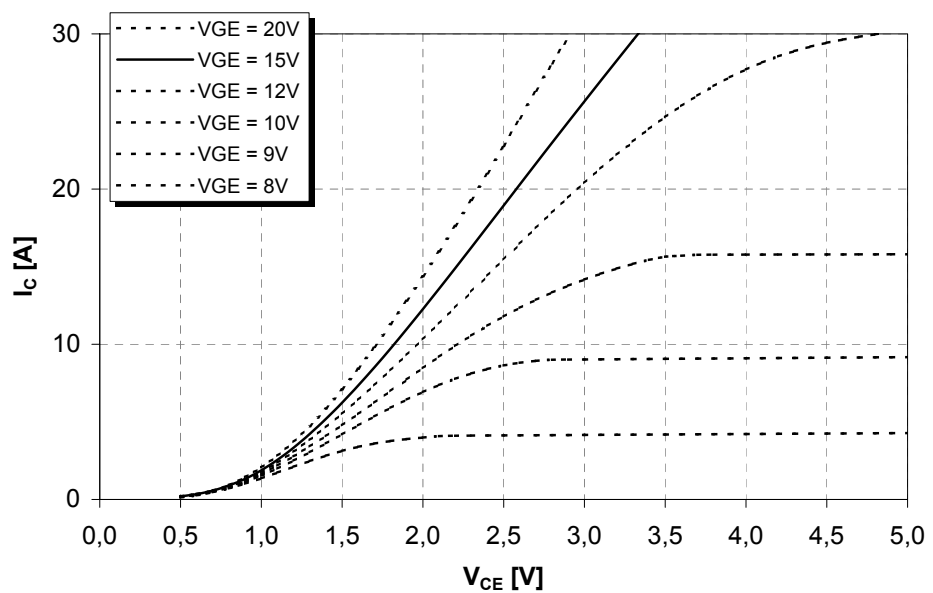
Ausgangskennlinie (typisch)
output characteristic (typical)

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



Ausgangskennlinienfeld (typisch)
output characteristic (typical)

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

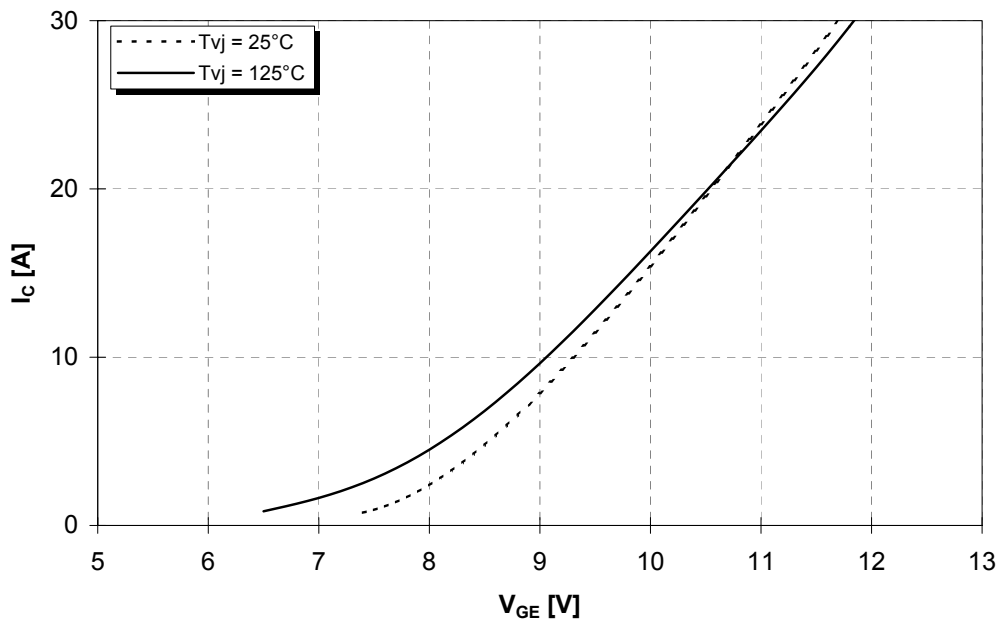




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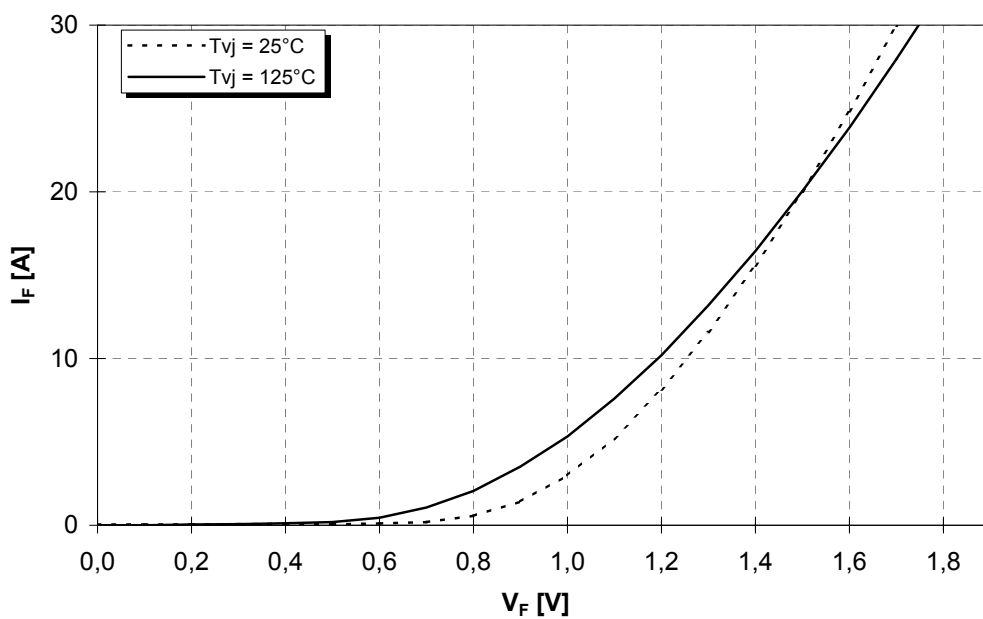
Übertragungscharakteristik (typisch)
transfer characteristic (typical)

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



Durchlasskennlinie der Inversdiode (typisch)
forward characteristic of inverse diode (typical)

$I_F = f(V_F)$

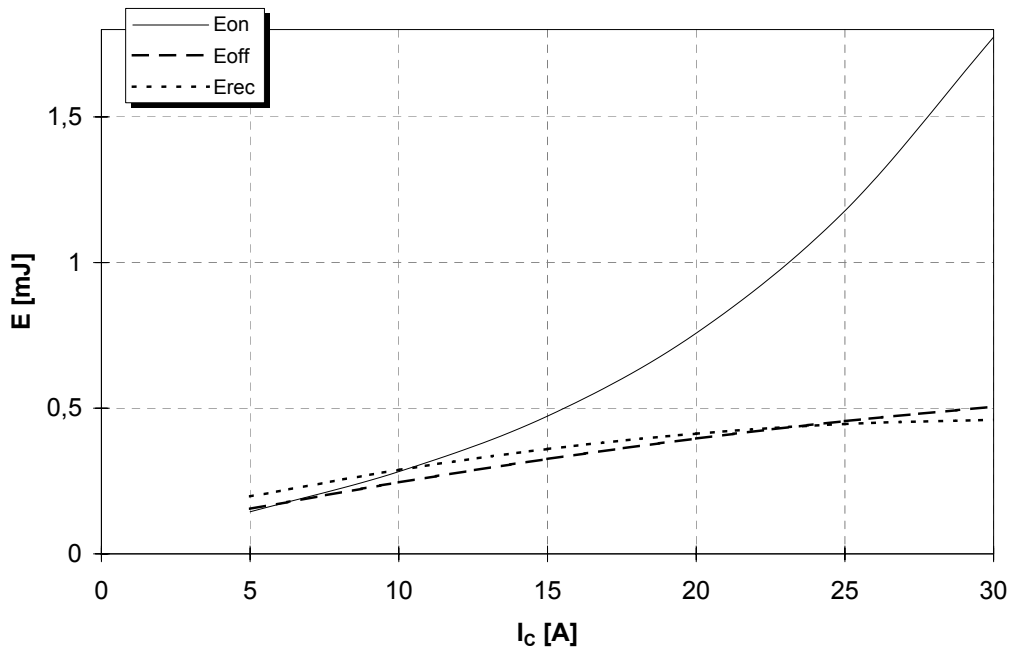




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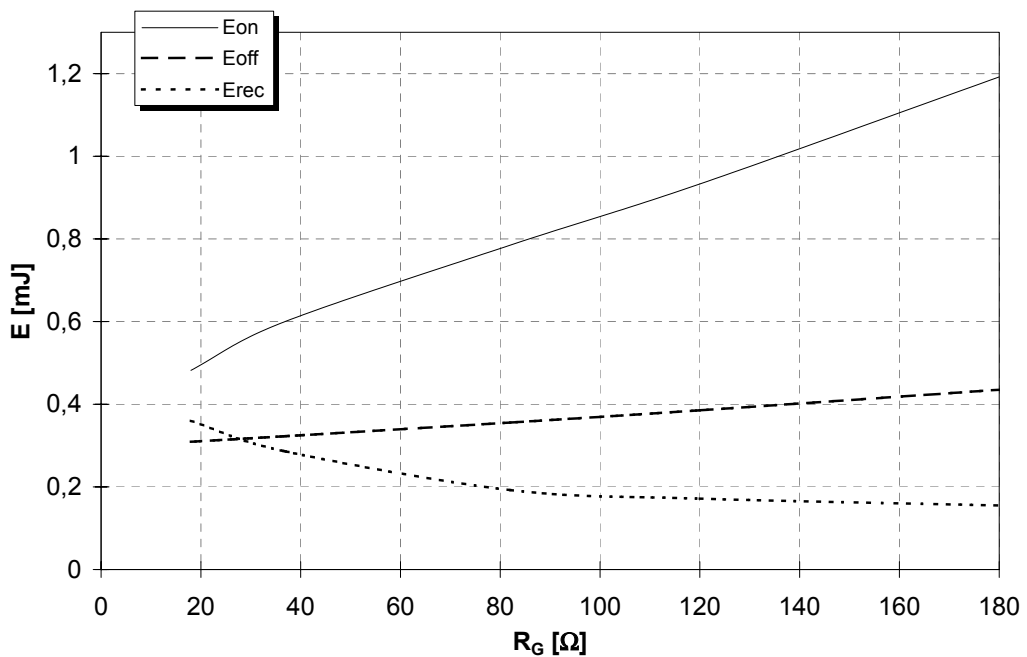
Schaltverluste (typisch)
switching losses (typical)

$E_{on} = f(I_C), E_{off} = f(I_C), E_{rec} = f(I_C)$
 $V_{GE} = \pm 15V, R_{Gon} = R_{Goff} = 18\Omega, V_{CE} = 300V, T_{vj} = 125^\circ C$



Schaltverluste (typisch)
switching losses (typical)

$E_{on} = f(R_G), E_{off} = f(R_G), E_{rec} = f(R_G)$
 $V_{GE} = \pm 15V, I_C = 15A, V_{CE} = 300V, T_{vj} = 125^\circ C$

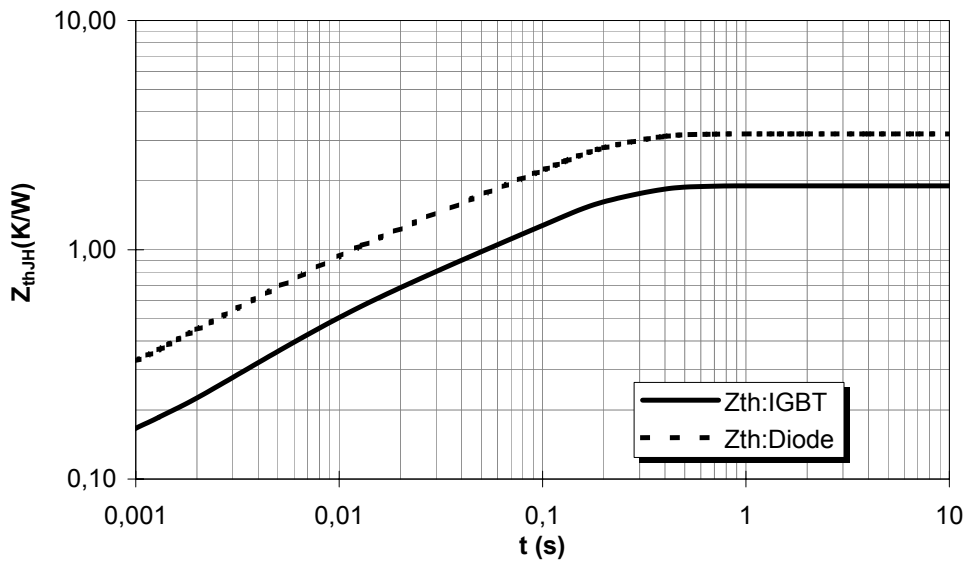




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**Transienter Wärmewiderstand
transient thermal impedance**

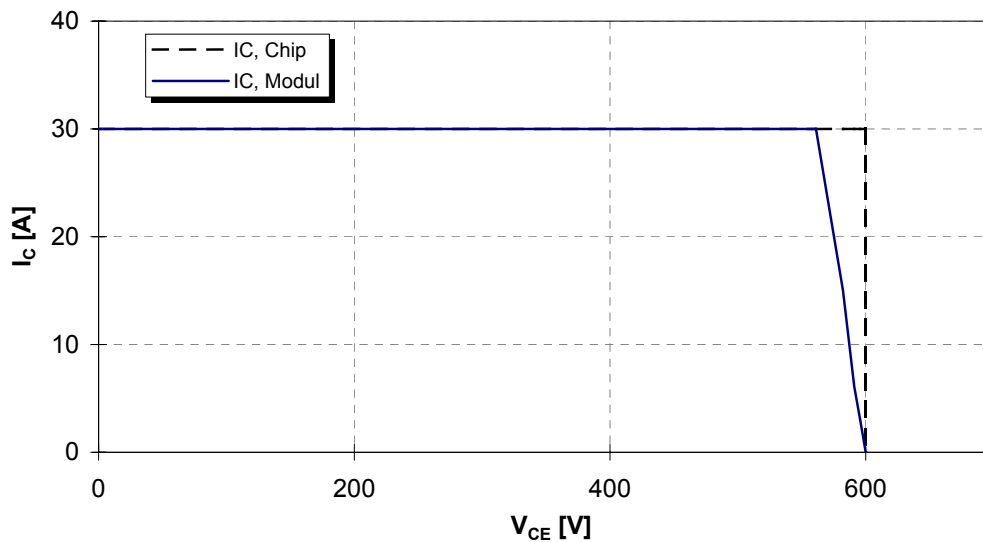
$Z_{thJH} = f(t)$



i	1	2	3	4
r_i [K/kW]: IGBT	114,0	380,0	1064,0	342,0
τ_i [s]: IGBT	0,000379	0,00745	0,11319	0,16026
r_i [K/kW]: Diode	192,0	640,0	1792,0	576,0
τ_i [s]: Diode	0,00031	0,00484	0,10644	0,14203

**Sicherer Arbeitsbereich (RBSOA)
reverse bias safe operation area (RBSOA)**

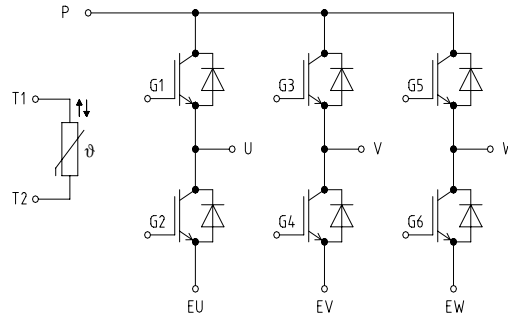
$V_{GE}=15V, T_j=125^\circ C, R_G = 18 \Omega$



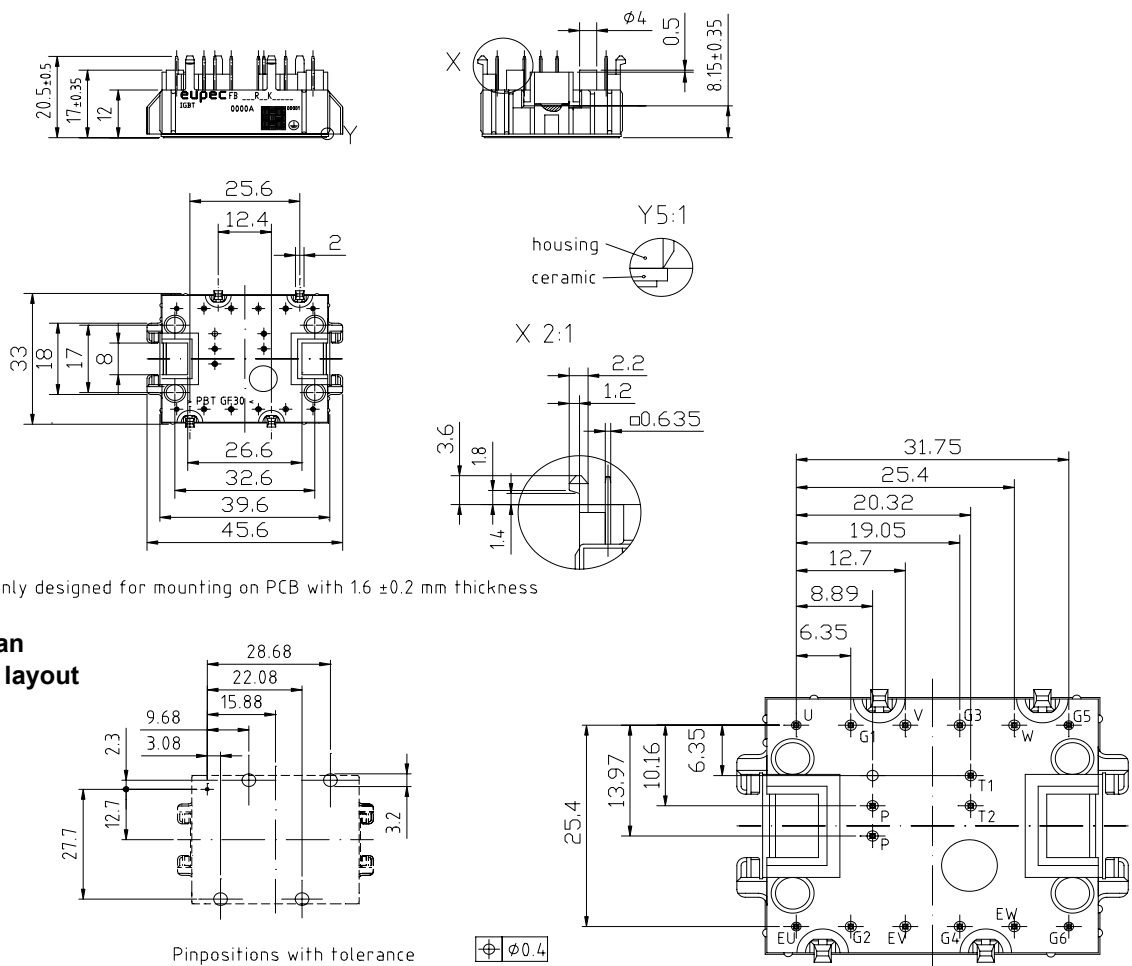


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Schaltbild circuit diagram

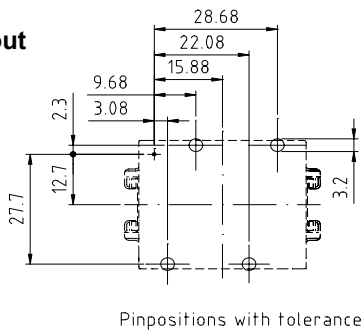


Gehäusemaße package outline



Module only designed for mounting on PCB with 1.6 ± 0.2 mm thickness

Bohrplan drilling layout



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