



vorläufige Daten
preliminary data

Höchstzulässige Werte / maximum rated values

Elektrische Eigenschaften / electrical properties

Kollektor Emitter Sperrspannung collector emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	600	V
Kollektor Dauergleichstrom DC collector current	$T_c = 55^{\circ}\text{C}$ $T_c = 25^{\circ}\text{C}$	$I_{C,nom.}$ I_C	50 55	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ms}$, $T_c = 55^{\circ}\text{C}$	I_{CRM}	100	A
Gesamt Verlustleistung total power dissipation	$T_c = 25^{\circ}\text{C}$, Transistor	P_{tot}	202	W
Gate Emitter Spitzenspannung gate emitter peak voltage		V_{GES}	± 20	V
Dauergleichstrom DC forward current		I_F	50	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1\text{ms}$	I_{FRM}	100	A
Grenzlastintegral I^2t value	$V_R = 0\text{V}$, $t_p = 10\text{ms}$, $T_{vj} = 125^{\circ}\text{C}$	I^2t	630	A^2s
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	$V_{GE} = 15\text{V}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = I_{C,nom}$ $V_{GE} = 15\text{V}$, $T_{vj} = 125^{\circ}\text{C}$, $I_C = I_{C,nom}$	V_{CESat}	- -	1,95 2,20	2,55 -	V V
Gate Schwellenspannung gate threshold voltage	$V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$, $I_C = 1\text{mA}$	$V_{GE(th)}$	4,5	5,5	6,5	V
Gateladung gate charge	$V_{GE} = -15\text{V} \dots +15\text{V}$	Q_G	-	0,3	-	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}	-	2,2	-	nF
Rückwirkungskapazität reverse transfer capacitance	$f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{V}$, $V_{GE} = 0\text{V}$	C_{res}	-	0,2	-	nF
Kollektor Emitter Reststrom collector emitter cut off current	$V_{CE} = 600\text{V}$, $V_{GE} = 0\text{V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{CES}	-	-	5	mA
Gate Emitter Reststrom gate emitter leakage current	$V_{CE} = 0\text{V}$, $V_{GE} = 20\text{V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{GES}	-	-	400	nA

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IGBT-Module
IGBT-Modules

FS50R06YL4



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Charakteristische Werte / characteristic values

Transistor Wechselrichter / transistor inverter

			min.	typ.	max.	
Einschaltverzögerungszeit (induktive Last) turn on delay time (inductive load)	$I_C = 50A, V_{CC} = 300V$	$t_{d,on}$				
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 25^\circ C$		-	42	-	ns
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 125^\circ C$		-	43	-	ns
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 50A, V_{CC} = 300V$	t_r				
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 25^\circ C$		-	11	-	ns
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 125^\circ C$		-	12	-	ns
Abschaltverzögerungszeit (induktive Last) turn off delay time (inductive load)	$I_C = 50A, V_{CC} = 300V$	$t_{d,off}$				
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 25^\circ C$		-	120	-	ns
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 125^\circ C$		-	130	-	ns
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 50A, V_{CC} = 300V$	t_f				
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 25^\circ C$		-	20	-	ns
	$V_{GE} = \pm 15V, R_G = 3,3\Omega, T_{vj} = 125^\circ C$		-	30	-	ns
Einschaltverlustenergie pro Puls turn on energy loss per pulse	$I_C = 50A, V_{CC} = 300V, V_{GE} = 15V$ $R_G = 3,3\Omega, T_{vj} = 125^\circ C, L_G = 15nH$	E_{on}	-	0,5	-	mJ
Ausschaltverlustenergie pro Puls turn off energy loss per pulse	$I_C = 50A, V_{CC} = 300V, V_{GE} = 15V$ $R_G = 3,3\Omega, T_{vj} = 125^\circ C, L_G = 15nH$	E_{off}	-	1,35	-	mJ
Kurzschlussverhalten SC data	$t_p \leq 10\mu sec, V_{GE} \leq 15V, T_{vj} = 125^\circ C,$ $V_{CC} = 360V, V_{CEmax} = V_{CES} - L_{GCE} \cdot di/dt $	I_{SC}	-	225	-	A
Modulinduktivität stray inductance module		L_{GCE}	-	35	-	nH
Leitungswiderstand, Anschluss-Chip lead resistance, terminal-chip	$T_c = 25^\circ C$	$R_{CC/EE}$	-	4	-	mΩ

Charakteristische Werte / characteristic values

Diode Wechselrichter / diode inverter

Durchlassspannung forward voltage	$I_F = 50A, V_{GE} = 0V, T_{vj} = 25^\circ C$	V_F	-	1,25	1,7	V
	$I_F = 50A, V_{GE} = 0V, T_{vj} = 125^\circ C$		-	1,20	-	V
Rückstromspitze peak reverse recovery current	$I_F = 50A, -di_F/dt = 2600 A/\mu s$	I_{RM}				
	$V_R = 300V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 300V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	88	-	A
Sperrverzögerungsladung recovered charge	$I_F = 50A, -di_F/dt = 2600 A/\mu s$	Q_r				
	$V_R = 300V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 300V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	3,2	-	μC
Ausschaltenergie pro Puls reverse recovery energy	$I_F = 50A, -di_F/dt = 2600 A/\mu s$	E_{rec}				
	$V_R = 300V, V_{GE} = -10V, T_{vj} = 25^\circ C$ $V_R = 300V, V_{GE} = -10V, T_{vj} = 125^\circ C$		-	1,05	-	mJ
			-	1,50	-	mJ

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Charakteristische Werte / characteristic values

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 Wecheln. / transistor inverter	R_{thJC}	-	-	0,62	K/W
	Diode Wechselrichter / diode inverter		-	-	1,20	K/W
Wärmewiderstand; DC thermal resistance, junction to heatsink, DC	Transistor Wecheln. / transistor inverter	R_{thJH}	-	0,95	-	K/W
	Diode Wechselrichter / diode inverter $\lambda_{\text{Paste}} = 1 \text{ W / m}^2\text{K} / \lambda_{\text{grease}} = 1 \text{ W / m}^2\text{K}$		-	1,50	-	K/W
Übergangs-Wärmewiderstand, DC thermal resistance, case to heatsink; DC	Transistor Wecheln. / transistor inverter	R_{thCH}	-	0,35	-	K/W
	Diode Wechselrichter / diode inverter $\lambda_{\text{Paste}} = 1 \text{ W / m}^2\text{K} / \lambda_{\text{grease}} = 1 \text{ W / m}^2\text{K}$		-	0,45	-	K/W
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

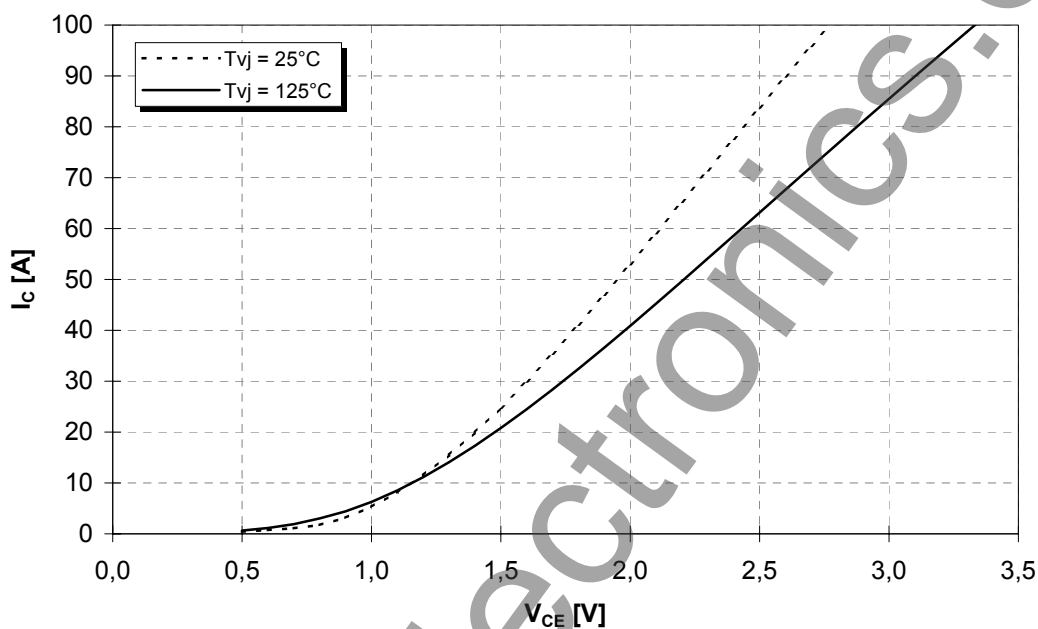
Innere Isolation internal insulation			Al_2O_3	
CTI comperative tracking index			225	
Anpresskraft pro Feder mounting force per clamp		F	40..80	N
Gewicht weight		G	36	g
Kriechstrecke creepage distance	Anschluss - Kühlkörper terminal to heatsink		13,5	mm
	Anschluss - Anschluss terminal to terminal		5,0	mm
Luftstrecke clearance distance	Anschluss - Kühlkörper terminal to heatsink		12,0	mm
	Anschluss - Anschluss terminal to terminal		5,0	mm



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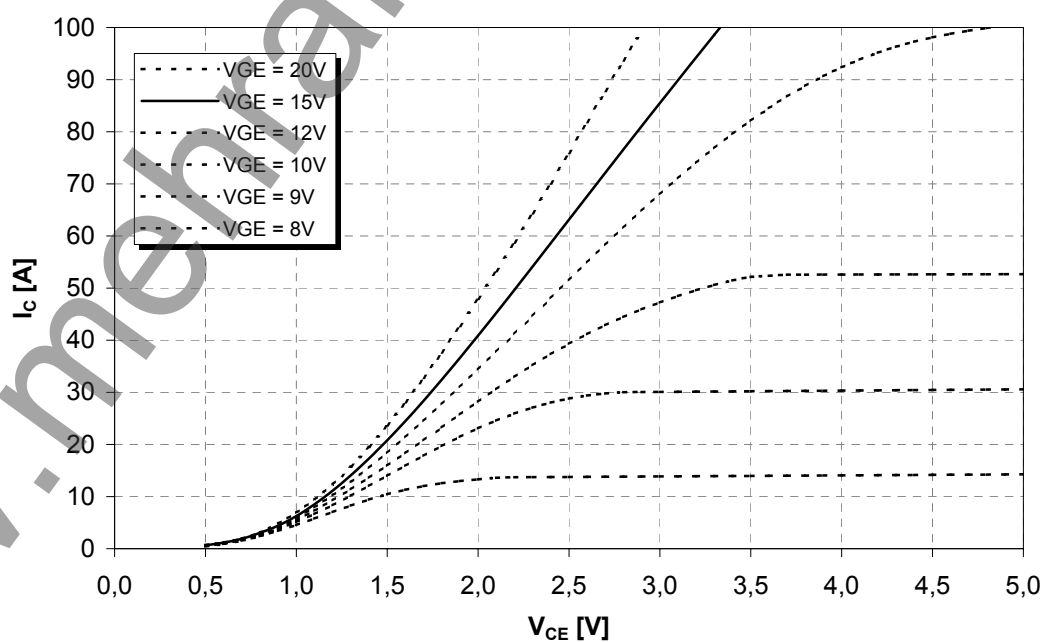
Ausgangskennlinie (typisch)
output characteristic (typical)

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



Ausgangskennlinienfeld (typisch)
output characteristic (typical)

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



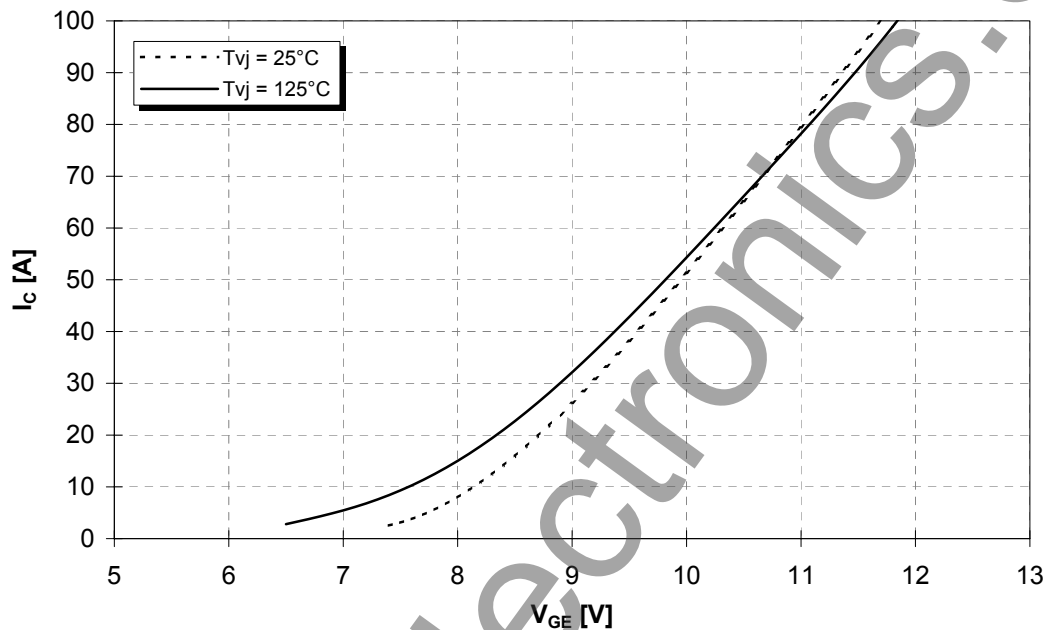


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Übertragungscharakteristik (typisch)
transfer characteristic (typical)

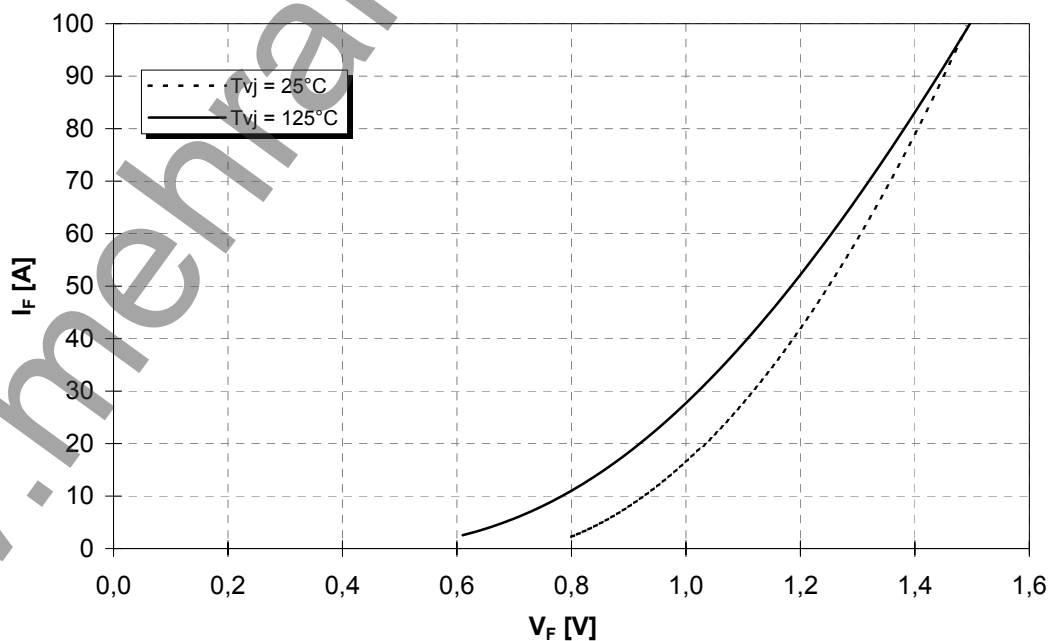
$$I_C = f(V_{GE})$$

$$V_{CE} = 20V$$



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

$$I_F = f(V_F)$$



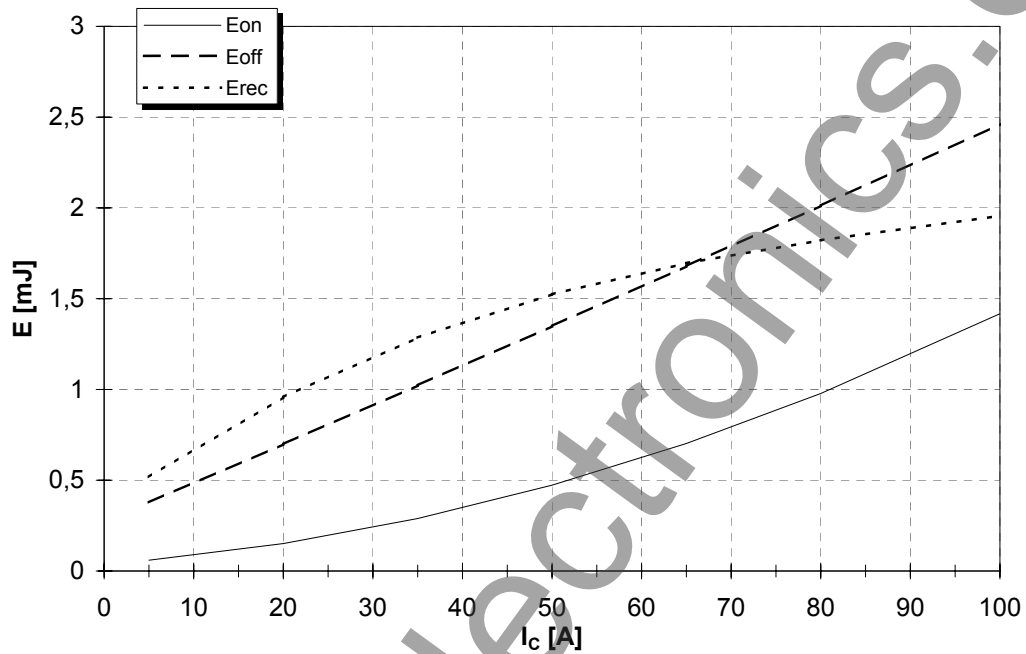


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Schaltverluste (typisch)
switching losses (typical)

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

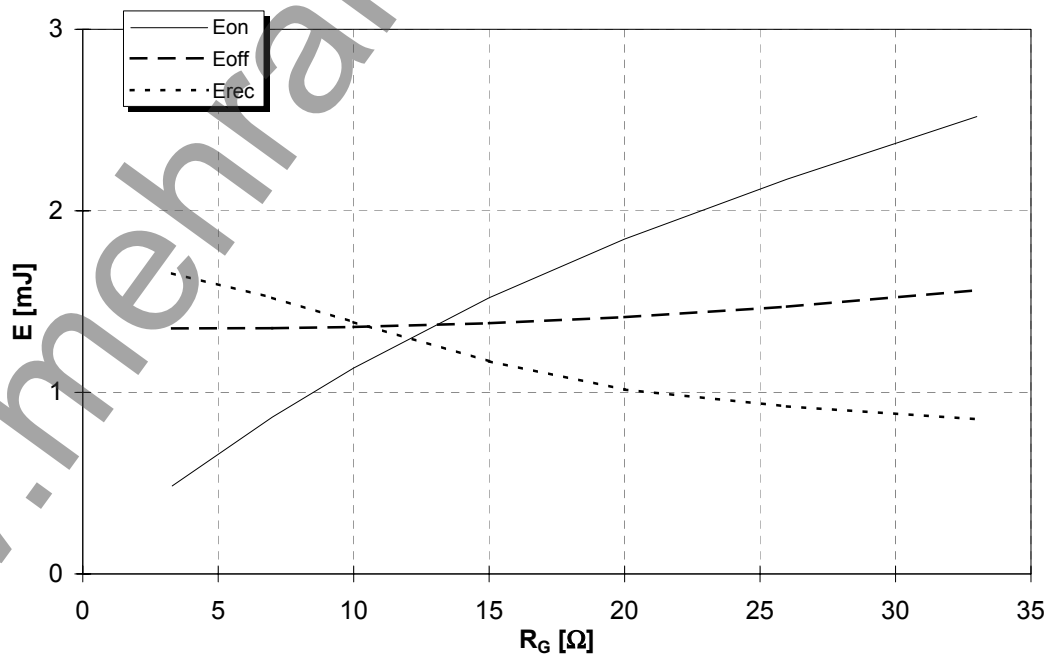
$$V_{GE} = \pm 15V, R_G = 3,3\Omega, V_{CE} = 300V, T_{vj} = 125^\circ C$$



Schaltverluste (typisch)
switching losses (typical)

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

$$V_{GE} = \pm 15V, I_C = 50A, V_{CE} = 300V, T_{vj} = 125^\circ C$$

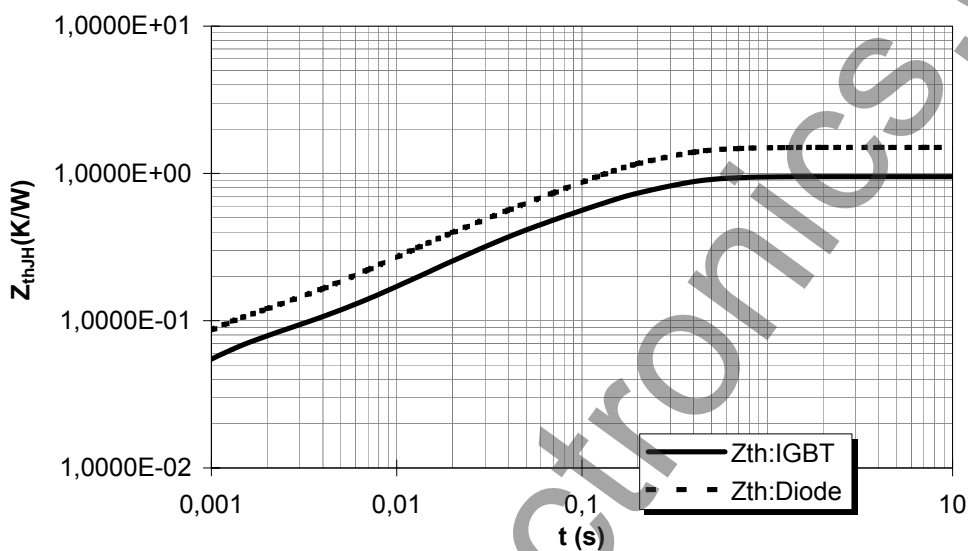




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Transienter Wärmewiderstand
transient thermal impedance

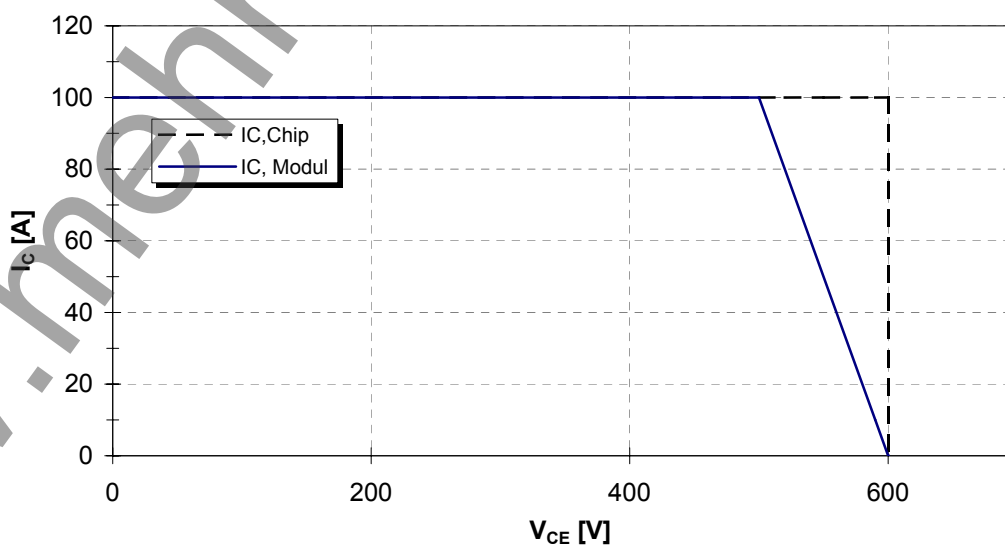
$$Z_{thJH} = f(t)$$



i	1	2	3	4
r_i [K/kW]: IGBT	57,0	190,0	532,0	171,0
τ_i [s]: IGBT	0,00075	0,02088	0,14800	0,25430
r_i [K/kW]: Diode	75,0	210,0	885,0	330,0
τ_i [s]: Diode	0,00056	0,01240	0,12800	0,25430

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

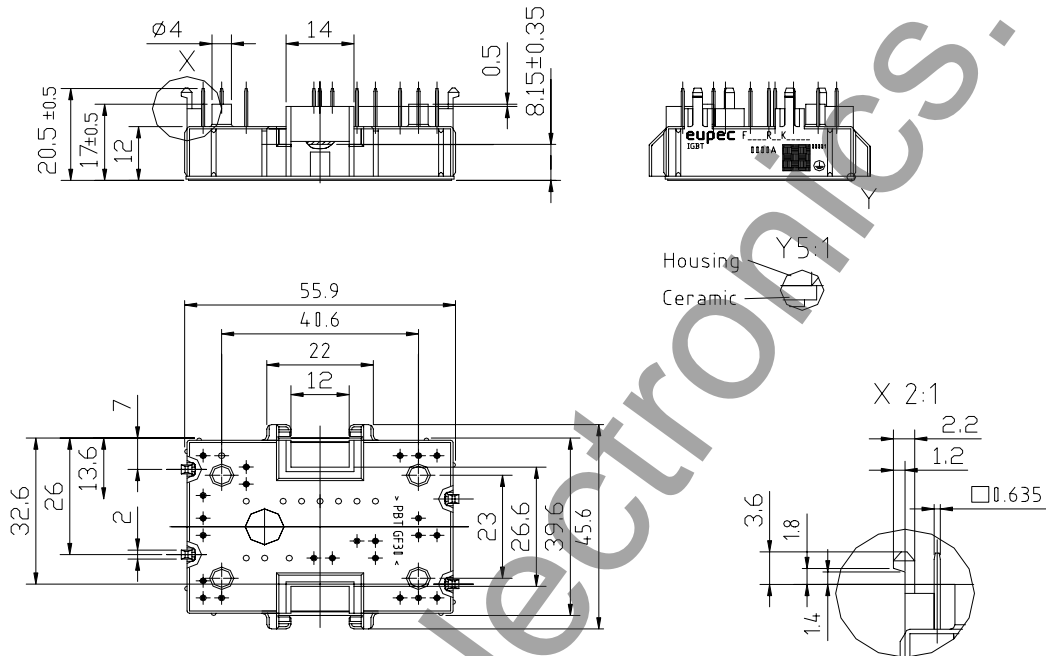
$$V_{GE} = \pm 15V, T_J = 125^\circ C$$





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Gehäusemaße Fortsetzung package outline contd.



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