

Technische Information / technical information

IGBT-Module
IGBT-modules

FS10R12YT3

power electronics in motion
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Vorläufige Daten preliminary data

IGBT-Wechselrichter / IGBT-inverter

Höchstzulässige Werte / maximum rated values

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1200	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C\text{ nom}}$ I_C	10 16	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}$, $T_C = 80^{\circ}\text{C}$	I_{CRM}	20	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	P_{tot}	78,0	W
Gate-Emitter-Spitzenspannung gate-emitter peak voltage		V_{GES}	+/-20	V

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Kollektor-Emitter Sättigungsspannung collector-emitter saturation voltage	$I_C = 10\text{ A}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$ $I_C = 10\text{ A}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 125^{\circ}\text{C}$	$V_{CE\text{ sat}}$		1,90 2,20	2,45	V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 0,30\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	5,0	5,8	6,5	V
Gateladung gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$	Q_G		0,10		μC
Interner Gatewiderstand internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		0,0		Ω
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}		0,70		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}		0,026		nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$	I_{CES}			5,0	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
Einschaltverzögerungszeit (ind. Last) turn-on delay time (inductive load)	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{ on}}$		0,05 0,05		μs μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	t_r		0,02 0,025		μs μs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{ off}}$		0,23 0,35		μs μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	t_f		0,09 0,15		μs μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$, $L_S = 70\text{ nH}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	E_{on}		0,75 1,20		mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 10\text{ A}$, $V_{CE} = 600\text{ V}$, $L_S = 70\text{ nH}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 82\ \Omega$, $T_{vj} = 125^{\circ}\text{C}$	E_{off}		0,75 1,10		mJ mJ
Kurzschlußverhalten SC data	$t_p \leq 10\ \mu\text{s}$, $V_{GE} \leq 15\text{ V}$ $T_{vj} \leq 125^{\circ}\text{C}$, $V_{CC} = 900\text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	I_{SC}		35		A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT per IGBT	R_{thJC}		1,60	1,80	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{Paste} = 1\text{ W/(m}\cdot\text{K)}$ / $\lambda_{grease} = 1\text{ W/(m}\cdot\text{K)}$	R_{thCH}		0,45		K/W

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Diode-Wechselrichter / diode-inverter

Höchstzulässige Werte / maximum rated values

Periodische Spitzensperrspannung repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1200	V
Dauergleichstrom DC forward current		I_F	10	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1 \text{ ms}$	I_{FRM}	20	A
Grenzlastintegral I^2t - value	$V_R = 0 \text{ V}, t_p = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$	I^2t	40,0	A^2s

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	$I_F = 10 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $I_F = 10 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	V_F		1,65 1,65	2,10	V V
Rückstromspitze peak reverse recovery current	$I_F = 10 \text{ A}, -di_F/dt = 600 \text{ A}/\mu\text{s}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	I_{RM}		20,0 19,0		A A
Sperrverzögerungsladung recovered charge	$I_F = 10 \text{ A}, -di_F/dt = 600 \text{ A}/\mu\text{s}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	Q_r		1,10 2,10		μC μC
Abschaltenergie pro Puls reverse recovery energy	$I_F = 10 \text{ A}, -di_F/dt = 600 \text{ A}/\mu\text{s}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	E_{rec}		0,40 0,75		mJ mJ
Innerer Wärmewiderstand thermal resistance, junction to case	pro Diode per diode	R_{thJC}		1,90	2,10	K/W
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Diode / per diode $\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) \quad / \quad \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$	R_{thCH}		0,60		K/W

NTC-Widerstand / NTC-thermistor

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Nennwiderstand rated resistance	$T_C = 25^{\circ}\text{C}$	R_{25}		5,00		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}			20,0	mW
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298, 15\text{K}))]$	$B_{25/50}$		3375		K

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Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min	V _{ISOL}	2,5	kV
Material für innere Isolation material for internal insulation			Al ₂ O ₃	
Kriechstrecke creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		13,5 7,50	mm
Luftstrecke clearance distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		12,0 7,50	mm
Vergleichszahl der Kriechwegbildung comparative tracking index		CTI	> 225	
min. typ. max.				
Modulinduktivität stray inductance module		L _{sCE}	35	nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	T _C = 25°C, pro Zweig / per arm	R _{CC+EE}	4,00	mΩ
Höchstzulässige Sperrschichttemperatur maximum junction temperature		T _{vj max}	150	°C
Temperatur im Schaltbetrieb temperature under switching conditions		T _{vj op}	-40	125 °C
Lagertemperatur storage temperature		T _{stg}	-40	125 °C
Anpreßkraft für mech. Bef. pro Feder mounting force per clamp		F	40	- 80 N
Gewicht weight		G	36	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 guarantees no characteristics. It is valid with the appropriate technical explanations.

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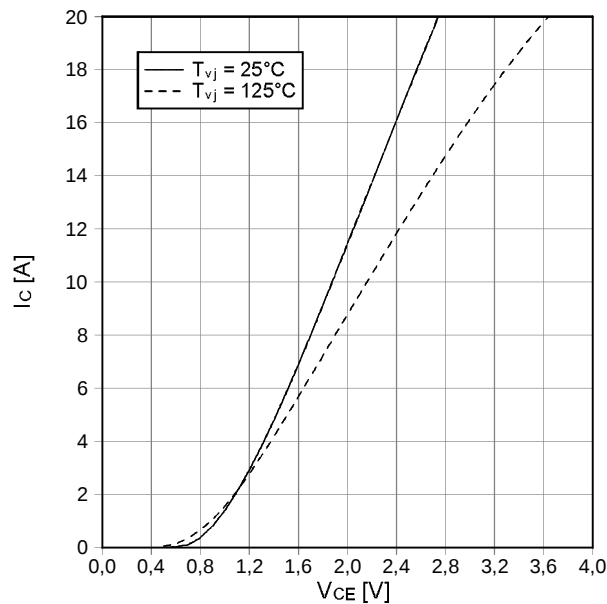
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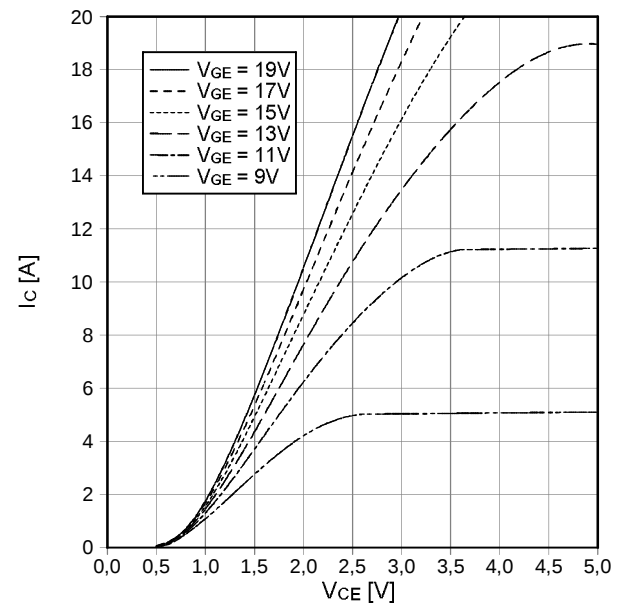
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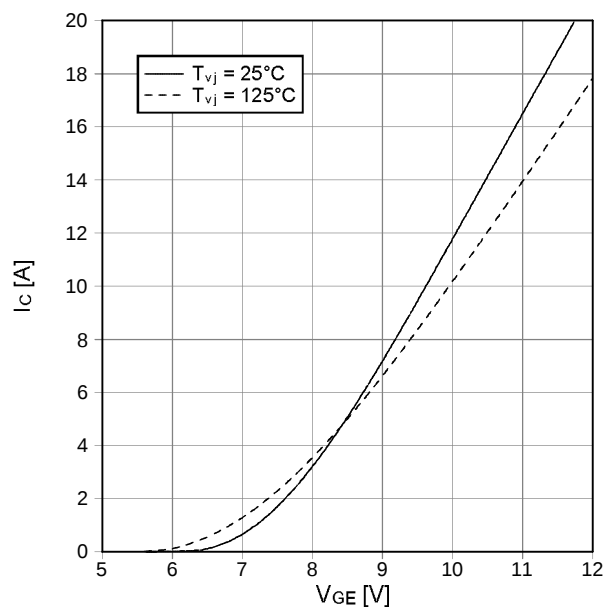
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



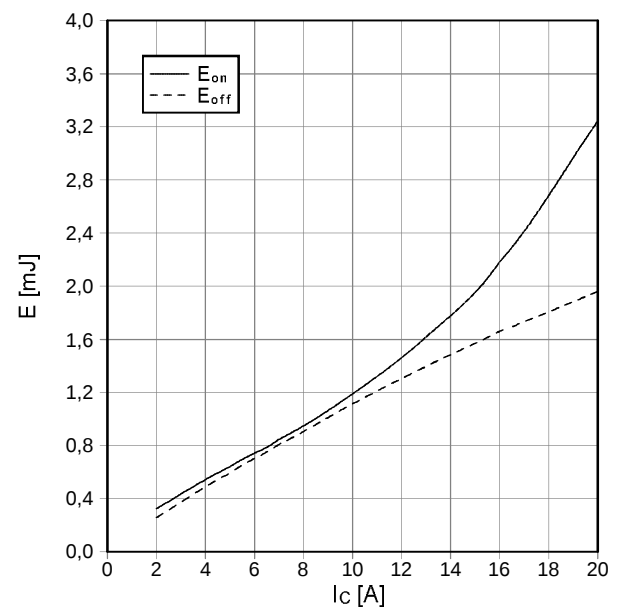
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_C = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



Übertragungscharakteristik IGBT-Wechselr. (typisch)
transfer characteristic IGBT-inverter (typical)
 $I_C = f(V_{GE})$
 $V_{CE} = 20 \text{ V}$

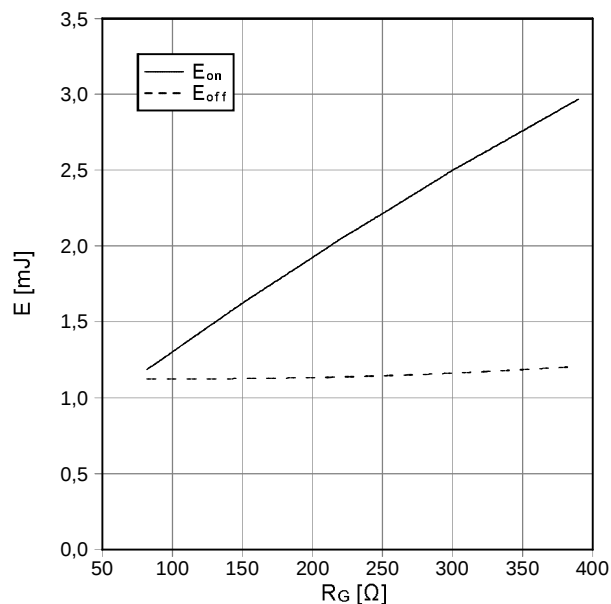


Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 82 \Omega$, $R_{Goff} = 82 \Omega$, $V_{CE} = 600 \text{ V}$,
 $T_{vj} = 125^\circ\text{C}$

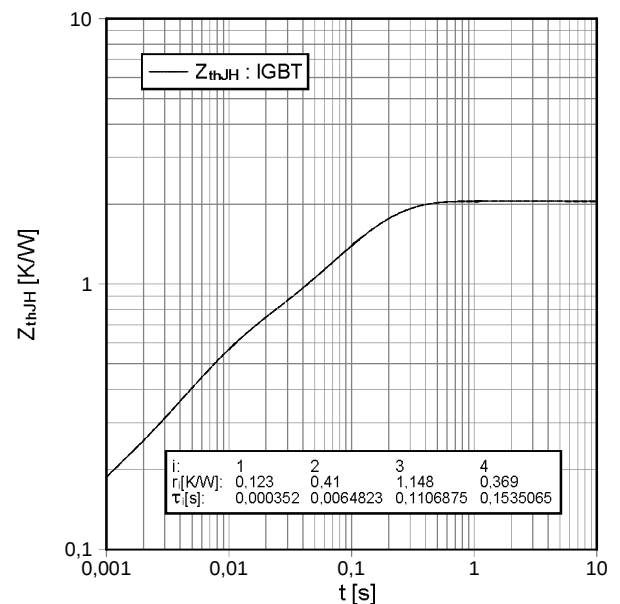


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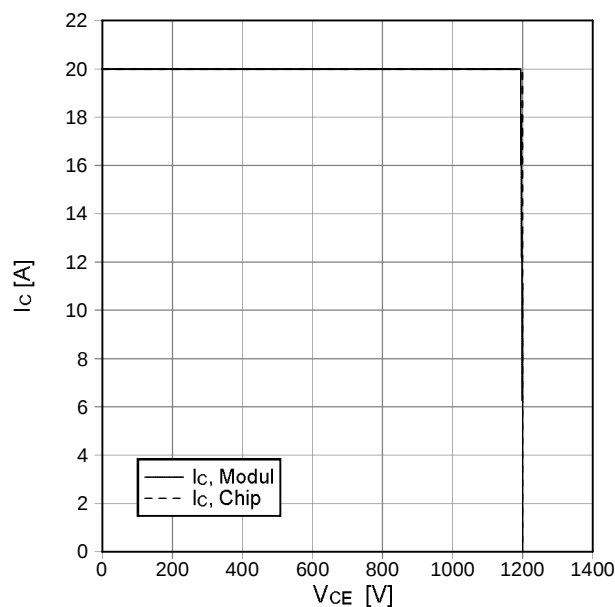
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 10 \text{ A}$, $V_{CE} = 600 \text{ V}$, $T_{vj} = 125^\circ\text{C}$



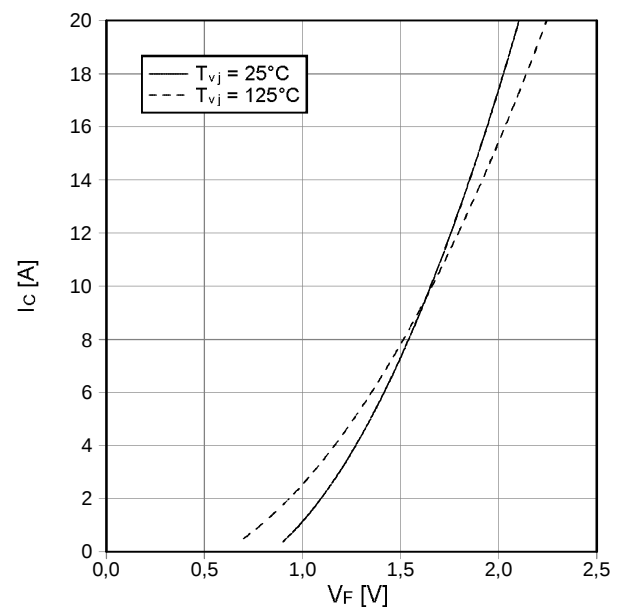
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
 $Z_{thJH} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 82 \Omega$, $T_{vj} = 125^\circ\text{C}$



Durchlaßkennlinie der Diode-Wechselr. (typisch)
forward characteristic of diode-inverter (typical)
 $I_F = f(V_F)$



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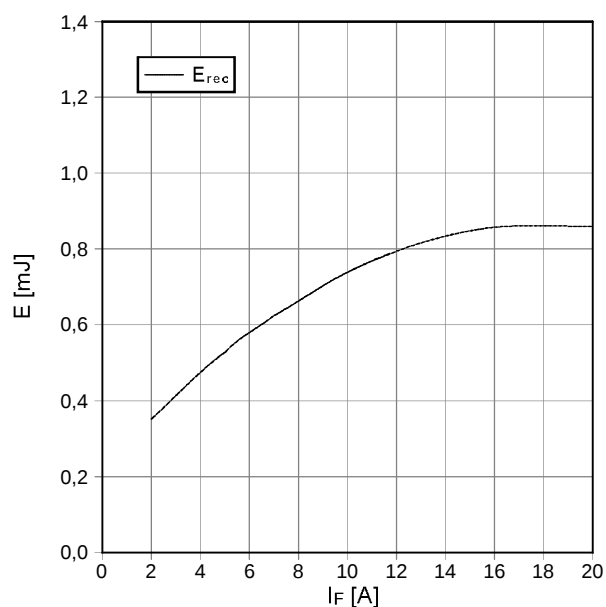
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Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

$$E_{rec} = f(I_F)$$

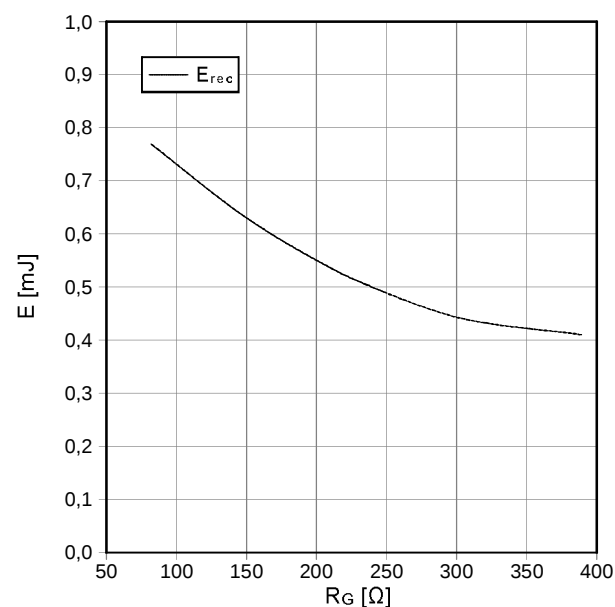
$R_{Gon} = 82 \Omega$, $V_{CE} = 600 \text{ V}$, $T_{vj} = 125^\circ\text{C}$



Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

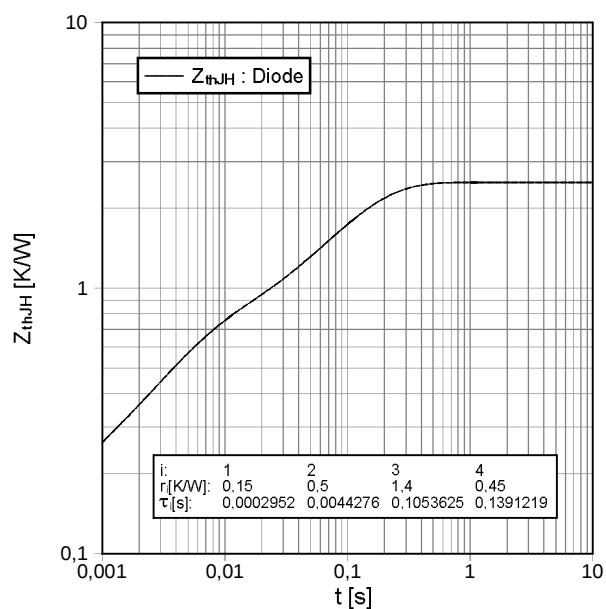
$$E_{rec} = f(R_G)$$

$I_F = 10 \text{ A}$, $V_{CE} = 600 \text{ V}$, $T_{vj} = 125^\circ\text{C}$



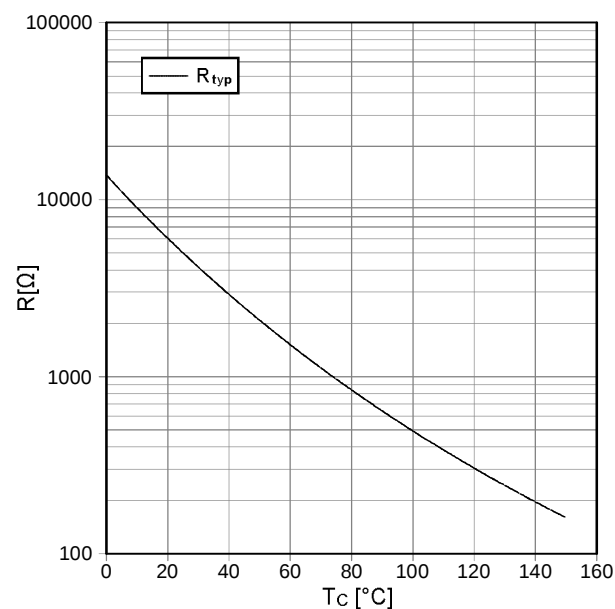
Transienter Wärmewiderstand Diode-Wechselr.
transient thermal impedance diode-inverter

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



NTC-Temperaturkennlinie (typisch)
NTC-temperature characteristic (typical)

$$R = f(T)$$



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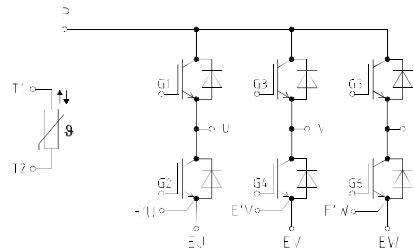
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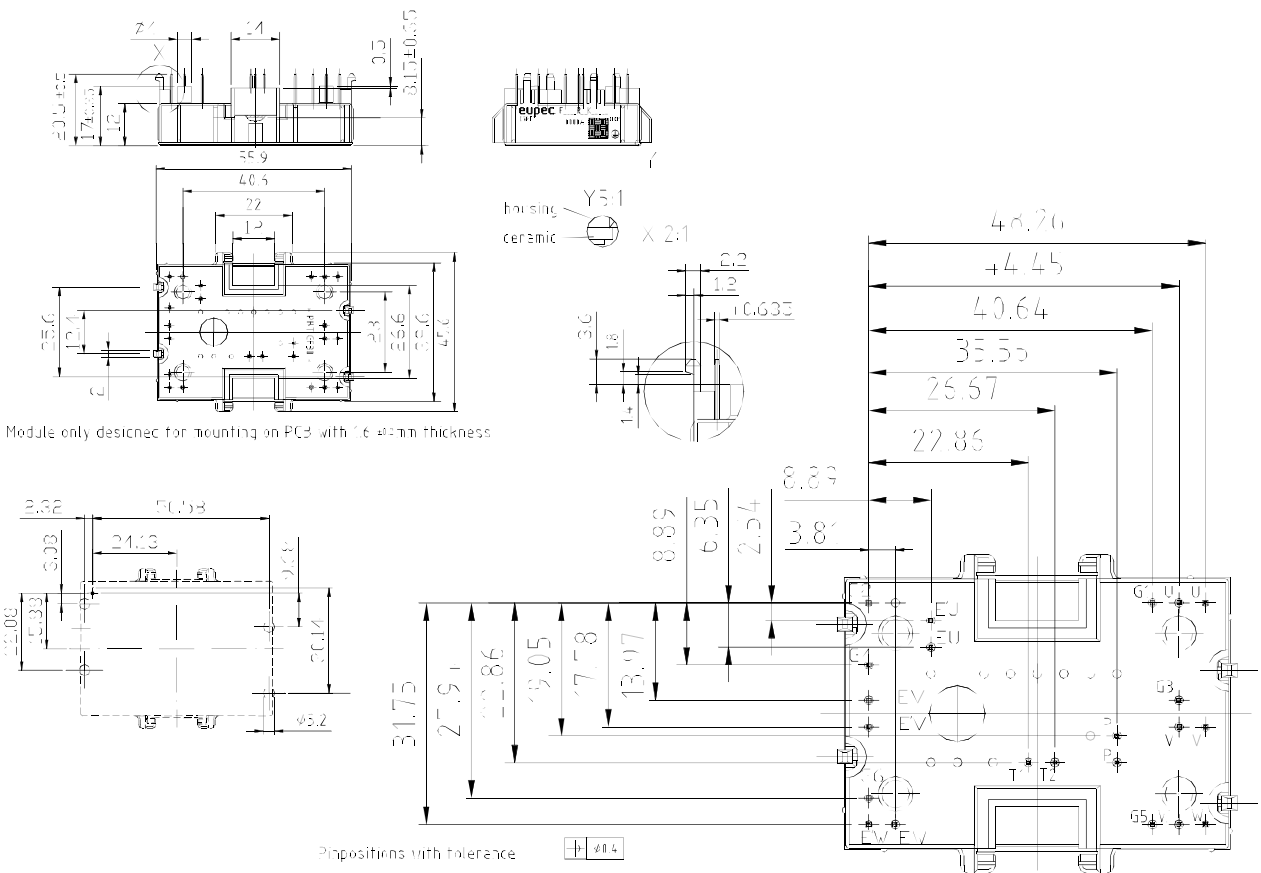
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Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



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