

**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}	600	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 45^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C\text{ nom}}$ I_C	200 225	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\text{ ms}, T_C = 45^{\circ}\text{C}$	I_{CRM}	400	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	P_{tot}	695	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	$I_C = 200\text{ A}, V_{GE} = 15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $I_C = 200\text{ A}, V_{GE} = 15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	$V_{CE\text{ sat}}$		1,95 2,20	2,55	V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 3,00\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	4,5	5,5	6,5	V
Gateladung gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$	Q_G		1,10		μC
Interner Gatewiderstand internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		5,0		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}		9,00		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}		0,80		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}			5,0	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)	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{ on}}$		0,16 0,18		μs μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_r		0,04 0,05		μs μs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{ off}}$		0,25 0,29		μs μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_f		0,03 0,04		μs μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{on}		3,70		mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 200\text{ A}, V_{CE} = 300\text{ V}, L_S = 30\text{ nH}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\text{ V}, R_{Goff} = 1,5\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{off}		6,60		mJ mJ
Kurzschlußverhalten SC data	$t_p \leq 10\ \mu\text{s}, V_{GE} \leq 15\text{ V}$ $T_{vj} \leq 125^{\circ}\text{C}, V_{CC} = 360\text{ V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	I_{SC}		900		A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT per IGBT	R_{thJC}			0,18	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}	600	V
Dauergleichstrom DC forward current		I_F	200	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1\text{ ms}$	I_{FRM}	400	A
Grenzlastintegral I^2t - value	$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$	I^2t	8450	A ² s

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	$I_F = 200\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $I_F = 200\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 125^{\circ}\text{C}$	V_F		1,25 1,20	1,70	V V
Rückstromspitze peak reverse recovery current	$I_F = 200\text{ A}, -di_F/dt = 4800\text{ A}/\mu\text{s}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	I_{RM}		170 190		A A
Sperrverzögerungsladung recovered charge	$I_F = 200\text{ A}, -di_F/dt = 4800\text{ A}/\mu\text{s}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	Q_r		12,0 20,0		μC μC
Abschaltenergie pro Puls reverse recovery energy	$I_F = 200\text{ A}, -di_F/dt = 4800\text{ A}/\mu\text{s}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 300\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	E_{rec}		2,80 4,10		mJ mJ
Innerer Wärmewiderstand thermal resistance, junction to case	pro Diode per diode	R_{thJC}			0,32	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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Technische Information / technical information

IGBT-Module
IGBT-modules

F4-200R06KL4

power electronics in motion
eupec

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Modul / module

Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISO}	2,5		kV	
Material Modulgrundplatte material of module baseplate			Cu			
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		10,0		mm	
Luftstrecke clearance distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		7,50		mm	
Vergleichszahl der Kriechwegbildung comparative tracking index		CTI	> 225			
			min.	typ.	max.	
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $\lambda_{\text{Paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$	R _{thCH}		0,009		K/W
Modulinduktivität stray inductance module		L _{sCE}		21		nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	T _C = 25°C, pro Schalter / per switch	R _{CC'+EE'}		2,60		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
Anzugsdrehmoment f. mech. Befestigung mounting torque	Schraube / screw M5	M	3,00	-	6,00	Nm
Gewicht weight		G		300		g

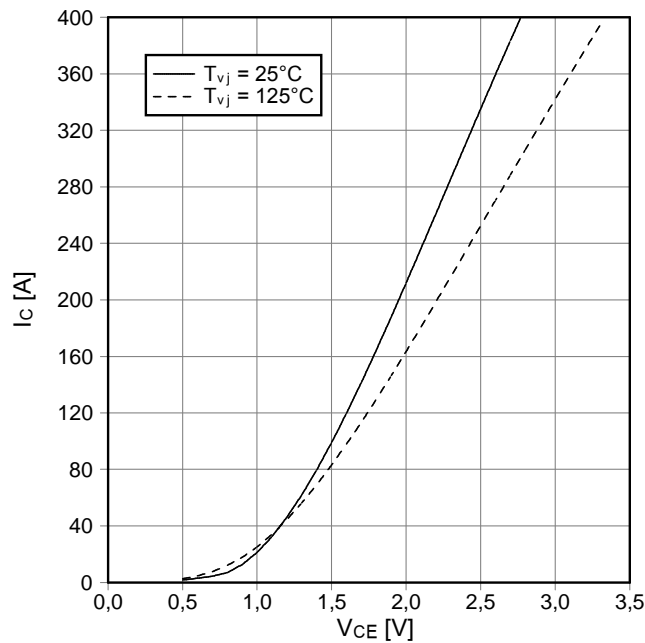
Mit dieser technischen Information werden Halbleiterbauelemente spezifiziert, jedoch keine Eigenschaften zugesichert. Sie gilt in Verbindung mit den zugehörigen technischen Erläuterungen.

This technical information specifies semiconductor devices but guarantees no characteristics. It is valid with the appropriate technical explanations.

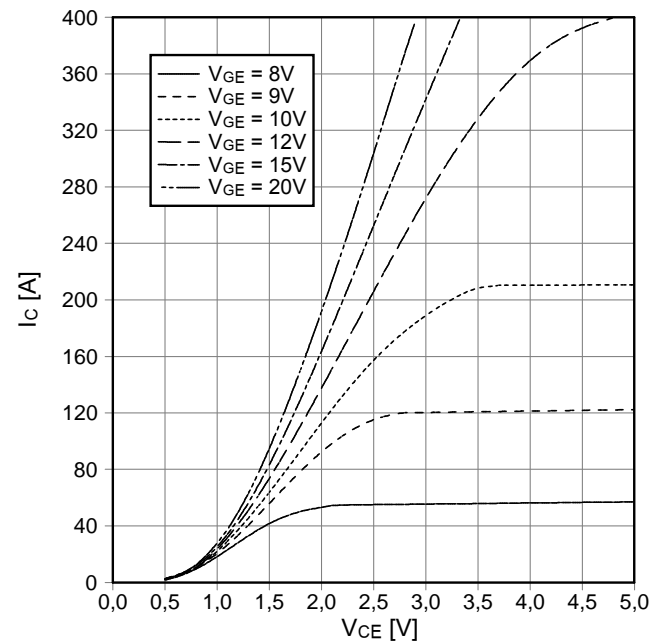
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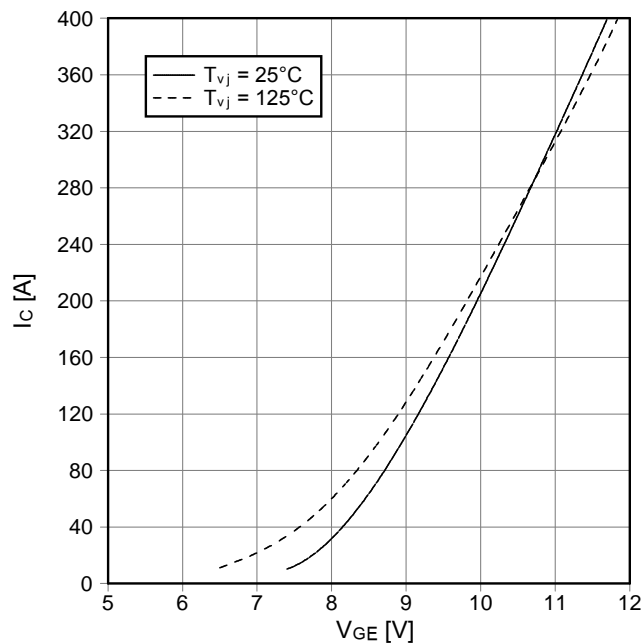
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



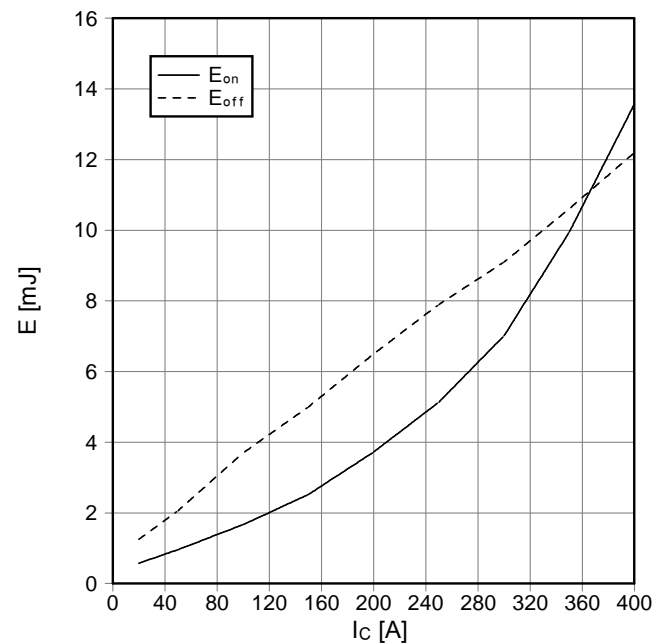
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



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



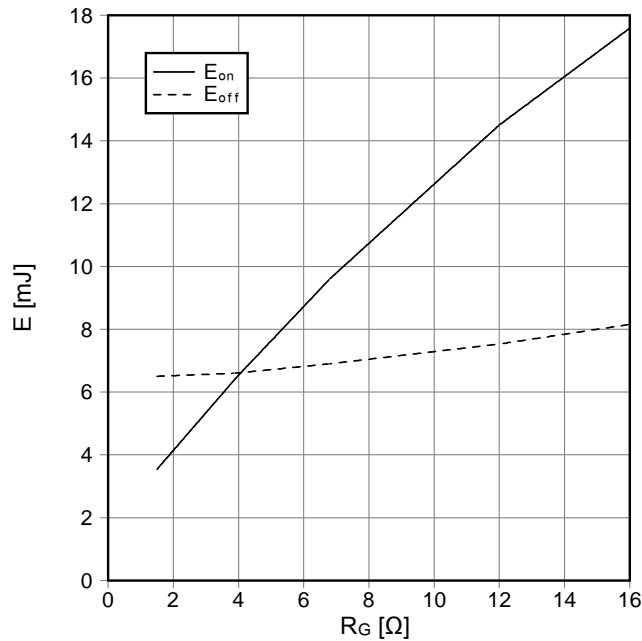
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_c)$, $E_{off} = f(I_c)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 1,5\ \Omega$, $R_{Goff} = 1,5\ \Omega$, $V_{CE} = 300\text{ V}$,
 $T_{vj} = 125^\circ\text{C}$



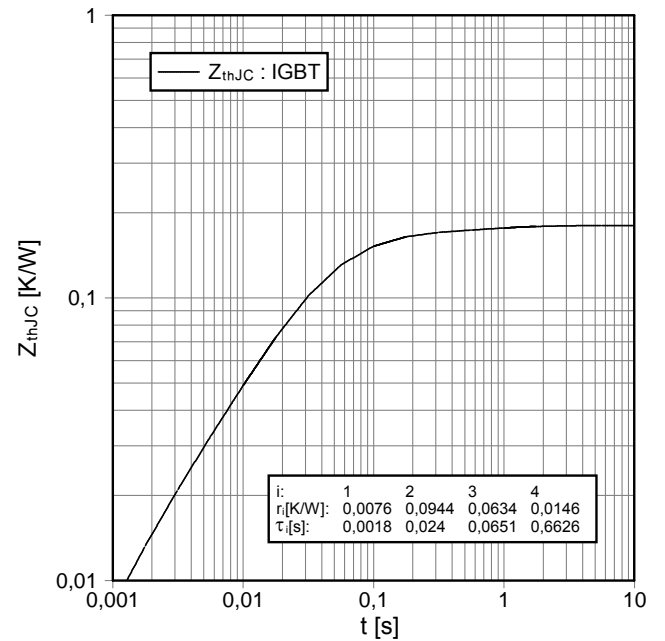
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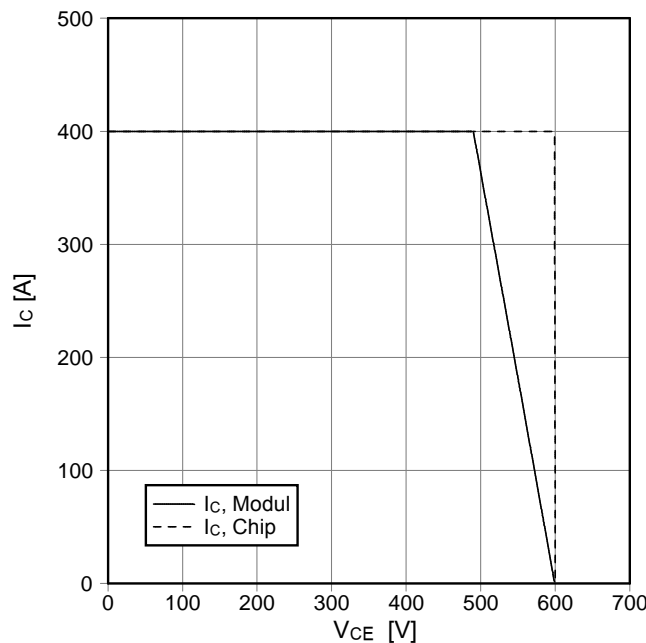
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 200\text{ A}$, $V_{CE} = 300\text{ V}$, $T_{vj} = 125^\circ\text{C}$



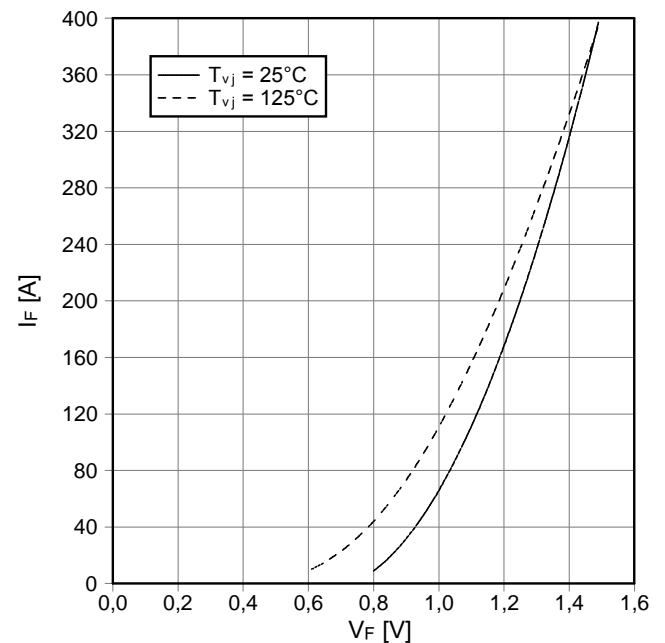
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
 $Z_{thJC} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 1,5\ \Omega$, $T_{vj} = 125^\circ\text{C}$



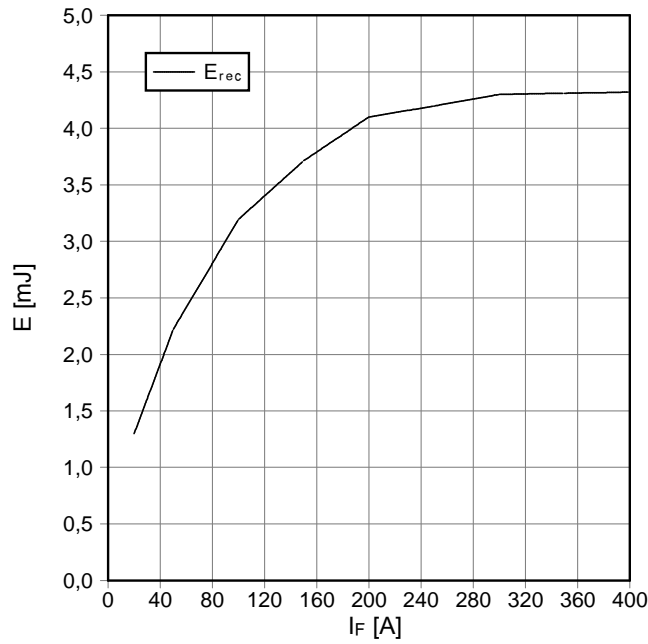
Durchlaßkennlinie der Diode-Wechselr. (typisch)
forward characteristic of diode-inverter (typical)
 $I_F = f(V_F)$



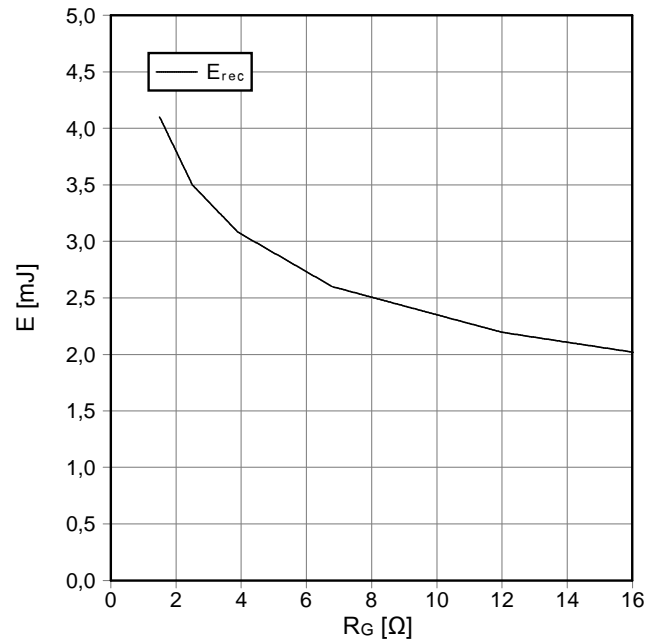
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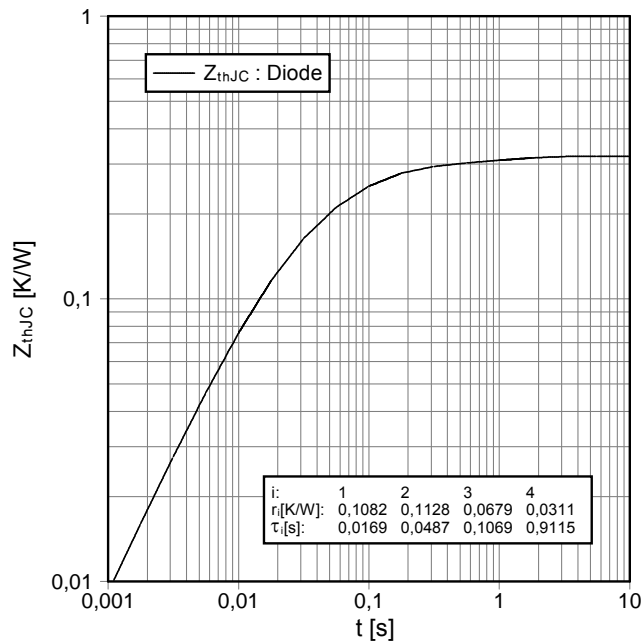
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 1,5 \Omega$, $V_{CE} = 300 V$, $T_{vj} = 125^\circ C$



Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 200 A$, $V_{CE} = 300 V$, $T_{vj} = 125^\circ C$

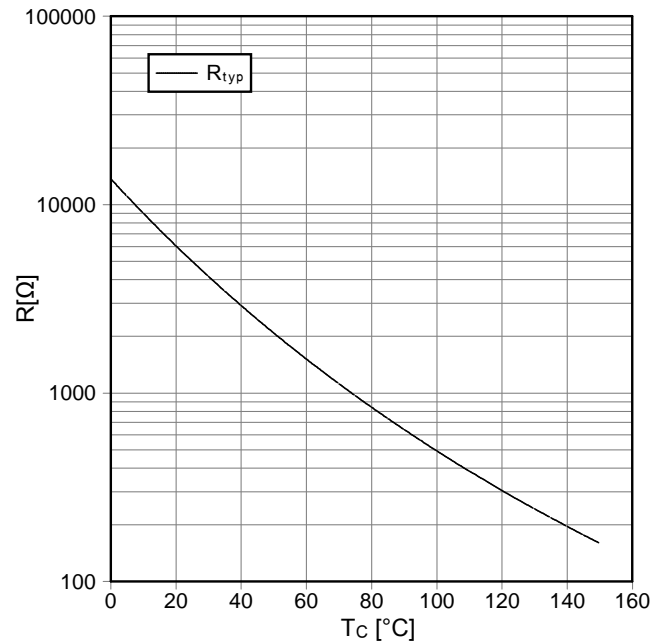


Transienter Wärmewiderstand Diode-Wechselr.
transient thermal impedance diode-inverter
 $Z_{thJC} = f(t)$



i:	1	2	3	4
r _i [K/W]:	0,1082	0,1128	0,0679	0,0311
τ _i [s]:	0,0169	0,0487	0,1069	0,9115

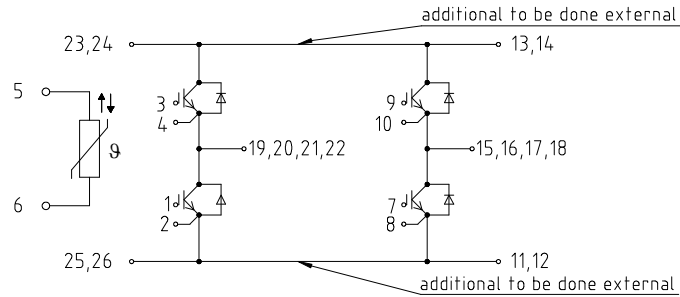
NTC-Temperaturkennlinie (typisch)
NTC-temperature characteristic (typical)
 $R = f(T)$



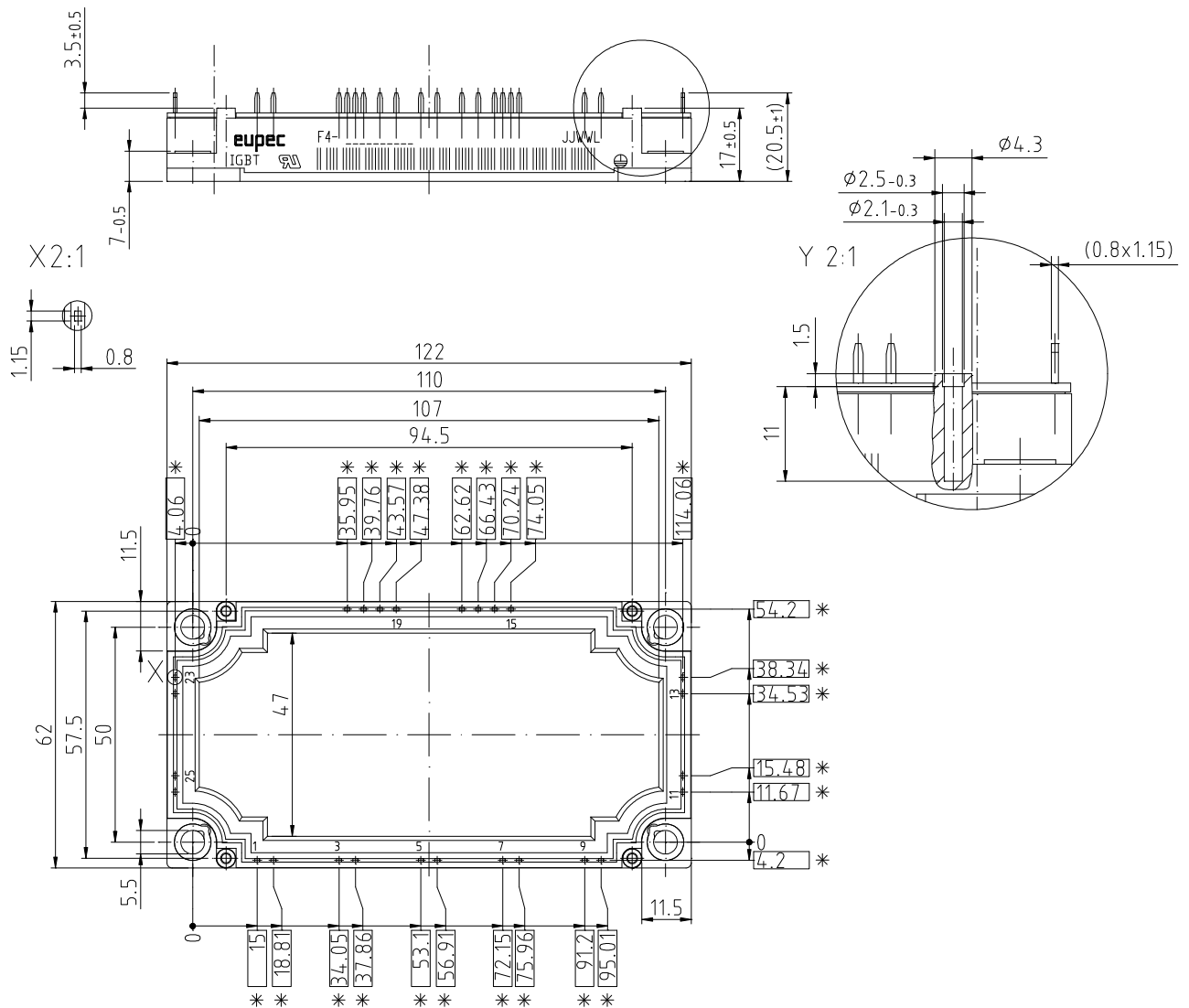
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**Vorläufige Daten
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Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



* = alle Maße mit einer Toleranz von ± 0.5

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