

**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	$T_C = 60^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C\ nom}$ I_C	150 180	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_p = 1\ \text{ms}, T_C = 60^{\circ}\text{C}$	I_{CRM}	300	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	P_{tot}	960	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	$I_C = 150\ \text{A}, V_{GE} = 15\ \text{V}, T_{vj} = 25^{\circ}\text{C}$ $I_C = 150\ \text{A}, V_{GE} = 15\ \text{V}, T_{vj} = 125^{\circ}\text{C}$	$V_{CE\ sat}$		3,20 3,85	3,75	V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 6,00\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	4,5	5,5	6,5	V
Gateladung gate charge	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	Q_G		1,60		μC
Interner Gatewiderstand internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}		2,0		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}		10,0		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}		0,63		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)	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\ on}$		0,12 0,13		μs μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_r		0,05 0,06		μs μs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\ off}$		0,31 0,36		μs μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_f		0,02 0,03		μs μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}, L_S = 30\ \text{nH}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{on}		18,0		mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 150\ \text{A}, V_{CE} = 600\ \text{V}, L_S = 30\ \text{nH}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 5,6\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{off}		7,50		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}		900		A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT per IGBT	R_{thJC}			0,13	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	150	A
Periodischer Spitzenstrom repetitive peak forward current	$t_p = 1\text{ ms}$	I_{FRM}	300	A
Grenzlastintegral I^2t - value	$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$	I^2t	4300	A ² s

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	$I_F = 150\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $I_F = 150\text{ A}, V_{GE} = 0\text{ V}, T_{vj} = 125^{\circ}\text{C}$	V_F		2,30 2,00	2,85	V V
Rückstromspitze peak reverse recovery current	$I_F = 150\text{ A}, -di_F/dt = 2800\text{ A}/\mu\text{s}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	I_{RM}		51,0 75,0		A A
Sperrverzögerungsladung recovered charge	$I_F = 150\text{ A}, -di_F/dt = 2800\text{ A}/\mu\text{s}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	Q_r		7,00 20,0		μC μC
Abschaltenergie pro Puls reverse recovery energy	$I_F = 150\text{ A}, -di_F/dt = 2800\text{ A}/\mu\text{s}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 600\text{ V}, V_{GE} = -15\text{ V}, T_{vj} = 125^{\circ}\text{C}$	E_{rec}		2,40 6,00		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

F4-150R12KS4



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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

All Power

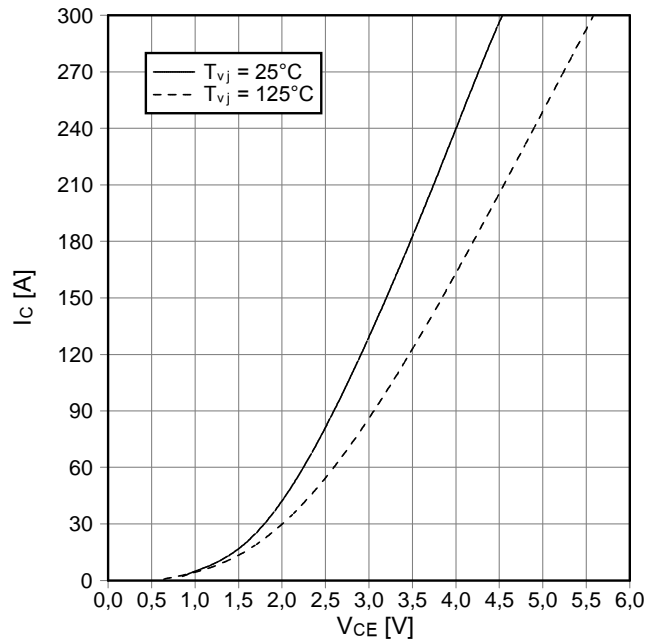
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This technical information specifies semiconductor devices but guarantees no characteristics. It is valid with the appropriate technical explanations.

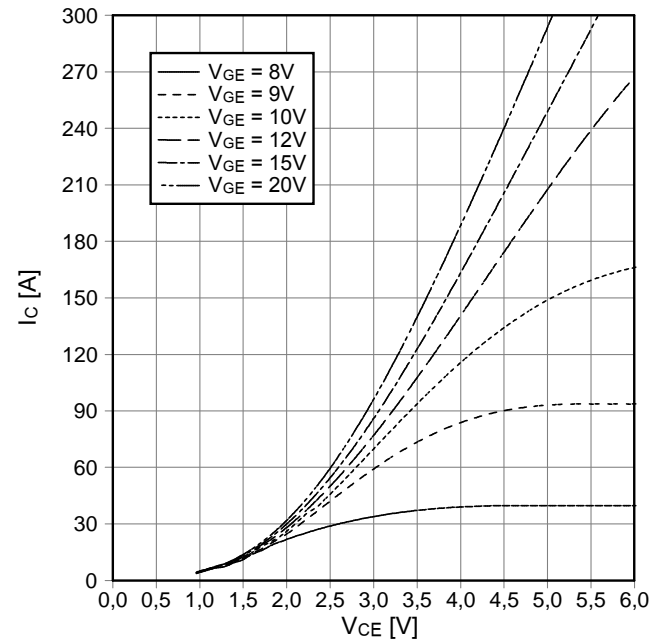
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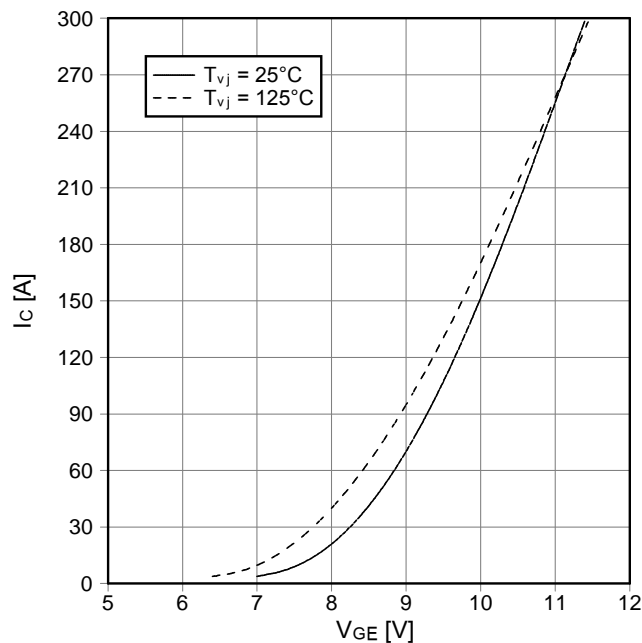
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



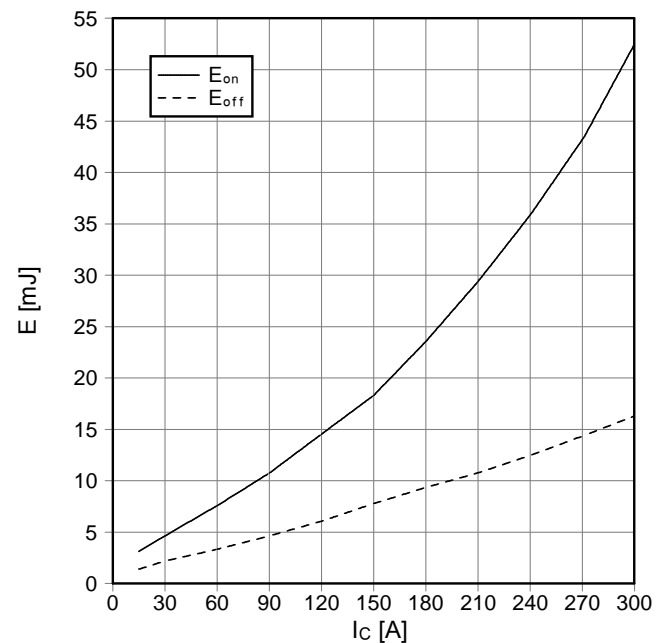
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



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



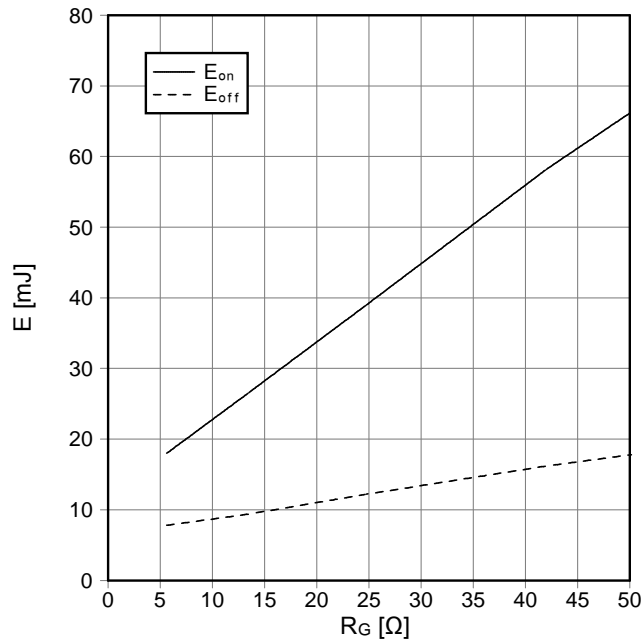
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_c)$, $E_{off} = f(I_c)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 5,6\ \Omega$, $R_{Goff} = 5,6\ \Omega$, $V_{CE} = 600\text{ V}$,
 $T_{vj} = 125^\circ\text{C}$



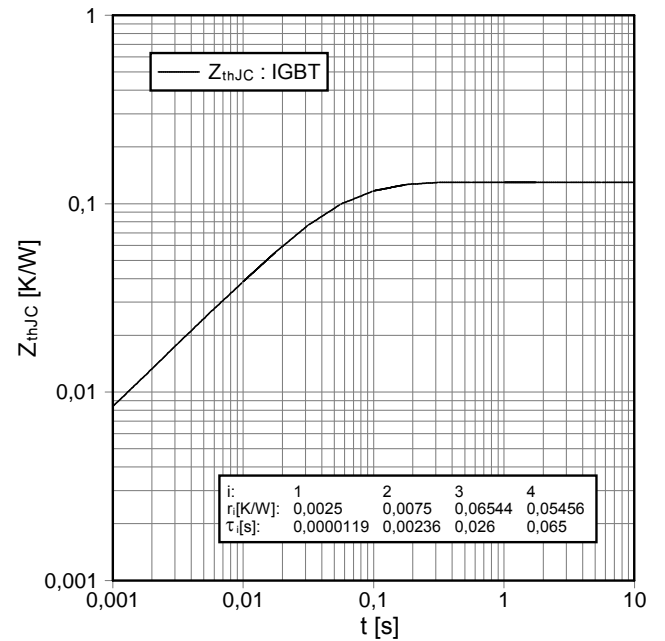
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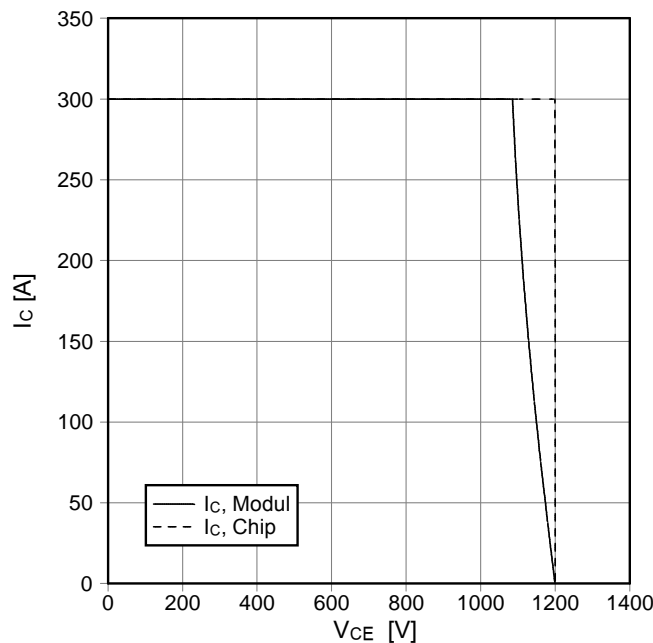
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 150\text{ A}$, $V_{CE} = 600\text{ V}$, $T_{vj} = 125^\circ\text{C}$



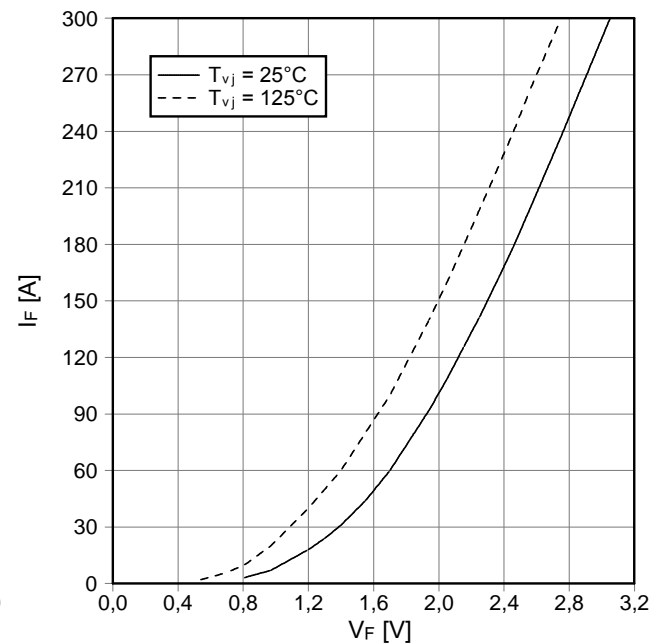
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
 $Z_{thJC} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
 $I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 5,6\ \Omega$, $T_{vj} = 125^\circ\text{C}$



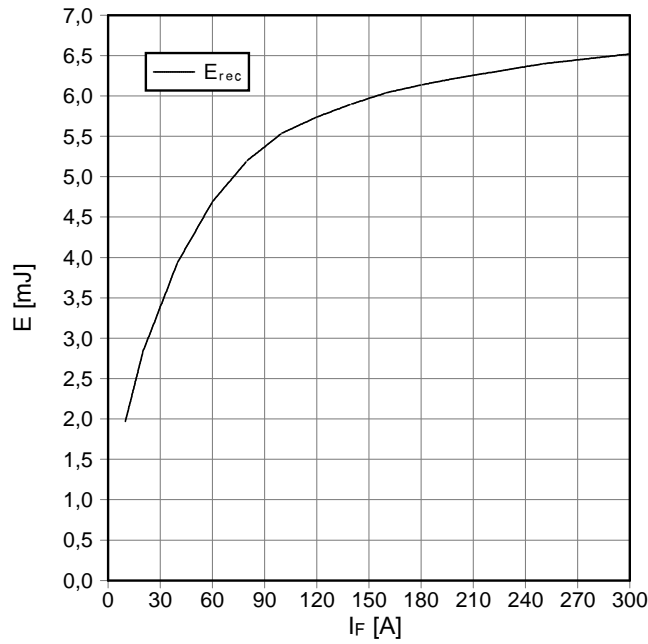
Durchlaßkennlinie der Diode-Wechselr. (typisch)
forward characteristic of diode-inverter (typical)
 $I_F = f(V_F)$



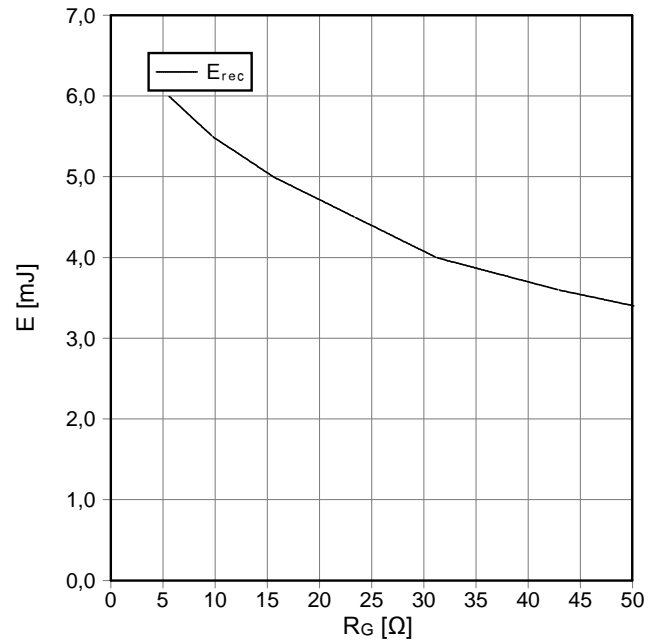
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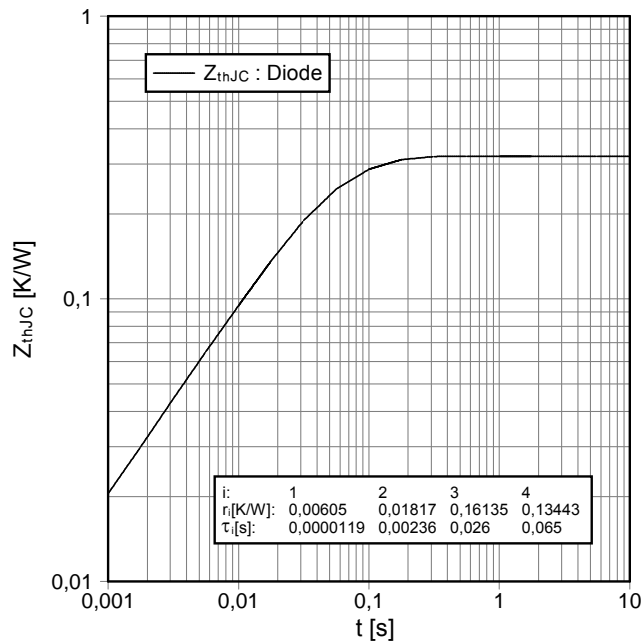
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 5,6 \Omega$, $V_{CE} = 600 V$, $T_{vj} = 125^\circ C$



Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 150 A$, $V_{CE} = 600 V$, $T_{vj} = 125^\circ C$

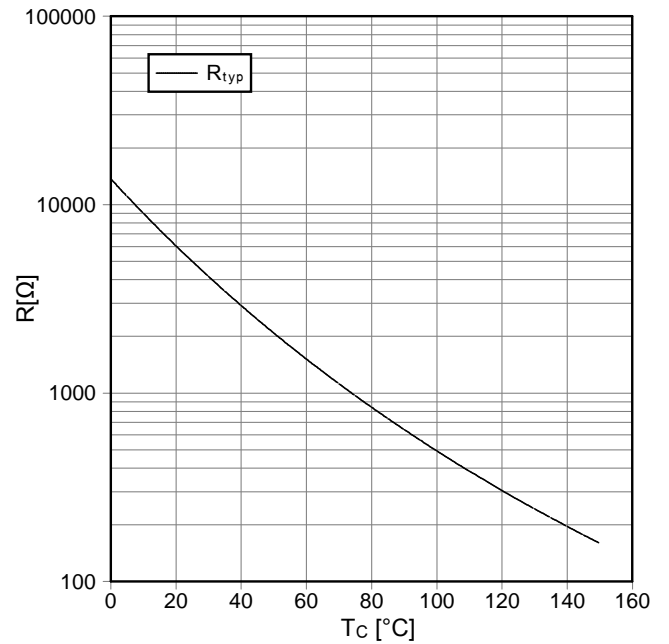


Transienter Wärmewiderstand Diode-Wechselr.
transient thermal impedance diode-inverter
 $Z_{thJC} = f(t)$



i:	1	2	3	4
r _i [K/W]:	0,00605	0,01817	0,16135	0,13443
τ _i [s]:	0,0000119	0,00236	0,026	0,065

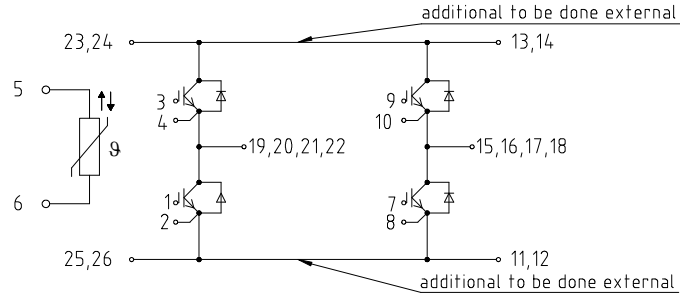
NTC-Temperaturkennlinie (typisch)
NTC-temperature characteristic (typical)
 $R = f(T)$



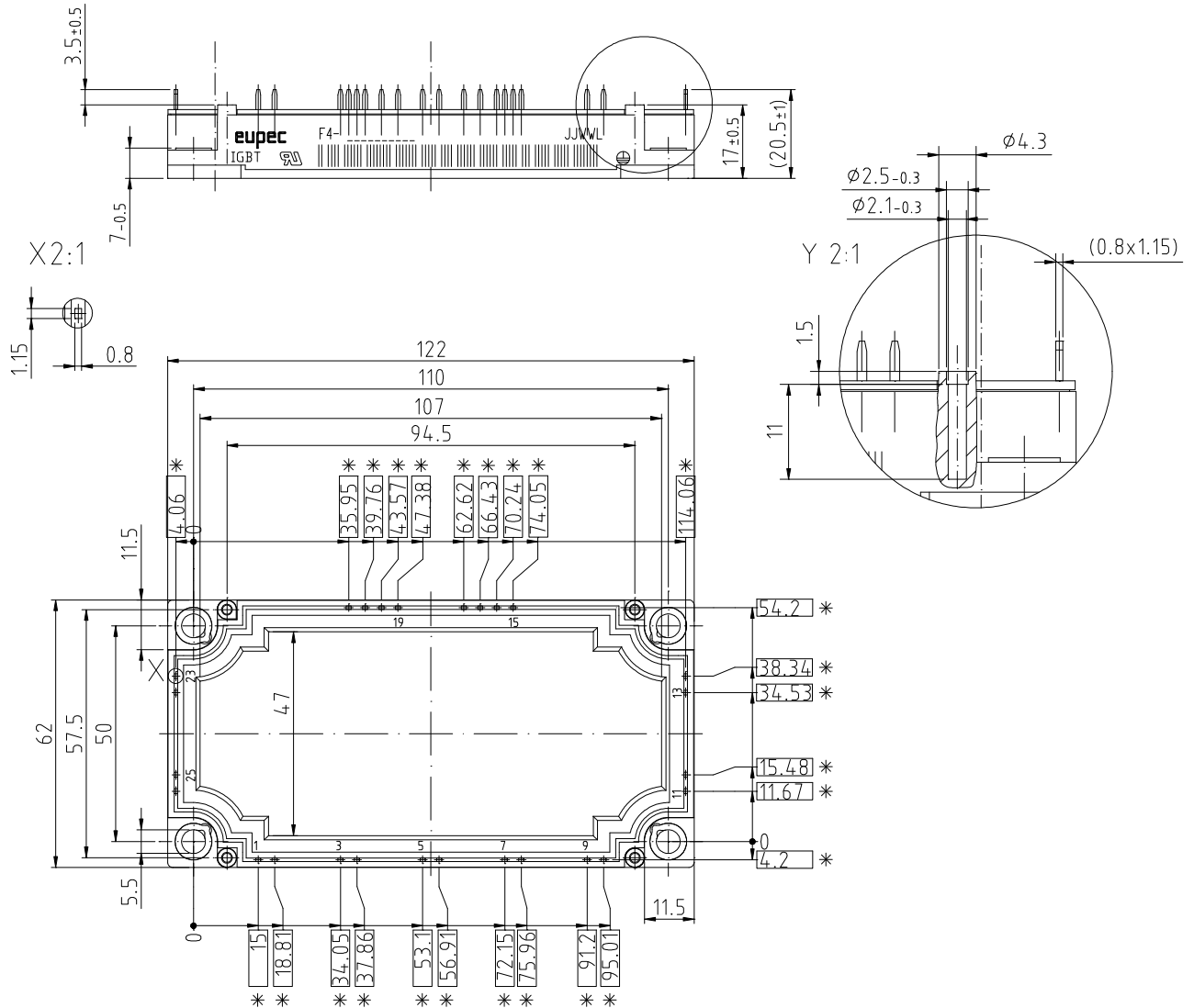
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**Vorläufige Daten
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Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



* = alle Maße mit einer Toleranz von ± 0.5

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