

Technische Information/technical information

IGBT-Module
IGBT-modules

FZ1600R17KE3



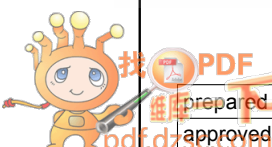
Vorläufige Daten
preliminary data

IGBT-Wechselrichter/IGBT-inverter
Höchstzulässige Werte/maxim rated values

Kollektor-Emitter-Sperrspannung collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1700	V
Kollektor-Dauergleichstrom DC-collector current	$T_C = 80^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}$	$I_{C\ nom}$ I_C	1600 2300	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	$t_P = 1\ \text{ms}, T_C = 80^{\circ}\text{C}$	I_{CRM}	3200	A
Gesamt-Verlustleistung total power dissipation	$T_C = 25^{\circ}\text{C}$	P_{tot}	8,95	kW
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	$I_C = 1600\ \text{A}, V_{GE} = 15\ \text{V}, T_{vj} = 25^{\circ}\text{C}$ $I_C = 1600\ \text{A}, V_{GE} = 15\ \text{V}, T_{vj} = 125^{\circ}\text{C}$	$V_{CE\ sat}$	2,00 2,40	2,45		V V
Gate-Schwellenspannung gate threshold voltage	$I_C = 64,0\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$	V_{GEth}	5,2	5,8	6,4	V
Gateladung gate charge	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$	Q_G	19,0			μC
Interner Gatewiderstand internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$	R_{Gint}	1,0			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}	145			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}	4,70			nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	$V_{CE} = 1700\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$	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)	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\ on}$	0,54 0,58			μs μs
Anstiegszeit (induktive Last) rise time (inductive load)	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_r	0,16 0,17			μs μs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 125^{\circ}\text{C}$	$t_{d\ off}$	1,30 1,50			μs μs
Fallzeit (induktive Last) fall time (inductive load)	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 125^{\circ}\text{C}$	t_f	0,15 0,27			μs μs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}, L_S = 50\ \text{nH}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Gon} = 0,9\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{on}	290 440			mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	$I_C = 1600\ \text{A}, V_{CE} = 900\ \text{V}, L_S = 50\ \text{nH}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 25^{\circ}\text{C}$ $V_{GE} = \pm 15\ \text{V}, R_{Goff} = 1,1\ \Omega, T_{vj} = 125^{\circ}\text{C}$	E_{off}	435 585			mJ mJ
Kurzschlussverhalten SC data	$t_P \leq 10\ \mu\text{s}, V_{GE} \leq 15\ \text{V}$ $T_{vj} \leq 125^{\circ}\text{C}, V_{CC} = 1000\ \text{V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	I_{sc}	6100			A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT per IGBT	R_{thJC}			14,0	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{Paste} = 1\ \text{W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\ \text{W}/(\text{m}\cdot\text{K})$	R_{thCH}	9,00			K/kW



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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}	1700	V
Dauergleichstrom DC forward current		I_F	1600	A
Periodischer Spitzenstrom repetitive peak forward current	$t_P = 1 \text{ ms}$	I_{FRM}	3200	A
Grenzlastintegral I^2t - value	$V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$	I^2t	335	kA^2s

Charakteristische Werte/characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	$I_F = 1600 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $I_F = 1600 \text{ A}, V_{GE} = 0 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	V_F		1,80 1,90	2,20	V V
Rückstromspitze peak reverse recovery current	$I_F = 1600 \text{ A}, -di_F/dt = 8700 \text{ A}/\mu\text{s}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	I_{RM}		1450 1700		A A
Sperrverzögerungsladung recovered charge	$I_F = 1600 \text{ A}, -di_F/dt = 8700 \text{ A}/\mu\text{s}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	Q_r		385 670		μC μC
Abschaltenergie pro Puls reverse recovery energy	$I_F = 1600 \text{ A}, -di_F/dt = 8700 \text{ A}/\mu\text{s}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 25^{\circ}\text{C}$ $V_R = 900 \text{ V}, V_{GE} = -15 \text{ V}, T_{vj} = 125^{\circ}\text{C}$	E_{rec}		255 455		mJ mJ
Innerer Wärmewiderstand thermal resistance, junction to case	pro Diode per diode	R_{thJC}			32,0	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Diode / per diode $\lambda_{\text{paste}} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$	R_{thCH}		20,0		K/kW

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Modul/module

Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	3,4		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		32,0 32,0		mm
Luftstrecke clearance distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		19,0 19,0		mm
Vergleichszahl der Kriechwegbildung comparative tracking index		CTI	> 400		
			min.	typ.	max.
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Modul / per module $\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$	R _{thCH}	6,00		K/kW
Modulinduktivität stray inductance module		L _{sCE}	12		nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	T _C = 25°C, pro Zweig / per arm	R _{CC+EE'}	0,19		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 M6	M	4,25	-	5,75 Nm
Anzugsdrehmoment f. elektr. Anschlüsse terminal connection torque	Schraube / screw M4 Schraube / screw M8	M	1,8 8,0	- -	2,1 10 Nm
Gewicht weight		G		1500	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.

prepared by: Martin Wölz

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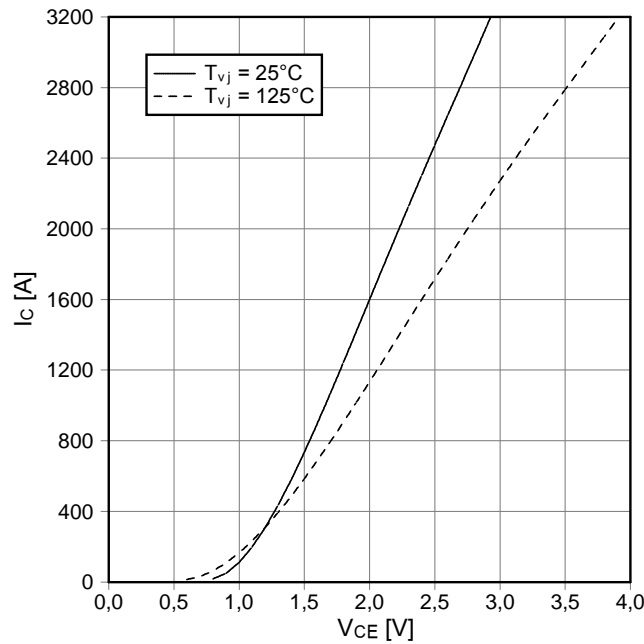
approved by: Christoph Lübke

revision: 2.0

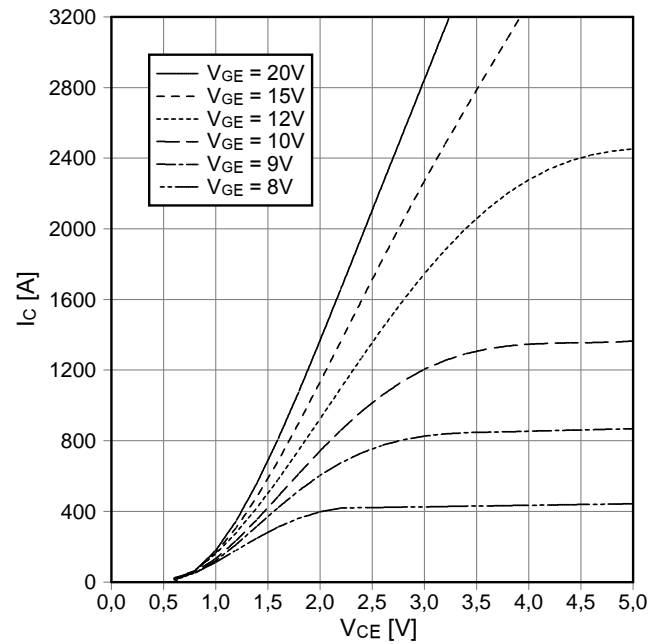


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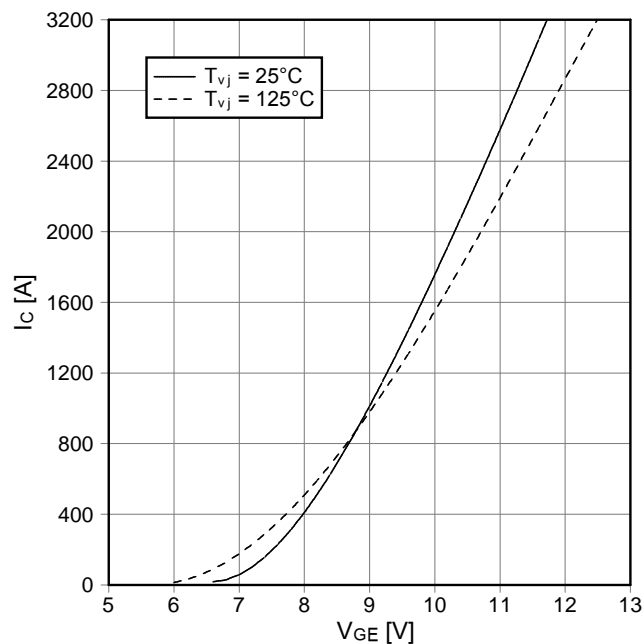
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



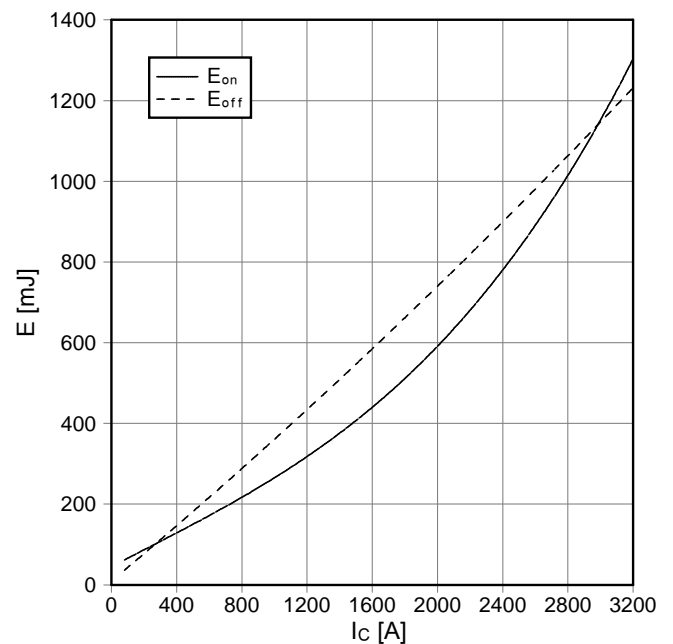
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



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



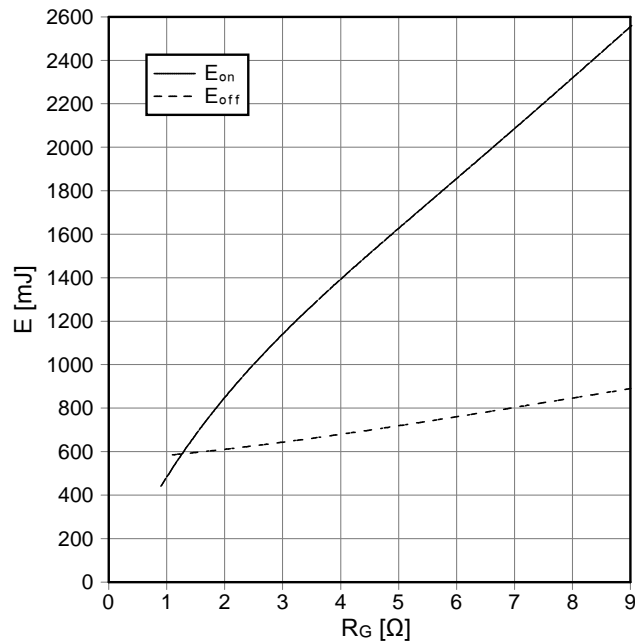
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_c)$, $E_{off} = f(I_c)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0,9\ \Omega$, $R_{Goff} = 1,1\ \Omega$, $V_{CE} = 900\text{ V}$,
 $T_{vj} = 125^\circ\text{C}$



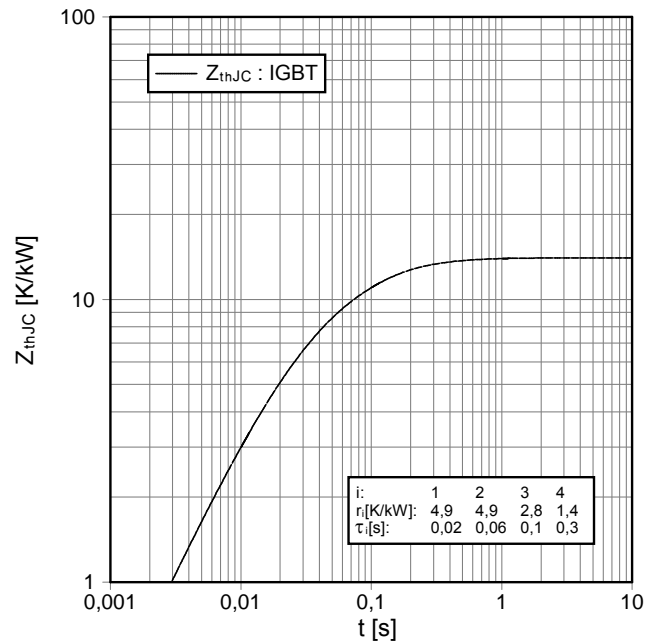


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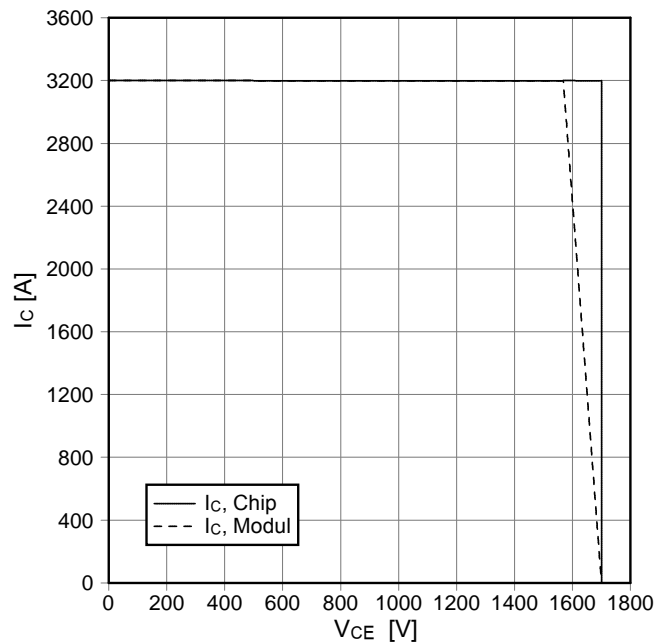
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_c = 1600\text{ A}$, $V_{CE} = 900\text{ V}$, $T_{vj} = 125^\circ\text{C}$



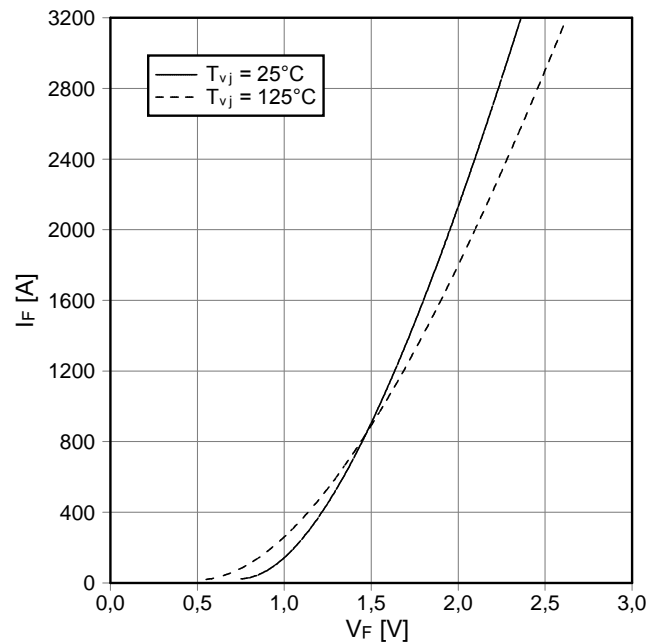
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
 $Z_{thJC} = f(t)$



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



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



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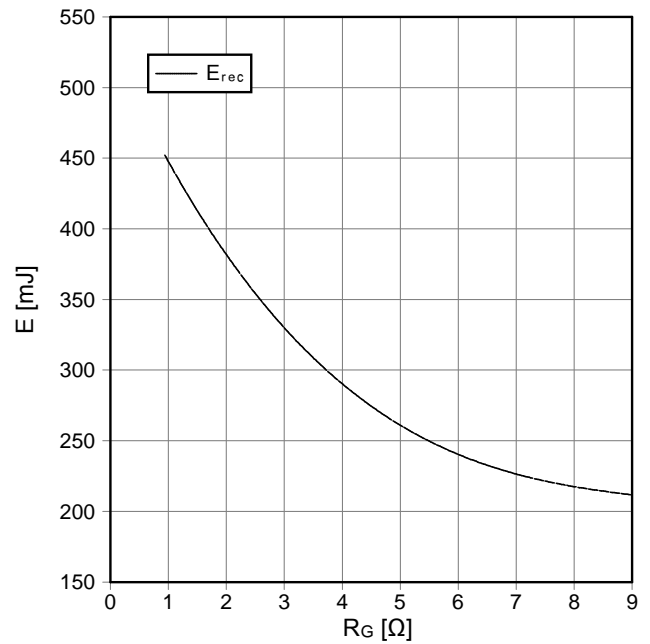
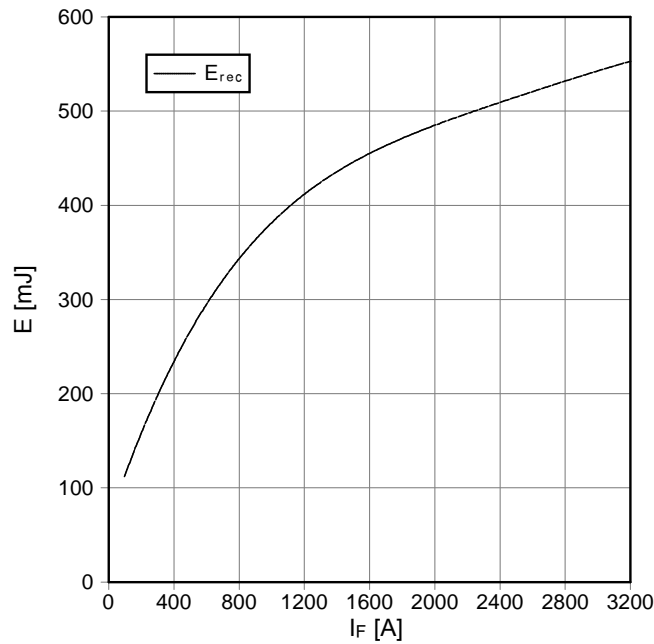
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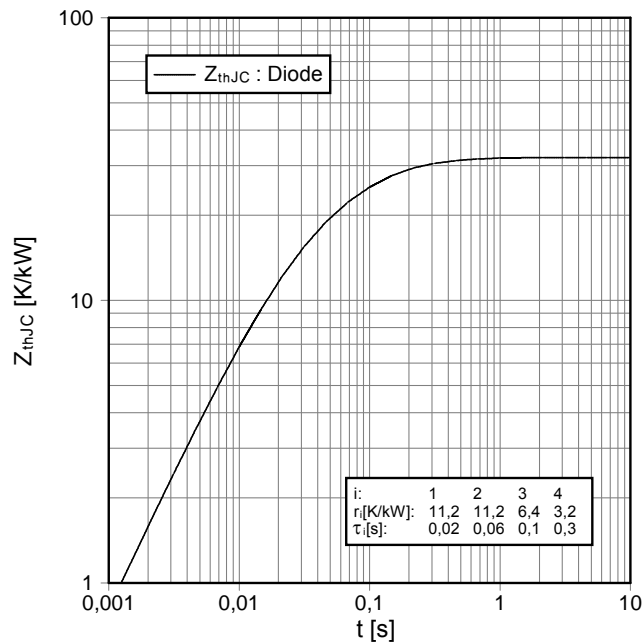
Vorläufige Daten
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Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 0,9 \Omega$, $V_{CE} = 900 V$, $T_{vj} = 125^\circ C$

Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
 $E_{rec} = f(R_G)$
 $I_F = 1600 A$, $V_{CE} = 900 V$, $T_{vj} = 125^\circ C$



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

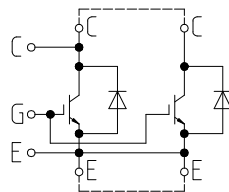


i:	1	2	3	4
r _i [K/KW]:	11,2	11,2	6,4	3,2
τ _i [s]:	0,02	0,06	0,1	0,3



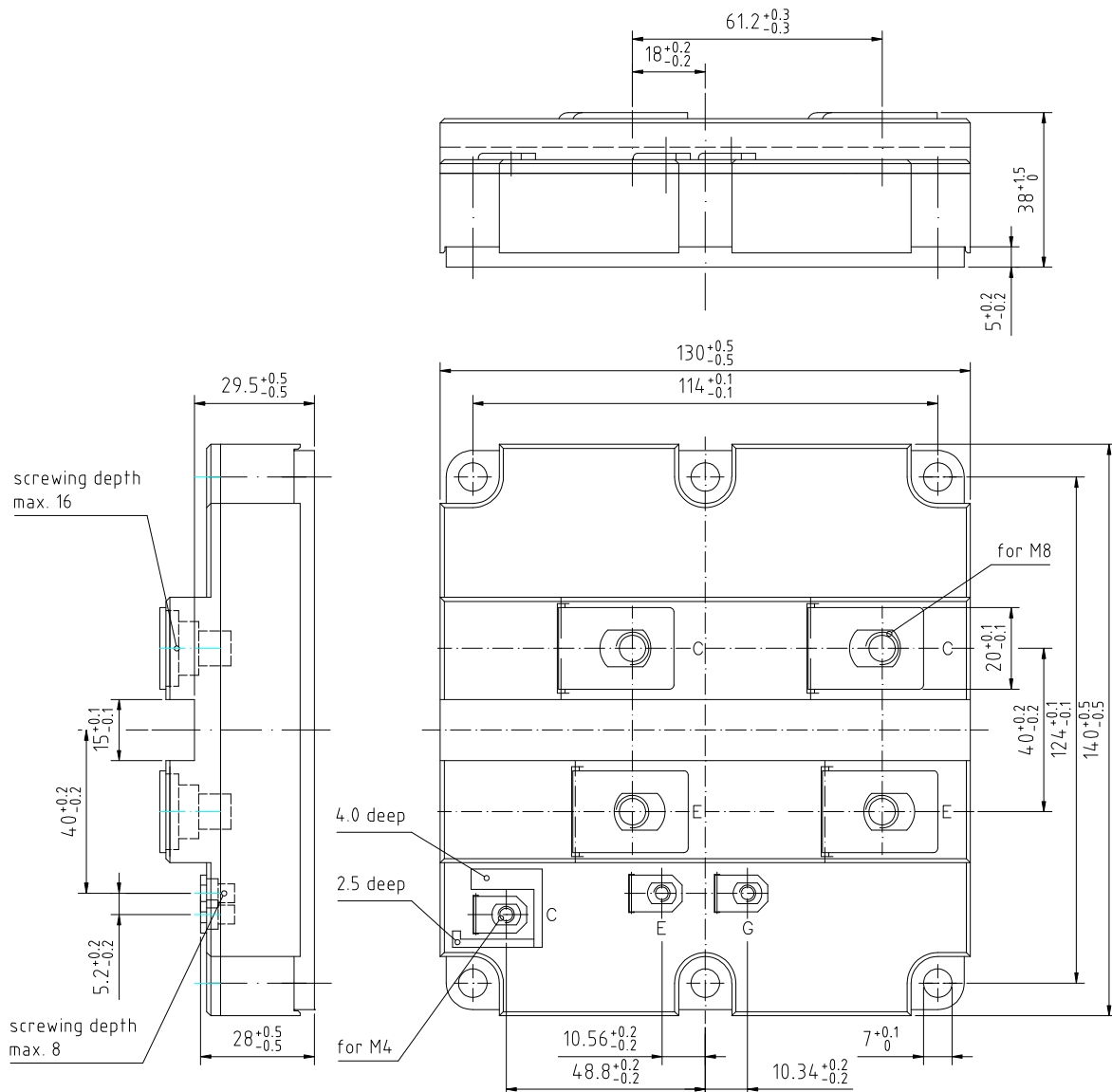
Vorläufige Daten
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Schaltplan/circuit diagram



external connection
to be done

Gehäuseabmessungen/package outlines



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