Technische Information / technical information

IGBT-Module
IGBT-modules

FF200R33KF2C

power electronics in motion
eupec

Vorläufige Daten
preliminary data

IGBT-Wechselrichter / IGBT-inverter

Höchstzulässige Werte / maximum rated values

Kollektor-Emitter-Sperrspannung collector-emitter voltage	T_{vj} = 25°C T_{vj} = -25°C	V_{CES}	3300 3300	V
Kollektor-Dauergleichstrom DC-collector current	T_C = 80°C T_C = 25°C	$I_{C\ nom}$ I_C	200 330	A A
Periodischer Kollektor Spitzenstrom repetitive peak collector current	t_P = 1 ms, T_C = 80°C	I_{CRM}	400	A
Gesamt-Verlustleistung total power dissipation	T_C = 25°C	P_{tot}	2,20	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 = 200 A, V_{GE} = 15 V, T_{vj} = 25°C I_C = 200 A, V_{GE} = 15 V, T_{vj} = 125°C	$V_{CE\ sat}$		3,40 4,30	4,25 5,00	V V
Gate-Schwellenspannung gate threshold voltage	I_C = 20,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	4,2	5,1	6,0	V
Gateladung gate charge	V_{GE} = -15 V ... +15 V, V_{CE} = 1800V	Q_G		4,00		µC
Interner Gatewiderstand internal gate resistor	T_{vj} = 25°C	R_{Gint}		2,5		Ω
Eingangskapazität input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}		25,0		nF
Rückwirkungskapazität reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{res}		1,40		nF
Kollektor-Emitter Reststrom collector-emitter cut-off current	V_{CE} = 3300 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}			5,0	mA
Gate-Emitter Reststrom gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C	I_{GES}			400	nA
Einschaltverzögerungszeit (ind. Last) turn-on delay time (inductive load)	I_C = 200 A, V_{CE} = 1800 V V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	$t_{d\ on}$		0,28 0,28		µs µs
Anstiegszeit (induktive Last) rise time (inductive load)	I_C = 200 A, V_{CE} = 1800 V V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	t_r		0,18 0,20		µs µs
Abschaltverzögerungszeit (ind. Last) turn-off delay time (inductive load)	I_C = 200 A, V_{CE} = 1800 V V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	$t_{d\ off}$		1,55 1,70		µs µs
Fallzeit (induktive Last) fall time (inductive load)	I_C = 200 A, V_{CE} = 1800 V V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	t_f		0,20 0,20		µs µs
Einschaltverlustenergie pro Puls turn-on energy loss per pulse	I_C = 200 A, V_{CE} = 1800 V, L_S = 70 nH V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	E_{on}		235 365		mJ mJ
Abschaltverlustenergie pro Puls turn-off energy loss per pulse	I_C = 200 A, V_{CE} = 1800 V, L_S = 70 nH V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 25°C V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, C_{GE} = 33,0 nF, T_{vj} = 125°C	E_{off}		215 255		mJ mJ
Kurzschlußverhalten SC data	t_P ≤ 10 µs, V_{GE} ≤ 15 V T_{vj}≤125°C, V_{CC} = 2500 V, V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	I_{SC}		1000		A
Innerer Wärmewiderstand thermal resistance, junction to case	pro IGBT per IGBT	R_{thJC}			57,0	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		49,0		K/kW

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Vorläufige Daten
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Diode-Wechselrichter / diode-inverter

Höchstzulässige Werte / maximum rated values

Periodische Spitzensperrspannung repetitive peak reverse voltage	T_{vj} = 25°C T_{vj} = -25°C	V_{RRM}	3300 3300	V
Dauergleichstrom DC forward current		I_F	200	A
Periodischer Spitzenstrom repetitive peak forward current	t_P = 1 ms	I_{FRM}	400	A
Grenzlastintegral I²t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C	I^2t	14,0	kA²s
Spitzenverlustleistung maximum power dissipation	T_{vj} = 125°C	P_{RQM}	400	kW
Mindesteinschaltdauer minimum turn-on time		$t_{Fon\ min}$	10,0	µs

Charakteristische Werte / characteristic values

			min.	typ.	max.	
Durchlassspannung forward voltage	I_F = 200 A, V_{GE} = 0 V, T_{vj} = 25°C I_F = 200 A, V_{GE} = 0 V, T_{vj} = 125°C	V_F		2,80 2,80	3,50 3,50	V V
Rückstromspitze peak reverse recovery current	I_F = 200 A, - di_F/dt = 1100 A/µs V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 25°C V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 125°C	I_{RM}		275 325		A A
Sperrverzögerungsladung recovered charge	I_F = 200 A, -di_F/dt = 1100 A/µs V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 25°C V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 125°C	Q_r		120 220		µC µC
Abschaltenergie pro Puls reverse recovery energy	I_F = 200 A, -di_F/dt = 1100 A/µs V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 25°C V_R = 1800 V, V_{GE} = -15 V, T_{vj} = 125°C	E_{rec}		125 255		mJ mJ
Innerer Wärmewiderstand thermal resistance, junction to case	pro Diode per diode	R_{thJC}			110	K/kW
Übergangs-Wärmewiderstand thermal resistance, case to heatsink	pro Diode / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		93,0		K/kW

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Modul / module

Isolations-Prüfspannung insulation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}	6,0		kV
Teilentladungs Aussetzspannung partial discharge extinction voltage	RMS, f = 50 Hz, Q_{PD} ≤ 10 pC (acc. to IEC 1287)	V_{ISOL}	2,6		kV
Kollektor-Emitter-Gleichsperrspannung DC stability	T_{vj} = 25°C, 100 fit	$V_{CE\,D}$	1800		V
Material Modulgrundplatte material of module baseplate			AlSiC		
Material für innere Isolation material for internal insulation			AlN		
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 λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		16,0		K/kW
Modulinduktivität stray inductance module		L_{sCE}		58		nH
Modulleitungswiderstand, Anschlüsse - Chip module lead resistance, terminals - chip	T_C = 25°C, pro Zweig / per arm	$R_{CC'+EE'}$		0,78		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 M5	M	3,6	-	4,2	Nm
Gewicht weight		G		500		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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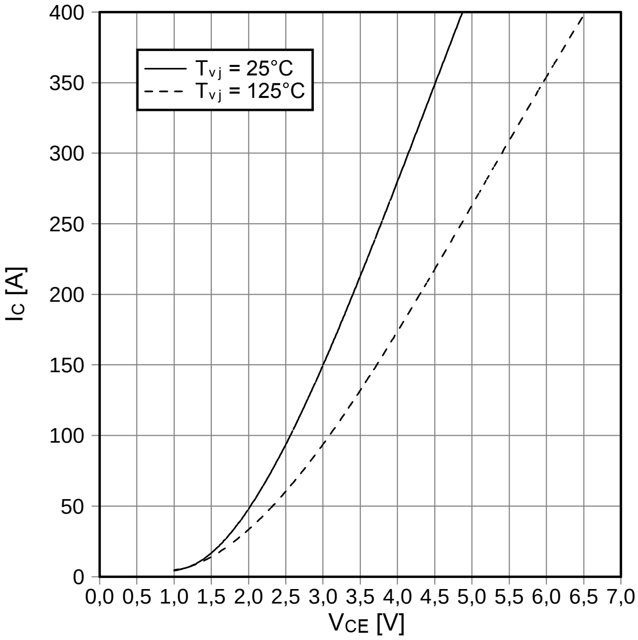
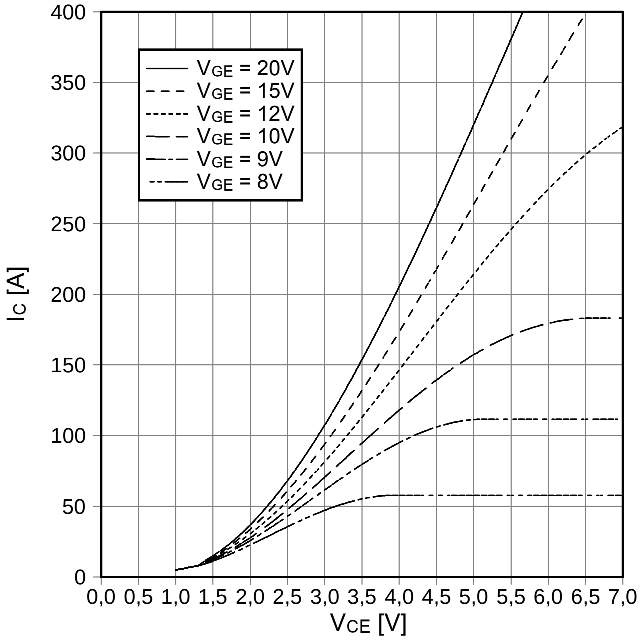
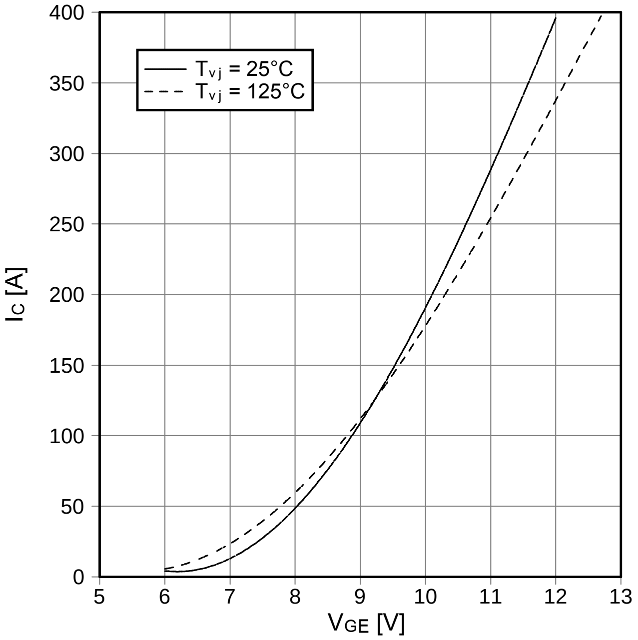
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



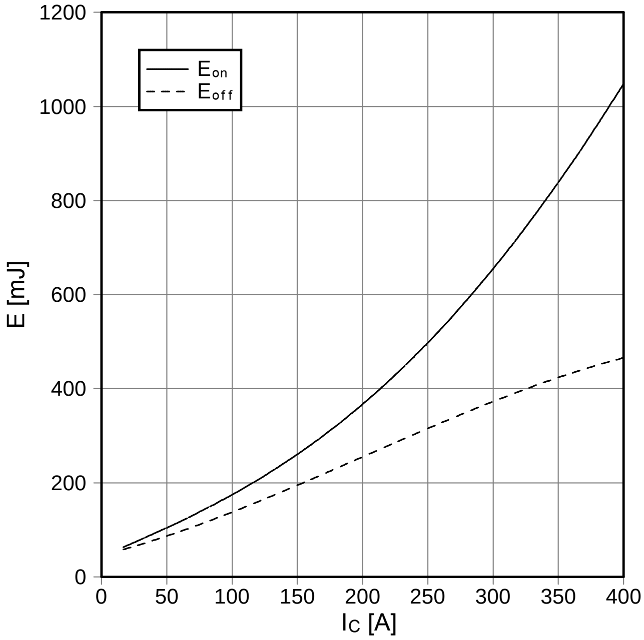
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 125°C



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



Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 5,6 Ω, R_{Goff} = 7,5 Ω, V_{CE} = 1800 V,
T_{vj} = 125°C, C_{GE} = 33 nF



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Vorläufige Daten
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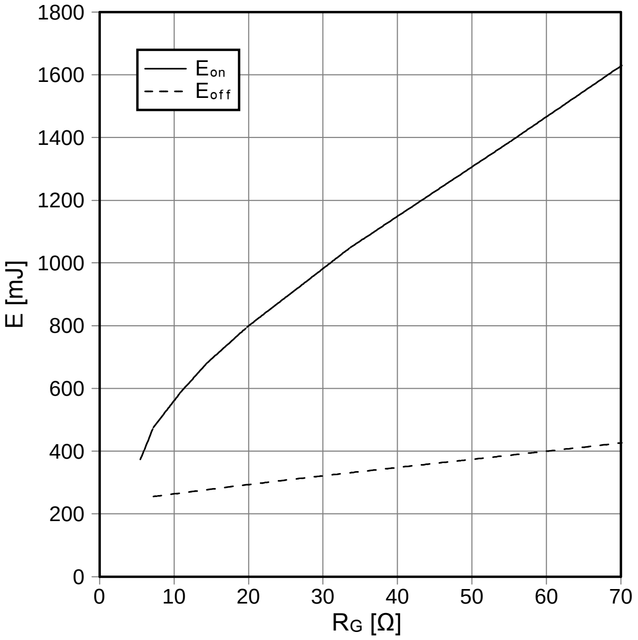
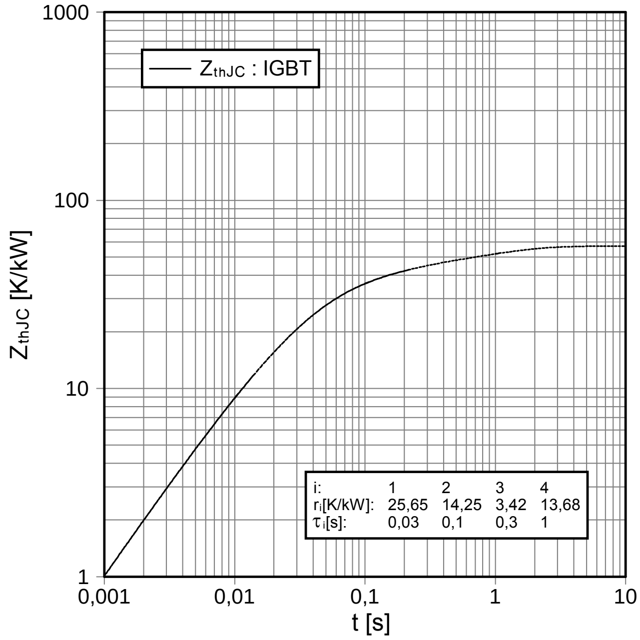
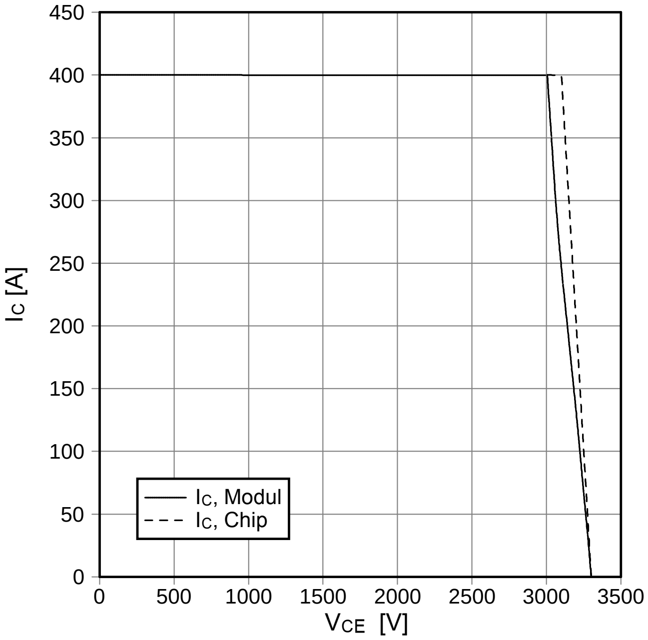
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-Inverter (typical)
E_{on} = f (R_G), E_{off} = f (R_G)
V_{GE} = ±15 V, I_C = 200 A, V_{CE} = 1800 V, T_{vj} = 125°C,
C_{GE} = 33 nF



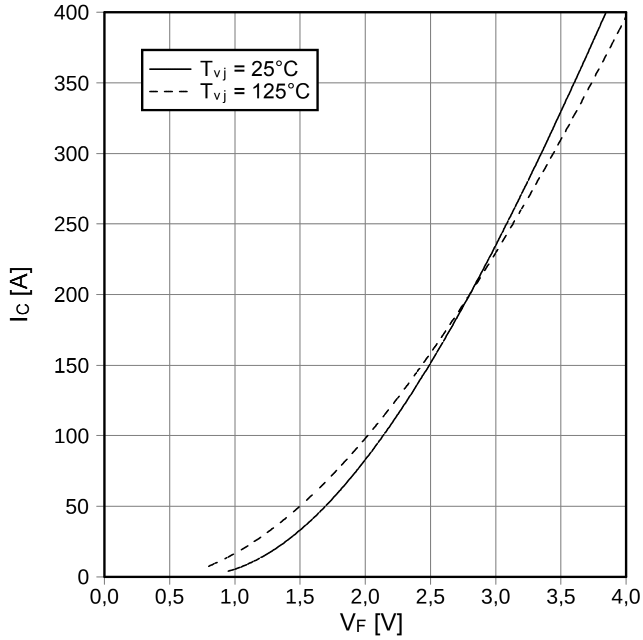
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
Z_{thJC} = f (t)



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
I_C = f (V_{CE})
V_{GE} = ±15 V, R_{Goff} = 7,5 Ω, T_{vj} = 125°C, C_{GE} = 33 nF



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



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Vorläufige Daten
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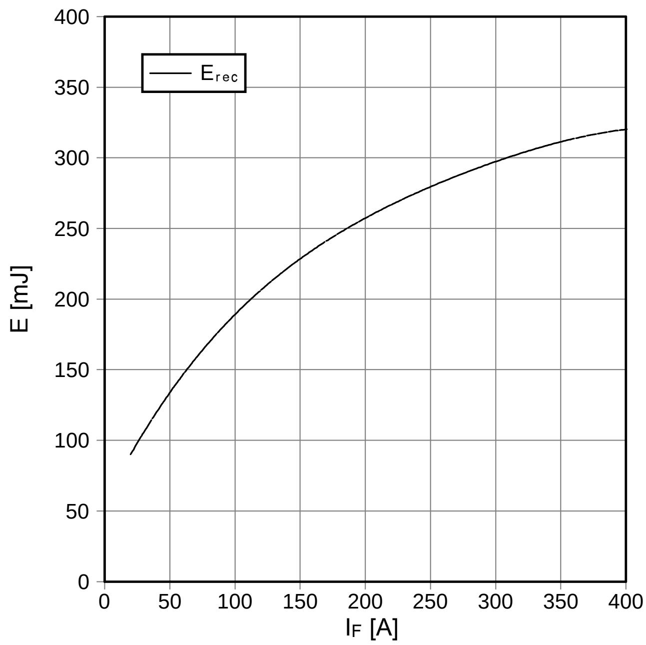
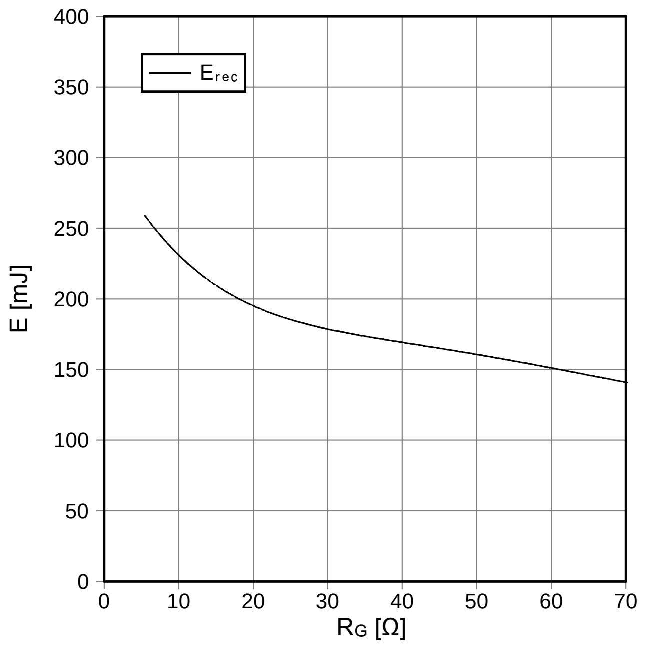
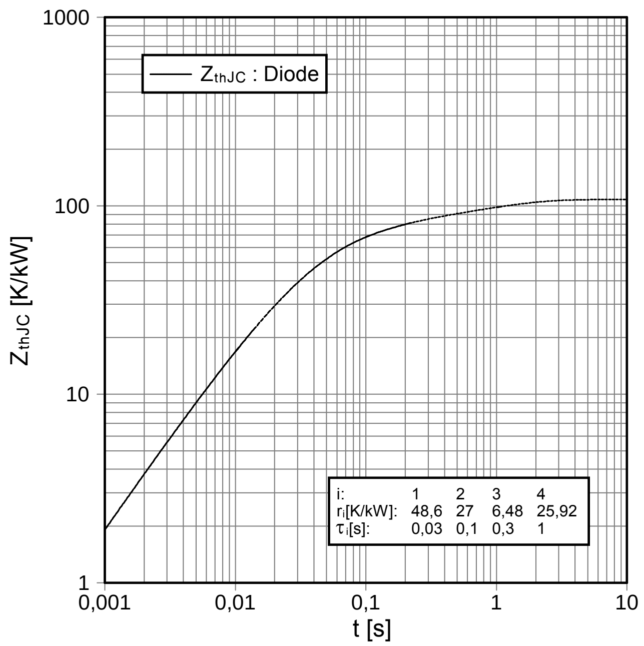
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
E_{rec} = f (I_F)
R_{Gon} = 5,6 Ω, V_{CE} = 1800 V, T_{vj} = 125°C



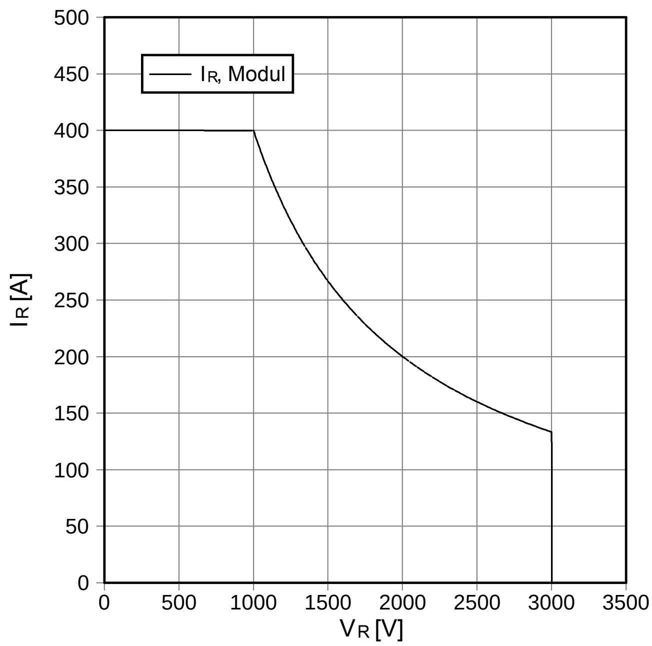
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
E_{rec} = f (R_G)
I_F = 200 A, V_{CE} = 1800 V, T_{vj} = 125°C



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



Sicherer Arbeitsbereich Diode-Wechselr. (SOA)
save operation area diode-inverter (SOA)
I_R = f(V_R)
T_{vj} = 125°C



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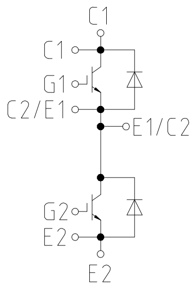
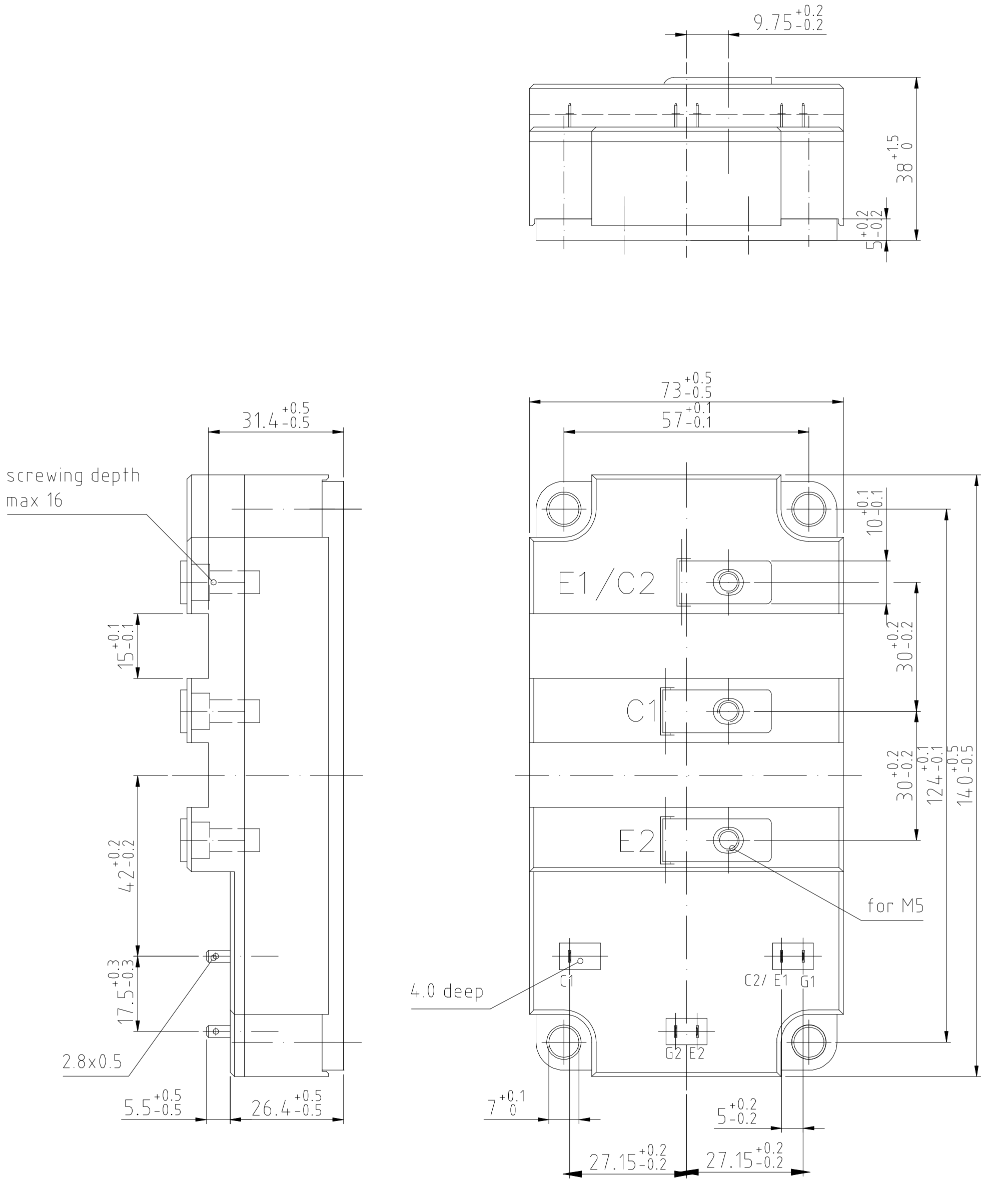
Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



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