Technische Information / Technical Information

IGBT-Module
IGBT-modules

FS450R12KE3

- EconoPACK™+ Modul mit Trench/Feldstop IGBT3 und High Efficiency Diode
- EconoPACK™+ with trench/fieldstop IGBT3 and Emitter Controlled High Efficiency diode

IGBT,Wechselrichter / IGBT,Inverter

Höchstzulässige Werte / Maximum Rated Values

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom Continuous DC collector current	T_C = 80°C, $T_{vj\,max}$ = 150°C T_C = 25°C, $T_{vj\,max}$ = 150°C	$I_{C\,nom}$ I_C	450 600	A A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	t_P = 1 ms	I_{CRM}	900	A
Gesamt-Verlustleistung Total power dissipation	T_C = 25°C, $T_{vj\,max}$ = 150	P_{tot}	2100	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 = 450 A, V_{GE} = 15 V I_C = 450 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C	$V_{CE\,sat}$		1,70 2,00	2,15	V V
Gate-Schwellenspannung Gate threshold voltage	I_C = 18,0 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	5,0	5,8	6,5	V
Gateladung Gate charge	V_{GE} = -15 V ... +15 V		Q_G		4,30		µC
Interner Gatewiderstand Internal gate resistor	T_{vj} = 25°C		R_{Gint}		1,7		Ω
Eingangskapazität Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		32,0		nF
Rückwirkungskapazität Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		1,50		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	V_{CE} = 1200 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, induktive Last Turn-on delay time, inductive load	I_C = 450 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Gon} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	$t_{d\,on}$		0,25 0,30		µs µs
Anstiegszeit, induktive Last Rise time, inductive load	I_C = 450 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Gon} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	t_r		0,09 0,10		µs µs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	I_C = 450 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Goff} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	$t_{d\,off}$		0,55 0,65		µs µs
Fallzeit, induktive Last Fall time, inductive load	I_C = 450 A, V_{CE} = 600 V V_{GE} = ±15 V R_{Goff} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	t_f		0,13 0,16		µs µs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	I_C = 450 A, V_{CE} = 600 V, L_S = 80 nH V_{GE} = ±15 V R_{Gon} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	E_{on}		33,0		mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	I_C = 450 A, V_{CE} = 600 V, L_S = 80 nH V_{GE} = ±15 V R_{Goff} = 1,6 Ω	T_{vj} = 25°C T_{vj} = 125°C	E_{off}		65,0		mJ mJ
Kurzschlußverhalten SC data	V_{GE} ≤ 15 V, V_{CC} = 900 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 10 µs, T_{vj} = 125°C	I_{SC}		1800		A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}			0,06	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,048		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\,op}$	-40		125	°C

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Diode, Wechselrichter / Diode, Inverter

Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Dauergleichstrom Continuous DC forward current		I_F	450	A
Periodischer Spitzenstrom Repetitive peak forward current	t_P = 1 ms	I_{FRM}	900	A
Grenzlastintegral I²t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C	I²t	35000	A²s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	I_F = 450 A, V_{GE} = 0 V I_F = 450 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C	V_F		1,65 1,65	2,15	V V
Rückstromspitze Peak reverse recovery current	I_F = 450 A, - di_F/dt = 5200 A/µs (T_{vj}=125°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C	I_{RM}		315 405		A A
Sperrverzögerungsladung Recovered charge	I_F = 450 A, - di_F/dt = 5200 A/µs (T_{vj}=125°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C	Q_r		45,0 85,0		µC µC
Abschaltenergie pro Puls Reverse recovery energy	I_F = 450 A, - di_F/dt = 5200 A/µs (T_{vj}=125°C) V_R = 600 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C	E_{rec}		21,0 39,0		mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		R_{thJC}			0,10	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Diode / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,08		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\,op}$	-40		125	°C

NTC-Widerstand / NTC-Thermistor

Charakteristische Werte / Characteristic Values

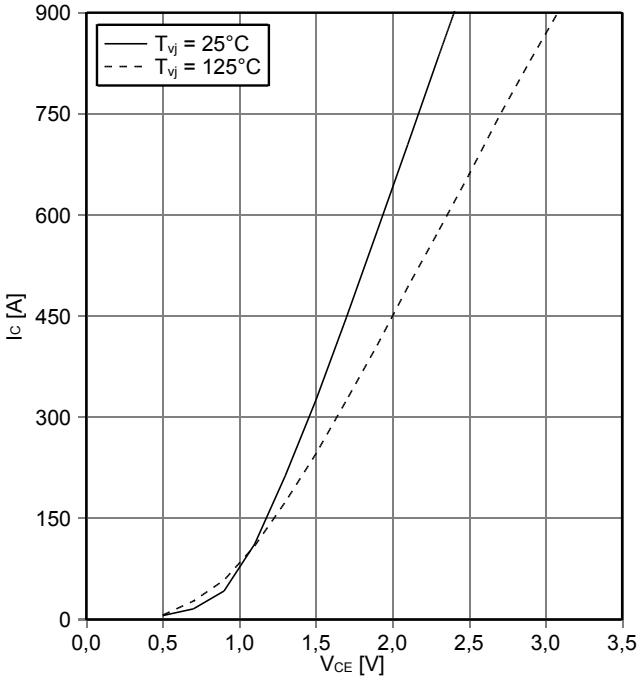
			min.	typ.	max.	
Nennwiderstand Rated resistance	T_C = 25°C	R_{25}		5,00		kΩ
Abweichung von R100 Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung Power dissipation	T_C = 25°C	P_{25}			20,0	mW
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/50}$		3375		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/80}$		t.b.d.		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/100}$		t.b.d.		K

Angaben gemäß gültiger Application Note.
Specification according to the valid application note.

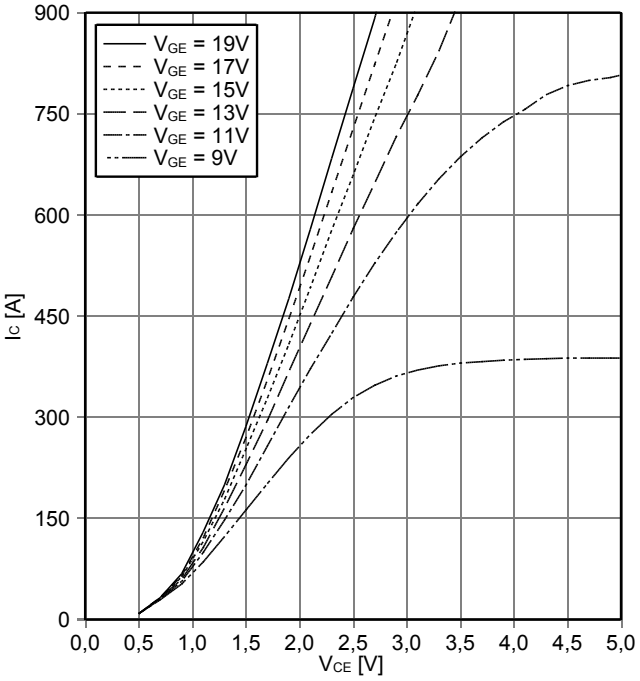
Modul / Module

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min	V_{ISOL}		2,5		kV
Innere Isolation Internal isolation	Basisisolierung (Schutzklasse 1, EN61140) basic insulation (class 1, IEC 61140)			Al_2O_3		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal			14,5		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal			10,0		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI		> 225		
			min.	typ.	max.	
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Modul / per module λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)	R_{thCH}		0,005		K/W
Modulstreuinduktivität Stray inductance module		L_{sCE}		20		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T_C = 25°C, pro Schalter / per switch	$R_{CC'+EE'}$		1,10		mΩ
Lagertemperatur Storage temperature		T_{stg}	-40		125	°C
Anzugsdrehmoment f. Modulmontage Mounting torque for modul mounting	Schraube M5 - Montage gem. gültiger Applikationsschrift Screw M5 - Mounting according to valid application note	M	3,00	-	6,00	Nm
Anzugsdrehmoment f. elektr. Anschlüsse Terminal connection torque	Schraube M6 - Montage gem. gültiger Applikationsschrift Screw M6 - Mounting according to valid application note	M	3,0	-	6,0	Nm
Gewicht Weight		G		910		g

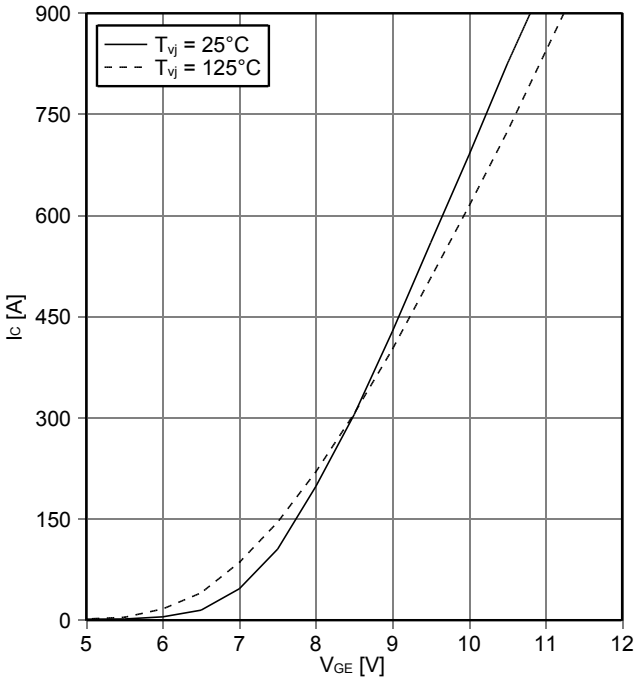
Ausgangskennlinie IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



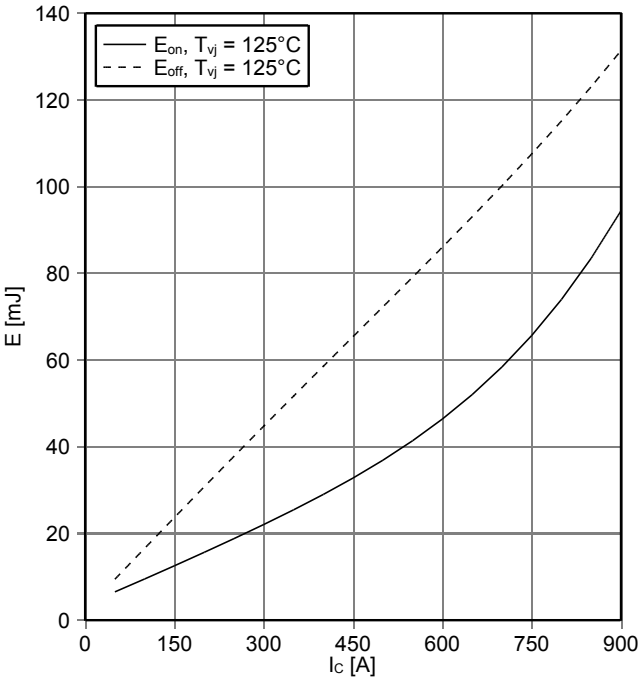
Ausgangskennlinienfeld IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 125°C



Übertragungscharakteristik IGBT,Wechselrichter (typisch)
transfer characteristic IGBT,Inverter(typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V



SchaltverlusteIGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 1.6 Ω, R_{Goff} = 1.6 Ω, V_{CE} = 600 V



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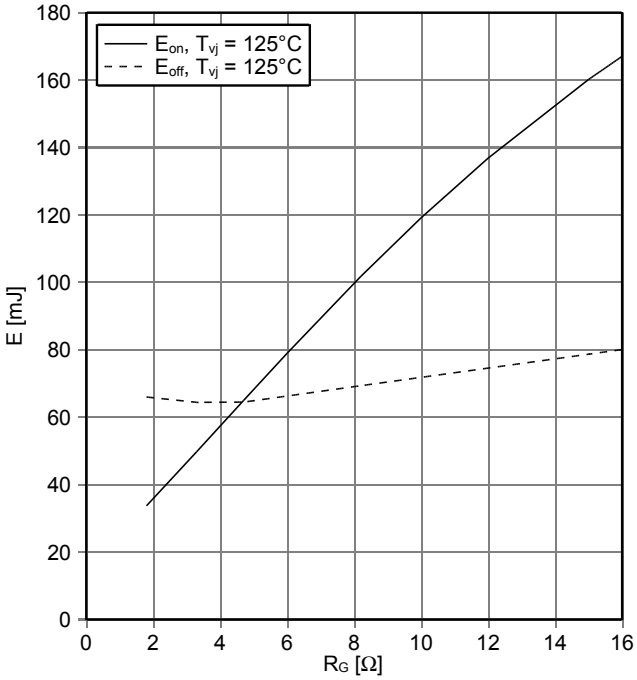
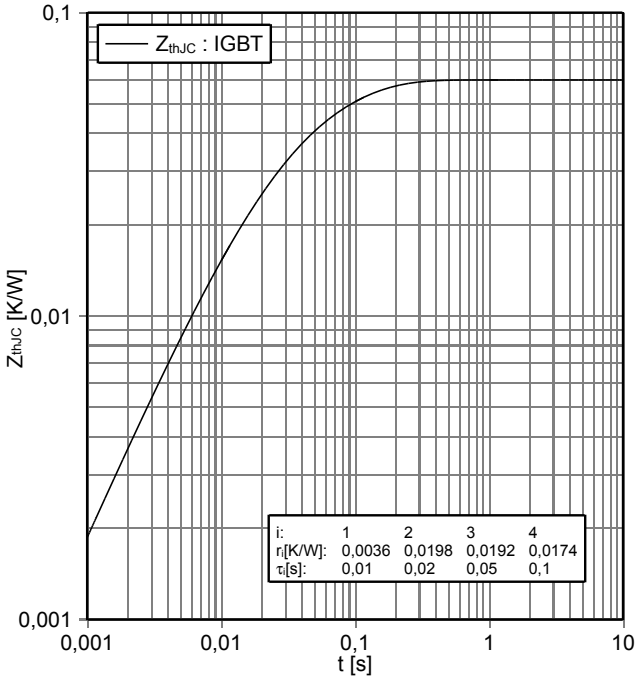
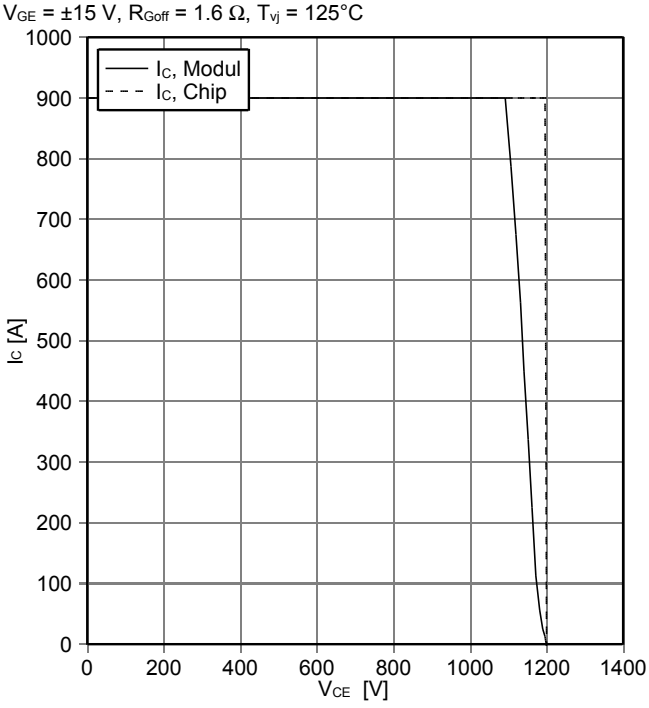
SchaltverlusteIGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 450 A, V_{CE} = 600 V



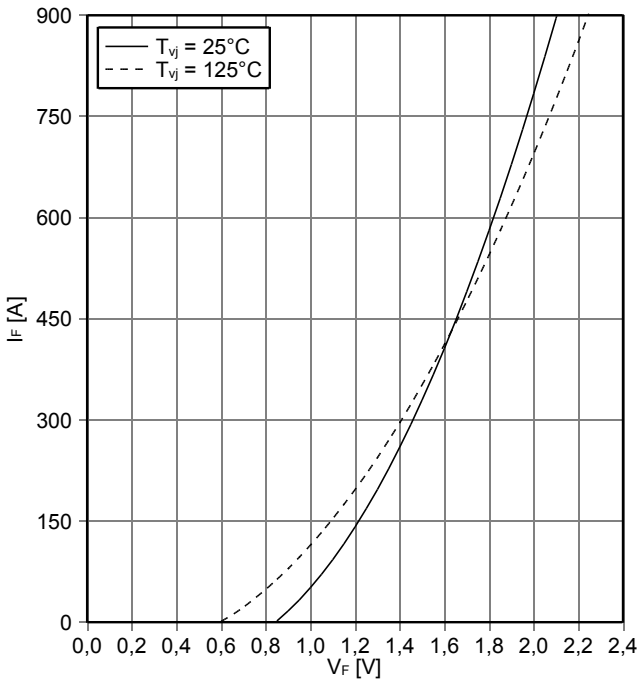
Transienter Wärmewiderstand IGBT,Wechselrichter
transient thermal impedance IGBT,Inverter
$Z_{thJC} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT,Wechselrichter (RBSOA)
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 1.6 Ω, T_{vj} = 125°C



Durchlasskennlinie der Diode, Wechselrichter (typisch)
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



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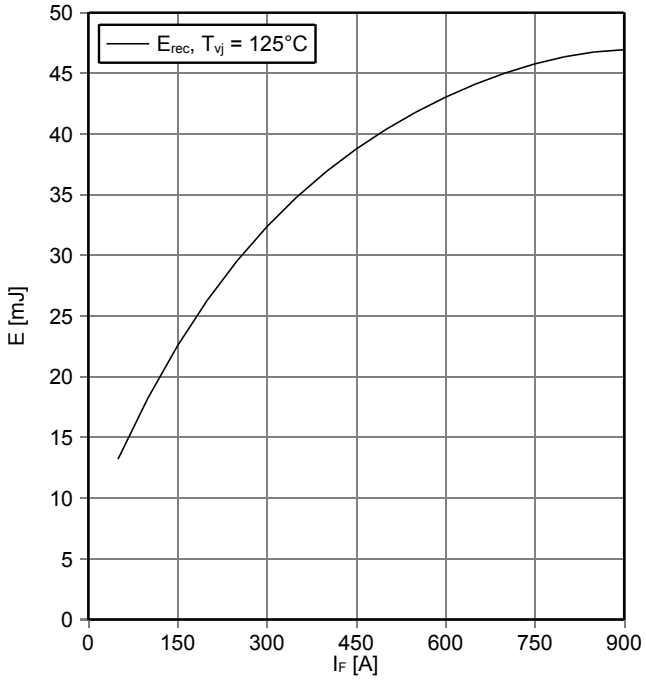
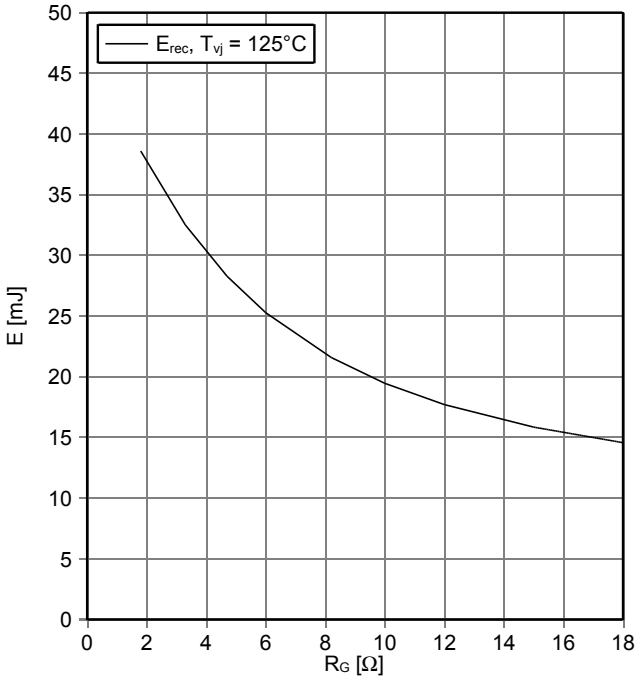
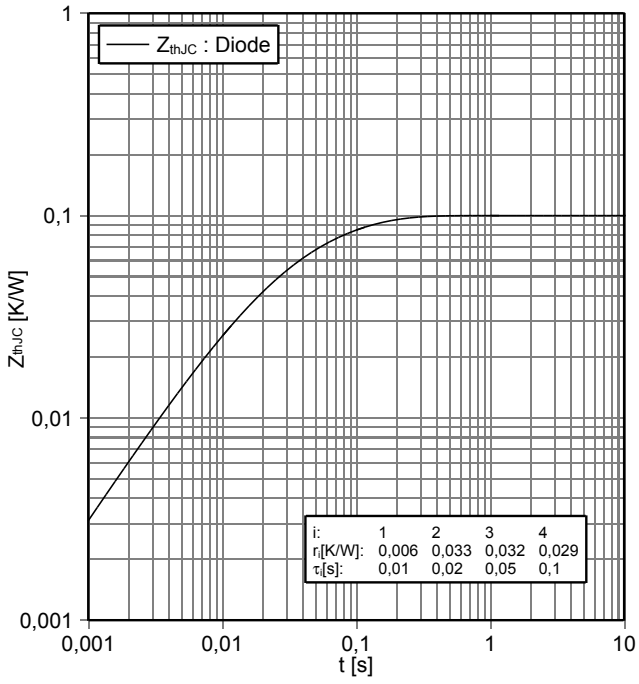
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.6\ \Omega$, $V_{CE} = 600$ V



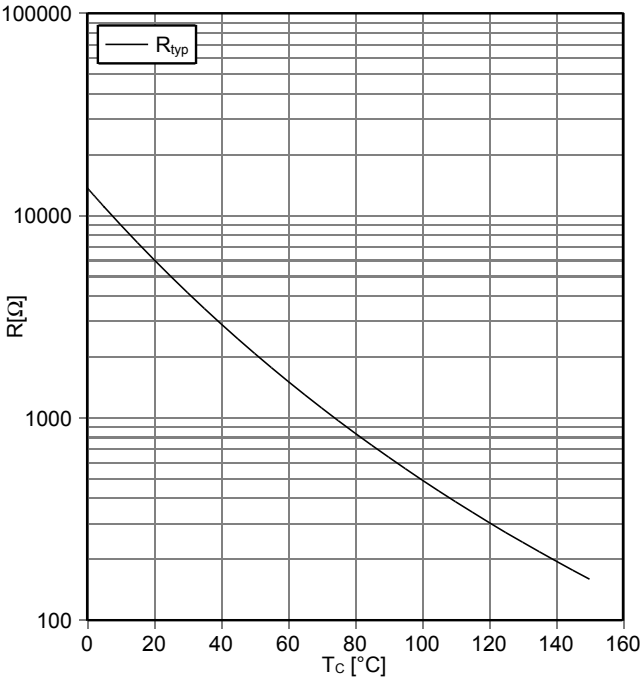
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 450$ A, $V_{CE} = 600$ V



Transienter Wärmewiderstand Diode, Wechselrichter
transient thermal impedance Diode, Inverter
$Z_{thJC} = f(t)$



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



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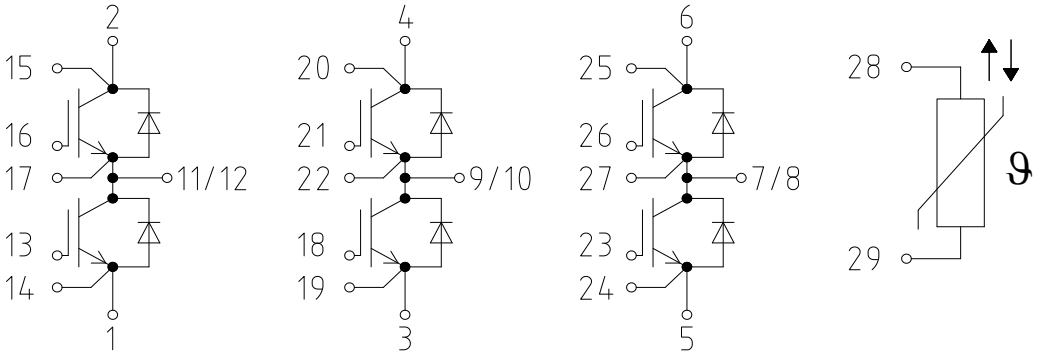
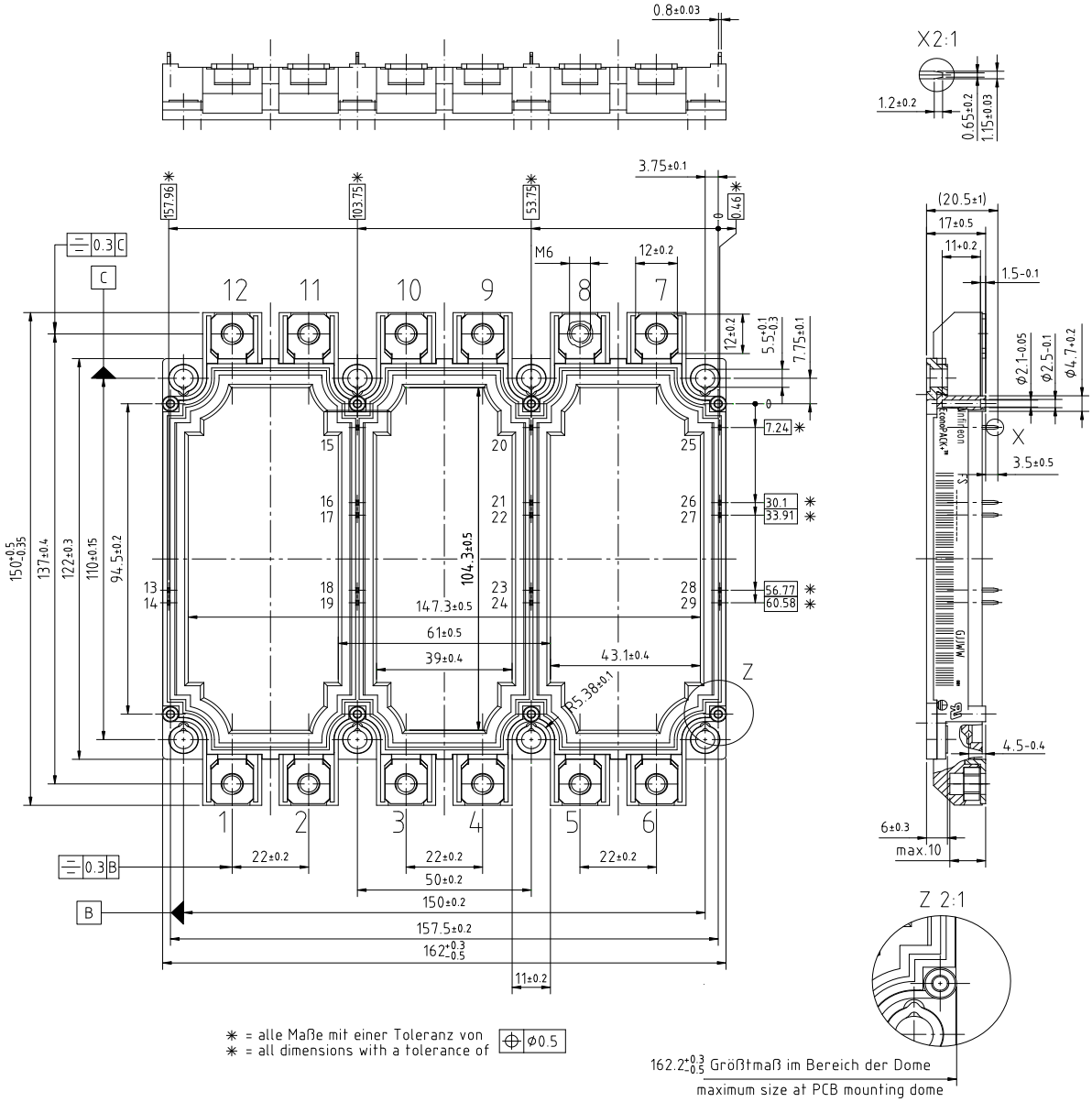
Schaltplan / circuit_diagram_headline



Gehäuseabmessungen / package outlines



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