



EconoPACK™2 Modul mit schnellem Trench/Feldstop IGBT3 und High Efficiency Diode
EconoPACK™2 with fast trench/fieldstop IGBT3 and Emitter Controlled High Efficiency diode

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 Continuous DC collector current	$T_C = 80^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\max} = 150^{\circ}\text{C}$	$I_{C\text{nom}}$ I_C	35 55	A A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	70	A
Gesamt-Verlustleistung Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 150$	P_{tot}	210	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	$I_C = 35\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 35\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,70 1,90	2,15	V V
Gate-Schwellenspannung Gate threshold voltage	$I_C = 1,50\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{G\text{Eth}}$	5,0	5,8	6,5 V
Gateladung Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		Q_G	0,33		μC
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{G\text{int}}$	6,0		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}	2,50		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}	0,09		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, induktive Last Turn-on delay time, inductive load	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{on}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{on}}$	0,09 0,09		μs μs
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{on}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	t_r	0,03 0,05		μs μs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{off}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	$t_{d\text{off}}$	0,42 0,52		μs μs
Fallzeit, induktive Last Fall time, inductive load	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{off}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	t_f	0,07 0,09		μs μs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}, L_S = 70\text{ nH}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{on}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	E_{on}	3,50		mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 35\text{ A}, V_{CE} = 600\text{ V}, L_S = 70\text{ nH}$ $V_{GE} = \pm 15\text{ V}$ $R_{G\text{off}} = 27\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	E_{off}	4,10		mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 900\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$	$t_P \leq 10\ \mu\text{s}, T_{vj} = 125^{\circ}\text{C}$	I_{SC}	140		A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}		0,60	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	0,19		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{op}}$	-40	125	$^{\circ}\text{C}$

prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1

**Vorläufige Daten
Preliminary Data**

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 Continuous DC forward current		I_F	35	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1 \text{ ms}$	I_{FRM}	70	A
Grenzlastintegral I^2t - value	$V_R = 0 \text{ V}, t_P = 10 \text{ ms}, T_{vj} = 125^{\circ}\text{C}$	I^2t	300	A^2s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 35 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 35 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	V_F	1,65 1,65	2,15	V V
Rückstromspitze Peak reverse recovery current	$I_F = 35 \text{ A}, -di_F/dt = 1500 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	I_{RM}	49,0 51,0		A A
Sperrverzögerungsladung Recovered charge	$I_F = 35 \text{ A}, -di_F/dt = 1500 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	Q_r	3,70 6,80		μC μC
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 35 \text{ A}, -di_F/dt = 1500 \text{ A}/\mu\text{s} (T_{vj}=125^{\circ}\text{C})$ $V_R = 600 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$	E_{rec}	1,40 2,70		mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		R_{thJC}		0,95	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Diode / per diode $\lambda_{paste} = 1 \text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		R_{thCH}	0,32		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj op}$	-40	125	$^{\circ}\text{C}$

NTC-Widerstand / NTC-Thermistor

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Nennwiderstand Rated resistance	$T_C = 25^{\circ}\text{C}$		R_{25}	5,00		$\text{k}\Omega$
Abweichung von R100 Deviation of R100	$T_C = 100^{\circ}\text{C}, R_{100} = 493 \Omega$		$\Delta R/R$	-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
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$		$B_{25/80}$	t.b.d.		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$		$B_{25/100}$	t.b.d.		K

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

prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1



**Vorläufige Daten
Preliminary Data**

Modul / Module

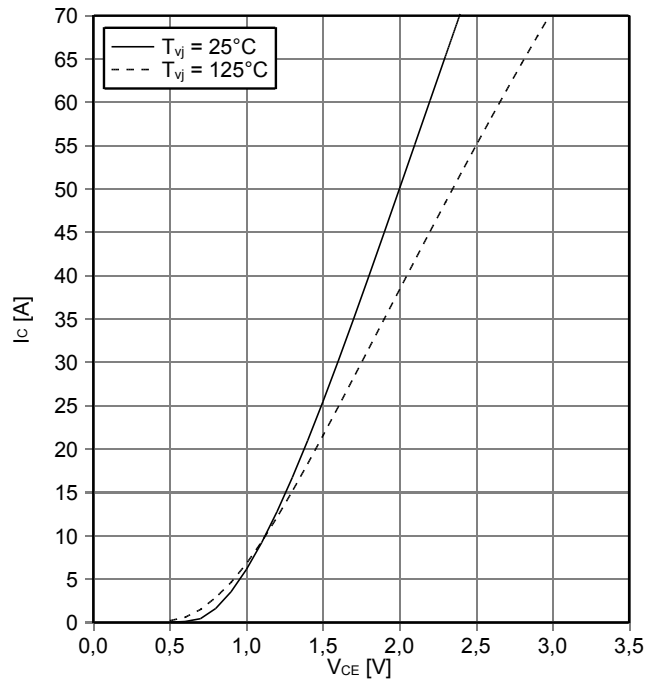
Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min	V _{ISOL}	2,5		kV
Material Modulgrundplatte Material of module baseplate			Cu		
Innere Isolation Internal isolation	Basisisolierung (Schutzklasse 1, EN61140) basic insulation (class 1, IEC 61140)		Al ₂ O ₃		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		10,0		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		7,5		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 $\lambda_{\text{Paste}} = 1 \text{ W/(m}\cdot\text{K)} / \lambda_{\text{grease}} = 1 \text{ W/(m}\cdot\text{K)}$	R _{thCH}	0,02		K/W
Modulstreuinduktivität Stray inductance module		L _{sCE}	19		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T _c = 25°C, pro Schalter / per switch	R _{CC+EE'}	2,50		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
Gewicht Weight		G	180		g

prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1

Vorläufige Daten
Preliminary Data

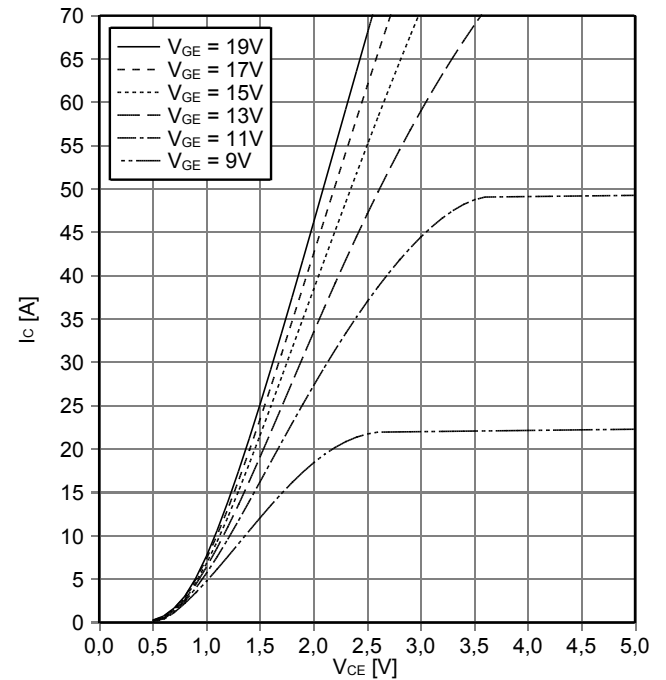
Ausgangskennlinie IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



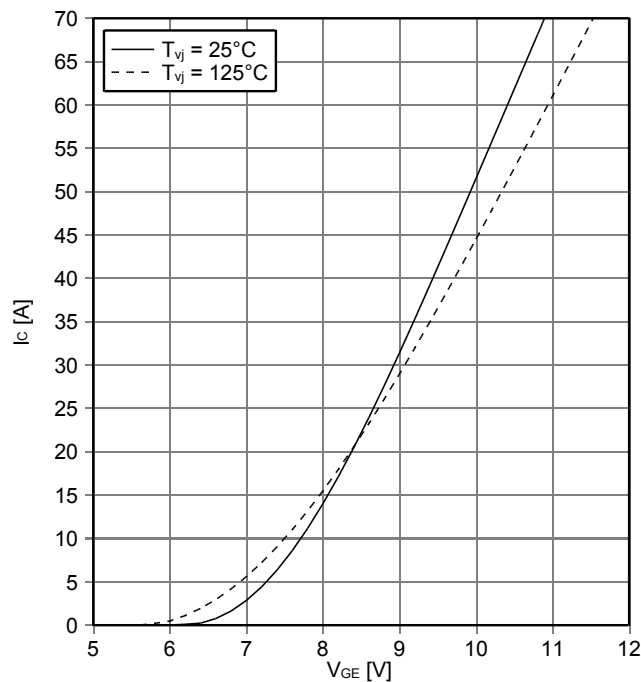
Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 125^\circ\text{C}$



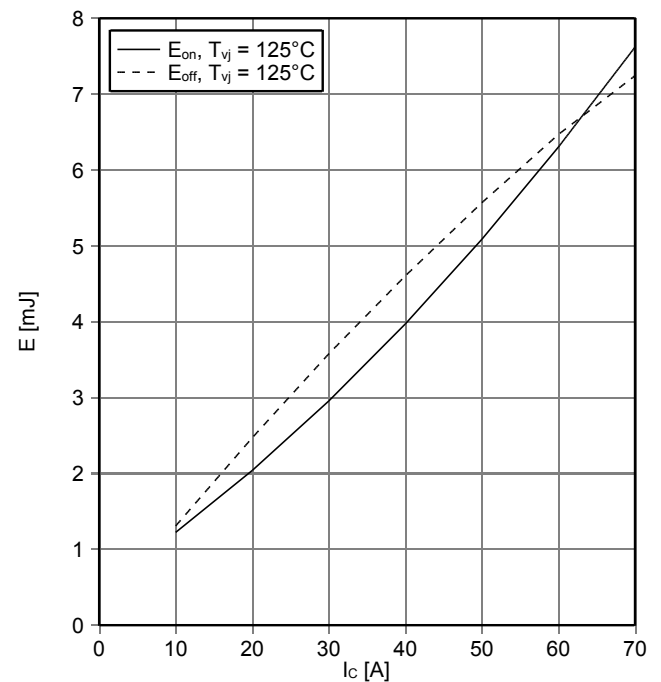
Übertragungscharakteristik IGBT, Wechselrichter (typisch)
transfer characteristic IGBT, Inverter (typical)

$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



Schaltverluste IGBT, Wechselrichter (typisch)
switching losses IGBT, Inverter (typical)

$E_{on} = f(I_C), E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 27\ \Omega, R_{Goff} = 27\ \Omega, V_{CE} = 600\text{ V}$



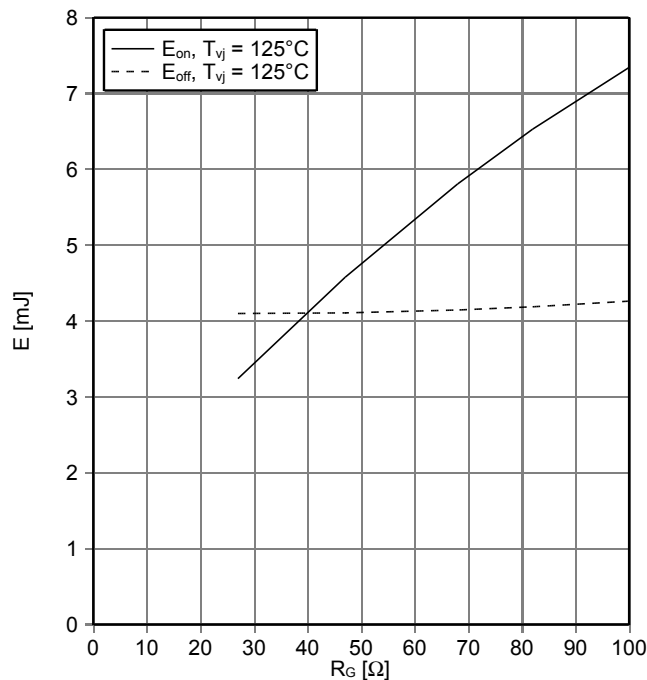
prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1



Vorläufige Daten Preliminary Data

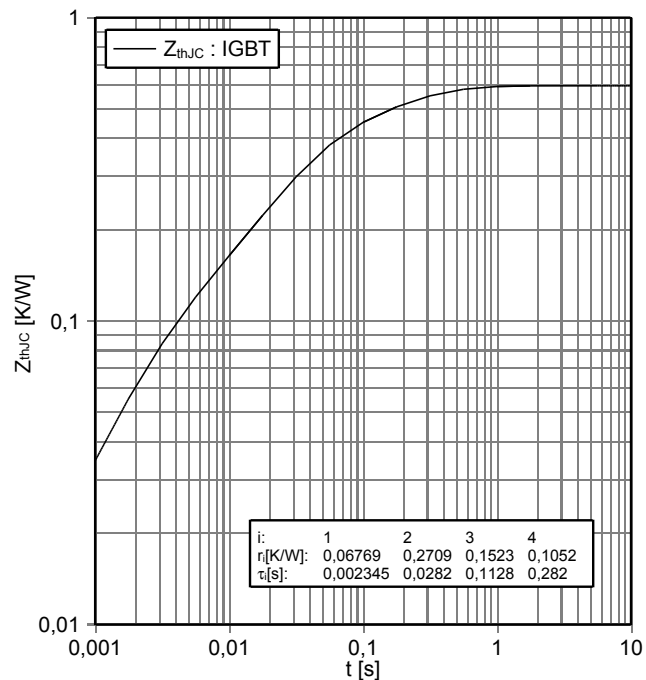
Schaltverluste IGBT, Wechselrichter (typisch) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}, I_C = 35\text{ A}, V_{CE} = 600\text{ V}$



Transienter Wärmewiderstand IGBT, Wechselrichter transient thermal impedance IGBT, Inverter

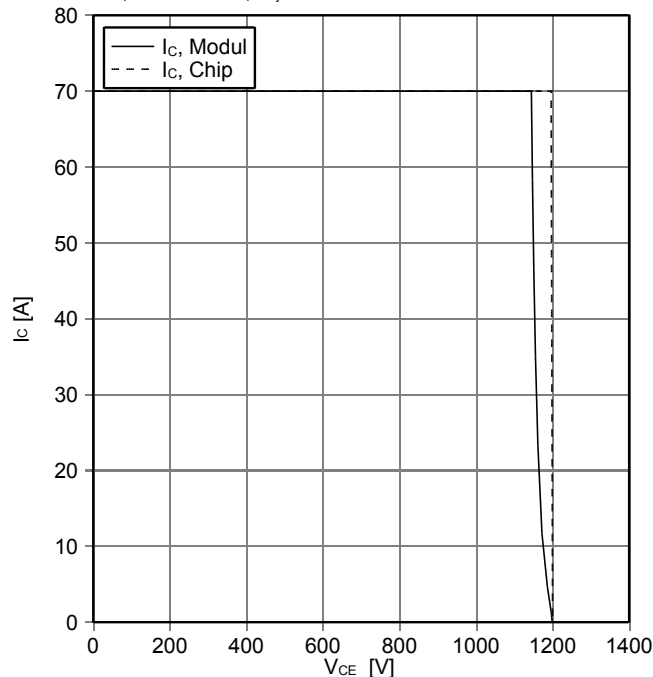
$Z_{thJC} = f(t)$



Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter (RBSOA)

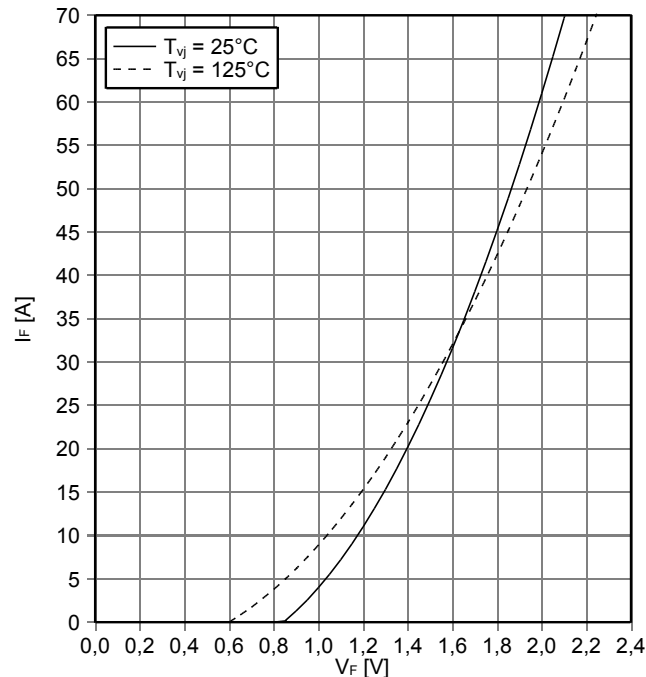
reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}, R_{Goff} = 27\ \Omega, T_{vj} = 125^\circ\text{C}$



Durchlasskennlinie der Diode, Wechselrichter (typisch) forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



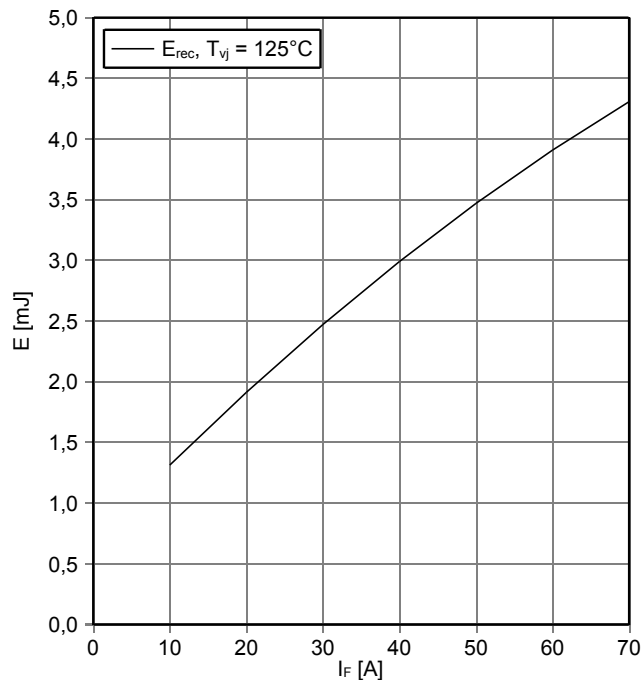
prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1



Vorläufige Daten
Preliminary Data

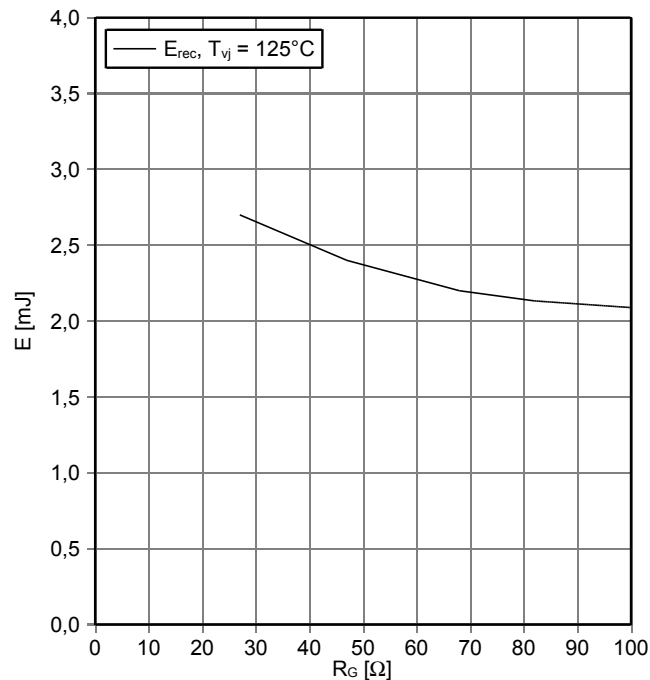
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 27 \Omega, V_{CE} = 600 V$



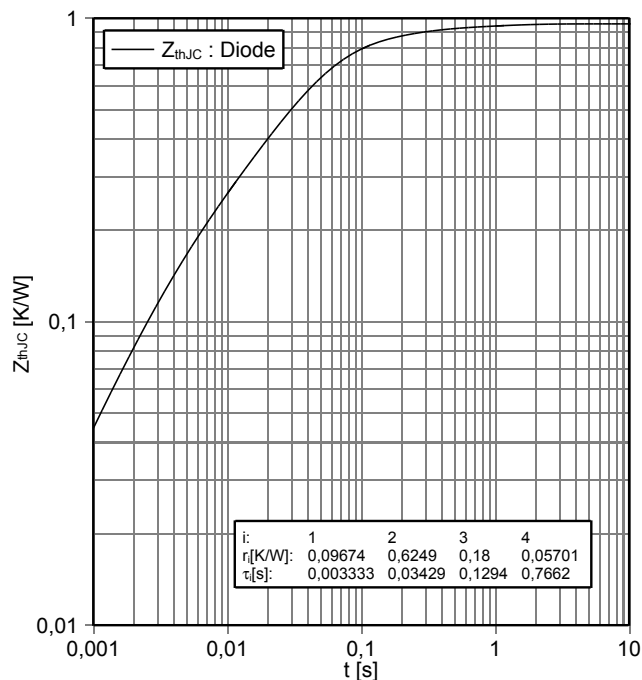
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 35 A, V_{CE} = 600 V$



Transienter Wärmewiderstand Diode, Wechselrichter
transient thermal impedance Diode, Inverter

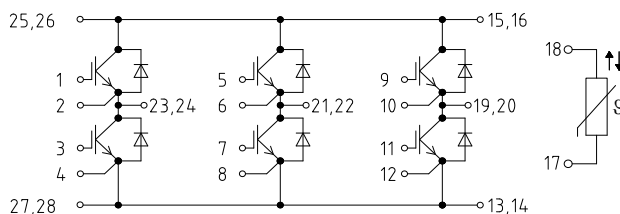
$Z_{thJC} = f(t)$



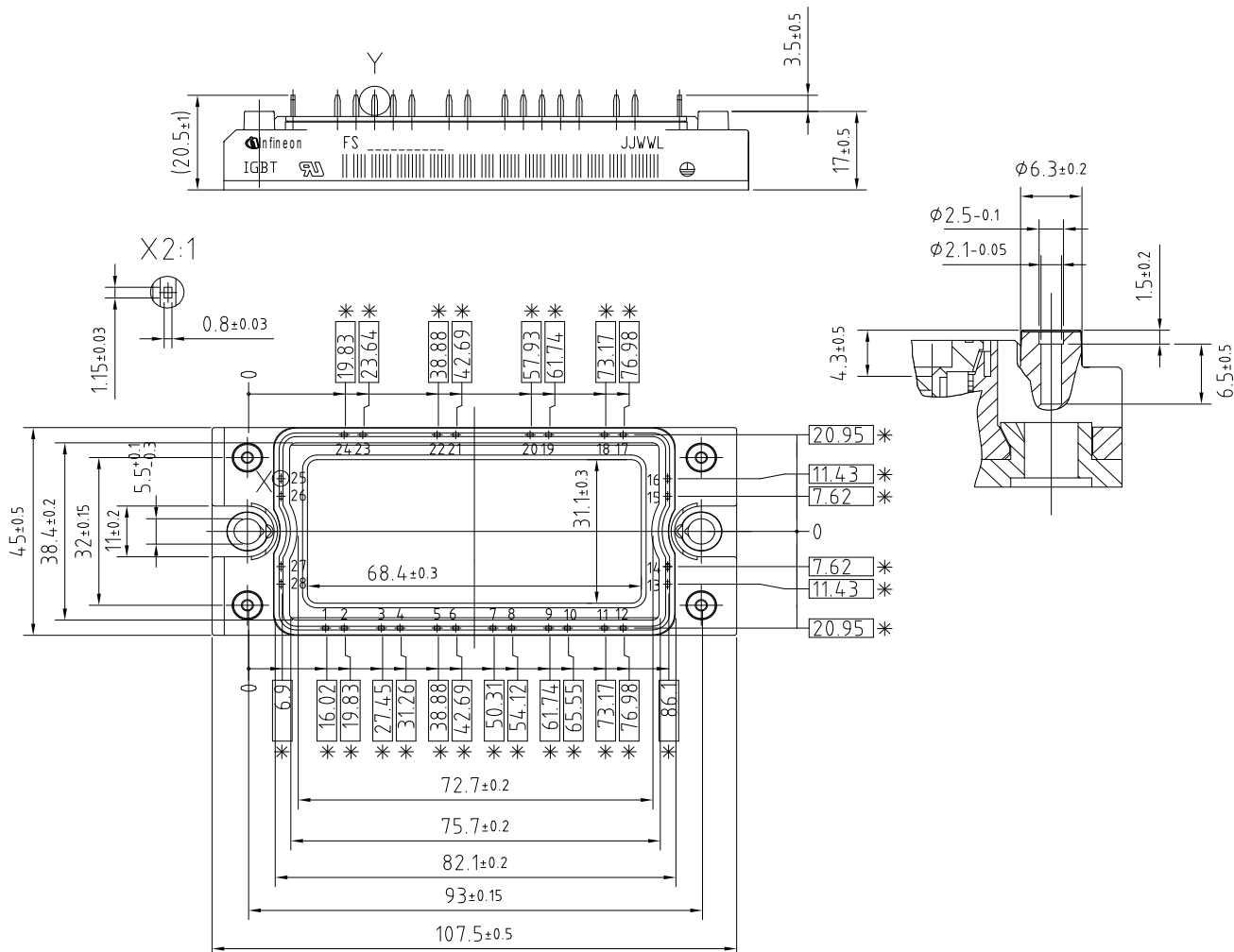
prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1

Vorläufige Daten
Preliminary Data

Schaltplan / circuit_diagram_headline



Gehäuseabmessungen / package outlines



* = alle Maße mit einer Toleranz von ± 0.4
* = all dimensions with tolerance of ± 0.4

prepared by: MK	date of publication: 2013-10-03
approved by: RS	revision: 2.1