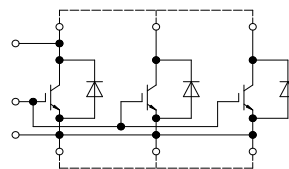


IHM-B Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled Diode  
IHM-B module with Trench/Fieldstop IGBT4 and Emitter Controlled diode



Typical Appearance



external connection  
(to be done)

$V_{CES} = 1700V$   
 $I_{C\ nom} = 1800A / I_{CRM} = 3600A$

### Typische Anwendungen

- Anwendungen für Resonanz Umrichter
- Hochleistungsumrichter
- Traktionsumrichter
- Windgeneratoren

### Elektrische Eigenschaften

- Erweiterte Sperrschichttemperatur  $T_{vj\ op}$
- Niedriges  $V_{CEsat}$
- Verstärkte Diode für Rückspeisebetrieb

### Mechanische Eigenschaften

- 4 kV AC 1min Isolationsfestigkeit
- AlSiC Bodenplatte für erhöhte thermische Lastwechselfestigkeit
- Gehäuse mit CTI > 400
- Große Luft- und Kriechstrecken
- Hohe Last- und thermische Wechselfestigkeit
- Hohe Leistungsdichte
- IHM B Gehäuse

### Typical Applications

- Resonant inverter applications
- High power converters
- Traction drives
- Wind turbines

### Electrical Features

- Extended operating temperature  $T_{vj\ op}$
- Low  $V_{CEsat}$
- Enlarged diode for regenerative operation

### Mechanical Features

- 4 kV AC 1min insulation
- AlSiC base plate for increased thermal cycling capability
- Package with CTI > 400
- High creepage and clearance distances
- High power and thermal cycling capability
- High power density
- IHM B housing

### Module Label Code

#### Barcode Code 128



#### DMX - Code



#### Content of the Code

Content of the Code	Digit
Module Serial Number	1 - 5
Module Material Number	6 - 11
Production Order Number	12 - 19
Datecode (Production Year)	20 - 21
Datecode (Production Week)	22 - 23

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approved by: IB	revision: V3.1	UL approved (E83335)



**IGBT, Wechselrichter / IGBT, Inverter**  
**Höchstzulässige Werte / Maximum Rated Values**

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1700	V
Kollektor-Dauergleichstrom Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$	1800	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	3600	A
Gesamt-Verlustleistung Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$P_{\text{tot}}$	11,5	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	$I_C = 1800\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1800\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 1800\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,90 2,30 2,40	2,25	V V V
Gate-Schwellenspannung Gate threshold voltage	$I_C = 72,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,20	5,80	6,40 V
Gateladung Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		$Q_G$	19,0		$\mu\text{C}$
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	1,1		$\Omega$
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	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	4,75		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, induktive Last Turn-on delay time, inductive load	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{on}}$	0,65 0,70 0,72		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,15 0,16 0,16		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,8\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{off}}$	1,25 1,35 1,40		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Fallzeit, induktive Last Fall time, inductive load	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 0,8\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,27 0,41 0,46		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 12000\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	265 380 420		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 1800\text{ A}, V_{CE} = 900\text{ V}, L_S = 50\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3000\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 0,8\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	470 620 660		mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 1000\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	7500		A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		$R_{thJC}$		9,55	K/kW
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	11,0		K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{op}}$	-40	150	$^{\circ}\text{C}$

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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 Continuous DC forward current		$I_F$	1800	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	3600	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	795 750	$\text{kA}^2\text{s}$ $\text{kA}^2\text{s}$
Spitzenverlustleistung Maximum power dissipation	$T_{vj} = 125^{\circ}\text{C}$	$P_{RQM}$	2700	kW
Mindesteinschaltdauer Minimum turn-on time		$t_{on\ min}$	10,0	$\mu\text{s}$

**Charakteristische Werte / Characteristic Values**

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 1800\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1800\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1800\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,65 1,65 1,65	2,10	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 1800\text{ A}, -di_F/dt = 12000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	2200 2600 2650		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 1800\text{ A}, -di_F/dt = 12000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	500 850 960		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 1800\text{ A}, -di_F/dt = 12000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 900\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	335 590 670		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		$R_{thJC}$		13,3	K/kW
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Diode / per diode $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	11,5		K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\ op}$	-40	150	$^{\circ}\text{C}$

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**Modul / Module**

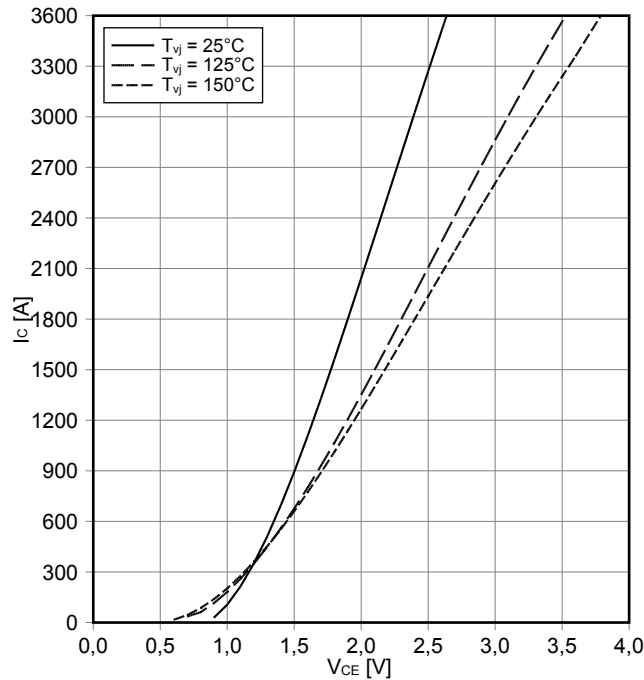
Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	4,0		kV
Material Modulgrundplatte Material of module baseplate			AlSiC		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		32,2 32,2		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		19,1 19,1		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI	> 400		
			min.	typ.	max.
Modulstreuinduktivität Stray inductance module		L <sub>SCE</sub>		6,0	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T <sub>c</sub> = 25°C, pro Schalter / per switch	R <sub>CC+EE'</sub>		0,12	mΩ
Lagertemperatur Storage temperature		T <sub>stg</sub>	-40		150 °C
Anzugsdrehmoment f. Modulmontage Mounting torque for modul mounting	Schraube M6 - Montage gem. gültiger Applikationsschrift Screw M6 - Mounting according to valid application note	M	4,25		5,75 Nm
Anzugsdrehmoment f. elektr. Anschlüsse Terminal connection torque	Schraube M4 - Montage gem. gültiger Applikationsschrift Screw M4 - Mounting according to valid application note	M	1,8	-	2,1 Nm
	Schraube M8 - Montage gem. gültiger Applikationsschrift Screw M8 - Mounting according to valid application note		8,0	-	10 Nm
Gewicht Weight		G		1200	g

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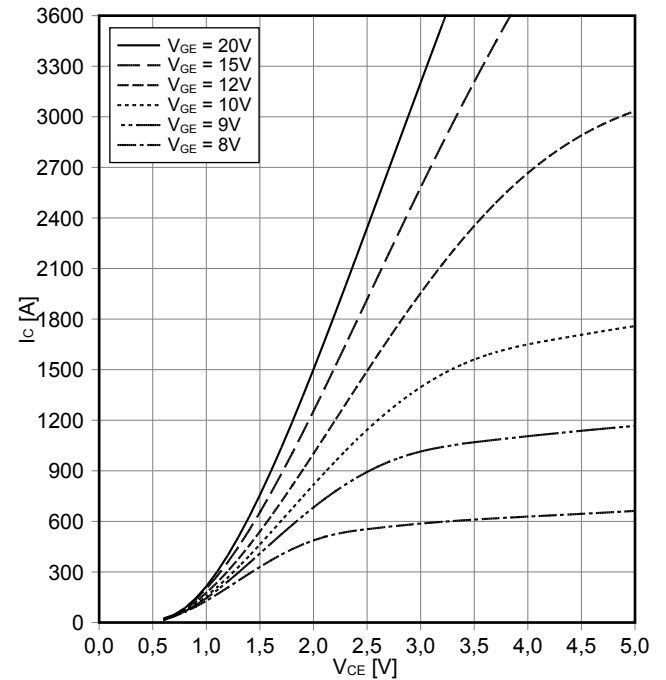
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
output characteristic IGBT, Inverter (typical)

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



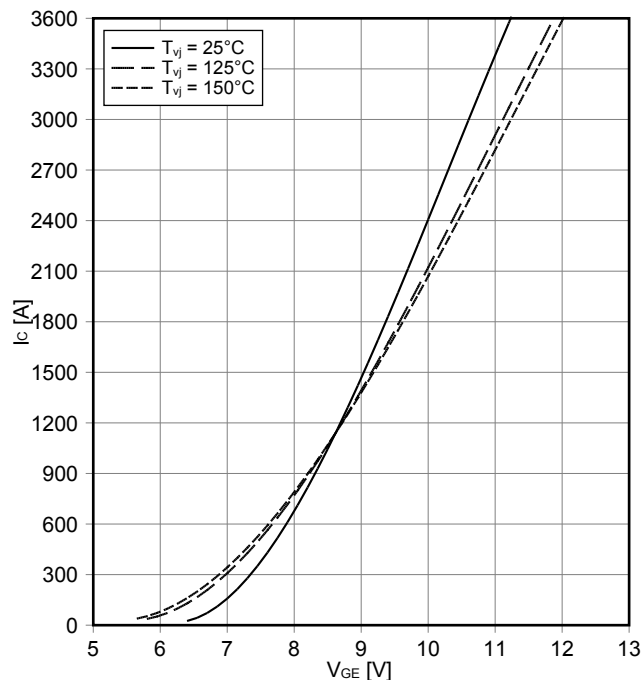
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$



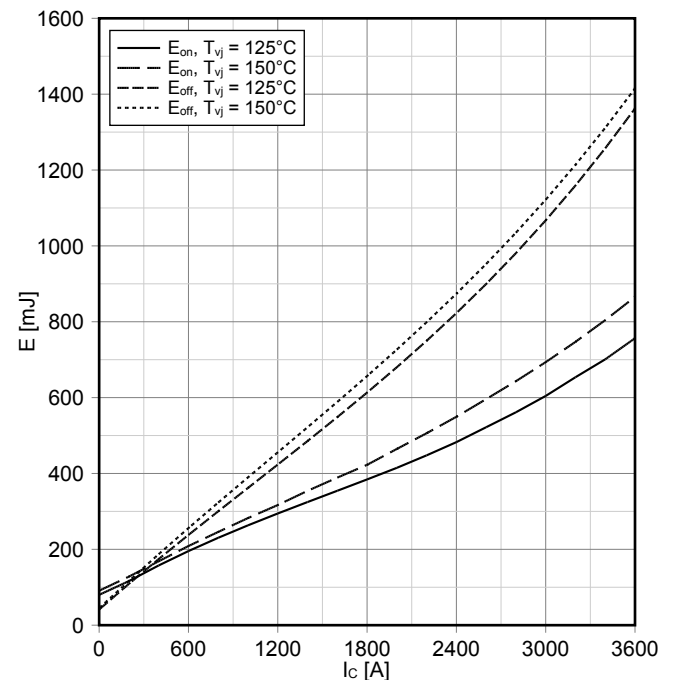
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
transfer characteristic IGBT, Inverter (typical)

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



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

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 0.5\ \Omega$ ,  $R_{Goff} = 0.8\ \Omega$ ,  $V_{CE} = 900\text{ V}$

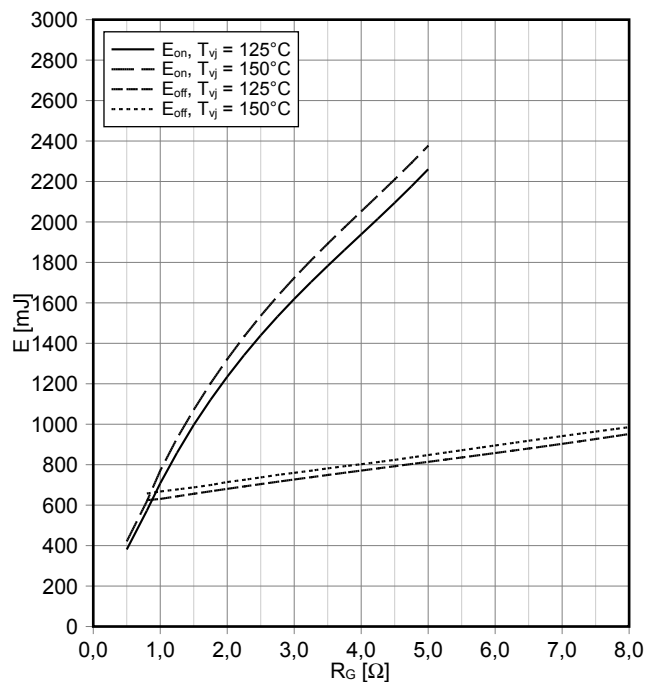


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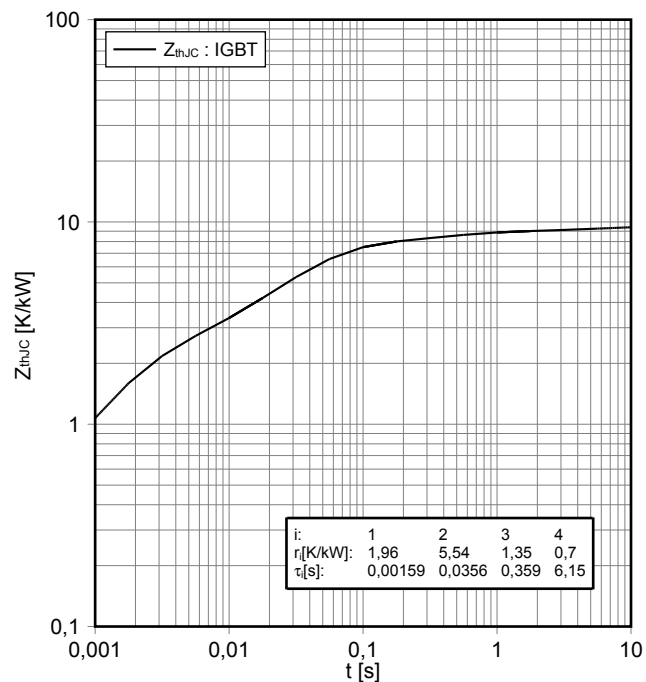
**Schaltverluste IGBT, Wechselrichter (typisch)**  
**switching losses IGBT, Inverter (typical)**

$E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 1800\text{ A}$ ,  $V_{CE} = 900\text{ V}$



**Transienter Wärmewiderstand IGBT, Wechselrichter**  
**transient thermal impedance IGBT, Inverter**

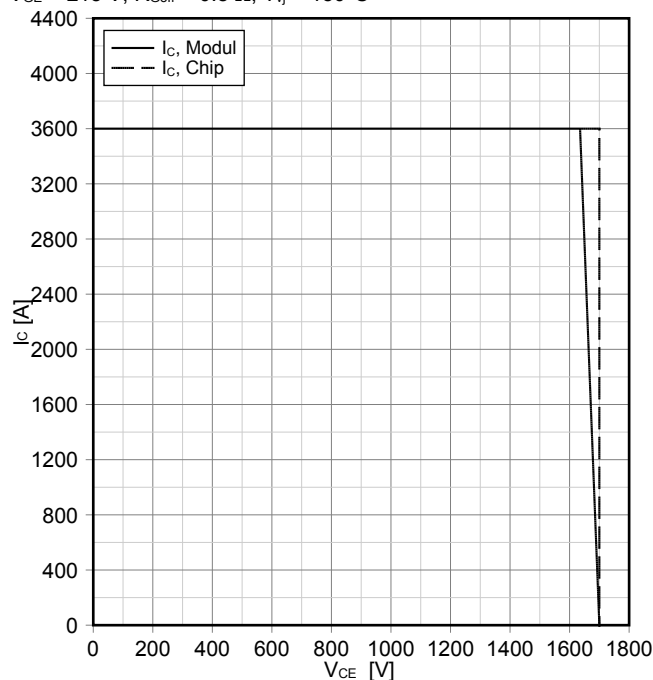
$Z_{thJC} = f(t)$



**Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter**  
**(RBSOA)**

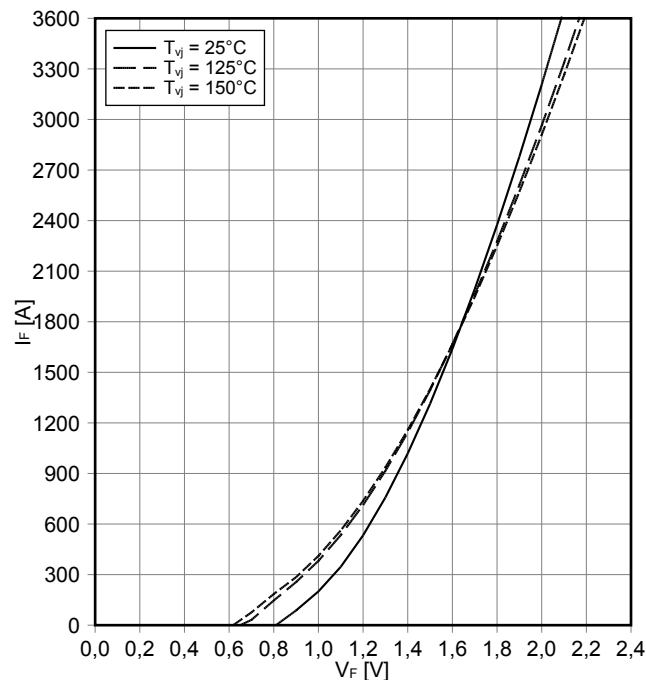
**reverse bias safe operating area IGBT, Inverter (RBSOA)**

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 0.8\ \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



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

$I_F = f(V_F)$

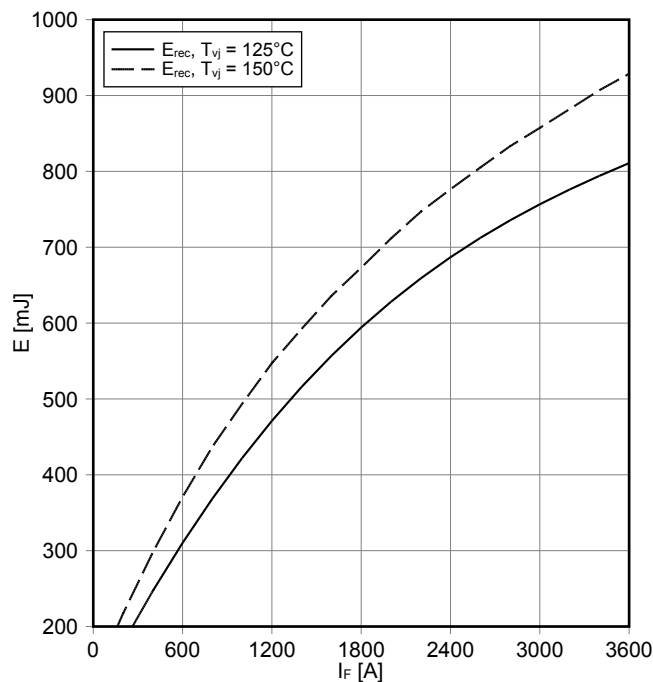


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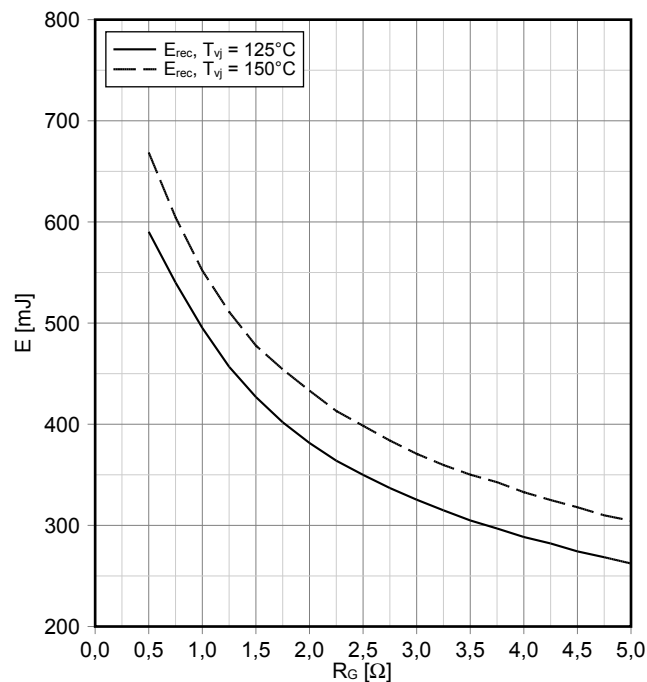
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 0.5 \Omega, V_{CE} = 900 V$



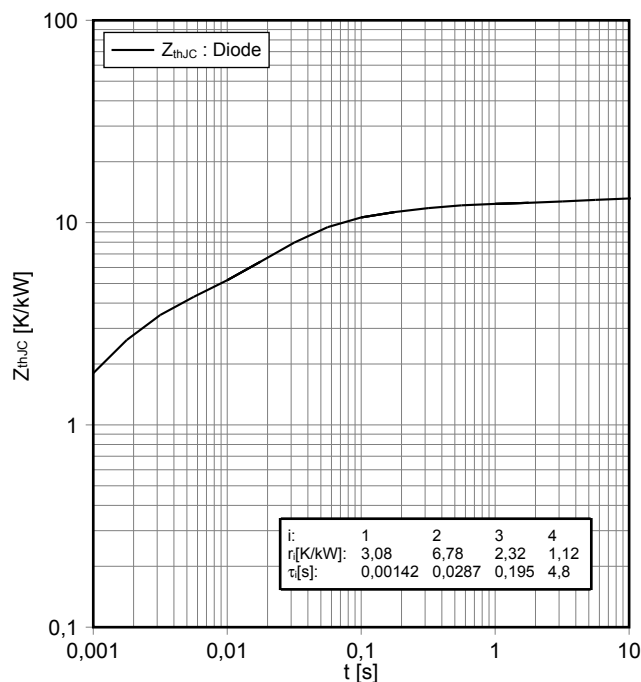
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

$E_{rec} = f(R_G)$   
 $I_F = 1800 A, V_{CE} = 900 V$



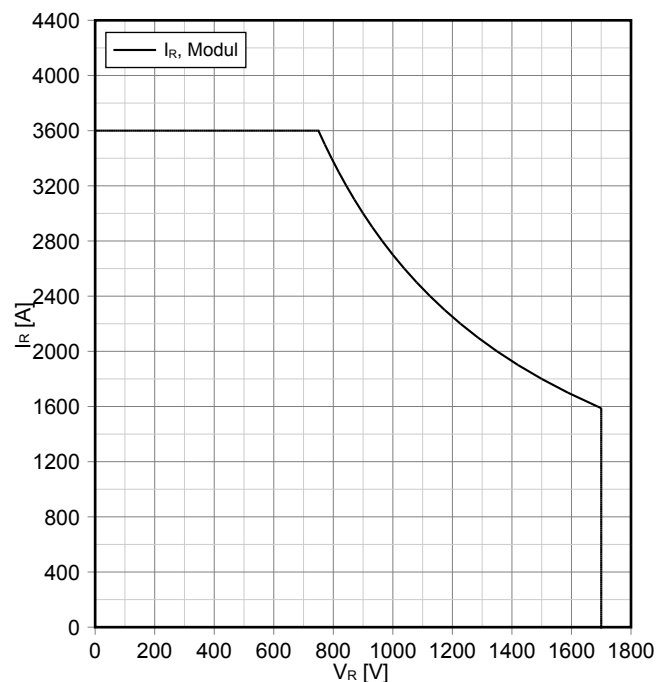
**Transienter Wärmewiderstand Diode, Wechselrichter**  
**transient thermal impedance Diode, Inverter**

$Z_{thJC} = f(t)$



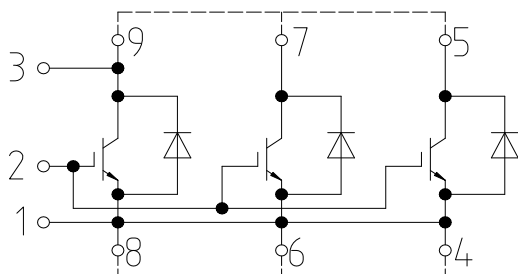
**Sicherer Arbeitsbereich Diode, Wechselrichter (SOA)**  
**safe operation area Diode, Inverter (SOA)**

$I_R = f(V_R)$   
 $T_{vj} = 150^\circ C$



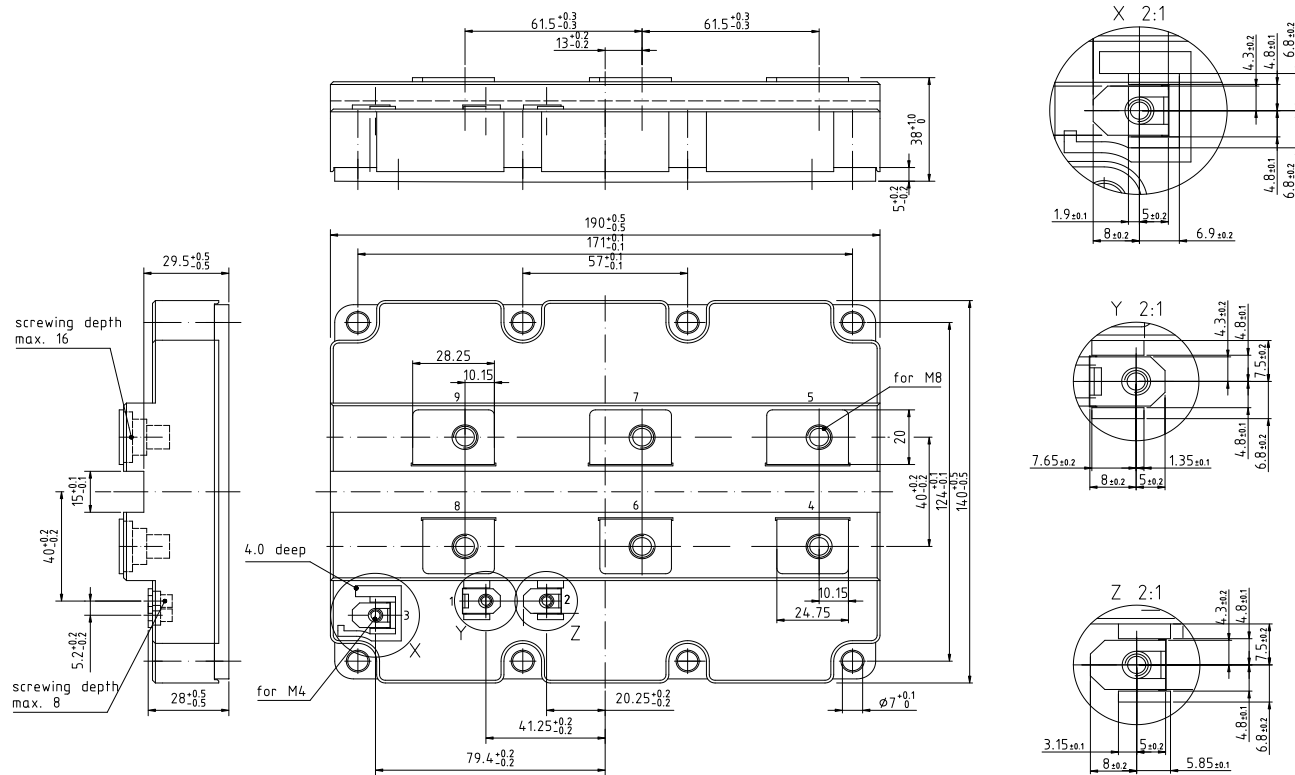
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Schaltplan / Circuit diagram



external connection  
(to be done)

Gehäuseabmessungen / Package outlines



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