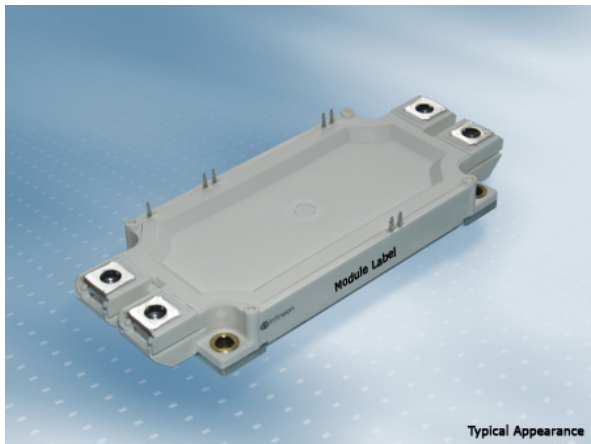


EconoDUAL™3 Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled HE Diode und NTC  
EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and NTC



$V_{CES} = 1200V$   
 $I_{C\ nom} = 450A / I_{CRM} = 900A$

### Typische Anwendungen

- Motorantriebe
- Servoumrichter
- USV-Systeme
- Windgeneratoren

### Elektrische Eigenschaften

- Niedriges  $V_{CEsat}$
- $T_{vj\ op} = 150^{\circ}C$

### Mechanische Eigenschaften

- Standardgehäuse

### Typical Applications

- Motor Drives
- Servo Drives
- UPS Systems
- Wind Turbines

### Electrical Features

- Low  $V_{CEsat}$
- $T_{vj\ op} = 150^{\circ}C$

### Mechanical Features

- Standard 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: MK	revision: 3.1	UL approved (E83335)



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

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	1200	V
Kollektor-Dauergleichstrom Continuous DC collector current	$T_C = 100^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{C\text{nom}}$ $I_C$	450 675	A A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	900	A
Gesamt-Verlustleistung Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$P_{\text{tot}}$	2250	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	$I_C = 450\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 450\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 450\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,75 2,00 2,05	2,10	V V V	
Gate-Schwellenspannung Gate threshold voltage	$I_C = 17,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,2	5,8	6,4	V
Gateladung Gate charge	$V_{GE} = -15\text{ V} \dots +15\text{ V}$		$Q_G$	3,30		$\mu\text{C}$	
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	1,7		$\Omega$	
Eingangskapazität Input capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	28,0		nF	
Rückwirkungskapazität Reverse transfer capacitance	$f = 1\text{ MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	1,55		nF	
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$		3,0	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	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	0,19 0,22 0,22		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$	
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,06 0,07 0,07		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$	
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	0,49 0,58 0,62		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$	
Fallzeit, induktive Last Fall time, inductive load	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,08 0,11 0,12		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$	
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$ $V_{GE} = \pm 15\text{ V}, di/dt = 7000\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Gon} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	15,0 26,0 28,5		mJ mJ mJ	
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 450\text{ A}, V_{CE} = 600\text{ V}, L_S = 35\text{ nH}$ $V_{GE} = \pm 15\text{ V}, du/dt = 3100\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $R_{Goff} = 1,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	38,0 55,5 61,5		mJ mJ mJ	
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	1800		A	
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		$R_{thJC}$		0,066	K/W	
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K})$ / $\lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,03		K/W	
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	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
Dauergleichstrom Continuous DC forward current		$I_F$	450	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1\text{ ms}$	$I_{FRM}$	900	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_P = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	35000 28500	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

**Charakteristische Werte / Characteristic Values**

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 450\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 450\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 450\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,65 1,65 1,65	2,10	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 450\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	450 550 575		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 450\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	48,0 92,0 105		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 450\text{ A}, -di_F/dt = 7000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	26,5 48,5 55,0		mJ 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 $\lambda_{Paste} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,045		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{ op}}$	-40	150	$^{\circ}\text{C}$

**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	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		$B_{25/80}$	3411		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		$B_{25/100}$	3433		K

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

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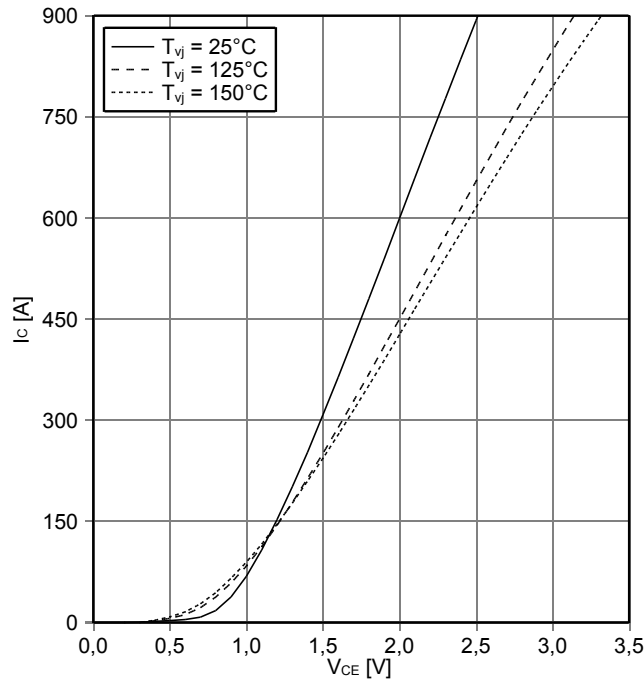
**Modul / Module**

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min	V <sub>ISOL</sub>	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 <sub>2</sub> O <sub>3</sub>		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		14,5 13,0		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		12,5 10,0		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI	> 200		
			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 <sub>thCH</sub>	0,009		K/W
Modulstreuinduktivität Stray inductance module		L <sub>sCE</sub>	20		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T <sub>c</sub> = 25°C, pro Schalter / per switch	R <sub>CC+EE'</sub>	1,10		mΩ
Lagertemperatur Storage temperature		T <sub>stg</sub>	-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	345		g

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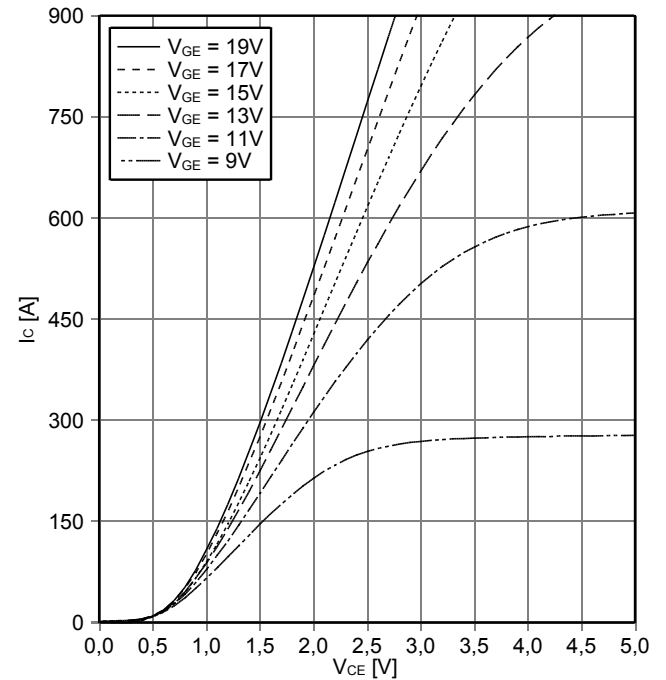
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



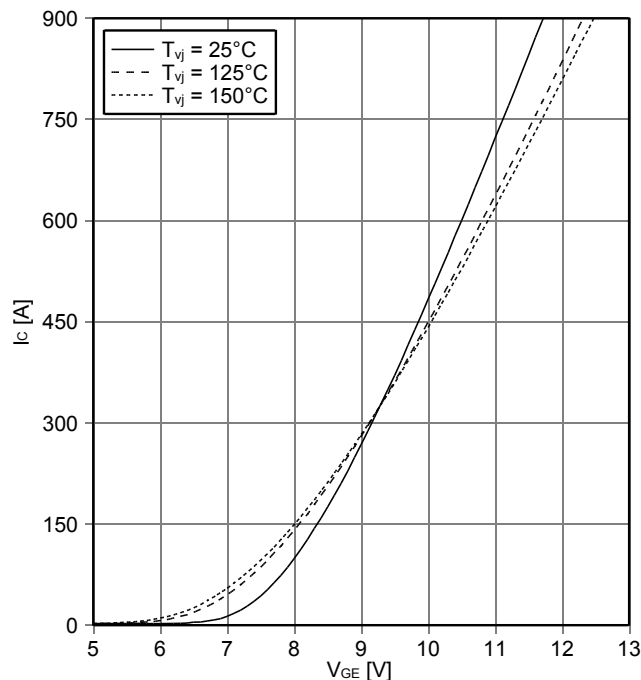
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



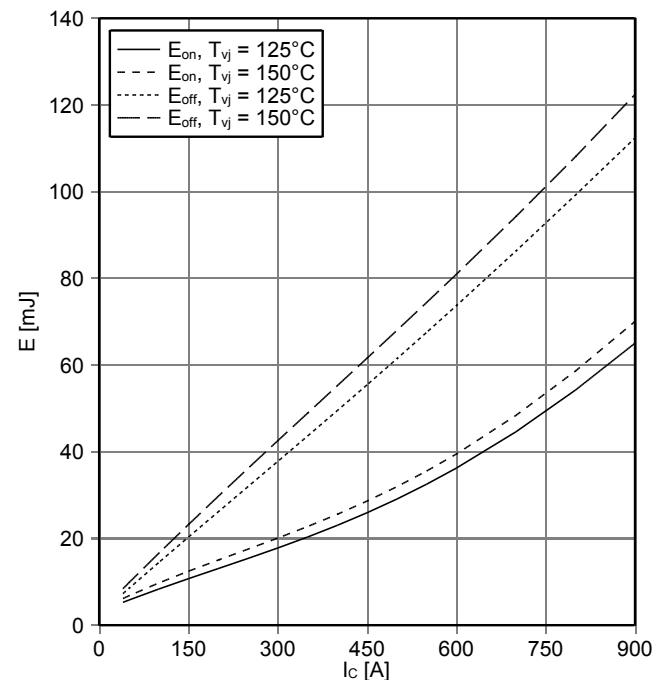
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
**transfer characteristic IGBT, Inverter (typical)**

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



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

$E_{on} = f(I_C), E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 1.3\ \Omega, R_{Goff} = 1.3\ \Omega, V_{CE} = 600\text{ V}$

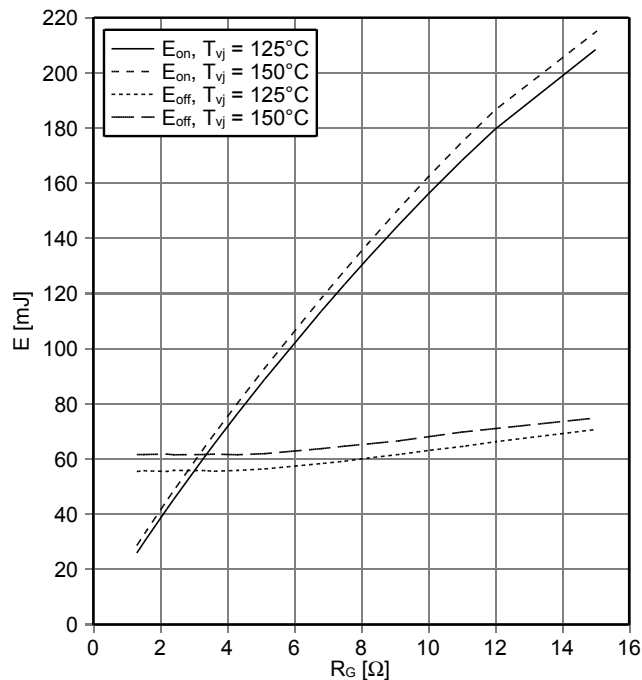


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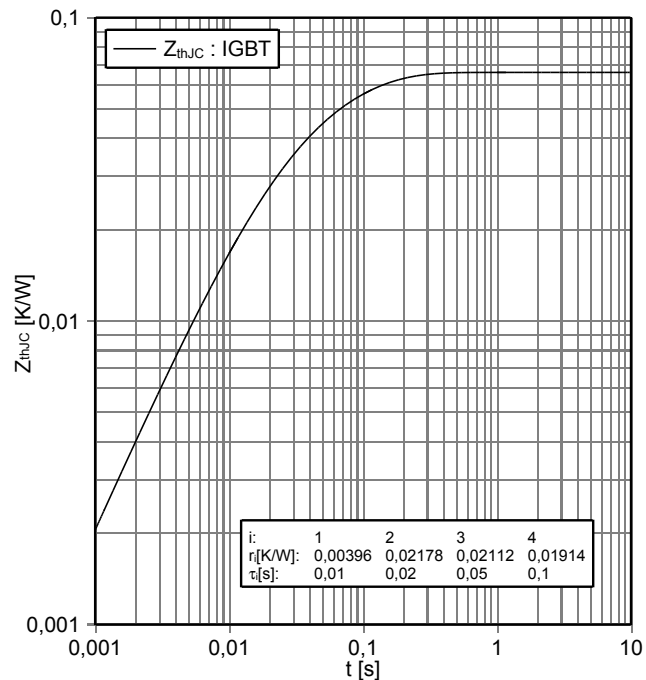
**Schaltverluste IGBT, Wechselrichter (typisch)**  
**switching losses IGBT, Inverter (typical)**

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15 V, I_C = 450 A, V_{CE} = 600 V$



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

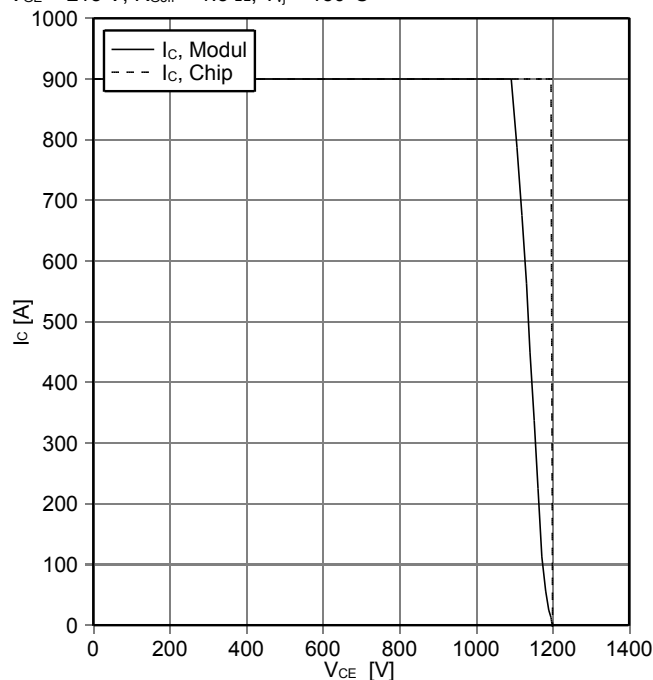
$Z_{thJC} = f(t)$



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

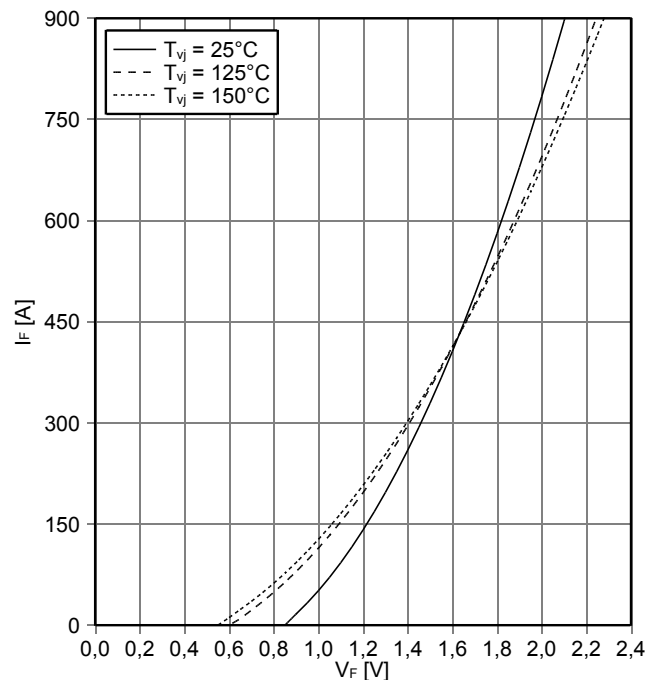
**reverse bias safe operating area IGBT, Inverter (RBSOA)**

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 V, R_{Goff} = 1.3 \Omega, T_{vj} = 150^\circ C$



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

$I_F = f(V_F)$

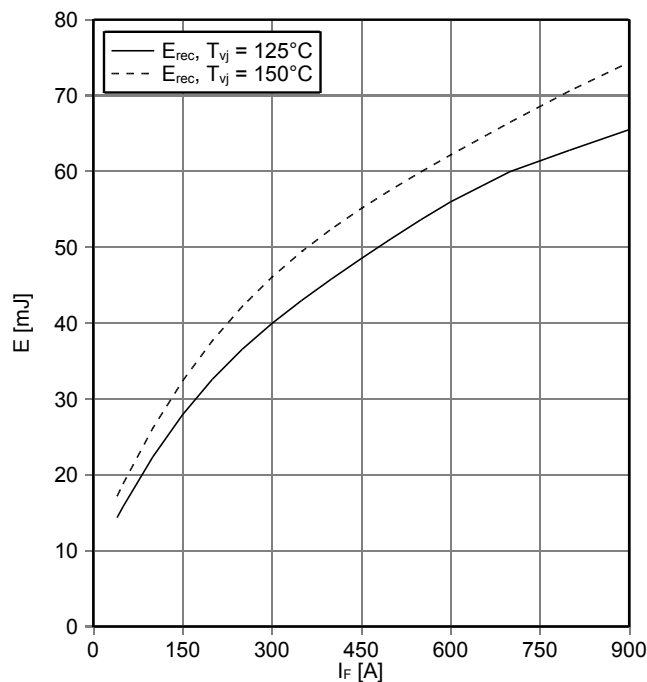


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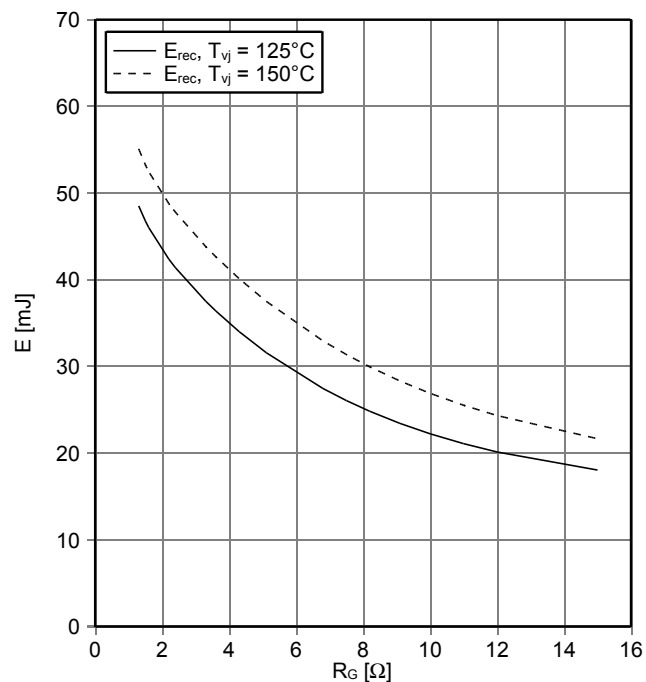
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.3 \Omega, V_{CE} = 600 V$



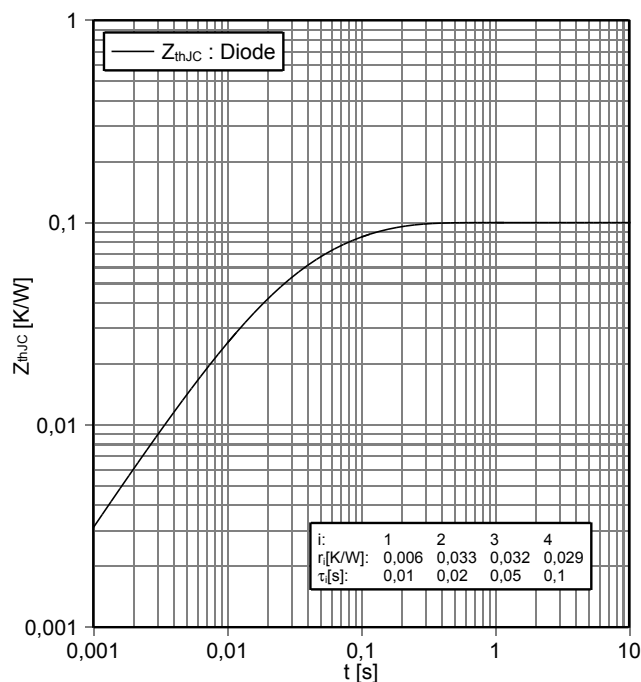
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

$E_{rec} = f(R_G)$   
 $I_F = 450 A, V_{CE} = 600 V$



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

$Z_{thJC} = f(t)$



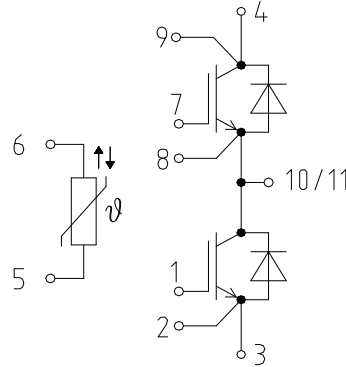
**NTC-Widerstand-Temperaturkennlinie (typisch)**  
**NTC-Thermistor-temperature characteristic (typical)**

$R = f(T)$

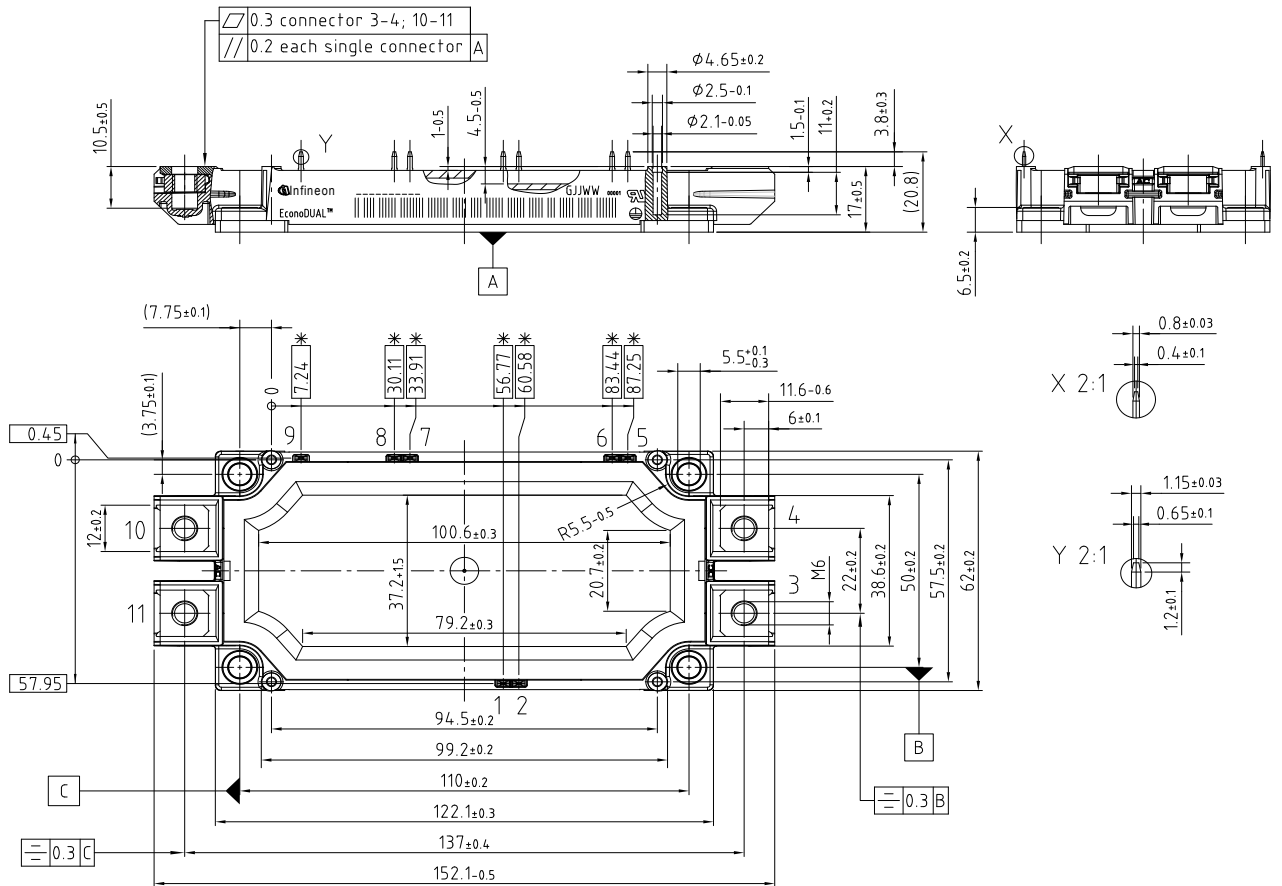


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Schaltplan / circuit\_diagram\_headline



Gehäuseabmessungen / package outlines



\* = all dimensions with a tolerance of  $\pm 0.5$   
 dimensions valid in mounted condition

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