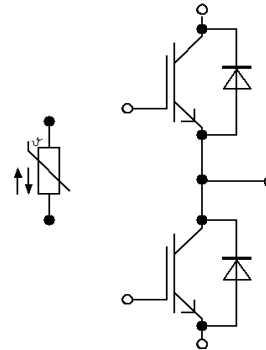
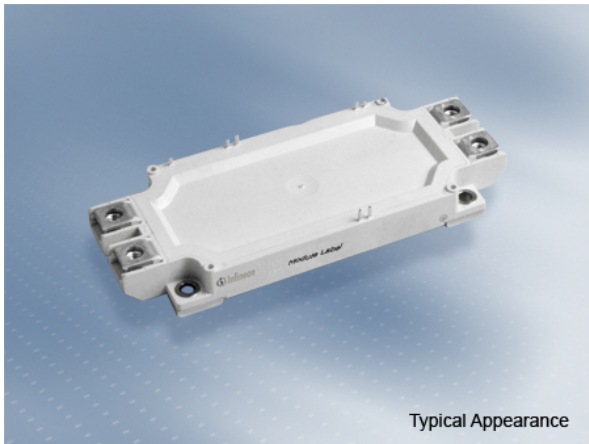


EconoDUAL™3 Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled Diode und NTC / bereits aufgetragenem Thermal Interface Material

EconoDUAL™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC / pre-applied Thermal Interface Material



$V_{CES} = 1200V$   
 $I_{C\ nom} = 600A / I_{CRM} = 1200A$

### Potentielle Anwendungen

- Hochleistungsumrichter
- Motorantriebe
- Servoumrichter
- USV-Systeme
- Windgeneratoren

### Potential Applications

- High power converters
- Motor drives
- Servo drives
- UPS systems
- Wind turbines

### Elektrische Eigenschaften

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

### Electrical Features

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

### Mechanische Eigenschaften

- Hohe Leistungsdichte
- Isolierte Bodenplatte
- Standardgehäuse
- Thermisches Interface Material bereits aufgetragen

### Mechanical Features

- High power density
- Isolated base plate
- Standard housing
- Pre-applied Thermal Interface Material

## 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

## 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	$T_H = 70^{\circ}\text{C}, T_{vj\max} = 175^{\circ}\text{C}$	$I_{CDC}$	600	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	1200	A
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	$I_C = 600\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	1,75 2,00 2,05	2,10	V V V	
Gate-Schwellenspannung Gate threshold voltage	$I_C = 23,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	5,20	5,80	6,40	V
Gateladung Gate charge	$V_{GE} = -15 / 15\text{ V}$		$Q_G$	4,40			$\mu\text{C}$
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	1,2			$\Omega$
Eingangskapazität Input capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	37,0			nF
Rückwirkungskapazität Reverse transfer capacitance	$f = 1000\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	2,05			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	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{don}$	0,16 0,21 0,21			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,09 0,09 0,10			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{doff}$	0,48 0,61 0,65			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Fallzeit, induktive Last Fall time, inductive load	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,07 0,11 0,12			$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $di/dt = 5100\text{ A}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	62,5 83,0 90,0			mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 600\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 35\text{ nH}$ $du/dt = 3700\text{ V}/\mu\text{s} (T_{vj} = 150^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 1,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	47,0 72,0 79,5			mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$		$I_{SC}$	2400			A
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro IGBT / per IGBT valid with IFX pre-applied thermal interface material		$R_{thJH}$			0,0707	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

## Diode, Wechselrichter / Diode, Inverter

### Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzenspernung Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	1200	V
Dauergleichstrom Continuous DC forward current		$I_F$	600	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_p = 1\text{ ms}$	$I_{FRM}$	1200	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	40000 37500	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

### Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 600\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 600\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 600\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,65 1,65 1,65	2,10	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 600\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	290 420 450		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 600\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	62,0 113 130		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 600\text{ A}, -di_F/dt = 5100\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	22,0 44,0 51,0		mJ mJ mJ
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro Diode / per diode valid with IFX pre-applied thermal interface material		$R_{thJH}$		0,116	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	$T_{NTC} = 25^{\circ}\text{C}$		$R_{25}$	5,00		k $\Omega$
Abweichung von R100 Deviation of R100	$T_{NTC} = 100^{\circ}\text{C}, R_{100} = 493\ \Omega$		$\Delta R/R$	-5	5	%
Verlustleistung Power dissipation	$T_{NTC} = 25^{\circ}\text{C}$		$P_{25}$		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.

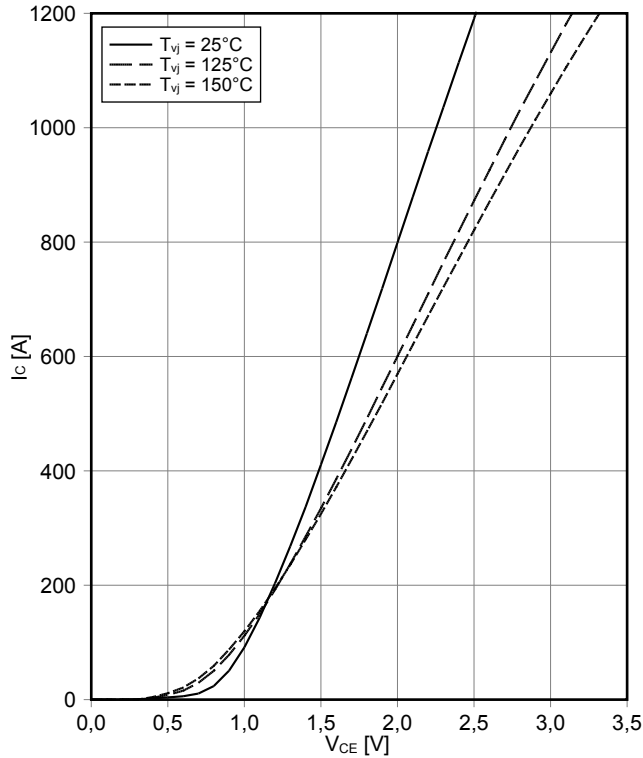
## Modul / Module

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min	V <sub>ISOL</sub>	3,4		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		15,0 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		
Relativer Temperaturindex (elektr.) RTI Elec.	Gehäuse housing	RTI	140		°C
			min.	typ.	max.
Modulstreuinduktivität Stray inductance module		L <sub>sCE</sub>		20	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T <sub>H</sub> = 25°C, pro Schalter / per switch	R <sub>CC+EE'</sub>		1,00	mΩ
Lagertemperatur Storage temperature		T <sub>stg</sub>	-40		125 °C
Höchstzulässige Bodenplattenbetriebstemperatur Maximum baseplate operation temperature		T <sub>BPmax</sub>			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

Lagerung und Transport von Modulen mit TIM => siehe AN2012-07  
Storage and shipment of modules with TIM => see AN2012-07

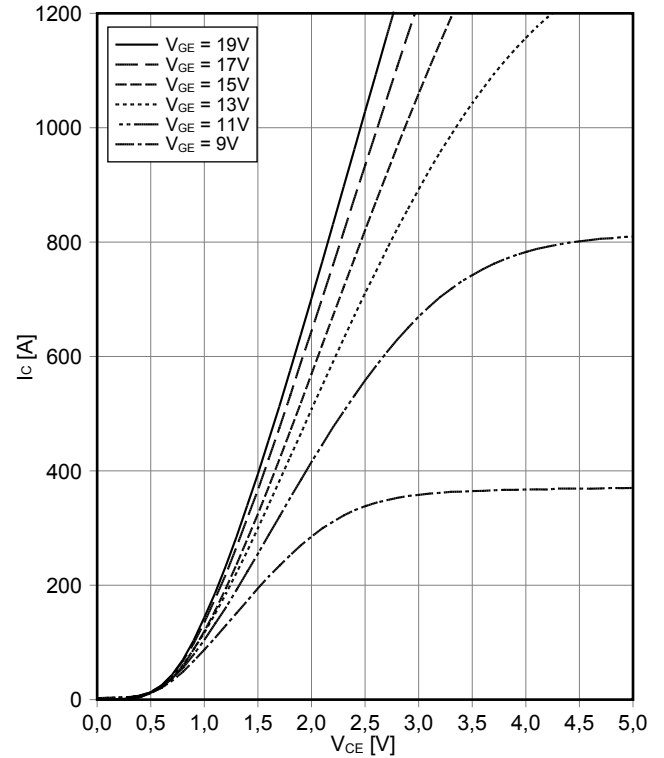
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



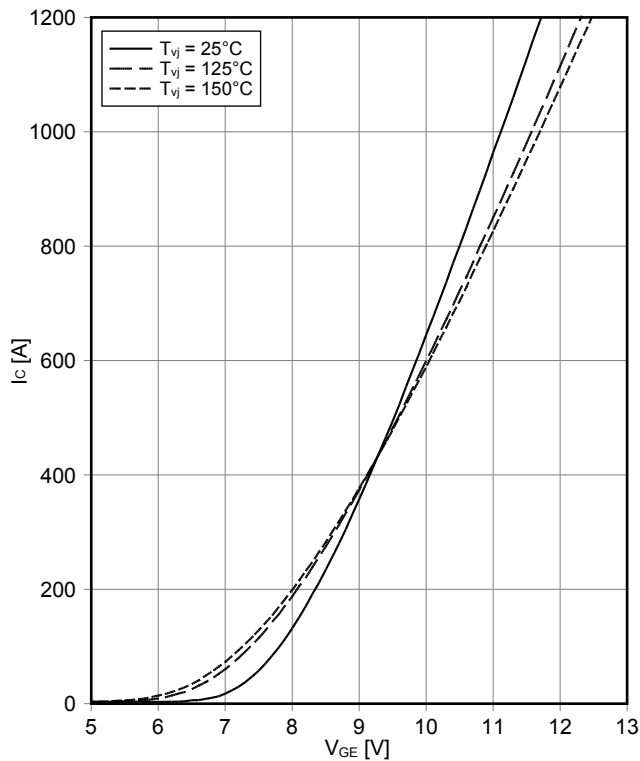
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



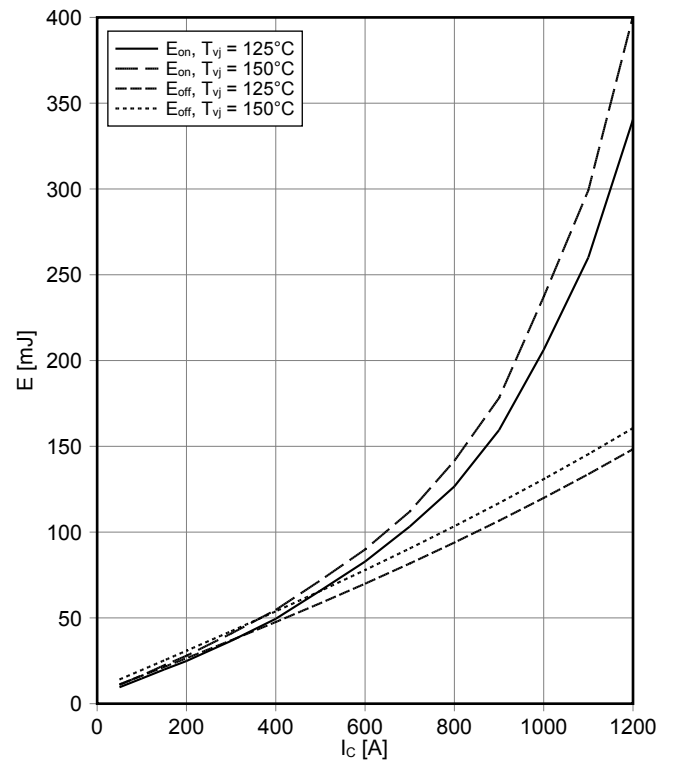
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
**transfer characteristic IGBT, Inverter (typical)**

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



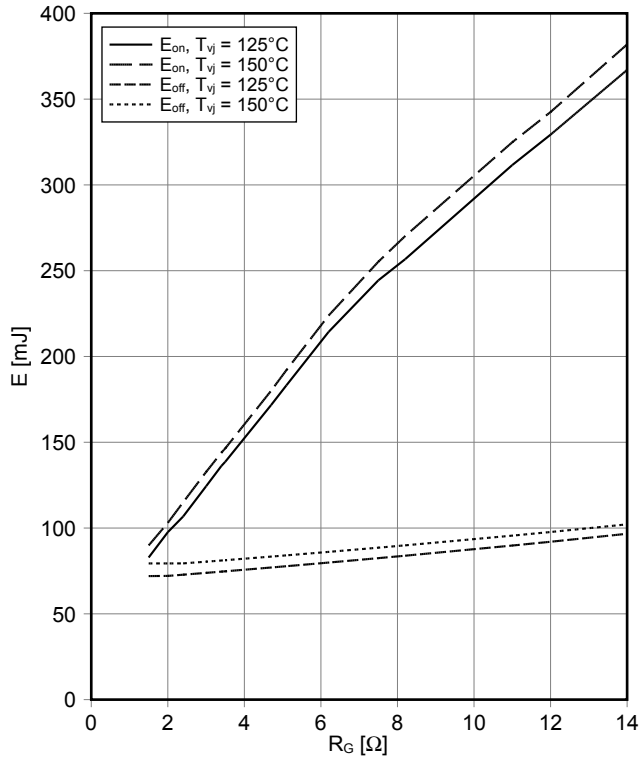
**Schaltverluste IGBT, Wechselrichter (typisch)**  
**switching losses IGBT, Inverter (typical)**

$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 1.5\ \Omega$ ,  $R_{Goff} = 1.5\ \Omega$ ,  $V_{CE} = 600\text{ V}$



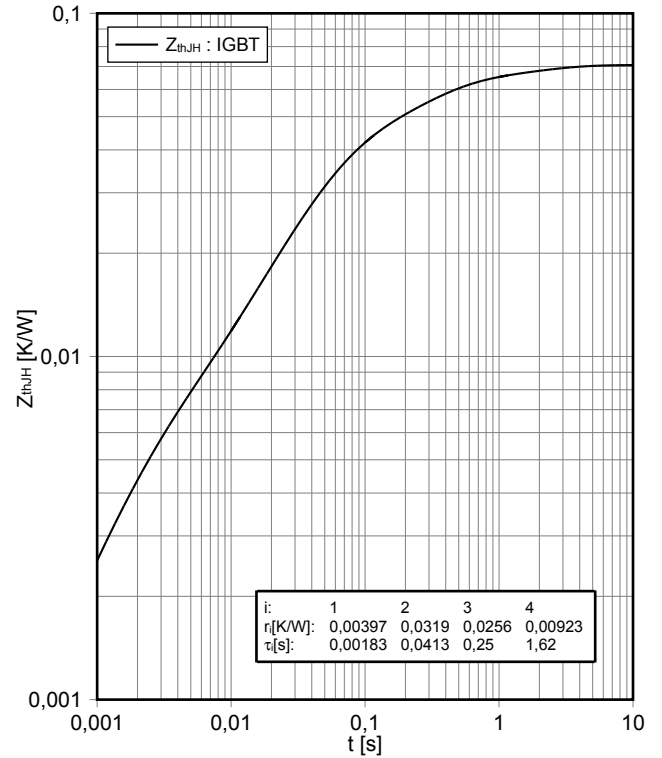
### Schaltverluste IGBT, Wechselrichter (typisch) switching losses IGBT, Inverter (typical)

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



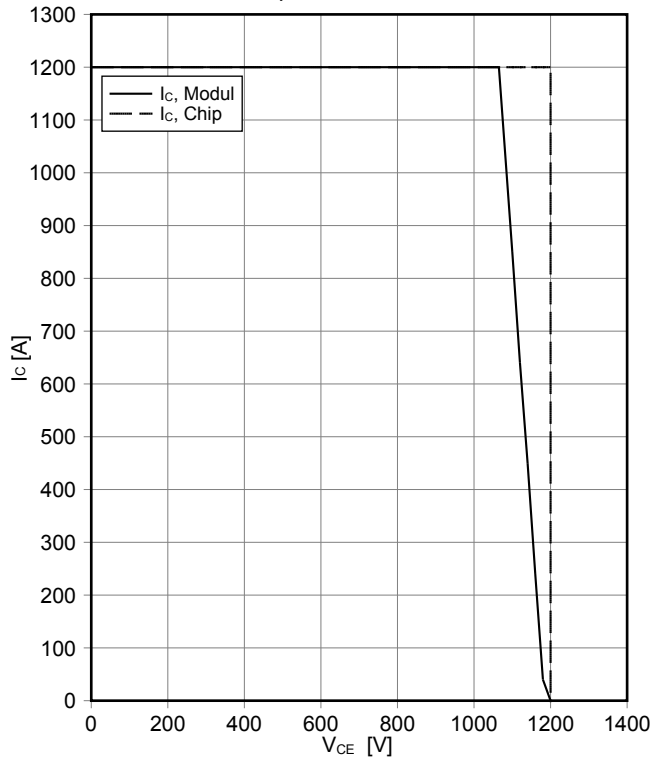
### Transienter Wärmewiderstand IGBT, Wechselrichter transient thermal impedance IGBT, Inverter

$Z_{thJH} = f(t)$



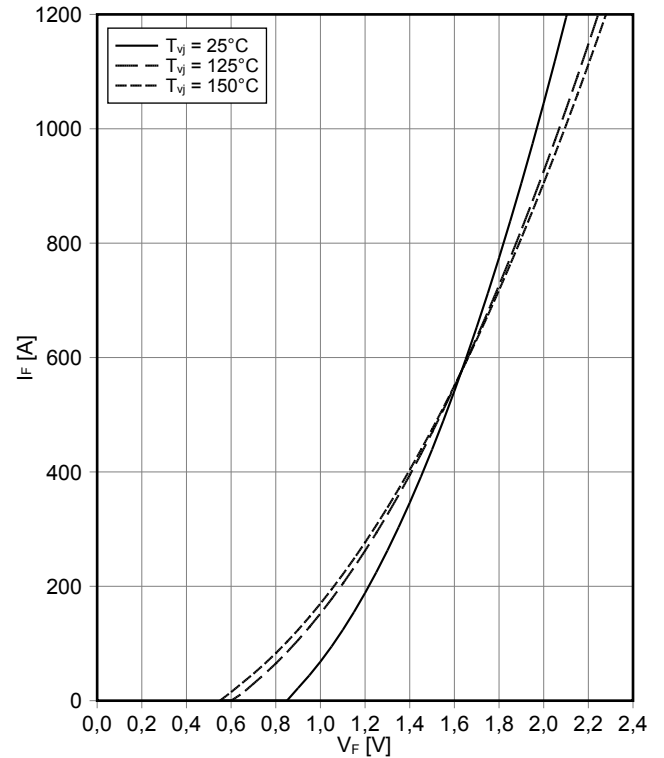
### Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter (RBSOA) reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$   
 $V_{GE} = \pm 15 \text{ V}$ ,  $R_{Goff} = 1.5 \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



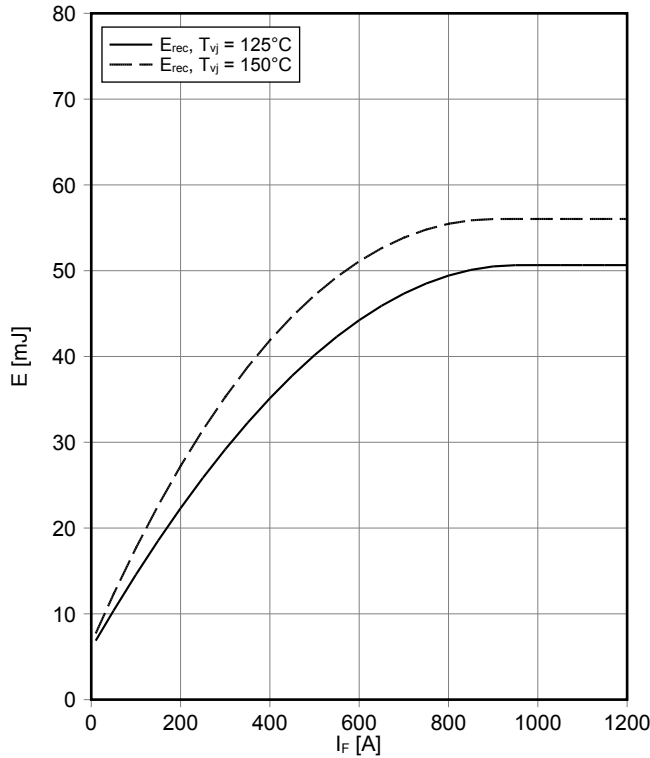
### Durchlasskennlinie der Diode, Wechselrichter (typisch) forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$



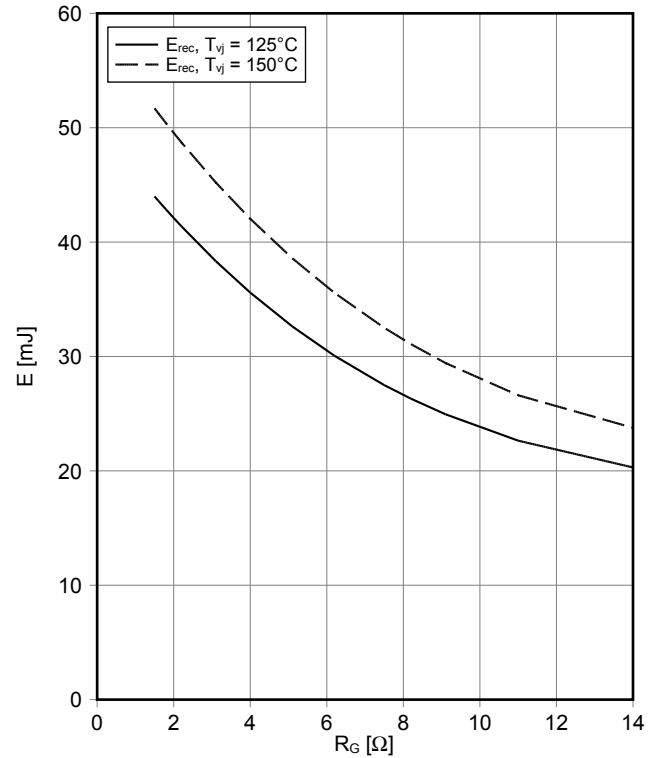
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 1.5 \Omega, V_{CE} = 600 V$



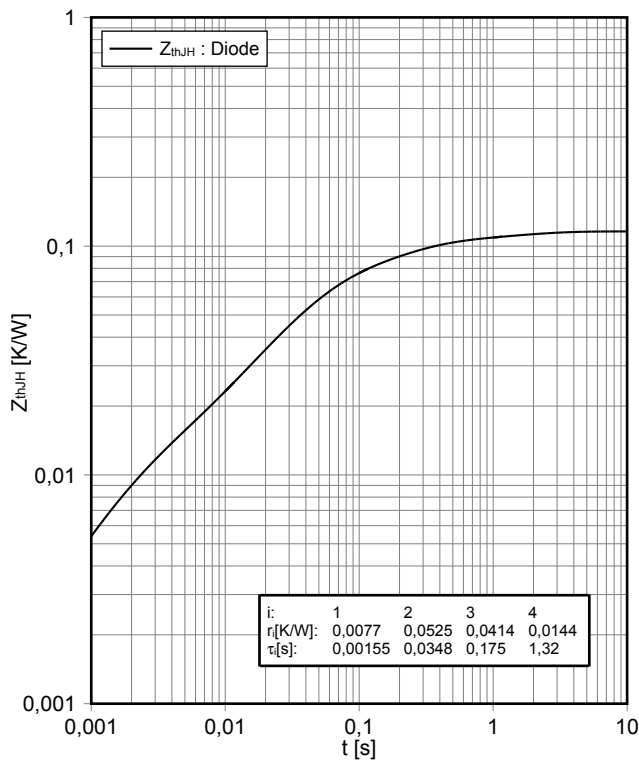
**Schaltverluste Diode, Wechselrichter (typisch)**  
**switching losses Diode, Inverter (typical)**

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



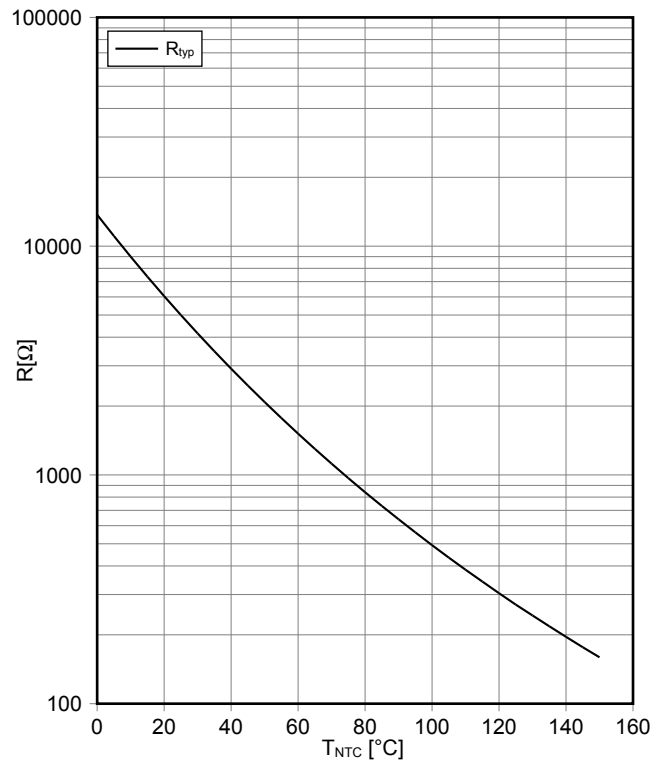
**Transienter Wärmewiderstand Diode, Wechselrichter**  
**transient thermal impedance Diode, Inverter**

$Z_{thJH} = f(t)$

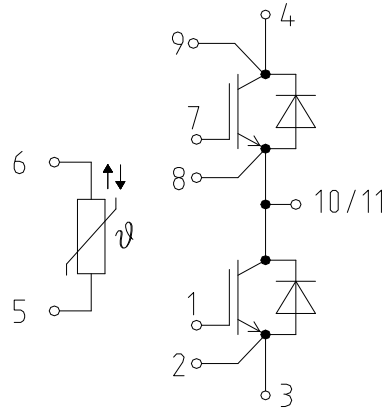


**NTC-Widerstand-Temperaturkennlinie (typisch)**  
**NTC-Thermistor-temperature characteristic (typical)**

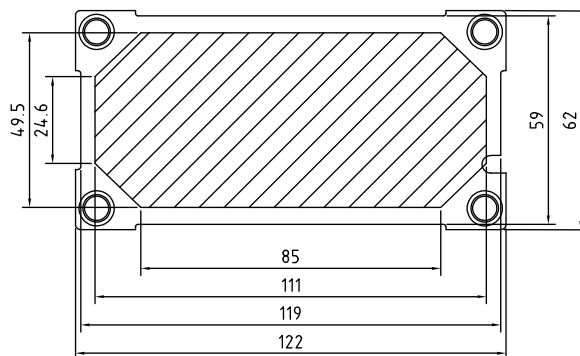
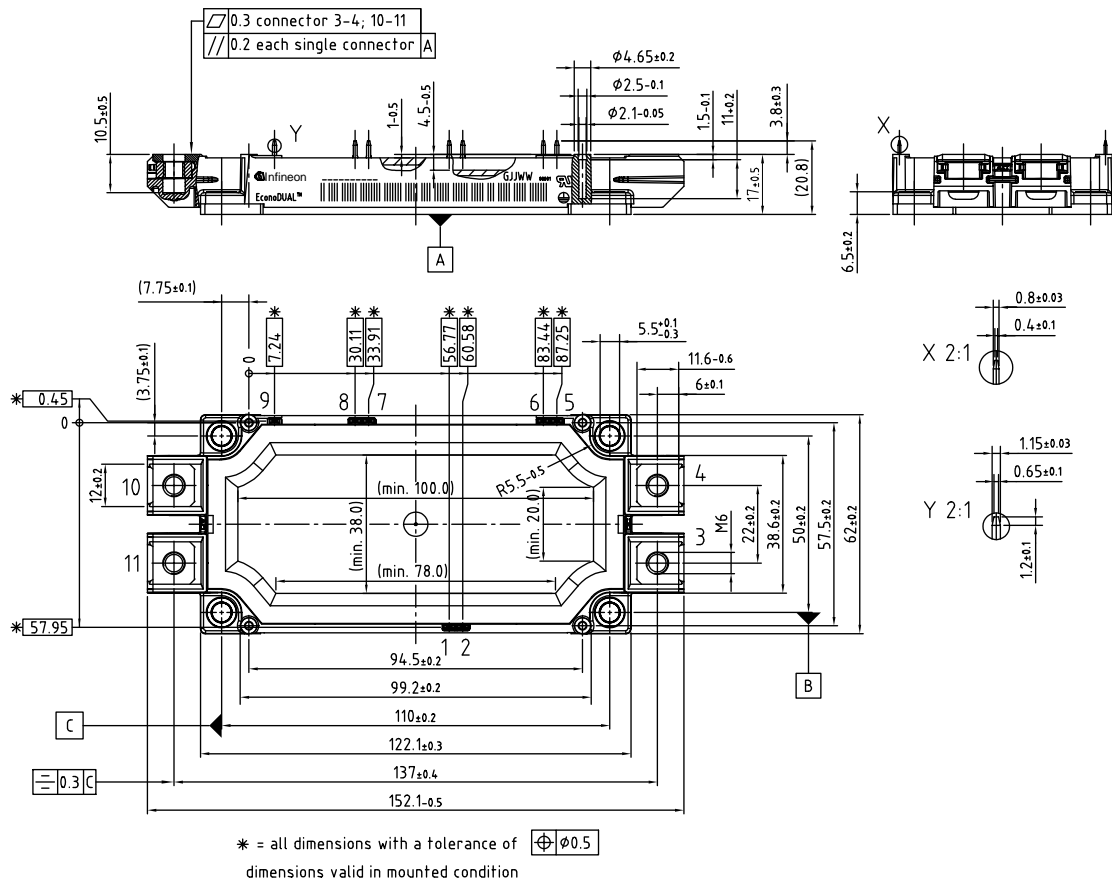
$R = f(T)$



## Schaltplan / Circuit diagram



## Gehäuseabmessungen / Package outlines



restricted area for Thermal Interface Material