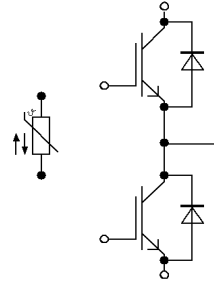
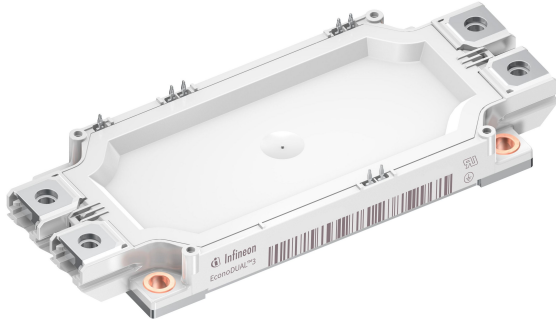


EconoDUAL™3 Modul mit TRENCHSTOP™ IGBT7 und Emitter Controlled 7 Diode und NTC / bereits aufgetragenem Thermal Interface Material

EconoDUAL™3 module with TRENCHSTOP™ IGBT7 and Emitter Controlled 7 diode and NTC / pre-applied Thermal Interface Material

## Vorläufige Daten / Preliminary Data



$V_{CES} = 1200V$   
 $I_{C\ nom} = 900A / I_{CRM} = 1800A$

### Potentielle Anwendungen

- Hochleistungsumrichter
- Hybrid-Nutzfahrzeuge
- Motorantriebe
- Servoumrichter
- USV-Systeme

### Potential Applications

- High power converters
- Commercial Agriculture Vehicles
- Motor drives
- Servo drives
- UPS systems

### Elektrische Eigenschaften

- Integrierter Temperatursensor
- Trenchstop™ IGBT7
- $V_{CESat}$  mit positivem Temperaturkoeffizienten

### Electrical Features

- Integrated temperature sensor
- Trenchstop™ IGBT7
- $V_{CESat}$  with positive temperature coefficient

### Mechanische Eigenschaften

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

### Mechanical Features

- High power density
- Isolated base plate
- PressFIT contact technology
- 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
Implementierter Kollektor-Strom Implemented collector current		$I_{CN}$	900	A
Kollektor-Dauergleichstrom Continuous DC collector current	$T_H = 45^{\circ}\text{C}, T_{vj\text{max}} = 175^{\circ}\text{C}$	$I_{CDC}$	875	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	$I_{CRM}$	1800	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	$I_C = 900\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_{CE\text{sat}}$	1,50 1,65 1,75	1,80	V V V
Gate-Schwellenspannung Gate threshold voltage	$I_C = 18,0\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GETH}$	5,15	5,80	6,45 V
Gateladung Gate charge	$V_{GE} = -15 / 15\text{ V}, V_{CE} = 600\text{ V}$		$Q_G$	14,3		$\mu\text{C}$
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	0,5		$\Omega$
Eingangskapazität Input capacitance	$f = 100\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{ies}$	122		nF
Rückwirkungskapazität Reverse transfer capacitance	$f = 100\text{ kHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		$C_{res}$	0,72		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$	$I_{CES}$		0,1	mA
Gate-Emitter-Reststrom Gate-emitter leakage current	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25^{\circ}\text{C}$		$I_{GES}$		100	nA
Einschaltverzögerungszeit, induktive Last Turn-on delay time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{don}$	0,41 0,46 0,49		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_r$	0,10 0,11 0,12		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_{doff}$	0,55 0,63 0,69		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Fallzeit, induktive Last Fall time, inductive load	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$t_f$	0,11 0,23 0,33		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 25\text{ nH}$ $di/dt = 6200\text{ A}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Gon} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{on}$	89,0 138 170		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 900\text{ A}, V_{CE} = 600\text{ V}, L\sigma = 25\text{ nH}$ $du/dt = 3000\text{ V}/\mu\text{s} (T_{vj} = 175^{\circ}\text{C})$ $V_{GE} = -15 / 15\text{ V}, R_{Goff} = 0,51\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{off}$	89,0 130 158		mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}$ $V_{CE\text{max}} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq 8\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$ $t_P \leq 6\ \mu\text{s}, T_{vj} = 175^{\circ}\text{C}$	$I_{SC}$	3200 3000		A A
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro IGBT / per IGBT valid with IFX pre-applied thermal interface material		$R_{thJH}$		0,0716	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{op}}$	-40	175	$^{\circ}\text{C}$

## 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		$I_F$	900	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_p = 1\text{ ms}$	$I_{FRM}$	1800	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 175^{\circ}\text{C}$	$I^2t$	35000 30000	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

### Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 900\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 900\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 900\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$V_F$	1,80 1,70 1,65	2,05	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 900\text{ A}, -di_F/dt = 6200\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$I_{RM}$	389 511 578		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 900\text{ A}, -di_F/dt = 6200\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$Q_r$	65,0 127 171		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 900\text{ A}, -di_F/dt = 6200\text{ A}/\mu\text{s} (T_{vj}=175^{\circ}\text{C})$ $V_R = 600\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 175^{\circ}\text{C}$	$E_{rec}$	29,0 52,0 68,0		mJ mJ mJ
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro Diode / per diode valid with IFX pre-applied thermal interface material		$R_{thJH}$		0,126	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{ op}}$	-40	175	$^{\circ}\text{C}$

## 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.

## Vorläufige Daten Preliminary Data

### 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>		0,80	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

T<sub>vjop</sub> > 150 °C ist nur im Überlastbetrieb zulässig. Detaillierte Angaben sind AN 2018-14 zu entnehmen.

T<sub>vjop</sub> > 150 °C is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

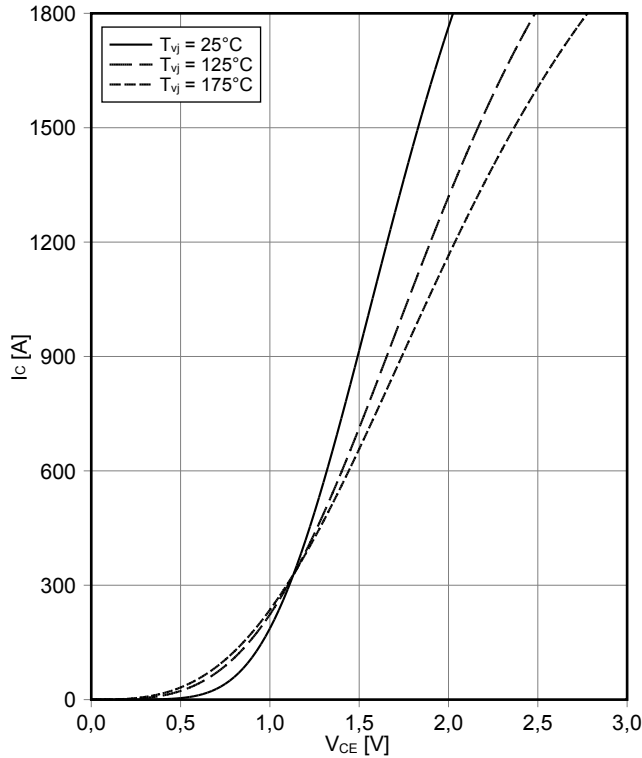
Lagerung und Transport von Modulen mit TIM => siehe AN2012-07

Storage and shipment of modules with TIM => see AN2012-07

## Vorläufige Daten Preliminary Data

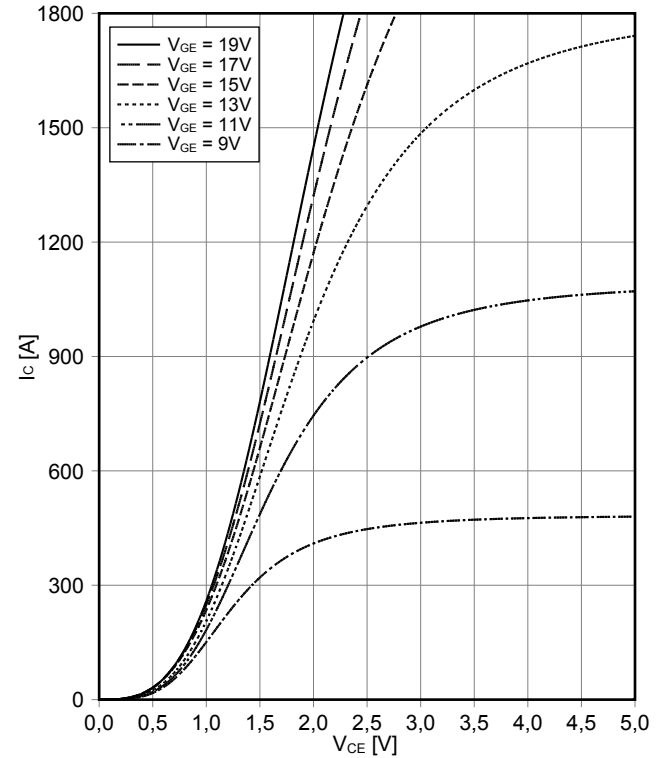
**Ausgangskennlinie IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

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



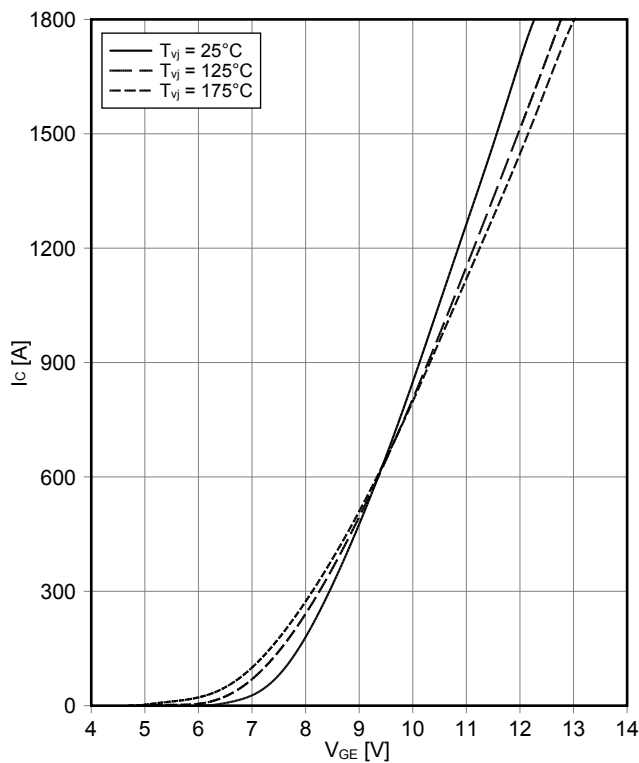
**Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)**  
**output characteristic IGBT, Inverter (typical)**

$I_C = f(V_{CE})$   
 $T_{vj} = 175^\circ\text{C}$



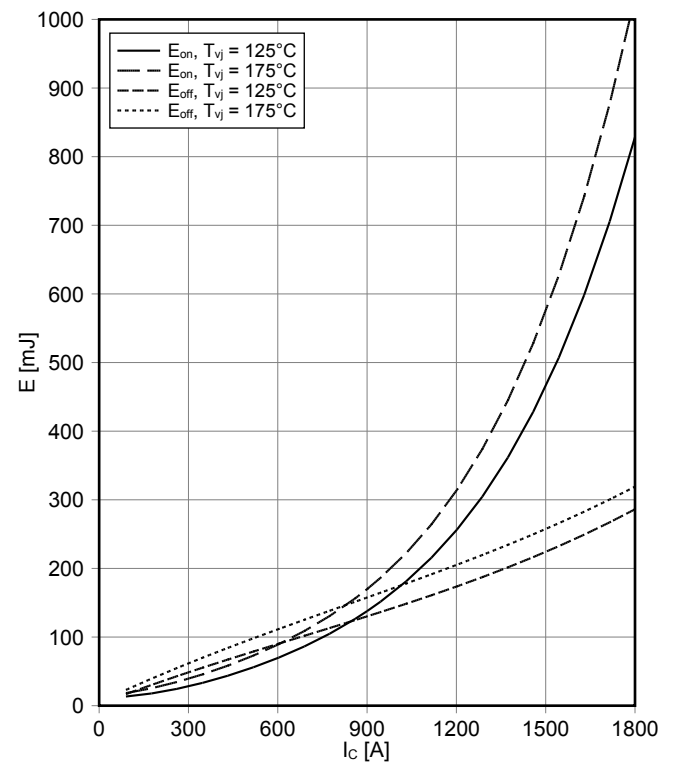
**Übertragungscharakteristik IGBT, Wechselrichter (typisch)**  
**transfer characteristic IGBT, Inverter (typical)**

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



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

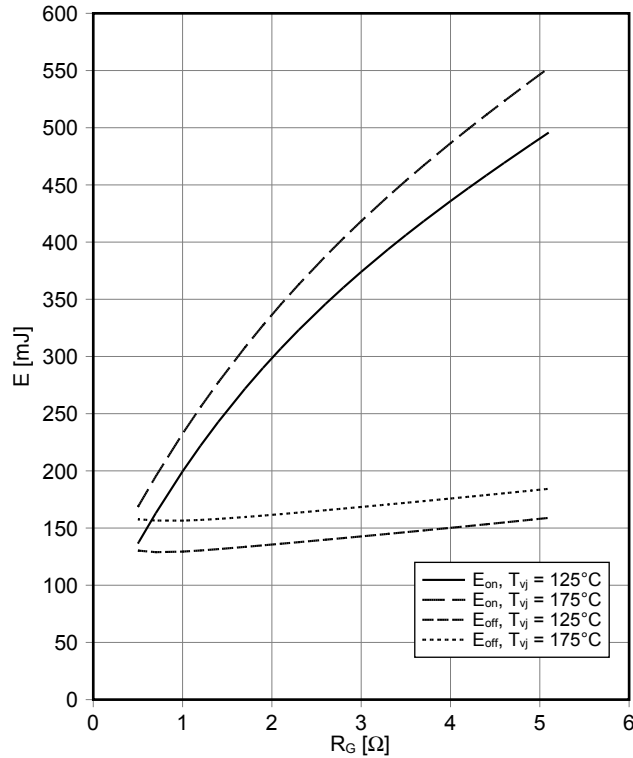
$E_{on} = f(I_C)$ ,  $E_{off} = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Gon} = 0.51\ \Omega$ ,  $R_{Goff} = 0.51\ \Omega$ ,  $V_{CE} = 600\text{ V}$



## Vorläufige Daten Preliminary Data

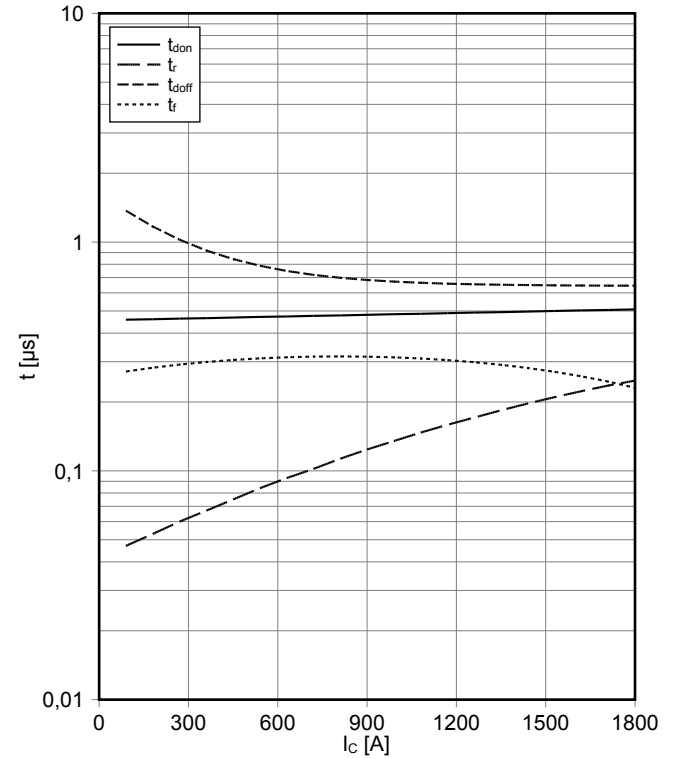
### Schaltverluste IGBT, Wechselrichter (typisch) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 900\text{ A}, V_{CE} = 600\text{ V}$



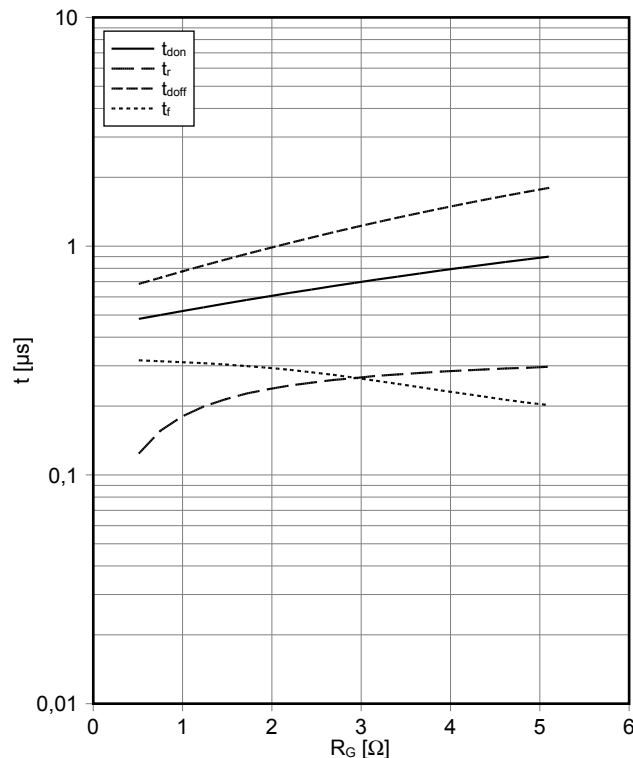
### Schaltzeiten IGBT, Wechselrichter (typisch) switching times IGBT, Inverter (typical)

$t_{don} = f(I_C), t_r = f(I_C), t_{doff} = f(I_C), t_f = f(I_C)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 0.51\ \Omega, R_{Goff} = 0.51\ \Omega, V_{CE} = 600\text{ V}$



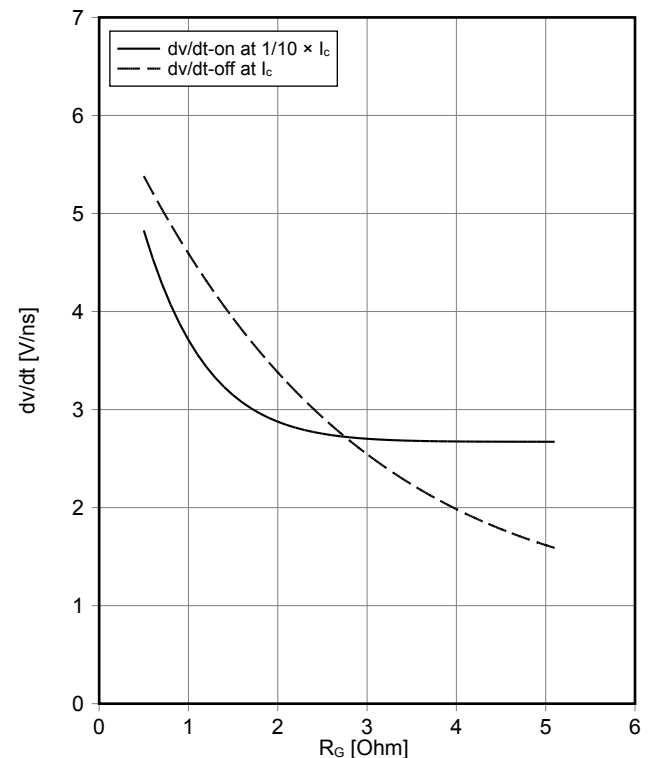
### Schaltzeiten IGBT, Wechselrichter (typisch) switching times IGBT, Inverter (typical)

$t_{don} = f(R_G), t_r = f(R_G), t_{doff} = f(R_G), t_f = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 900\text{ A}, V_{CE} = 600\text{ V}$



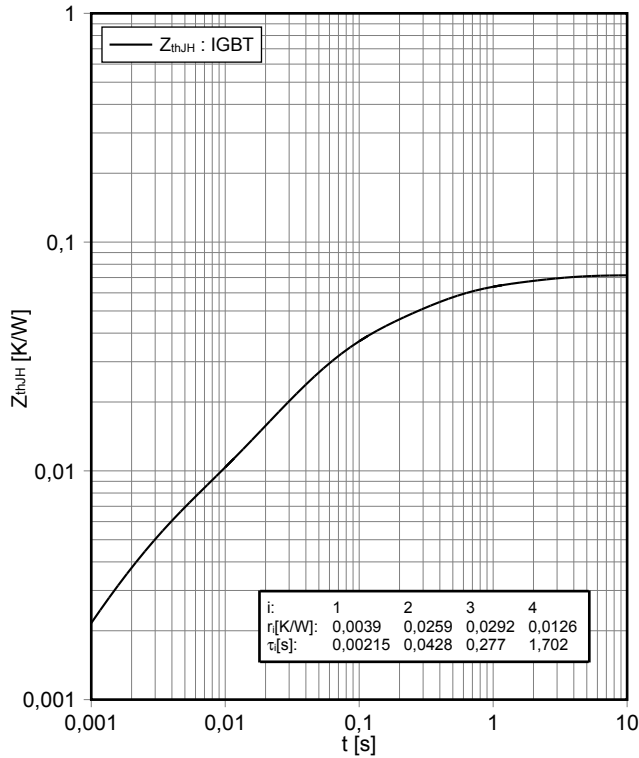
### dv/dt IGBT, Wechselrichter (typisch) dv/dt IGBT, Inverter (typical)

$dv/dt = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}, I_C = 900\text{ A}, V_{CE} = 600\text{ V}, T_{vj} = 25^\circ\text{C}$

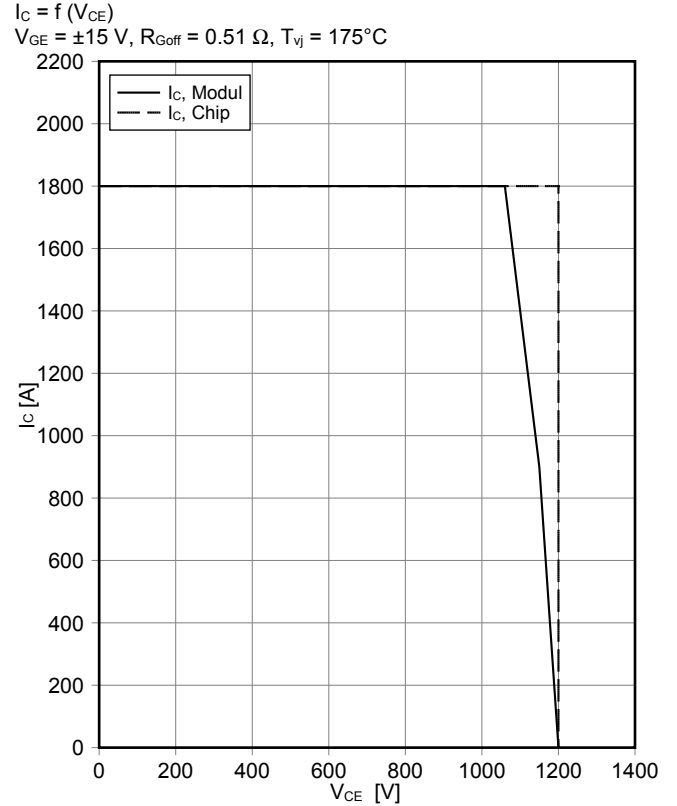


## Vorläufige Daten Preliminary Data

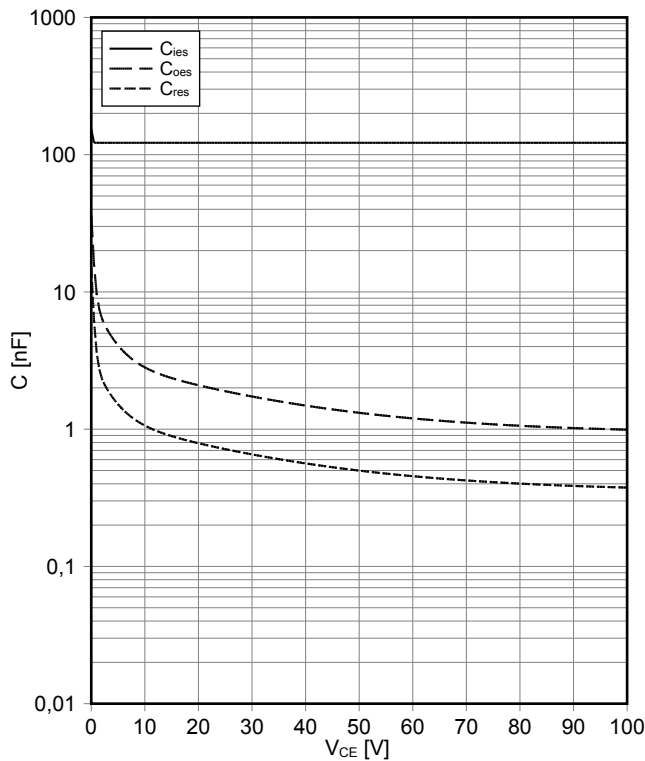
**Transienter Wärmewiderstand IGBT, Wechselrichter**  
**transient thermal impedance IGBT, Inverter**  
 $Z_{thJH} = f(t)$



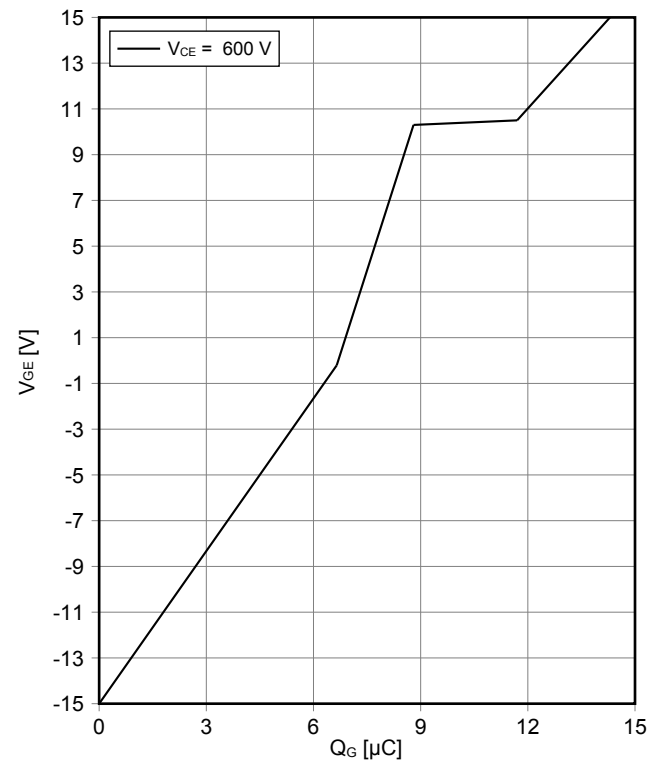
**Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter (RBSOA)**  
**reverse bias safe operating area IGBT, Inverter (RBSOA)**  
 $I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 0.51\ \Omega$ ,  $T_{vj} = 175^\circ\text{C}$



**Kapazitäts Charakteristik IGBT, Wechselrichter (typisch)**  
**capacity characteristic IGBT, Inverter (typical)**  
 $C = f(V_{CE})$   
 $V_{GE} = 0\text{ V}$ ,  $T_{vj} = 25^\circ\text{C}$ ,  $f = 100\text{kHz}$

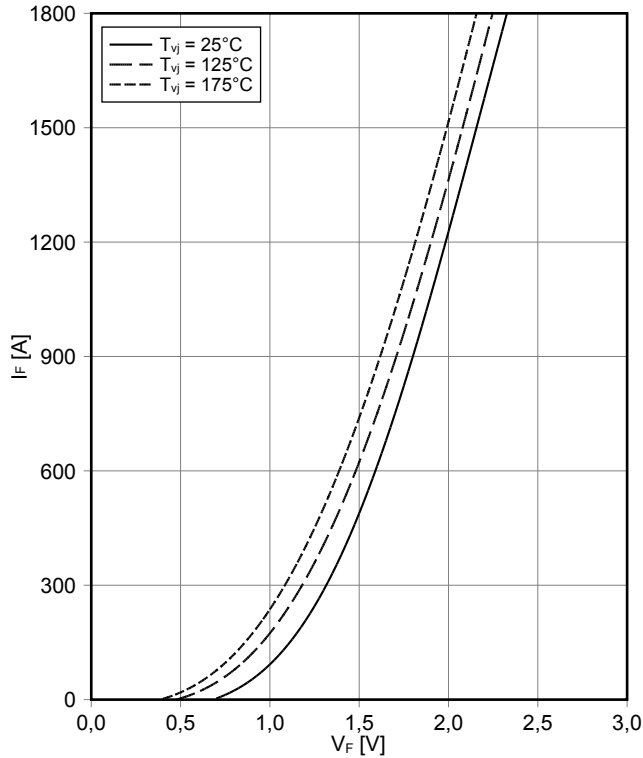


**Gateladungs Charakteristik IGBT, Wechselrichter (typisch)**  
**gate charge characteristic IGBT, Inverter (typical)**  
 $V_{GE} = f(Q_G)$   
 $I_C = 900\text{ A}$ ,  $T_{vj} = 25^\circ\text{C}$

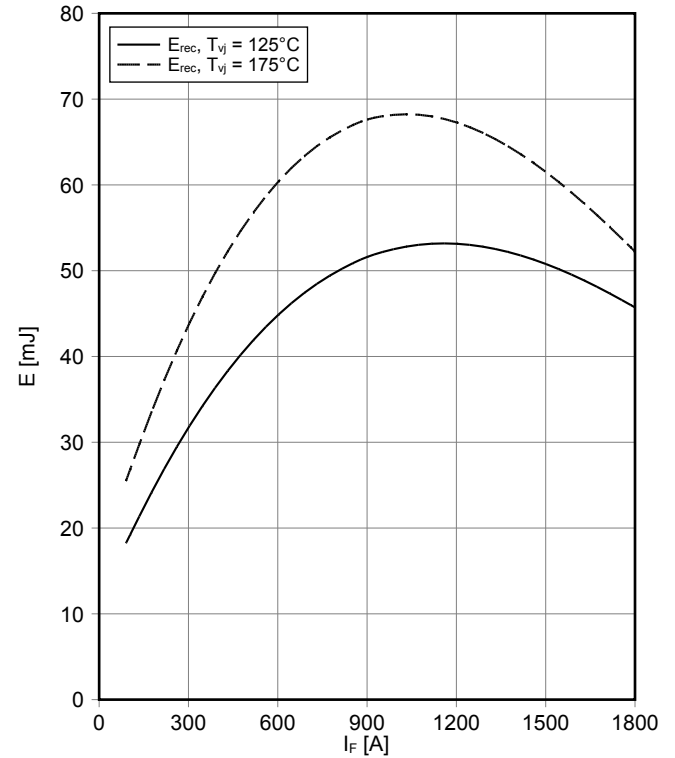


## Vorläufige Daten Preliminary Data

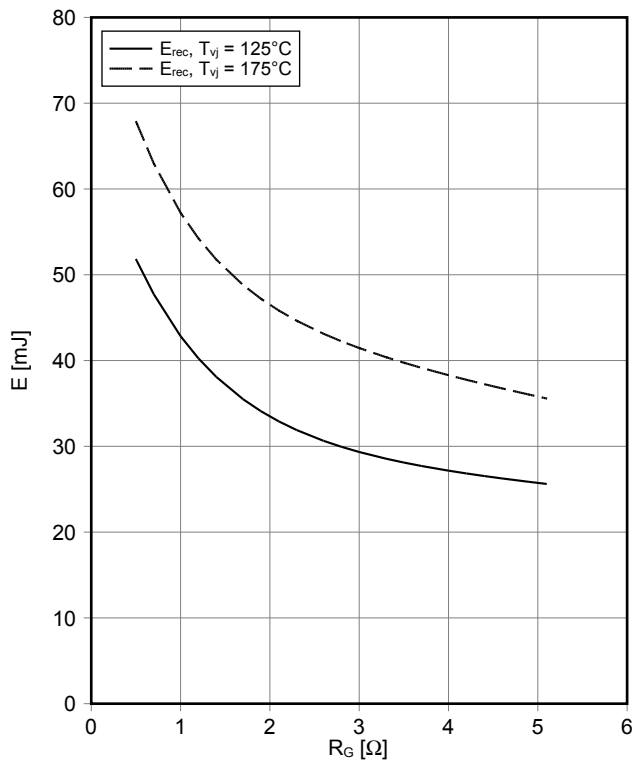
**Durchlasskennlinie der Diode, Wechselrichter (typisch)**  
forward characteristic of Diode, Inverter (typical)  
 $I_F = f(V_F)$



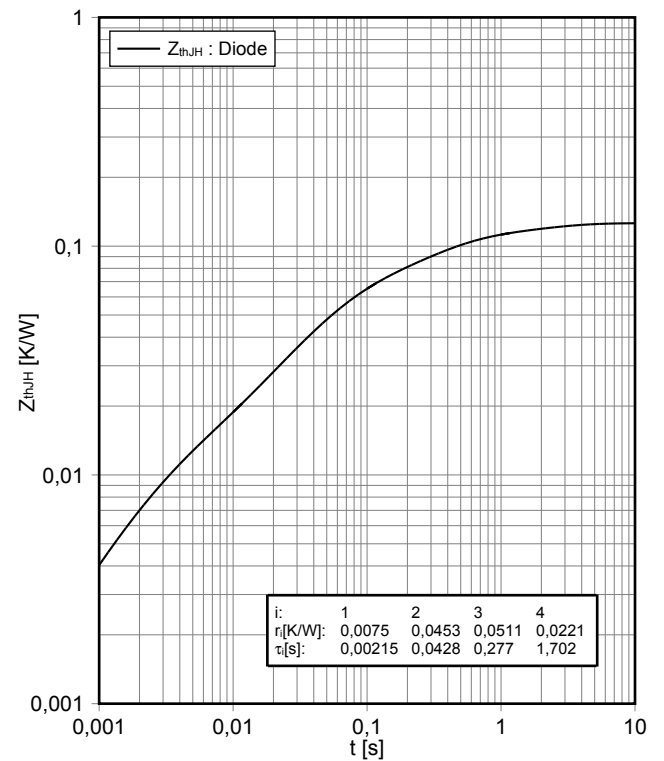
**Schaltverluste Diode, Wechselrichter (typisch)**  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(I_F)$   
 $R_{Gon} = 0.51 \Omega, V_{CE} = 600 \text{ V}$



**Schaltverluste Diode, Wechselrichter (typisch)**  
switching losses Diode, Inverter (typical)  
 $E_{rec} = f(R_G)$   
 $I_F = 900 \text{ A}, V_{CE} = 600 \text{ V}$

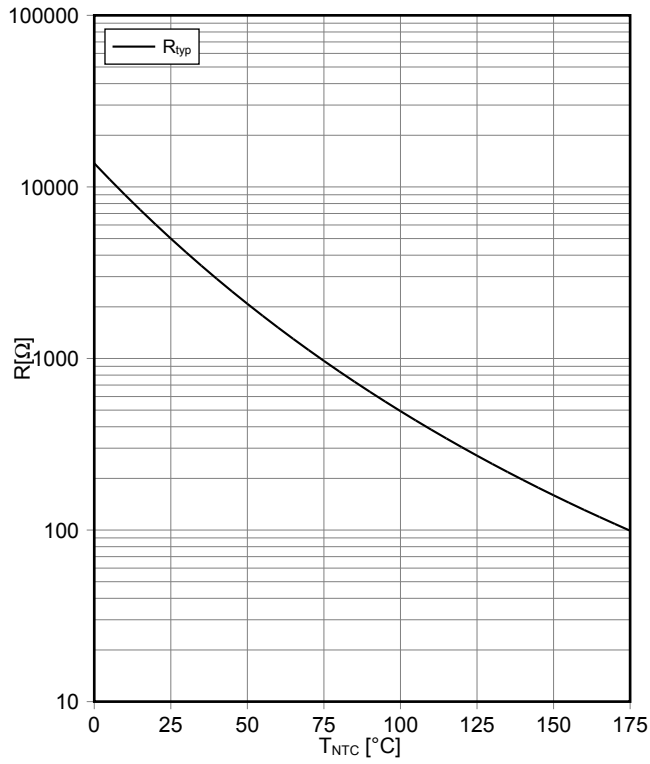


**Transienter Wärmewiderstand Diode, Wechselrichter**  
transient thermal impedance Diode, Inverter  
 $Z_{thJH} = f(t)$

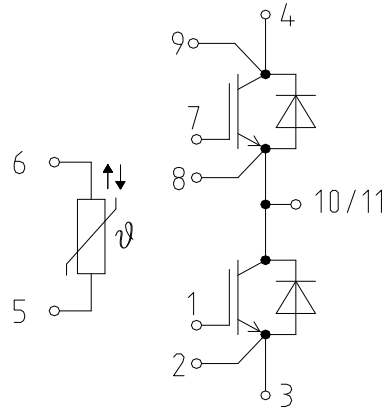




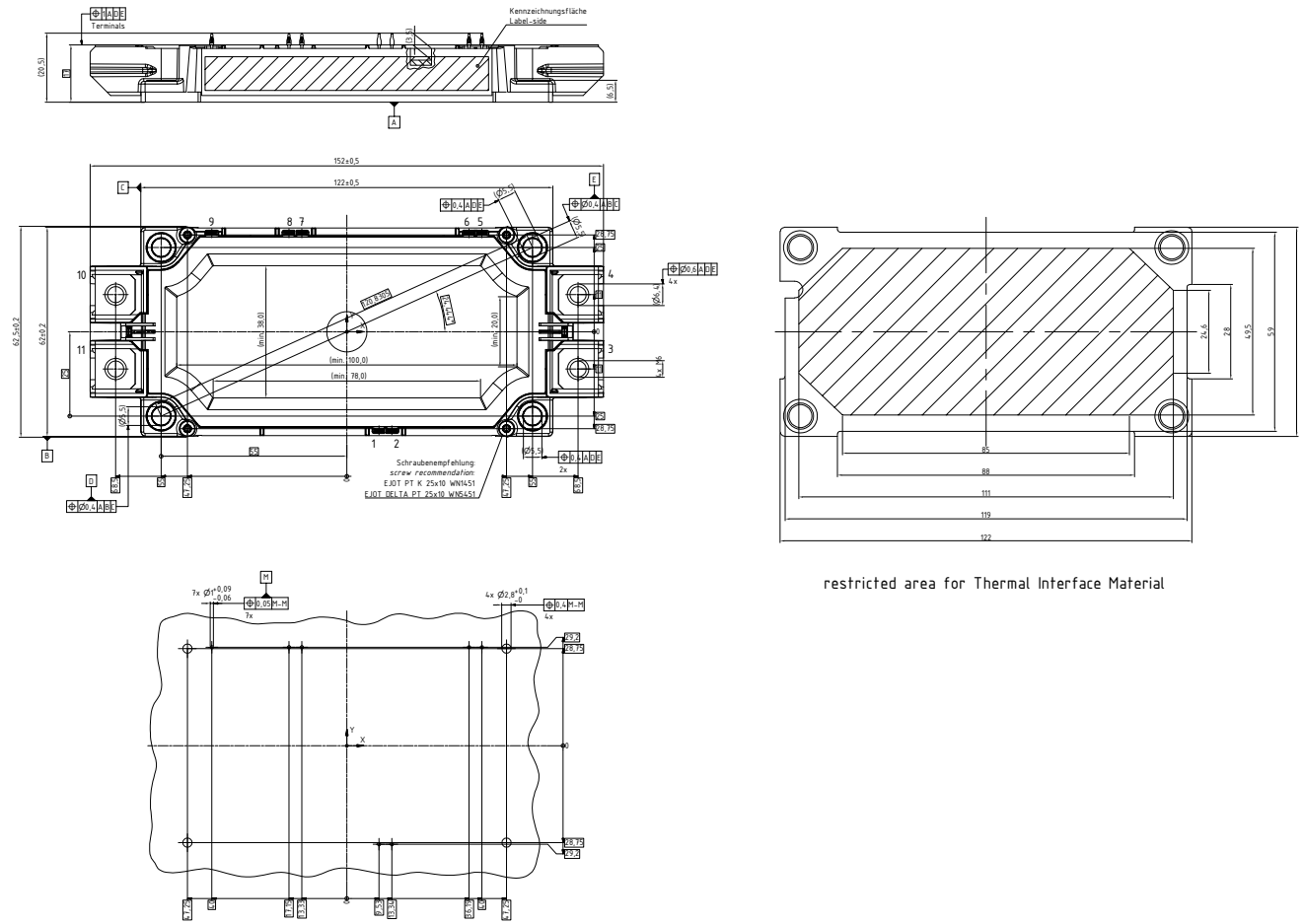
**NTC-Widerstand-Temperaturkennlinie (typisch)**  
**NTC-Thermistor-temperature characteristic (typical)**  
 $R = f(T_{NTC})$



## Schaltplan / Circuit diagram



## Gehäuseabmessungen / Package outlines



restricted area for Thermal Interface Material