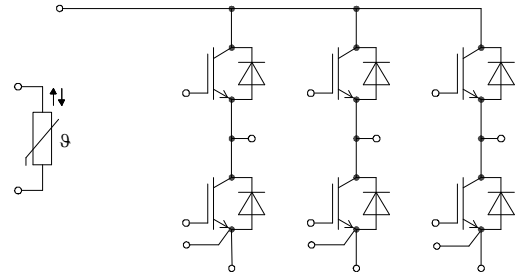
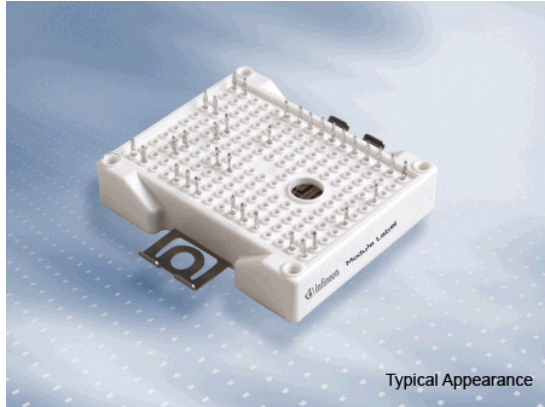


EasyPACK Modul mit Trench/Feldstopp IGBT3 und Emitter Controlled 3 Diode und PressFIT / NTC  
EasyPACK module with Trench/Fieldstop IGBT3 and Emitter Controlled 3 diode and PressFIT / NTC



$V_{CES} = 650V$   
 $I_{C\ nom} = 75A / I_{CRM} = 150A$

**Typische Anwendungen**

- Hybrid-Elektrofahrzeuge (H)EV
- Klimaanlage
- Motorantriebe

**Typical Applications**

- Hybrid Electrical Vehicles (H)EV
- Air Conditioning
- Motor Drives

**Elektrische Eigenschaften**

- Erhöhte Sperrspannungsfestigkeit auf 650V
- Niedrige Schaltverluste
- Niedriges  $V_{CEsat}$
- Trench IGBT 3

**Electrical Features**

- Increased blocking voltage capability to 650V
- Low Switching Losses
- Low  $V_{CEsat}$
- Trench IGBT 3

**Mechanische Eigenschaften**

- $Al_2O_3$  Substrat mit kleinem thermischen Widerstand
- Hohe Leistungsdichte
- Integrierter NTC Temperatur Sensor
- Kompaktes Design
- PressFIT Verbindungstechnik
- RoHS konform
- Robuste Montage durch integrierte Befestigungsklammern

**Mechanical Features**

- $Al_2O_3$  Substrate with Low Thermal Resistance
- High Power Density
- Integrated NTC temperature sensor
- Compact design
- PressFIT Contact Technology
- RoHS compliant
- Rugged mounting due to integrated mounting clamps

**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: TR	revision: 3.0	



**IGBT-Wechselrichter / IGBT-inverter**

**Höchstzulässige Werte / Maximum Rated Values**

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{CES}$	650	V
Kollektor-Dauergleichstrom Continuous DC collector current	$T_C = 80^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$	$I_{C\ nom}$ $I_C$	75 95	A A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_p = 1\ \text{ms}$	$I_{CRM}$	150	A
Gesamt-Verlustleistung Total power dissipation	$T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$	$P_{tot}$	275	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	$I_C = 75\ \text{A}, V_{GE} = 15\ \text{V}$ $I_C = 75\ \text{A}, V_{GE} = 15\ \text{V}$ $I_C = 75\ \text{A}, V_{GE} = 15\ \text{V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\ sat}$	1,45 1,60 1,70	1,90	V V V
Gate-Schwellenspannung Gate threshold voltage	$I_C = 1,20\ \text{mA}, V_{CE} = V_{GE}, T_{vj} = 25^{\circ}\text{C}$		$V_{GEth}$	4,9 5,8	6,5	V
Gateladung Gate charge	$V_{GE} = -15\ \text{V} \dots +15\ \text{V}$		$Q_G$	0,80		$\mu\text{C}$
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		$R_{Gint}$	0,0		$\Omega$
Eingangskapazität Input capacitance	$f = 1\ \text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\ \text{V}, V_{GE} = 0\ \text{V}$		$C_{ies}$	4,60		nF
Rückwirkungskapazität Reverse transfer capacitance	$f = 1\ \text{MHz}, T_{vj} = 25^{\circ}\text{C}, V_{CE} = 25\ \text{V}, V_{GE} = 0\ \text{V}$		$C_{res}$	0,145		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	$V_{CE} = 650\ \text{V}, V_{GE} = 0\ \text{V}, T_{vj} = 25^{\circ}\text{C}$		$I_{CES}$		0,05	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	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Gon} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\ on}$	0,022 0,022 0,022		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Gon} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_r$	0,018 0,021 0,022		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Goff} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\ off}$	0,18 0,20 0,21		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Fallzeit, induktive Last Fall time, inductive load	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}$ $V_{GE} = \pm 15\ \text{V}$ $R_{Goff} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_f$	0,035 0,043 0,048		$\mu\text{s}$ $\mu\text{s}$ $\mu\text{s}$
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}, L_S = \text{t.b.d. nH}$ $V_{GE} = \pm 15\ \text{V}, di/dt = 3500\ \text{A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $R_{Gon} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{on}$	0,90 1,20 1,30		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 75\ \text{A}, V_{CE} = 300\ \text{V}, L_S = \text{t.b.d. nH}$ $V_{GE} = \pm 15\ \text{V}, du/dt = 3500\ \text{V}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $R_{Goff} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{off}$	1,60 2,15 2,30		mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\ \text{V}, V_{CC} = 360\ \text{V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8\ \mu\text{s}, T_{vj} = 25^{\circ}\text{C}$ $t_p \leq 6\ \mu\text{s}, T_{vj} = 150^{\circ}\text{C}$	$I_{SC}$	530 380		A A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		$R_{thJC}$	0,50	0,55	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT $\lambda_{Paste} = 1\ \text{W}/(\text{m}\cdot\text{K}) / \lambda_{grease} = 1\ \text{W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,60		K/W

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**Diode-Wechselrichter / Diode-inverter**  
**Höchstzulässige Werte / Maximum Rated Values**

Periodische Spitzensperrspannung Repetitive peak reverse voltage	$T_{vj} = 25^{\circ}\text{C}$	$V_{RRM}$	650	V
Dauergleichstrom Continuous DC forward current		$I_F$	75	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_p = 1\text{ ms}$	$I_{FRM}$	150	A
Grenzlastintegral $I^2t$ - value	$V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 125^{\circ}\text{C}$ $V_R = 0\text{ V}, t_p = 10\text{ ms}, T_{vj} = 150^{\circ}\text{C}$	$I^2t$	660 610	$\text{A}^2\text{s}$ $\text{A}^2\text{s}$

**Charakteristische Werte / Characteristic Values**

			min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 75\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 75\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 75\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_F$	1,55 1,50 1,45	1,95	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 75\text{ A}, -di_F/dt = 3500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$I_{RM}$	85,0 100 105		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 75\text{ A}, -di_F/dt = 3500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$Q_r$	3,20 5,90 6,80		$\mu\text{C}$ $\mu\text{C}$ $\mu\text{C}$
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 75\text{ A}, -di_F/dt = 3500\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 300\text{ V}$ $V_{GE} = -15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$E_{rec}$	0,80 1,40 1,65		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		$R_{thJC}$	0,70	0,80	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Diode / per diode $\lambda_{\text{Paste}} = 1\text{ W}/(\text{m}\cdot\text{K}) / \lambda_{\text{grease}} = 1\text{ W}/(\text{m}\cdot\text{K})$		$R_{thCH}$	0,65		K/W

**NTC-Widerstand / NTC-thermistor**

**Charakteristische Werte / Characteristic Values**

			min.	typ.	max.	
Nennwiderstand Rated resistance	$T_C = 25^{\circ}\text{C}$		$R_{25}$	5,00		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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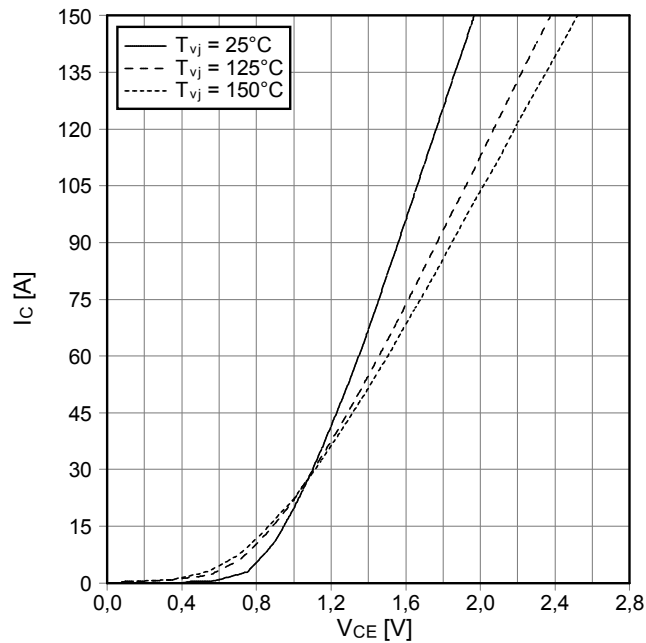


**Modul / Module**

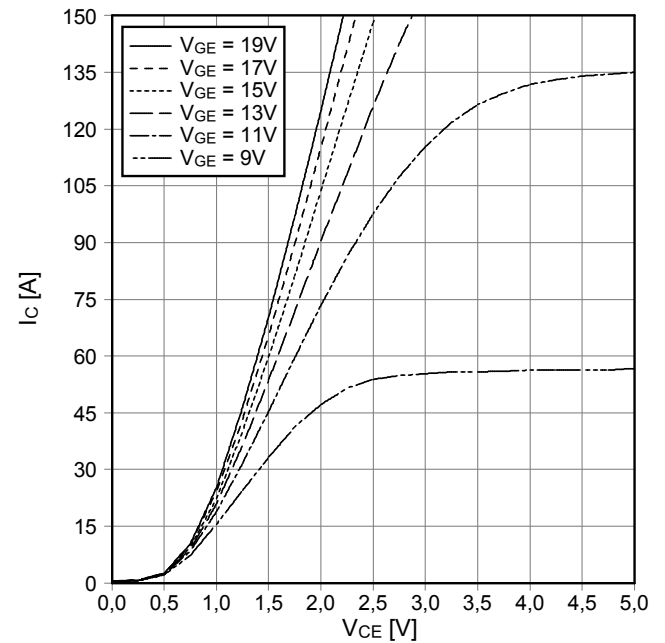
Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V <sub>ISOL</sub>	2,5		kV
Innere Isolation Internal isolation			impr. Al <sub>2</sub> O <sub>3</sub>		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		11,5 6,3		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		10,0 5,0		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI	> 200		
			min.	typ.	max.
Modulstreuintduktivität Stray inductance module		L <sub>SCE</sub>		35	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T <sub>C</sub> = 25°C, pro Schalter / per switch	R <sub>CC'+EE'</sub>		3,00	mΩ
Höchstzulässige Sperschichttemperatur Maximum junction temperature	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	T <sub>vj max</sub>			175 °C
Temperatur im Schaltbetrieb Temperature under switching conditions	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	T <sub>vj op</sub>	-40		150 °C
Lagertemperatur Storage temperature		T <sub>stg</sub>	-40		125 °C
Anpresskraft für mech. Bef. pro Feder mounting force per clamp		F	40	-	80 N
Gewicht Weight		G		42	g

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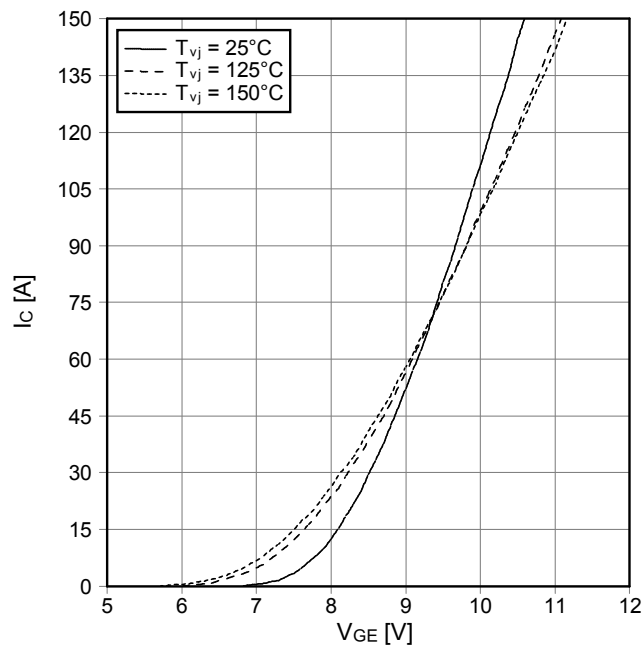
**Ausgangskennlinie IGBT-Wechselr. (typisch)**  
output characteristic IGBT-inverter (typical)  
 $I_c = f(V_{CE})$   
 $V_{GE} = 15\text{ V}$



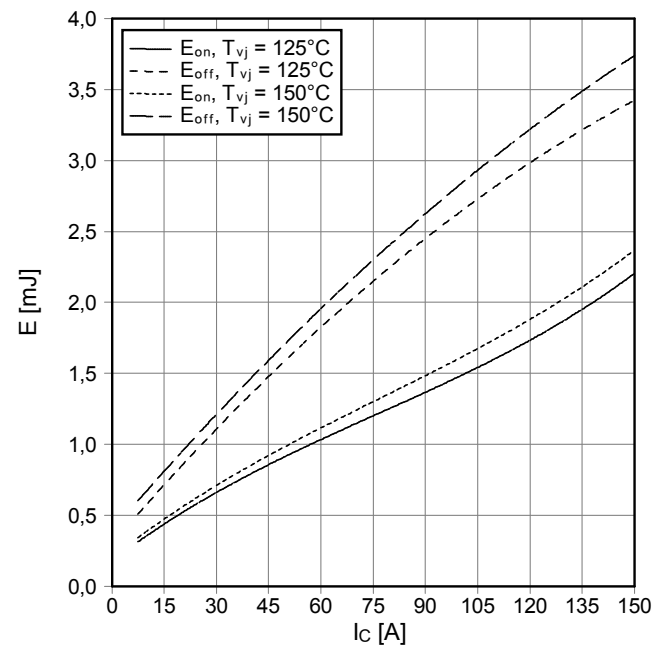
**Ausgangskennlinienfeld IGBT-Wechselr. (typisch)**  
output characteristic IGBT-inverter (typical)  
 $I_c = f(V_{CE})$   
 $T_{vj} = 150^\circ\text{C}$



**Übertragungscharakteristik IGBT-Wechselr. (typisch)**  
transfer characteristic IGBT-inverter (typical)  
 $I_c = f(V_{GE})$   
 $V_{CE} = 20\text{ V}$



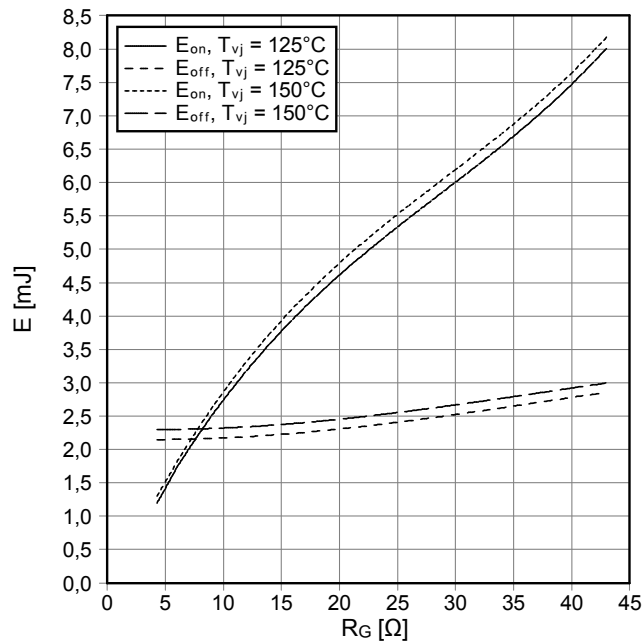
**Schaltverluste IGBT-Wechselr. (typisch)**  
switching losses IGBT-inverter (typical)  
 $E_{on} = f(I_c), E_{off} = f(I_c)$   
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 4.3\ \Omega, R_{Goff} = 4.3\ \Omega, V_{CE} = 300\text{ V}$



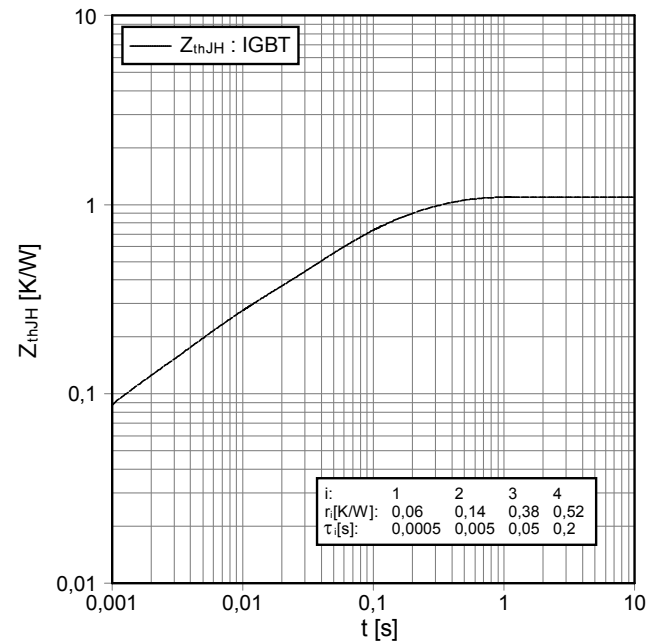
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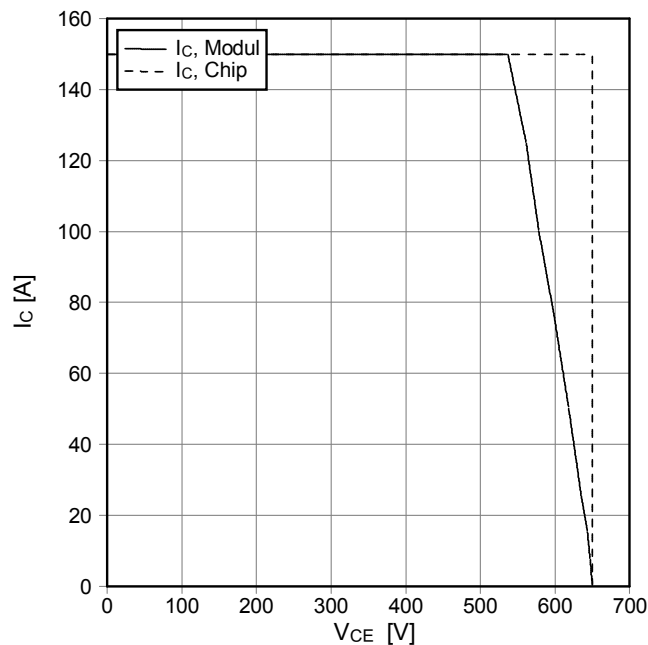
**Schaltverluste IGBT-Wechselr. (typisch)**  
switching losses IGBT-Inverter (typical)  
 $E_{on} = f(R_G)$ ,  $E_{off} = f(R_G)$   
 $V_{GE} = \pm 15\text{ V}$ ,  $I_C = 75\text{ A}$ ,  $V_{CE} = 300\text{ V}$



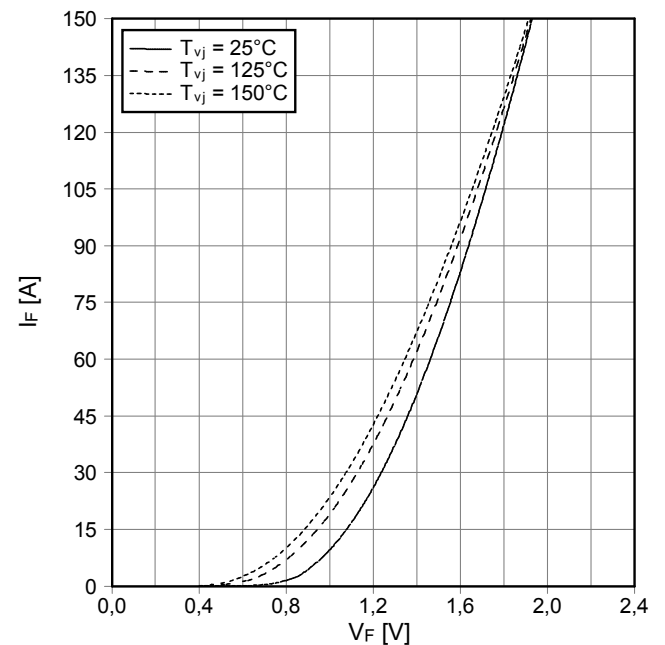
**Transienter Wärmewiderstand IGBT-Wechselr.**  
transient thermal impedance IGBT-inverter  
 $Z_{thJH} = f(t)$



**Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)**  
reverse bias safe operating area IGBT-inv. (RBSOA)  
 $I_C = f(V_{CE})$   
 $V_{GE} = \pm 15\text{ V}$ ,  $R_{Goff} = 4.3\ \Omega$ ,  $T_{vj} = 150^\circ\text{C}$



**Durchlasskennlinie der Diode-Wechselr. (typisch)**  
forward characteristic of diode-inverter (typical)  
 $I_F = f(V_F)$

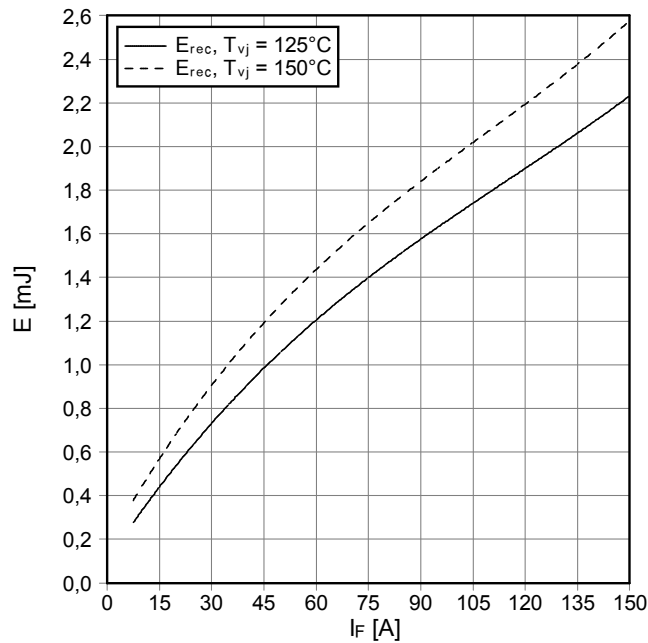


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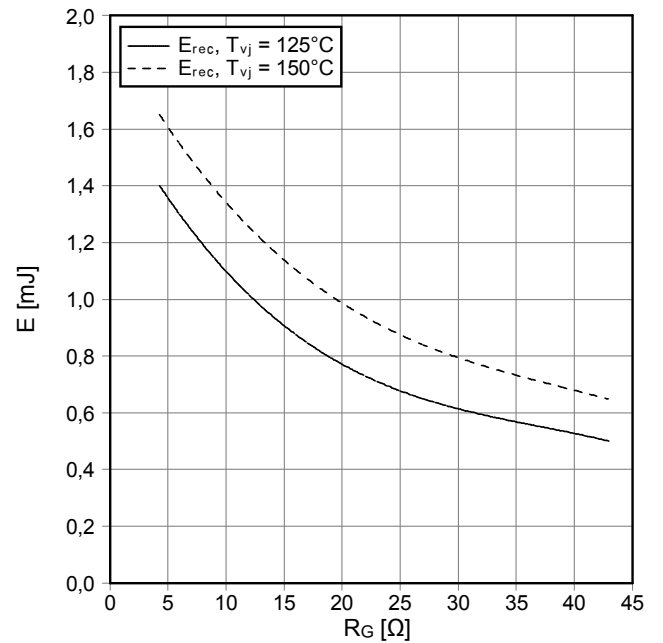
**Schaltverluste Diode-Wechselr. (typisch)**  
**switching losses diode-inverter (typical)**

$E_{rec} = f(I_F)$   
 $R_{Gon} = 4.3 \Omega, V_{CE} = 300 V$



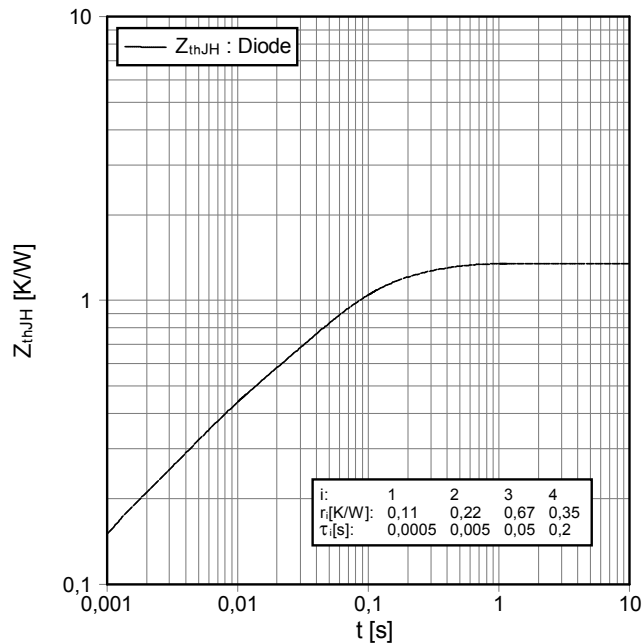
**Schaltverluste Diode-Wechselr. (typisch)**  
**switching losses diode-inverter (typical)**

$E_{rec} = f(R_G)$   
 $I_F = 75 A, V_{CE} = 300 V$



**Transienter Wärmewiderstand Diode-Wechselr.**  
**transient thermal impedance diode-inverter**

$Z_{thJH} = f(t)$



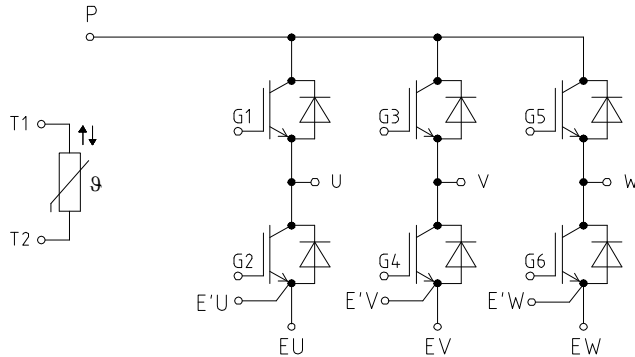
**NTC-Temperaturkennlinie (typisch)**

**NTC-temperature characteristic (typical)**  
 $R = f(T)$

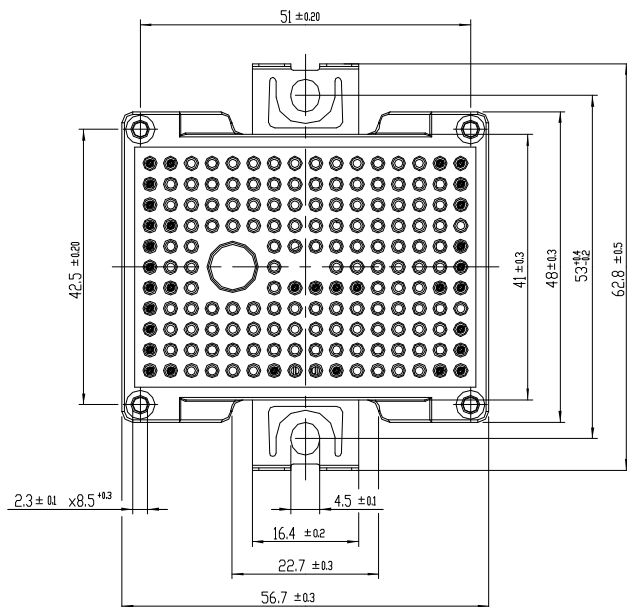
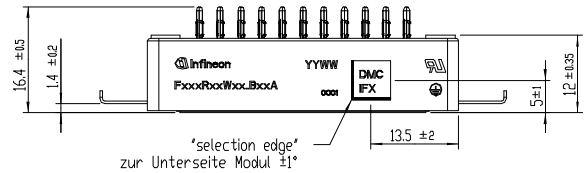
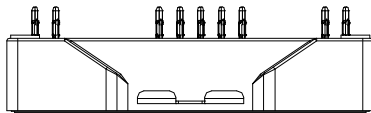


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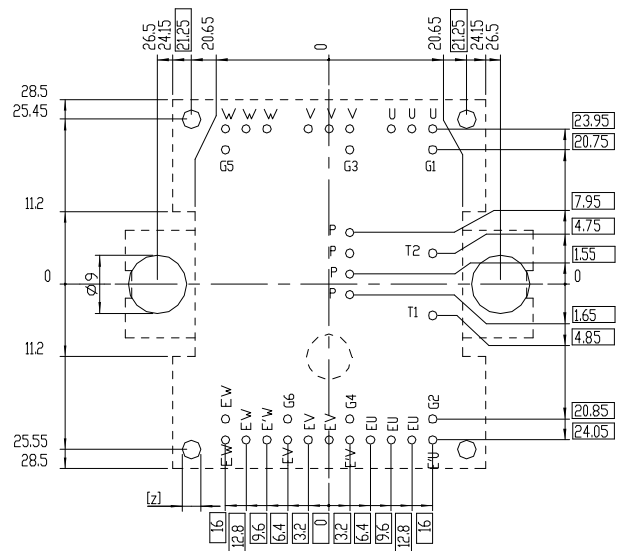
Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



PCB hole pattern



- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern  $\pm 0.1$  37x
- Hole specification for contacts see application note Easy PressFIT
- Diameters of drill  $\phi$  1.15 mm and copper thickness in hole 25 - 50  $\mu$ m
- [z] recommended diameter of PCB positioning guiding holes  $\phi$  2.8 mm

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