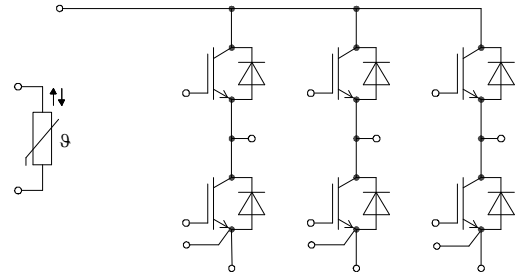
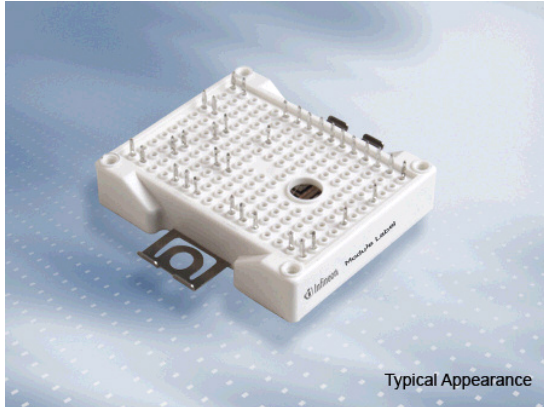


EasyPACK Modul mit Trench/Feldstopp IGBT3 und Emitter Controlled 3 Diode und PressFIT / NTC
EasyPACK module with Trench/Fieldstop IGBT3 and Emitter Controlled 3 diode and PressFIT / NTC



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

- Al₂O₃ Substrat mit kleinem thermischen Widerstand
- Hohe Leistungsdichte
- Integrierter NTC Temperatur Sensor
- Kompaktes Design
- PressFIT Verbindungstechnik
- RoHS konform
- Robuste Montage durch integrierte Befestigungsklammern

Mechanical Features

- Al₂O₃ 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	$T_C = 80^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$ $T_C = 25^{\circ}\text{C}, T_{vj} = 175^{\circ}\text{C}$	$I_{C\text{ nom}}$ 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	$I_C = 75\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 75\text{ A}, V_{GE} = 15\text{ V}$ $I_C = 75\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	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		μC
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	0,0		Ω
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	$I_C = 75\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Gon} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{ on}}$	0,022 0,022 0,022		μs μs μs
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		μs μs μs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 75\text{ A}, V_{CE} = 300\text{ V}$ $V_{GE} = \pm 15\text{ V}$ $R_{Goff} = 4,3\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$t_{d\text{ off}}$	0,18 0,20 0,21		μs μs μs
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		μs μs μs
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	A^2s A^2s

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		μC μC μC
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 Ω
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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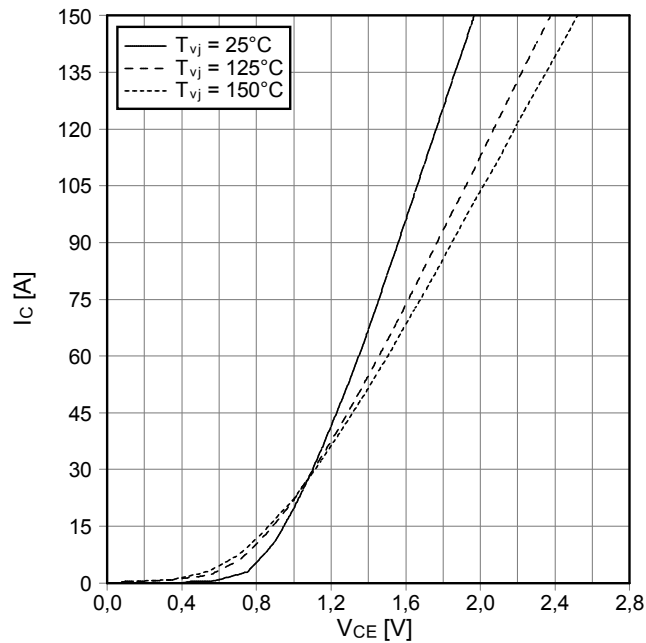
Modul / Module

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	2,5		kV
Innere Isolation Internal isolation			impr. Al ₂ O ₃		
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 _{SCE}		35	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T _C = 25°C, pro Schalter / per switch	R _{CC'+EE'}		3,00	mΩ
Höchstzulässige Sperrschichttemperatur Maximum junction temperature	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	T _{vj max}			175 °C
Temperatur im Schaltbetrieb Temperature under switching conditions	Wechselrichter, Brems-Chopper / Inverter, Brake-Chopper	T _{vj op}	-40		150 °C
Lagertemperatur Storage temperature		T _{stg}	-40		125 °C
Anpresskraft für mech. Bef. pro Feder mounting force per clamp		F	40	-	80 N
Gewicht Weight		G		42	g

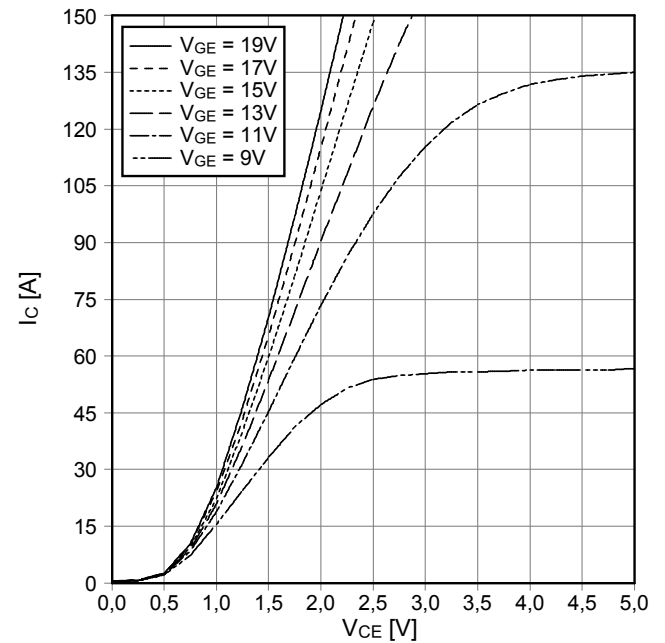
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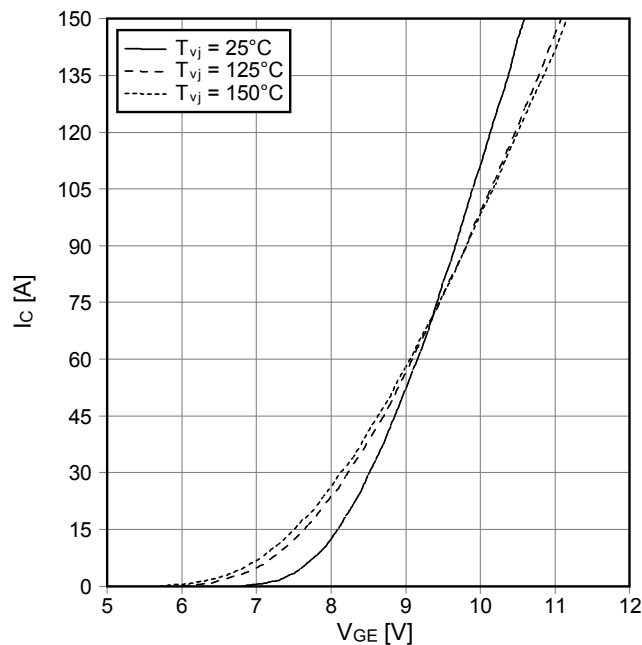
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $V_{GE} = 15\text{ V}$



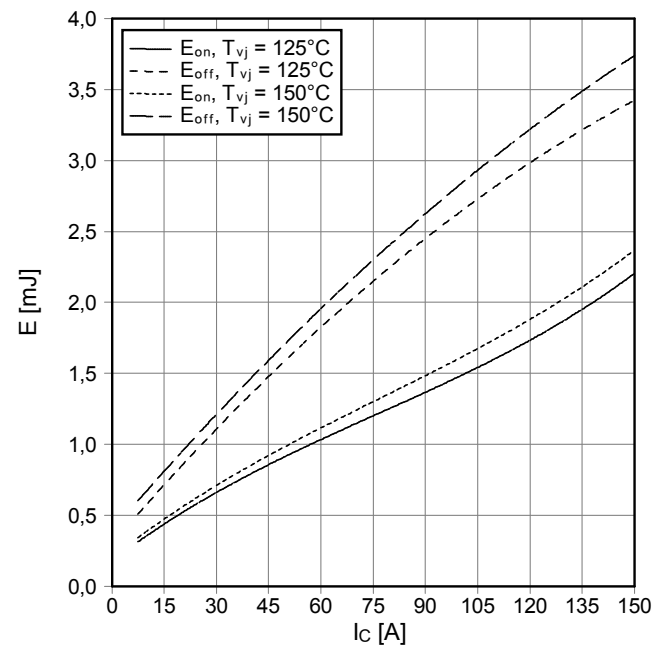
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
 $I_c = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



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



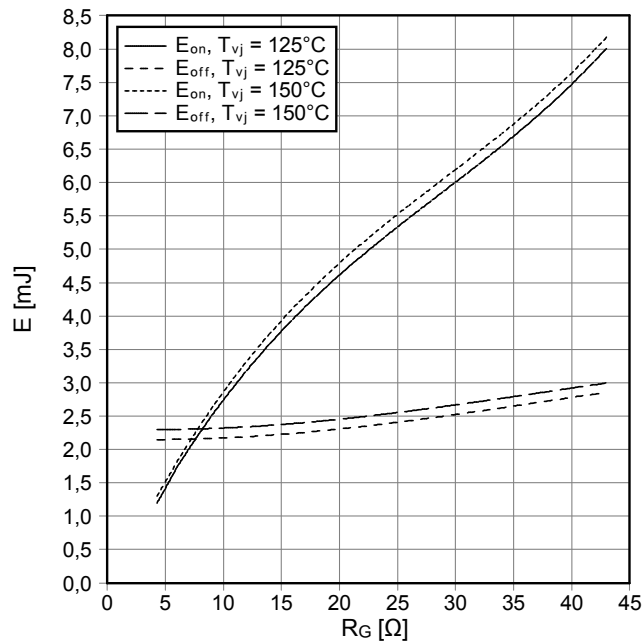
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
 $E_{on} = f(I_c), E_{off} = f(I_c)$
 $V_{GE} = \pm 15\text{ V}, R_{Gon} = 4.3\ \Omega, R_{Goff} = 4.3\ \Omega, V_{CE} = 300\text{ V}$



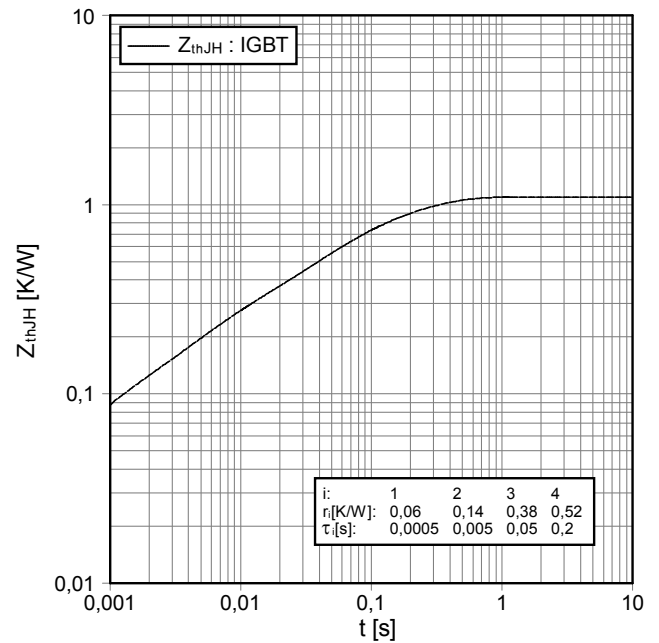
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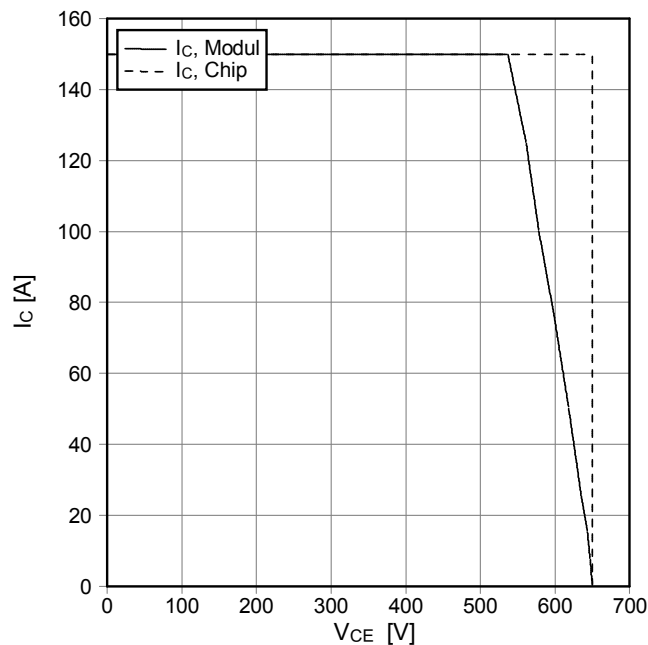
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-Inverter (typical)
 $E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 75\text{ A}$, $V_{CE} = 300\text{ V}$



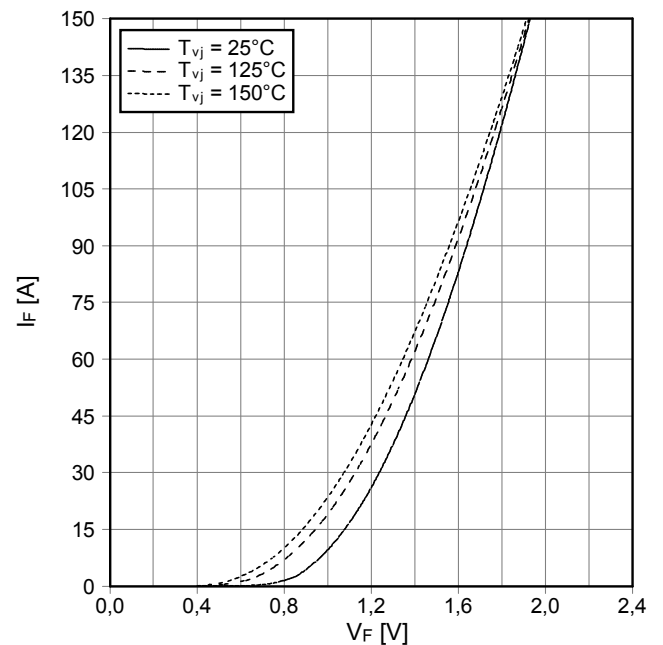
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
 $Z_{thJH} = f(t)$



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)
 $I_F = f(V_F)$

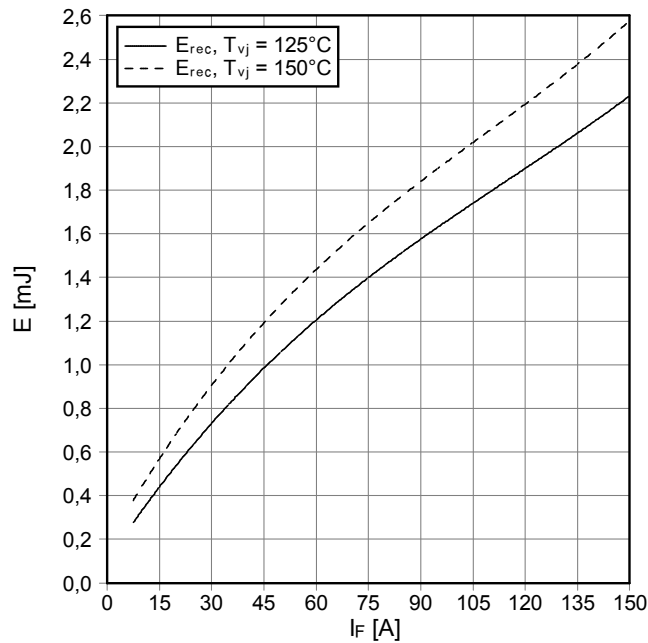


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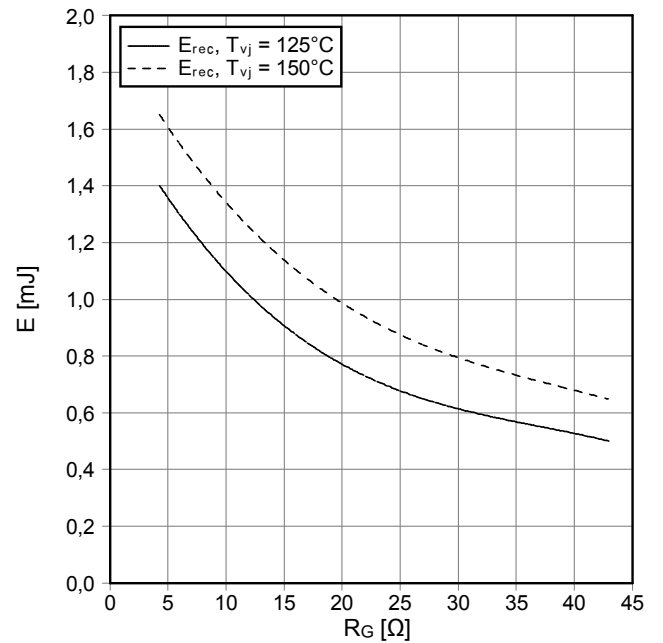
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

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



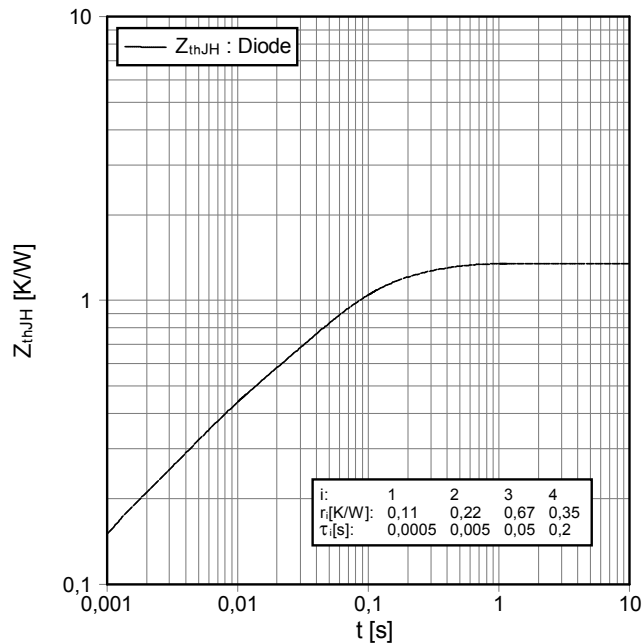
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)

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



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

$Z_{thJH} = f(t)$



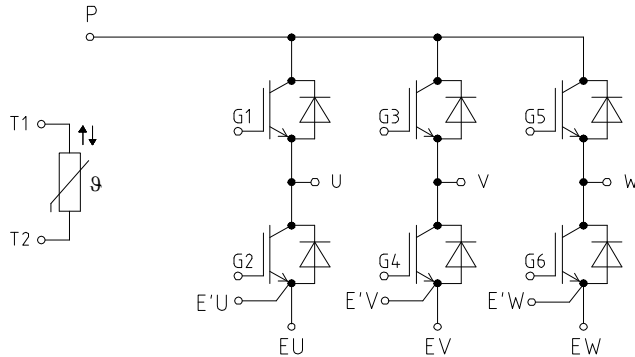
NTC-Temperaturkennlinie (typisch)
NTC-temperature characteristic (typical)

$R = f(T)$

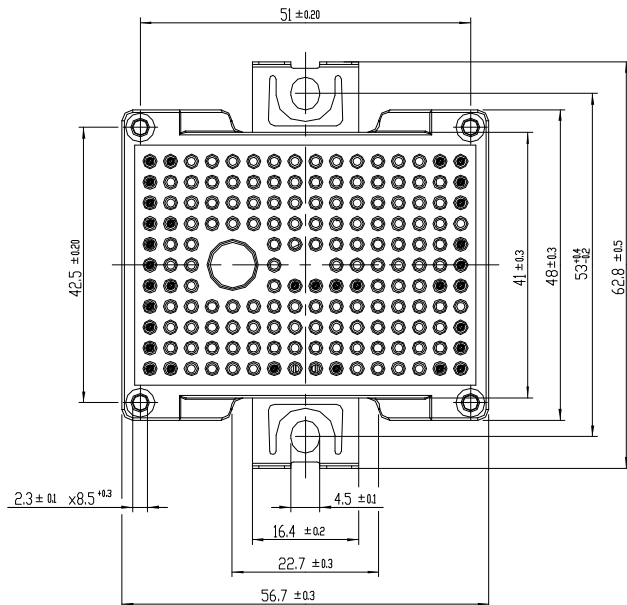
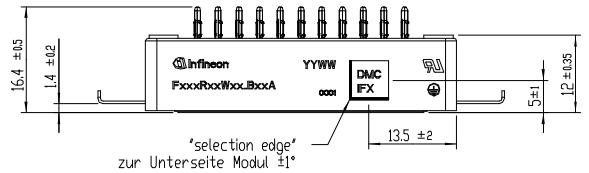
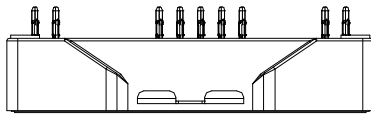


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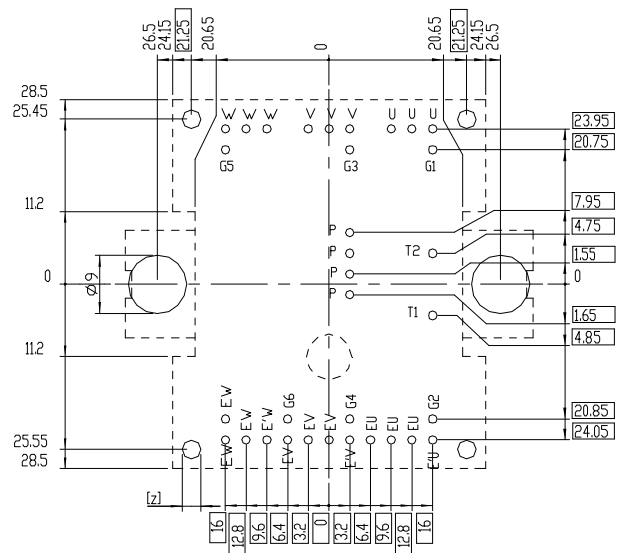
Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines



PCB hole pattern



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

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