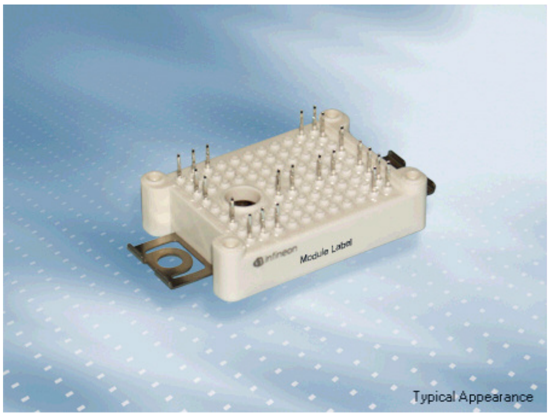
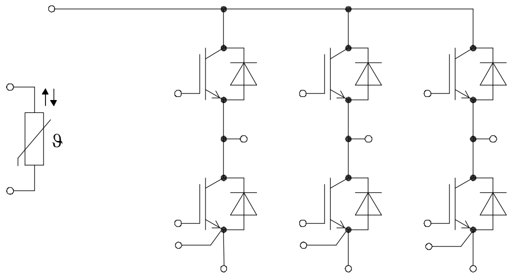
IGBT-Module
IGBT-modules

FS50R07W1E3_B11A

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
$I_{C\ nom}$ = 50A / I_{CRM} = 100A

Typische Anwendungen
- Hybrid-Elektrofahrzeuge (H)EV
- Klimaanlagen
- 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

Sample
00000123456000000000000

DMX - Code

Sample

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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IGBT-Wechselrichter / IGBT-inverter

Höchstzulässige Werte / Maximum Rated Values

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	650	V
Kollektor-Dauergleichstrom Continuous DC collector current	T_C = 90°C, T_{vj} = 175°C T_C = 25°C, T_{vj} = 175°C	$I_{C\ nom}$ I_C	50 70	A A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	t_P = 1 ms	I_{CRM}	100	A
Gesamt-Verlustleistung Total power dissipation	T_C = 25°C, T_{vj} = 175°C	P_{tot}	205	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 = 50 A, V_{GE} = 15 V I_C = 50 A, V_{GE} = 15 V I_C = 50 A, V_{GE} = 15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\ sat}$		1,45 1,60 1,70	1,90	V V V
Gate-Schwellenspannung Gate threshold voltage	I_C = 0,80 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		V_{GEth}	4,9	5,8	6,5	V
Gateladung Gate charge	V_{GE} = -15 V ... +15 V		Q_G		0,50		µC
Interner Gatewiderstand Internal gate resistor	T_{vj} = 25°C		R_{Gint}		0,0		Ω
Eingangskapazität Input capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{ies}		3,10		nF
Rückwirkungskapazität Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V		C_{res}		0,095		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	V_{CE} = 650 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			0,05	mA
Gate-Emitter-Reststrom Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			400	nA
Einschaltverzögerungszeit, induktive Last Turn-on delay time, inductive load	I_C = 50 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Gon} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ on}$		0,023 0,023 0,023		µs µs µs
Anstiegszeit, induktive Last Rise time, inductive load	I_C = 50 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Gon} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,019 0,022 0,022		µs µs µs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	I_C = 50 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Goff} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\ off}$		0,17 0,19 0,20		µs µs µs
Fallzeit, induktive Last Fall time, inductive load	I_C = 50 A, V_{CE} = 300 V V_{GE} = ±15 V R_{Goff} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,03 0,04 0,05		µs µs µs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	I_C = 50 A, V_{CE} = 300 V, L_S = 50 nH V_{GE} = ±15 V, di/dt = 2200 A/µs (T_{vj}=150°C) R_{Gon} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		0,40 0,57 0,64		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	I_C = 50 A, V_{CE} = 300 V, L_S = 50 nH V_{GE} = ±15 V, du/dt = 4000 V/µs (T_{vj}=150°C) R_{Goff} = 6,8 Ω	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		1,20 1,60 1,70		mJ mJ mJ
Kurzschlußverhalten SC data	V_{GE} ≤ 15 V, V_{CC} = 360 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt	t_P ≤ 8 µs, T_{vj} = 25°C t_P ≤ 6 µs, T_{vj} = 150°C	I_{SC}		350 250		A A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}		0,65	0,73	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro IGBT / per IGBT λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,80		K/W

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Diode-Wechselrichter / Diode-inverter

Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	650	V
Dauergleichstrom Continuous DC forward current		I_F	50	A
Periodischer Spitzenstrom Repetitive peak forward current	t_P = 1 ms	I_{FRM}	100	A
Grenzlastintegral I^2t - value	V_R = 0 V, t_P = 10 ms, T_{vj} = 125°C V_R = 0 V, t_P = 10 ms, T_{vj} = 150°C	I^2t	370 330	A^2s A^2s

Charakteristische Werte / Characteristic Values

				min.	typ.	max.	
Durchlassspannung Forward voltage	I_F = 50 A, V_{GE} = 0 V I_F = 50 A, V_{GE} = 0 V I_F = 50 A, V_{GE} = 0 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	V_F		1,55 1,50 1,45	2,00	V V V
Rückstromspitze Peak reverse recovery current	I_F = 50 A, - di_F/dt = 2200 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		50,0 60,0 65,0		A A A
Sperrverzögerungsladung Recovered charge	I_F = 50 A, - di_F/dt = 2200 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		2,00 3,90 4,40		µC µC µC
Abschaltenergie pro Puls Reverse recovery energy	I_F = 50 A, - di_F/dt = 2200 A/µs (T_{vj}=150°C) V_R = 300 V V_{GE} = -15 V	T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		0,50 1,00 1,15		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		R_{thJC}		1,00	1,10	K/W
Wärmewiderstand, Gehäuse bis Kühlkörper Thermal resistance, case to heatsink	pro Diode / per diode λ_{Paste} = 1 W/(m·K) / λ_{grease} = 1 W/(m·K)		R_{thCH}		0,85		K/W

NTC-Widerstand / NTC-thermistor

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Nennwiderstand Rated resistance	T_C = 25°C	R_{25}		5,00		kΩ
Abweichung von R100 Deviation of R100	T_C = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung Power dissipation	T_C = 25°C	P_{25}			20,0	mW
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 K))]$	$B_{25/50}$		3375		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 K))]$	$B_{25/80}$		3411		K
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 K))]$	$B_{25/100}$		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_2O_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.	
Modulstreuinduktivität Stray inductance module		L_{sCE}		25		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T_C = 25°C, pro Schalter / per switch	$R_{CC'+EE'}$		3,50		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 mountig force per clamp		F	20	-	50	N
Gewicht Weight		G		24		g

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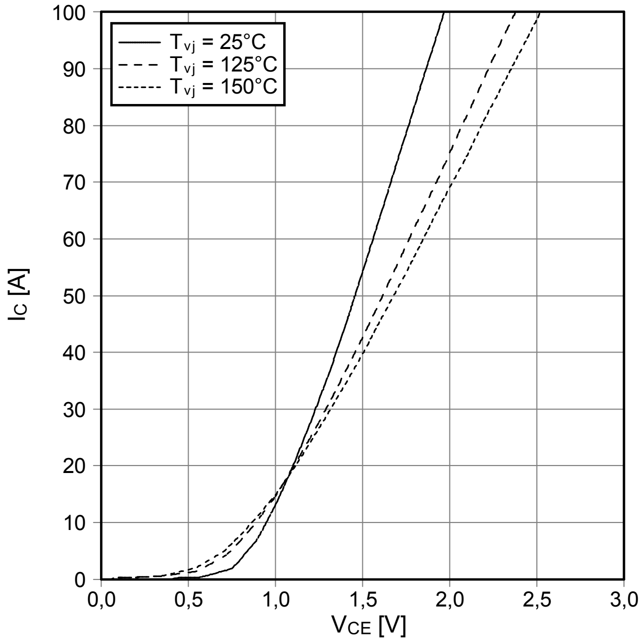
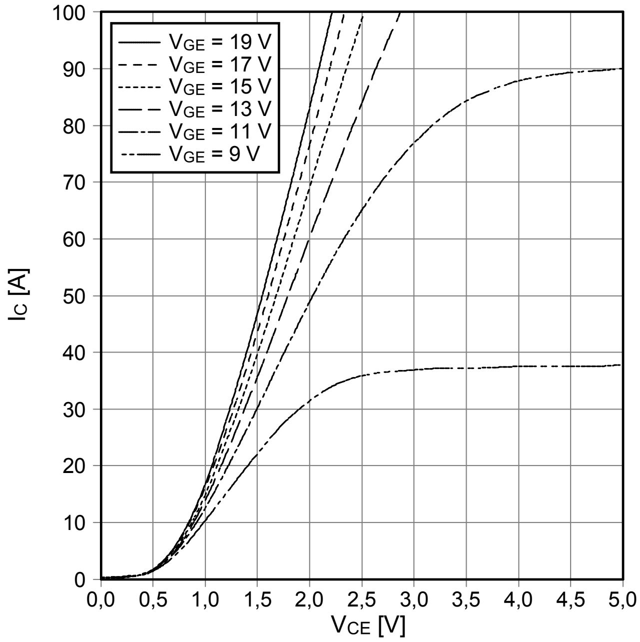
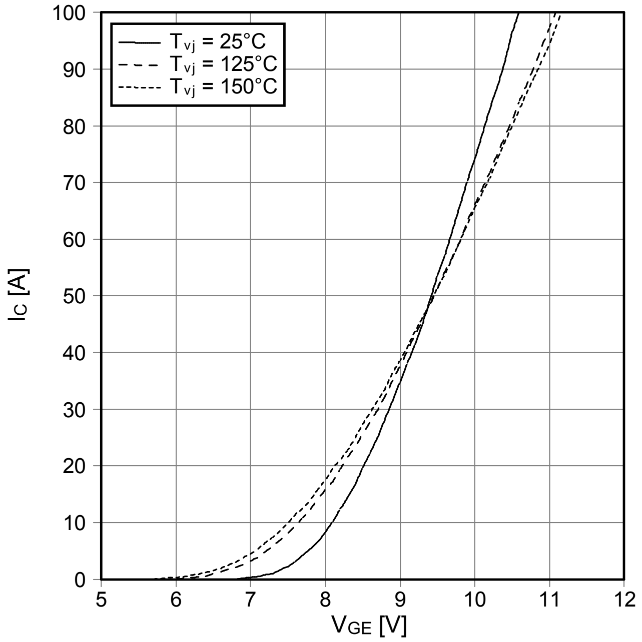
Ausgangskennlinie IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



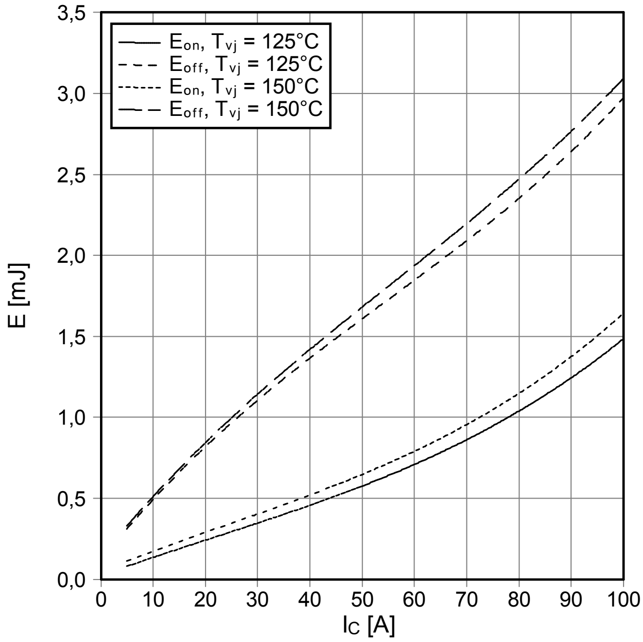
Ausgangskennlinienfeld IGBT-Wechselr. (typisch)
output characteristic IGBT-inverter (typical)
$I_C = f(V_{CE})$
$T_{vj} = 150°C$



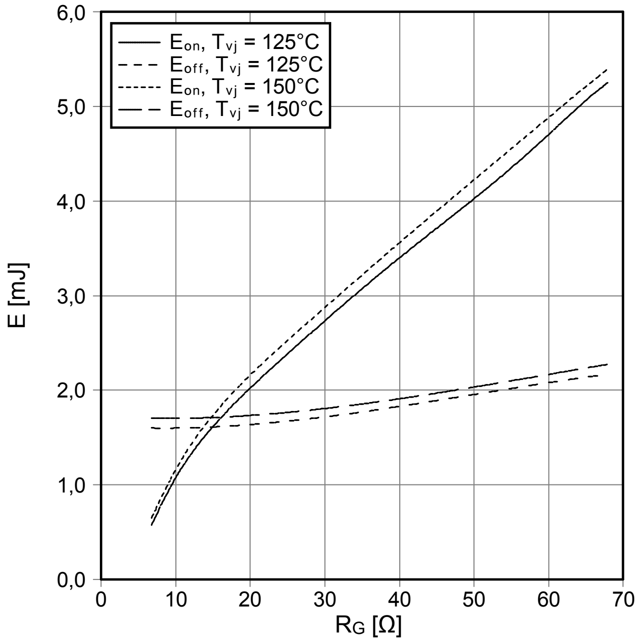
Übertragungscharakteristik IGBT-Wechselr. (typisch)
transfer characteristic IGBT-inverter (typical)
$I_C = f(V_{GE})$
$V_{CE} = 20$ V



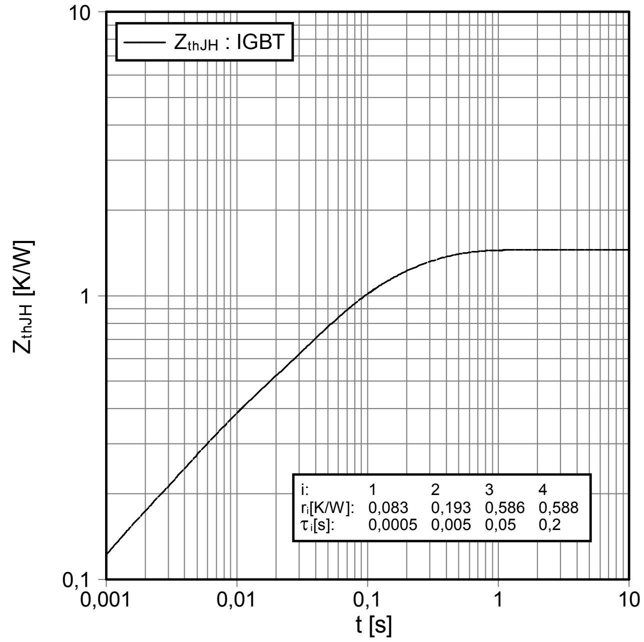
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
$V_{GE} = \pm 15$ V, $R_{Gon} = 6.8\ \Omega$, $R_{Goff} = 6.8\ \Omega$, $V_{CE} = 300$ V



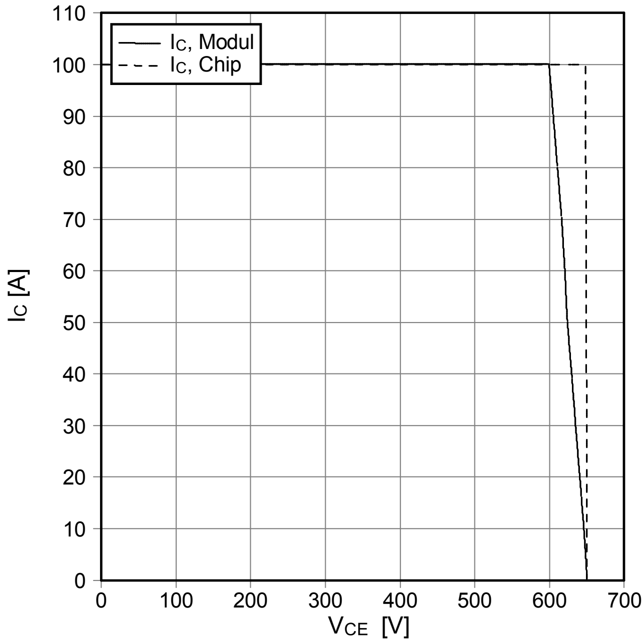
Schaltverluste IGBT-Wechselr. (typisch)
switching losses IGBT-Inverter (typical)
E_{on} = f (R_G), E_{off} = f (R_G)
V_{GE} = ±15 V, I_C = 50 A, V_{CE} = 300 V



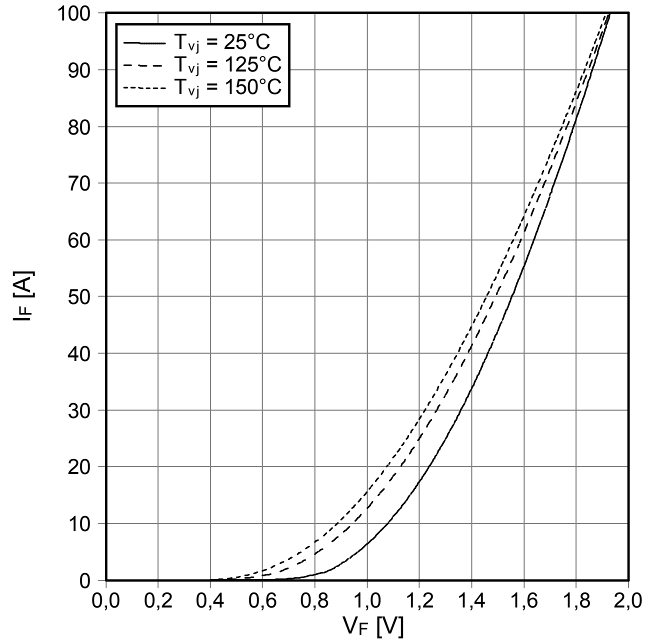
Transienter Wärmewiderstand IGBT-Wechselr.
transient thermal impedance IGBT-inverter
Z_{thJH} = f (t)



Sicherer Rückwärts-Arbeitsbereich IGBT-Wr. (RBSOA)
reverse bias safe operating area IGBT-inv. (RBSOA)
I_C = f (V_{CE})
V_{GE} = ±15 V, R_{Goff} = 6.8 Ω, T_{vj} = 150°C



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



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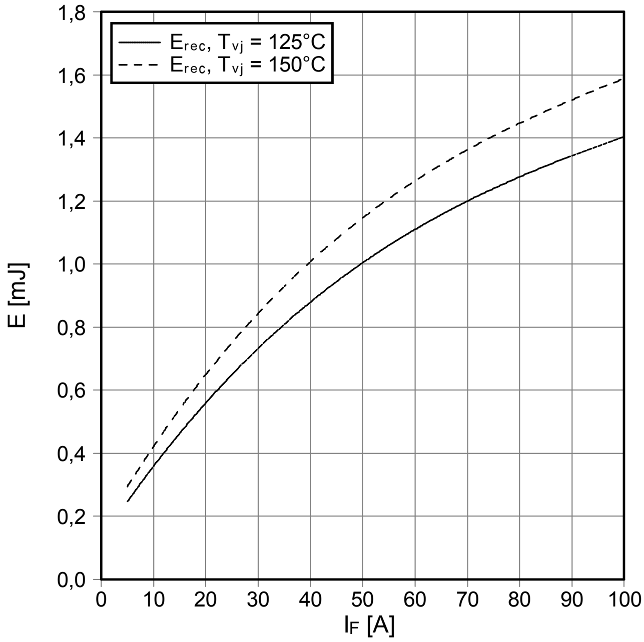
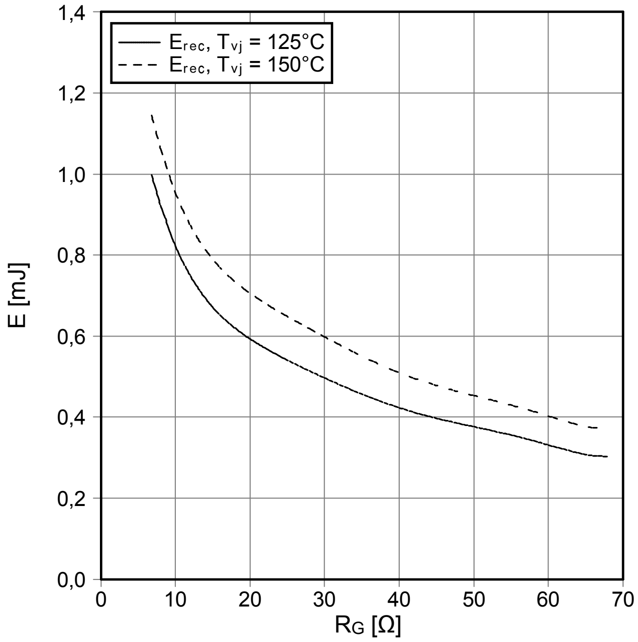
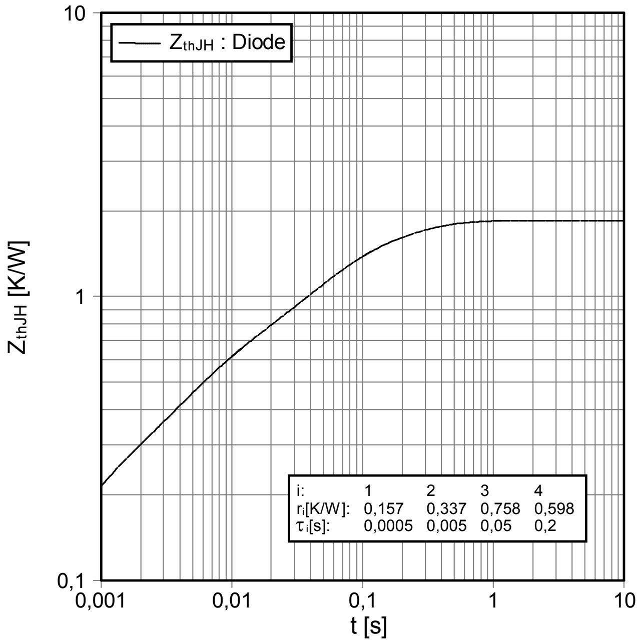
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 6.8\ \Omega$, $V_{CE} = 300$ V



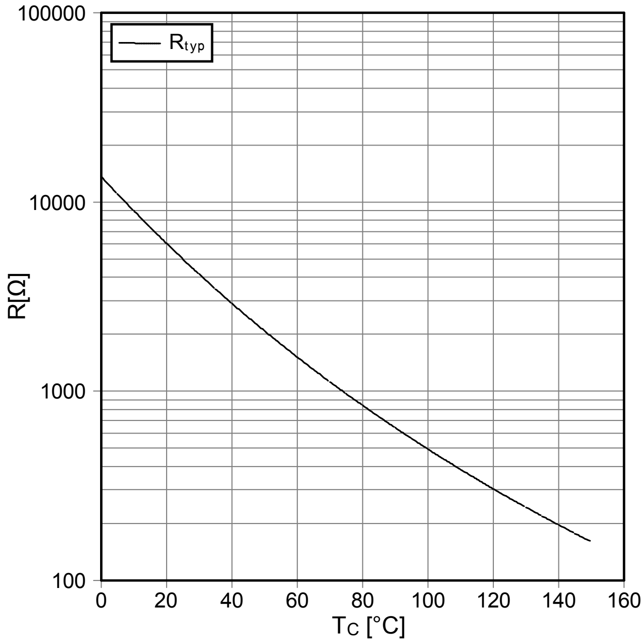
Schaltverluste Diode-Wechselr. (typisch)
switching losses diode-inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 50$ A, $V_{CE} = 300$ V



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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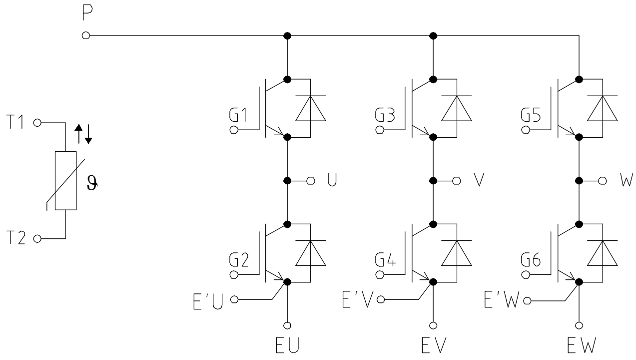
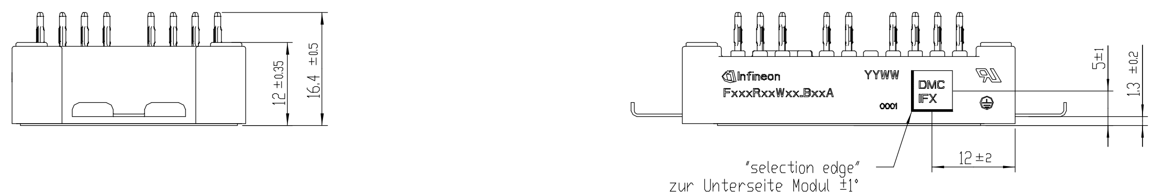
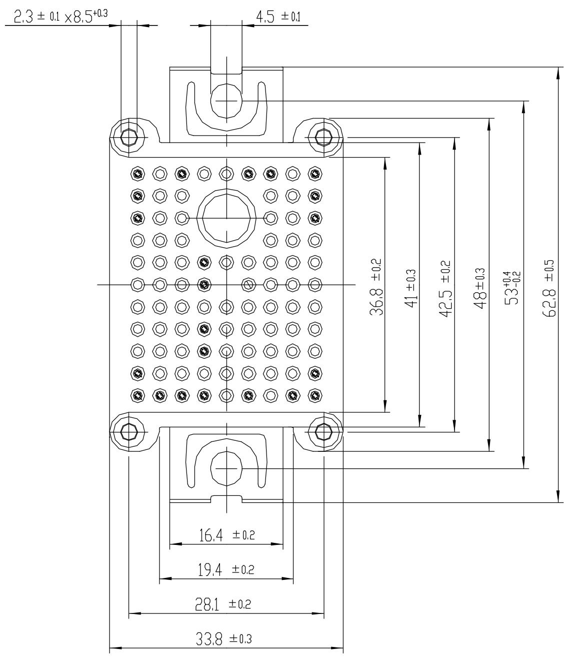
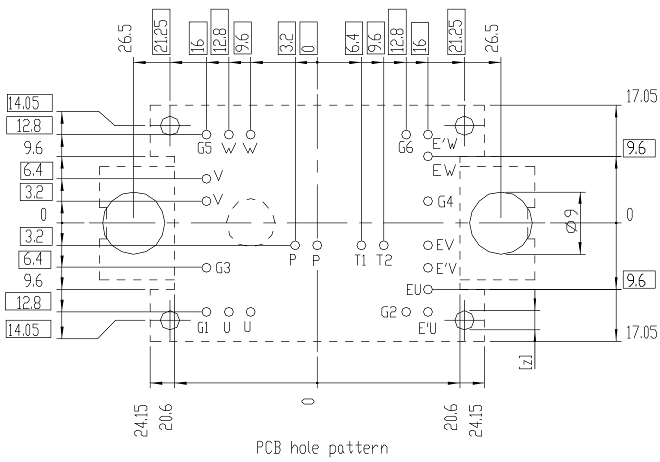
Schaltplan / circuit diagram



Gehäuseabmessungen / package outlines







- Pin-Grid 3.2 mm
- Tolerance of PCB hole pattern ⌖ Ø0.1 26x
- Hole specification for contacts see application note Easy PressFIT
- Diameters of drill Ø 1.15 mm
  and copper thickness in hole 25 - 50 µm
- [z] recommended diameter of PCB positioning
  guiding holes Ø2.8 mm

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