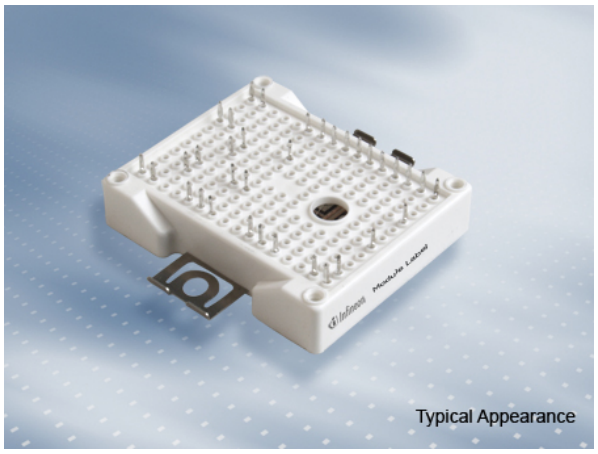
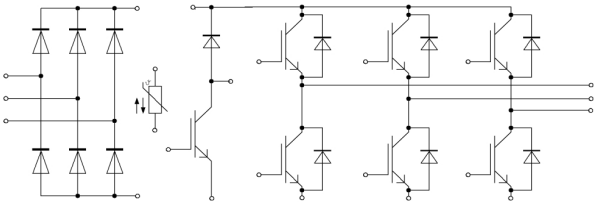
FP35R12W2T4P_B11

EasyPIM™ Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled 4 Diode und PressFIT / bereits aufgetragenem Thermal Interface Material

EasyPIM™ module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and PressFIT / pre-applied Thermal Interface Material





V_{CES} = 1200V

$I_{C\ nom}$ = 35A / I_{CRM} = 70A

Typische Anwendungen
- Hilfsumrichter
- Klimaanlagen
- Motorantriebe

Typical Applications
- Auxiliary inverters
- Air conditioning
- Motor drives

Elektrische Eigenschaften
- Niedrige Schaltverluste
- Niedriges V_{CEsat}
- Trench IGBT 4
- V_{CEsat} mit positivem Temperaturkoeffizienten

Electrical Features
- Low switching losses
- Low V_{CEsat}
- Trench IGBT 4
- V_{CEsat} with positive temperature coefficient

Mechanische Eigenschaften
- Al_2O_3 Substrat mit kleinem thermischen Widerstand
- Kompaktes Design
- PressFIT Verbindungstechnik
- Robuste Montage durch integrierte Befestigungsklammern
- Thermisches Interface Material bereits aufgetragen

Mechanical Features
- Al_2O_3 substrate with low thermal resistance
- Compact design
- PressFIT contact technology
- Rugged mounting due to integrated mounting clamps
- Pre-applied Thermal Interface Material

Module Label Code

Barcode Code 128

Sample

00000123456000000000000

DMX - 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°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom Continuous DC collector current	T_H = 80°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	35	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	t_P = 1 ms	I_{CRM}	70	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 = 35 A, V_{GE} = 15 V, T_{vj} = 25°C I_C = 35 A, V_{GE} = 15 V, T_{vj} = 125°C I_C = 35 A, V_{GE} = 15 V, T_{vj} = 150°C	$V_{CE\,sat}$		1,85 2,15 2,25	2,25	V V V
Gate-Schwellenspannung Gate threshold voltage	I_C = 1,20 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	5,20	5,80	6,40	V
Gateladung Gate charge	V_{GE} = -15 V ... +15 V	Q_G		0,27		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}		2,00		nF
Rückwirkungskapazität Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{res}		0,07		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}			1,0	mA
Gate-Emitter-Reststrom Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C	I_{GES}			100	nA
Einschaltverzögerungszeit, induktive Last Turn-on delay time, inductive load	I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 25°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 125°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 150°C	$t_{d\,on}$		0,025 0,025 0,025		µs µs µs
Anstiegszeit, induktive Last Rise time, inductive load	I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 25°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 125°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω, T_{vj} = 150°C	t_r		0,013 0,016 0,018		µs µs µs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 25°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 125°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 150°C	$t_{d\,off}$		0,24 0,295 0,31		µs µs µs
Fallzeit, induktive Last Fall time, inductive load	I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 25°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 125°C I_C = 35 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 150°C	t_f		0,115 0,17 0,20		µs µs µs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	I_C = 35 A, V_{CE} = 600 V, L_S = 35 nH, V_{GE} = ±15 V, di/dt = 2500 A/µs (T_{vj} = 150°C), R_{Gon} = 12 Ω, T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		1,90 2,90 3,15		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	I_C = 35 A, V_{CE} = 600 V, L_S = 35 nH, V_{GE} = ±15 V, du/dt = 3600 V/µs (T_{vj} = 150°C), R_{Goff} = 12 Ω, T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		2,00 2,90 3,20		mJ mJ mJ
Kurzschlußverhalten SC data	V_{GE} ≤ 15 V, V_{CC} = 800 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt, t_P ≤ 10 µs, T_{vj} = 150°C	I_{SC}		130		A
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro IGBT / per IGBT valid with IFX pre-applied thermal interface material	R_{thJH}			1,00	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

Diode, Wechselrichter / Diode, Inverter

Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Dauergleichstrom Continuous DC forward current		I_F	35	A
Periodischer Spitzenstrom Repetitive peak forward current	t_P = 1 ms	I_{FRM}	70	A
Grenzlastintegral I²t - 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	I²t	240 220	A²s A²s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	I_F = 35 A, V_{GE} = 0 V, T_{vj} = 25°C I_F = 35 A, V_{GE} = 0 V, T_{vj} = 125°C I_F = 35 A, V_{GE} = 0 V, T_{vj} = 150°C	V_F		1,65 1,65 1,65	2,15	V V V
Rückstromspitze Peak reverse recovery current	I_F = 35 A, - di_F/dt = 2500 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 600 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	I_{RM}		81,0 85,0 88,0		A A A
Sperrverzögerungsladung Recovered charge	I_F = 35 A, - di_F/dt = 2500 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 600 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	Q_r		3,95 6,80 7,50		µC µC µC
Abschaltenergie pro Puls Reverse recovery energy	I_F = 35 A, - di_F/dt = 2500 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 600 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	E_{rec}		1,50 2,70 2,95		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}			1,29	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

Diode, Gleichrichter / Diode, Rectifier

Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1600	V
Durchlassstrom Grenzeffektivwert pro Chip Maximum RMS forward current per chip	T_H = 80°C	I_{FRMSM}	50	A
Gleichrichter Ausgang Grenzeffektivstrom Maximum RMS current at rectifier output	T_H = 80°C	I_{RMSM}	50	A
Stoßstrom Grenzwert Surge forward current	t_p = 10 ms, T_{vj} = 25°C t_p = 10 ms, T_{vj} = 150°C	I_{FSM}	450 370	A A
Grenzlastintegral I²t - value	t_p = 10 ms, T_{vj} = 25°C t_p = 10 ms, T_{vj} = 150°C	I²t	1000 685	A²s A²s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	T_{vj} = 150°C, I_F = 35 A	V_F		0,95		V
Sperrstrom Reverse current	T_{vj} = 150°C, V_R = 1600 V	I_R		1,00		mA
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro Diode / per diode valid with IFX pre-applied thermal interface material	R_{thJH}			1,42	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

IGBT, Brems-Chopper / IGBT, Brake-Chopper

Höchstzulässige Werte / Maximum Rated Values

Kollektor-Emitter-Sperrspannung Collector-emitter voltage	T_{vj} = 25°C	V_{CES}	1200	V
Kollektor-Dauergleichstrom Continuous DC collector current	T_H = 80°C, $T_{vj\,max}$ = 175°C	$I_{C\,nom}$	35	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	t_P = 1 ms	I_{CRM}	70	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 = 35 A, V_{GE} = 15 V, T_{vj} = 25°C I_C = 35 A, V_{GE} = 15 V, T_{vj} = 125°C I_C = 35 A, V_{GE} = 15 V, T_{vj} = 150°C	$V_{CE\,sat}$		1,85 2,15 2,25	2,25	V V V
Gate-Schwellenspannung Gate threshold voltage	I_C = 1,20 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	5,20	5,80	6,40	V
Gateladung Gate charge	V_{GE} = -15 V ... +15 V	Q_G		0,27		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}		2,00		nF
Rückwirkungskapazität Reverse transfer capacitance	f = 1 MHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{res}		0,07		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C	I_{CES}			1,0	mA
Gate-Emitter-Reststrom Gate-emitter leakage current	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C	I_{GES}			100	nA
Einschaltverzögerungszeit, induktive Last Turn-on delay time, inductive load	I_C = 35 A, V_{CE} = 600 V, T_{vj} = 25°C V_{GE} = ±15 V, T_{vj} = 125°C R_{Gon} = 47 Ω, T_{vj} = 150°C	$t_{d\,on}$		0,07 0,07 0,07		µs µs µs
Anstiegszeit, induktive Last Rise time, inductive load	I_C = 35 A, V_{CE} = 600 V, T_{vj} = 25°C V_{GE} = ±15 V, T_{vj} = 125°C R_{Gon} = 47 Ω, T_{vj} = 150°C	t_r		0,045 0,05 0,057		µs µs µs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	I_C = 35 A, V_{CE} = 600 V, T_{vj} = 25°C V_{GE} = ±15 V, T_{vj} = 125°C R_{Goff} = 47 Ω, T_{vj} = 150°C	$t_{d\,off}$		0,28 0,44 0,45		µs µs µs
Fallzeit, induktive Last Fall time, inductive load	I_C = 35 A, V_{CE} = 600 V, T_{vj} = 25°C V_{GE} = ±15 V, T_{vj} = 125°C R_{Goff} = 47 Ω, T_{vj} = 150°C	t_f		0,115 0,175 0,205		µs µs µs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	I_C = 35 A, V_{CE} = 600 V, L_S = 35 nH, T_{vj} = 25°C V_{GE} = ±15 V, di/dt = 350 A/µs (T_{vj} = 150°C), T_{vj} = 125°C R_{Gon} = 47 Ω, T_{vj} = 150°C	E_{on}		5,00 6,50 7,00		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	I_C = 35 A, V_{CE} = 600 V, L_S = 35 nH, T_{vj} = 25°C V_{GE} = ±15 V, du/dt = 3500 V/µs (T_{vj} = 150°C), T_{vj} = 125°C R_{Goff} = 47 Ω, T_{vj} = 150°C	E_{off}		2,10 3,05 3,35		mJ mJ mJ
Kurzschlußverhalten SC data	V_{GE} ≤ 15 V, V_{CC} = 800 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt, t_P ≤ 10 µs, T_{vj} = 150°C	I_{SC}		130		A
Wärmewiderstand, Chip bis Kühlkörper Thermal resistance, junction to heatsink	pro IGBT / per IGBT valid with IFX pre-applied thermal interface material	R_{thJH}			1,00	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

Diode, Brems-Chopper / Diode, Brake-Chopper

Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	T_{vj} = 25°C	V_{RRM}	1200	V
Dauergleichstrom Continuous DC forward current		I_F	10	A
Periodischer Spitzenstrom Repetitive peak forward current	t_P = 1 ms	I_{FRM}	20	A
Grenzlastintegral I²t - 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	I²t	16,0 14,0	A²s A²s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	I_F = 10 A, V_{GE} = 0 V, T_{vj} = 25°C I_F = 10 A, V_{GE} = 0 V, T_{vj} = 125°C I_F = 10 A, V_{GE} = 0 V, T_{vj} = 150°C	V_F		1,75 1,75 1,75	2,25	V V V
Rückstromspitze Peak reverse recovery current	I_F = 10 A, - di_F/dt = 350 A/µs (T_{vj}=150°C), V_R = 600 V; T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	I_{RM}		12,0 10,0 8,00		A A A
Sperrverzögerungsladung Recovered charge	I_F = 10 A, - di_F/dt = 350 A/µs (T_{vj}=150°C), V_R = 600 V; T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	Q_r		0,90 1,70 1,90		µC µC µC
Abschaltenergie pro Puls Reverse recovery energy	I_F = 10 A, - di_F/dt = 350 A/µs (T_{vj}=150°C), V_R = 600 V; T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{rec}		0,24 0,52 0,59		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}			2,69	K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

NTC-Widerstand / NTC-Thermistor

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Nennwiderstand Rated resistance	T_{NTC} = 25°C	R_{25}		5,00		kΩ
Abweichung von R100 Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung Power dissipation	T_{NTC} = 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

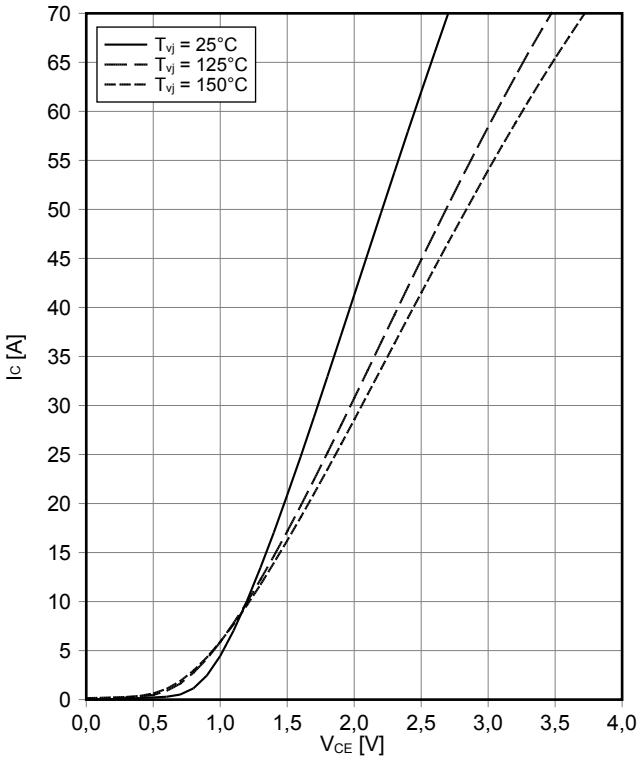
Angaben gemäß gültiger Application Note.
Specification according to the valid application note.

Modul / Module

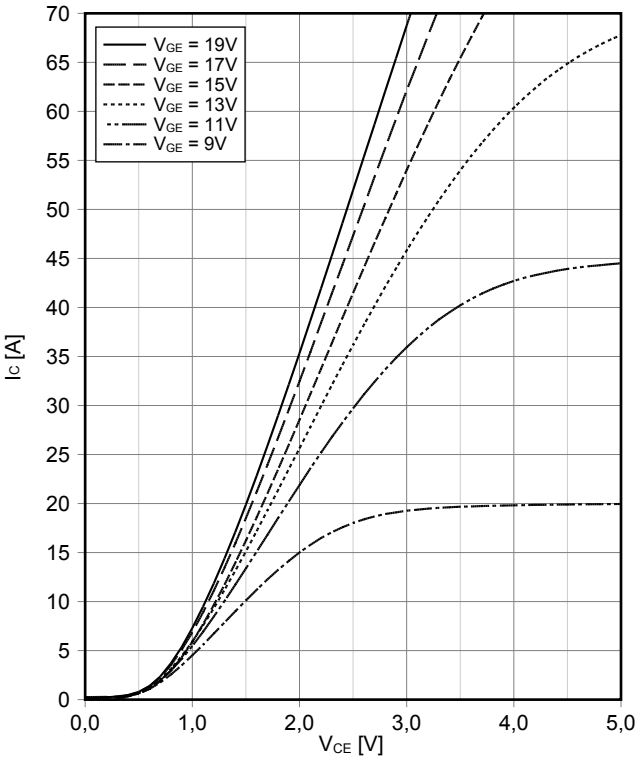
Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		2,5		kV
Innere Isolation Internal isolation	Basisisolierung (Schutzklasse 1, EN61140) basic insulation (class 1, IEC 61140)			Al_2O_3		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - 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}		30		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T_H = 25°C, pro Schalter / per switch	$R_{CC'+EE'}$ $R_{AA'+CC'}$		5,00 6,00		mΩ
Lagertemperatur Storage temperature		T_{stg}	-40		125	°C
Höchstzulässige Bodenplattenbetriebstemperatur Maximum baseplate operation temperature		T_{BPmax}			125	°C
Anpresskraft für mech. Bef. pro Feder mountig force per clamp		F	40	-	80	N
Gewicht Weight		G		39		g

Der Strom im Dauerbetrieb ist auf 25A effektiv pro Anschlusspin begrenzt.
The current under continuous operation is limited to 25A rms per connector pin.
Lagerung und Transport von Modulen mit TIM => siehe AN2012-07
Storage and shipment of modules with TIM => see AN2012-07

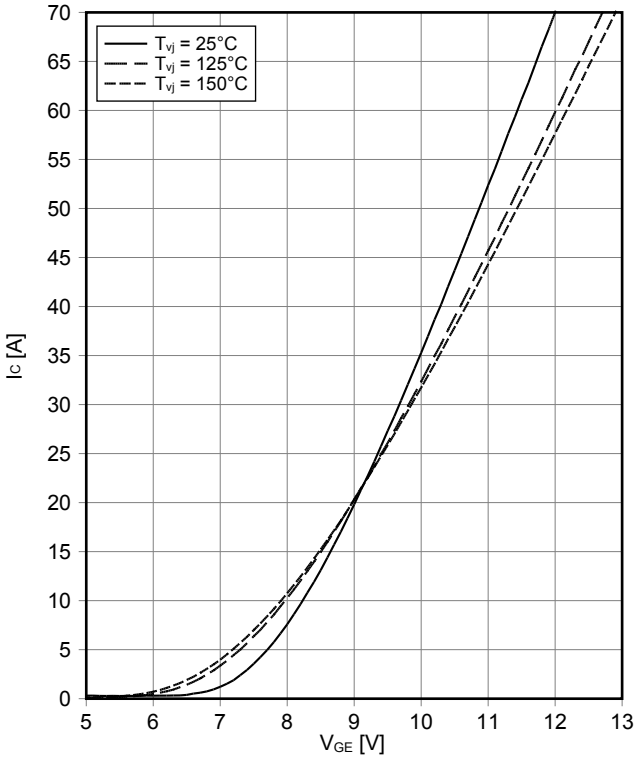
Ausgangskennlinie IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



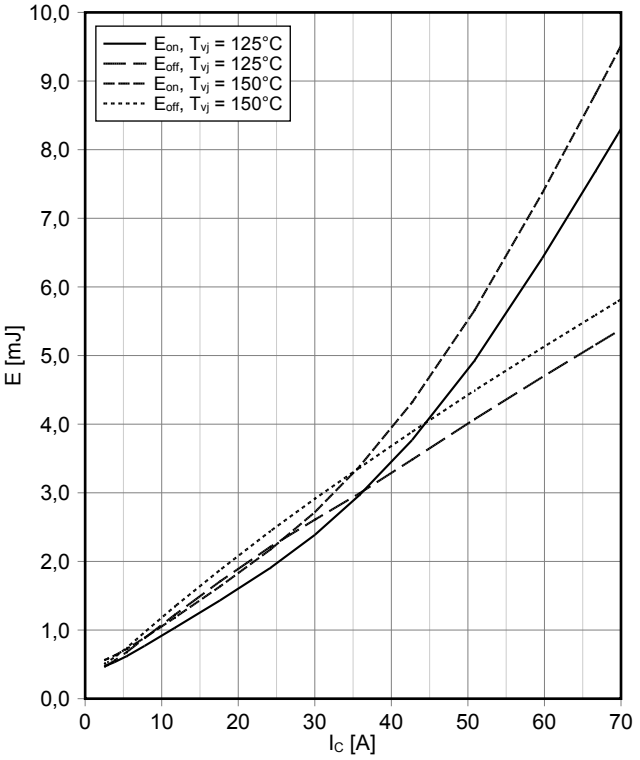
Ausgangskennlinienfeld IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



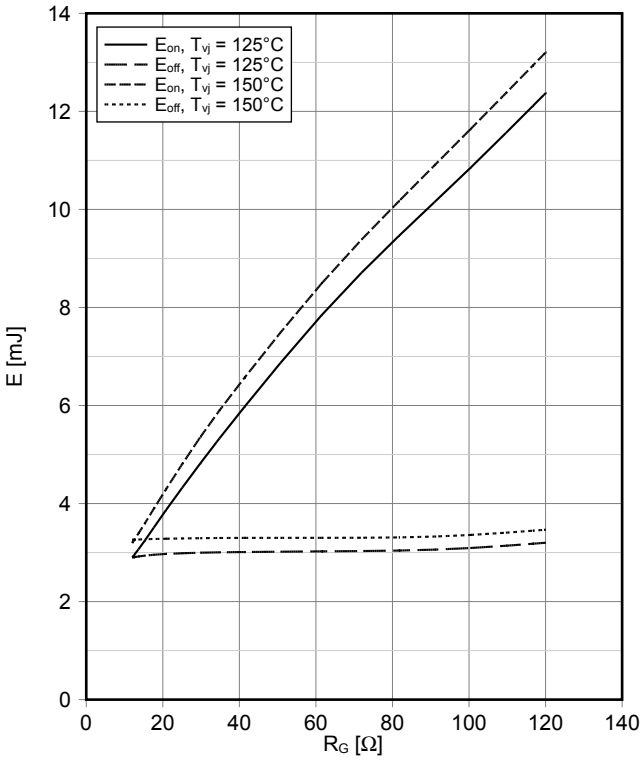
Übertragungscharakteristik IGBT,Wechselrichter (typisch)
transfer characteristic IGBT,Inverter (typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V



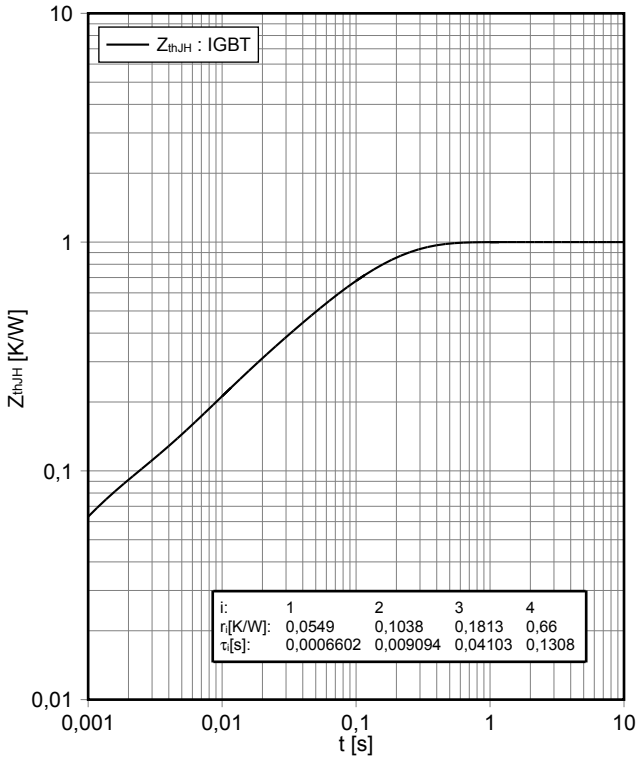
Schaltverluste IGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 12 Ω, R_{Goff} = 12 Ω, V_{CE} = 600 V



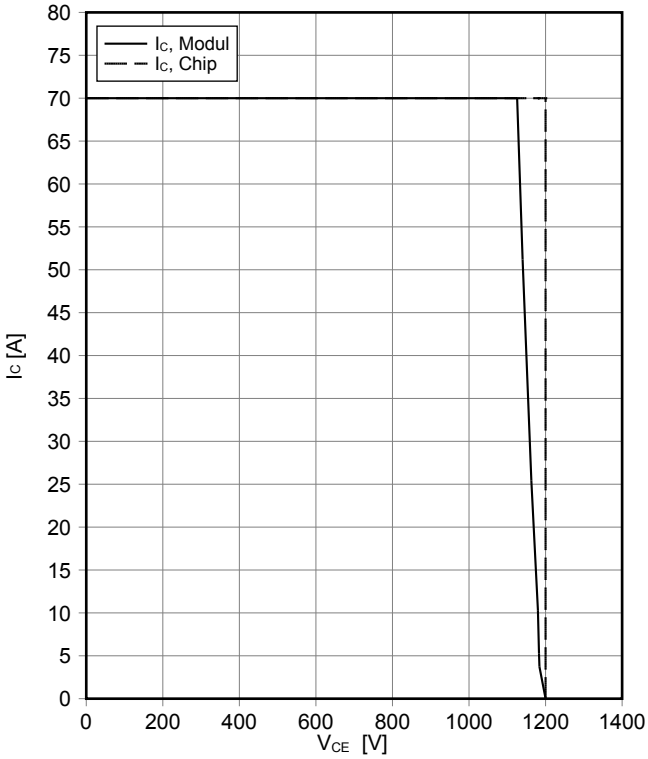
Schaltverluste IGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 35 A, V_{CE} = 600 V



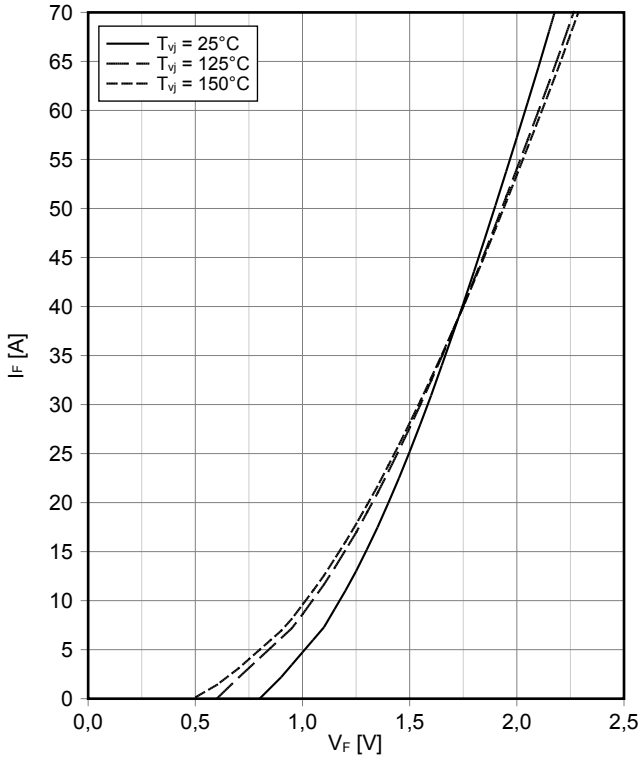
Transienter Wärmewiderstand IGBT,Wechselrichter
transient thermal impedance IGBT,Inverter
$Z_{thJH} = f(t)$



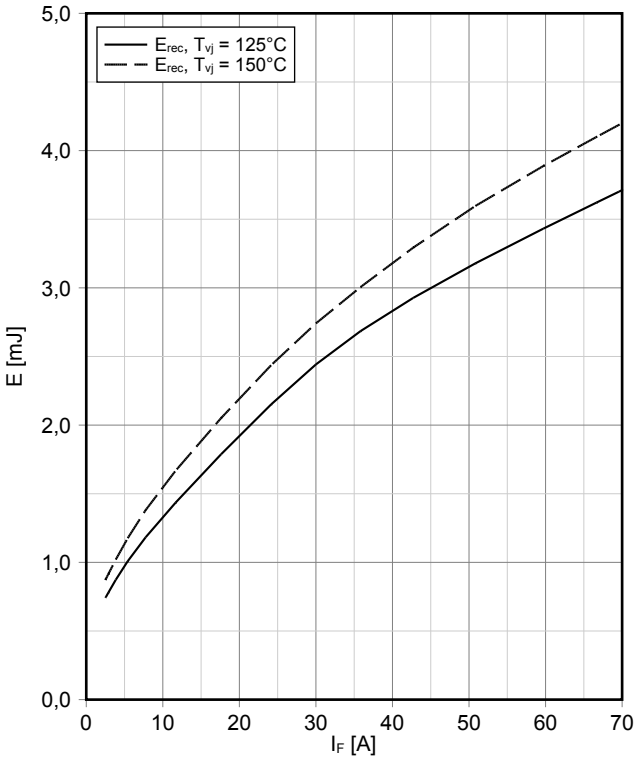
Sicherer Rückwärts-Arbeitsbereich IGBT,Wechselrichter (RBSOA)
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 12 Ω, T_{vj} = 150°C



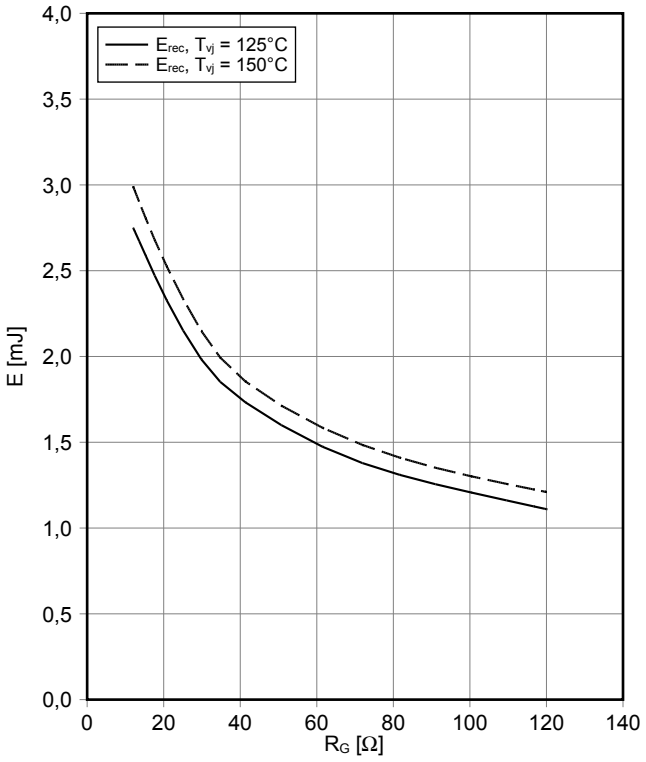
Durchlasskennlinie der Diode, Wechselrichter (typisch)
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



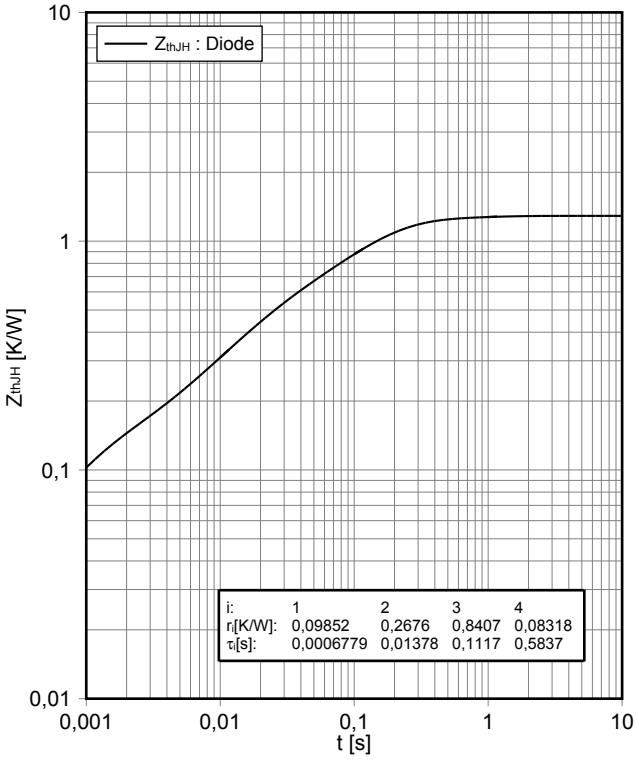
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 12\ \Omega$, $V_{CE} = 600\ V$



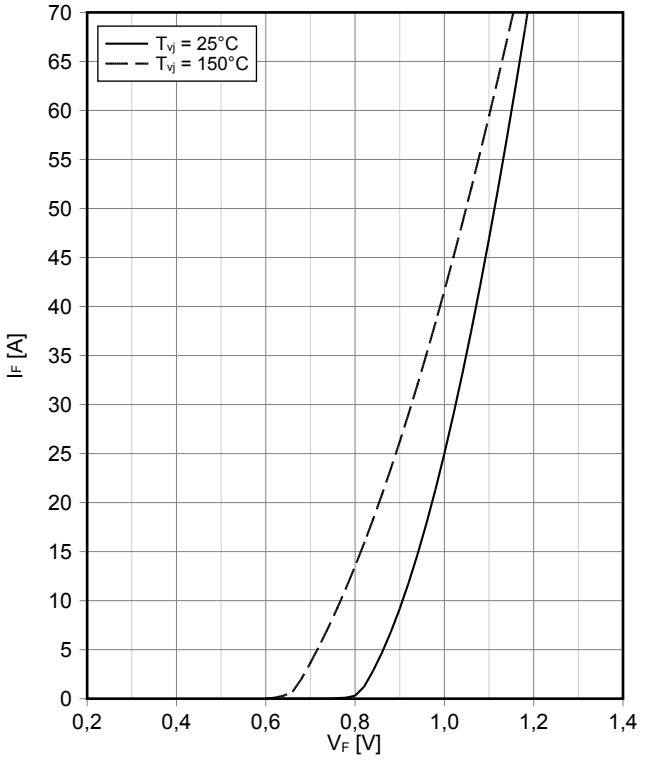
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 35\ A$, $V_{CE} = 600\ V$



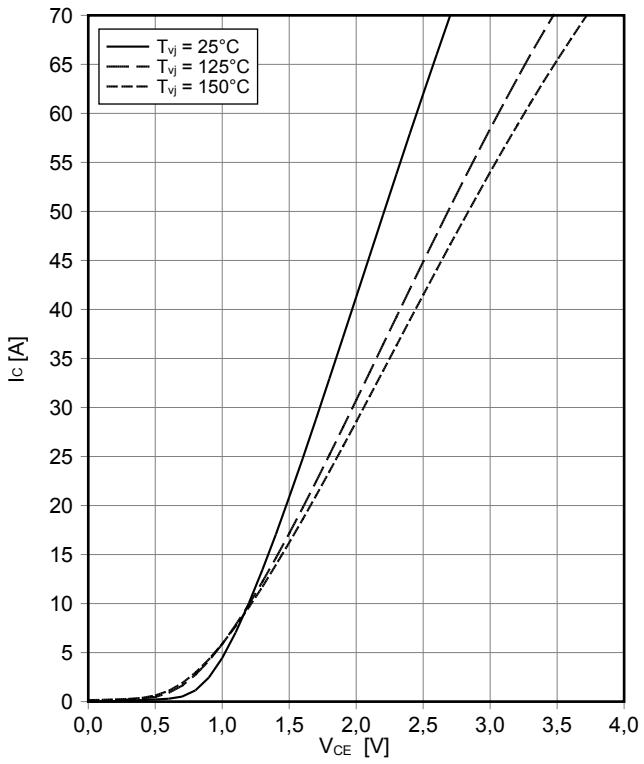
Transienter Wärmewiderstand Diode, Wechselrichter
transient thermal impedance Diode, Inverter
$Z_{thJH} = f(t)$



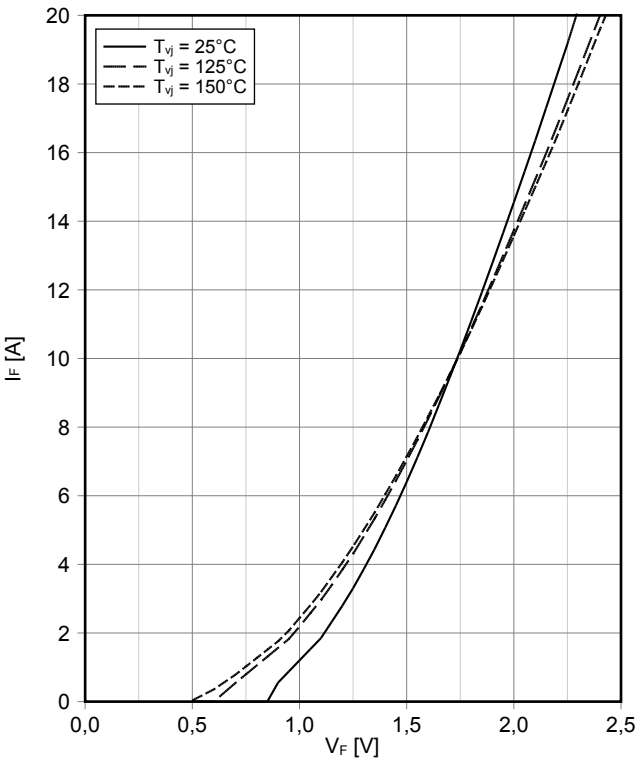
Durchlasskennlinie der Diode, Gleichrichter (typisch)
forward characteristic of Diode, Rectifier (typical)
$I_F = f(V_F)$



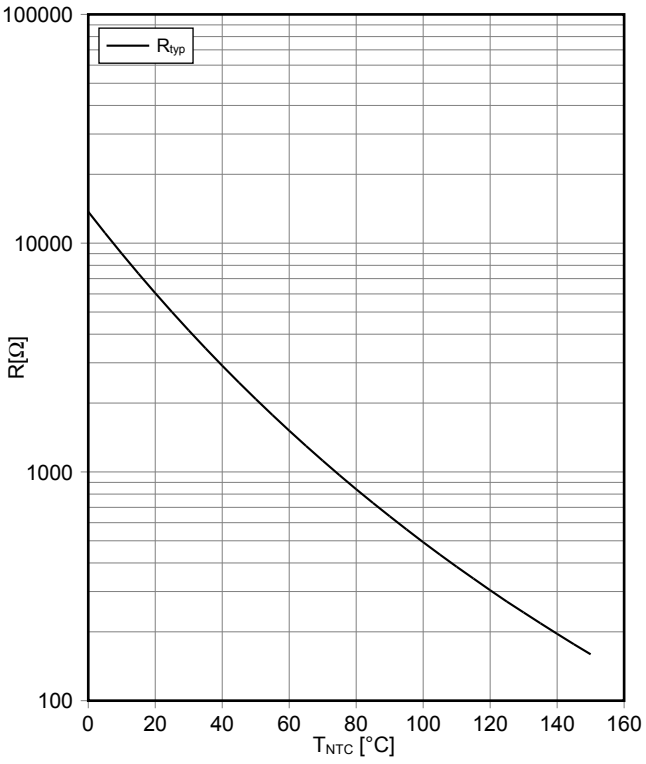
Ausgangskennlinie IGBT, Brems-Chopper (typisch)
output characteristic IGBT, Brake-Chopper (typical)
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



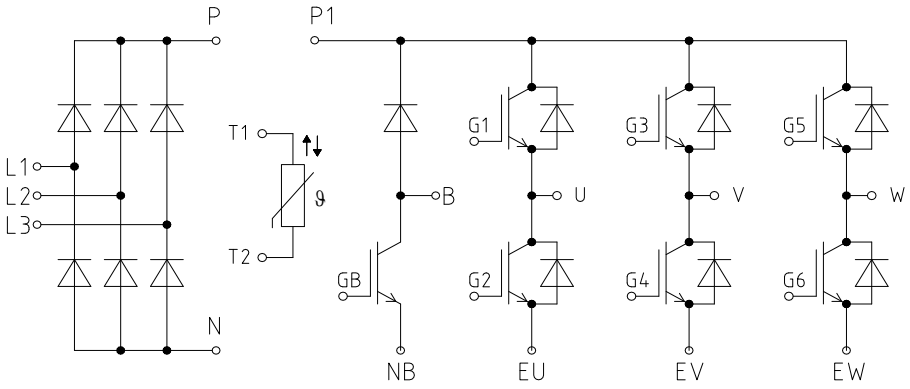
Durchlasskennlinie der Diode, Brems-Chopper (typisch)
forward characteristic of Diode, Brake-Chopper (typical)
$I_F = f(V_F)$



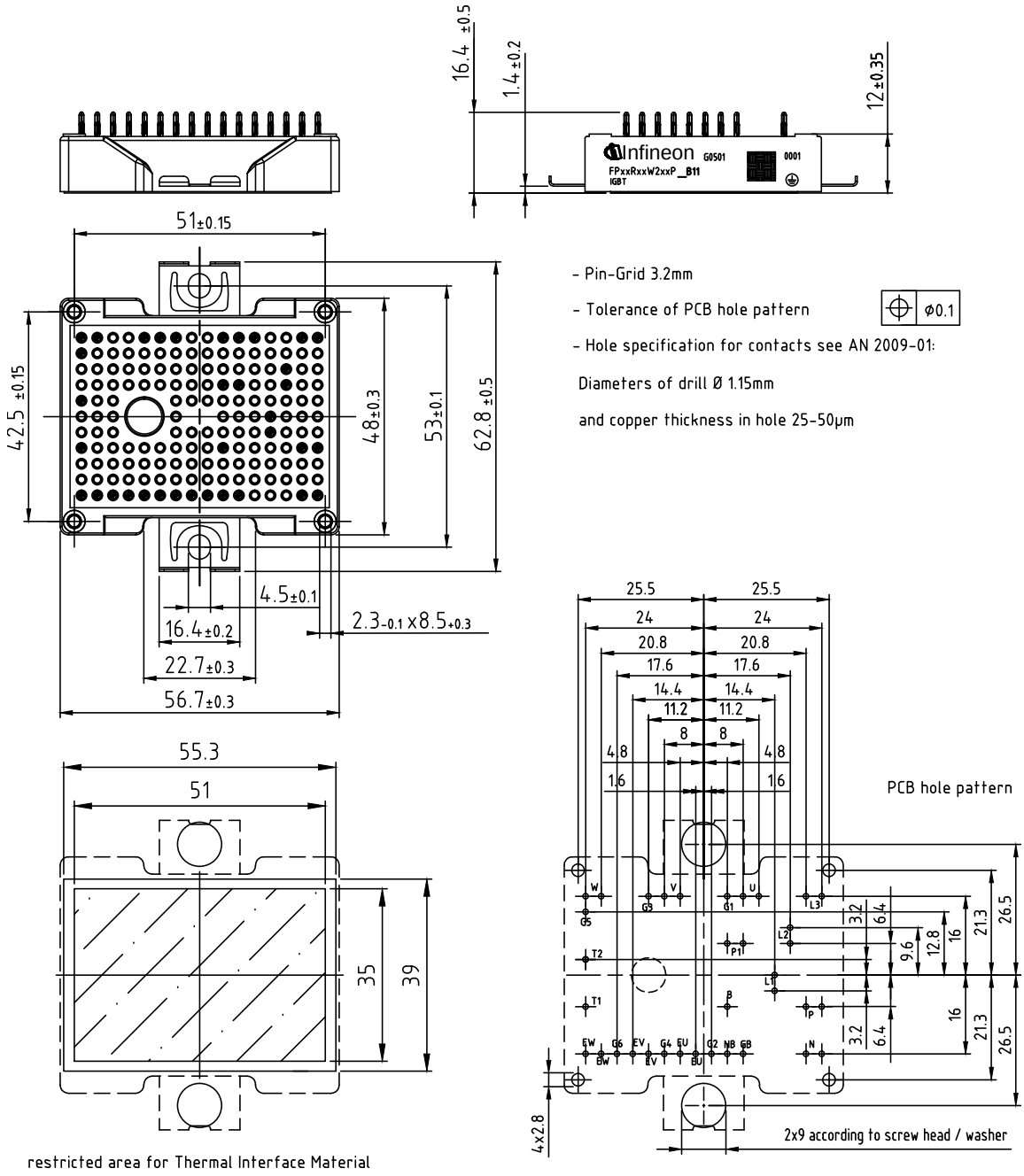
NTC-Widerstand-Temperaturkennlinie (typisch)
NTC-Thermistor-temperature characteristic (typical)
$R = f(T)$



Schaltplan / Circuit diagram



Gehäuseabmessungen / Package outlines



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