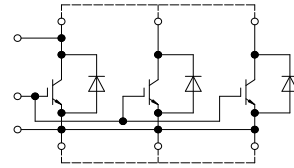


IHM-B Modul mit Trench/Feldstopp IGBT4 und Emitter Controlled 4 Diode
 IHM-B module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode

Vorläufige Daten / Preliminary Data



external connection
(to be done)

$V_{CES} = 3300V$
 $I_{C\ nom} = 2000A / I_{CRM} = 4000A$

Potentielle Anwendungen

- Aktiver Eingang (Rückspeisung)
- Hochleistungsumrichter
- Hybrid-Nutzfahrzeuge
- Mittelspannungsantriebe
- Motorantriebe
- Traktionsumrichter
- USV-Systeme

Elektrische Eigenschaften

- Große DC-Festigkeit
- Hohe Kurzschlussrobustheit
- Hohe Stromdichte
- Niedrige Schaltverluste
- Niedriges Qg und Cres
- Niedriges V_{CEsat}
- Sehr große Robustheit
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4
- V_{CEsat} mit positivem Temperaturkoeffizienten

Mechanische Eigenschaften

- AlSiC Bodenplatte für erhöhte thermische Lastwechselfestigkeit
- Gehäuse mit CTI > 600
- Hohe Leistungsdichte
- Isolierte Bodenplatte

Potential Applications

- Active frontend (energy recovery)
- High power converters
- Commercial Agriculture Vehicles
- Medium voltage converters
- Motor drives
- Traction drives
- UPS systems

Electrical Features

- High DC stability
- High short-circuit capability
- High current density
- Low switching losses
- Low Qg and Cres
- Low V_{CEsat}
- Unbeatable robustness
- $T_{vj\ op} = 150^{\circ}C$
- Trench IGBT 4
- V_{CEsat} with positive temperature coefficient

Mechanical Features

- AlSiC base plate for increased thermal cycling capability
- Package with CTI > 600
- High power density
- Isolated base plate

Module Label Code

Barcode Code 128



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	$T_{vj} = -40^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_{CES}	3300 3300	V
Kollektor-Dauergleichstrom Continuous DC collector current	$T_C = 115^{\circ}\text{C}$, $T_{vj\max} = 150^{\circ}\text{C}$	I_{CDC}	2000	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	4000	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	$I_C = 2000\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{ sat}}$	2,20 2,70 2,80	t.b.d.	V V V	
Gate-Schwellenspannung Gate threshold voltage	$I_C = 94,0\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$		V_{GEth}	5,20	5,80	6,40	V
Gateladung Gate charge	$V_{GE} = -15 / 15\text{ V}$, $V_{CE} = 1800\text{ V}$		Q_G	40,0			μC
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	0,5			Ω
Eingangskapazität Input capacitance	$f = 1000\text{ kHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		C_{ies}	280			nF
Rückwirkungskapazität Reverse transfer capacitance	$f = 1000\text{ kHz}$, $T_{vj} = 25^{\circ}\text{C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		C_{res}	8,00			nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	$V_{CE} = 3300\text{ V}$, $V_{GE} = 0\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$		I_{CES}			5,0	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	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,54 0,66 0,72			μs μs μs
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,22 0,24 0,24			μs μs μs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	2,90 3,20 3,30			μs μs μs
Fallzeit, induktive Last Fall time, inductive load	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,76 1,28 1,58			μs μs μs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$, $L\sigma = 85\text{ nH}$ $di/dt = 7600\text{ A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GE} = -15 / 15\text{ V}$, $R_{Gon} = 0,5\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	1600 2800 3200			mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 2000\text{ A}$, $V_{CE} = 1800\text{ V}$, $L\sigma = 85\text{ nH}$ $du/dt = 1800\text{ V}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GE} = -15 / 15\text{ V}$, $R_{Goff} = 2,0\ \Omega$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	2700 3600 3900			mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}$, $V_{CC} = 2400\text{ V}$ $V_{CE\max} = V_{CES} - L_{SCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}$, $T_{vj} = 150^{\circ}\text{C}$		I_{SC}	9600			A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}			5,50	K/kW
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}	4,30			K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{ op}}$	-40		150	$^{\circ}\text{C}$

Diode, Wechselrichter / Diode, Inverter
Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzensperrspannung Repetitive peak reverse voltage	$T_{vj} = -40^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_{RRM}	3300 3300	V
Dauergleichstrom Continuous DC forward current		I_F	2000	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1 \text{ ms}$	I_{FRM}	4000	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	1230 1110	kA^2s kA^2s
Spitzenverlustleistung Maximum power dissipation	$T_{vj} = 150^{\circ}\text{C}$	P_{RQM}	4200	kW
Mindesteinschaltzeit Minimum turn-on time		$t_{on \text{ min}}$	10,0	μs

Charakteristische Werte / Characteristic Values

			min.	typ.	max.		
Durchlassspannung Forward voltage	$I_F = 2000 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 2000 \text{ A}, V_{GE} = 0 \text{ V}$ $I_F = 2000 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F		2,70 2,35 2,25	t.b.d.	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 2000 \text{ A}, -di_F/dt = 7600 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}		2500 2800 2900		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 2000 \text{ A}, -di_F/dt = 7600 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r		1020 1980 2320		μC μC μC
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 2000 \text{ A}, -di_F/dt = 7600 \text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800 \text{ V}$ $V_{GE} = -15 \text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}		1350 2450 2900		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		R_{thJC}			10,6	K/kW
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}		5,10		K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj \text{ op}}$	-40		150	$^{\circ}\text{C}$

Vorläufige Daten Preliminary Data

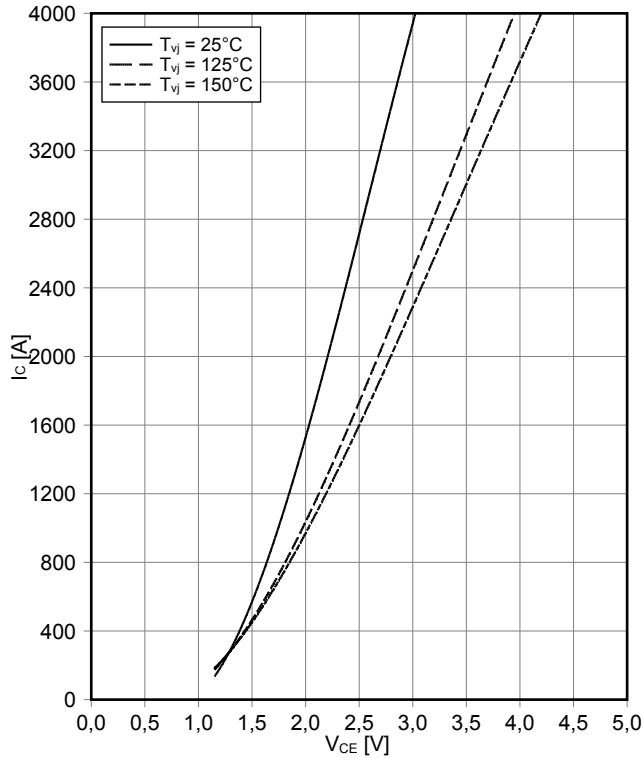
Modul / Module

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V _{ISOL}	6,0		kV
Teilentladungs-Aussetzspannung Partial discharge extinction voltage	RMS, f = 50 Hz, Q _{PD} ≤ 10 pC	V _{ISOL}	2,6		kV
Kollektor-Emitter-Gleichsperrspannung DC stability	T _{vj} = 25°C, 100 fit	V _{CE D}	2100		V
Material Modulgrundplatte Material of module baseplate			AlSiC		
Kriechstrecke Creepage distance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		32,2		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal		19,1		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI	> 600		
			min.	typ.	max.
Modulstreuinduktivität Stray inductance module		L _{sCE}		6,0	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T _c = 25°C, pro Schalter / per switch	R _{CC'+EE'} R _{AA'+CC'}		0,095 0,08	mΩ
Lagertemperatur Storage temperature		T _{stg}	-40		150 °C
Anzugsdrehmoment f. Modulmontage Mounting torque for modul mounting	Schraube M6 - Montage gem. gültiger Applikationsschrift Screw M6 - Mounting according to valid application note	M	4,25		5,75 Nm
Anzugsdrehmoment f. elektr. Anschlüsse Terminal connection torque	Schraube M4 - Montage gem. gültiger Applikationsschrift Screw M4 - Mounting according to valid application note Schraube M8 - Montage gem. gültiger Applikationsschrift Screw M8 - Mounting according to valid application note	M	1,8 8,0	- -	2,1 10 Nm
Gewicht Weight		G		1200	g

Vorläufige Daten Preliminary Data

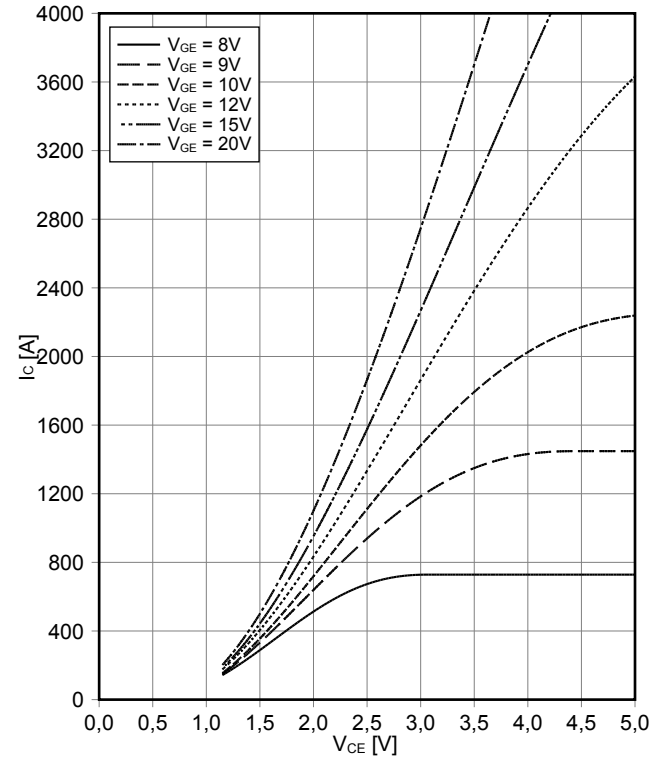
Ausgangskennlinie IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

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



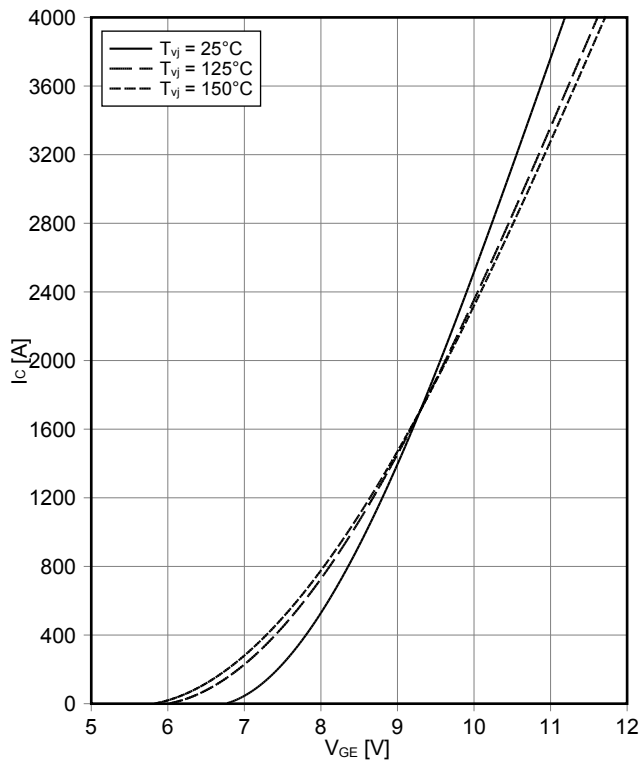
Ausgangskennlinienfeld IGBT, Wechselrichter (typisch)
output characteristic IGBT, Inverter (typical)

$I_C = f(V_{CE})$
 $T_{vj} = 150^\circ\text{C}$



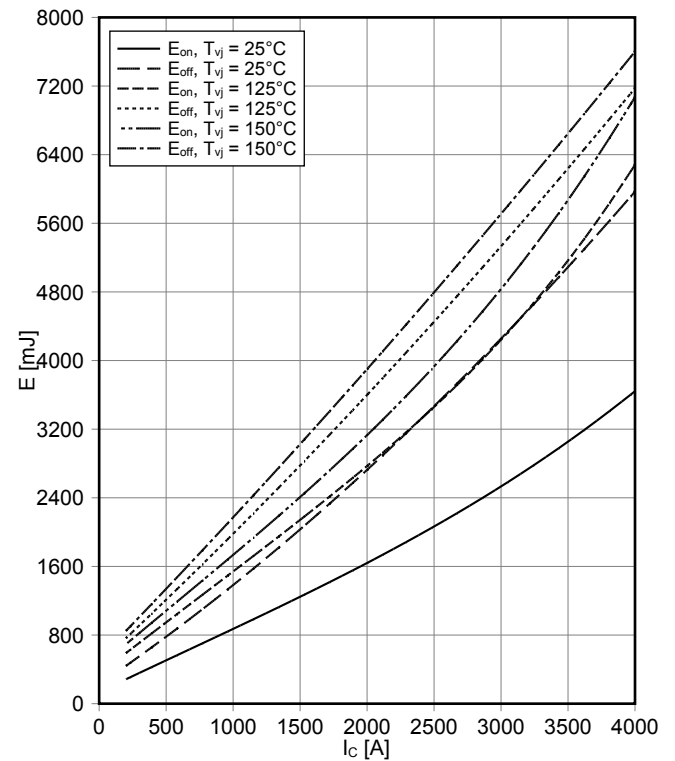
Übertragungscharakteristik IGBT, Wechselrichter (typisch)
transfer characteristic IGBT, Inverter (typical)

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



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

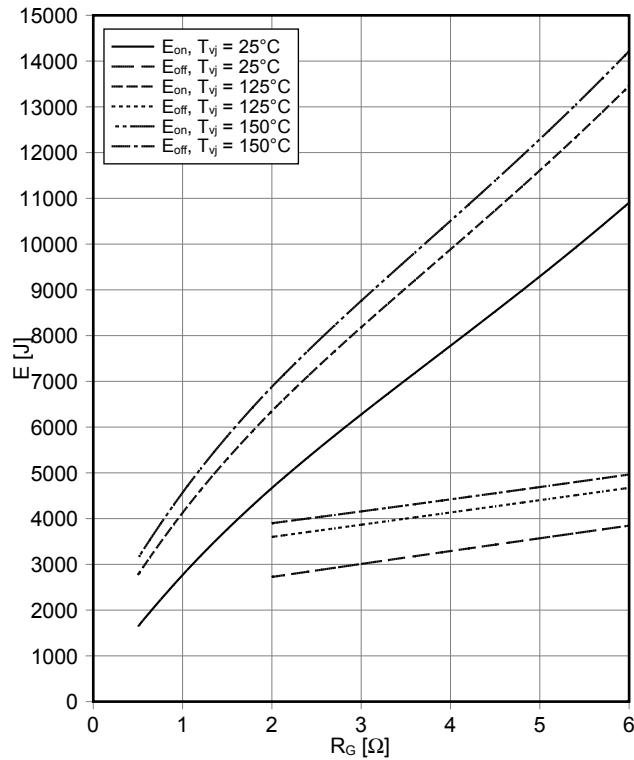
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.5\ \Omega$, $R_{Goff} = 2\ \Omega$, $V_{CE} = 1800\text{ V}$



Vorläufige Daten Preliminary Data

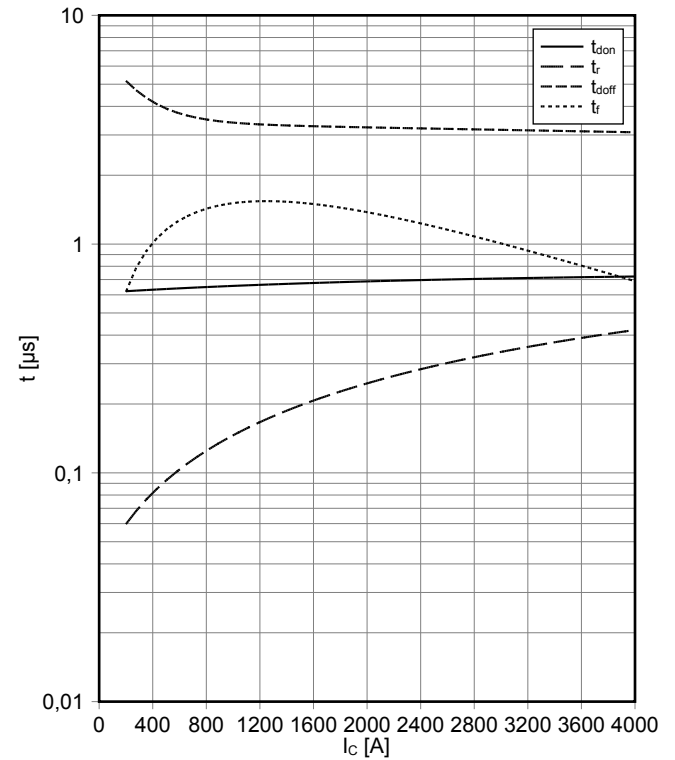
Schaltverluste IGBT, Wechselrichter (typisch) switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}, I_C = 2000 \text{ A}, V_{CE} = 1800 \text{ V}$



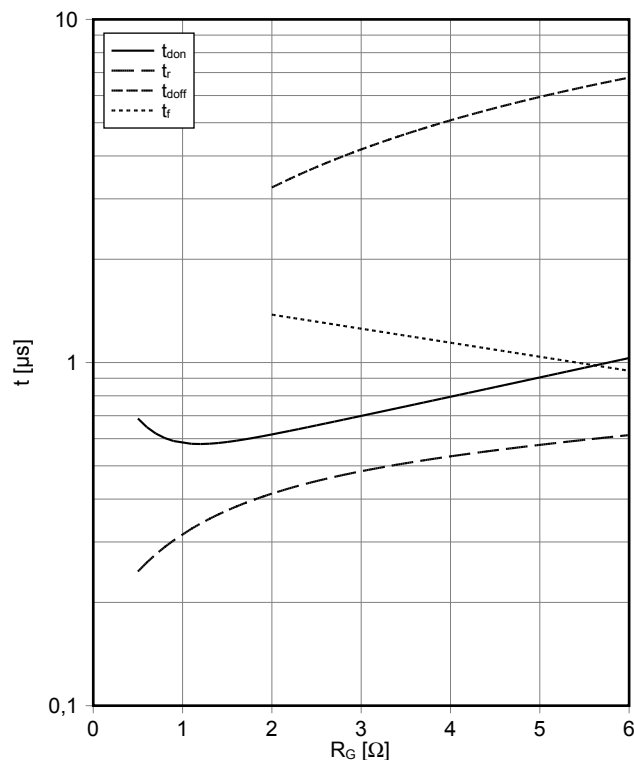
Schaltzeiten IGBT, Wechselrichter (typisch) switching times IGBT, Inverter (typical)

$t_{don} = f(I_C), t_r = f(I_C), t_{doff} = f(I_C), t_f = f(I_C)$
 $V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.5 \Omega, R_{Goff} = 2 \Omega, V_{CE} = 1800 \text{ V}, T_{vj} = 125^\circ\text{C}$



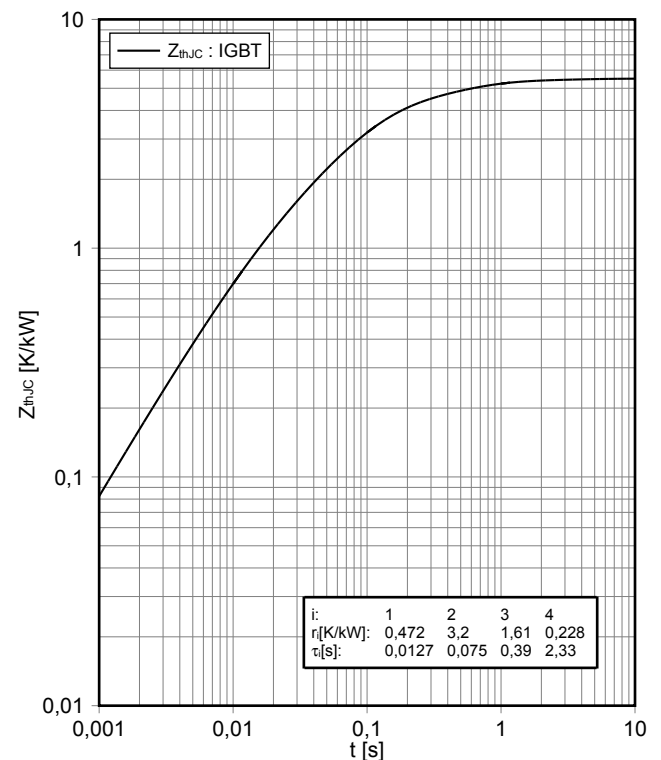
Schaltzeiten IGBT, Wechselrichter (typisch) switching times IGBT, Inverter (typical)

$t_{don} = f(R_G), t_r = f(R_G), t_{doff} = f(R_G), t_f = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}, I_C = 2000 \text{ A}, V_{CE} = 1800 \text{ V}, T_{vj} = 125^\circ\text{C}$



Transienter Wärmewiderstand IGBT, Wechselrichter transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$



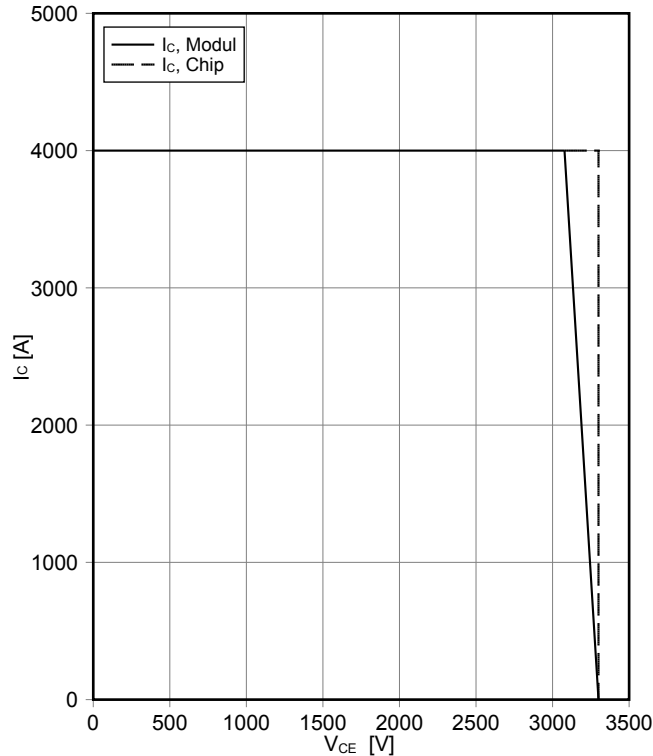
Vorläufige Daten Preliminary Data

Sicherer Rückwärts-Arbeitsbereich IGBT, Wechselrichter (RBSOA)

reverse bias safe operating area IGBT, Inverter (RBSOA)

$$I_C = f(V_{CE})$$

$V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 2\ \Omega$, $T_{vj} = 150^\circ\text{C}$

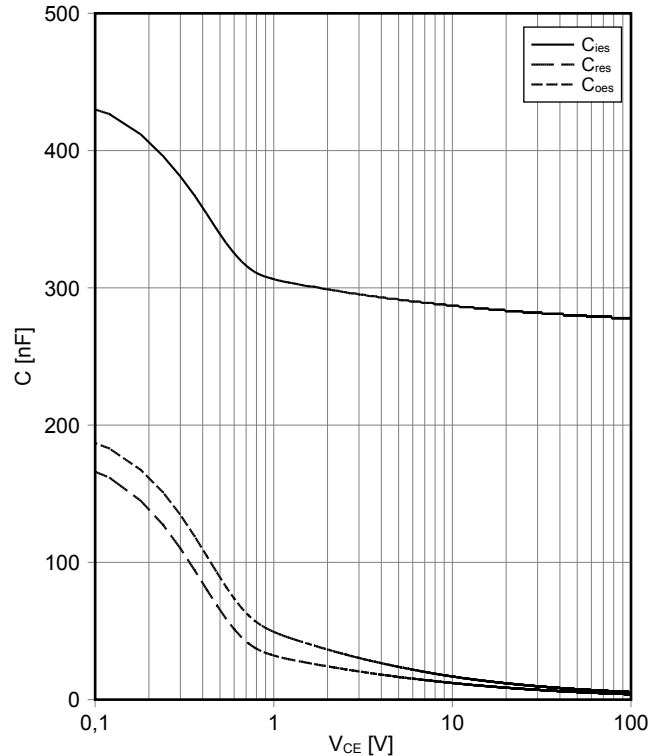


Kapazitäts Charakteristik IGBT, Wechselrichter (typisch)

capacity characteristic IGBT, Inverter (typical)

$$C = f(V_{CE})$$

$V_{GE} = 0\text{ V}$, $T_{vj} = 25^\circ\text{C}$, $f = 100\text{ kHz}$

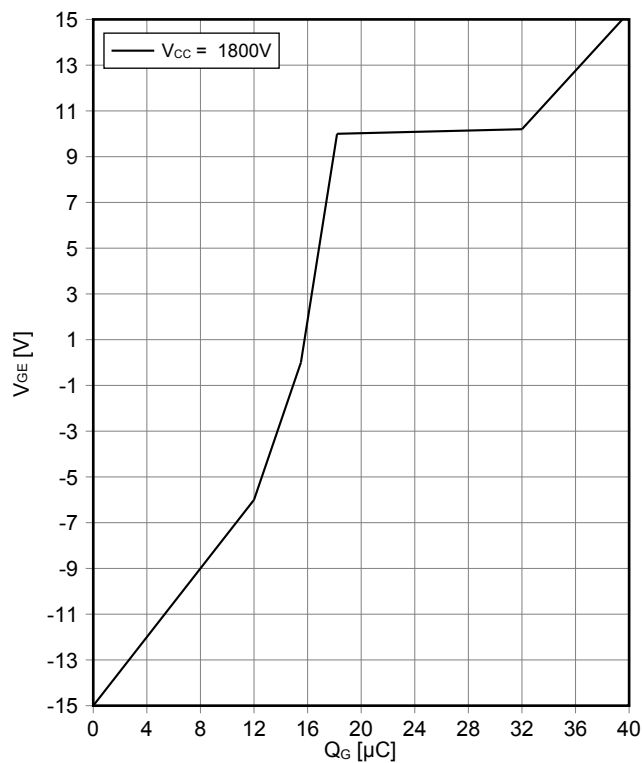


Gateladungs Charakteristik IGBT, Wechselrichter (typisch)

gate charge characteristic IGBT, Inverter (typical)

$$V_{GE} = f(Q_G)$$

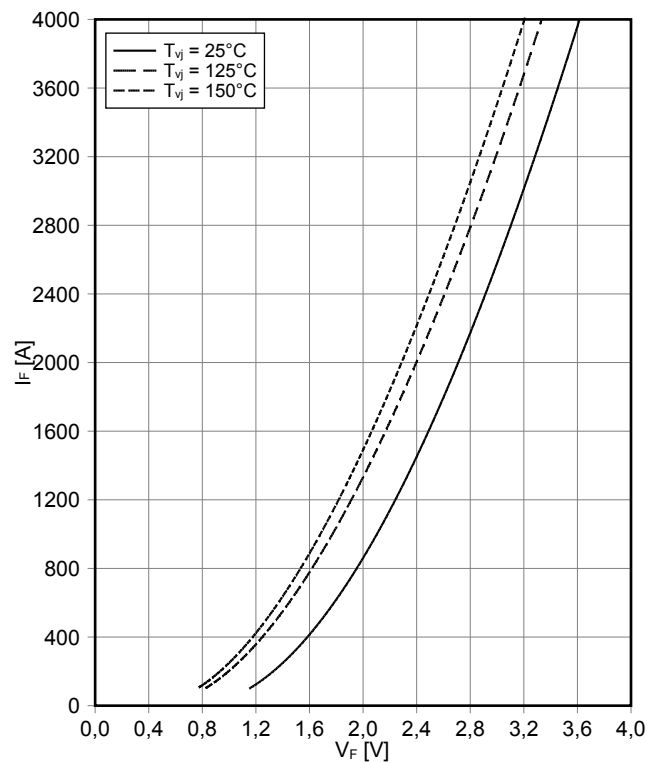
$I_C = 2000\text{ A}$, $T_{vj} = 25^\circ\text{C}$



Durchlasskennlinie der Diode, Wechselrichter (typisch)

forward characteristic of Diode, Inverter (typical)

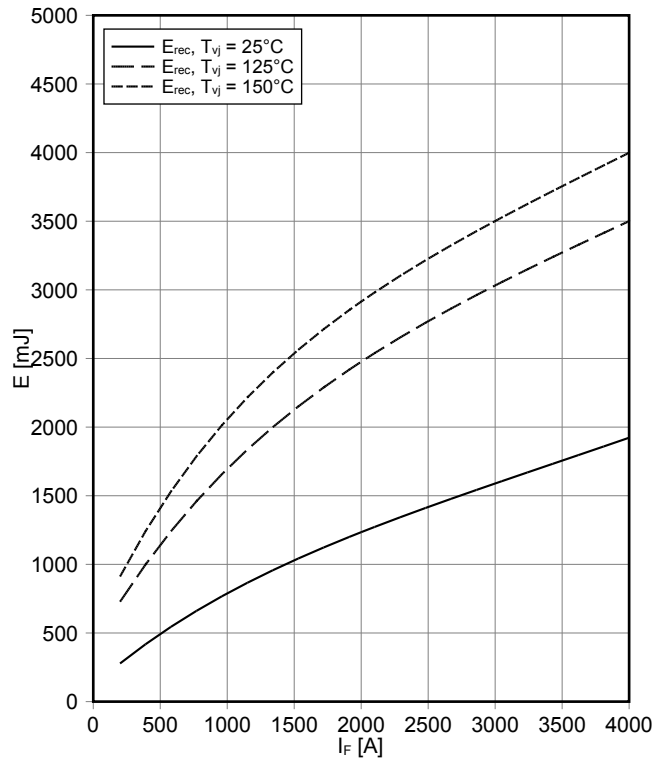
$$I_F = f(V_F)$$



Vorläufige Daten Preliminary Data

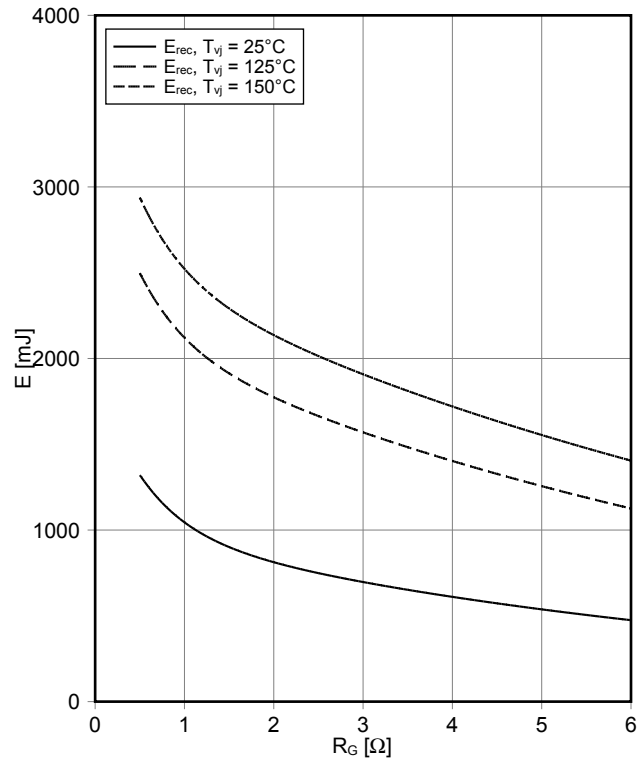
Schaltverluste Diode, Wechselrichter (typisch) switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.5 \Omega, V_{CE} = 1800 V$



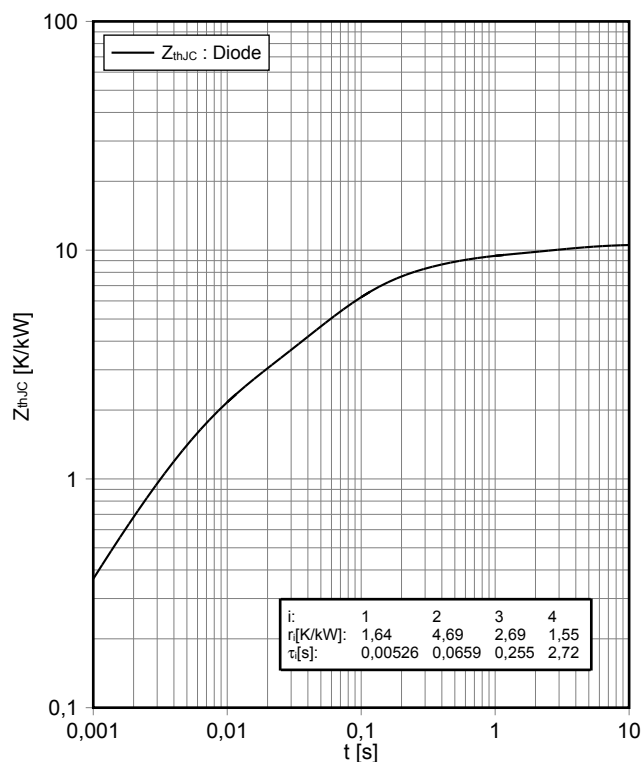
Schaltverluste Diode, Wechselrichter (typisch) switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$
 $I_F = 2000 A, V_{CE} = 1800 V$



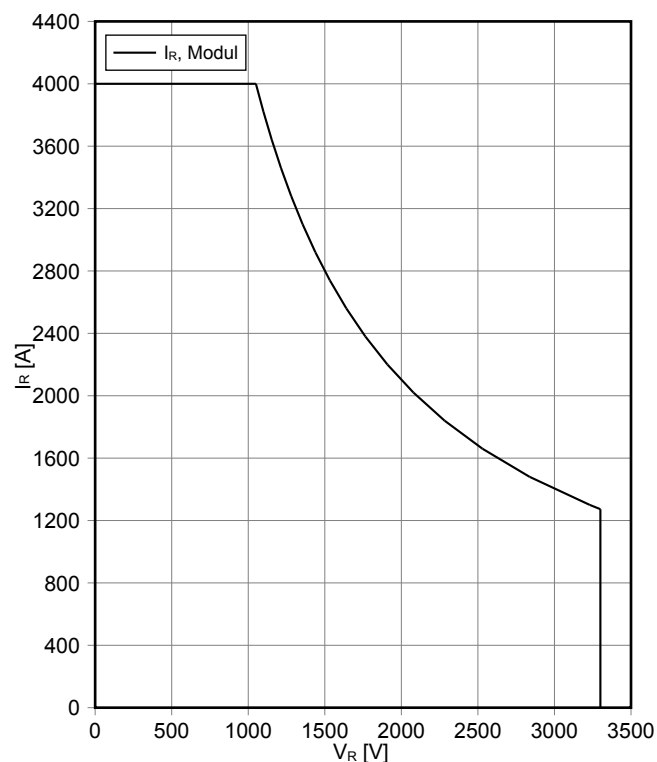
Transienter Wärmewiderstand Diode, Wechselrichter transient thermal impedance Diode, Inverter

$Z_{thJC} = f(t)$

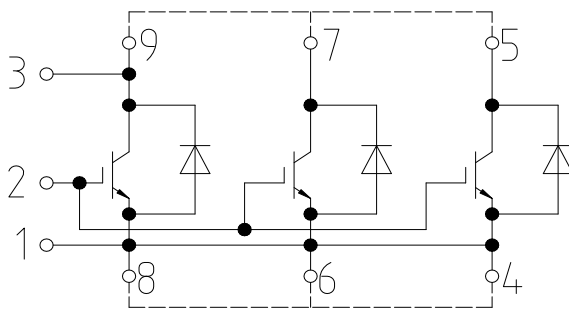


Sicherer Arbeitsbereich Diode, Wechselrichter (SOA) safe operation area Diode, Inverter (SOA)

$I_R = f(V_R)$
 $T_{vj} = 150^\circ C$



Schaltplan / Circuit diagram



external connection
(to be done)

Gehäuseabmessungen / Package outlines

