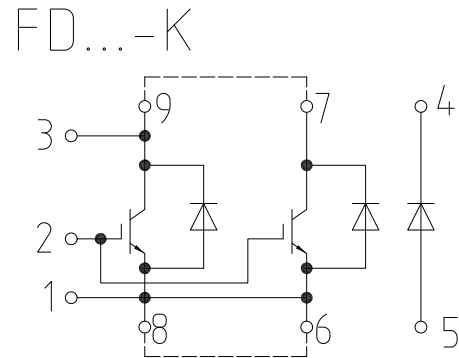


IHM-B Modul mit schnellem Trench/Feldstopp IGBT3 und Emitter Controlled 3 Diode
 IHM-B module with fast Trench/Fieldstop IGBT3 and Emitter Controlled 3 diode



$V_{CES} = 3300V$
 $I_{C\ nom} = 1000A / I_{CRM} = 2000A$

Potentielle Anwendungen

- Chopper-Anwendungen
- Mittelspannungsantriebe
- Motorantriebe
- Traktionsumrichter
- USV-Systeme
- Windgeneratoren

Potential Applications

- Chopper applications
- Medium voltage converters
- Motor drives
- Traction drives
- UPS systems
- Wind turbines

Elektrische Eigenschaften

- Große DC-Festigkeit
- Hohe Kurzschlussrobustheit
- Niedrige Schaltverluste
- Niedriges V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- V_{CEsat} mit positivem Temperaturkoeffizienten

Electrical Features

- High DC stability
- High short-circuit capability
- Low switching losses
- Low V_{CEsat}
- $T_{vj\ op} = 150^{\circ}C$
- V_{CEsat} with positive temperature coefficient

Mechanische Eigenschaften

- AlSiC Bodenplatte für erhöhte thermische Lastwechselfestigkeit
- Gehäuse mit CTI > 600
- IHM B Gehäuse
- Isolierte Bodenplatte

Mechanical Features

- AlSiC base plate for increased thermal cycling capability
- Package with CTI > 600
- IHM B housing
- Isolated base plate

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

IGBT, Brems-Chopper / IGBT, Brake-Chopper 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	$T_C = 95^{\circ}\text{C}$, $T_{vj\text{max}} = 150^{\circ}\text{C}$	I_{CDC}	1000	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	$t_P = 1\text{ ms}$	I_{CRM}	2000	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	$I_C = 1000\text{ A}$ $V_{GE} = 15\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	$V_{CE\text{sat}}$	2,55 3,00 3,15	3,10 3,45	V V V	
Gate-Schwellenspannung Gate threshold voltage	$I_C = 48,0\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^{\circ}\text{C}$		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	28,0			μC
Interner Gatewiderstand Internal gate resistor	$T_{vj} = 25^{\circ}\text{C}$		R_{Gint}	0,63			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}	190			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}	4,00			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	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,71\ \Omega$, $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{don}	0,35 0,38 0,38			μs μs μs
Anstiegszeit, induktive Last Rise time, inductive load	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Gon} = 0,71\ \Omega$, $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_r	0,35 0,38 0,38			μs μs μs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,3\ \Omega$, $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_{doff}	3,00 3,20 3,20			μs μs μs
Fallzeit, induktive Last Fall time, inductive load	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$ $V_{GE} = -15 / 15\text{ V}$ $R_{Goff} = 2,3\ \Omega$, $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	t_f	0,30 0,35 0,35			μs μs μs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$, $L_{\sigma} = 85\text{ nH}$ $di/dt = 3000\text{ A}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GE} = -15 / 15\text{ V}$, $R_{Gon} = 0,71\ \Omega$ $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{on}	1250 1700 1950			mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	$I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$, $L_{\sigma} = 85\text{ nH}$ $du/dt = 2100\text{ V}/\mu\text{s}$ ($T_{vj} = 150^{\circ}\text{C}$) $V_{GE} = -15 / 15\text{ V}$, $R_{Goff} = 2,3\ \Omega$ $C_{GE} = 220\text{ nF}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{off}	1050 1400 1550			mJ mJ mJ
Kurzschlußverhalten SC data	$V_{GE} \leq 15\text{ V}$, $V_{CE} = 2500\text{ V}$ $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 10\ \mu\text{s}$, $T_{vj} = 150^{\circ}\text{C}$		I_{SC}	4300			A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT		R_{thJC}		11,0		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}		14,5		K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\text{op}}$	-40	150		$^{\circ}\text{C}$

Diode, Brems-Chopper / Diode, Brake-Chopper Höchstzulässige Werte / Maximum Rated Values

Periodische Spitzenspernung 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	1000	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	2000	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	260 245	kA^2s kA^2s
Spitzenverlustleistung Maximum power dissipation	$T_{vj} = 150^{\circ}\text{C}$	P_{RQM}	1600	kW
Mindesteinschaltzeit Minimum turn-on time		$t_{on\ min}$	10,0	μs

Charakteristische Werte / Characteristic Values

		min.	typ.	max.	
Durchlassspannung Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$		3,10	3,85	V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$		2,75	3,25	V
	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$		2,65		V
Rückstromspitze Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$		1000		A
	$V_R = 1800\text{ V}$		1200		A
	$V_{GE} = -15\text{ V}$		1250		A
Sperrverzögerungsladung Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$		450		μC
	$V_R = 1800\text{ V}$		900		μC
	$V_{GE} = -15\text{ V}$		1050		μC
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$		450		mJ
	$V_R = 1800\text{ V}$		1100		mJ
	$V_{GE} = -15\text{ V}$		1300		mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode	R_{thJC}		20,0	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}		16,5	K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\ op}$	-40	150	$^{\circ}\text{C}$

Diode, Revers / Diode, Reverse 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	1000	A
Periodischer Spitzenstrom Repetitive peak forward current	$t_P = 1\text{ ms}$	I_{FRM}	2000	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	260 245	kA^2s kA^2s
Spitzenverlustleistung Maximum power dissipation	$T_{vj} = 150^{\circ}\text{C}$	P_{RQM}	1600	kW
Mindesteinschaltdauer Minimum turn-on time		$t_{on\ min}$	10,0	μs

Charakteristische Werte / Characteristic Values

		min. typ. max.				
Durchlassspannung Forward voltage	$I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$ $I_F = 1000\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	V_F	3,10 2,75 2,65	3,85 3,25 V	V V V
Rückstromspitze Peak reverse recovery current	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	I_{RM}	1000 1200 1250		A A A
Sperrverzögerungsladung Recovered charge	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	Q_r	450 900 1050		μC μC μC
Abschaltenergie pro Puls Reverse recovery energy	$I_F = 1000\text{ A}, -di_F/dt = 3000\text{ A}/\mu\text{s} (T_{vj}=150^{\circ}\text{C})$ $V_R = 1800\text{ V}$	$T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 125^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	E_{rec}	450 1100 1300		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode		R_{thJC}		21,5	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}		16,5	K/kW
Temperatur im Schaltbetrieb Temperature under switching conditions			$T_{vj\ op}$	-40	150	$^{\circ}\text{C}$

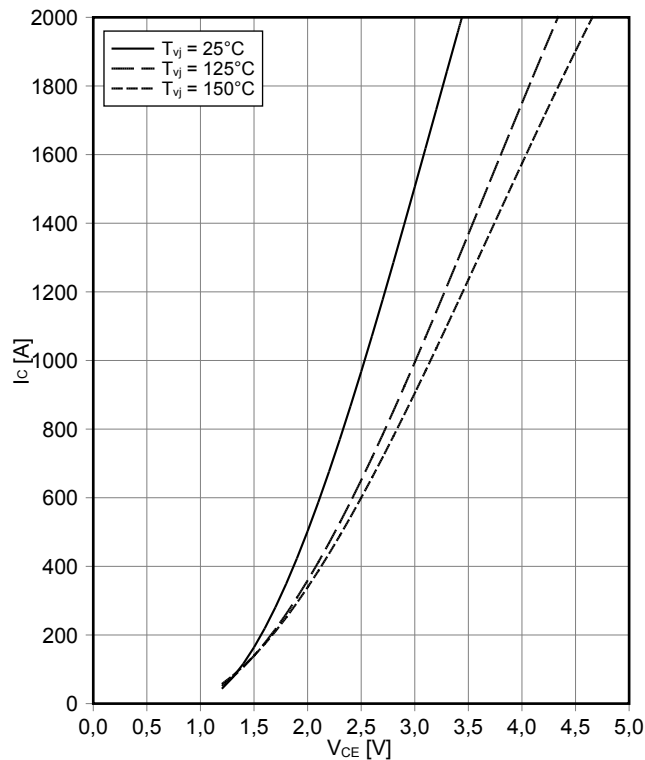
Modul / Module

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}		9,0	nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T _c = 25°C, pro Schalter / per switch	R _{CC'+EE'} R _{AA'+CC'}		0,19 0,28	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

Modulinduktivität: IGBT (Zweig 1+2 parallel): 9nH; Diode (Zweig 3): 18nH
 stray inductance module: IGBT (arm 1+2 parallel): 9nH; diode (arm 3): 18nH

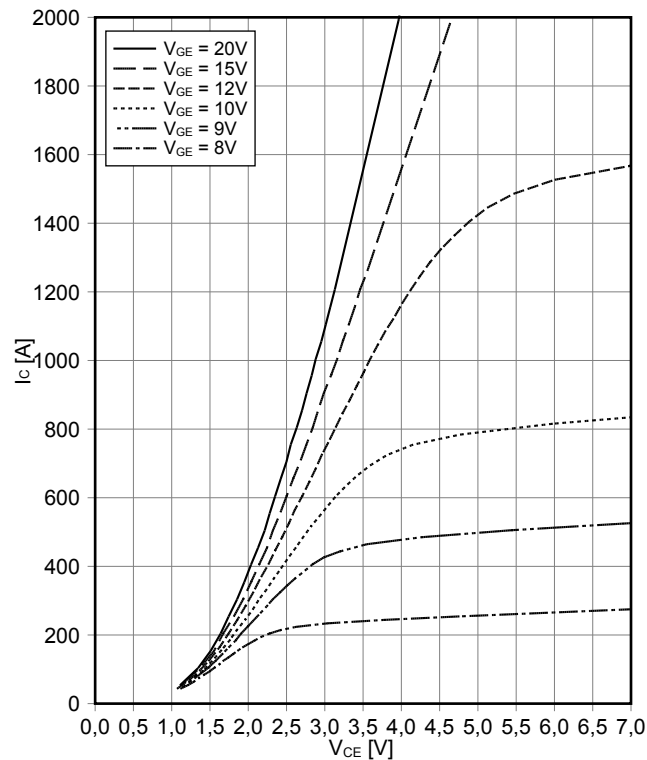
Ausgangskennlinie IGBT, Brems-Chopper (typisch)
output characteristic IGBT, Brake-Chopper (typical)

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



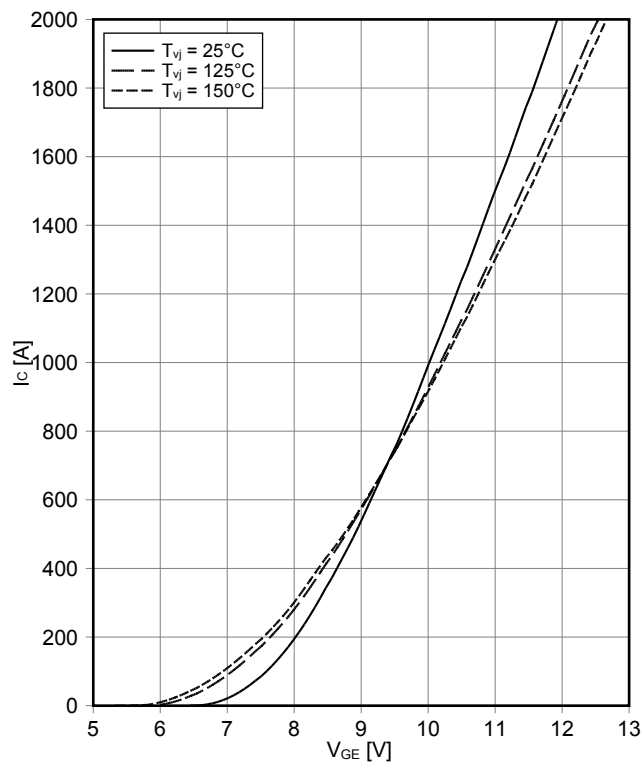
Ausgangskennlinienfeld IGBT, Brems-Chopper (typisch)
output characteristic IGBT, Brake-Chopper (typical)

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



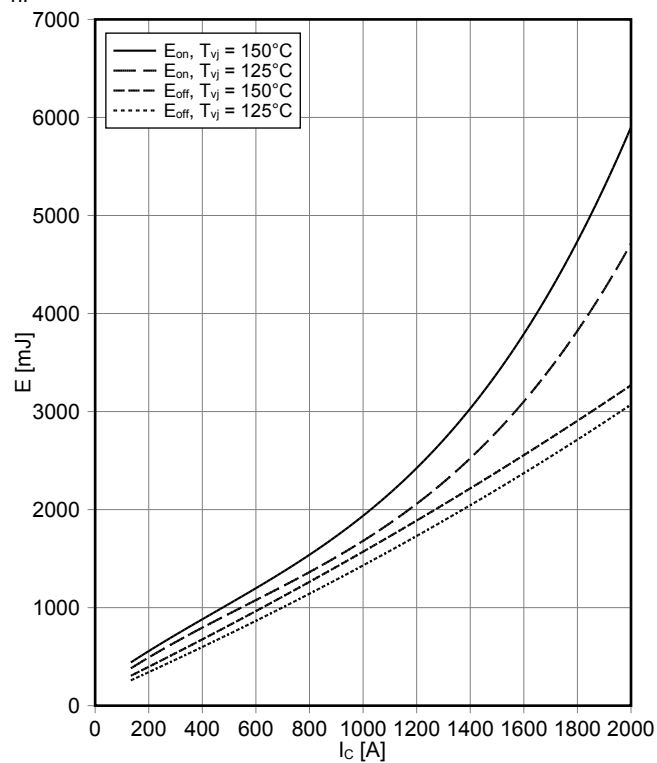
Übertragungscharakteristik IGBT, Brems-Chopper (typisch)
transfer characteristic IGBT, Brake-Chopper (typical)

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



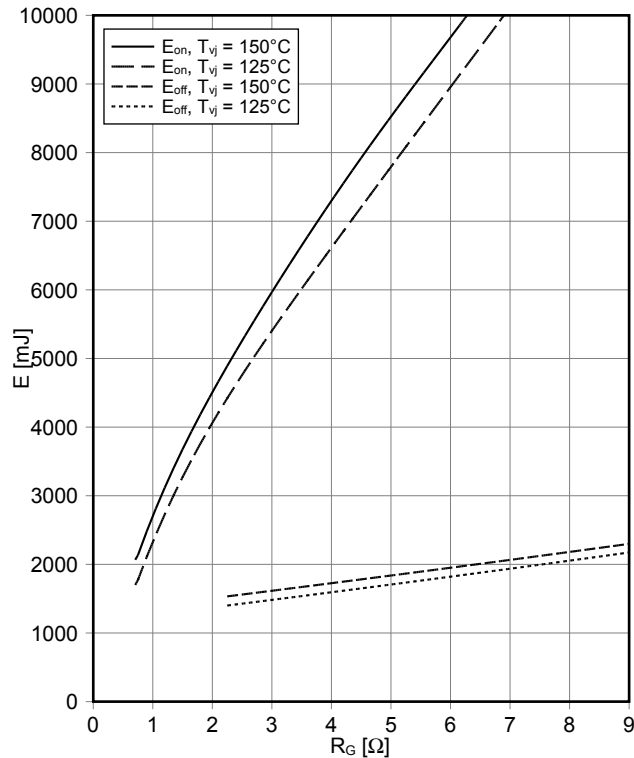
Schaltverluste IGBT, Brems-Chopper (typisch)
switching losses IGBT, Brake-Chopper (typical)

$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.71\ \Omega$, $R_{Goff} = 2.3\ \Omega$, $V_{CE} = 1800\text{ V}$, $C_{GE} = 220\text{ nF}$



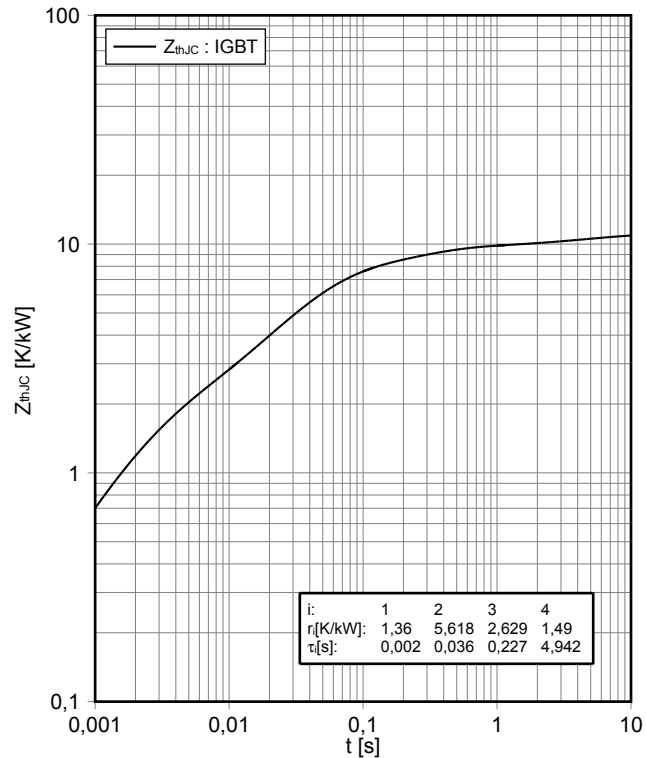
Schaltverluste IGBT, Brems-Chopper (typisch) switching losses IGBT, Brake-Chopper (typical)

$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
 $V_{GE} = \pm 15\text{ V}$, $I_C = 1000\text{ A}$, $V_{CE} = 1800\text{ V}$, $C_{GE} = 220\text{ nF}$



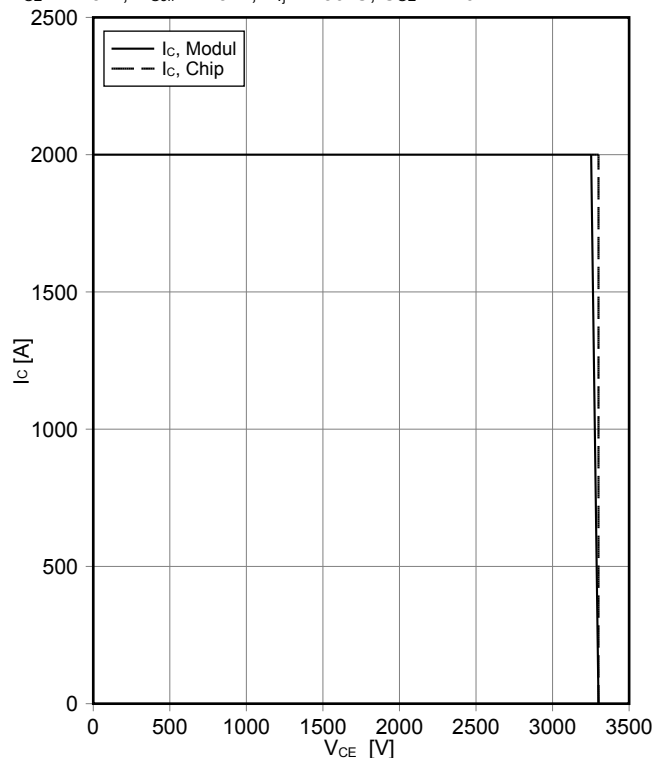
Transienter Wärmewiderstand IGBT, Brems-Chopper transient thermal impedance IGBT, Brake-Chopper

$Z_{thJC} = f(t)$



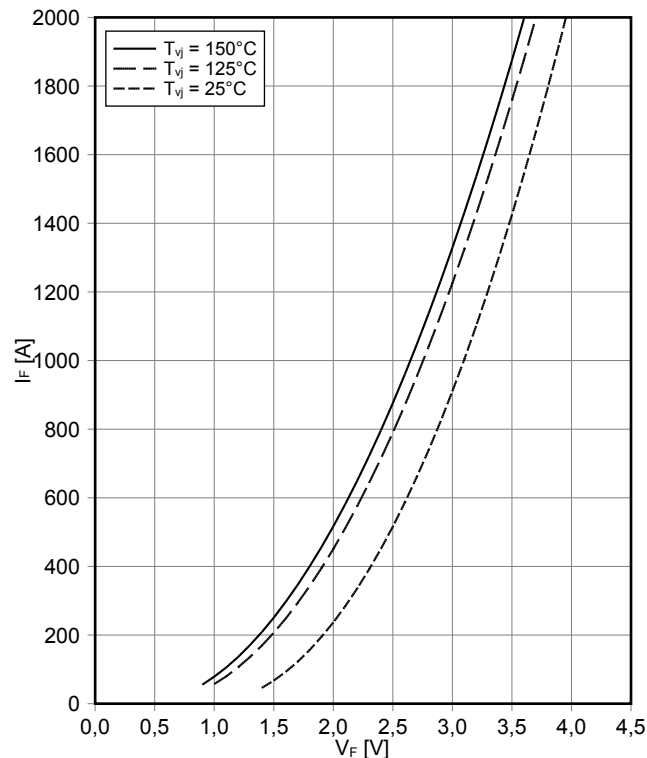
Sicherer Rückw.-Arbeitsber. IGBT, Brems-Chopper (RBSOA) reverse bias safe operating area IGBT, Brake-Chopper (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 2.3\ \Omega$, $T_{vj} = 150^\circ\text{C}$, $C_{GE} = 220\text{ nF}$



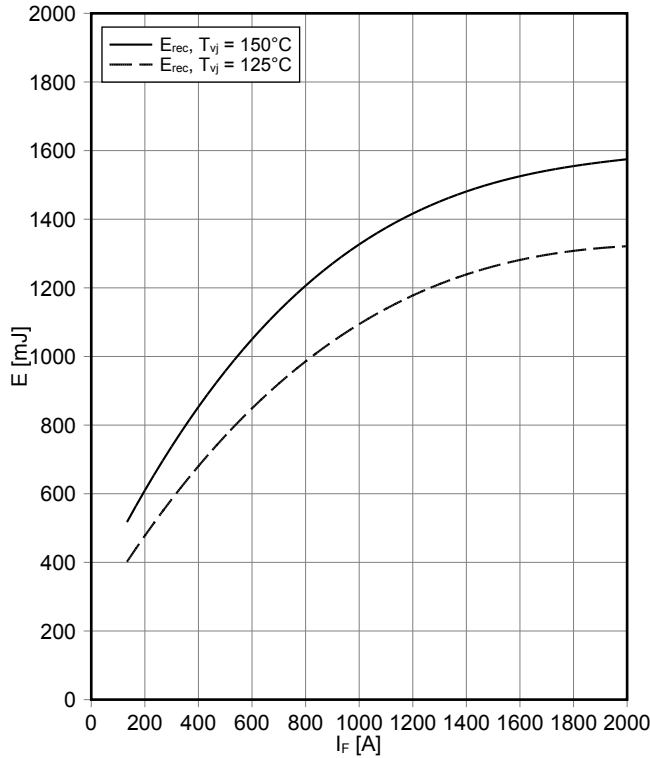
Durchlasskennlinie der Diode, Brems-Chopper (typisch) forward characteristic of Diode, Brake-Chopper (typical)

$I_F = f(V_F)$



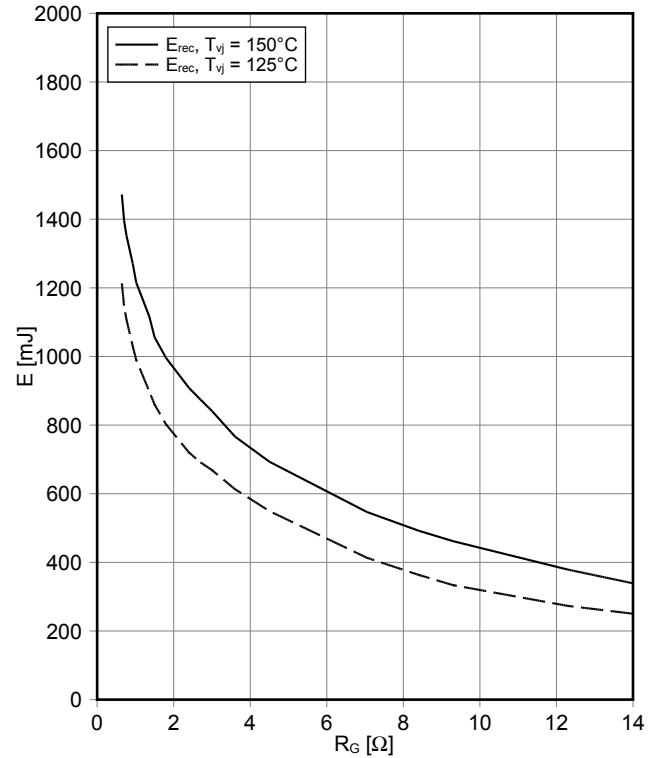
Schaltverluste Diode, Brems-Chopper (typisch)
switching losses Diode, Brake-Chopper (typical)

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.71 \Omega, V_{CE} = 1800 V$



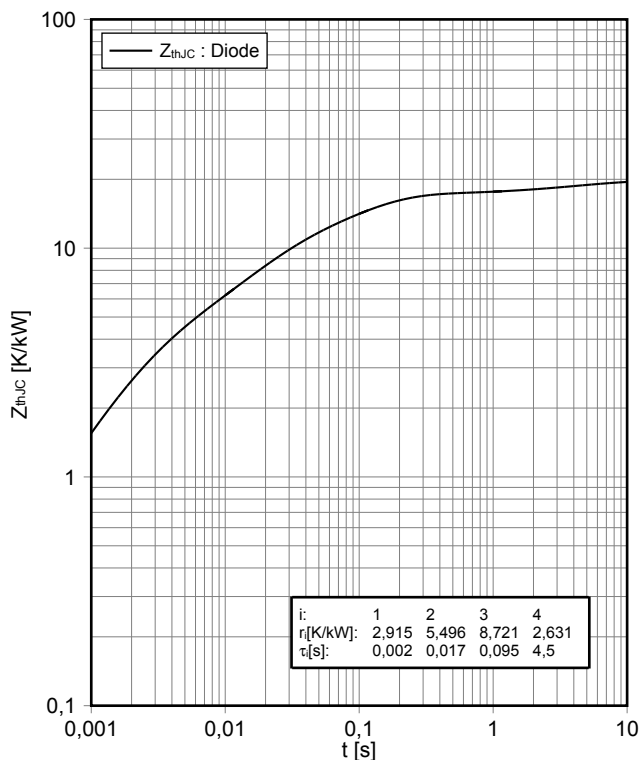
Schaltverluste Diode, Brems-Chopper (typisch)
switching losses Diode, Brake-Chopper (typical)

$E_{rec} = f(R_G)$
 $I_F = 1000 A, V_{CE} = 1800 V$



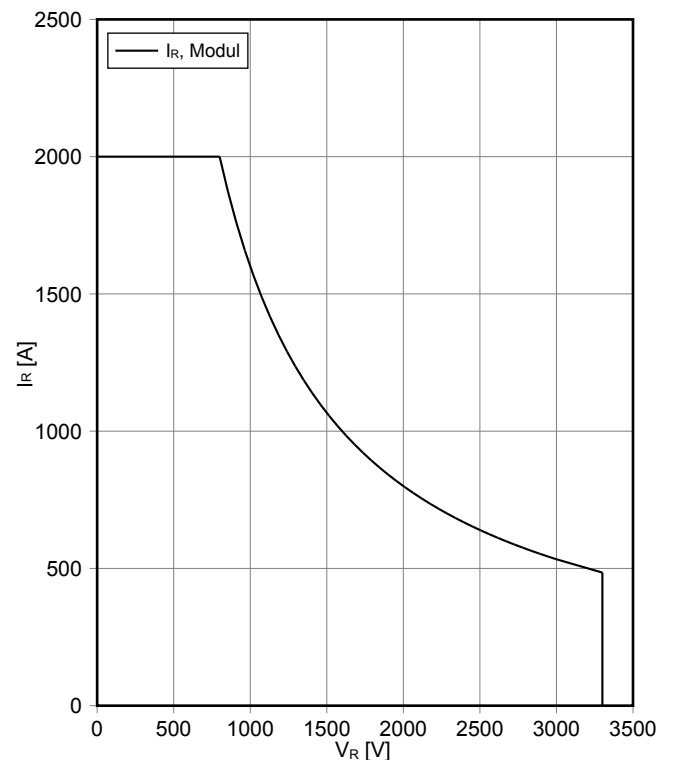
Transienter Wärmewiderstand Diode, Brems-Chopper
transient thermal impedance Diode, Brake-Chopper

$Z_{thJC} = f(t)$

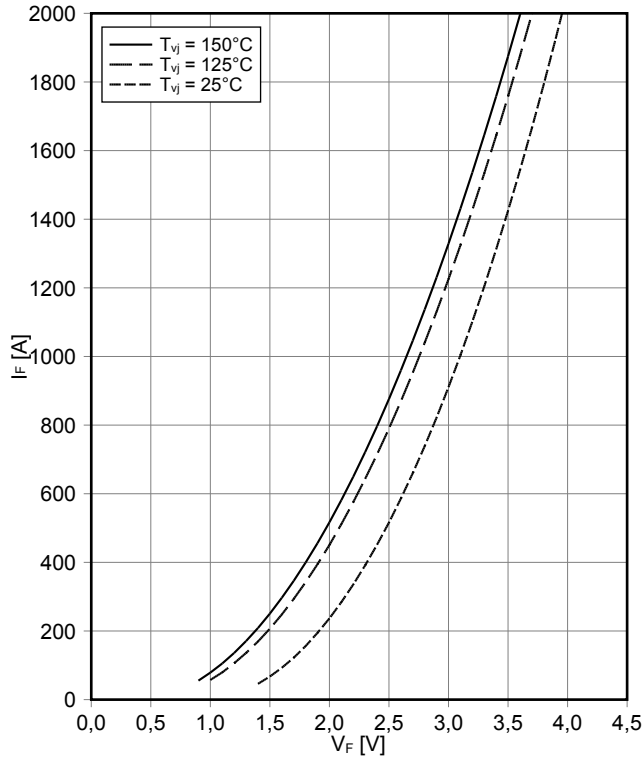


Sicherer Arbeitsbereich Diode, Brems-Chopper (SOA)
safe operation area Diode, Brake-Chopper (SOA)

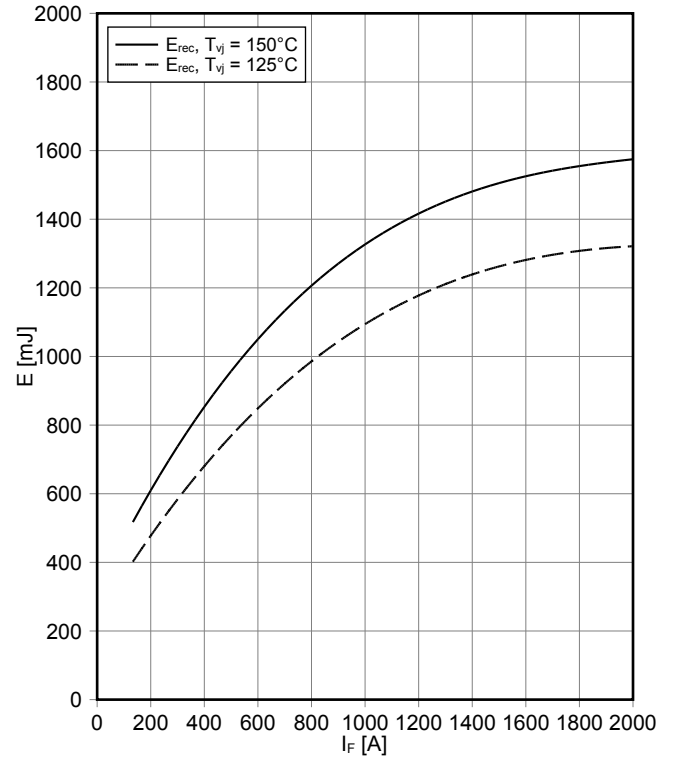
$I_R = f(V_R)$
 $T_{vj} = 150^\circ C$



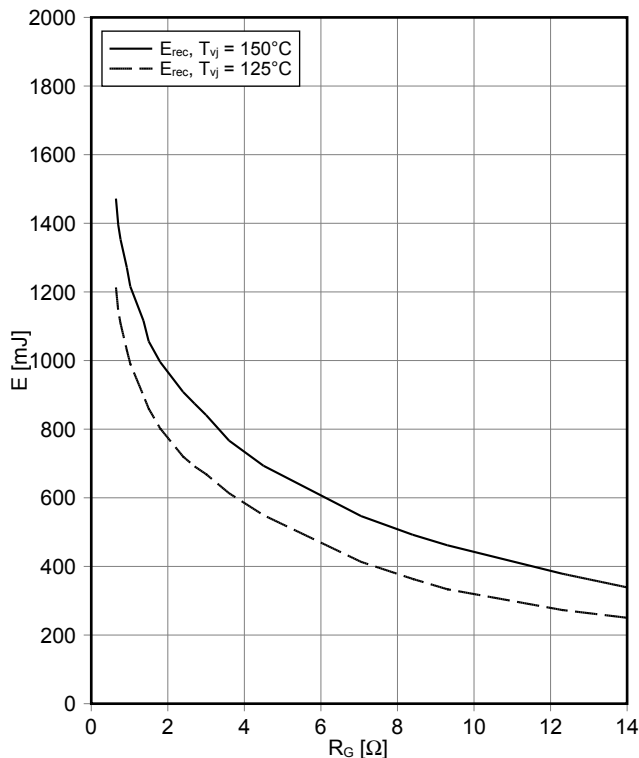
Durchlasskennlinie der Diode, Revers (typisch)
forward characteristic of Diode, Reverse (typical)
 $I_F = f(V_F)$



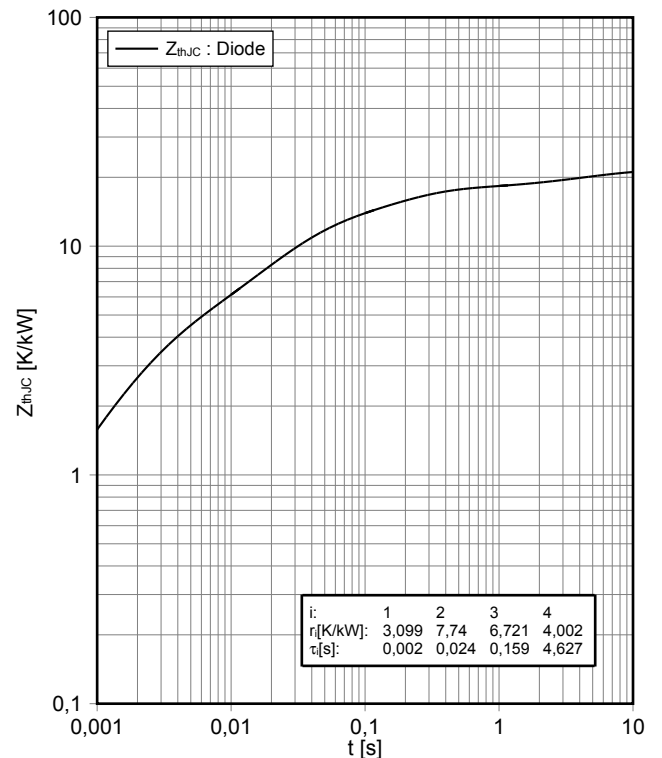
Schaltverluste Diode, Revers (typisch)
switching losses Diode, Reverse (typical)
 $E_{rec} = f(I_F)$
 $R_{Gon} = 0.71 \Omega, V_{CE} = 1800 \text{ V}$



Schaltverluste Diode, Revers (typisch)
switching losses Diode, Reverse (typical)
 $E_{rec} = f(R_G)$
 $I_F = 1000 \text{ A}, V_{CE} = 1800 \text{ V}$

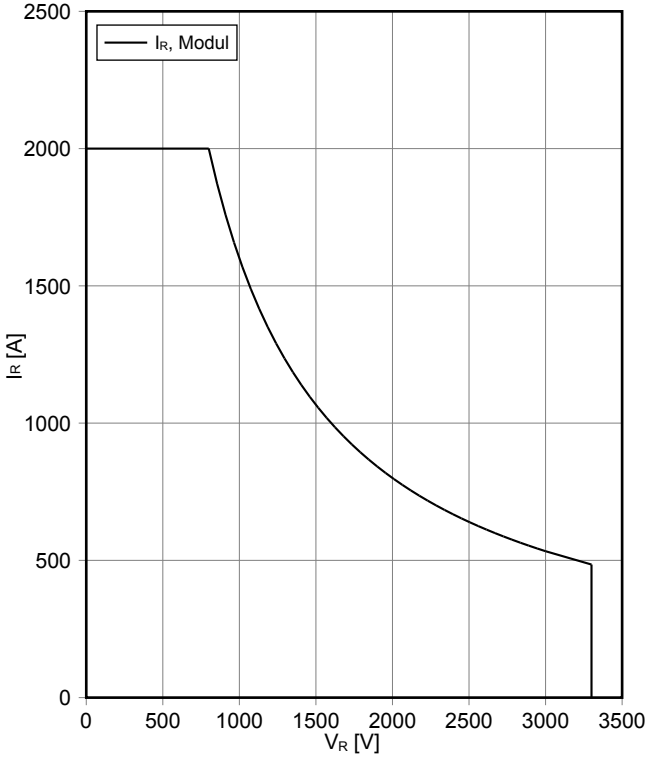


Transienter Wärmewiderstand Diode, Revers
transient thermal impedance Diode, Reverse
 $Z_{thJC} = f(t)$



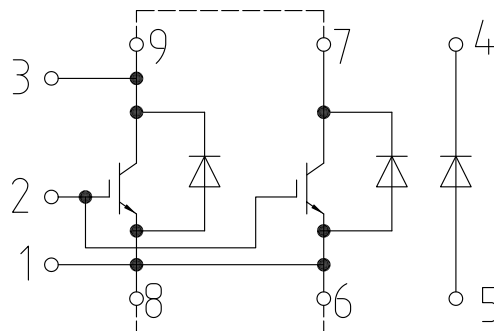
Sicherer Arbeitsbereich Diode, Revers (SOA)
safe operation area Diode, Reverse (SOA)

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



Schaltplan / Circuit diagram

FD...-K



Gehäuseabmessungen / Package outlines

