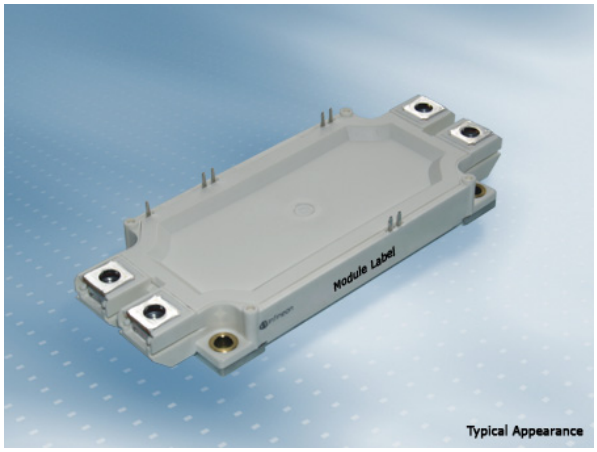
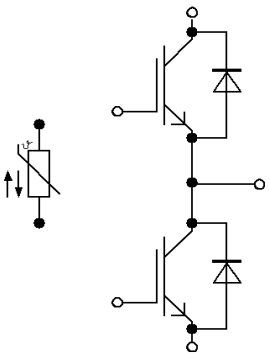
EconoDUAL™3 Modul mit schnellem Trench/Feldstopp IGBT4 und Emitter Controlled Diode und NTC
EconoDUAL™3 module with fast Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC





V_{CES} = 650V
$I_{C\ nom}$ = 450A / I_{CRM} = 900A

Potentielle Anwendungen
- Hybrid-Nutzfahrzeuge
- Motorantriebe
- Solar Anwendungen
- USV-Systeme

Potential Applications
- Commercial Agriculture Vehicles
- Motor drives
- Solar applications
- UPS systems

Elektrische Eigenschaften
- Erhöhte Sperrspannungsfestigkeit auf 650V
- Erhöhte Zwischenkreisspannung
- Hohe Kurzschlussrobustheit
- Hohe Stoßstromfestigkeit
- Hohe Stromdichte
- $T_{vj\ op}$ = 150°C
- Trench IGBT 4

Electrical Features
- Increased blocking voltage capability up to 650V
- Increased DC-link voltage
- High short-circuit capability
- High surge current capability
- High current density
- $T_{vj\ op}$ = 150°C
- Trench IGBT 4

Mechanische Eigenschaften
- Hohe Leistungsdichte
- Integrierter NTC Temperatur Sensor
- Isolierte Bodenplatte
- Kupferbodenplatte
- Standardgehäuse

Mechanical Features
- High power density
- Integrated NTC temperature sensor
- Isolated base plate
- Copper base plate
- Standard housing

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} = 25°C	V_{CES}	650	V
Kollektor-Dauergleichstrom Continuous DC collector current	T_C = 70°C, $T_{vj\,max}$ = 175°C	I_{CDC}	450	A
Periodischer Kollektor-Spitzenstrom Repetitive peak collector current	t_P = 1 ms	I_{CRM}	900	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 = 450 A, V_{GE} = 15 V T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$V_{CE\,sat}$		1,55 1,70 1,75	1,95	V V V
Gate-Schwellenspannung Gate threshold voltage	I_C = 7,20 mA, V_{CE} = V_{GE}, T_{vj} = 25°C	V_{GEth}	5,10	5,80	6,40	V
Gateladung Gate charge	V_{GE} = -15 / 15 V	Q_G		4,80		µC
Interner Gatewiderstand Internal gate resistor	T_{vj} = 25°C	R_{Gint}		0,67		Ω
Eingangskapazität Input capacitance	f = 1000 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{ies}		27,5		nF
Rückwirkungskapazität Reverse transfer capacitance	f = 1000 kHz, T_{vj} = 25°C, V_{CE} = 25 V, V_{GE} = 0 V	C_{res}		0,82		nF
Kollektor-Emitter-Reststrom Collector-emitter cut-off current	V_{CE} = 650 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 = 450 A, V_{CE} = 300 V, V_{GE} = -15 / 15 V, R_{Gon} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,on}$		0,085 0,089 0,093		µs µs µs
Anstiegszeit, induktive Last Rise time, inductive load	I_C = 450 A, V_{CE} = 300 V, V_{GE} = -15 / 15 V, R_{Gon} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_r		0,082 0,087 0,088		µs µs µs
Abschaltverzögerungszeit, induktive Last Turn-off delay time, inductive load	I_C = 450 A, V_{CE} = 300 V, V_{GE} = -15 / 15 V, R_{Goff} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	$t_{d\,off}$		0,48 0,51 0,52		µs µs µs
Fallzeit, induktive Last Fall time, inductive load	I_C = 450 A, V_{CE} = 300 V, V_{GE} = -15 / 15 V, R_{Goff} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	t_f		0,067 0,093 0,099		µs µs µs
Einschaltverlustenergie pro Puls Turn-on energy loss per pulse	I_C = 450 A, V_{CE} = 300 V, Lσ = 30 nH, di/dt = 4900 A/µs (T_{vj} = 150°C), V_{GE} = -15 / 15 V, R_{Gon} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{on}		3,40 4,60 4,90		mJ mJ mJ
Abschaltverlustenergie pro Puls Turn-off energy loss per pulse	I_C = 450 A, V_{CE} = 300 V, Lσ = 30 nH, du/dt = 2600 V/µs (T_{vj} = 150°C), V_{GE} = -15 / 15 V, R_{Goff} = 1,8 Ω T_{vj} = 25°C T_{vj} = 125°C T_{vj} = 150°C	E_{off}		23,5 28,5 30,0		mJ mJ mJ
Kurzschlußverhalten SC data	V_{GE} ≤ 15 V, V_{CC} = 360 V V_{CEmax} = V_{CES} -L_{sCE} ·di/dt, t_P ≤ 10 µs, T_{vj} = 150°C	I_{SC}		2400		A
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro IGBT / per IGBT	R_{thJC}			0,102	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}		0,0390		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}	650	V
Dauergleichstrom Continuous DC forward current		I_F	450	A
Periodischer Spitzenstrom Repetitive peak forward current	t_P = 1 ms	I_{FRM}	900	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	15000 14500	A²s A²s

Charakteristische Werte / Characteristic Values

			min.	typ.	max.	
Durchlassspannung Forward voltage	I_F = 450 A, V_{GE} = 0 V, T_{vj} = 25°C I_F = 450 A, V_{GE} = 0 V, T_{vj} = 125°C I_F = 450 A, V_{GE} = 0 V, T_{vj} = 150°C	V_F		1,55 1,50 1,45	1,95	V V V
Rückstromspitze Peak reverse recovery current	I_F = 450 A, - di_F/dt = 4900 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 300 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	I_{RM}		185 270 285		A A A
Sperrverzögerungsladung Recovered charge	I_F = 450 A, - di_F/dt = 4900 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 300 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	Q_r		26,5 30,0 35,5		µC µC µC
Abschaltenergie pro Puls Reverse recovery energy	I_F = 450 A, - di_F/dt = 4900 A/µs (T_{vj}=150°C), T_{vj} = 25°C V_R = 300 V, T_{vj} = 125°C V_{GE} = -15 V, T_{vj} = 150°C	E_{rec}		5,90 8,90 10,5		mJ mJ mJ
Wärmewiderstand, Chip bis Gehäuse Thermal resistance, junction to case	pro Diode / per diode	R_{thJC}			0,165	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}		0,0400		K/W
Temperatur im Schaltbetrieb Temperature under switching conditions		$T_{vj\,op}$	-40		150	°C

NTC-Widerstand / NTC-Thermistor

Charakteristische Werte / Characteristic Values

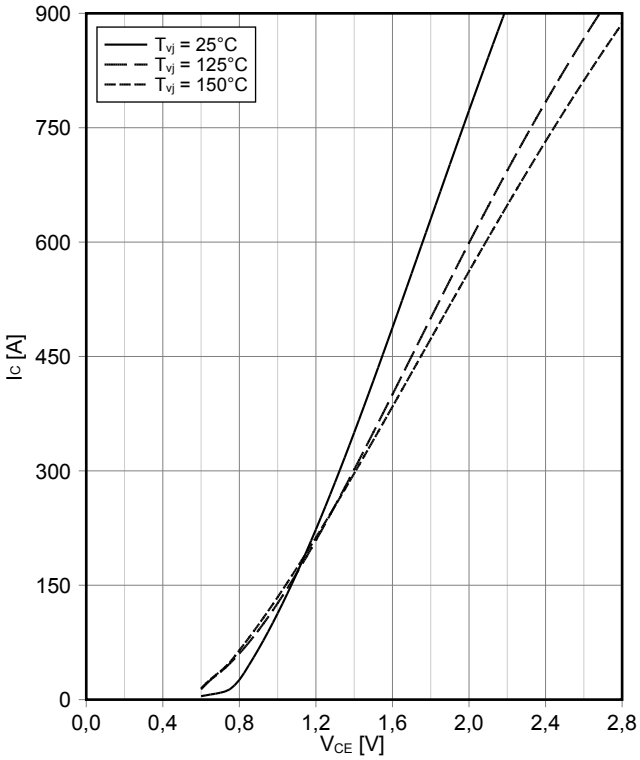
			min.	typ.	max.	
Nennwiderstand Rated resistance	T_{NTC} = 25°C	R_{25}		5,00		kΩ
Abweichung von R100 Deviation of R100	T_{NTC} = 100°C, R_{100} = 493 Ω	ΔR/R	-5		5	%
Verlustleistung Power dissipation	T_{NTC} = 25°C	P_{25}			20,0	mW
B-Wert B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298{,}15\ K))]$	$B_{25/50}$		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.

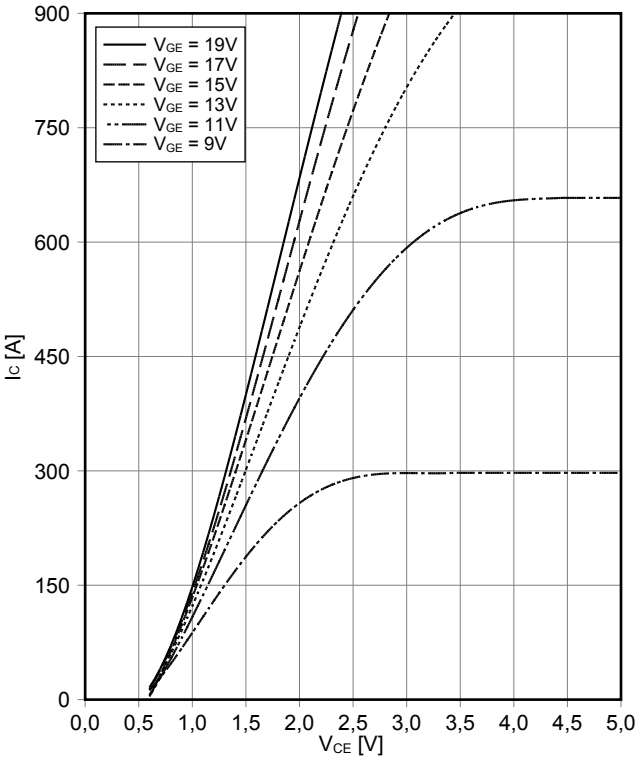
Modul / Module

Isolations-Prüfspannung Isolation test voltage	RMS, f = 50 Hz, t = 1 min.	V_{ISOL}		2,5		kV
Material Modulgrundplatte Material of module baseplate				Cu		
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			14,5 13,0		mm
Luftstrecke Clearance	Kontakt - Kühlkörper / terminal to heatsink Kontakt - Kontakt / terminal to terminal			12,5 10,0		mm
Vergleichszahl der Kriechwegbildung Comperative tracking index		CTI		> 200		
			min.	typ.	max.	
Modulstreuinduktivität Stray inductance module		L_{sCE}		20		nH
Modulleitungswiderstand, Anschlüsse - Chip Module lead resistance, terminals - chip	T_C = 25°C, pro Schalter / per switch	$R_{CC'+EE'}$		1,10		mΩ
Lagertemperatur Storage temperature		T_{stg}	-40		125	°C
Anzugsdrehmoment f. Modulmontage Mounting torque for modul mounting	Schraube M5 - Montage gem. gültiger Applikationsschrift Screw M5 - Mounting according to valid application note	M	3,00		6,00	Nm
Anzugsdrehmoment f. elektr. Anschlüsse Terminal connection torque	Schraube M6 - Montage gem. gültiger Applikationsschrift Screw M6 - Mounting according to valid application note	M	3,0	-	6,0	Nm
Gewicht Weight		G		345		g

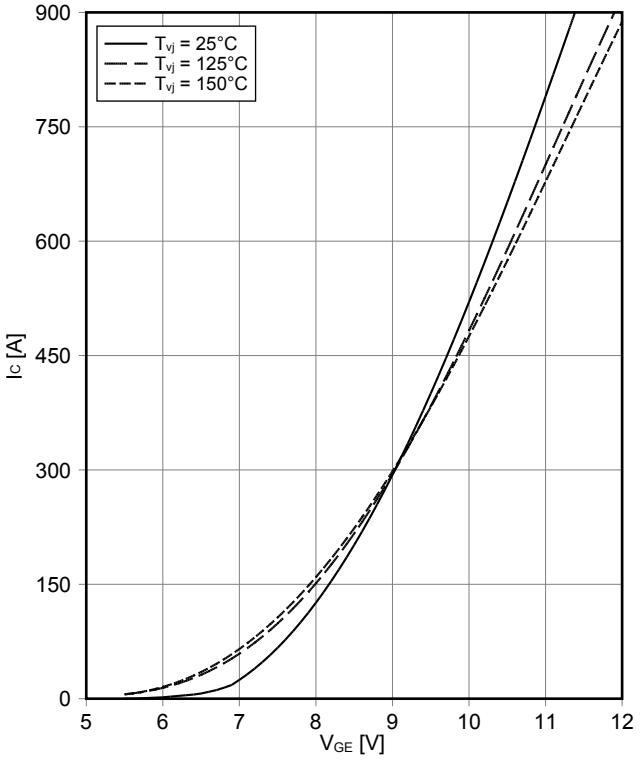
Ausgangskennlinie IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
V_{GE} = 15 V



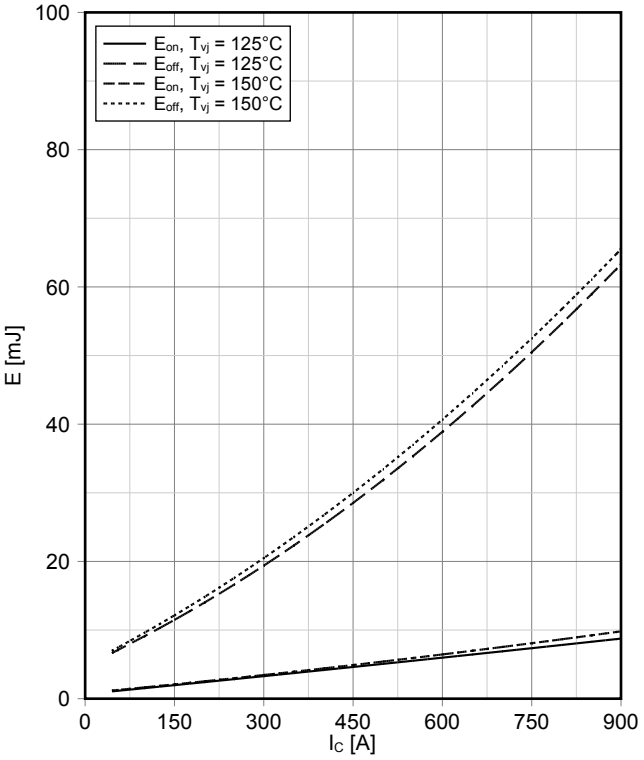
Ausgangskennlinienfeld IGBT,Wechselrichter (typisch)
output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$
T_{vj} = 150°C



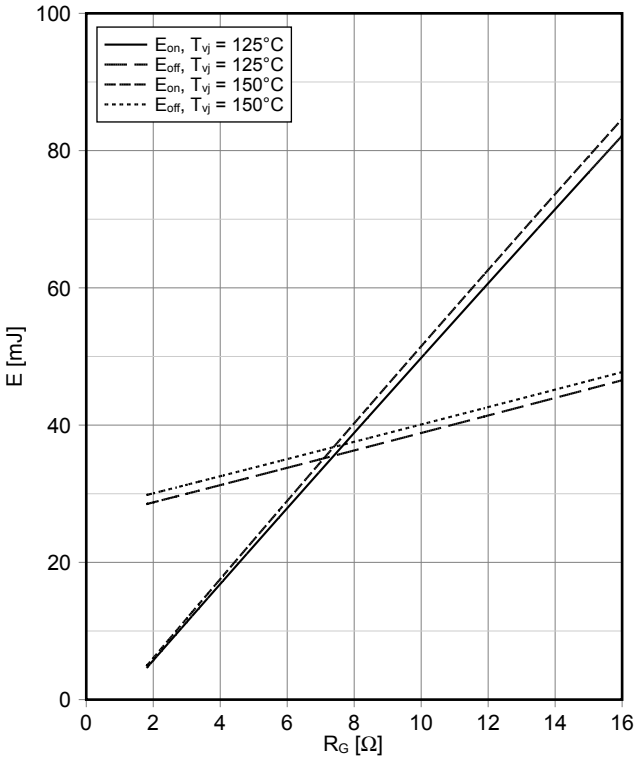
Übertragungscharakteristik IGBT,Wechselrichter (typisch)
transfer characteristic IGBT,Inverter (typical)
$I_C = f(V_{GE})$
V_{CE} = 20 V



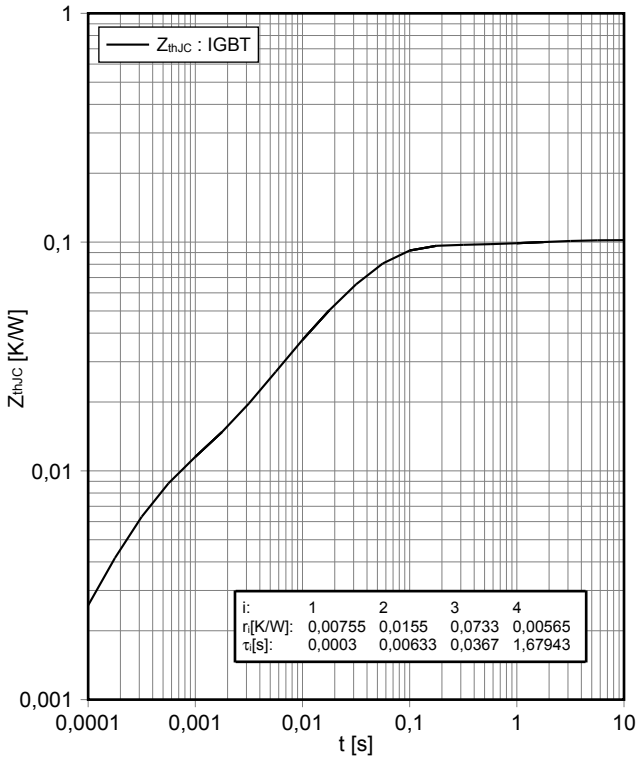
Schaltverluste IGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 1.8 Ω, R_{Goff} = 1.8 Ω, V_{CE} = 300 V



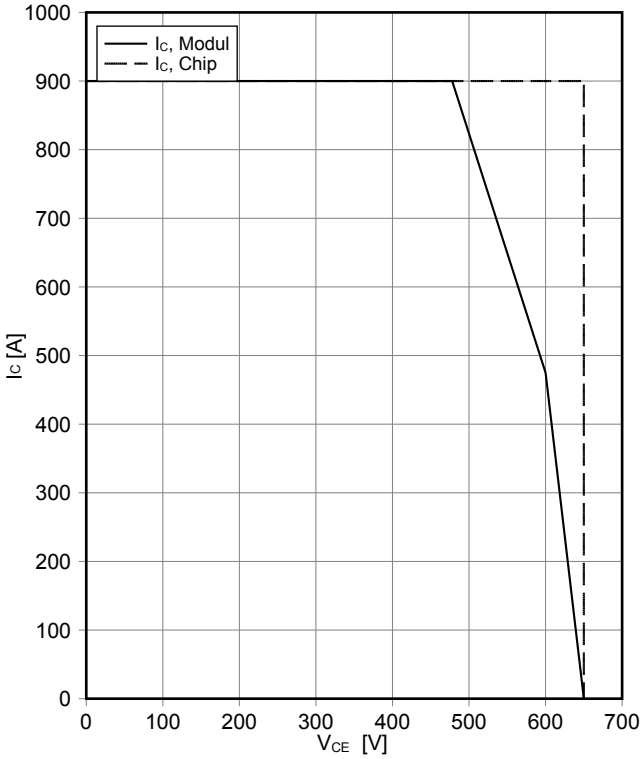
Schaltverluste IGBT,Wechselrichter (typisch)
switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
V_{GE} = ±15 V, I_C = 450 A, V_{CE} = 300 V



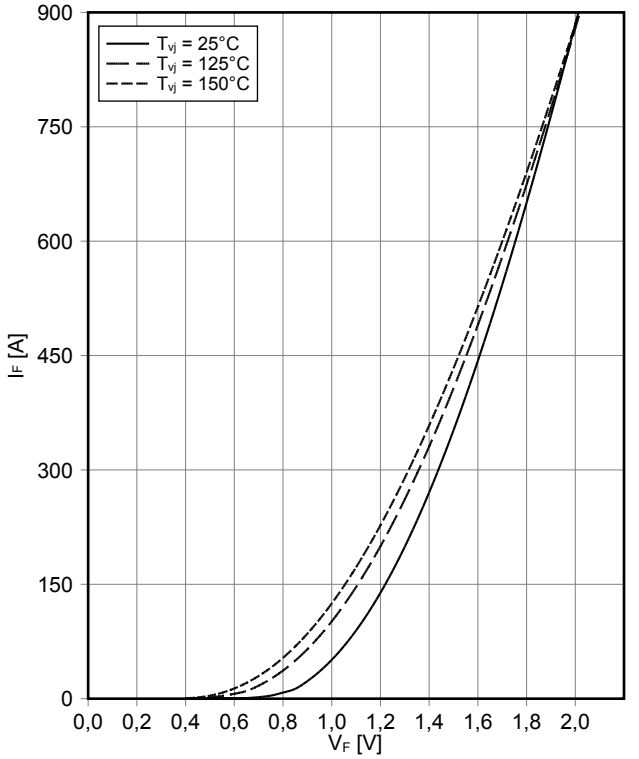
Transienter Wärmewiderstand IGBT,Wechselrichter
transient thermal impedance IGBT,Inverter
$Z_{thJC} = f(t)$



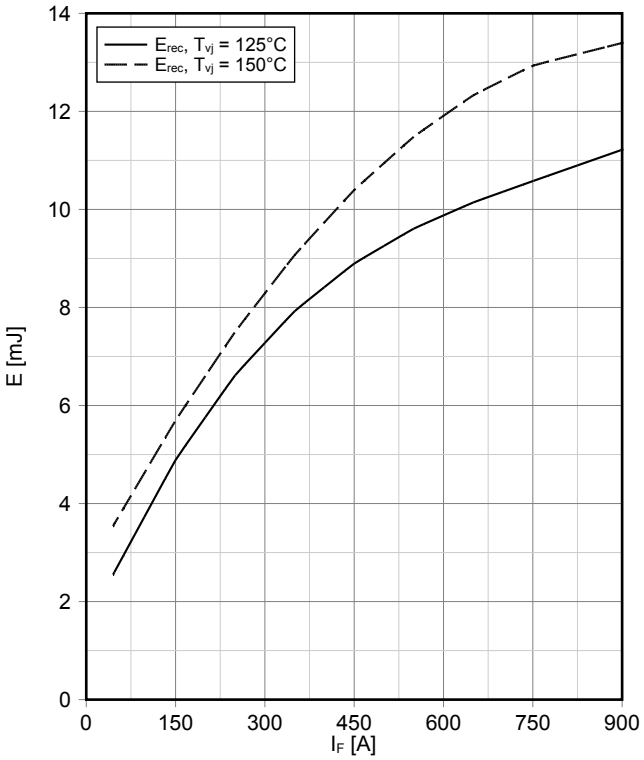
Sicherer Rückwärts-Arbeitsbereich IGBT,Wechselrichter (RBSOA)
reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
V_{GE} = ±15 V, R_{Goff} = 1.8 Ω, T_{vj} = 150°C



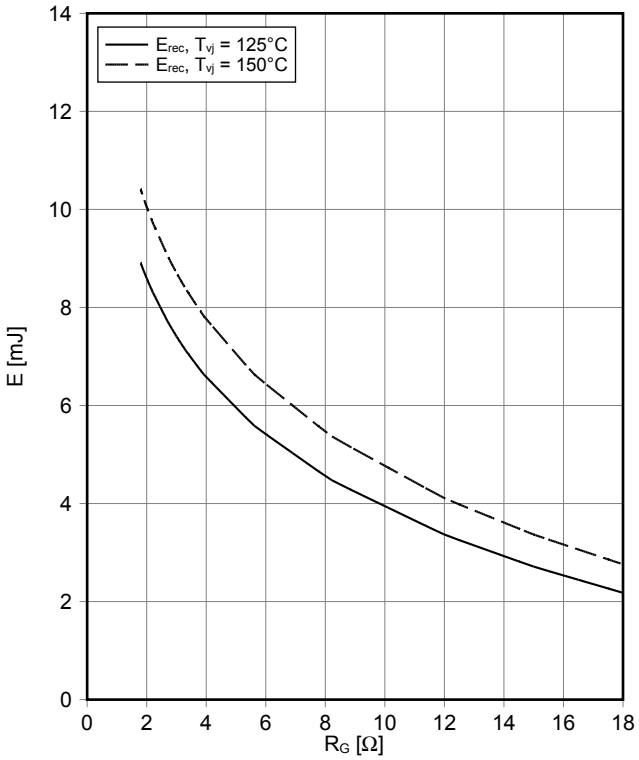
Durchlasskennlinie der Diode, Wechselrichter (typisch)
forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$



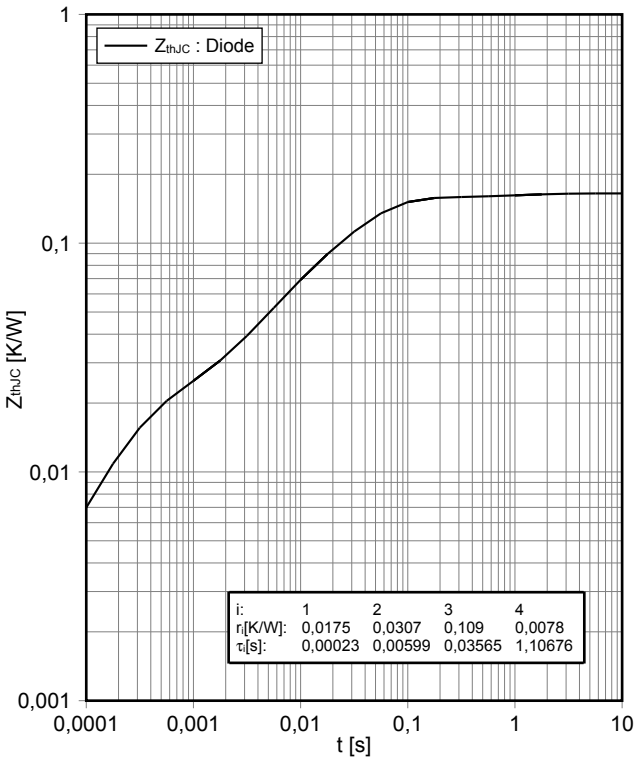
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
$R_{Gon} = 1.8\ \Omega$, $V_{CE} = 300$ V



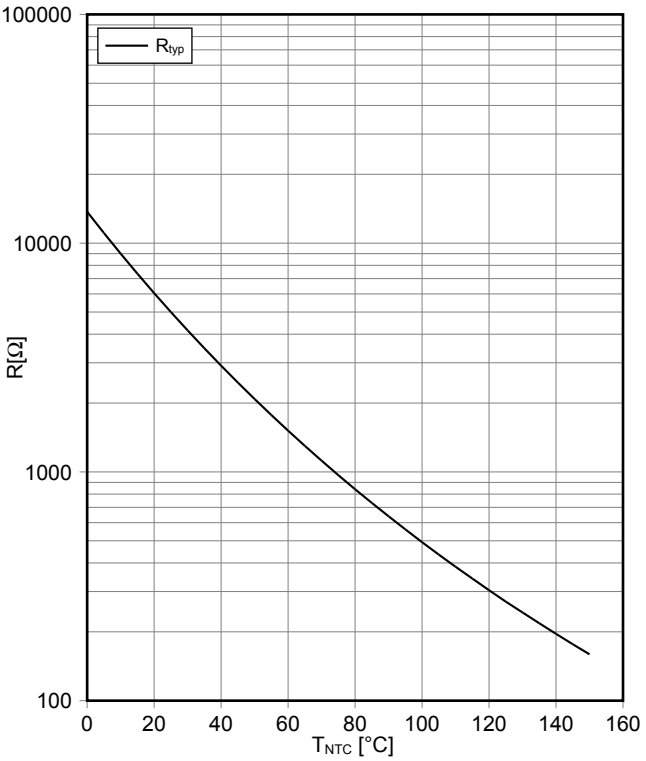
Schaltverluste Diode, Wechselrichter (typisch)
switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
$I_F = 450$ A, $V_{CE} = 300$ V



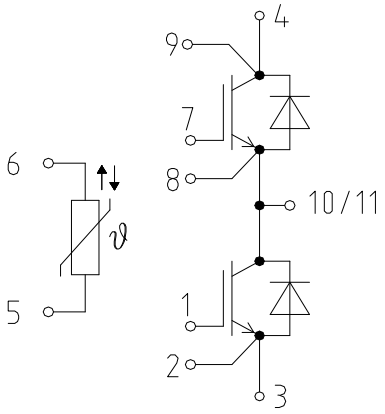
Transienter Wärmewiderstand Diode, Wechselrichter
transient thermal impedance Diode, Inverter
$Z_{thJC} = f(t)$



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



Schaltplan / Circuit diagram



Gehäuseabmessungen / Package outlines