EconoPACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled diode and NTC

Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 100 A / I_{CRM} = 200 A
  - Low V_{CEsat}
  - $T_{vj\ op}$ = 150 °C
  - Trench IGBT 4
  - V_{CEsat} with positive temperature coefficient
- Mechanical features
  - Integrated NTC temperature sensor
  - Standard housing
  - Solder contact technology
  - Isolated base plate

Potential applications

- High power converters
- Medium voltage converters

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

Description

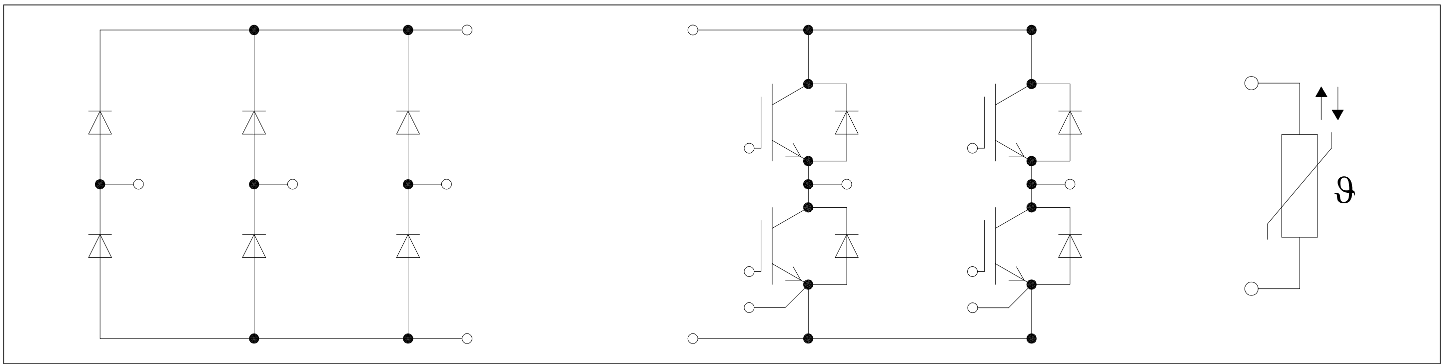


Table of contents

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, t = 1 min	3.4	kV
Material of module baseplate			Cu	
Internal Isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to heatsink	7.5	mm
Comparative tracking index	CTI		> 225	
RTI Elec.	RTI	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				33		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C=25°C, per switch			4		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C=25°C, per switch			3		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for modul mounting	M	- Mounting according to valid application note	M5, Screw	3		6	Nm
Weight	G				300		g

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1700	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 95 °C	100	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		200	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C = 100 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.90	2.25	V
			T_{vj} = 125 °C		2.30		
			T_{vj} = 150 °C		2.40		
Gate threshold voltage	V_{GEth}	I_C = 4 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.35	5.80	6.25	V
Gate charge	Q_G	V_{GE} = ±15 V			1.2		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			7.5		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			9		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.29		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				400	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 100 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.91 Ω	T_{vj} = 25 °C		0.191		µs
			T_{vj} = 125 °C		0.213		
			T_{vj} = 150 °C		0.218		
Rise time (inductive load)	t_r	I_C = 100 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.91 Ω	T_{vj} = 25 °C		0.052		µs
			T_{vj} = 125 °C		0.056		
			T_{vj} = 150 °C		0.058		
Turn-off delay time (inductive load)	t_{doff}	I_C = 100 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Goff} = 0.91 Ω	T_{vj} = 25 °C		0.409		µs
			T_{vj} = 125 °C		0.562		
			T_{vj} = 150 °C		0.599		
Fall time (inductive load)	t_f	I_C = 100 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Goff} = 0.91 Ω	T_{vj} = 25 °C		0.289		µs
			T_{vj} = 125 °C		0.507		
			T_{vj} = 150 °C		0.556		
Turn-on energy loss per pulse	E_{on}	I_C = 100 A, V_{CE} = 900 V, $L_σ$ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 0.91 Ω, di/dt = 1050 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		27.9		mJ
			T_{vj} = 125 °C		38.2		
			T_{vj} = 150 °C		40.9		
Turn-off energy loss per pulse	E_{off}	I_C = 100 A, V_{CE} = 900 V, $L_σ$ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 0.91 Ω, dv/dt = 3050 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		19		mJ
			T_{vj} = 125 °C		31.1		
			T_{vj} = 150 °C		34.9		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 1000 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 10 µs, T_{vj} = 150 °C		460		A
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.267	K/W

Table 4 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)		0.0680		K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

3 Diode, Inverter

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1700	V
Continous DC forward current	I_F			100	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		200	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	1130	A^2s
			T_{vj} = 150 °C	1100	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 100 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.35	V
			T_{vj} = 125 °C		1.90		
			T_{vj} = 150 °C		1.95		
Peak reverse recovery current	I_{RM}	V_R = 900 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		71.4		A
			T_{vj} = 125 °C		77.9		
			T_{vj} = 150 °C		79.9		
Recovered charge	Q_r	V_R = 900 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		23.2		µC
			T_{vj} = 125 °C		40.5		
			T_{vj} = 150 °C		46.1		
Reverse recovery energy	E_{rec}	V_R = 900 V, I_F = 100 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		11.9		mJ
			T_{vj} = 125 °C		22.8		
			T_{vj} = 150 °C		26.4		
Thermal resistance, junction to case	R_{thJC}	per diode				0.465	K/W

Table 6 **Characteristic values (continued)**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)		0.0700		K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

4 Diode, Rectifier

Table 7 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1800	V
Maximum RMS forward current per chip	I_{FRMSM}	T_C = 80 °C		100	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C = 80 °C		150	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	829	A
			T_{vj} = 150 °C	705	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	3440	A^2s
			T_{vj} = 150 °C	2490	

Table 8 **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	T_{vj} = 150 °C, I_F = 150 A		1.15		V
Threshold voltage	$V_{(TO)}$	T_{vj} = 150 °C		0.78		V
Slope resistance	r_t	T_{vj} = 150 °C		2.4		mΩ
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1800 V		1		mA
Thermal resistance, junction to case	R_{thJC}	per diode			0.552	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{Paste}= 1 W /(m*K) / λ_{grease}= 1 W/(m*K)		0.0740		K/W
Temperature under switching conditions	$T_{vj,\ op}$		-40		150	°C

5 NTC-Thermistor

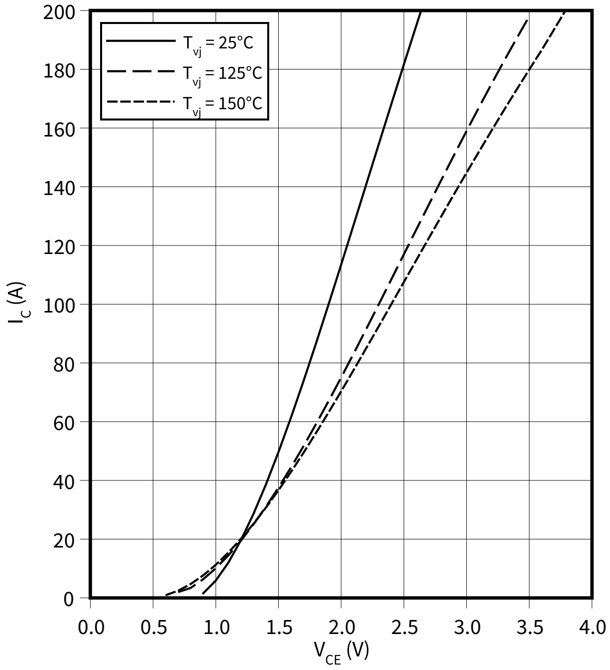
Table 9 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25}\ \exp[B_{25/50}(1/T_2-1/(298,15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25}\ \exp[B_{25/80}(1/T_2-1/(298,15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25}\ \exp[B_{25/100}(1/T_2-1/(298,15\ K))]$		3433		K

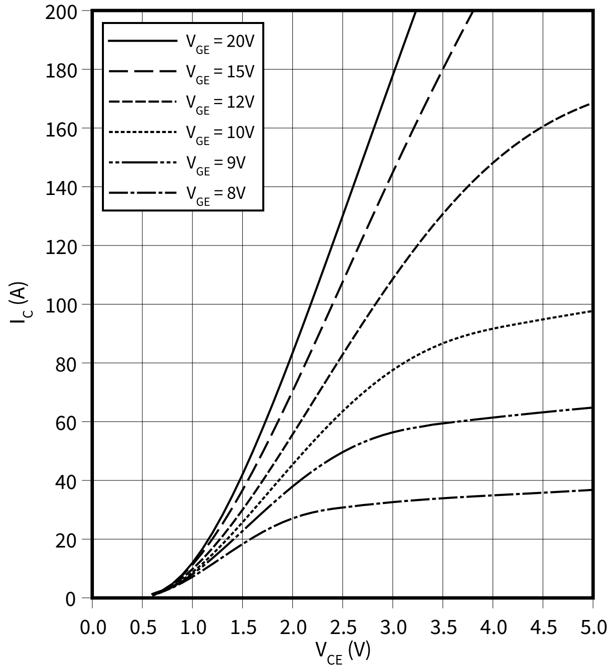
Note: Specification according to the valid application note.

6 Characteristics diagrams

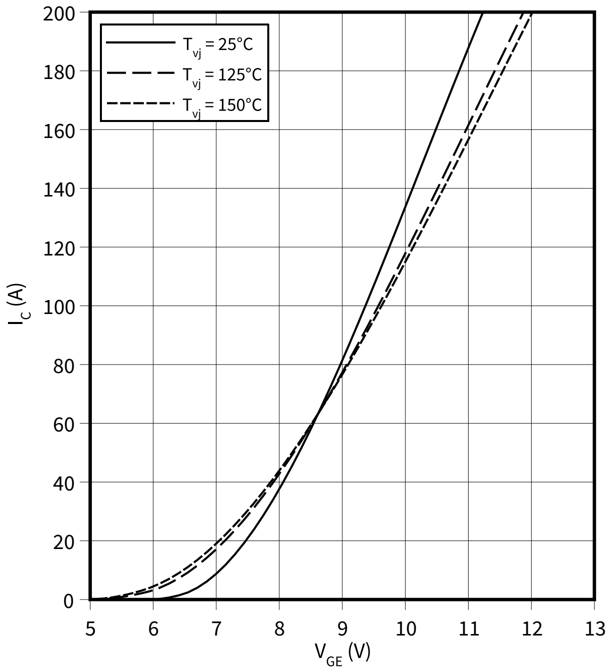
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



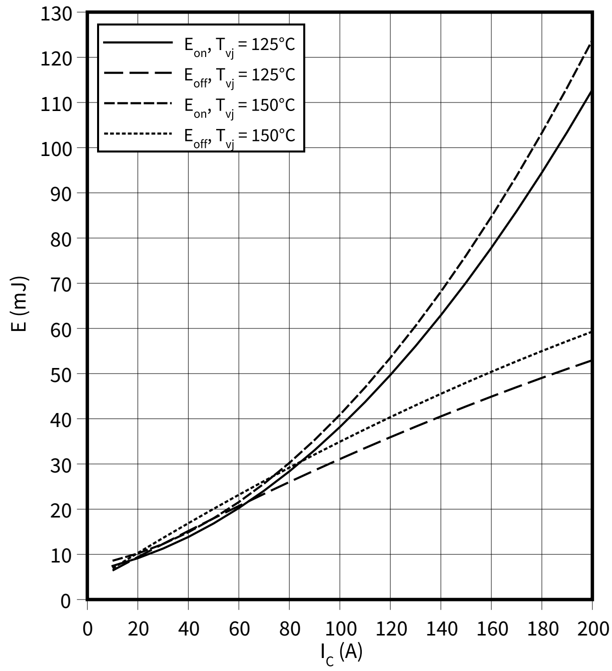
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



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



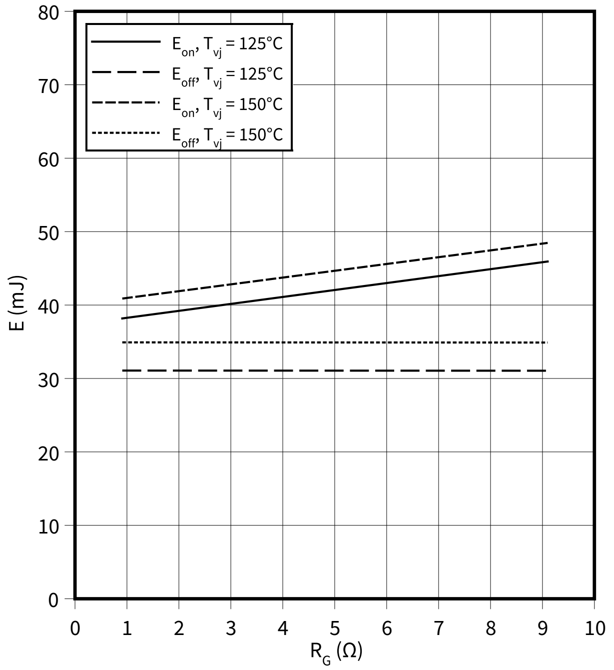
switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 0.91\ \Omega$, $R_{Gon} = 0.91\ \Omega$, $V_{CE} = 900\ V$, $V_{GE} = \pm 15\ V$



switching losses (typical), IGBT, Inverter

$E = f(R_G)$

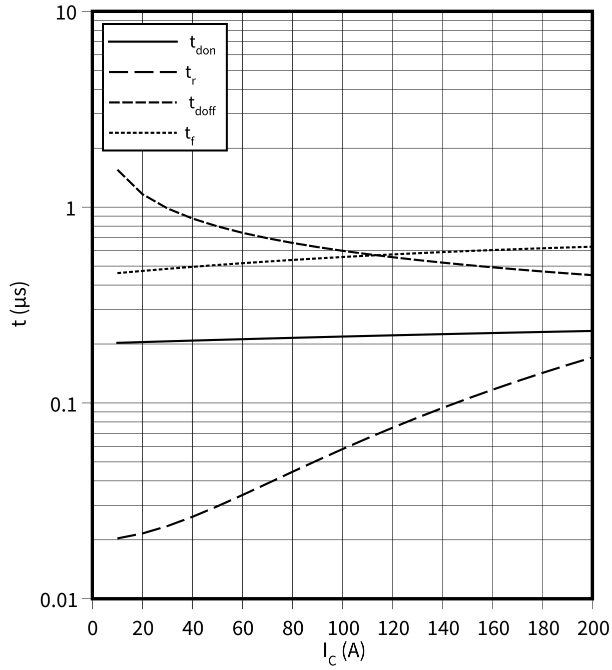
$I_C = 100$ A, $V_{CE} = 900$ V, $V_{GE} = \pm 15$ V



switching times (typical), IGBT, Inverter

$t = f(I_C)$

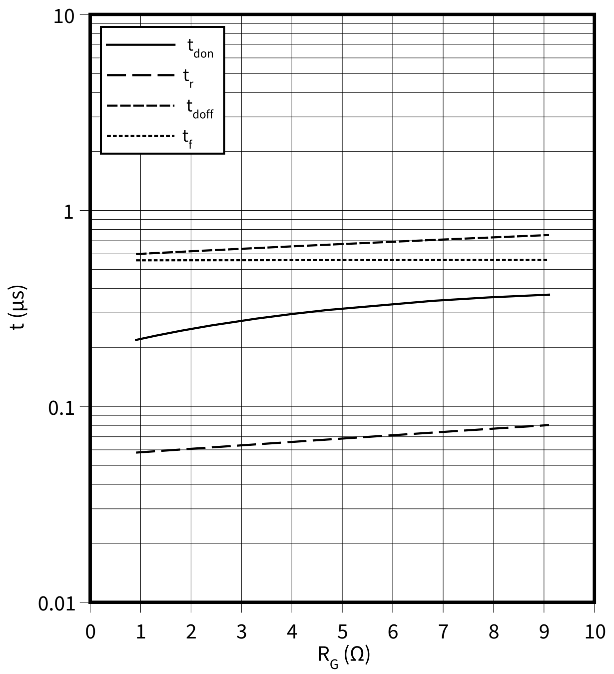
$R_{Goff} = 0.91$ Ω, $R_{Gon} = 0.91$ Ω, $V_{CE} = 900$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



switching times (typical), IGBT, Inverter

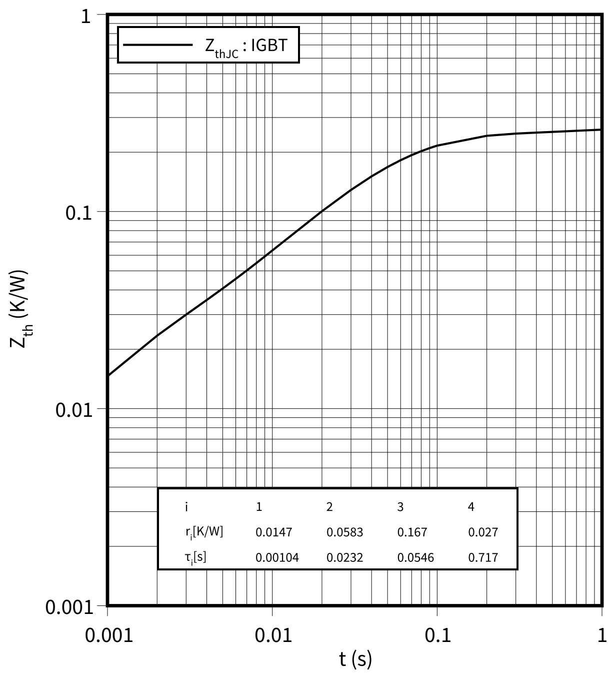
$t = f(R_G)$

$I_C = 100$ A, $V_{CE} = 900$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$

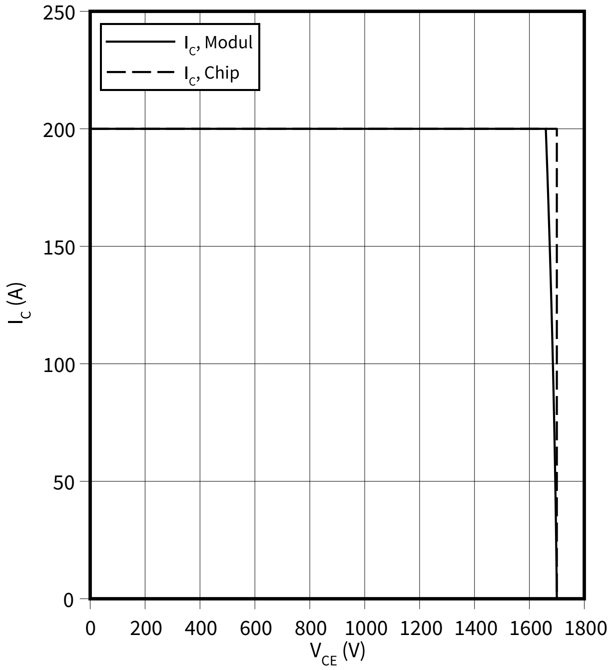


i	1	2	3	4
r_i[K/W]	0.0147	0.0583	0.167	0.027
τ_i[s]	0.00104	0.0232	0.0546	0.717

reverse bias safe operating area (RBSOA), IGBT, Inverter

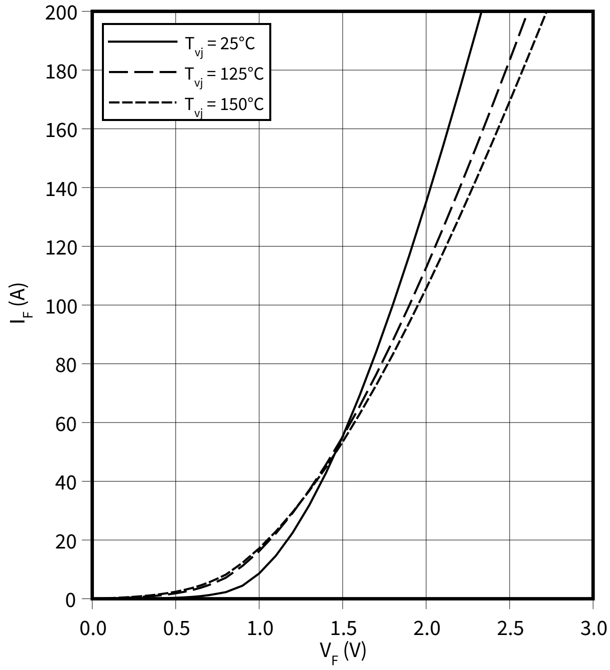
$I_C = f(V_{CE})$

$R_{Goff} = 0.91\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



forward characteristic (typical), Diode, Inverter

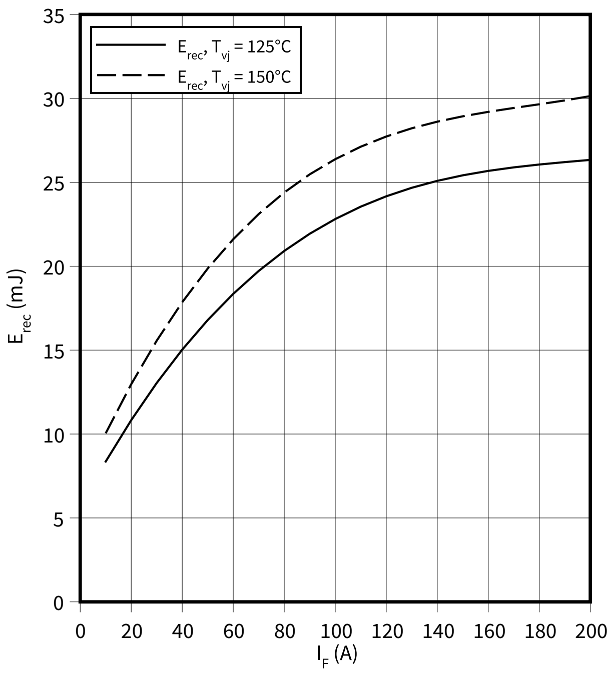
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

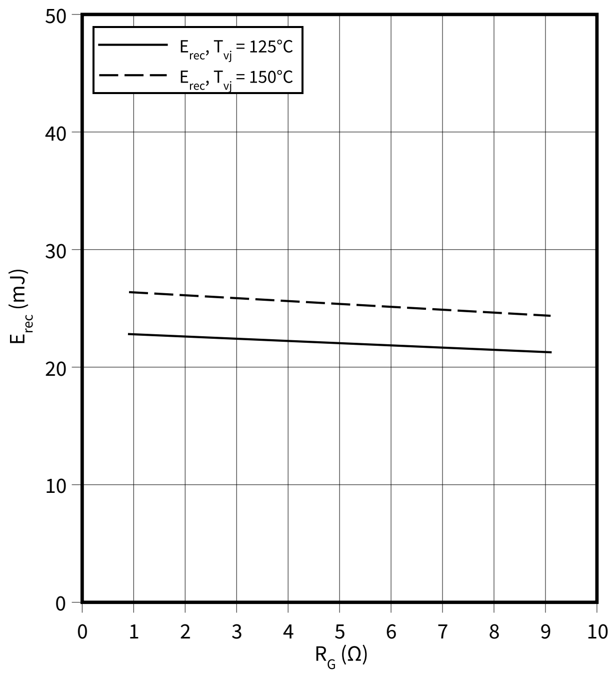
$V_{CE} = 900$ V, $R_{Gon} = R_{Gon}$(IGBT)



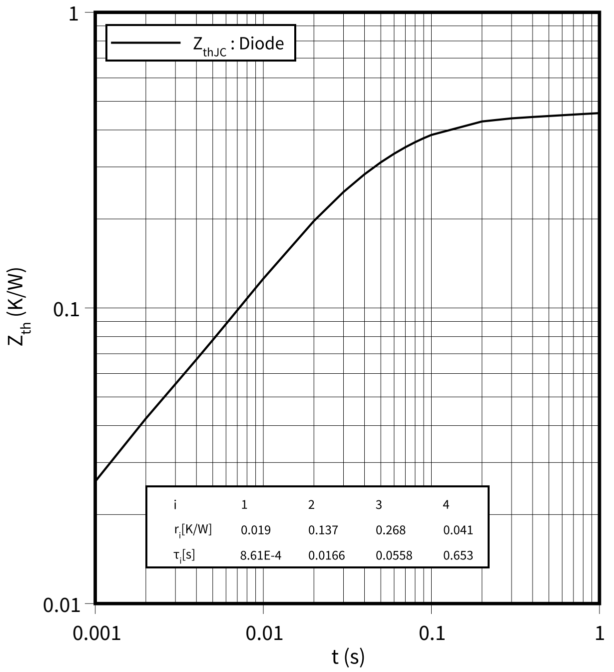
switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$

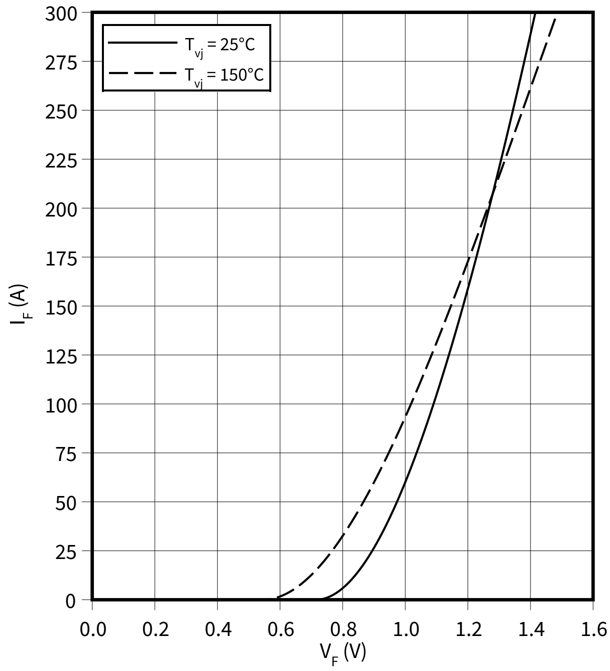
$V_{CE} = 900$ V, $I_F = 100$ A



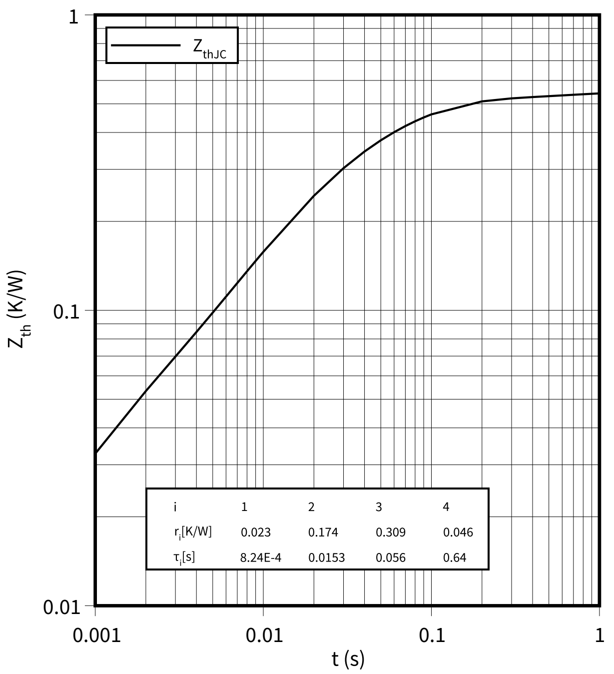
transient thermal impedance , Diode, Inverter
$Z_{th} = f(t)$



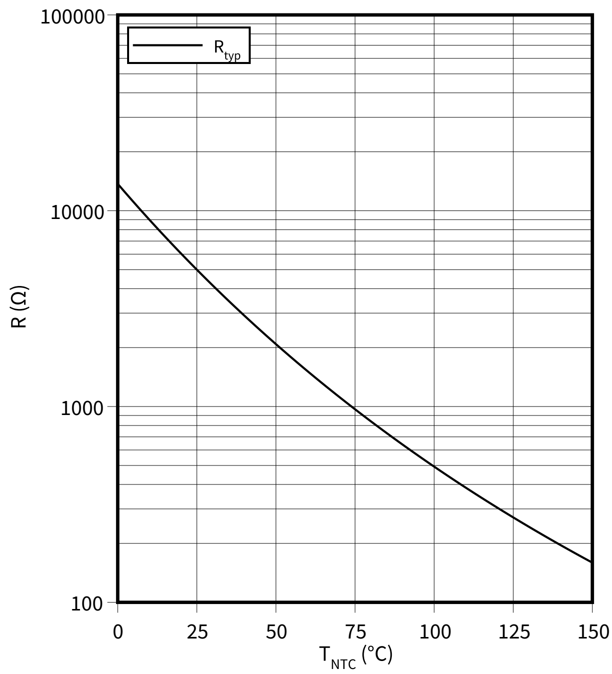
Forward characteristic (typical), Diode, Rectifier
$I_F = f(V_F)$



Transient thermal impedance, Diode, Rectifier
$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor
$R = f(T_{NTC})$



7 Circuit diagram

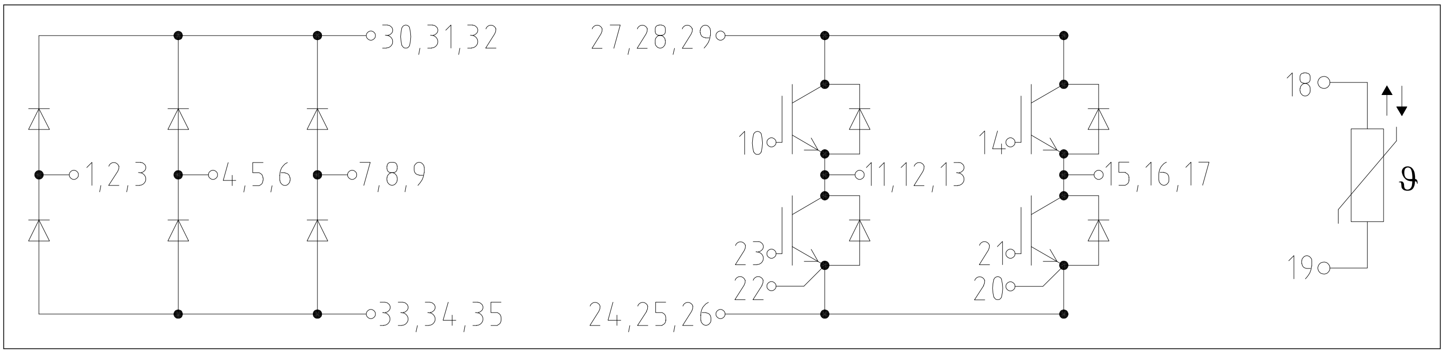


Figure 2

8 Package outlines

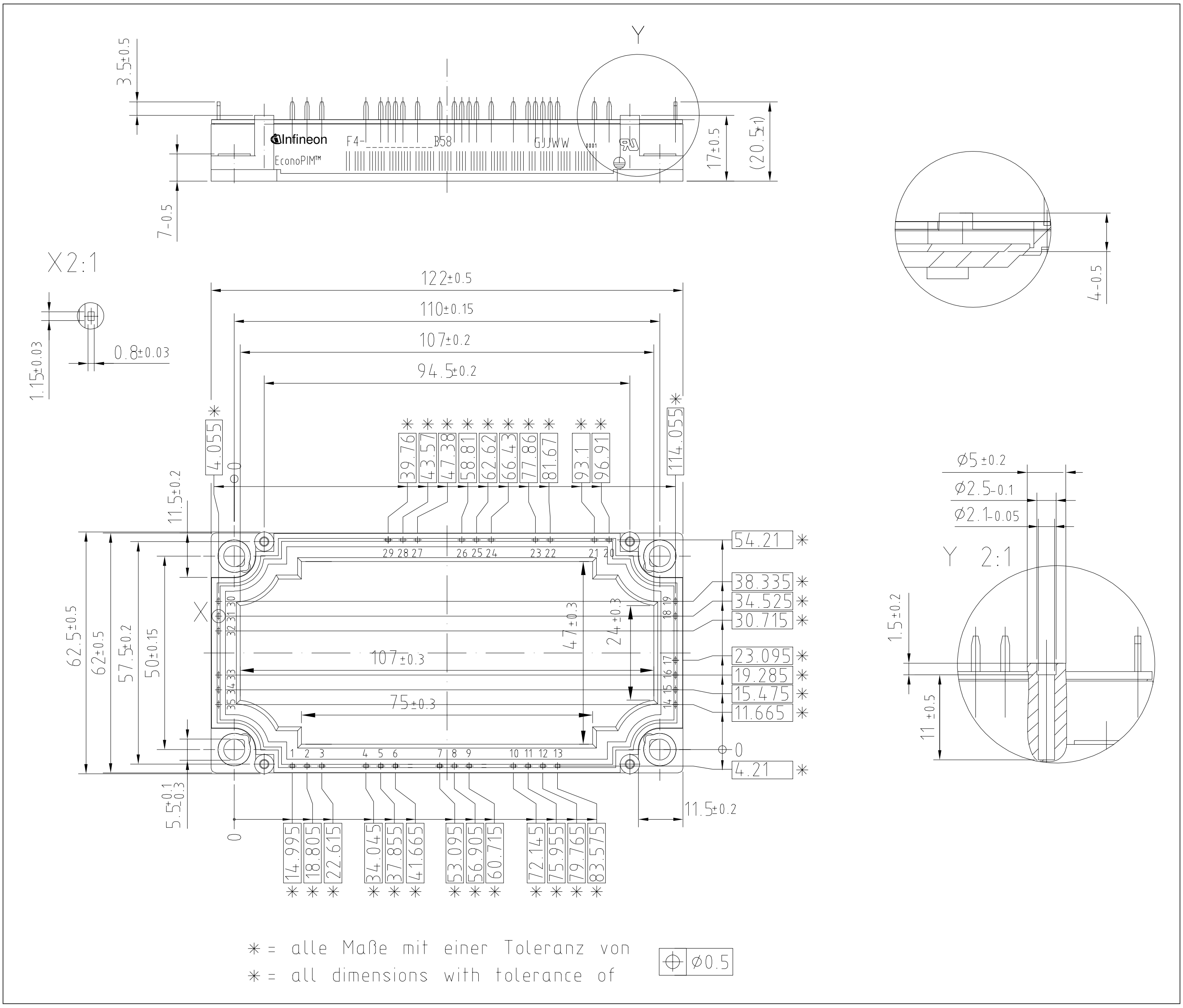


Figure 3

Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

Edition 2021-04-16

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-