EasyPACK™ 2B module with TRENCHSTOP™ 5 H5 IGBT and PressFIT / NTC

Features


Typical appearance

- Electrical features
  - V_{CES} = 650 V
  - $I_{C\ nom}$ = 35 A / I_{CRM} = 70 A
  - Trench IGBT 5
  - Low switching losses
  - Increased blocking voltage capability up to 650 V
- Mechanical features
  - Rugged mounting due to integrated mounting clamps
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology

Potential applications

- UPS systems
- DC charger for EV
- Motor drives

Product validation

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

Description

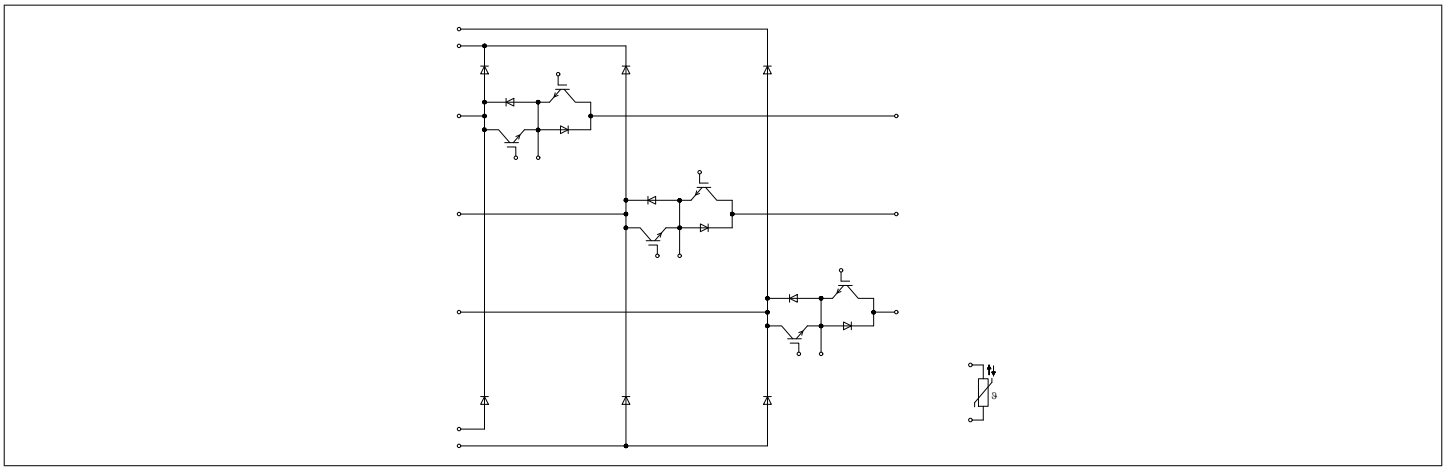


Table of contents

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	2.5	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Comparative tracking index	*CTI*		> 200	
Relative thermal index (electrical)	*RTI*	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			20		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_H = 25 °C, per switch		2.4		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		3.9		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		40		80	N
Weight	*G*			39		g

Note: The current under continuous operation is limited to 25A rms per connector pin

2 IGBT, T1-T6

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	650	V
Implemented collector current	I_{CN}			35	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	25	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		70	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 = 20 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.32	1.67	V
			T_{vj} = 125 °C		1.39		
			T_{vj} = 150 °C		1.41		
Gate threshold voltage	V_{GEth}	I_C = 0.35 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		3.85	4.60	5.35	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 300 V			0.152		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			1.94		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.007		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 650 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.012	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω	T_{vj} = 25 °C		0.016		µs
			T_{vj} = 125 °C		0.017		
			T_{vj} = 150 °C		0.017		
Rise time (inductive load)	t_r	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω	T_{vj} = 25 °C		0.004		µs
			T_{vj} = 125 °C		0.005		
			T_{vj} = 150 °C		0.006		
Turn-off delay time (inductive load)	t_{doff}	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.090		µs
			T_{vj} = 125 °C		0.110		
			T_{vj} = 150 °C		0.120		
Fall time (inductive load)	t_f	I_C = 20 A, V_{CC} = 350 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.018		µs
			T_{vj} = 125 °C		0.052		
			T_{vj} = 150 °C		0.073		
Turn-on energy loss per pulse	E_{on}	I_C = 20 A, V_{CC} = 350 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 6.2 Ω, di/dt = 2260 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.39		mJ
			T_{vj} = 125 °C		0.49		
			T_{vj} = 150 °C		0.507		
Turn-off energy loss per pulse	E_{off}	I_C = 20 A, V_{CC} = 350 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 7200 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.14		mJ
			T_{vj} = 125 °C		0.31		
			T_{vj} = 150 °C		0.365		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			2.12		K/W

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

3 Diode, D1-D6

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	650	V
Continuous DC forward current	I_F			30	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		60	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	90	A^2s
			T_{vj} = 150 °C	82	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.60	2.00	V
			T_{vj} = 125 °C		1.55		
			T_{vj} = 150 °C		1.52		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			2.48		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

4 Diode, D7-D12

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Implemented forward current	I_{FN}			50	A
Continuous DC forward current	I_F			20	A

(table continues...)

Table 7 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		100	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	220	A^2s
			T_{vj} = 175 °C	200	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 20 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.30	1.50	V
			T_{vj} = 125 °C		1.18		
			T_{vj} = 175 °C		1.10		
Peak reverse recovery current	I_{RM}	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		40.9		A
			T_{vj} = 125 °C		53.1		
			T_{vj} = 175 °C		62		
Recovered charge	Q_r	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.27		µC
			T_{vj} = 125 °C		4.36		
			T_{vj} = 175 °C		5.6		
Reverse recovery energy	E_{rec}	V_{CC} = 350 V, I_F = 20 A, V_{GE} = -15 V, -di$_F$/dt = 2260 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.5		mJ
			T_{vj} = 125 °C		1.08		
			T_{vj} = 175 °C		1.48		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			1.46		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

Note: $T_{vj\,op}$ > 150°C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

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

(table continues...)

Table 9 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3433		K

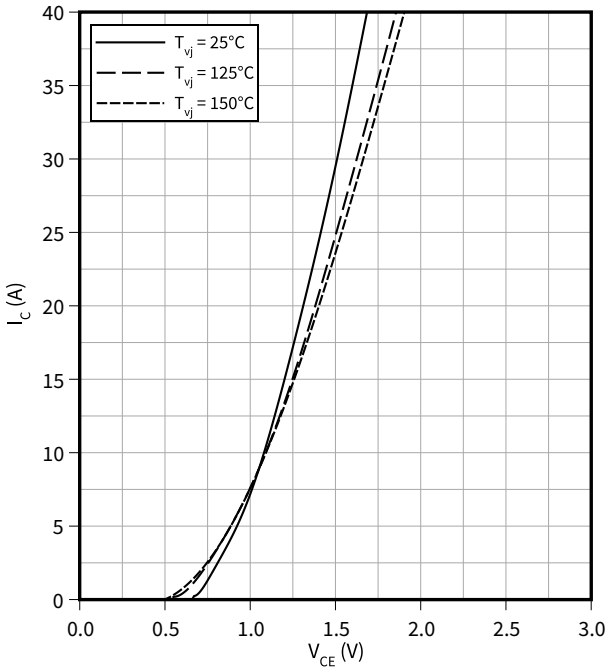
Note: Specification according to the valid application note.

6 Characteristics diagrams

Output characteristic (typical), IGBT, T1-T6

$I_C = f(V_{CE})$

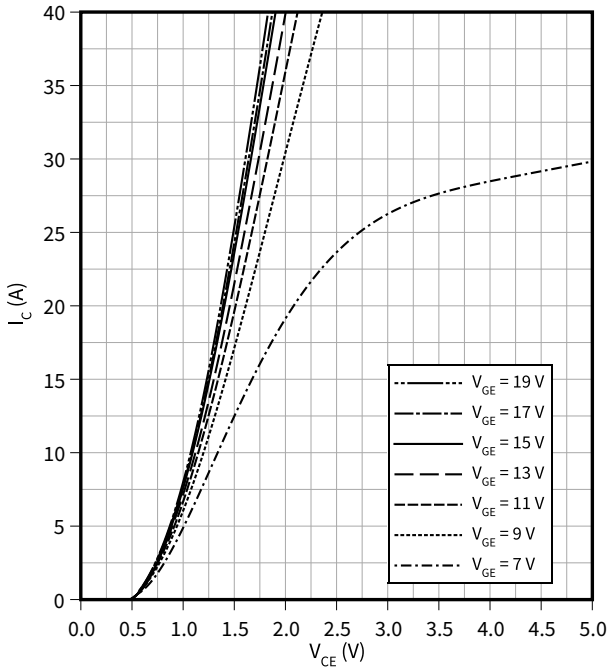
$V_{GE} = 15$ V



Output characteristic field (typical), IGBT, T1-T6

$I_C = f(V_{CE})$

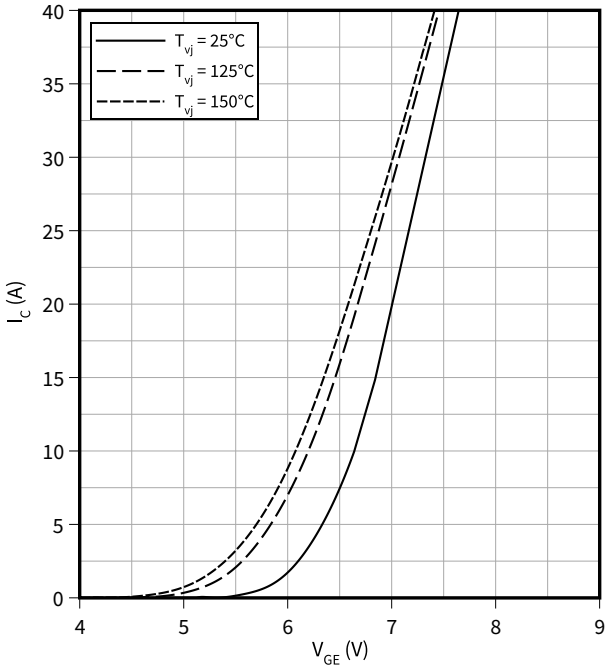
$T_{vj} = 150$ °C



Transfer characteristic (typical), IGBT, T1-T6

$I_C = f(V_{GE})$

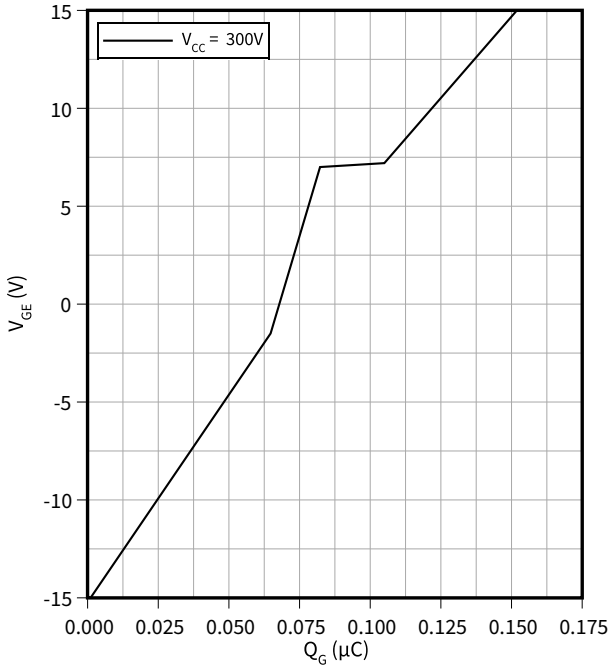
$V_{CE} = 20$ V



Gate charge characteristic (typical), IGBT, T1-T6

$V_{GE} = f(Q_G)$

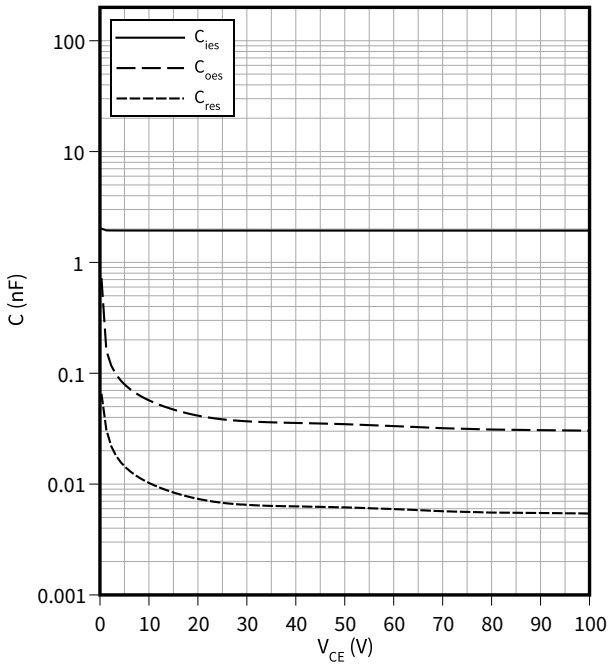
$I_C = 35$ A, $T_{vj} = 25$ °C



Capacity characteristic (typical), IGBT, T1-T6

$C = f(V_{CE})$

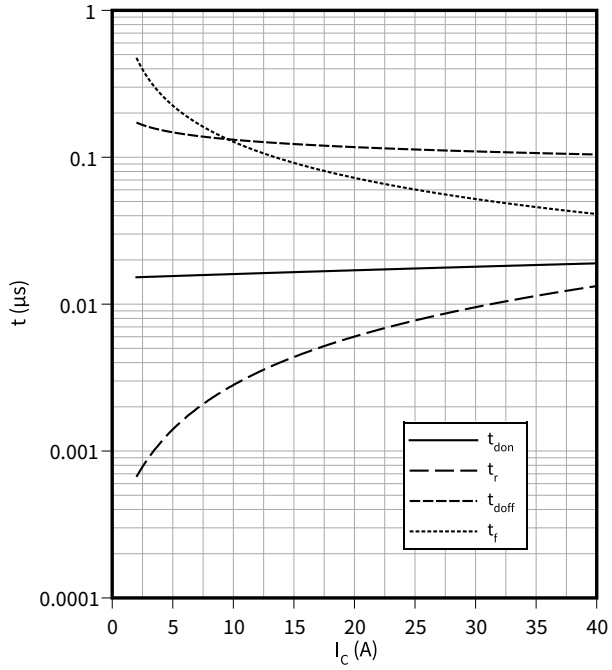
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, T1-T6

$t = f(I_C)$

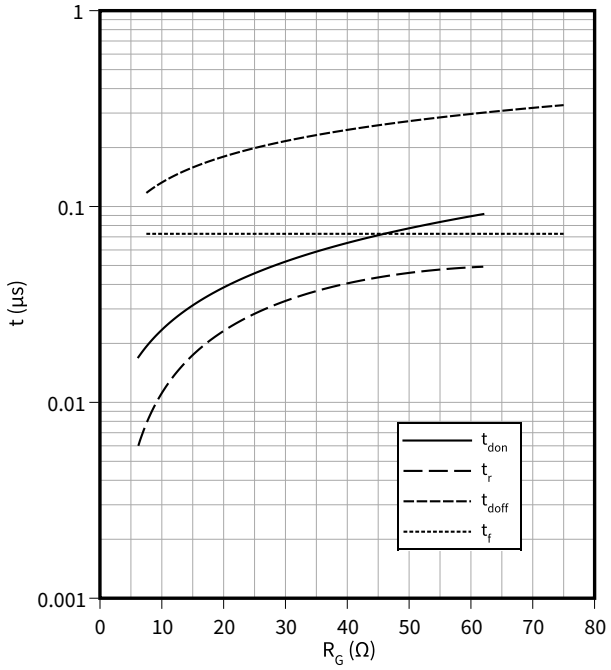
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, T1-T6

$t = f(R_G)$

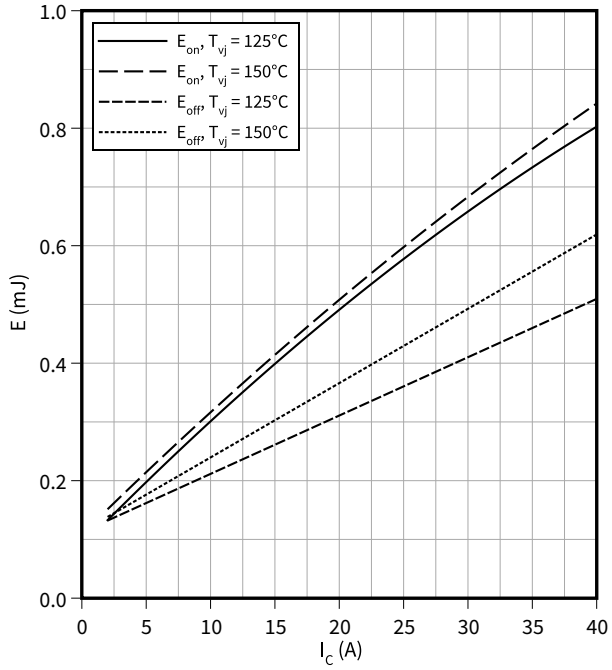
$I_C = 20$ A, $V_{CC} = 350$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



Switching losses (typical), IGBT, T1-T6

$E = f(I_C)$

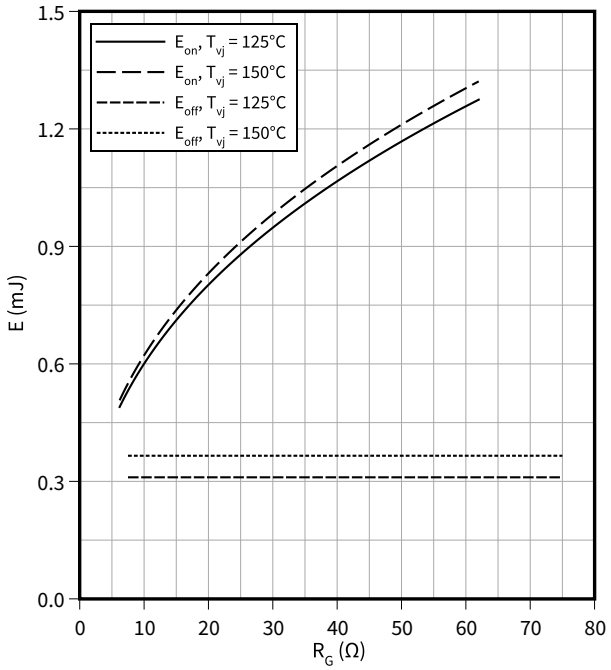
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350$ V, $V_{GE} = -15 / 15$ V



Switching losses (typical), IGBT, T1-T6

$E = f(R_G)$

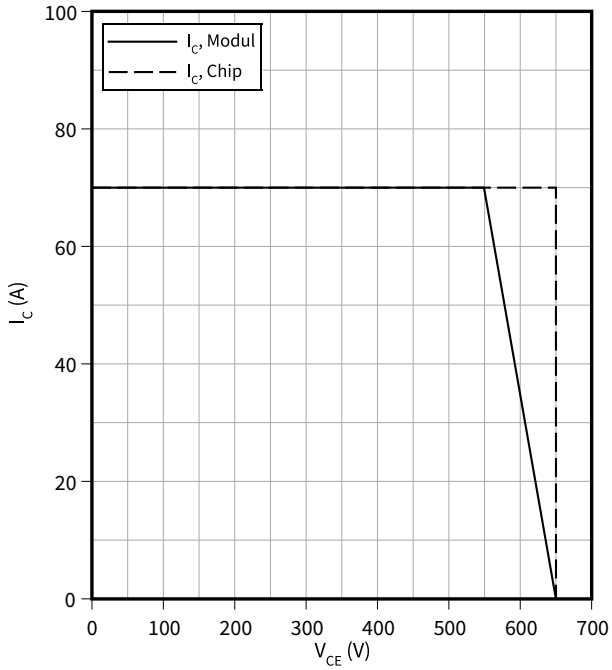
I_C = 20 A, V_{CC} = 350 V, V_{GE} = -15 / 15 V



Reverse bias safe operating area (RBSOA), IGBT, T1-T6

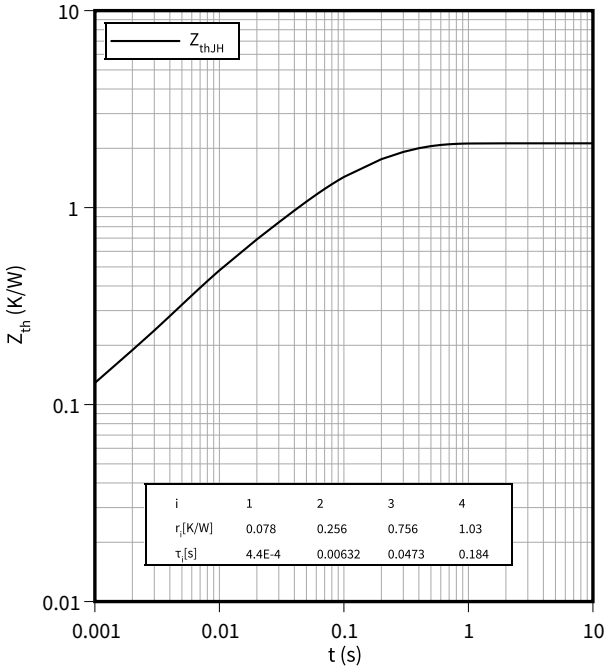
$I_C = f(V_{CE})$

R_{Goff} = 7.5 Ω, V_{GE} = ±15 V, T_{vj} = 150 °C



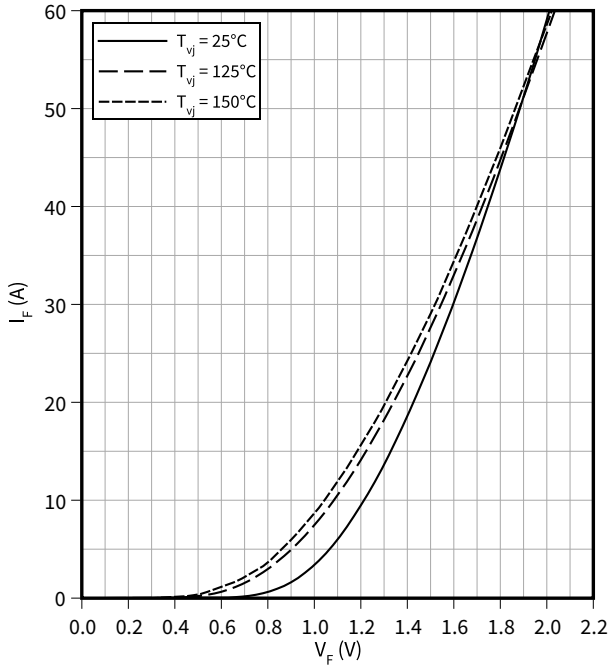
Transient thermal impedance , IGBT, T1-T6

$Z_{th} = f(t)$



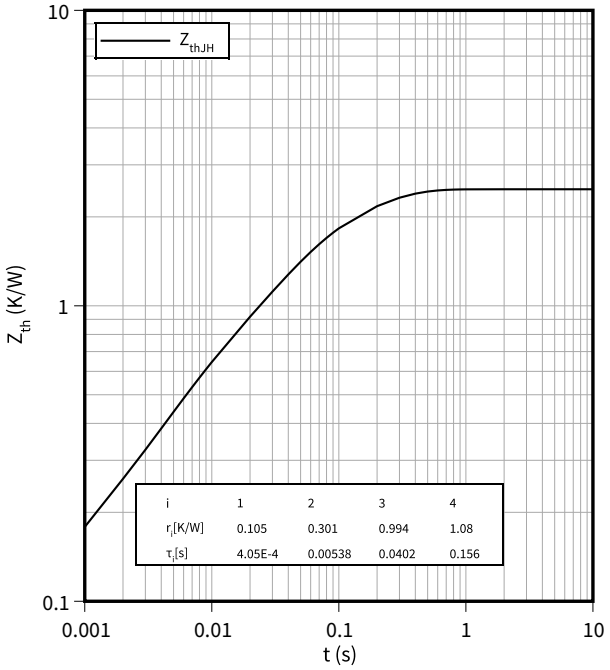
Forward characteristic (typical), Diode, D1-D6

$I_F = f(V_F)$



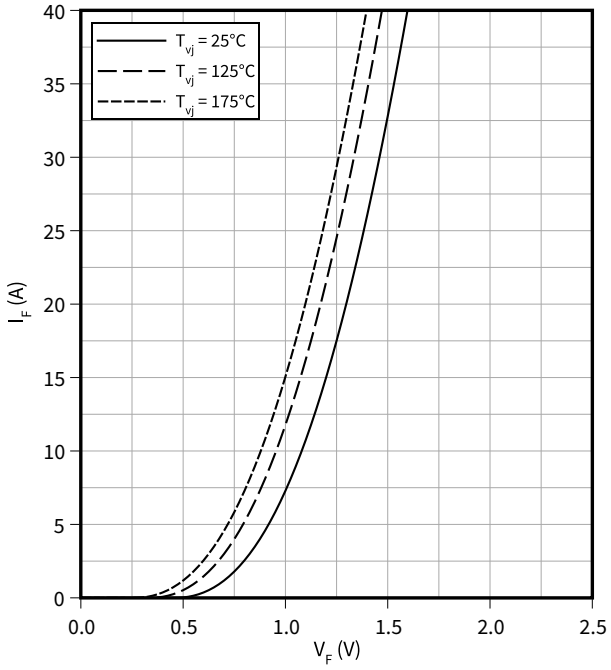
Transient thermal impedance, Diode, D1-D6

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D7-D12

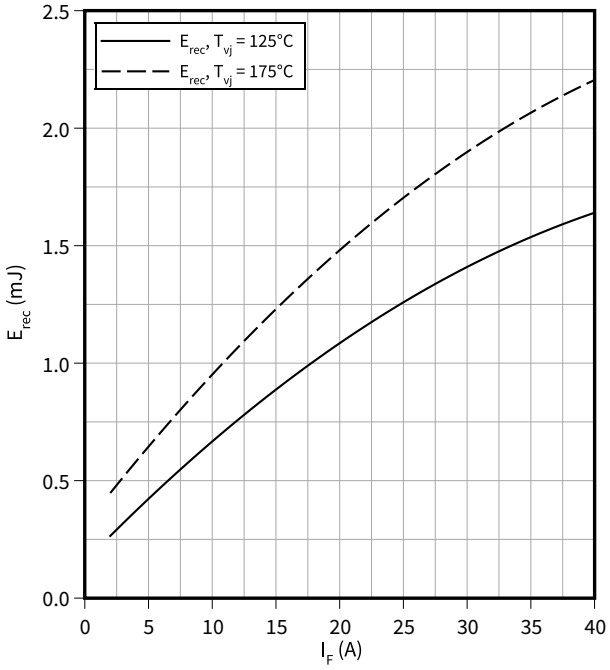
$I_F = f(V_F)$



Switching losses (typical), Diode, D7-D12

$E_{rec} = f(I_F)$

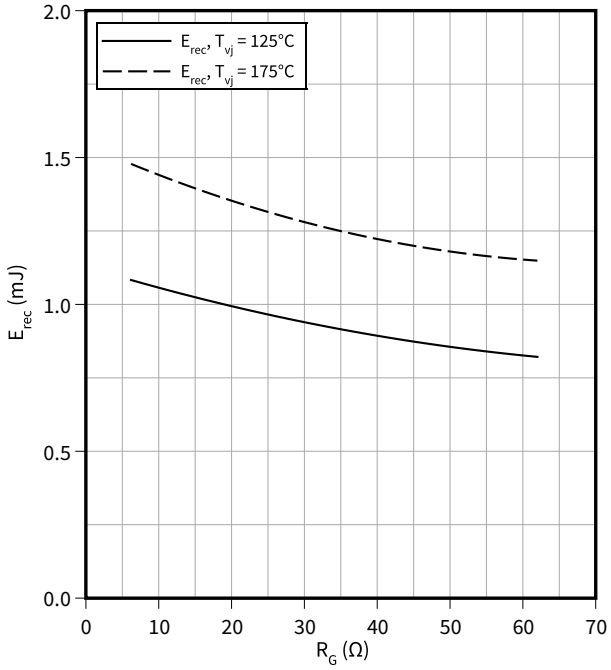
$R_{Gon} = 6.2\ \Omega$, $V_{CC} = 350\ V$



Switching losses (typical), Diode, D7-D12

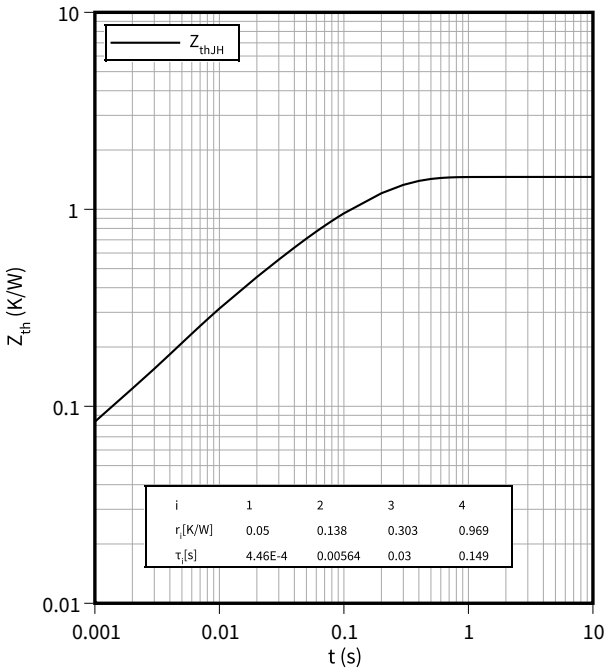
$E_{rec} = f(R_G)$

$I_F = 20\ A$, $V_{CC} = 350\ V$



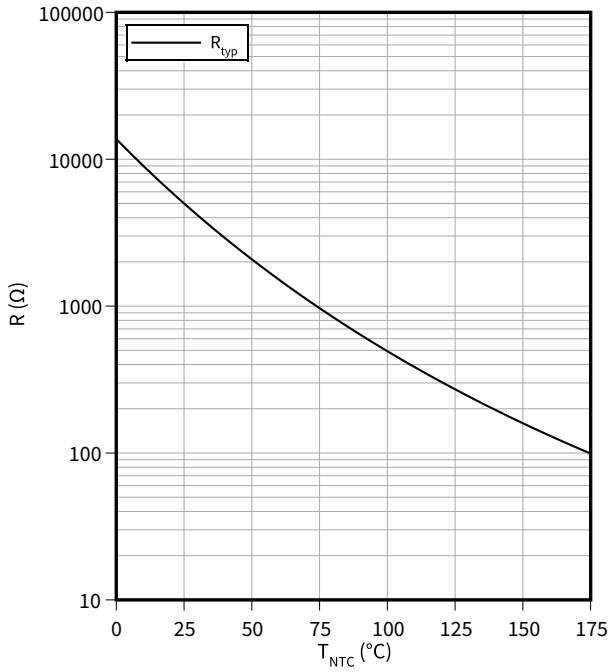
Transient thermal impedance, Diode, D7-D12

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

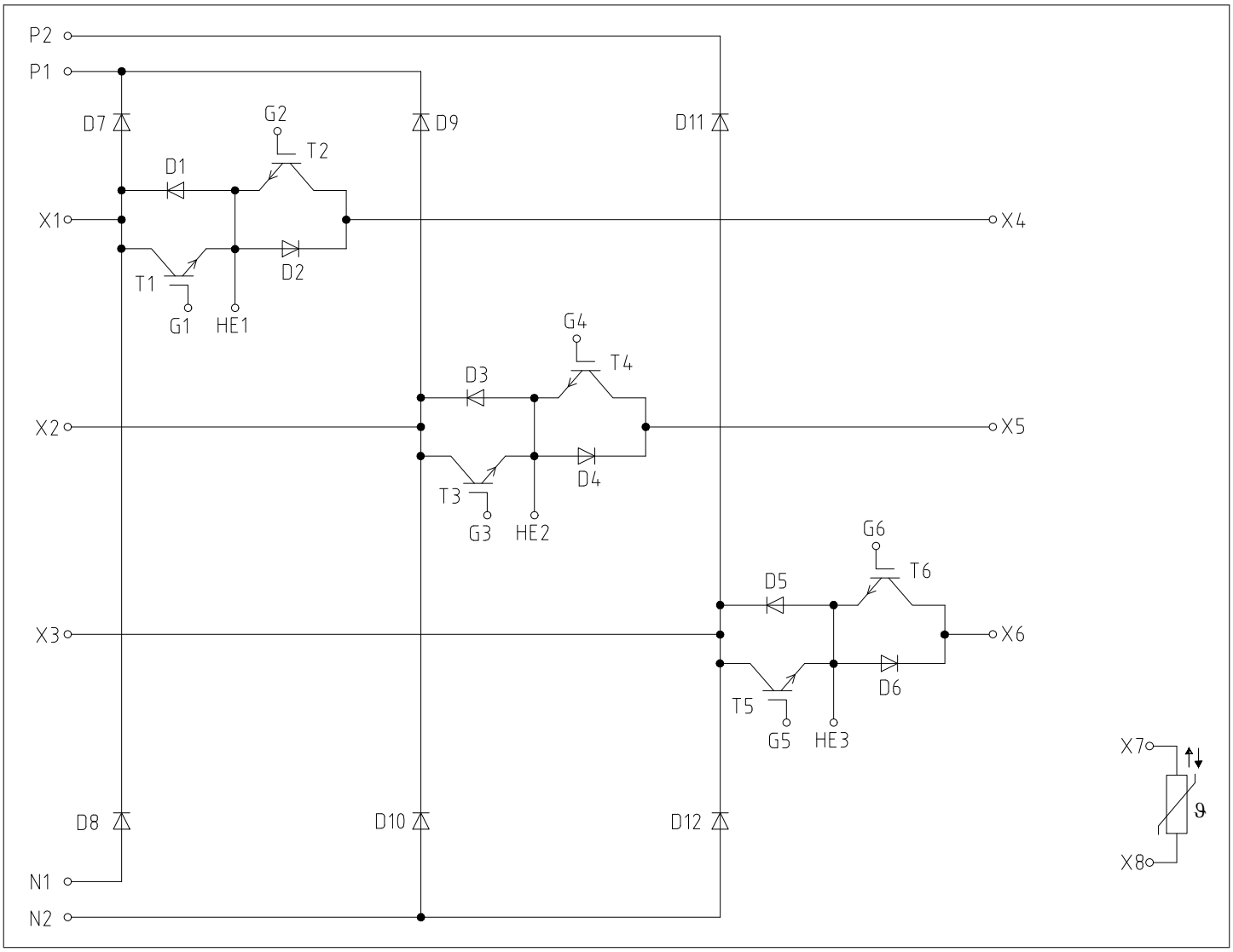


Figure 1

8 Package outlines

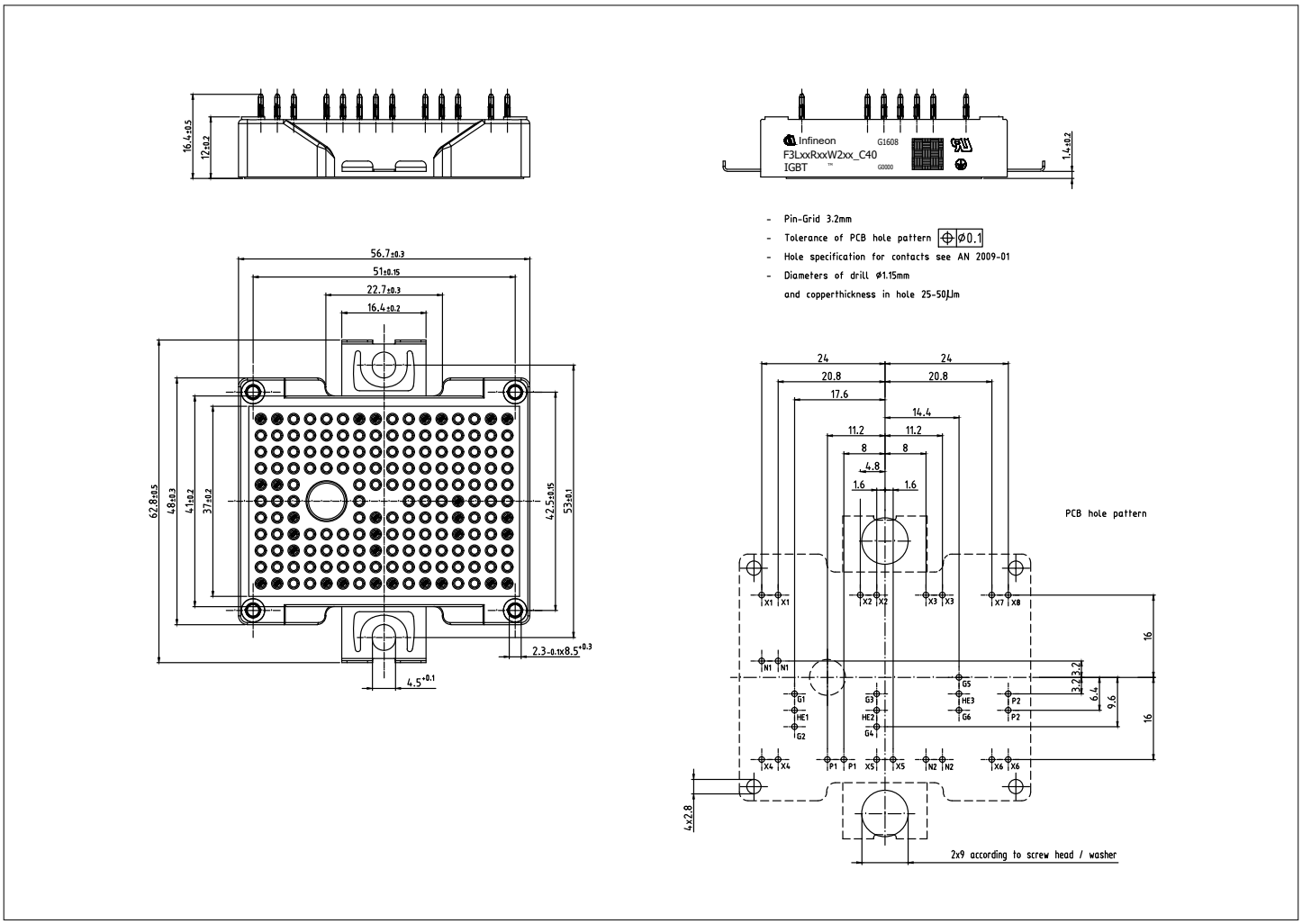


Figure 2

9 Module label code

Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	7154914284655054991530		7154914284655054991530

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2023-04-26	Final datasheet

Trademarks

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

Edition 2023-04-26

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-ABF962-002

Important notice

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

Warnings

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.