Final datasheet

EasyPACK™ 2B module with TRENCHSTOP™ 5 H5 and CoolSiC™ Schottky diode and PressFIT / NTC


Typical appearance

Features

- Electrical features
  - V_{CES} = 650 V
  - $I_{C\ nom}$ = 40 A / I_{CRM} = 80 A
  - CoolSiC™ Schottky diode gen 5
  - Low switching losses
  - Increased blocking voltage capability up to 650 V
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - Rugged mounting due to integrated mounting clamps
  - AlN substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology

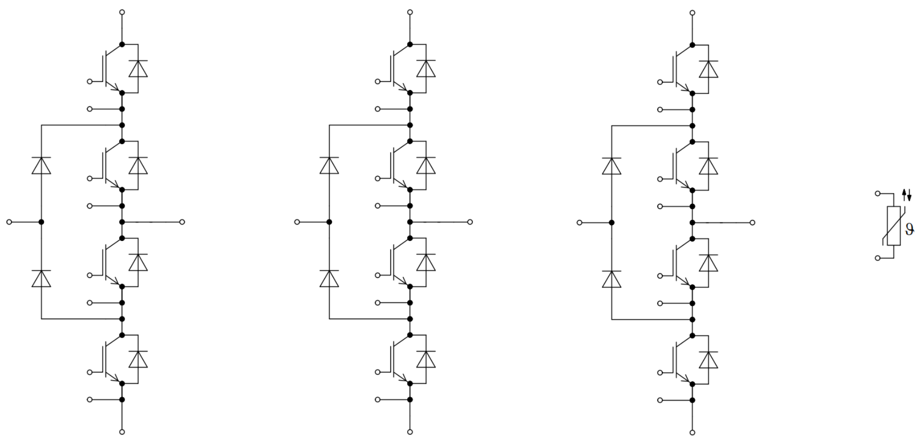
Potential applications

- Three-level applications
- UPS systems
- Solar applications
- Motor drives

Product validation

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

Description



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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, t = 60 s	3.0	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, t = 60 s	3.0	kV
Internal isolation		basic insulation (class 1, IEC 61140)	AlN	
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}			36		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		8.2		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting force per clamp	*F*		40		80	N
Weight	*G*			42		g

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

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	650	V
Implemented collector current	I_{CN}			40	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 115 °C	20	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		80	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	1.81	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			0.018	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} = 300 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.011		µs
			T_{vj} = 125 °C		0.012		
			T_{vj} = 150 °C		0.012		
Rise time (inductive load)	t_r	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.009		µs
			T_{vj} = 125 °C		0.014		
			T_{vj} = 150 °C		0.015		
Turn-off delay time (inductive load)	t_{doff}	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.078		µs
			T_{vj} = 125 °C		0.099		
			T_{vj} = 150 °C		0.105		
Fall time (inductive load)	t_f	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.018		µs
			T_{vj} = 125 °C		0.029		
			T_{vj} = 150 °C		0.046		
Turn-on energy loss per pulse	E_{on}	I_C = 20 A, V_{CC} = 300 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω, di/dt = 1100 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.17		mJ
			T_{vj} = 125 °C		0.2		
			T_{vj} = 150 °C		0.21		
Turn-off energy loss per pulse	E_{off}	I_C = 20 A, V_{CC} = 300 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 6250 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.1		mJ
			T_{vj} = 125 °C		0.2		
			T_{vj} = 150 °C		0.22		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			1.36		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, Inverter

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
Implemented forward current	I_{FN}			25	A
Continuous DC forward current	I_F			20	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		50	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	55	A^2s
			T_{vj} = 150 °C	50	

Table 6 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		1.65	2.15	V
			T_{vj} = 125 °C		1.55		
			T_{vj} = 150 °C		1.50		
Peak reverse recovery current	I_{RM}	V_{CC} = 300 V, I_F = 20 A, V_{GE} = -15 V, -di_F/dt = 1100 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		14		A
			T_{vj} = 125 °C		18		
			T_{vj} = 150 °C		20		
Recovered charge	Q_r	V_{CC} = 300 V, I_F = 20 A, V_{GE} = -15 V, -di_F/dt = 1100 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.77		µC
			T_{vj} = 125 °C		1.2		
			T_{vj} = 150 °C		1.44		
Reverse recovery energy	E_{rec}	V_{CC} = 300 V, I_F = 20 A, V_{GE} = -15 V, -di_F/dt = 1100 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.16		mJ
			T_{vj} = 125 °C		0.22		
			T_{vj} = 150 °C		0.27		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			1.78		K/W

(table continues...)

Table 6 **(continued) Characteristic values**

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

4 IGBT, 3-Level

Table 7 **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}			40	A
Continuous DC collector current	I_{CDC}	$T_{vj\ max}$ = 175 °C	T_H = 115 °C	20	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$		80	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 8 **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	1.81	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			0.018	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} = 300 V, V_{GE} = ±15 V, R_{Gon} = 3.9 Ω	T_{vj} = 25 °C		0.011		µs
			T_{vj} = 125 °C		0.012		
			T_{vj} = 150 °C		0.012		

(table continues...)

Table 8 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Rise time (inductive load)	t_r	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Gon} = 3.9 Ω	T_{vj} = 25 °C		0.005		µs
			T_{vj} = 125 °C		0.006		
			T_{vj} = 150 °C		0.006		
Turn-off delay time (inductive load)	t_{doff}	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Goff} = 3.9 Ω	T_{vj} = 25 °C		0.069		µs
			T_{vj} = 125 °C		0.085		
			T_{vj} = 150 °C		0.091		
Fall time (inductive load)	t_f	I_C = 20 A, V_{CC} = 300 V, V_{GE} = ±15 V, R_{Goff} = 3.9 Ω	T_{vj} = 25 °C		0.021		µs
			T_{vj} = 125 °C		0.052		
			T_{vj} = 150 °C		0.065		
Turn-on energy loss per pulse	E_{on}	I_C = 20 A, V_{CC} = 300 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 3.9 Ω, di/dt = 3500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.08		mJ
			T_{vj} = 125 °C		0.09		
			T_{vj} = 150 °C		0.09		
Turn-off energy loss per pulse	E_{off}	I_C = 20 A, V_{CC} = 300 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 3.9 Ω, dv/dt = 6210 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.11		mJ
			T_{vj} = 125 °C		0.19		
			T_{vj} = 150 °C		0.21		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			1.36		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

5 Diode, 3-Level

Table 9 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			20	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		40	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	65	A^2s
			T_{vj} = 150 °C	65	

Table 10 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		1.45	1.85	V
			T_{vj} = 125 °C		1.60		
			T_{vj} = 150 °C		1.65		
Peak reverse recovery current	I_{RM}	V_{CC} = 300 V, I_F = 20 A, V_{GE} = 15 V, -di_F/dt = 3500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		19		A
			T_{vj} = 125 °C		17		
			T_{vj} = 150 °C		16		
Recovered charge	Q_r	V_{CC} = 300 V, I_F = 20 A, V_{GE} = 15 V, -di_F/dt = 3500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.13		µC
			T_{vj} = 125 °C		0.12		
			T_{vj} = 150 °C		0.12		
Reverse recovery energy	E_{rec}	V_{CC} = 300 V, I_F = 20 A, V_{GE} = 15 V, -di_F/dt = 3500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.015		mJ
			T_{vj} = 125 °C		0.015		
			T_{vj} = 150 °C		0.015		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			1.92		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

6 NTC-Thermistor

Table 11 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

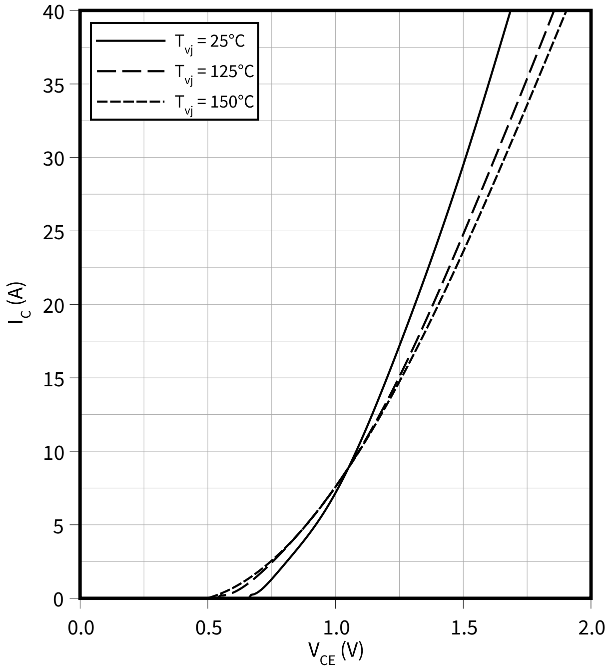
***Note**: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

7 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

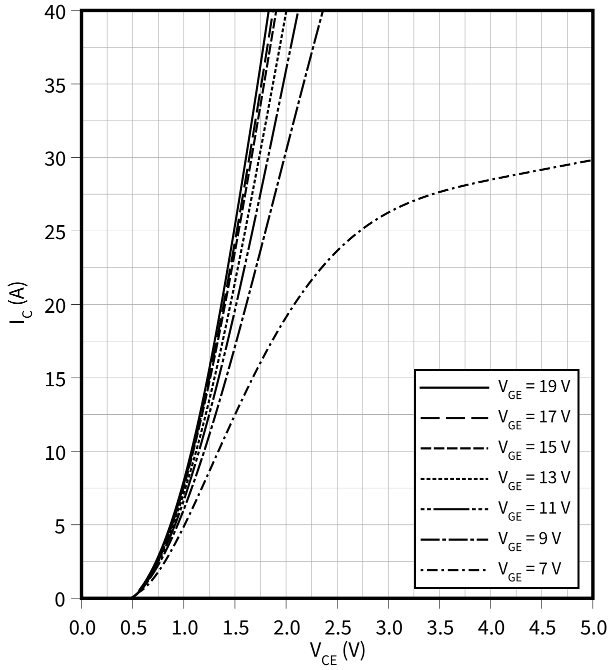
$V_{GE} = 15\ V$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

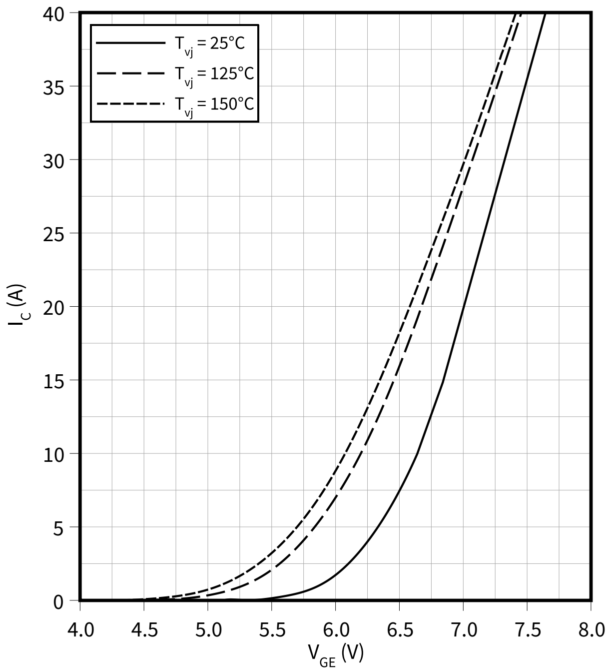
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

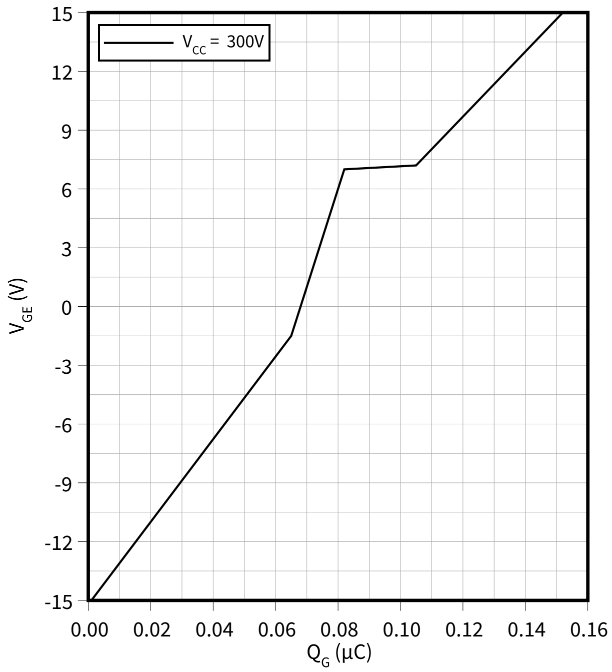
$V_{CE} = 20\ V$



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

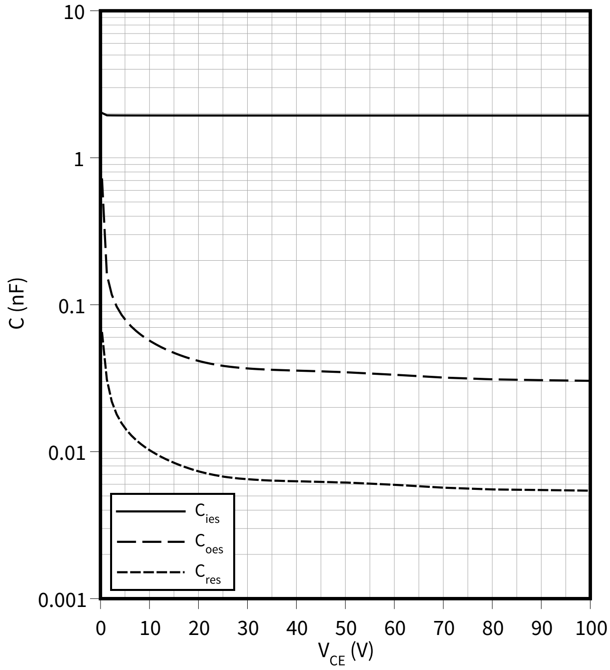
$I_C = 20\ A,\ T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

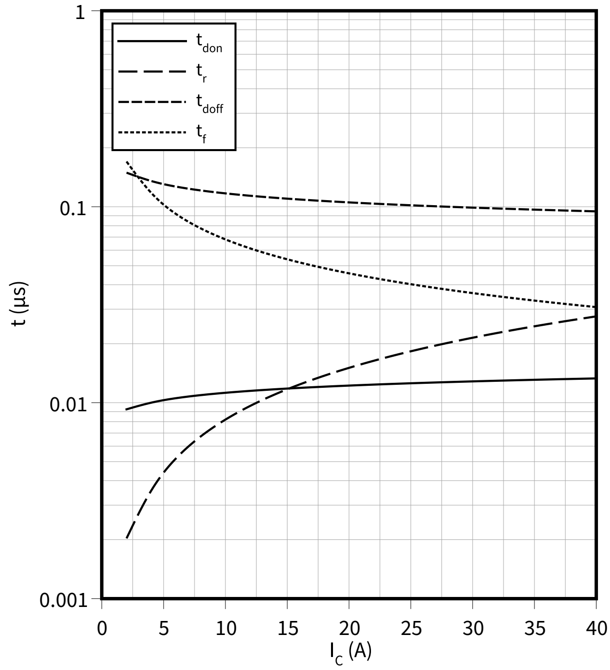
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

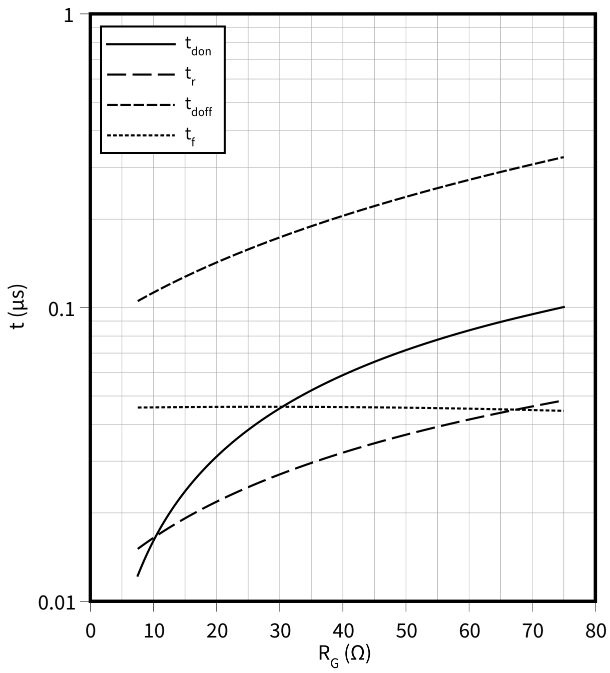
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 7.5\ \Omega$, $V_{CC} = 300$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

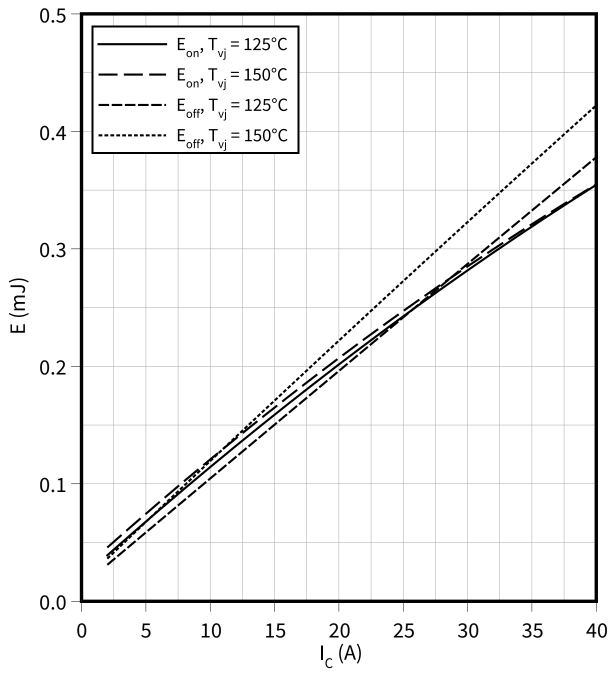
$I_C = 20$ A, $V_{CC} = 300$ V, $V_{GE} = -15 / 15$ V, $T_{vj} = 150$ °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

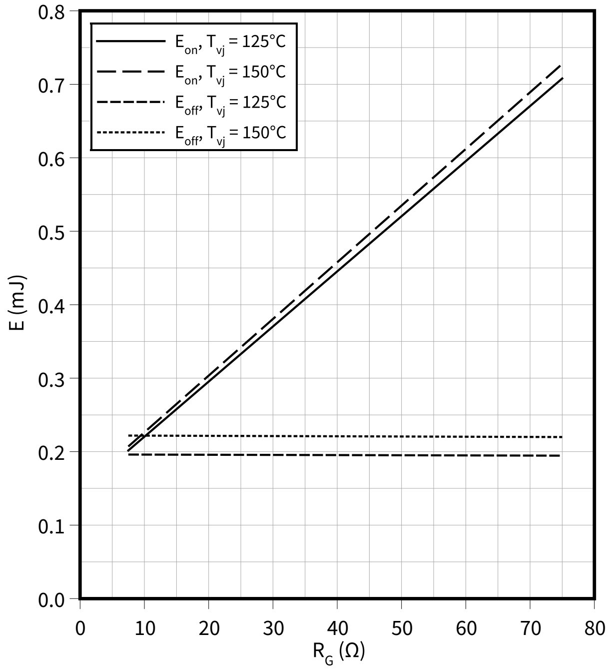
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 7.5\ \Omega$, $V_{CC} = 300$ V, $V_{GE} = -15 / 15$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

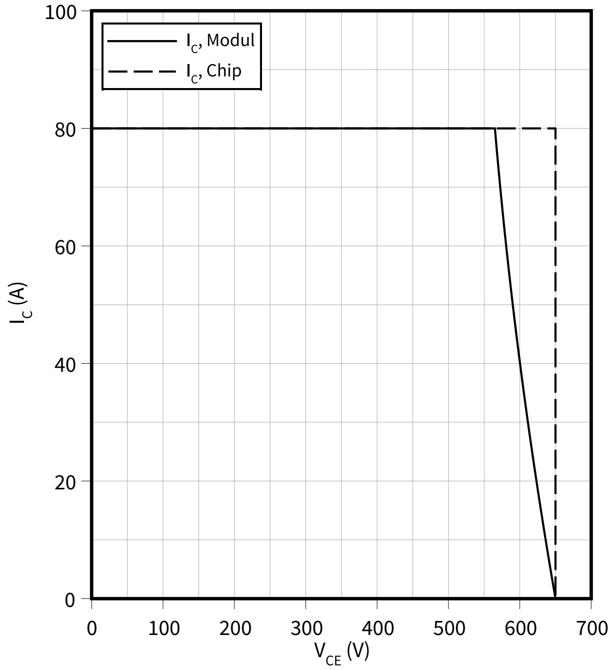
$I_C = 20$ A, $V_{CC} = 300$ V, $V_{GE} = -15 / 15$ V



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

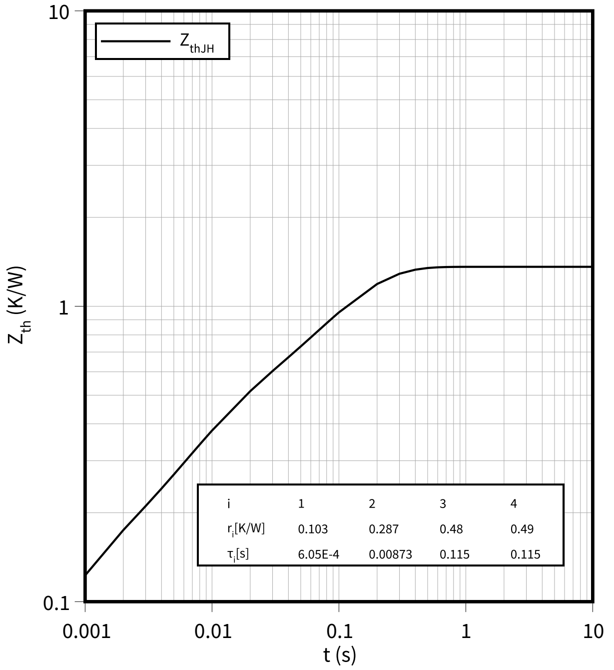
$I_C = f(V_{CE})$

$R_{Goff} = 7.5\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



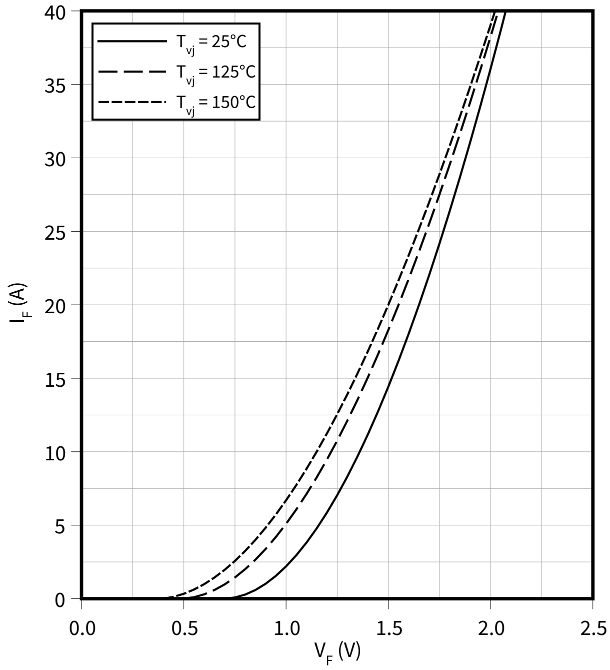
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

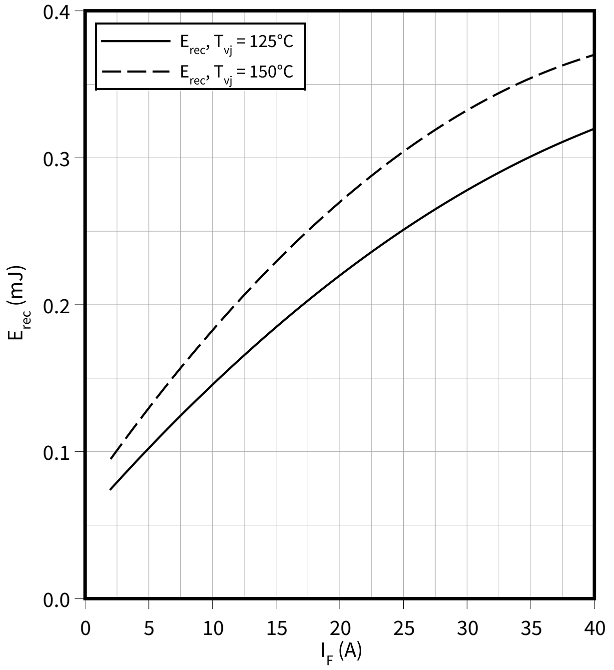
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

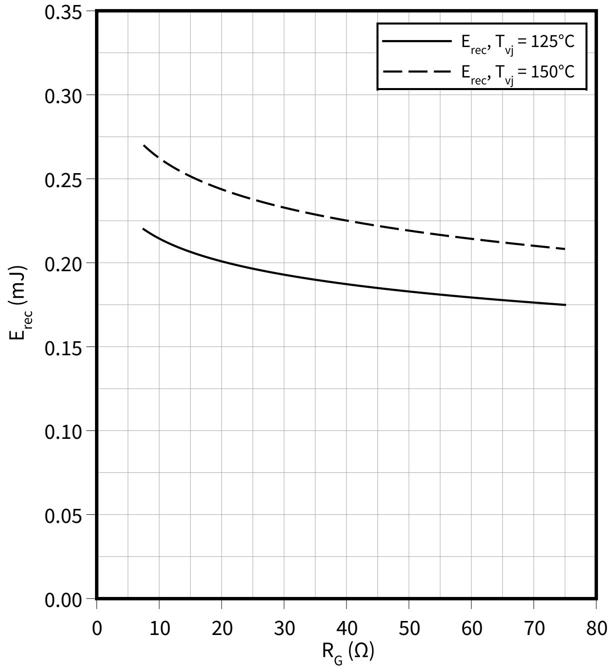
$R_{Gon} = 7.5\ \Omega$, $V_{CE} = 300$ V



Switching losses (typical), Diode, Inverter

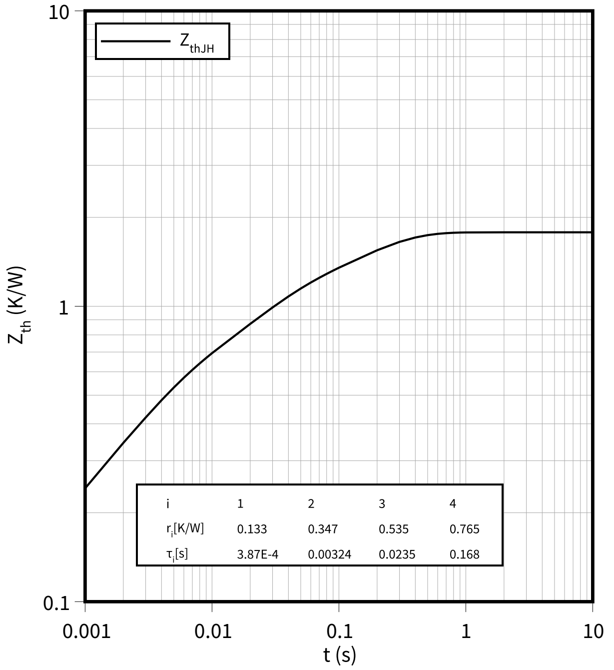
$E_{rec} = f(R_G)$

$V_{CE} = 300$ V, $I_F = 20$ A



Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$

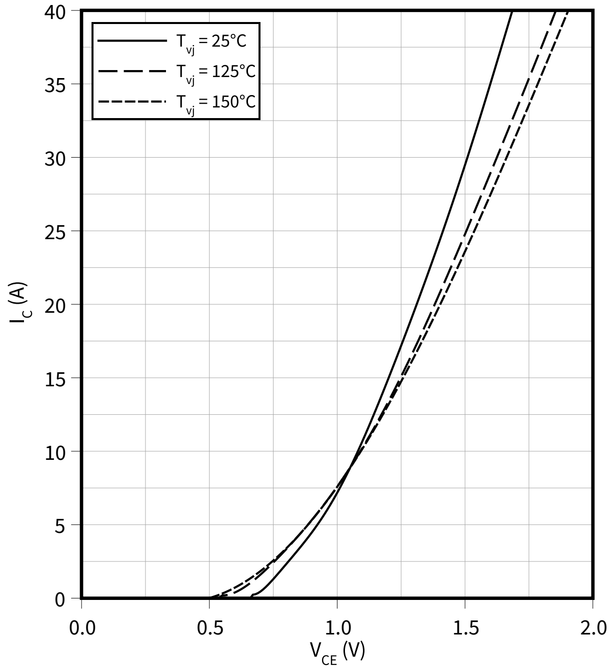


i	1	2	3	4
r_i[K/W]	0.133	0.347	0.535	0.765
τ_i[s]	3.87E-4	0.00324	0.0235	0.168

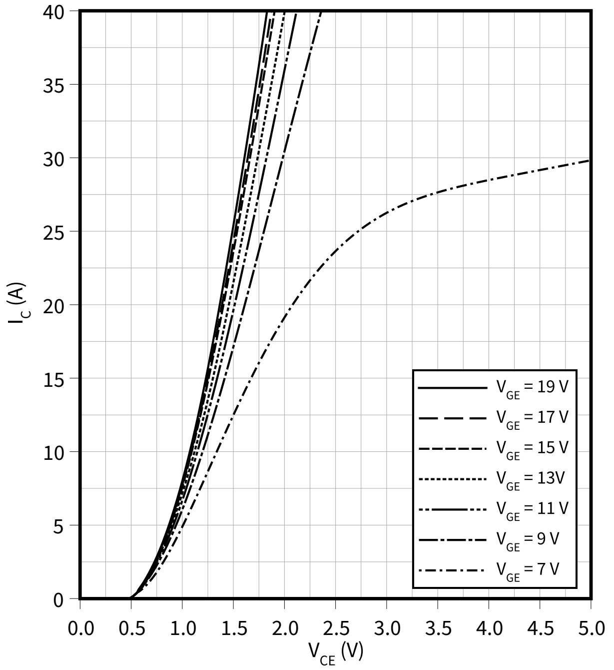
Output characteristic (typical), IGBT, 3-Level

$I_C = f(V_{CE})$

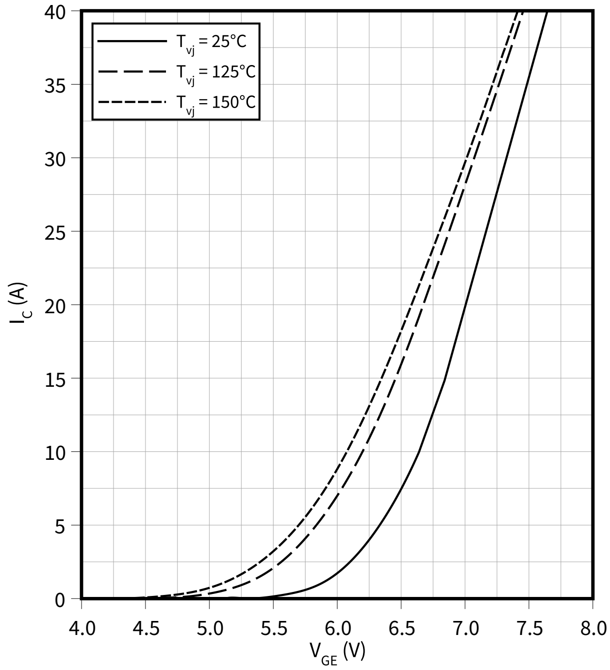
$V_{GE} = 15$ V



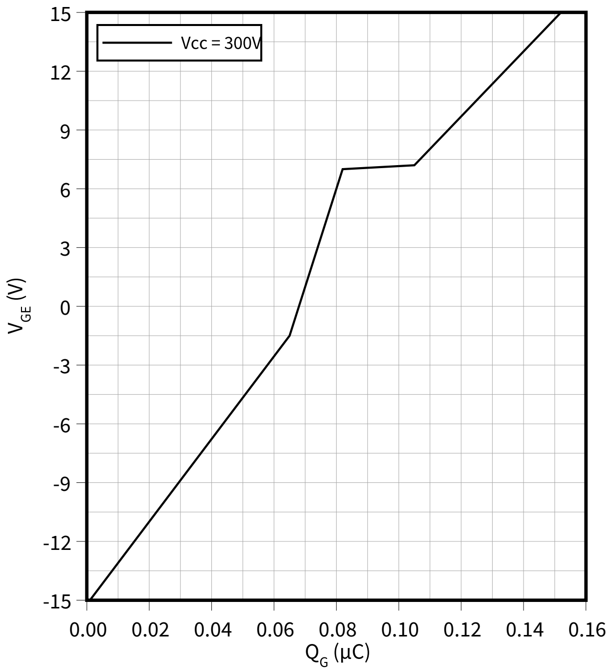
Output characteristic field (typical), IGBT, 3-Level
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



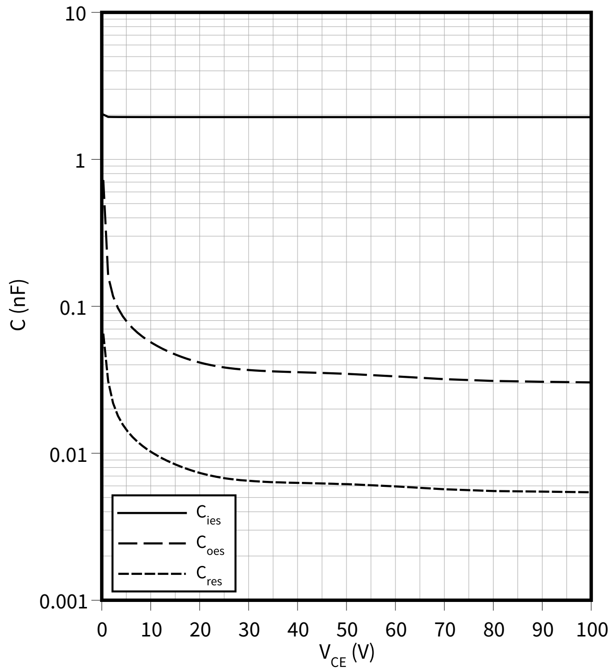
Transfer characteristic (typical), IGBT, 3-Level
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



Gate charge characteristic (typical), IGBT, 3-Level
$V_{GE} = f(Q_G)$
$I_C = 20\ A$, $T_{vj} = 25\ °C$



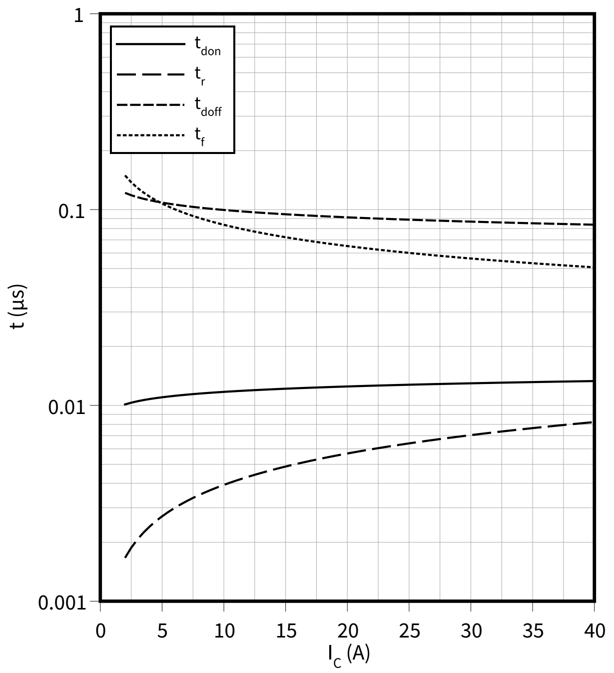
Capacity characteristic (typical), IGBT, 3-Level
$C = f(V_{CE})$
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



Switching times (typical), IGBT, 3-Level

$t = f(I_C)$

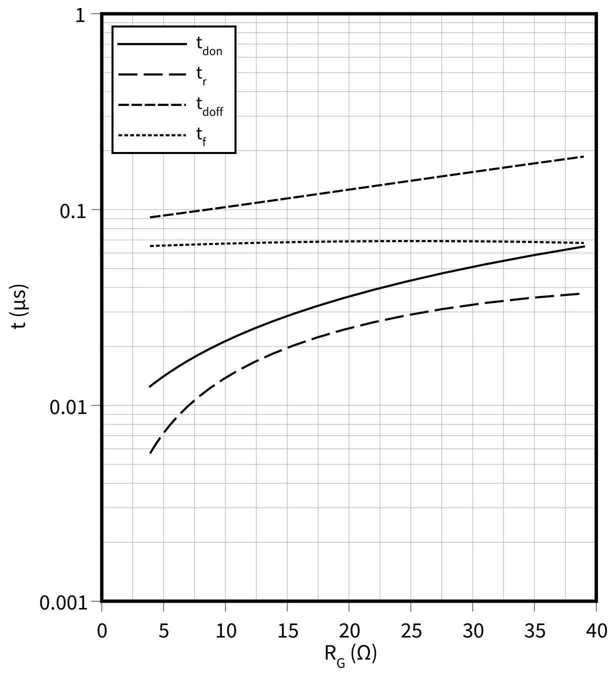
R_{Goff} = 3.9 Ω, R_{Gon} = 3.9 Ω, V_{CC} = 300 V, V_{GE} = -15 / 15 V, T_{vj} = 150 °C



Switching times (typical), IGBT, 3-Level

$t = f(R_G)$

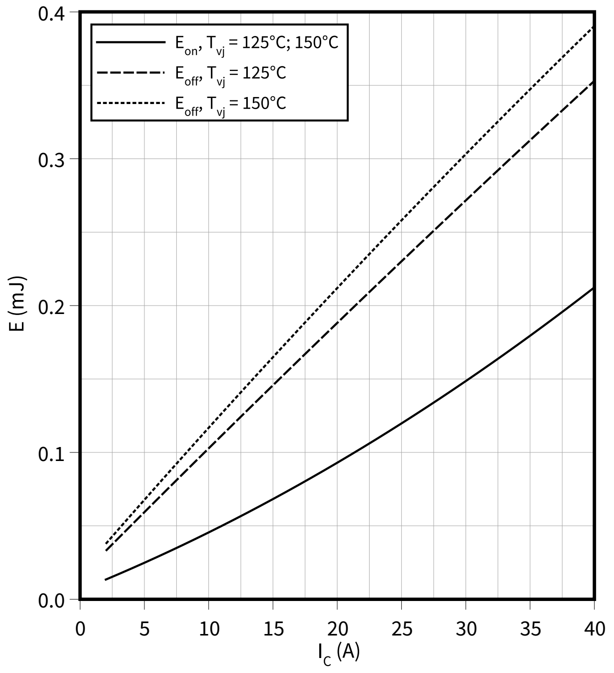
I_C = 20 A, V_{CC} = 300 V, V_{GE} = -15 / 15 V, T_{vj} = 150 °C



Switching losses (typical), IGBT, 3-Level

$E = f(I_C)$

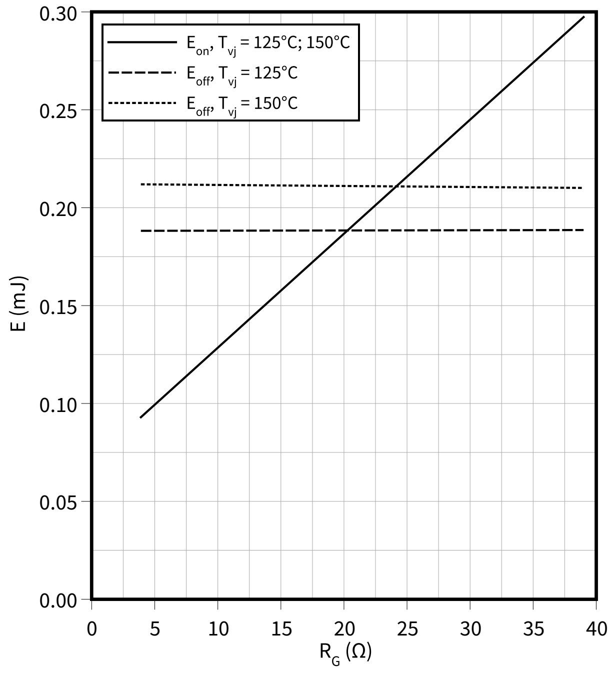
R_{Goff} = 3.9 Ω, R_{Gon} = 3.9 Ω, V_{CC} = 300 V, V_{GE} = -15 / 15 V



Switching losses (typical), IGBT, 3-Level

$E = f(R_G)$

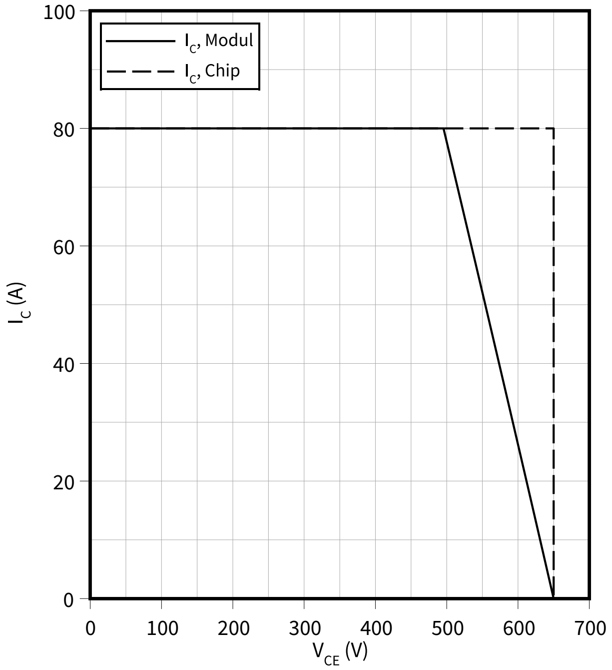
I_C = 20 A, V_{CC} = 300 V, V_{GE} = -15 / 15 V



Reverse bias safe operating area (RBSOA), IGBT, 3-Level

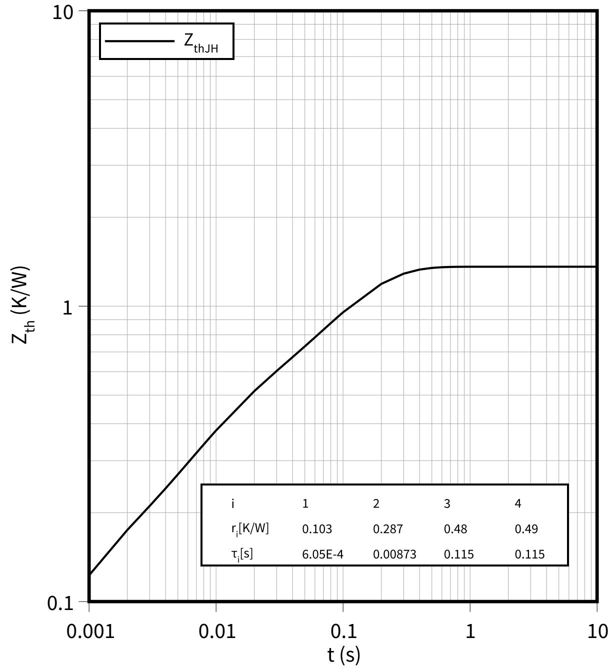
$I_C = f(V_{CE})$

$R_{Goff} = 3.9\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$



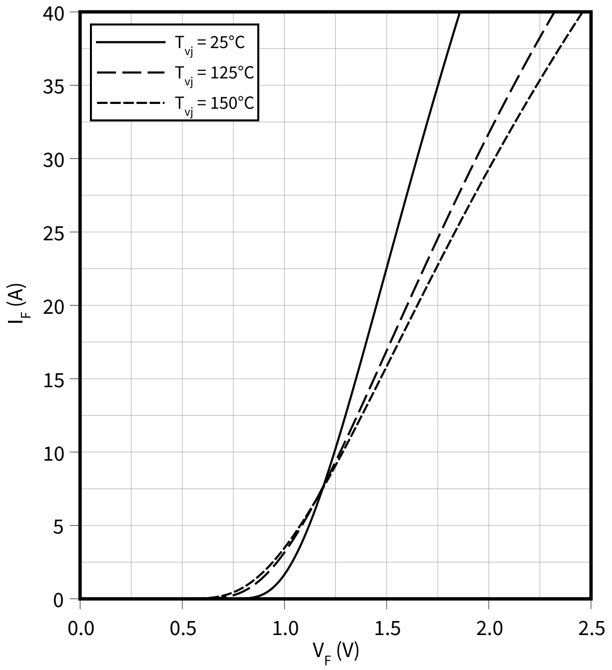
Transient thermal impedance, IGBT, 3-Level

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, 3-Level

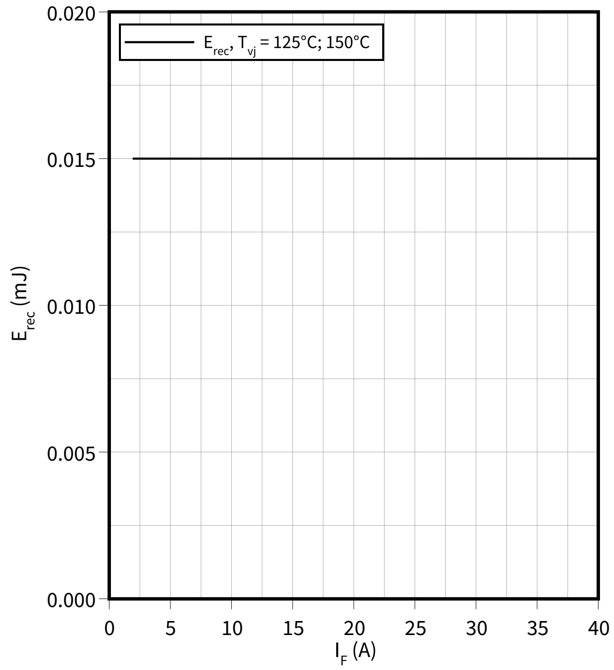
$I_F = f(V_F)$



Switching losses (typical), Diode, 3-Level

$E_{rec} = f(I_F)$

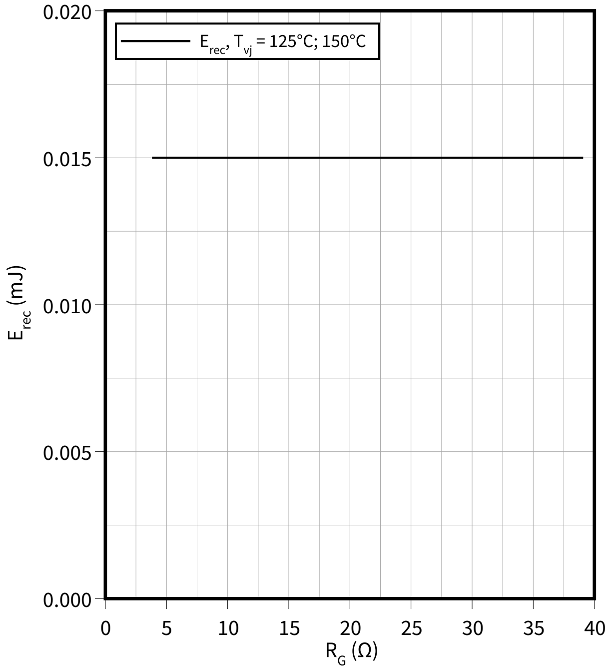
$R_{Gon} = 3.9\ \Omega$, $V_{CE} = 300\ V$



Switching losses (typical), Diode, 3-Level

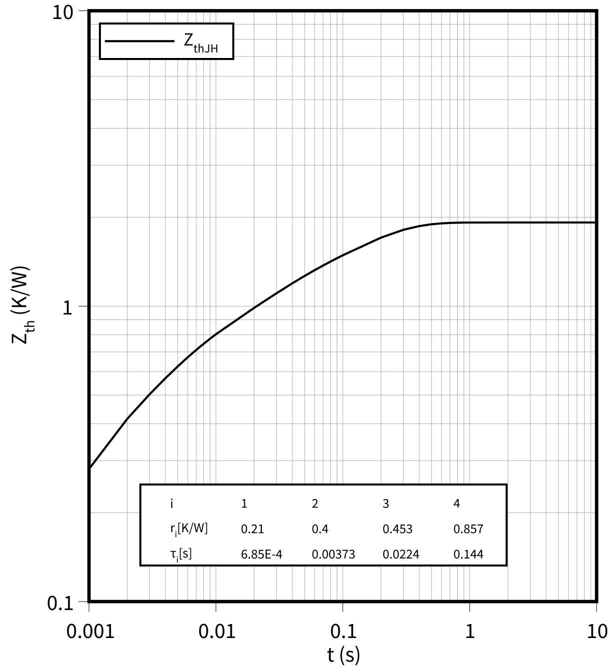
$E_{rec} = f(R_G)$

$V_{CE} = 300\ V$, $I_F = 20\ A$



Transient thermal impedance, Diode, 3-Level

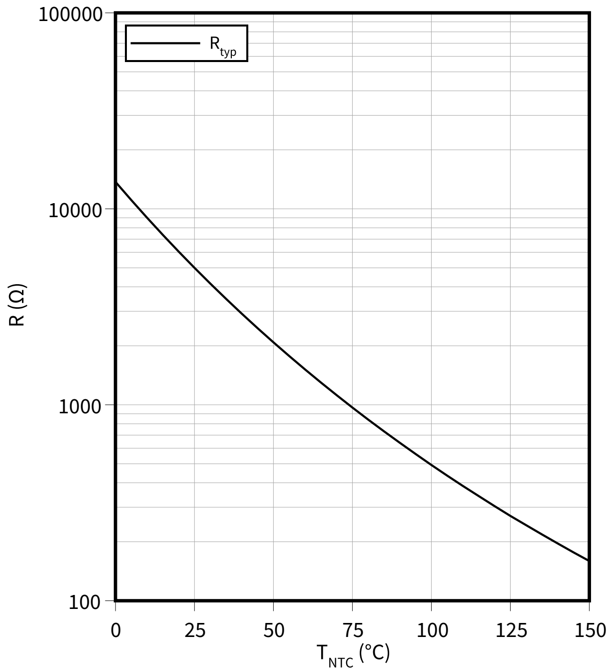
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.21	0.4	0.453	0.857
τ_i[s]	6.85E-4	0.00373	0.0224	0.144

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



8 Circuit diagram

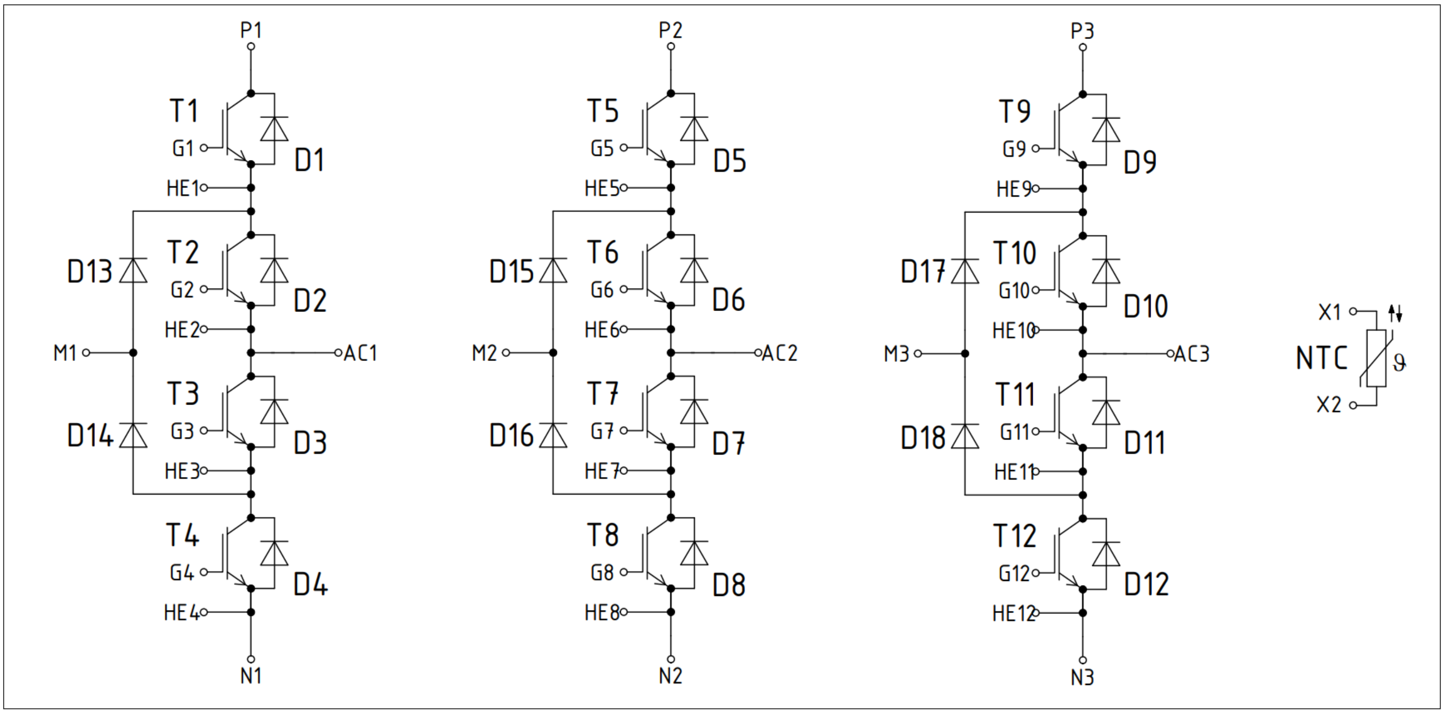


Figure 1

9 Package outlines

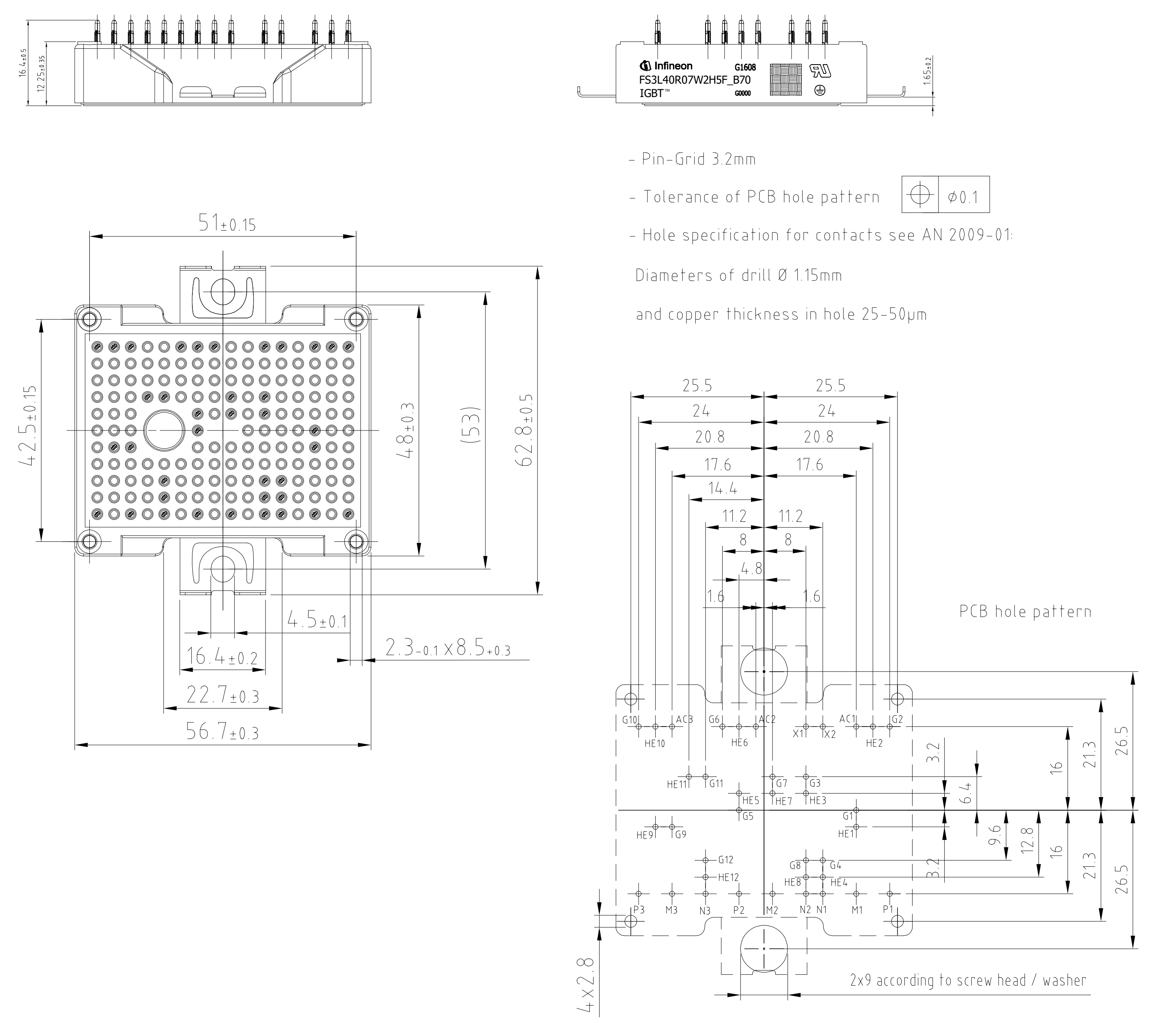


Figure 2

10 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	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2023-10-04	Initial version
1.00	2024-04-09	Final datasheet

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Edition 2024-04-09

Published by

Infineon Technologies AG

81726 Munich, Germany

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Document reference
IFX-ABH459-002