

Final datasheet

EconoPIM™3 module with fast Trench/Fieldstop IGBT4 and emitter controlled 4 diode and PressFIT / NTC / TIM

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 75\text{ A} / I_{CRM} = 150\text{ A}$
 - $V_{CE,sat}$ with positive temperature coefficient
 - Low switching losses
 - Low $V_{CE,sat}$
 - $T_{vj,op} = 150^\circ\text{C}$
- Mechanical features
 - Integrated NTC temperature sensor
 - Standard housing
 - Pre-applied thermal interface material
 - High power and thermal cycling capability
 - Copper base plate
 - PressFIT contact technology



Typical appearance

Potential applications

- Auxiliary inverters
- Motor drives
- Servo drives

Product validation

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

Description

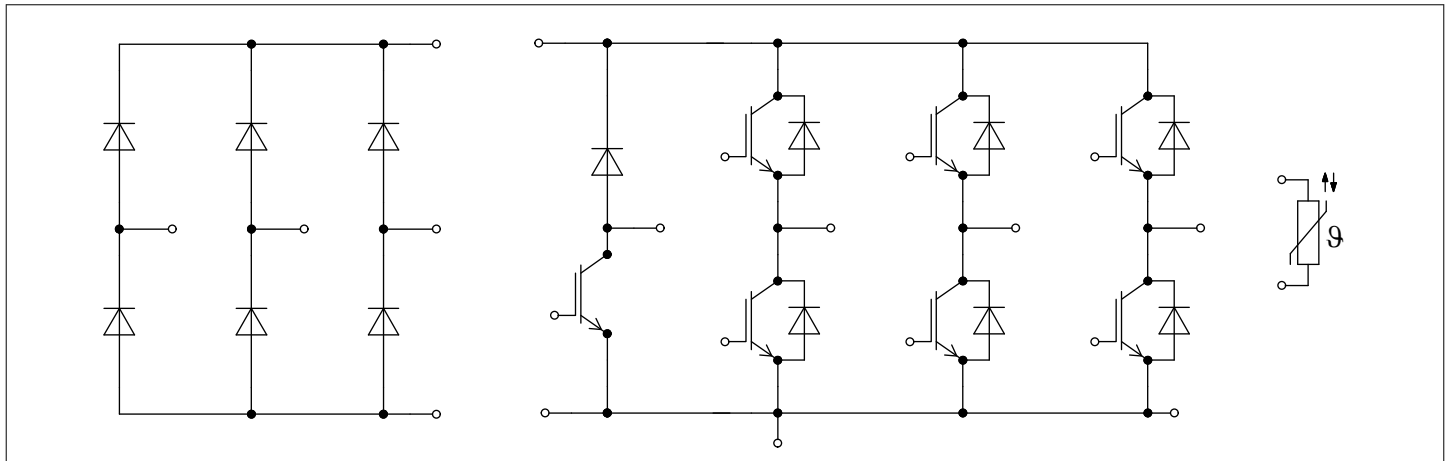


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	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		> 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}			40		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_H = 25^\circ\text{C}$, per switch		3		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$, per switch		4		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	3	6	Nm
Weight	G			300		g

Note: Storage and shipment of modules with TIM => see AN2012-07
The current under continuous operation is limited to 50 A 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}		$T_{vj} = 25^\circ\text{C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj \max} = 175^\circ\text{C}$	$T_H = 75^\circ\text{C}$	75	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$	150	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	$V_{CE\ sat}$	$I_C = 75\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.85	2.15	V
			$T_{vj} = 125\ ^\circ C$	2.15		
			$T_{vj} = 150\ ^\circ C$	2.25		
Gate threshold voltage	V_{GETh}	$I_C = 2.4\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	5.20	5.80	6.40	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V$		0.57		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$		10		Ω
Input capacitance	C_{ies}	$f = 1000\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		4.3		nF
Reverse transfer capacitance	C_{res}	$f = 1000\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.16		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V, T_{vj} = 25\ ^\circ C$			1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$			100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 75\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 1.1\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.160		μs
			$T_{vj} = 125\ ^\circ C$	0.170		
			$T_{vj} = 150\ ^\circ C$	0.170		
Rise time (inductive load)	t_r	$I_C = 75\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 1.1\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.030		μs
			$T_{vj} = 125\ ^\circ C$	0.040		
			$T_{vj} = 150\ ^\circ C$	0.040		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 75\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.1\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.340		μs
			$T_{vj} = 125\ ^\circ C$	0.430		
			$T_{vj} = 150\ ^\circ C$	0.450		
Fall time (inductive load)	t_f	$I_C = 75\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.1\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.080		μs
			$T_{vj} = 125\ ^\circ C$	0.150		
			$T_{vj} = 150\ ^\circ C$	0.170		
Turn-on energy loss per pulse	E_{on}	$I_C = 75\ A, V_{CC} = 600\ V, L_\sigma = 40\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 1.1\ \Omega, di/dt = 2500\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	3.1		mJ
			$T_{vj} = 125\ ^\circ C$	6.6		
			$T_{vj} = 150\ ^\circ C$	7.65		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy loss per pulse	E_{off}	$I_C = 75\text{ A}$, $V_{CC} = 600\text{ V}$, $L_\sigma = 40\text{ nH}$, $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 1.1\ \Omega$, $dv/dt = 3600\text{ V}/\mu\text{s}$ ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	4.2		mJ
			$T_{vj} = 125\text{ °C}$	6.4		
			$T_{vj} = 150\text{ °C}$	7.2		
SC data	I_{SC}	$V_{GE} \leq 15\text{ V}$, $V_{CC} = 800\text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 10\ \mu\text{s}$, $T_{vj} = 150\text{ °C}$	270		A
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material			0.481	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}		$T_{vj} = 25\text{ }^{\circ}\text{C}$	1200	V
Continuous DC forward current	I_F			75	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		150	A
I^2t - value	I^2t	$t_P = 10\text{ ms}$, $V_R = 0\text{ V}$	$T_{vj} = 125\text{ }^{\circ}\text{C}$	960	A ² s

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 75\text{ A}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	1.70	2.15	V
			$T_{vj} = 125\text{ °C}$	1.65		
			$T_{vj} = 150\text{ °C}$	1.65		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600\text{ V}$, $I_F = 75\text{ A}$, $V_{GE} = -15\text{ V}$, $-di_F/dt = 2500\text{ A}/\mu\text{s}$ ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	88		A
			$T_{vj} = 125\text{ °C}$	89		
			$T_{vj} = 150\text{ °C}$	90		
Recovered charge	Q_r	$V_{CC} = 600\text{ V}$, $I_F = 75\text{ A}$, $V_{GE} = -15\text{ V}$, $-di_F/dt = 2500\text{ A}/\mu\text{s}$ ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	7.3		μC
			$T_{vj} = 125\text{ °C}$	13		
			$T_{vj} = 150\text{ °C}$	14.5		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Reverse recovery energy	E_{rec}	$V_{CC} = 600\text{ V}$, $I_F = 75\text{ A}$, $V_{GE} = -15\text{ V}$, $-di_F/dt = 2500\text{ A}/\mu\text{s}$ ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$		2.65		mJ
			$T_{vj} = 125\text{ °C}$		4.6		
			$T_{vj} = 150\text{ °C}$		5.65		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.694	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}		$T_{vj} = 25\text{ °C}$	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	$T_H = 85\text{ °C}$		80	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 85\text{ °C}$		140	A
Surge forward current	I_{FSM}	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	600	A
			$T_{vj} = 150\text{ °C}$	470	
I^2t - value	I^2t	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	1800	A ² s
			$T_{vj} = 150\text{ °C}$	1100	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 75\text{ A}$	$T_{vj} = 150\text{ °C}$		1.15		V
Reverse current	I_r	$T_{vj} = 150\text{ °C}$, $V_R = 1600\text{ V}$			1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.814	K/W
Temperature under switching conditions	$T_{vj,op}$			-40		150	°C

5 IGBT, Brake-Chopper

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25\text{ °C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\text{ max}} = 175\text{ °C}$	$T_H = 85\text{ °C}$	50	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\text{ op}}$		100	A
Gate-emitter peak voltage	V_{GES}			± 20	V

Table 10 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\text{ sat}}$	$I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.85	2.15	V
			$T_{vj} = 125\text{ °C}$		2.15		
			$T_{vj} = 150\text{ °C}$		2.25		
Gate threshold voltage	V_{GETh}	$I_C = 1.6\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25\text{ °C}$		5.20	5.80	6.40	V
Gate charge	Q_G	$V_{GE} = \pm 15\text{ V}$			0.38		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ °C}$			4		Ω
Input capacitance	C_{ies}	$f = 1000\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$			2.8		nF
Reverse transfer capacitance	C_{res}	$f = 1000\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$			0.1		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$, $T_{vj} = 25\text{ °C}$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 50\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 15\text{ }\Omega$	$T_{vj} = 25\text{ °C}$		0.160		μs
			$T_{vj} = 125\text{ °C}$		0.170		
			$T_{vj} = 150\text{ °C}$		0.170		
Rise time (inductive load)	t_r	$I_C = 50\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 15\text{ }\Omega$	$T_{vj} = 25\text{ °C}$		0.030		μs
			$T_{vj} = 125\text{ °C}$		0.040		
			$T_{vj} = 150\text{ °C}$		0.040		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 50\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 15\text{ }\Omega$	$T_{vj} = 25\text{ °C}$		0.330		μs
			$T_{vj} = 125\text{ °C}$		0.430		
			$T_{vj} = 150\text{ °C}$		0.450		

(table continues...)

Table 10 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Fall time (inductive load)	t_f	$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 15 \Omega$	$T_{vj} = 25 \text{ °C}$	0.080		μs
			$T_{vj} = 125 \text{ °C}$	0.150		
			$T_{vj} = 150 \text{ °C}$	0.170		
Turn-on energy loss per pulse	E_{on}	$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 40 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 15 \Omega$	$T_{vj} = 25 \text{ °C}$	5.7		mJ
			$T_{vj} = 125 \text{ °C}$	7.7		
			$T_{vj} = 150 \text{ °C}$	8.4		
Turn-off energy loss per pulse	E_{off}	$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 40 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 15 \Omega$	$T_{vj} = 25 \text{ °C}$	2.8		mJ
			$T_{vj} = 125 \text{ °C}$	4.3		
			$T_{vj} = 150 \text{ °C}$	4.8		
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 10 \mu\text{s}$, $T_{vj} = 150 \text{ °C}$	180		A
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material			0.634	K/W
Temperature under switching conditions	$T_{vj op}$		-40		150	°C

6 Diode, Brake-Chopper

Table 11 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25 \text{ °C}$	1200	V
Continuous DC forward current	I_F		25	A
Repetitive peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$	50	A
I^2t - value	I^2t	$t_p = 10 \text{ ms}$, $V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	A^2s
			$T_{vj} = 150 \text{ °C}$	

Table 12 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 25 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.75	2.15	V
			$T_{vj} = 125 \text{ °C}$	1.75		
			$T_{vj} = 150 \text{ °C}$	1.75		

(table continues...)

Table 12 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}, I_F = 25 \text{ A}$	$T_{vj} = 25 \text{ °C}$	39		A
			$T_{vj} = 125 \text{ °C}$	40		
			$T_{vj} = 150 \text{ °C}$	41		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}, I_F = 25 \text{ A}$	$T_{vj} = 25 \text{ °C}$	2.4		μC
			$T_{vj} = 125 \text{ °C}$	4.1		
			$T_{vj} = 150 \text{ °C}$	4.4		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}, I_F = 25 \text{ A}$	$T_{vj} = 25 \text{ °C}$	0.9		mJ
			$T_{vj} = 125 \text{ °C}$	1.5		
			$T_{vj} = 150 \text{ °C}$	1.7		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material			1.27	K/W
Temperature under switching conditions	$T_{vj op}$		-40		150	°C

7 NTC-Thermistor

Table 13 Characteristic values

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

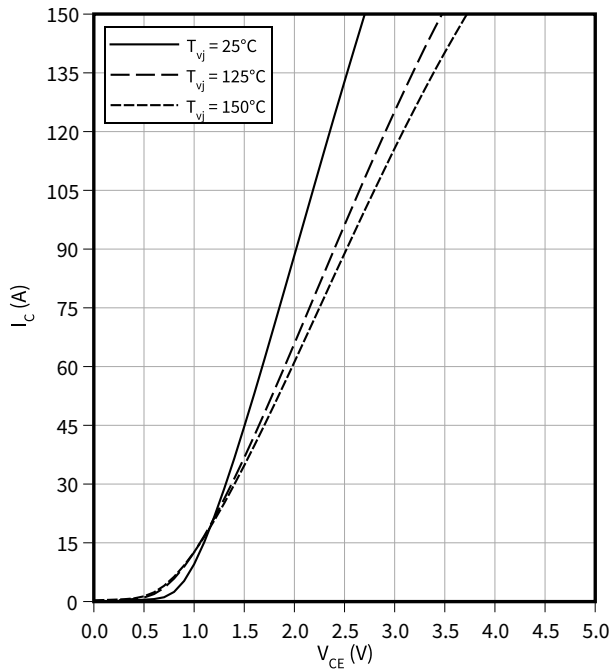
Note: Specification according to the valid application note.

8 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

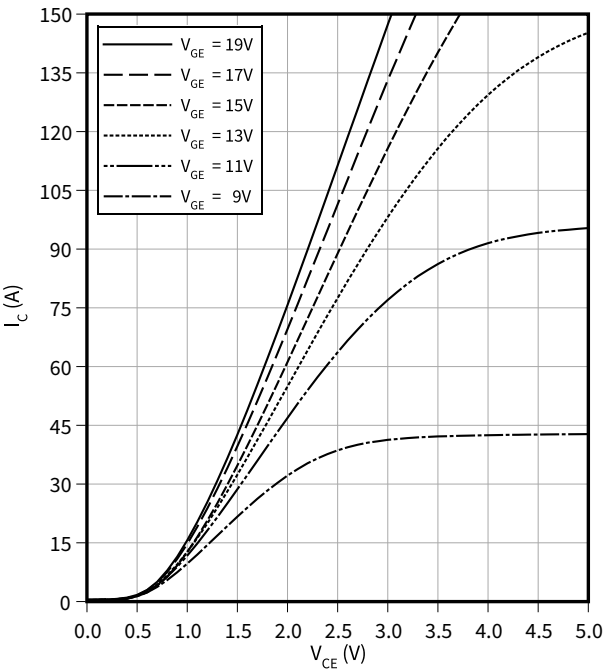
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

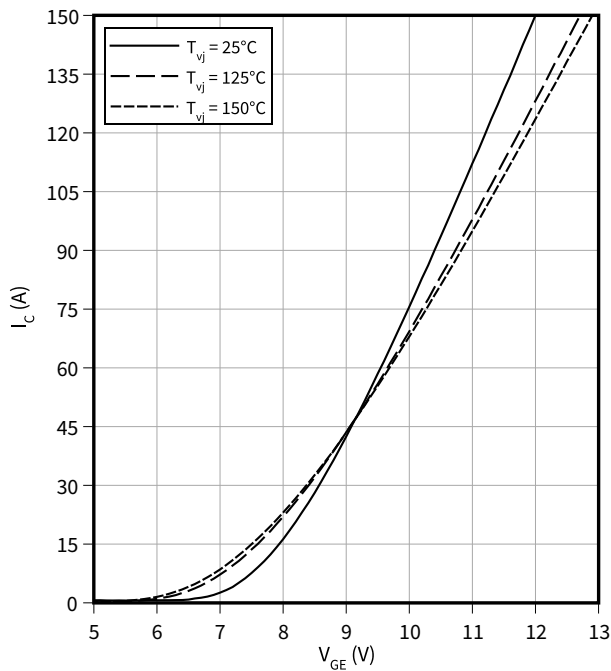
$T_{vj} = 150\text{ °C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

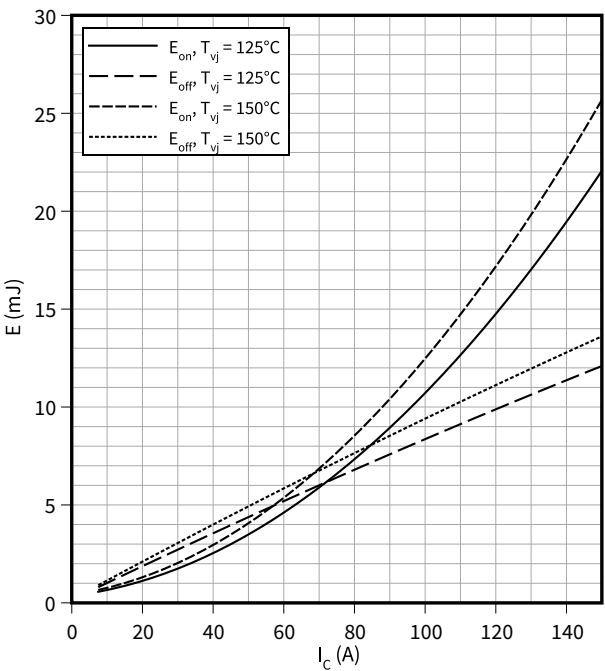
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

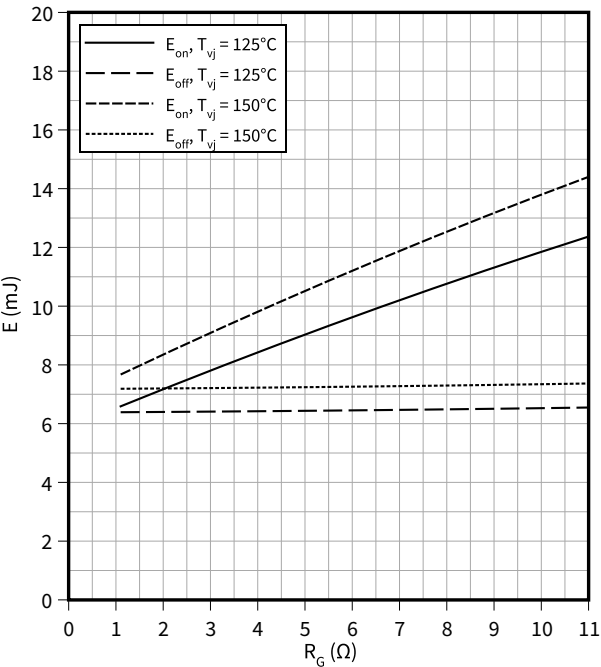
$R_{Goff} = 1.1\text{ }\Omega$, $R_{Gon} = 1.1\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CC} = 600\text{ V}$



8 Characteristics diagrams

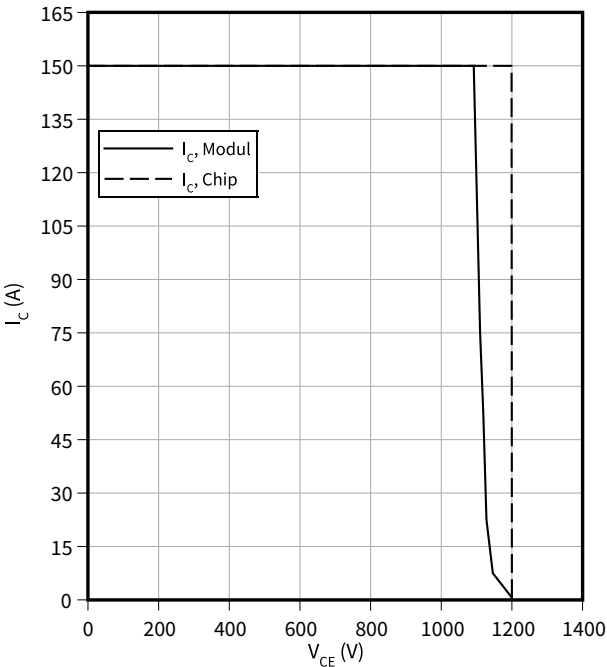
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$
 $V_{GE} = \pm 15\text{ V}, I_C = 75\text{ A}, V_{CC} = 600\text{ V}$



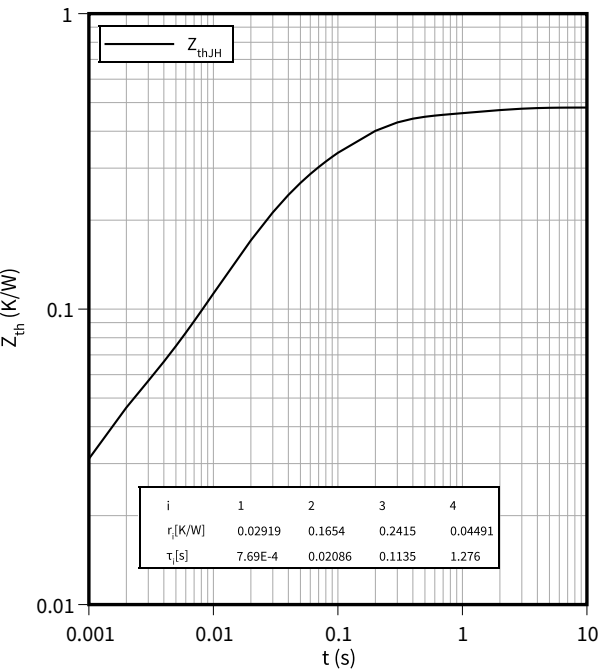
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$
 $R_{Goff} = 1.1\text{ }\Omega, V_{GE} = \pm 15\text{ V}, T_{vj} = 150\text{ }^\circ\text{C}$



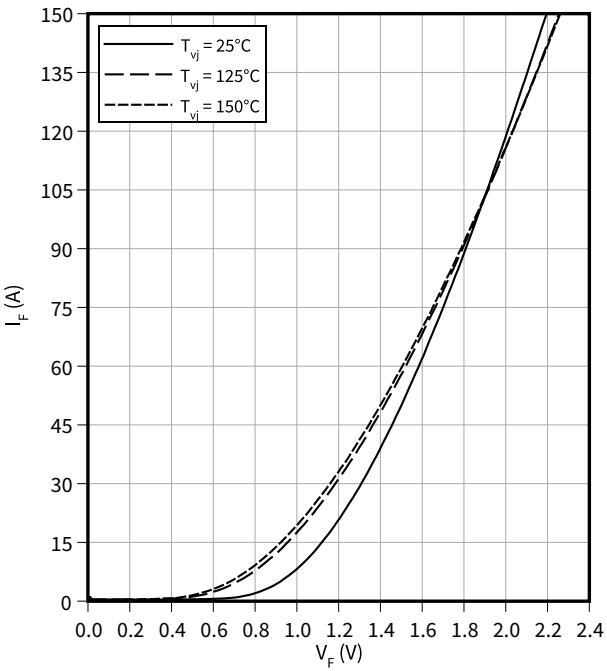
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

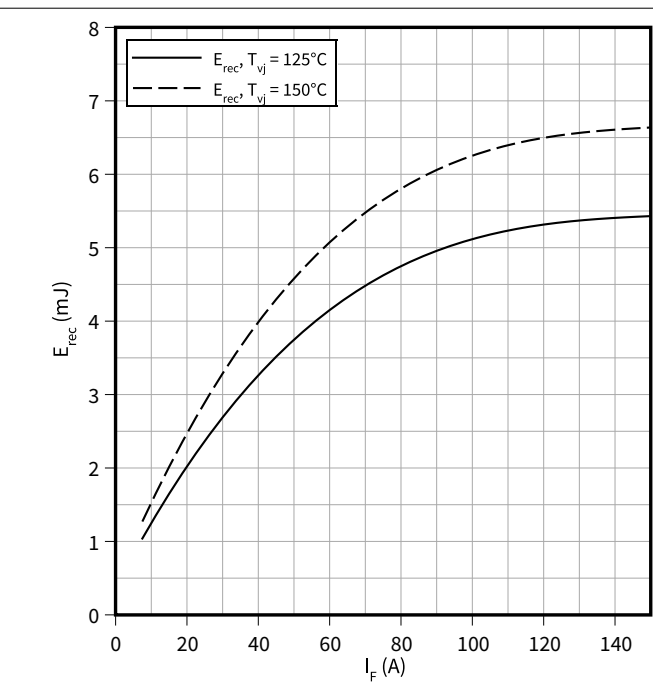
$I_F = f(V_F)$



8 Characteristics diagrams

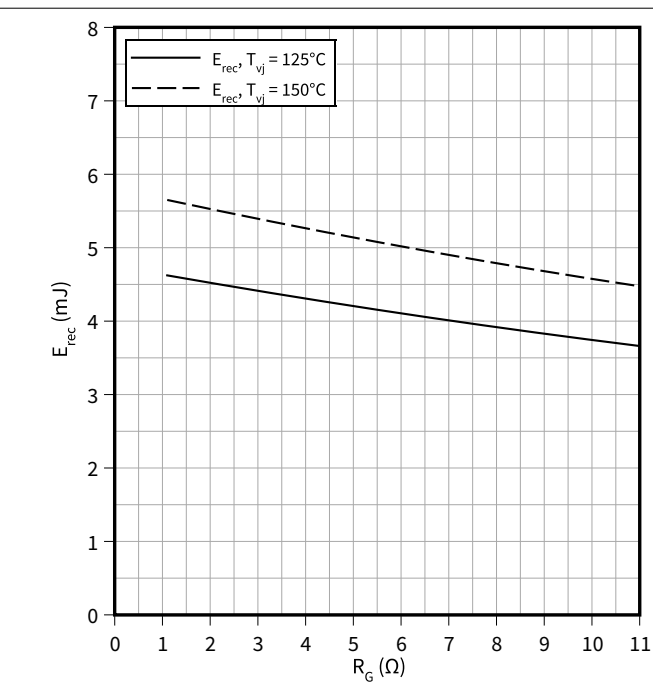
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$
 $R_{Gon} = 1.1 \Omega, V_{CC} = 600 V$



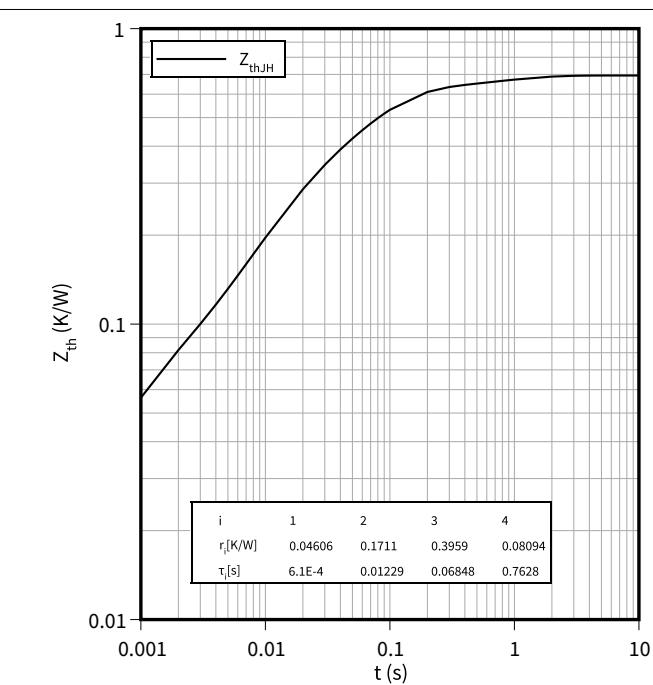
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$
 $I_F = 75 A, V_{CC} = 600 V$



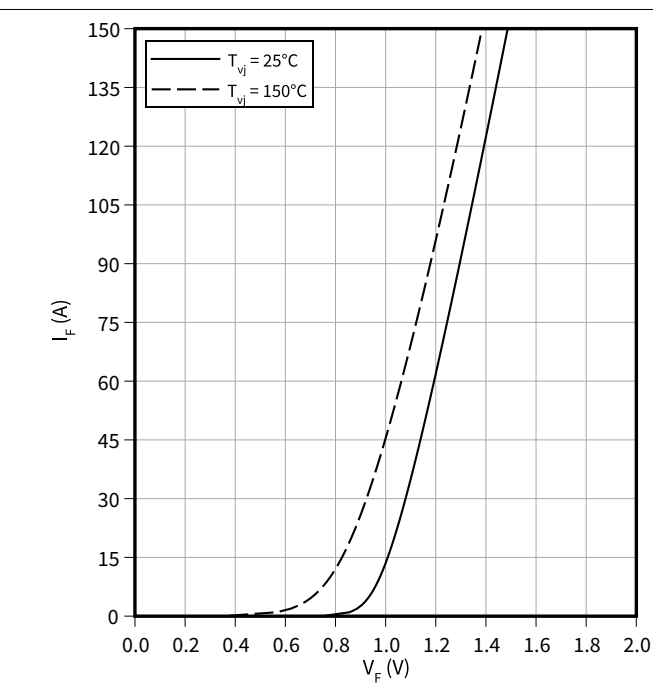
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$

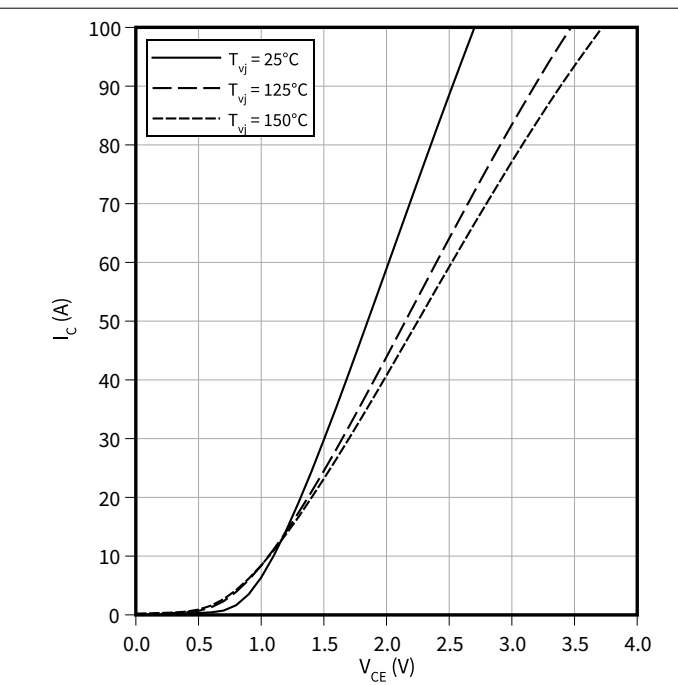


8 Characteristics diagrams

Output characteristic (typical), IGBT, Brake-Chopper

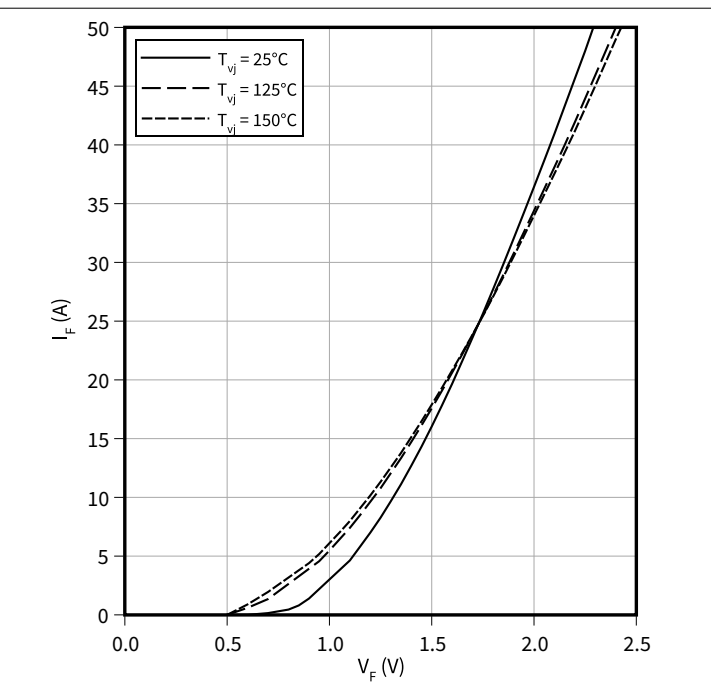
$I_C = f(V_{CE})$

$V_{GE} = 15\text{ V}$



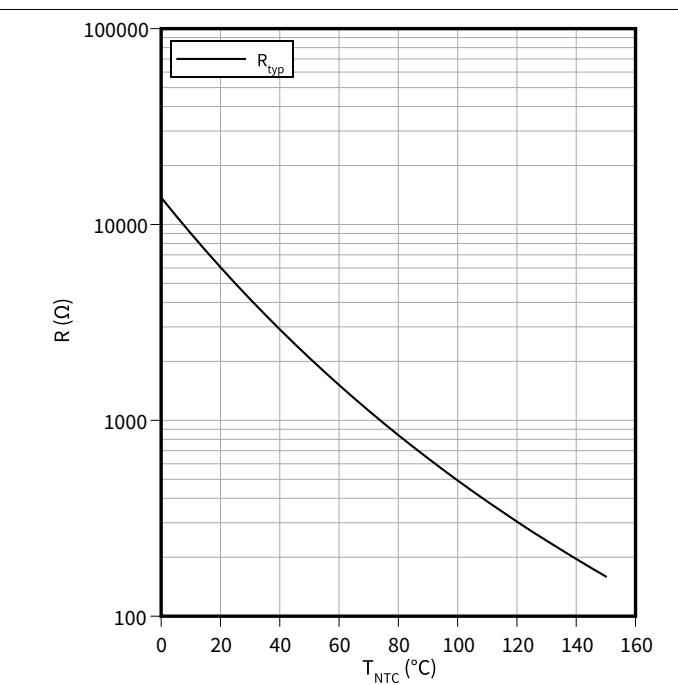
Forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 **Circuit diagram**

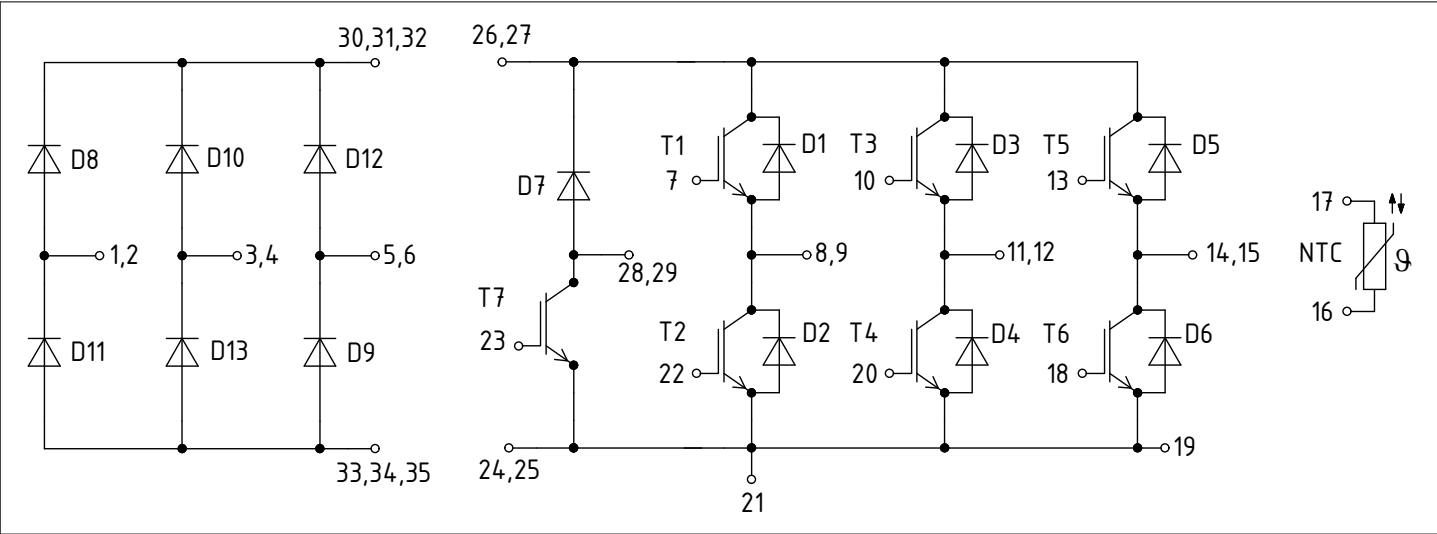


Figure 1

Figure 2

11 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	Digit	Example
	Module serial number	1 – 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 – 21	15
	Date code (production week)	22 – 23	30
Example	 7154914284655054991153071549142846550549911530		

Figure 3



Revision history

Revision history

Document revision	Date of release	Description of changes
V3.0	2017-04-11	Final datasheet
n/a	2020-09-01	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2024-02-12	Final datasheet

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Edition 2024-02-12

Published by

Infineon Technologies AG
81726 Munich, Germany

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Document reference
IFX-AAX573-002

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