

Final datasheet

EasyDUAL module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and PressFIT / NTC

Features

- Electrical features
 - $V_{CES} = 1200 \text{ V}$
 - $I_{C \text{ nom}} = 150 \text{ A} / I_{CRM} = 300 \text{ A}$
 - Overload operation up to 175°C
 - Low $V_{CE, \text{sat}}$
 - TRENCHSTOP™ IGBT7
 - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
 - High power density
 - Compact design
 - Al_2O_3 substrate with low thermal resistance
 - PressFIT contact technology
 - 2.5 kV AC 1 minute insulation
 - Integrated NTC temperature sensor



Potential applications

- Motor drives
- Air conditioning
- Auxiliary inverters
- Servo drives
- UPS systems

Product validation

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

Description

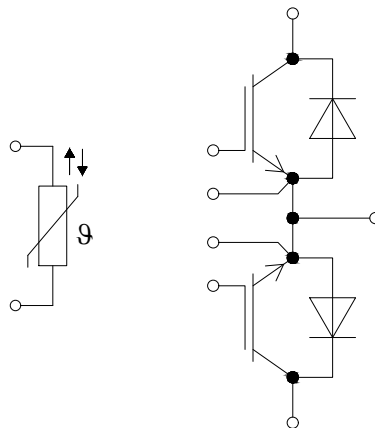


Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	Table of contents	2
1	Package	3
2	IGBT, Inverter	3
3	Diode, Inverter	5
4	NTC-Thermistor	6
5	Characteristics diagrams	7
6	Circuit diagram	12
7	Package outlines	13
8	Module label code	14
	Revision history	15
	Disclaimer	16

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al2O3	
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}			17		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T = 25 \text{ °C}$, per switch		1.7		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.
The electrical characterization was performed in NPC2 topology, which combines two FF150R12W2T7E_B11 modules. It has to be considered, that the commutation in this configuration takes place between both modules.

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ °C}$	1200	V
Implemented collector current	I_{CN}			150	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_H = 65 \text{ °C}$	135	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj \text{ op}}$		300	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	$V_{CE\ sat}$	$I_C = 150\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.55	1.80	V
			$T_{vj} = 125\ ^\circ C$		1.69		
			$T_{vj} = 175\ ^\circ C$		1.77		
Gate threshold voltage	V_{GETh}	$I_C = 3.4\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V, T_{vj} = 25\ ^\circ C$			2.5		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			1		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			30.1		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.106		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			11	μA
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}	$I_C = 150\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.121		μs
			$T_{vj} = 125\ ^\circ C$		0.133		
			$T_{vj} = 175\ ^\circ C$		0.147		
Rise time (inductive load)	t_r	$I_C = 150\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.046		μs
			$T_{vj} = 125\ ^\circ C$		0.052		
			$T_{vj} = 175\ ^\circ C$		0.054		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 150\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.273		μs
			$T_{vj} = 125\ ^\circ C$		0.348		
			$T_{vj} = 175\ ^\circ C$		0.387		
Fall time (inductive load)	t_f	$I_C = 150\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.072		μs
			$T_{vj} = 125\ ^\circ C$		0.150		
			$T_{vj} = 175\ ^\circ C$		0.217		
Turn-on energy loss per pulse	E_{on}	$I_C = 150\ A, V_{CC} = 600\ V, L_\sigma = 62\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 1.5\ \Omega, di/dt = 2860\ A/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		7.6		mJ
			$T_{vj} = 125\ ^\circ C$		10.5		
			$T_{vj} = 175\ ^\circ C$		12.9		
Turn-off energy loss per pulse	E_{off}	$I_C = 150\ A, V_{CC} = 600\ V, L_\sigma = 62\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega, dv/dt = 3200\ V/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		9.3		mJ
			$T_{vj} = 125\ ^\circ C$		14.7		
			$T_{vj} = 175\ ^\circ C$		18.2		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		480		A
		$t_p \leq 8 \mu\text{s}$, $T_{vj} = 150 \text{ }^\circ\text{C}$				
		$t_p \leq 7 \mu\text{s}$, $T_{vj} = 175 \text{ }^\circ\text{C}$		450		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 1 \text{ W/(m}\cdot\text{K)}$		0.414		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	$^\circ\text{C}$

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

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		150	A
Repetitive peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$	300	A
I^2t - value	I^2t	$t_p = 10 \text{ ms}$, $V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ }^\circ\text{C}$	A^2s
			$T_{vj} = 175 \text{ }^\circ\text{C}$	
			3280	
			2810	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 150 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		1.72	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$		1.59	
			$T_{vj} = 175 \text{ }^\circ\text{C}$		1.52	
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 150 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt =$ $2860 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$		125	A
			$T_{vj} = 125 \text{ }^\circ\text{C}$		160	
			$T_{vj} = 175 \text{ }^\circ\text{C}$		182	

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 150 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2860 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	8.8		μC
			$T_{vj} = 125 \text{ }^\circ\text{C}$	17.9		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	27		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}$, $I_F = 150 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2860 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	2.95		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	6.55		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	10.1		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		0.600		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^\circ\text{C}$

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

4 NTC-Thermistor

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25 \text{ }^\circ\text{C}$		5		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100 \text{ }^\circ\text{C}$, $R_{100} = 493 \text{ } \Omega$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25 \text{ }^\circ\text{C}$			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

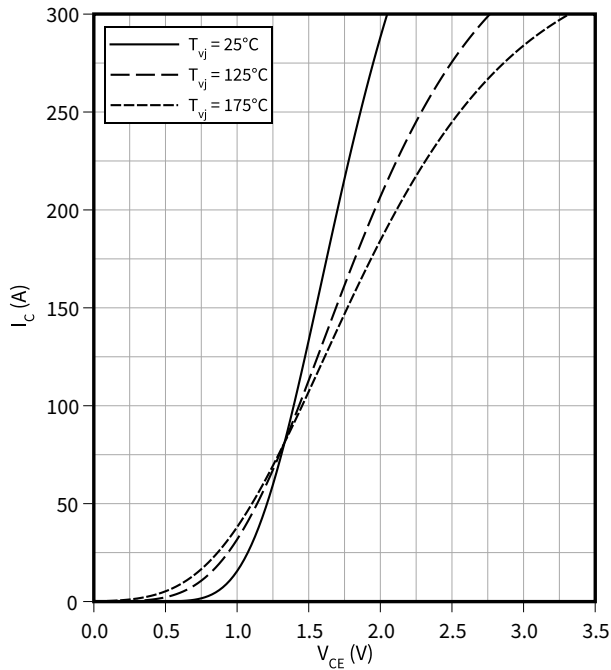
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

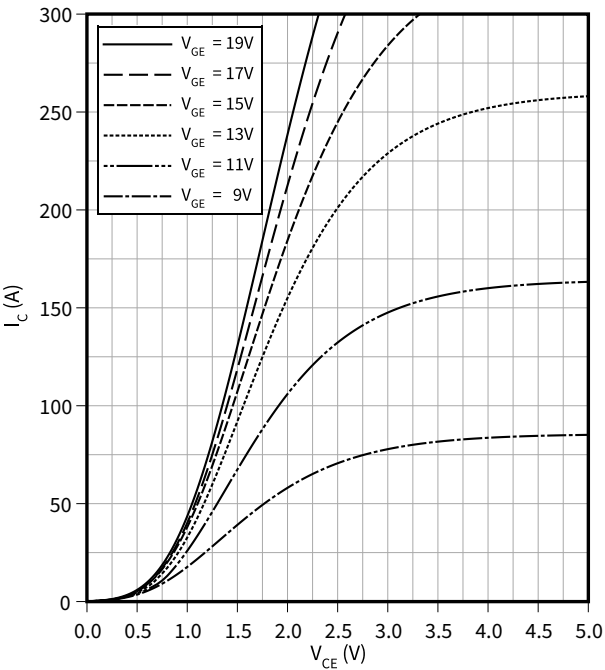
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

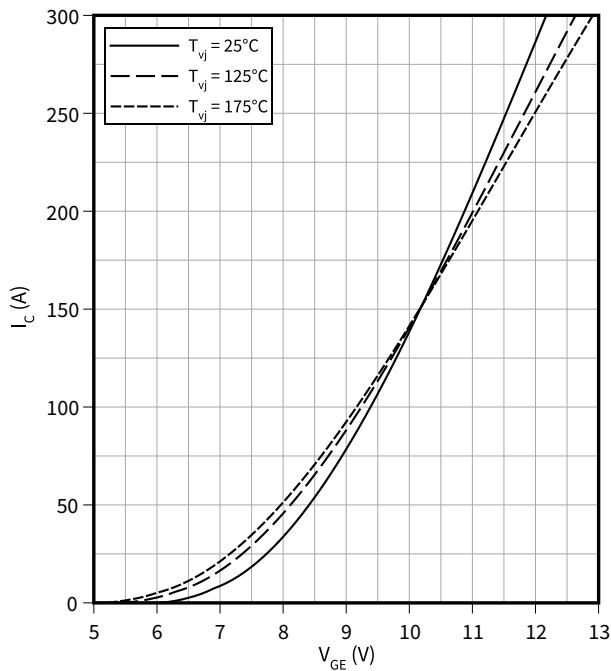
$T_{vj} = 175\text{ °C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

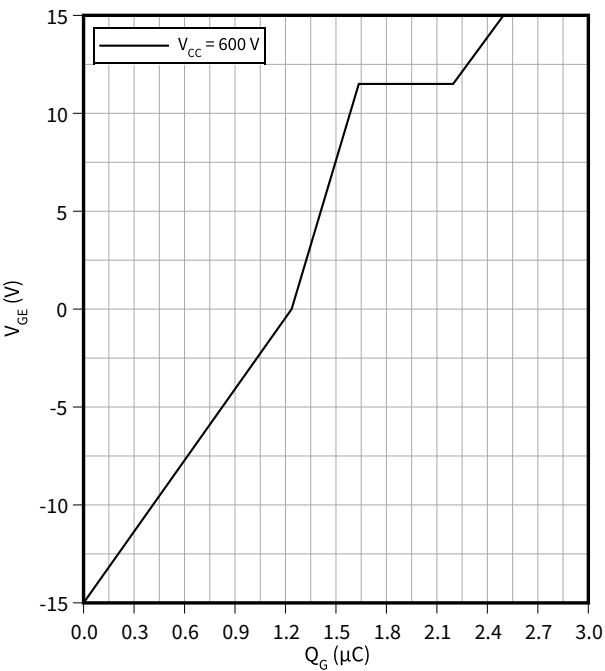
$V_{CE} = 20\text{ V}$



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

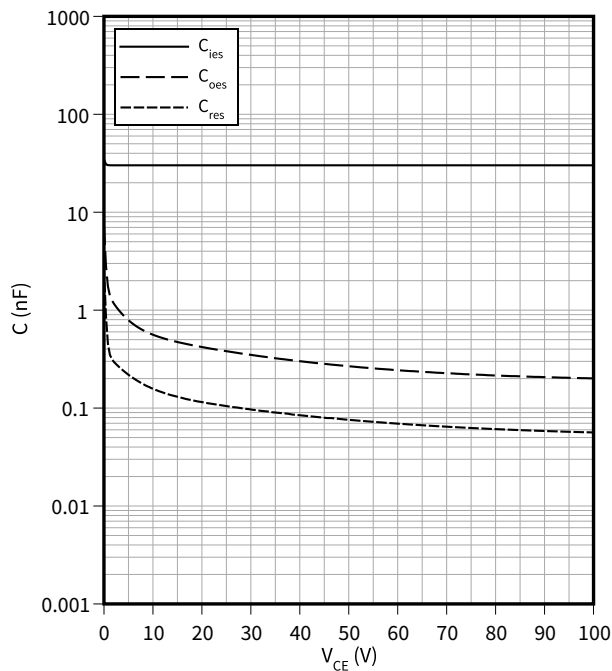
$I_C = 150\text{ A}, T_{vj} = 25\text{ °C}$



5 Characteristics diagrams

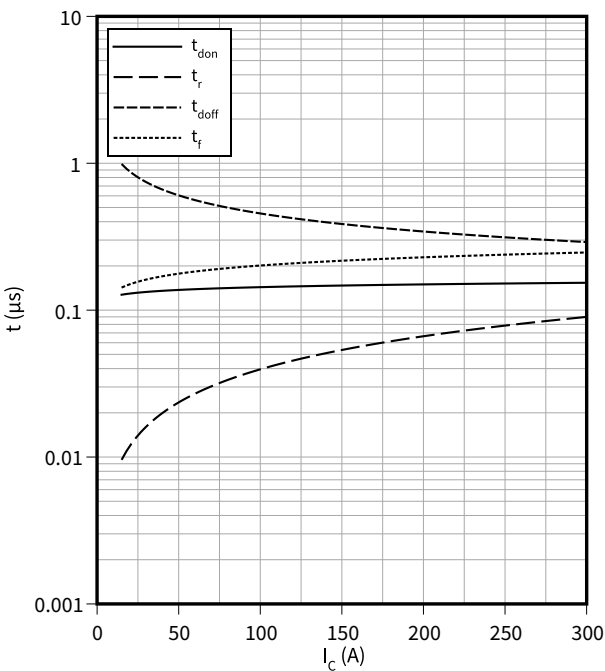
Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$
 $f = 100 \text{ kHz}$, $V_{GE} = 0 \text{ V}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



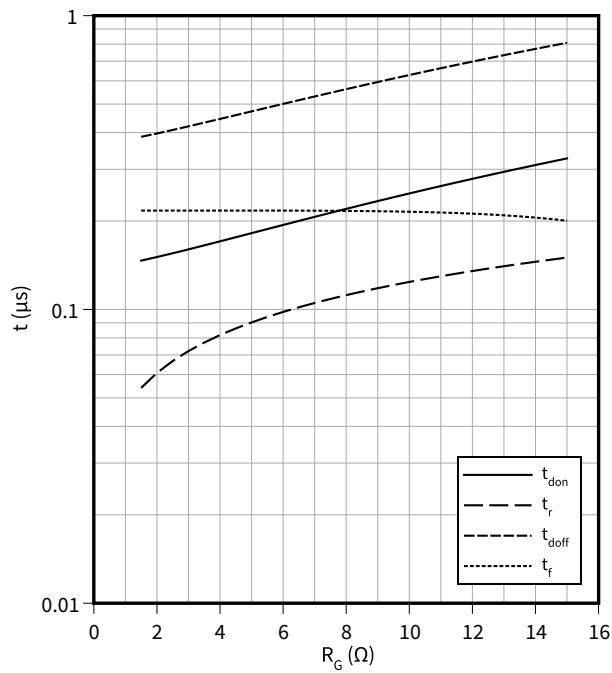
Switching times (typical), IGBT, Inverter

$t = f(I_C)$
 $R_{Goff} = 1.5 \text{ } \Omega$, $R_{Gon} = 1.5 \text{ } \Omega$, $V_{GE} = \pm 15 \text{ V}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$



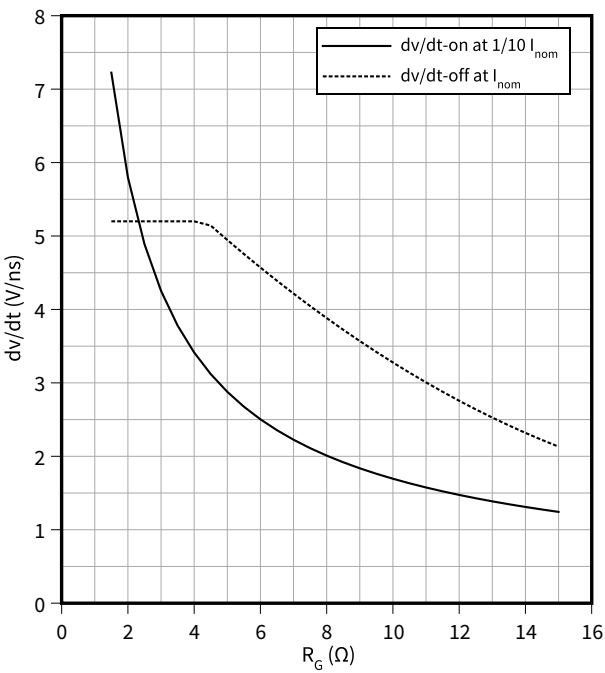
Switching times (typical), IGBT, Inverter

$t = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 150 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$



Voltage slope (typical), IGBT, Inverter

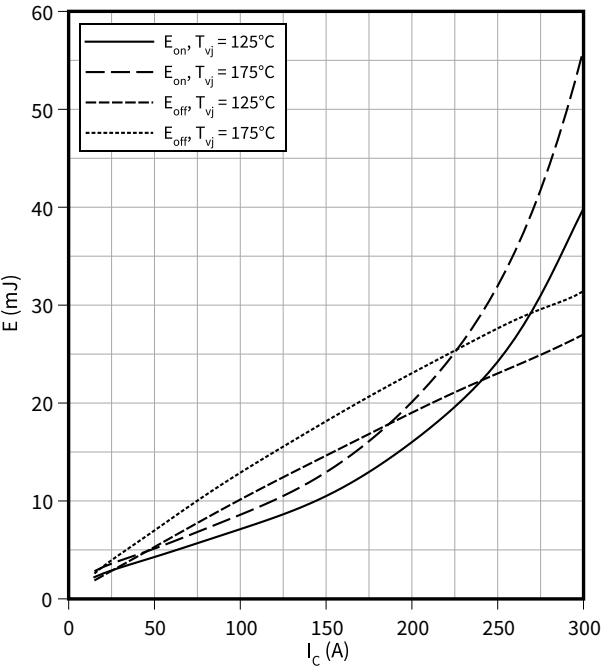
$dv/dt = f(R_G)$
 $I_C = 150 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



5 Characteristics diagrams

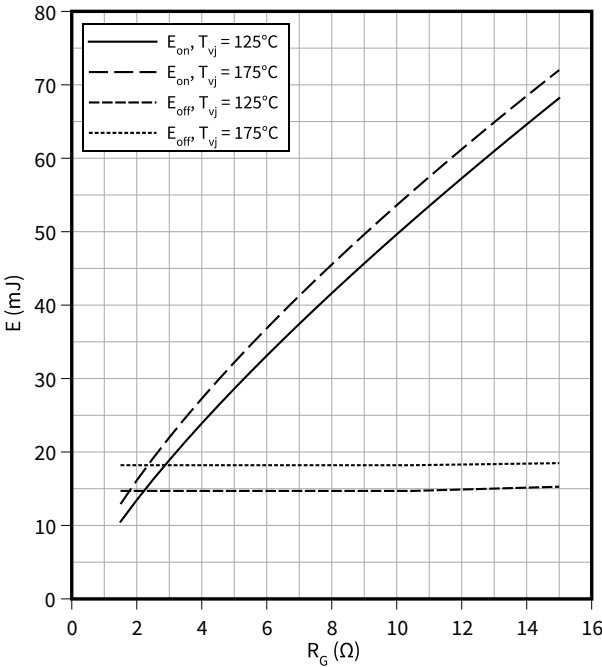
Switching losses (typical), IGBT, Inverter

$E = f(I_C)$
 $R_{Goff} = 1.5\ \Omega$, $R_{Gon} = 1.5\ \Omega$, $V_{GE} = \pm 15\ V$, $V_{CC} = 600\ V$



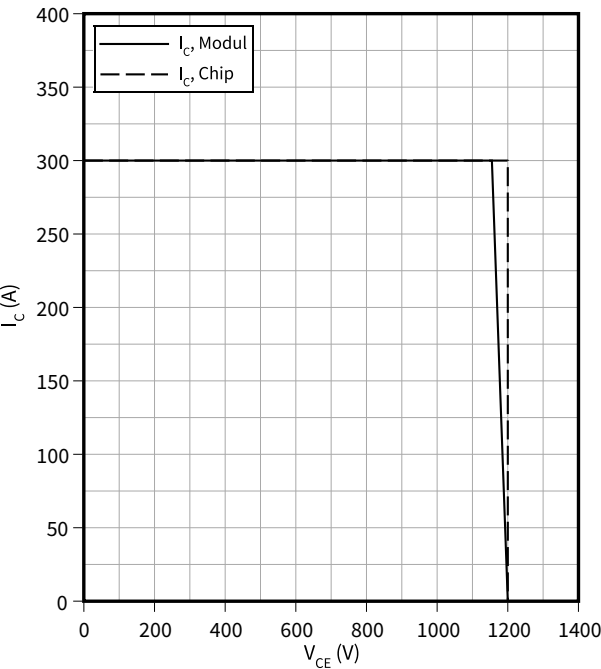
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$
 $V_{GE} = \pm 15\ V$, $I_C = 150\ A$, $V_{CC} = 600\ V$



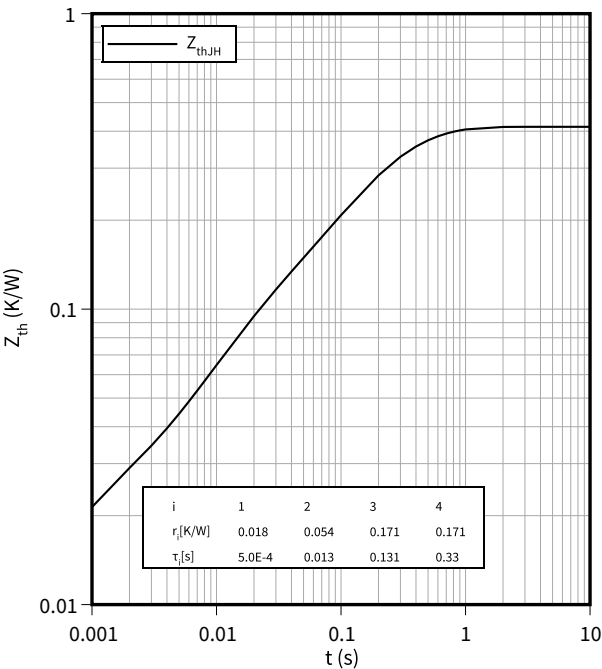
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$
 $R_{Goff} = 1.5\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ ^\circ C$



Transient thermal impedance, IGBT, Inverter

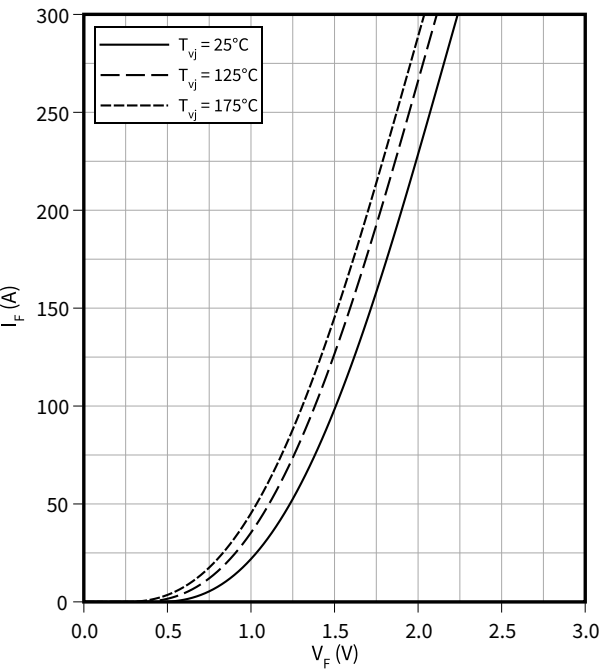
$Z_{th} = f(t)$



5 Characteristics diagrams

Forward characteristic (typical), Diode, Inverter

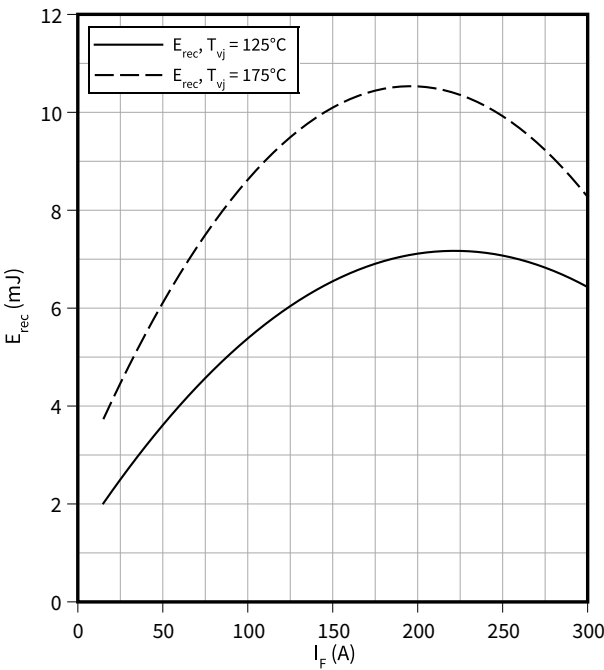
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

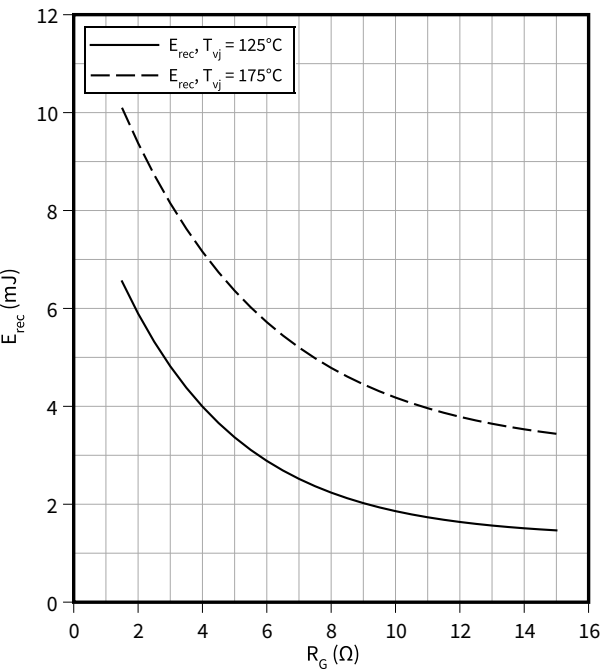
$R_{Gon} = 1.5 \Omega, V_{CC} = 600 \text{ V}$



Switching losses (typical), Diode, Inverter

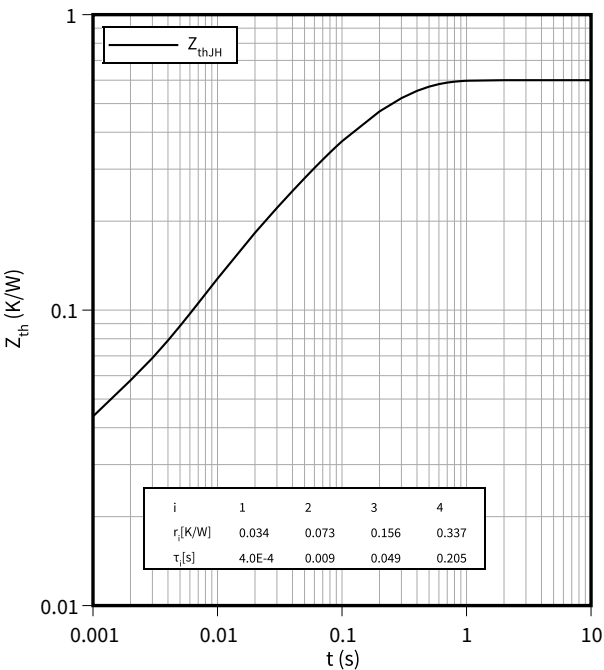
$E_{rec} = f(R_G)$

$I_F = 150 \text{ A}, V_{CC} = 600 \text{ V}$



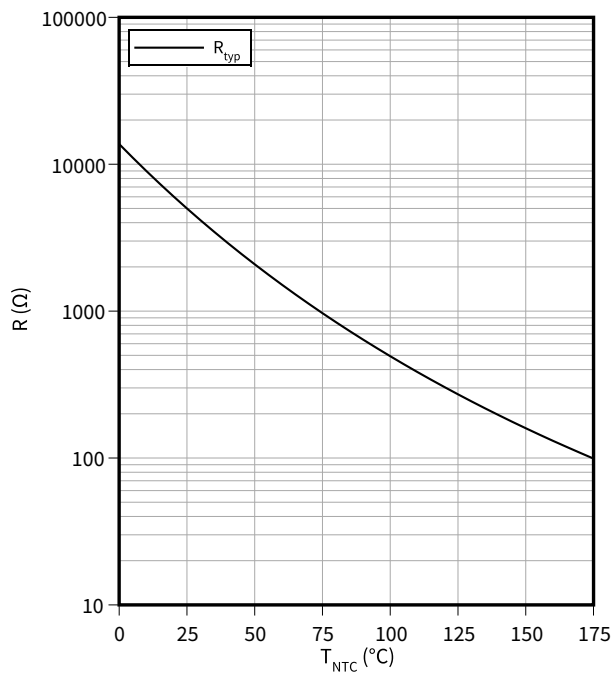
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

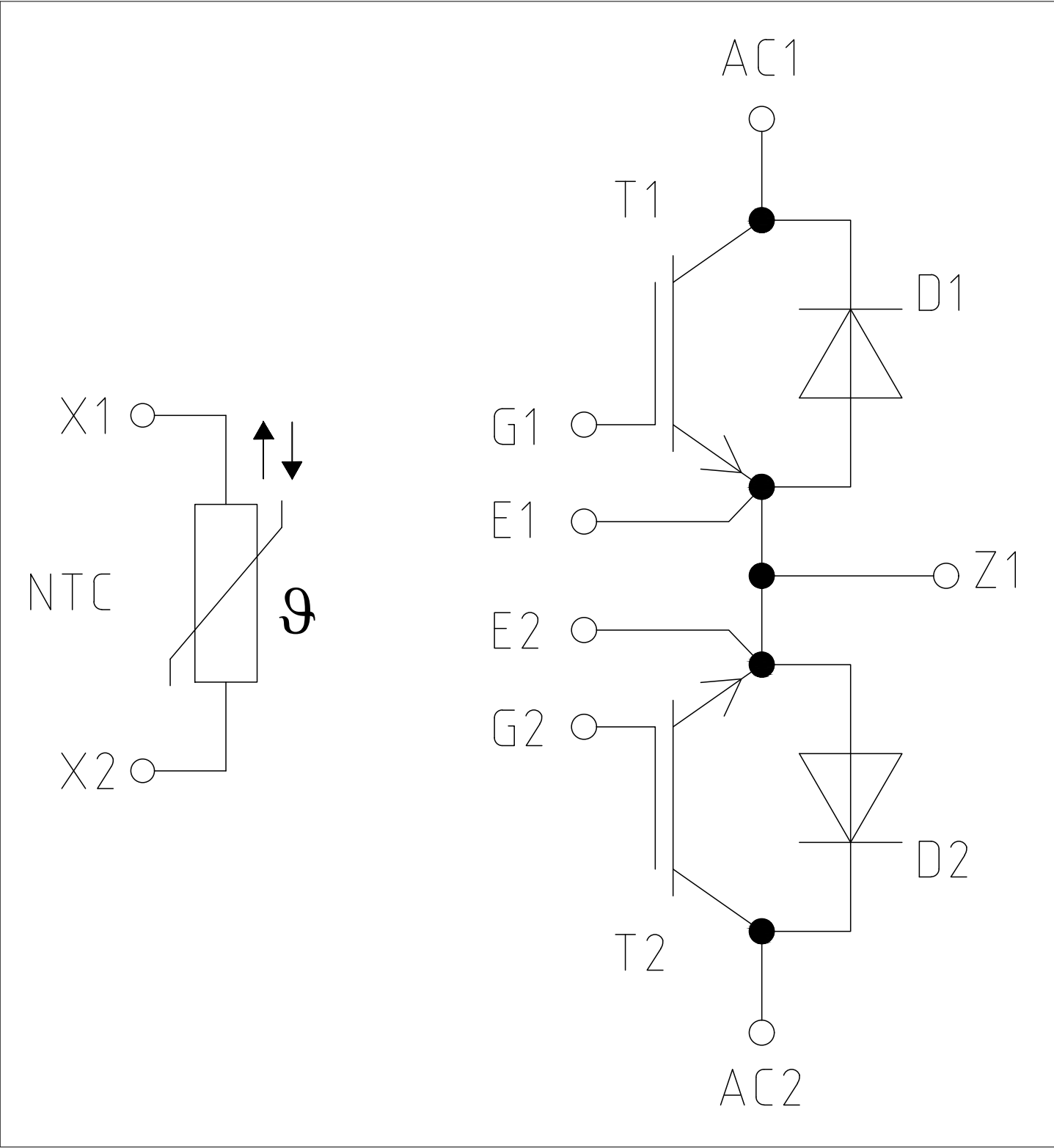


Figure 1

7 Package outlines

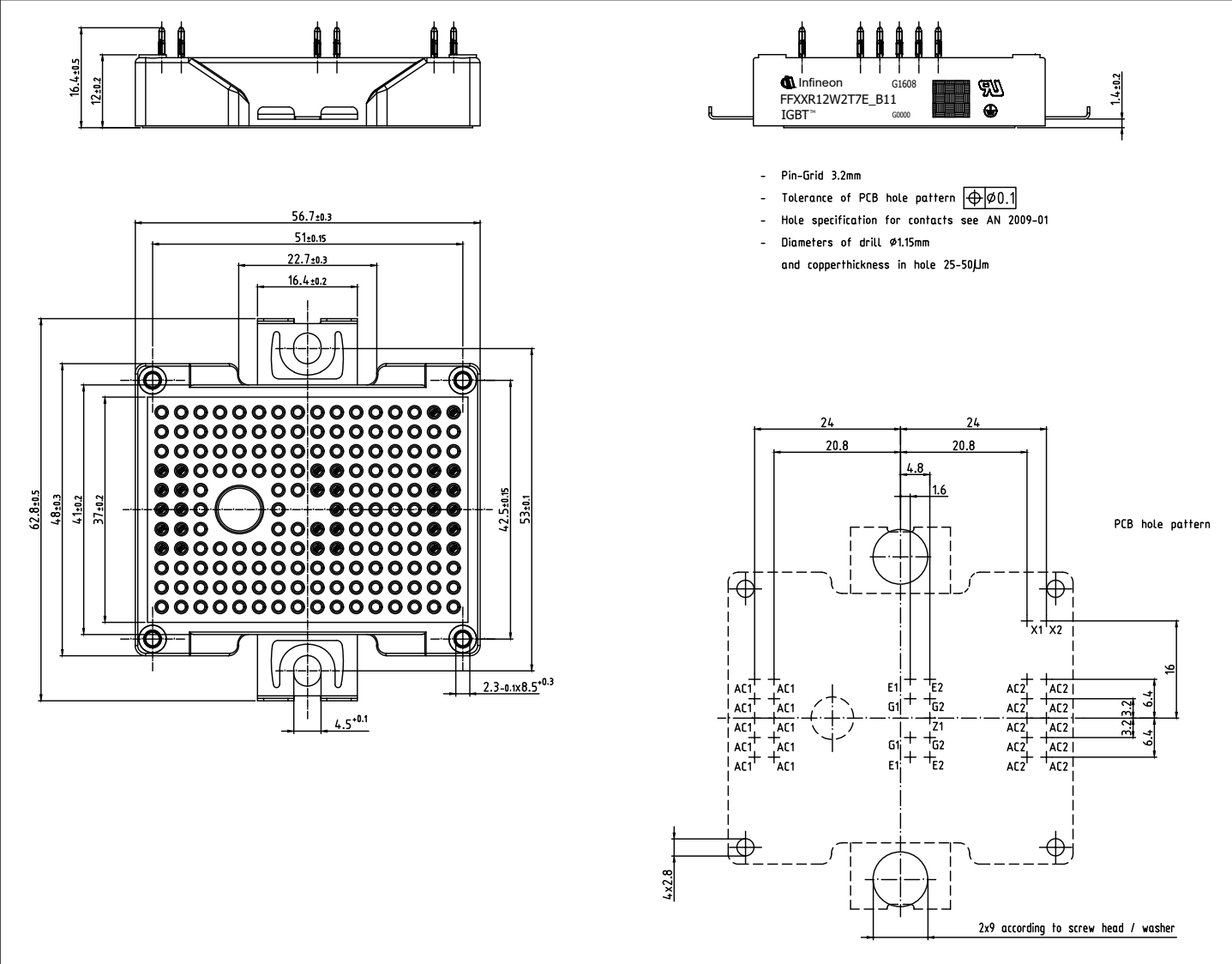


Figure 2

8 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	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	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	 71549142846550549911530  71549142846550549911530		

Figure 3



Revision history

Document version	Date of release	Description of changes
0.10	2024-03-22	Initial version
1.00	2024-07-04	Final datasheet

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