

Final datasheet

EasyPACK™ module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and NTC

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 50\text{ A} / I_{CRM} = 100\text{ A}$
 - Low $V_{CE,sat}$
 - Overload operation up to 175°C
 - TRENCHSTOP™ IGBT7
- Mechanical features
 - 2.5 kV AC 1 minute insulation
 - Al_2O_3 substrate with low thermal resistance
 - Compact design
 - High power density
 - Solder contact technology



Typical appearance

Potential applications

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

Product validation

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

Description

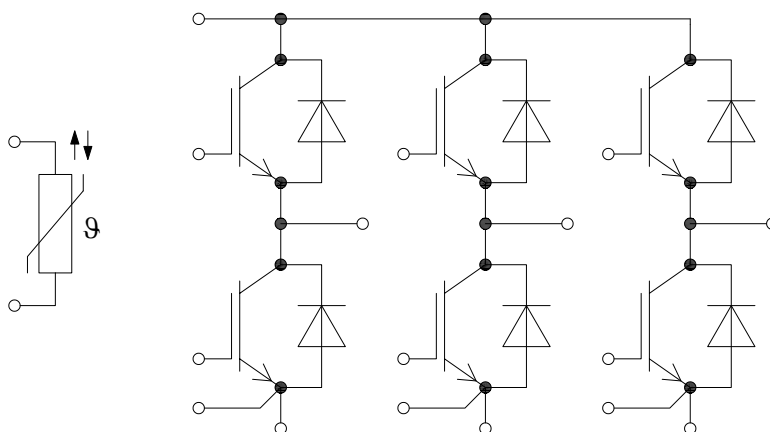


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1 Package

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
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}			40		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$, per switch		4		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 30 A rms per connector pin. $T_{vj \text{ op}} > 150 \text{ °C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

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
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_H = 105 \text{ °C}$	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 4 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 50\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.50	1.80	V
			$T_{vj} = 125\ ^\circ C$		1.64		
			$T_{vj} = 175\ ^\circ C$		1.72		
Gate threshold voltage	V_{GETh}	$I_C = 1.28\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V$			0.92		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			0		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			11.1		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.039		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			0.0079	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}	$I_C = 50\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 5.1\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.018		μs
			$T_{vj} = 125\ ^\circ C$		0.030		
			$T_{vj} = 175\ ^\circ C$		0.035		
Rise time (inductive load)	t_r	$I_C = 50\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 5.1\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.021		μs
			$T_{vj} = 125\ ^\circ C$		0.024		
			$T_{vj} = 175\ ^\circ C$		0.025		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 50\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 5.1\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.270		μs
			$T_{vj} = 125\ ^\circ C$		0.325		
			$T_{vj} = 175\ ^\circ C$		0.360		
Fall time (inductive load)	t_f	$I_C = 50\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 5.1\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.120		μs
			$T_{vj} = 125\ ^\circ C$		0.187		
			$T_{vj} = 175\ ^\circ C$		0.264		
Turn-on energy loss per pulse	E_{on}	$I_C = 50\ A, V_{CC} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 5.1\ \Omega, di/dt = 1650\ A/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		2.41		mJ
			$T_{vj} = 125\ ^\circ C$		4.3		
			$T_{vj} = 175\ ^\circ C$		5.45		
Turn-off energy loss per pulse	E_{off}	$I_C = 50\ A, V_{CC} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 5.1\ \Omega, dv/dt = 2900\ V/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		1.9		mJ
			$T_{vj} = 125\ ^\circ C$		4.72		
			$T_{vj} = 175\ ^\circ C$		6.12		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$		185		A
				175		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 4.3 \text{ W/(m} \cdot \text{K)}$		0.651		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	°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			50	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		100	A
I^2t - value	I^2t	$t_P = 10\text{ ms}$, $V_R = 0\text{ V}$	$T_{vj} = 125\text{ }^{\circ}\text{C}$	300	A^2s
			$T_{vj} = 175\text{ }^{\circ}\text{C}$	250	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 50 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.72	2.10	V
			$T_{vj} = 125 \text{ °C}$	1.59		
			$T_{vj} = 175 \text{ °C}$	1.52		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 50 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt =$ $1650 \text{ A/}\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	42.5		A
			$T_{vj} = 125 \text{ °C}$	53		
			$T_{vj} = 175 \text{ °C}$	60.5		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 50 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt =$ $1650 \text{ A/}\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	3.74		μC
			$T_{vj} = 125 \text{ °C}$	8.19		
			$T_{vj} = 175 \text{ °C}$	10.4		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Reverse recovery energy	E_{rec}	$V_{CC} = 600\text{ V}$, $I_F = 50\text{ A}$, $V_{GE} = -15\text{ V}$, $-di_F/dt = 1650\text{ A}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)	$T_{vj} = 25\text{ °C}$	1.72		mJ
			$T_{vj} = 125\text{ °C}$	3.06		
			$T_{vj} = 175\text{ °C}$	3.73		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 4.3\text{ W}/(\text{m}\cdot\text{K})$		1.02		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	°C

4 NTC-Thermistor

Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100\text{ °C}$, $R_{100} = 493\text{ Ω}$	-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

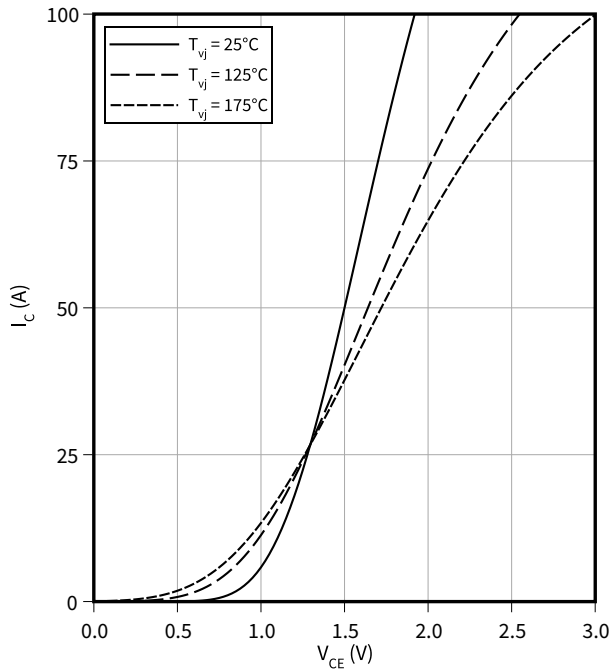
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

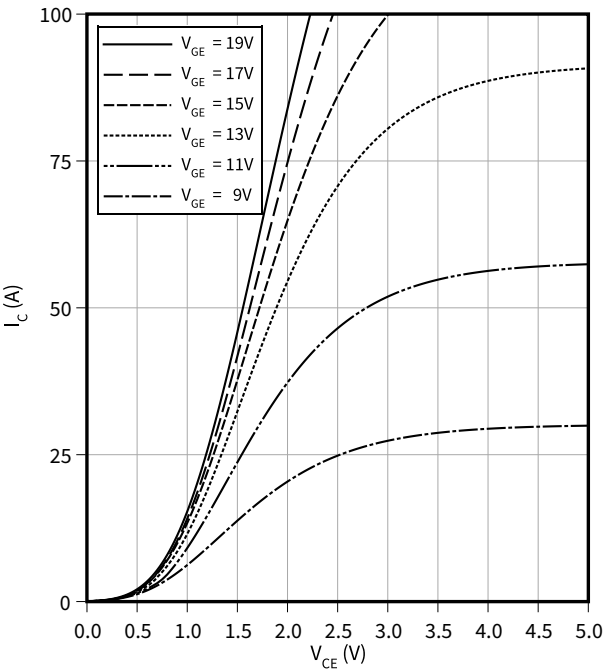
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

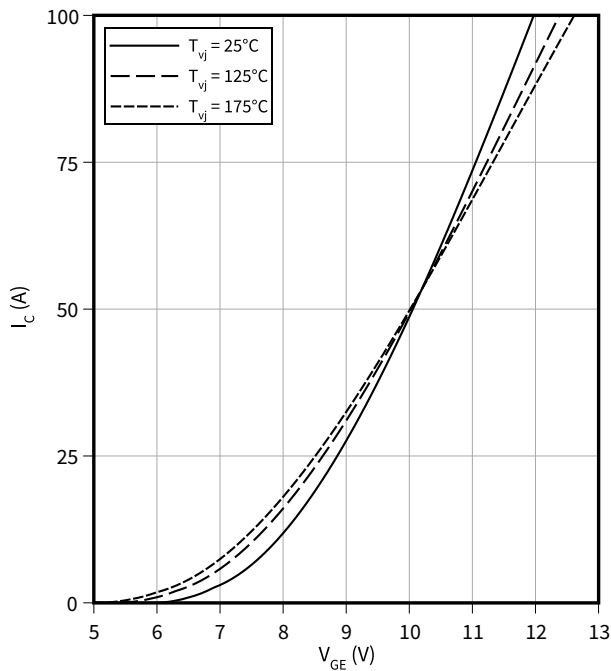
$T_{vj} = 175^\circ\text{C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

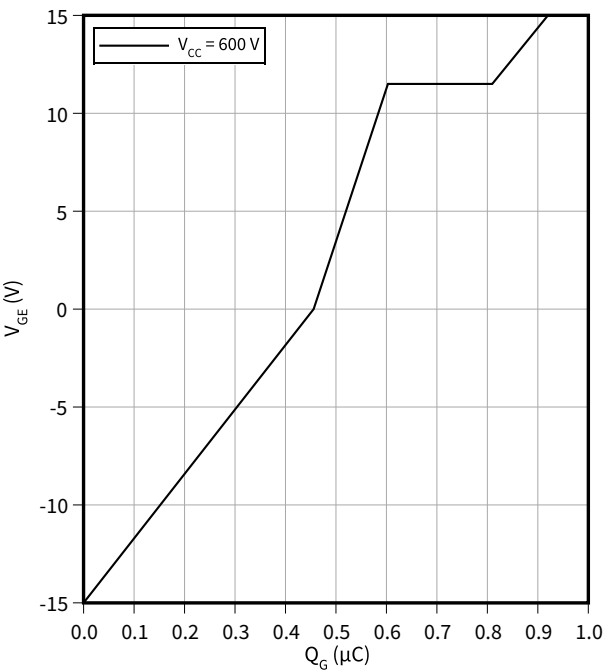
$V_{CE} = 20\text{ V}$



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

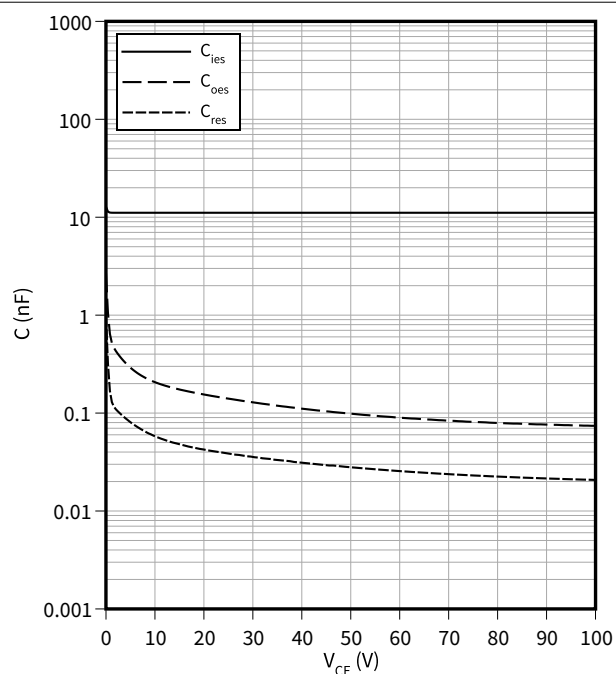
$I_C = 50\text{ A}, T_{vj} = 25^\circ\text{C}$



Capacity characteristic (typical), IGBT, Inverter

$$C = f(V_{CE})$$

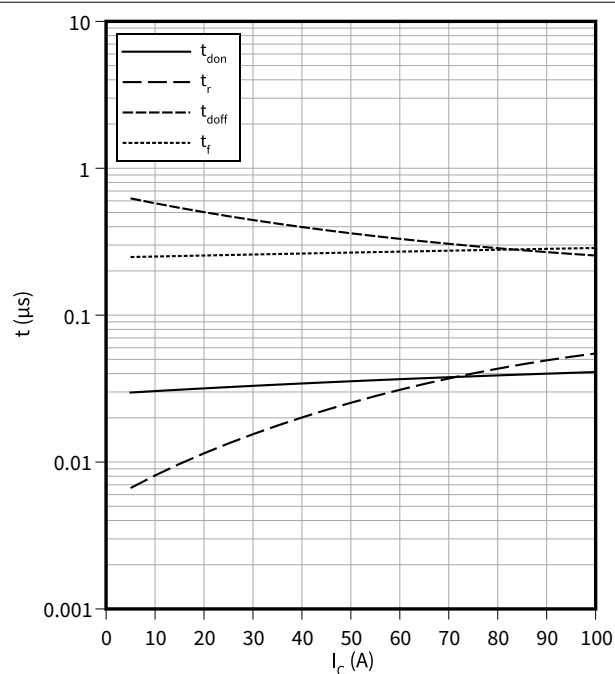
$f = 100 \text{ kHz}$, $V_{GE} = 0 \text{ V}$, $T_{vj} = 25 \text{ °C}$



Switching times (typical), IGBT, Inverter

$$t = f(I_C)$$

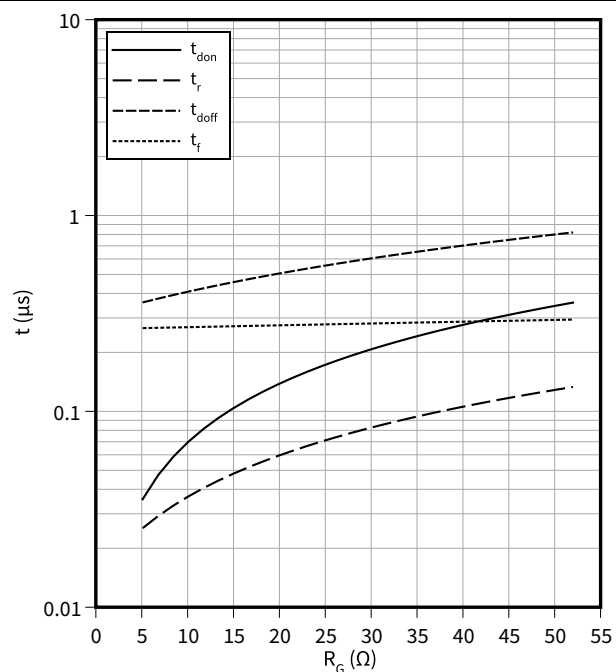
$R_{Goff} = 5.1 \text{ } \Omega$, $R_{Gon} = 5.1 \text{ } \Omega$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Switching times (typical), IGBT, Inverter

$$t = f(R_G)$$

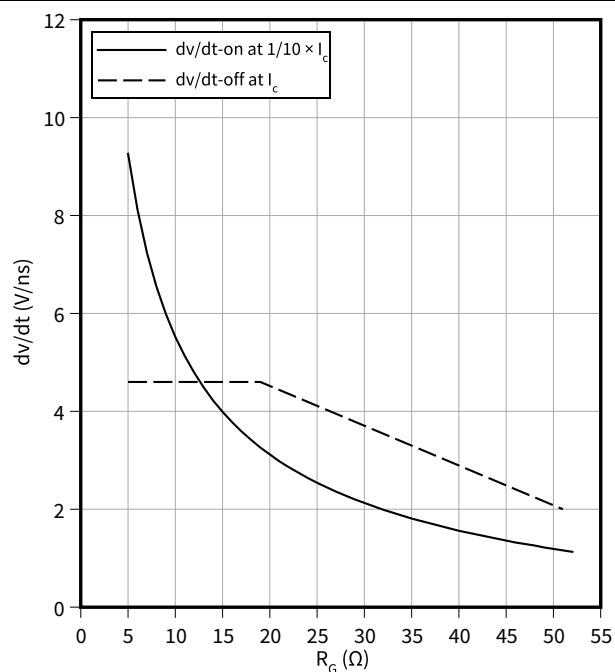
$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Voltage slope (typical), IGBT, Inverter

$$dv/dt = f(R_G)$$

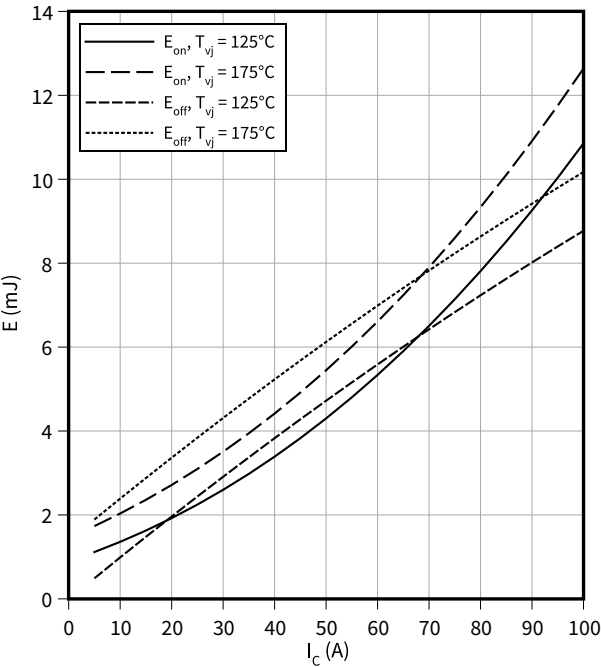
$I_C = 50 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 25 \text{ °C}$



5 Characteristics diagrams

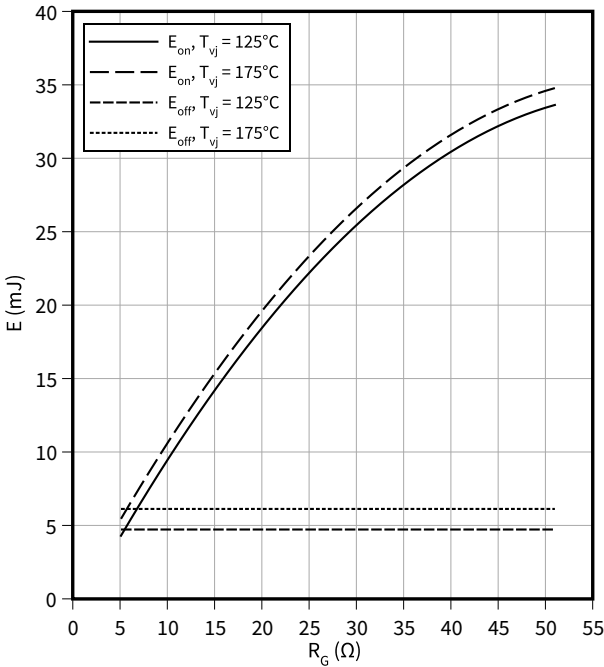
Switching losses (typical), IGBT, Inverter

$E = f(I_C)$
 $R_{Goff} = 5.1 \Omega, R_{Gon} = 5.1 \Omega, V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$



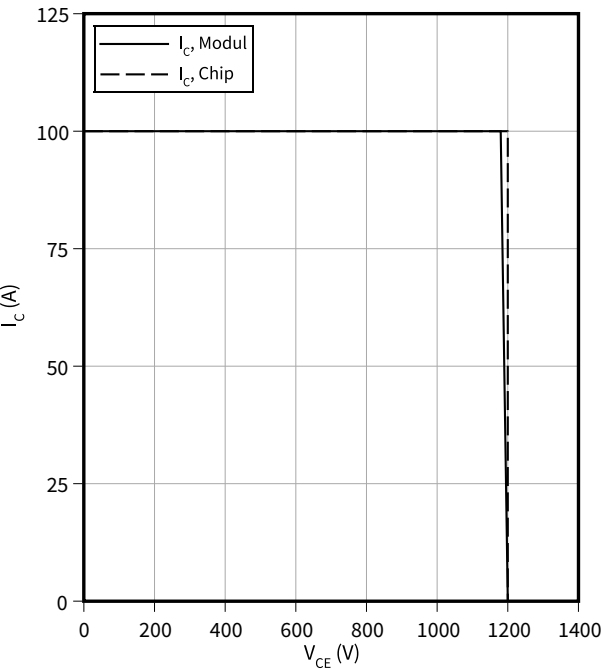
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$
 $I_C = 50 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$



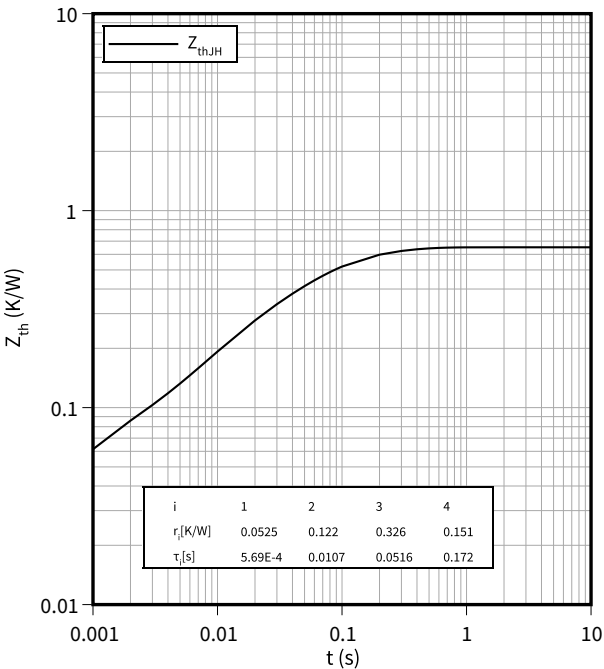
Reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$
 $R_{Goff} = 5.1 \Omega, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ °C}$



Transient thermal impedance, IGBT, Inverter

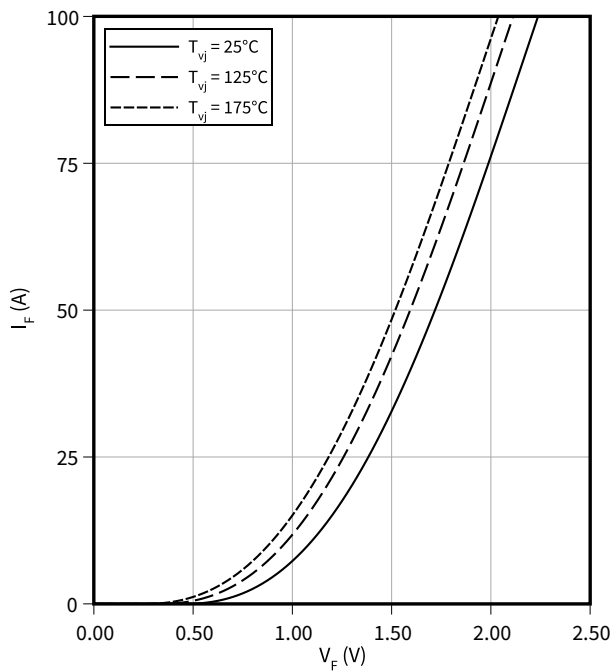
$Z_{th} = f(t)$



5 Characteristics diagrams

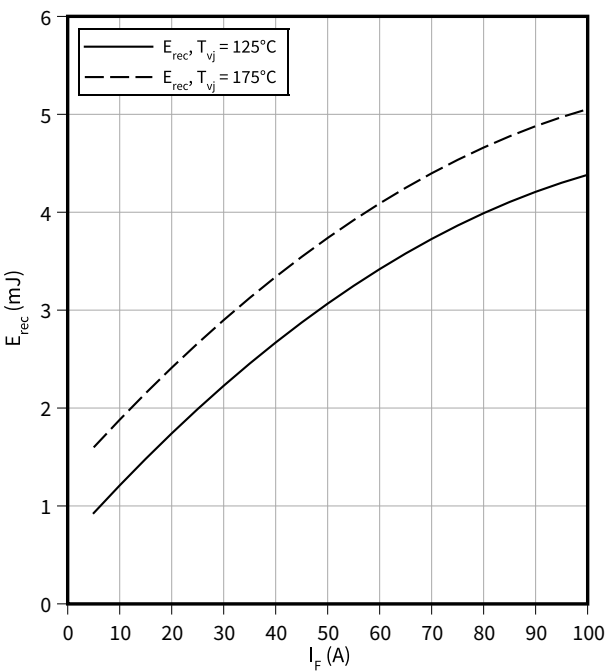
Forward characteristic (typical), Diode, Inverter

$I_F = f(V_F)$



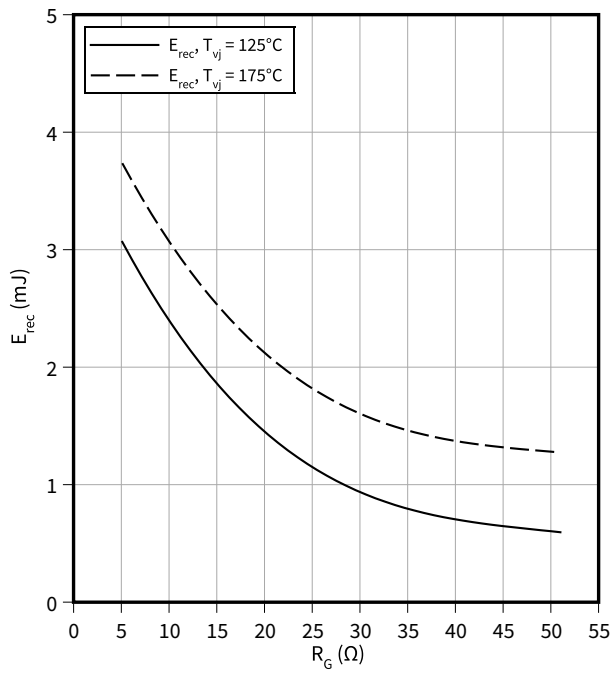
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$
 $R_{Gon} = 5.1\ \Omega, V_{CC} = 600\ \text{V}$



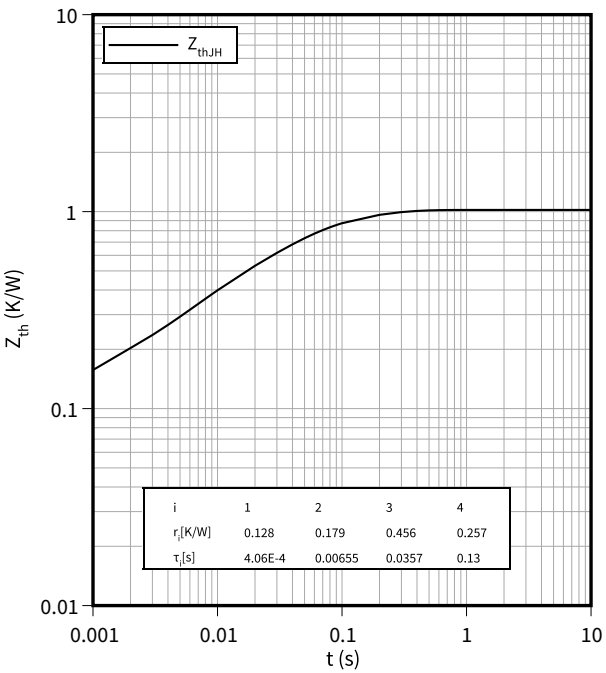
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$
 $I_F = 50\ \text{A}, V_{CC} = 600\ \text{V}$



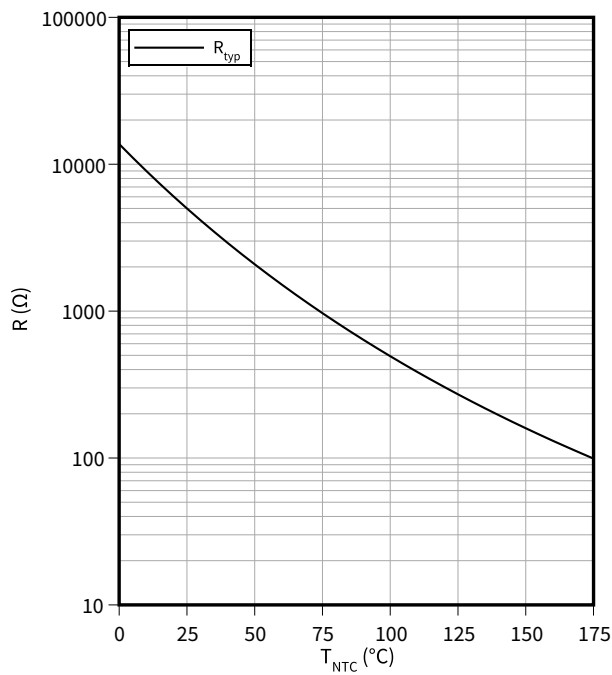
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

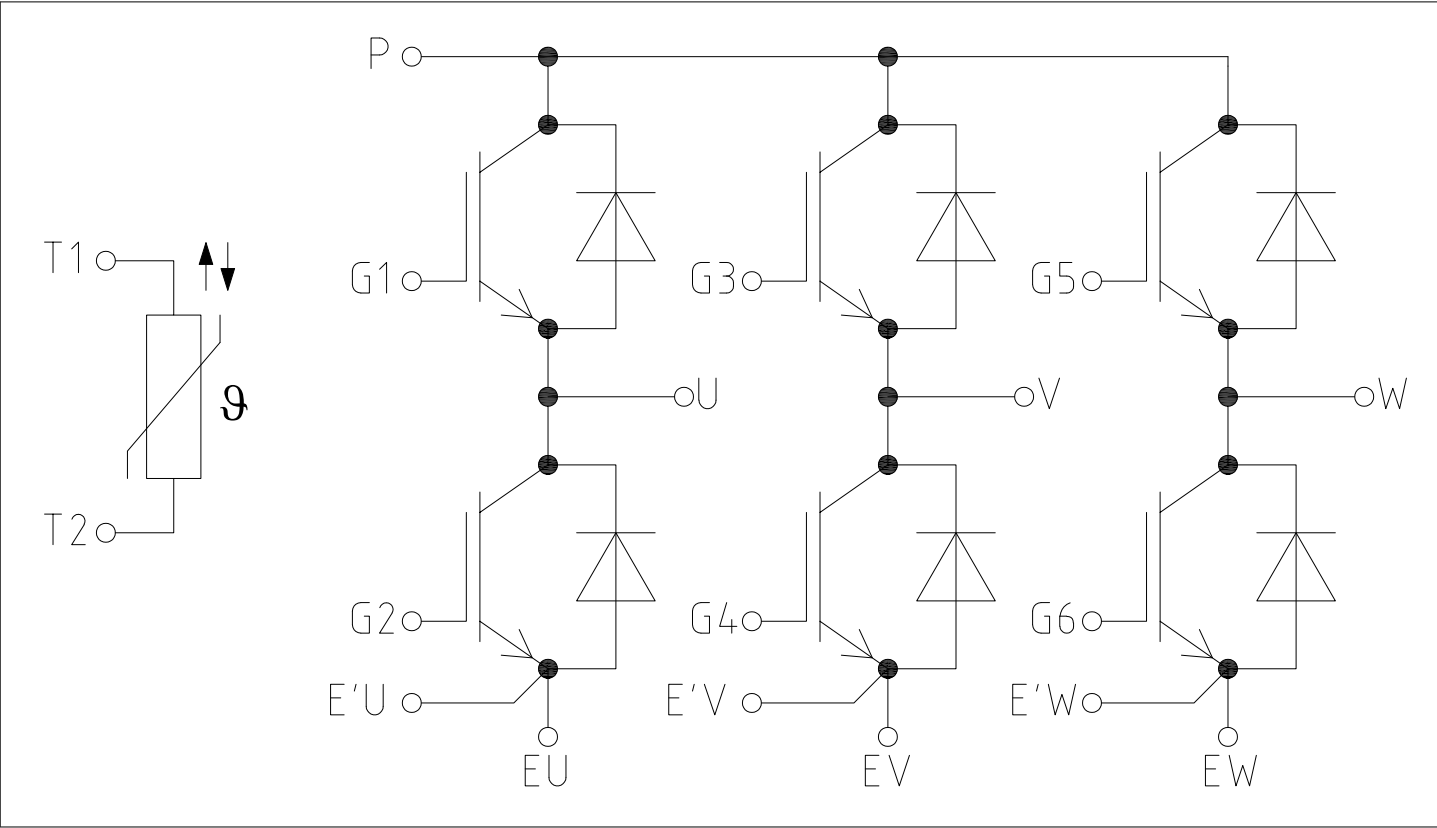


Figure 1

7 Package outlines

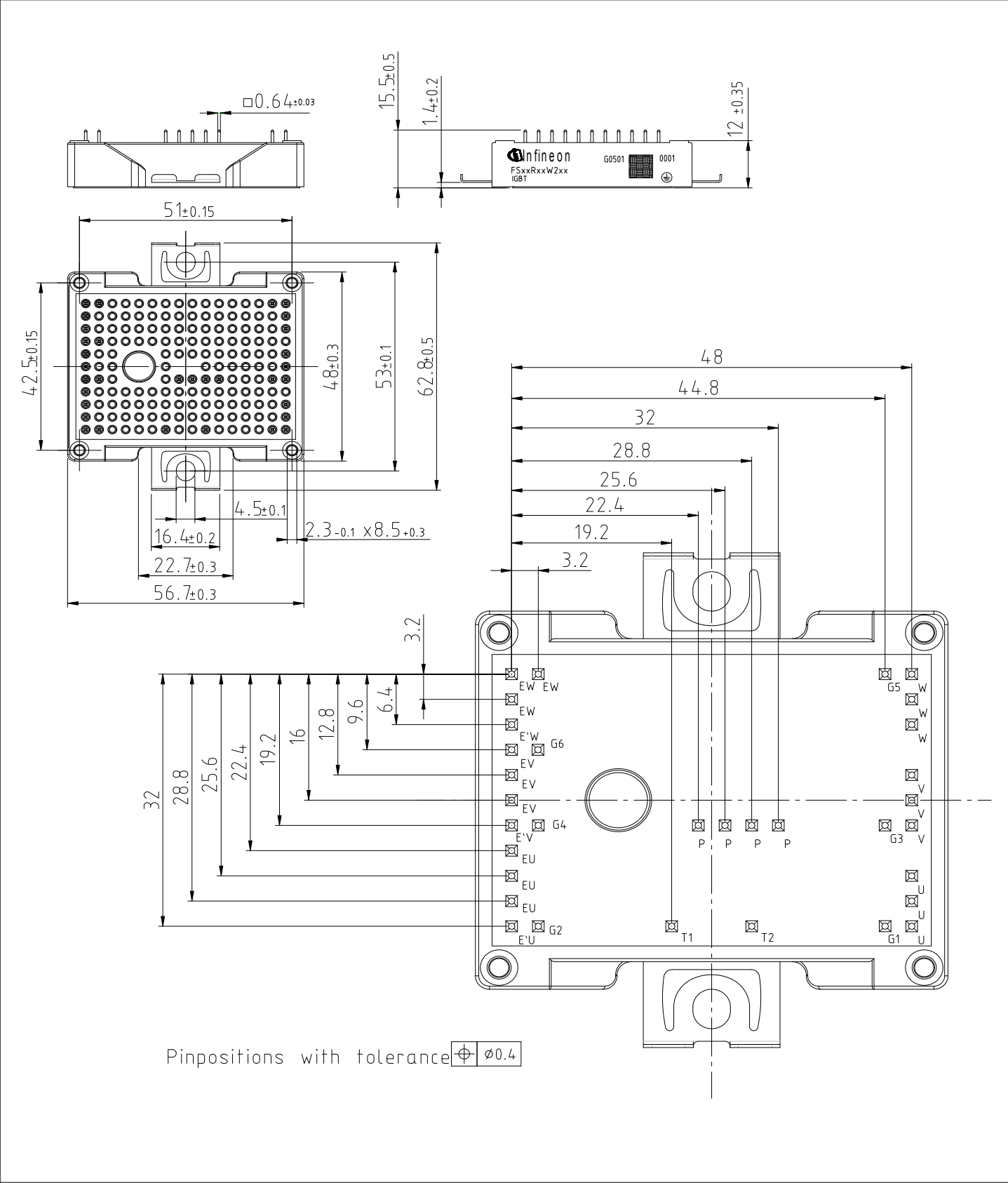


Figure 2

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 revision	Date of release	Description of changes
V2.0	2020-05-12	Preliminary 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
1.00	2025-07-18	Final datasheet

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