

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

Features

- Electrical features
 - $V_{CES} = 950\text{ V}$
 - $I_{C\text{nom}} = 200\text{ A} / I_{CRM} = 300\text{ A}$
 - Low $V_{CE,sat}$
 - $T_{vj,op} = 150^\circ\text{C}$
 - TRENCHSTOP™ IGBT7
- Mechanical features
 - Al_2O_3 substrate with low thermal resistance
 - High power and thermal cycling capability
 - Integrated NTC temperature sensor
 - PressFIT contact technology



Potential applications

- Motor drives
- Energy storage systems
- Auxiliary inverters

Product validation

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

Description

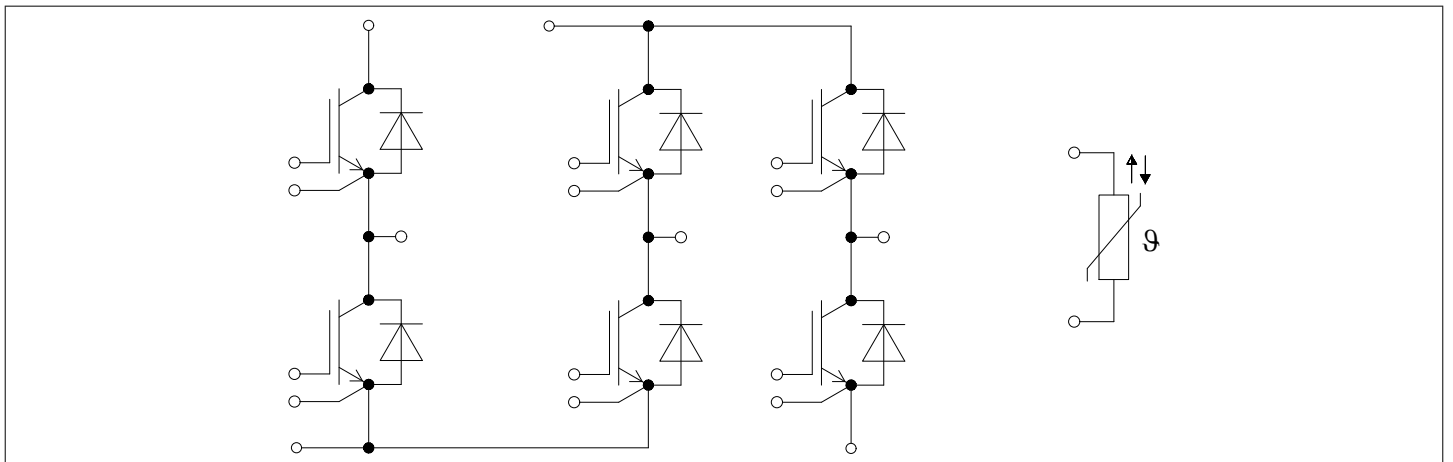


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.2	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.2	mm
Creepage distance	d_{Creep}	terminal to terminal	6.8	mm
Clearance	d_{Clear}	terminal to heatsink	9.4	mm
Clearance	d_{Clear}	terminal to terminal	5.5	mm
Comparative tracking index	CTI		>400	
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}			12		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$, per switch		3.5		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	1.3	1.5	Nm
Weight	G			78		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}	$T_{vj} = 25^\circ\text{C}$	950	V
Implemented collector current	I_{CN}		200	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175^\circ\text{C}$ $T_H = 65^\circ\text{C}$	130	A
Repetitive peak collector current	I_{CRM}	$t_p = 1 \text{ ms}$	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	$V_{CE\ sat}$	$I_C = 150\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.69	1.98	V	
			$T_{vj} = 125\ ^\circ C$	1.87			
			$T_{vj} = 150\ ^\circ C$	1.91			
Gate threshold voltage	V_{GEth}	$I_C = 3.25\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	4.35	5.10	5.85	V	
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$		0.46		μC	
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$		0.75		Ω	
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		13		nF	
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.04		nF	
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$		0.053	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}	$I_C = 150\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 12\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.120		μs	
			$T_{vj} = 125\ ^\circ C$	0.120			
			$T_{vj} = 150\ ^\circ C$	0.120			
Rise time (inductive load)	t_r	$I_C = 150\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 12\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.050		μs	
			$T_{vj} = 125\ ^\circ C$	0.050			
			$T_{vj} = 150\ ^\circ C$	0.050			
Turn-off delay time (inductive load)	t_{doff}	$I_C = 150\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 12\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.290		μs	
			$T_{vj} = 125\ ^\circ C$	0.310			
			$T_{vj} = 150\ ^\circ C$	0.320			
Fall time (inductive load)	t_f	$I_C = 150\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 12\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.020		μs	
			$T_{vj} = 125\ ^\circ C$	0.080			
			$T_{vj} = 150\ ^\circ C$	0.090			
Turn-on energy loss per pulse	E_{on}	$I_C = 150\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 12\ \Omega, di/dt = 2300\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	10.3		mJ	
			$T_{vj} = 125\ ^\circ C$	12.2			
			$T_{vj} = 150\ ^\circ C$	12.9			
Turn-off energy loss per pulse	E_{off}	$I_C = 150\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 12\ \Omega, dv/dt = 7900\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	3.88		mJ	
			$T_{vj} = 125\ ^\circ C$	5.89			
			$T_{vj} = 150\ ^\circ C$	6.41			
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3\ W/(m^*K)$			0.387		K/W
Temperature under switching conditions	$T_{vj\ op}$				-40	150	$^\circ C$

3 Diode, Inverter

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ °C}$		950		V
Implemented forward current	I_{FN}				200		A
Continuous DC forward current	I_F				150		A
Repetitive peak forward current	I_{FRM}	$t_p = 1\text{ ms}$			400		A
I^2t - value	I^2t	$V_R = 0\text{ V}, t_p = 10\text{ ms}$	$T_{vj} = 125\text{ °C}$		1520		A^2s
			$T_{vj} = 150\text{ °C}$		1480		

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 150\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		2.33	2.57	V
			$T_{vj} = 125\text{ °C}$		2.12		
			$T_{vj} = 150\text{ °C}$		2.07		
Peak reverse recovery current	I_{RM}	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		73.8		A
			$T_{vj} = 125\text{ °C}$		108		
			$T_{vj} = 150\text{ °C}$		118		
Recovered charge	Q_r	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		6.19		μC
			$T_{vj} = 125\text{ °C}$		11.7		
			$T_{vj} = 150\text{ °C}$		13.6		
Reverse recovery energy	E_{rec}	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		1.1		mJ
			$T_{vj} = 125\text{ °C}$		2.51		
			$T_{vj} = 150\text{ °C}$		3.13		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3\text{ W}/(\text{m}^2\text{K})$			0.530		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$			-40		150	$^{\circ}\text{C}$

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}	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ }\Omega$	-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

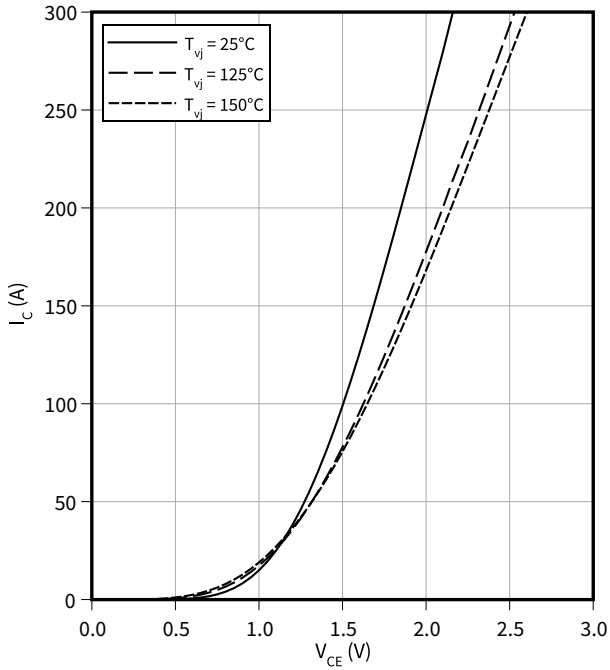
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

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

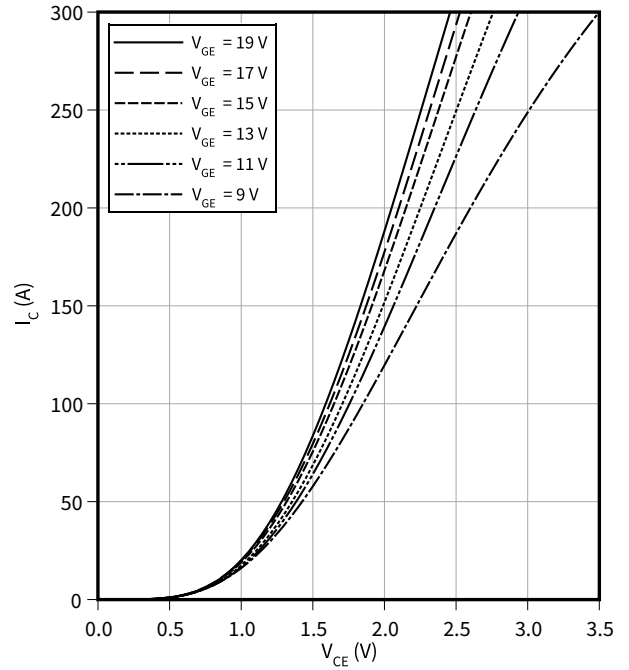
$$V_{GE} = 15 \text{ V}$$



Output characteristic field (typical), IGBT, Inverter

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

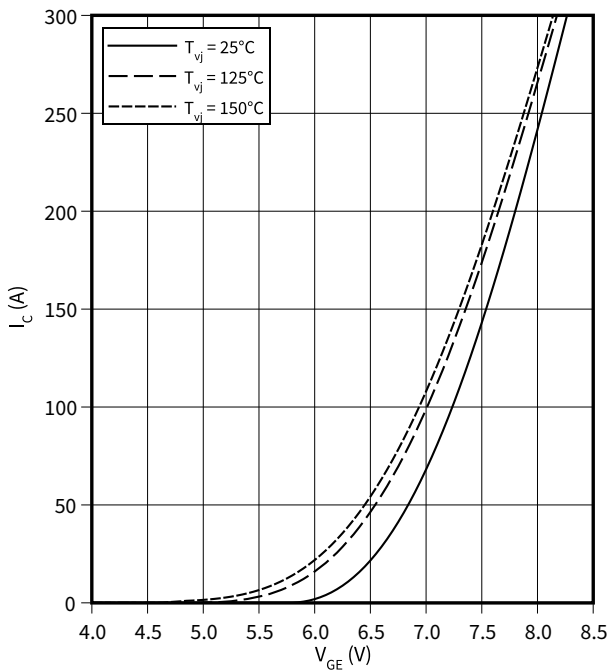
$$T_{vj} = 150 \text{ °C}$$



Transfer characteristic (typical), IGBT, Inverter

$$I_C = f(V_{GE})$$

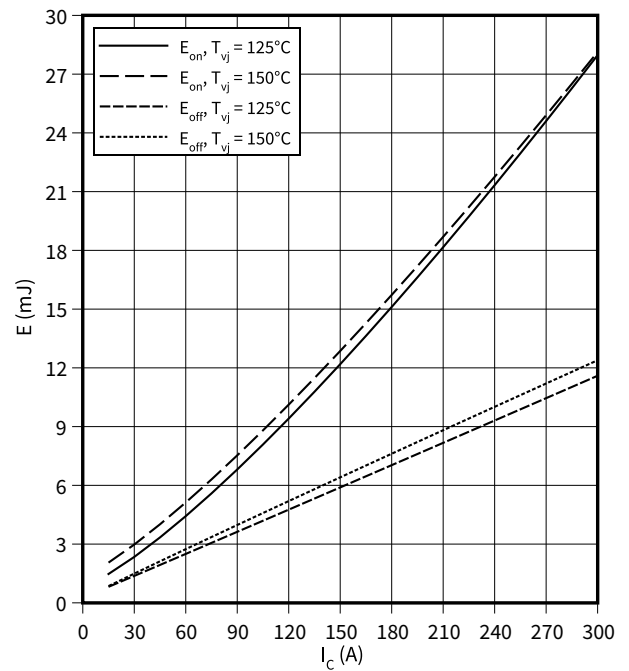
$$V_{CE} = 20 \text{ V}$$



Switching losses (typical), IGBT, Inverter

$$E = f(I_C)$$

$$R_{Goff} = 12 \text{ } \Omega, R_{Gon} = 12 \text{ } \Omega, V_{CE} = 500 \text{ V}, V_{GE} = \pm 15 \text{ V}$$

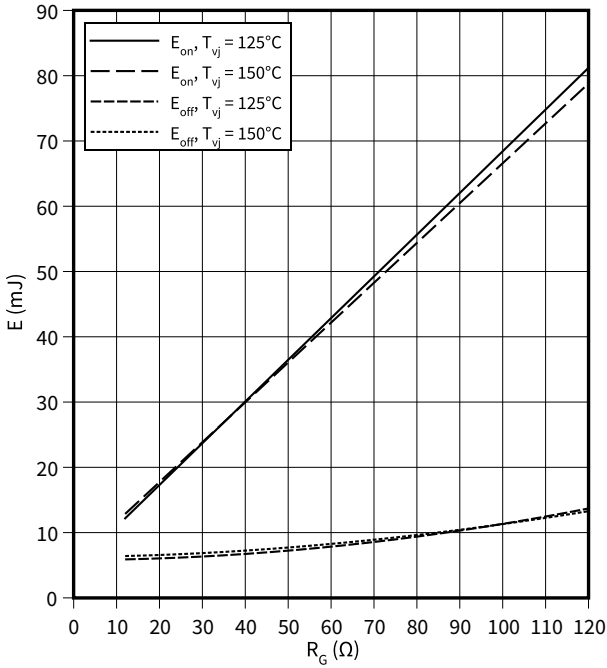


5 Characteristics diagrams

Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

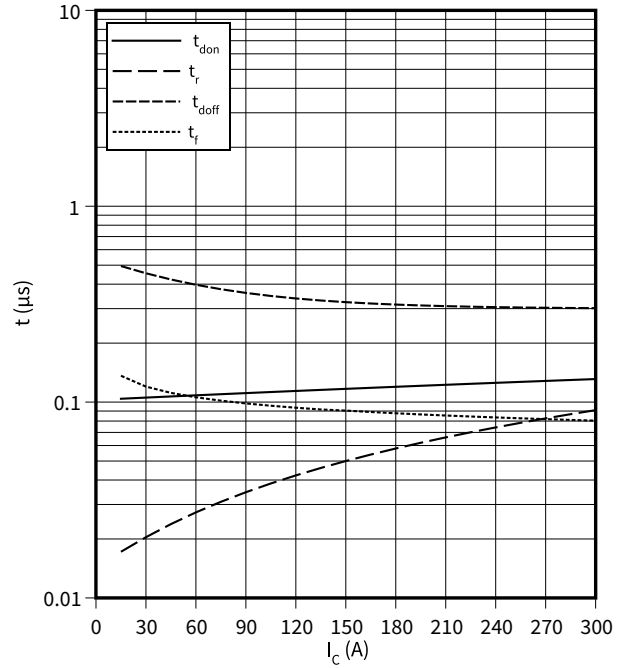
$I_C = 150 \text{ A}, V_{CE} = 500 \text{ V}, V_{GE} = \pm 15 \text{ V}$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

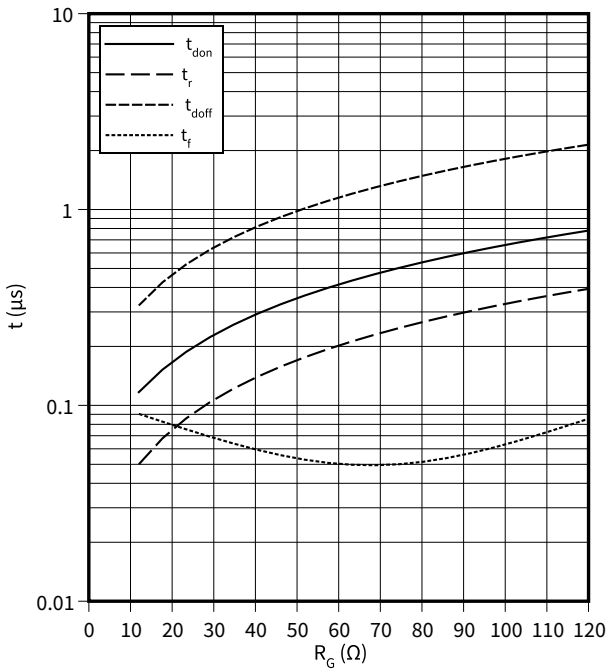
$R_{Goff} = 12 \Omega, R_{Gon} = 12 \Omega, V_{CE} = 500 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150 \text{ }^\circ\text{C}$



Switching times (typical), IGBT, Inverter

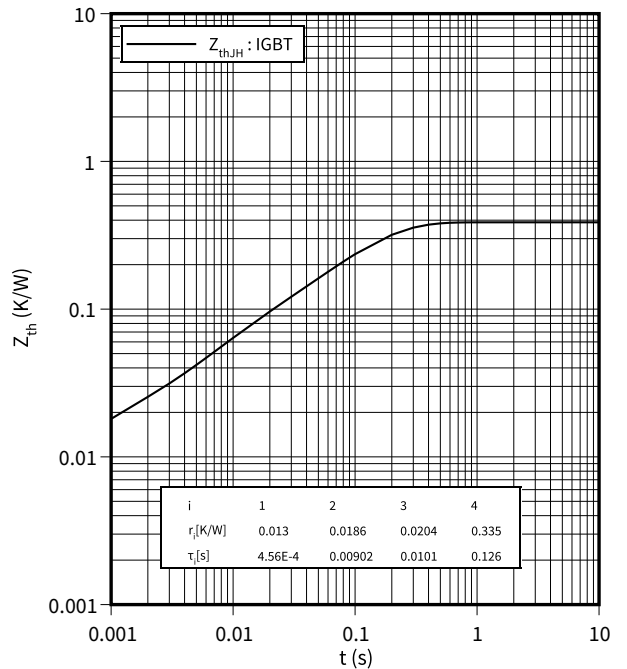
$t = f(R_G)$

$I_C = 150 \text{ A}, V_{CE} = 500 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150 \text{ }^\circ\text{C}$



Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$

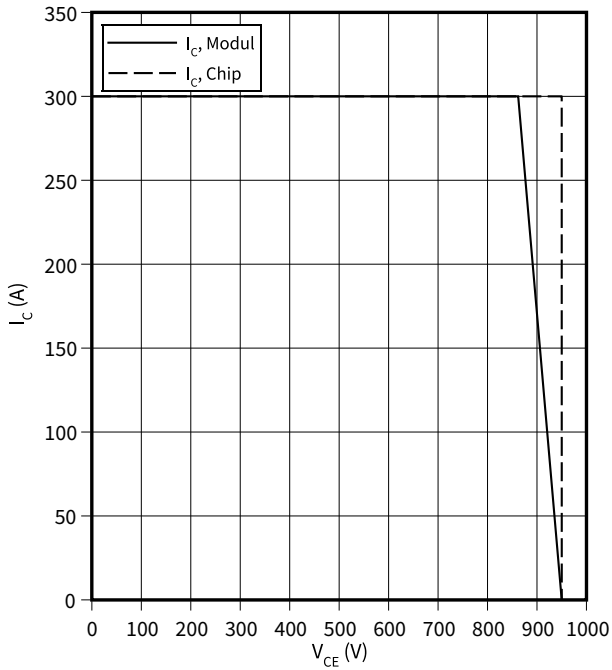


5 Characteristics diagrams

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

$I_C = f(V_{CE})$

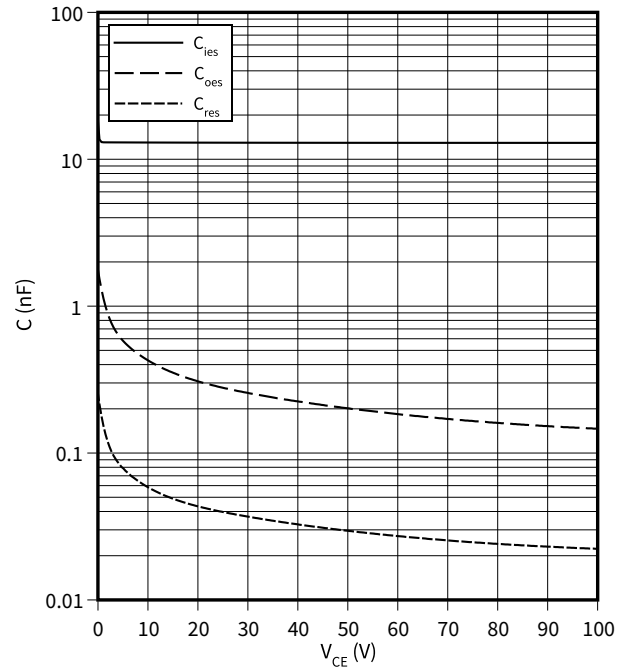
$R_{Goff} = 12 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150 \text{ }^\circ\text{C}$



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

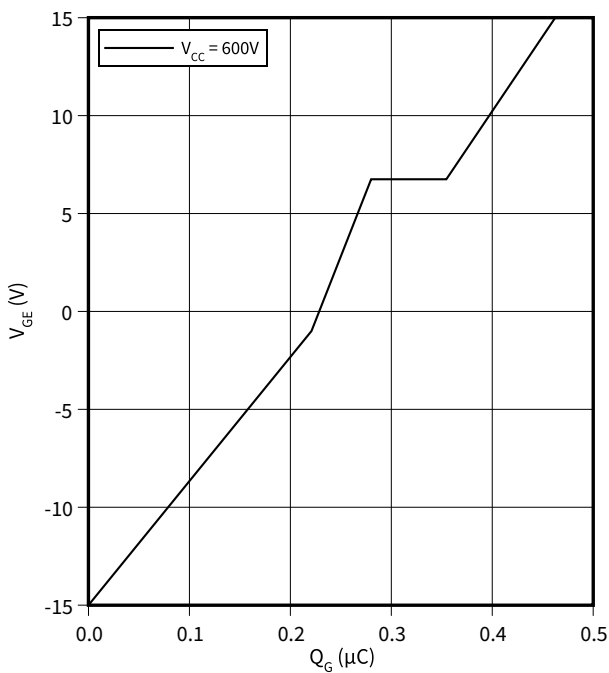
$f = 100 \text{ kHz}$, $V_{GE} = 0 \text{ V}$, $T_{vj} = 25 \text{ }^\circ\text{C}$



Gate charge characteristic (typical), IGBT, Inverter

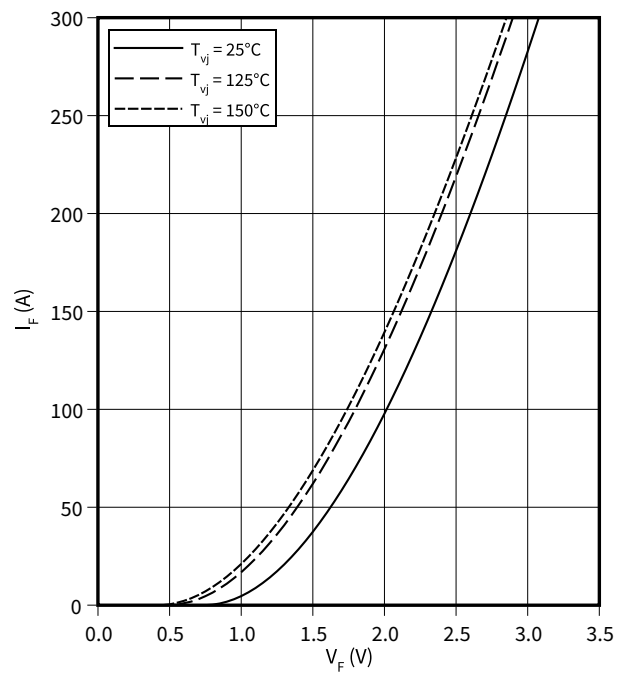
$V_{GE} = f(Q_G)$

$I_C = 200 \text{ A}$, $T_{vj} = 25 \text{ }^\circ\text{C}$



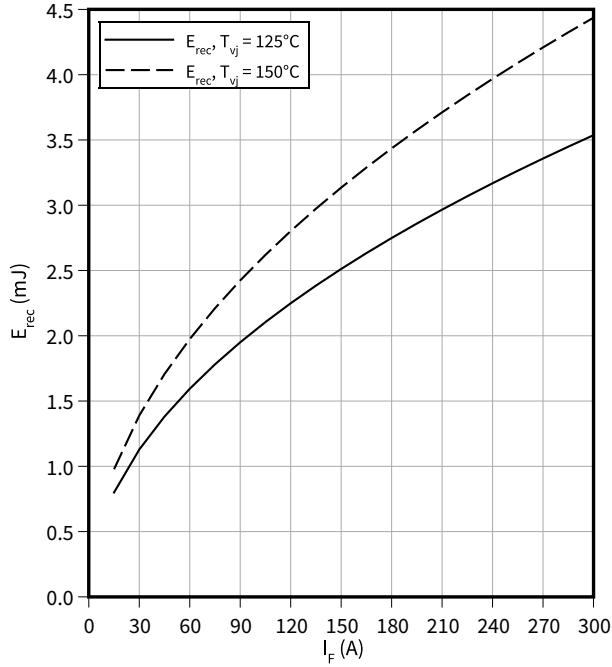
Forward characteristic (typical), Diode, Inverter

$I_F = f(V_F)$



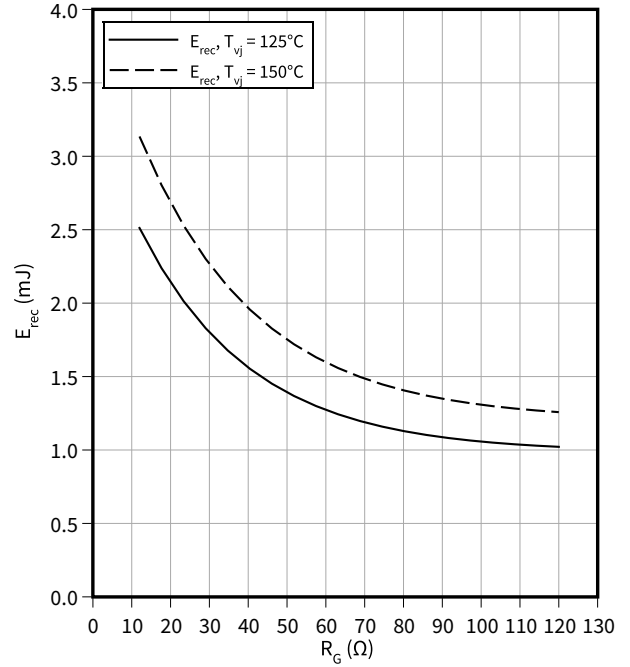
Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$
 $R_{Gon} = 12 \Omega, V_R = 500 V$



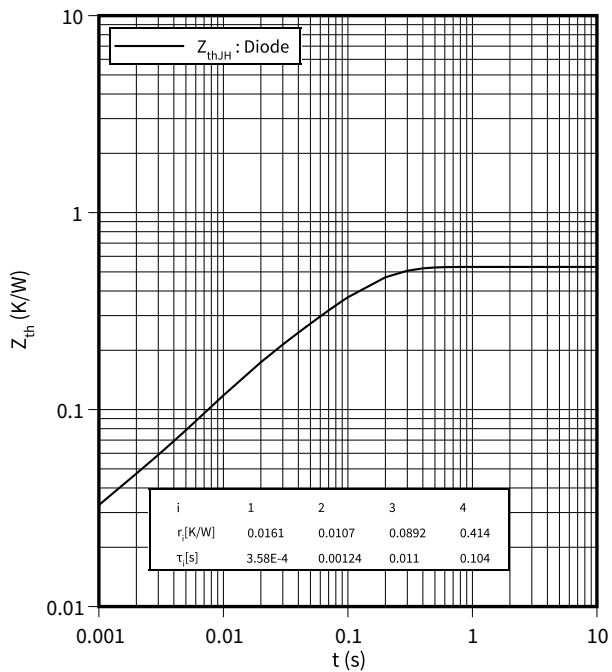
Switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$
 $I_F = 200 A, V_R = 500 V$



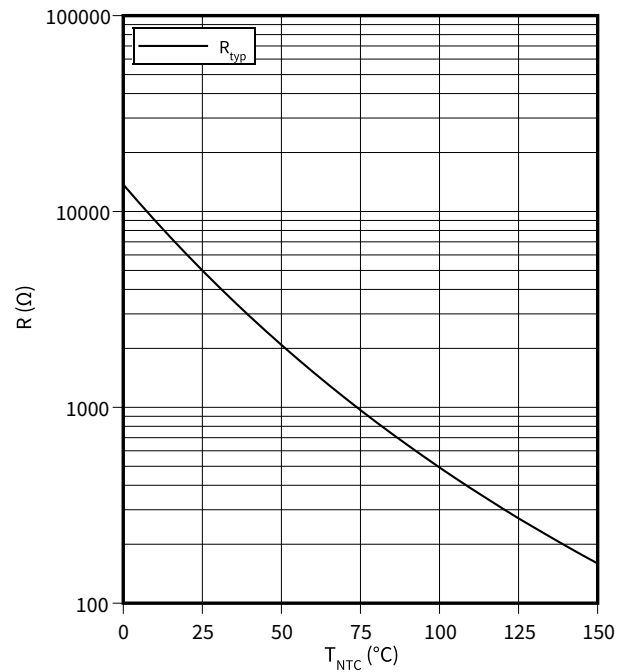
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

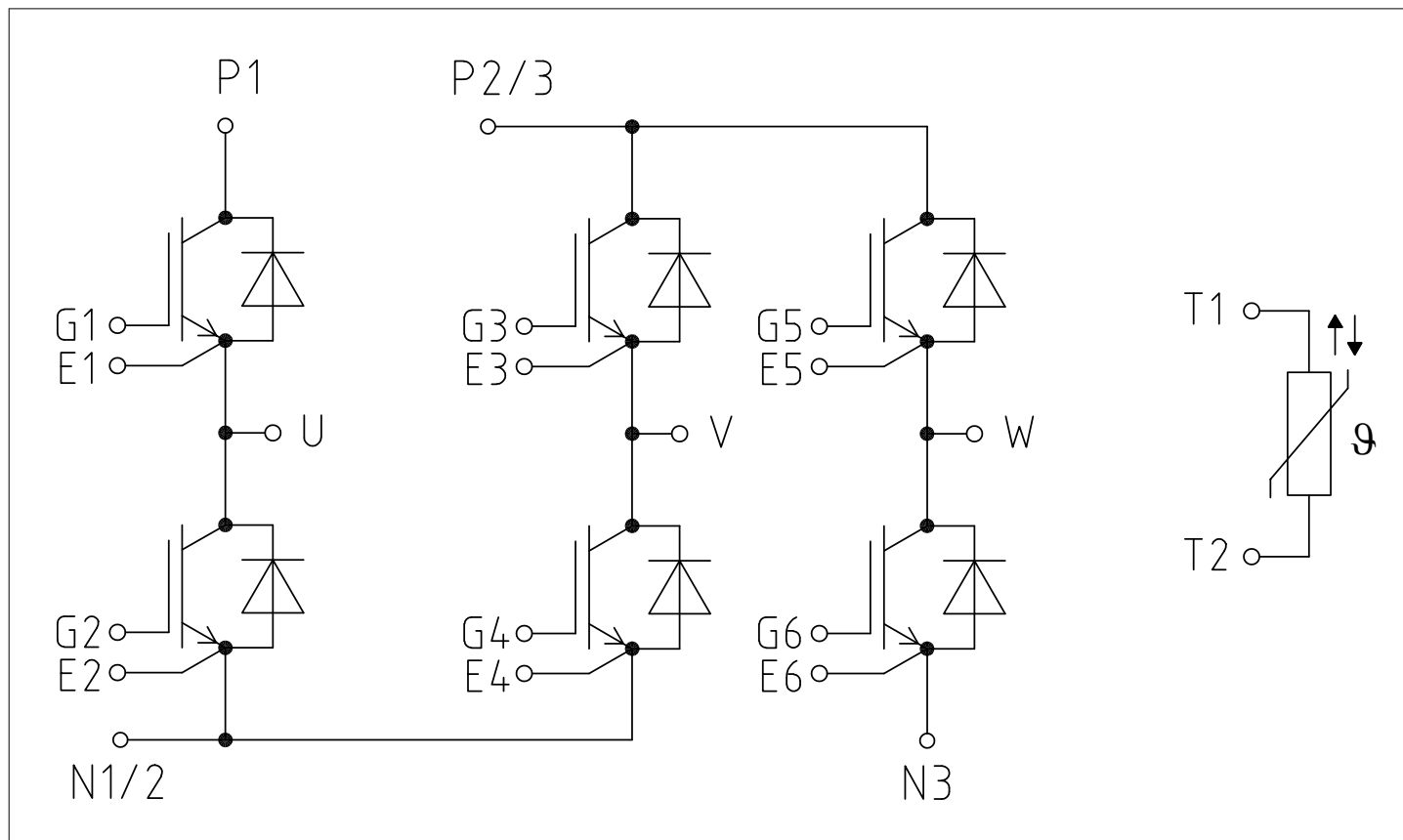


Figure 1

7 Package outlines

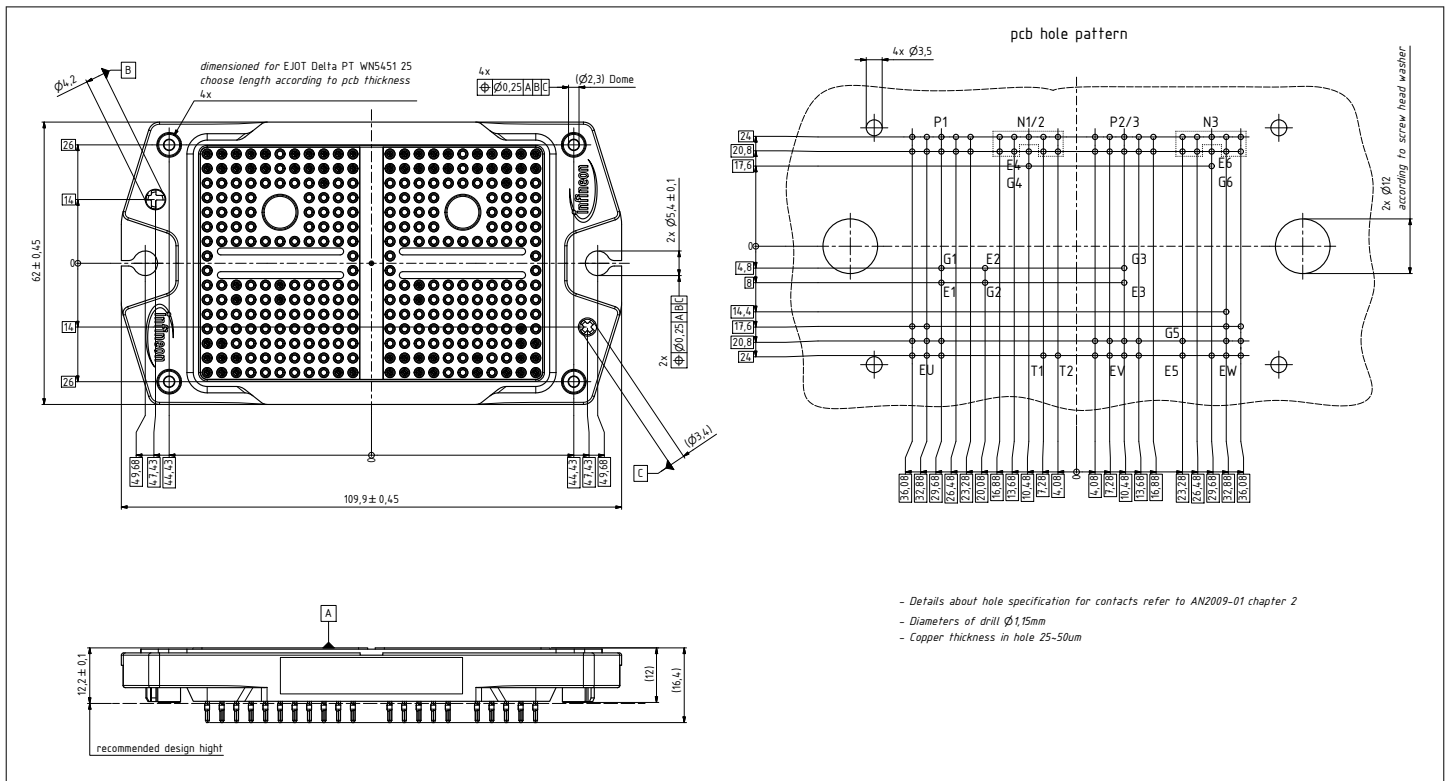


Figure 2

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
0.20	2021-03-25	
1.00	2022-01-13	Final datasheet

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