

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



Typical appearance

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

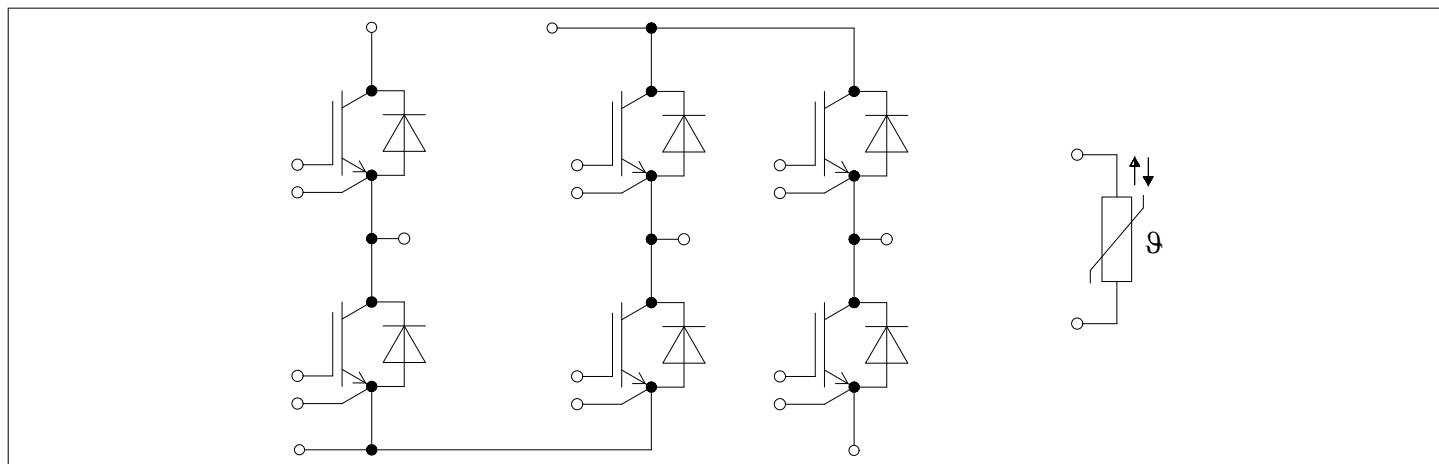


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1 Package

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
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	V
			$T_{vj} = 125\text{ °C}$		2.12	
			$T_{vj} = 150\text{ °C}$		2.07	
Peak reverse recovery current	I_{RM}	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		73.8	A
			$T_{vj} = 125\text{ °C}$		108	
			$T_{vj} = 150\text{ °C}$		118	
Recovered charge	Q_r	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		6.19	μC
			$T_{vj} = 125\text{ °C}$		11.7	
			$T_{vj} = 150\text{ °C}$		13.6	
Reverse recovery energy	E_{rec}	$I_F = 150\text{ A}, V_R = 500\text{ V}, V_{GE} = -15\text{ V}, -di_F/dt = 2300\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$		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, $\lambda_{grease} = 3.3\text{ W}/(m^{\circ}K)$			0.530	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$			-40	150	$^{\circ}C$

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

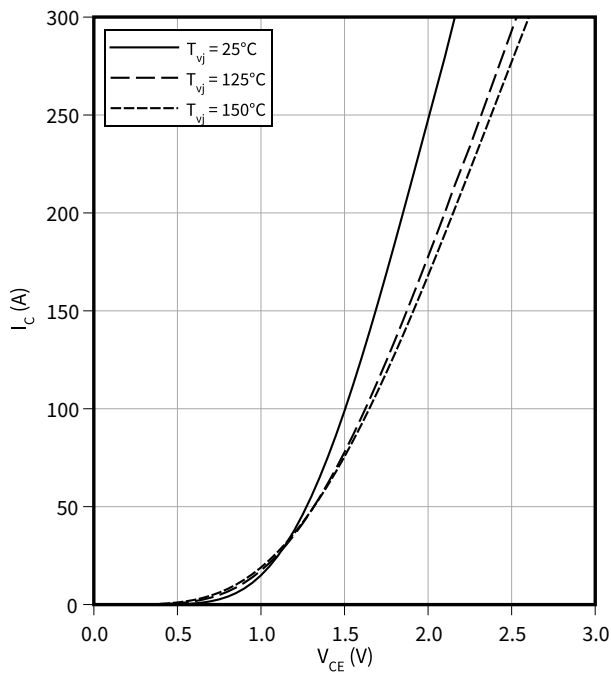
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

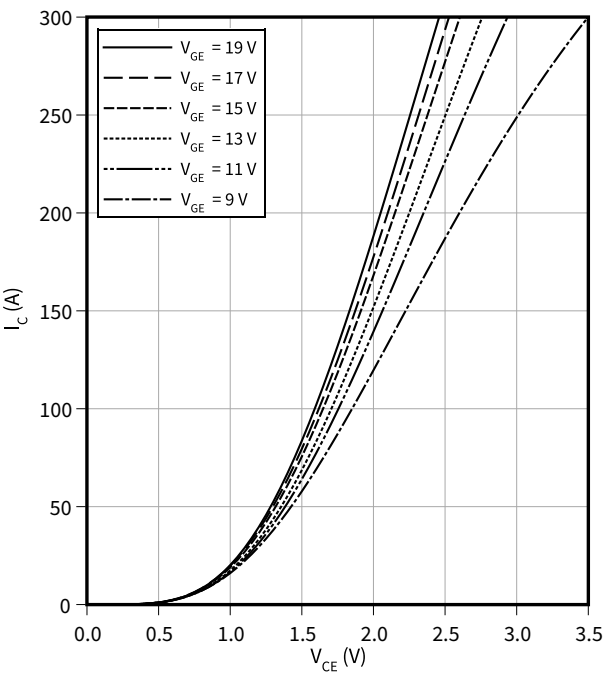
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

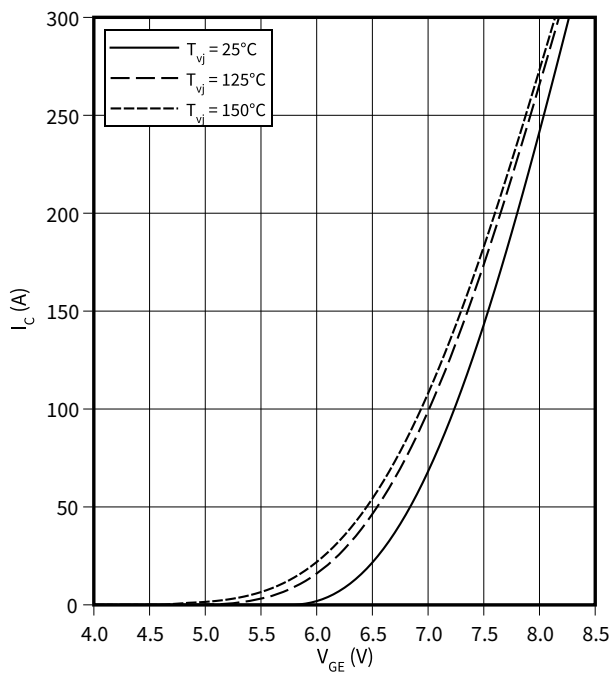
$T_{vj} = 150^\circ\text{C}$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

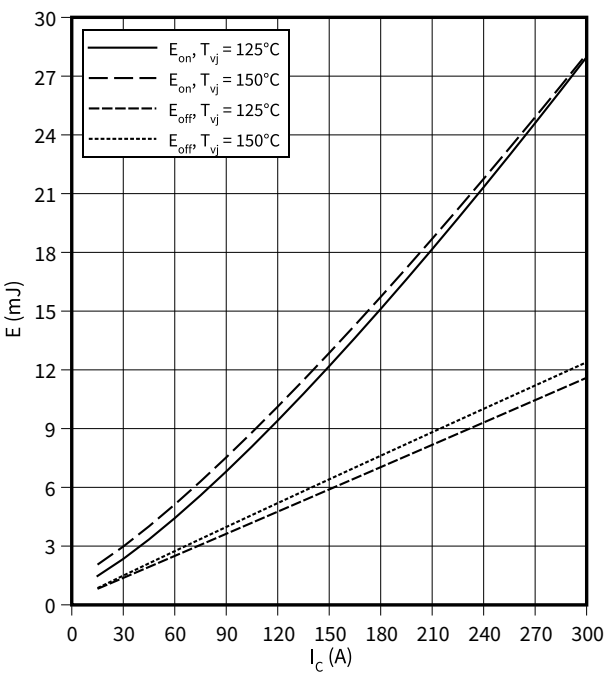
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

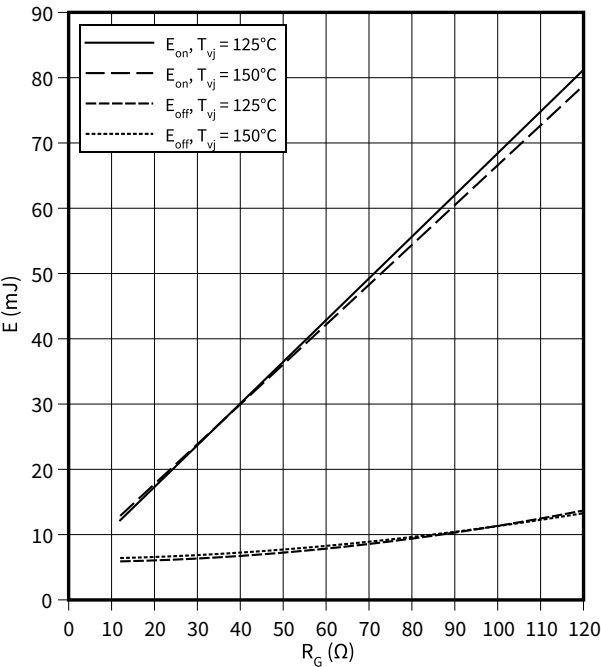
$R_{Goff} = 12\ \Omega$, $R_{Gon} = 12\ \Omega$, $V_{CE} = 500\text{ V}$, $V_{GE} = \pm 15\text{ V}$



5 Characteristics diagrams

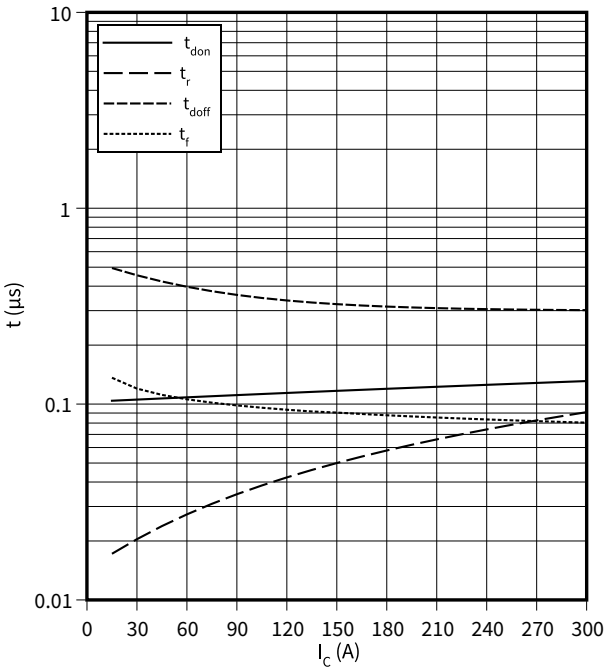
Switching losses (typical), IGBT, Inverter

$E = f(R_G)$
 $I_C = 150\text{ A}$, $V_{CE} = 500\text{ V}$, $V_{GE} = \pm 15\text{ V}$



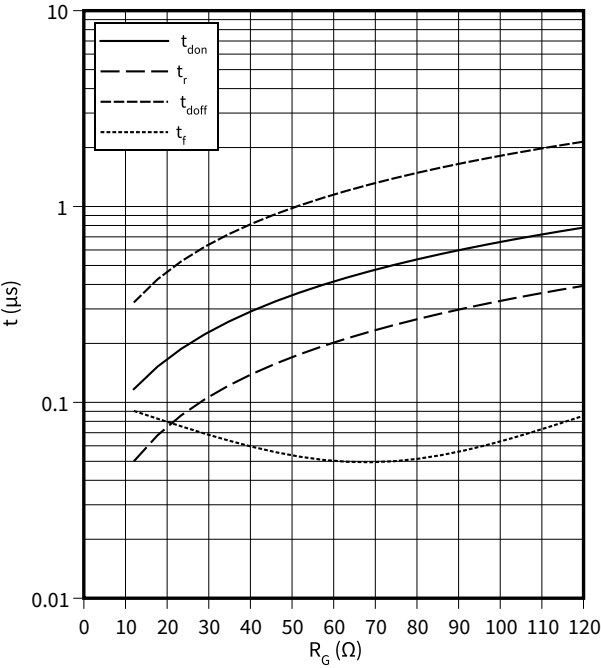
Switching times (typical), IGBT, Inverter

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



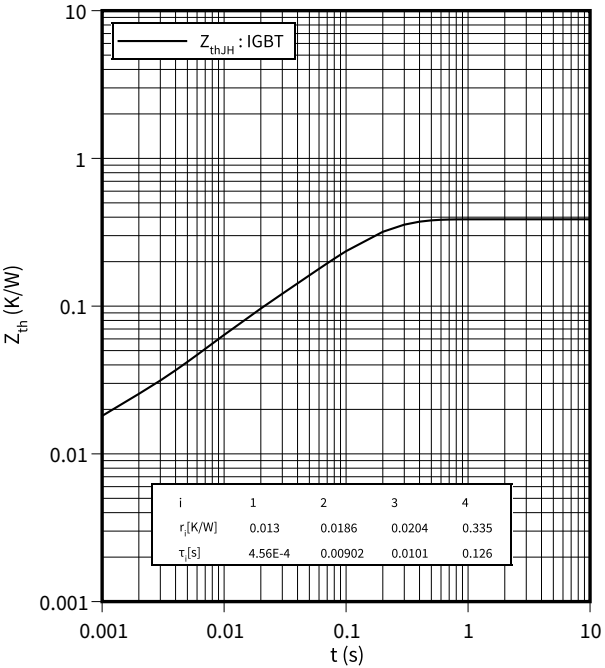
Switching times (typical), IGBT, Inverter

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



Transient thermal impedance , IGBT, Inverter

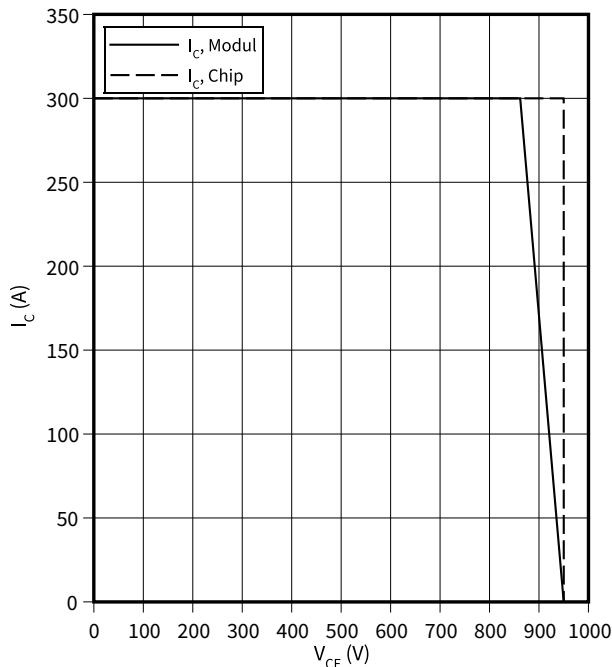
$Z_{th} = f(t)$



5 Characteristics diagrams

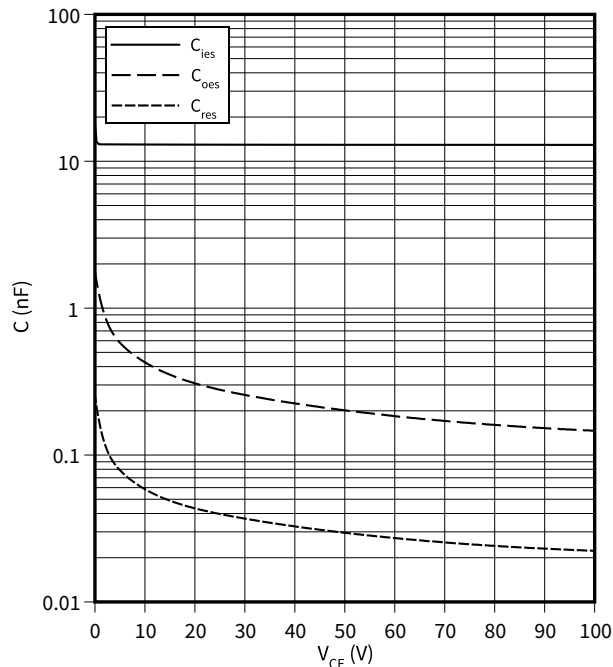
Reverse bias safe operating area (RBSOA), IGBT, Inverter

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



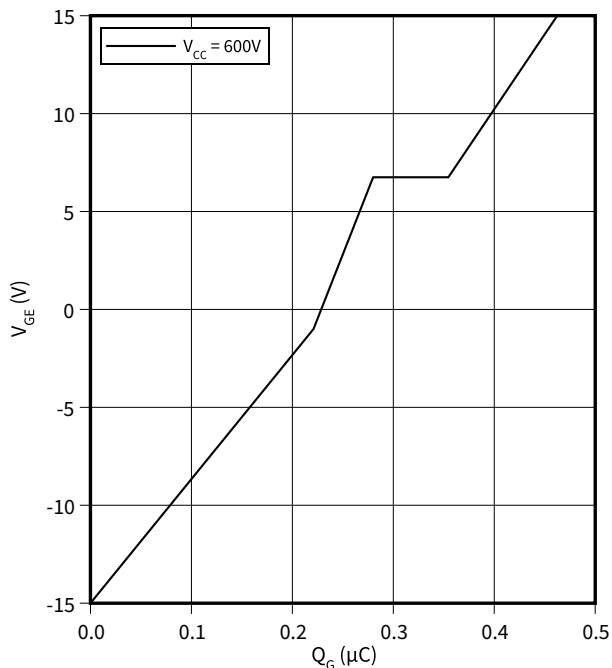
Capacity characteristic (typical), IGBT, Inverter

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



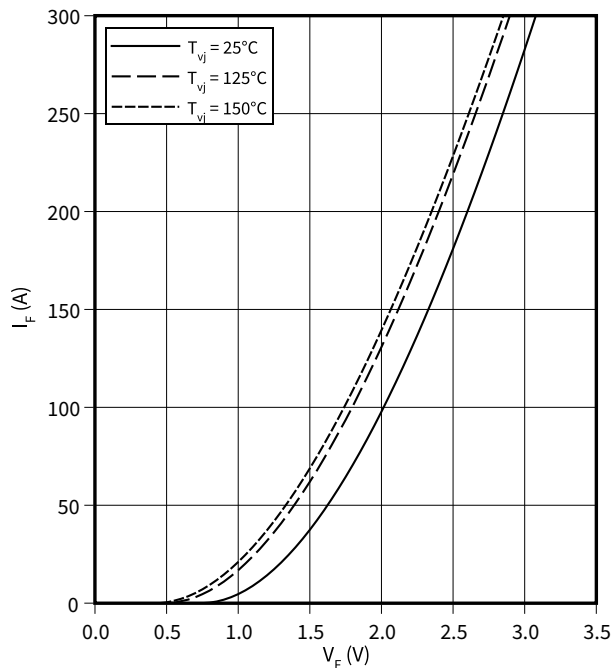
Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$
 $I_C = 200 \text{ A}$, $T_{vj} = 25^\circ\text{C}$



Forward characteristic (typical), Diode, Inverter

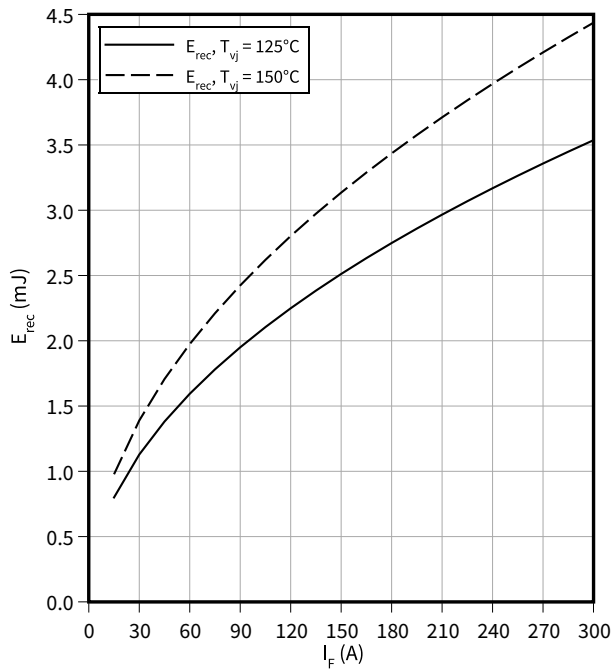
$I_F = f(V_F)$



5 Characteristics diagrams

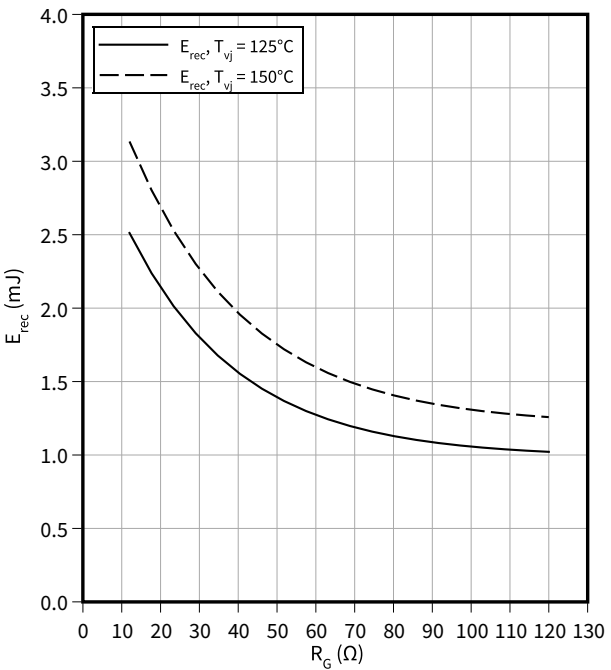
Switching losses (typical), Diode, Inverter

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



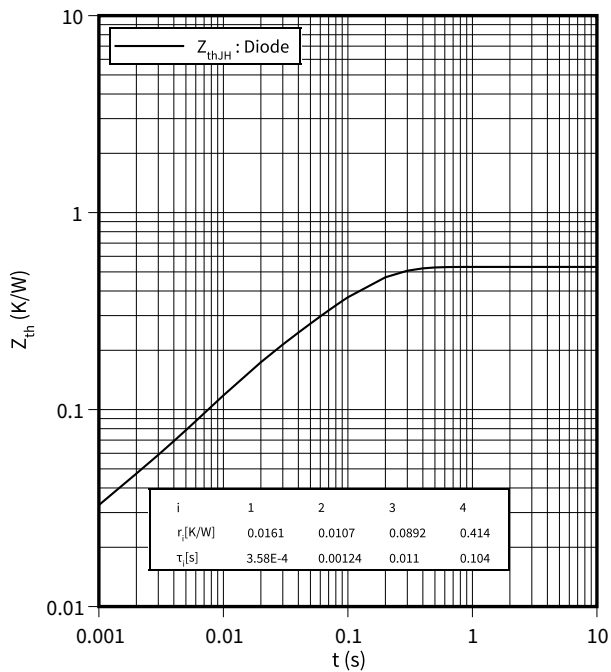
Switching losses (typical), Diode, Inverter

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



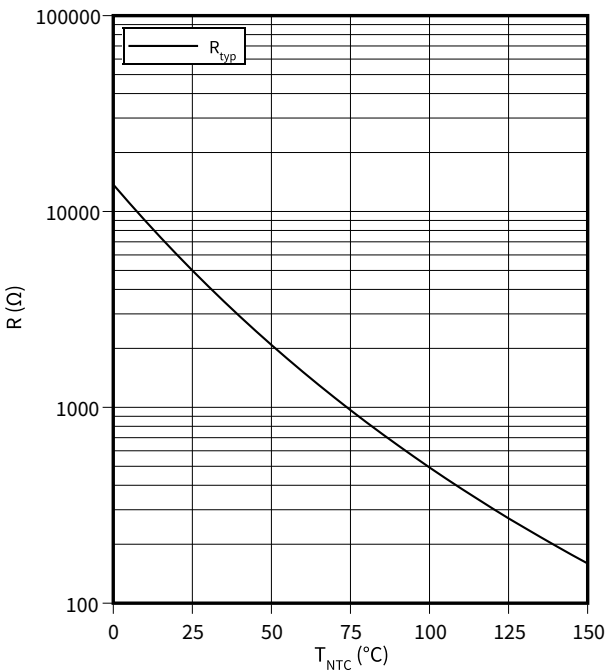
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



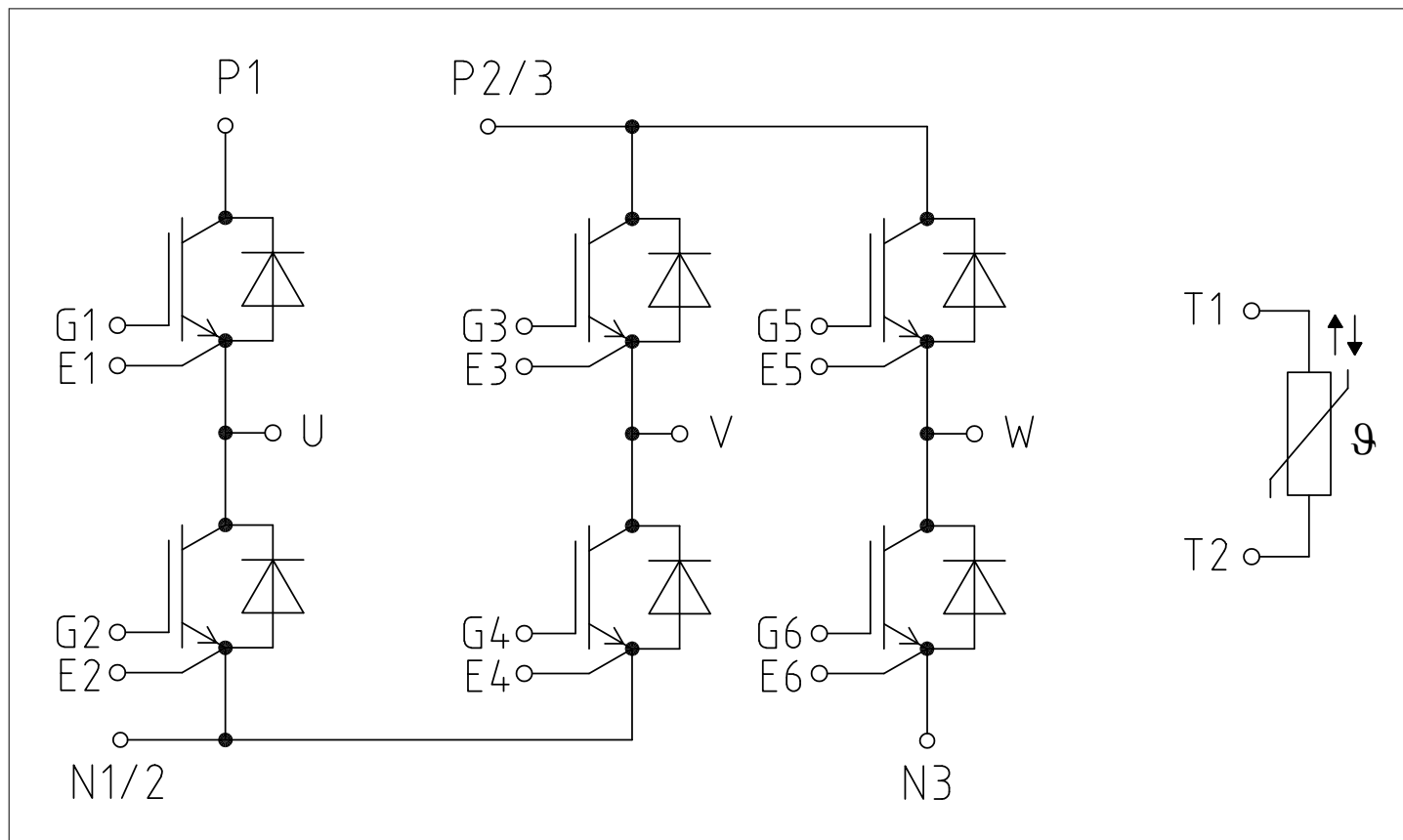


Figure 1

7 Package outlines

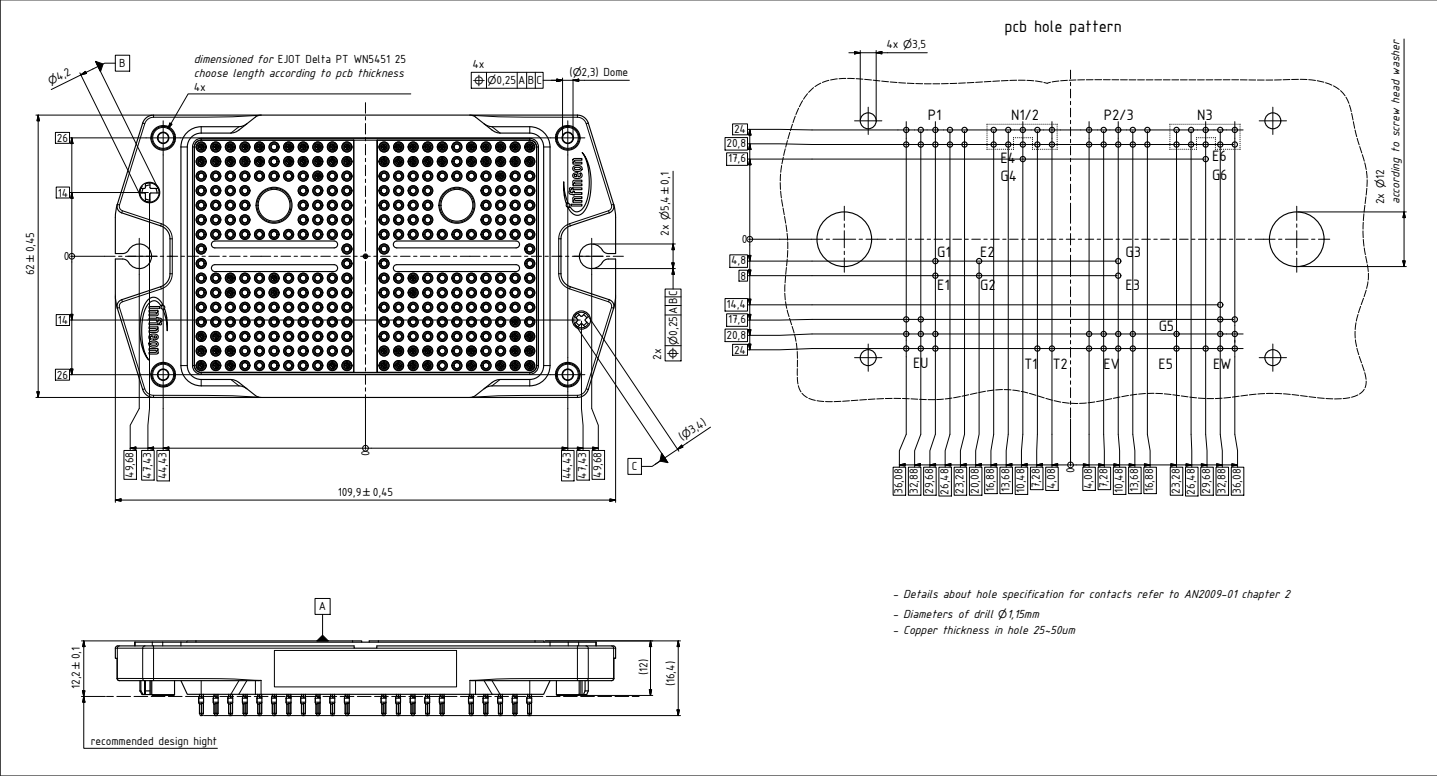


Figure 2

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

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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