

EasyPACK™ module with TRENCHSTOP™ IGBT7 and CoolSiC™ Schottky diode and PressFIT / NTC

Features

- Electrical features
 - $V_{CES} = 950 \text{ V}$
 - $I_{C \text{ nom}} = 200 \text{ A} / I_{CRM} = 300 \text{ A}$
 - CoolSiC™ Schottky diode gen 5
 - Low switching losses
 - TRENCHSTOP™ IGBT7
- Mechanical features
 - Integrated NTC temperature sensor
 - Al_2O_3 substrate with low thermal resistance
 - PressFIT contact technology
 - Compact design



Typical appearance

Potential applications

- Three-level applications
- Solar applications
- UPS systems

Product validation

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

Description

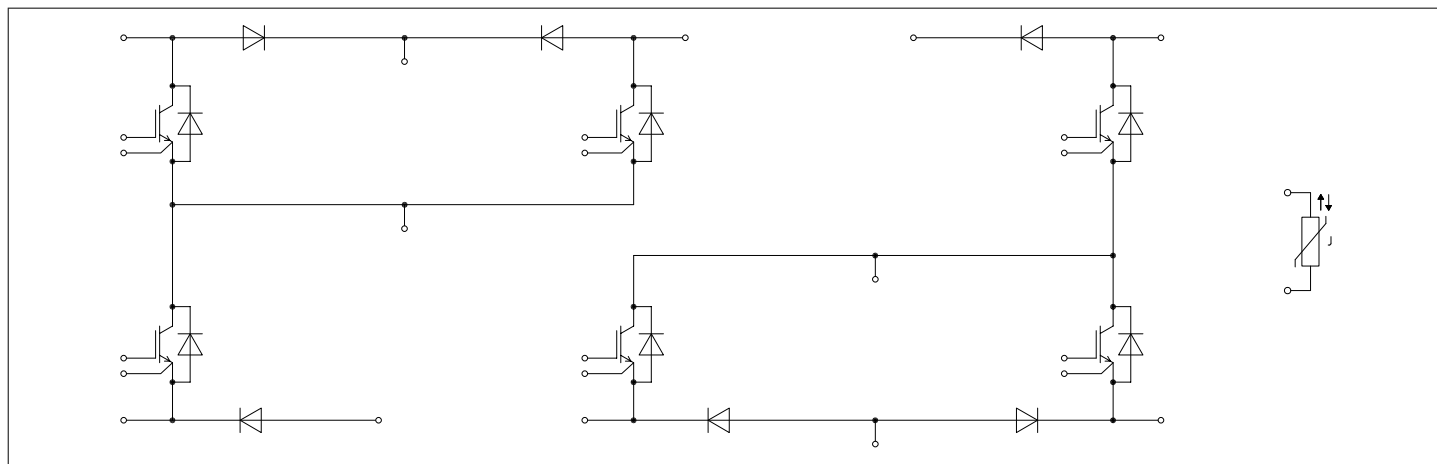


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1 Package

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}			18		nH
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	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, Boost

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CES}	$T_{vj} = 25 \text{ °C}$	950	V
Implemented collector current	I_{CN}		200	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$ $T_H = 65 \text{ °C}$	120	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	$V_{CE\ sat}$	$I_C = 45\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.23	1.48	V
			$T_{vj} = 125\ ^\circ C$		1.27		
			$T_{vj} = 150\ ^\circ C$		1.27		
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	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V$			0.45		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			1.5		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			12.6		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}	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			0.026	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}	$I_C = 45\ A, V_{CC} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 3.9\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.068		μs
			$T_{vj} = 125\ ^\circ C$		0.078		
			$T_{vj} = 150\ ^\circ C$		0.080		
Rise time (inductive load)	t_r	$I_C = 45\ A, V_{CC} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 3.9\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.007		μs
			$T_{vj} = 125\ ^\circ C$		0.008		
			$T_{vj} = 150\ ^\circ C$		0.009		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 45\ A, V_{CC} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.198		μs
			$T_{vj} = 125\ ^\circ C$		0.263		
			$T_{vj} = 150\ ^\circ C$		0.280		
Fall time (inductive load)	t_f	$I_C = 45\ A, V_{CC} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.043		μs
			$T_{vj} = 125\ ^\circ C$		0.089		
			$T_{vj} = 150\ ^\circ C$		0.097		
Turn-on energy loss per pulse	E_{on}	$I_C = 45\ A, V_{CC} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 3.9\ \Omega, di/dt = 4000\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		0.473		mJ
			$T_{vj} = 125\ ^\circ C$		0.544		
			$T_{vj} = 150\ ^\circ C$		0.557		
Turn-off energy loss per pulse	E_{off}	$I_C = 45\ A, V_{CC} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 1.5\ \Omega, dv/dt = 3200\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		1.14		mJ
			$T_{vj} = 125\ ^\circ C$		1.95		
			$T_{vj} = 150\ ^\circ C$		2.19		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3\ W/(m \cdot K)$			0.433		K/W

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

3 Diode, Reverse

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\,^{\circ}\text{C}$	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	$t_p = 10\,\text{ms}, V_R = 0\,\text{V}$	$T_{vj} = 125\,^{\circ}\text{C}$	453	A^2s
			$T_{vj} = 175\,^{\circ}\text{C}$	392	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 75\,\text{A}, V_{GE} = 0\,\text{V}$		$T_{vj} = 25\,^{\circ}\text{C}$	1.72	V
				$T_{vj} = 125\,^{\circ}\text{C}$	1.59	
				$T_{vj} = 175\,^{\circ}\text{C}$	1.52	
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3\,\text{W}/(\text{m}\cdot\text{K})$		0.933		K/W
Temperature under switching conditions	$T_{vj\,op}$		-40		175	°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.

4 Diode, Boost

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\,^{\circ}\text{C}$	1200	V

(table continues...)

Table 7 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Continuous DC forward current	I_F		60	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	120	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 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 45 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.38	1.58	V
			$T_{vj} = 125 \text{ °C}$	1.52		
			$T_{vj} = 150 \text{ °C}$	1.60		
Peak reverse recovery current	I_{RM}	$V_{CC} = 500 \text{ V}, I_F = 45 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 4000 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	46.2		A
			$T_{vj} = 125 \text{ °C}$	46.2		
			$T_{vj} = 150 \text{ °C}$	46.2		
Recovered charge	Q_r	$V_{CC} = 500 \text{ V}, I_F = 45 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 4000 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	1.27		μC
			$T_{vj} = 125 \text{ °C}$	1.27		
			$T_{vj} = 150 \text{ °C}$	1.27		
Reverse recovery energy	E_{rec}	$V_{CC} = 500 \text{ V}, I_F = 45 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 4000 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	0.128		mJ
			$T_{vj} = 125 \text{ °C}$	0.128		
			$T_{vj} = 150 \text{ °C}$	0.128		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3 \text{ W}/(\text{m} \cdot \text{K})$		0.689		K/W
Temperature under switching conditions	$T_{vj op}$		-40		150	°C

5 NTC-Thermistor

Table 9 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

(table continues...)

Table 9 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
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

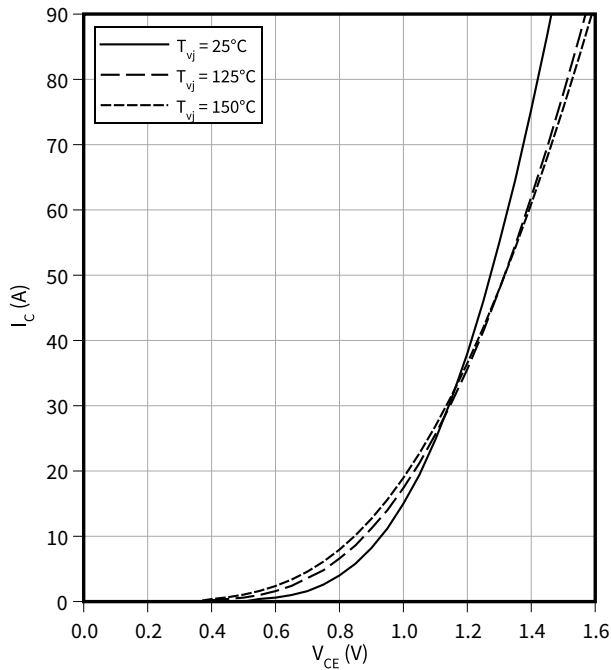
Note: Specification according to the valid application note.

6 Characteristics diagrams

Output characteristic (typical), IGBT, Boost

$I_C = f(V_{CE})$

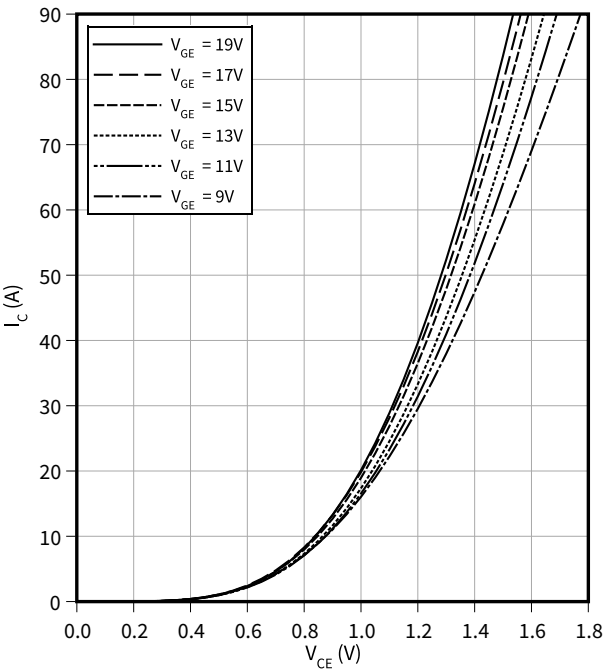
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Boost

$I_C = f(V_{CE})$

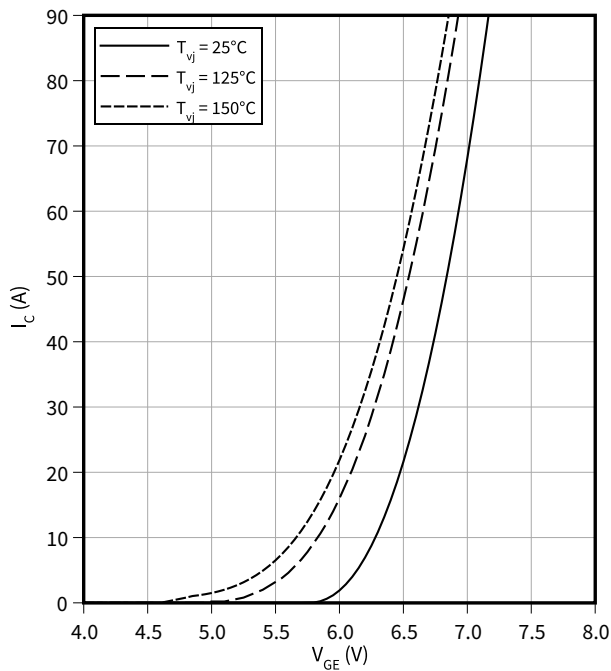
$T_{vj} = 150\text{ °C}$



Transfer characteristic (typical), IGBT, Boost

$I_C = f(V_{GE})$

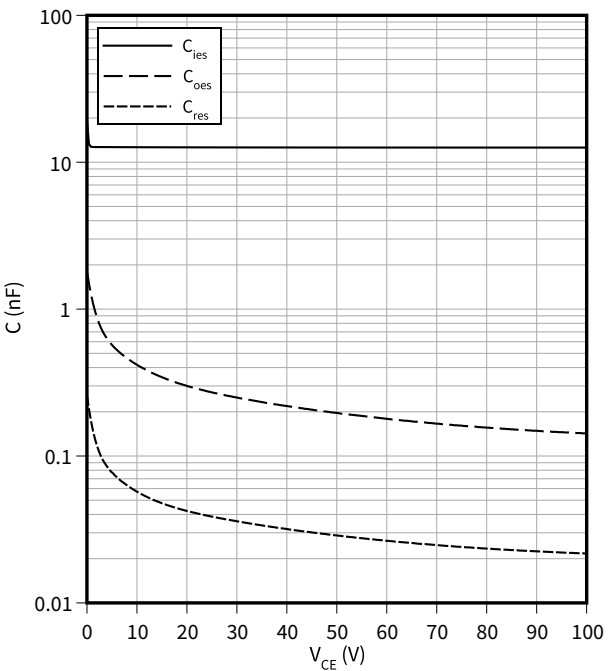
$V_{CE} = 20\text{ V}$



Capacity characteristic (typical), IGBT, Boost

$C = f(V_{CE})$

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

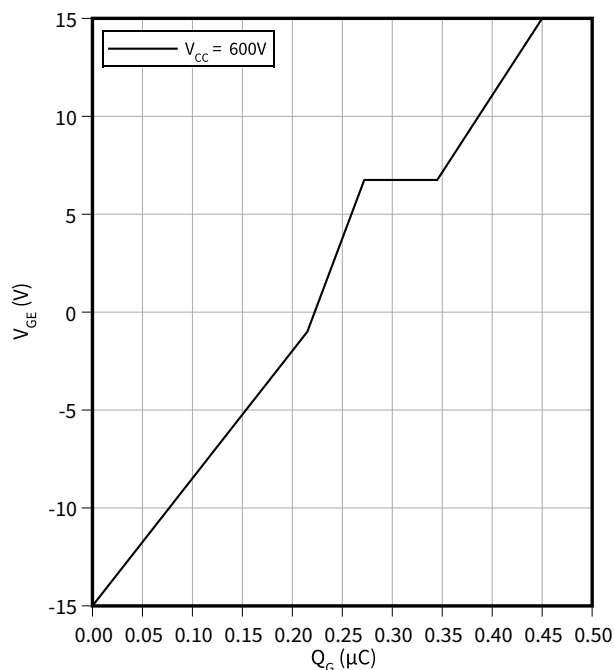


6 Characteristics diagrams

Gate charge characteristic (typical), IGBT, Boost

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

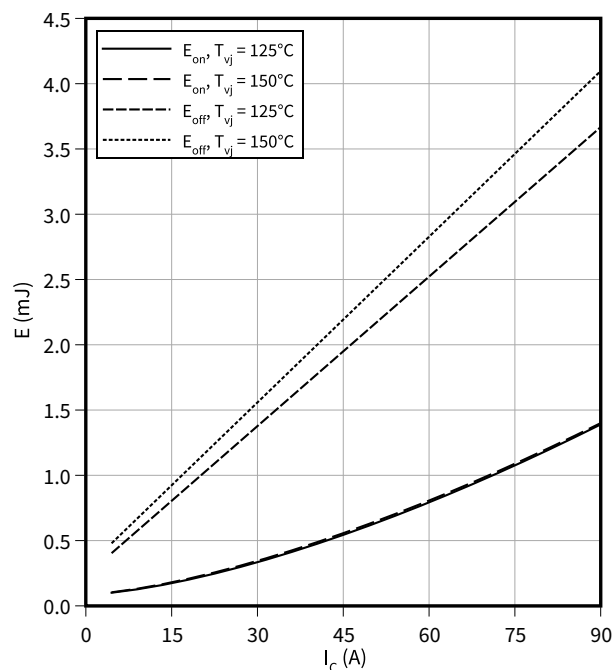
$I_C = 200 \text{ A}$, $T_{vj} = 25^\circ \text{C}$



Switching losses (typical), IGBT, Boost

$$E = f(I_C)$$

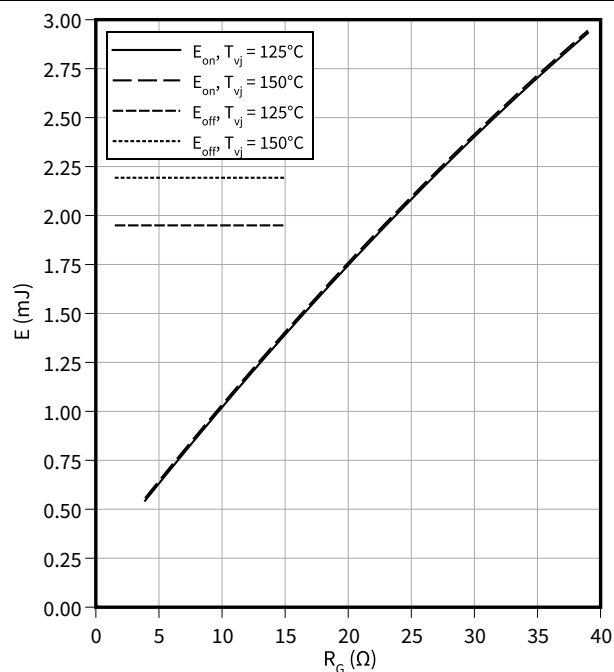
$R_{Goff} = 1.5 \Omega$, $R_{Gon} = 3.9 \Omega$, $V_{CC} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



Switching losses (typical), IGBT, Boost

$$E = f(R_G)$$

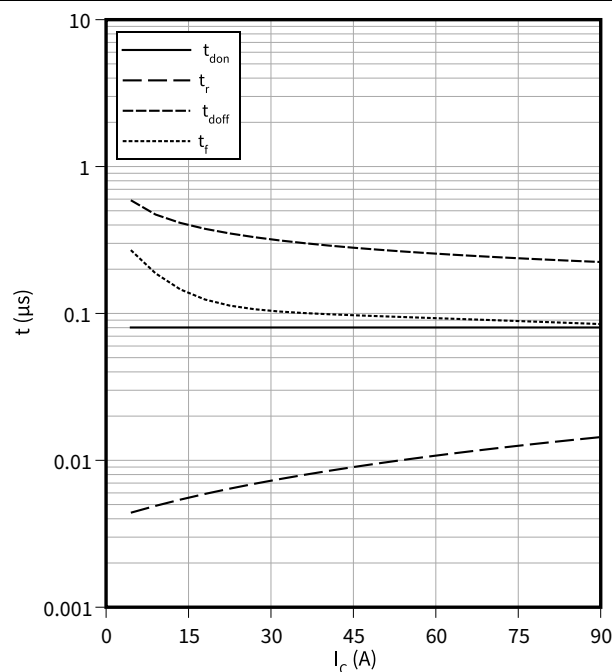
$I_C = 45 \text{ A}$, $V_{CC} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



Switching times (typical), IGBT, Boost

$$t = f(I_C)$$

$R_{Goff} = 1.5 \Omega$, $R_{Gon} = 3.9 \Omega$, $V_{CC} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150^\circ \text{C}$

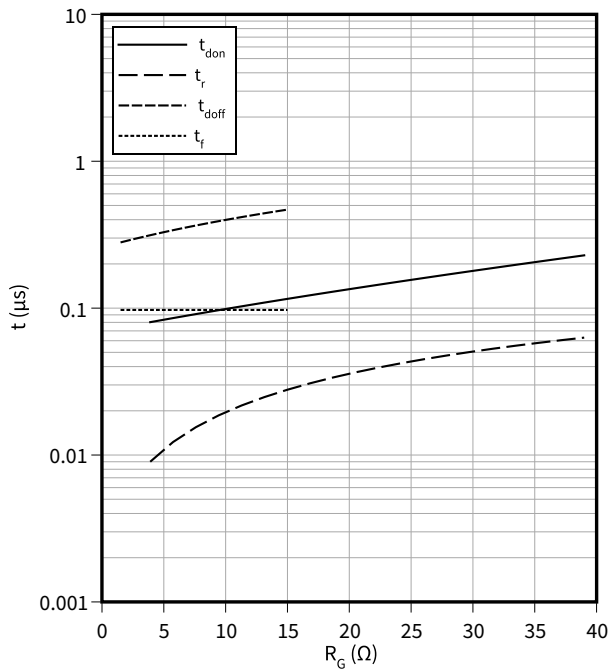


6 Characteristics diagrams

Switching times (typical), IGBT, Boost

$t = f(R_G)$

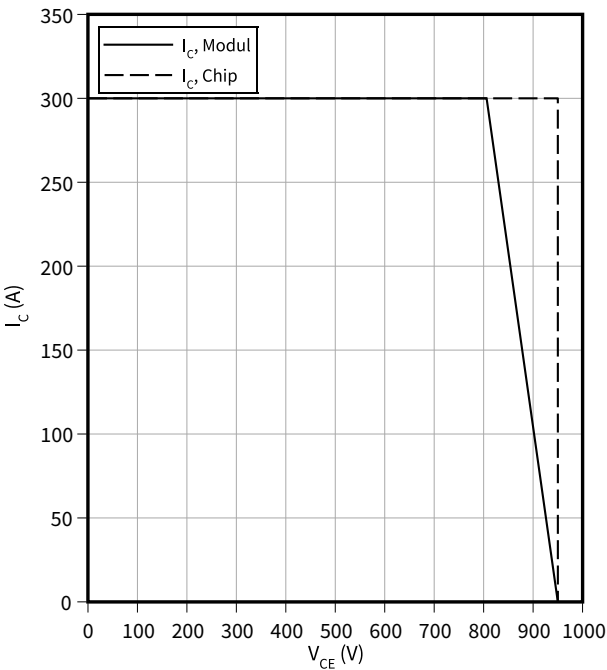
$I_C = 45\text{ A}$, $V_{CC} = 500\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$



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

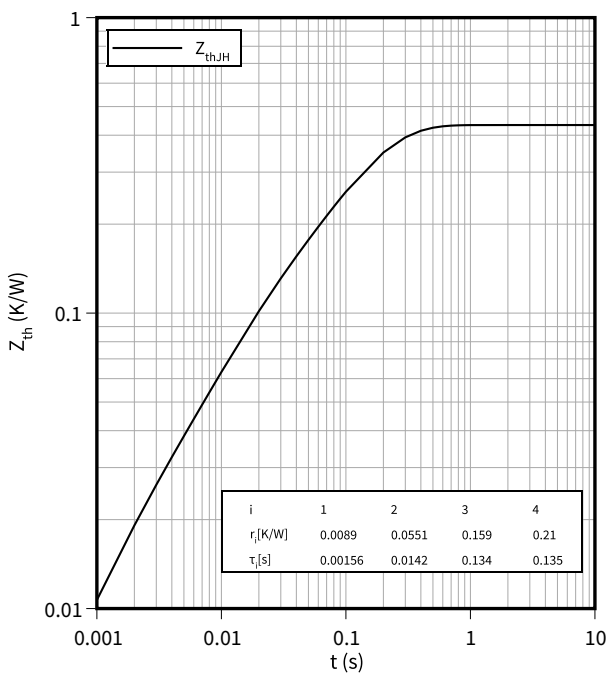
$I_C = f(V_{CE})$

$R_{Goff} = 1.5\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$



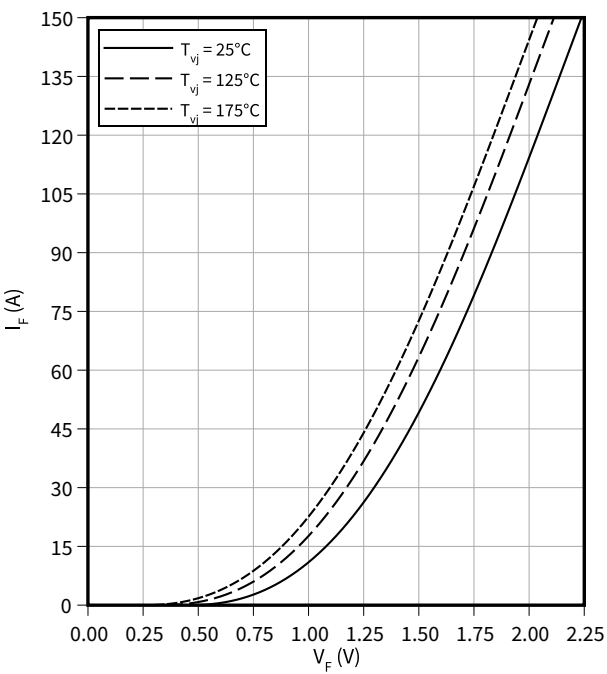
Transient thermal impedance , IGBT, Boost

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Reverse

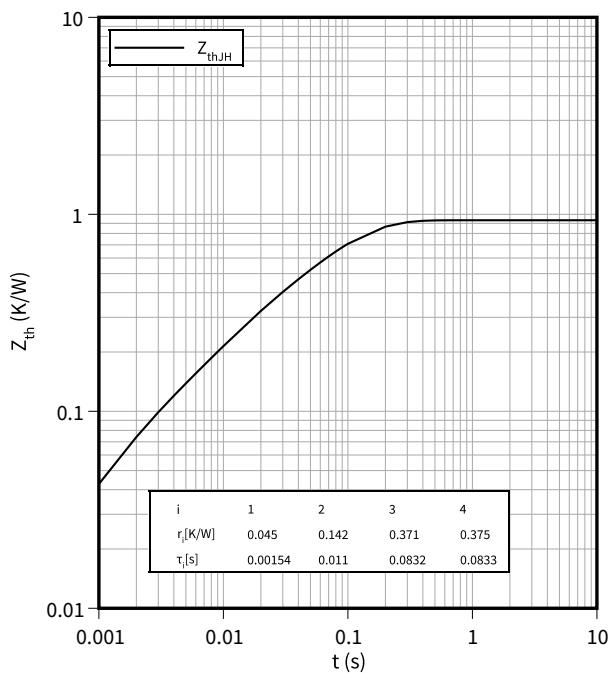
$I_F = f(V_F)$



6 Characteristics diagrams

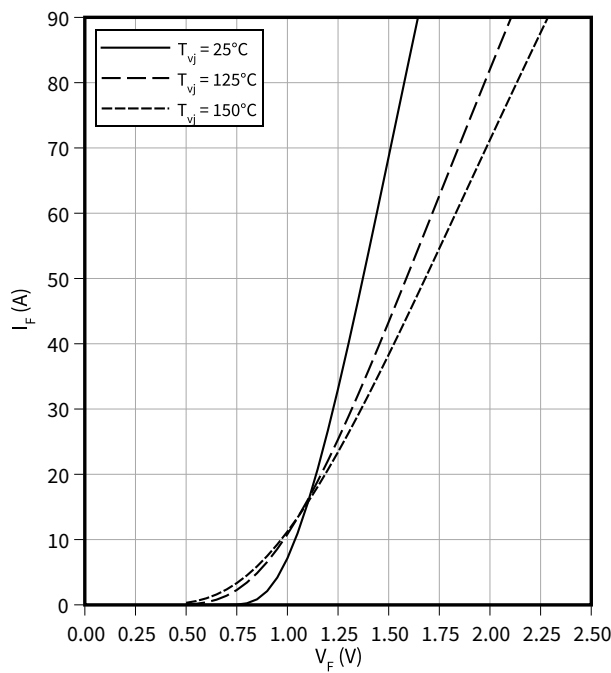
Transient thermal impedance, Diode, Reverse

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Boost

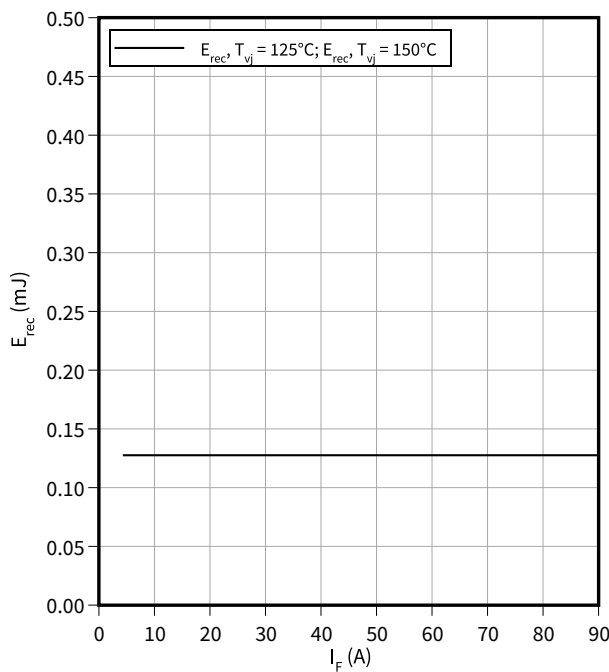
$I_F = f(V_F)$



Switching losses (typical), Diode, Boost

$E_{rec} = f(I_F)$

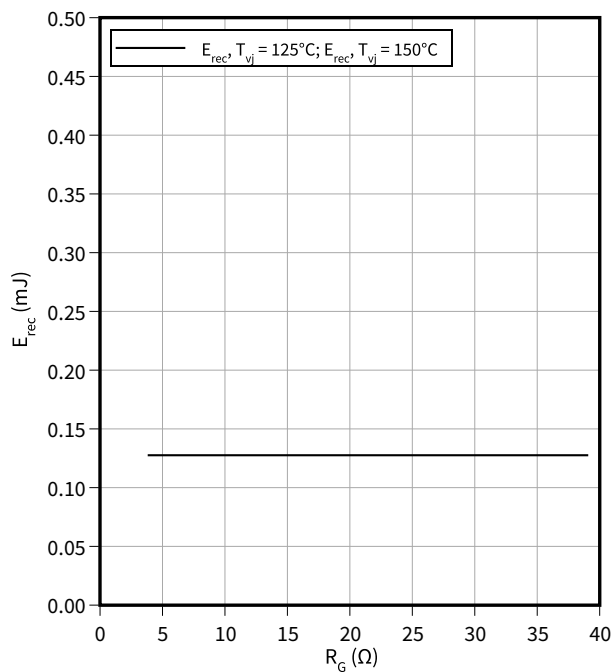
$R_{Gon} = 3.9 \Omega, V_{CC} = 500 V$

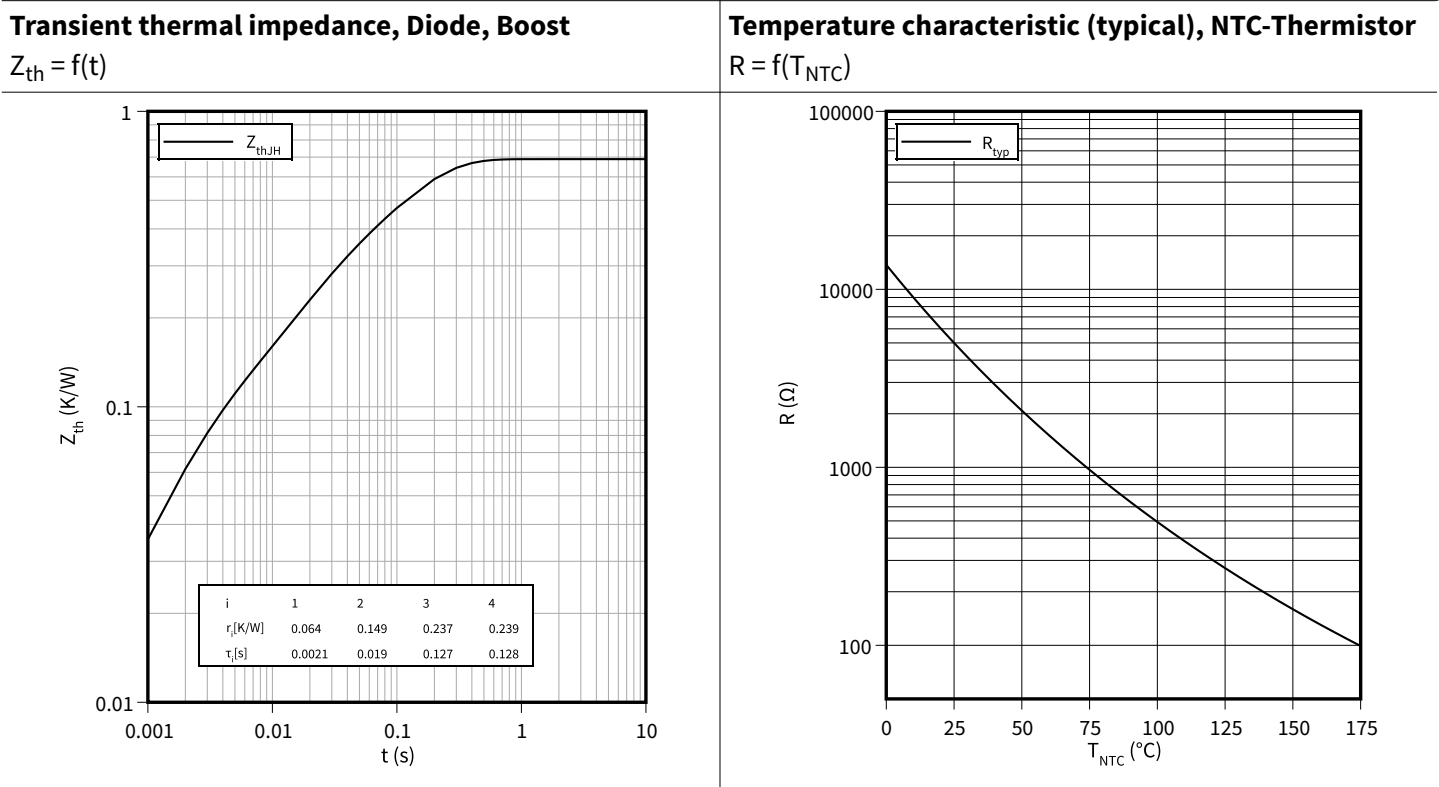


Switching losses (typical), Diode, Boost

$E_{rec} = f(R_G)$

$I_F = 45 A, V_{CC} = 500 V$





7 Circuit diagram

7 Circuit diagram

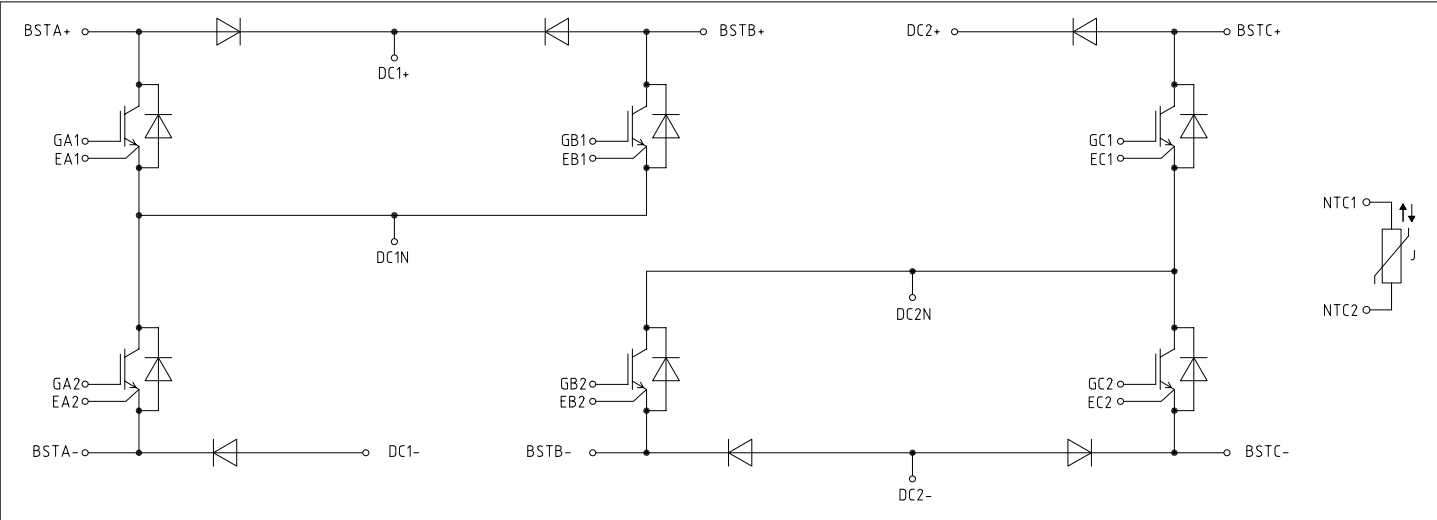


Figure 1

8 Package outlines

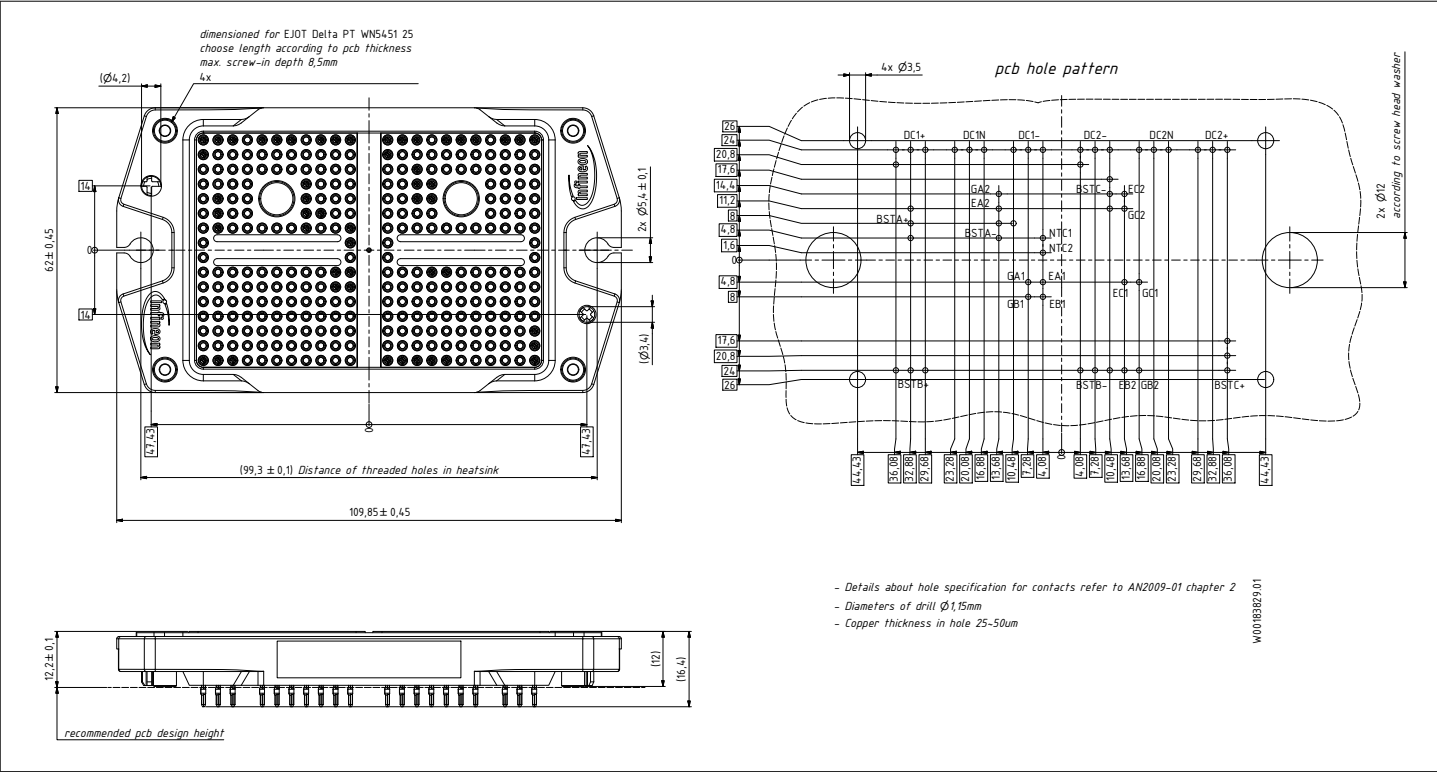


Figure 2

9 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
0.10	2022-04-29	Initial version
1.00	2022-08-24	Final datasheet

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