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

Features

- Electrical features
  - V_{CES} = 950 V
  - $I_{C\ nom}$ = 100 A / I_{CRM} = 200 A
  - CoolSiC™ Schottky diode gen 5
  - Low switching losses
  - TRENCHSTOP™ IGBT7
- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - Integrated NTC temperature sensor
  - PressFIT contact technology

Potential applications

- UPS systems
- Three-level applications
- Solar applications

Product validation

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

Description

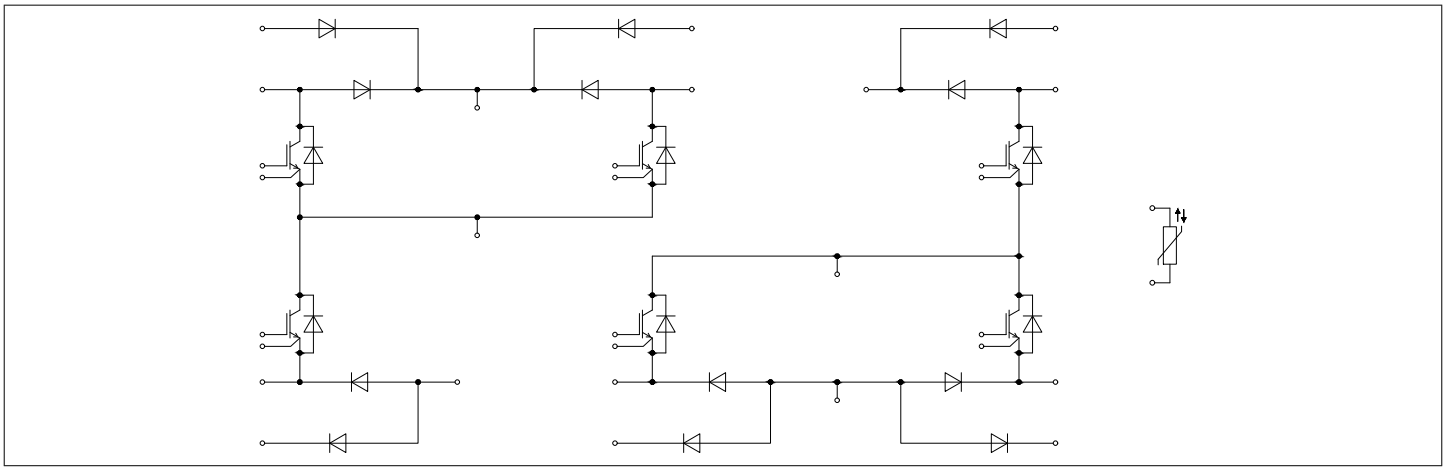


Table of contents

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 1 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}				22		nH
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, Boost

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	950	V
Implemented collector current	I_{CN}			100	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	70	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		200	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 = 30 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.33	1.53	V
			T_{vj} = 125 °C		1.39		
			T_{vj} = 150 °C		1.40		
Gate threshold voltage	V_{GEth}	I_C = 1.67 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.35	5.10	5.85	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CE} = 600 V			0.23		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.5		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			6.48		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.02		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 950 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.031	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 30 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Gon} = 10 Ω	T_{vj} = 25 °C		0.060		µs
			T_{vj} = 125 °C		0.060		
			T_{vj} = 150 °C		0.060		
Rise time (inductive load)	t_r	I_C = 30 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Gon} = 10 Ω	T_{vj} = 25 °C		0.020		µs
			T_{vj} = 125 °C		0.020		
			T_{vj} = 150 °C		0.020		
Turn-off delay time (inductive load)	t_{doff}	I_C = 30 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Goff} = 10 Ω	T_{vj} = 25 °C		0.180		µs
			T_{vj} = 125 °C		0.220		
			T_{vj} = 150 °C		0.240		
Fall time (inductive load)	t_f	I_C = 30 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Goff} = 10 Ω	T_{vj} = 25 °C		0.080		µs
			T_{vj} = 125 °C		0.120		
			T_{vj} = 150 °C		0.130		
Turn-on energy loss per pulse	E_{on}	I_C = 30 A, V_{CE} = 500 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 10 Ω, di/dt = 1900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.525		mJ
			T_{vj} = 125 °C		0.557		
			T_{vj} = 150 °C		0.567		
Turn-off energy loss per pulse	E_{off}	I_C = 30 A, V_{CE} = 500 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 10 Ω, dv/dt = 3500 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.72		mJ
			T_{vj} = 125 °C		1.21		
			T_{vj} = 150 °C		1.37		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease}= 3.3 W/(m*K)			0.667		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, Boost

Table 5 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Implemented forward current	I_{FN}			40	A
Continuous DC forward current	I_F			30	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		80	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	200	A^2s
			T_{vj} = 150 °C	111	

Table 6 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.29	1.63	V
			T_{vj} = 125 °C		1.49		
			T_{vj} = 150 °C		1.61		
Peak reverse recovery current	I_{RM}	I_F = 30 A, V_R = 500 V, -di$_F$/dt = 1900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		16.4		A
			T_{vj} = 125 °C		16.4		
			T_{vj} = 150 °C		16.4		
Recovered charge	Q_r	I_F = 30 A, V_R = 500 V, -di$_F$/dt = 1900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.74		µC
			T_{vj} = 125 °C		0.74		
			T_{vj} = 150 °C		0.74		
Reverse recovery energy	E_{rec}	I_F = 30 A, V_R = 500 V, -di$_F$/dt = 1900 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		0.249		mJ
			T_{vj} = 125 °C		0.249		
			T_{vj} = 150 °C		0.249		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease}= 3.3 W/(m*K)			0.979		K/W

(table continues...)

Table 6 (continued) Characteristic values

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

4 Bypass-diode

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} = 25 °C		1200	V
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 95 °C		50	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 95 °C		50	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	1070	A
			T_{vj} = 110 °C	957	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	5770	A^2s
			T_{vj} = 110 °C	4580	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 45 A	T_{vj} = 110 °C		0.88		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1200 V			1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease}= 3.3 W/(m*K)			0.549		K/W
Temperature under switching conditions	$T_{vj,\,op}$			-40		110	°C

5 Inverse-polarity protection diode A

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} = 25 °C	1200	V
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 95 °C	50	A

(table continues...)

Table 9 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 95 °C		50	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 125 °C	395	A
			T_{vj} = 150 °C	378	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 125 °C	780	A^2s
			T_{vj} = 150 °C	714	

Table 10 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 30 A	T_{vj} = 150 °C		0.88		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1200 V			0.1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease}= 3.3 W/(m*K)			0.934		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

6 NTC-Thermistor

Table 11 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298{,}15\ K))]$		3433		K

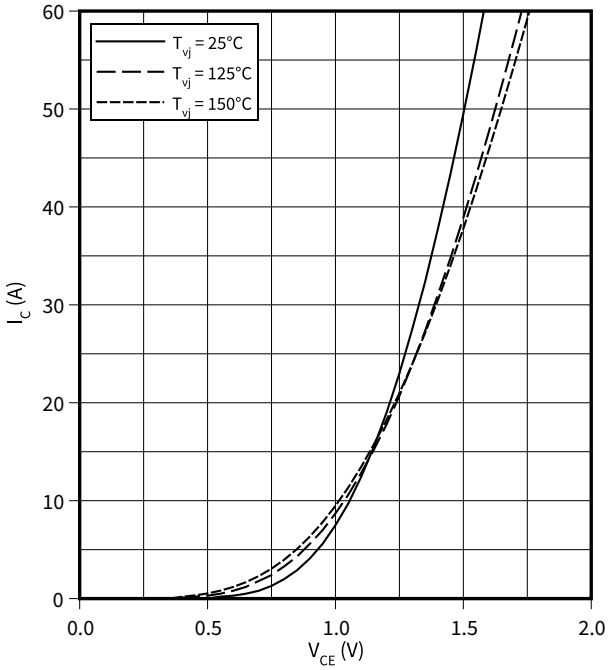
Note: Specification according to the valid application note.

7 Characteristics diagrams

Output characteristic (typical), IGBT, Boost

$I_C = f(V_{CE})$

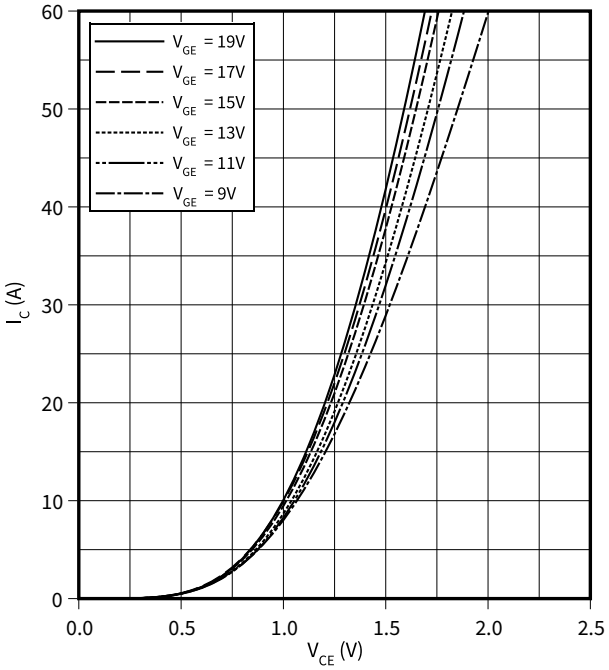
V_{GE} = 15 V



Output characteristic field (typical), IGBT, Boost

$I_C = f(V_{CE})$

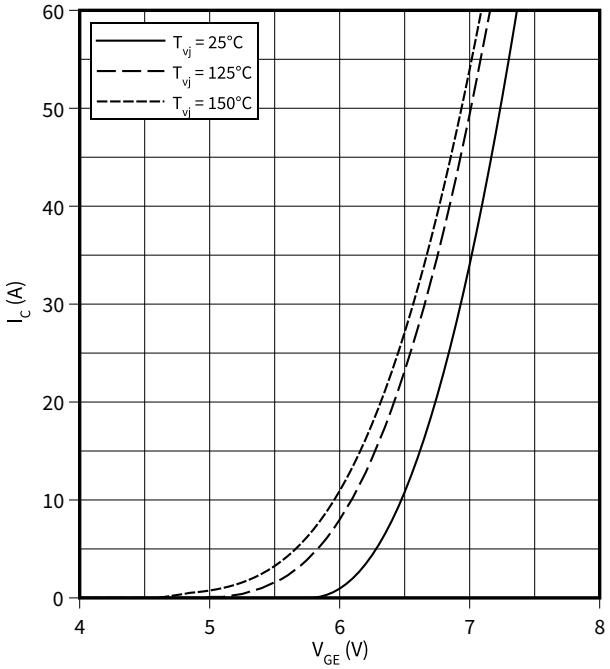
T_{vj} = 150 °C



Transfer characteristic (typical), IGBT, Boost

$I_C = f(V_{GE})$

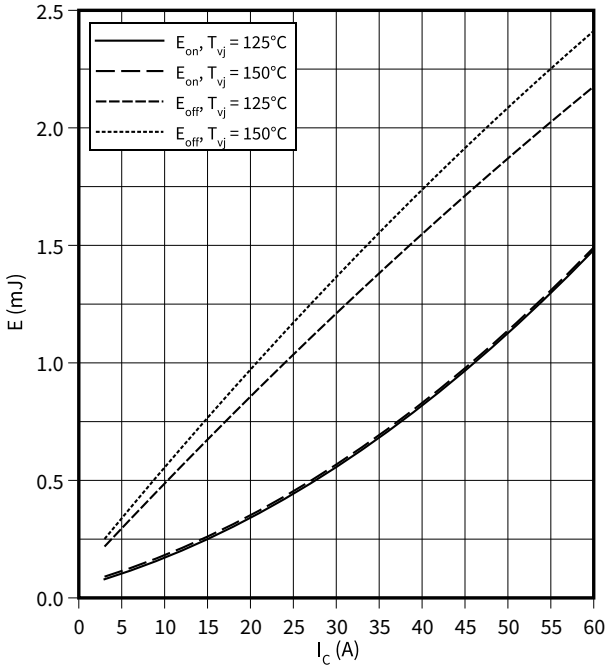
V_{CE} = 20 V



Switching losses (typical), IGBT, Boost

$E = f(I_C)$

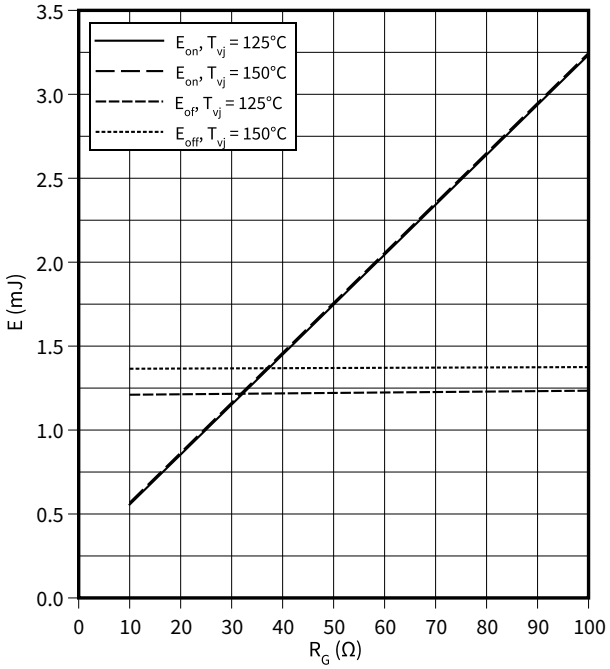
R_{Goff} = 10 Ω, R_{Gon} = 10 Ω, V_{CE} = 500 V, V_{GE} = ± 15 V



Switching losses (typical), IGBT, Boost

$E = f(R_G)$

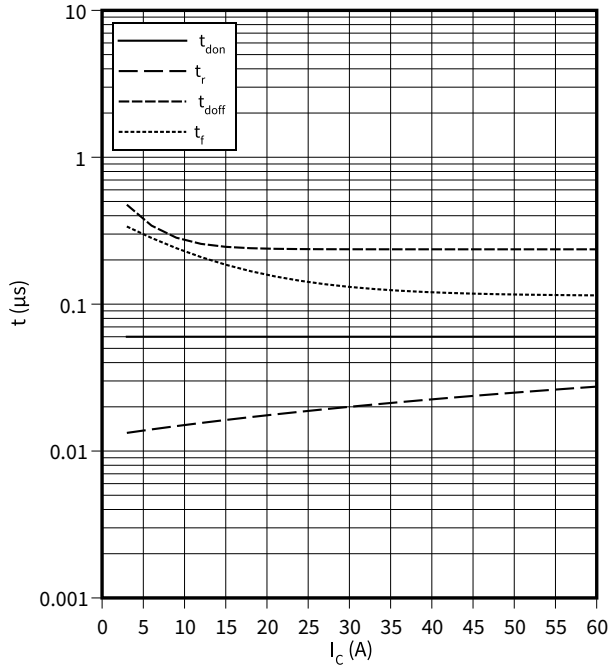
$I_C = 30$ A, $V_{CE} = 500$ V, $V_{GE} = \pm 15$ V



Switching times (typical), IGBT, Boost

$t = f(I_C)$

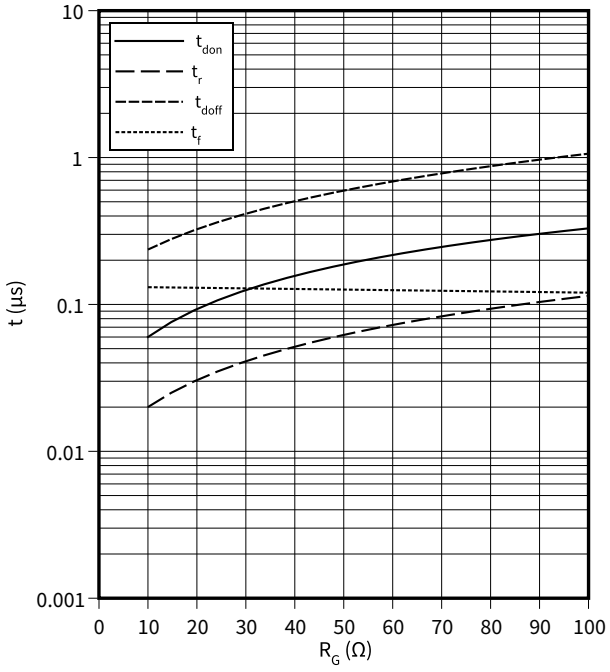
$R_{Goff} = 10\ \Omega$, $R_{Gon} = 10\ \Omega$, $V_{CE} = 500$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, Boost

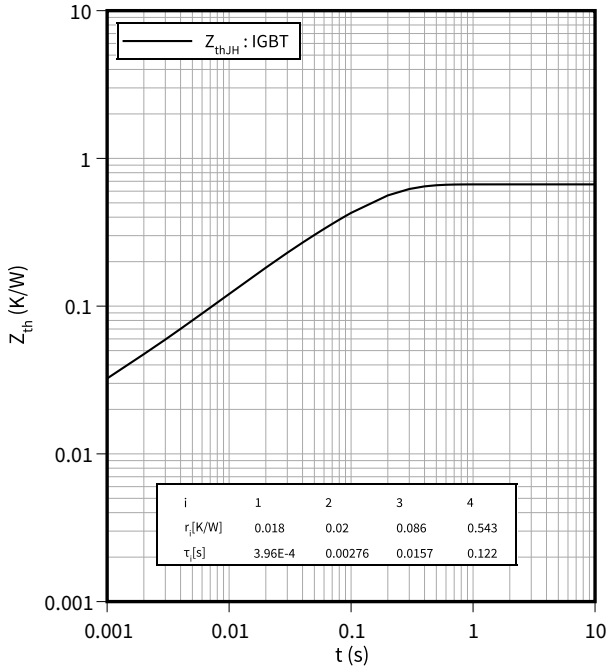
$t = f(R_G)$

$I_C = 30$ A, $V_{CE} = 500$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



Transient thermal impedance , IGBT, Boost

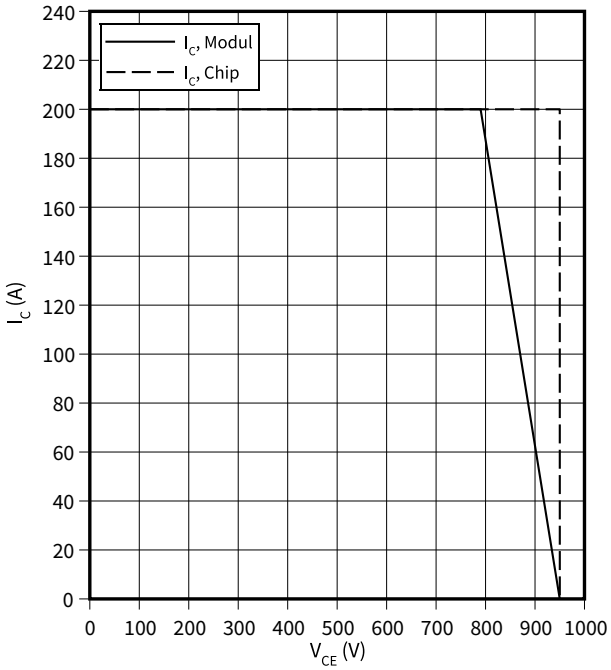
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

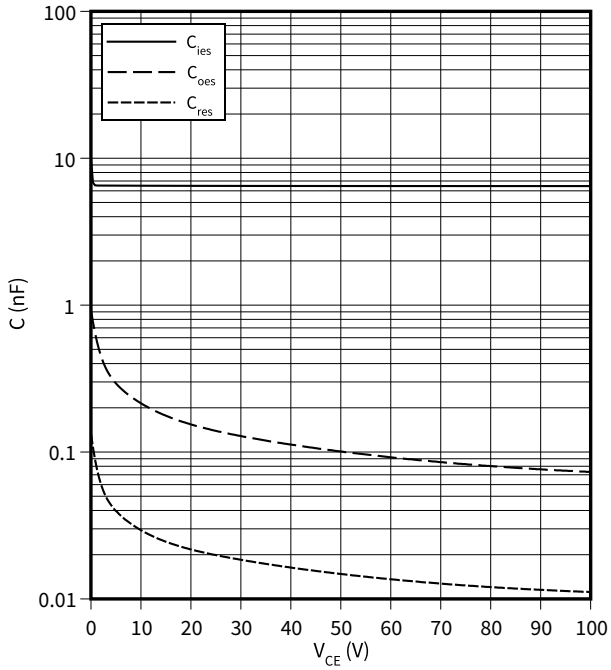
$R_{Goff} = 10\ \Omega$, $V_{GE} = \pm 15.0$ V, $T_{vj} = 150$ °C



Capacity characteristic (typical), IGBT, Boost

$C = f(V_{CE})$

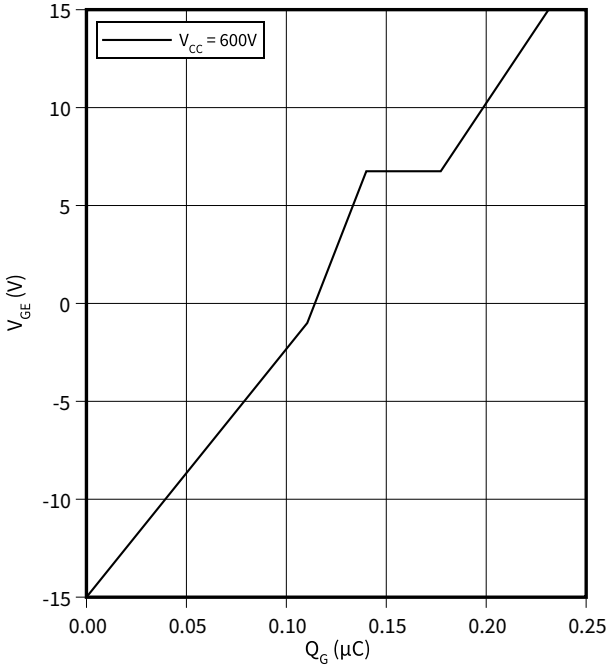
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Gate charge characteristic (typical), IGBT, Boost

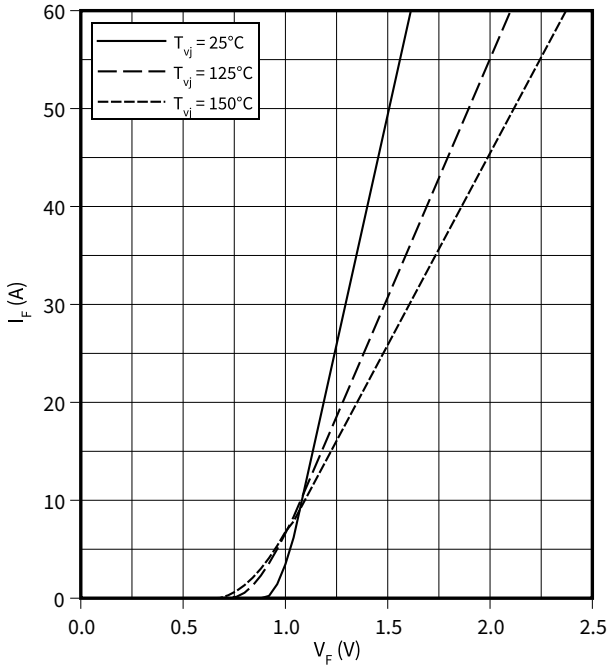
$V_{GE} = f(Q_G)$

$I_C = 100$ A, $T_{vj} = 25$ °C



Forward characteristic (typical), Diode, Boost

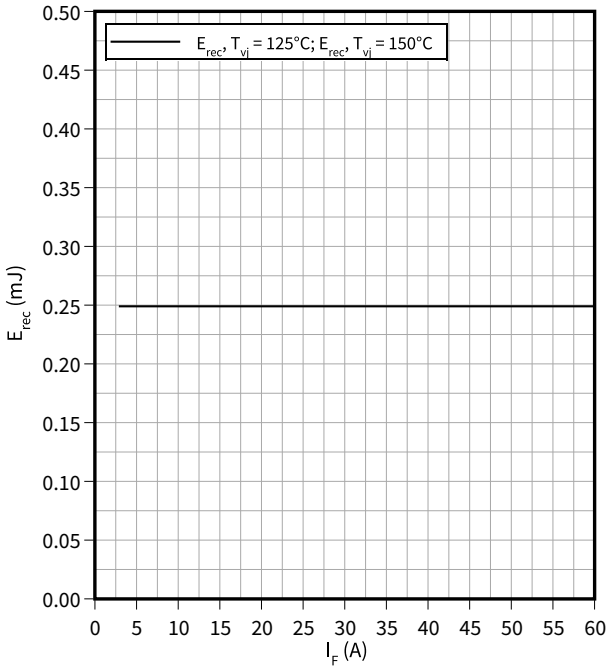
$I_F = f(V_F)$



Switching losses (typical), Diode, Boost

$E_{rec} = f(I_F)$

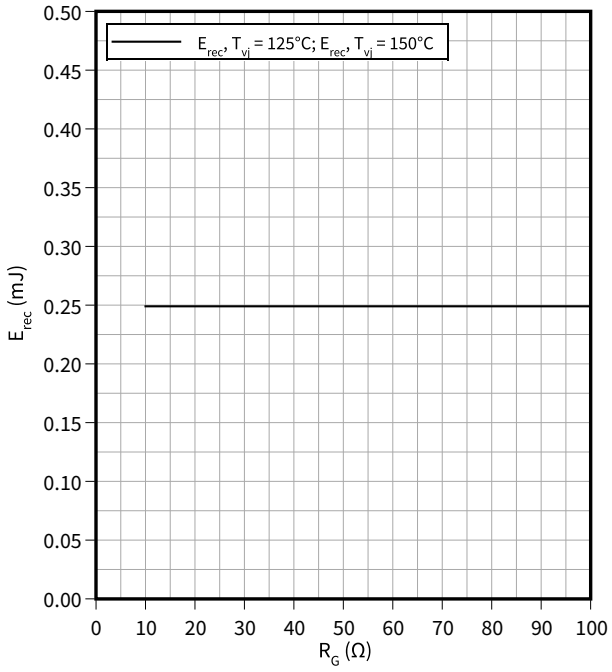
$R_{Gon} = 10\ \Omega$, $V_{CE} = 500\ V$



Switching losses (typical), Diode, Boost

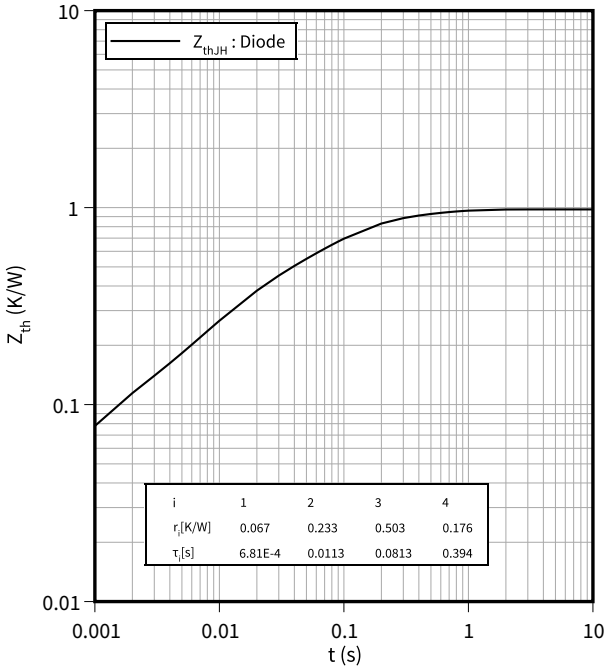
$E_{rec} = f(R_G)$

$V_{CE} = 500\ V$, $I_F = 30\ A$



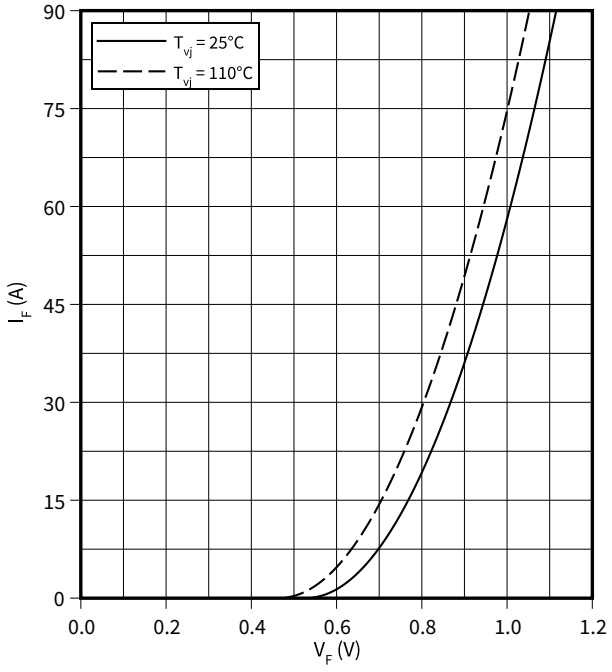
Transient thermal impedance, Diode, Boost

$Z_{th} = f(t)$



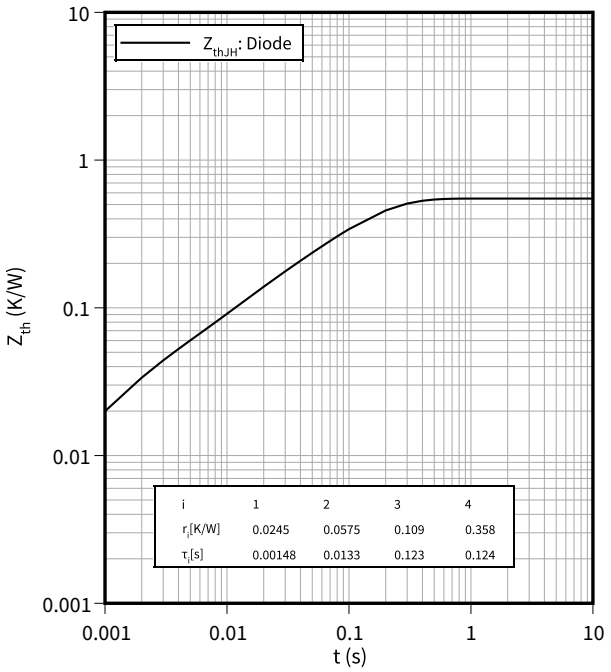
Forward characteristic (typical), Bypass-diode

$I_F = f(V_F)$



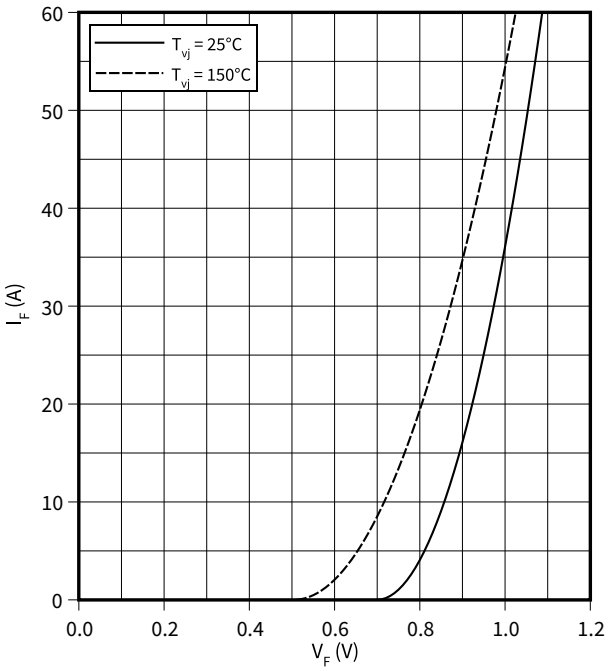
Transient thermal impedance, Bypass-diode

$Z_{th} = f(t)$



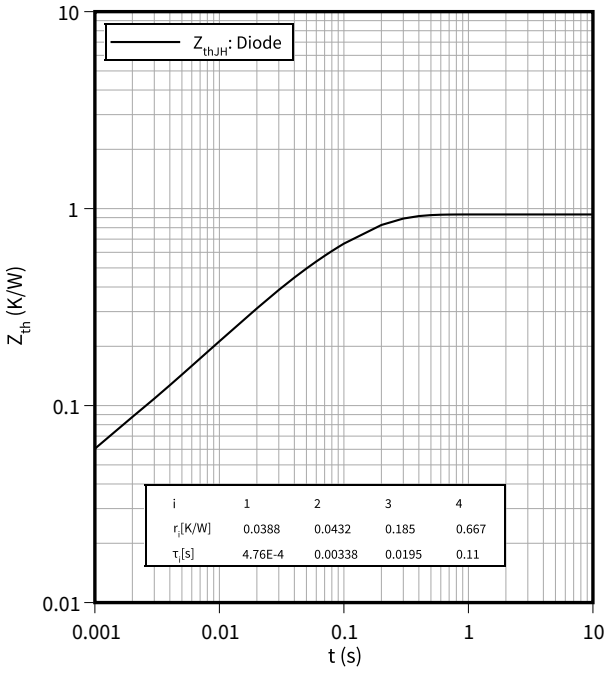
Forward characteristic (typical), Inverse-polarity protection diode A

$I_F = f(V_F)$



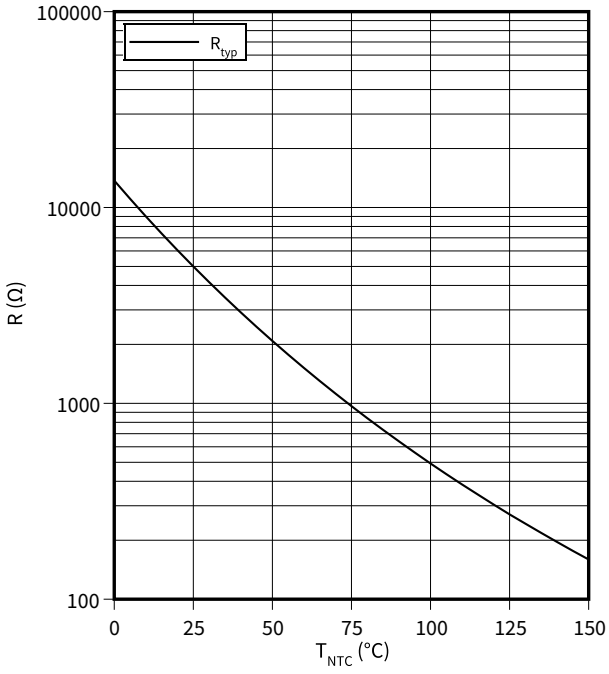
Transient thermal impedance, Inverse-polarity protection diode A

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



8 Circuit diagram

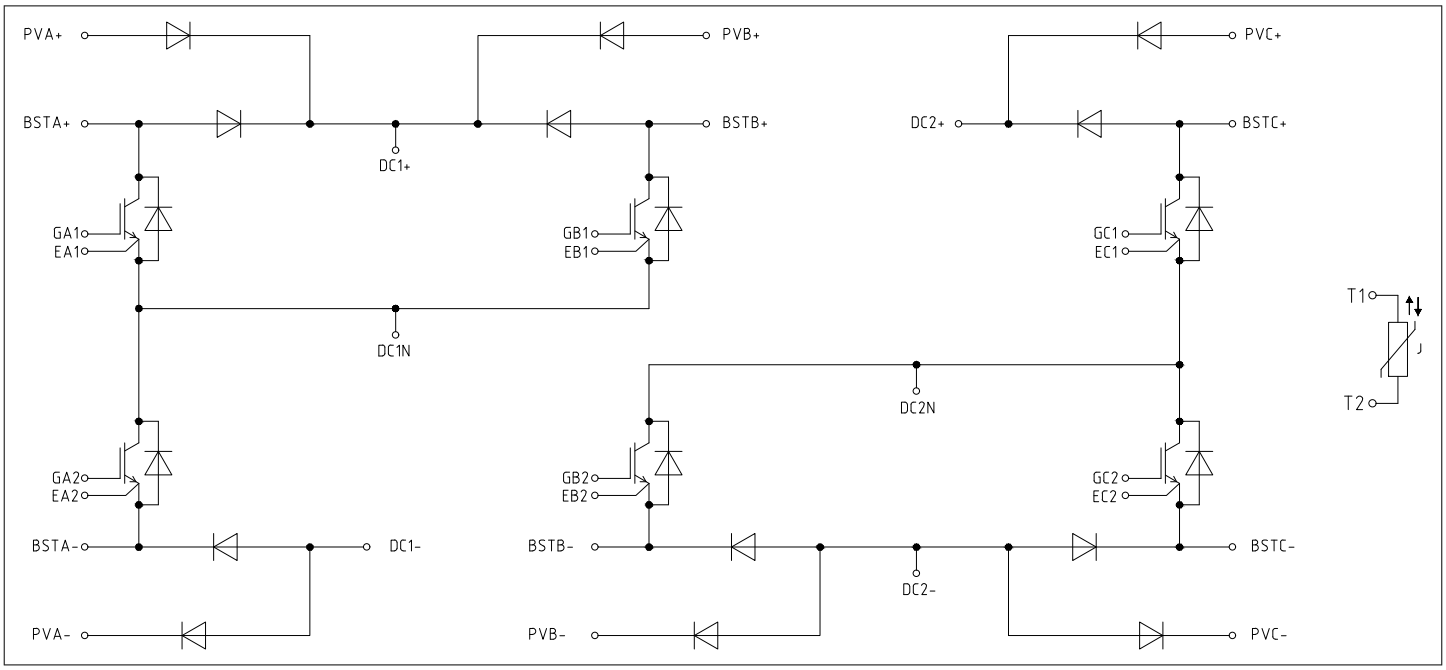


Figure 1

9 Package outlines

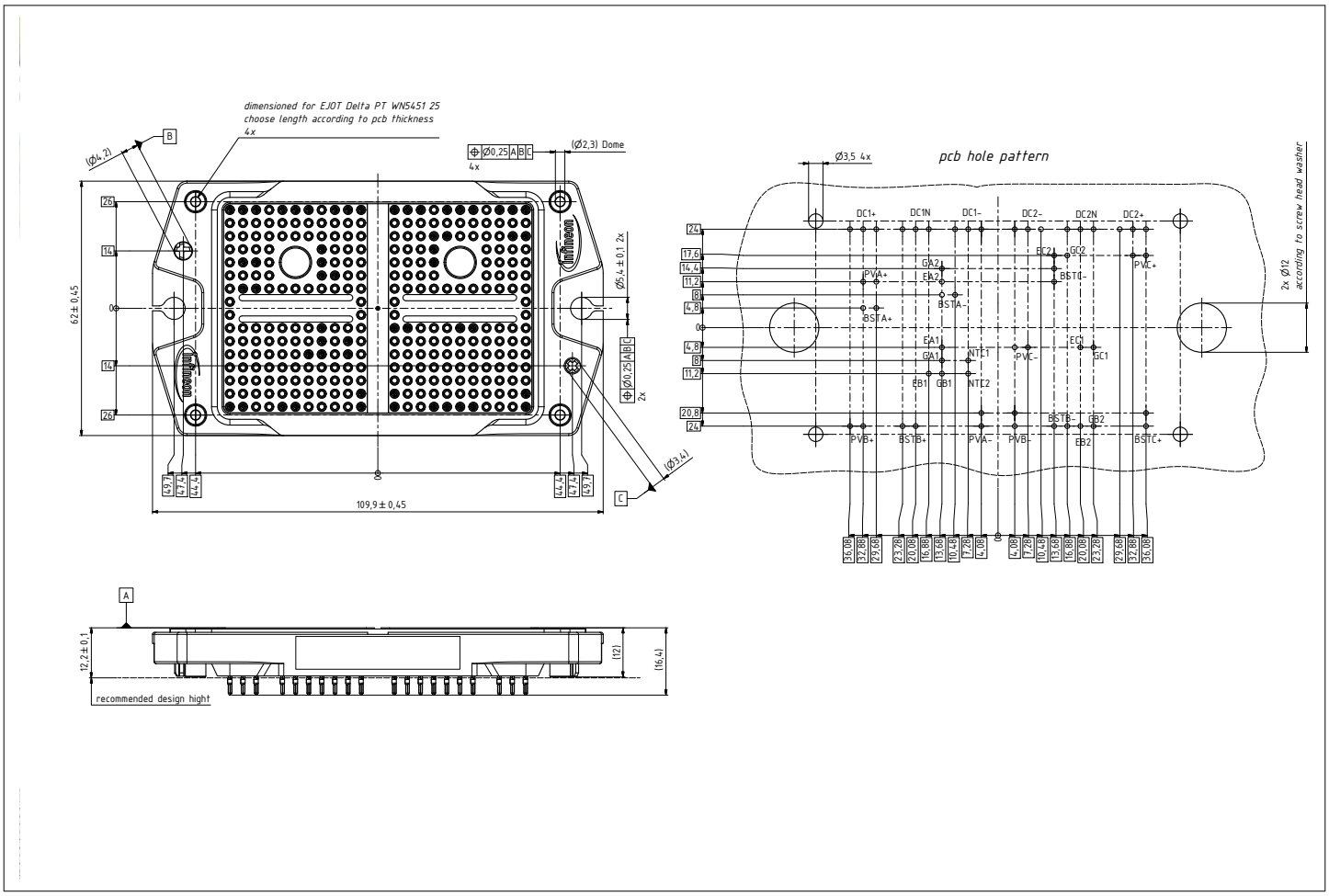


Figure 2

10 Module label code

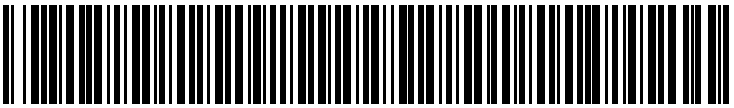
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 7154914284655054991530	 7154914284655054991530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2020-12-15	
1.00	2022-02-16	Final datasheet

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