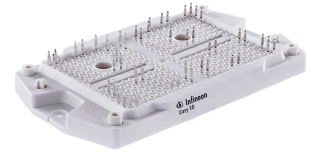


## EasyPACK™ module with TRENCHSTOP™ IGBT7 and CoolSiC™ Schottky diode and PressFIT / NTC

### Features

- Electrical features
  - $V_{CES} = 950\text{ V}$
  - $I_{C\text{nom}} = 100\text{ A} / I_{CRM} = 200\text{ A}$
  - CoolSiC™ Schottky diode gen 5
  - Low switching losses
  - TRENCHSTOP™ IGBT7
- Mechanical features
  - $\text{Al}_2\text{O}_3$  substrate with low thermal resistance
  - Compact design
  - Integrated NTC temperature sensor
  - PressFIT contact technology



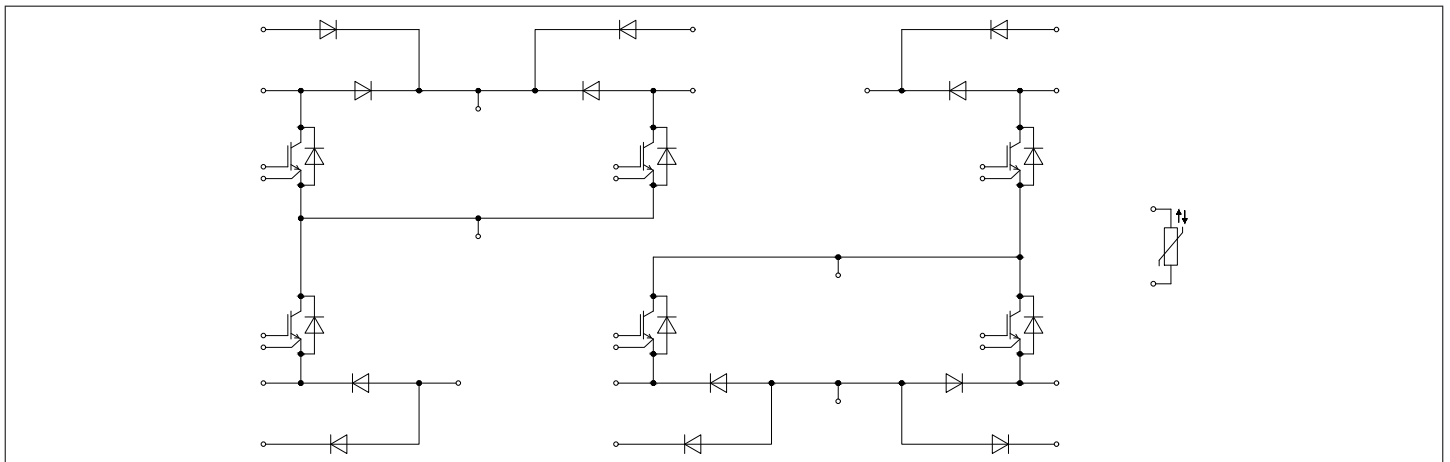
### Potential applications

- 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



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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)	$\text{Al}_2\text{O}_3$	
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	$V_{CES}$	$T_{vj} = 25 \text{ °C}$	950	V
Implemented collector current	$I_{CN}$		100	A
Continuous DC collector current	$I_{CDC}$	$T_{vj \text{ max}} = 175 \text{ °C}$ $T_H = 65 \text{ °C}$	70	A
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{vj \text{ op}}$	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	$V_{CE\ sat}$	$I_C = 30\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.33	1.53	V
			$T_{vj} = 125\ ^\circ C$		1.39		
			$T_{vj} = 150\ ^\circ C$		1.40		
Gate threshold voltage	$V_{GETh}$	$I_C = 1.67\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		4.35	5.10	5.85	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$			0.23		$\mu C$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\ ^\circ C$			1.5		$\Omega$
Input capacitance	$C_{ies}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			6.48		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.02		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			0.031	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)	$t_{don}$	$I_C = 30\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 10\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.060		$\mu s$
			$T_{vj} = 125\ ^\circ C$		0.060		
			$T_{vj} = 150\ ^\circ C$		0.060		
Rise time (inductive load)	$t_r$	$I_C = 30\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 10\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.020		$\mu s$
			$T_{vj} = 125\ ^\circ C$		0.020		
			$T_{vj} = 150\ ^\circ C$		0.020		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 30\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 10\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.180		$\mu s$
			$T_{vj} = 125\ ^\circ C$		0.220		
			$T_{vj} = 150\ ^\circ C$		0.240		
Fall time (inductive load)	$t_f$	$I_C = 30\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 10\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.080		$\mu s$
			$T_{vj} = 125\ ^\circ C$		0.120		
			$T_{vj} = 150\ ^\circ C$		0.130		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 30\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 10\ \Omega, di/dt = 1900\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		0.525		mJ
			$T_{vj} = 125\ ^\circ C$		0.557		
			$T_{vj} = 150\ ^\circ C$		0.567		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 30\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 10\ \Omega, dv/dt = 3500\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		0.72		mJ
			$T_{vj} = 125\ ^\circ C$		1.21		
			$T_{vj} = 150\ ^\circ C$		1.37		
Thermal resistance, junction to heat sink	$R_{thJH}$	per IGBT, $\lambda_{grease} = 3.3\ W/(m^*K)$			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	$V_{RRM}$	$T_{vj} = 25\ ^\circ\text{C}$	1200	V	
Implemented forward current	$I_{FN}$		40	A	
Continuous DC forward current	$I_F$		30	A	
Repetitive peak forward current	$I_{FRM}$	$t_p = 1\ \text{ms}$	80	A	
$I^2t$ - value	$I^2t$	$V_R = 0\ \text{V}, t_p = 10\ \text{ms}$	$T_{vj} = 125\ ^\circ\text{C}$	200	A <sup>2</sup> s
			$T_{vj} = 150\ ^\circ\text{C}$	111	

**Table 6 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 30\ \text{A}, V_{GE} = 0\ \text{V}$	$T_{vj} = 25\ ^\circ\text{C}$	1.29	1.63	V
			$T_{vj} = 125\ ^\circ\text{C}$	1.49		
			$T_{vj} = 150\ ^\circ\text{C}$	1.61		
Peak reverse recovery current	$I_{RM}$	$I_F = 30\ \text{A}, V_R = 500\ \text{V}, -di_F/dt = 1900\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$	16.4		A
			$T_{vj} = 125\ ^\circ\text{C}$	16.4		
			$T_{vj} = 150\ ^\circ\text{C}$	16.4		
Recovered charge	$Q_R$	$I_F = 30\ \text{A}, V_R = 500\ \text{V}, -di_F/dt = 1900\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$	0.74		$\mu\text{C}$
			$T_{vj} = 125\ ^\circ\text{C}$	0.74		
			$T_{vj} = 150\ ^\circ\text{C}$	0.74		
Reverse recovery energy	$E_{rec}$	$I_F = 30\ \text{A}, V_R = 500\ \text{V}, -di_F/dt = 1900\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$	0.249		mJ
			$T_{vj} = 125\ ^\circ\text{C}$	0.249		
			$T_{vj} = 150\ ^\circ\text{C}$	0.249		
Thermal resistance, junction to heat sink	$R_{thJH}$	per diode, $\lambda_{grease} = 3.3\ \text{W}/(\text{m}^*\text{K})$		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	$V_{RRM}$	$T_{vj} = 25\text{ °C}$	1200	V	
Maximum RMS forward current per chip	$I_{FRMSM}$	$T_H = 95\text{ °C}$	50	A	
Maximum RMS current at rectifier output	$I_{RMSM}$	$T_H = 95\text{ °C}$	50	A	
Surge forward current	$I_{FSM}$	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	1070	A
			$T_{vj} = 110\text{ °C}$	957	
$I^2t$ - value	$I^2t$	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	5770	A <sup>2</sup> s
			$T_{vj} = 110\text{ °C}$	4580	

**Table 8 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 45\text{ A}$ $T_{vj} = 110\text{ °C}$		0.88		V
Reverse current	$I_r$	$T_{vj} = 150\text{ °C}$ , $V_R = 1200\text{ V}$		1		mA
Thermal resistance, junction to heat sink	$R_{thJH}$	per diode, $\lambda_{grease} = 3.3\text{ W/(m}^2\text{K)}$		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	$V_{RRM}$	$T_{vj} = 25\text{ °C}$	1200	V
Maximum RMS forward current per chip	$I_{FRMSM}$	$T_H = 95\text{ °C}$	50	A

(table continues...)

**Table 9 (continued) Maximum rated values**

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

**Table 10 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 30\text{ A}$ , $T_{vj} = 150\text{ °C}$		0.88		V
Reverse current	$I_r$	$T_{vj} = 150\text{ °C}$ , $V_R = 1200\text{ V}$		0.1		mA
Thermal resistance, junction to heat sink	$R_{thJH}$	per diode, $\lambda_{grease} = 3.3\text{ W/(m}^2\text{K)}$		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	$R_{25}$	$T_{NTC} = 25\text{ °C}$		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

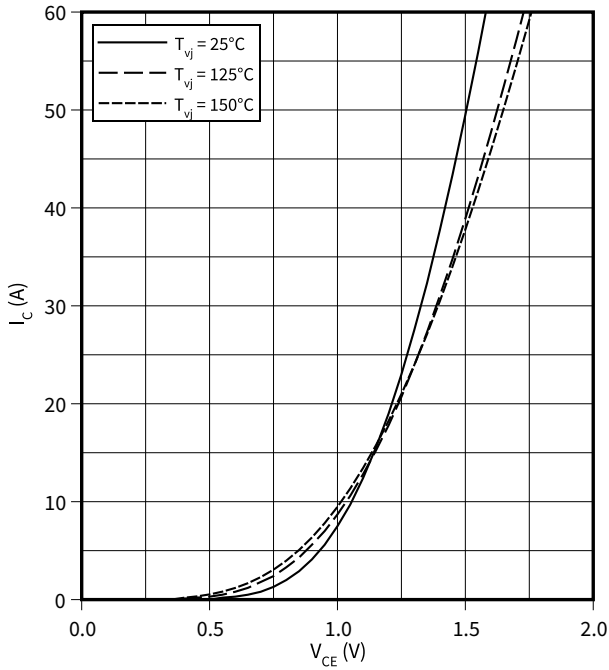
Note: Specification according to the valid application note.

## 7 Characteristics diagrams

### Output characteristic (typical), IGBT, Boost

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

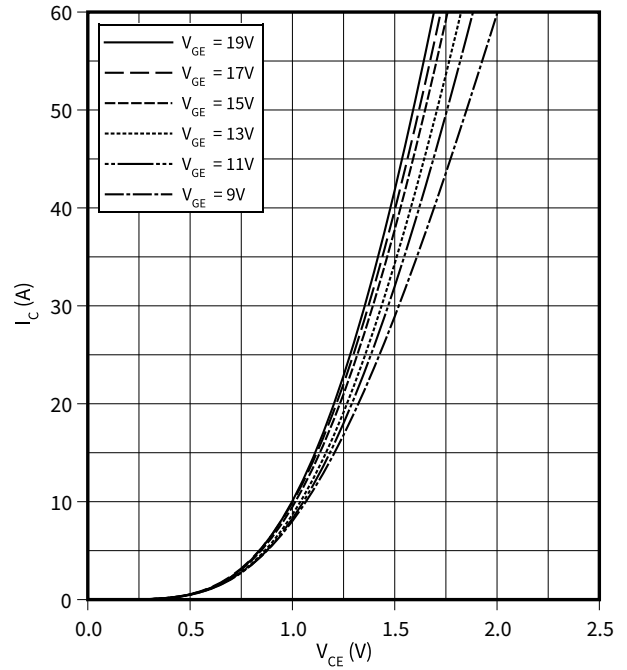
$$V_{GE} = 15 \text{ V}$$



### Output characteristic field (typical), IGBT, Boost

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

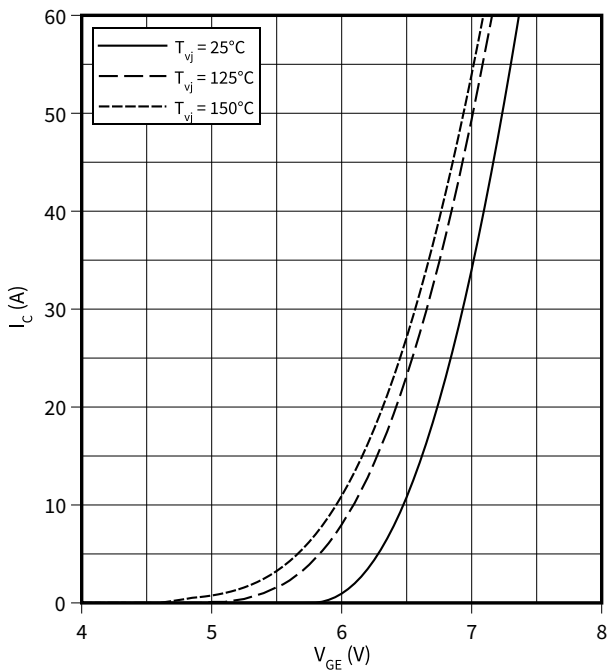
$$T_{vj} = 150 \text{ °C}$$



### Transfer characteristic (typical), IGBT, Boost

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

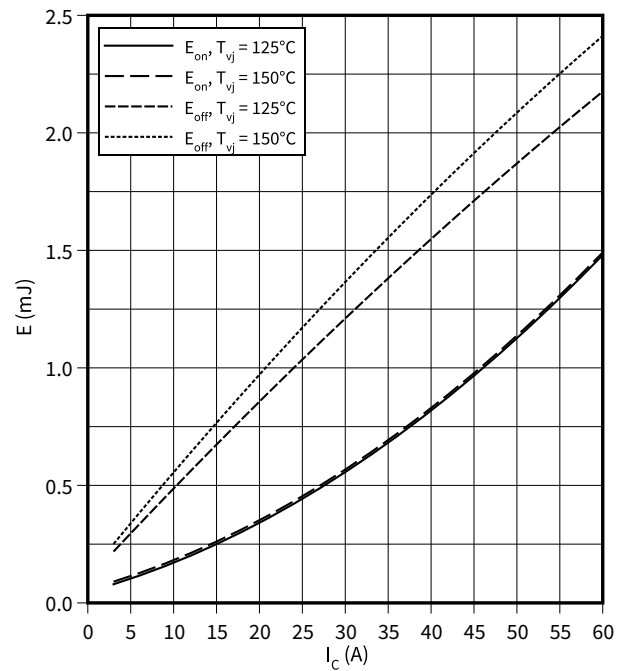
$$V_{CE} = 20 \text{ V}$$



### Switching losses (typical), IGBT, Boost

$$E = f(I_C)$$

$$R_{Goff} = 10 \text{ } \Omega, R_{Gon} = 10 \text{ } \Omega, V_{CE} = 500 \text{ V}, V_{GE} = \pm 15 \text{ V}$$



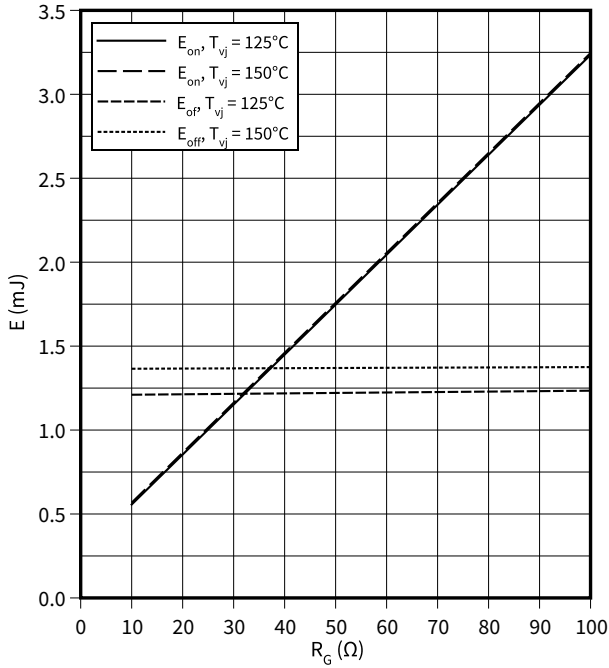


7 Characteristics diagrams

**Switching losses (typical), IGBT, Boost**

$E = f(R_G)$

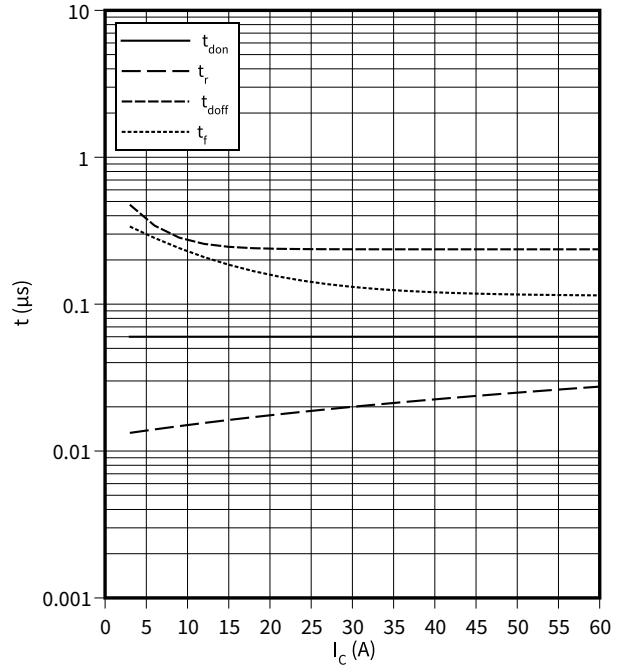
$I_C = 30\text{ A}, V_{CE} = 500\text{ V}, V_{GE} = \pm 15\text{ V}$



**Switching times (typical), IGBT, Boost**

$t = f(I_C)$

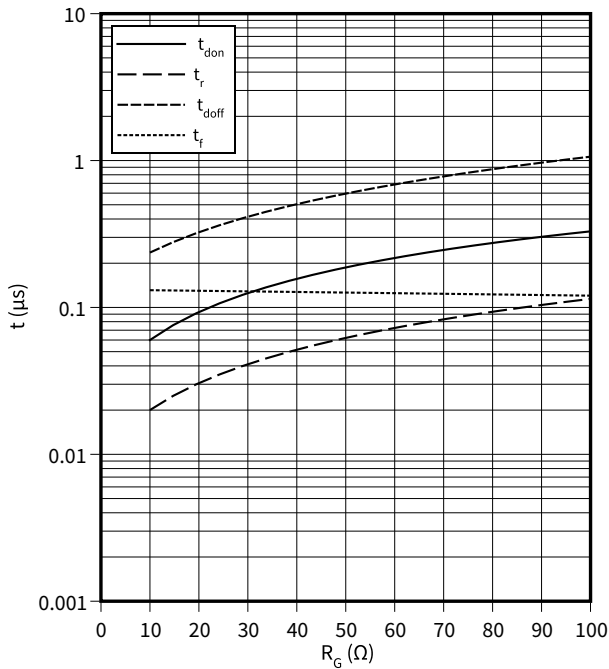
$R_{Goff} = 10\ \Omega, R_{Gon} = 10\ \Omega, V_{CE} = 500\text{ V}, V_{GE} = \pm 15\text{ V}, T_{vj} = 150\text{ }^\circ\text{C}$



**Switching times (typical), IGBT, Boost**

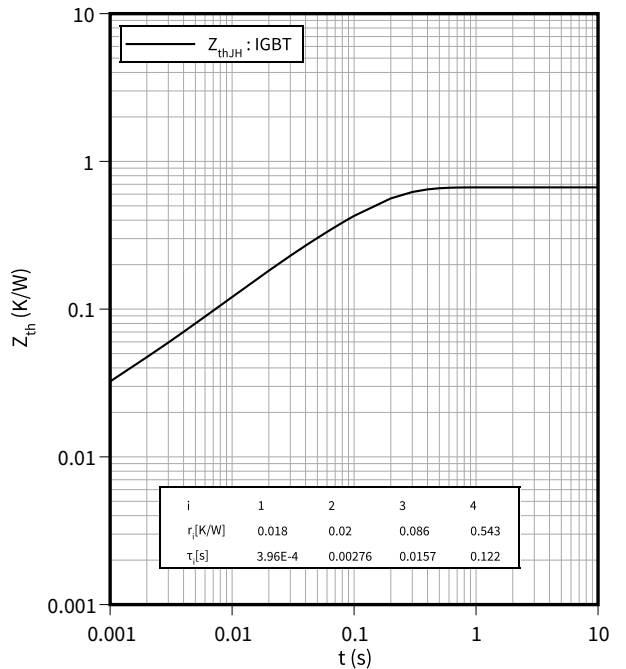
$t = f(R_G)$

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



**Transient thermal impedance, IGBT, Boost**

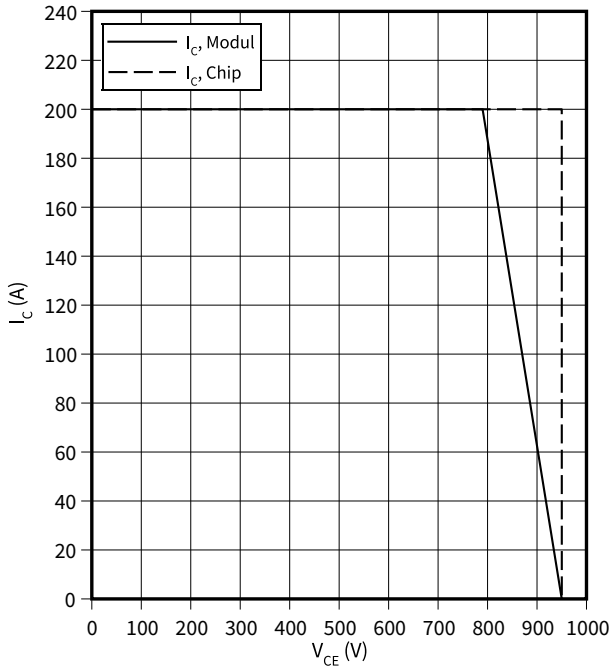
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

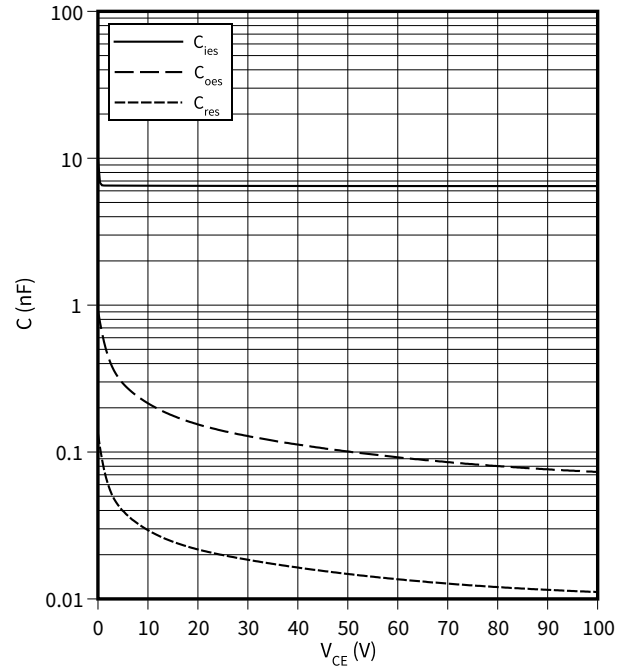
$R_{Goff} = 10 \Omega$ ,  $V_{GE} = \pm 15.0 \text{ V}$ ,  $T_{vj} = 150 \text{ }^\circ\text{C}$



**Capacity characteristic (typical), IGBT, Boost**

$C = f(V_{CE})$

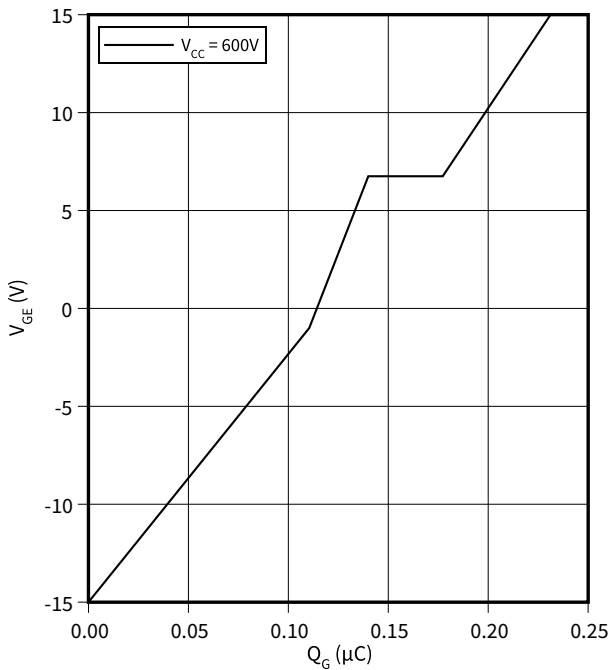
$f = 100 \text{ kHz}$ ,  $V_{GE} = 0 \text{ V}$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$



**Gate charge characteristic (typical), IGBT, Boost**

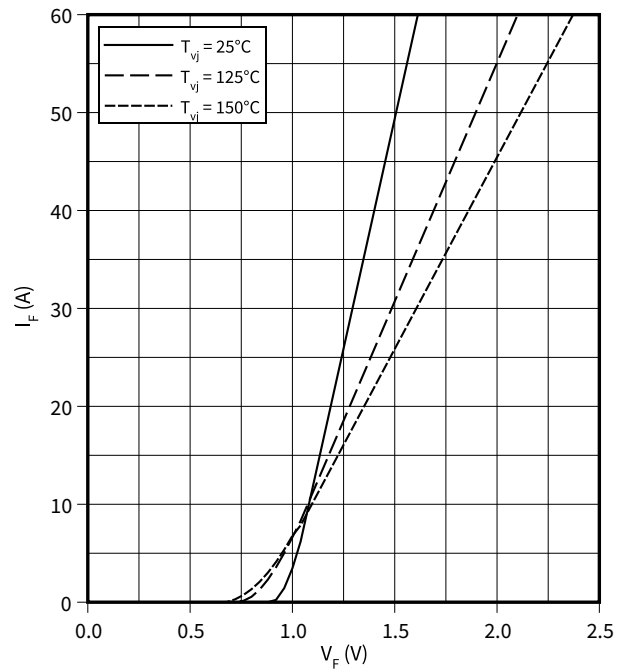
$V_{GE} = f(Q_G)$

$I_C = 100 \text{ A}$ ,  $T_{vj} = 25 \text{ }^\circ\text{C}$



**Forward characteristic (typical), Diode, Boost**

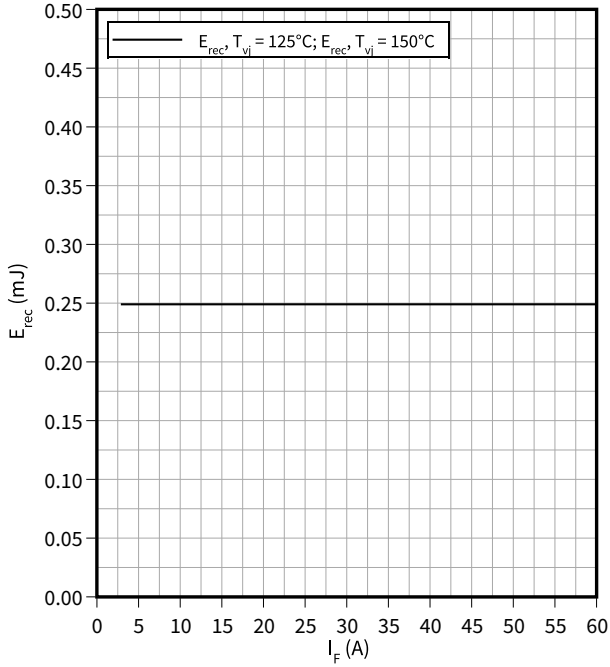
$I_F = f(V_F)$



**Switching losses (typical), Diode, Boost**

$E_{rec} = f(I_F)$

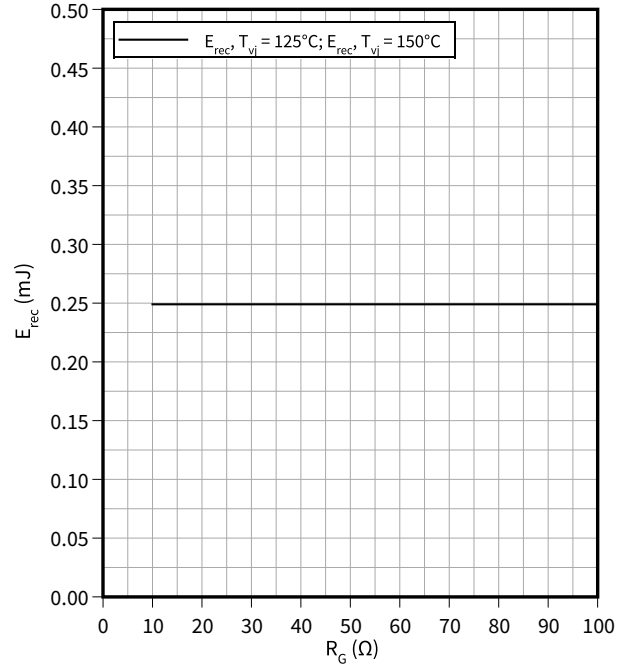
$R_{Gon} = 10 \Omega, V_{CE} = 500 V$



**Switching losses (typical), Diode, Boost**

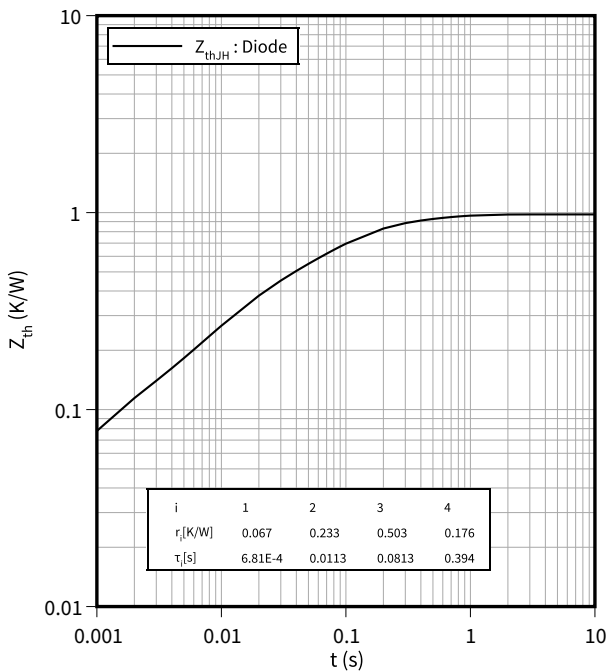
$E_{rec} = f(R_G)$

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



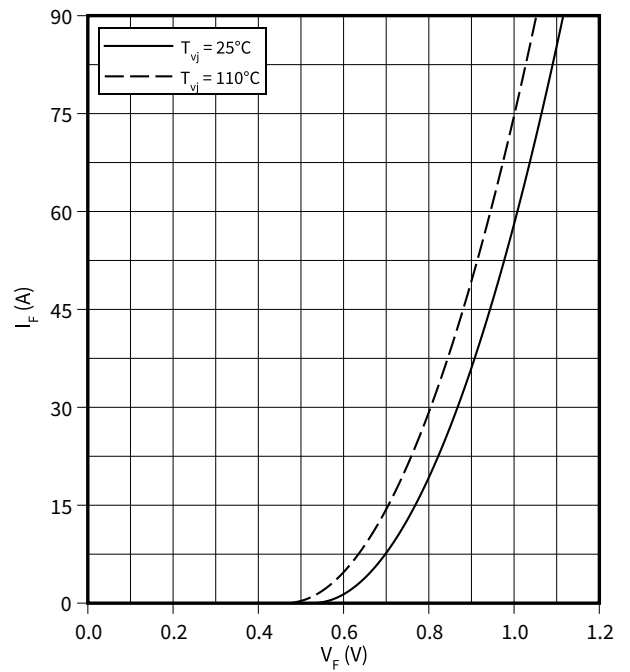
**Transient thermal impedance, Diode, Boost**

$Z_{th} = f(t)$



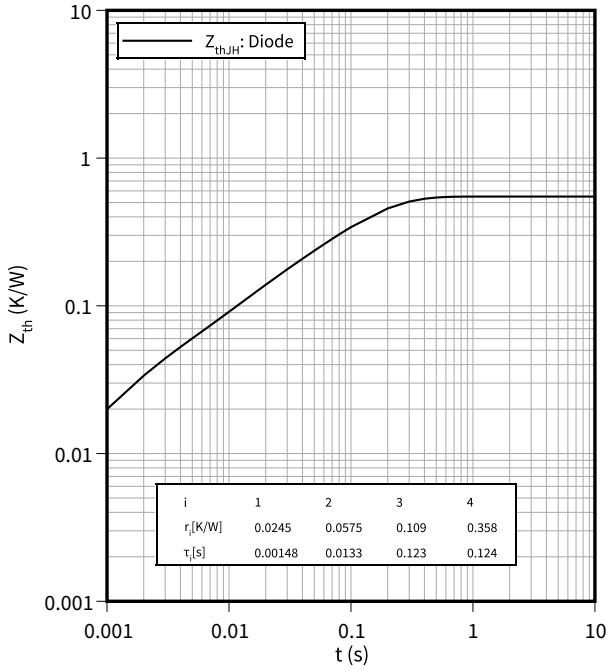
**Forward characteristic (typical), Bypass-diode**

$I_F = f(V_F)$



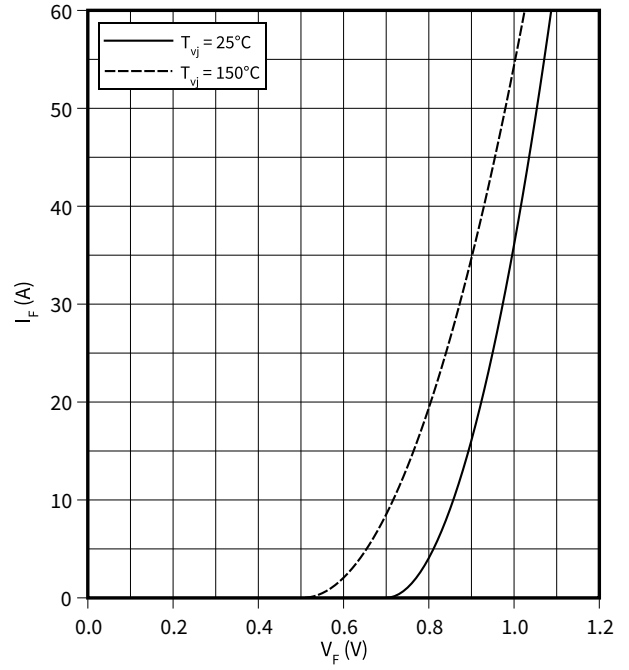
**Transient thermal impedance, Bypass-diode**

$Z_{th} = f(t)$



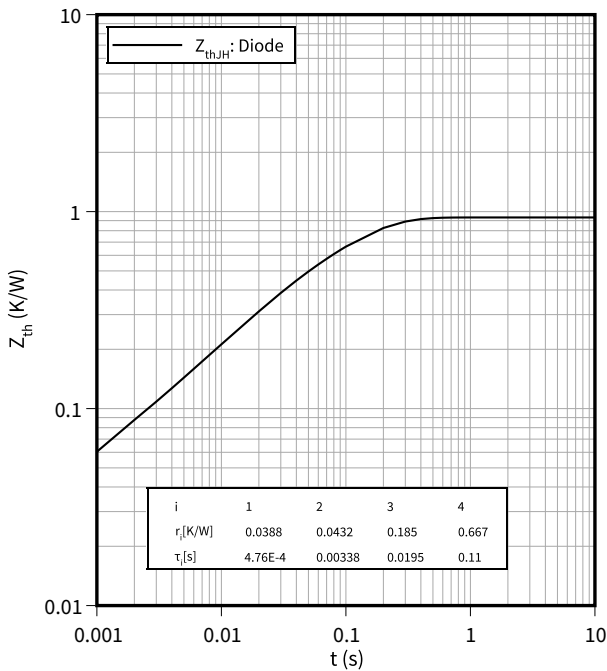
**Forward characteristic (typical), Inverse-polarity protection diode A**

$I_F = f(V_F)$



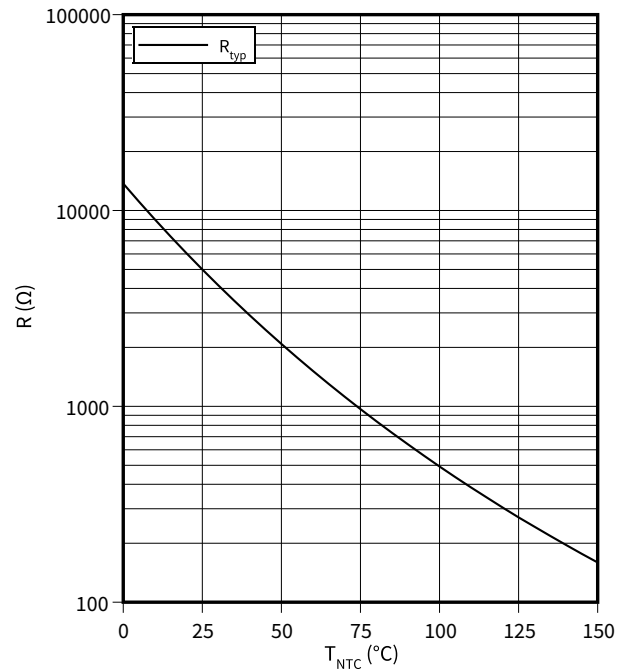
**Transient thermal impedance, Inverse-polarity protection diode A**

$Z_{th} = f(t)$

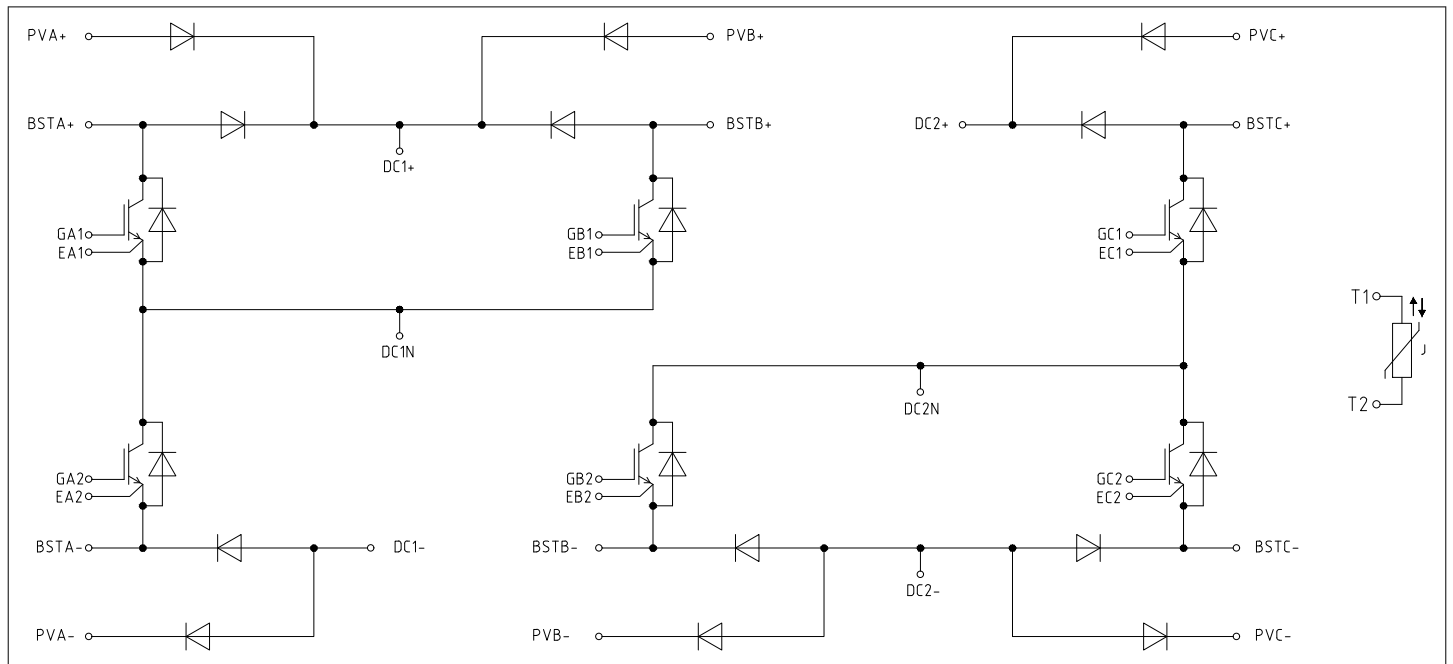


**Temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$



## 8 Circuit diagram



**Figure 1**

## 9 Package outlines

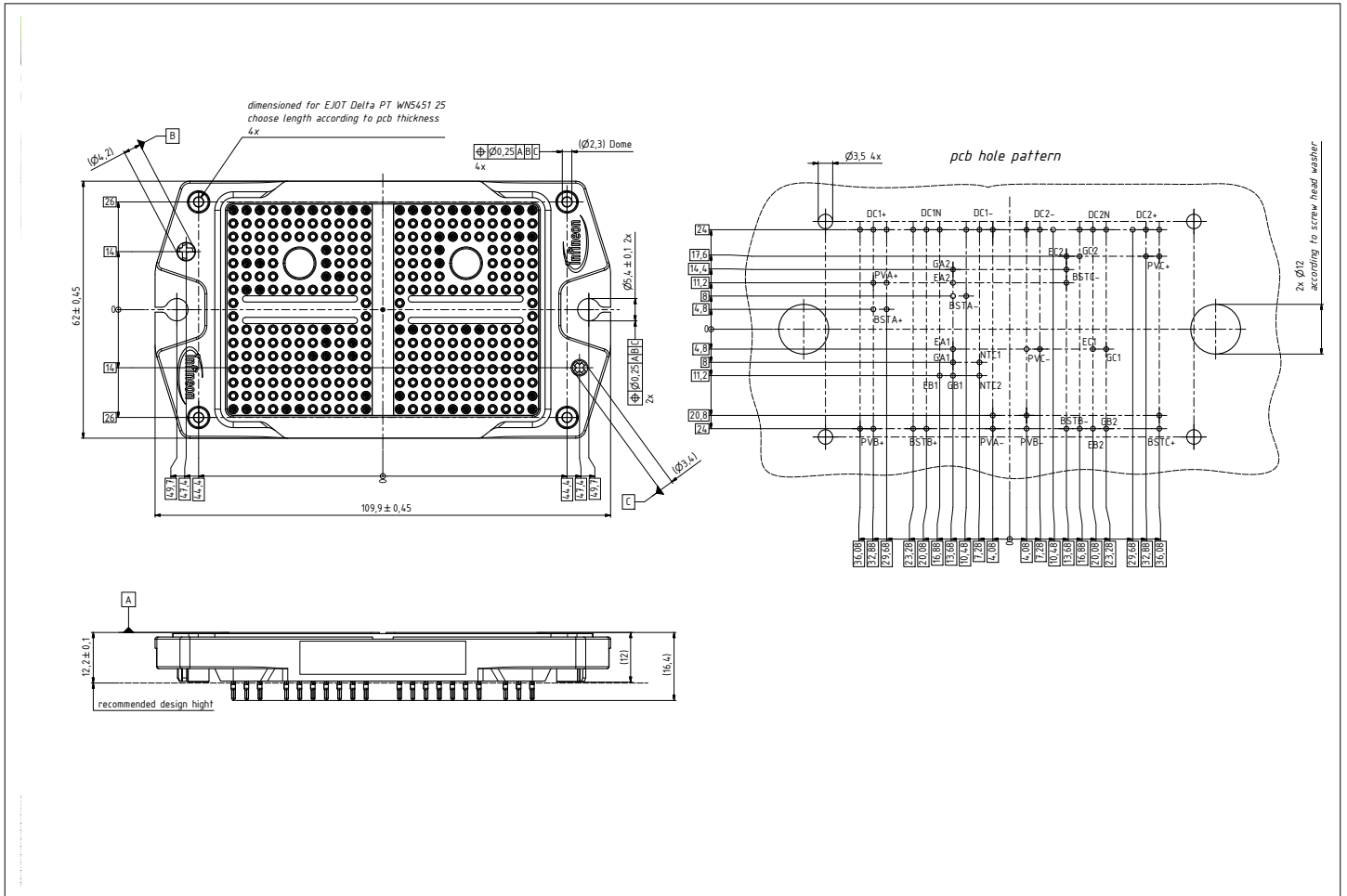

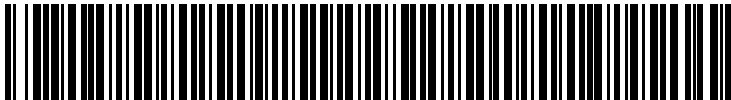


Figure 2

## 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	<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	2020-12-15	
1.00	2022-02-16	Final datasheet



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