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


Typical appearance

Features

- Electrical features
  - V_{CES} = 950 V
  - $I_{C\ nom}$ = 200 A / I_{CRM} = 300 A
  - Low $V_{CE,sat}$
  - $T_{vj,op}$ = 150°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

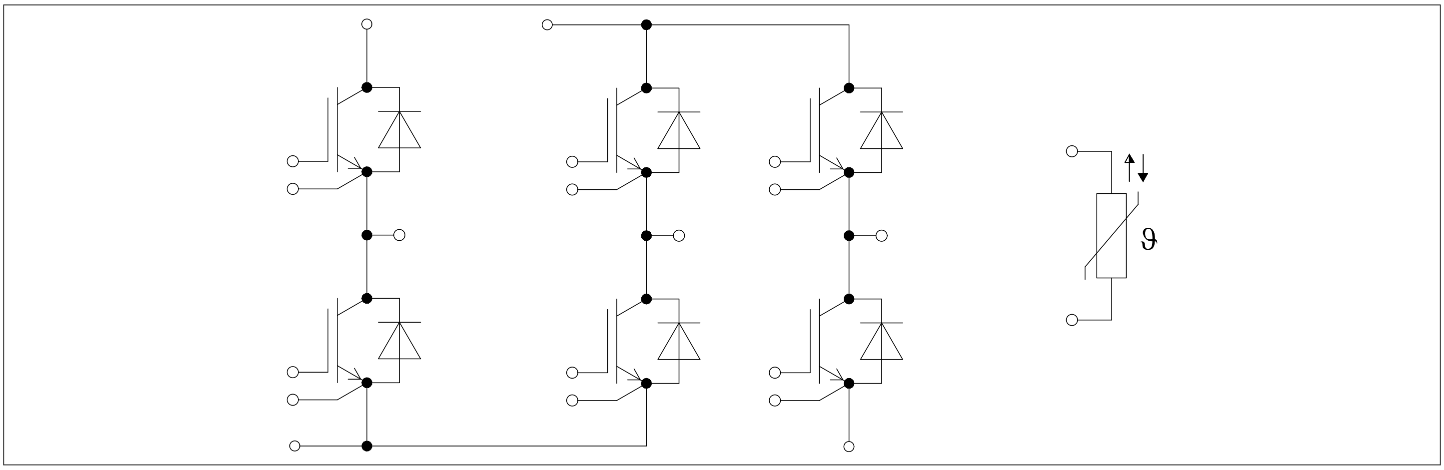
Potential applications

- 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 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}				12		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H=25°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 °C	950	V
Implemented collector current	I_{CN}			200	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	130	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		300	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 4 **Characteristic values**

Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C = 150 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.69	1.98	V
			T_{vj} = 125 °C		1.87		
			T_{vj} = 150 °C		1.91		
Gate threshold voltage	V_{GEth}	I_C = 3.25 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			0.46		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.75		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			13		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °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 °C			0.053	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 = 150 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω	T_{vj} = 25 °C		0.120		µs
			T_{vj} = 125 °C		0.120		
			T_{vj} = 150 °C		0.120		
Rise time (inductive load)	t_r	I_C = 150 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Gon} = 12 Ω	T_{vj} = 25 °C		0.050		µs
			T_{vj} = 125 °C		0.050		
			T_{vj} = 150 °C		0.050		
Turn-off delay time (inductive load)	t_{doff}	I_C = 150 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω	T_{vj} = 25 °C		0.290		µs
			T_{vj} = 125 °C		0.310		
			T_{vj} = 150 °C		0.320		
Fall time (inductive load)	t_f	I_C = 150 A, V_{CE} = 500 V, V_{GE} = ±15 V, R_{Goff} = 12 Ω	T_{vj} = 25 °C		0.020		µs
			T_{vj} = 125 °C		0.080		
			T_{vj} = 150 °C		0.090		
Turn-on energy loss per pulse	E_{on}	I_C = 150 A, V_{CE} = 500 V, L_{σ} = 35 nH, V_{GE} = ±15 V, R_{Gon} = 12 Ω, di/dt = 2300 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		10.3		mJ
			T_{vj} = 125 °C		12.2		
			T_{vj} = 150 °C		12.9		
Turn-off energy loss per pulse	E_{off}	I_C = 150 A, V_{CE} = 500 V, L_{σ} = 35 nH, V_{GE} = ±15 V, R_{Goff} = 12 Ω, dv/dt = 7900 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		3.88		mJ
			T_{vj} = 125 °C		5.89		
			T_{vj} = 150 °C		6.41		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease}= 3.3 W/(m*K)			0.387		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°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 °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 ms		400	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	1520	A^2s
			T_{vj} = 150 °C	1480	

Table 6 Characteristic values

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

4 NTC-Thermistor

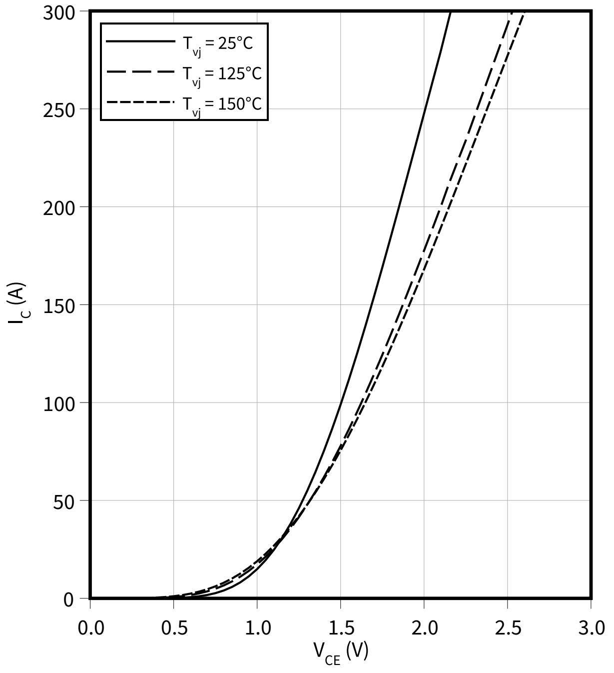
Table 7 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °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

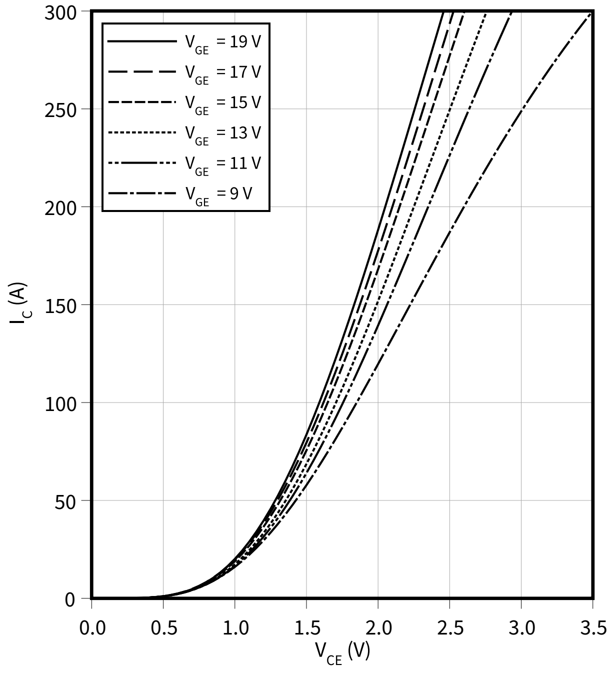
Note: *Specification according to the valid application note.*

5 Characteristics diagrams

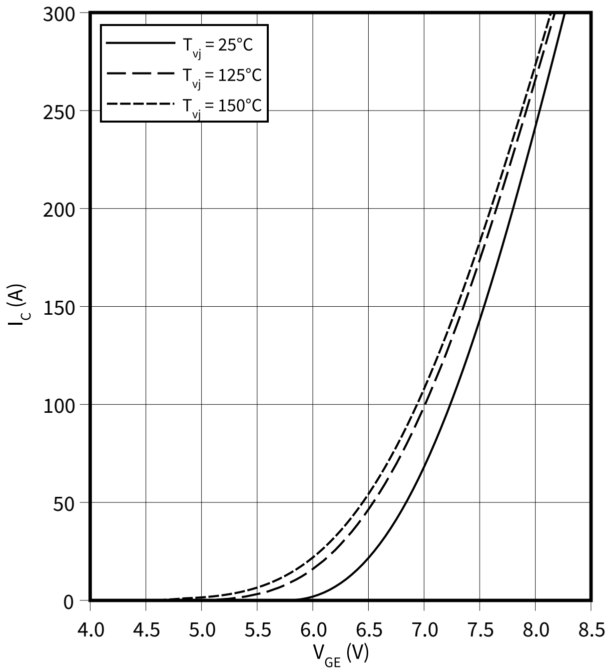
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



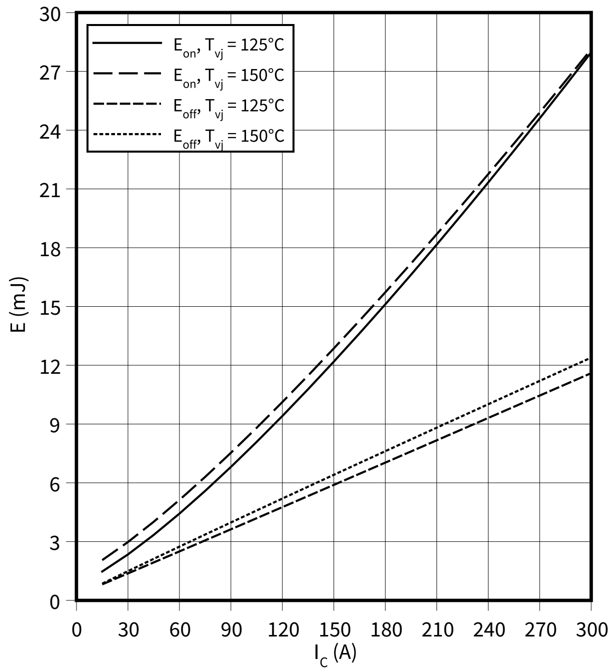
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150$ °C



Transfer characteristic (typical), IGBT, Inverter
$I_C = f(V_{GE})$
$V_{CE} = 20$ V



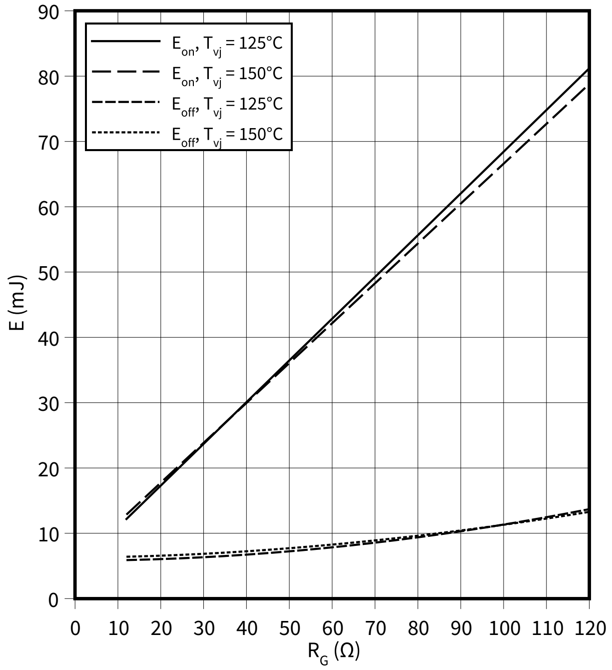
Switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 12\ \Omega$, $R_{Gon} = 12\ \Omega$, $V_{CE} = 500$ V, $V_{GE} = \pm 15$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

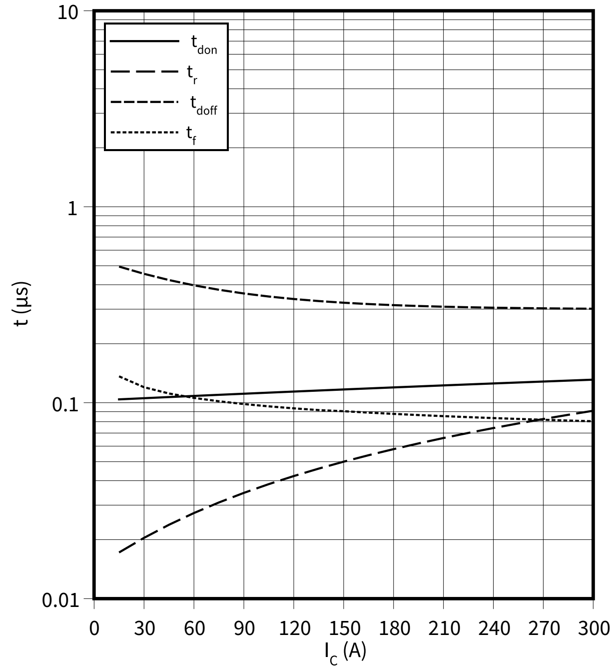
I_C = 150 A, V_{CE} = 500 V, V_{GE} = ± 15 V



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

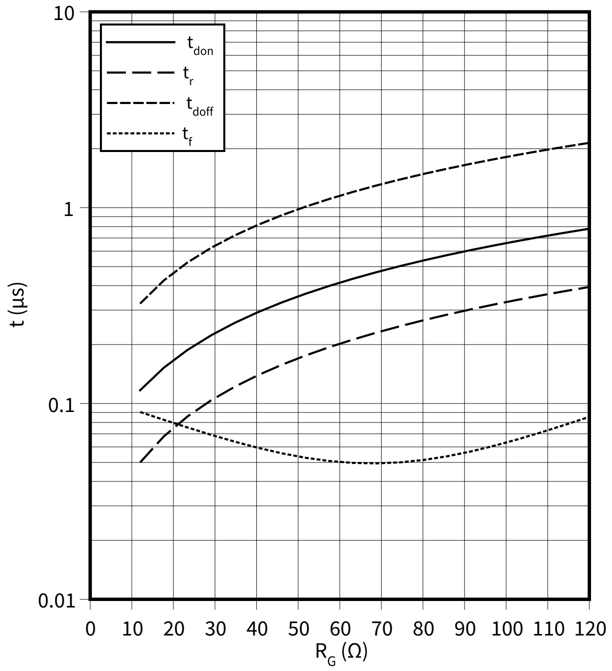
R_{Goff} = 12 Ω, R_{Gon} = 12 Ω, V_{CE} = 500 V, V_{GE} = ± 15 V, T_{vj} = 150 °C



Switching times (typical), IGBT, Inverter

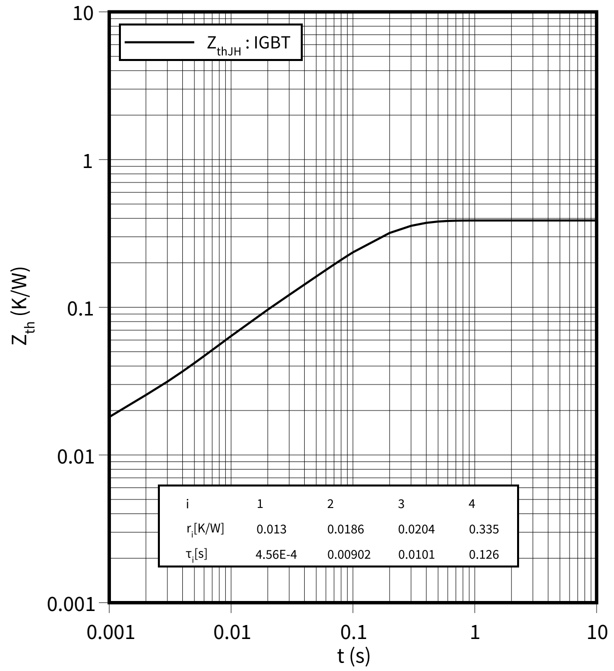
$t = f(R_G)$

I_C = 150 A, V_{CE} = 500 V, V_{GE} = ± 15 V, T_{vj} = 150 °C



Transient thermal impedance , IGBT, Inverter

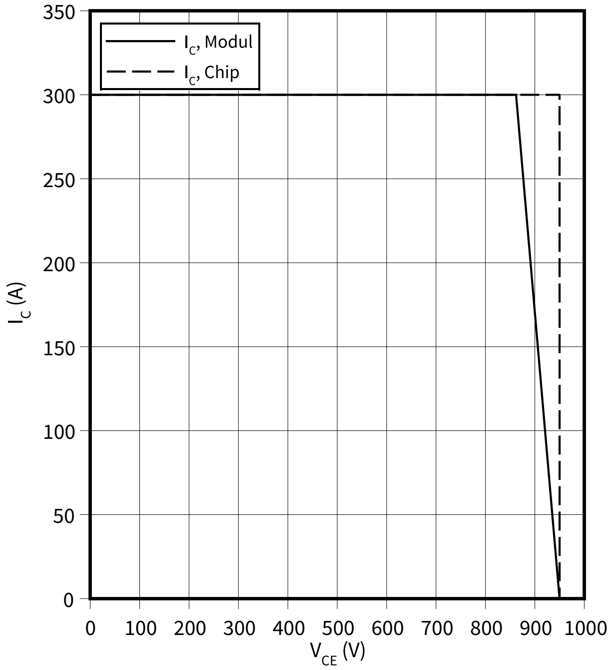
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

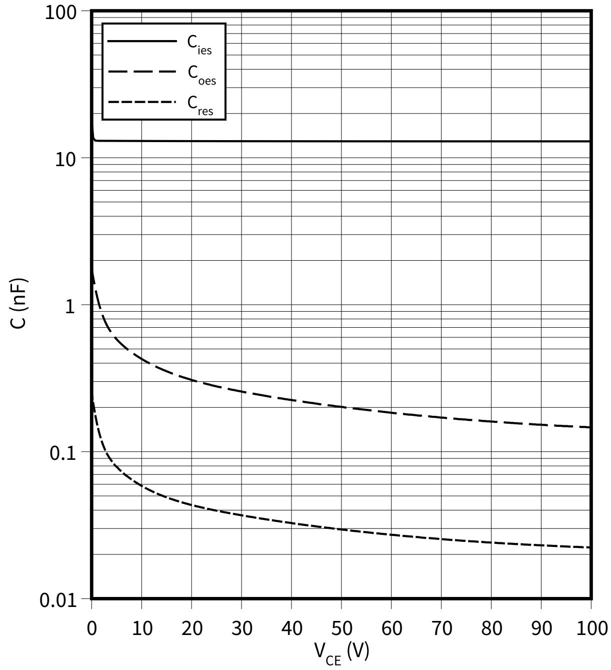
$R_{Goff} = 12\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

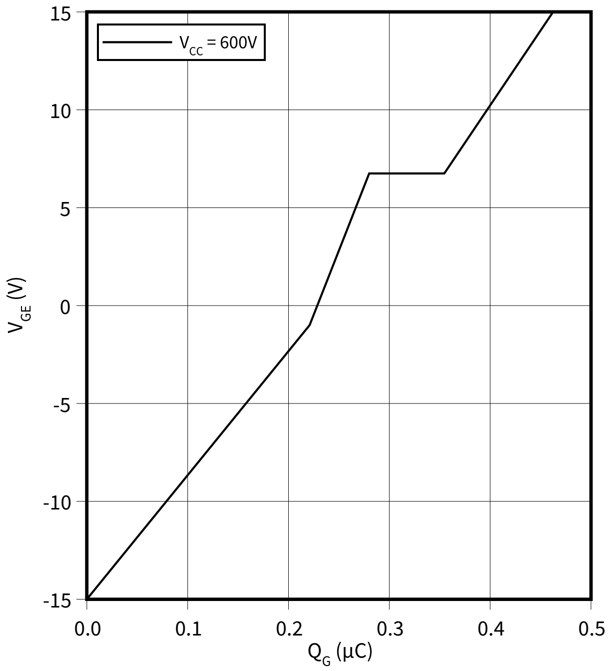
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Gate charge characteristic (typical), IGBT, Inverter

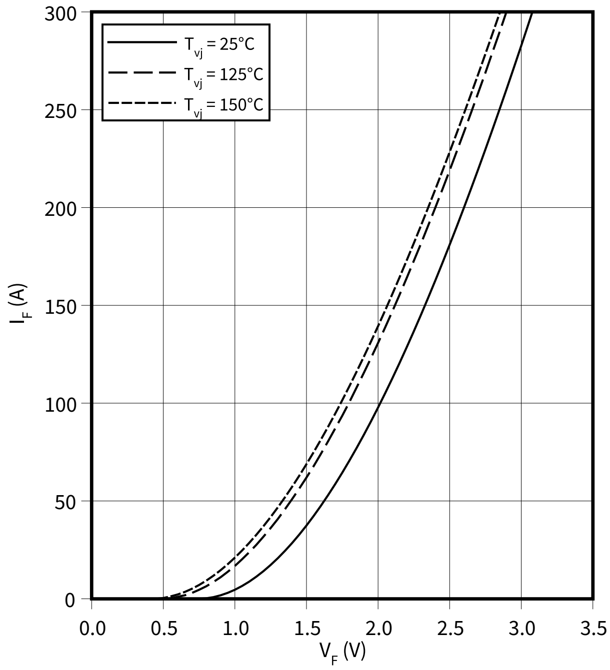
$V_{GE} = f(Q_G)$

$I_C = 200$ A, $T_{vj} = 25$ °C



Forward characteristic (typical), Diode, Inverter

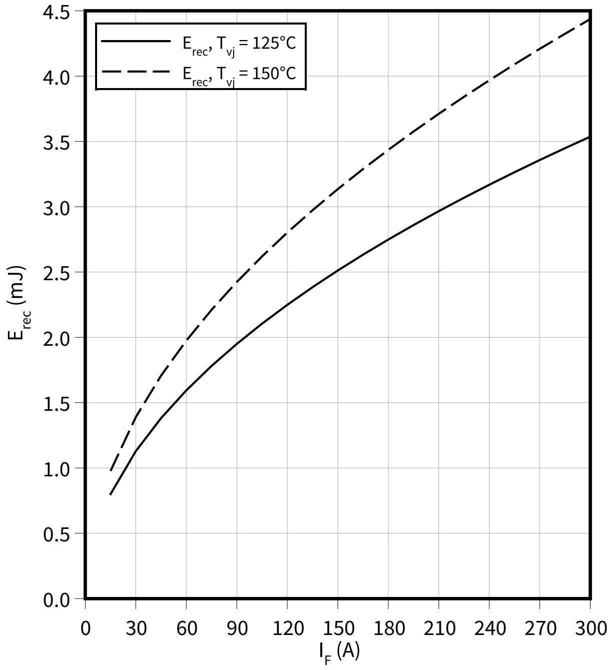
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

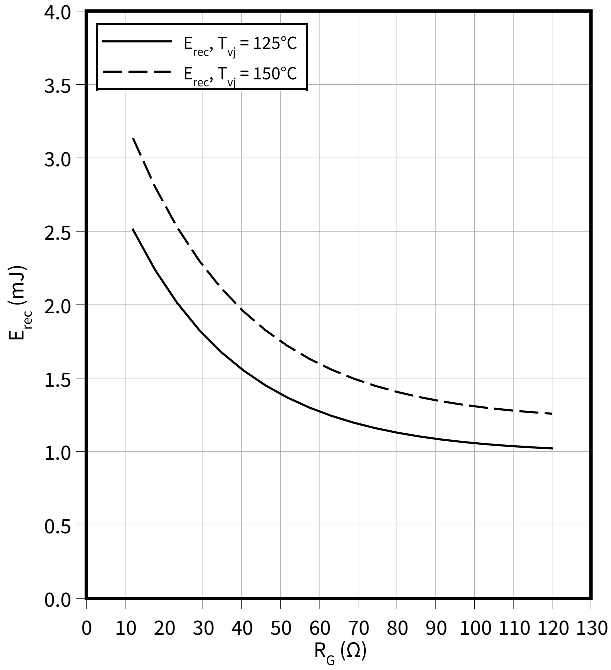
$R_{Gon} = 12\ \Omega$, $V_R = 500$ V



Switching losses (typical), Diode, Inverter

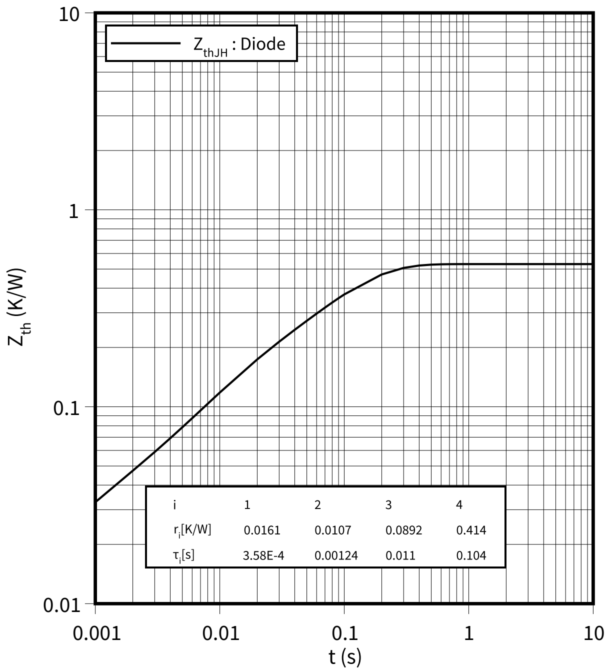
$E_{rec} = f(R_G)$

$I_F = 200$ A, $V_R = 500$ V



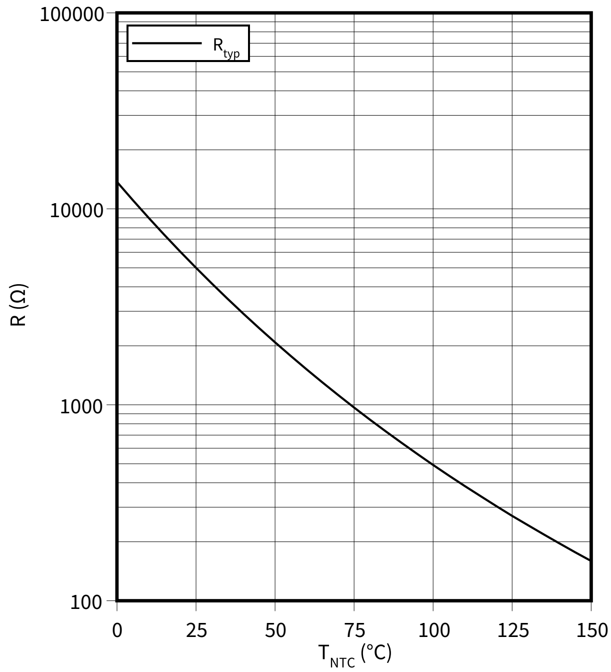
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

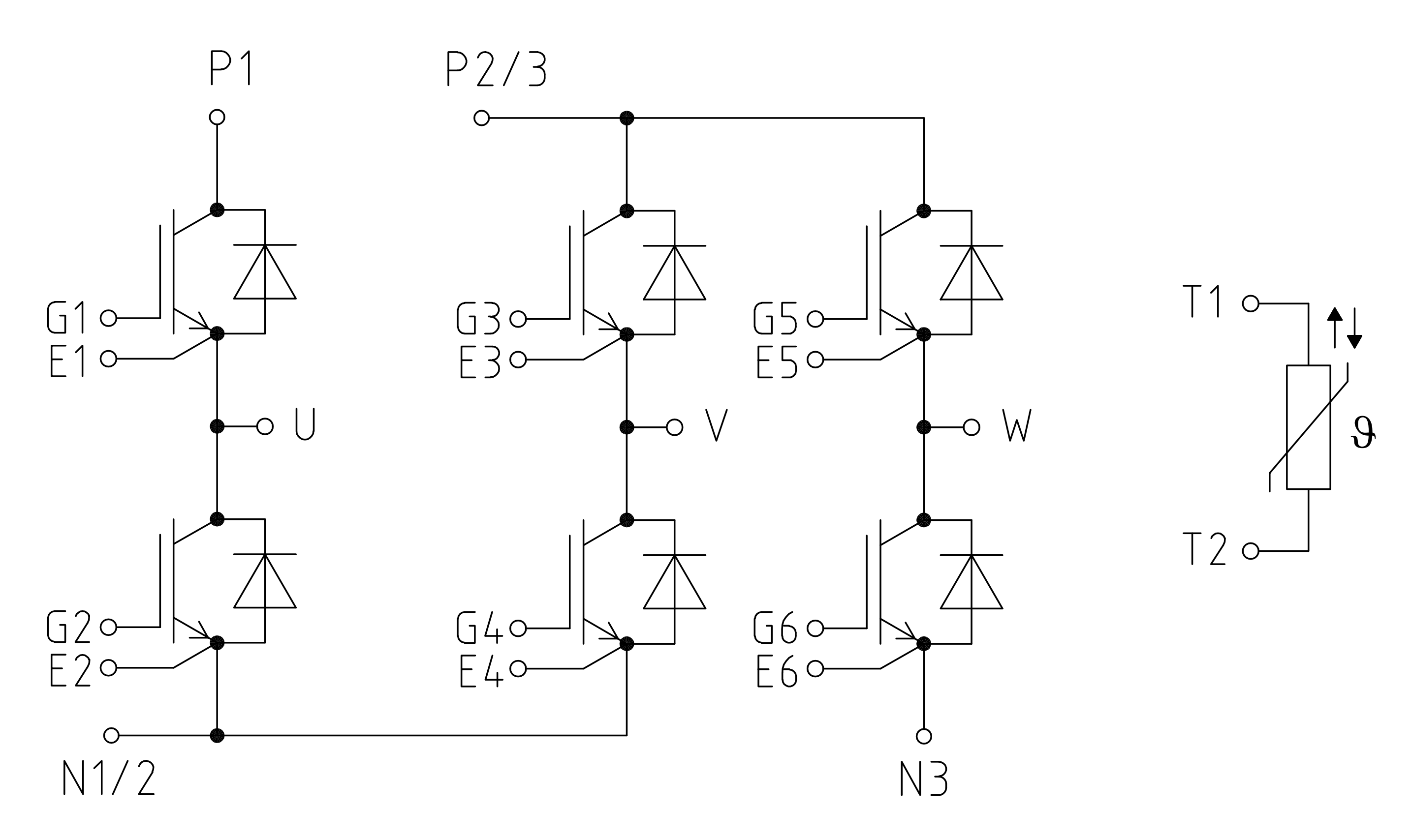


Figure 1

7 Package outlines

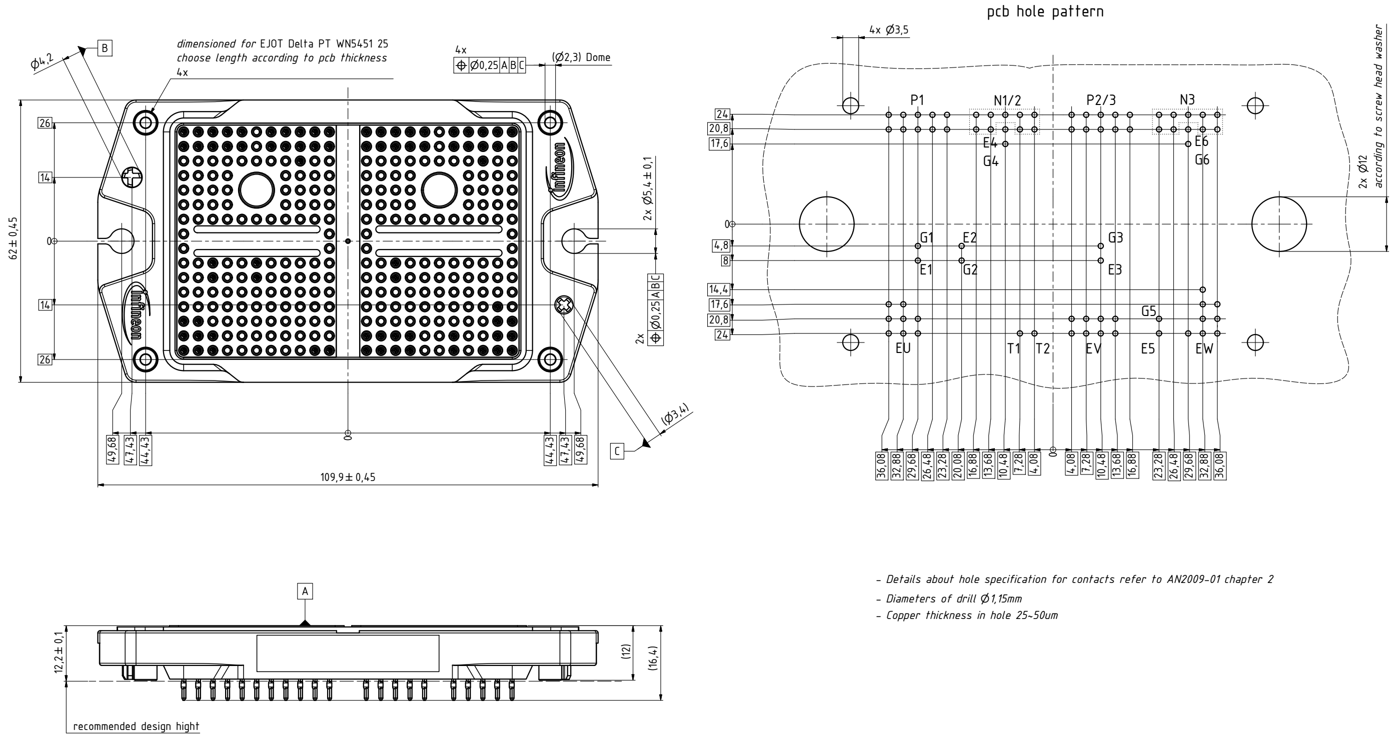


Figure 2

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	*Content*	*Digit*	*Example*
	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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