

Final datasheet

EconoPACK™2 module with Trench/Fieldstop IGBT4 and emitter controlled 4 diode and PressFIT / NTC

Features

- Electrical features
 - $V_{CES} = 1600 \text{ V}$
 - $I_{C \text{ nom}} = 180 \text{ A} / I_{CRM} = 360 \text{ A}$
 - $T_{vj,op} = 150^\circ\text{C}$
- Mechanical features
 - Al_2O_3 substrate with low thermal resistance
 - High power density
 - Isolated base plate
 - Compact design
 - PressFIT contact technology
 - RoHS compliant
 - Standard housing



Typical appearance

Potential applications

- Auxiliary inverters
- Air conditioning
- Motor drives
- Servo drives

Product validation

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

Description

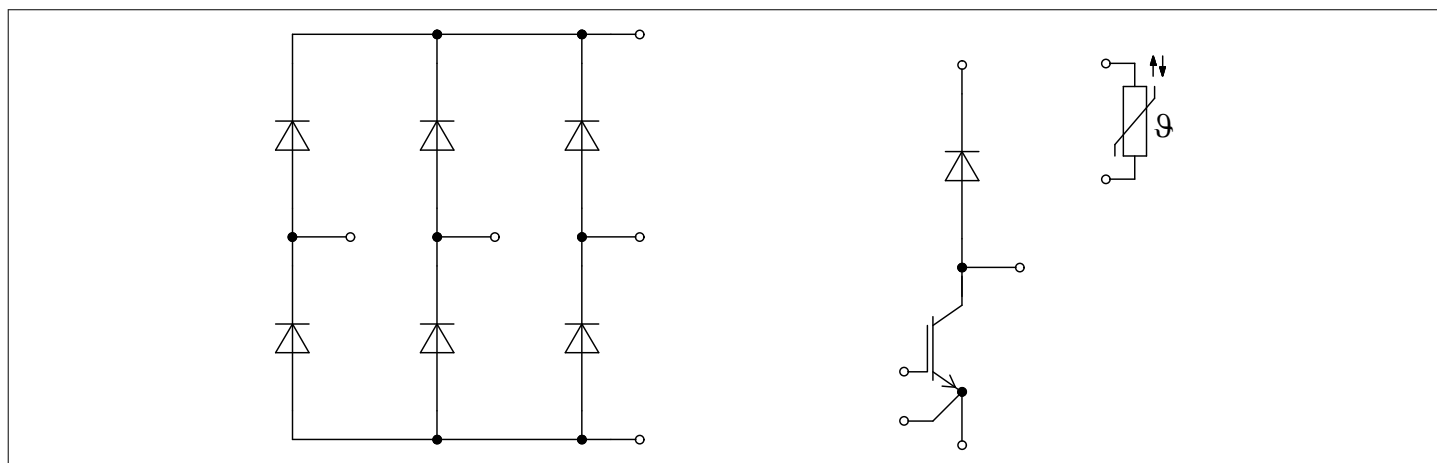


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1 Package

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to heatsink	7.5	mm
Comparative tracking index	CTI		> 200	
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}			50		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_C = 25^\circ\text{C}$, per switch		1.3		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	3		6	Nm
Weight	G			180		g

Note: The current under continuous operation is limited to 50 A rms per connector pin.

2 Diode, Rectifier

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25^\circ\text{C}$	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	$T_C = 100^\circ\text{C}$		150	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_C = 100^\circ\text{C}$		180	A
Surge forward current	I_{FSM}	$t_p = 10 \text{ ms}$	$T_{vj} = 25^\circ\text{C}$	1600	A
			$T_{vj} = 150^\circ\text{C}$	1400	

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
I^2t - value	I^2t	$t_p = 10 \text{ ms}$	$T_{vj} = 25 \text{ °C}$	13000	A^2s
			$T_{vj} = 150 \text{ °C}$	9800	

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 150 \text{ A}$	$T_{vj} = 150 \text{ °C}$		1.20		V
Threshold voltage	$V_{(TO)}$	$T_{vj} = 150 \text{ °C}$			0.83		V
Slope resistance	r_t	$T_{vj} = 150 \text{ °C}$			2.3		mΩ
Reverse current	I_r	$T_{vj} = 150 \text{ °C}, V_R = 1600 \text{ V}$			1		mA
Thermal resistance, junction to case	R_{thJC}	per diode				0.330	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W/(m·K)}$			0.137		K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

3 IGBT, Brake-Chopper

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ °C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_C = 95 \text{ °C}$	100	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 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE \text{ sat}}$	$I_C = 100 \text{ A}, V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ °C}$		1.75	2.10	V
			$T_{vj} = 125 \text{ °C}$		2.05		
			$T_{vj} = 150 \text{ °C}$		2.10		
Gate threshold voltage	V_{GEth}	$I_C = 3.8 \text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25 \text{ °C}$		5.25	5.80	6.35	V
Gate charge	Q_G	$V_{GE} = \pm 15 \text{ V}$			0.75		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25 \text{ °C}$			7.5		Ω

(table continues...)

Table 6 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Input capacitance	C_{ies}	$f = 1000 \text{ kHz}$, $T_{vj} = 25 \text{ °C}$, $V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$			6.2		nF
Reverse transfer capacitance	C_{res}	$f = 1000 \text{ kHz}$, $T_{vj} = 25 \text{ °C}$, $V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$			0.35		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200 \text{ V}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$			1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = 20 \text{ V}$, $T_{vj} = 25 \text{ °C}$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 1.6 \text{ } \Omega$	$T_{vj} = 25 \text{ °C}$		0.160		μs
			$T_{vj} = 125 \text{ °C}$		0.170		
			$T_{vj} = 150 \text{ °C}$		0.170		
Rise time (inductive load)	t_r	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 1.6 \text{ } \Omega$	$T_{vj} = 25 \text{ °C}$		0.030		μs
			$T_{vj} = 125 \text{ °C}$		0.040		
			$T_{vj} = 150 \text{ °C}$		0.040		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 1.6 \text{ } \Omega$	$T_{vj} = 25 \text{ °C}$		0.330		μs
			$T_{vj} = 125 \text{ °C}$		0.430		
			$T_{vj} = 150 \text{ °C}$		0.450		
Fall time (inductive load)	t_f	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 1.6 \text{ } \Omega$	$T_{vj} = 25 \text{ °C}$		0.080		μs
			$T_{vj} = 125 \text{ °C}$		0.145		
			$T_{vj} = 150 \text{ °C}$		0.170		
Turn-on energy loss per pulse	E_{on}	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 30 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 1.6 \text{ } \Omega$, $di/dt = 3000 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$		5.5		mJ
			$T_{vj} = 125 \text{ °C}$		8.5		
			$T_{vj} = 150 \text{ °C}$		9.5		
Turn-off energy loss per pulse	E_{off}	$I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 30 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 1.6 \text{ } \Omega$, $dv/dt = 3600 \text{ V}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$		5.5		mJ
			$T_{vj} = 125 \text{ °C}$		8.5		
			$T_{vj} = 150 \text{ °C}$		9.5		
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq 10 \text{ } \mu\text{s}$, $T_{vj} = 150 \text{ °C}$		360		A
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.302	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m} \cdot \text{K})$			0.135		K/W
Temperature under switching conditions	T_{vjop}			-40		150	°C

4 Diode, Brake-Chopper

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
Continuous DC forward current	I_F			50	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		100	A
I^2t - value	I^2t	$t_P = 10\text{ ms}$, $V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	510	A ² s

Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 50\text{ A}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	1.70	2.15	V
			$T_{vj} = 125\text{ °C}$	1.65		
			$T_{vj} = 150\text{ °C}$	1.65		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600\text{ V}$, $I_F = 50\text{ A}$, -di _F /dt = 2500 A/μs ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	54		A
			$T_{vj} = 125\text{ °C}$	60		
			$T_{vj} = 150\text{ °C}$	63		
Recovered charge	Q_r	$V_{CC} = 600\text{ V}$, $I_F = 50\text{ A}$, -di _F /dt = 2500 A/μs ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	5.5		μC
			$T_{vj} = 125\text{ °C}$	8.8		
			$T_{vj} = 150\text{ °C}$	10		
Reverse recovery energy	E_{rec}	$V_{CC} = 600\text{ V}$, $I_F = 50\text{ A}$, -di _F /dt = 2500 A/μs ($T_{vj} = 150\text{ °C}$)	$T_{vj} = 25\text{ °C}$	1.7		mJ
			$T_{vj} = 125\text{ °C}$	3		
			$T_{vj} = 150\text{ °C}$	3.7		
Thermal resistance, junction to case	R_{thJC}	per diode			0.713	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 1\text{ W/(m·K)}$		0.157		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		150	°C

5 NTC-Thermistor

Table 9 Characteristic values

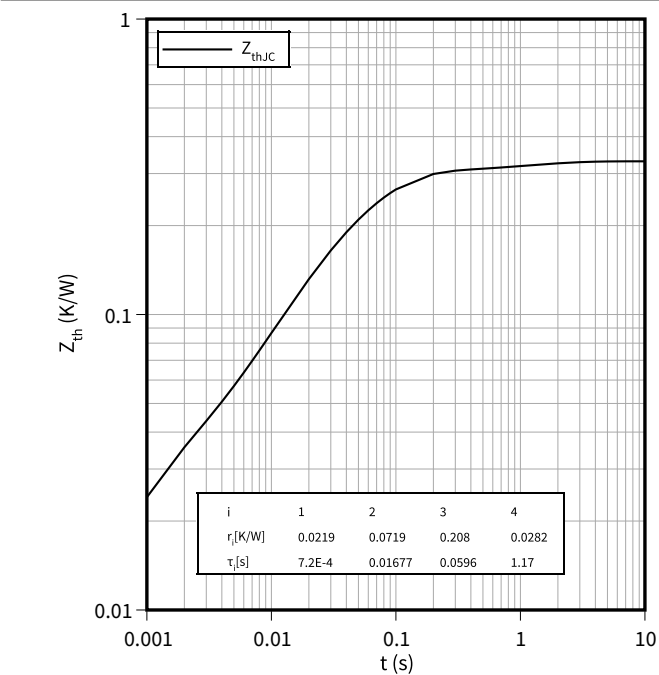
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ Ω}$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2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

Transient thermal impedance, Diode, Rectifier

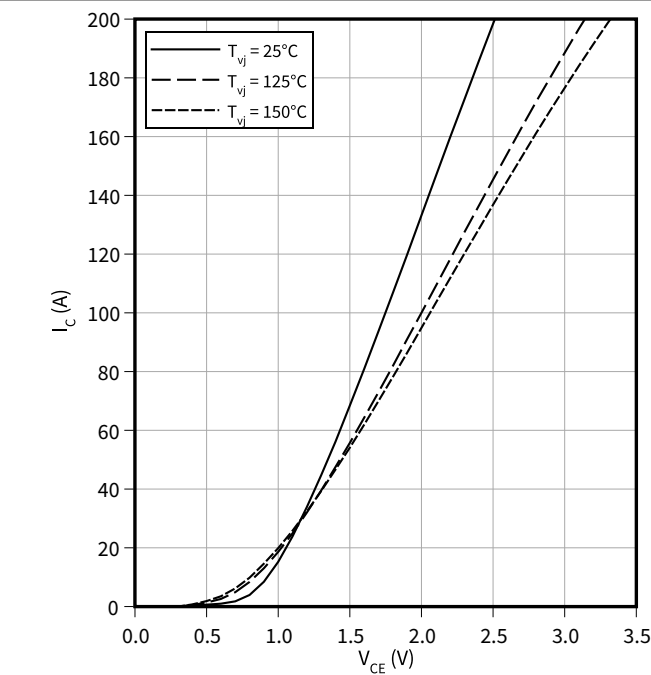
$Z_{th} = f(t)$



Output characteristic (typical), IGBT, Brake-Chopper

$I_C = f(V_{CE})$

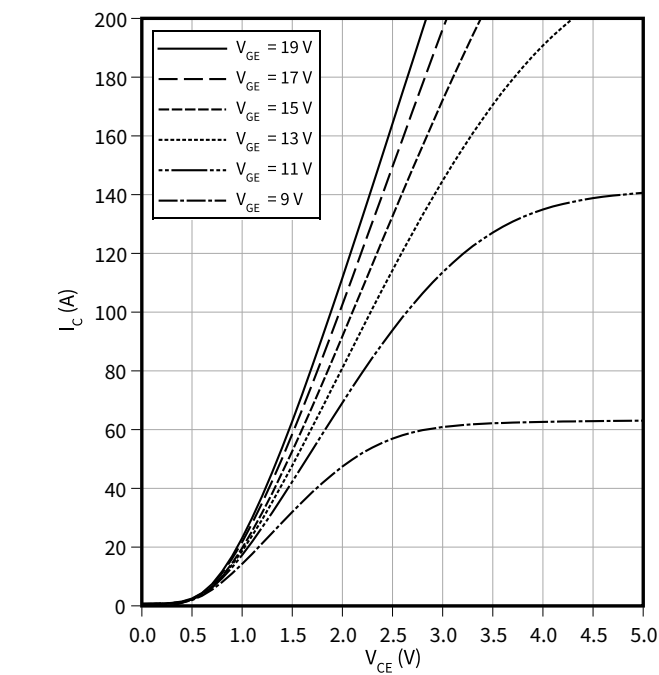
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, Brake-Chopper

$I_C = f(V_{CE})$

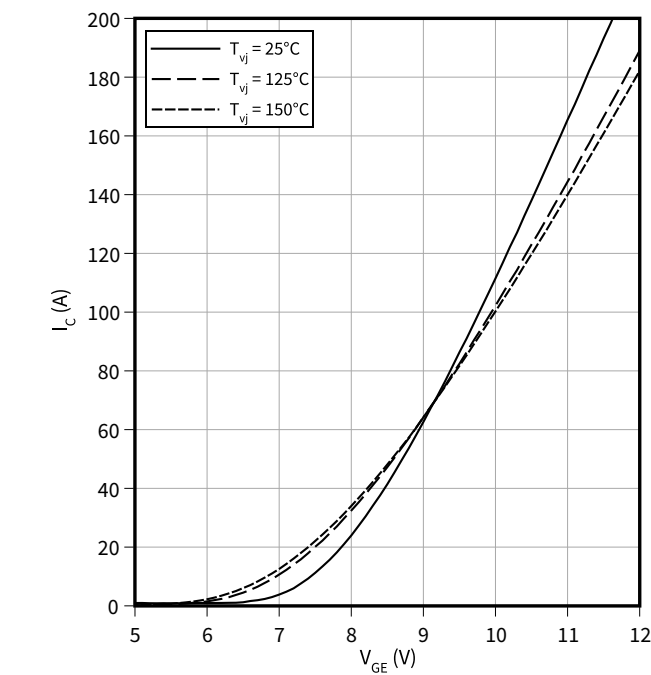
$T_{vj} = 150\text{ °C}$



Transfer characteristic (typical), IGBT, Brake-Chopper

$I_C = f(V_{GE})$

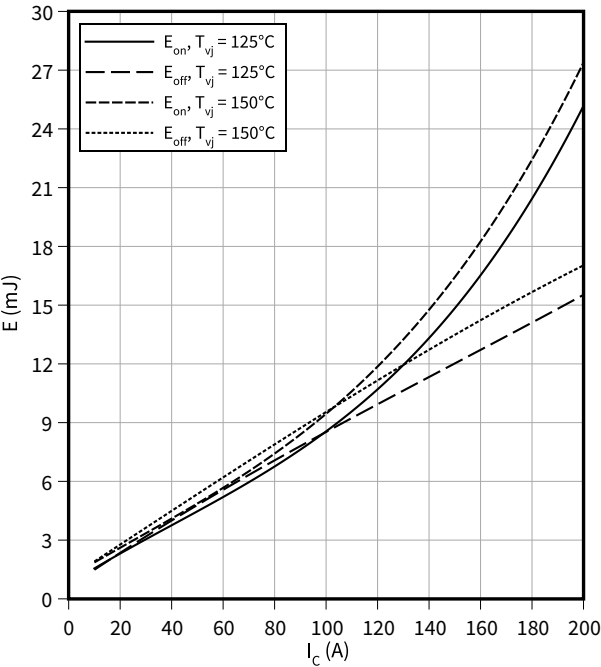
$V_{CE} = 20\text{ V}$



6 Characteristics diagrams

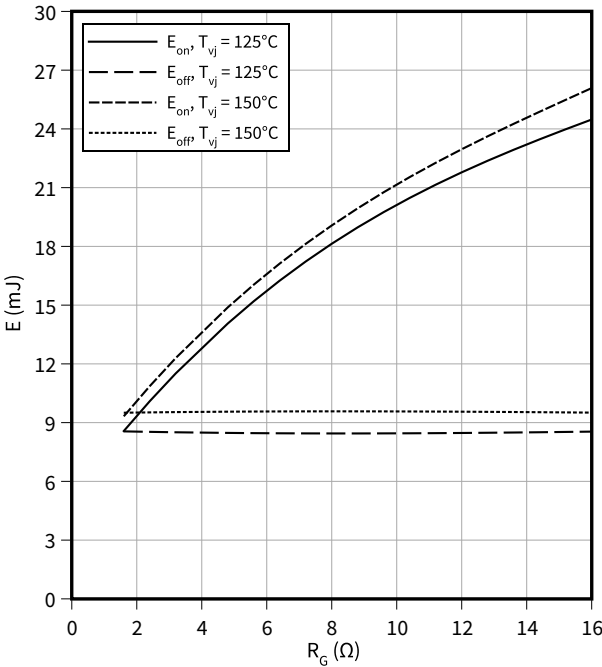
Switching losses (typical), IGBT, Brake-Chopper

$E = f(I_C)$
 $R_{Goff} = 1.6 \Omega$, $R_{Gon} = 1.6 \Omega$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



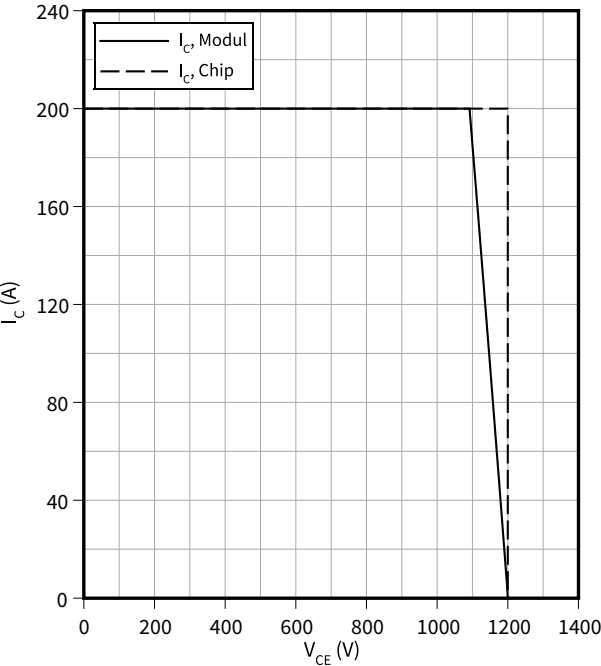
Switching losses (typical), IGBT, Brake-Chopper

$E = f(R_G)$
 $I_C = 100 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



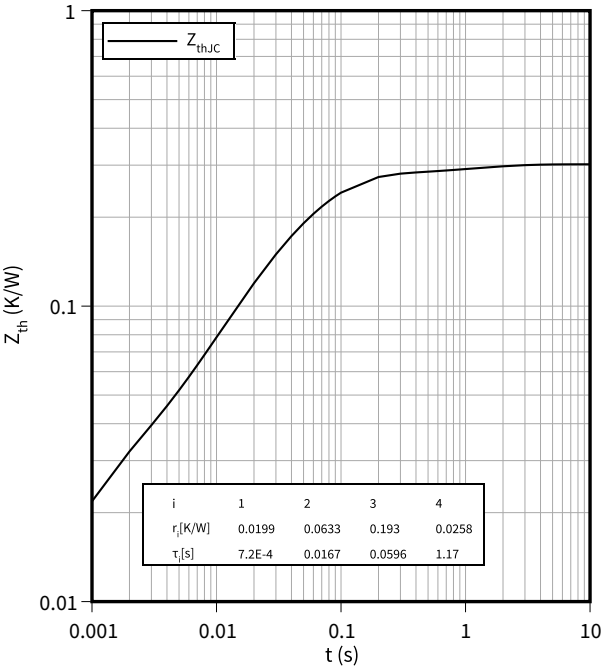
Reverse bias safe operating area (RBSOA), IGBT, Brake-Chopper

$I_C = f(V_{CE})$
 $R_{Goff} = 1.6 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150 \text{ °C}$



Transient thermal impedance, IGBT, Brake-Chopper

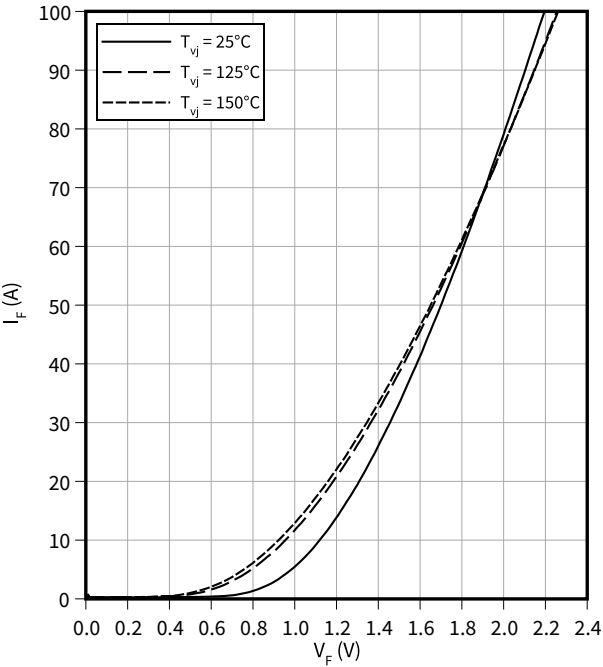
$Z_{th} = f(t)$



6 Characteristics diagrams

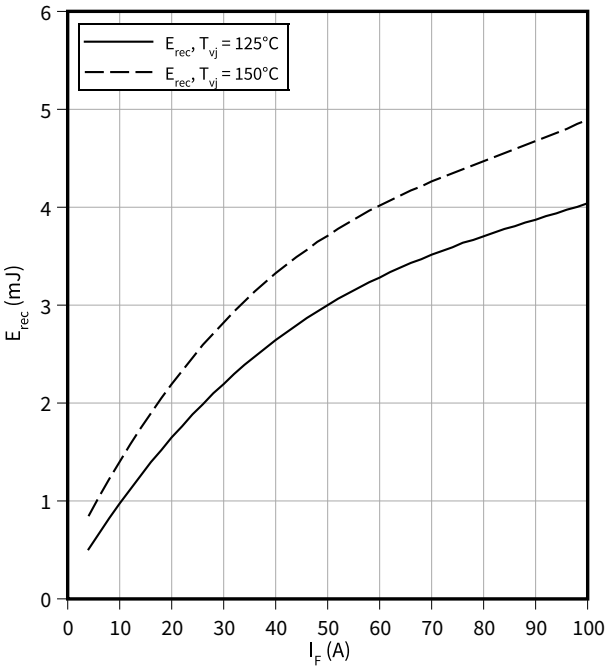
Forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



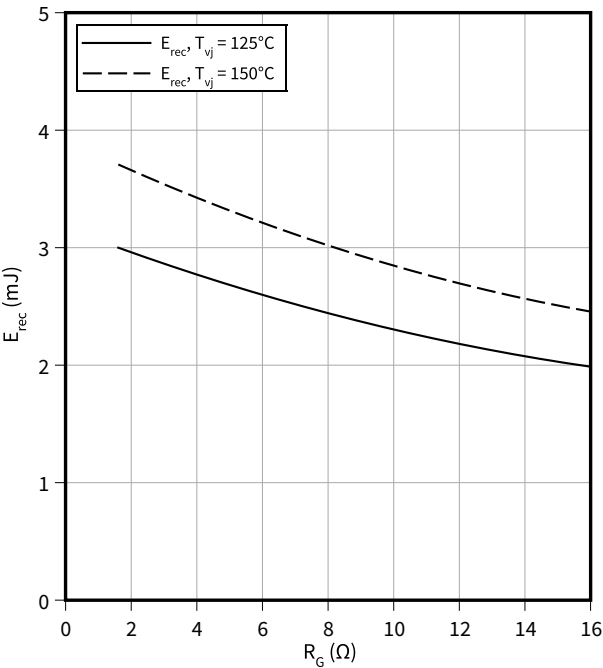
Switching losses (typical), Diode, Brake-Chopper

$E_{rec} = f(I_F)$
 $R_{Gon} = 1.6\ \Omega, V_{CC} = 600\ \text{V}$



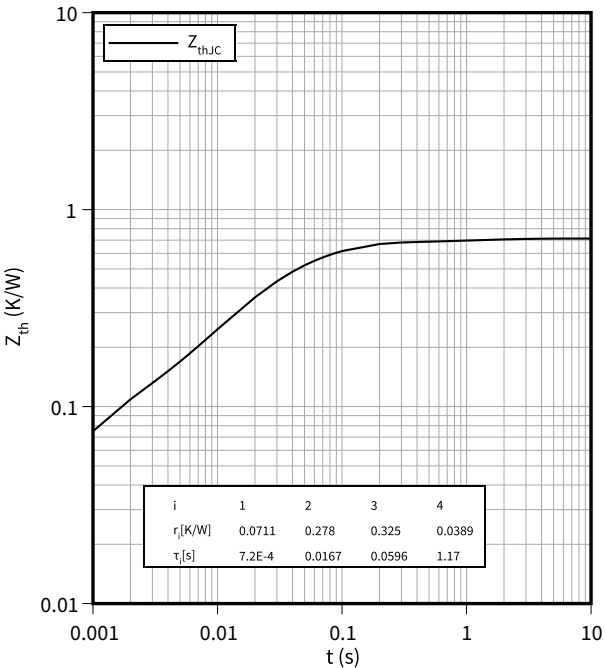
Switching losses (typical), Diode, Brake-Chopper

$E_{rec} = f(R_G)$
 $I_F = 50\ \text{A}, V_{CC} = 600\ \text{V}$



Transient thermal impedance, Diode, Brake-Chopper

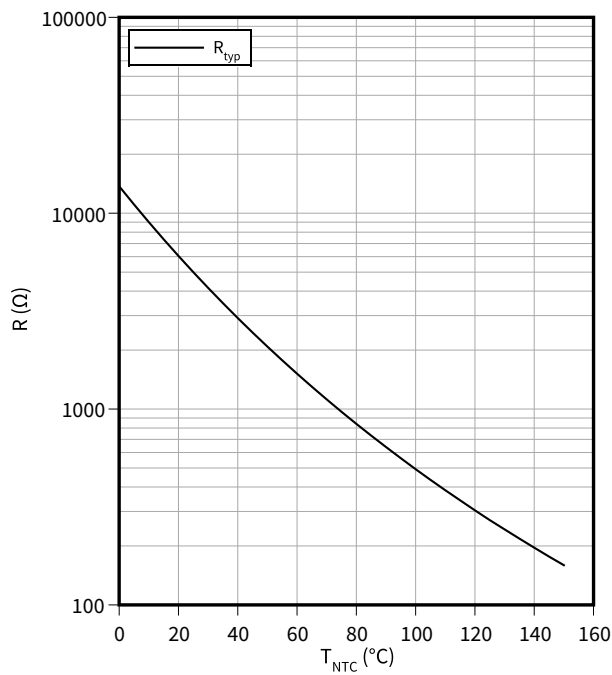
$Z_{th} = f(t)$



6 Characteristics diagrams

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 **Circuit diagram**

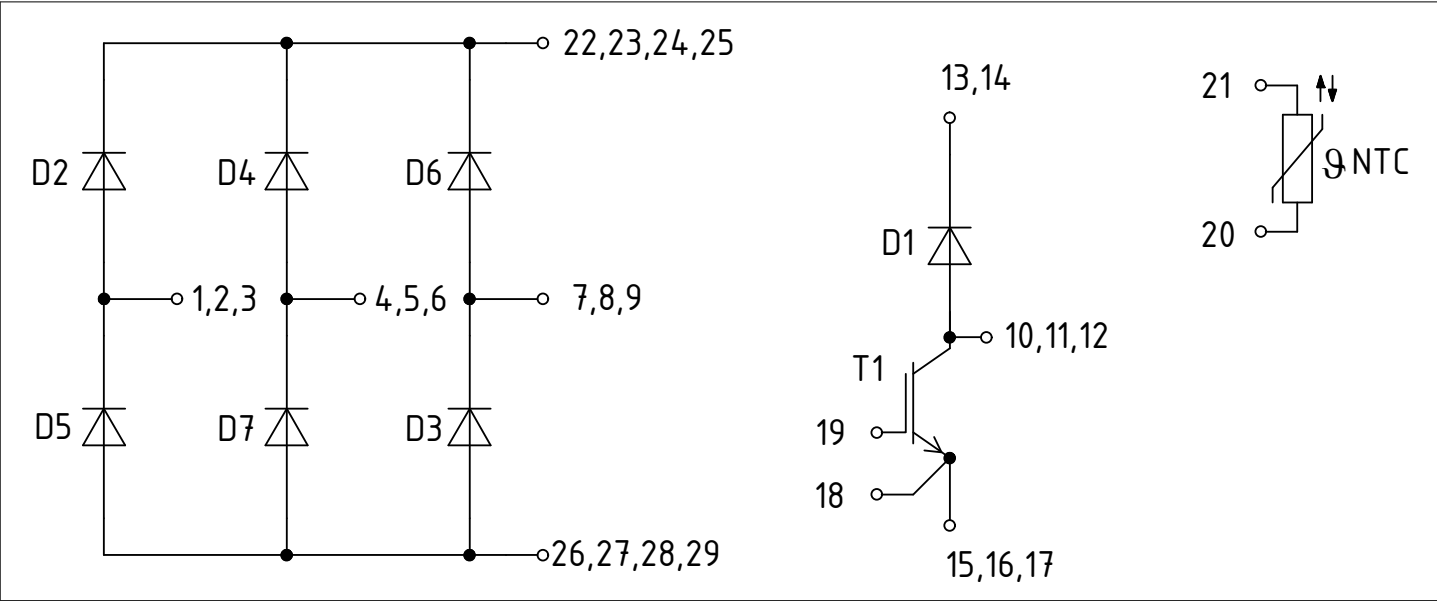


Figure 1

8 Package outlines

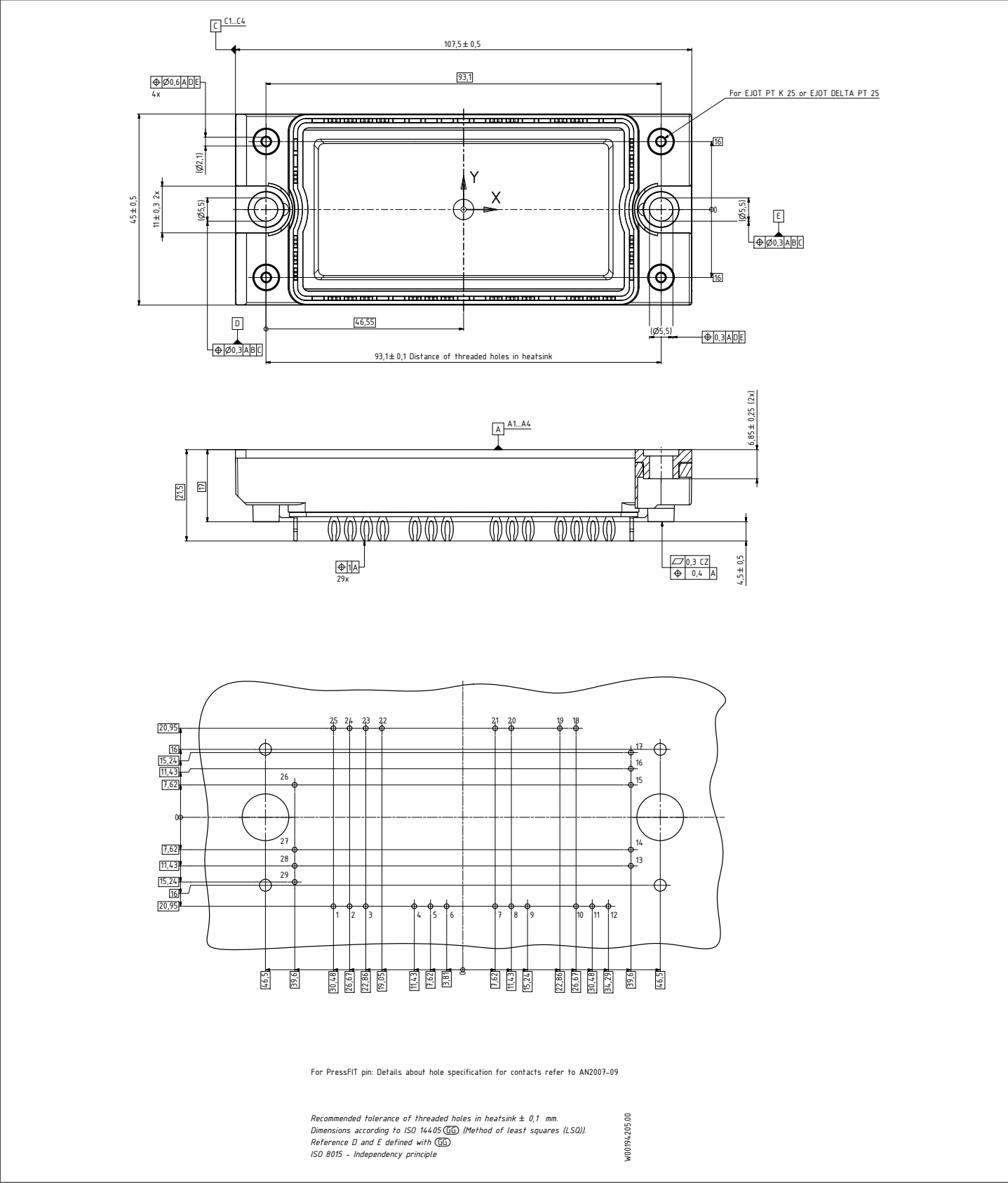


Figure 2

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	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	 7154914284655054991153071549142846550549911530		

Figure 3

Revision history

Revision history

Document revision	Date of release	Description of changes
V3.0	2017-07-25	Final datasheet
n/a	2020-09-01	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2024-01-25	Final

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Email: erratum@infineon.com

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