Final datasheet

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

Features

Typical appearance

- Electrical features
  - V_{CES} = 1600 V
  - $I_{C\ nom}$ = 180 A / I_{CRM} = 360 A
  - $T_{vj,op}$ = 150°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

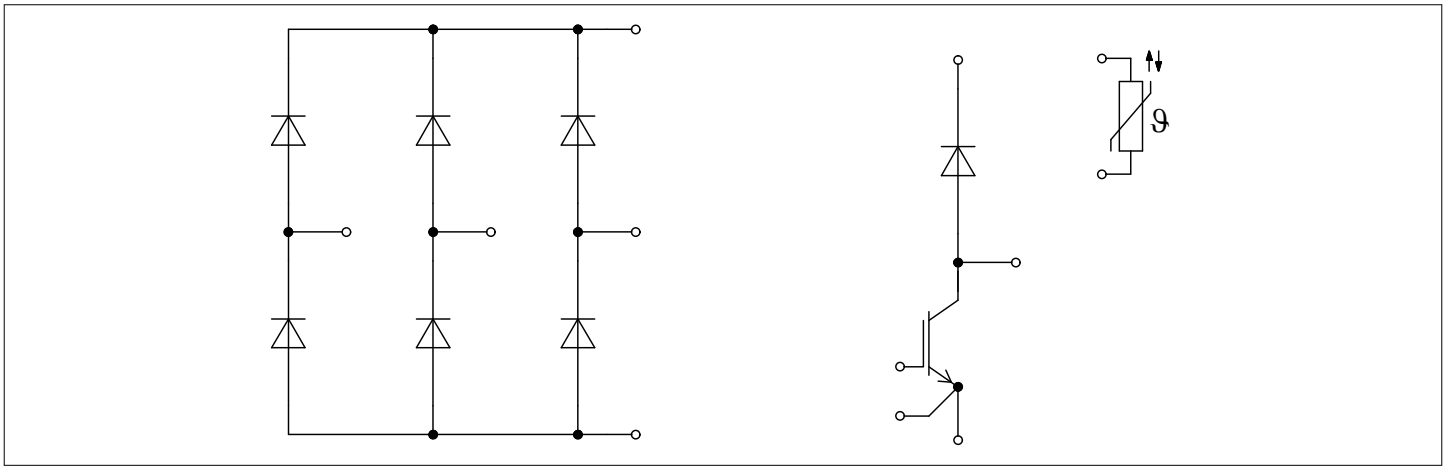
Potential applications

- 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

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, t = 1 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°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	M5, Screw	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 °C	1600	V
Maximum RMS forward current per chip	I_{FRMSM}	T_C = 100 °C		150	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C = 100 °C		180	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	1600	A
			T_{vj} = 150 °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 ms	T_{vj} = 25 °C	13000	A^2s
			T_{vj} = 150 °C	9800	

Table 4 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 150 A	T_{vj} = 150 °C		1.20		V
Threshold voltage	$V_{(TO)}$	T_{vj} = 150 °C			0.83		V
Slope resistance	r_t	T_{vj} = 150 °C			2.3		mΩ
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1600 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, λ_{grease} = 1 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 °C	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 95 °C	100	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 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 100 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.75	2.10	V
			T_{vj} = 125 °C		2.05		
			T_{vj} = 150 °C		2.10		
Gate threshold voltage	V_{GEth}	I_C = 3.8 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.25	5.80	6.35	V
Gate charge	Q_G	V_{GE} = ±15 V			0.75		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °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 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			6.2		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.35		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	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 = 100 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.6 Ω	T_{vj} = 25 °C		0.160		µs
			T_{vj} = 125 °C		0.170		
			T_{vj} = 150 °C		0.170		
Rise time (inductive load)	t_r	I_C = 100 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.6 Ω	T_{vj} = 25 °C		0.030		µs
			T_{vj} = 125 °C		0.040		
			T_{vj} = 150 °C		0.040		
Turn-off delay time (inductive load)	t_{doff}	I_C = 100 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.6 Ω	T_{vj} = 25 °C		0.330		µs
			T_{vj} = 125 °C		0.430		
			T_{vj} = 150 °C		0.450		
Fall time (inductive load)	t_f	I_C = 100 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.6 Ω	T_{vj} = 25 °C		0.080		µs
			T_{vj} = 125 °C		0.145		
			T_{vj} = 150 °C		0.170		
Turn-on energy loss per pulse	E_{on}	I_C = 100 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = ±15 V, R_{Gon} = 1.6 Ω, di/dt = 3000 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		5.5		mJ
			T_{vj} = 125 °C		8.5		
			T_{vj} = 150 °C		9.5		
Turn-off energy loss per pulse	E_{off}	I_C = 100 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = ±15 V, R_{Goff} = 1.6 Ω, dv/dt = 3600 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		5.5		mJ
			T_{vj} = 125 °C		8.5		
			T_{vj} = 150 °C		9.5		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 800 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 10 µs, T_{vj}=150 °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, λ_{grease} = 1 W/(m·K)			0.135		K/W
Temperature under switching conditions	$T_{vj\,op}$			-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 °C	1200	V
Continuous DC forward current	I_F			50	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		100	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	510	A^2s

Table 8 Characteristic values

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

5 NTC-Thermistor

Table 9 Characteristic values

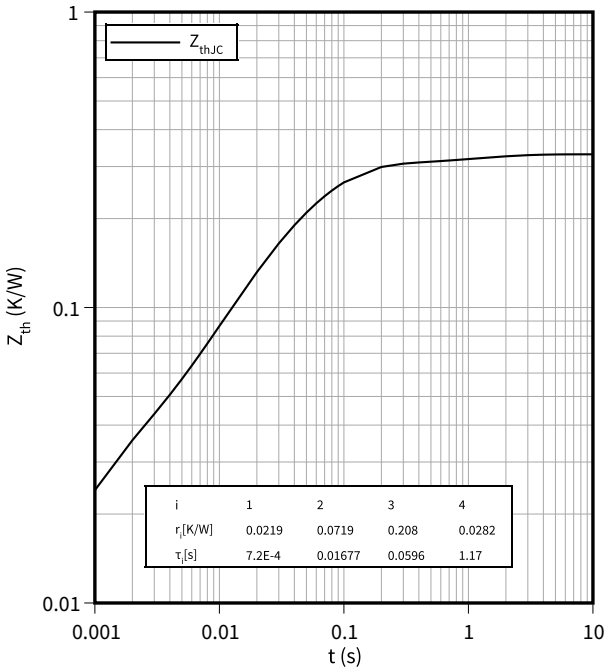
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298{,}15\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

6 Characteristics diagrams

Transient thermal impedance, Diode, Rectifier

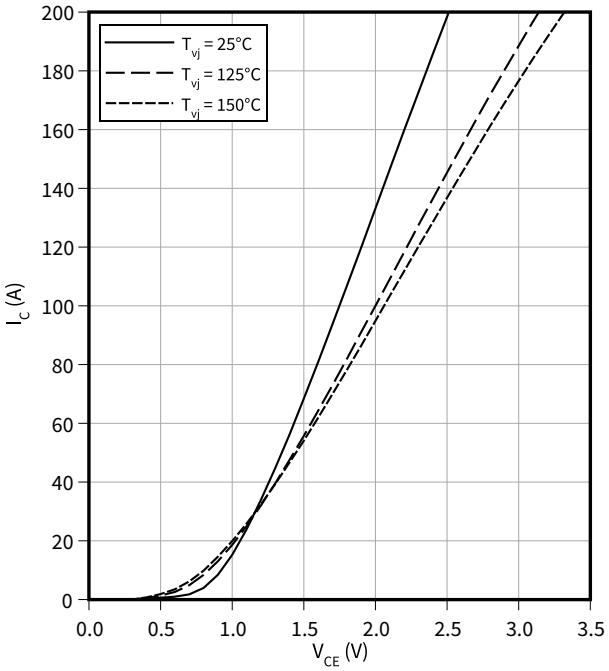
$Z_{th} = f(t)$



Output characteristic (typical), IGBT, Brake-Chopper

$I_C = f(V_{CE})$

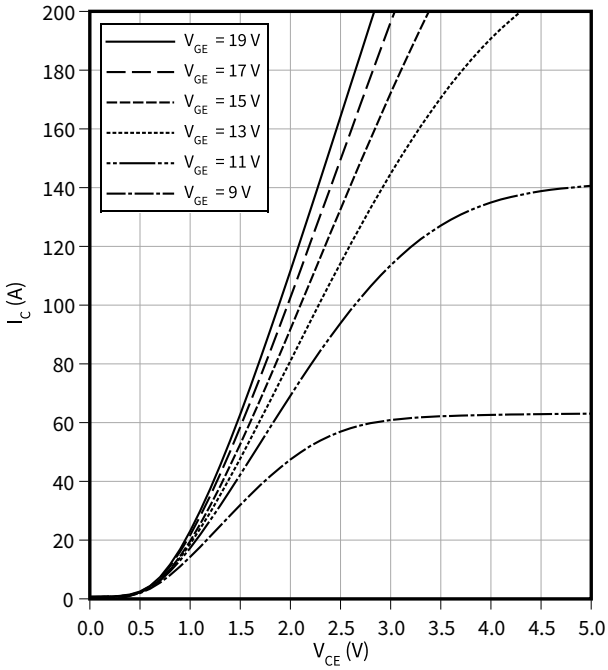
$V_{GE} = 15\ V$



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

$I_C = f(V_{CE})$

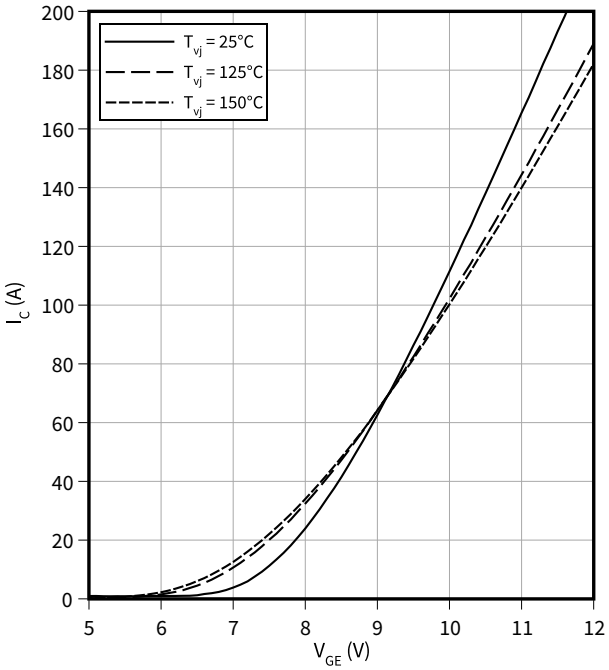
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, Brake-Chopper

$I_C = f(V_{GE})$

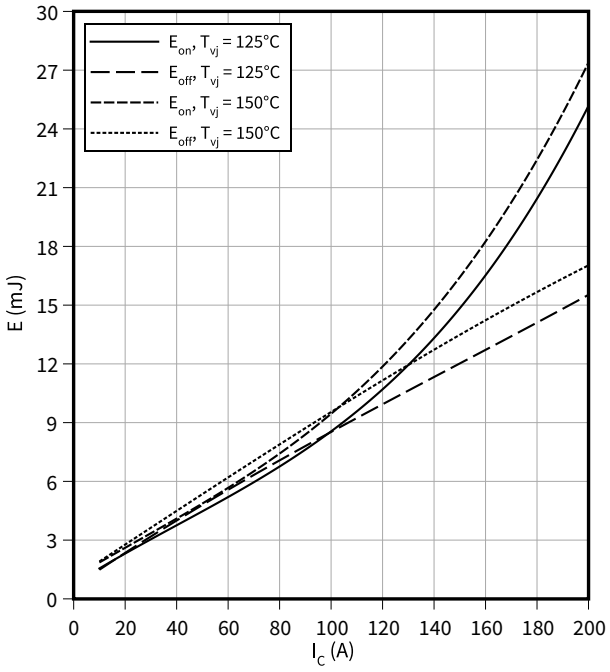
$V_{CE} = 20\ V$



Switching losses (typical), IGBT, Brake-Chopper

$E = f(I_C)$

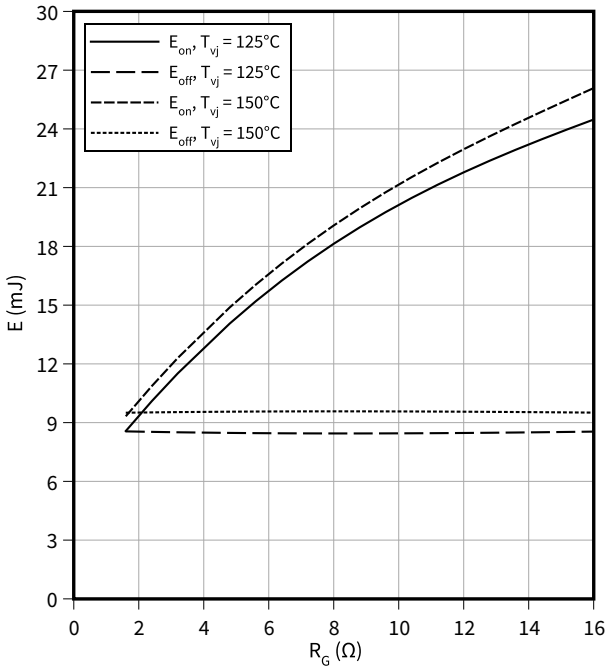
$R_{Goff} = 1.6\ \Omega$, $R_{Gon} = 1.6\ \Omega$, $V_{CC} = 600\ V$, $V_{GE} = \pm 15\ V$



Switching losses (typical), IGBT, Brake-Chopper

$E = f(R_G)$

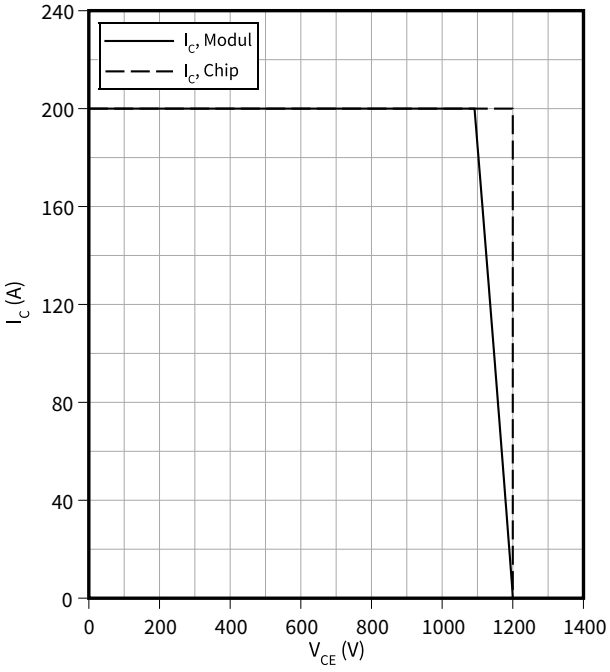
$I_C = 100\ A$, $V_{CC} = 600\ V$, $V_{GE} = \pm 15\ V$



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

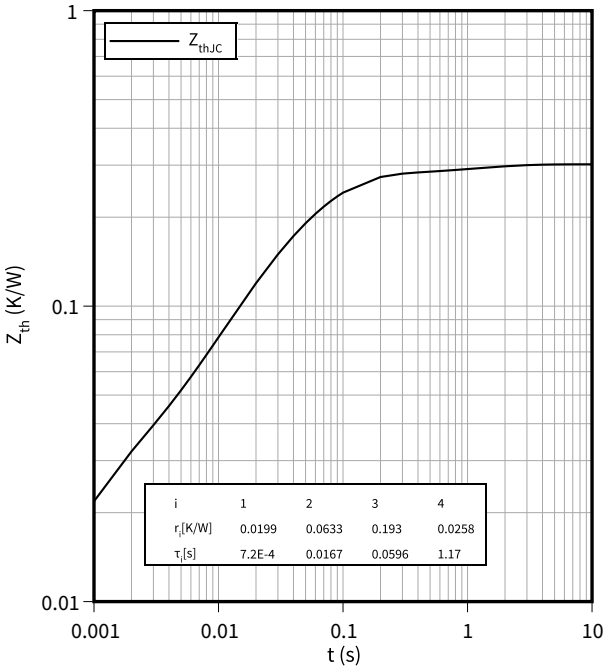
$I_C = f(V_{CE})$

$R_{Goff} = 1.6\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 150\ °C$



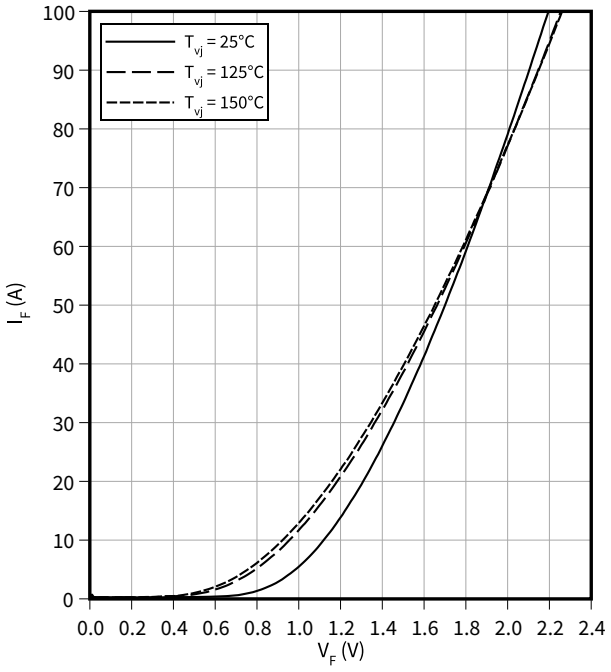
Transient thermal impedance, IGBT, Brake-Chopper

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Brake-Chopper

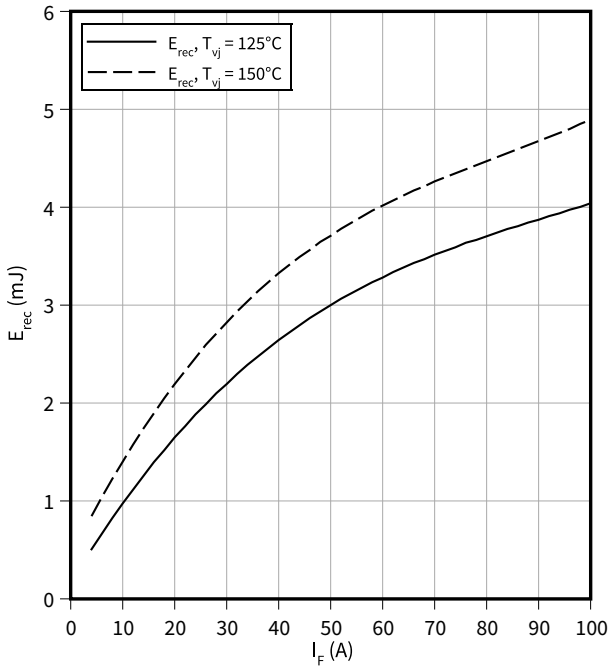
$I_F = f(V_F)$



Switching losses (typical), Diode, Brake-Chopper

$E_{rec} = f(I_F)$

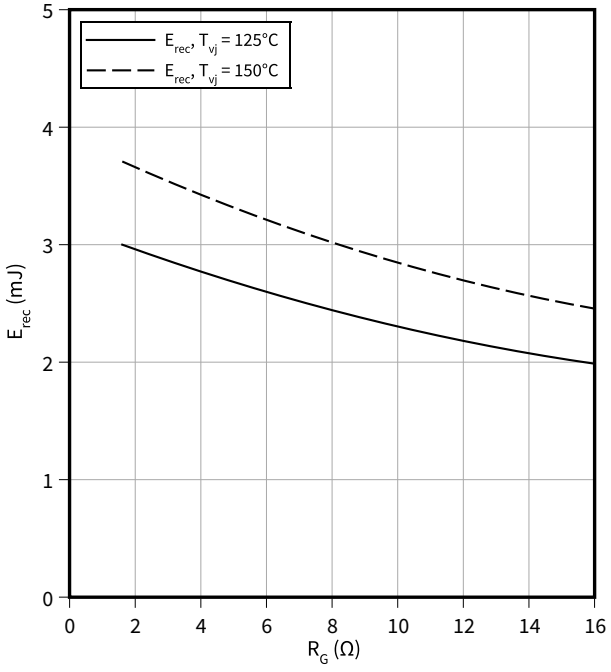
$R_{Gon} = 1.6\ \Omega$, $V_{CC} = 600\ V$



Switching losses (typical), Diode, Brake-Chopper

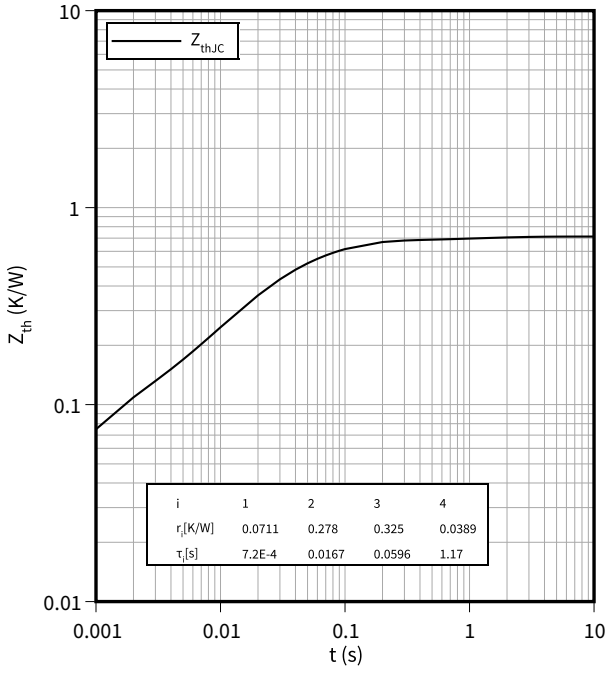
$E_{rec} = f(R_G)$

$I_F = 50\ A$, $V_{CC} = 600\ V$



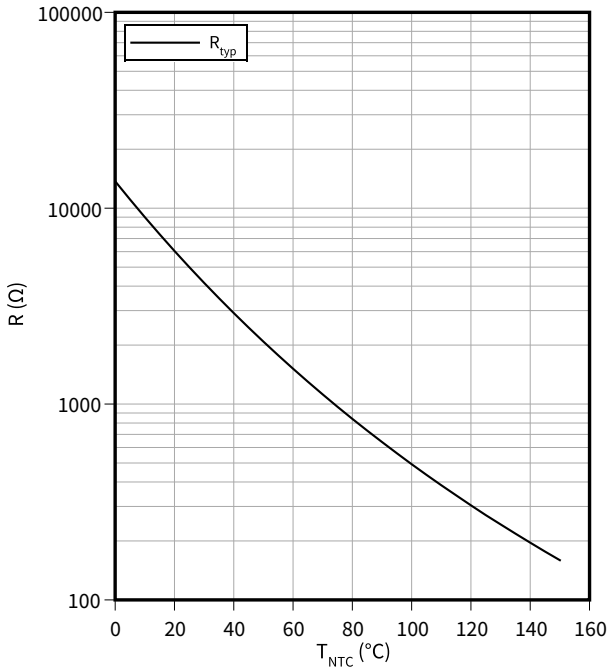
Transient thermal impedance, Diode, Brake-Chopper

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

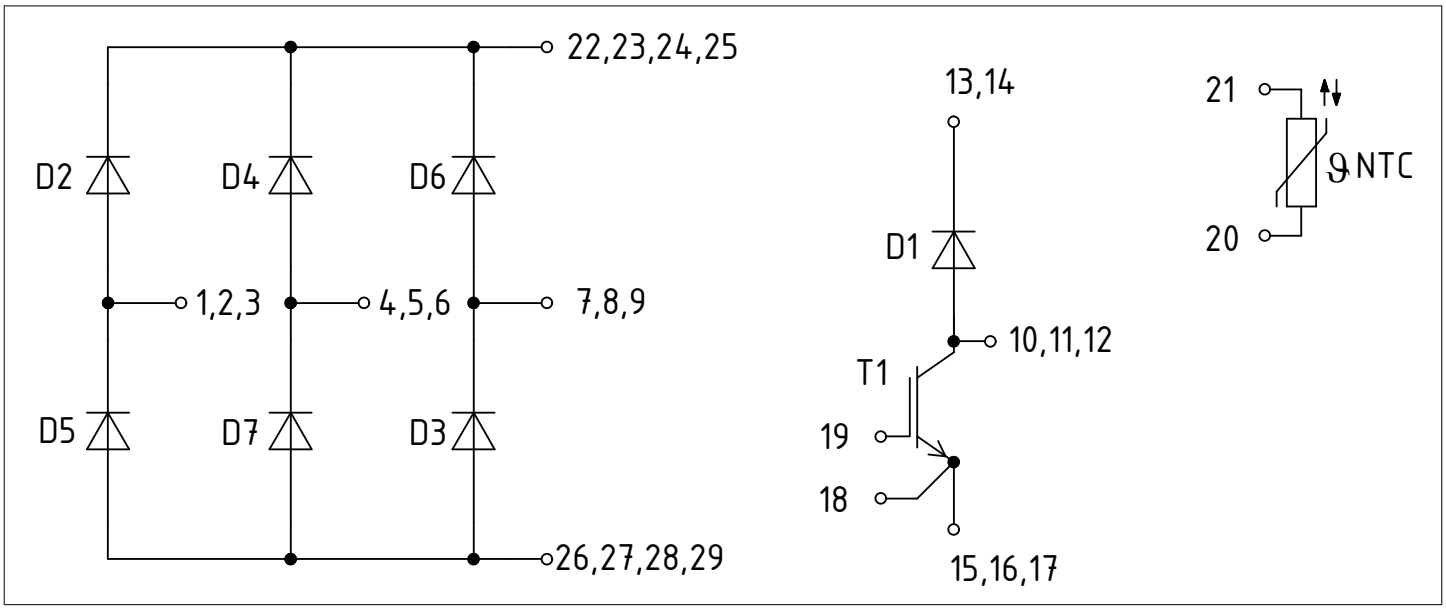


Figure 1

8 Package outlines

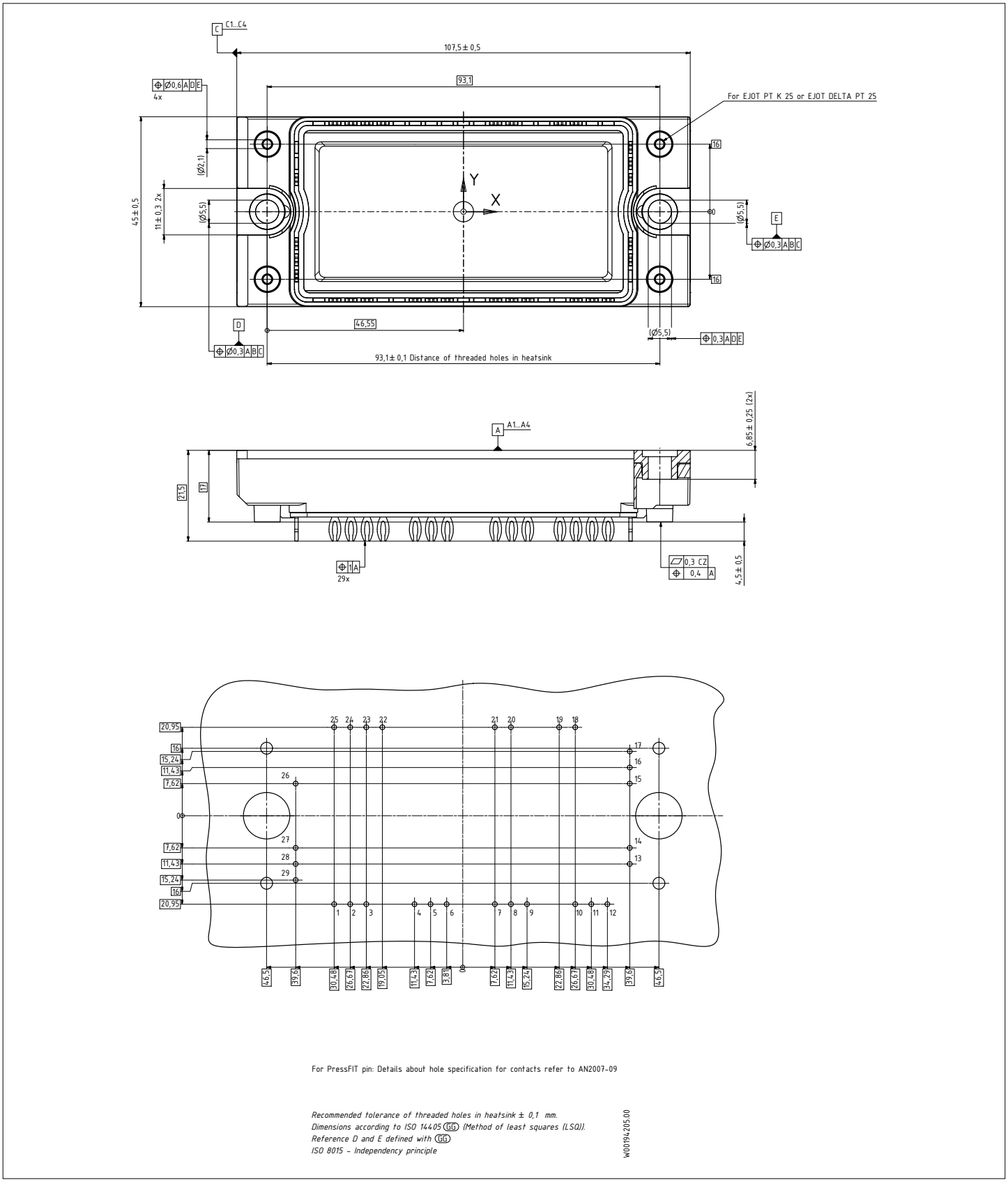


Figure 2

9 Module label code

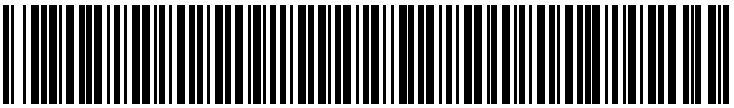
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production 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
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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