EconoPACK™3 module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode and NTC

Features

Typical appearance

- Electrical features
  - Low V_{CEsat}
  - Trench IGBT 4
  - $T_{vj\ op}$ = 150 °C
- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - Copper base plate
  - PressFIT contact technology
  - H_2S ruggedness

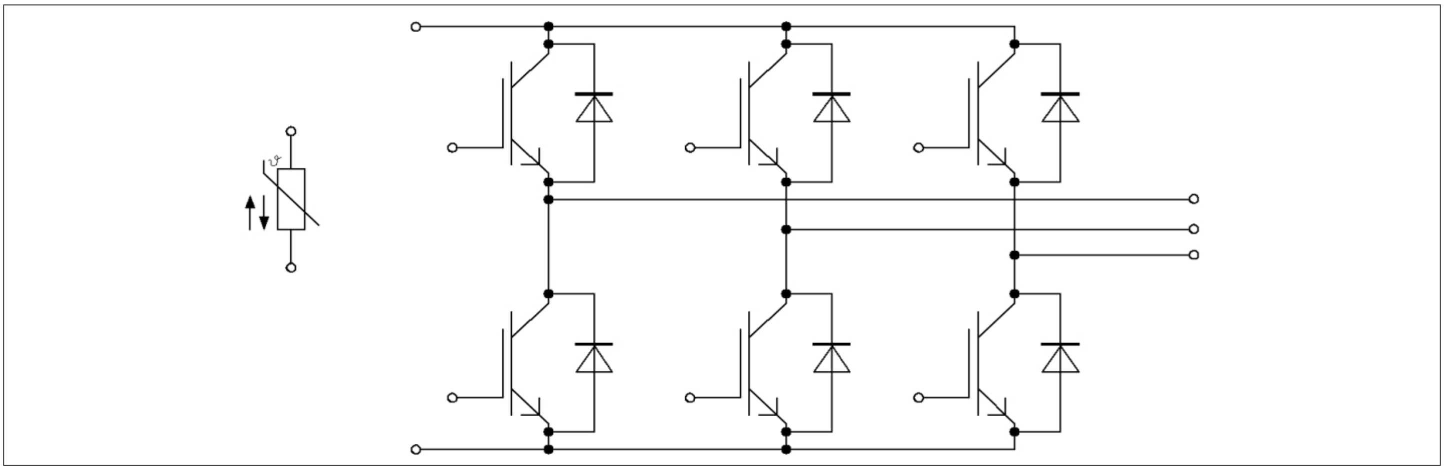
Potential applications

- 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	
RTI Elec.	*RTI*	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Stray inductance module	L_{sCE}				21		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C=25°C, per switch			1.8		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for modul mounting	*M*	- Mounting according to valid application note	M5, Screw	3		6	Nm
Weight	*G*				300		g

Note: *The current under continuous operation is limited to 50 A 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	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 100 °C	185	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		400	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 = 200 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 = 7.6 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.20	5.80	6.40	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CE} = 600 V			1.66		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			3.5		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			14		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.5		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				400	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.1 Ω	T_{vj} = 25 °C		0.140		µs
			T_{vj} = 125 °C		0.150		
			T_{vj} = 150 °C		0.150		
Rise time (inductive load)	t_r	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.1 Ω	T_{vj} = 25 °C		0.030		µs
			T_{vj} = 125 °C		0.035		
			T_{vj} = 150 °C		0.040		
Turn-off delay time (inductive load)	t_{doff}	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.1 Ω	T_{vj} = 25 °C		0.320		µs
			T_{vj} = 125 °C		0.400		
			T_{vj} = 150 °C		0.420		
Fall time (inductive load)	t_f	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.1 Ω	T_{vj} = 25 °C		0.090		µs
			T_{vj} = 125 °C		0.160		
			T_{vj} = 150 °C		0.180		
Turn-on energy loss per pulse	E_{on}	I_C = 200 A, V_{CE} = 600 V, L_σ = 30 nH, V_{GE} = ±15 V, R_{Gon} = 1.1 Ω, di/dt = 5400 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		10.5		mJ
			T_{vj} = 125 °C		18.5		
			T_{vj} = 150 °C		20.5		
Turn-off energy loss per pulse	E_{off}	I_C = 200 A, V_{CE} = 600 V, L_σ = 30 nH, V_{GE} = ±15 V, R_{Goff} = 1.1 Ω, dv/dt = 5000 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		11		mJ
			T_{vj} = 125 °C		16.5		
			T_{vj} = 150 °C		18.5		
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		800		A
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.150	K/W

Table 4 **Characteristic values (continued)**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)		0.0850		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	1200	V
Continous DC forward current	I_F			200	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		400	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	5200	A^2s
			T_{vj} = 150 °C	5000	

Table 6 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	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_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5400 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		240		A
			T_{vj} = 125 °C		250		
			T_{vj} = 150 °C		260		
Recovered charge	Q_r	V_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5400 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		18.5		µC
			T_{vj} = 125 °C		33.5		
			T_{vj} = 150 °C		38.5		
Reverse recovery energy	E_{rec}	V_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5400 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		8.1		mJ
			T_{vj} = 125 °C		14.5		
			T_{vj} = 150 °C		16		
Thermal resistance, junction to case	R_{thJC}	per diode				0.260	K/W

Table 6 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)		0.148		K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

4 NTC-Thermistor

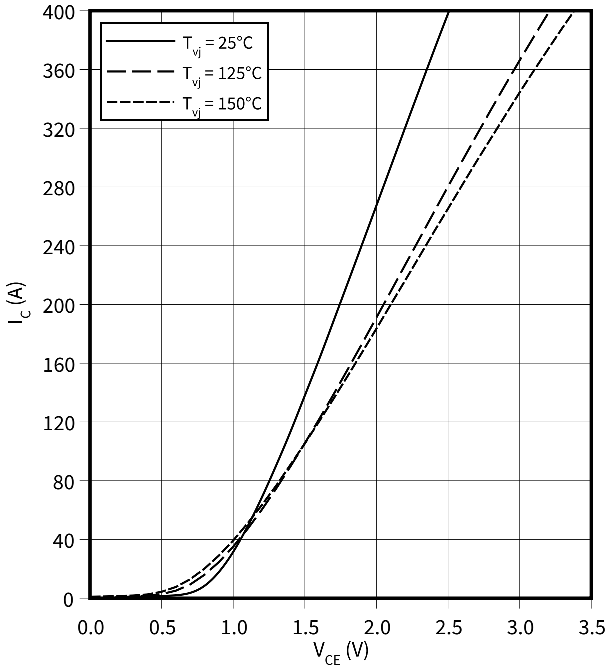
Table 7 Characteristic values

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

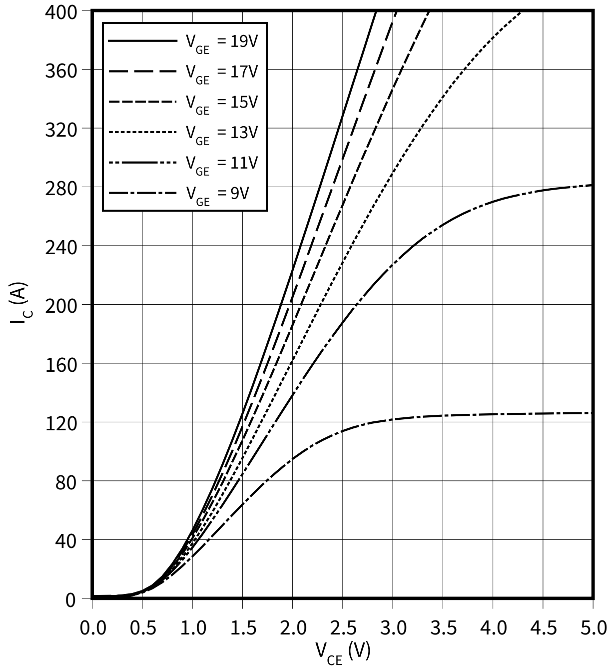
Note: Specification according to the valid application note.

5 Characteristics diagrams

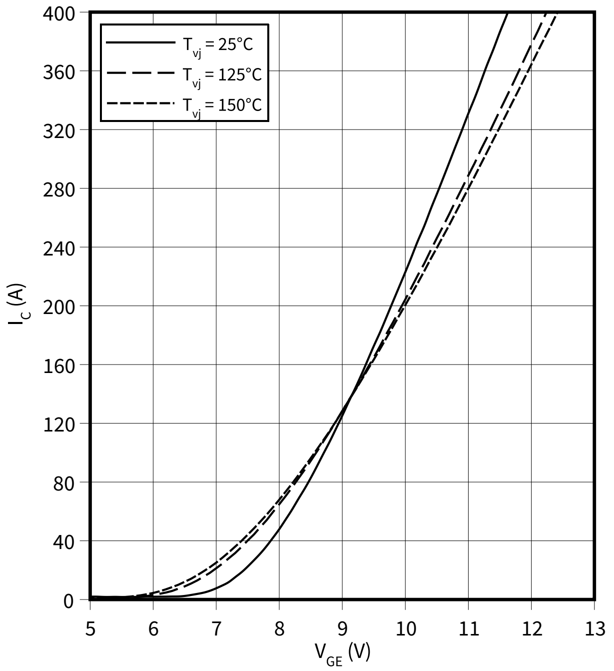
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



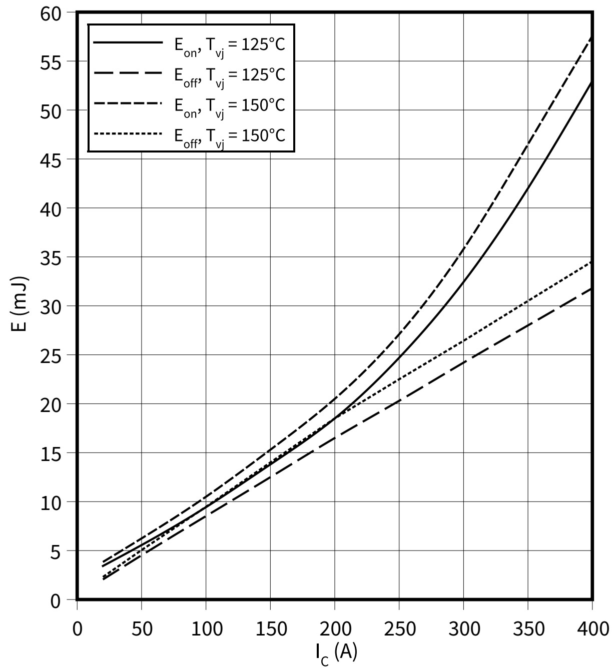
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150$ °C



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



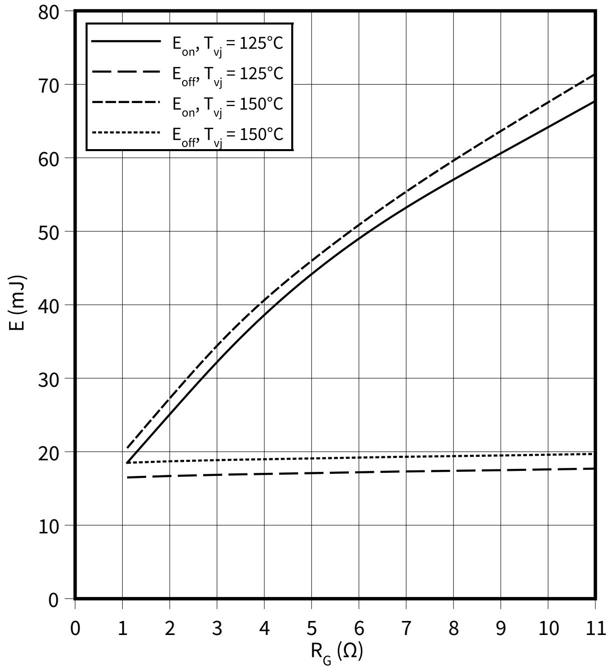
switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 1.1\ \Omega$, $R_{Gon} = 1.1\ \Omega$, $V_{CE} = 600$ V, $V_{GE} = \pm 15$ V



switching losses (typical), IGBT, Inverter

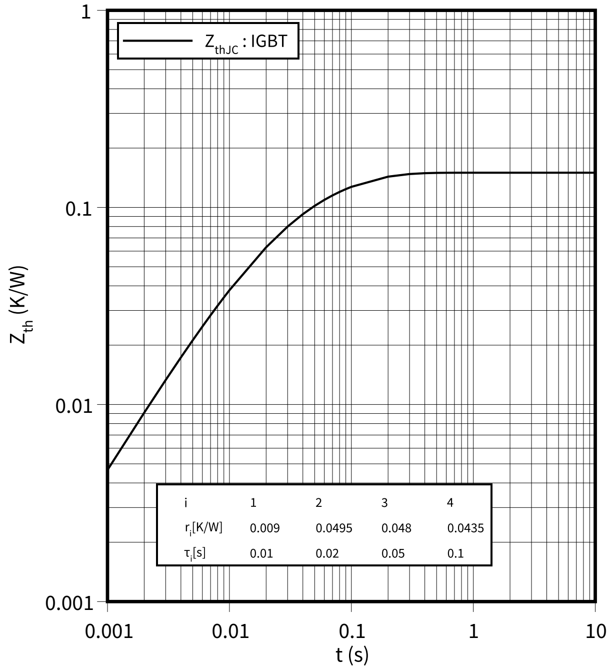
$E = f(R_G)$

$I_C = 200\ A$, $V_{CE} = 600\ V$, $V_{GE} = \pm\ 15\ V$



transient thermal impedance , IGBT, Inverter

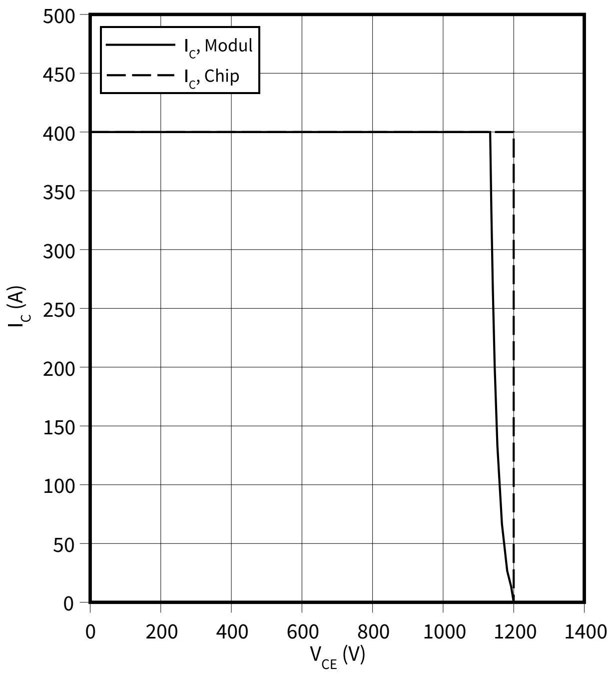
$Z_{th} = f(t)$



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

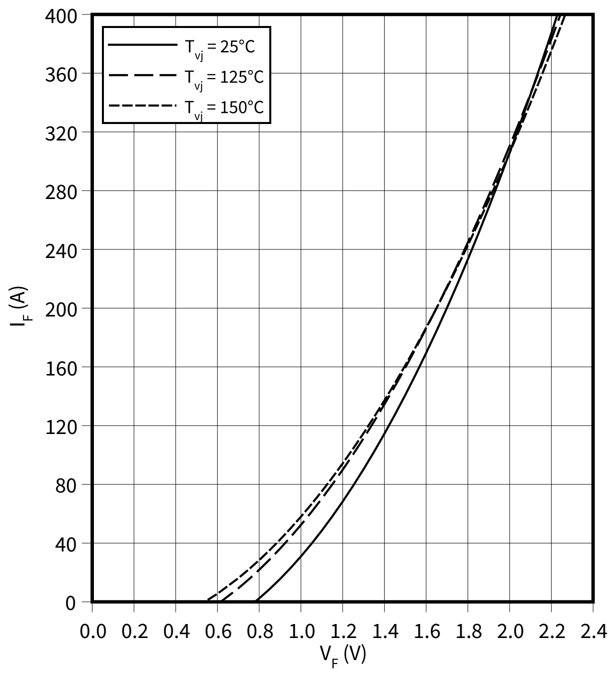
$I_C = f(V_{CE})$

$R_{Goff} = 1.1\ \Omega$, $V_{GE} = \pm 15.0\ V$, $T_{vj} = 150\ °C$



forward characteristic (typical), Diode, Inverter

$I_F = f(V_F)$

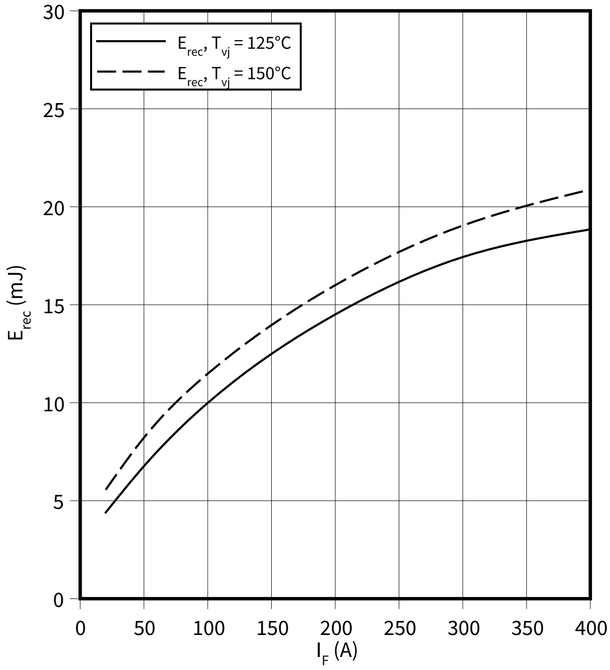


5 Characteristics diagrams

switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

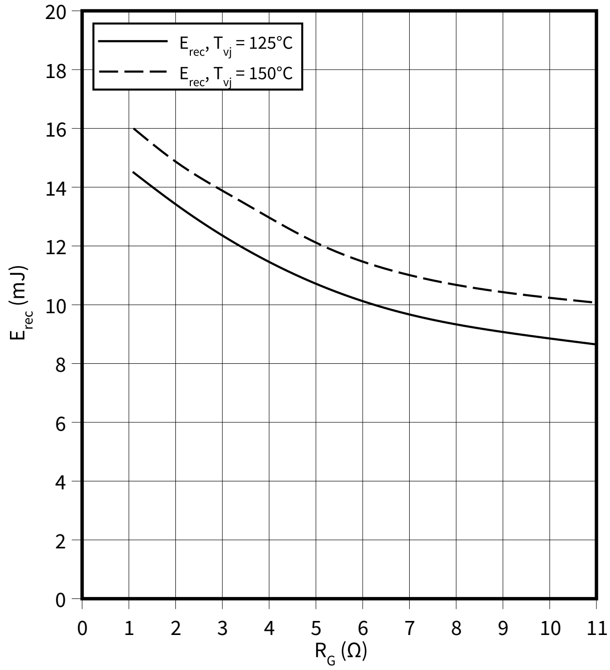
$V_{CE} = 600$ V, $R_{Gon} = R_{Gon}$(IGBT)



switching losses (typical), Diode, Inverter

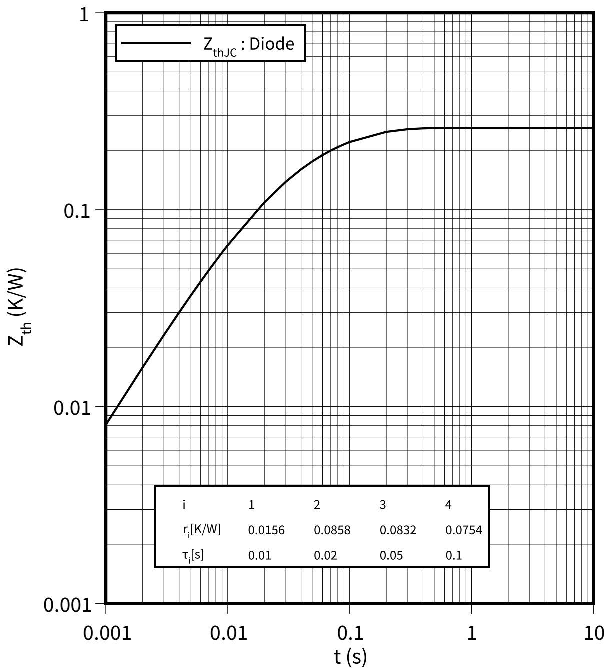
$E_{rec} = f(R_G)$

$V_{CE} = 600$ V, $I_F = 200$ A



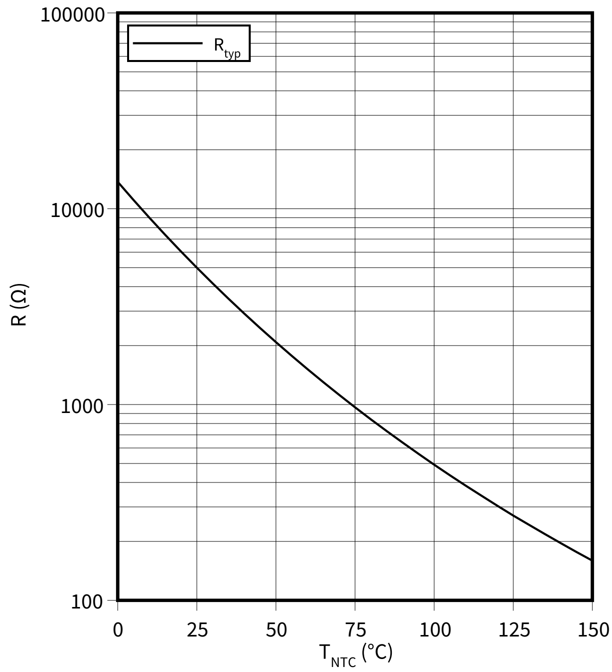
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

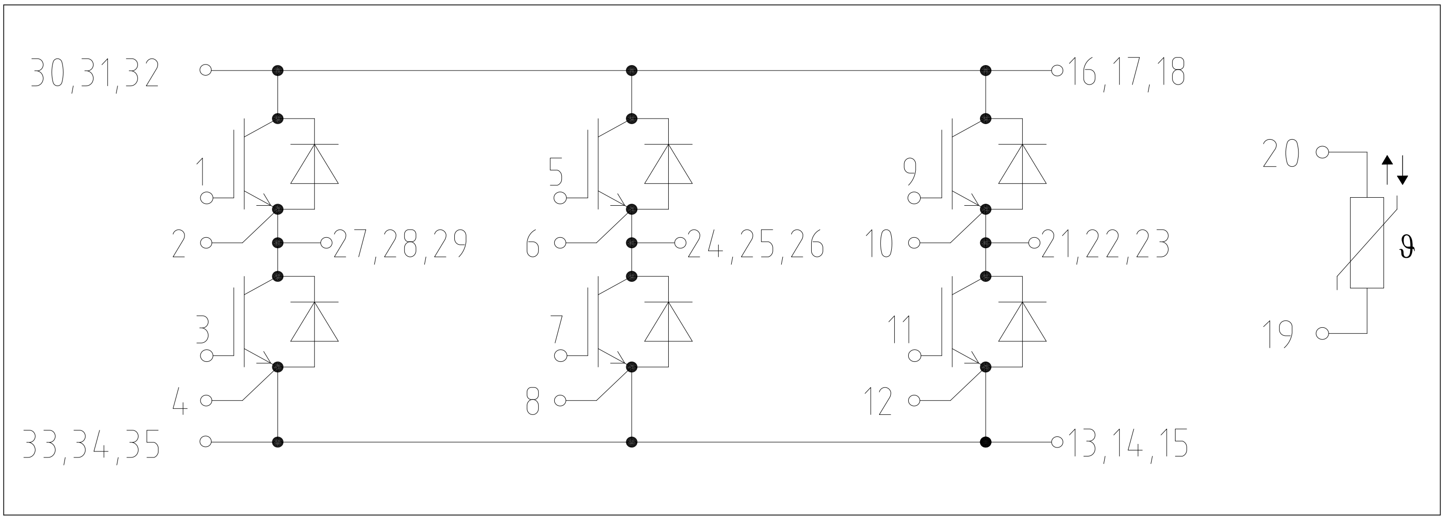
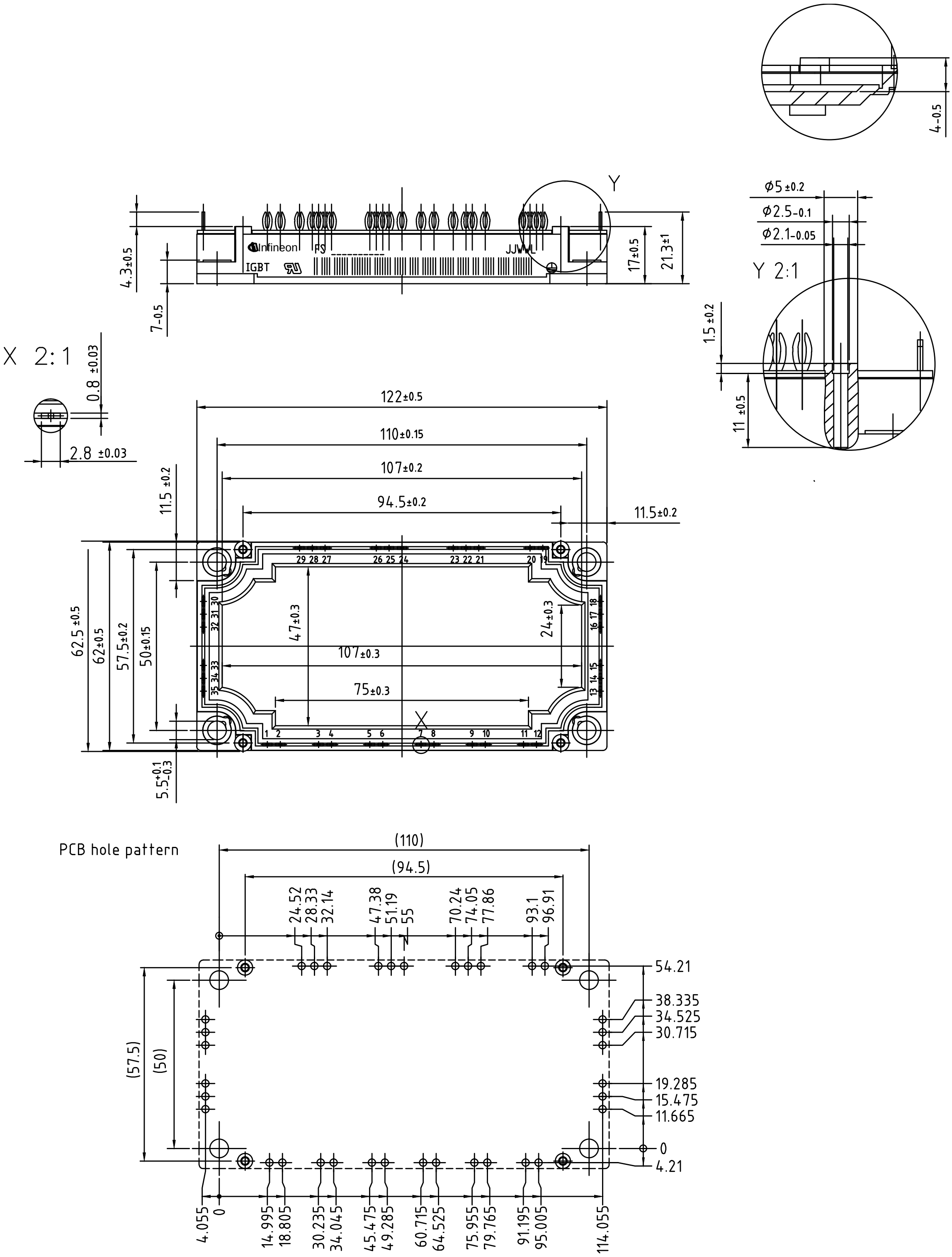


Figure 2

7 Package outlines



- Tolerance of PCB hole pattern ⌖ Ø0.1
- hole specifications see AN 2007-09
- Diameters of plated holes Ø 2.14mm - 2.29mm
- Diameter of drill Ø 2.35mm

Figure 3

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