MIPAQ™base module with Trench/Fieldstop IGBT4 and Emitter Controlled HE diode and NTC / shunt / pre-applied TIM

Features


Typical appearance

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 200 A / I_{CRM} = 400 A
  - Low switching losses
  - Low V_{CEsat}
  - $T_{vj\ op}$ = 150 °C
- Mechanical features
  - High power and thermal cycling capability
  - Isolated base plate
  - Copper base plate
  - Solder contact technology
  - Standard housing
  - Pre-applied Thermal Interface Material

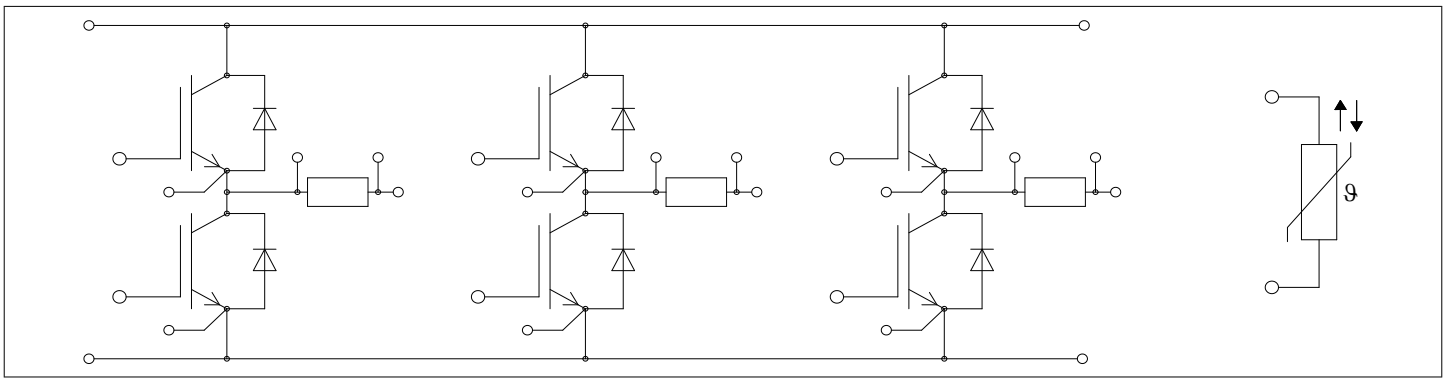
Potential applications

- 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}			20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H=25°C, per switch		1.8		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				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. The shunt value is not a part of the Rcc'+ee' resistance.

Storage and shipment of modules with TIM => see AN2012-07

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_H = 60 °C	200	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		2.00		
			T_{vj} = 150 °C		2.05		
Gate threshold voltage	V_{GEth}	I_C = 7.6 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.25	5.80	6.35	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CE} = 600 V			1.65		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				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 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 Ω	T_{vj} = 25 °C		0.028		µs
			T_{vj} = 125 °C		0.034		
			T_{vj} = 150 °C		0.035		
Turn-off delay time (inductive load)	t_{doff}	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1 Ω	T_{vj} = 25 °C		0.320		µs
			T_{vj} = 125 °C		0.410		
			T_{vj} = 150 °C		0.440		
Fall time (inductive load)	t_f	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1 Ω	T_{vj} = 25 °C		0.043		µs
			T_{vj} = 125 °C		0.079		
			T_{vj} = 150 °C		0.088		
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 Ω, di/dt = 5500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		13		mJ
			T_{vj} = 125 °C		21		
			T_{vj} = 150 °C		23.5		
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 Ω, dv/dt = 3300 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		15.5		mJ
			T_{vj} = 125 °C		24		
			T_{vj} = 150 °C		26.5		
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 heatsink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.227	K/W

Table 4 Characteristic Values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
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	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	7800	A^2s
			T_{vj} = 150 °C	7400	

Table 6 Characteristic Values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 200 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}	I_F = 200 A, V_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		195		A
			T_{vj} = 125 °C		215		
			T_{vj} = 150 °C		220		
Recovered charge	Q_r	I_F = 200 A, V_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		18		µC
			T_{vj} = 125 °C		33		
			T_{vj} = 150 °C		37		
Reverse recovery energy	E_{rec}	I_F = 200 A, V_R = 600 V, V_{GE} = -15 V, -di_F/dt = 5500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		8.85		mJ
			T_{vj} = 125 °C		17.5		
			T_{vj} = 150 °C		20		
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.337	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

4 Shunt

Table 7 Characteristic Values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{20}			0.53		mΩ
Temperature coefficient	*TCR*	T_{Range} = +20/+60 °C			30	ppm/K
Operation temperature	$T_{vj\,op}$				200	°C
Thermal resistance, junction to heatsink	R_{thJH}	per shunt, Valid with IFX pre-applied Thermal Interface Material			7.00	K/W

5 NTC-Thermistor

Table 8 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	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3433		K

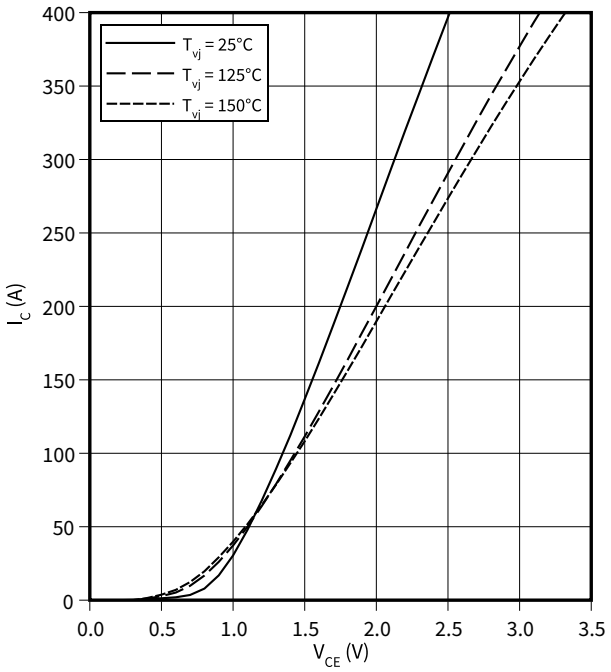
Note: Specification according to the valid application note.

6 Characteristics diagrams

output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

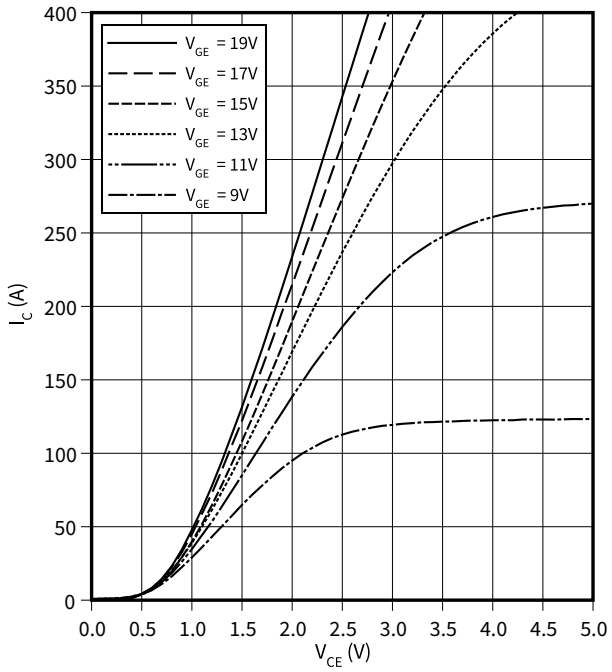
V_{GE} = 15 V



output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

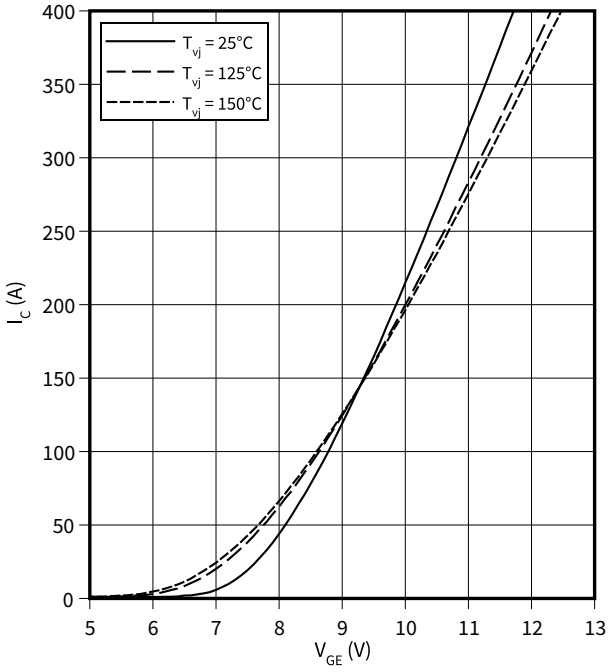
T_{vj} = 150 °C



transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

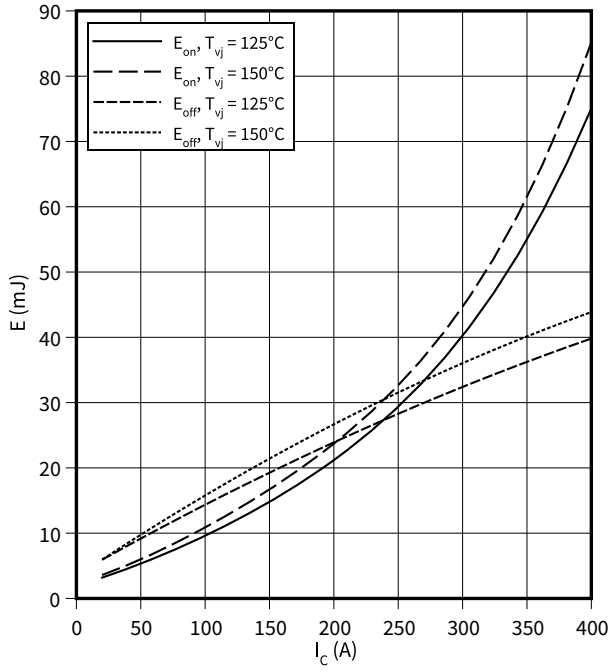
V_{CE} = 20 V



switching losses (typical), IGBT, Inverter

$E = f(I_C)$

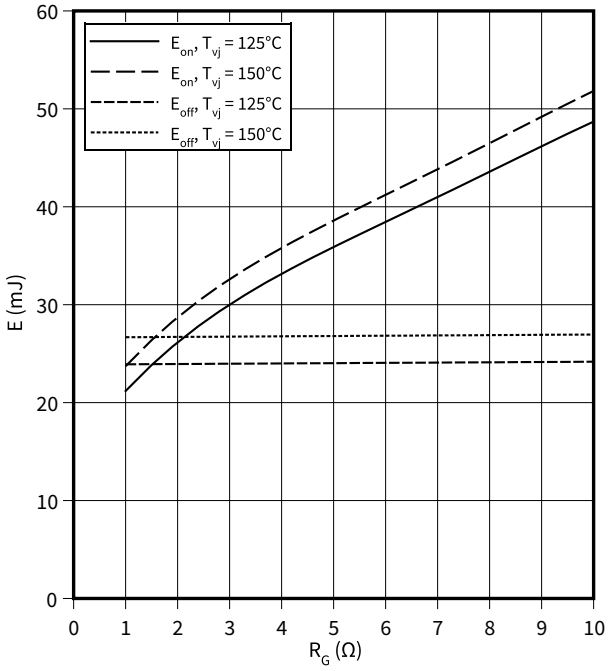
R_{Goff} = 1 Ω, R_{Gon} = 1 Ω, V_{CE} = 600 V, V_{GE} = ± 15 V



switching losses (typical), IGBT, Inverter

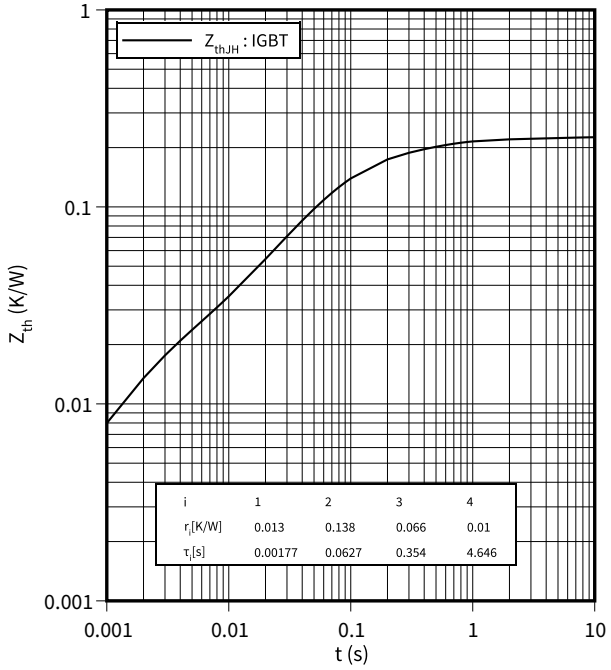
$E = f(R_G)$

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



transient thermal impedance , IGBT, Inverter

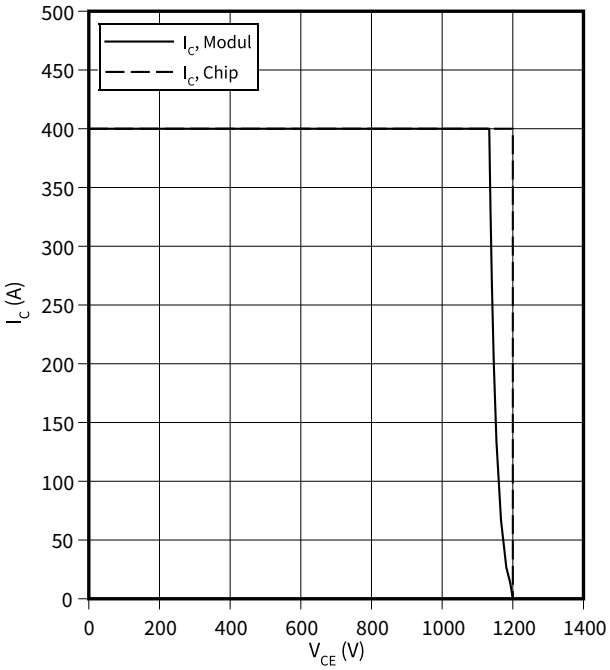
$Z_{th} = f(t)$



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

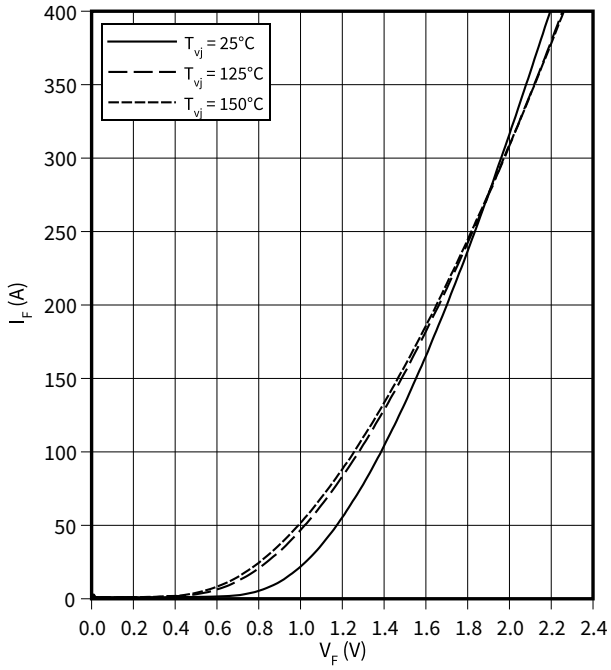
$I_C = f(V_{CE})$

$R_{Goff} = 1\ \Omega, V_{GE} = \pm 15\ V, T_{vj} = 150\ °C$



forward characteristic (typical), Diode, Inverter

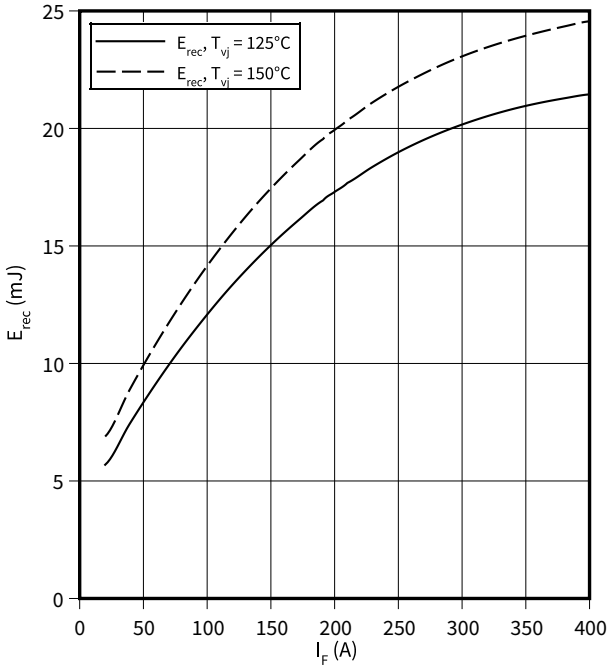
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

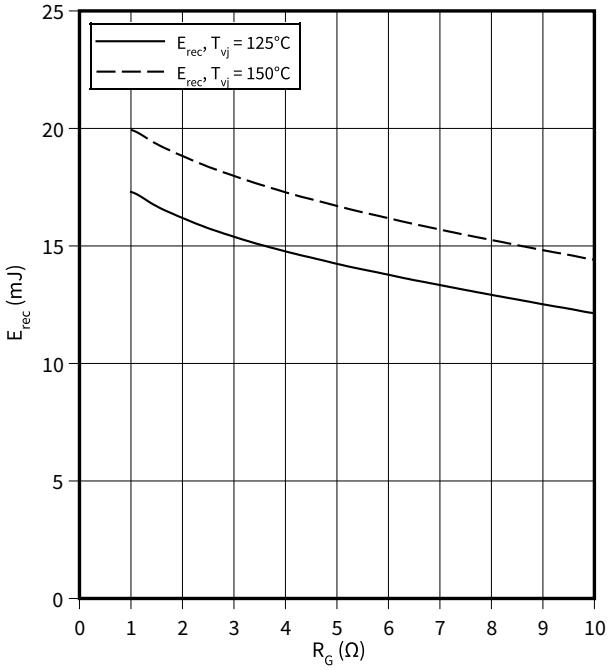
V_{CE} = 600 V, $R_{Gon} = R_{Gon}$(IGBT)



switching losses (typical), Diode, Inverter

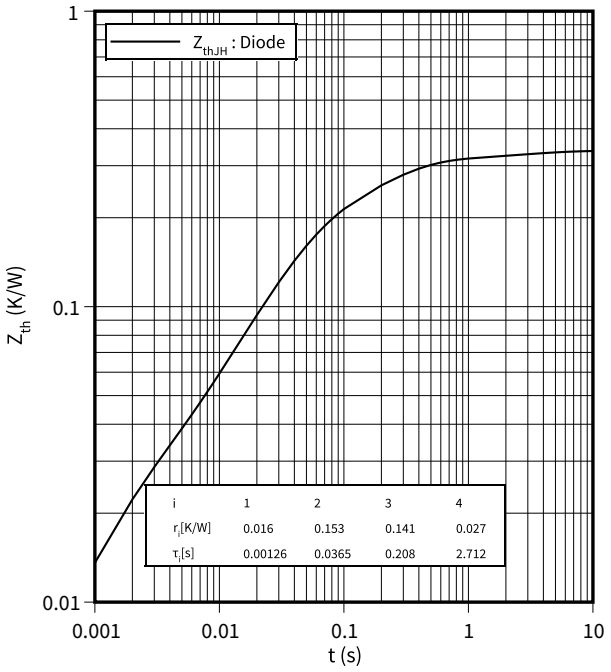
$E_{rec} = f(R_G)$

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



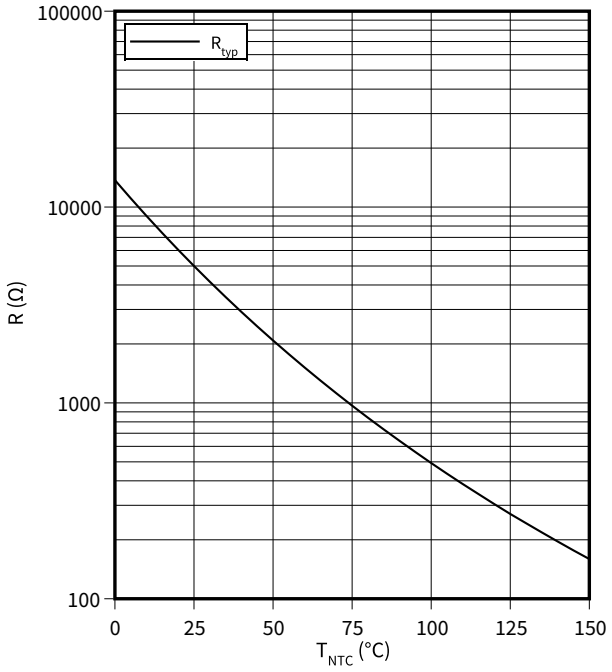
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

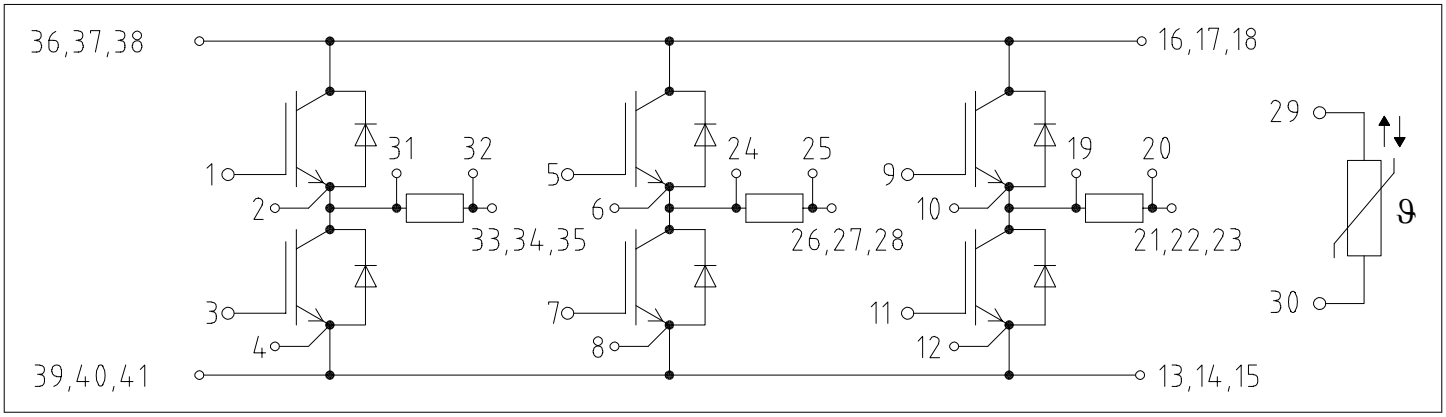


Figure 2

8 Package outlines

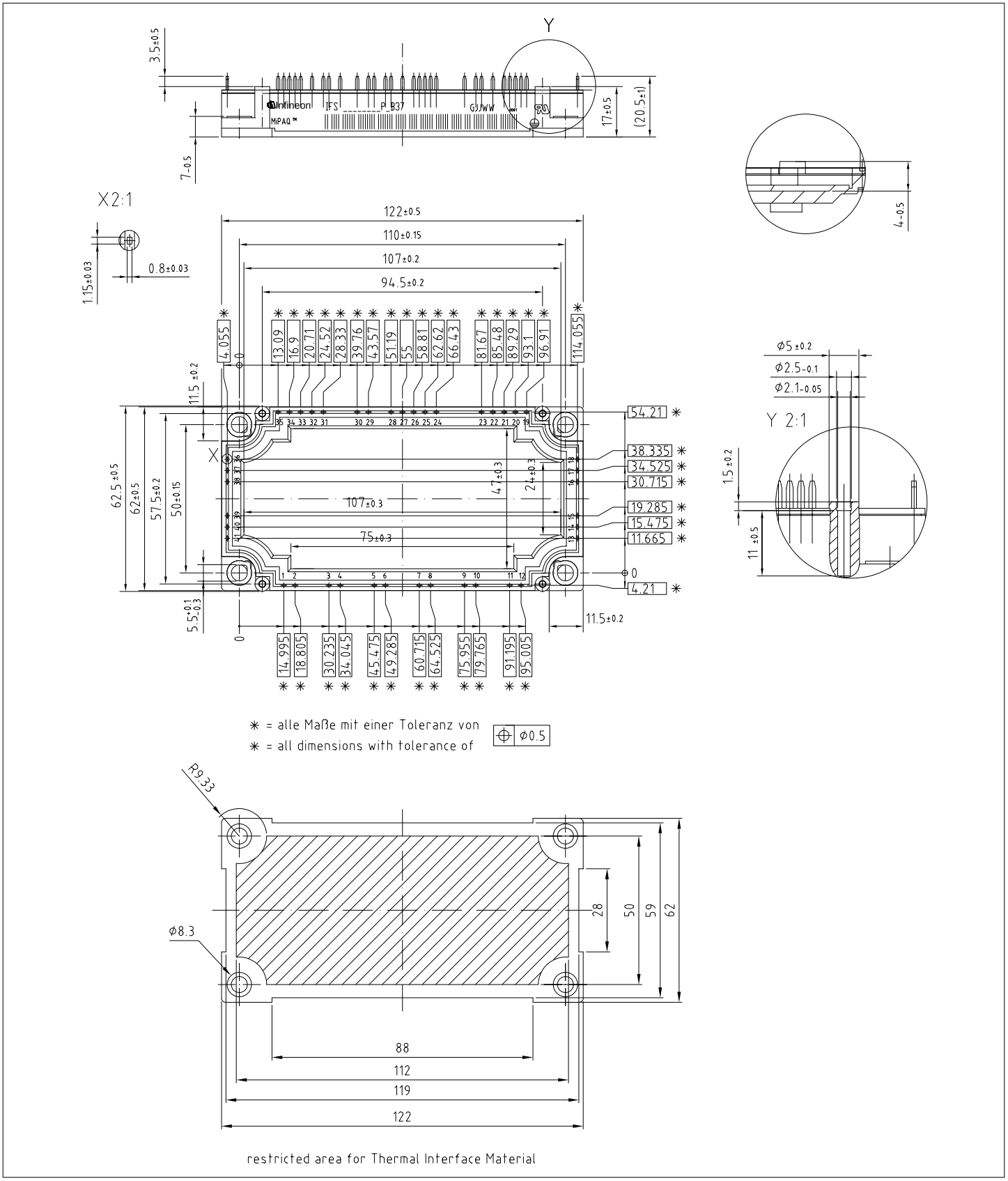


Figure 3

9 Module label code

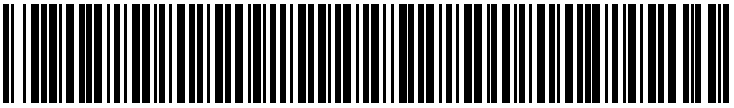
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	 715491428465505499115 30		 715491428465505499115 30

Figure 4

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