

Preliminary datasheet

EconoPACK™2 module and NTC / pre-applied Thermal Interface Material

Features

- Electrical features
 - $V_{CES} = 1700\text{ V}$
 - $I_{C\text{ nom}} = 150\text{ A} / I_{CRM} = 300\text{ A}$
 - High surge current capability
- Mechanical features
 - RoHS compliant
 - PressFIT contact technology
 - Pre-applied Thermal Interface Material
 - High power density
 - Al_2O_3 substrate with low thermal resistance



Potential applications

- Active rectifier
- Half-controlled B6-bridge

Product validation

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

Description

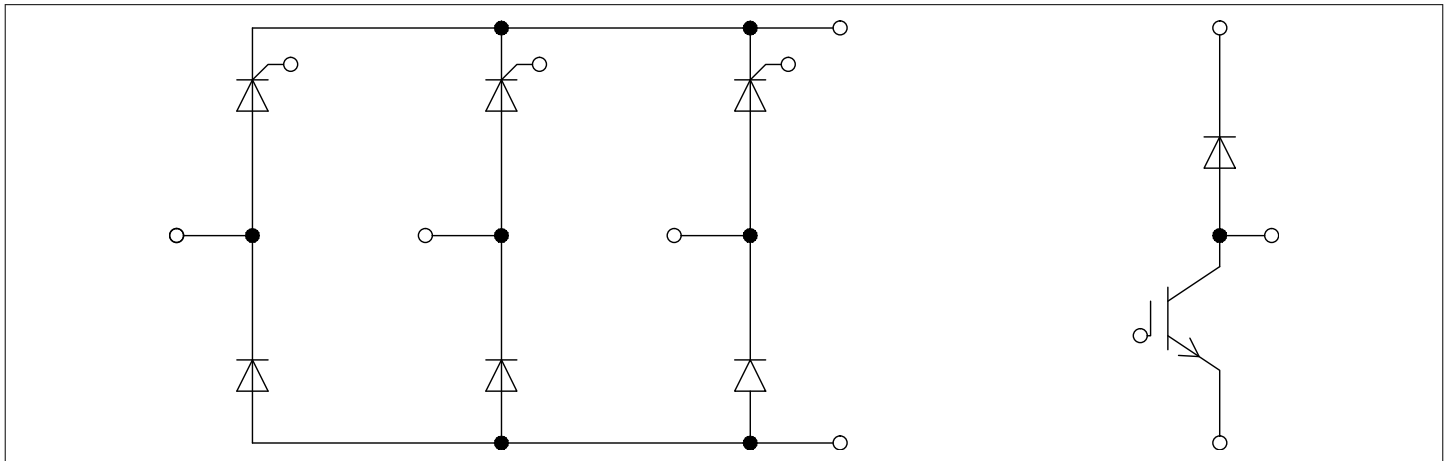


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1 Package

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 60 \text{ s}$	3.4	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}			50		nH
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			180		g

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

2 IGBT, Brake-Chopper

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CES}	$T_{vj} = 25 \text{ °C}$	1700	V
Implemented collector current	I_{CN}		100	A
Continuous DC collector current	I_{CDC}	$T_{vj \max} = 150 \text{ °C}$ $T_H = 65 \text{ °C}$	77	A
Repetitive peak collector current	I_{CRM}	$t_p = 1 \text{ ms}$	200	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	$V_{CE\ sat}$	$I_C = 100\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.95	2.30	V
			$T_{vj} = 125\ ^\circ C$		2.35		
			$T_{vj} = 150\ ^\circ C$		2.45		
Gate threshold voltage	V_{GEth}	$I_C = 4\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		5.20	5.80	6.40	V
Gate charge	Q_G				1.2		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			7.5		Ω
Input capacitance	C_{ies}	$f = 1000\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			9		nF
Reverse transfer capacitance	C_{res}	$f = 1000\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.29		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1700\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 100\ A, V_{CE} = 900\ V, R_{Gon} = 0.91\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.187		μs
			$T_{vj} = 125\ ^\circ C$		0.214		
			$T_{vj} = 150\ ^\circ C$		0.219		
Rise time (inductive load)	t_r	$I_C = 100\ A, V_{CE} = 900\ V, R_{Gon} = 0.91\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.050		μs
			$T_{vj} = 125\ ^\circ C$		0.050		
			$T_{vj} = 150\ ^\circ C$		0.050		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 100\ A, V_{CE} = 900\ V, R_{Goff} = 0.91\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.430		μs
			$T_{vj} = 125\ ^\circ C$		0.580		
			$T_{vj} = 150\ ^\circ C$		0.610		
Fall time (inductive load)	t_f	$I_C = 100\ A, V_{CE} = 900\ V, R_{Goff} = 0.91\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.260		μs
			$T_{vj} = 125\ ^\circ C$		0.500		
			$T_{vj} = 150\ ^\circ C$		0.590		
Turn-on energy loss per pulse	E_{on}	$I_C = 100\ A, V_{CE} = 900\ V, L_\sigma = 50\ nH, R_{Gon} = 0.91\ \Omega, di/dt = 1600\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		20.3		mJ
			$T_{vj} = 125\ ^\circ C$		23		
			$T_{vj} = 150\ ^\circ C$		24.2		
Turn-off energy loss per pulse	E_{off}	$I_C = 100\ A, V_{CE} = 900\ V, L_\sigma = 50\ nH, R_{Goff} = 0.91\ \Omega, dv/dt = 3000\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		18.8		mJ
			$T_{vj} = 125\ ^\circ C$		30.7		
			$T_{vj} = 150\ ^\circ C$		34.5		
SC data	I_{SC}	$V_{GE} \leq 15\ V, V_{CC} = 1000\ V, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt, t_p \leq 10\ \mu s, T_{vj} \leq 150\ ^\circ C$			450		A
Thermal resistance, junction to heatsink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.445	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, Brake-Chopper

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\ ^\circ\text{C}$	1700	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	$V_R = 0\ \text{V}, t_p = 10\ \text{ms}$	$T_{vj} = 125\ ^\circ\text{C}$	310	A^2s
			$T_{vj} = 150\ ^\circ\text{C}$	260	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 50\ \text{A}$	$T_{vj} = 25\ ^\circ\text{C}$		1.80	2.35	V
			$T_{vj} = 125\ ^\circ\text{C}$		1.90		
			$T_{vj} = 150\ ^\circ\text{C}$		1.95		
Peak reverse recovery current	I_{RM}	$I_F = 50\ \text{A}, V_R = 900\ \text{V}, V_{GE} = -15\ \text{V}, -di_F/dt = 1600\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$		52.6		A
			$T_{vj} = 125\ ^\circ\text{C}$		60.5		
			$T_{vj} = 150\ ^\circ\text{C}$		63.7		
Recovered charge	Q_r	$I_F = 50\ \text{A}, V_R = 900\ \text{V}, V_{GE} = -15\ \text{V}, -di_F/dt = 1600\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$		10		μC
			$T_{vj} = 125\ ^\circ\text{C}$		17		
			$T_{vj} = 150\ ^\circ\text{C}$		19.5		
Reverse recovery energy	E_{rec}	$I_F = 50\ \text{A}, V_R = 900\ \text{V}, V_{GE} = -15\ \text{V}, -di_F/dt = 1600\ \text{A}/\mu\text{s} (T_{vj} = 150\ ^\circ\text{C})$	$T_{vj} = 25\ ^\circ\text{C}$		5.9		mJ
			$T_{vj} = 125\ ^\circ\text{C}$		10.2		
			$T_{vj} = 150\ ^\circ\text{C}$		11.9		
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.879	K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°C

4 Thyristor, Rectifier

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ }^{\circ}\text{C}$	2200	V
Repetitive peak off-state voltage	V_{DRM}		$T_{vj} = 25\text{ }^{\circ}\text{C}$	2200	V
Maximum RMS current at rectifier output	I_{RMSmax}	$T_H = 90\text{ }^{\circ}\text{C}$		150	A
Maximum RMS forward current per chip	I_{FRMSM}	$T_H = 90\text{ }^{\circ}\text{C}$		87	A
Surge forward current	I_{FSM}	$t_P = 10\text{ ms}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	870	A
			$T_{vj} = 125\text{ }^{\circ}\text{C}$	800	
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	770	
I^2t - value	I^2t	$t_P = 10\text{ ms}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	3780	A^2s
			$T_{vj} = 125\text{ }^{\circ}\text{C}$	3200	
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	2960	
Critical rate of rise of on-state current	$(di/dt)_{cr}$	DIN IEC 60 754-6, $f = 50\text{ Hz}$, $i_{GM} = 0.5\text{ A}$, $di_G/dt = 0.5\text{ A}/\mu s$	$T_{vj} = 150\text{ }^{\circ}\text{C}$	150	$A/\mu s$
Critical rate of rise of off-state voltage	$(dv/dt)_{cr}$	$V_D/V_{DRM} = 0.67$	$T_{vj} = 150\text{ }^{\circ}\text{C}$	1000	$V/\mu s$

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_T	$I_T = 100\text{ A}$	$T_{vj} = 25\text{ °C}$		1.3		V
			$T_{vj} = 125\text{ °C}$		1.3		
			$T_{vj} = 150\text{ °C}$		1.35		
Gate trigger current	I_{gt}	$V_d = 6\text{ V}$	$T_{vj} = 25\text{ °C}$			70	mA
Gate trigger voltage	V_{gt}	$V_d = 6\text{ V}$	$T_{vj} = 25\text{ °C}$			1.5	V
Gate non-trigger current	I_{gd}	$V_D/V_{DRM} = 0.67$	$T_{vj} = 150\text{ °C}$			5.0	mA
Gate non-trigger voltage	V_{gd}	$V_D/V_{DRM} = 0.67$	$T_{vj} = 150\text{ °C}$			0.2	V
Holding current	I_H	$V_d = 6\text{ V}$	$T_{vj} = 25\text{ °C}$			100	mA
Latching current	I_L	$R_{GK} \geq 20\text{ }\Omega$, $i_{GM} = 0.5\text{ A}$, $t_g = 10\text{ }\mu s$	$T_{vj} = 25\text{ °C}$			250	mA
Gate controlled delay time	t_{gd}	DIN IEC 747-6, $i_{GM} = 0.5\text{ A}$, $di_G/dt = 0.5\text{ A}/\mu s$	$T_{vj} = 25\text{ °C}$			2.0	μs

Table 8 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Circuit commutated turn-off time	t_q	$I_{TM} = 144 \text{ A}$, $V_{RM} = 100 \text{ V}$, $V_{DM}/V_{DRM} = 0.50$, $dv_D/dt = 20 \text{ V}/\mu\text{s}$, $-di_T/dt = 10 \text{ A}/\mu\text{s}$		150		μs
Reverse current	I_r	$T_{vj} = 25 \text{ }^\circ\text{C}$, $V_R = 2200 \text{ V}$			0.5	mA
		$T_{vj} = 150 \text{ }^\circ\text{C}$, $V_R = 1250 \text{ V}$			10	
Thermal resistance, junction to heatsink	R_{thJH}	per Thyristor, Valid with IFX pre-applied Thermal Interface Material			0.592	K/W
Temperature under switching conditions	$T_{vj, op}$		-40		150	$^\circ\text{C}$

Note: Thyristors are qualified to only operate for a short time in forward blocking mode according to standard IEC60747-2 for diodes.

5 Diode, Rectifier

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25 \text{ }^\circ\text{C}$		2200	V
Maximum RMS forward current per chip	I_{FRMSM}	$T_H = 90 \text{ }^\circ\text{C}$		87	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_H = 90 \text{ }^\circ\text{C}$		150	A
Surge forward current	I_{FSM}	$t_p = 10 \text{ ms}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1450	A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1160	
			$T_{vj} = 150 \text{ }^\circ\text{C}$	1150	
I^2t - value	I^2t	$t_p = 10 \text{ ms}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	10500	A^2s
			$T_{vj} = 125 \text{ }^\circ\text{C}$	6730	
			$T_{vj} = 150 \text{ }^\circ\text{C}$	6610	

Table 10 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 110 \text{ A}$	$T_{vj} = 25 \text{ °C}$		1.10		V
			$T_{vj} = 125 \text{ °C}$		1.00		
			$T_{vj} = 150 \text{ °C}$		1.00		
Reverse current	I_r	$T_{vj} = 150 \text{ °C}, V_R = 1760 \text{ V}$			0.3		mA
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.548	K/W
Temperature under switching conditions	$T_{vj, op}$			-40		150	°C

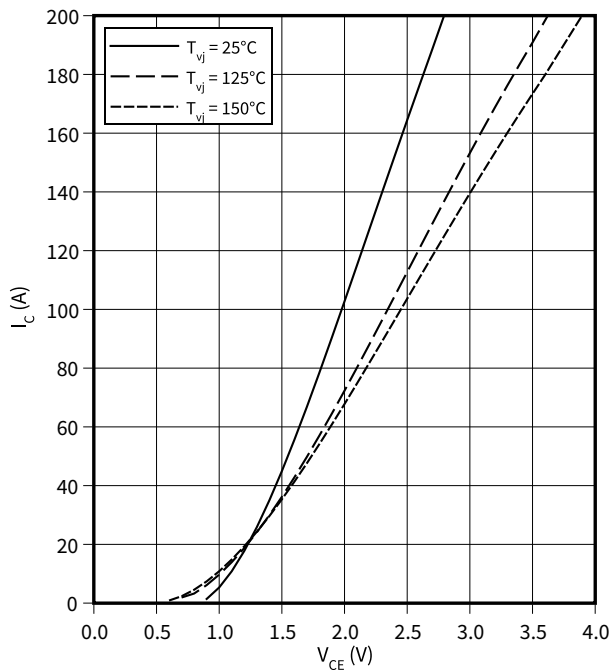
6 Characteristics diagrams

6 Characteristics diagrams

output characteristic (typical), IGBT, Brake-Chopper

$I_C = f(V_{CE})$

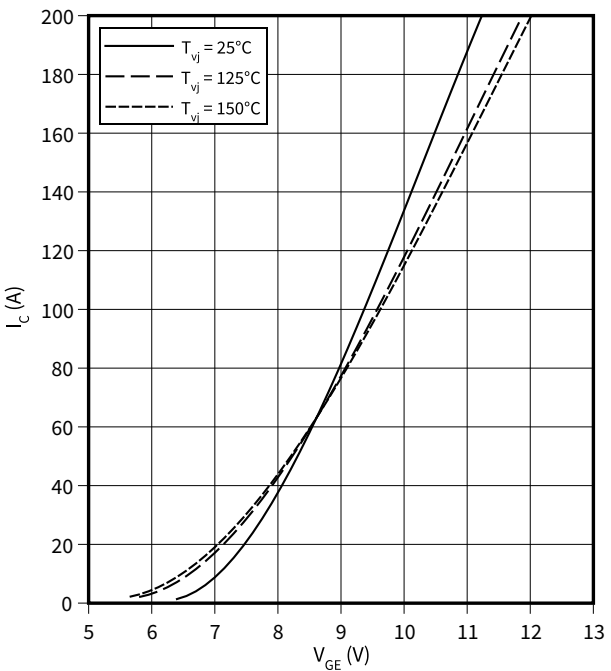
$V_{GE} = 15\text{ V}$



transfer characteristic (typical), IGBT, Brake-Chopper

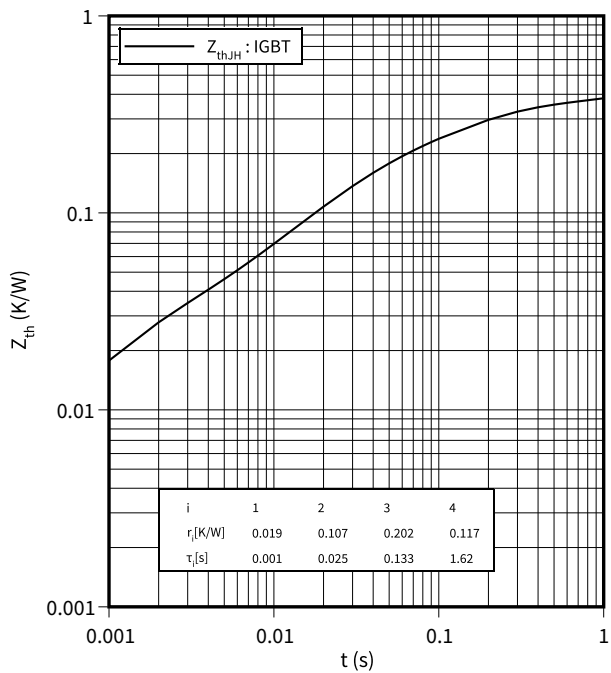
$I_C = f(V_{GE})$

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



transient thermal impedance , IGBT, Brake-Chopper

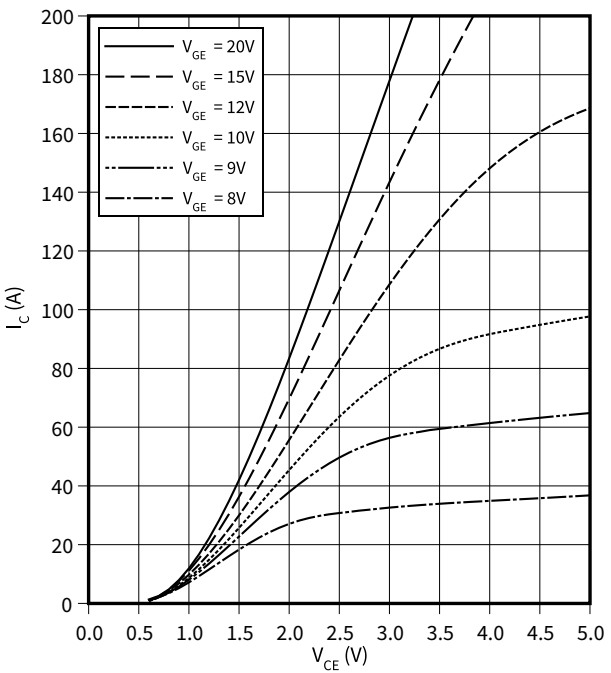
$Z_{th} = f(t)$



output characteristic (typical), IGBT, Brake-Chopper

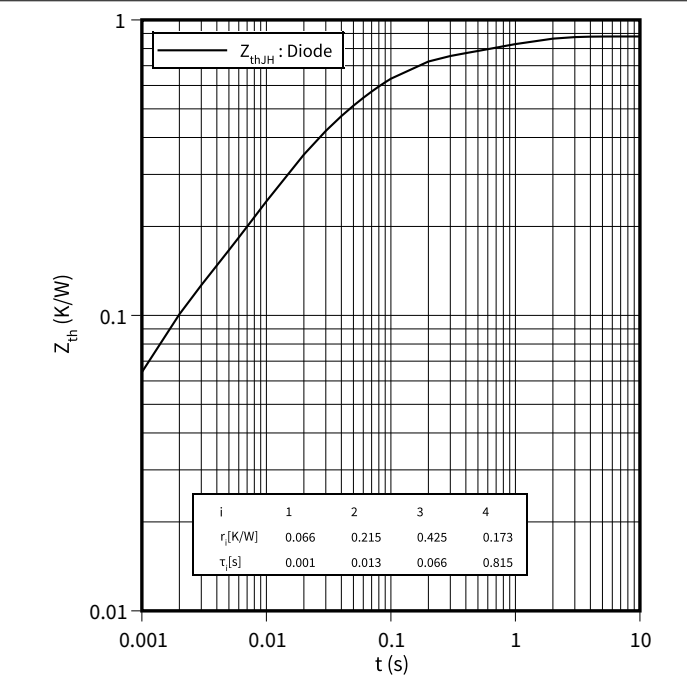
$I_C = f(V_{CE})$

$T_{vj} = 150\text{ °C}$

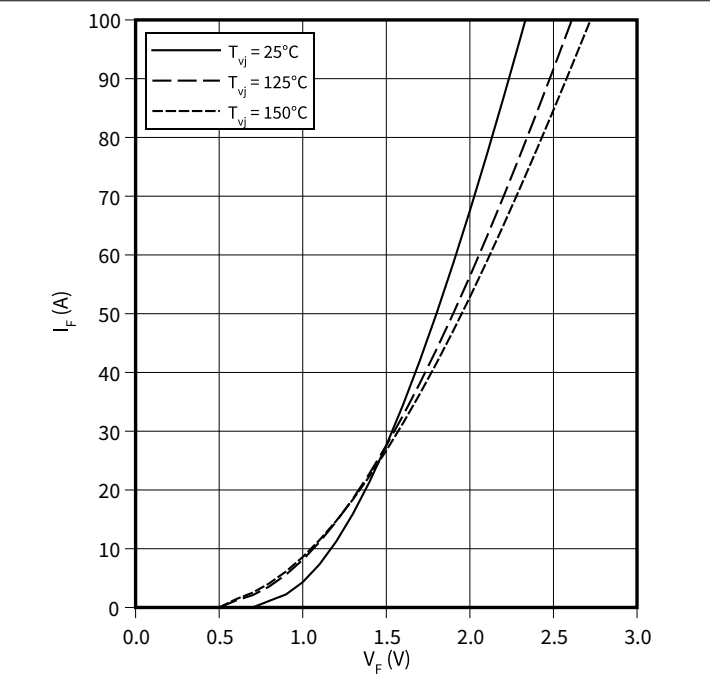


6 Characteristics diagrams

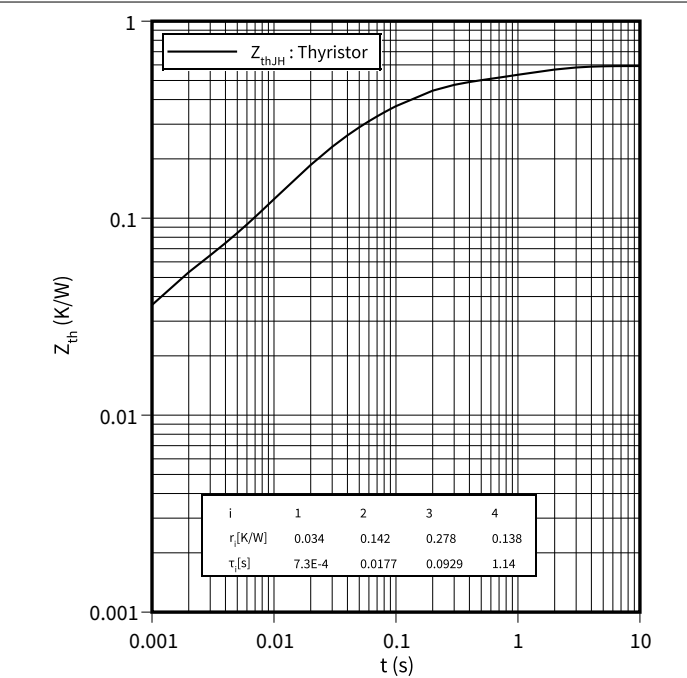
transient thermal impedance , Diode, Brake-Chopper
 $Z_{th} = f(t)$



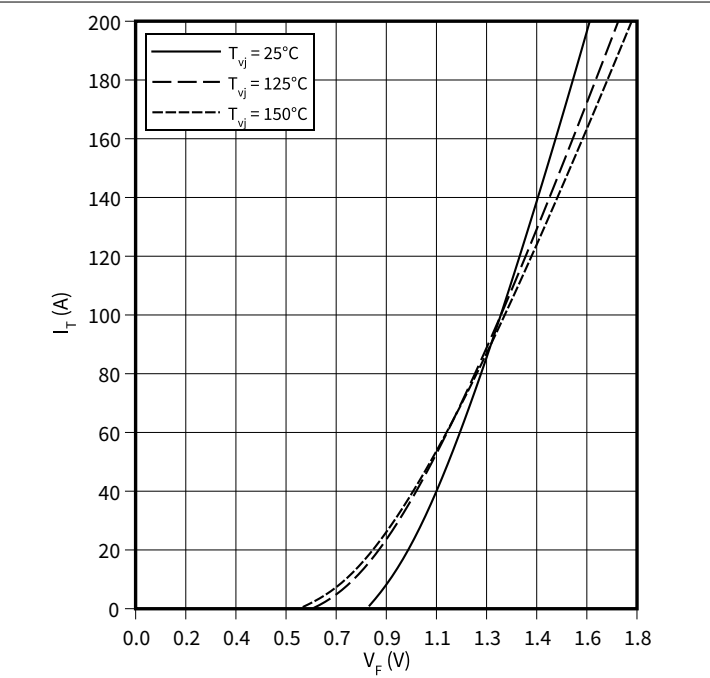
forward characteristic of (typical), Diode, Brake-Chopper
 $I_F = f(V_F)$



Transient thermal impedance, Thyristor, Rectifier
 $Z_{th} = f(t)$



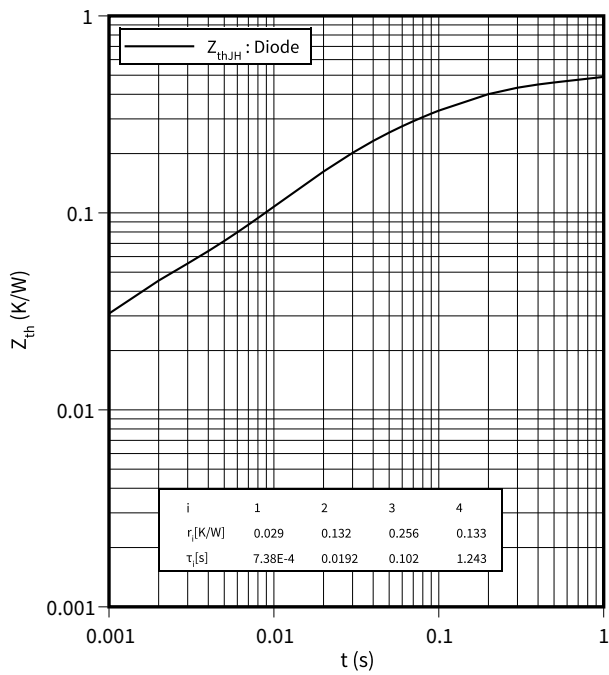
Forward characteristic (typical), Thyristor, Rectifier
 $I_T = f(V_F)$



6 Characteristics diagrams

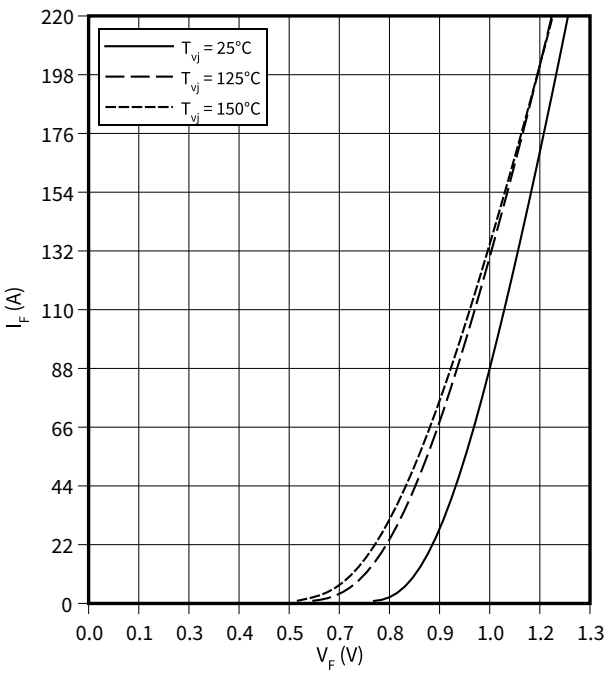
Transient thermal impedance, Diode, Rectifier

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



7 **Circuit diagram**

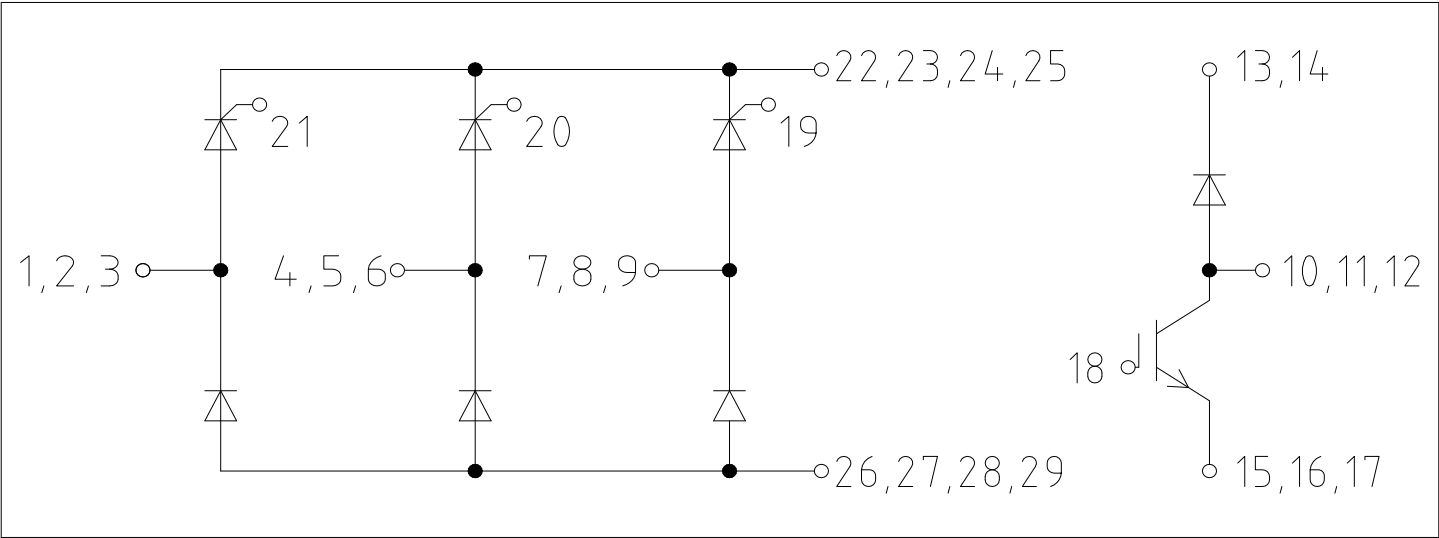


Figure 2

8 Package outlines

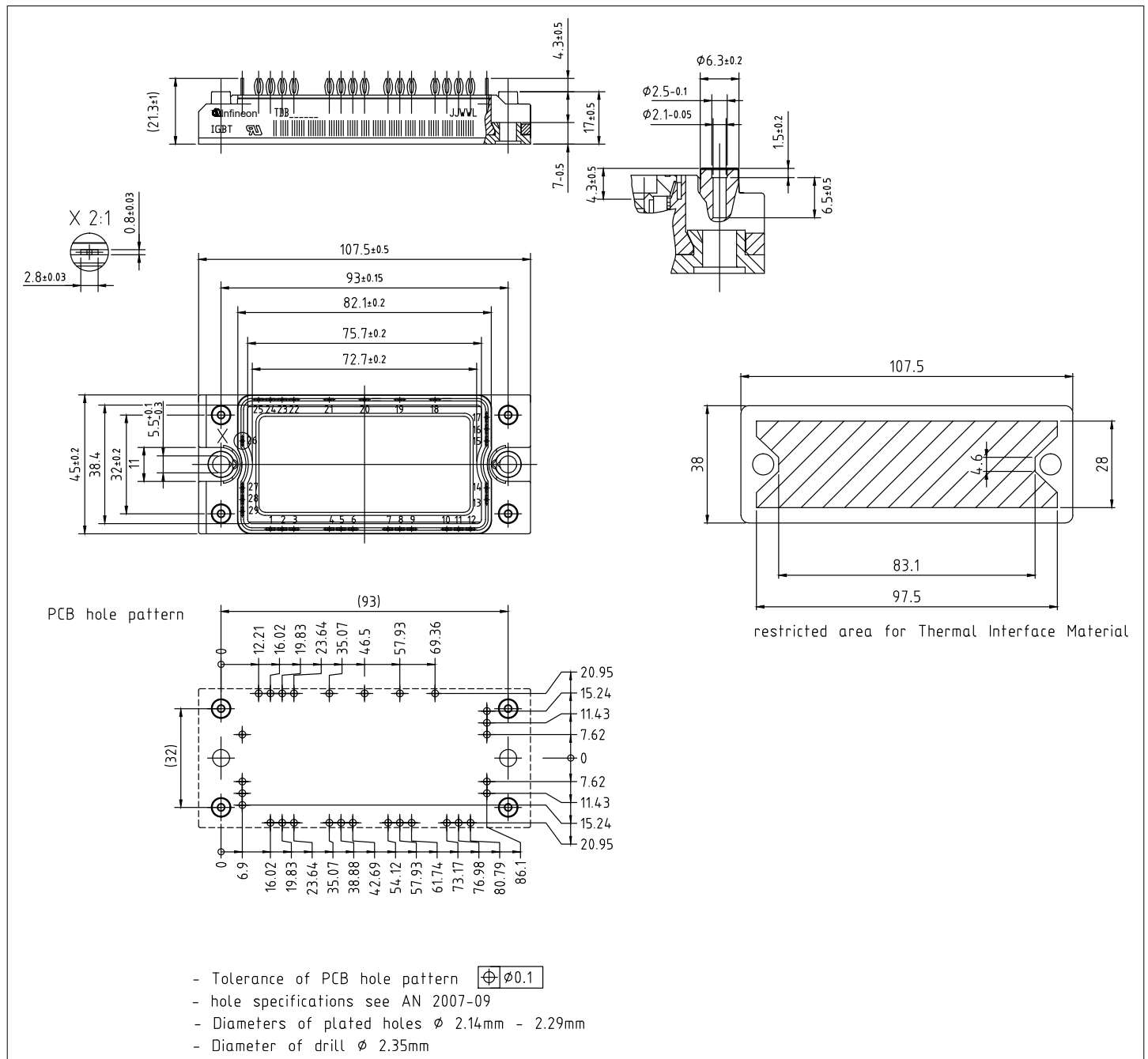


Figure 3

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	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	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 4

Revision history

Revision history

Document revision	Date of release	Description of changes
0.10	2021-06-17	Target datasheet
0.20	2021-07-16	Preliminary datasheet

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