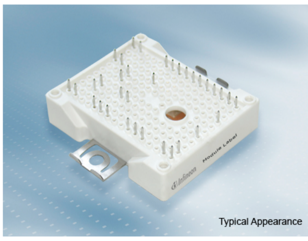
EasyPACK™ module with Trench/Fieldstop IGBT4 and emitter controlled 4 diode and PressFIT / NTC / TIM

Features



- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\,nom}$ = 75 A / I_{CRM} = 150 A
  - Low switching losses
  - Low $V_{CE,sat}$
- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - PressFIT contact technology
  - Rugged mounting due to integrated mounting clamps
  - Compact design
  - Pre-applied thermal interface material

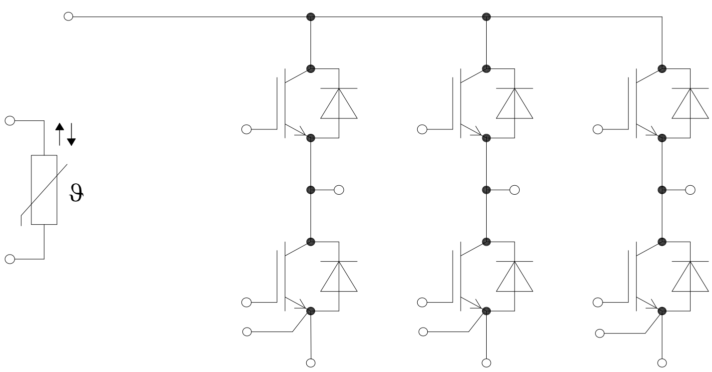
Potential applications

- UPS systems
- 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	4.0	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.5	mm
Creepage distance	d_{Creep}	terminal to terminal	6.3	mm
Clearance	d_{Clear}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to terminal	5.0	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}			40		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H=25°C, per switch		4		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				125	°C
Mounting force per clamp	*F*		40		80	N
Weight	*G*			42		g

Note: The current under continuous operation is limited to 25 A_{rms} per connector pin.
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	1700	V
Implemented collector current	I_{CN}			75	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 150 °C	T_H = 65 °C	45	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$	150	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	$V_{CE\ sat}$	$I_C = 75$ A, $V_{GE} = 15$ V	$T_{vj} = 25$ °C		1.95	2.30	V
			$T_{vj} = 125$ °C		2.35		
			$T_{vj} = 150$ °C		2.45		
Gate threshold voltage	V_{GEth}	$I_C = 3$ mA, $V_{CE} = V_{GE}$, $T_{vj} = 25$ °C		5.35	5.80	6.25	V
Gate charge	Q_G	$V_{GE} = ±15$ V, $V_{CC} = 900$ V			0.9		µC
Internal gate resistor	R_{Gint}	$T_{vj} = 25$ °C			8.5		Ω
Input capacitance	C_{ies}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			6.8		nF
Reverse transfer capacitance	C_{res}	$f = 1000$ kHz, $T_{vj} = 25$ °C, $V_{CE} = 25$ V, $V_{GE} = 0$ V			0.22		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1700$ V, $V_{GE} = 0$ V	$T_{vj} = 25$ °C			35	µA
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}	$I_C = 75$ A, $V_{CC} = 900$ V, $V_{GE} = ±15$ V, $R_{Gon} = 1$ Ω	$T_{vj} = 25$ °C		0.170		µs
			$T_{vj} = 125$ °C		0.188		
			$T_{vj} = 150$ °C		0.193		
Rise time (inductive load)	t_r	$I_C = 75$ A, $V_{CC} = 900$ V, $V_{GE} = ±15$ V, $R_{Gon} = 1$ Ω	$T_{vj} = 25$ °C		0.031		µs
			$T_{vj} = 125$ °C		0.035		
			$T_{vj} = 150$ °C		0.036		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 75$ A, $V_{CC} = 900$ V, $V_{GE} = ±15$ V, $R_{Goff} = 1$ Ω	$T_{vj} = 25$ °C		0.405		µs
			$T_{vj} = 125$ °C		0.532		
			$T_{vj} = 150$ °C		0.568		
Fall time (inductive load)	t_f	$I_C = 75$ A, $V_{CC} = 900$ V, $V_{GE} = ±15$ V, $R_{Goff} = 1$ Ω	$T_{vj} = 25$ °C		0.288		µs
			$T_{vj} = 125$ °C		0.526		
			$T_{vj} = 150$ °C		0.598		
Turn-on energy loss per pulse	E_{on}	$I_C = 75$ A, $V_{CC} = 900$ V, $L_\sigma = 35$ nH, $V_{GE} = ±15$ V, $R_{Gon} = 1$ Ω, di/dt = 1800 A/µs ($T_{vj} = 150$ °C)	$T_{vj} = 25$ °C		17.8		mJ
			$T_{vj} = 125$ °C		24.8		
			$T_{vj} = 150$ °C		27.3		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-off energy loss per pulse	E_{off}	I_C = 75 A, V_{CC} = 900 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 1 Ω, dv/dt = 3050 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		15.7		mJ
			T_{vj} = 125 °C		25.4		
			T_{vj} = 150 °C		28.2		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 1000 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 10 µs, T_{vj}=150 °C		350		A
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.632	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	1700	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	425	A^2s
			T_{vj} = 150 °C	390	

Table 6 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		1.80	2.20	V
			T_{vj} = 125 °C		1.90		
			T_{vj} = 150 °C		1.95		
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 50 A, V_{GE} = -15 V, -di_F/dt = 1600 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		145		A
			T_{vj} = 125 °C		152		
			T_{vj} = 150 °C		154		
Recovered charge	Q_r	V_{CC} = 900 V, I_F = 50 A, V_{GE} = -15 V, -di_F/dt = 1600 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		12.6		µC
			T_{vj} = 125 °C		19		
			T_{vj} = 150 °C		21.6		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Reverse recovery energy	E_{rec}	V_{CC} = 900 V, I_F = 50 A, V_{GE} = -15 V, -di_F/dt = 1600 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		9.1		mJ
			T_{vj} = 125 °C		15.8		
			T_{vj} = 150 °C		17.9		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				1.16	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

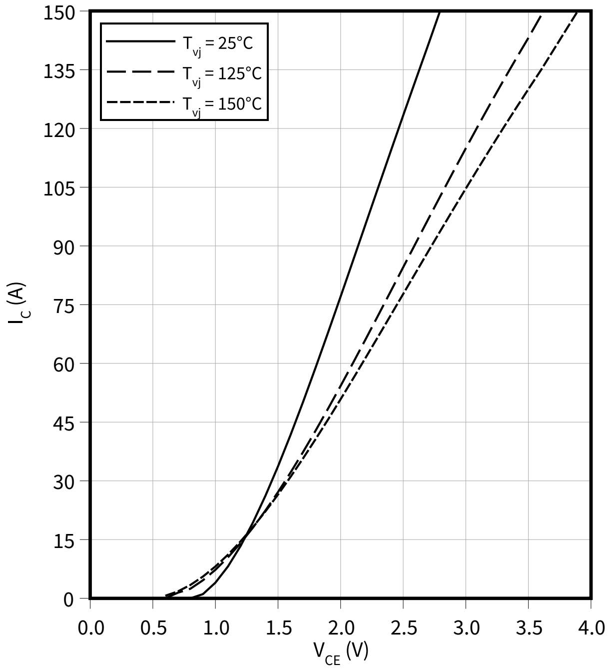
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

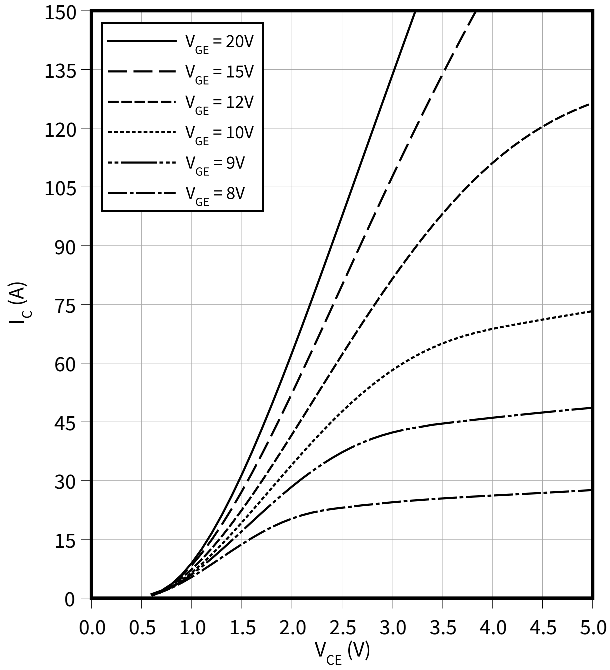
$V_{GE} = 15\ V$



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

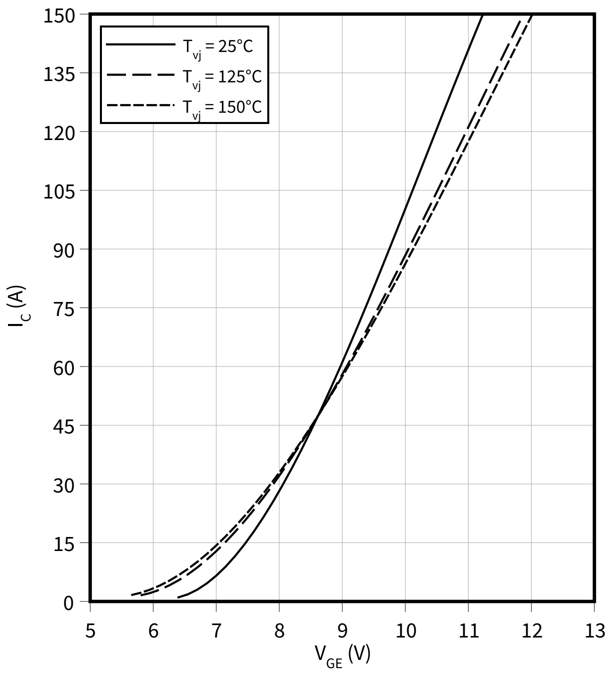
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

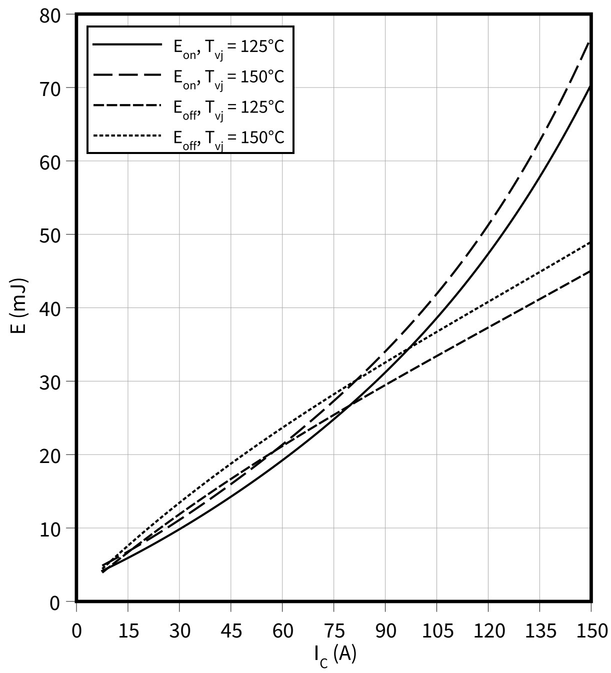
$V_{CE} = 20\ V$



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

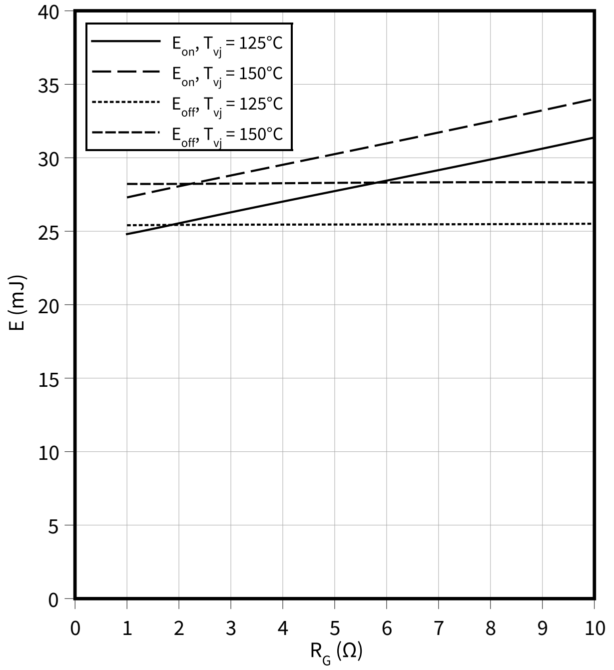
$R_{Goff} = 1\ \Omega$, $R_{Gon} = 1\ \Omega$, $V_{CC} = 900\ V$, $V_{GE} = \pm 15\ V$



Switching losses (typical), IGBT, Inverter

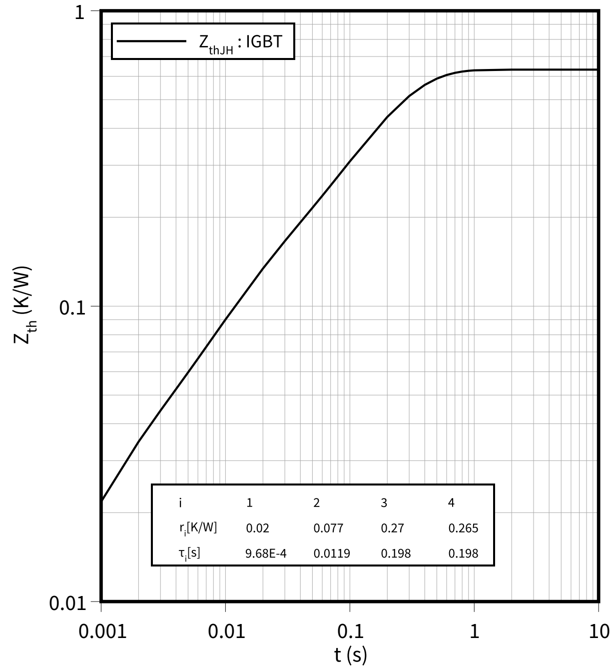
$E = f(R_G)$

$I_C = 75$ A, $V_{CC} = 900$ V, $V_{GE} = \pm 15$ V



Transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$

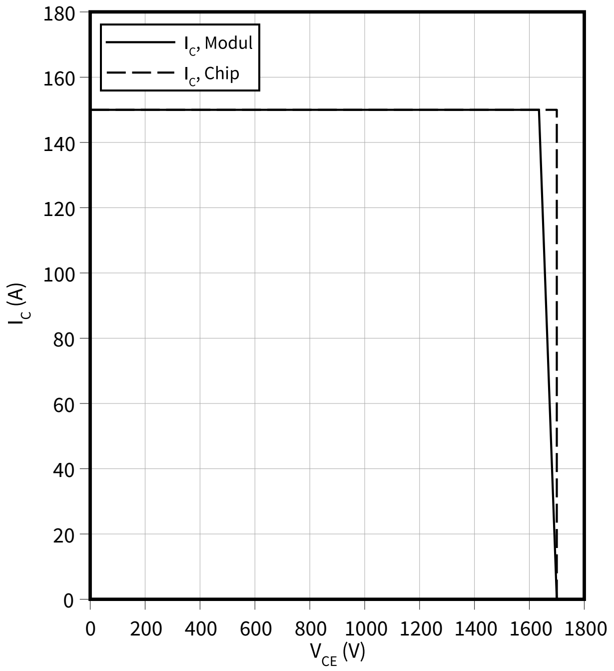


i	1	2	3	4
r_i[K/W]	0.02	0.077	0.27	0.265
τ_i[s]	9.68E-4	0.0119	0.198	0.198

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

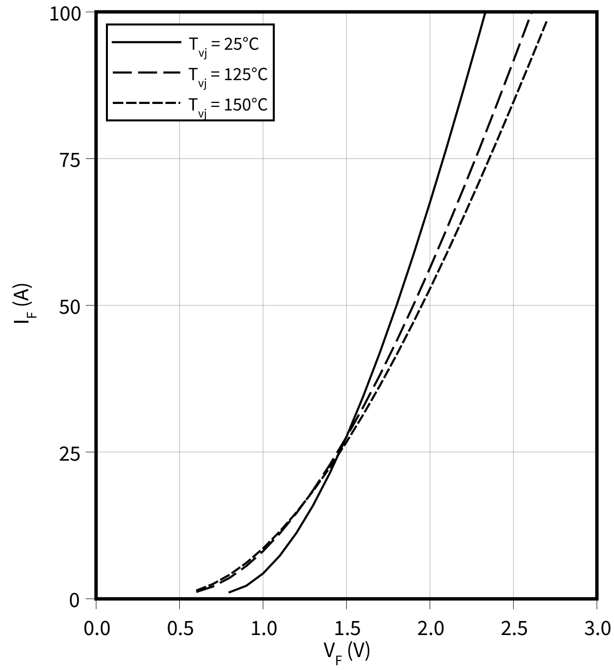
$I_C = f(V_{CE})$

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



Forward characteristic (typical), Diode, Inverter

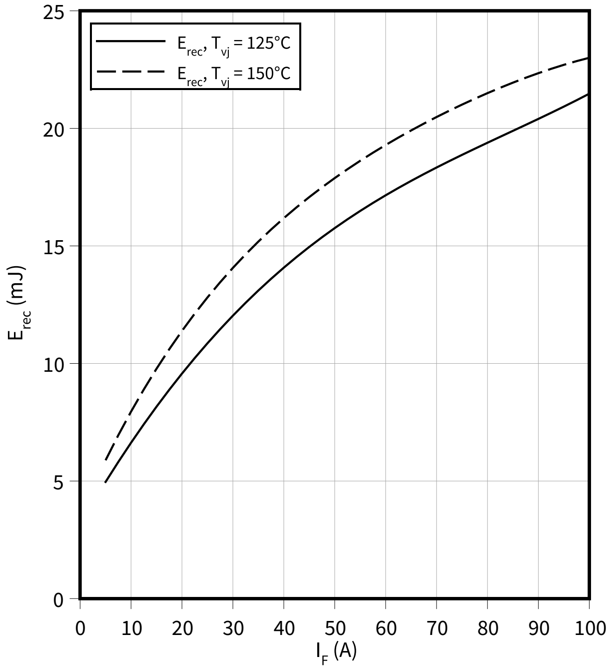
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

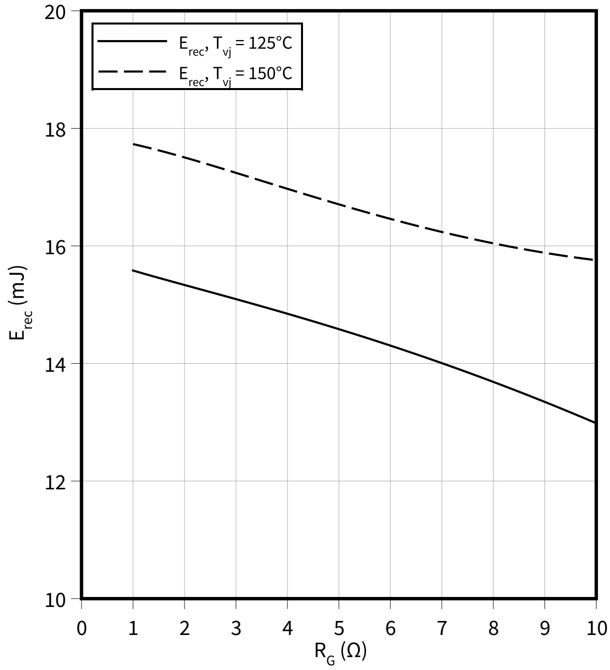
V_{CE} = 900 V, R_G = 1 Ω



Switching losses (typical), Diode, Inverter

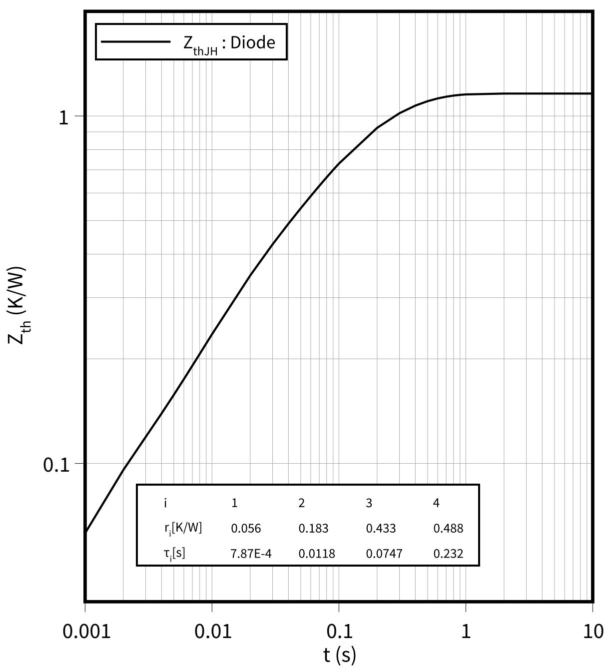
$E_{rec} = f(R_G)$

V_{CE} = 900 V, I_F = 50 A



Transient thermal impedance, Diode, Inverter

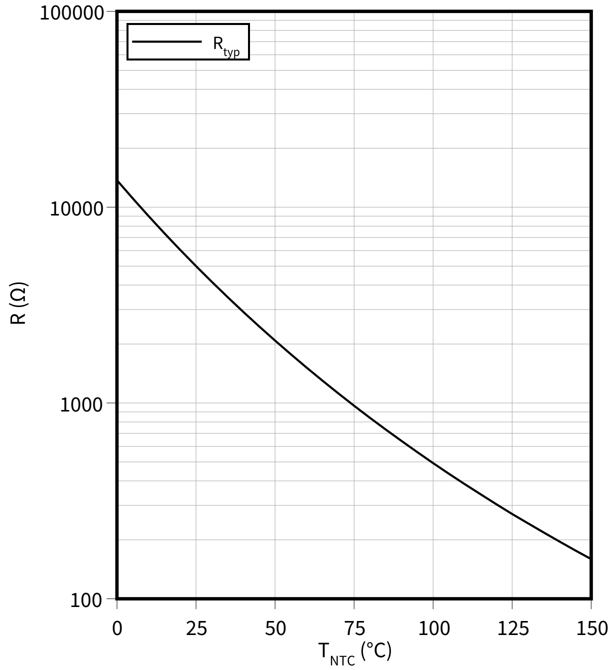
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.056	0.183	0.433	0.488
τ_i[s]	7.87E-4	0.0118	0.0747	0.232

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

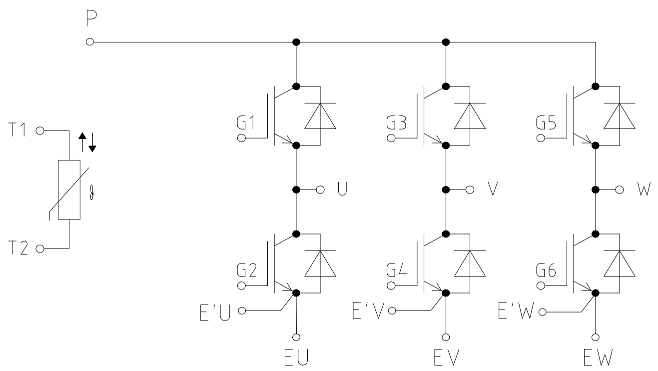


Figure 1

7 Package outlines

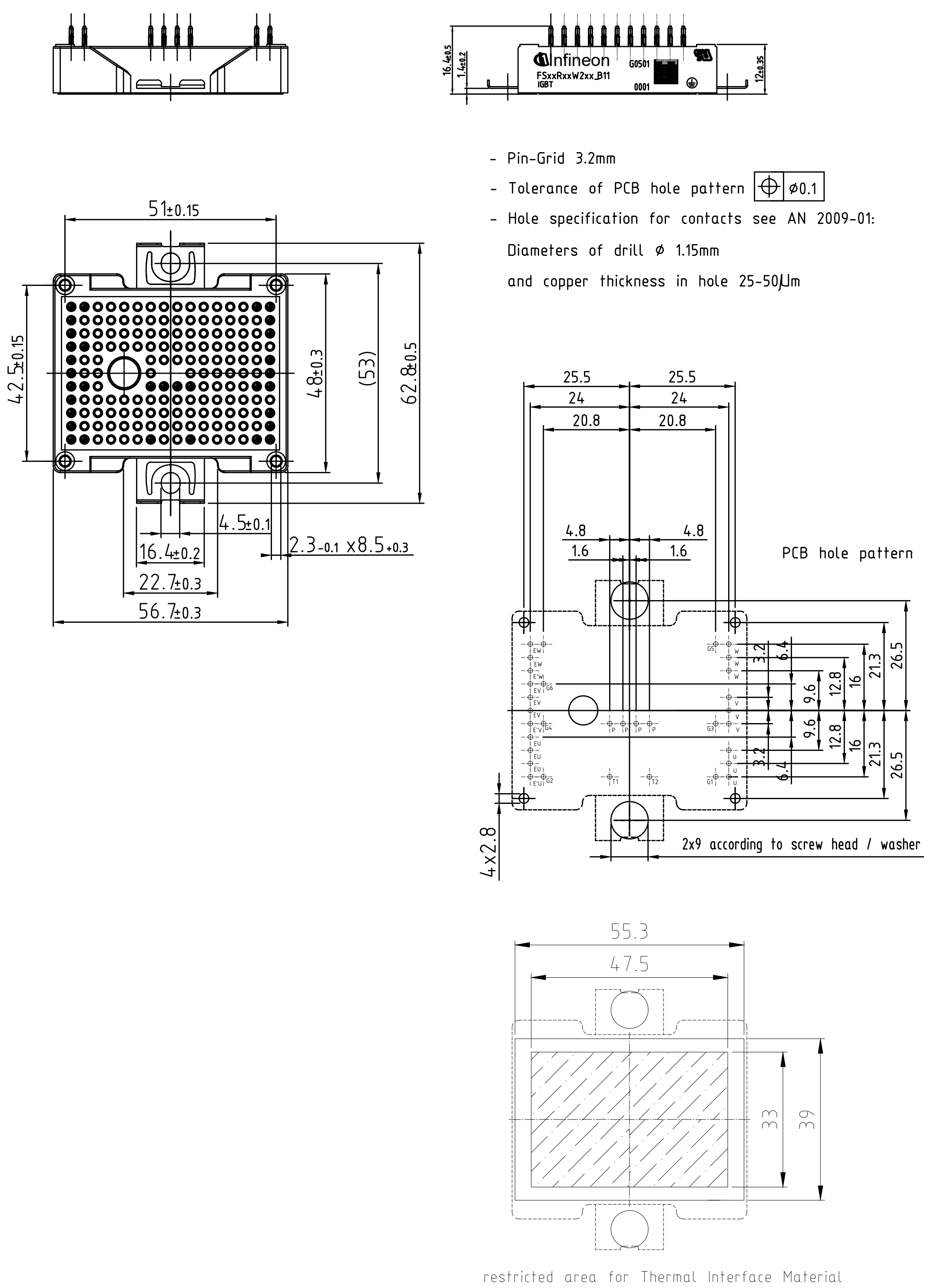


Figure 2

8 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	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
0.10	2021-09-21	Initial version
0.20	2022-04-12	Preliminary datasheet
1.00	2022-06-27	Final datasheet

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