IFF600B12ME4P_B11

EconoDUAL™3 module

Final datasheet

EconoDUAL™3 module with Trench/Fieldstop IGBT4 and emitter controlled 4 diode and PressFIT / NTC / current sense shunt

Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 600 A / I_{CRM} = 1200 A
  - Integrated current sensor
  - Low $V_{CE,sat}$
  - $T_{vj,op}$ = 150°C
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - PressFIT contact technology
  - Pre-applied thermal interface material
  - High power density
  - Isolated base plate

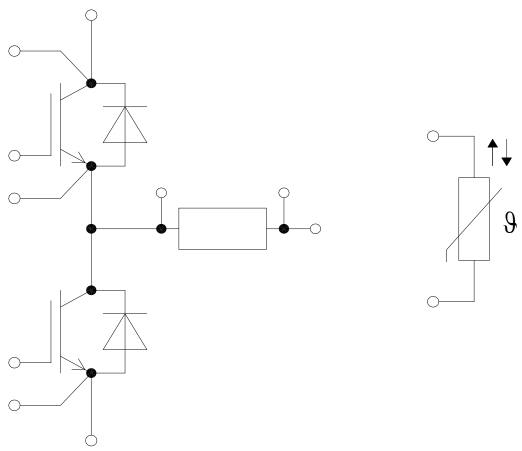
Potential applications

- UPS systems
- Servo drives
- Motor drives
- High-power converters
- Wind turbines

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	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	$d_{Creep\ nom}$	terminal to baseplate, nom., (PD2, IEC 60664-1, Ed. 3.0)	> 15	mm
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min., (PD2, IEC 60664-1, Ed. 3.0)	14.7	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom., (PD2, IEC 60664-1, Ed. 3.0)	12.1	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min., (PD2, IEC 60664-1, Ed. 3.0)	11.5	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	> 12.5	mm
Clearance	$d_{Clear\ min}$	terminal to baseplate, min.	12.5	mm
Clearance	$d_{Clear\ nom}$	terminal to terminal, nom.	10.0	mm
Clearance	$d_{Clear\ min}$	terminal to terminal, min.	9.6	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}				20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch			1.05		mΩ
Storage temperature	T_{stg}			-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}					125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	3		6	Nm
Terminal connection torque	M	- Mounting according to valid application note	M6, Screw	3		6	Nm
Weight	G				345		g

Note: *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
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 55 °C	600	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		1200	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 = 600 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 = 23 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.25	5.80	6.35	V
Gate charge	Q_G	V_{GE} = ±15 V			4.4		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.2		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			37		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			2.05		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			3	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 = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.3 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 = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω	T_{vj} = 25 °C		0.070		µs
			T_{vj} = 125 °C		0.080		
			T_{vj} = 150 °C		0.080		
Turn-off delay time (inductive load)	t_{doff}	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.3 Ω	T_{vj} = 25 °C		0.510		µs
			T_{vj} = 125 °C		0.520		
			T_{vj} = 150 °C		0.550		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Fall time (inductive load)	t_f	I_C = 600 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 1.3 Ω	T_{vj} = 25 °C		0.080		µs
			T_{vj} = 125 °C		0.170		
			T_{vj} = 150 °C		0.200		
Turn-on energy loss per pulse	E_{on}	I_C = 600 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 1.3 Ω, di/dt = 7000 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		35.5		mJ
			T_{vj} = 125 °C		55.5		
			T_{vj} = 150 °C		63		
Turn-off energy loss per pulse	E_{off}	I_C = 600 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 1.3 Ω, dv/dt = 3300 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		50.5		mJ
			T_{vj} = 125 °C		74		
			T_{vj} = 150 °C		83.5		
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		2300		A
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.0780	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
Continuous DC forward current	I_F			600	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1200	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	41000	A^2s
			T_{vj} = 150 °C	38500	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Forward voltage	V_F	I_F = 600 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.35	V
			T_{vj} = 125 °C		1.75		
			T_{vj} = 150 °C		1.70		

(table continues...)

Table 6 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di_F/dt = 7000 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		355		A
			T_{vj} = 125 °C		450		
			T_{vj} = 150 °C		475		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di_F/dt = 7000 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		57		µC
			T_{vj} = 125 °C		100		
			T_{vj} = 150 °C		115		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 600 A, V_{GE} = -15 V, -di_F/dt = 7000 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		27		mJ
			T_{vj} = 125 °C		44.5		
			T_{vj} = 150 °C		52		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.113	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}	T_C = 20 °C		0.26		mΩ
Temperature coefficient	TCR	T_{Range} = 20...60 °C		< 30		ppm/K
Load capacity per shunt resistor	P	T_C = 80 °C			40	W
Operation temperature	$T_{vj\,op}$				200	°C
Thermal resistance, junction to heat sink	R_{thJH}	per shunt, Valid with IFX pre-applied Thermal Interface Material			3.00	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	%

(table continues...)

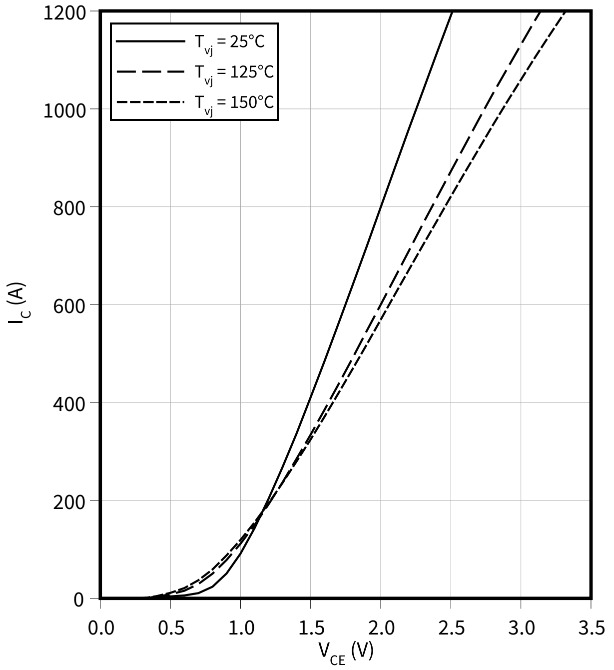
Table 8 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
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

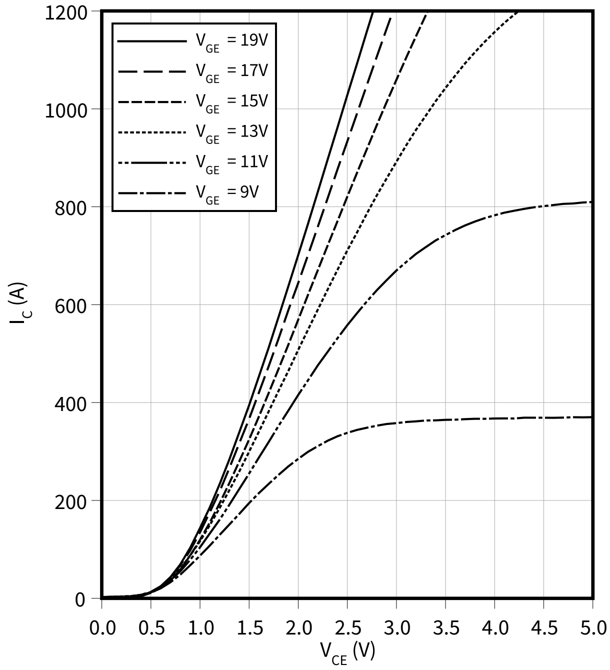
Note: *For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.*

6 Characteristics diagrams

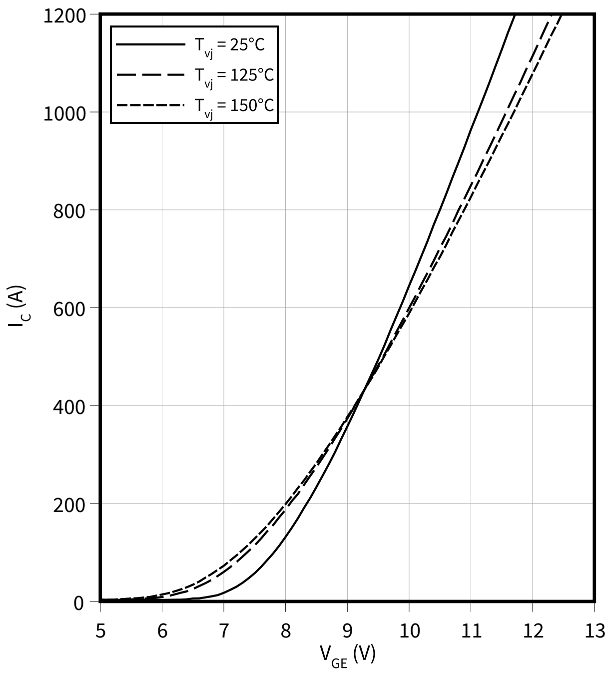
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



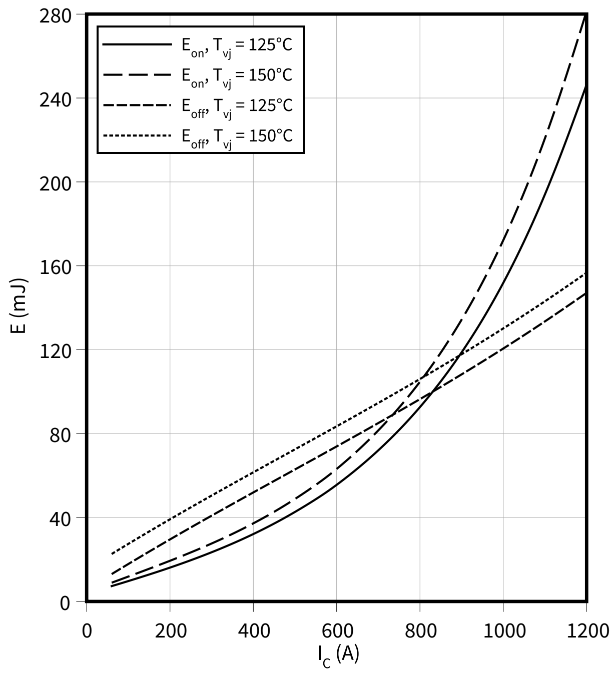
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



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



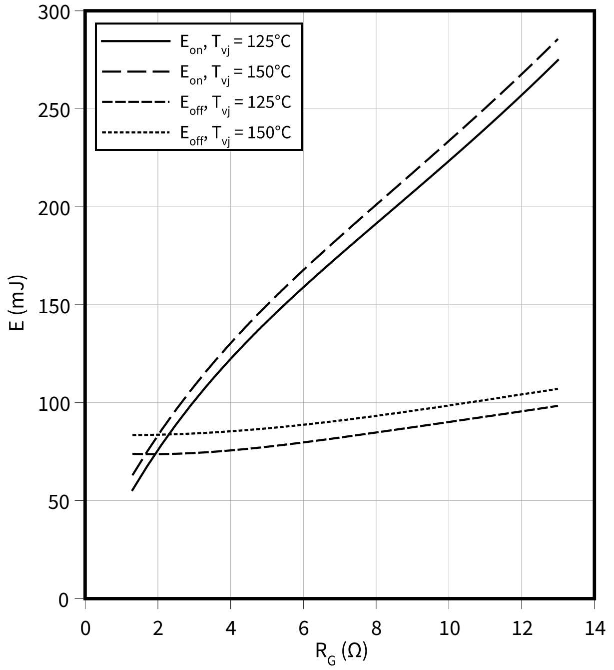
Switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 1.3\ \Omega$, $R_{Gon} = 1.3\ \Omega$, $V_{GE} = \pm 15\ V$, $V_{CC} = 600\ V$



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

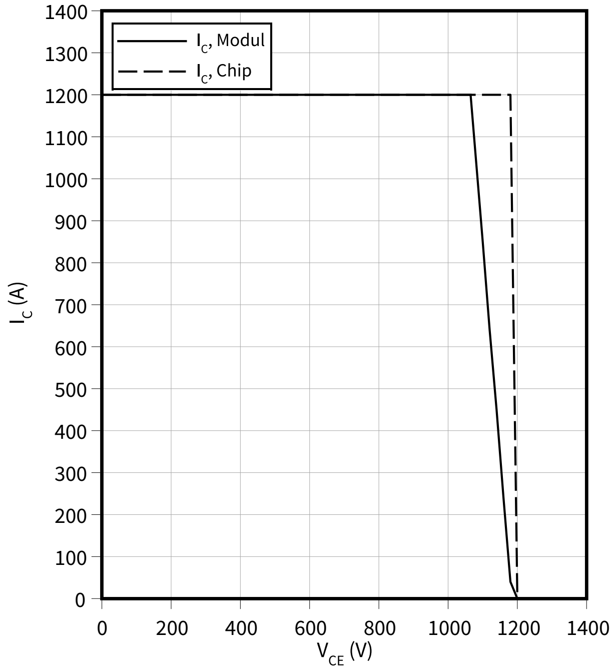
$V_{GE} = \pm15$ V, $I_C = 600$ A, $V_{CC} = 600$ V



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

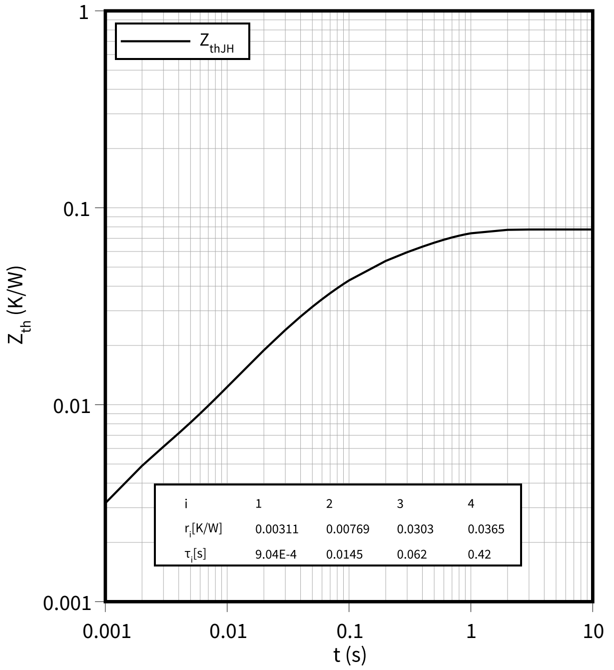
$I_C = f(V_{CE})$

$R_{Goff} = 1.3\ \Omega$, $V_{GE} = \pm15$ V, $T_{vj} = 150$ °C



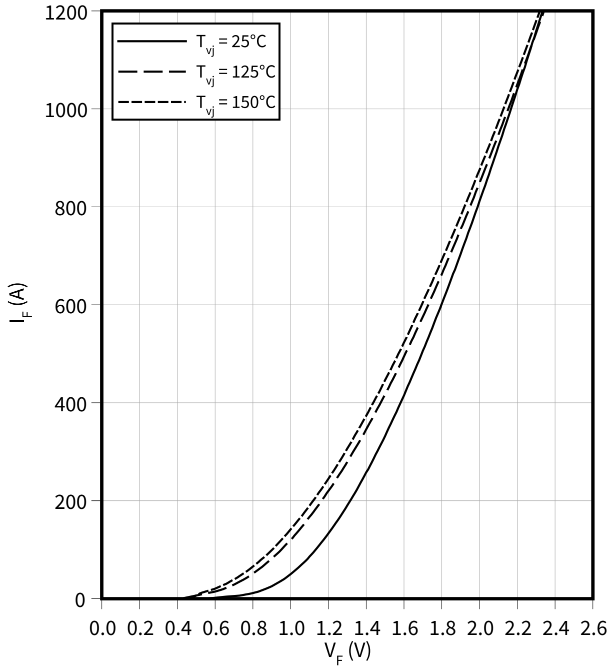
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

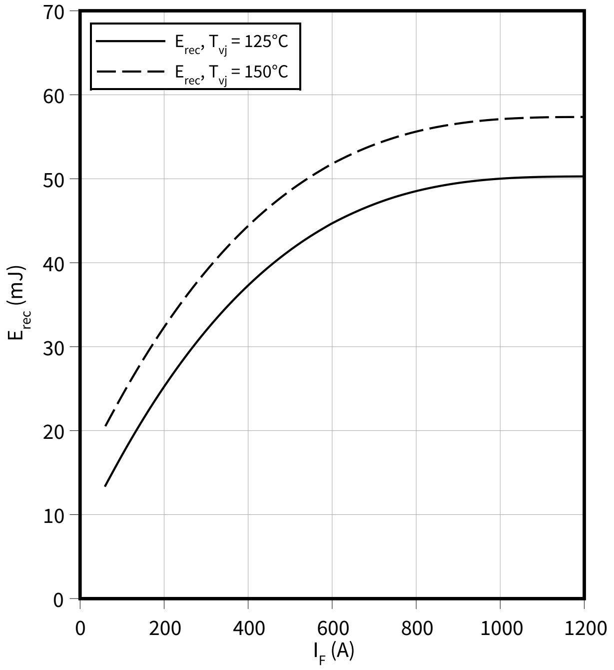
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

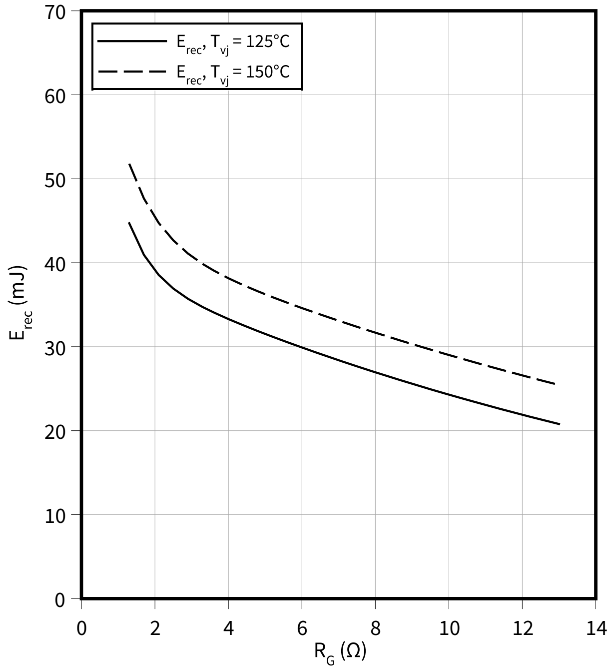
$R_{Gon} = 1.3\ \Omega$, $V_{CC} = 600\ V$



Switching losses (typical), Diode, Inverter

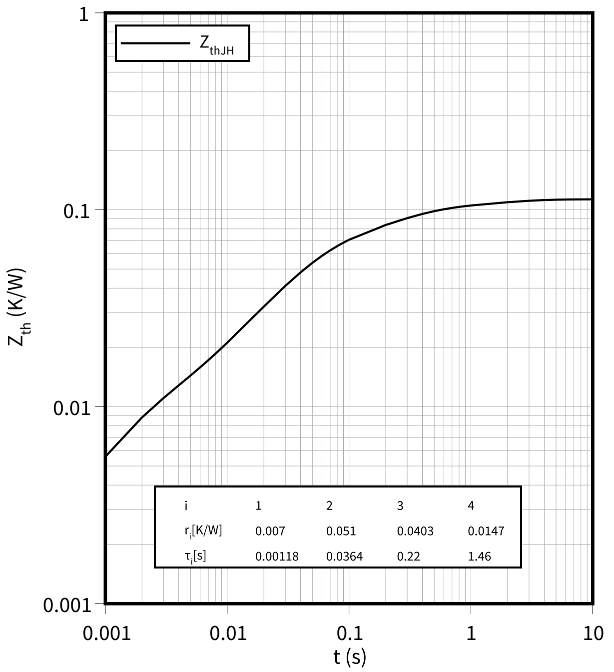
$E_{rec} = f(R_G)$

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



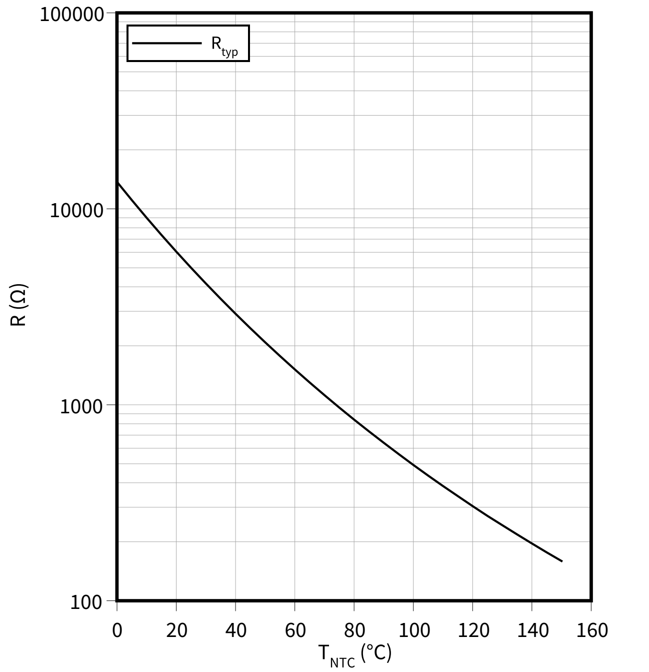
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

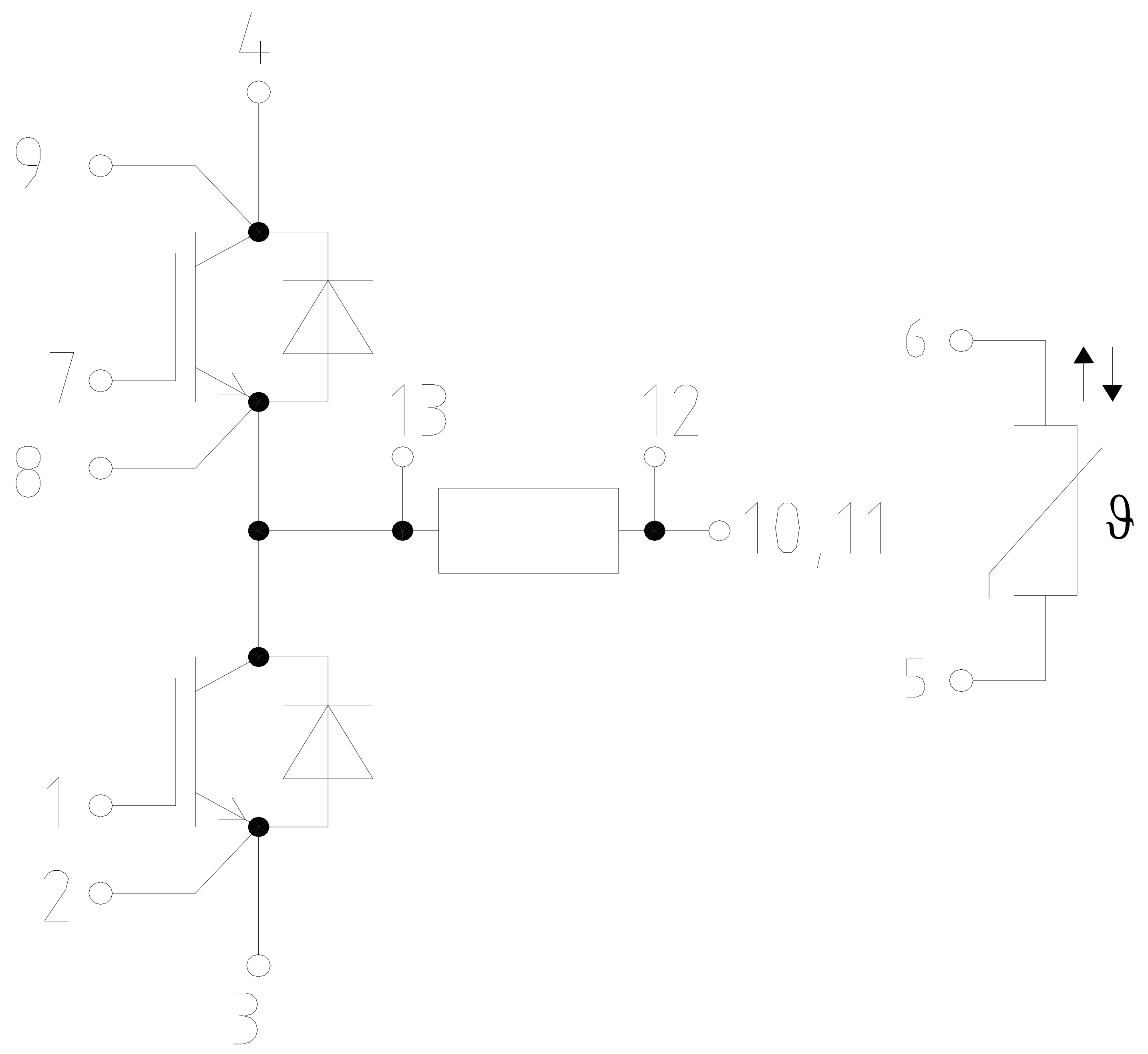


Figure 1

8 Package outlines

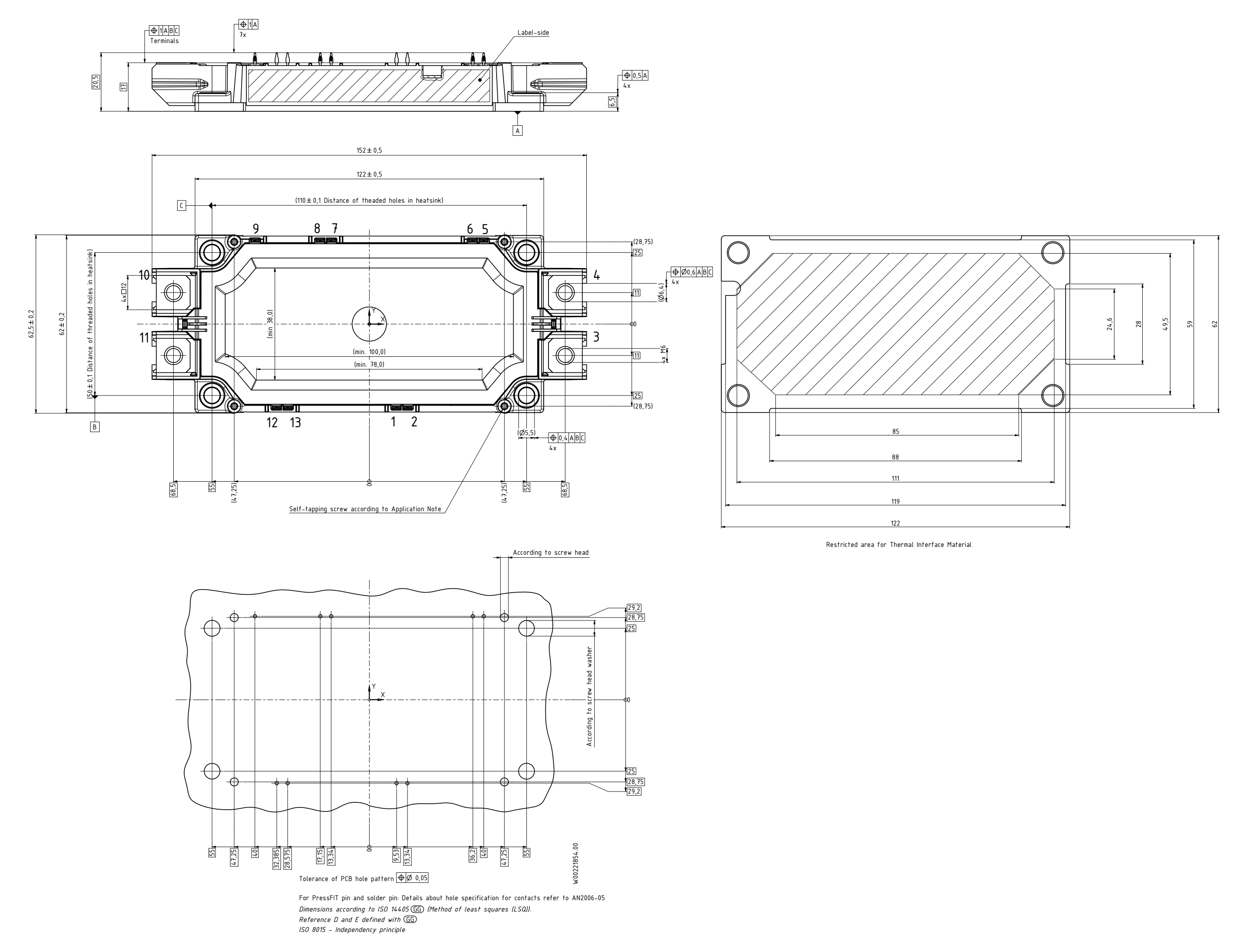


Figure 2

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	71549142846550549911530	71549142846550549911530	

Figure 3

Revision history

Document revision	Date of release	Description of changes
V1.0	2015-09-09	Target datasheet
V1.1	2017-08-23	Target datasheet
V3.0	2017-10-02	Final datasheet
V3.1	2017-12-01	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	2024-03-18	Final datasheet

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