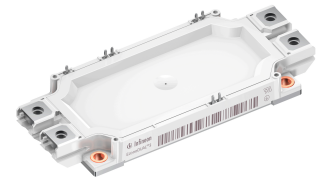


## Final datasheet

### EconoDUAL™3 module with Trench/Fieldstop IGBT4 and emitter controlled 3 diode and NTC

#### Features

- Electrical features
  - $V_{CES} = 1700\text{ V}$
  - $I_{C\text{ nom}} = 450\text{ A} / I_{CRM} = 900\text{ A}$
  - Low  $V_{CE,sat}$
  - $T_{vj,op} = 150^{\circ}\text{C}$
  - $V_{CE,sat}$  with positive temperature coefficient
  - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
  - High power density
  - Isolated base plate
  - Standard housing



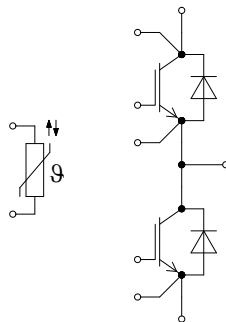
#### Potential applications

- Motor drives
- Servo drives
- UPS systems
- 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	3.4	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50$ Hz, $t = 1$ min	3.4	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.	> 15	mm
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min.	14.7	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom.	> 19.3	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min.	19.3	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	mm
Clearance	$d_{Clear\ min}$	terminal to terminal, min.	9.6	mm
Comparative tracking index	$CTI$		> 200	
Relative thermal index (electrical)	$RTI$		140	°C

**Table 2** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heat sink	$R_{thCH}$	$\lambda_{grease} = 1$ W/(m·K)		0.009		K/W
Stray inductance module	$L_{SCE}$			20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_C = 25$ °C, per switch		1.1		mΩ
Storage temperature	$T_{stg}$		-40		125	°C
Mounting torque for module mounting	$M$	- Mounting according to valid application note		3	6	Nm
Terminal connection torque	$M$	- Mounting according to valid application note		3	6	Nm
Weight	$G$			345		g

## 2 IGBT, Inverter

**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	
Continuous DC collector current	$I_{CDC}$	$T_{vj\ max} = 175\text{ °C}$	$T_C = 25\text{ °C}$	600	A
			$T_C = 100\text{ °C}$	450	
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{vj\ op}$	900	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	$V_{CE\ sat}$	$I_C = 450\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.95	2.30	V
			$T_{vj} = 125\text{ °C}$	2.35		
			$T_{vj} = 150\text{ °C}$	2.45		
Gate threshold voltage	$V_{GETh}$	$I_C = 18\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}$	5.2	5.8	6.4	V
Gate charge	$Q_G$	$T_{vj} = 25\text{ °C}$		4.6		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\text{ °C}$		1.7		Ω
Input capacitance	$C_{ies}$	$f = 1000\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		36		nF
Reverse transfer capacitance	$C_{res}$	$f = 1000\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		1.15		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1700\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		3	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25\text{ °C}$			400	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 450\text{ A}, V_{CC} = 900\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 3.3\text{ }\Omega$	$T_{vj} = 25\text{ °C}$	0.210		μs
			$T_{vj} = 125\text{ °C}$	0.260		
			$T_{vj} = 150\text{ °C}$	0.260		
Rise time (inductive load)	$t_r$	$I_C = 450\text{ A}, V_{CC} = 900\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 3.3\text{ }\Omega$	$T_{vj} = 25\text{ °C}$	0.110		μs
			$T_{vj} = 125\text{ °C}$	0.120		
			$T_{vj} = 150\text{ °C}$	0.120		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 450\text{ A}, V_{CC} = 900\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 3.3\text{ }\Omega$	$T_{vj} = 25\text{ °C}$	0.800		μs
			$T_{vj} = 125\text{ °C}$	0.950		
			$T_{vj} = 150\text{ °C}$	1.000		

(table continues...)

**Table 4 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Fall time (inductive load)	$t_f$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 3.3 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$		0.300	$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$		0.500	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		0.600	
Turn-on energy loss per pulse	$E_{on}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 3.3 \Omega, di/dt = 3900 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		105	mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$		135	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		145	
Turn-off energy loss per pulse	$E_{off}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 3.3 \Omega, dv/dt = 3000 \text{ V}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		98	mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$		155	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		170	
SC data	$I_{SC}$	$V_{GE} \leq 15 \text{ V}, V_{CC} = 1000 \text{ V}, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_p \leq 10 \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$		2300	A
Thermal resistance, junction to case	$R_{thJC}$	per IGBT				0.0600 K/W
Thermal resistance, case to heat sink	$R_{thCH}$	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$			0.0290	K/W
Temperature under switching conditions	$T_{vj op}$			-40		150 $^\circ\text{C}$

### 3 Diode, Inverter

**Table 5 Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1700	V
Continuous DC forward current	$I_F$		450	A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1 \text{ ms}$	900	A
$I^2t$ - value	$I^2t$	$t_p = 10 \text{ ms}, V_R = 0 \text{ V}, T_{vj} = 125 \text{ }^\circ\text{C}$	20000	$\text{A}^2\text{s}$

**Table 6 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Forward voltage	$V_F$	$I_F = 450 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		1.80	2.20	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$		1.90		
			$T_{vj} = 150 \text{ }^\circ\text{C}$		1.95		

(table continues...)

**Table 6 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Peak reverse recovery current	$I_{RM}$	$V_{CC} = 900\text{ V}$ , $I_F = 450\text{ A}$ , $V_{GE} = -15\text{ V}$ , $-di_F/dt = 3900\text{ A}/\mu\text{s}$ ( $T_{vj} = 150\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	480		A
			$T_{vj} = 125\text{ °C}$	550		
			$T_{vj} = 150\text{ °C}$	585		
Recovered charge	$Q_r$	$V_{CC} = 900\text{ V}$ , $I_F = 450\text{ A}$ , $V_{GE} = -15\text{ V}$ , $-di_F/dt = 3900\text{ A}/\mu\text{s}$ ( $T_{vj} = 150\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	95		$\mu\text{C}$
			$T_{vj} = 125\text{ °C}$	170		
			$T_{vj} = 150\text{ °C}$	190		
Reverse recovery energy	$E_{rec}$	$V_{CC} = 900\text{ V}$ , $I_F = 450\text{ A}$ , $V_{GE} = -15\text{ V}$ , $-di_F/dt = 3900\text{ A}/\mu\text{s}$ ( $T_{vj} = 150\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	60		mJ
			$T_{vj} = 125\text{ °C}$	110		
			$T_{vj} = 150\text{ °C}$	125		
Thermal resistance, junction to case	$R_{thJC}$	per diode			0.100	K/W
Thermal resistance, case to heat sink	$R_{thCH}$	per diode, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		0.0480		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		150	$^{\circ}\text{C}$

## 4 NTC-Thermistor

**Table 7 Characteristic values**

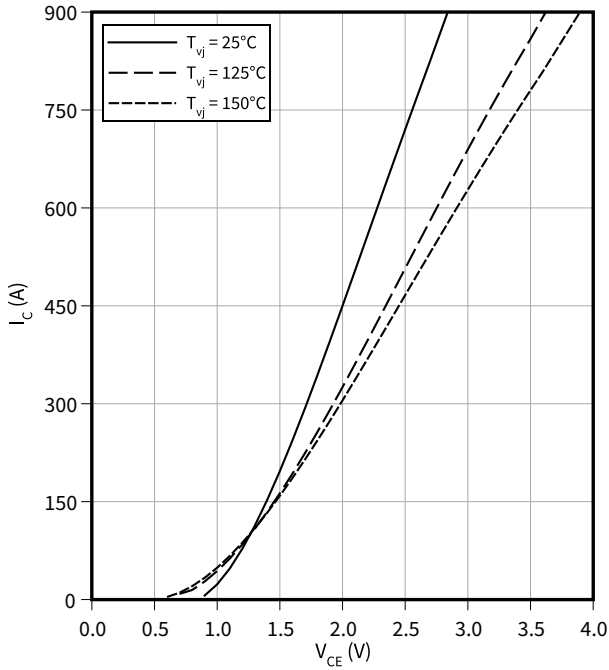
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	$R_{25}$	$T_{NTC} = 25\text{ °C}$		5		k $\Omega$
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}$ , $R_{100} = 493\text{ }\Omega$	-5		5	%
Power dissipation	$P_{25}$	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\text{ K}))]$		3433		K

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

## 5 Characteristics diagrams

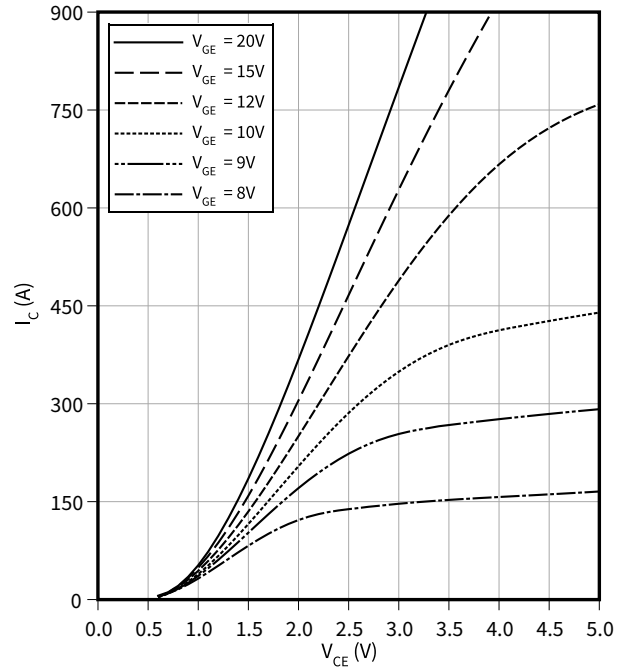
**Output characteristic (typical), IGBT, Inverter**

$I_C = f(V_{CE})$   
 $V_{GE} = 15 \text{ V}$



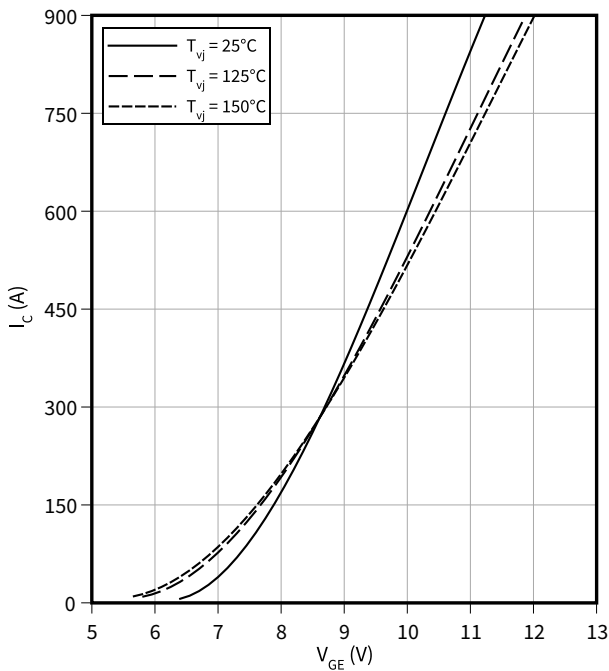
**Output characteristic field (typical), IGBT, Inverter**

$I_C = f(V_{CE})$   
 $T_{vj} = 150 \text{ °C}$



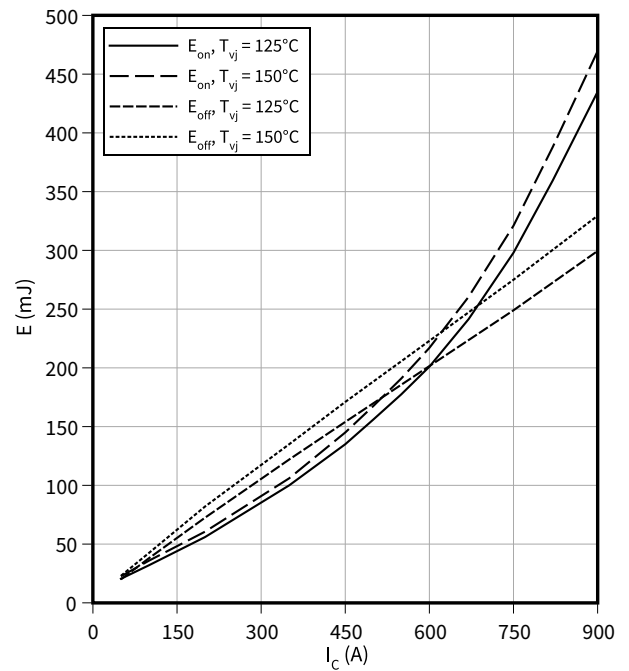
**Transfer characteristic (typical), IGBT, Inverter**

$I_C = f(V_{GE})$   
 $V_{CE} = 20 \text{ V}$



**Switching losses (typical), IGBT, Inverter**

$E = f(I_C)$   
 $R_{Goff} = 3.3 \text{ } \Omega$ ,  $R_{Gon} = 3.3 \text{ } \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $V_{CC} = 900 \text{ V}$

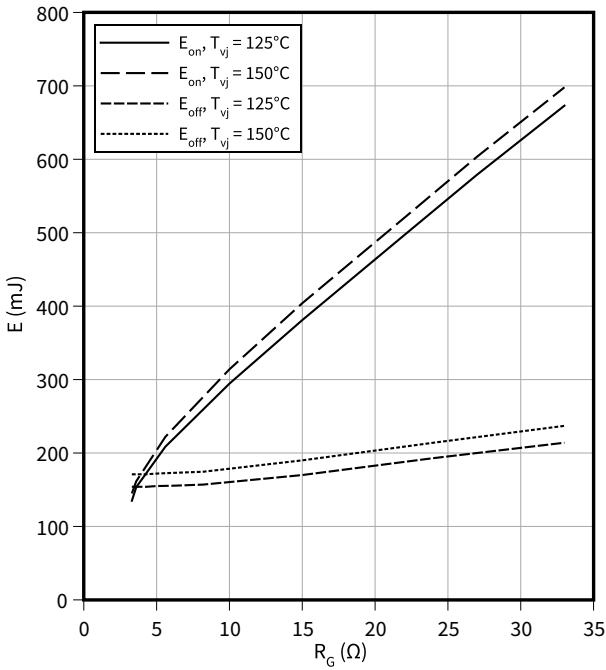


**5 Characteristics diagrams**

**Switching losses (typical), IGBT, Inverter**

$E = f(R_G)$

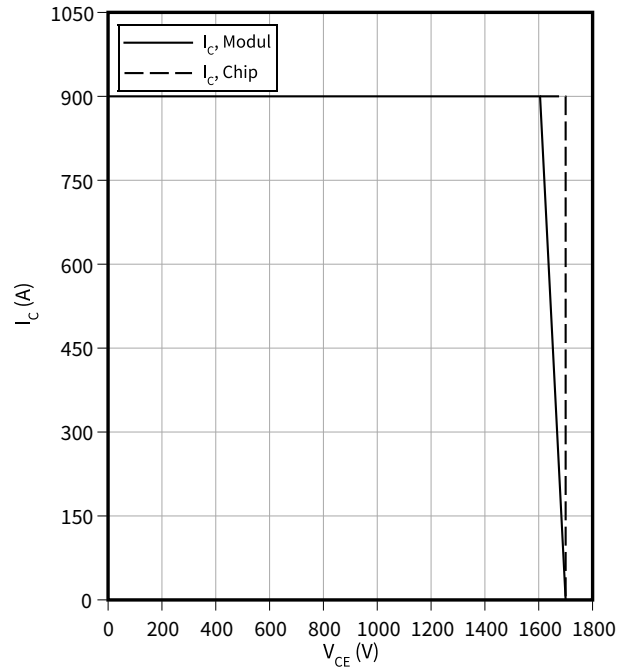
$V_{GE} = \pm 15 \text{ V}, I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}$



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

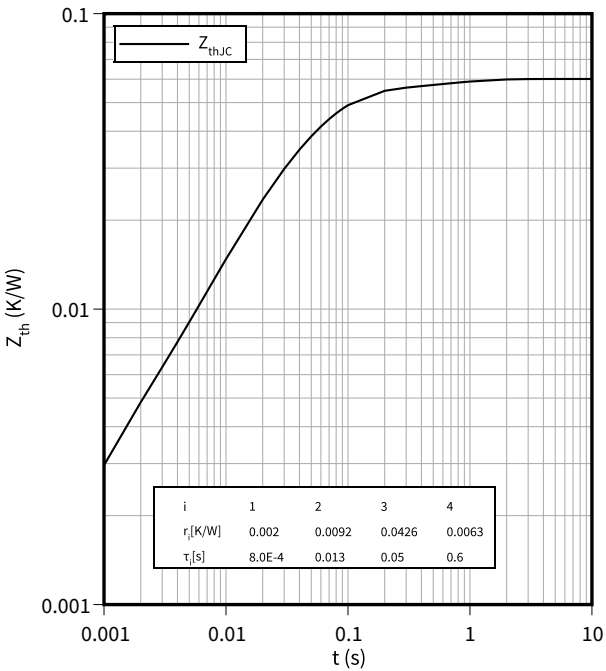
$I_C = f(V_{CE})$

$R_{Goff} = 3.3 \Omega, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150 \text{ °C}$



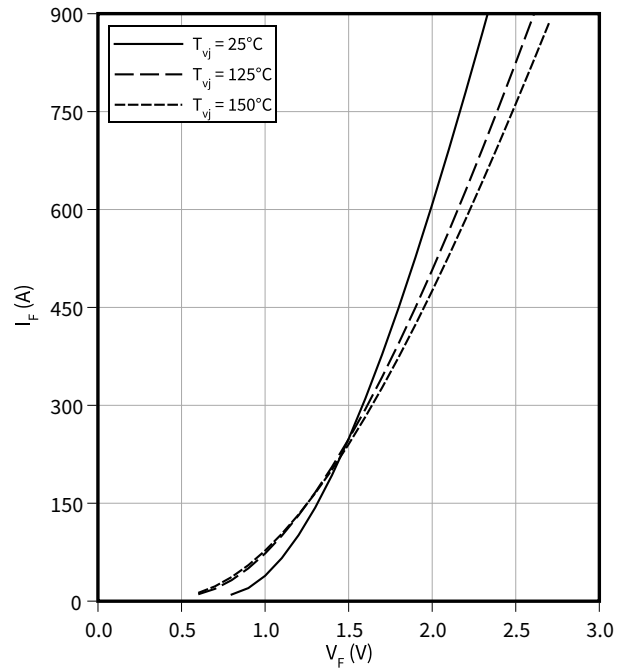
**Transient thermal impedance, IGBT, Inverter**

$Z_{th} = f(t)$



**Forward characteristic (typical), Diode, Inverter**

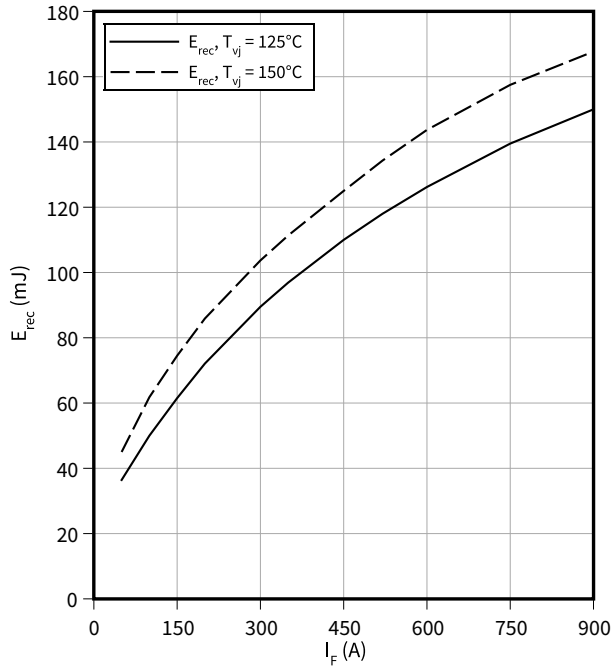
$I_F = f(V_F)$



5 Characteristics diagrams

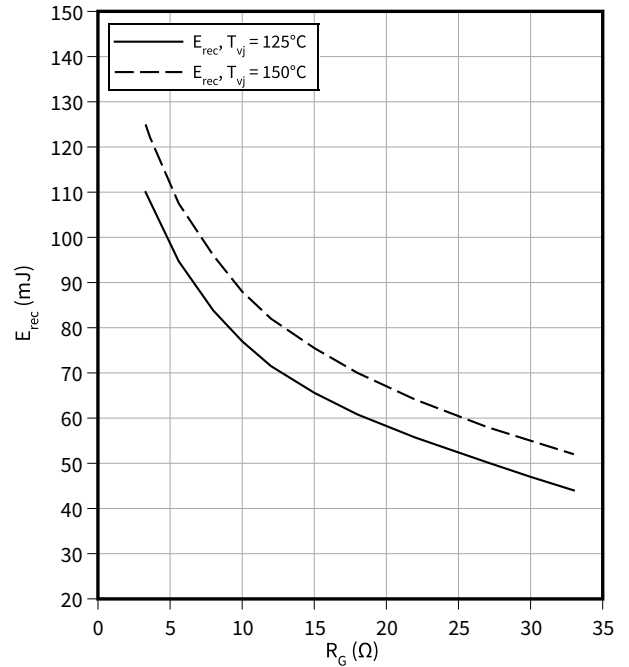
**Switching losses (typical), Diode, Inverter**

$E_{rec} = f(I_F)$   
 $R_G = 3,3 \Omega, V_{CC} = 900 V$



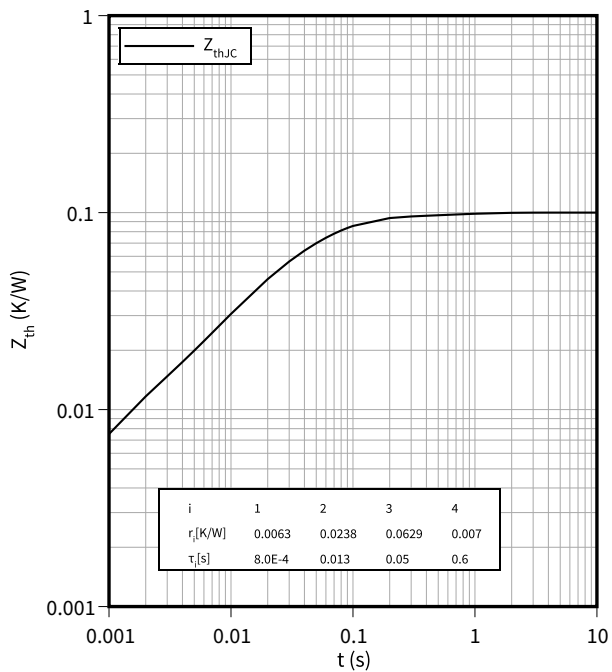
**Switching losses (typical), Diode, Inverter**

$E_{rec} = f(R_G)$   
 $I_F = 450 A, V_{CC} = 900 V$



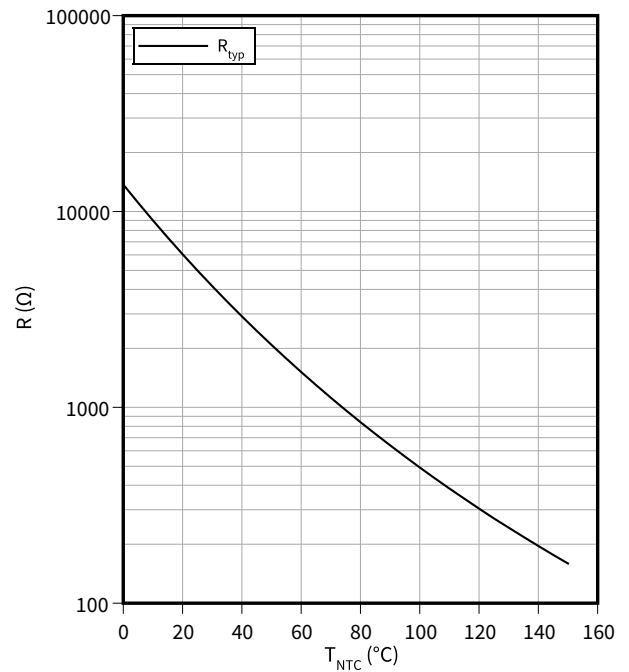
**Transient thermal impedance, Diode, Inverter**

$Z_{th} = f(t)$



**Temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$



## 6 Circuit diagram

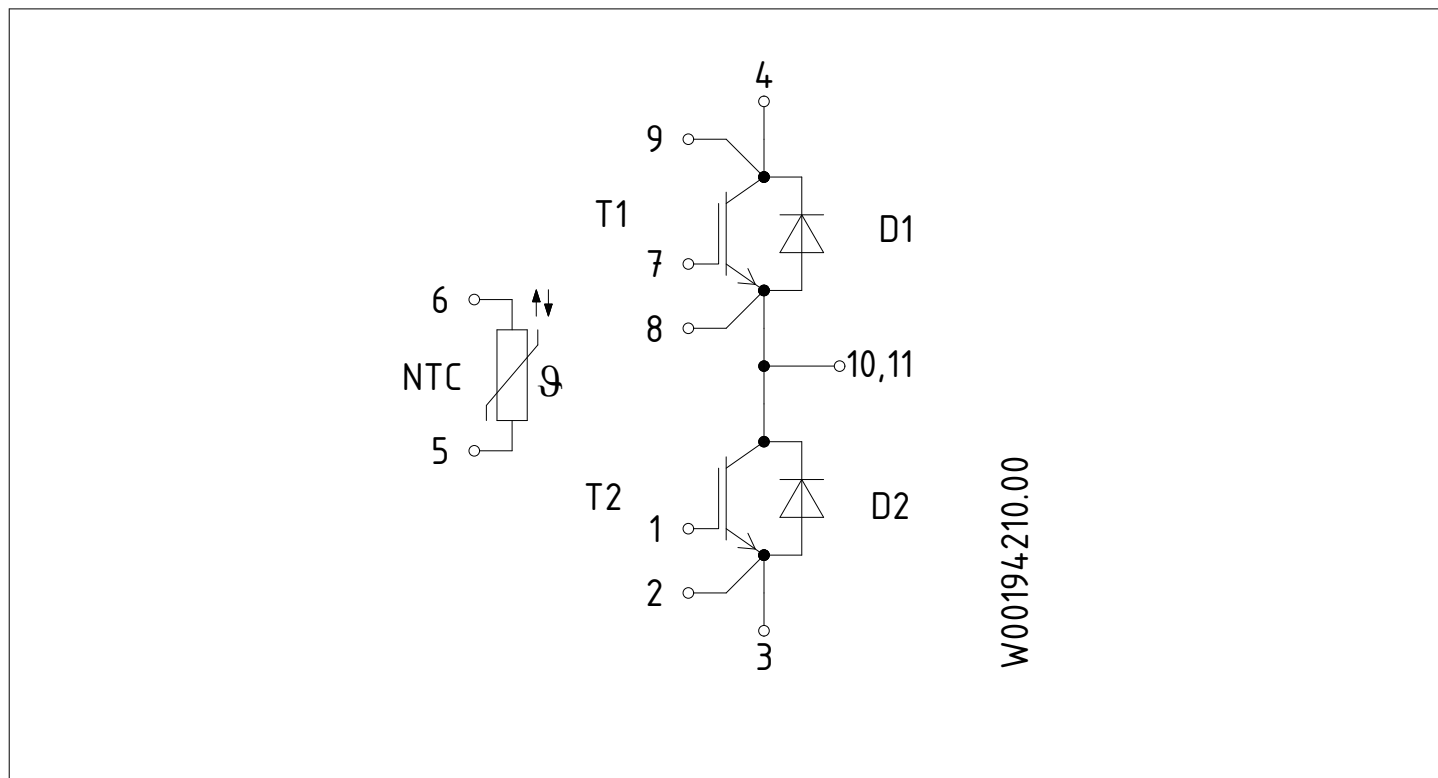


Figure 1

7 Package outlines

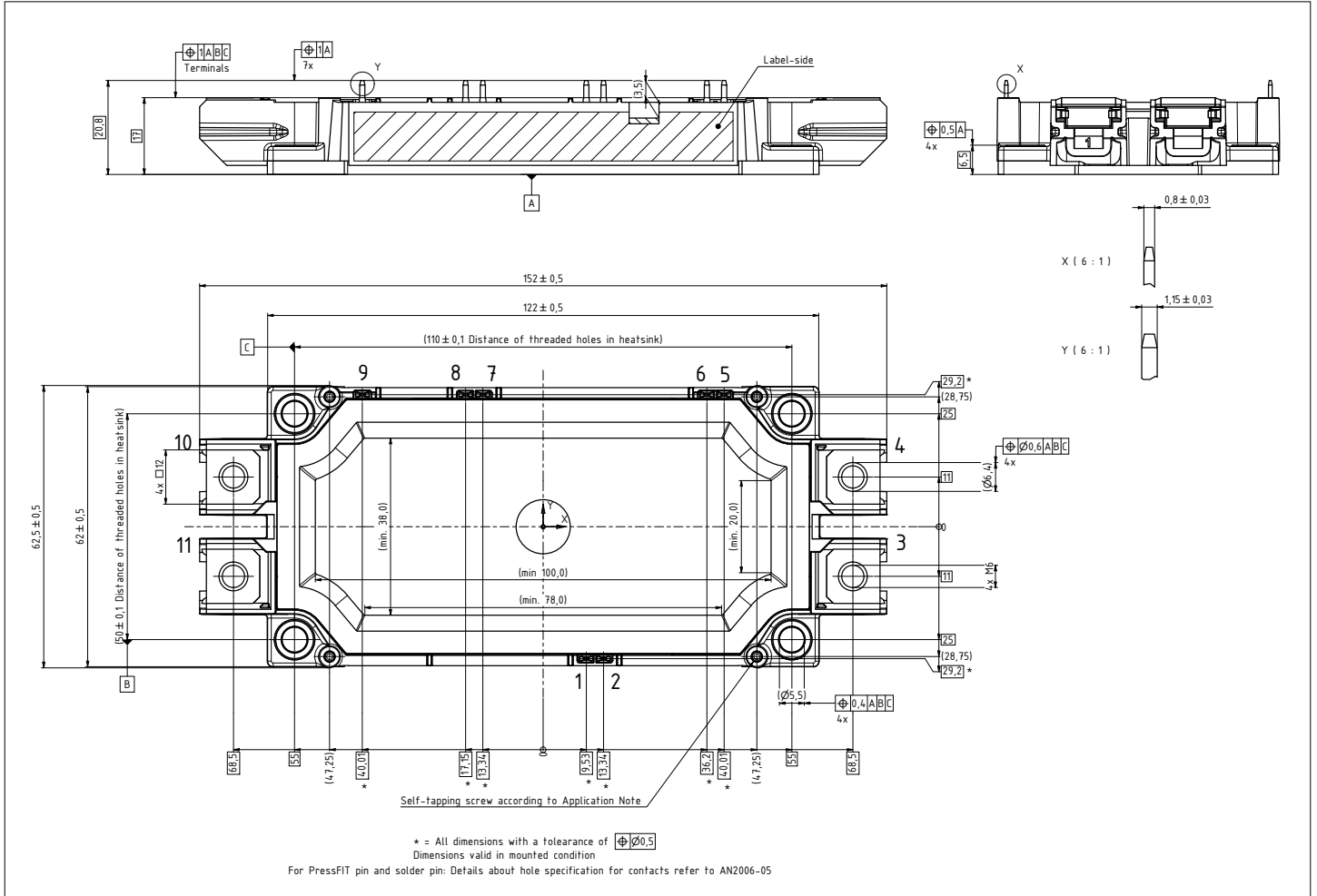

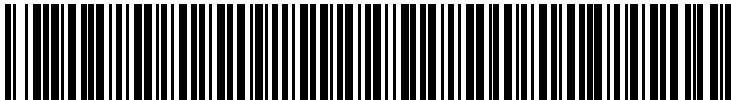


Figure 2

## 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
V1.0	2007-12-12	Target datasheet
V2.0	2008-11-05	Preliminary datasheet
V2.1	2008-12-09	Preliminary datasheet
V2.2	2009-01-06	Preliminary datasheet
V2.3	2010-11-04	Preliminary datasheet
V2.4	2011-03-01	Preliminary datasheet
V2.5	2014-06-06	Preliminary 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
1.00	2025-05-28	Final datasheet

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**Document reference**

**IFX-AAV726-008**

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