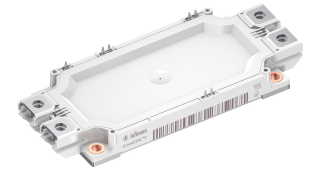


## Final datasheet

### EconoDUAL™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC

#### Features

- Electrical features
  - $V_{CES} = 1700\text{ V}$
  - $I_{C\text{ nom}} = 450\text{ A} / I_{CRM} = 900\text{ A}$
  - Integrated temperature sensor
  - High current density
  - Low  $V_{CE,sat}$
  - Overload operation up to  $175^\circ\text{C}$
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$  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
  - PressFIT contact technology
  - Standard housing



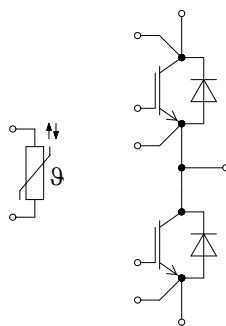
#### Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- 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., (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	$R_{CC'+EE'}$	$T_C = 25$ °C, per switch		0.8		mΩ
Storage temperature	$T_{stg}$		-40		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

## 2 IGBT, T1 / T2

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter voltage	$V_{CES}$		$T_{vj} = 25\text{ °C}$		1700		V
Implemented collector current	$I_{CN}$				450		A
Continuous DC collector current	$I_{CDC}$	$T_{vj\ max} = 175\text{ °C}$	$T_C = 90\text{ °C}$		450		A
Maximum RMS module DC-terminal current	$I_{tRMS}$		$T_{Terminal} = 90\text{ °C},$ $T_C = 90\text{ °C}$		580		A
				$T_{Terminal} = 105\text{ °C},$ $T_C = 90\text{ °C}$	565		
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{vj\ op}$			900		A
Gate-emitter peak voltage	$V_{GES}$				$\pm 20$		V

**Table 4** Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 450\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.70	1.85	V
			$T_{vj} = 125\text{ °C}$		1.95		
			$T_{vj} = 150\text{ °C}$		2.05		
			$T_{vj} = 175\text{ °C}$		2.10		
Gate threshold voltage	$V_{Geth}$	$I_C = 9.3\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}$		5.15	5.80	6.45	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\text{ V}, V_{CC} = 900\text{ V}$			4.2		$\mu\text{C}$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\text{ °C}$			0.57		$\Omega$
Input capacitance	$C_{ies}$	$f = 100\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$			45.9		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$			0.162		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1700\text{ V}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$			5	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{ V}, V_{GE} = 20\text{ V}, T_{vj} = 25\text{ °C}$				100	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 450\text{ A}, V_{CC} = 900\text{ V},$ $V_{GE} = \pm 15\text{ V}, R_{Gon} = 0.62\ \Omega$	$T_{vj} = 25\text{ °C}$		0.144		$\mu\text{s}$
			$T_{vj} = 125\text{ °C}$		0.162		
			$T_{vj} = 150\text{ °C}$		0.165		
			$T_{vj} = 175\text{ °C}$		0.168		

(table continues...)

**Table 4 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rise time (inductive load)	$t_r$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.62 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.034		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.038		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.040		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.043		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.599		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.678		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.684		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.689		
Fall time (inductive load)	$t_f$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.248		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.443		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.515		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.587		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.62 \Omega, di/dt = 9000 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	44.4		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	87.1		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	100		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	114		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 5.1 \Omega, dv/dt = 3800 \text{ V}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	72.1		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	111		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	125		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	139		
SC data	$I_{SC}$	$V_{GE} = 15 \text{ V}, V_{CC} = 1000 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8 \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$	1600		A
			$t_p \leq 6 \mu\text{s}, T_{vj} = 175 \text{ }^\circ\text{C}$	1500		
Thermal resistance, junction to case	$R_{thJC}$	per IGBT			0.0812	K/W
Thermal resistance, case to heat sink	$R_{thCH}$	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		0.0368		K/W
Temperature under switching conditions	$T_{vjop}$		-40		175	$^\circ\text{C}$

**Note:**  $T_{vjop} > 150 \text{ }^\circ\text{C}$  is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

### 3 Diode, D1 / D2

**Table 5** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25\text{ °C}$	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	$I^2t$	$t_p = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	14500	A <sup>2</sup> s
			$T_{vj} = 175\text{ °C}$	12500	

**Table 6** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 450\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	2.35	2.50	V
			$T_{vj} = 125\text{ °C}$	2.25		
			$T_{vj} = 150\text{ °C}$	2.20		
			$T_{vj} = 175\text{ °C}$	2.10		
Peak reverse recovery current	$I_{RM}$	$V_{CC} = 900\text{ V}, I_F = 450\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 9300\text{ A}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	574		A
			$T_{vj} = 125\text{ °C}$	605		
			$T_{vj} = 150\text{ °C}$	605		
			$T_{vj} = 175\text{ °C}$	605		
Recovered charge	$Q_r$	$V_{CC} = 900\text{ V}, I_F = 450\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 9300\text{ A}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	59.4		$\mu\text{C}$
			$T_{vj} = 125\text{ °C}$	113		
			$T_{vj} = 150\text{ °C}$	130		
			$T_{vj} = 175\text{ °C}$	146		
Reverse recovery energy	$E_{rec}$	$V_{CC} = 900\text{ V}, I_F = 450\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 9300\text{ A}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	32.9		mJ
			$T_{vj} = 125\text{ °C}$	66.6		
			$T_{vj} = 150\text{ °C}$	76.1		
			$T_{vj} = 175\text{ °C}$	85.5		
Thermal resistance, junction to case	$R_{thJC}$	per diode			0.143	K/W
Thermal resistance, case to heat sink	$R_{thCH}$	per diode, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		0.0479		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	°C

**Note:**  $T_{vjop} > 150\text{ °C}$  is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

## 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		kΩ
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}$ , $R_{100} = 493\text{ Ω}$	-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

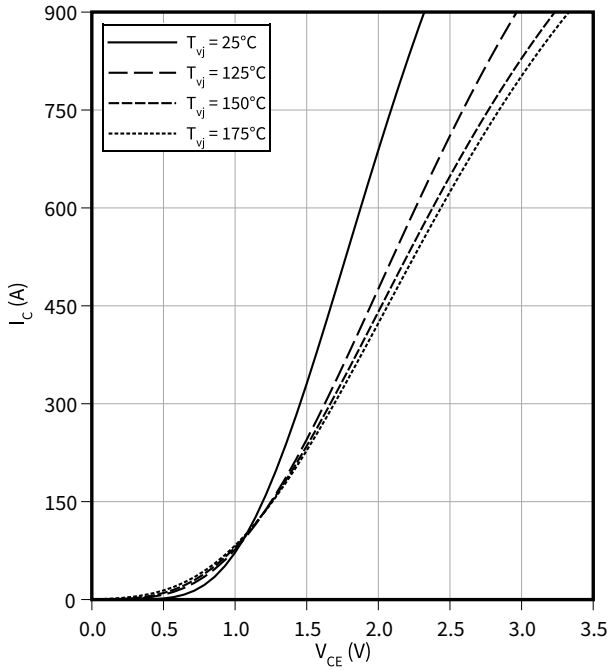
**Note:** For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

## 5 Characteristics diagrams

**Output characteristic (typical), IGBT, T1 / T2**

$$I_C = f(V_{CE})$$

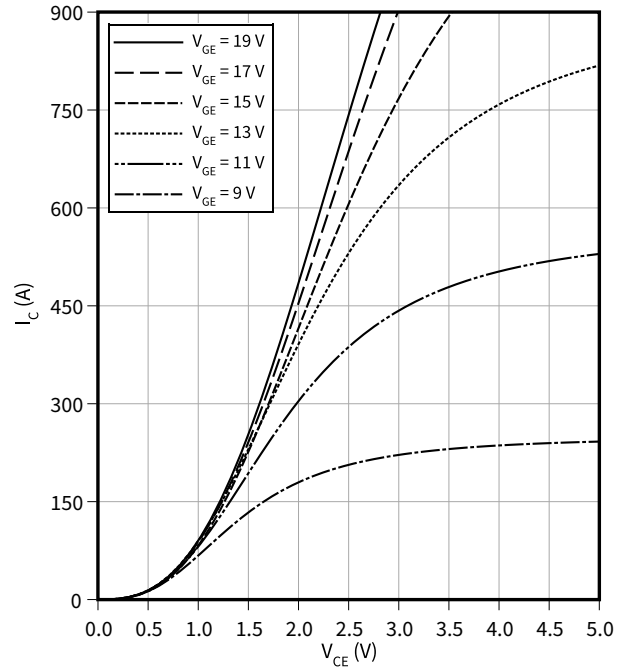
$$V_{GE} = 15 \text{ V}$$



**Output characteristic field (typical), IGBT, T1 / T2**

$$I_C = f(V_{CE})$$

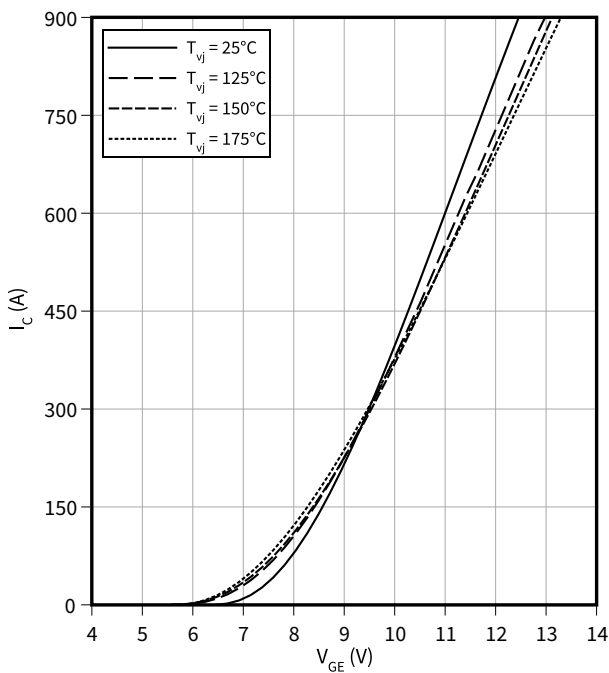
$$T_{vj} = 175 \text{ °C}$$



**Transfer characteristic (typical), IGBT, T1 / T2**

$$I_C = f(V_{GE})$$

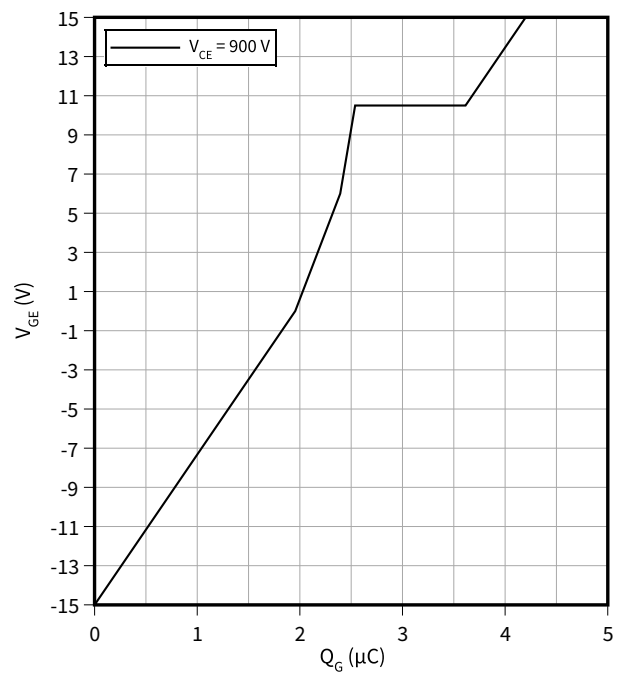
$$V_{CE} = 20 \text{ V}$$



**Gate charge characteristic (typical), IGBT, T1 / T2**

$$V_{GE} = f(Q_G)$$

$$I_C = 450 \text{ A}, T_{vj} = 25 \text{ °C}$$



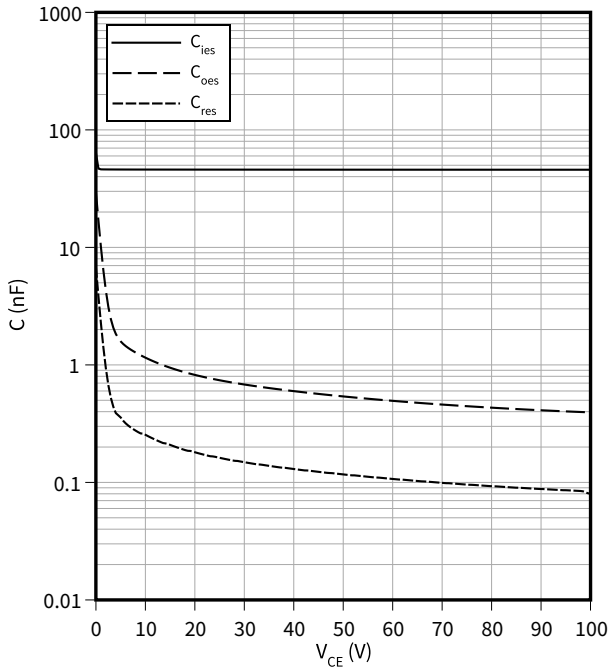


**5 Characteristics diagrams**

**Capacity characteristic (typical), IGBT, T1 / T2**

$C = f(V_{CE})$

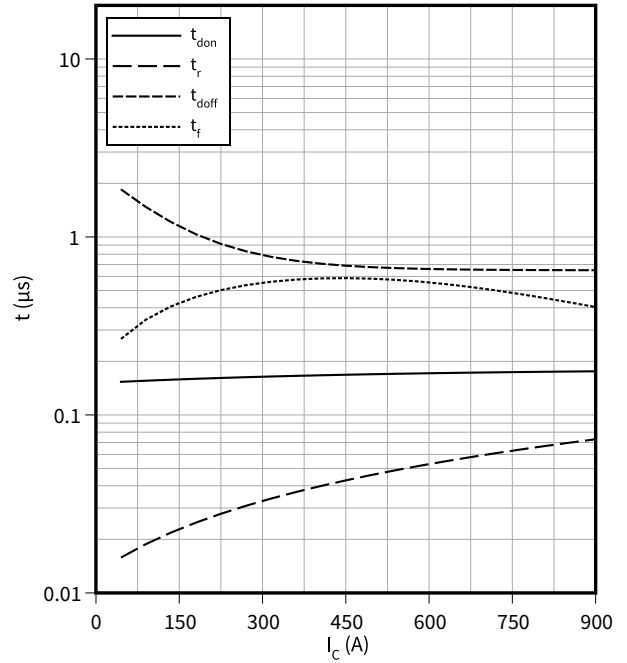
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$



**Switching times (typical), IGBT, T1 / T2**

$t = f(I_C)$

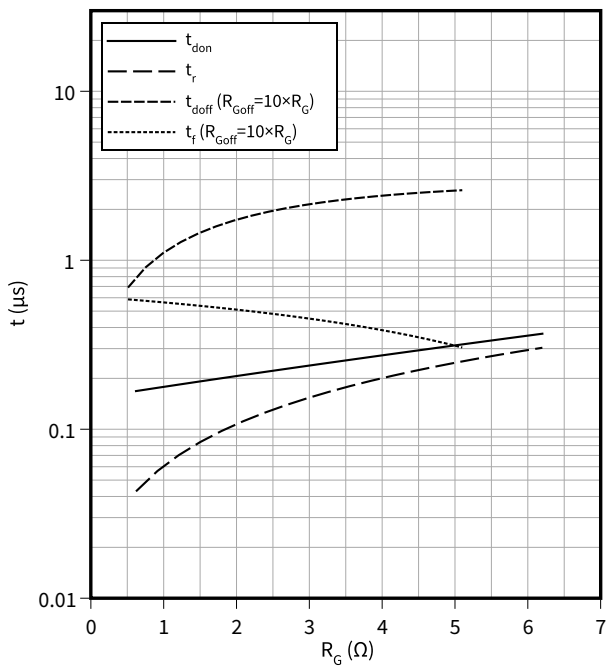
$R_{Goff} = 5.1 \text{ } \Omega, R_{Gon} = 0.62 \text{ } \Omega, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



**Switching times (typical), IGBT, T1 / T2**

$t = f(R_G)$

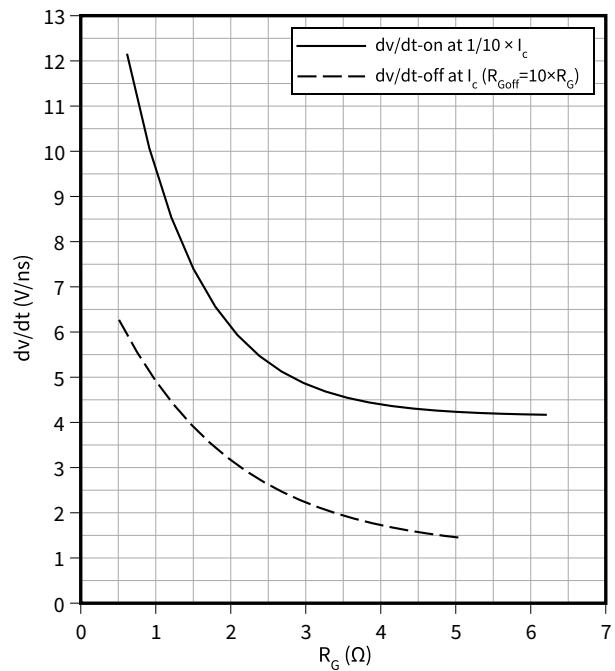
$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



**Voltage slope (typical), IGBT, T1 / T2**

$dv/dt = f(R_G)$

$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$

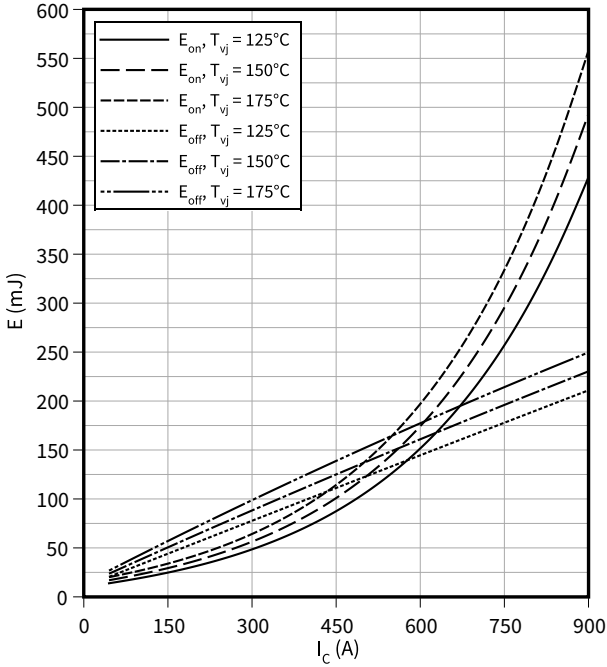


**5 Characteristics diagrams**

**Switching losses (typical), IGBT, T1 / T2**

$E = f(I_C)$

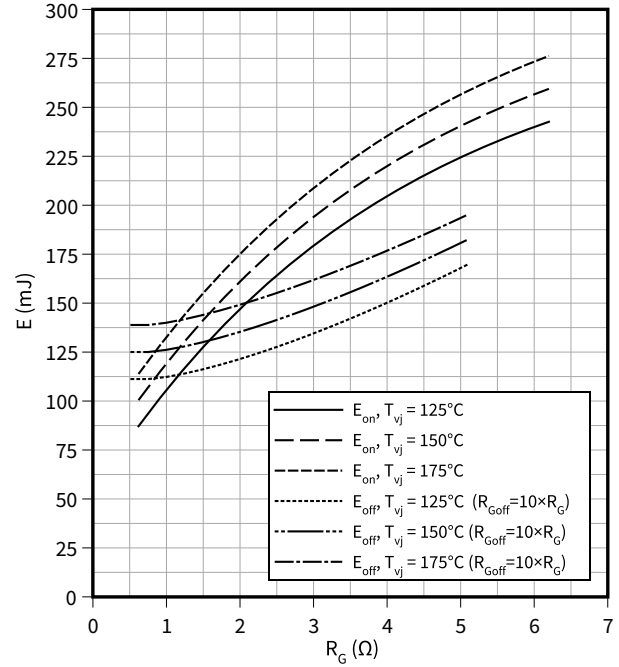
$R_{Goff} = 5.1 \Omega$ ,  $R_{Gon} = 0.62 \Omega$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



**Switching losses (typical), IGBT, T1 / T2**

$E = f(R_G)$

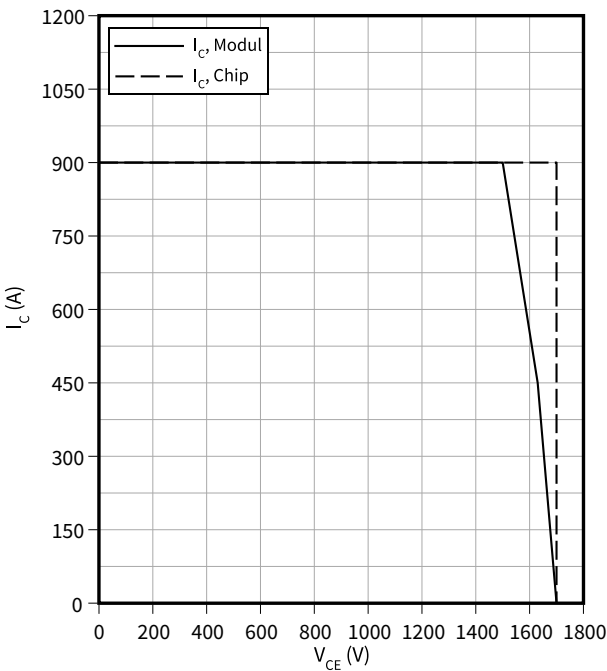
$I_C = 450 \text{ A}$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



**Reverse bias safe operating area (RBSOA), IGBT, T1 / T2**

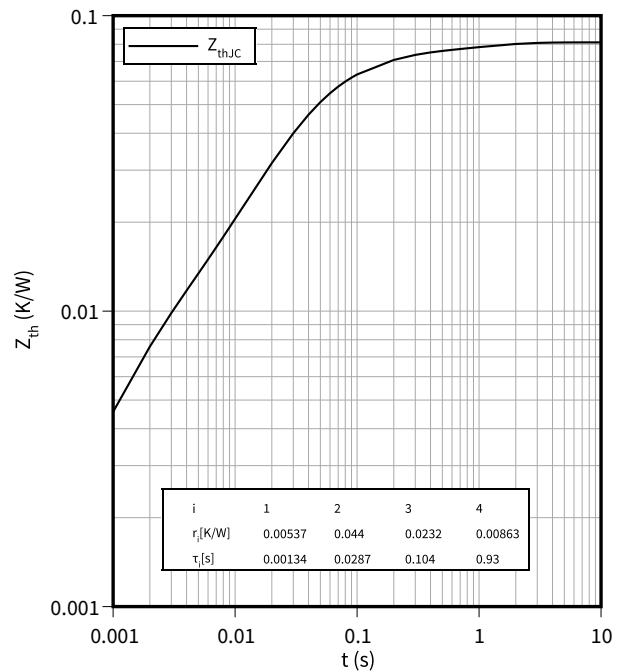
$I_C = f(V_{CE})$

$R_{Goff} = 5.1 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ °C}$



**Transient thermal impedance, IGBT, T1 / T2**

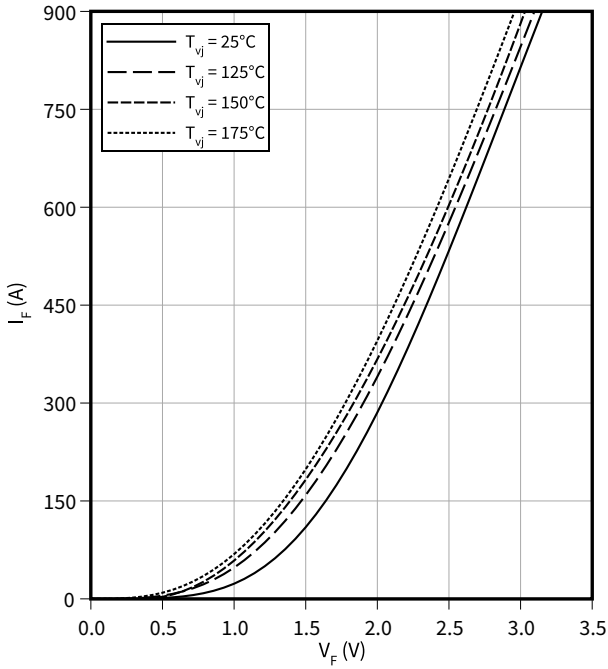
$Z_{th} = f(t)$



**5 Characteristics diagrams**

**Forward characteristic (typical), Diode, D1 / D2**

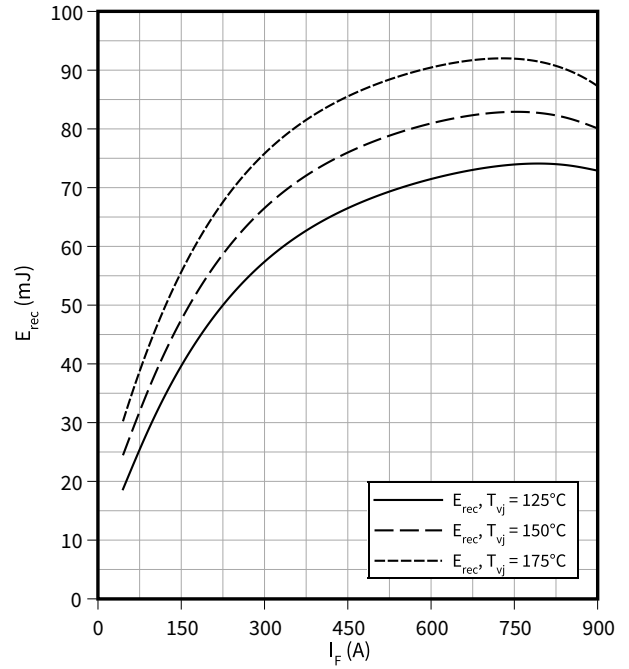
$I_F = f(V_F)$



**Switching losses (typical), Diode, D1 / D2**

$E_{rec} = f(I_F)$

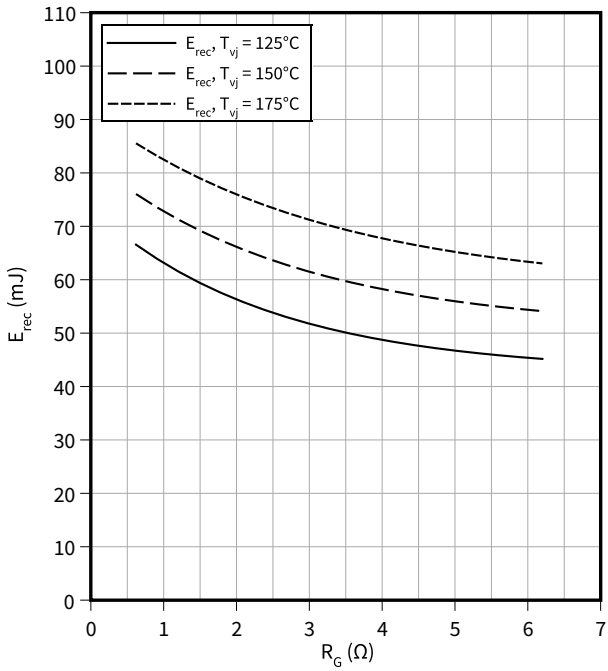
$R_{Gon} = 0.62 \Omega, V_{CC} = 900 \text{ V}$



**Switching losses (typical), Diode, D1 / D2**

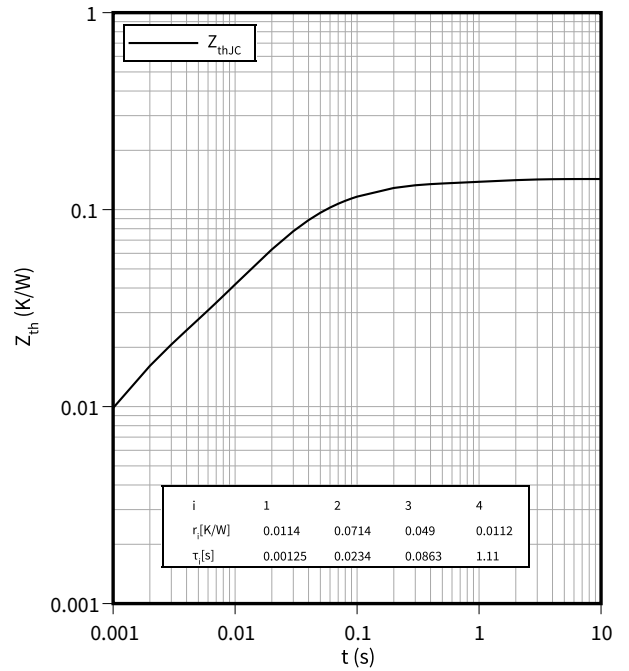
$E_{rec} = f(R_G)$

$I_F = 450 \text{ A}, V_{CC} = 900 \text{ V}$



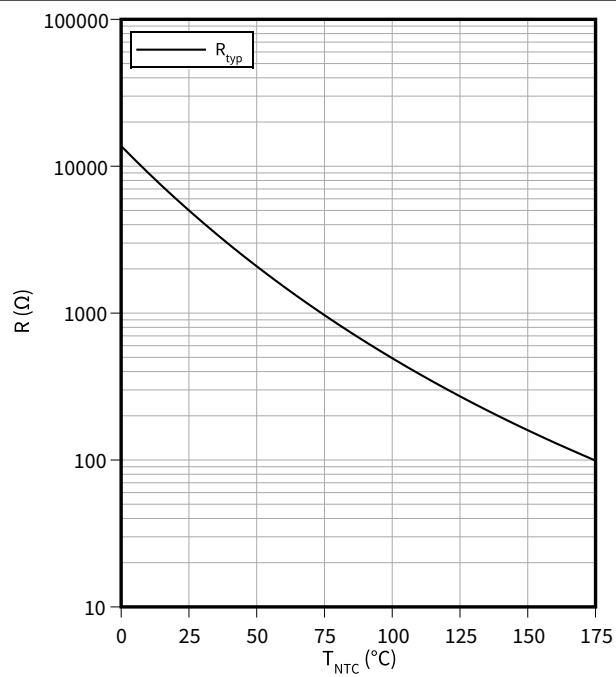
**Transient thermal impedance, Diode, D1 / D2**

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$$R = f(T_{NTC})$$



## 6 Circuit diagram

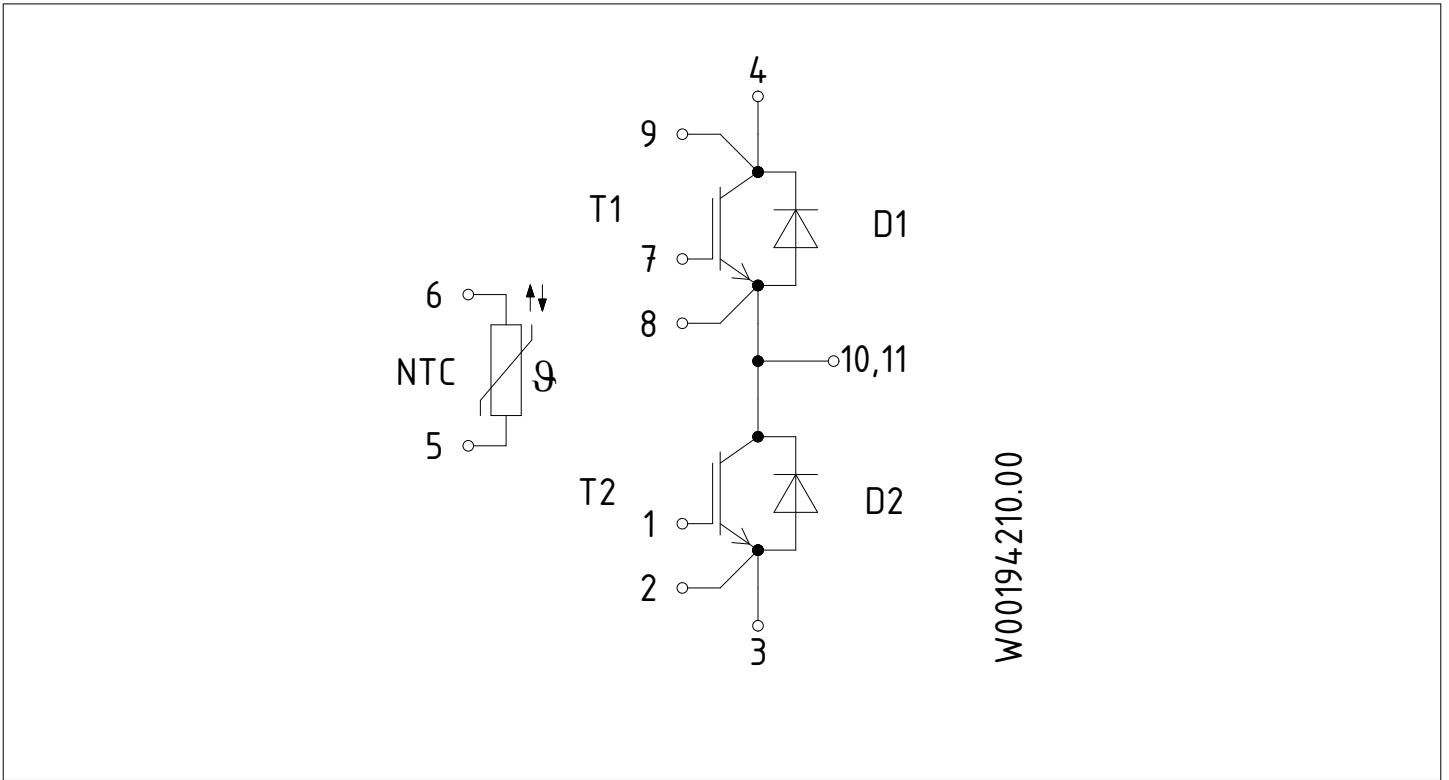


Figure 1

## 7 Package outlines

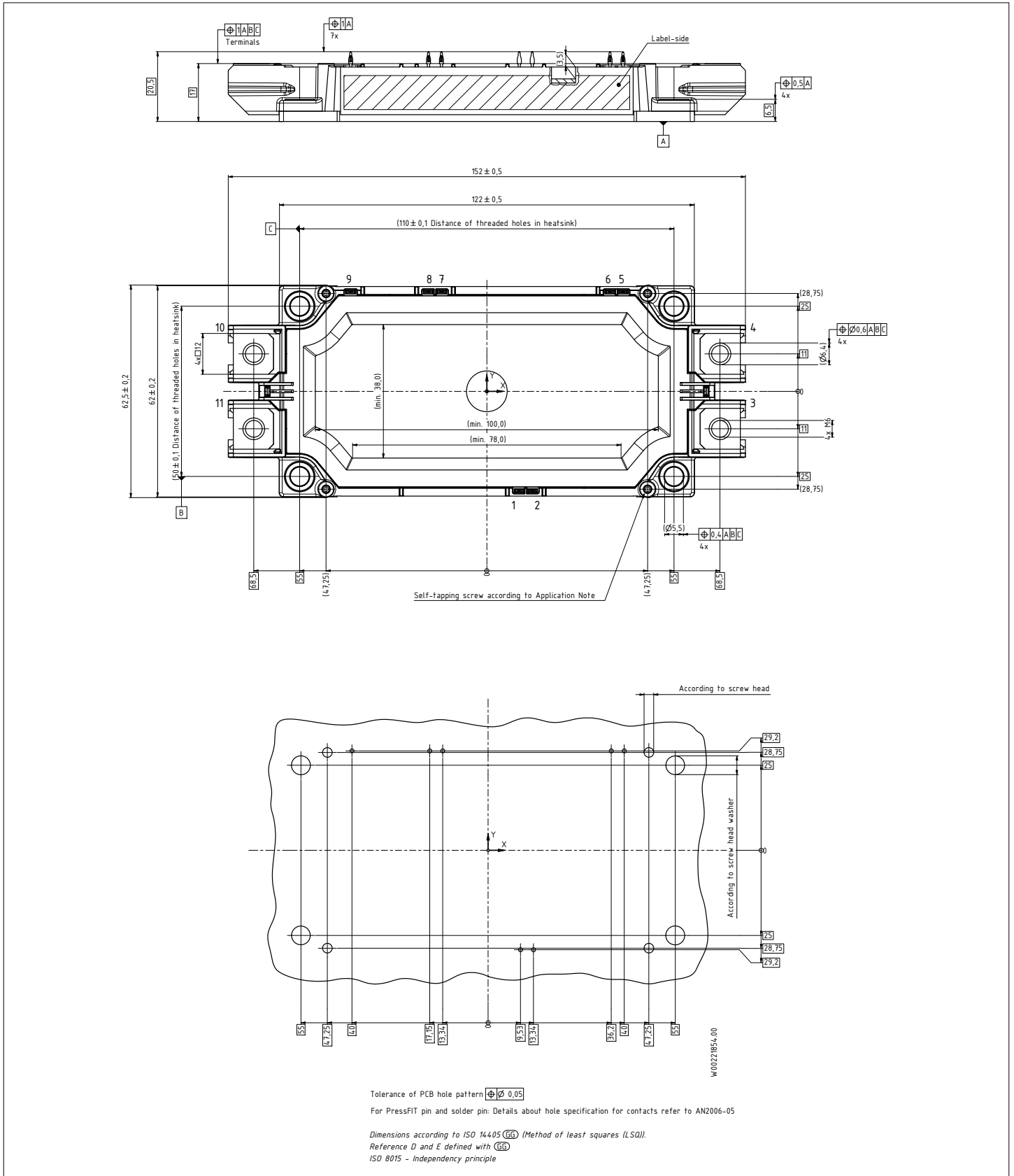

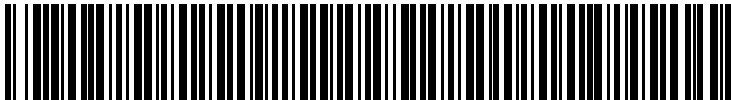


Figure 2

## 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	<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 3**

## Revision history

Document revision	Date of release	Description of changes
0.10	2023-04-06	Initial version
1.00	2023-08-07	Final datasheet
1.10	2024-03-11	Final datasheet



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