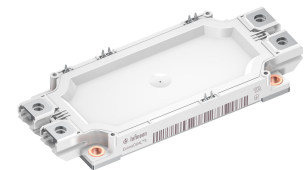


## Final datasheet

### 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



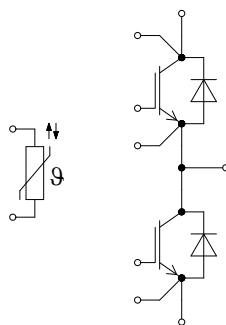
#### Potential applications

- 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, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$	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	15.0	mm
Creepage distance	$d_{Creep}$	terminal to terminal	13.0	mm
Clearance	$d_{Clear}$	terminal to heatsink	12.5	mm
Clearance	$d_{Clear}$	terminal to terminal	10.0	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	$L_{sCE}$			20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_C = 25 \text{ °C}$ , 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
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25 \text{ °C}$	1700	V
Implemented collector current	$I_{CN}$		450	A
Continuous DC collector current	$I_{CDC}$	$T_{vj \text{ max}} = 175 \text{ °C}$ $T_C = 90 \text{ °C}$	450	A

(table continues...)

**Table 3 (continued) Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit	
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	$V_{GES}$		±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		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\text{ °C}$		0.57		Ω
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	$I_{CES}$	$V_{CE} = 1700\text{ V}$ , $V_{GE} = 0\text{ V}$			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)	$t_{don}$	$I_C = 450\text{ A}$ , $V_{CC} = 900\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 0.62\text{ }\Omega$	$T_{vj} = 25\text{ °C}$	0.144		μs
			$T_{vj} = 125\text{ °C}$	0.162		
			$T_{vj} = 150\text{ °C}$	0.165		
			$T_{vj} = 175\text{ °C}$	0.168		
Rise time (inductive load)	$t_r$	$I_C = 450\text{ A}$ , $V_{CC} = 900\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 0.62\text{ }\Omega$	$T_{vj} = 25\text{ °C}$	0.034		μs
			$T_{vj} = 125\text{ °C}$	0.038		
			$T_{vj} = 150\text{ °C}$	0.040		
			$T_{vj} = 175\text{ °C}$	0.043		

(table continues...)

**Table 4** (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	$t_{\text{doff}}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V},$ $V_{GE} = \pm 15 \text{ V}, R_{\text{Goff}} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$		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)	$t_f$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V},$ $V_{GE} = \pm 15 \text{ V}, R_{\text{Goff}} = 5.1 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$		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	$E_{\text{on}}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V},$ $L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V},$ $R_{\text{Gon}} = 0.62 \Omega, di/dt =$ $9000 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		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	$E_{\text{off}}$	$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V},$ $L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V},$ $R_{\text{Goff}} = 5.1 \Omega, dv/dt =$ $3800 \text{ V}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		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	$I_{\text{SC}}$	$V_{GE} = 15 \text{ V}, V_{CC} = 1000 \text{ V},$ $V_{\text{CEmax}} = V_{\text{CES}} - L_{\text{sCE}} \cdot di/dt$	$t_p \leq 8 \mu\text{s},$ $T_{vj} = 150 \text{ }^\circ\text{C}$		1600	A
			$t_p \leq 6 \mu\text{s},$ $T_{vj} = 175 \text{ }^\circ\text{C}$		1500	
Thermal resistance, junction to case	$R_{\text{thJC}}$	per IGBT			0.0812	K/W
Thermal resistance, case to heat sink	$R_{\text{thCH}}$	per IGBT, $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}\cdot\text{K})$			0.0368	K/W
Temperature under switching conditions	$T_{vj\text{op}}$		-40		175	$^\circ\text{C}$

Note:  $T_{vj\text{op}} > 150 \text{ }^\circ\text{C}$  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	$V_{\text{RRM}}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1700	V

(table continues...)

**Table 5 (continued) Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit	
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	$A^2s$
			$T_{vj} = 175 \text{ °C}$	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	$T_{vjop}$		-40		175	$^{\circ}\text{C}$	

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 $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ }\Omega$	-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

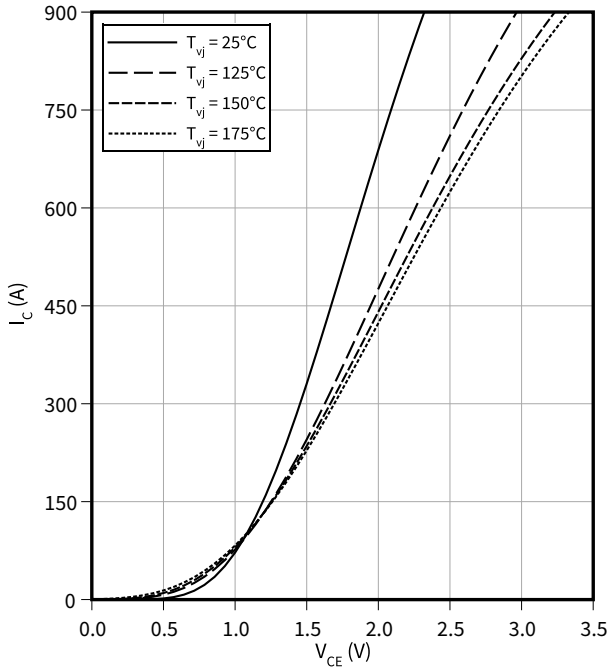
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

## 5 Characteristics diagrams

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

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

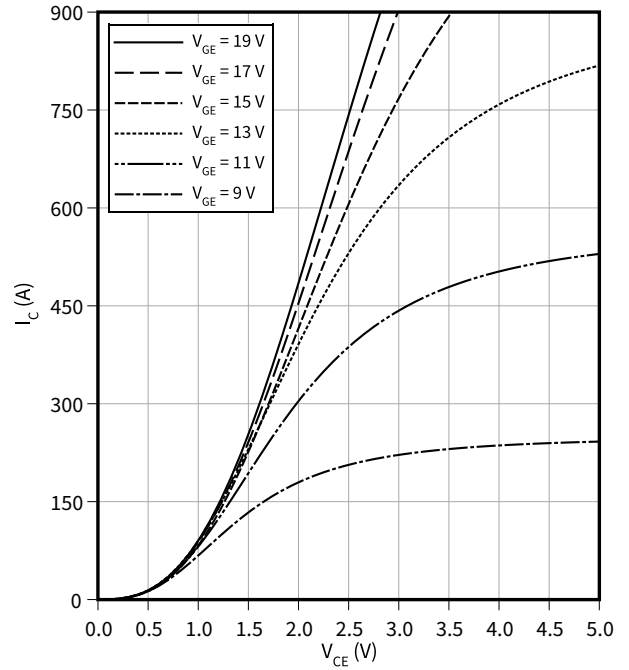
$$V_{GE} = 15 \text{ V}$$



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

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

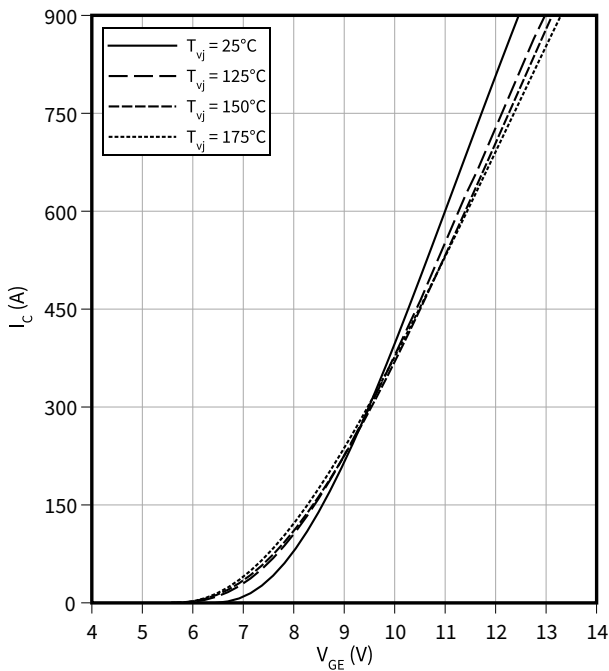
$$T_{vj} = 175 \text{ °C}$$



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

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

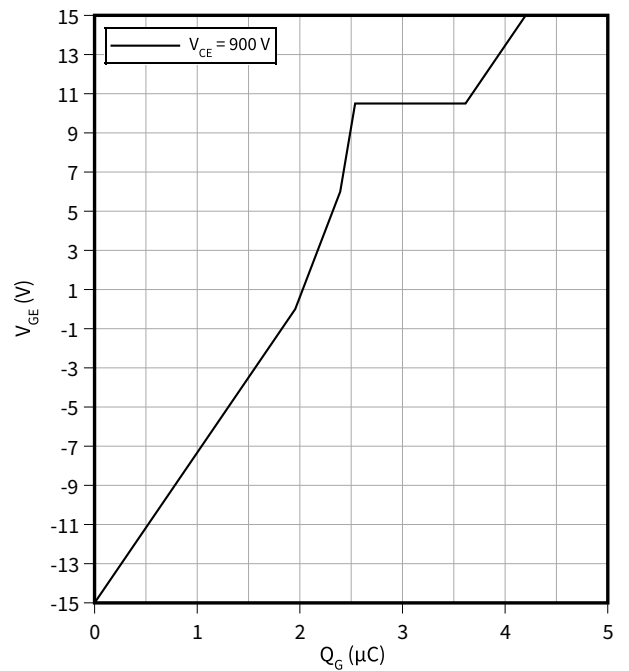
$$V_{CE} = 20 \text{ V}$$



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

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

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



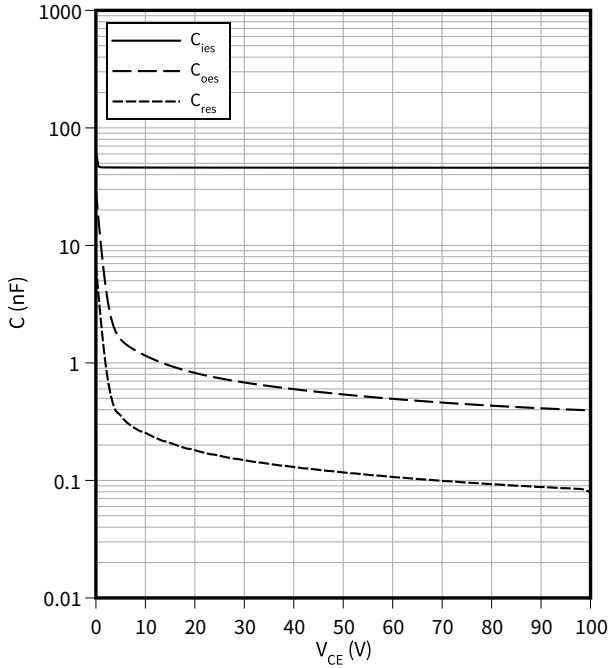


5 Characteristics diagrams

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

$C = f(V_{CE})$

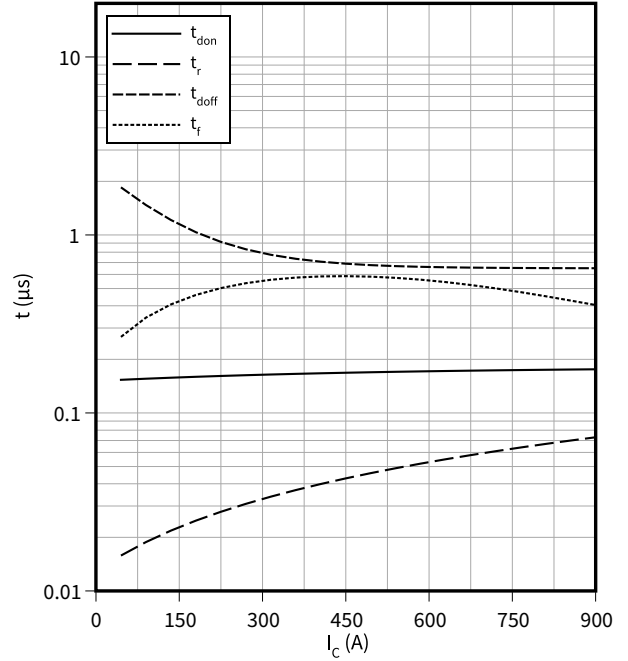
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$



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

$t = f(I_C)$

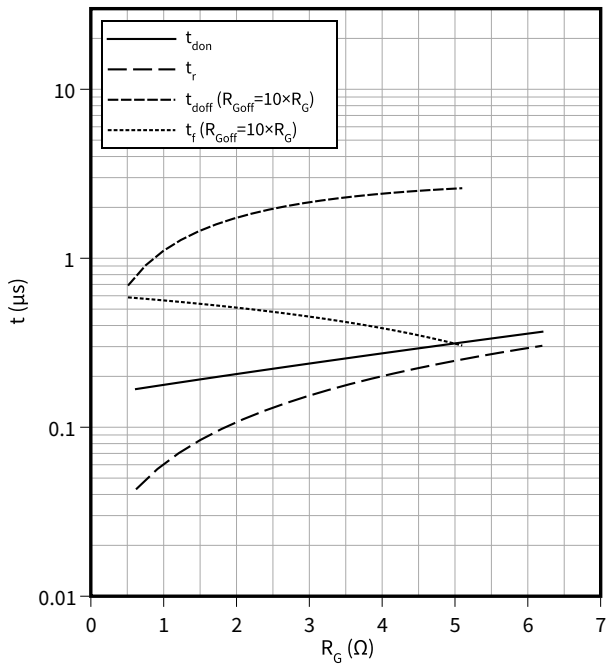
$R_{Goff} = 5.1 \text{ } \Omega, R_{Gon} = 0.62 \text{ } \Omega, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



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

$t = f(R_G)$

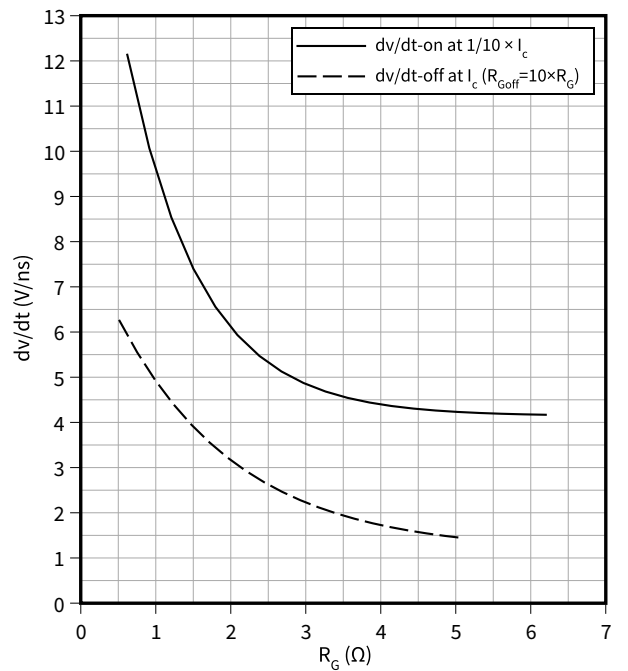
$I_C = 450 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



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

$dv/dt = f(R_G)$

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

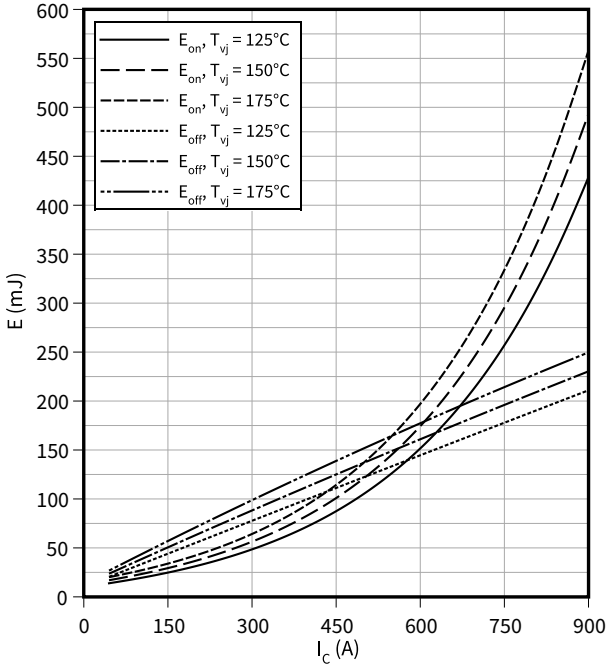


5 Characteristics diagrams

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

$E = f(I_C)$

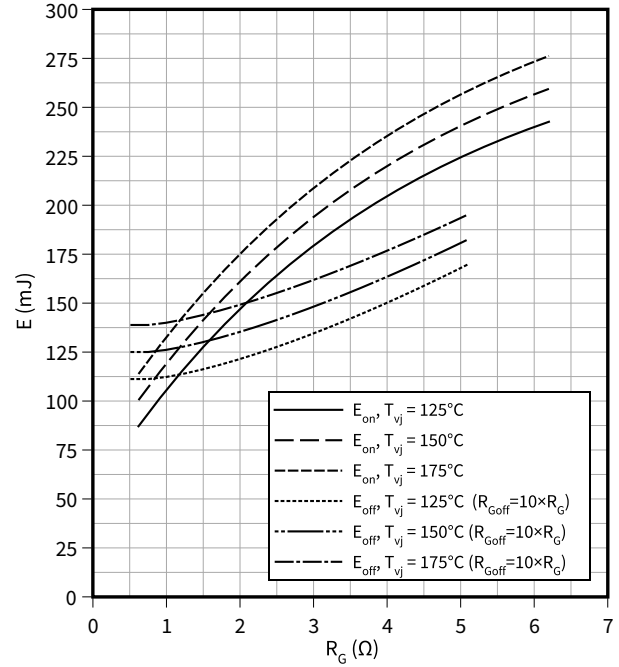
$R_{Goff} = 5.1 \Omega$ ,  $R_{Gon} = 0.62 \Omega$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



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

$E = f(R_G)$

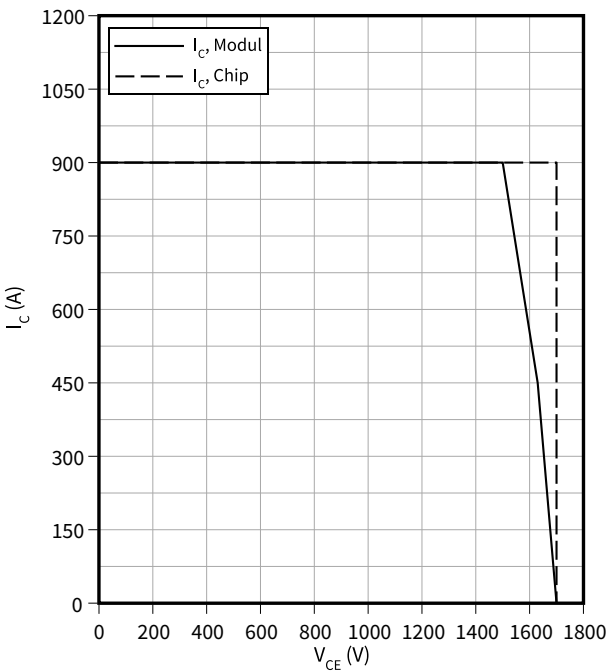
$I_C = 450 \text{ A}$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



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

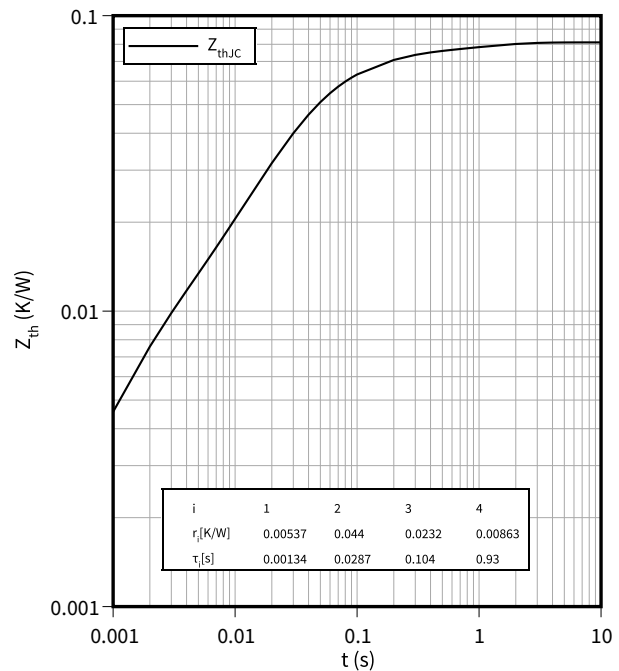
$I_C = f(V_{CE})$

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



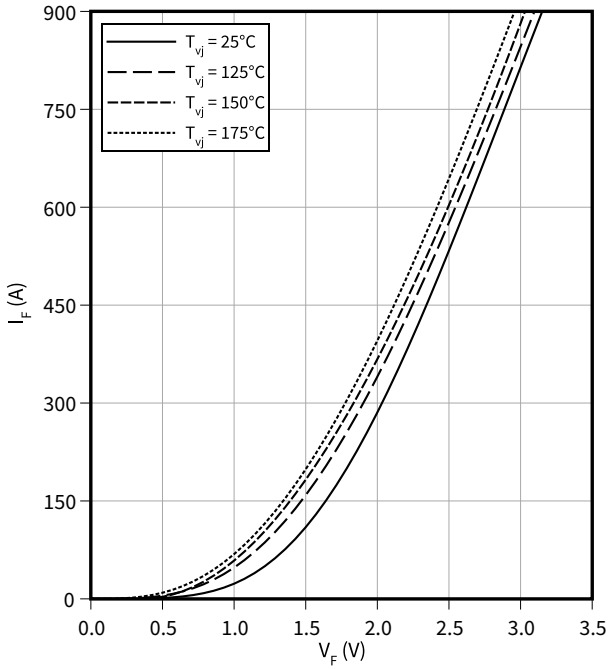
**Transient thermal impedance, IGBT, T1 / T2**

$Z_{th} = f(t)$



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

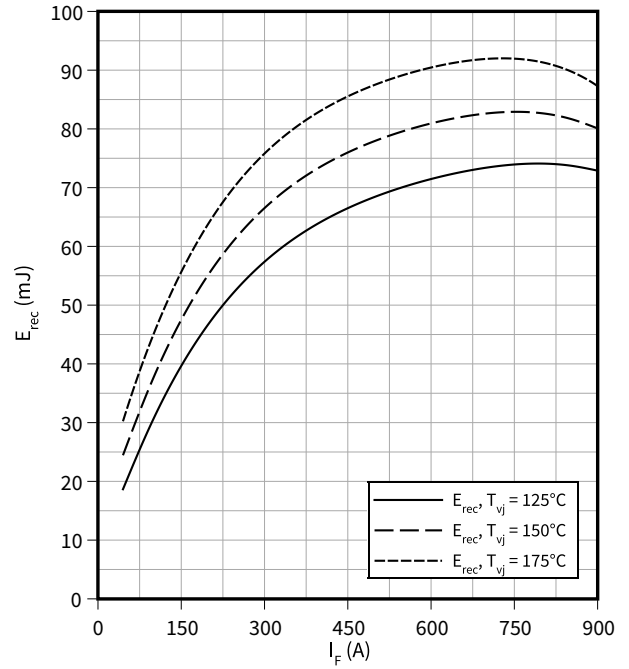
$I_F = f(V_F)$



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

$E_{rec} = f(I_F)$

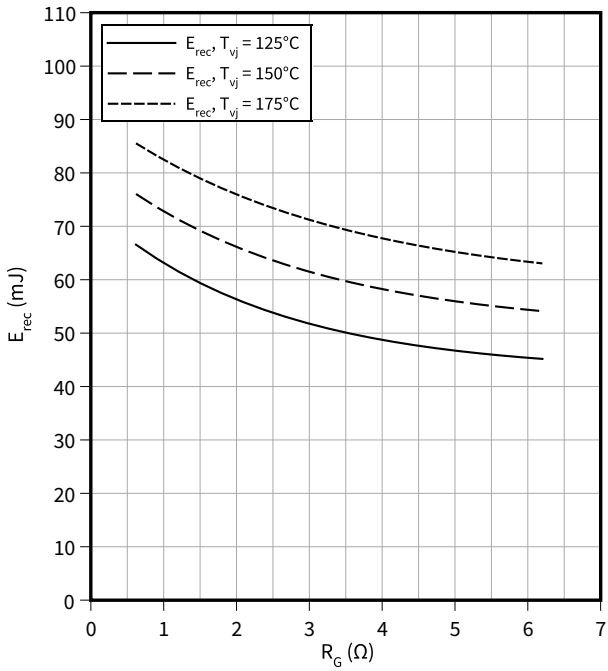
$R_{Gon} = 0.62 \Omega, V_{CC} = 900 V$



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

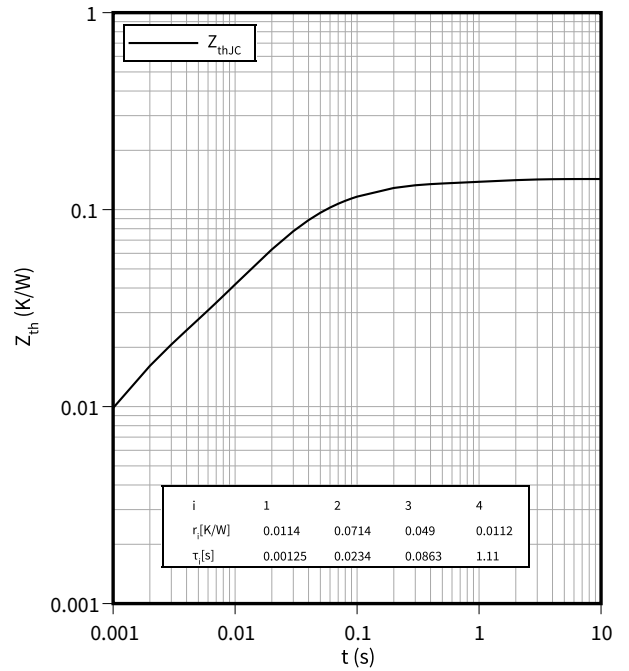
$E_{rec} = f(R_G)$

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



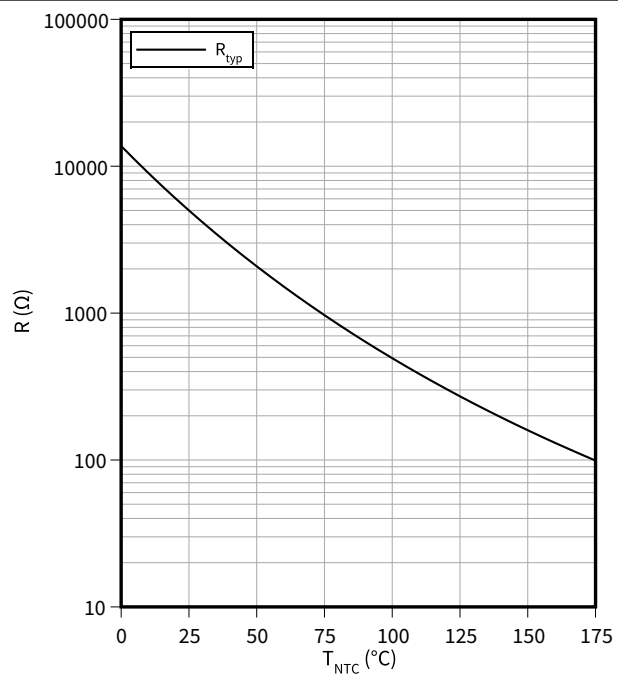
**Transient thermal impedance, Diode, D1 / D2**

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



## 6 Circuit diagram

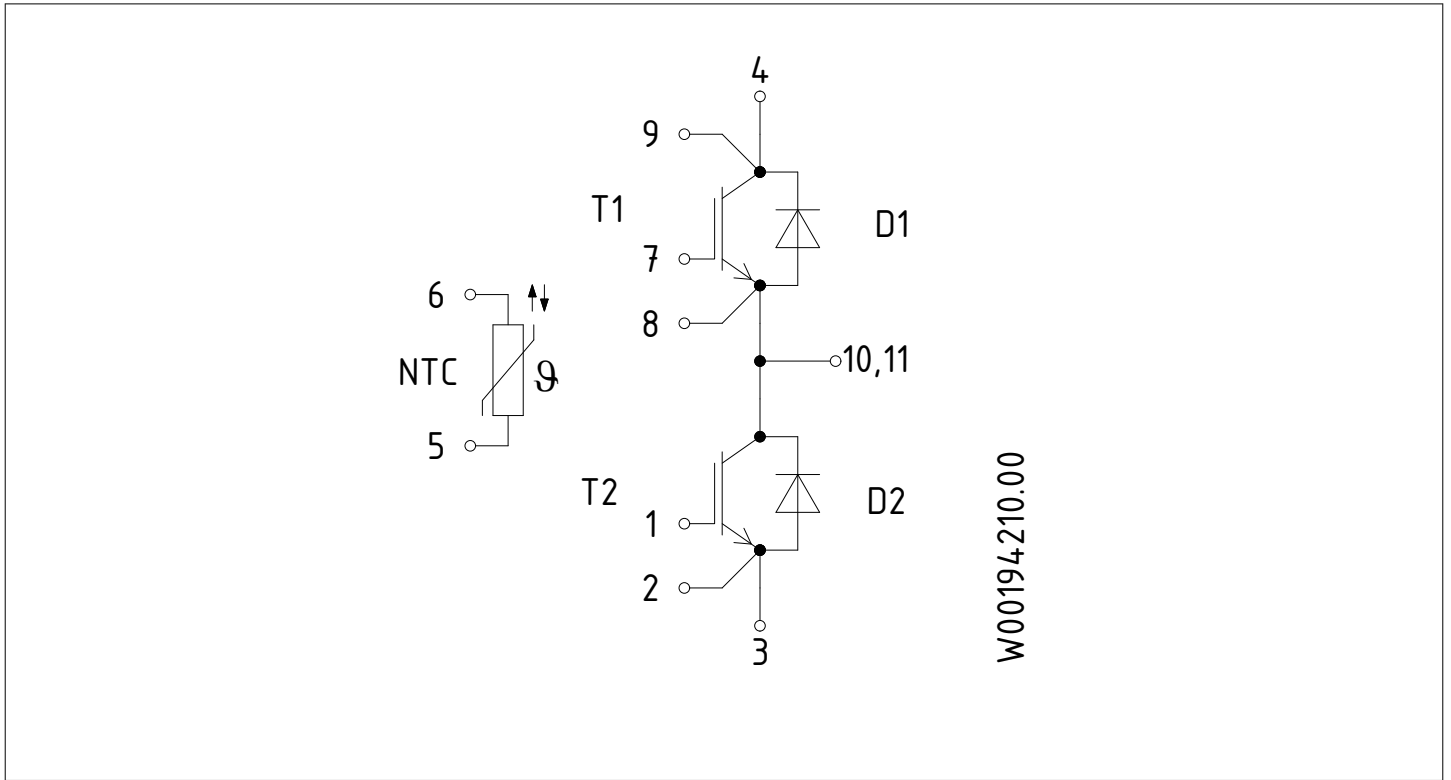


Figure 1

## 7 Package outlines

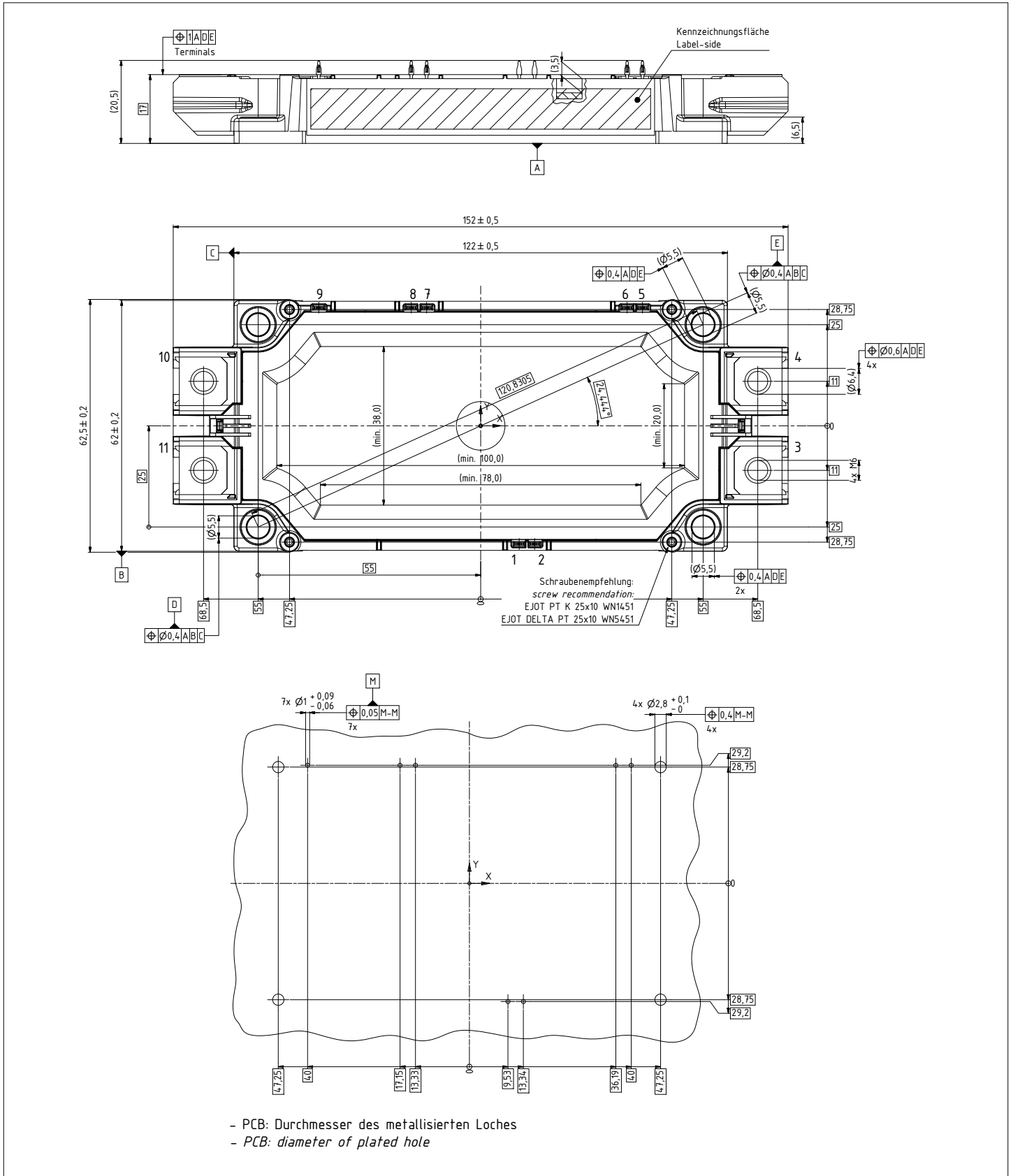

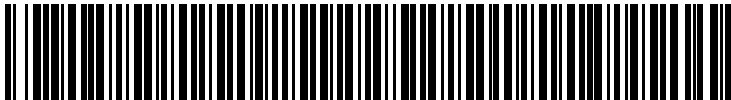


Figure 2

## 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> Module serial number Module material number Production order number Date code (production year) Date code (production week)	<i>Digit</i> 1 - 5 6 - 11 12 - 19 20 - 21 22 - 23	<i>Example</i> 71549 142846 55054991 15 30
Example	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   71549142846550549911530 </div> <div style="text-align: center;">   71549142846550549911530 </div> </div>		

**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



## Trademarks

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