

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

### Features

- Electrical features
  - $V_{CES} = 1700\text{ V}$
  - $I_{C\text{nom}} = 750\text{ A} / I_{CRM} = 1500\text{ A}$
  - Integrated temperature sensor
  - High current density
  - Low  $V_{CE,\text{sat}}$
  - Overload operation up to  $175^\circ\text{C}$
  - TRENCHSTOP™ IGBT7
  - $V_{CE,\text{sat}}$  with positive temperature coefficient
  - Enlarged diode for regenerative operation
- Mechanical features
  - High power density
  - Isolated base plate
  - PressFIT contact technology
  - Standard housing



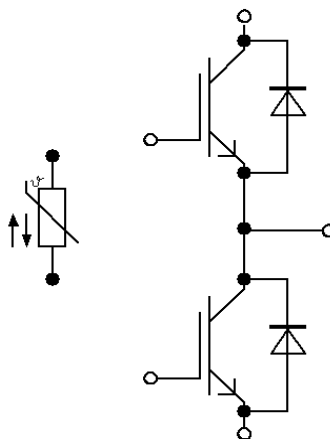
### Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- Wind turbines
- Power transmission and distribution

### 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
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al2O3	
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	$R_{CC'+EE'}$	$T_C = 25^\circ\text{C}$ , 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, Inverter

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25^\circ\text{C}$	1700	V
Continuous DC collector current	$I_{CDC}$	$T_{vj\ max} = 175^\circ\text{C}$ $T_C = 80^\circ\text{C}$	750	A
Maximum RMS module DC-terminal current	$I_{tRMS}$	$T_{Terminal} = 90^\circ\text{C}$ , $T_C = 90^\circ\text{C}$	580	A
		$T_{Terminal} = 105^\circ\text{C}$ , $T_C = 90^\circ\text{C}$	565	

(table continues...)  
Datasheet

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

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{vj\ op}$	1500	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	$V_{CE\ sat}$	$I_C = 750\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.70	1.85	V
			$T_{vj} = 125\ ^\circ C$	1.95		
			$T_{vj} = 150\ ^\circ C$	2.05		
			$T_{vj} = 175\ ^\circ C$	2.10		
Gate threshold voltage	$V_{Geth}$	$I_C = 15.7\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\ V, V_{CE} = 900\ V$		7.15		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\ ^\circ C$		0.33		Ω
Input capacitance	$C_{ies}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		78.1		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.275		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1700\ V, V_{GE} = 0\ V$			5	mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$			100	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 750\ A, V_{CE} = 900\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.51\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.158		μs
			$T_{vj} = 125\ ^\circ C$	0.172		
			$T_{vj} = 150\ ^\circ C$	0.178		
			$T_{vj} = 175\ ^\circ C$	0.184		
Rise time (inductive load)	$t_r$	$I_C = 750\ A, V_{CE} = 900\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.51\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.046		μs
			$T_{vj} = 125\ ^\circ C$	0.053		
			$T_{vj} = 150\ ^\circ C$	0.055		
			$T_{vj} = 175\ ^\circ C$	0.057		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 750\ A, V_{CE} = 900\ V, V_{GE} = \pm 15\ V, R_{Goff} = 2.2\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.536		μs
			$T_{vj} = 125\ ^\circ C$	0.613		
			$T_{vj} = 150\ ^\circ C$	0.631		
			$T_{vj} = 175\ ^\circ C$	0.648		

(table continues...)

**Table 4** (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Fall time (inductive load)	$t_f$	$I_C = 750 \text{ A}, V_{CE} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$		0.231	$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$		0.450	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		0.525	
			$T_{vj} = 175 \text{ }^\circ\text{C}$		0.599	
Turn-on energy loss per pulse	$E_{on}$	$I_C = 750 \text{ A}, V_{CE} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.51 \Omega, di/dt = 11.1 \text{ kA}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		74	mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$		171	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		204	
			$T_{vj} = 175 \text{ }^\circ\text{C}$		238	
Turn-off energy loss per pulse	$E_{off}$	$I_C = 750 \text{ A}, V_{CE} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega, dv/dt = 3600 \text{ V}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		132	mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$		208	
			$T_{vj} = 150 \text{ }^\circ\text{C}$		224	
			$T_{vj} = 175 \text{ }^\circ\text{C}$		239	
SC data	$I_{SC}$	$V_{GE} = 15 \text{ V}, V_{CC} = 1000 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 8 \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$		2600	A
			$t_p \leq 6 \mu\text{s}, T_{vj} = 175 \text{ }^\circ\text{C}$		2500	
Thermal resistance, junction to case	$R_{thJC}$	per IGBT			0.0551	K/W
Thermal resistance, case to heat sink	$R_{thCH}$	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$			0.0345	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, 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
Implemented forward current	$I_{FN}$		1200	A
Continuous DC forward current	$I_F$		750	A

(table continues...)

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

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak forward current	$I_{FRM}$	$t_p = 1 \text{ ms}$	1500	A	
$I^2t$ - value	$I^2t$	$t_p = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	48300	$A^2s$
			$T_{vj} = 175 \text{ °C}$	37200	

**Table 6 Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Forward voltage	$V_F$	$I_F = 750 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		2.00	2.15	V
			$T_{vj} = 125 \text{ °C}$		1.85		
			$T_{vj} = 150 \text{ °C}$		1.80		
			$T_{vj} = 175 \text{ °C}$		1.75		
Peak reverse recovery current	$I_{RM}$	$V_R = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11.8 \text{ kA}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		950		A
			$T_{vj} = 125 \text{ °C}$		1020		
			$T_{vj} = 150 \text{ °C}$		1020		
			$T_{vj} = 175 \text{ °C}$		1020		
Recovered charge	$Q_r$	$V_R = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11.8 \text{ kA}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		115		$\mu\text{C}$
			$T_{vj} = 125 \text{ °C}$		218		
			$T_{vj} = 150 \text{ °C}$		255		
			$T_{vj} = 175 \text{ °C}$		292		
Reverse recovery energy	$E_{rec}$	$V_R = 900 \text{ V}, I_F = 750 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 11.8 \text{ kA}/\mu\text{s} (T_{vj} = 175 \text{ °C})$	$T_{vj} = 25 \text{ °C}$		76		mJ
			$T_{vj} = 125 \text{ °C}$		132		
			$T_{vj} = 150 \text{ °C}$		152		
			$T_{vj} = 175 \text{ °C}$		171		
Thermal resistance, junction to case	$R_{thJC}$	per diode			0.0753	K/W	
Thermal resistance, case to heat sink	$R_{thCH}$	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}\cdot\text{K})$		0.0363		K/W	
Temperature under switching conditions	$T_{vj\text{op}}$		-40		175	$^{\circ}\text{C}$	

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

## 4 NTC-Thermistor

**Table 7** Characteristic values

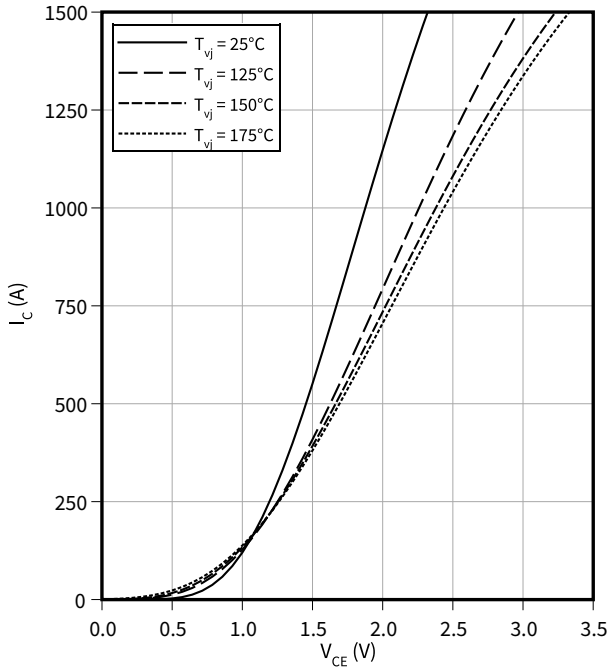
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	$R_{25}$	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\ \Omega$	-5		5	%
Power dissipation	$P_{25}$	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$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

## 5 Characteristics diagrams

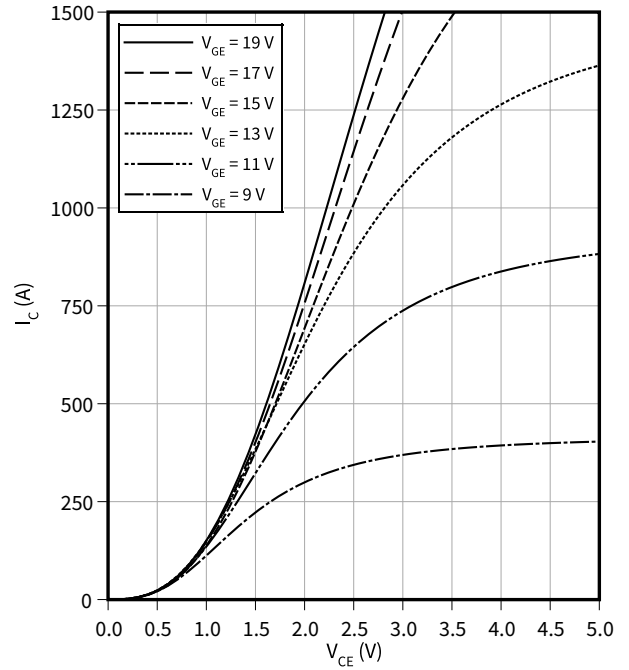
**Output characteristic (typical), IGBT, Inverter**

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



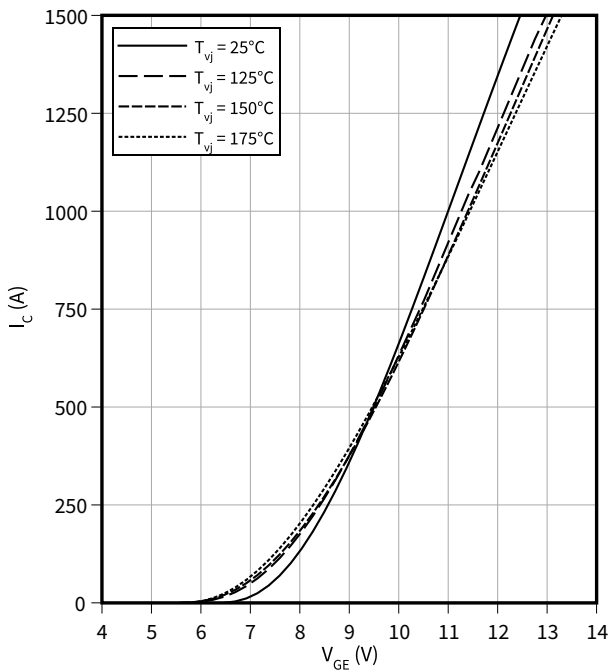
**Output characteristic field (typical), IGBT, Inverter**

$I_C = f(V_{CE})$   
 $T_{vj} = 175 \text{ °C}$



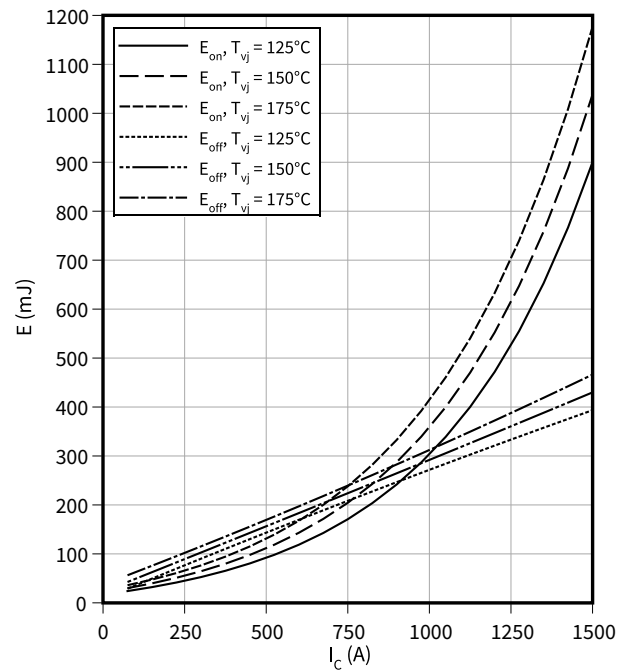
**Transfer characteristic (typical), IGBT, Inverter**

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



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

$E = f(I_C)$   
 $R_{Goff} = 2.2 \text{ } \Omega$ ,  $R_{Gon} = 0.51 \text{ } \Omega$ ,  $V_{CE} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



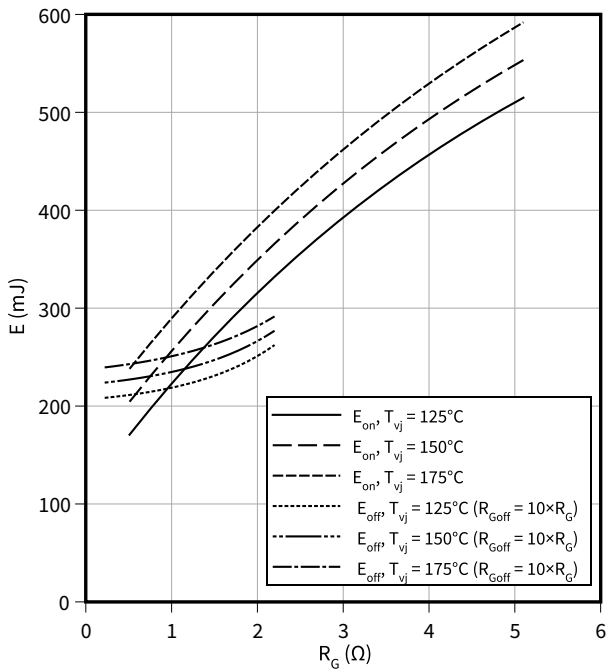


5 Characteristics diagrams

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

$E = f(R_G)$

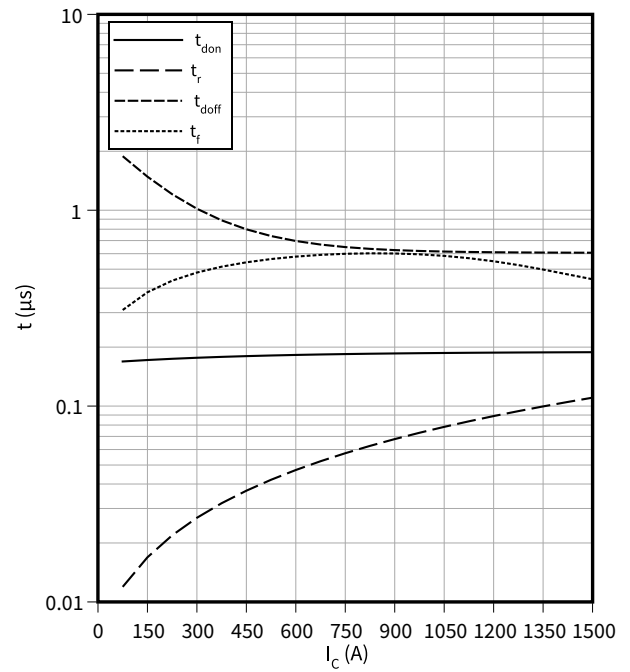
$I_C = 750 \text{ A}$ ,  $V_{CE} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



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

$t = f(I_C)$

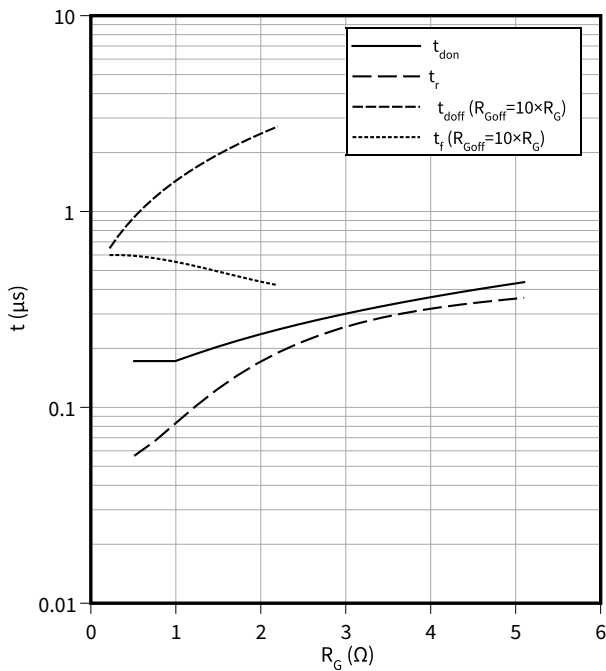
$R_{Goff} = 2.2 \Omega$ ,  $R_{Gon} = 0.51 \Omega$ ,  $V_{CE} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ °C}$



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

$t = f(R_G)$

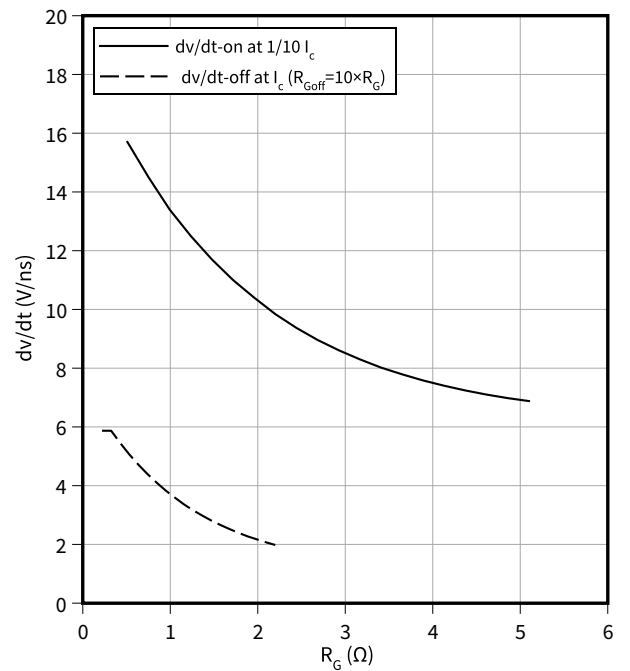
$I_C = 750 \text{ A}$ ,  $V_{CE} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ °C}$



**Voltage slope (typical), IGBT, Inverter**

$dv/dt = f(R_G)$

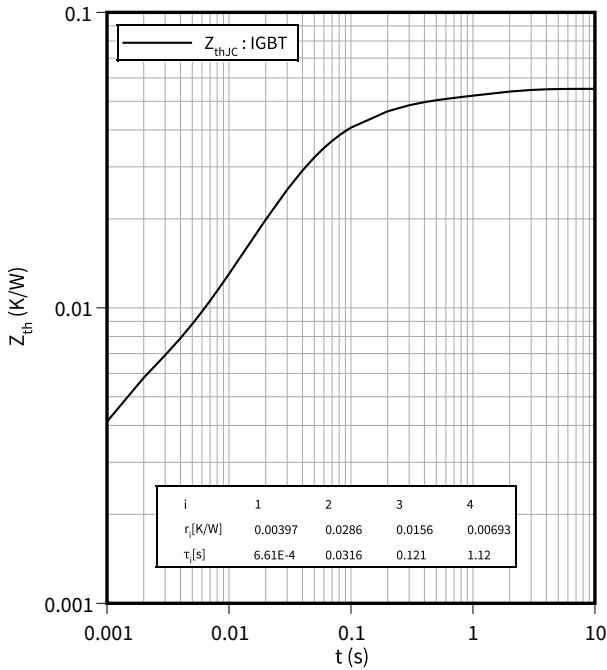
$I_C = 750 \text{ A}$ ,  $V_{CE} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 25 \text{ °C}$



5 Characteristics diagrams

**Transient thermal impedance, IGBT, Inverter**

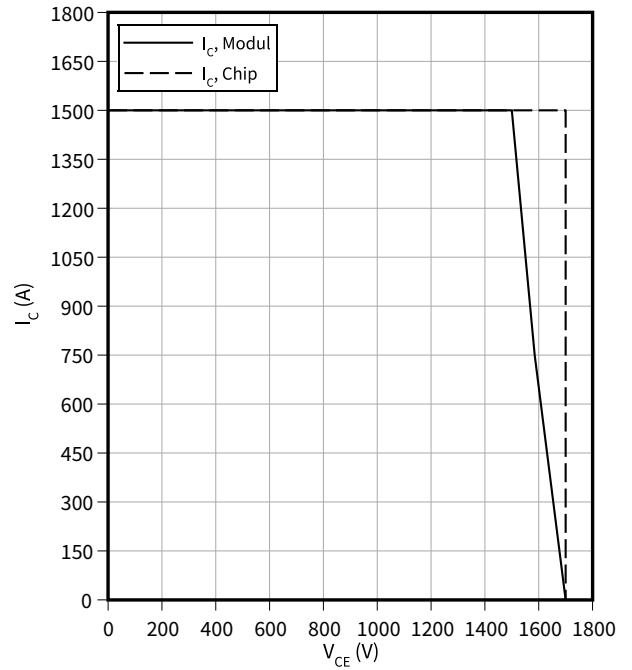
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

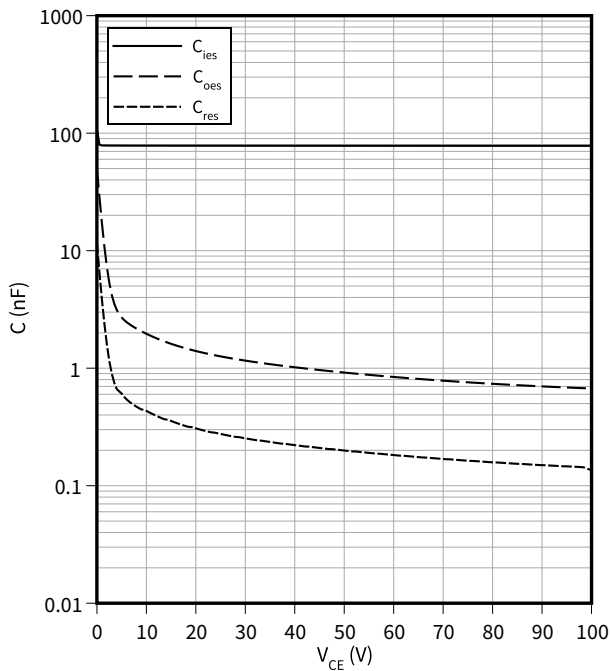
$R_{Goff} = 2.2 \Omega, V_{GE} = \pm 15 V, T_{vj} = 175 \text{ }^\circ\text{C}$



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

$C = f(V_{CE})$

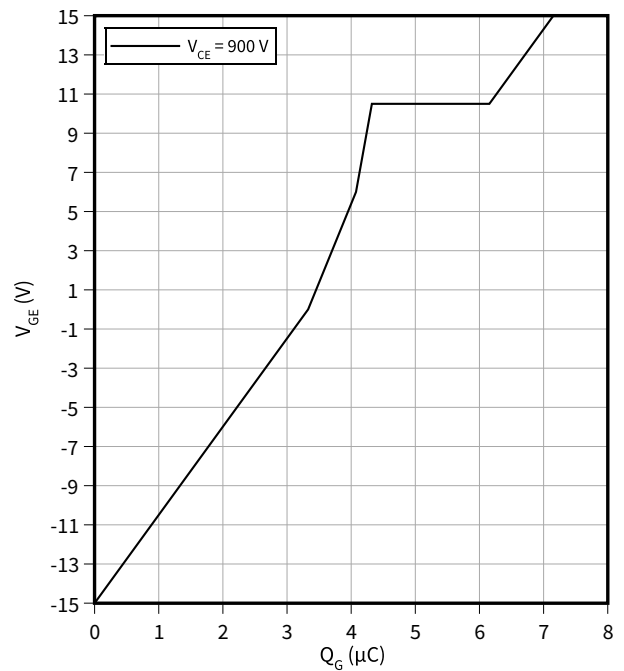
$f = 100 \text{ kHz}, V_{GE} = 0 V, T_{vj} = 25 \text{ }^\circ\text{C}$



**Gate charge characteristic (typical), IGBT, Inverter**

$V_{GE} = f(Q_G)$

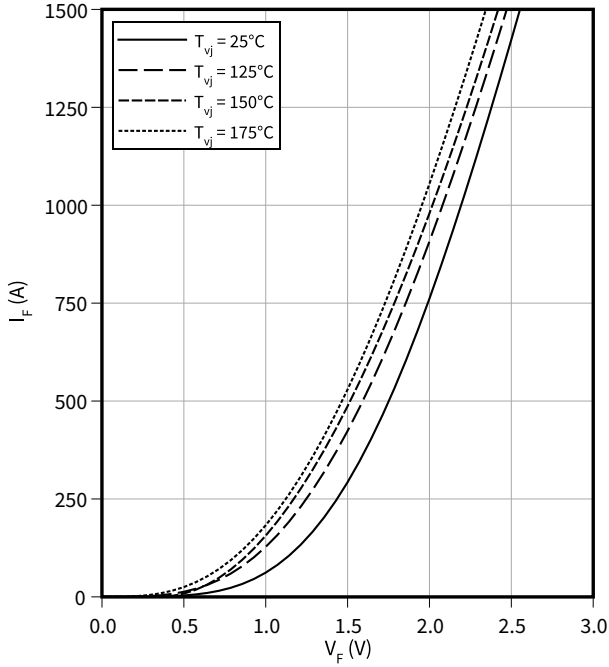
$I_C = 750 A, T_{vj} = 25 \text{ }^\circ\text{C}$



5 Characteristics diagrams

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

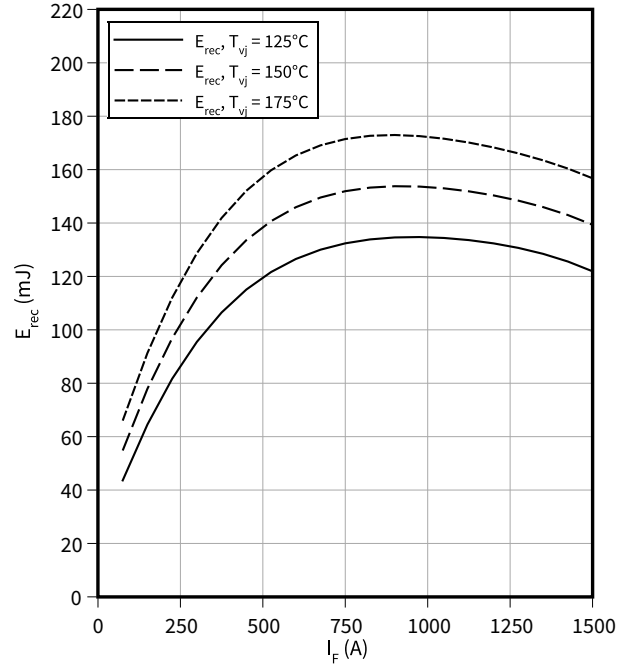
$I_F = f(V_F)$



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

$E_{rec} = f(I_F)$

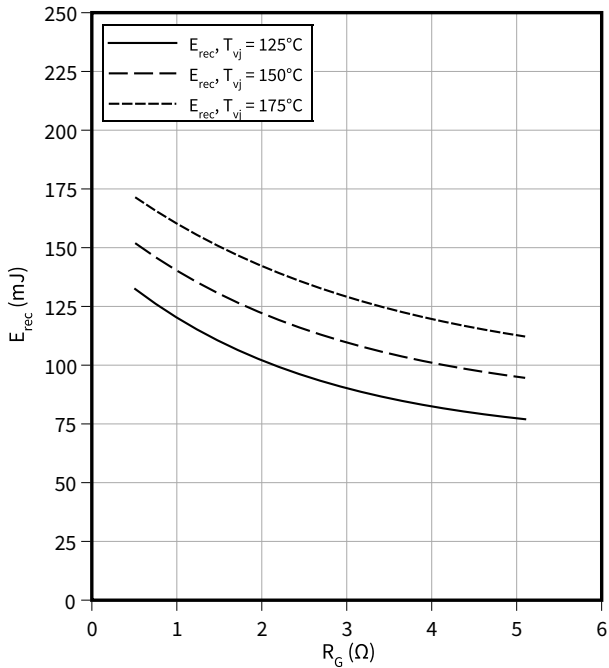
$R_{Gon} = 0.51 \Omega, V_{CE} = 900 V$



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

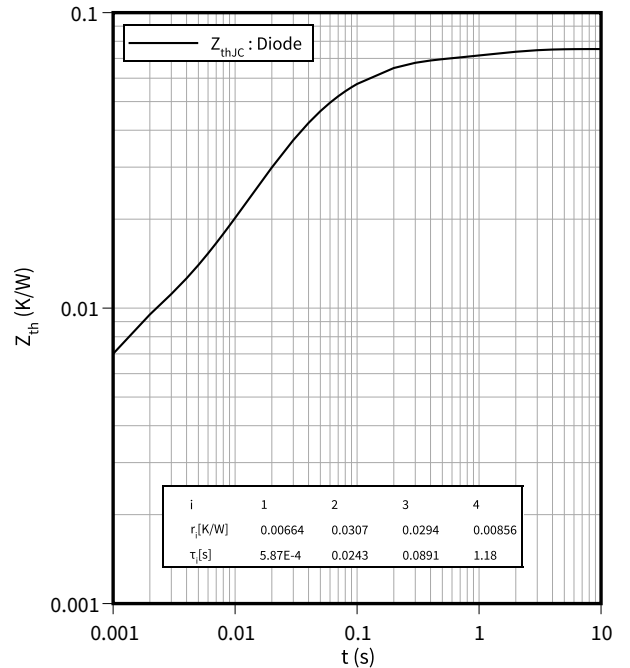
$E_{rec} = f(R_G)$

$V_{CE} = 900 V, I_F = 750 A$



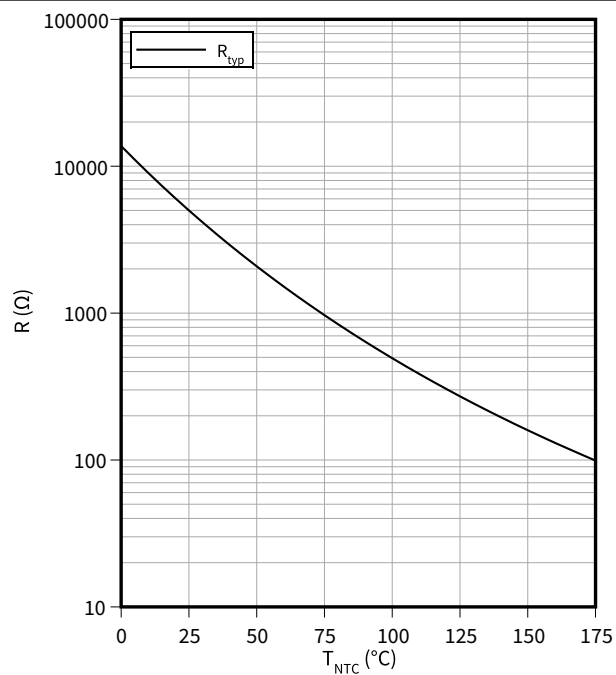
**Transient thermal impedance, Diode, Inverter**

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

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



## 6 Circuit diagram

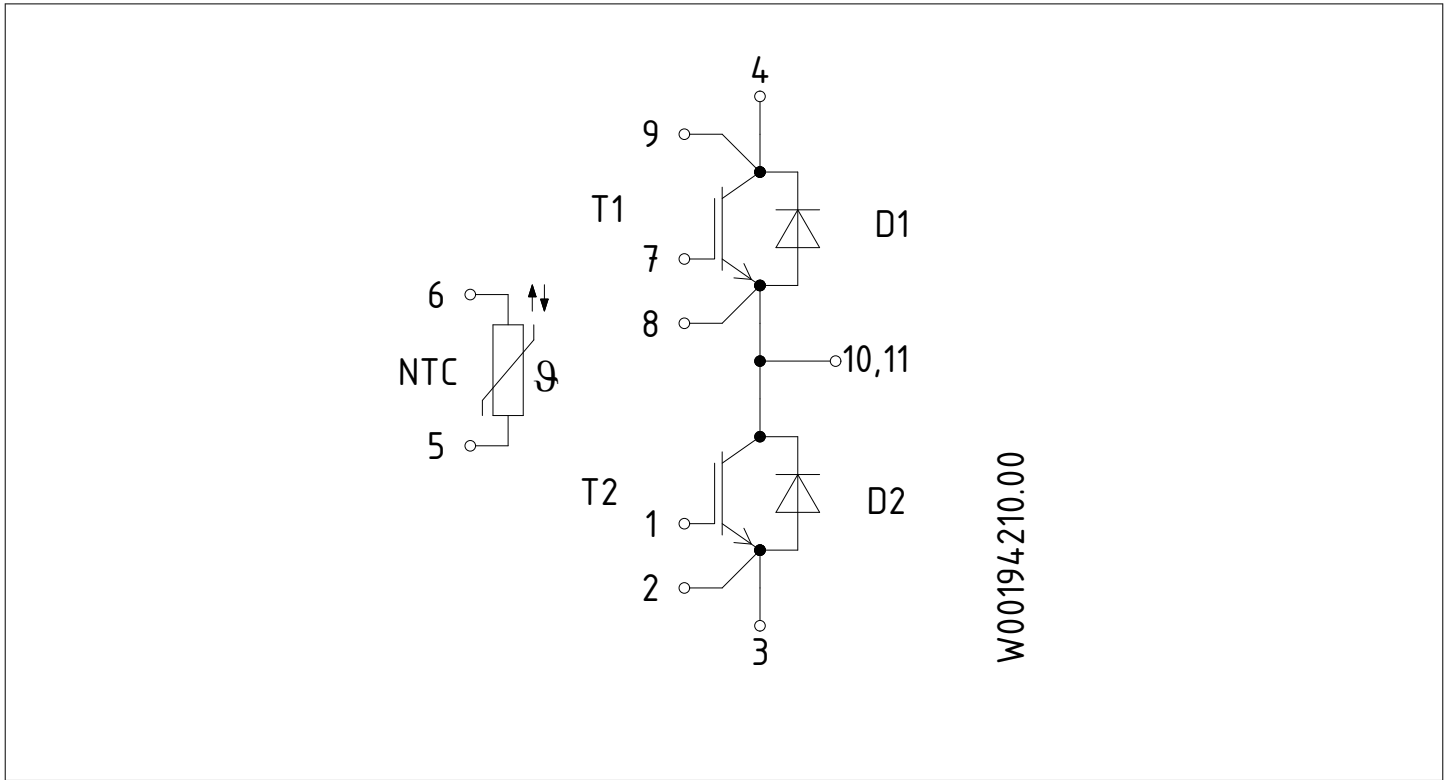


Figure 1

## 7 Package outlines

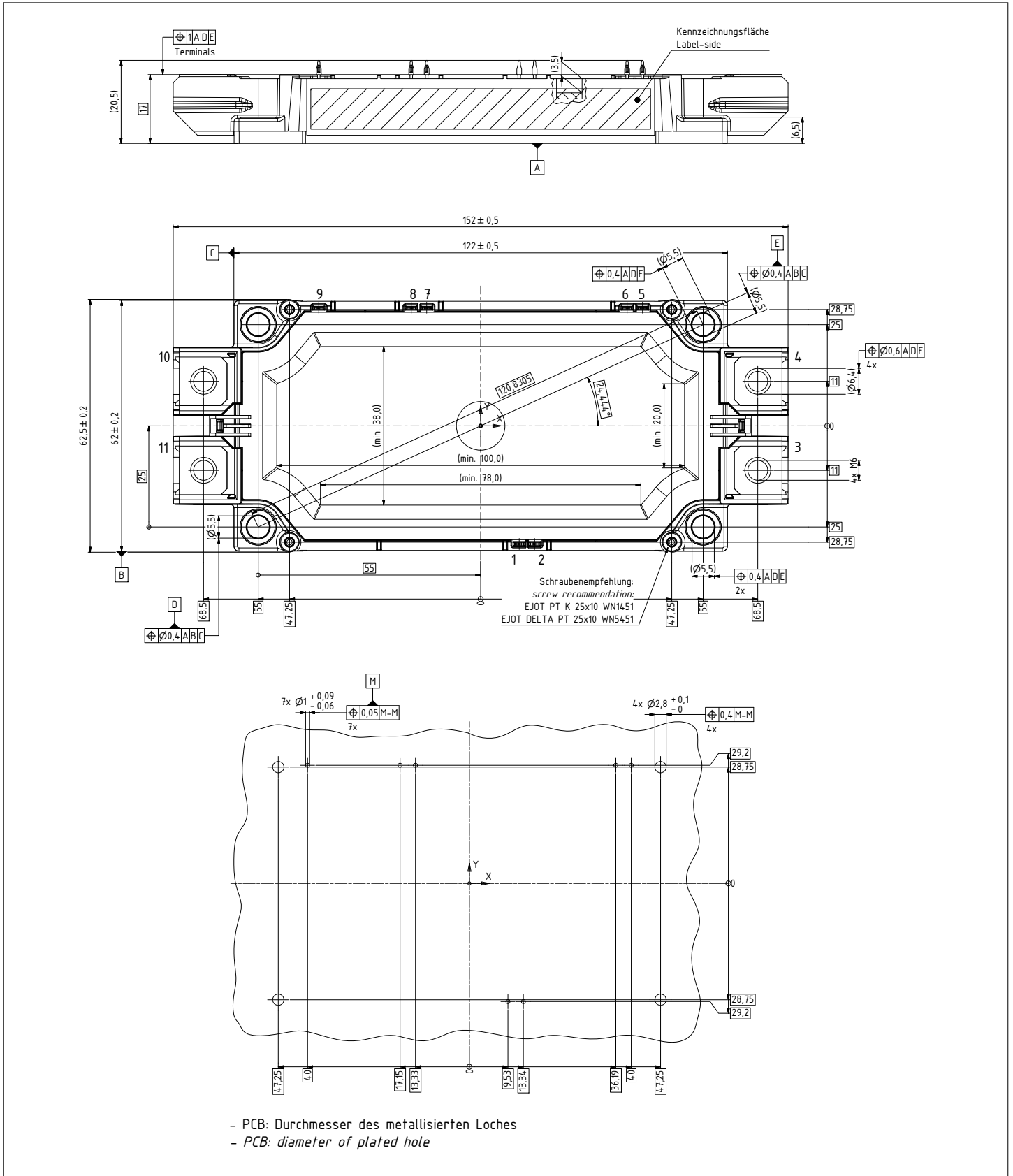


Figure 2

## 8 Module label code


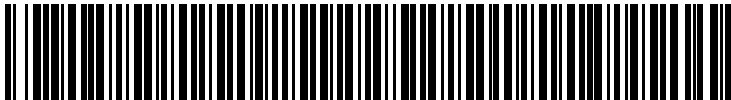
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production 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	2021-10-20	Initial version
1.00	2022-05-06	Final datasheet



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Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.