

## Preliminary datasheet

### EasyDUAL module with CoolSiC™ Trench MOSFET and PressFIT / NTC

#### Features

- Electrical features
  - $V_{DSS} = 1200\text{ V}$
  - $I_{DN} = 50\text{ A}$  /  $I_{DRM} = 100\text{ A}$
  - Low inductive design
  - Low switching losses
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - Rugged mounting due to integrated mounting clamps



Typical appearance

#### Potential applications

- High-frequency switching application
- DC/DC converter
- UPS systems
- DC charger for EV

#### Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

#### Description

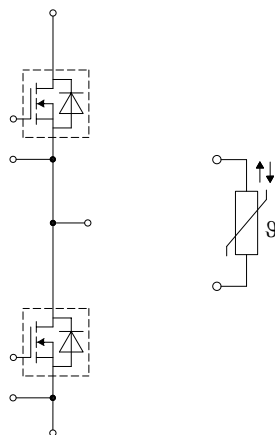


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## 1 Package

**Table 1** Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	$V_{ISOL}$	RMS, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$	3.0	kV
Internal isolation		basic insulation (class 1, IEC 61140)	$Al_2O_3$	
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	$L_{sCE}$			9		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$ , per switch		2.1		mΩ
Storage temperature	$T_{stg}$		-40		125	°C
Mounting force per clamp	$F$		20		50	N
Weight	$G$			24		g

Note: The current under continuous operation is limited to 25 A rms per connector pin.

## 2 MOSFET

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	$V_{DSS}$		$T_{vj} = 25 \text{ °C}$	1200	V
Continuous DC drain current	$I_{DDC}$	$T_{vj} = 175 \text{ °C}$ , $V_{GS} = 18 \text{ V}$	$T_H = 80 \text{ °C}$	50	A
Repetitive peak drain current	$I_{DRM}$	verified by design, $t_p$ limited by $T_{vjmax}$		100	A
Gate-source voltage, max. transient voltage	$V_{GS}$	$D < 0.01$		-10/23	V
Gate-source voltage, max. static voltage	$V_{GS}$			-7/20	V

**Table 4** Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{GS(on)}$		15...18	V
Off-state gate voltage	$V_{GS(off)}$		-5...0	V

**Table 5** Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	$I_D = 50 \text{ A}$	$V_{GS} = 18 \text{ V}$ , $T_{vj} = 25 \text{ °C}$		16.2		mΩ
			$V_{GS} = 18 \text{ V}$ , $T_{vj} = 125 \text{ °C}$		26.1		
			$V_{GS} = 18 \text{ V}$ , $T_{vj} = 175 \text{ °C}$		34.7		
			$V_{GS} = 15 \text{ V}$ , $T_{vj} = 25 \text{ °C}$		19.4		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 20 \text{ mA}$ , $V_{DS} = V_{GS}$ , $T_{vj} = 25 \text{ °C}$ , (tested after 1ms pulse at $V_{GS} = +20 \text{ V}$ )		3.45	4.3	5.15	V
Total gate charge	$Q_G$	$V_{DD} = 800 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$			0.149		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25 \text{ °C}$			4.1		Ω
Input capacitance	$C_{ISS}$	$f = 100 \text{ kHz}$ , $V_{DS} = 800 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		4.4		nF
Output capacitance	$C_{OSS}$	$f = 100 \text{ kHz}$ , $V_{DS} = 800 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		0.21		nF
Reverse transfer capacitance	$C_{rss}$	$f = 100 \text{ kHz}$ , $V_{DS} = 800 \text{ V}$ , $V_{GS} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		0.014		nF
$C_{OSS}$ stored energy	$E_{OSS}$	$V_{DS} = 800 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$ , $T_{vj} = 25 \text{ °C}$			86		μJ
Drain-source leakage current	$I_{DSS}$	$V_{DS} = 1200 \text{ V}$ , $V_{GS} = -3 \text{ V}$	$T_{vj} = 25 \text{ °C}$		0.03	210	μA
Gate-source leakage current	$I_{GSS}$	$V_{DS} = 0 \text{ V}$ , $T_{vj} = 25 \text{ °C}$	$V_{GS} = 20 \text{ V}$			400	nA
Turn-on delay time (inductive load)	$t_{d on}$	$I_D = 50 \text{ A}$ , $R_{Gon} = 6.8 \text{ Ω}$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ °C}$		36		ns
			$T_{vj} = 125 \text{ °C}$		36		
			$T_{vj} = 175 \text{ °C}$		36		
Rise time (inductive load)	$t_r$	$I_D = 50 \text{ A}$ , $R_{Gon} = 6.8 \text{ Ω}$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ °C}$		43		ns
			$T_{vj} = 125 \text{ °C}$		43		
			$T_{vj} = 175 \text{ °C}$		43		
Turn-off delay time (inductive load)	$t_{d off}$	$I_D = 50 \text{ A}$ , $R_{Goff} = 1 \text{ Ω}$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ °C}$		54		ns
			$T_{vj} = 125 \text{ °C}$		58		
			$T_{vj} = 175 \text{ °C}$		60		
Fall time (inductive load)	$t_f$	$I_D = 50 \text{ A}$ , $R_{Goff} = 1 \text{ Ω}$ , $V_{DD} = 600 \text{ V}$ , $V_{GS} = -3/18 \text{ V}$	$T_{vj} = 25 \text{ °C}$		14		ns
			$T_{vj} = 125 \text{ °C}$		14		
			$T_{vj} = 175 \text{ °C}$		14		

(table continues...)

**Table 5** (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on energy loss per pulse	$E_{on}$	$I_D = 50\text{ A}$ , $V_{DD} = 600\text{ V}$ , $L_\sigma = 35\text{ nH}$ , $V_{GS} = -3/18\text{ V}$ , $R_{Gon} = 6.8\text{ }\Omega$ , $di/dt = 3.6\text{ kA}/\mu\text{s}$ ( $T_{vj} = 175\text{ }^\circ\text{C}$ )	$T_{vj} = 25\text{ }^\circ\text{C}$	0.79		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.91		
			$T_{vj} = 175\text{ }^\circ\text{C}$	1.02		
Turn-off energy loss per pulse	$E_{off}$	$I_D = 50\text{ A}$ , $V_{DD} = 600\text{ V}$ , $L_\sigma = 35\text{ nH}$ , $V_{GS} = -3/18\text{ V}$ , $R_{Goff} = 1\text{ }\Omega$ , $dv/dt = 34.3\text{ kV}/\mu\text{s}$ ( $T_{vj} = 175\text{ }^\circ\text{C}$ )	$T_{vj} = 25\text{ }^\circ\text{C}$	0.14		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.148		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.157		
SC data	$I_{SC}$	$V_{GS} = -5/15\text{ V}$ , $V_{DD} = 800\text{ V}$ , $V_{DSmax} = V_{DSS} - L_{SDS} \cdot di/dt$ , $R_G = 10\text{ }\Omega$	$t_P = 2\text{ }\mu\text{s}$ , $T_{vj} = 25\text{ }^\circ\text{C}$	420		A
			$t_P = 2\text{ }\mu\text{s}$ , $T_{vj} = 150\text{ }^\circ\text{C}$	410		
Thermal resistance, junction to heat sink	$R_{thJH}$	per MOSFET, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		0.8		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^\circ\text{C}$

**Note:** The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Note AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.

$T_{vj,op} > 150\text{ }^\circ\text{C}$  is allowed for operation at overload conditions for MOSFET and body diode. For detailed specifications, please refer to AN 2021-13

### 3 Body diode (MOSFET)

**Table 6** **Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit
DC body diode forward current	$I_{SD}$	$T_{vj} = 175\text{ }^\circ\text{C}$ , $V_{GS} = -3\text{ V}$ $T_H = 80\text{ }^\circ\text{C}$	25	A

**Table 7** **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_{SD}$	$I_{SD} = 50\text{ A}$ , $V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ }^\circ\text{C}$	4.2	5.35	V
			$T_{vj} = 125\text{ }^\circ\text{C}$	3.9		
			$T_{vj} = 175\text{ }^\circ\text{C}$	3.8		

## 4 NTC-Thermistor

**Table 8** 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

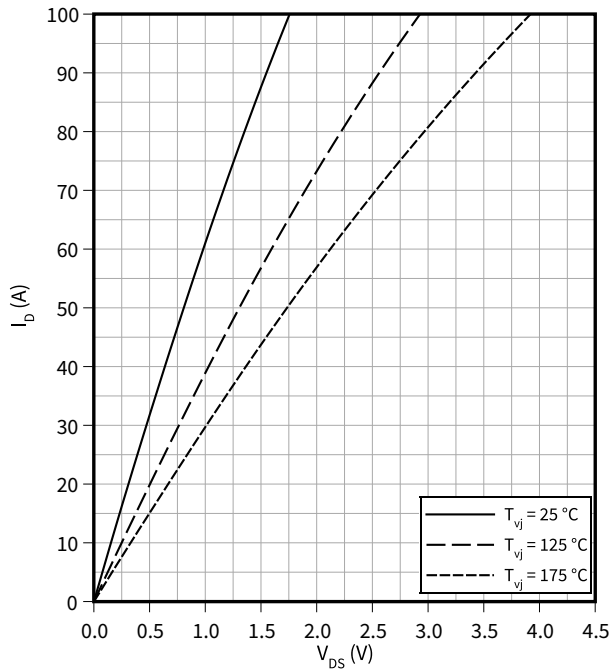
Note: Specification according to the valid application note.

5 Characteristics diagrams

Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

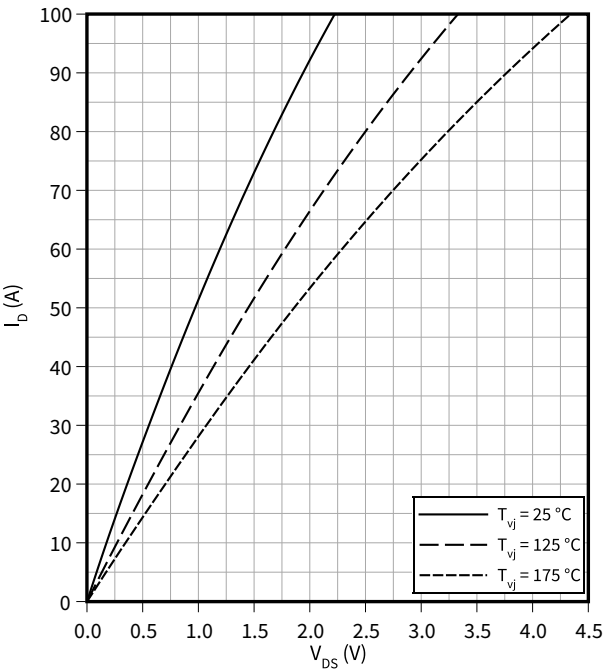
$V_{GS} = 18\text{ V}$



Output characteristic (typical), MOSFET

$I_D = f(V_{DS})$

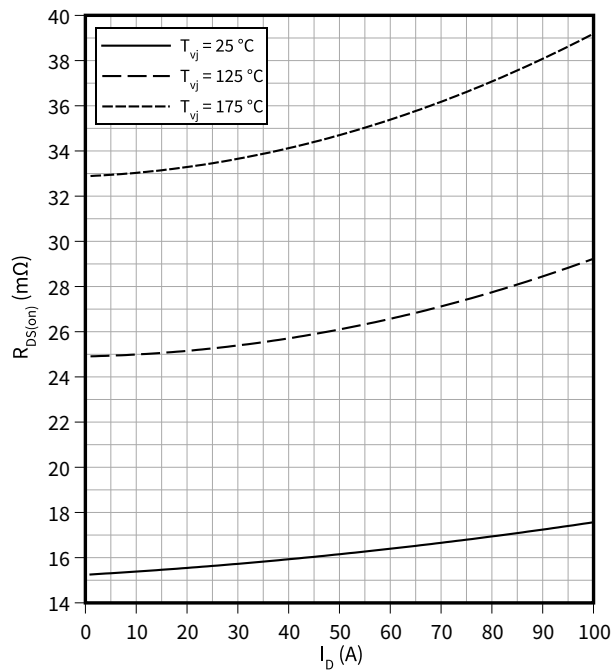
$V_{GS} = 15\text{ V}$



Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(I_D)$

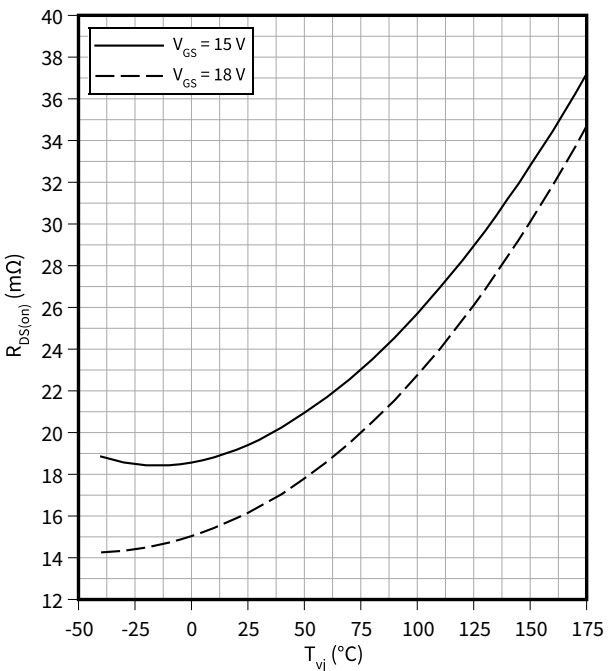
$V_{GS} = 18\text{ V}$



Drain source on-resistance (typical), MOSFET

$R_{DS(on)} = f(T_{vj})$

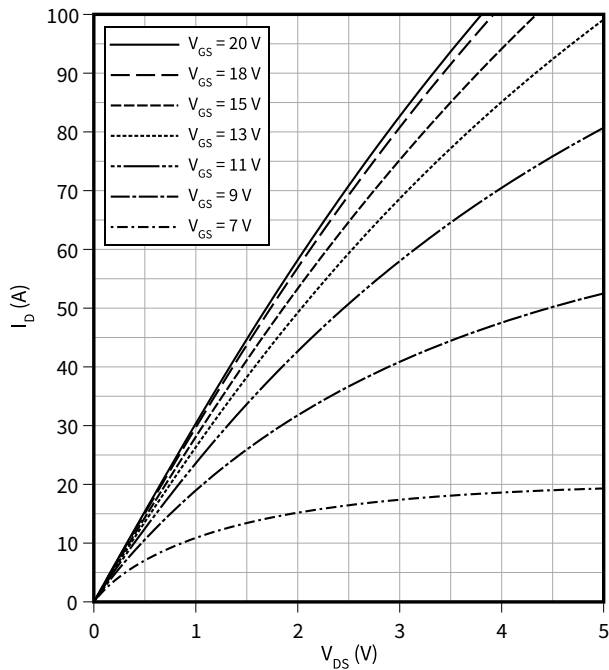
$I_D = 50\text{ A}$



5 Characteristics diagrams

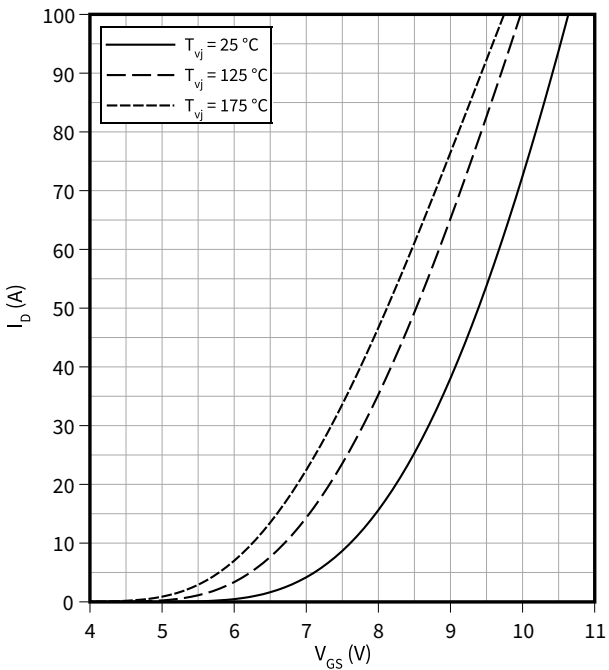
Output characteristic field (typical), MOSFET

$I_D = f(V_{DS})$   
 $T_{vj} = 175\text{ }^{\circ}\text{C}$



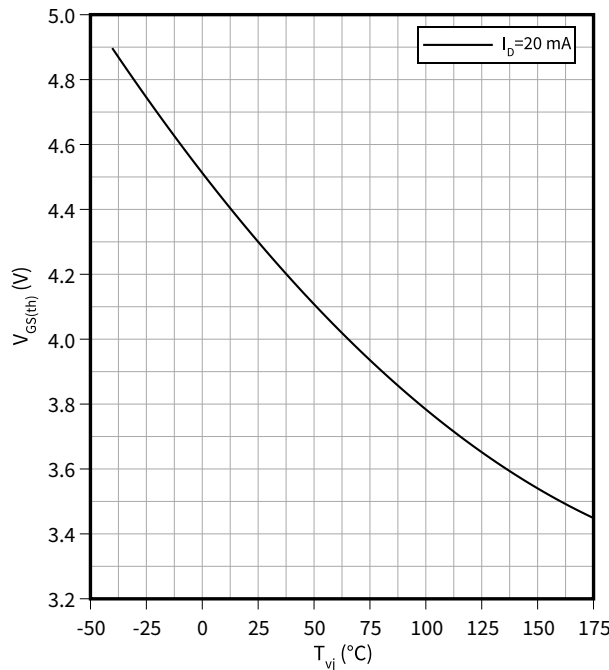
Transfer characteristic (typical), MOSFET

$I_D = f(V_{GS})$   
 $V_{DS} = 20\text{ V}$



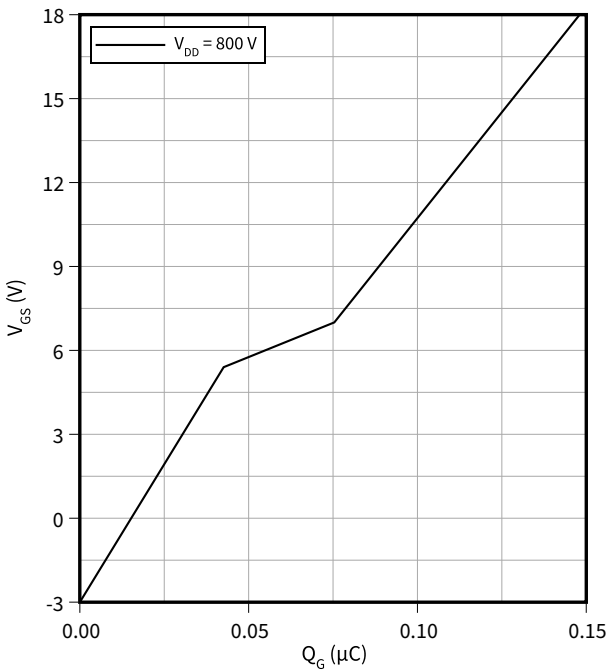
Gate-source threshold voltage (typical), MOSFET

$V_{GS(th)} = f(T_{vj})$   
 $V_{GS} = V_{DS}$



Gate charge characteristic (typical), MOSFET

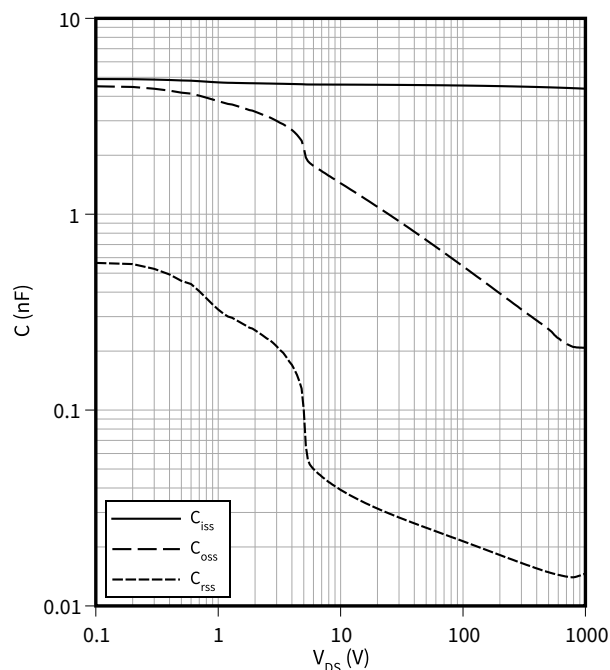
$V_{GS} = f(Q_G)$   
 $I_D = 50\text{ A}$ ,  $T_{vj} = 25\text{ }^{\circ}\text{C}$



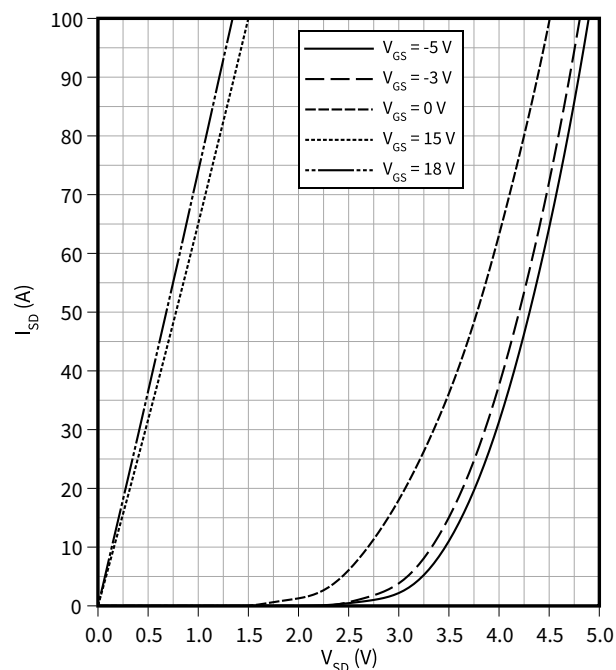


**Capacity characteristic (typical), MOSFET**

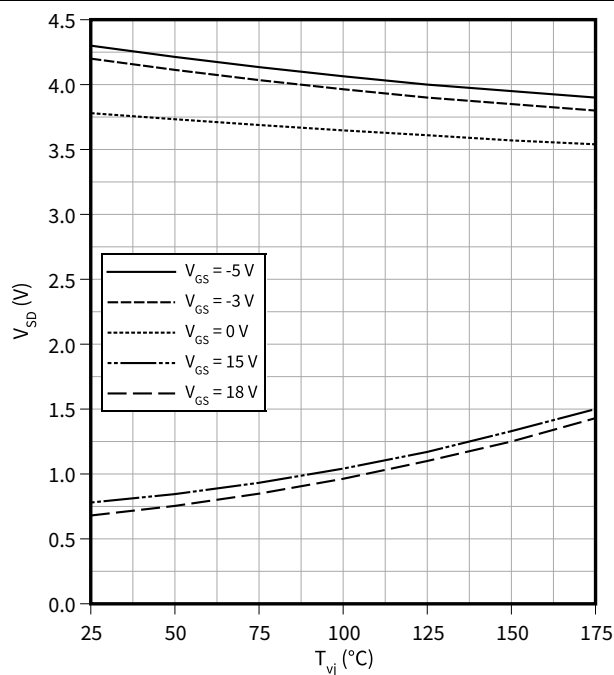
$$C = f(V_{DS})$$

 $f = 100 \text{ kHz}, T_{vj} = 25^\circ\text{C}, V_{GS} = 0 \text{ V}$ 
**Forward characteristic body diode (typical), MOSFET**

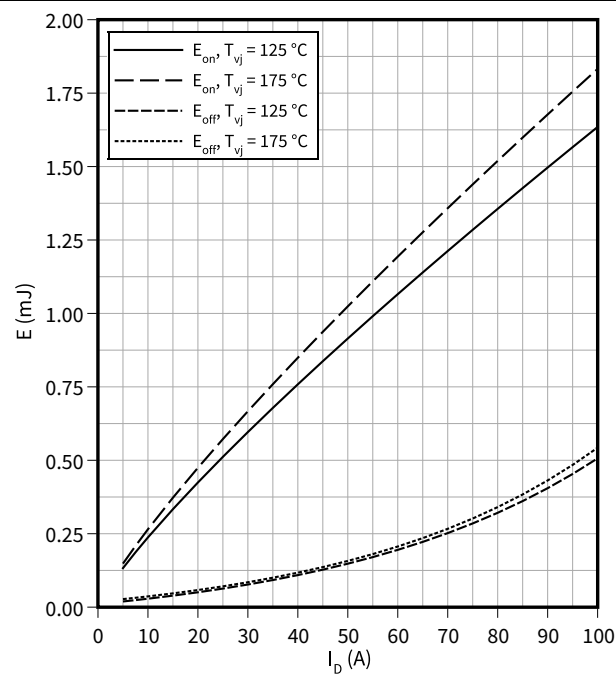
$$I_{SD} = f(V_{SD})$$

 $T_{vj} = 25^\circ\text{C}$ 
**Forward voltage of body diode (typical), MOSFET**

$$V_{SD} = f(T_{vj})$$

 $I_{SD} = 50 \text{ A}$ 
**Switching losses (typical), MOSFET**

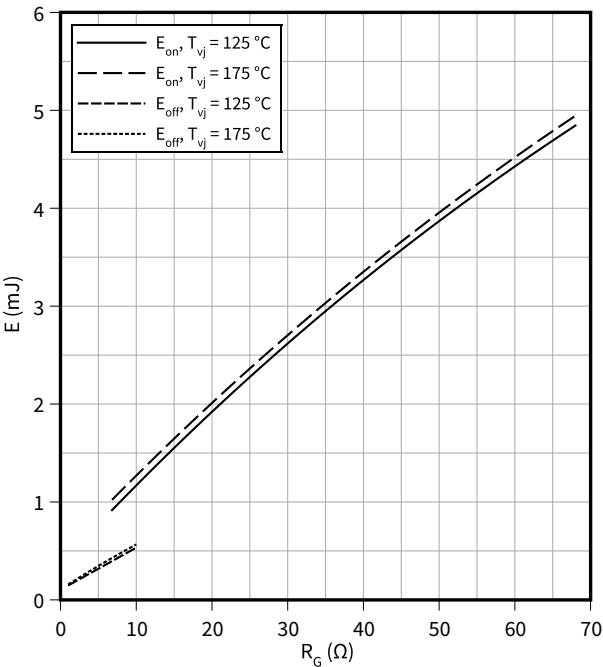
$$E = f(I_D)$$

 $R_{Goff} = 1 \Omega, R_{Gon} = 6.8 \Omega, V_{DD} = 600 \text{ V}, V_{GS} = -3/18 \text{ V}$ 


5 Characteristics diagrams

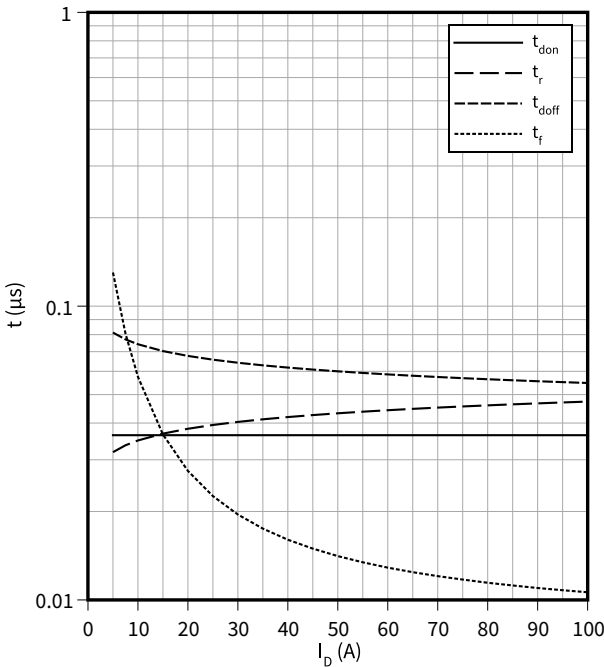
Switching losses (typical), MOSFET

$E = f(R_G)$   
 $V_{DD} = 600\text{ V}$ ,  $I_D = 50\text{ A}$ ,  $V_{GS} = -3/18\text{ V}$



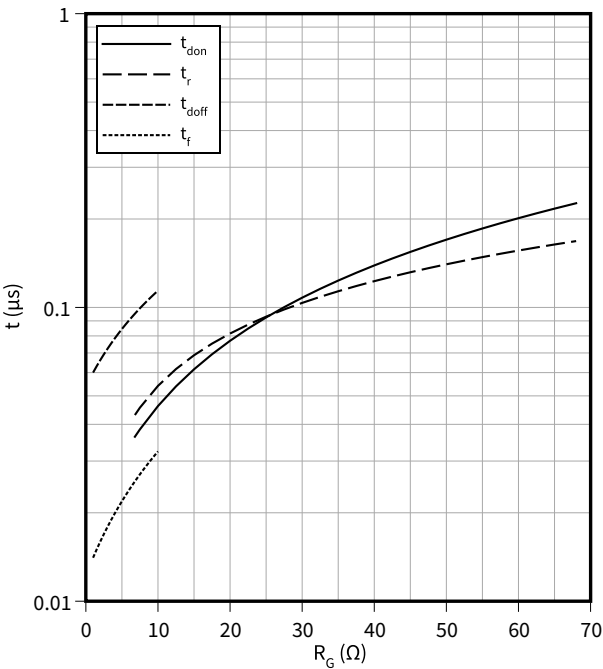
Switching times (typical), MOSFET

$t = f(I_D)$   
 $R_{Goff} = 1\text{ }\Omega$ ,  $R_{Gon} = 6.8\text{ }\Omega$ ,  $V_{DD} = 600\text{ V}$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GS} = -3/18\text{ V}$



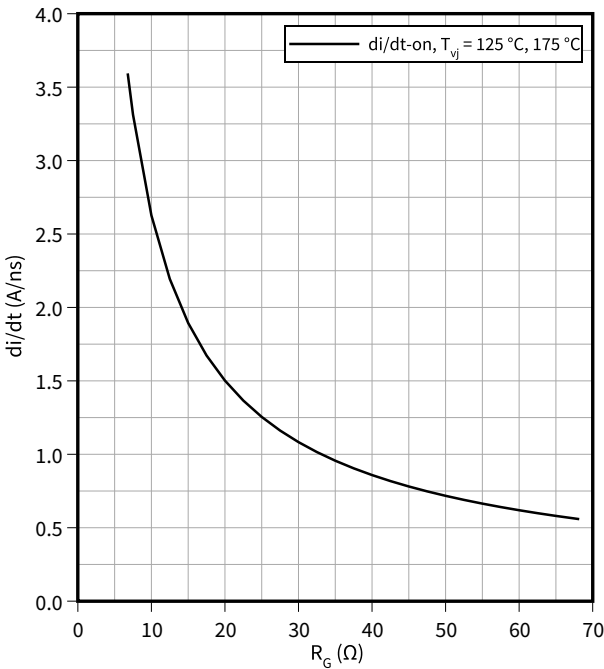
Switching times (typical), MOSFET

$t = f(R_G)$   
 $V_{DD} = 600\text{ V}$ ,  $I_D = 50\text{ A}$ ,  $T_{vj} = 175\text{ }^\circ\text{C}$ ,  $V_{GS} = -3/18\text{ V}$



Current slope (typical), MOSFET

$di/dt = f(R_G)$   
 $V_{DD} = 600\text{ V}$ ,  $I_D = 50\text{ A}$ ,  $V_{GS} = -3/18\text{ V}$

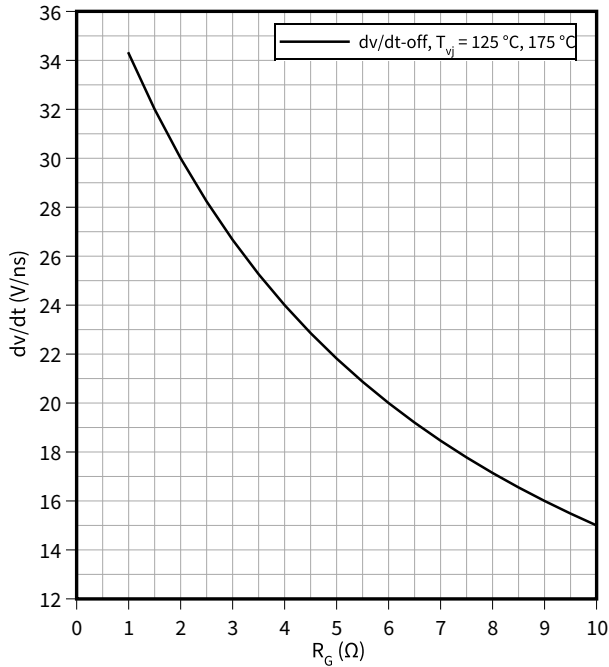


5 Characteristics diagrams

Voltage slope (typical), MOSFET

$dv/dt = f(R_G)$

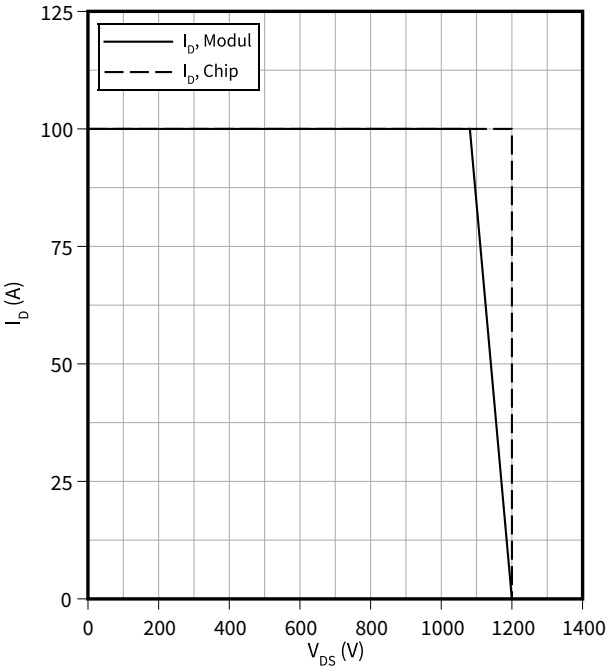
$V_{DD} = 600\text{ V}$ ,  $I_D = 50\text{ A}$ ,  $V_{GS} = -3/18\text{ V}$



Reverse bias safe operating area (RBSOA), MOSFET

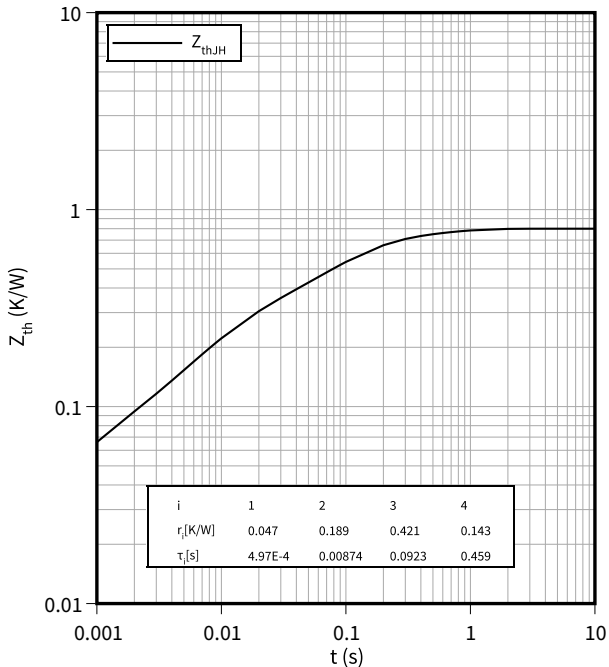
$I_D = f(V_{DS})$

$R_{Goff} = 1\text{ }\Omega$ ,  $T_{vj} = 175^\circ\text{C}$ ,  $V_{GS} = -3/18\text{ V}$



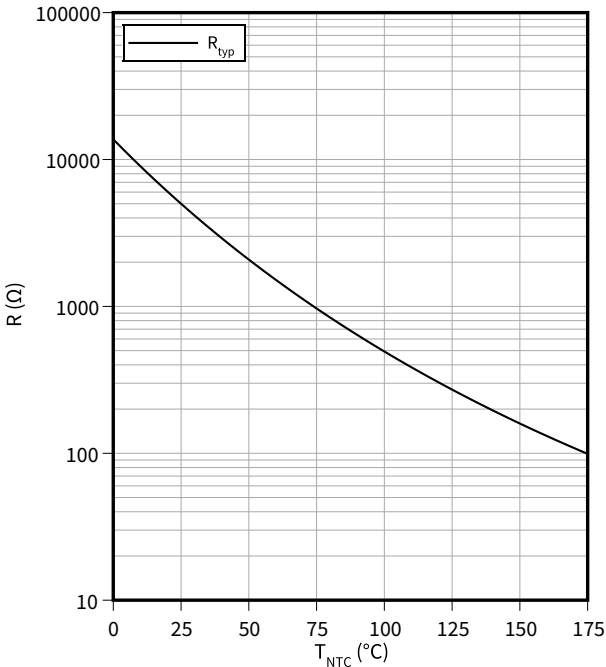
Transient thermal impedance , MOSFET

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



6 Circuit diagram

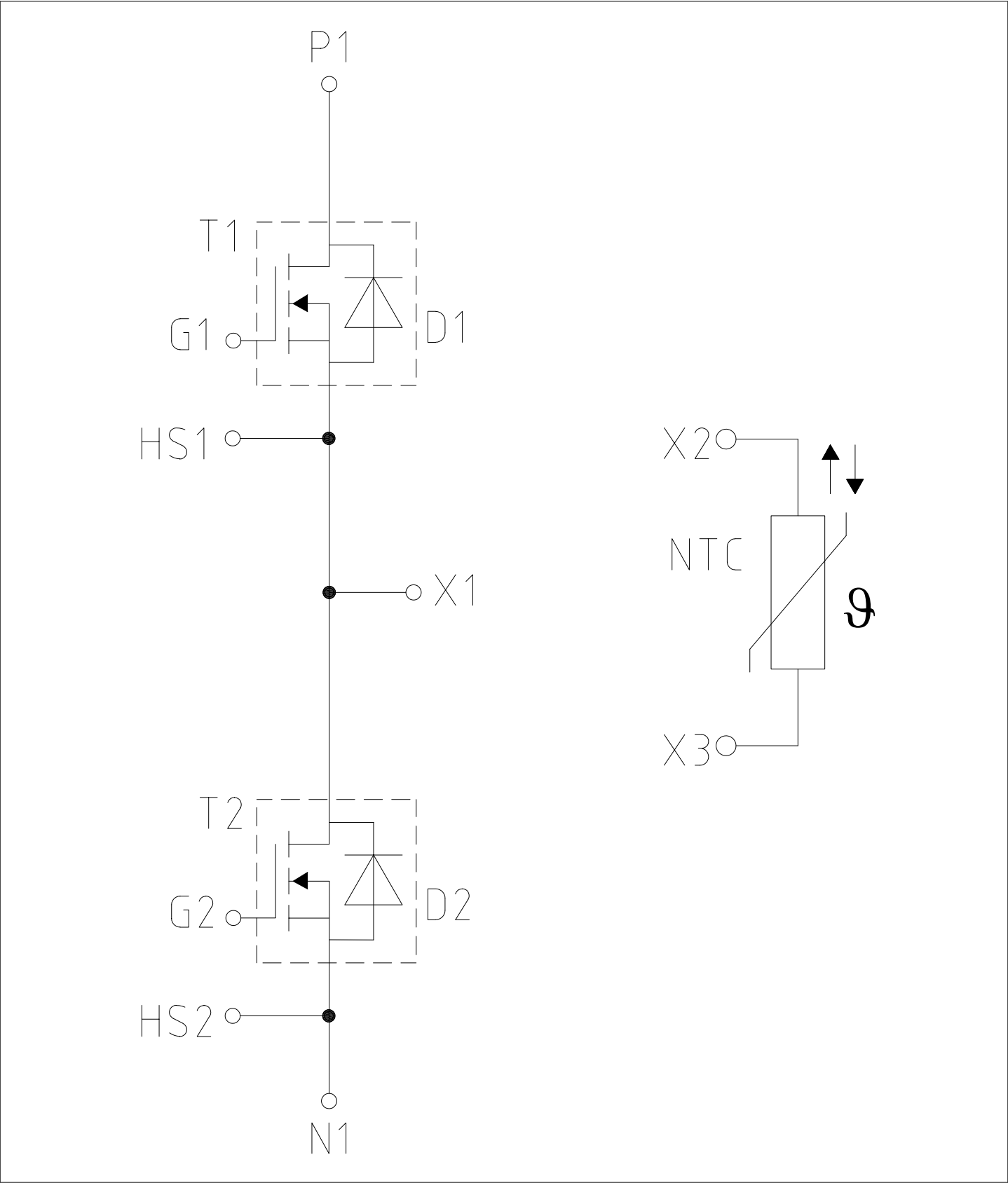
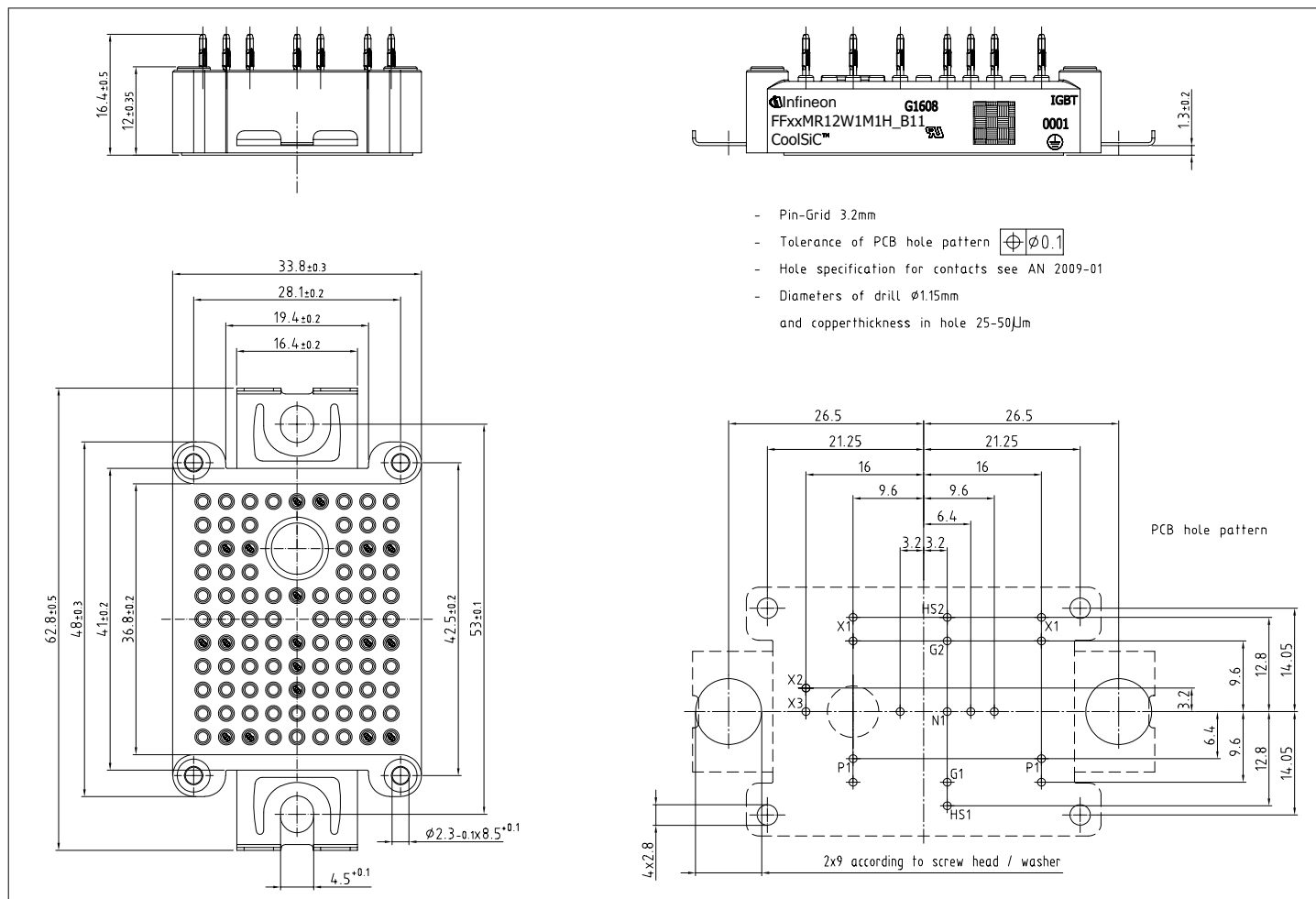


Figure 1

## 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	<div><div>7154914284655054991153071549142846550549911530</div></div>		

Figure 3

## Revision history

Document revision	Date of release	Description of changes
0.10	2022-08-04	Initial version
0.20	2023-01-24	Preliminary datasheet
0.30	2023-02-07	Preliminary datasheet

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**Edition 2023-02-07**

**Published by**

**Infineon Technologies AG**  
**81726 Munich, Germany**

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**Document reference**  
**IFX-ABF152-003**

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