

## Preliminary datasheet

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

#### Features

- Electrical features
  - $V_{DSS} = 1200\text{ V}$
  - $I_{DN} = 120\text{ A} / I_{DRM} = 240\text{ A}$
  - Low inductive design
  - Low switching losses
  - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
  - PressFIT contact technology
  - Integrated NTC temperature sensor
  - Rugged mounting due to integrated mounting clamps



Typical appearance

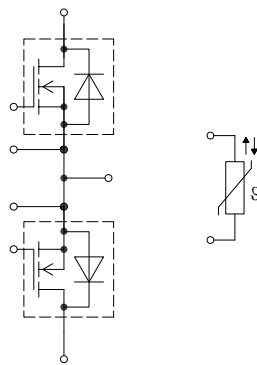
#### Potential applications

- 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, $f = 50$ Hz, $t = 1$ min	3.0	kV
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50$ Hz, $t = 1$ 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	$L_{SCE}$			13		nH
Module lead resistance, terminals - chip	$R_{CC+EE'}$	$T_H = 25$ °C, per switch		2.3		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.  
The electrical characterization was performed in NPC2 topology, which combines two FF7MR12W1M1H\_B17 modules. It has to be considered, that the commutation in this configuration takes place between both modules.

## 2 MOSFET

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Drain-source voltage	$V_{DSS}$	$T_{vj} = 25$ °C	1200	V
Implemented drain current	$I_{DN}$		120	A
Continuous DC drain current	$I_{DDC}$	$T_{vj} = 175$ °C, $V_{GS} = 18$ V $T_H = 65$ °C	105	A
Repetitive peak drain current	$I_{DRM}$	verified by design, $t_p$ limited by $T_{vjmax}$	240	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	$R_{DS(on)}$	$I_D = 120\text{ A}$	$V_{GS} = 18\text{ V}, T_{vj} = 25\text{ °C}$		5.8	mΩ
			$V_{GS} = 18\text{ V}, T_{vj} = 125\text{ °C}$		9.4	
			$V_{GS} = 18\text{ V}, T_{vj} = 175\text{ °C}$		12.5	
			$V_{GS} = 15\text{ V}, T_{vj} = 25\text{ °C}$		7	
Gate threshold voltage	$V_{GS(th)}$	$I_D = 56\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25\text{ °C},$ (tested after 1ms pulse at $V_{GS} = +20\text{ V}$ )	3.45	4.3	5.15	V
Total gate charge	$Q_G$	$V_{DD} = 800\text{ V}, V_{GS} = -3/18\text{ V}$		0.4		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\text{ °C}$		3.8		Ω
Input capacitance	$C_{ISS}$	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, T_{vj} = 25\text{ °C}$		12.1		nF
Output capacitance	$C_{OSS}$	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, T_{vj} = 25\text{ °C}$		0.6		nF
Reverse transfer capacitance	$C_{rSS}$	$f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, T_{vj} = 25\text{ °C}$		0.039		nF
$C_{OSS}$ stored energy	$E_{OSS}$	$V_{DS} = 800\text{ V}, V_{GS} = -3/18\text{ V}, T_{vj} = 25\text{ °C}$		236		μJ
Drain-source leakage current	$I_{DSS}$	$V_{DS} = 1200\text{ V}, V_{GS} = -3\text{ V}, T_{vj} = 25\text{ °C}$		0.08	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)	$t_{d on}$	$I_D = 120\text{ A}, R_{Gon} = 7.5\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		78	ns
			$T_{vj} = 125\text{ °C}$		78	
			$T_{vj} = 175\text{ °C}$		78	
Rise time (inductive load)	$t_r$	$I_D = 120\text{ A}, R_{Gon} = 7.5\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$	$T_{vj} = 25\text{ °C}$		110	ns
			$T_{vj} = 125\text{ °C}$		110	
			$T_{vj} = 175\text{ °C}$		110	

(table continues...)

**Table 5** (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	$t_{d\ off}$	$I_D = 120\ A, R_{Goff} = 4.3\ \Omega, V_{DD} = 600\ V, V_{GS} = -3/18\ V$	$T_{vj} = 25\ ^\circ C$		119	ns
			$T_{vj} = 125\ ^\circ C$		134	
			$T_{vj} = 175\ ^\circ C$		141	
Fall time (inductive load)	$t_f$	$I_D = 120\ A, R_{Goff} = 4.3\ \Omega, V_{DD} = 600\ V, V_{GS} = -3/18\ V$	$T_{vj} = 25\ ^\circ C$		34	ns
			$T_{vj} = 125\ ^\circ C$		35	
			$T_{vj} = 175\ ^\circ C$		36	
Turn-on energy loss per pulse	$E_{on}$	$I_D = 120\ A, V_{DD} = 600\ V, L_\sigma = 43\ nH, V_{GS} = -3/18\ V, R_{Gon} = 7.5\ \Omega, di/dt = 2.1\ kA/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		4	mJ
			$T_{vj} = 125\ ^\circ C$		4.2	
			$T_{vj} = 175\ ^\circ C$		4.53	
Turn-off energy loss per pulse	$E_{off}$	$I_D = 120\ A, V_{DD} = 600\ V, L_\sigma = 43\ nH, V_{GS} = -3/18\ V, R_{Goff} = 4.3\ \Omega, dv/dt = 13.3\ kV/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		1.95	mJ
			$T_{vj} = 125\ ^\circ C$		2.16	
			$T_{vj} = 175\ ^\circ C$		2.25	
Thermal resistance, junction to heat sink	$R_{thJH}$	per MOSFET, $\lambda_{grease} = 1\ W/(m \cdot K)$		0.609		K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		175	$^\circ C$

**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.

$T_{vj,op} > 150\ ^\circ C$  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	$I_{SD}$	$T_{vj} = 175\ ^\circ C, V_{GS} = -3\ V, T_H = 65\ ^\circ C$	45	A

**Table 7** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Forward voltage	$V_{SD}$	$I_{SD} = 120\ A, V_{GS} = -3\ V$	$T_{vj} = 25\ ^\circ C$		4.11	5.28	V
			$T_{vj} = 125\ ^\circ C$		3.85		
			$T_{vj} = 175\ ^\circ C$		3.75		

## 4 NTC-Thermistor

**Table 8** Characteristic values

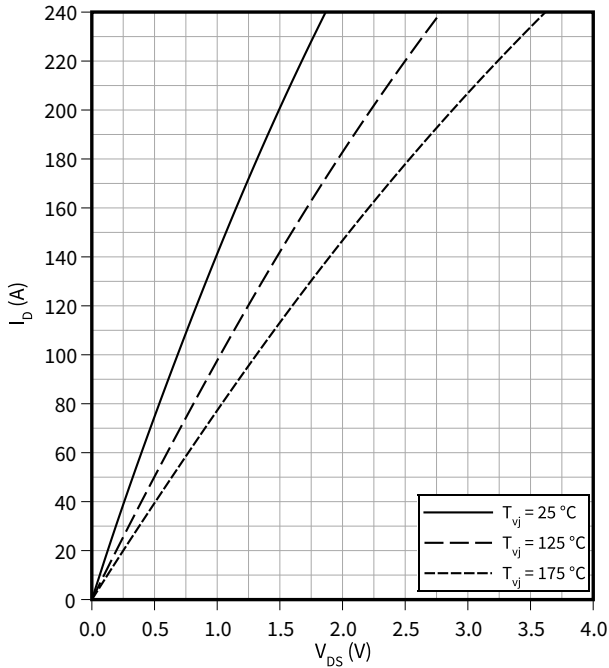
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	$R_{25}$	$T_{NTC} = 25\text{ °C}$		5		kΩ
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ }\Omega$	-5		5	%
Power dissipation	$P_{25}$	$T_{NTC} = 25\text{ °C}$			20	mW
B-value	$B_{25/50}$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

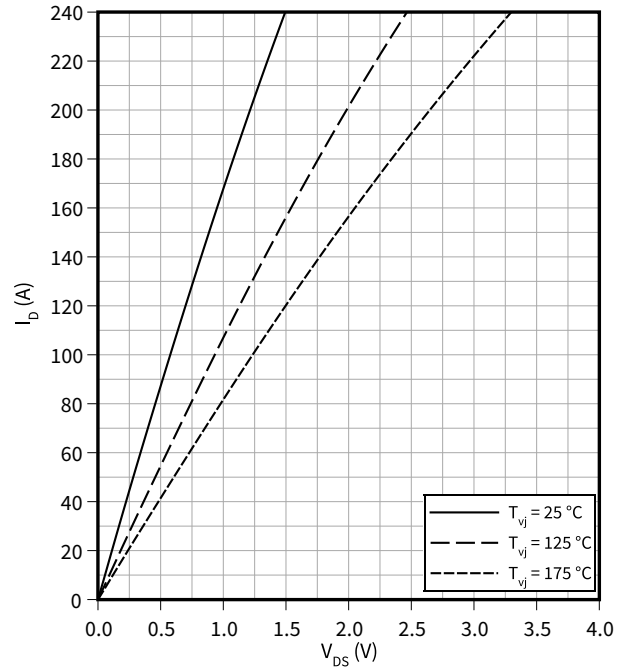
**Output characteristic (typical), MOSFET**

$I_D = f(V_{DS})$   
 $V_{GS} = 15\text{ V}$



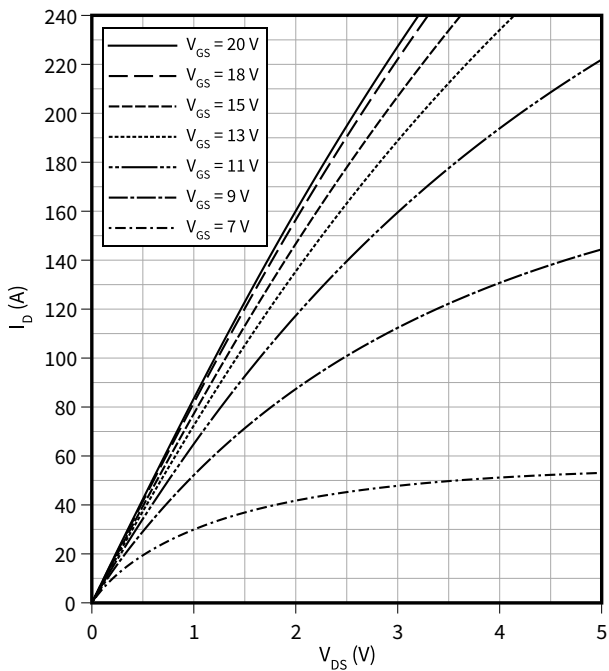
**Output characteristic (typical), MOSFET**

$I_D = f(V_{DS})$   
 $V_{GS} = 18\text{ V}$



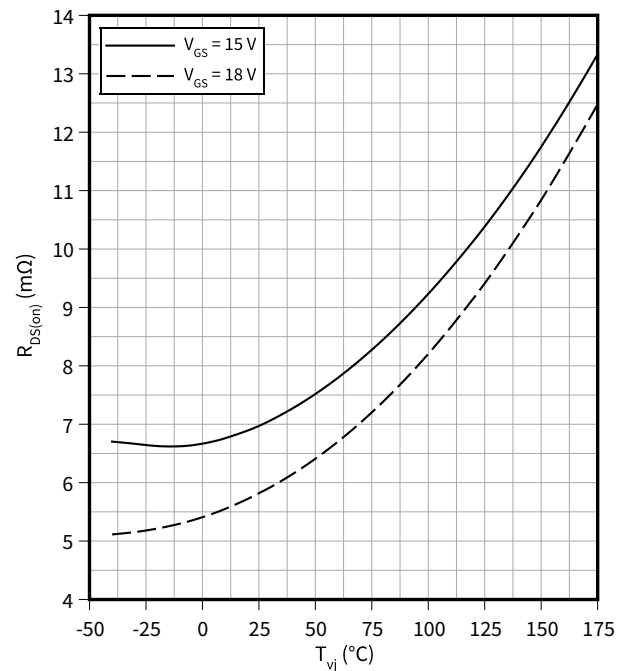
**Output characteristic field (typical), MOSFET**

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



**Drain source on-resistance (typical), MOSFET**

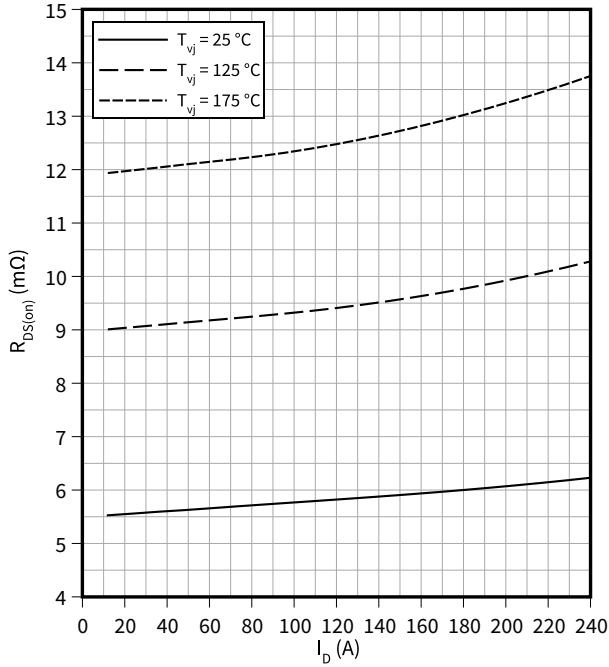
$R_{DS(on)} = f(T_{vj})$   
 $I_D = 120\text{ A}$



5 Characteristics diagrams

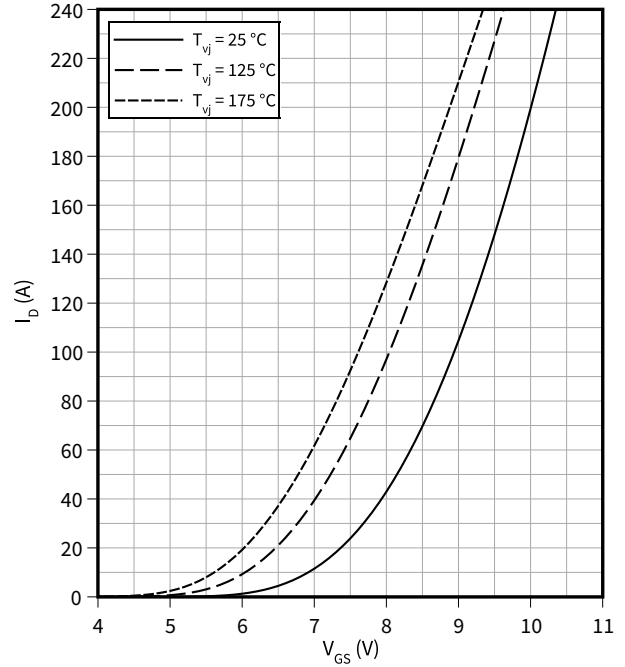
**Drain source on-resistance (typical), MOSFET**

$R_{DS(on)} = f(I_D)$   
 $V_{GS} = 18\text{ V}$



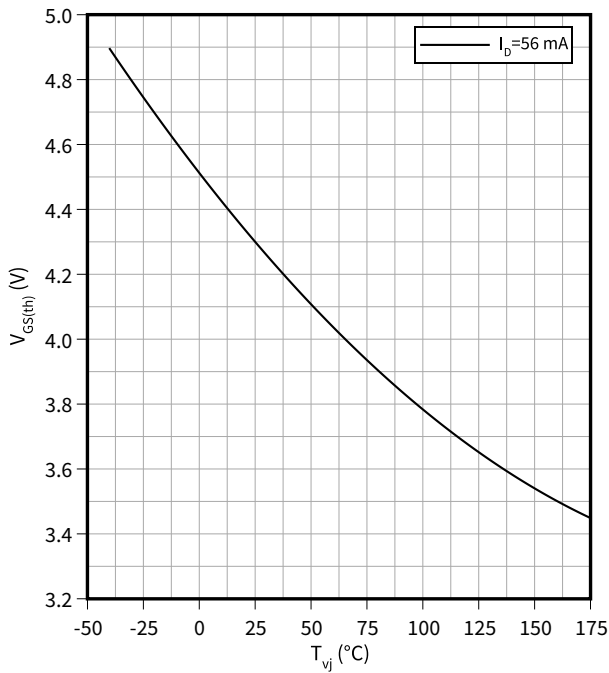
**Transfer characteristic (typical), MOSFET**

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



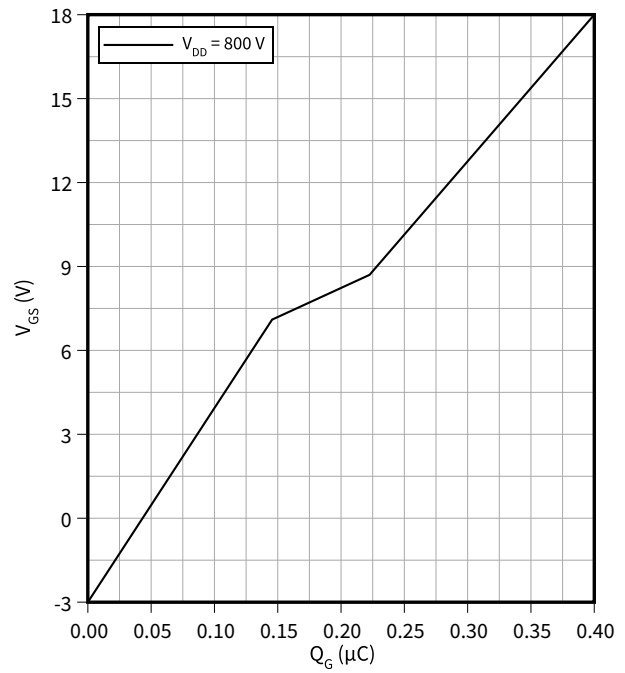
**Gate-source threshold voltage (typical), MOSFET**

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



**Gate charge characteristic (typical), MOSFET**

$V_{GS} = f(Q_G)$   
 $I_D = 120\text{ A}, T_{vj} = 25\text{ °C}$

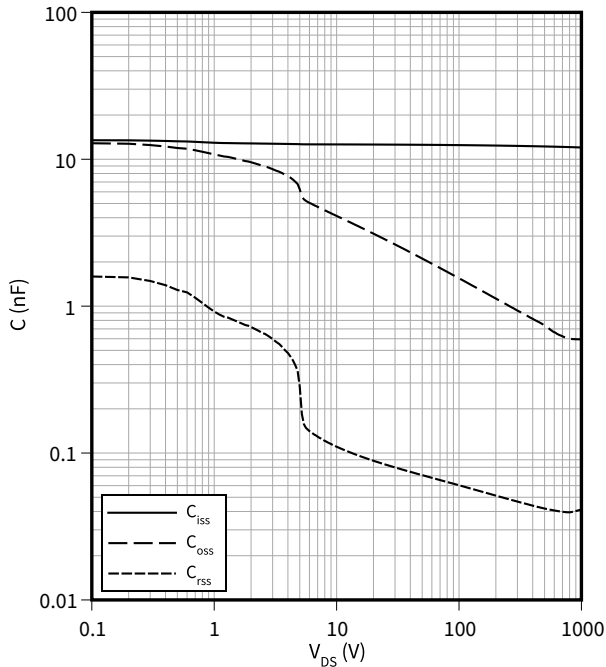




5 Characteristics diagrams

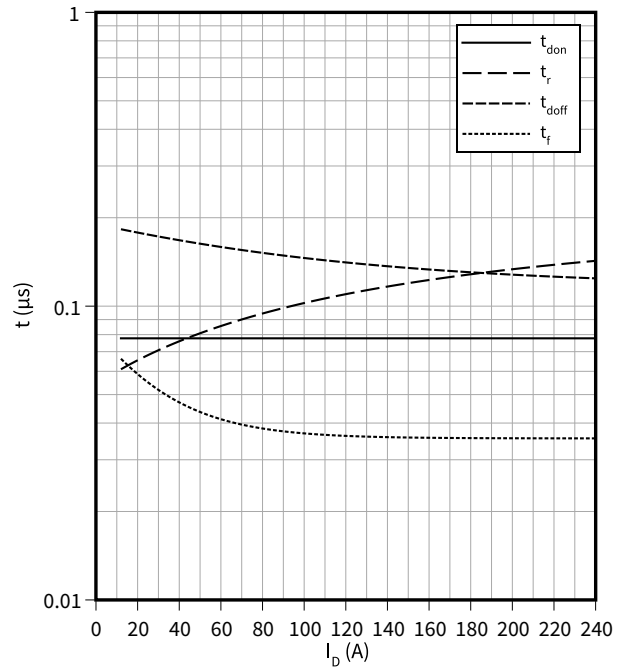
**Capacity characteristic (typical), MOSFET**

$C = f(V_{DS})$   
 $f = 100 \text{ kHz}, T_{vj} = 25 \text{ }^\circ\text{C}, V_{GS} = 0 \text{ V}$



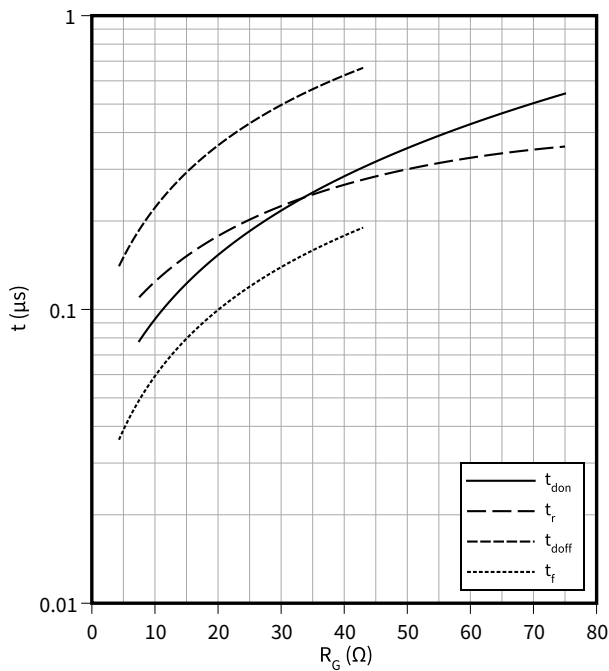
**Switching times (typical), MOSFET**

$t = f(I_D)$   
 $R_{Goff} = 4.3 \text{ } \Omega, R_{Gon} = 7.5 \text{ } \Omega, V_{DD} = 600 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GS} = -3/18 \text{ V}$



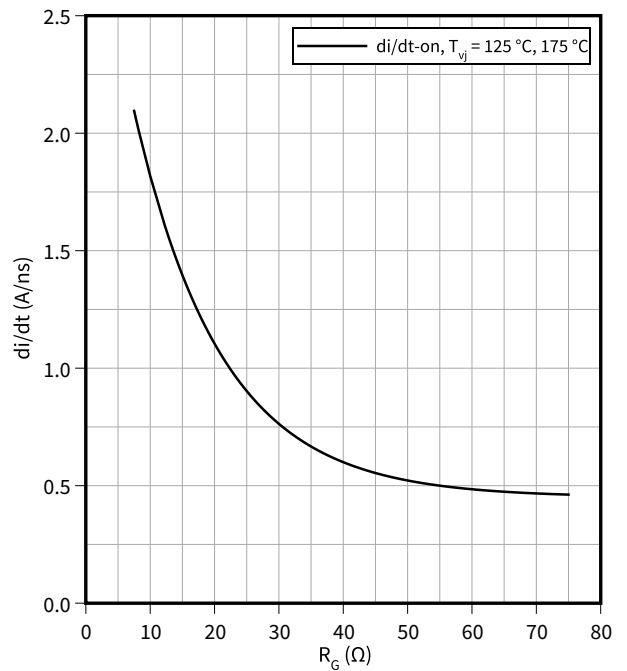
**Switching times (typical), MOSFET**

$t = f(R_G)$   
 $V_{DD} = 600 \text{ V}, I_D = 120 \text{ A}, T_{vj} = 175 \text{ }^\circ\text{C}, V_{GS} = -3/18 \text{ V}$



**Current slope (typical), MOSFET**

$di/dt = f(R_G)$   
 $V_{DD} = 600 \text{ V}, I_D = 120 \text{ A}, V_{GS} = -3/18 \text{ V}$

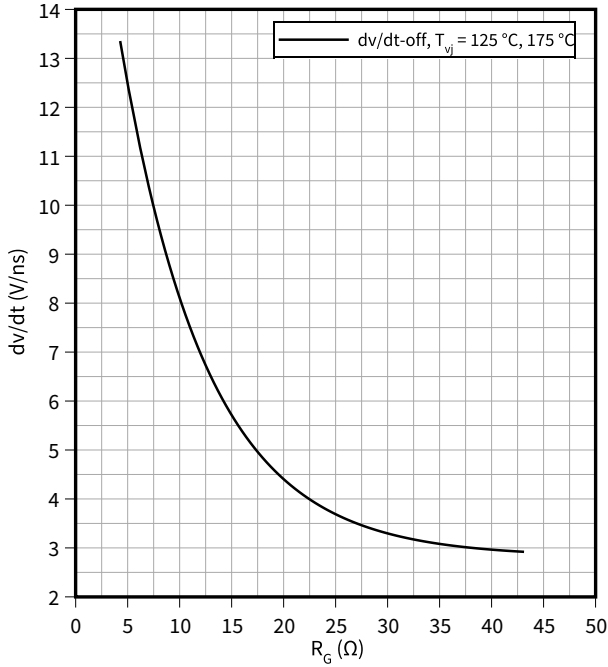


5 Characteristics diagrams

**Voltage slope (typical), MOSFET**

$dv/dt = f(R_G)$

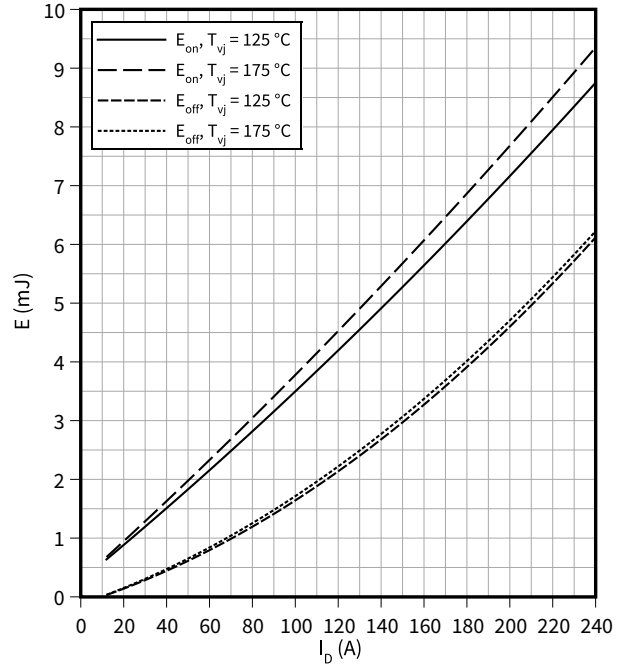
$V_{DD} = 600\text{ V}, I_D = 120\text{ A}, V_{GS} = -3/18\text{ V}$



**Switching losses (typical), MOSFET**

$E = f(I_D)$

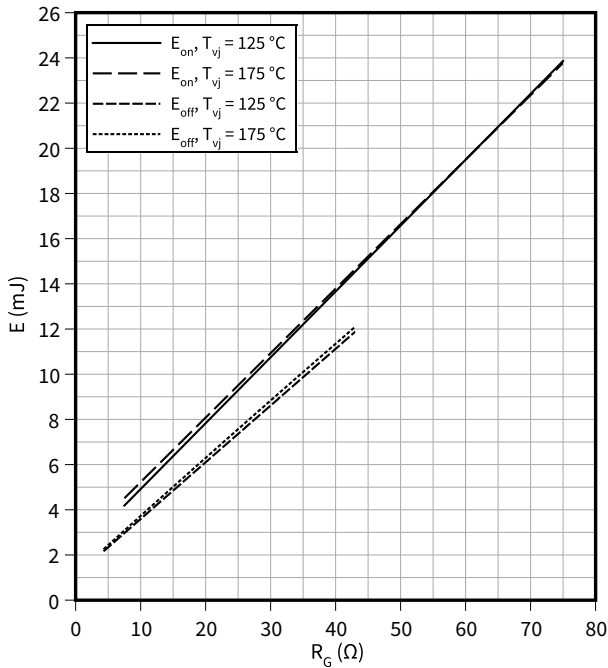
$R_{Goff} = 4.3\ \Omega, R_{Gon} = 7.5\ \Omega, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$



**Switching losses (typical), MOSFET**

$E = f(R_G)$

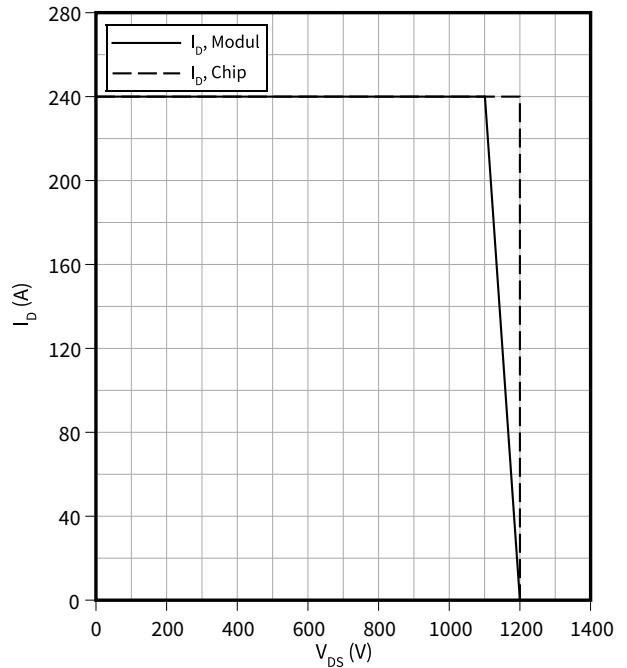
$V_{DD} = 600\text{ V}, I_D = 120\text{ A}, V_{GS} = -3/18\text{ V}$



**Reverse bias safe operating area (RBSOA), MOSFET**

$I_D = f(V_{DS})$

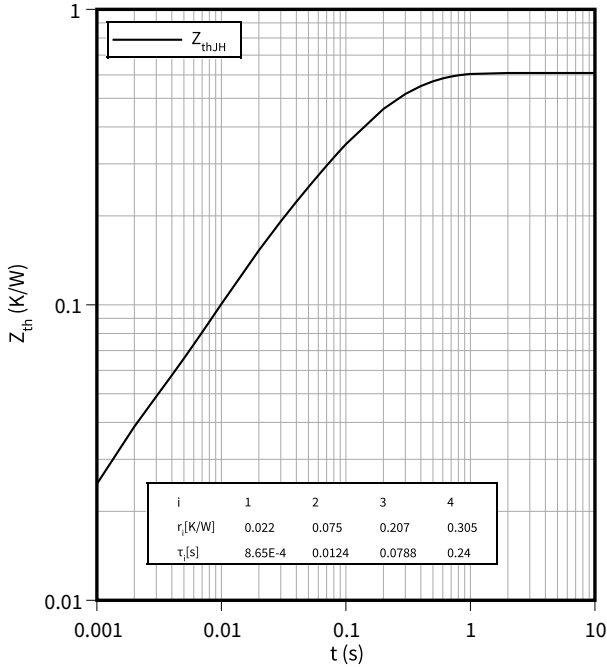
$R_{Goff} = 4.3\ \Omega, T_{vj} = 175\ \text{°C}, V_{GS} = -3/18\text{ V}$



5 Characteristics diagrams

**Transient thermal impedance, MOSFET**

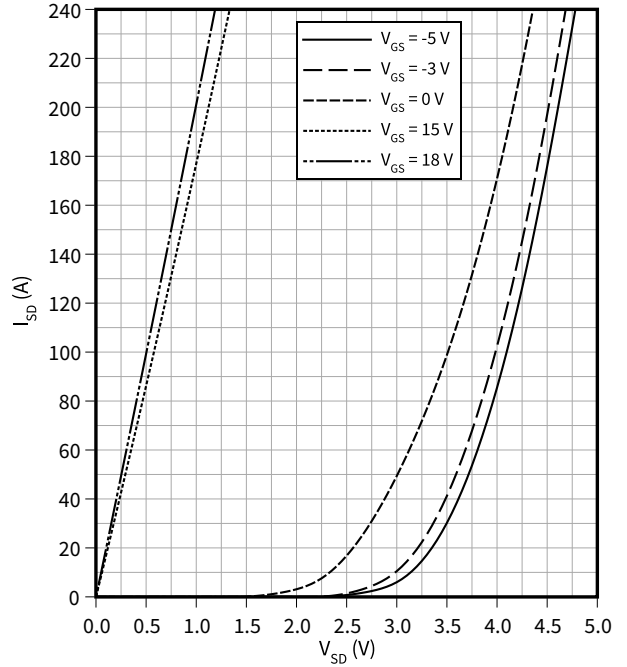
$Z_{th} = f(t)$



**Forward characteristic body diode (typical), MOSFET**

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

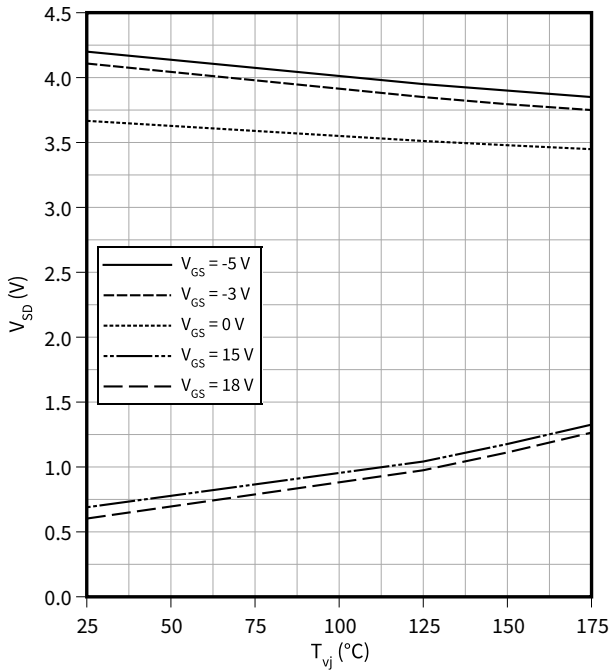
$T_{vj} = 25\text{ }^\circ\text{C}$



**Forward voltage of body diode (typical), MOSFET**

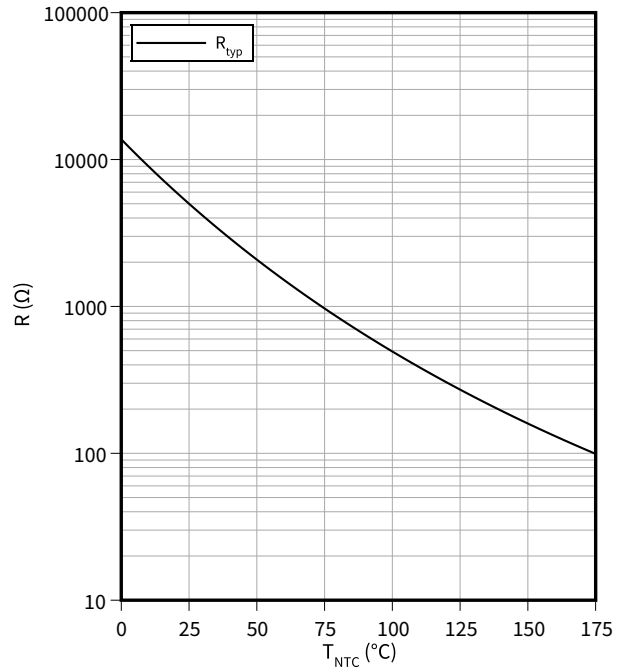
$V_{SD} = f(T_{vj})$

$I_{SD} = 120\text{ A}$



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

$R = f(T_{NTC})$



## 6 Circuit diagram

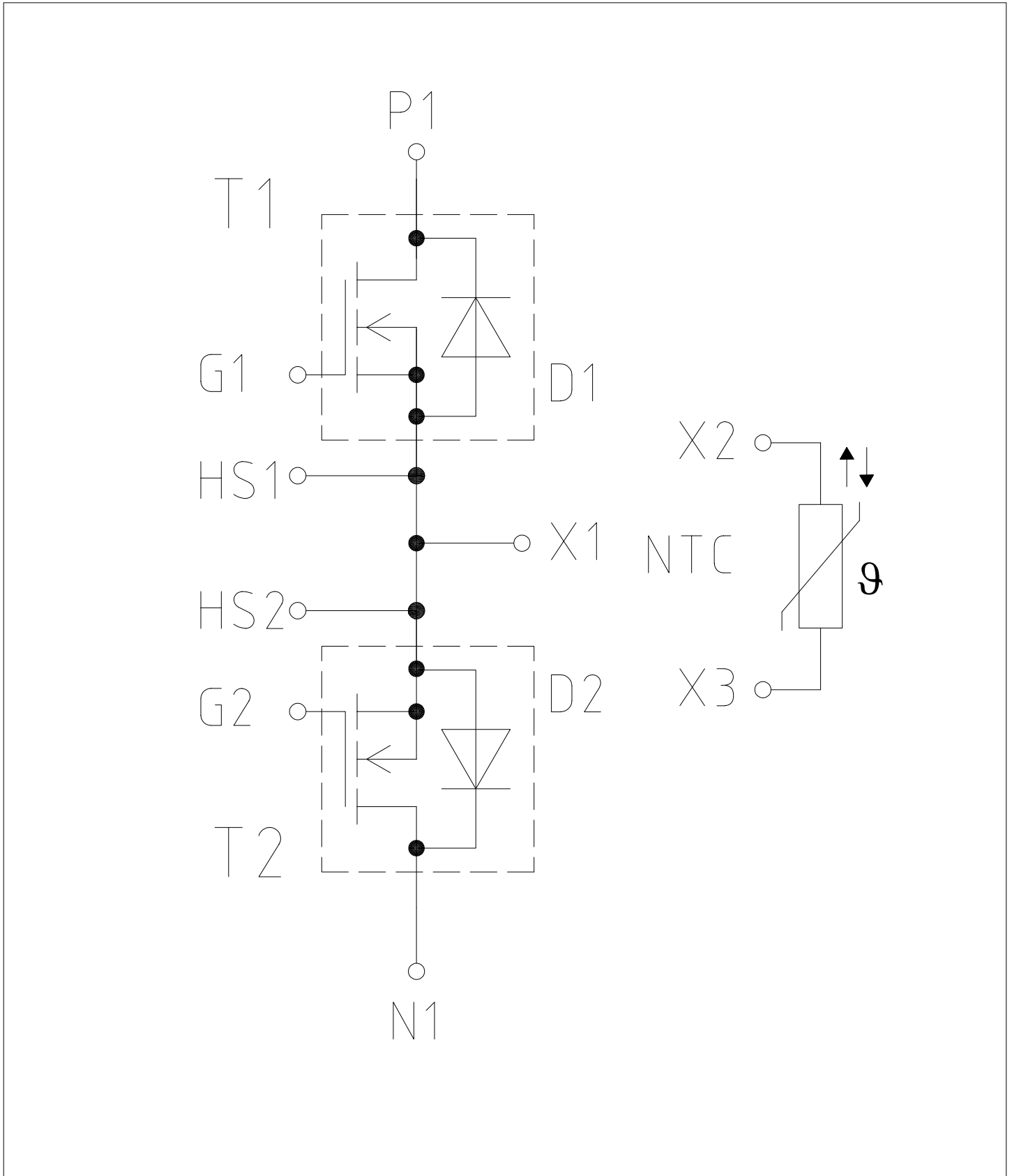
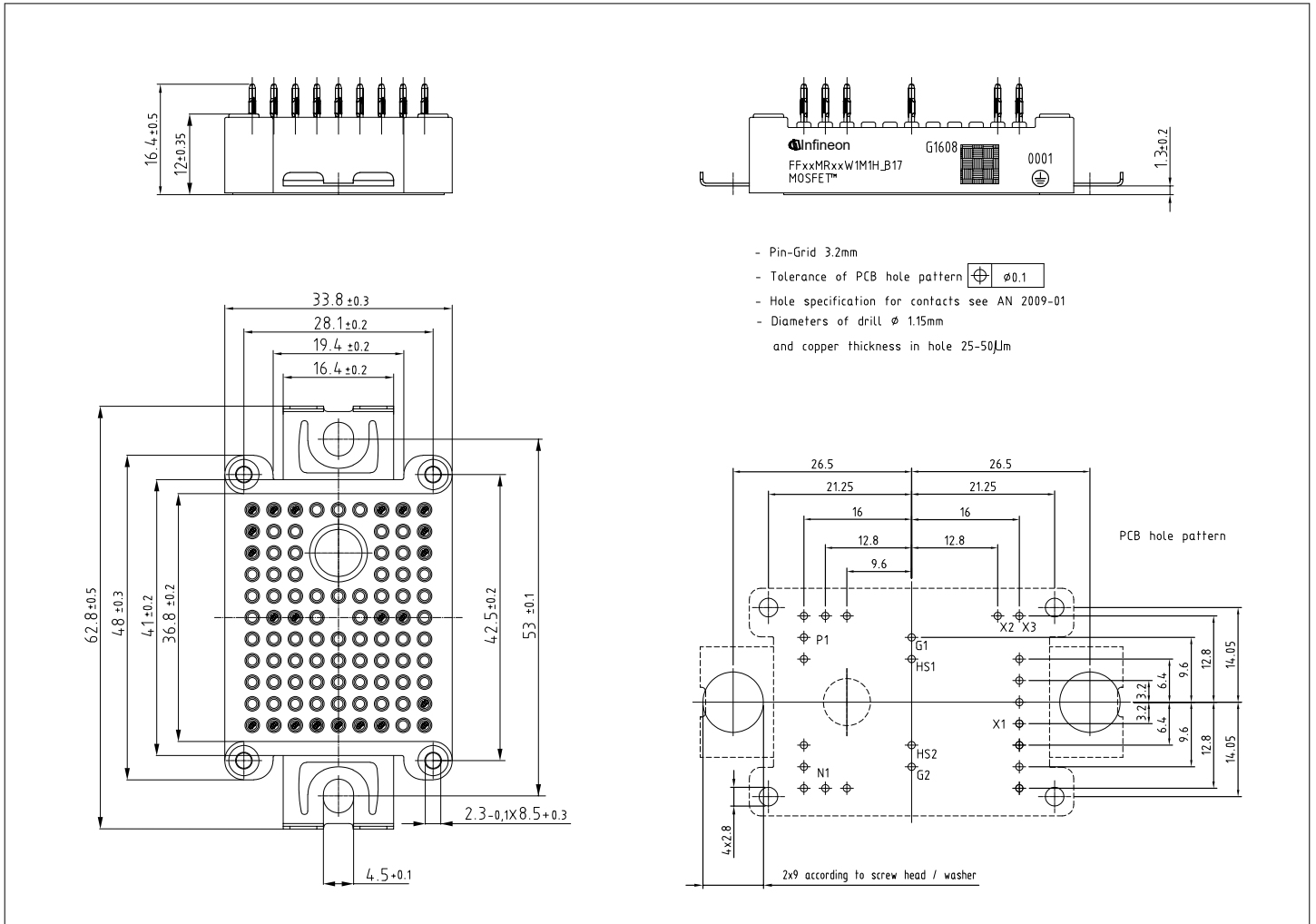


Figure 1

**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
0.10	2023-10-31	Initial version
0.20	2023-12-11	Preliminary datasheet

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**Email:** [erratum@infineon.com](mailto:erratum@infineon.com)

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