

**Preliminary datasheet**

**EasyPACK™ module with CoolSiC™ Trench MOSFET and PressFIT / NTC**

**Features**

- Electrical features
  - $V_{DSS} = 1200\text{ V}$
  - $I_{DN} = 30\text{ A} / I_{DRM} = 60\text{ A}$
  - Low inductive design
  - Low switching losses
- Mechanical features
  - Rugged mounting due to integrated mounting clamps
  - PressFIT contact technology
  - Integrated NTC temperature sensor



Typical appearance

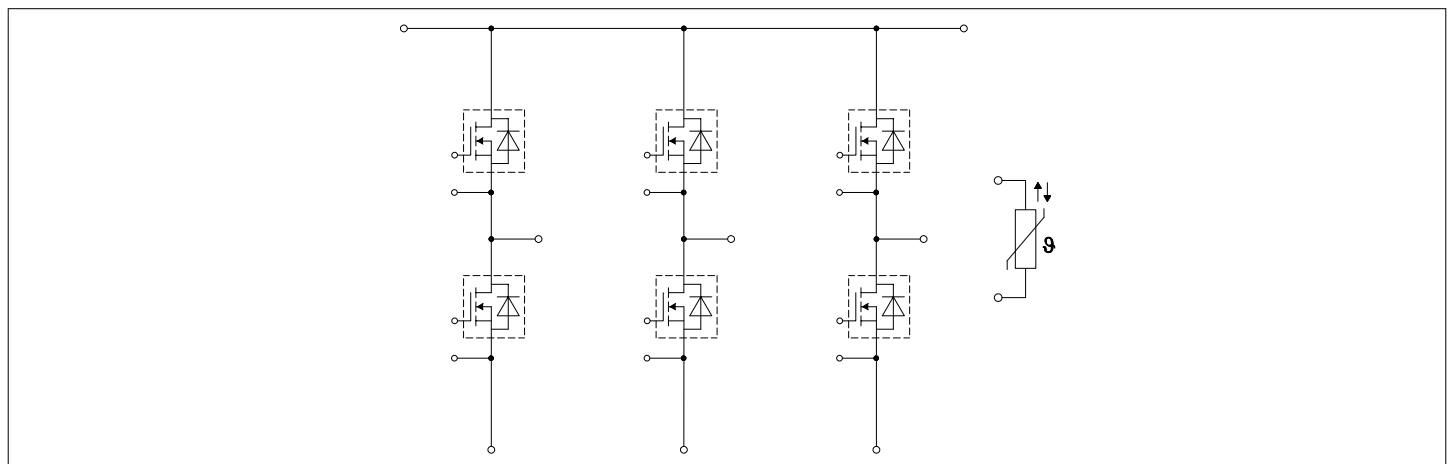
**Potential applications**

- High-frequency switching application
- DC/DC converter
- Motor drives
- UPS systems

**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   |
| 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                  | $L_{sCE}$     |                           |        | 19   |      | nH   |
| Module lead resistance, terminals - chip | $R_{CC'+EE'}$ | $T_H = 25$ °C, per switch |        | 5.3  |      | 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.

## 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    |
| Continuous DC drain current                 | $I_{DDC}$ | $T_{vj} = 175$ °C, $V_{GS} = 18$ V<br>$T_H = 80$ °C | 30     | A    |
| Repetitive peak drain current               | $I_{DRM}$ | verified by design, $t_p$ limited by $T_{vjmax}$    | 60     | 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           | $R_{DS(on)}$ | $I_D = 30\text{ A}$  | $V_{GS} = 18\text{ V}, T_{vj} = 25\text{ °C}$ |        | 26.4  |      | mΩ   |
|                                      |              |  |   |        | 42.8  |      |      |
|                                      |              |  |   |        | 56.8  |      |      |
|                                      |              |  |   |        | 31.8  |      |      |
| Gate threshold voltage               | $V_{GS(th)}$ | $I_D = 12\text{ mA}, V_{DS} = V_{GS}, T_{vj} = 25\text{ °C},$ (tested after 1ms pulse at $V_{GS} = +20\text{ V}$ ) |   | 3.45   | 4.3   | 5.15 | V    |
| Total gate charge                    | $Q_G$        | $V_{DD} = 800\text{ V}, V_{GS} = -3/18\text{ V}$   |   |        | 0.09  |      | μC   |
| Internal gate resistor               | $R_{Gint}$   | $T_{vj} = 25\text{ °C}$  |   |        | 3.8   |      | Ω    |
| Input capacitance                    | $C_{ISS}$    | $f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$   | $T_{vj} = 25\text{ °C}$                       |        | 2.7   |      | nF   |
| Output capacitance                   | $C_{OSS}$    | $f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$   | $T_{vj} = 25\text{ °C}$                       |        | 0.128 |      | nF   |
| Reverse transfer capacitance         | $C_{rSS}$    | $f = 100\text{ kHz}, V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$   | $T_{vj} = 25\text{ °C}$                       |        | 0.009 |      | nF   |
| $C_{OSS}$ stored energy              | $E_{OSS}$    | $V_{DS} = 800\text{ V}, V_{GS} = -3/18\text{ V}, T_{vj} = 25\text{ °C}$  |   |        | 52.4  |      | μJ   |
| Drain-source leakage current         | $I_{DSS}$    | $V_{DS} = 1200\text{ V}, V_{GS} = -3\text{ V}$   | $T_{vj} = 25\text{ °C}$                       |        | 0.02  | 208  | 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)  | $t_{d\ on}$  | $I_D = 30\text{ A}, R_{Gon} = 6.2\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$                        | $T_{vj} = 25\text{ °C}$                       |        | 16    |      | ns   |
|                                      |              |  | $T_{vj} = 125\text{ °C}$                      |        | 16    |      |      |
|                                      |              |  | $T_{vj} = 175\text{ °C}$                      |        | 16    |      |      |
| Rise time (inductive load)           | $t_r$        | $I_D = 30\text{ A}, R_{Gon} = 6.2\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$                        | $T_{vj} = 25\text{ °C}$                       |        | 30    |      | ns   |
|                                      |              |  | $T_{vj} = 125\text{ °C}$                      |        | 30    |      |      |
|                                      |              |  | $T_{vj} = 175\text{ °C}$                      |        | 30    |      |      |
| Turn-off delay time (inductive load) | $t_{d\ off}$ | $I_D = 30\text{ A}, R_{Goff} = 5.1\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$                       | $T_{vj} = 25\text{ °C}$                       |        | 47    |      | ns   |
|                                      |              |  | $T_{vj} = 125\text{ °C}$                      |        | 52    |      |      |
|                                      |              |  | $T_{vj} = 175\text{ °C}$                      |        | 55    |      |      |
| Fall time (inductive load)           | $t_f$        | $I_D = 30\text{ A}, R_{Goff} = 5.1\text{ Ω}, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$                       | $T_{vj} = 25\text{ °C}$                       |        | 19    |      | ns   |
|                                      |              |  | $T_{vj} = 125\text{ °C}$                      |        | 19    |      |      |
|                                      |              |  | $T_{vj} = 175\text{ °C}$                      |        | 19    |      |      |

(table continues...)

**Table 5 (continued) Characteristic values**

| Parameter                                 | Symbol            | Note or test condition   | Values                               |       |      | Unit             |
|---|-------------------|--|--------------------------------------|-------|------|------------------|
|   |                   |  | Min.                                 | Typ.  | Max. |                  |
| Turn-on energy loss per pulse             | $E_{on}$          | $I_D = 30\text{ A}$ , $V_{DD} = 600\text{ V}$ ,<br>$L_\sigma = 35\text{ nH}$ , $V_{GS} = -3/18\text{ V}$ ,<br>$R_{Gon} = 6.2\ \Omega$ , $di/dt = 2.7\text{ kA}/\mu\text{s}$ ( $T_{vj} = 175\text{ }^\circ\text{C}$ ) | $T_{vj} = 25\text{ }^\circ\text{C}$  | 0.47  |      | mJ               |
|   |                   |  | $T_{vj} = 125\text{ }^\circ\text{C}$ | 0.589 |      |                  |
|   |                   |  | $T_{vj} = 175\text{ }^\circ\text{C}$ | 0.661 |      |                  |
| Turn-off energy loss per pulse            | $E_{off}$         | $I_D = 30\text{ A}$ , $V_{DD} = 600\text{ V}$ ,<br>$L_\sigma = 35\text{ nH}$ , $V_{GS} = -3/18\text{ V}$ ,<br>$R_{Goff} = 5.1\ \Omega$ , $dv/dt = 25\text{ kV}/\mu\text{s}$ ( $T_{vj} = 175\text{ }^\circ\text{C}$ ) | $T_{vj} = 25\text{ }^\circ\text{C}$  | 0.112 |      | mJ               |
|   |                   |  | $T_{vj} = 125\text{ }^\circ\text{C}$ | 0.121 |      |                  |
|   |                   |  | $T_{vj} = 175\text{ }^\circ\text{C}$ | 0.123 |      |                  |
| Thermal resistance, junction to heat sink | $R_{thJH}$        | per MOSFET, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$  |                                      | 1.4   |      | 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 Notes 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 | $I_{SD}$ | $T_{vj} = 175\text{ }^\circ\text{C}$ , $V_{GS} = -3\text{ V}$<br>$T_H = 80\text{ }^\circ\text{C}$ | 15     | A    |

**Table 7 Characteristic values**

| Parameter       | Symbol   | Note or test condition                          | Values                               |      |      | Unit |
|-----------------|----------|---|--------------------------------------|------|------|------|
|                 |          |   | Min.                                 | Typ. | Max. |      |
| Forward voltage | $V_{SD}$ | $I_{SD} = 30\text{ A}$ , $V_{GS} = -3\text{ V}$ | $T_{vj} = 25\text{ }^\circ\text{C}$  | 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

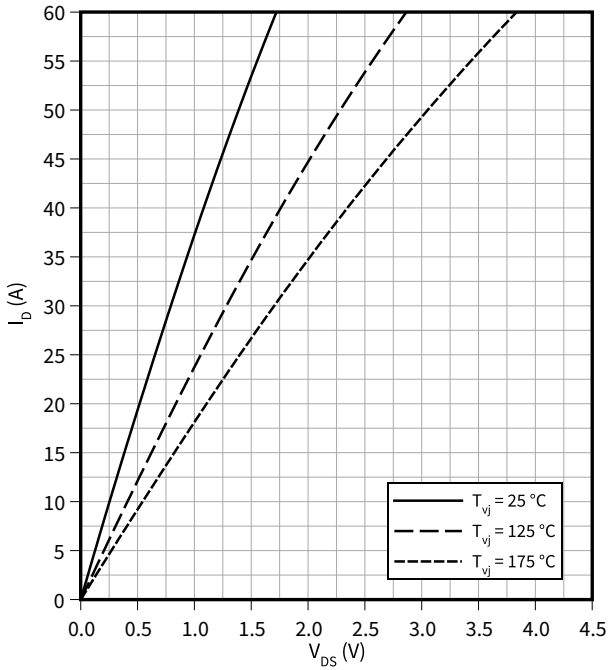
| Parameter              | Symbol       | Note or test condition                                       | Values |      |      | Unit |
|------------------------|--------------|--|--------|------|------|------|
|                        |              |  | Min.   | Typ. | Max. |      |
| Rated resistance       | $R_{25}$     | $T_{NTC} = 25\text{ °C}$                                     |        | 5    |      | kΩ   |
| Deviation of $R_{100}$ | $\Delta R/R$ | $T_{NTC} = 100\text{ °C}, R_{100} = 493\ \Omega$             | -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

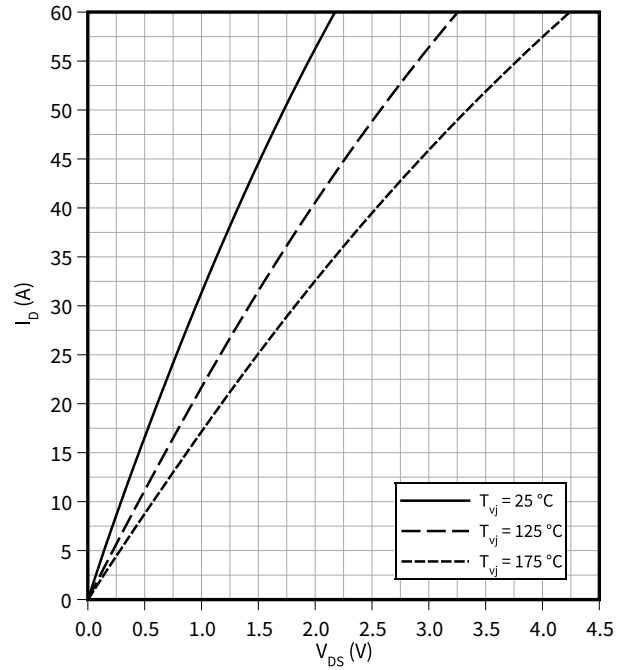
**Output characteristic (typical), MOSFET**

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



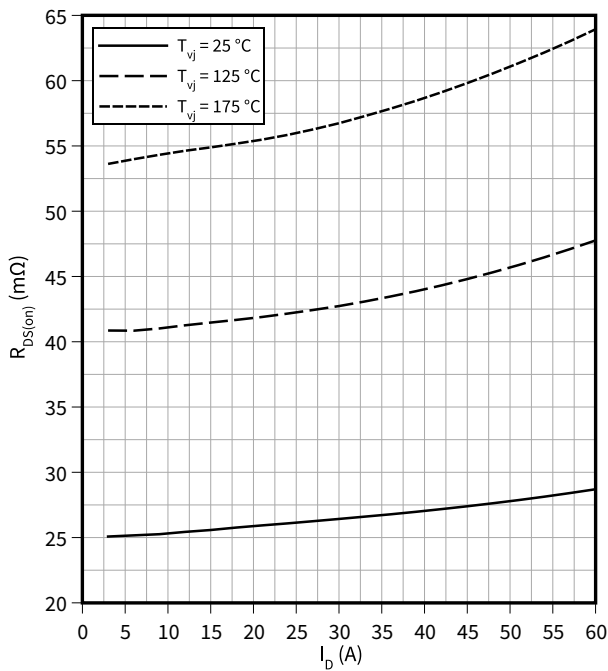
**Output characteristic (typical), MOSFET**

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



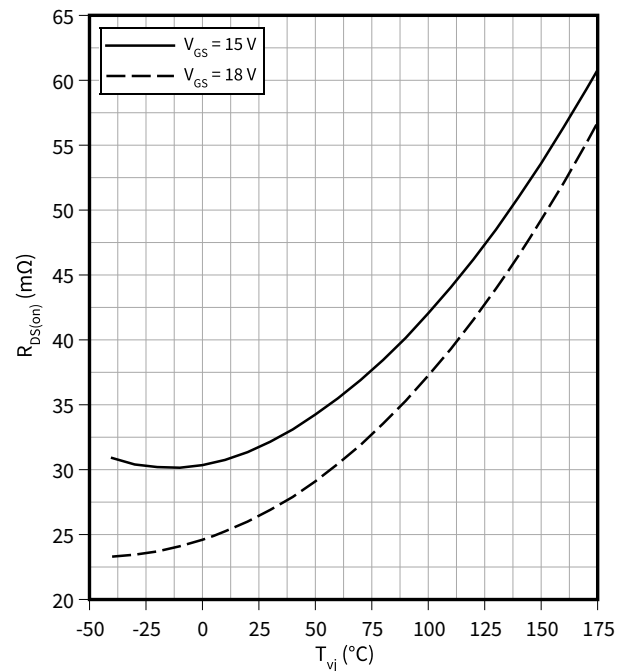
**Drain source on-resistance (typical), MOSFET**

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



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

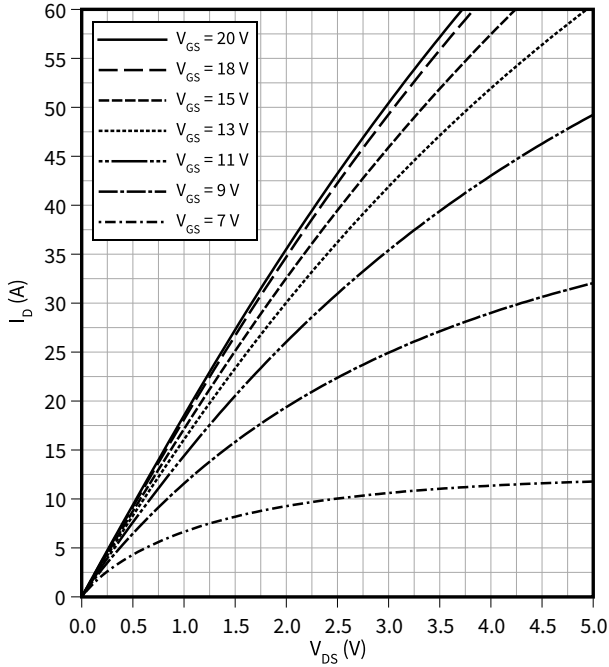
$R_{DS(on)} = f(T_{vj})$   
 $I_D = 30\text{ A}$



5 Characteristics diagrams

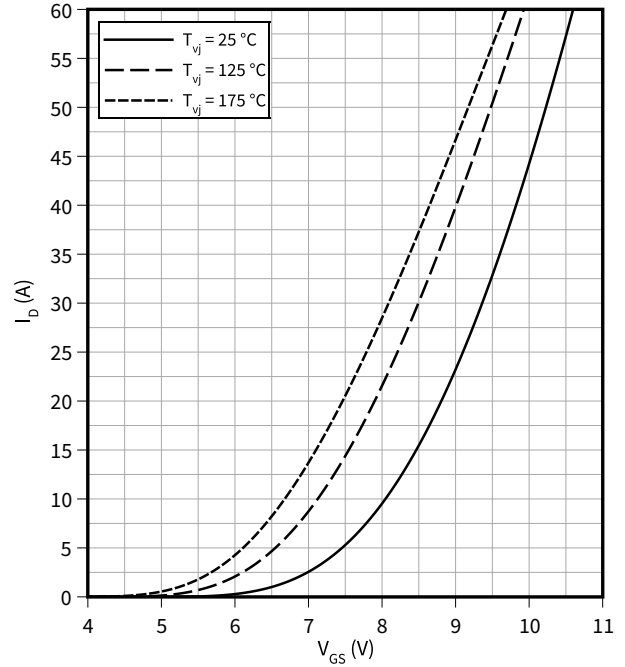
**Output characteristic field (typical), MOSFET**

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



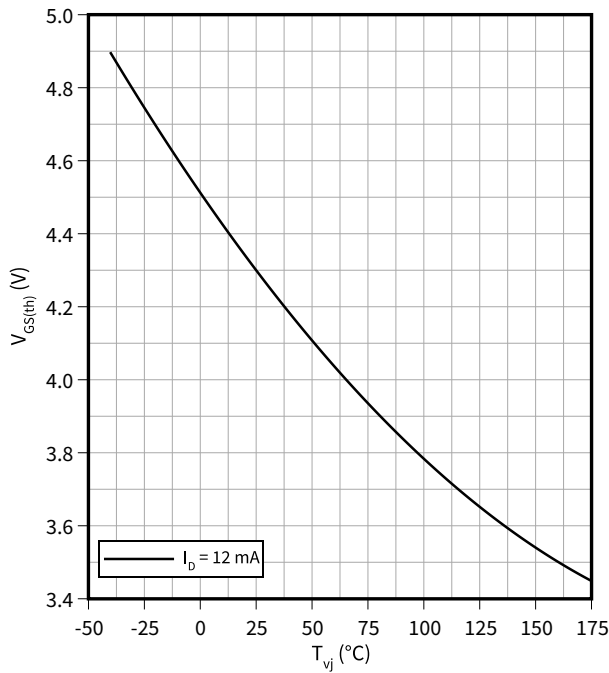
**Transfer characteristic (typical), MOSFET**

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



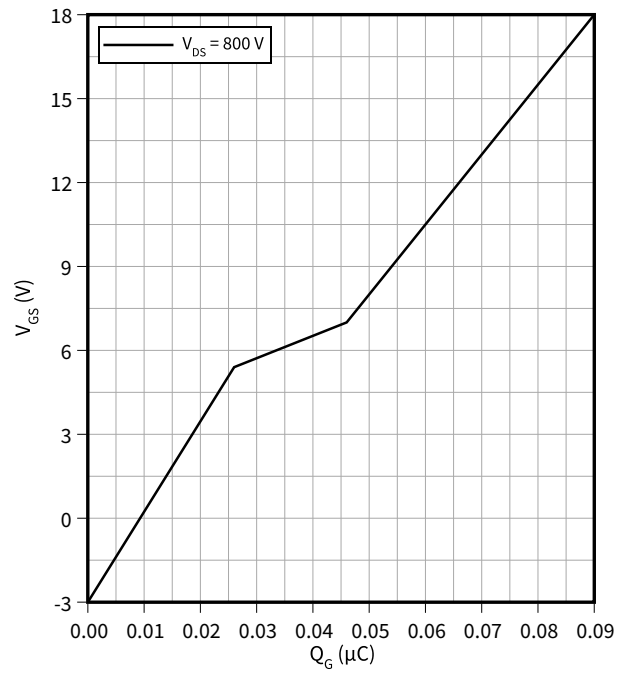
**Gate-source threshold voltage (typical), MOSFET**

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



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

$V_{GS} = f(Q_G)$   
 $I_D = 30\text{ A}, T_{vj} = 25\text{ °C}$

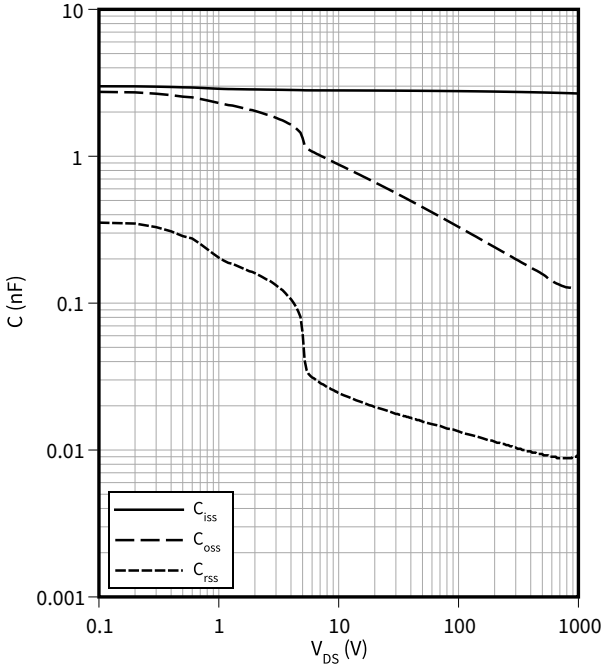




5 Characteristics diagrams

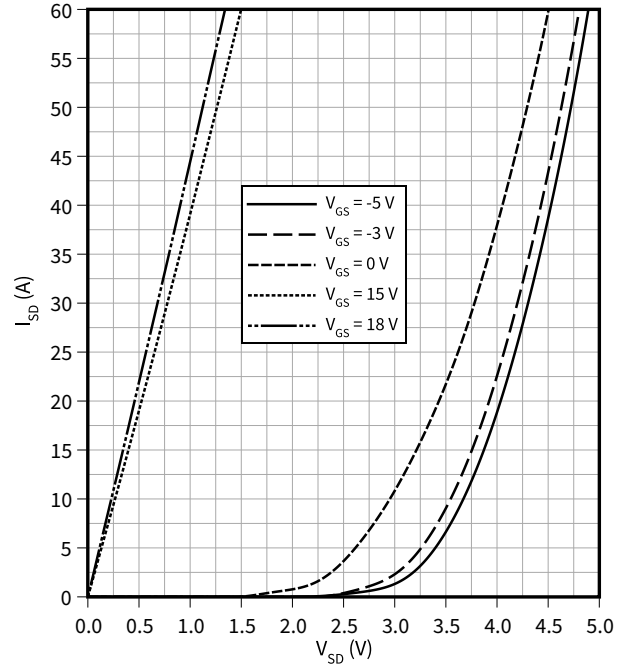
**Capacity characteristic (typical), MOSFET**

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



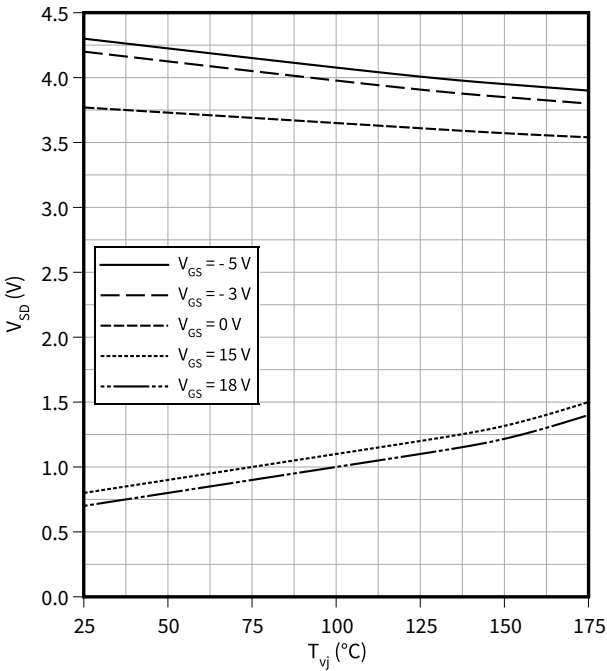
**Forward characteristic body diode (typical), MOSFET**

$I_{SD} = f(V_{SD})$   
 $T_{vj} = 25 \text{ }^\circ\text{C}$



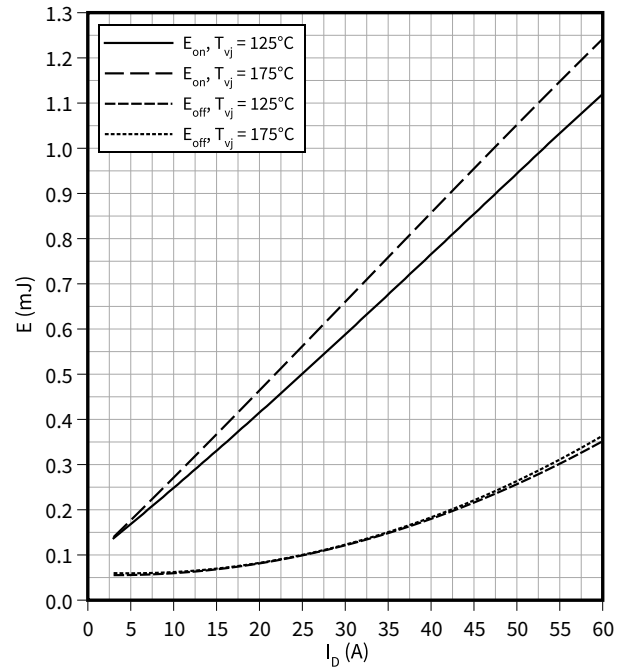
**Forward voltage of body diode (typical), MOSFET**

$V_{SD} = f(T_{vj})$   
 $I_{SD} = 30 \text{ A}$



**Switching losses (typical), MOSFET**

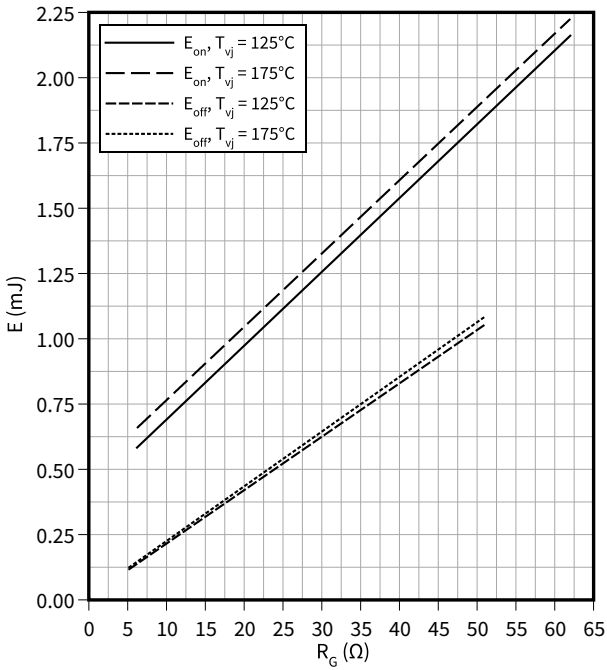
$E = f(I_D)$   
 $R_{Goff} = 5.1 \text{ } \Omega, R_{Gon} = 6.2 \text{ } \Omega, V_{DD} = 600 \text{ V}, V_{GS} = -3/18 \text{ V}$



**Switching losses (typical), MOSFET**

$E = f(R_G)$

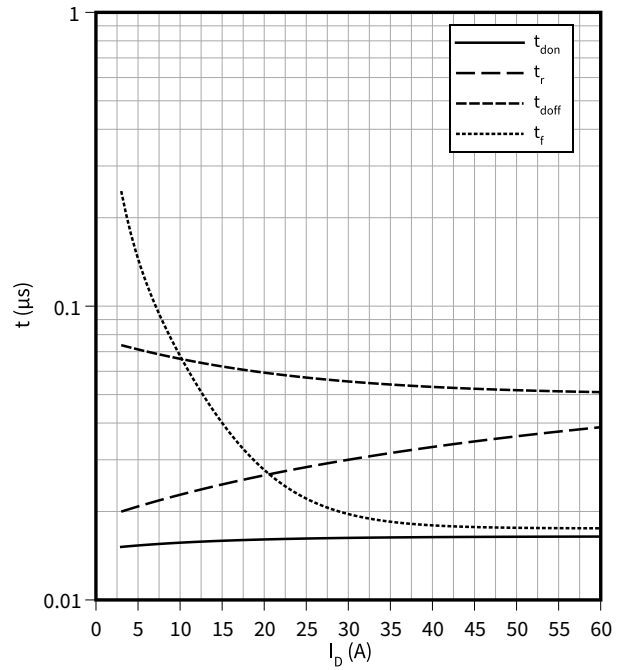
$V_{DD} = 600\text{ V}, I_D = 30\text{ A}, V_{GS} = -3/18\text{ V}$



**Switching times (typical), MOSFET**

$t = f(I_D)$

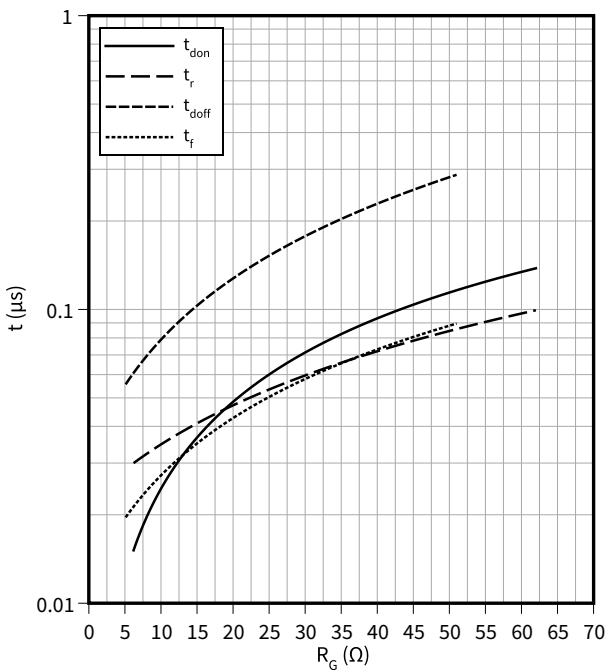
$R_{Goff} = 5.1\ \Omega, R_{Gon} = 6.2\ \Omega, V_{DD} = 600\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GS} = -3/18\text{ V}$



**Switching times (typical), MOSFET**

$t = f(R_G)$

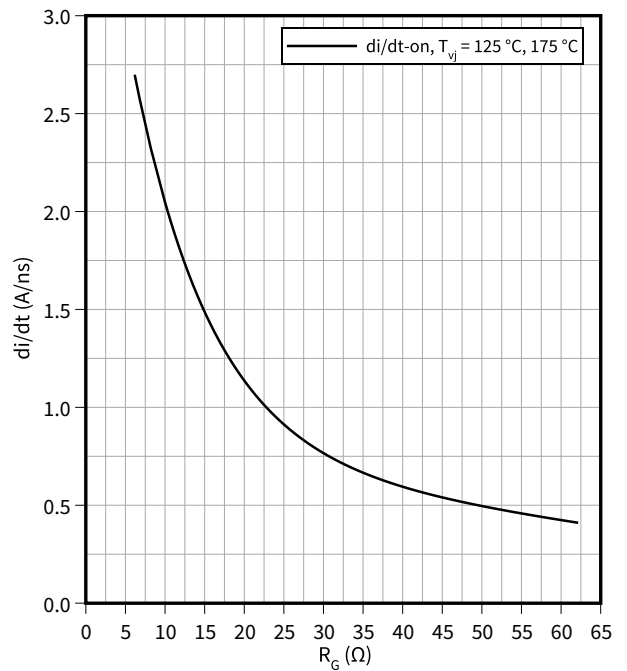
$V_{DD} = 600\text{ V}, I_D = 30\text{ A}, T_{vj} = 175\text{ }^\circ\text{C}, V_{GS} = -3/18\text{ V}$



**Current slope (typical), MOSFET**

$di/dt = f(R_G)$

$V_{DD} = 600\text{ V}, I_D = 30\text{ A}, V_{GS} = -3/18\text{ V}$

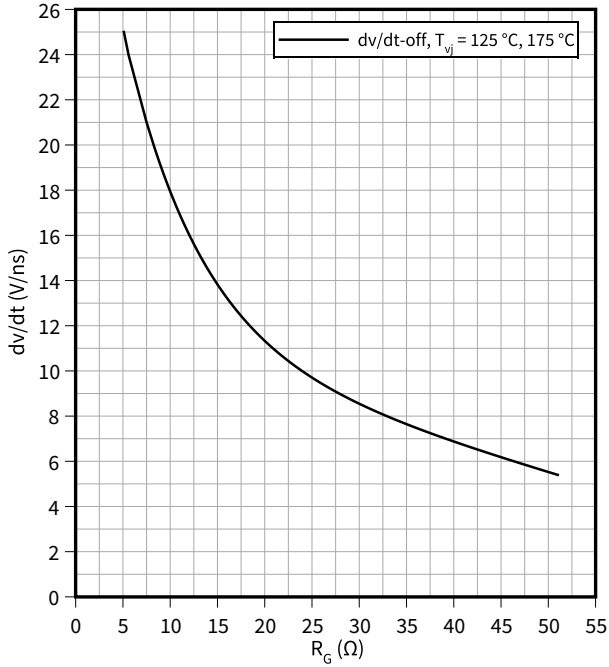


5 Characteristics diagrams

**Voltage slope (typical), MOSFET**

$dv/dt = f(R_G)$

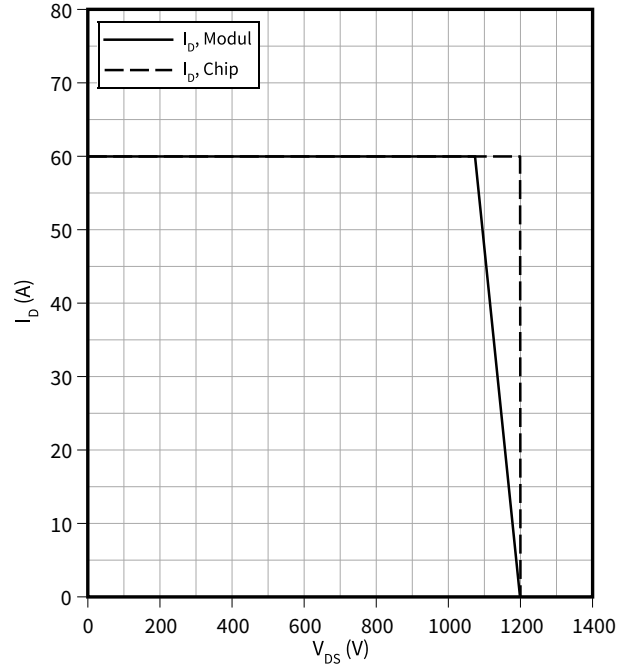
$V_{DD} = 600\text{ V}$ ,  $I_D = 30\text{ A}$ ,  $V_{GS} = -3/18\text{ V}$



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

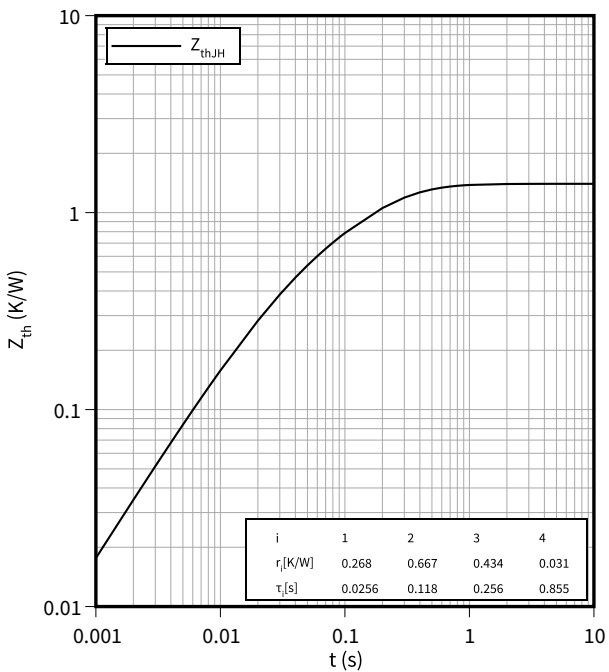
$I_D = f(V_{DS})$

$R_{Goff} = 5.1\ \Omega$ ,  $T_{vj} = 175\ ^\circ\text{C}$ ,  $V_{GS} = -3/18\text{ V}$



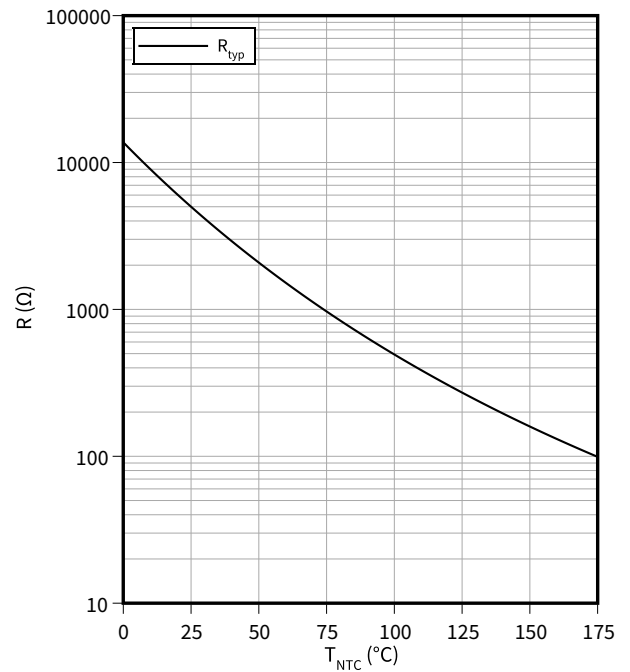
**Transient thermal impedance, MOSFET**

$Z_{th} = f(t)$

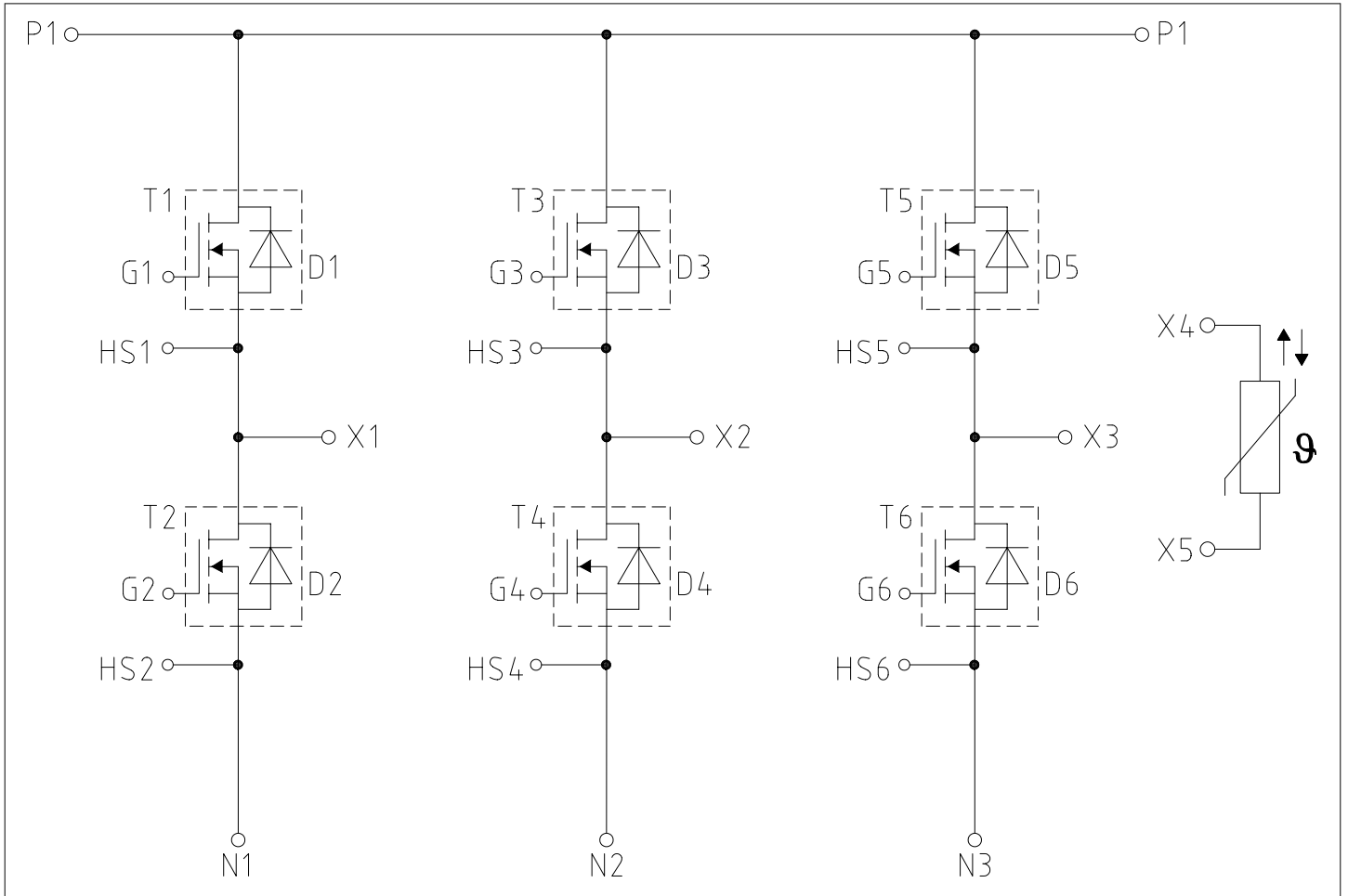


**Temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$



**6 Circuit diagram**



**Figure 1**

## 7 Package outlines

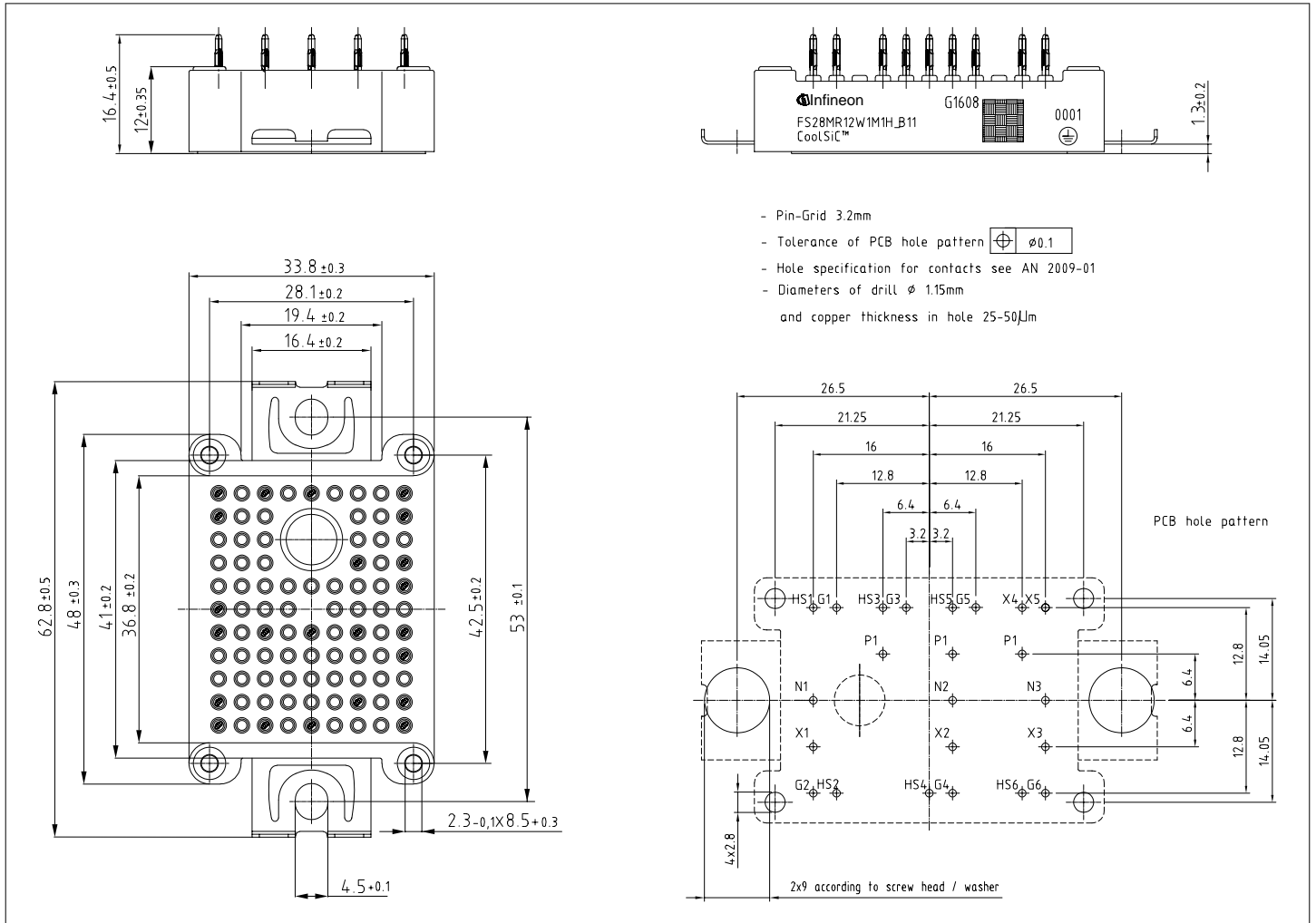

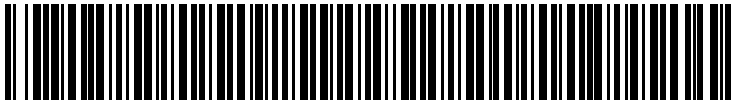


Figure 2

## 8 Module label code

| <b>Module label code</b> |  |  |   |
|--------------------------|--|--|---|
| 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><br>Module serial number<br>Module material number<br>Production order number<br>Date code (production year)<br>Date code (production week)              | <i>Digit</i><br>1 - 5<br>6 - 11<br>12 - 19<br>20 - 21<br>22 - 23 | <i>Example</i><br>71549<br>142846<br>55054991<br>15<br>30 |
| Example                  |   |  |   |
|                          | 71549142846550549911530  |  | 71549142846550549911530                                   |

**Figure 3**

## Revision history

| Document revision | Date of release | Description of changes |
|-------------------|-----------------|------------------------|
| 0.10              | 2022-08-02      | Initial version        |
| 0.20              | 2023-02-28      | Preliminary datasheet  |

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