



# PSMN018-100PSF

NextPower 100 V, 18 mΩ N-channel MOSFET in TO220 package

10 April 2017

Product data sheet

## 1. General description

NextPower 100 V standard level gate drive MOSFET. Qualified to 175 °C and recommended for industrial & consumer applications.

## 2. Features and benefits

- Optimised for fast switching, low spiking, high efficiency
- Low  $Q_G \times R_{DSon}$  FOM for high efficiency switching applications
- Low body diode losses ( $Q_{rr}$ ) and fast recovery ( $t_{rr}$ )
- Strong avalanche energy rating ( $E_{AS}$ )
- Avalanche rated & 100% tested
- Ha-free & RoHS compliant TO220 package

## 3. Applications

- Synchronous rectification in AC-to-DC and DC-to-DC applications
- Brushed & BLDC motor control
- UPS & solar inverter
- LED lighting
- Battery protection
- Full-bridge & half-bridge applications
- Flyback & resonant topologies

## 4. Quick reference data

Table 1. Quick reference data

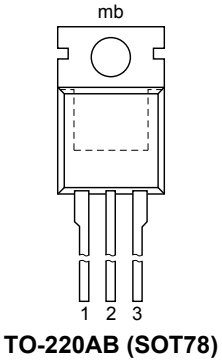
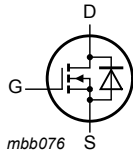
| Symbol                         | Parameter                        | Conditions  | Min | Typ  | Max | Unit |
|--------------------------------|----------------------------------|---|-----|------|-----|------|
| $V_{DS}$                       | drain-source voltage             | $25\text{ °C} \leq T_j \leq 175\text{ °C}$  | -   | -    | 100 | V    |
| $I_D$                          | drain current                    | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>   | [1] | -    | 53  | A    |
| $P_{tot}$                      | total power dissipation          | $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>  | -   | -    | 111 | W    |
| $T_j$                          | junction temperature             |   | -55 | -    | 175 | °C   |
| <b>Static characteristics</b>  |                                  |   |     |      |     |      |
| $R_{DSon}$                     | drain-source on-state resistance | $V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>                             | -   | 14.9 | 18  | mΩ   |
|                                |                                  | $V_{GS} = 10\text{ V}$ ; $I_D = 15\text{ A}$ ; $T_j = 100\text{ °C}$ ; <a href="#">Fig. 11</a>                            | -   | 22   | 28  | mΩ   |
| <b>Dynamic characteristics</b> |                                  |   |     |      |     |      |
| $Q_{GD}$                       | gate-drain charge                | $I_D = 15\text{ A}$ ; $V_{DS} = 50\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; <a href="#">Fig. 12</a> ; <a href="#">Fig. 13</a> | -   | 4.2  | -   | nC   |
| $Q_{G(tot)}$                   | total gate charge                |   | -   | 21.4 | -   | nC   |

| Symbol                      | Parameter                                    | Conditions  |     | Min | Typ | Max | Unit |
|-----------------------------|--|---|-----|-----|-----|-----|------|
| <b>Avalanche ruggedness</b> |  |   |     |     |     |     |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $I_D = 20.5\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\ \Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; Fig. 4; Unclamped | [2] | -   | -   | 109 | mJ   |

- [1] Avalanche current is limited by  $I_{AS}$
- [2] Protected by 100% test

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline   | Graphic symbol  |
|-----|--------|-----------------------------------|--|---|
| 1   | G      | gate                              |  <p style="text-align: center;">TO-220AB (SOT78)</p> |  |
| 2   | D      | drain                             |  |   |
| 3   | S      | source                            |  |   |
| mb  | D      | mounting base; connected to drain |  |   |

## 6. Ordering information

Table 3. Ordering information

| Type number    | Package  |  | Version |
|----------------|----------|--|---------|
|                | Name     | Description  |         |
| PSMN018-100PSF | TO-220AB | plastic, single-ended package (heatsink mounted, 1 mounting hole); 3 leads; 2.54 mm pitch; 15.6 mm x 10 mm x 4.4 mm body | SOT78   |

## 7. Marking

Table 4. Marking codes

| Type number    | Marking code   |
|----------------|----------------|
| PSMN018-100PSF | PSMN018-100PSF |

## 8. Limiting values

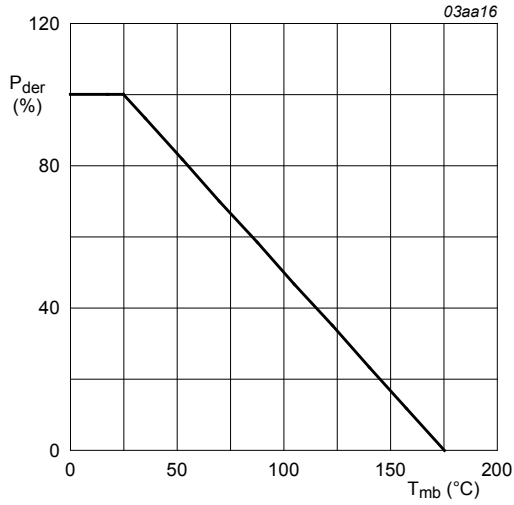
**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol                      | Parameter                                    | Conditions   |     | Min | Max  | Unit |
|-----------------------------|--|--|-----|-----|------|------|
| $V_{DS}$                    | drain-source voltage                         | $25\text{ °C} \leq T_j \leq 175\text{ °C}$   |     | -   | 100  | V    |
| $V_{DGR}$                   | drain-gate voltage                           | $25\text{ °C} \leq T_j \leq 175\text{ °C}$ ; $R_{GS} = 20\text{ k}\Omega$  |     | -   | 100  | V    |
| $V_{GS}$                    | gate-source voltage                          |  |     | -20 | 20   | V    |
| $P_{tot}$                   | total power dissipation                      | $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 1</a>   |     | -   | 111  | W    |
| $I_D$                       | drain current                                | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 2</a>  | [1] | -   | 53   | A    |
|                             |  | $V_{GS} = 10\text{ V}$ ; $T_{mb} = 100\text{ °C}$ ; <a href="#">Fig. 2</a>   |     | -   | 37   | A    |
| $I_{DM}$                    | peak drain current                           | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$ ; <a href="#">Fig. 3</a>  |     | -   | 212  | A    |
| $T_{stg}$                   | storage temperature                          |  |     | -55 | 175  | °C   |
| $T_j$                       | junction temperature                         |  |     | -55 | 175  | °C   |
| $T_{sld(M)}$                | peak soldering temperature                   |  |     | -   | 260  | °C   |
| <b>Source-drain diode</b>   |  |  |     |     |      |      |
| $I_S$                       | source current                               | $T_{mb} = 25\text{ °C}$  |     | -   | 53   | A    |
| $I_{SM}$                    | peak source current                          | pulsed; $t_p \leq 10\text{ }\mu\text{s}$ ; $T_{mb} = 25\text{ °C}$   |     | -   | 212  | A    |
| <b>Avalanche ruggedness</b> |  |  |     |     |      |      |
| $E_{DS(AL)S}$               | non-repetitive drain-source avalanche energy | $I_D = 20.5\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; <a href="#">Fig. 4</a> ; Unclamped | [2] | -   | 109  | mJ   |
| $I_{AS}$                    | non-repetitive avalanche current             | $V_{sup} \leq 100\text{ V}$ ; $V_{GS} = 10\text{ V}$ ; $T_{j(init)} = 25\text{ °C}$ ; $R_{GS} = 50\text{ }\Omega$  | [2] | -   | 20.5 | A    |

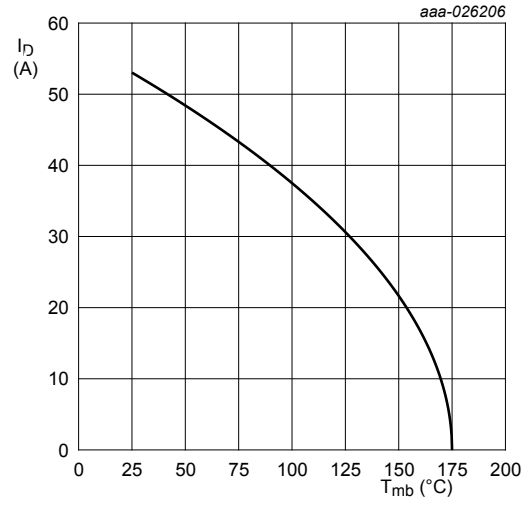
[1] Avalanche current is limited by  $I_{AS}$

[2] Protected by 100% test



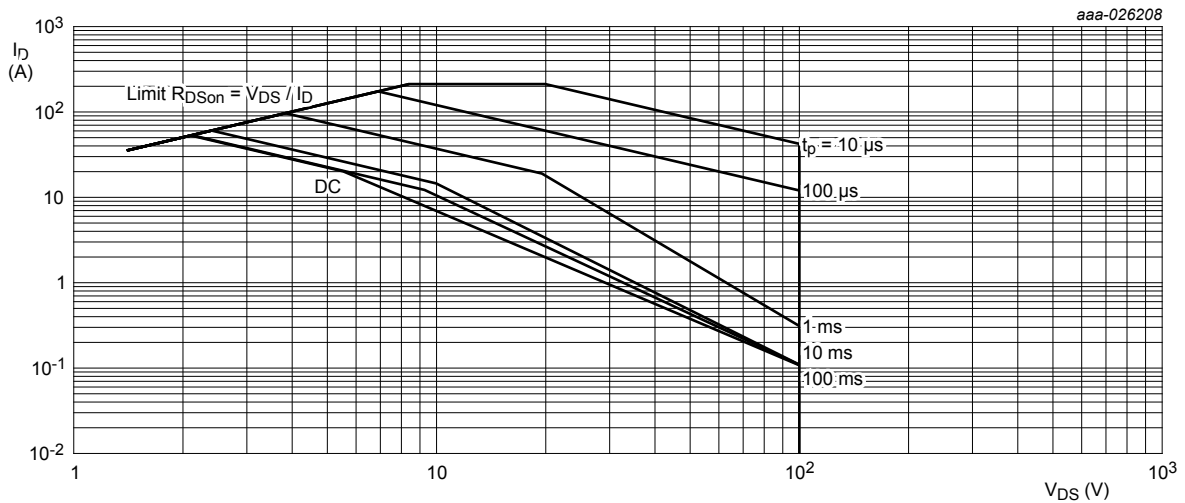
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

**Fig. 1. Normalized total power dissipation as a function of mounting base temperature**



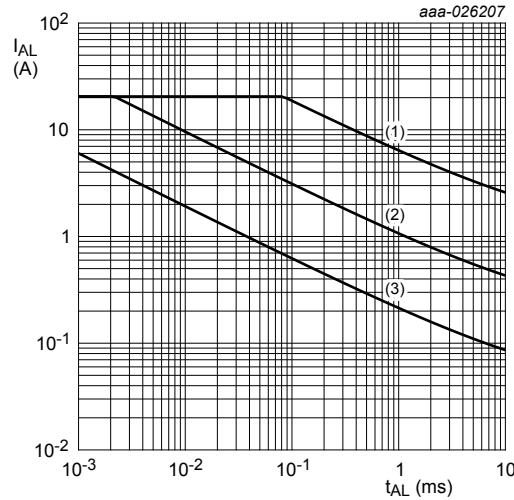
$V_{GS} \geq 10\text{ V}$

**Fig. 2. Continuous drain current as a function of mounting base temperature**



$T_{mb} = 25^{\circ}\text{C}$ ;  $I_{DM}$  is a single pulse

**Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage**



(1)  $T_{j\text{(init)}} = 25\text{ °C}$ ; (2)  $T_{j\text{(init)}} = 150\text{ °C}$ ; (3) Repetitive Avalanche

Fig. 4. Avalanche rating; avalanche current as a function of avalanche time

### 9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol         | Parameter   | Conditions | Min | Typ  | Max  | Unit |
|----------------|---|------------|-----|------|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Fig. 5     | -   | 1.22 | 1.35 | K/W  |

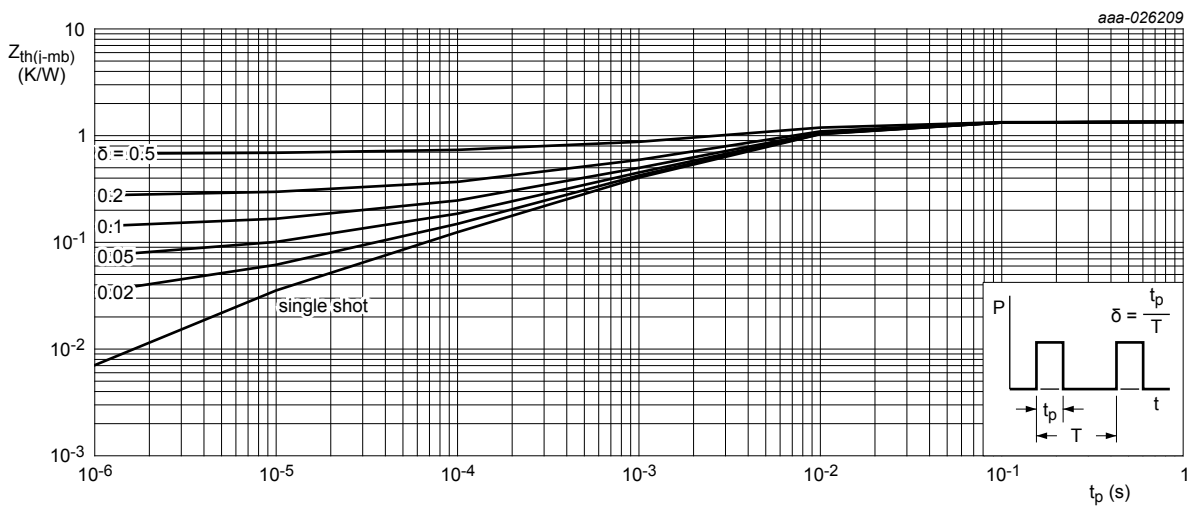


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Characteristics

Table 7. Characteristics

| Symbol                         | Parameter  | Conditions   | Min | Typ  | Max | Unit          |
|--------------------------------|--|--|-----|------|-----|---------------|
| <b>Static characteristics</b>  |  |  |     |      |     |               |
| $V_{(BR)DSS}$                  | drain-source breakdown voltage                           | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$   | 100 | -    | -   | V             |
|                                |  | $I_D = 250 \mu\text{A}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$  | 90  | -    | -   | V             |
| $V_{GS(th)}$                   | gate-source threshold voltage                            | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = -55 \text{ }^\circ\text{C}$  | -   | 3.6  | -   | V             |
|                                |  | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 175 \text{ }^\circ\text{C}$  | -   | 2.1  | -   | V             |
|                                |  | $I_D = 1 \text{ mA}; V_{DS}=V_{GS}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 9}$  | 2   | 3.2  | 4   | V             |
| $\Delta V_{GS(th)}/\Delta T$   | gate-source threshold voltage variation with temperature | $25 \text{ }^\circ\text{C} \leq T_j \leq 175 \text{ }^\circ\text{C}$   | -   | -7.1 | -   | mV/K          |
| $I_{DSS}$                      | drain leakage current                                    | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 0.01 | 1   | $\mu\text{A}$ |
|                                |  | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 125 \text{ }^\circ\text{C}$   | -   | -    | 100 | $\mu\text{A}$ |
| $I_{GSS}$                      | gate leakage current                                     | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$  | -   | 5    | 100 | nA            |
|                                |  | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$   | -   | 5    | 100 | nA            |
| $R_{DS(on)}$                   | drain-source on-state resistance                         | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 10}$   | -   | 14.9 | 18  | mΩ            |
|                                |  | $V_{GS} = 7 \text{ V}; I_D = 15 \text{ A}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 10}$  | -   | 17.8 | 27  | mΩ            |
|                                |  | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 100 \text{ }^\circ\text{C}; \text{Fig. 11}$  | -   | 22   | 28  | mΩ            |
|                                |  | $V_{GS} = 10 \text{ V}; I_D = 15 \text{ A}; T_j = 175 \text{ }^\circ\text{C}; \text{Fig. 11}$  | -   | 31   | 40  | mΩ            |
| $R_G$                          | gate resistance  | $f = 1 \text{ MHz}$  | -   | 1.58 | -   | Ω             |
| <b>Dynamic characteristics</b> |  |  |     |      |     |               |
| $Q_{G(tot)}$                   | total gate charge  | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$   | -   | 21.4 | -   | nC            |
|                                |  | $I_D = 0 \text{ A}; V_{DS} = 0 \text{ V}; V_{GS} = 10 \text{ V}$   | -   | 10.9 | -   | nC            |
| $Q_{GS}$                       | gate-source charge                                       | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$   | -   | 7.2  | -   | nC            |
| $Q_{GS(th)}$                   | pre-threshold gate-source charge                         |  | -   | 4.3  | -   | nC            |
| $Q_{GS(th-pl)}$                | post-threshold gate-source charge                        |  | -   | 2.9  | -   | nC            |
| $Q_{GD}$                       | gate-drain charge  |  | -   | 4.2  | -   | nC            |
| $V_{GS(pl)}$                   | gate-source plateau voltage                              | $I_D = 15 \text{ A}; V_{DS} = 50 \text{ V}; \text{Fig. 12}; \text{Fig. 13}$  | -   | 4.9  | -   | V             |
| $C_{iss}$                      | input capacitance  | $V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}; T_j = 25 \text{ }^\circ\text{C}; \text{Fig. 14}$                          | -   | 1482 | -   | pF            |
| $C_{oss}$                      | output capacitance                                       |  | -   | 280  | -   | pF            |
| $C_{rss}$                      | reverse transfer capacitance                             |  | -   | 13   | -   | pF            |
| $t_{d(on)}$                    | turn-on delay time                                       | $V_{DS} = 50 \text{ V}; R_L = 3.3 \text{ } \Omega; V_{GS} = 10 \text{ V}; R_{G(ext)} = 5 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}$ | -   | 10.2 | -   | ns            |
| $t_r$                          | rise time  |  | -   | 14.1 | -   | ns            |

| Symbol                    | Parameter             | Conditions  | Min | Typ  | Max | Unit |
|---------------------------|-----------------------|---|-----|------|-----|------|
| $t_{d(off)}$              | turn-off delay time   |   | -   | 17.3 | -   | ns   |
| $t_f$                     | fall time             |   | -   | 12.6 | -   | ns   |
| <b>Source-drain diode</b> |                       |   |     |      |     |      |
| $V_{SD}$                  | source-drain voltage  | $I_S = 15\text{ A}$ ; $V_{GS} = 0\text{ V}$ ; $T_j = 25\text{ °C}$ ; Fig. 15          | -   | 0.9  | 1.2 | V    |
| $t_{rr}$                  | reverse recovery time | $I_S = 15\text{ A}$ ; $di_S/dt = -100\text{ A}/\mu\text{s}$ ; $V_{GS} = 0\text{ V}$ ; | -   | 40   | -   | ns   |
| $Q_r$                     | recovered charge      | $V_{DS} = 50\text{ V}$ ; Fig. 16  | -   | 46   | -   | nC   |

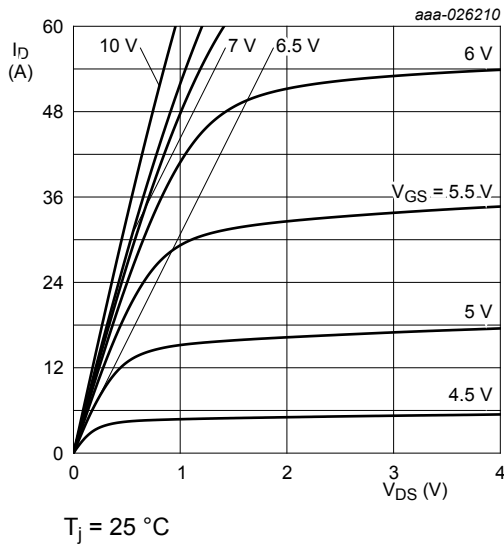


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

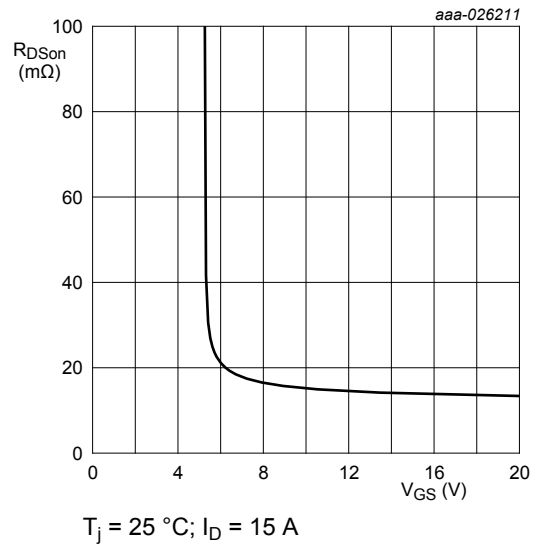


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

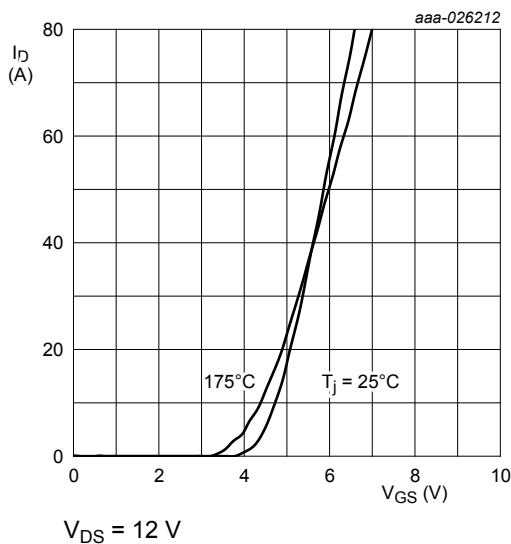


Fig. 8. Transfer characteristics; drain current as a function of gate-source voltage; typical values

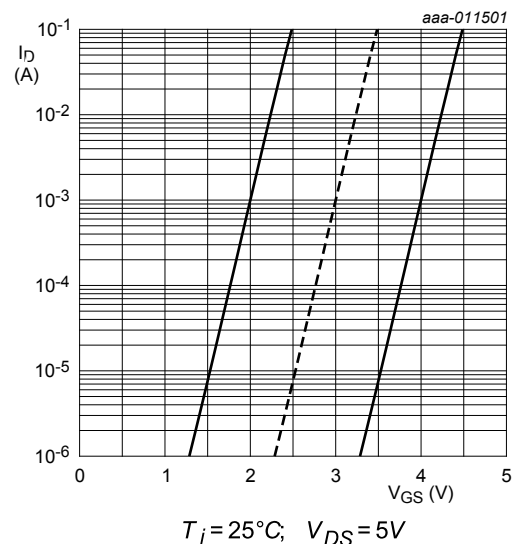


Fig. 9. Sub-threshold drain current as a function of gate-source voltage

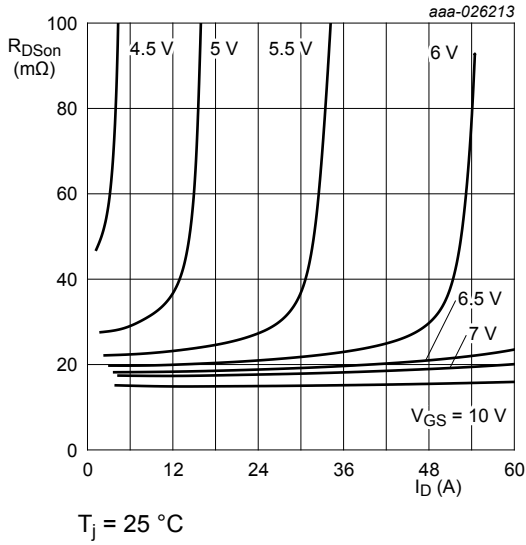


Fig. 10. Drain-source on-state resistance as a function of drain current; typical values

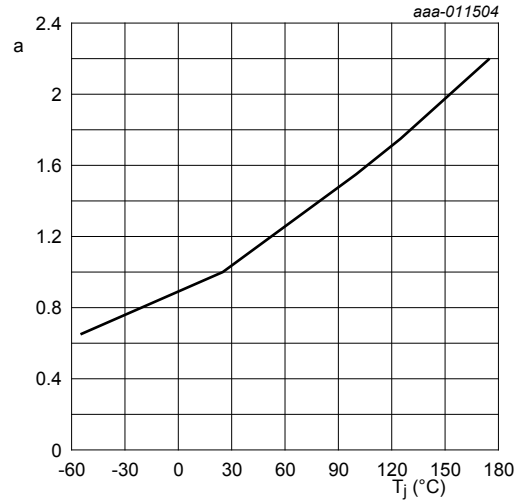


Fig. 11. Normalized drain-source on-state resistance factor as a function of junction temperature

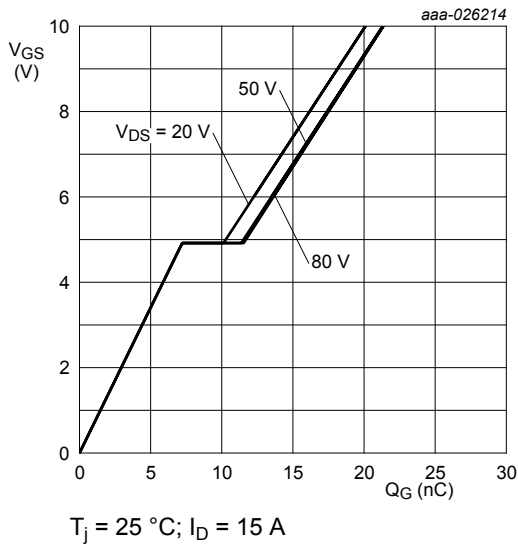


Fig. 12. Gate-source voltage as a function of gate charge; typical values

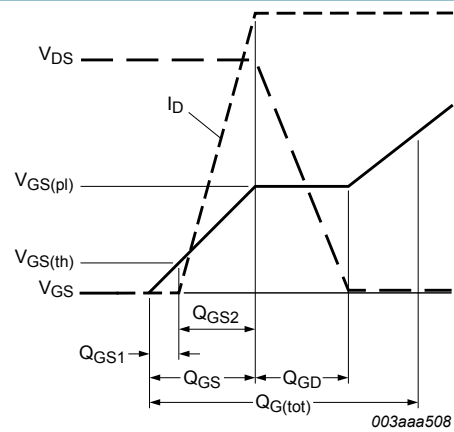


Fig. 13. Gate charge waveform definitions



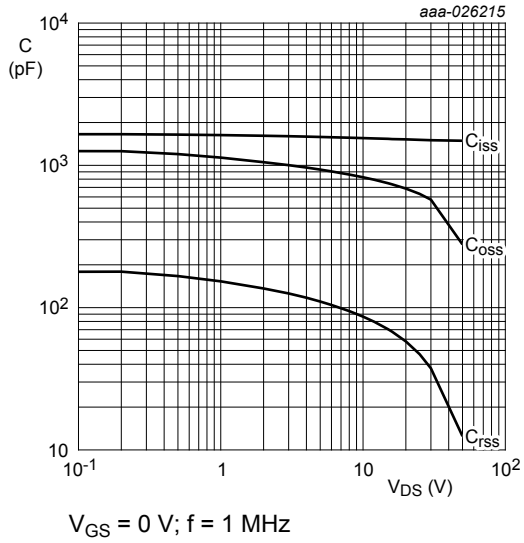


Fig. 14. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

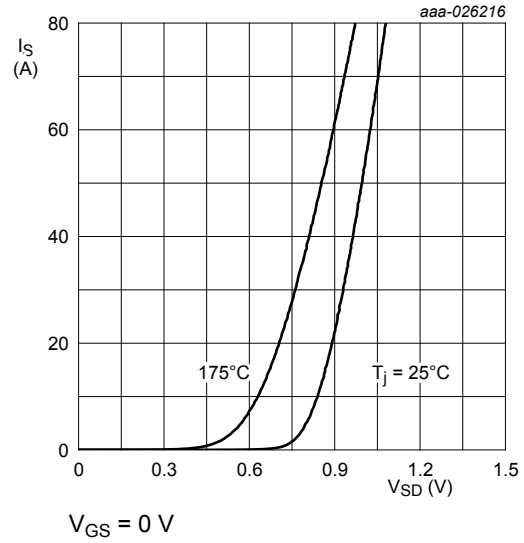


Fig. 15. Source-drain (diode forward) current as a function of source-drain (diode forward) voltage; typical values

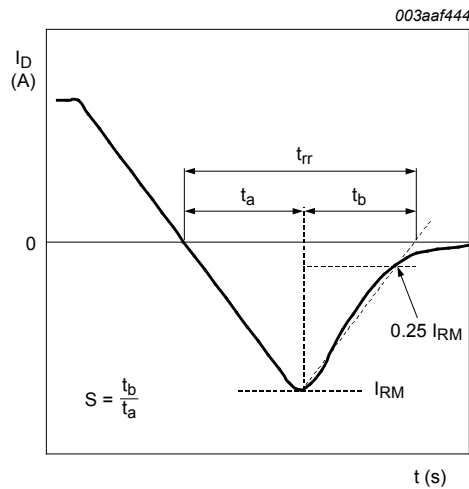


Fig. 16. Reverse recovery timing definition

### 11. Package outline

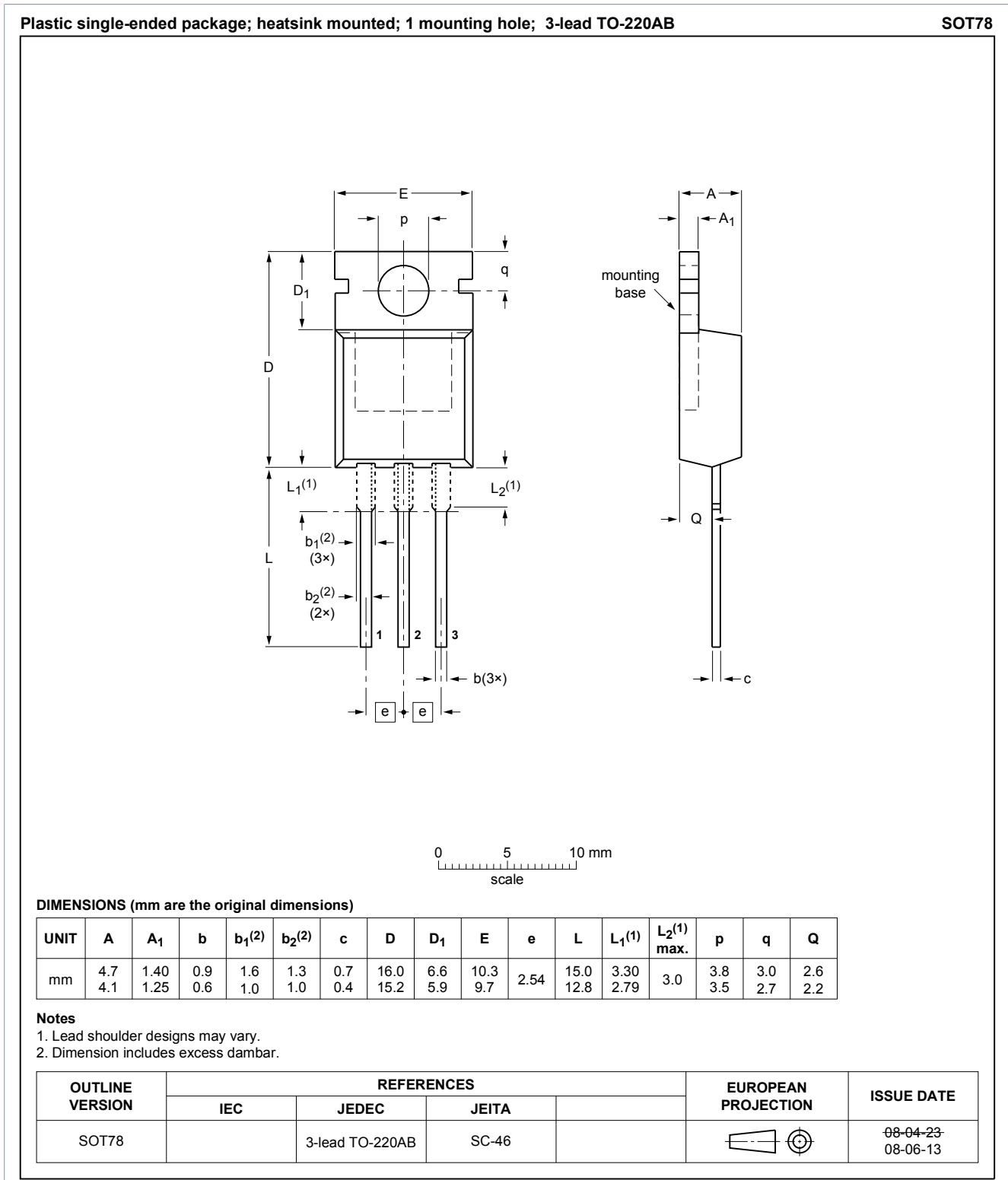


Fig. 17. Package outline TO-220AB (SOT78)

## 12. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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For more information, please visit: <http://www.nexperia.com>  
For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)  
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