



# PSMN7R8-100PSE

N-channel 100 V 7.8 mΩ standard level MOSFET with improved SOA in TO220 package

11 August 2014

Product data sheet

## 1. General description

Standard level N-channel MOSFET with improved SOA in a TO220 package. Part of Nexperia "NextPower Live" portfolio, the PSMN7R8-100PSE is robust enough to withstand substantial in-rush and fault condition currents during turn on/off, whilst offering a low RDS(on) characteristic to keep temperatures down and efficiency up in continued use. Ideal for telecommunication systems based on 48 V backplanes / supply rails.

## 2. Features and benefits

- Enhanced safe operating area (SOA) for superior protection during linear mode operation
- Low RDS(on) for low conduction losses

## 3. Applications

- Electronic fuse
- Hot-swap / Soft-start
- Uninterruptible power supplies
- Motor control

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                         | Parameter                        | Conditions                                                                                                               | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| V <sub>DS</sub>                | drain-source voltage             | T <sub>J</sub> ≥ 25 °C; T <sub>J</sub> ≤ 175 °C                                                                          | -   | -   | 100 | V    |
| I <sub>D</sub>                 | drain current                    | T <sub>mb</sub> = 100 °C; V <sub>GS</sub> = 10 V; <a href="#">Fig. 2</a>                                                 | -   | -   | 83  | A    |
| P <sub>tot</sub>               | total power dissipation          | T <sub>mb</sub> = 25 °C; <a href="#">Fig. 1</a>                                                                          | -   | -   | 294 | W    |
| <b>Static characteristics</b>  |                                  |                                                                                                                          |     |     |     |      |
| R <sub>DS(on)</sub>            | drain-source on-state resistance | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 25 °C; <a href="#">Fig. 12</a>                           | -   | 6.7 | 7.8 | mΩ   |
| <b>Dynamic characteristics</b> |                                  |                                                                                                                          |     |     |     |      |
| Q <sub>GD</sub>                | gate-drain charge                | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; V <sub>DS</sub> = 50 V; <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a> | -   | 41  | -   | nC   |
| Q <sub>G(tot)</sub>            | total gate charge                |                                                                                                                          | -   | 128 | -   | nC   |

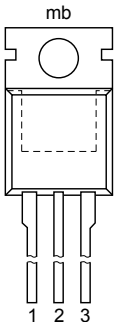
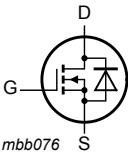
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| Symbol               | Parameter                                    | Conditions                                                                                                                                                                             | Min | Typ | Max | Unit |
|----------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| Avalanche ruggedness |                                              |                                                                                                                                                                                        |     |     |     |      |
| $E_{DS(AL)S}$        | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$ ; $T_{j(\text{init})} = 25\text{ °C}$ ; $I_D = 100\text{ A}$ ; $V_{sup} \leq 100\text{ V}$ ; $R_{GS} = 50\text{ }\Omega$ ; unclamped;<br><a href="#">Fig. 4</a> | -   | -   | 315 | mJ   |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline                                                                                     | Graphic symbol                                                                      |
|-----|--------|-----------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1   | G      | gate                              | <br>TO-220AB (SOT78) |  |
| 2   | D      | drain                             |                                                                                                        |                                                                                     |
| 3   | S      | source                            |                                                                                                        |                                                                                     |
| mb  | D      | mounting base; connected to drain |                                                                                                        |                                                                                     |

6. Ordering information

Table 3. Ordering information

| Type number    | Package  |                                                                                  |         |
|----------------|----------|----------------------------------------------------------------------------------|---------|
|                | Name     | Description                                                                      | Version |
| PSMN7R8-100PSE | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

7. Marking

Table 4. Marking codes

| Type number    | Marking code   |
|----------------|----------------|
| PSMN7R8-100PSE | PSMN7R8-100PSE |

8. Limiting values

Table 5. Limiting values

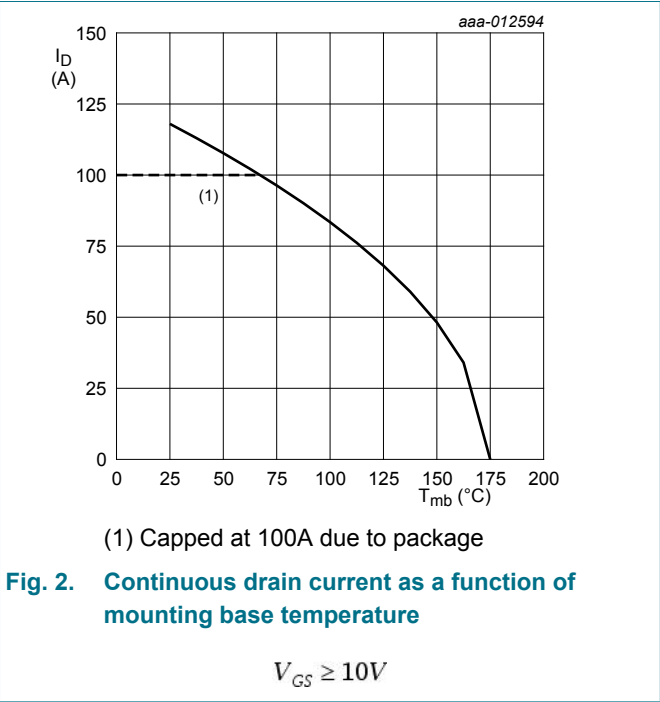
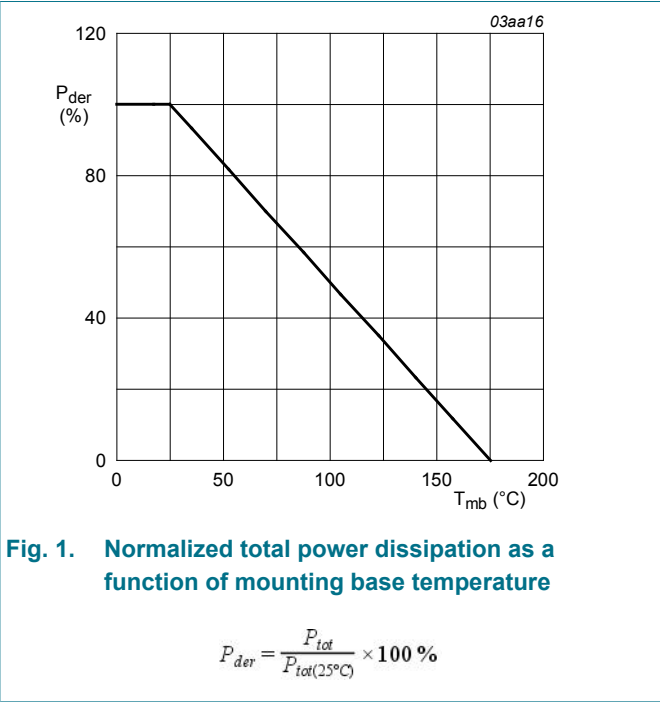
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol   | Parameter            | Conditions                                         | Min | Max | Unit |
|----------|----------------------|----------------------------------------------------|-----|-----|------|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25\text{ °C}$ ; $T_j \leq 175\text{ °C}$ | -   | 100 | V    |

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| Symbol               | Parameter                                    | Conditions                                                                                                                                           |     | Min | Max | Unit |
|----------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|------|
| V <sub>DGR</sub>     | drain-gate voltage                           | T <sub>j</sub> ≥ 25 °C; T <sub>j</sub> ≤ 175 °C; R <sub>GS</sub> = 20 kΩ                                                                             |     | -   | 100 | V    |
| V <sub>GS</sub>      | gate-source voltage                          |                                                                                                                                                      |     | -20 | 20  | V    |
| P <sub>tot</sub>     | total power dissipation                      | T <sub>mb</sub> = 25 °C; Fig. 1                                                                                                                      |     | -   | 294 | W    |
| I <sub>D</sub>       | drain current                                | V <sub>GS</sub> = 10 V; T <sub>j</sub> = 25 °C; Fig. 2                                                                                               | [1] | -   | 100 | A    |
|                      |                                              | V <sub>GS</sub> = 10 V; T <sub>mb</sub> = 100 °C; Fig. 2                                                                                             |     | -   | 83  | A    |
| I <sub>DM</sub>      | peak drain current                           | pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C; Fig. 3                                                                                      |     | -   | 473 | A    |
| T <sub>stg</sub>     | storage temperature                          |                                                                                                                                                      |     | -55 | 175 | °C   |
| T <sub>j</sub>       | junction temperature                         |                                                                                                                                                      |     | -55 | 175 | °C   |
| T <sub>sld(M)</sub>  | peak soldering temperature                   |                                                                                                                                                      |     | -   | 260 | °C   |
| Source-drain diode   |                                              |                                                                                                                                                      |     |     |     |      |
| I <sub>S</sub>       | source current                               | T <sub>mb</sub> = 25 °C                                                                                                                              | [1] | -   | 100 | A    |
| I <sub>SM</sub>      | peak source current                          | pulsed; t <sub>p</sub> ≤ 10 μs; T <sub>mb</sub> = 25 °C                                                                                              |     | -   | 473 | A    |
| Avalanche ruggedness |                                              |                                                                                                                                                      |     |     |     |      |
| E <sub>DS(AL)S</sub> | non-repetitive drain-source avalanche energy | V <sub>GS</sub> = 10 V; T <sub>j(initial)</sub> = 25 °C; I <sub>D</sub> = 100 A; V <sub>sup</sub> ≤ 100 V; R <sub>GS</sub> = 50 Ω; unclamped; Fig. 4 |     | -   | 315 | mJ   |

[1] Continuous current limited by package



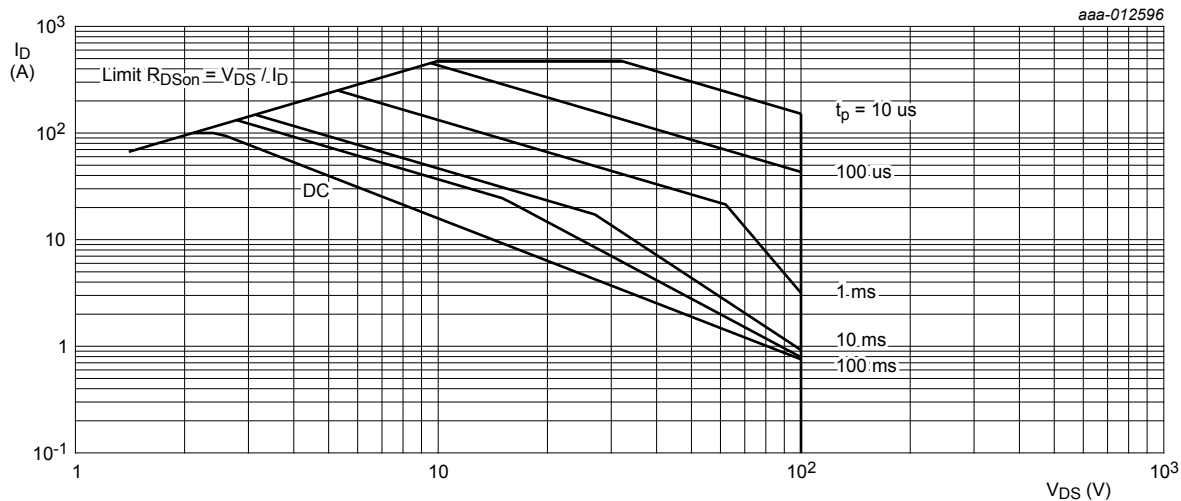


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

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

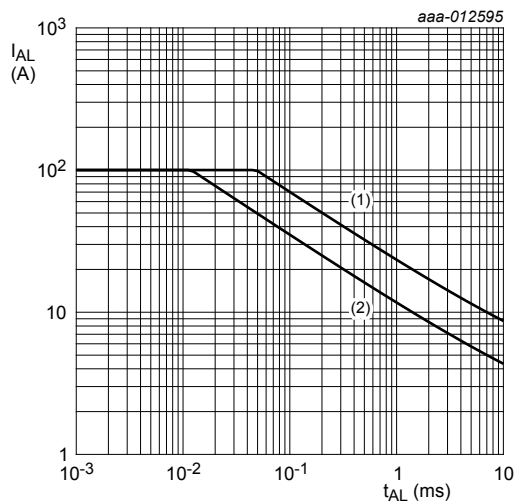


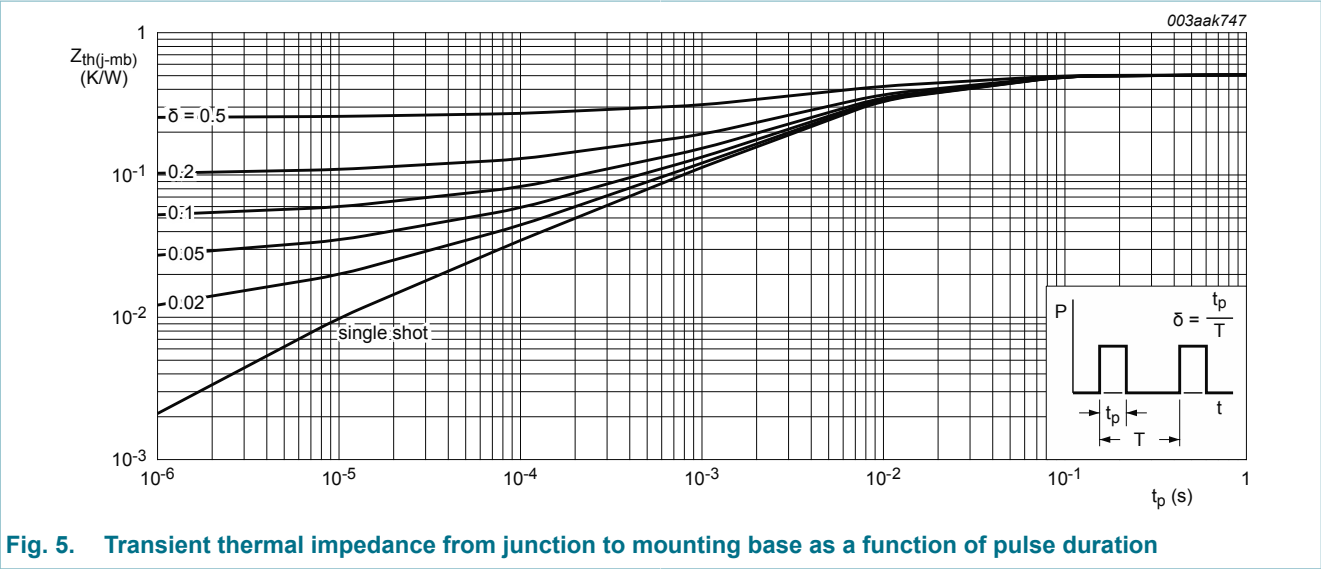
Fig. 4. Single pulse avalanche rating; avalanche current as a function of avalanche time

(1)  $T_{j\ (init)} = 25^{\circ}\text{C}$ ; (2)  $T_{j\ (init)} = 100^{\circ}\text{C}$

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                                                | -   | 0.42 | 0.51 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient       | Minimum footprint; mounted on a printed circuit board | -   | 50   | -    | K/W  |



10. Characteristics

Table 7. Characteristics

| Symbol                 | Parameter                        | Conditions                                                                                          | Min  | Typ  | Max  | Unit |
|------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------|------|------|------|------|
| Static characteristics |                                  |                                                                                                     |      |      |      |      |
| V <sub>(BR)DSS</sub>   | drain-source breakdown voltage   | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                              | 100  | -    | -    | V    |
|                        |                                  | I <sub>D</sub> = 250 μA; V <sub>GS</sub> = 0 V; T <sub>J</sub> = -55 °C                             | 90   | -    | -    | V    |
| V <sub>GS(th)</sub>    | gate-source threshold voltage    | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 25 °C; Fig. 10; Fig. 11 | 2    | 3    | 4    | V    |
| V <sub>GSth</sub>      | gate-source threshold voltage    | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = 175 °C; Fig. 11         | 1    | -    | -    | V    |
|                        |                                  | I <sub>D</sub> = 1 mA; V <sub>DS</sub> = V <sub>GS</sub> ; T <sub>J</sub> = -55 °C; Fig. 11         | -    | -    | 4.6  | V    |
| I <sub>DSS</sub>       | drain leakage current            | V <sub>DS</sub> = 100 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 25 °C                              | -    | 0.1  | 2    | μA   |
|                        |                                  | V <sub>DS</sub> = 100 V; V <sub>GS</sub> = 0 V; T <sub>J</sub> = 175 °C                             | -    | -    | 500  | μA   |
| I <sub>GSS</sub>       | gate leakage current             | V <sub>GS</sub> = -20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                              | -    | 10   | 100  | nA   |
|                        |                                  | V <sub>GS</sub> = 20 V; V <sub>DS</sub> = 0 V; T <sub>J</sub> = 25 °C                               | -    | 10   | 100  | nA   |
| R <sub>DSon</sub>      | drain-source on-state resistance | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 25 °C; Fig. 12                      | -    | 6.7  | 7.8  | mΩ   |
|                        |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 100 °C; Fig. 12; Fig. 13            | -    | -    | 14   | mΩ   |
|                        |                                  | V <sub>GS</sub> = 10 V; I <sub>D</sub> = 25 A; T <sub>J</sub> = 175 °C; Fig. 12; Fig. 13            | -    | -    | 21   | mΩ   |
| R <sub>G</sub>         | gate resistance                  | f = 1 MHz                                                                                           | 0.42 | 0.83 | 1.66 | Ω    |

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| Symbol                  | Parameter                    | Conditions                                                                                                                  |  | Min | Typ  | Max | Unit |
|-------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--|-----|------|-----|------|
| Dynamic characteristics |                              |                                                                                                                             |  |     |      |     |      |
| Q <sub>G(tot)</sub>     | total gate charge            | I <sub>D</sub> = 25 A; V <sub>DS</sub> = 50 V; V <sub>GS</sub> = 10 V;<br><a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a> |  | -   | 128  | -   | nC   |
|                         |                              | I <sub>D</sub> = 0 A; V <sub>DS</sub> = 0 V; V <sub>GS</sub> = 10 V                                                         |  | -   | 110  | -   | nC   |
| Q <sub>GS</sub>         | gate-source charge           | I <sub>D</sub> = 25 A; V <sub>DS</sub> = 50 V; V <sub>GS</sub> = 10 V;<br><a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a> |  | -   | 33   | -   | nC   |
| Q <sub>GD</sub>         | gate-drain charge            |                                                                                                                             |  | -   | 41   | -   | nC   |
| V <sub>GS(pl)</sub>     | gate-source plateau voltage  | I <sub>D</sub> = 25 A; V <sub>DS</sub> = 50 V; <a href="#">Fig. 14</a> ; <a href="#">Fig. 15</a>                            |  | -   | 5.3  | -   | V    |
| C <sub>iss</sub>        | input capacitance            | V <sub>DS</sub> = 50 V; V <sub>GS</sub> = 0 V; f = 1 MHz;<br>T <sub>j</sub> = 25 °C; <a href="#">Fig. 16</a>                |  | -   | 7110 | -   | pF   |
| C <sub>oss</sub>        | output capacitance           |                                                                                                                             |  | -   | 450  | -   | pF   |
| C <sub>rss</sub>        | reverse transfer capacitance |                                                                                                                             |  | -   | 310  | -   | pF   |
| t <sub>d(on)</sub>      | turn-on delay time           | V <sub>DS</sub> = 50 V; R <sub>L</sub> = 2 Ω; V <sub>GS</sub> = 10 V;<br>R <sub>G(ext)</sub> = 5 Ω                          |  | -   | 31   | -   | ns   |
| t <sub>r</sub>          | rise time                    |                                                                                                                             |  | -   | 48   | -   | ns   |
| t <sub>d(off)</sub>     | turn-off delay time          |                                                                                                                             |  | -   | 82   | -   | ns   |
| t <sub>f</sub>          | fall time                    |                                                                                                                             |  | -   | 47   | -   | ns   |
| Source-drain diode      |                              |                                                                                                                             |  |     |      |     |      |
| V <sub>SD</sub>         | source-drain voltage         | I <sub>S</sub> = 25 A; V <sub>GS</sub> = 0 V; T <sub>j</sub> = 25 °C; <a href="#">Fig. 17</a>                               |  | -   | 0.8  | 1.2 | V    |
| t <sub>rr</sub>         | reverse recovery time        | I <sub>S</sub> = 25 A; dI <sub>S</sub> /dt = -100 A/μs; V <sub>GS</sub> = 0 V;<br>V <sub>DS</sub> = 50 V                    |  | -   | 69   | -   | ns   |
| Q <sub>r</sub>          | recovered charge             |                                                                                                                             |  | -   | 210  | -   | nC   |

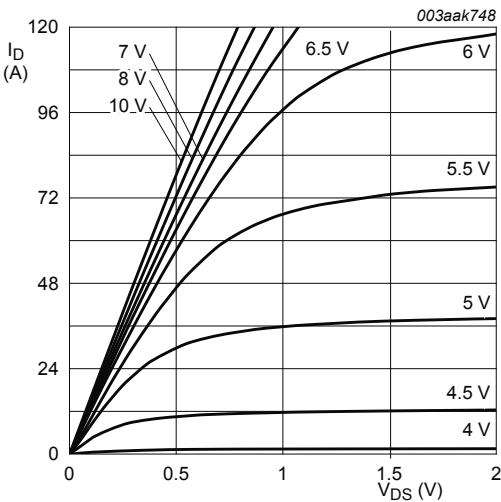


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

$T_j = 25^{\circ}\text{C}$

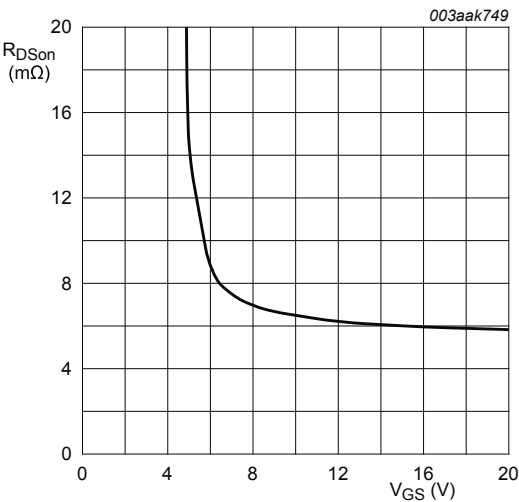


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

$T_j = 25^{\circ}\text{C}; I_D = 25\text{A}$

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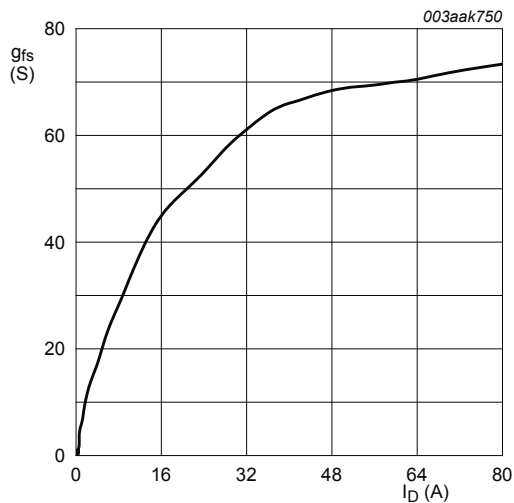


Fig. 8. Forward transconductance as a function of drain current; typical values

$T_j = 25^\circ\text{C}; V_{DS} = 10\text{V}$

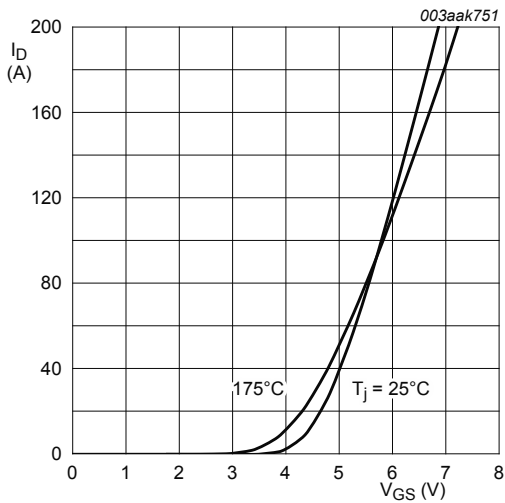


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

$V_{DS} = 10\text{V}$

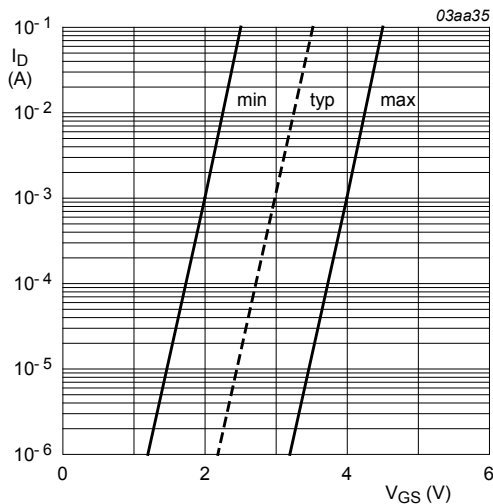


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

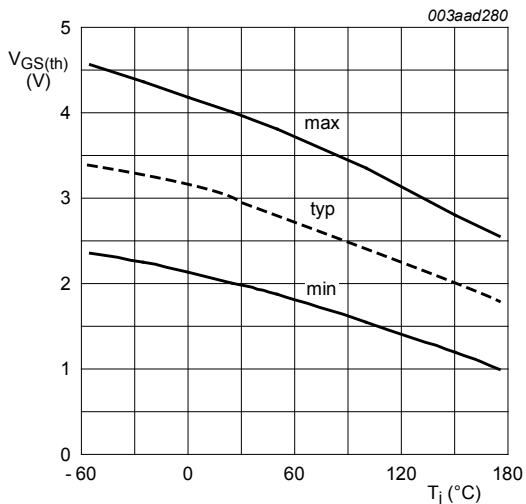


Fig. 11. Gate-source threshold voltage as a function of junction temperature

$I_D = 1\text{ mA}; V_{DS} = V_{GS}$

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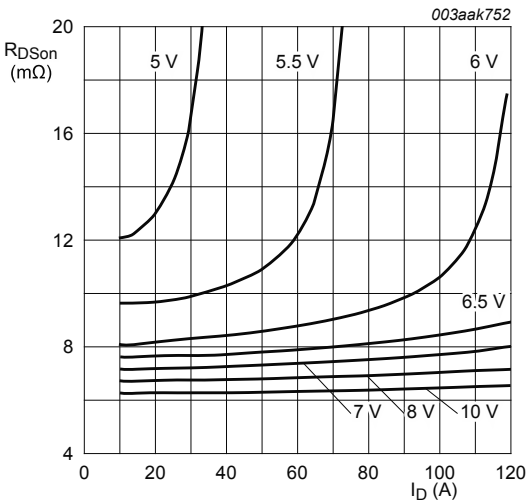


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

$T_j = 25^{\circ}C$

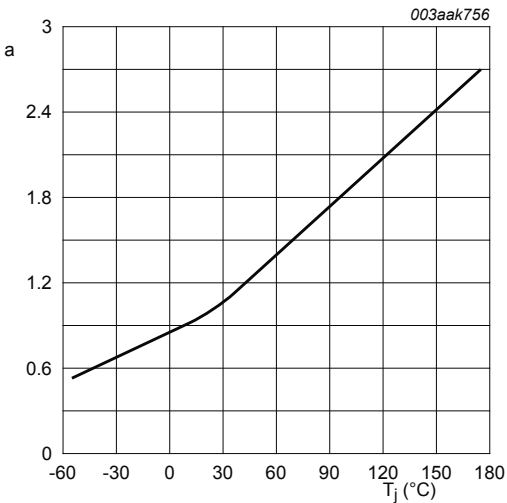


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DS(on)}}{R_{DS(on)}(25^{\circ}C)}$$

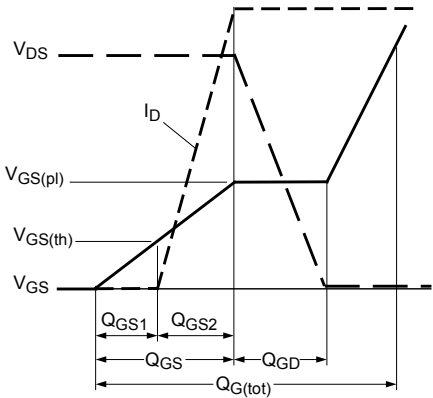


Fig. 14. Gate charge waveform definitions

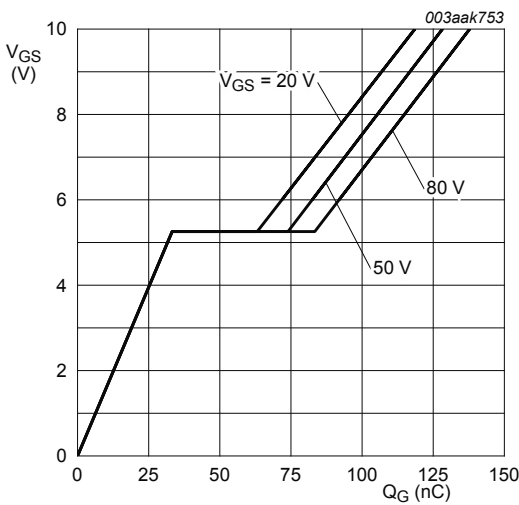


Fig. 15. Gate-source voltage as a function of gate charge; typical values

$T_j = 25^{\circ}C; I_D = 25A$

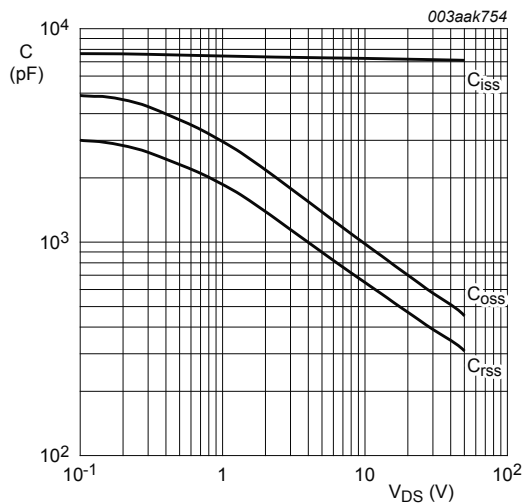


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

$V_{GS}=0V; f=1MHz$

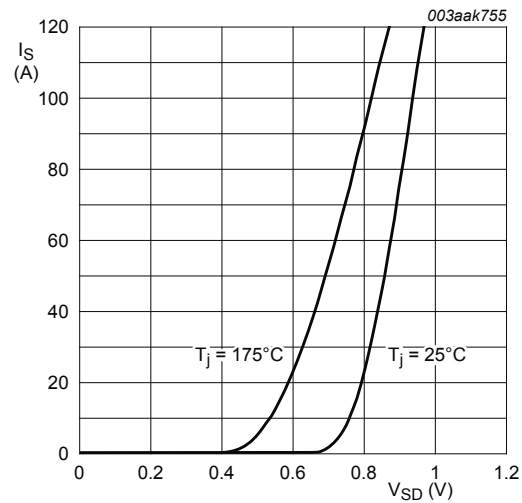


Fig. 17. Source current as a function of source-drain voltage; typical values

$V_{GS}=0V$

11. Package outline

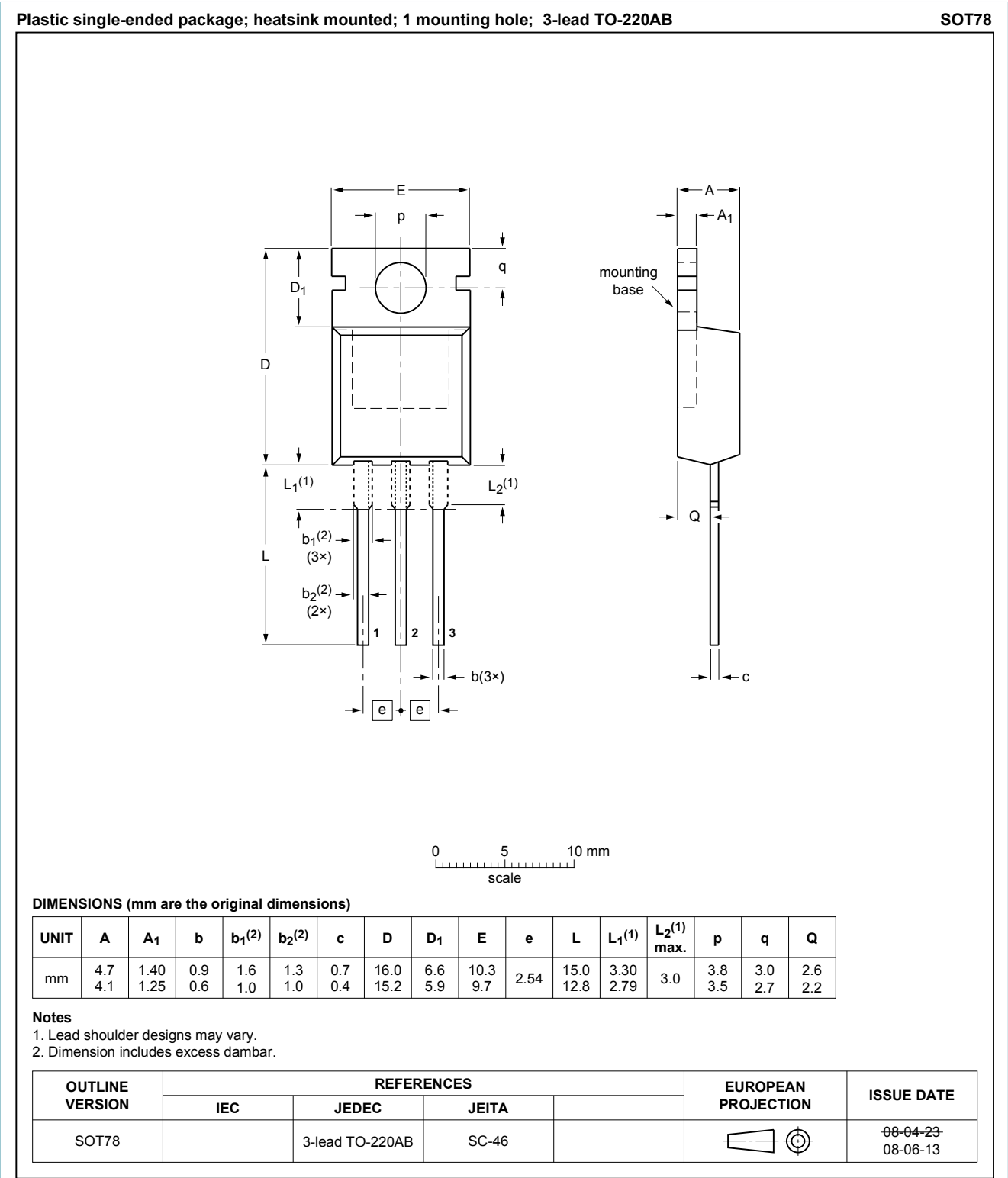


Fig. 18. Package outline TO-220AB (SOT78)

## N-channel 100 V 7.8 mΩ standard level MOSFET with improved SOA in TO220 package

## 12. Legal information

### 12.1 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".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nexperia.com>.

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