



PSMN4R8-100PSE

N-channel 100 V 5 m Ω standard level MOSFET with improved SOA in TO220 package

11 July 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 PSMN4R8-100PSE is robust enough to withstand substantial in-rush and fault condition currents during turn on/off, whilst offering a low $R_{DS(on)}$ 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
- Very low $R_{DS(on)}$ 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

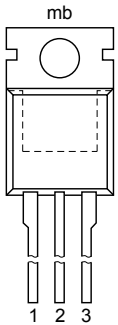
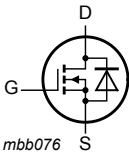
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|---|-----|-----|-----|------------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ }^\circ\text{C}$; $T_j \leq 175\text{ }^\circ\text{C}$ | - | - | 100 | V |
| I_{DM} | peak drain current | pulsed; $T_{mb} = 25\text{ }^\circ\text{C}$; $t_p \leq 10\text{ }\mu\text{s}$; Fig. 3 | - | - | 693 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ }^\circ\text{C}$; Fig. 1 | - | - | 405 | W |
| Static characteristics | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $T_j = 25\text{ }^\circ\text{C}$; Fig. 12 | - | 4.3 | 5 | m Ω |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 10\text{ V}$; $I_D = 25\text{ A}$; $V_{DS} = 50\text{ V}$; Fig. 14 ; Fig. 15 | - | 59 | 83 | nC |
| $Q_{G(tot)}$ | total gate charge | | - | 196 | 278 | nC |

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------------|--|--|-----|-----|-----|------|
| Avalanche ruggedness | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}$; $T_{j(\text{init})} = 25\text{ °C}$; $I_D = 120\text{ A}$; $V_{\text{sup}} \leq 100\text{ V}$; $R_{GS} = 50\text{ }\Omega$; unclamped; Fig. 4 | - | - | 542 | mJ |

5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|--|---|
| 1 | G | gate |  <p>TO-220AB (SOT78)</p> |  <p>mbb076</p> |
| 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 |
| PSMN4R8-100PSE | 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 |
|----------------|----------------|
| PSMN4R8-100PSE | PSMN4R8-100PSE |

8. Limiting values

Table 5. Limiting values

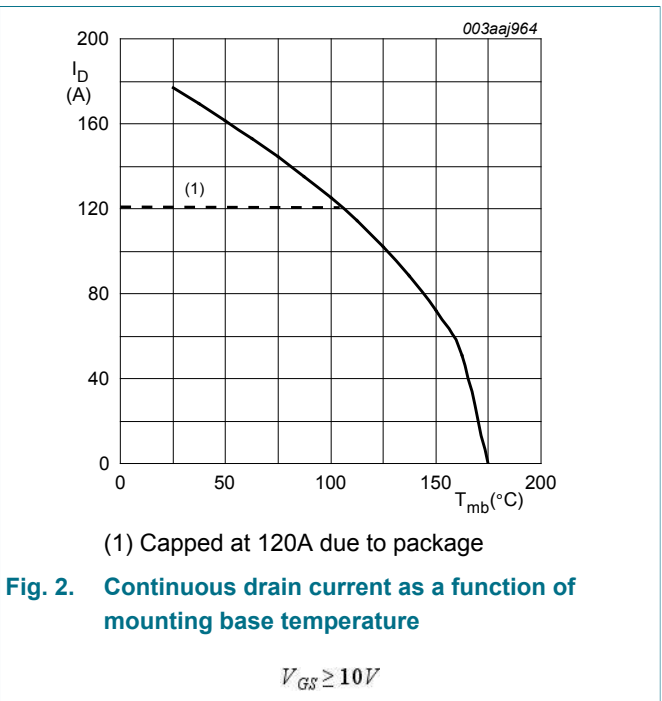
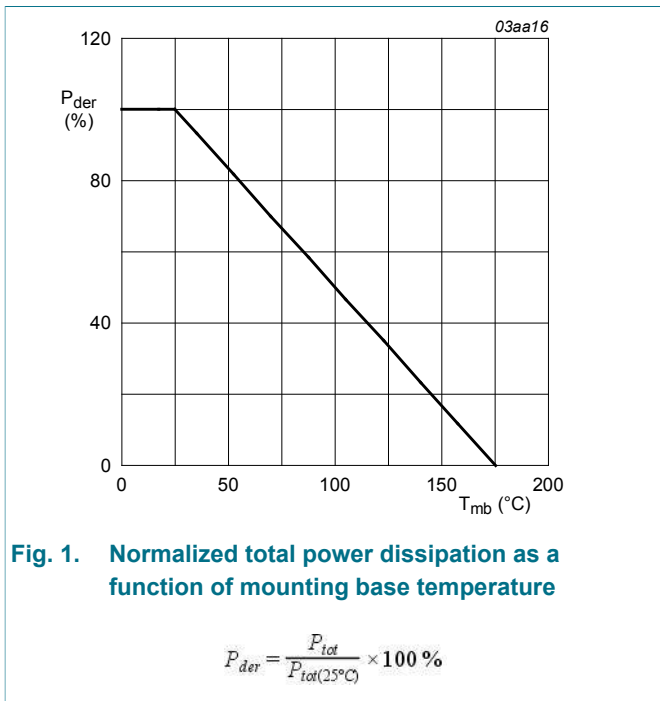
In accordance with the Absolute Maximum Rating System (IEC 60134).

| 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 _{DGR} | drain-gate voltage | T _j ≥ 25 °C; T _j ≤ 175 °C; R _{GS} = 20 kΩ | | - | 100 | V |
| V _{GS} | gate-source voltage | | | -20 | 20 | V |
| P _{tot} | total power dissipation | T _{mb} = 25 °C; Fig. 1 | | - | 405 | W |
| I _D | drain current | V _{GS} = 10 V; T _j = 25 °C; Fig. 2 | [1] | - | 120 | A |
| | | V _{GS} = 10 V; T _{mb} = 100 °C; Fig. 2 | [1] | - | 120 | A |
| I _{DM} | peak drain current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C; Fig. 3 | | - | 693 | A |
| T _{stg} | storage temperature | | | -55 | 175 | °C |
| T _j | junction temperature | | | -55 | 175 | °C |
| T _{slid(M)} | peak soldering temperature | | | - | 260 | °C |
| Source-drain diode | | | | | | |
| I _S | source current | T _{mb} = 25 °C | [1] | - | 120 | A |
| I _{SM} | peak source current | pulsed; t _p ≤ 10 μs; T _{mb} = 25 °C | | - | 693 | A |
| Avalanche ruggedness | | | | | | |
| E _{DS(AL)S} | non-repetitive drain-source avalanche energy | V _{GS} = 10 V; T _{j(initial)} = 25 °C; I _D = 120 A; V _{sup} ≤ 100 V; R _{GS} = 50 Ω; unclamped; Fig. 4 | | - | 542 | mJ |

[1] Continuous current limited by package.



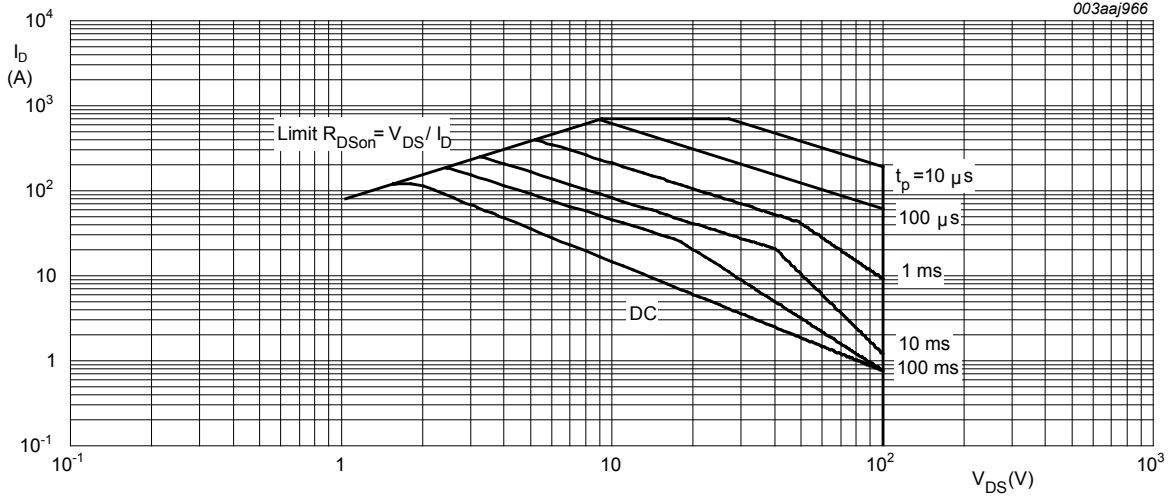


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ }^{\circ}\text{C}$; I_{DM} is a single pulse; Capped at 120 A due to package

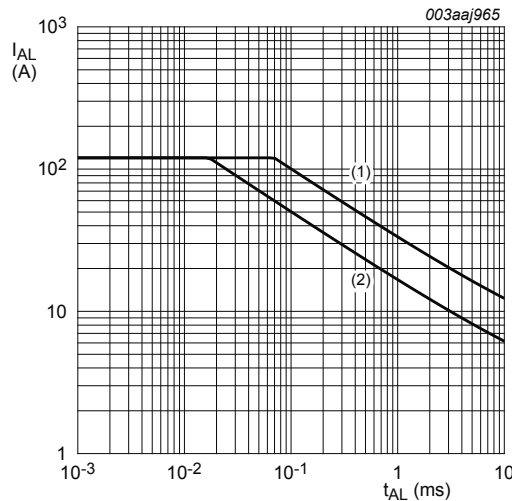


Fig. 4. Single pulse avalanche rating; avalanche current as a function of avalanche time

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

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 | - | 0.3 | 0.37 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Minimum footprint; mounted on a printed circuit board | - | 60 | - | K/W |

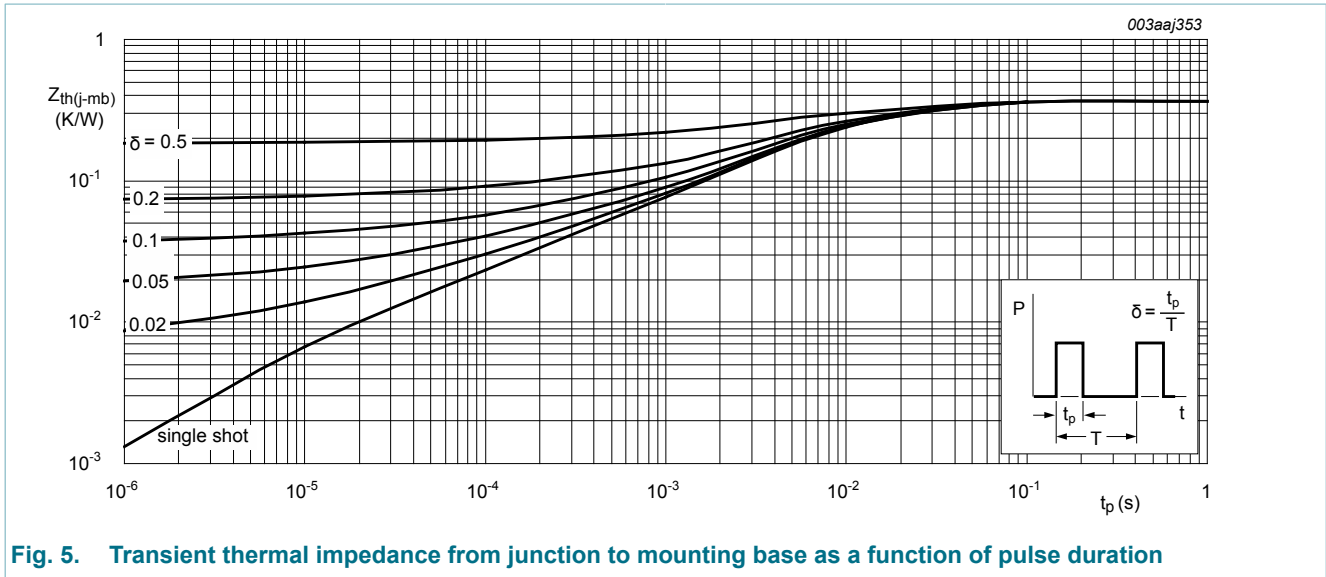


Fig. 5. Transient thermal impedance from junction to mounting base as a function of pulse duration

10. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------|----------------------------------|--|------|------|------|---------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = 25 \text{ }^\circ C$ | 100 | - | - | V |
| | | $I_D = 250 \mu A; V_{GS} = 0 V; T_j = -55 \text{ }^\circ C$ | 90 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ C;$ Fig. 10; Fig. 11 | 2 | 3 | 4 | V |
| V_{GSth} | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ C;$ Fig. 11 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ C;$ Fig. 11 | - | - | 4.6 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 0.16 | 10 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ C$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 10 | 100 | nA |
| | | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ C$ | - | 10 | 100 | nA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ C;$ Fig. 12 | - | 4.3 | 5 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 100 \text{ }^\circ C;$ Fig. 13; Fig. 12 | - | - | 9 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ C;$ Fig. 12; Fig. 13 | - | - | 13.5 | mΩ |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | 0.43 | 0.85 | 1.7 | Ω |

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| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|------------------------------|---|-----|-------|-------|------|
| Dynamic characteristics | | | | | | |
| Q _{G(tot)} | total gate charge | I _D = 25 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15 | - | 196 | 278 | nC |
| | | I _D = 0 A; V _{DS} = 0 V; V _{GS} = 10 V | - | 166.9 | 234 | nC |
| Q _{GS} | gate-source charge | I _D = 25 A; V _{DS} = 50 V; V _{GS} = 10 V; Fig. 14 ; Fig. 15 | - | 40 | 56 | nC |
| Q _{GD} | gate-drain charge | | - | 59 | 83 | nC |
| V _{GS(pl)} | gate-source plateau voltage | I _D = 25 A; V _{DS} = 50 V; Fig. 14 ; Fig. 15 | - | 4.3 | - | V |
| C _{iss} | input capacitance | V _{DS} = 50 V; V _{GS} = 0 V; f = 1 MHz; | - | 10665 | 14400 | pF |
| C _{oss} | output capacitance | T _j = 25 °C; Fig. 16 | - | 674 | 910 | pF |
| C _{rss} | reverse transfer capacitance | | - | 459 | 643 | pF |
| t _{d(on)} | turn-on delay time | V _{DS} = 50 V; R _L = 2 Ω; V _{GS} = 10 V; | - | 41 | 61.5 | ns |
| t _r | rise time | R _{G(ext)} = 4.7 Ω | - | 65 | 97.5 | ns |
| t _{d(off)} | turn-off delay time | | - | 127 | 190.5 | ns |
| t _f | fall time | | - | 69 | 103.5 | ns |
| Source-drain diode | | | | | | |
| V _{SD} | source-drain voltage | I _S = 25 A; V _{GS} = 0 V; T _j = 25 °C; Fig. 17 | - | 0.79 | 1.2 | V |
| t _{rr} | reverse recovery time | I _S = 25 A; di _S /dt = -100 A/μs; V _{GS} = 0 V; | - | 72 | 94 | ns |
| Q _r | recovered charge | V _{DS} = 50 V | - | 227 | 296 | nC |

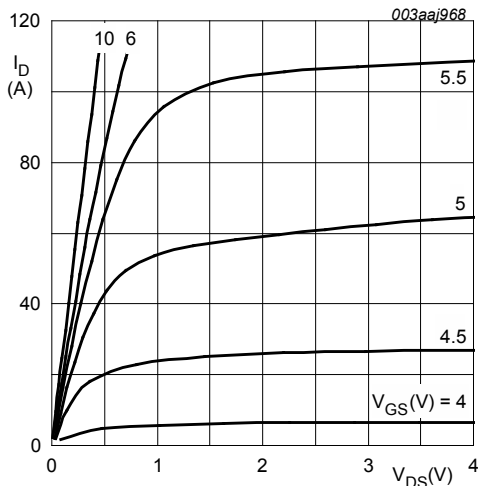


Fig. 6. Output characteristics; drain current as a function of drain-source voltage; typical values

T_j = 25 °C

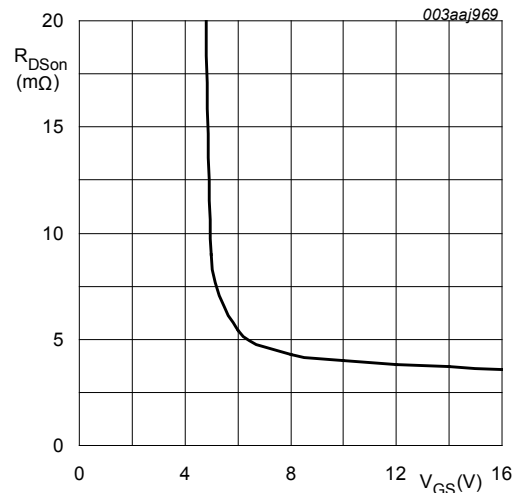


Fig. 7. Drain-source on-state resistance as a function of gate-source voltage; typical values

T_j = 25 °C; I_D = 25 A

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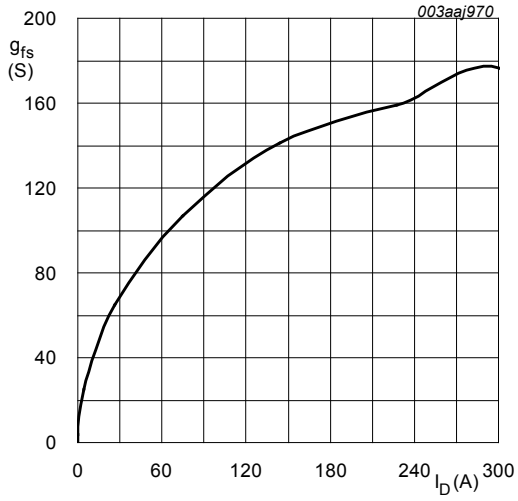


Fig. 8. Forward transconductance as a function of drain current; typical values

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

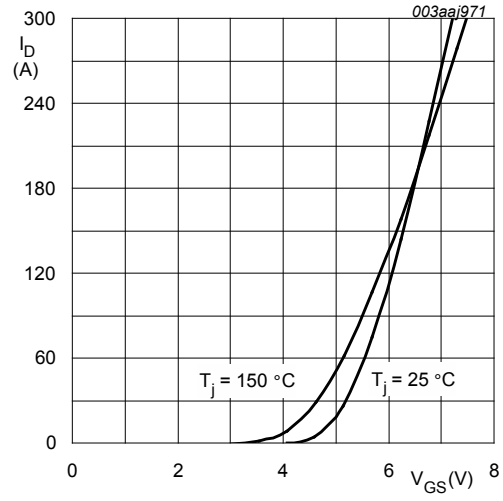


Fig. 9. Transfer characteristics; drain current as a function of gate-source voltage; typical values

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

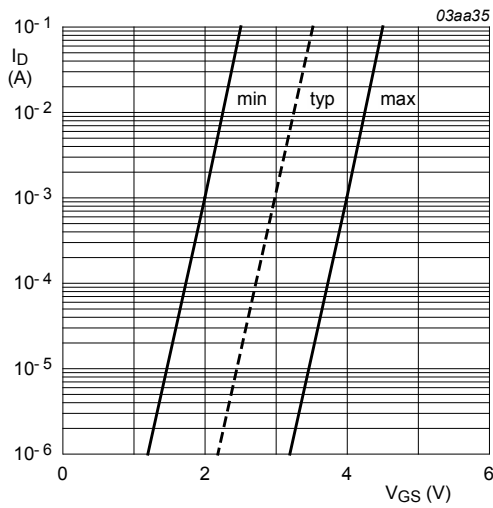


Fig. 10. Sub-threshold drain current as a function of gate-source voltage

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

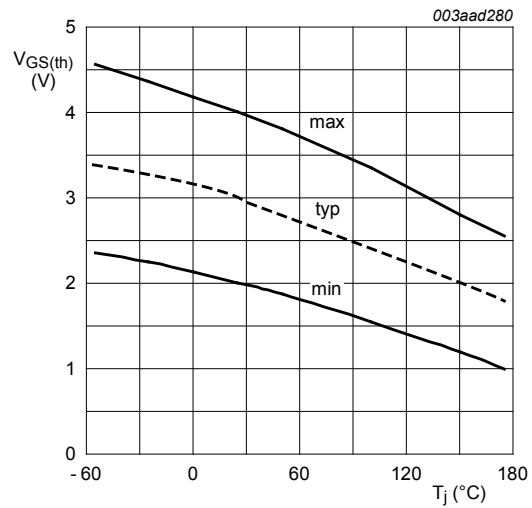


Fig. 11. Gate-source threshold voltage as a function of junction temperature

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

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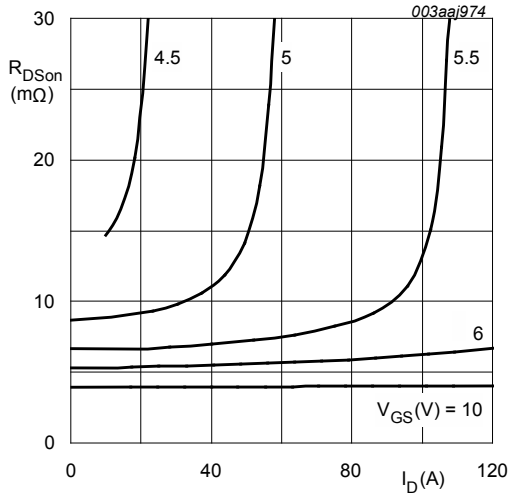


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

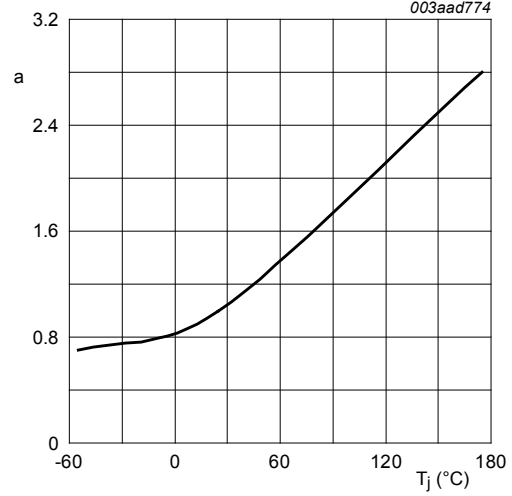


Fig. 13. Normalized drain-source on-state resistance factor as a function of junction temperature

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

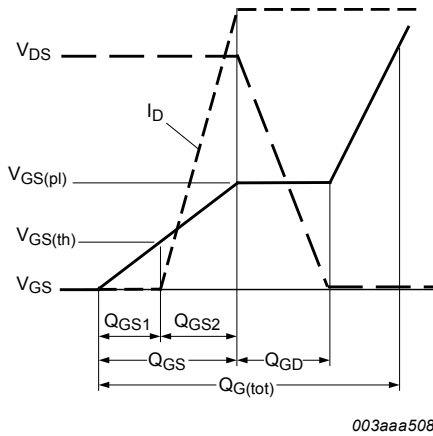


Fig. 14. Gate charge waveform definitions

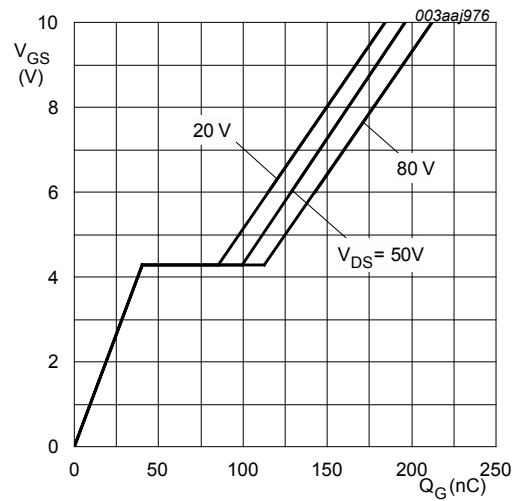


Fig. 15. Gate-source voltage as a function of gate charge; typical values

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

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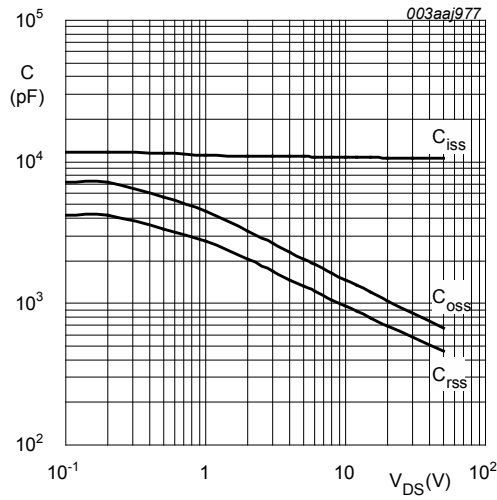


Fig. 16. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

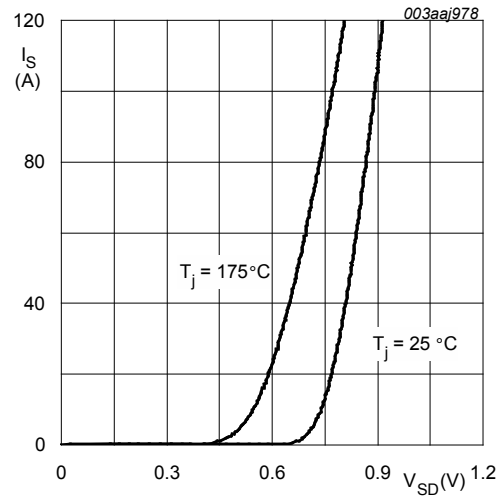


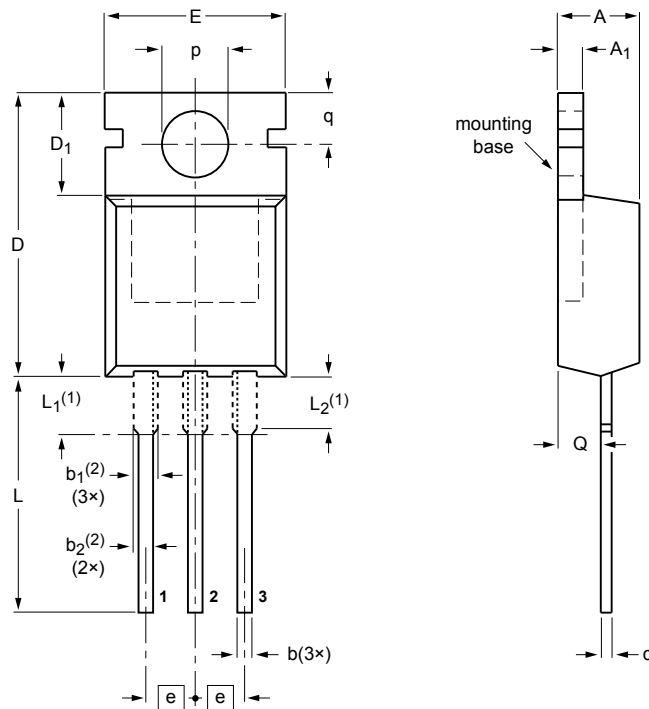
Fig. 17. Source current as a function of source-drain voltage; typical values

$$V_{GS} = 0V$$

11. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB

SOT78



DIMENSIONS (mm are the original dimensions)

| UNIT | A | A ₁ | b | b ₁ (2) | b ₂ (2) | c | D | D ₁ | E | e | L | L ₁ (1) | L ₂ (1) max. | p | q | Q |
|------|------------|----------------|------------|--------------------|--------------------|------------|--------------|----------------|-------------|------|--------------|--------------------|-------------------------|------------|------------|------------|
| mm | 4.7 4.1 | 1.40 1.25 | 0.9 0.6 | 1.6 1.0 | 1.3 1.0 | 0.7 0.4 | 16.0 15.2 | 6.6 5.9 | 10.3 9.7 | 2.54 | 15.0 12.8 | 3.30 2.79 | 3.0 | 3.8 3.5 | 3.0 2.7 | 2.6 2.2 |

Notes

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-----------------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT78 | | 3-lead TO-220AB | SC-46 | | 08-04-23 08-06-13 |

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

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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. |

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