



PSMN5R6-100PS

N-channel 100 V 5.6 mΩ standard level MOSFET in TO220

30 November 2012

Product data sheet

1. Product profile

1.1 General description

Standard level N-channel MOSFET in a TO-220 package qualified to 175 °C. This product is designed and qualified for use in a wide range of industrial, communications and domestic equipment.

1.2 Features and benefits

- High efficiency due to low switching and conduction losses
- Improved dynamic avalanche performance
- Suitable for standard level gate drive sources

1.3 Applications

- DC-to-DC converters
- Load switching
- Motor control
- Server power supplies

1.4 Quick reference data

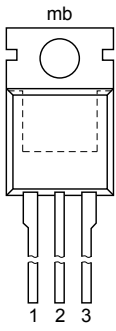
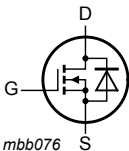
Table 1. Quick reference data

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|-----|-----|-----|------|
| V_{DS} | drain-source voltage | $T_j \geq 25\text{ °C}; T_j \leq 175\text{ °C}$ | | - | - | 100 | V |
| I_D | drain current | $T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ Fig. 1 | [1] | - | - | 100 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ Fig. 2 | | - | - | 306 | W |
| Static characteristics | | | | | | | |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ Fig. 11 ; Fig. 12 | | - | 4.3 | 5.6 | mΩ |
| Dynamic characteristics | | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 10\text{ V}; I_D = 80\text{ A}; V_{DS} = 50\text{ V};$ Fig. 13 ; Fig. 14 | | - | 43 | - | nC |
| $Q_{G(tot)}$ | total gate charge | | | - | 141 | - | nC |
| Avalanche Ruggedness | | | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(init)} = 25\text{ °C}; I_D = 100\text{ A};$ $V_{sup} \leq 100\text{ V}; R_{GS} = 50\text{ Ω};$ unclamped | | - | - | 469 | mJ |

[1] Continuous current limited by package.

2. 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 | | |

3. Ordering information

Table 3. Ordering information

| Type number | Package | | |
|---------------|----------|--|---------|
| | Name | Description | Version |
| PSMN5R6-100PS | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

4. Marking

Table 4. Marking codes

| Type number | Marking code |
|---------------|---------------|
| PSMN5R6-100PS | PSMN5R6-100PS |

5. Limiting values

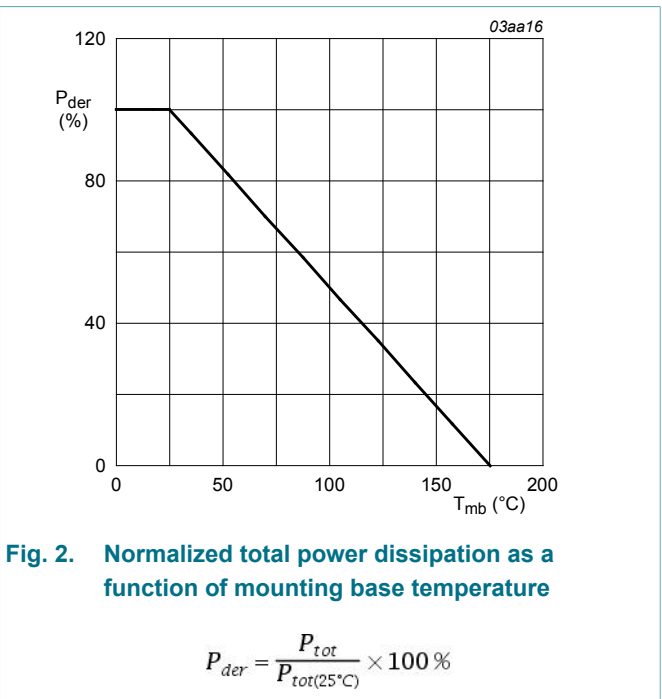
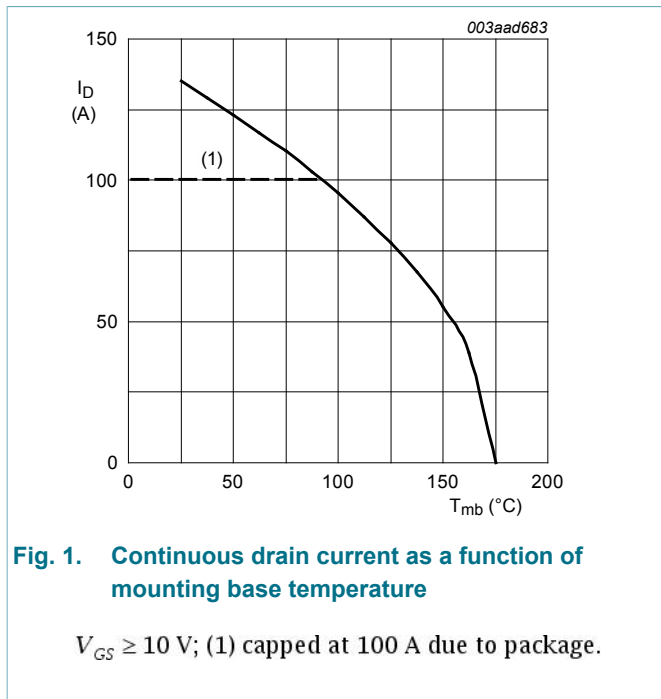
Table 5. Limiting values

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 |
| V_{DGR} | drain-gate voltage | $T_j \geq 25\text{ °C}$; $T_j \leq 175\text{ °C}$; $R_{GS} = 20\text{ k}\Omega$ | - | 100 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}$; $T_j = 100\text{ °C}$; Fig. 1 | - | 95 | A |
| | | $V_{GS} = 10\text{ V}$; $T_{mb} = 25\text{ °C}$; Fig. 1 | [1] | 100 | A |

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|--|--|-----|-----|------------------|
| I_{DM} | peak drain current | pulsed; $t_p \leq 10 \mu s$; $T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 3 | - | 539 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25 \text{ }^\circ\text{C}$; Fig. 2 | - | 306 | W |
| T_{stg} | storage temperature | | -55 | 175 | $^\circ\text{C}$ |
| T_j | junction temperature | | -55 | 175 | $^\circ\text{C}$ |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25 \text{ }^\circ\text{C}$ | [1] | 100 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10 \mu s$; $T_{mb} = 25 \text{ }^\circ\text{C}$ | - | 539 | A |
| Avalanche Ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10 \text{ V}$; $T_{j(\text{init})} = 25 \text{ }^\circ\text{C}$; $I_D = 100 \text{ A}$; $V_{sup} \leq 100 \text{ V}$; $R_{GS} = 50 \text{ } \Omega$; unclamped | - | 469 | mJ |

[1] Continuous current limited by package.



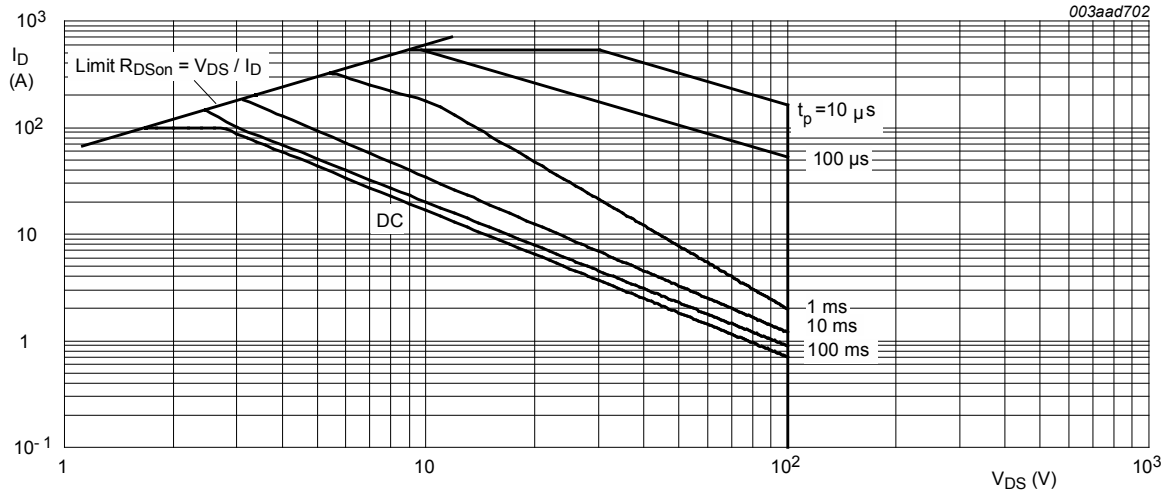


Fig. 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

$T_{mb} = 25\text{ }^\circ\text{C}$; I_{DM} is a single pulse; (1) Capped at 100 A due to package

6. 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. 4 | - | 0.3 | 0.49 | K/W |

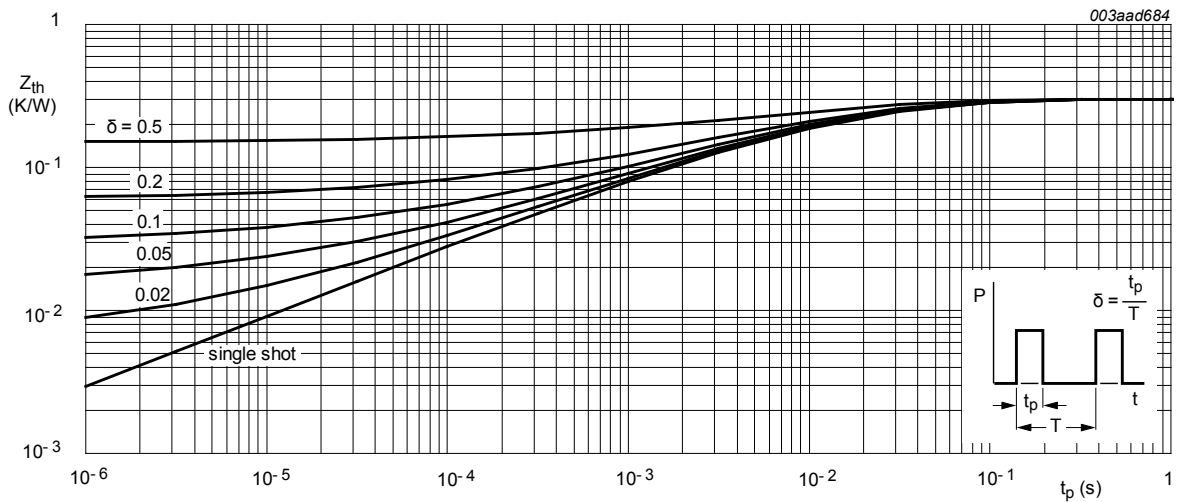


Fig. 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

7. Characteristics

Table 7. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | 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 | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 8; Fig. 9 | 2 | 3 | 4 | V |
| V_{GSth} | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ Fig. 9 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ Fig. 9 | - | - | 4.6 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.02 | 10 | μA |
| | | $V_{DS} = 100 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| | | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 2 | 100 | nA |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ Fig. 10 | - | - | 15.7 | mΩ |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 11; Fig. 12 | - | 4.3 | 5.6 | mΩ |
| R_G | gate resistance | $f = 1 \text{ MHz}$ | - | 0.97 | - | Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 80 \text{ A}; V_{DS} = 50 \text{ V}; V_{GS} = 10 \text{ V};$ Fig. 13; Fig. 14 | - | 141 | - | nC |
| Q_{GS} | gate-source charge | | - | 36 | - | nC |
| Q_{GD} | gate-drain charge | | - | 43 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ Fig. 15; Fig. 16 | - | 8061 | - | pF |
| C_{oss} | output capacitance | $V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ Fig. 15 | - | 561 | - | pF |
| C_{rSS} | reverse transfer capacitance | $V_{DS} = 50 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ Fig. 15; Fig. 16 | - | 330 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 50 \text{ V}; R_L = 0.6 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 1.5 \text{ } \Omega$ | - | 31 | - | ns |
| t_r | rise time | | - | 46 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 83 | - | ns |
| t_f | fall time | | - | 34 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ Fig. 17 | - | 0.79 | 1.2 | V |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------|-----------------------|--|-----|-----|-----|------|
| t_{rr} | reverse recovery time | $I_S = 25 \text{ A}$; $di_S/dt = -100 \text{ A}/\mu\text{s}$; $V_{GS} = 0 \text{ V}$; | - | 67 | - | ns |
| Q_r | recovered charge | $V_{DS} = 50 \text{ V}$ | - | 182 | - | nC |

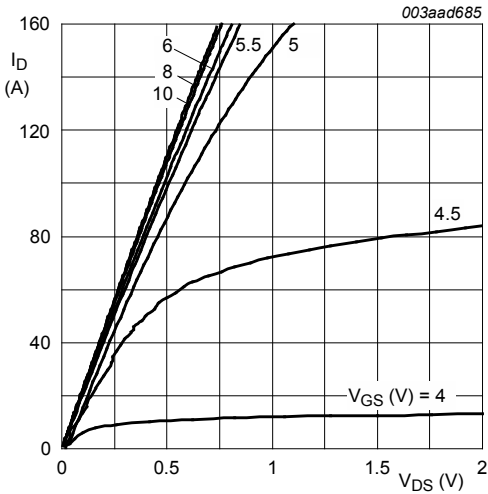


Fig. 5. Output characteristics: drain current as a function of drain-source voltage; typical values

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

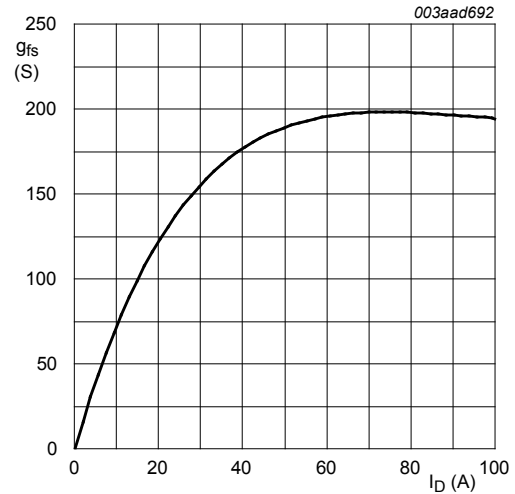


Fig. 6. Forward transconductance as a function of drain current; typical values

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

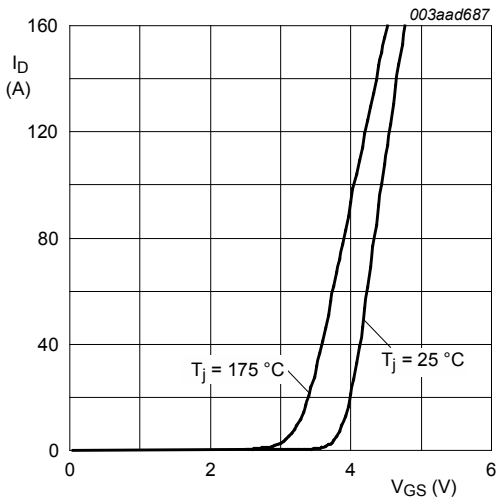


Fig. 7. Transfer characteristics: drain current as a function of gate-source voltage; typical values

$V_{DS} > I_D \times R_{DS(on)}$

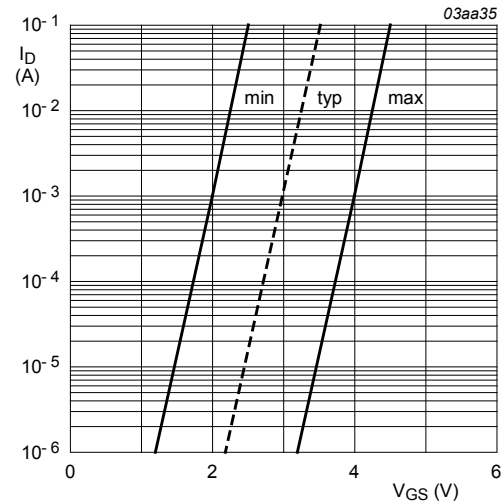


Fig. 8. Sub-threshold drain current as a function of gate-source voltage

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

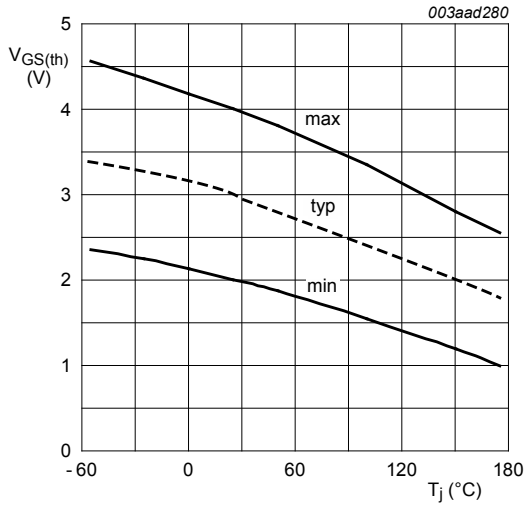


Fig. 9. Gate-source threshold voltage as a function of junction temperature

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

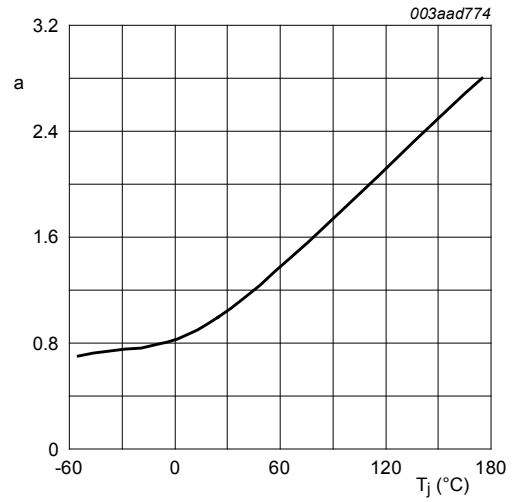


Fig. 10. Normalized drain-source on-state resistance factor as a function of junction temperature

$$a = \frac{R_{DSon}}{R_{DSon(25^\circ\text{C})}}$$

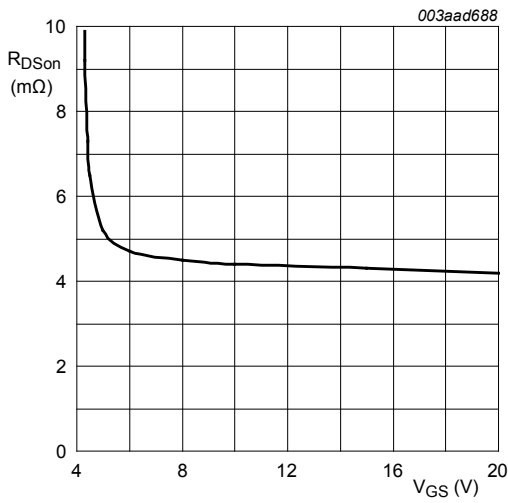


Fig. 11. Drain-source on-state resistance as a function of gate-source voltage; typical values

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

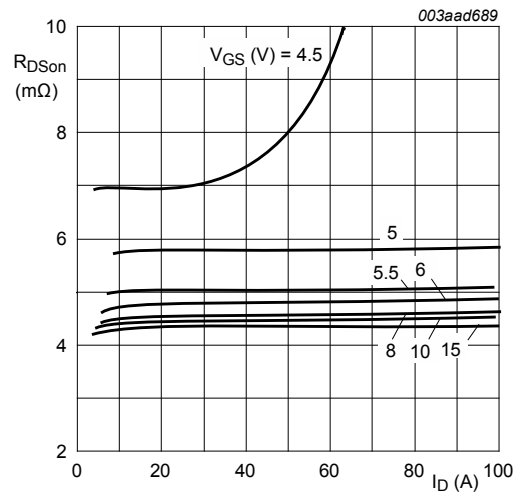


Fig. 12. Drain-source on-state resistance as a function of drain current; typical values

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

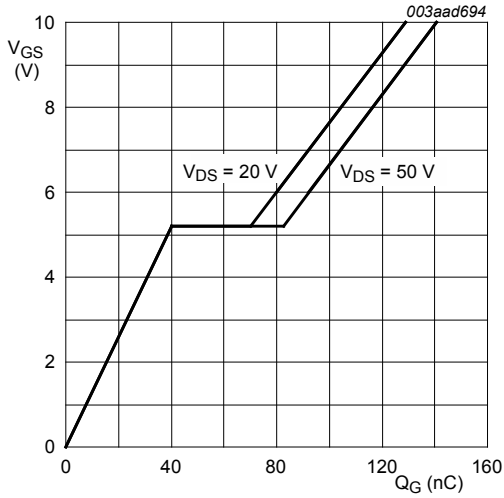


Fig. 13. Gate-source voltage as a function of gate charge; typical values

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



Fig. 14. Gate charge waveform definitions

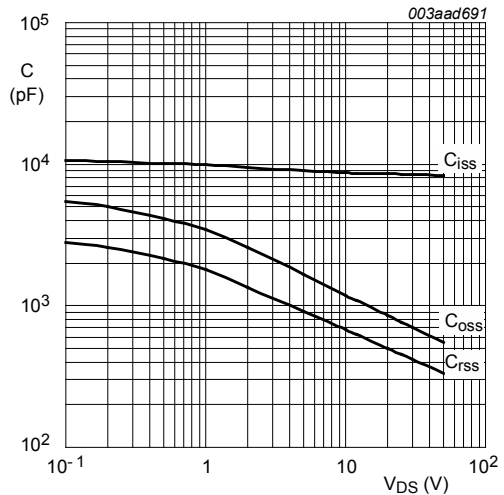


Fig. 15. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

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

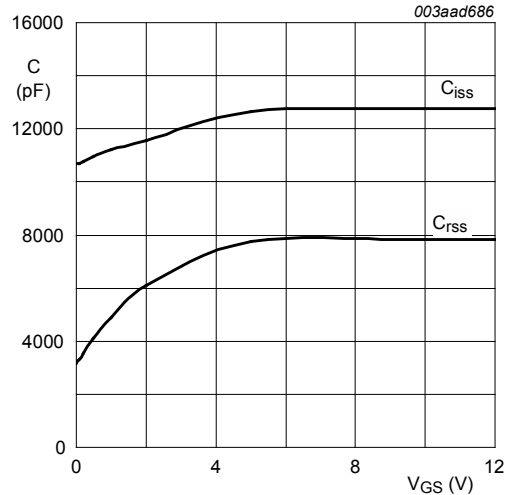


Fig. 16. Input and reverse transfer capacitances as a function of gate-source voltage, typical values

$f = 1\text{ MHz}; V_{DS} = 0\text{ V};$

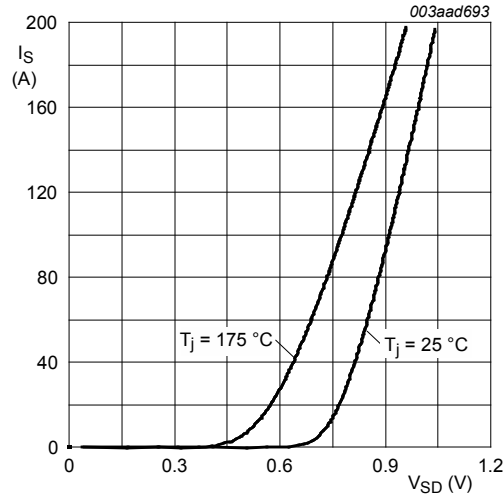


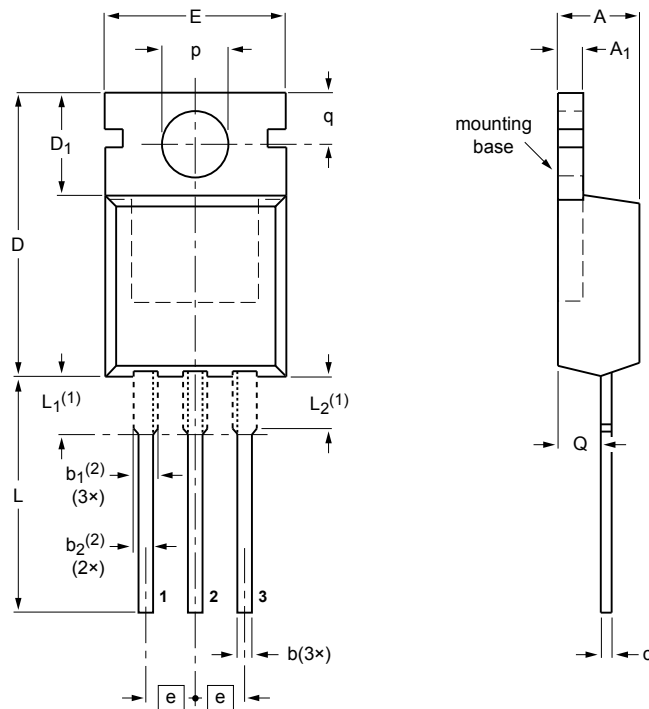
Fig. 17. Source current as a function of source-drain voltage; typical values

$$V_{GS} = 0 \text{ V}$$

8. 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)

9. Legal information

9.1 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. |
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10. Contents

| | | |
|----------|--------------------------------------|-----------|
| 1 | Product profile | 1 |
| 1.1 | General description | 1 |
| 1.2 | Features and benefits | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| 2 | Pinning information | 2 |
| 3 | Ordering information | 2 |
| 4 | Marking | 2 |
| 5 | Limiting values | 2 |
| 6 | Thermal characteristics | 4 |
| 7 | Characteristics | 5 |
| 8 | Package outline | 10 |
| 9 | Legal information | 11 |
| 9.1 | Data sheet status | 11 |
| 9.2 | Definitions | 11 |
| 9.3 | Disclaimers | 11 |
| 9.4 | Trademarks | 12 |

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