



PSMN009-100P

N-channel TrenchMOS SiliconMAX standard level FET

Rev. 4 — 27 December 2011

Product data sheet

1. Product profile

1.1 General description

SiliconMAX standard level N-channel enhancement mode Field-Effect Transistor (FET) in a plastic package using TrenchMOS technology. This product is designed and qualified for use in computing, communications, consumer and industrial applications only.

1.2 Features and benefits

- Low conduction losses due to low on-state resistance
- Suitable for high frequency applications due to fast switching characteristics

1.3 Applications

- High frequency computer motherboard DC-to-DC convertors
- OR-ing applications

1.4 Quick reference data

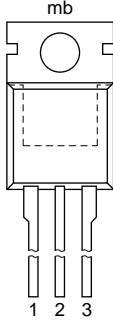
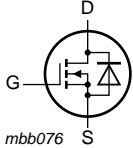
Table 1. Quick reference data

| 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 | $T_{mb} = 25\text{ °C}; V_{GS} = 10\text{ V};$ see Figure 1 ; see Figure 3 | - | - | 75 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | - | 230 | W |
| Static characteristics | | | | | | |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 10\text{ V}; I_D = 25\text{ A}; T_j = 25\text{ °C};$ see Figure 9 ; see Figure 10 | - | 7.5 | 8.8 | m Ω |
| Dynamic characteristics | | | | | | |
| Q_{GD} | gate-drain charge | $V_{GS} = 10\text{ V}; I_D = 75\text{ A}; V_{DS} = 80\text{ V};$ $T_j = 25\text{ °C};$ see Figure 11 | - | 44 | - | nC |

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2. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description | Simplified outline | Graphic symbol |
|-----|--------|-----------------------------------|---|---|
| 1 | G | gate |  |  |
| 2 | D | drain | | |
| 3 | S | source | | |
| mb | D | mounting base; connected to drain | | |

SOT78 (TO-220AB)

3. Ordering information

Table 3. Ordering information

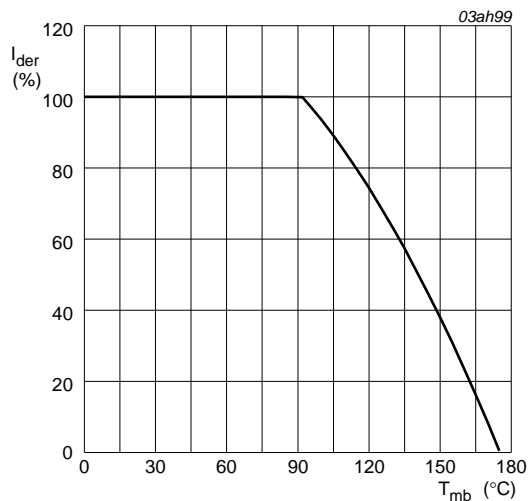
| Type number | Package | | |
|--------------|----------|--|---------|
| | Name | Description | Version |
| PSMN009-100P | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

4. Limiting values

Table 4. Limiting values

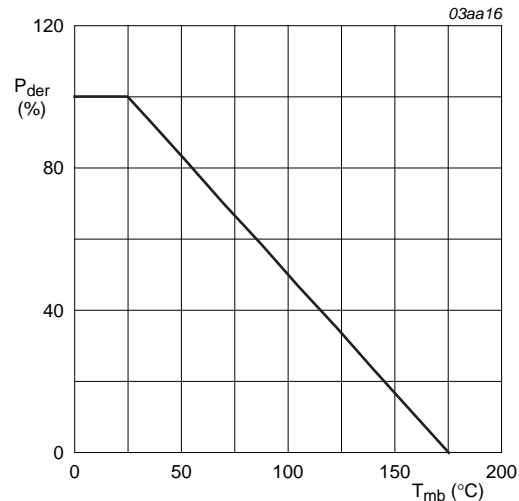
In accordance with the Absolute Maximum Rating System (IEC 60134).

| 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 | $T_j \leq 175\text{ °C}; T_j \geq 25\text{ °C}; R_{GS} = 20\text{ k}\Omega$ | - | 100 | V |
| V_{GS} | gate-source voltage | | -20 | 20 | V |
| I_D | drain current | $V_{GS} = 10\text{ V}; T_{mb} = 100\text{ °C};$ see Figure 1 | - | 65 | A |
| | | $V_{GS} = 10\text{ V}; T_{mb} = 25\text{ °C};$ see Figure 1 ; see Figure 3 | - | 75 | A |
| I_{DM} | peak drain current | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C};$ see Figure 3 | - | 400 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25\text{ °C};$ see Figure 2 | - | 230 | W |
| T_{stg} | storage temperature | | -55 | 175 | °C |
| T_j | junction temperature | | -55 | 175 | °C |
| V_{GSM} | peak gate-source voltage | pulsed; $t_p \leq 50\text{ }\mu\text{s}; T_j \leq 150\text{ °C}; \delta = 25\%$ | -30 | 30 | V |
| Source-drain diode | | | | | |
| I_S | source current | $T_{mb} = 25\text{ °C}$ | - | 75 | A |
| I_{SM} | peak source current | pulsed; $t_p \leq 10\text{ }\mu\text{s}; T_{mb} = 25\text{ °C}$ | - | 400 | A |
| Avalanche ruggedness | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10\text{ V}; T_{j(\text{init})} = 25\text{ °C}; I_D = 35\text{ A};$ $V_{sup} = 15\text{ V};$ unclamped; $t_p = 0.1\text{ ms};$ $R_{GS} = 50\text{ }\Omega$ | - | 120 | mJ |
| $I_{DS(AL)S}$ | non-repetitive drain-source avalanche current | $V_{GS} = 10\text{ V}; V_{sup} = 15\text{ V}; R_{GS} = 50\text{ }\Omega;$ $T_{j(\text{init})} = 25\text{ °C};$ unclamped | - | 75 | A |



$$I_{der} = \frac{I_D}{I_{D(25^\circ\text{C})}} \times 100\%$$

Fig 1. Normalized continuous drain current as a function of mounting base temperature



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

Fig 2. Normalized total power dissipation as a function of mounting base temperature

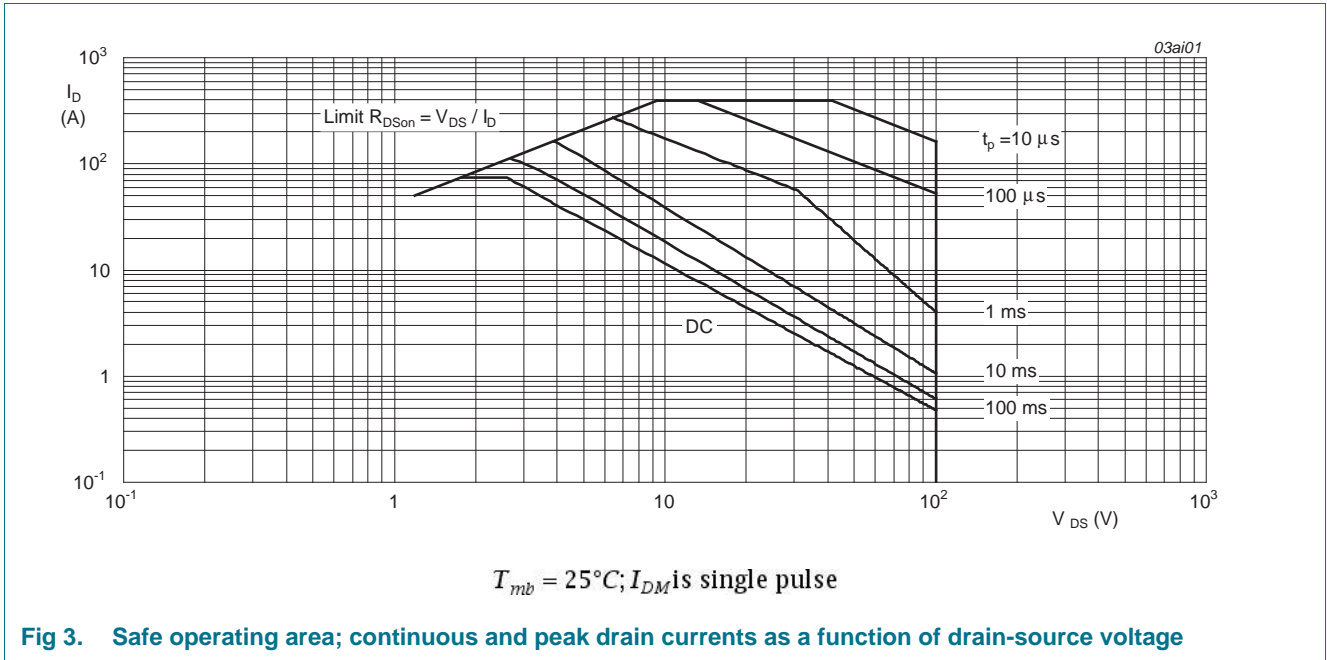


Fig 3. Safe operating area; continuous and peak drain currents as a function of drain-source voltage

5. Thermal characteristics

Table 5. Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|---|------------------------------|-----|-----|------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | see Figure 4 | - | - | 0.65 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | vertical in free air | - | 60 | - | K/W |

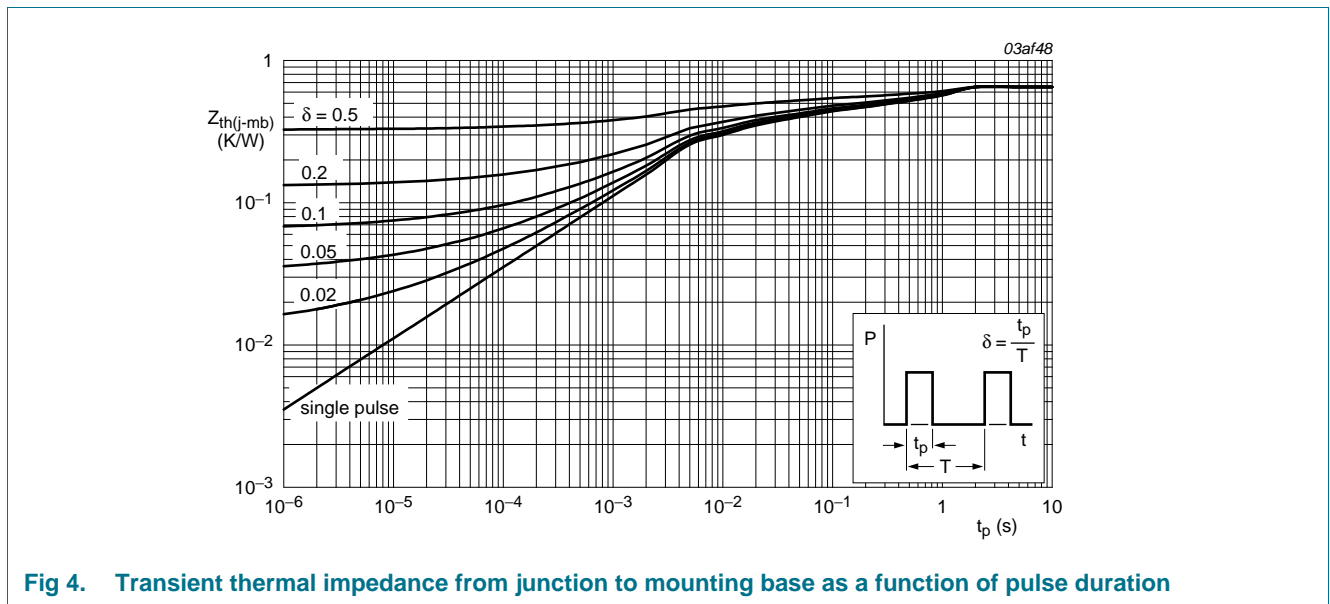
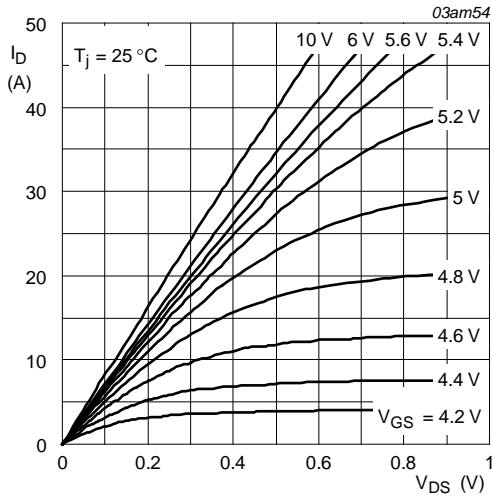


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration

6. Characteristics

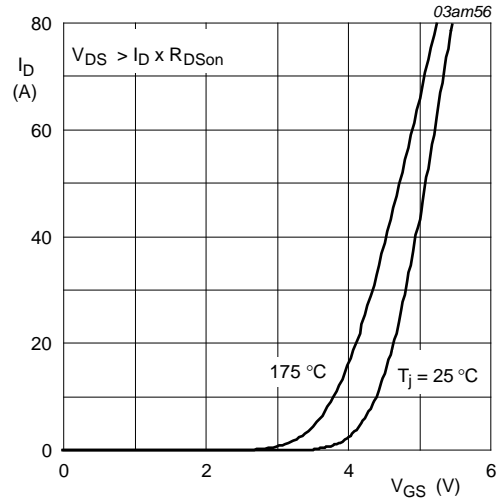
Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|----------------------------------|--|-----|-------|------|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = -55 \text{ }^\circ\text{C}$ | 90 | - | - | V |
| | | $I_D = 0.25 \text{ mA}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | 100 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 8 | 1 | - | - | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 8 | 2 | 3 | 4 | V |
| | | $I_D = 1 \text{ mA}; V_{DS} = V_{GS}; T_j = -55 \text{ }^\circ\text{C};$ see Figure 8 | - | - | 4.4 | V |
| I_{DSS} | drain leakage current | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 175 \text{ }^\circ\text{C}$ | - | - | 500 | μA |
| | | $V_{DS} = 30 \text{ V}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 0.02 | 1 | μA |
| I_{GSS} | gate leakage current | $V_{GS} = 20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | 100 | nA |
| | | $V_{GS} = -20 \text{ V}; V_{DS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C}$ | - | 10 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 175 \text{ }^\circ\text{C};$ see Figure 9 ; see Figure 10 | - | 20.25 | 23.8 | m Ω |
| | | $V_{GS} = 10 \text{ V}; I_D = 25 \text{ A}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 9 ; see Figure 10 | - | 7.5 | 8.8 | m Ω |
| Dynamic characteristics | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D = 75 \text{ A}; V_{DS} = 80 \text{ V}; V_{GS} = 10 \text{ V};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 11 | - | 156 | - | nC |
| Q_{GS} | gate-source charge | | - | 31 | - | nC |
| Q_{GD} | gate-drain charge | | - | 44 | - | nC |
| C_{iss} | input capacitance | $V_{DS} = 25 \text{ V}; V_{GS} = 0 \text{ V}; f = 1 \text{ MHz};$ $T_j = 25 \text{ }^\circ\text{C};$ see Figure 12 | - | 8250 | - | pF |
| C_{oss} | output capacitance | | - | 620 | - | pF |
| C_{rss} | reverse transfer capacitance | | - | 300 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DS} = 15 \text{ V}; R_L = 1.25 \text{ } \Omega; V_{GS} = 10 \text{ V};$ $R_{G(ext)} = 6 \text{ } \Omega; T_j = 25 \text{ }^\circ\text{C}; I_D = 12 \text{ A}$ | - | 38 | - | ns |
| t_r | rise time | | - | 59 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 120 | - | ns |
| t_f | fall time | | - | 43 | - | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain voltage | $I_S = 25 \text{ A}; V_{GS} = 0 \text{ V}; T_j = 25 \text{ }^\circ\text{C};$ see Figure 13 | - | 0.8 | 1.2 | V |



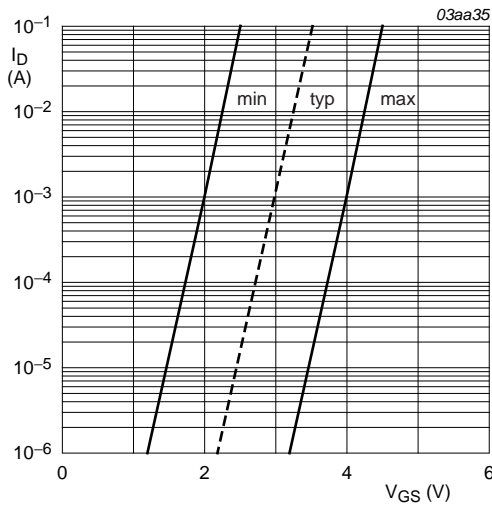
$T_j = 25^\circ\text{C}$

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



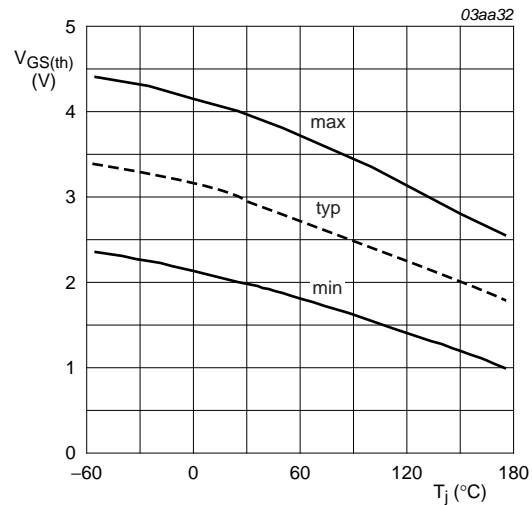
$T_j = 25^\circ\text{C}$ and $175^\circ\text{C}; V_{DS} > I_D \times R_{DSon}$

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



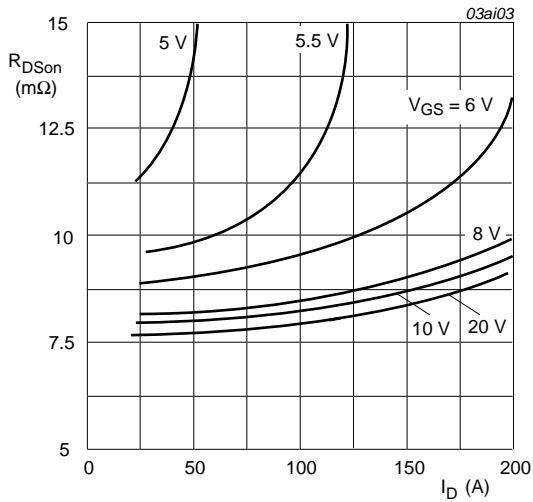
$T_j = 25^\circ\text{C}; V_{DS} = 5\text{V}$

Fig 7. Sub-threshold drain current as a function of gate-source voltage



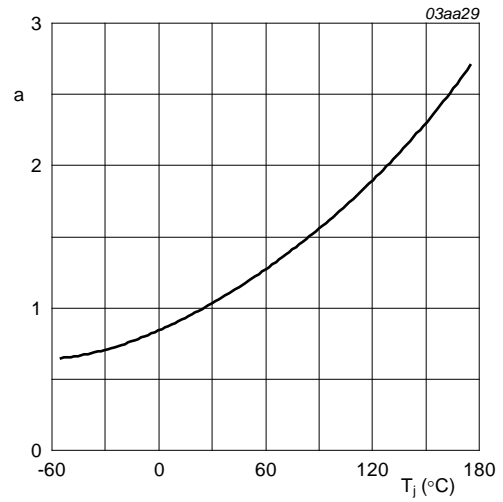
$I_D = 1\text{mA}; V_{DS} = V_{GS}$

Fig 8. Gate-source threshold voltage as a function of junction temperature



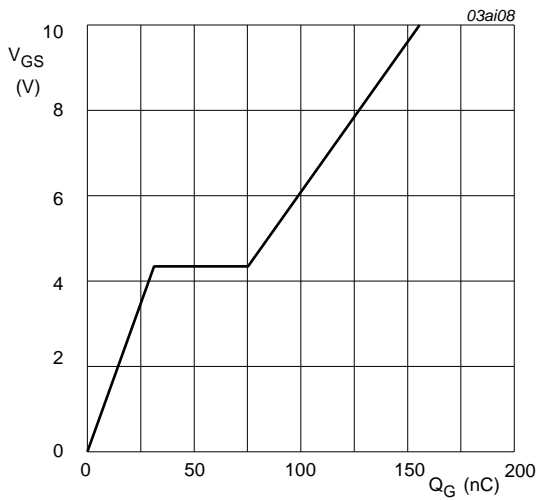
$T_j = 25^\circ C$

Fig 9. Drain-source on-state resistance as a function of drain current; typical values



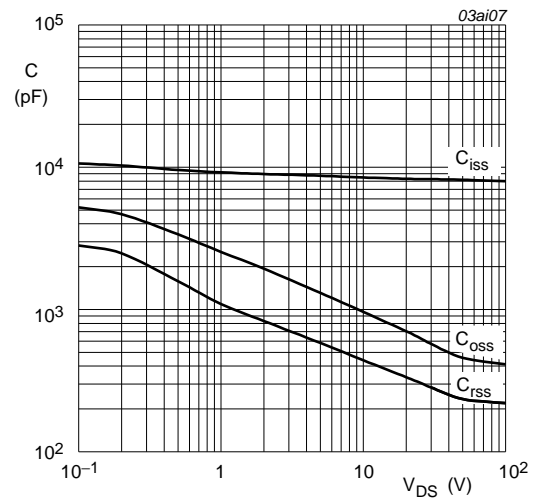
$$a = \frac{R_{DSon}}{R_{DSon}(25^\circ C)}$$

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



$I_D = 75A; V_{DS} = 80V$

Fig 11. Gate-source voltage as a function of gate charge; typical values



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

Fig 12. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values

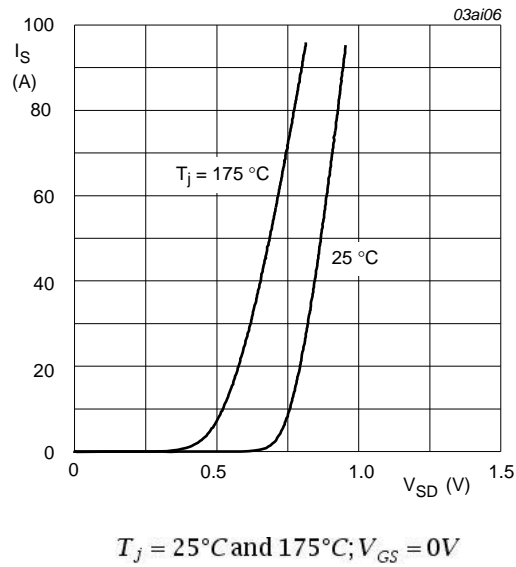


Fig 13. Source current as a function of source-drain voltage; typical values

7. Package outline

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

SOT78

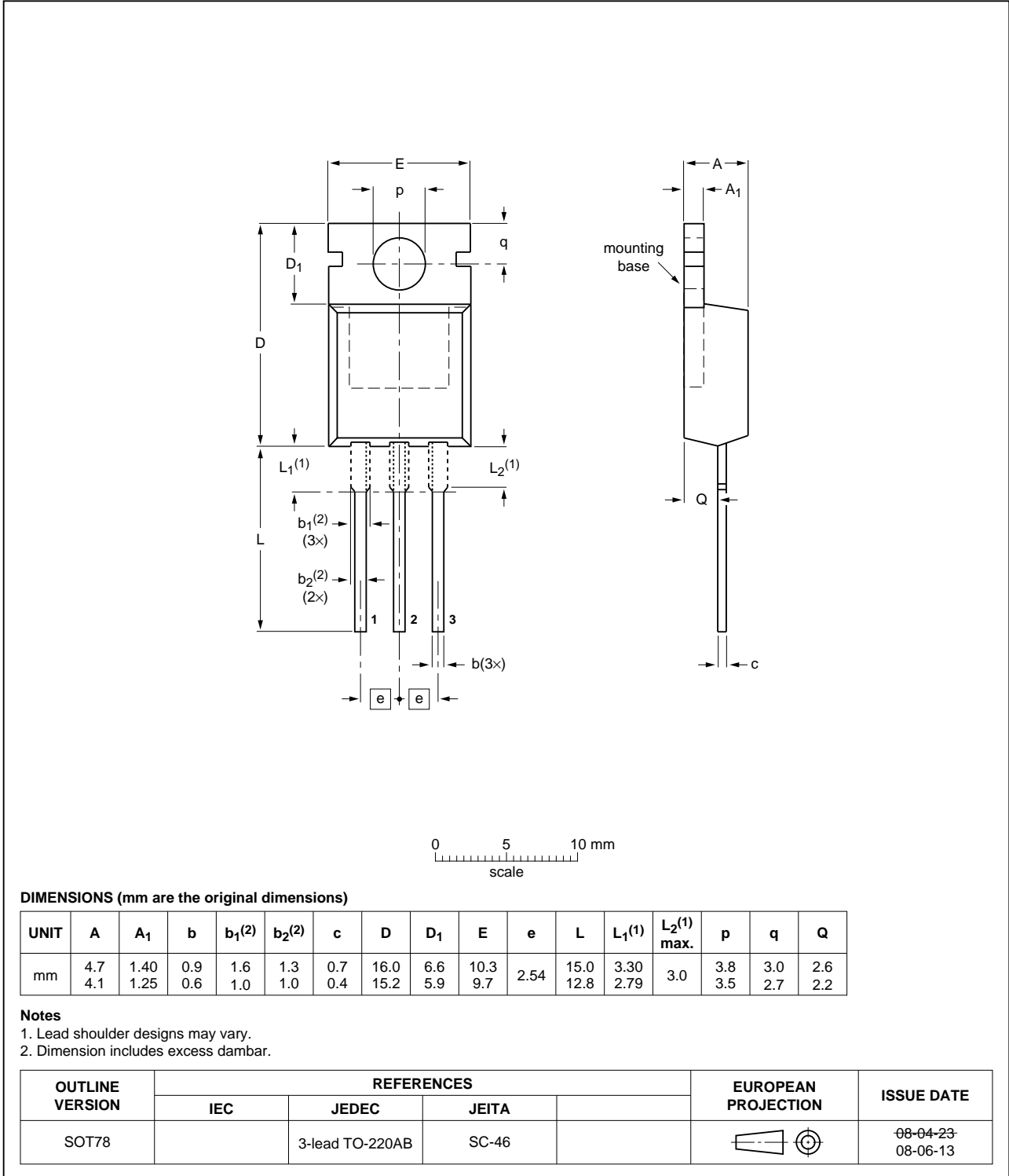


Fig 14. Package outline SOT78 (TO-220AB)

8. Revision history

Table 7. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|-------------------------------|--------------------|---------------|------------------|
| PSMN009-100P v.4 | 20111227 | Product data sheet | - | PSMN009-100P v.3 |
| Modifications: | • Various changes to content. | | | |
| PSMN009-100P v.3 | 20111121 | Product data sheet | - | PSMN009-100P v.2 |

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. |
| 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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