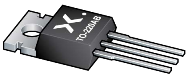


# PSMN009-100P

## 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 applicationss

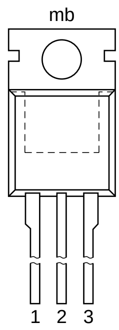
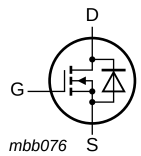
### 1.4 Quick reference data

Table 1. Quick reference data

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | - | - | 100 | V |
| $I_D$ | drain current | $T_{mb} = 25$ °C; $V_{GS} = 10$ V; see Figure 1; see Figure 3 | - | - | 75 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °C; see Figure 2 | - | - | 230 | W |
| **Static characteristics** | | | | | | |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS} = 10$ V; $I_D = 25$ A; $T_j = 25$ °C; see Figure 9; see Figure 10 | - | 7.5 | 8.8 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $Q_{GD}$ | gate-drain charge | $V_{GS} = 10$ V; $I_D = 75$ A; $V_{DS} = 80$ V; $T_j = 25$ °C; see Figure 11 | - | 44 | - | nC |

## 2. Pinning information

**Table 2. Pinning information**

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

## 3. Ordering information

**Table 3. Ordering information**

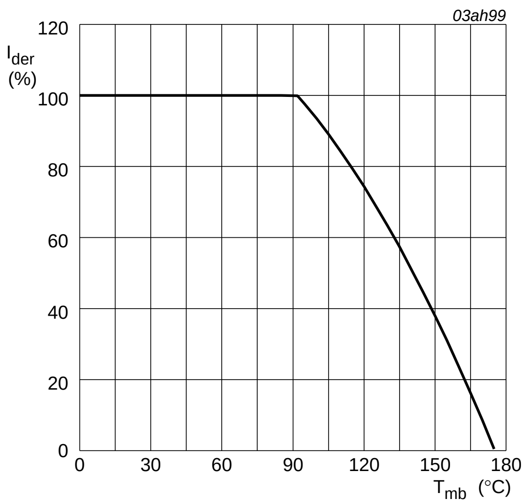
| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PSMN009-100P | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78 |

# 4. Limiting values

**Table 4. Limiting values**

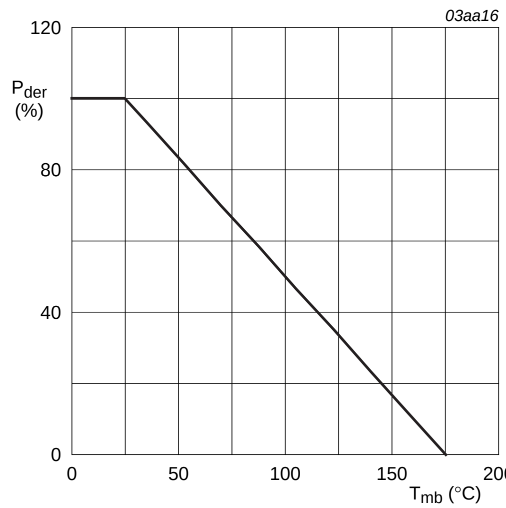
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | $T_j \geq 25$ °C; $T_j \leq 175$ °C | - | 100 | V |
| $V_{DGR}$ | drain-gate voltage | $T_j \leq 175$ °C; $T_j \geq 25$ °C; $R_{GS} = 20$ kΩ | - | 100 | V |
| $V_{GS}$ | gate-source voltage | | -20 | 20 | V |
| $I_D$ | drain current | $V_{GS} = 10$ V; $T_{mb} = 100$ °C; see Figure 1 | - | 65 | A |
| | | $V_{GS} = 10$ V; $T_{mb} = 25$ °C; see Figure 1; see Figure 3 | - | 75 | A |
| $I_{DM}$ | peak drain current | pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C; see Figure 3 | - | 400 | A |
| $P_{tot}$ | total power dissipation | $T_{mb} = 25$ °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; $t_p \leq 50$ µs; $T_j \leq 150$ °C; δ = 25 % | -30 | 30 | V |
| **Source-drain diode** | | | | | |
| $I_S$ | source current | $T_{mb} = 25$ °C | - | 75 | A |
| $I_{SM}$ | peak source current | pulsed; $t_p \leq 10$ µs; $T_{mb} = 25$ °C | - | 400 | A |
| **Avalanche ruggedness** | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | $V_{GS} = 10$ V; $T_{j(init)} = 25$ °C; $I_D = 35$ A; $V_{sup} = 15$ V; unclamped; $t_p = 0.1$ ms; $R_{GS} = 50$ Ω | - | 120 | mJ |
| $I_{DS(AL)S}$ | non-repetitive drain-source avalanche current | $V_{GS} = 10$ V; $V_{sup} = 15$ V; $R_{GS} = 50$ Ω; $T_{j(init)} = 25$ °C; unclamped | - | 75 | A |



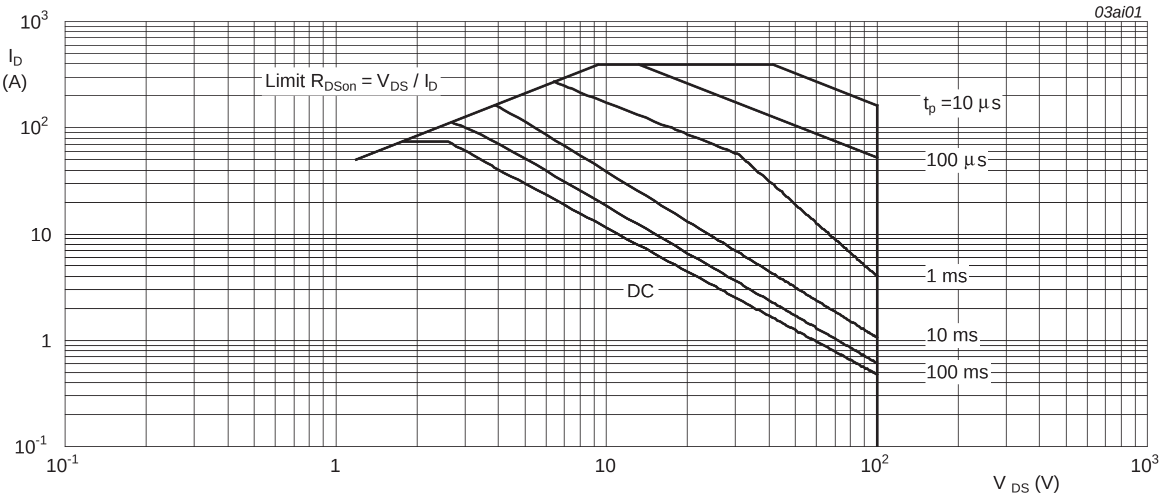

$$I_{der} = \frac{I_D}{I_{D(25^\circ C)}} \times 100\,\%$$

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




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

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




$T_{mb} = 25°C; I_{DM}$ is single pulse

**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 |

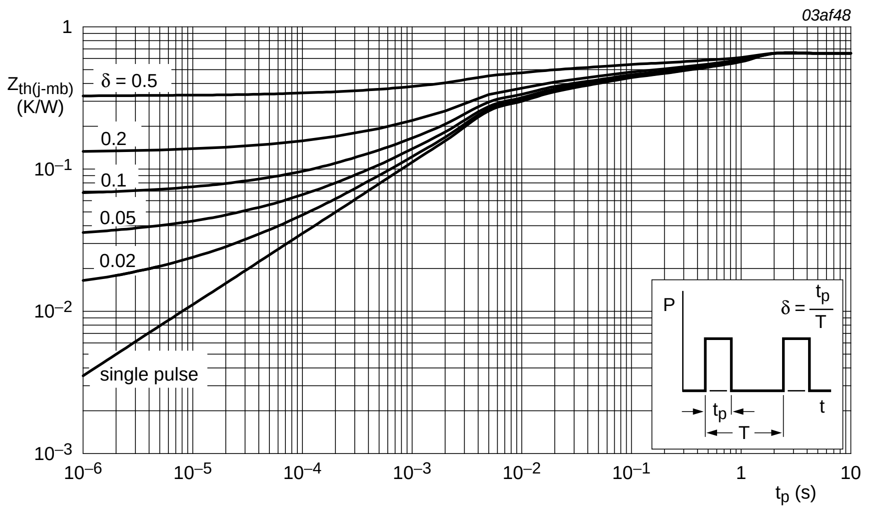
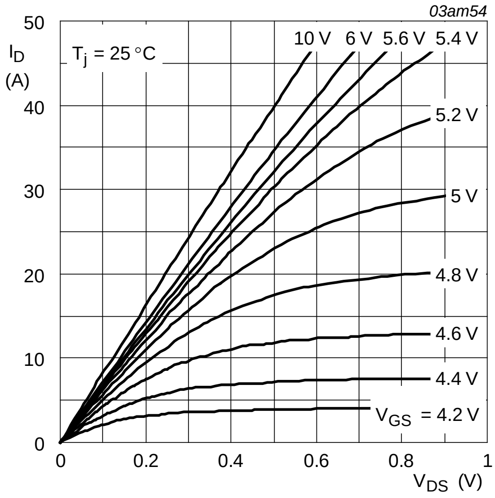



**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration**

# 6. Characteristics

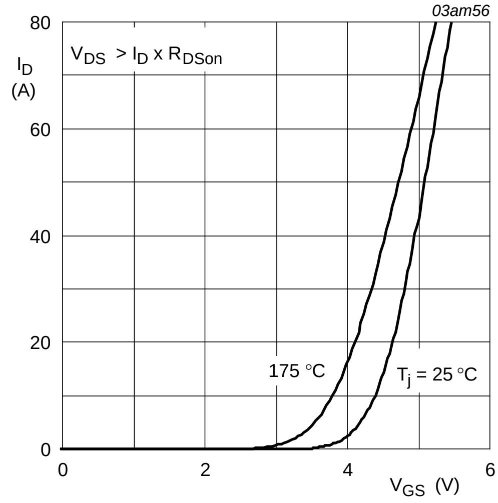
Table 6. Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = -55 °C | 90 | - | - | V |
| | | $I_D$ = 0.25 mA; $V_{GS}$ = 0 V; $T_j$ = 25 °C | 100 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 175 °C; see Figure 8 | 1 | - | - | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = 25 °C; see Figure 8 | 2 | 3 | 4 | V |
| | | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; $T_j$ = -55 °C; see Figure 8 | - | - | 4.4 | V |
| $I_{DSS}$ | drain leakage current | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 175 °C | - | - | 500 | µA |
| | | $V_{DS}$ = 30 V; $V_{GS}$ = 0 V; $T_j$ = 25 °C | - | 0.02 | 1 | µA |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 10 | 100 | nA |
| | | $V_{GS}$ = -20 V; $V_{DS}$ = 0 V; $T_j$ = 25 °C | - | 10 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 175 °C; see Figure 9; see Figure 10 | - | 20.25 | 23.8 | mΩ |
| | | $V_{GS}$ = 10 V; $I_D$ = 25 A; $T_j$ = 25 °C; see Figure 9; see Figure 10 | - | 7.5 | 8.8 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $Q_{G(tot)}$ | total gate charge | $I_D$ = 75 A; $V_{DS}$ = 80 V; $V_{GS}$ = 10 V; $T_j$ = 25 °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 V; $V_{GS}$ = 0 V; f = 1 MHz; $T_j$ = 25 °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 V; $R_L$ = 1.25 Ω; $V_{GS}$ = 10 V; $R_{G(ext)}$ = 6 Ω; $T_j$ = 25 °C; $I_D$ = 12 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 A; $V_{GS}$ = 0 V; $T_j$ = 25 °C; see Figure 13 | - | 0.8 | 1.2 | V |



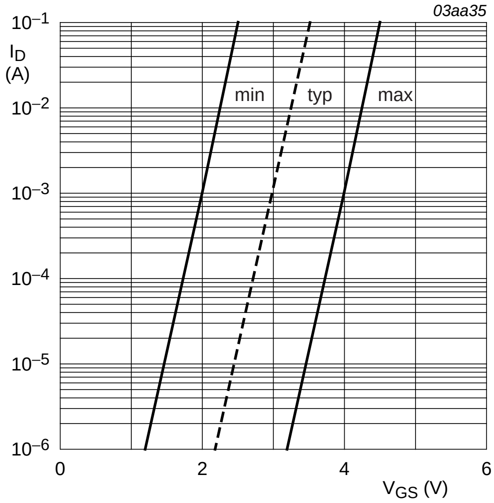

$T_j = 25°C$

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



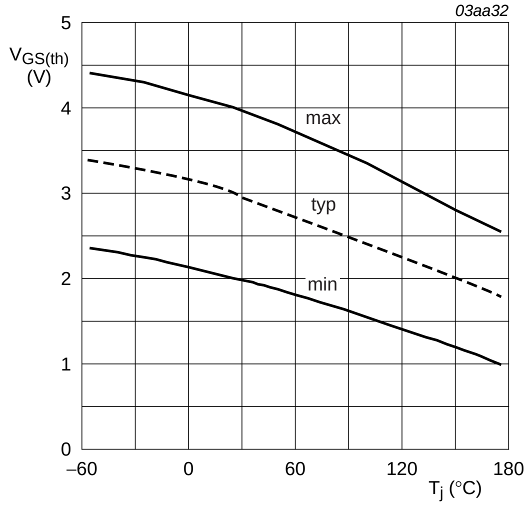

$T_j = 25°C$ and $175°C; V_{DS} > I_D \times R_{DSon}$

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



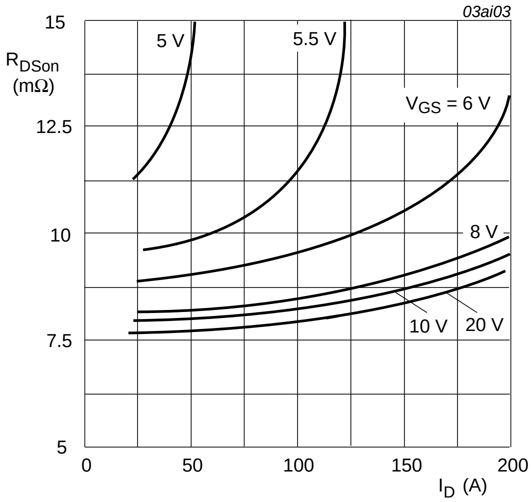

$T_j = 25°C; V_{DS} = 5V$

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



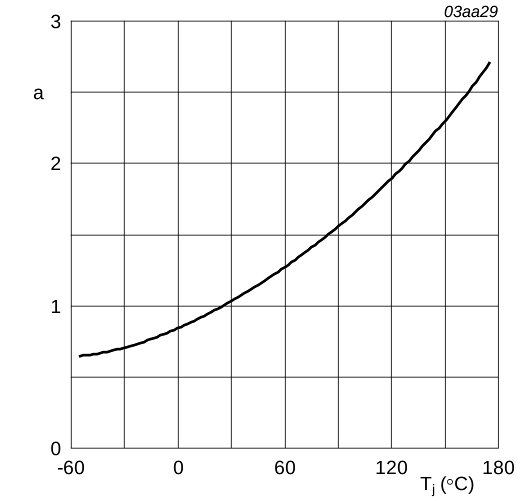

$I_D = 1mA; V_{DS} = V_{GS}$

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



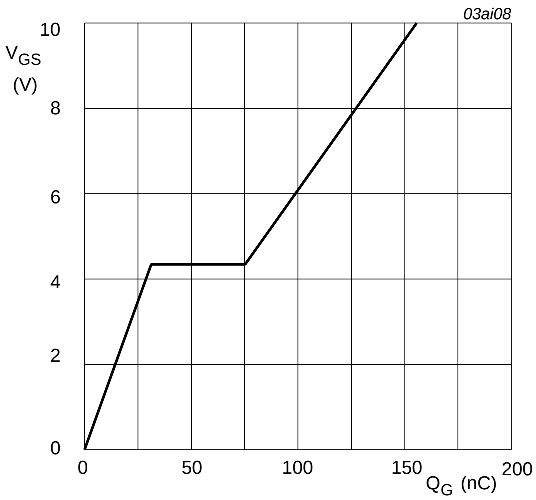

$$T_j = 25°C$$

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



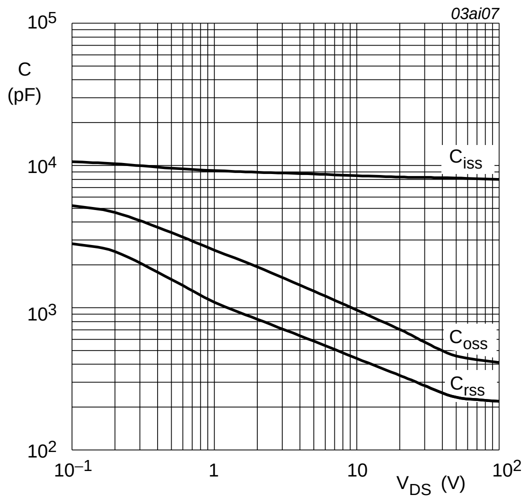

$$a = \frac{R_{DSon}}{R_{DSon(25°C)}}$$

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



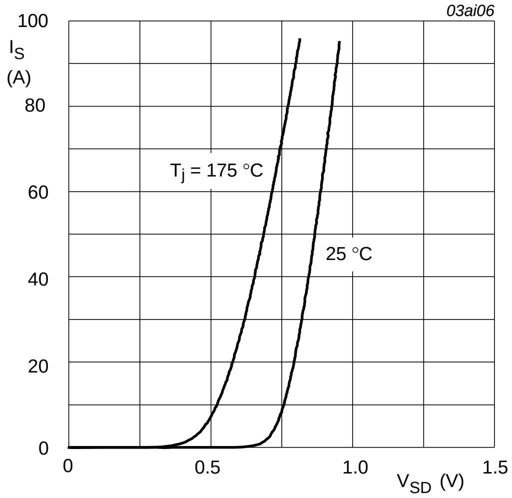

$$I_D = 75A; V_{DS} = 80V$$

**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**

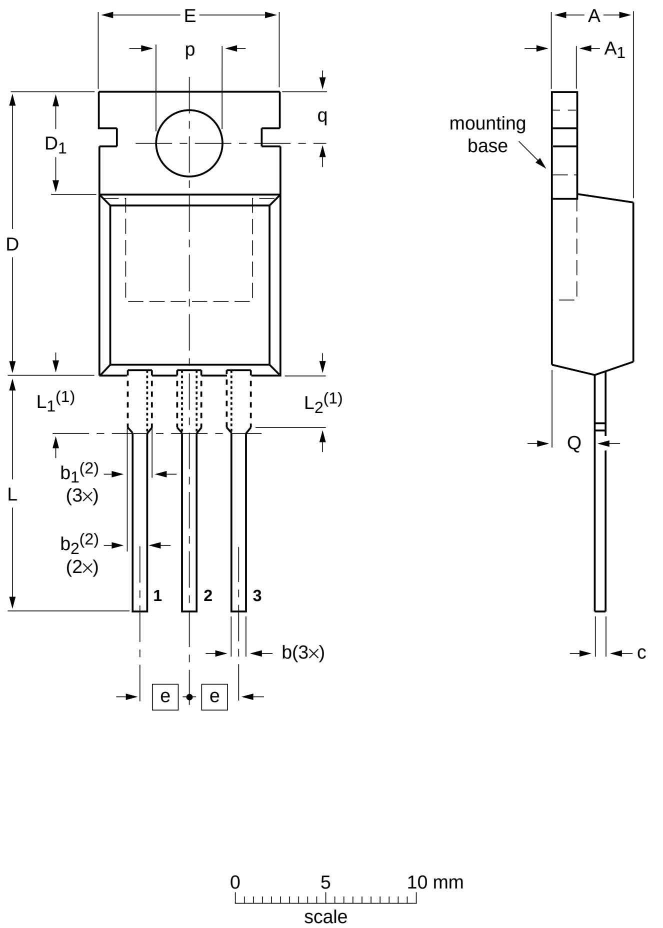



$T_j = 25°C$ and $175°C; V_{GS} = 0V$

**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**




**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<br>4.1 | 1.40<br>1.25 | 0.9<br>0.6 | 1.6<br>1.0 | 1.3<br>1.0 | 0.7<br>0.4 | 16.0<br>15.2 | 6.6<br>5.9 | 10.3<br>9.7 | 2.54 | 15.0<br>12.8 | 3.30<br>2.79 | 3.0 | 3.8<br>3.5 | 3.0<br>2.7 | 2.6<br>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~~<br>08-06-13 |

**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".

[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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## 11. Contents





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**Date of release: 27 December 2011**