

1. Description

SiliconMAX™ products use the latest Philips TrenchMOS™ technology to achieve the lowest possible on-state resistance in a SOT96-1 (SO8) package.

Product availability:

PSMN006-20K in SOT96-1 (SO8).

2. Features

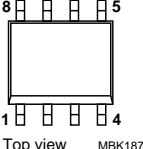
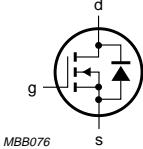
- Very low on-state resistance
- Very low threshold
- TrenchMOS™ technology.

3. Applications

- DC to DC converter
- Computer motherboards
- Switch mode power supplies.

4. Pinning information

Table 1: Pinning - SOT96-1, simplified outline and symbol

| Pin | Description | Simplified outline | Symbol |
|---------|-------------|--|---|
| 1,2,3 | source (s) |  <p>Top view MBK187</p> |  <p>MBB076</p> |
| 4 | gate (g) | | |
| 5,6,7,8 | drain (d) | | |

SOT96-1 (SO8)

5. Quick reference data

Table 2: Quick reference data

| Symbol | Parameter | Conditions | Typ | Max | Unit |
|------------|----------------------------------|---|-----|-----|------|
| V_{DS} | drain-source voltage (DC) | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ | - | 20 | V |
| I_D | drain current (DC) | $T_{sp} = 25\text{ °C}; V_{GS} = 4.5\text{ V}$ | - | 32 | A |
| P_{tot} | total power dissipation | $T_{sp} = 25\text{ °C}$ | - | 8.3 | W |
| T_j | junction temperature | | - | 150 | °C |
| R_{DSon} | drain-source on-state resistance | $V_{GS} = 4.5\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}$ | 4.2 | 5 | mΩ |
| | | $V_{GS} = 2.5\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}$ | 4.8 | 5.7 | mΩ |
| | | $V_{GS} = 1.8\text{ V}; I_D = 5\text{ A}; T_j = 25\text{ °C}$ | 5.7 | 8.2 | mΩ |

6. Limiting values

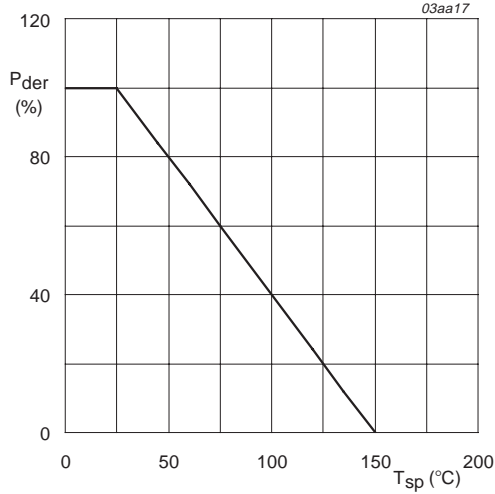
Table 3: Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|--------------------------------|--|-----|------|------|
| V_{DS} | drain-source voltage (DC) | $25\text{ °C} \leq T_j \leq 150\text{ °C}$ | - | 20 | V |
| I_D | drain current (DC) | $T_{sp} = 25\text{ °C}; V_{GS} = 4.5\text{ V};$ Figure 2 and 3 | - | 32 | A |
| V_{GS} | gate-source voltage | | - | ±10 | V |
| I_{DM} | peak drain current | $T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s};$ Figure 3 | - | 60 | A |
| P_{tot} | total power dissipation | $T_{sp} = 25\text{ °C};$ Figure 1 | - | 8.3 | W |
| T_{stg} | storage temperature | | - | 150 | °C |
| T_j | operating junction temperature | | -55 | +150 | °C |

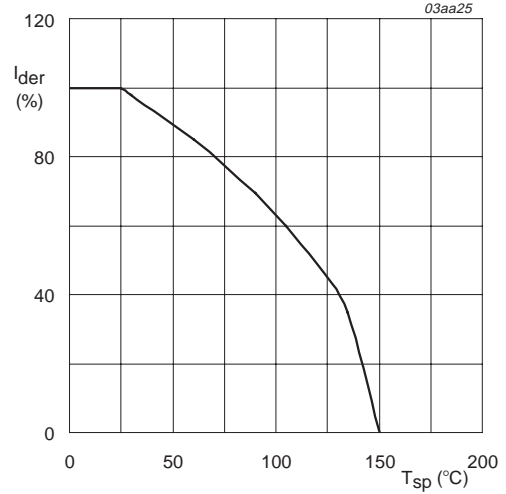
Source-drain diode

| | | | | | |
|----------|-------------------------------------|---|---|-----|---|
| I_S | source (diode forward) current (DC) | $T_{sp} = 25\text{ °C}$ | - | 7.5 | A |
| I_{SM} | peak source (diode forward) current | $T_{sp} = 25\text{ °C};$ pulsed; $t_p \leq 10\text{ }\mu\text{s}$ | - | 30 | A |



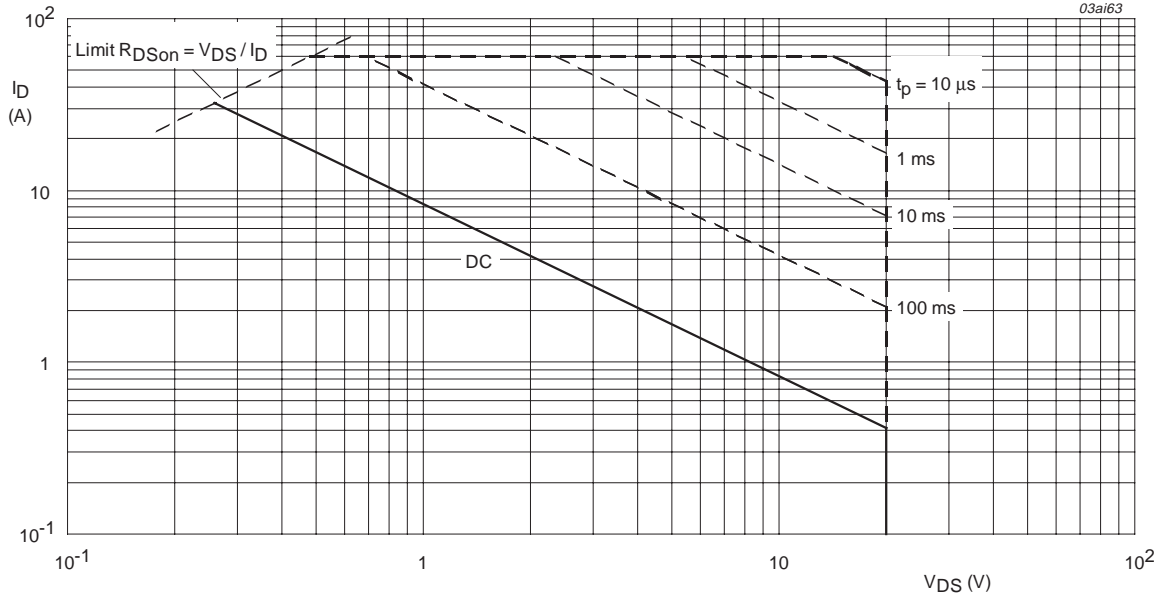
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of solder point temperature.



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

Fig 2. Normalized continuous drain current as a function of solder point temperature.



T_{sp} = 25 °C; I_{DM} is single pulse.

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

7. Thermal characteristics

Table 4: Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|----------------|--|---|-----|-----|-----|------|
| $R_{th(j-sp)}$ | thermal resistance from junction to solder point | mounted on a metal clad board; Figure 4 | - | - | 15 | K/W |

7.1 Transient thermal impedance

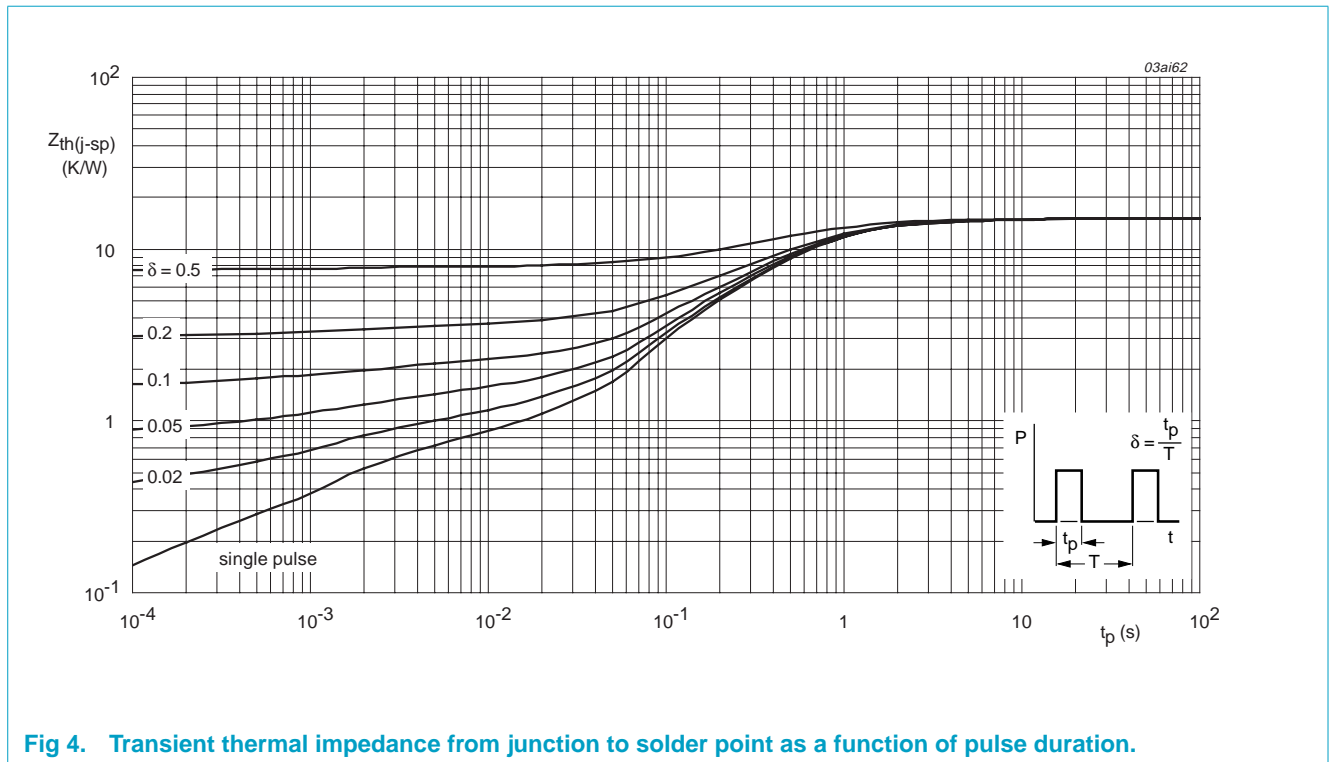
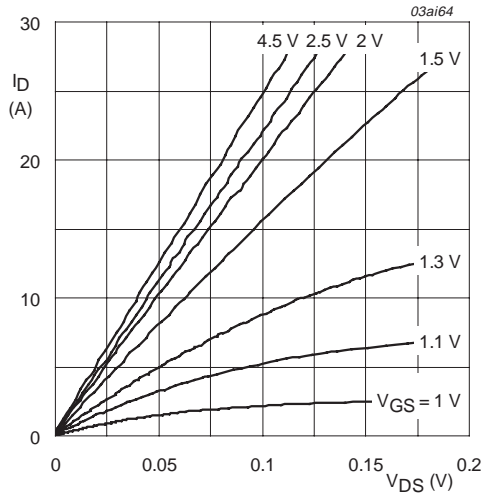


Fig 4. Transient thermal impedance from junction to solder point as a function of pulse duration.

8. Characteristics

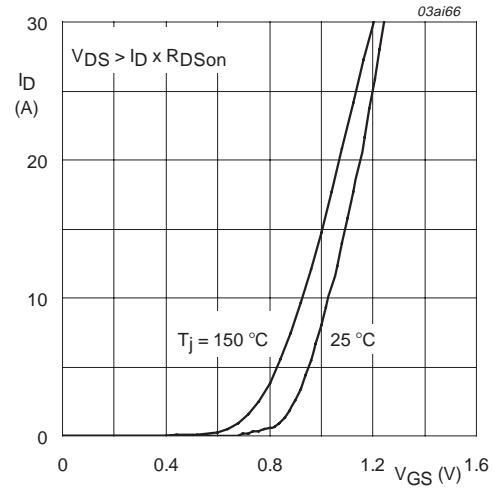
Table 5: Characteristics
T_j = 25 °C unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|--|------|------|-----|------|
| Static characteristics | | | | | | |
| V _{(BR)DSS} | drain-source breakdown voltage | I _D = 250 μA; V _{GS} = 0 V | 20 | - | - | V |
| V _{GS(th)} | gate-source threshold voltage | I _D = 1 mA; V _{DS} = V _{GS} ; Figure 9 | | | | |
| | | T _j = 25 °C | 0.4 | 0.7 | - | V |
| I _{DSS} | drain-source leakage current | V _{DS} = 20 V; V _{GS} = 0 V | | | | |
| | | T _j = 150 °C | 0.15 | - | - | V |
| I _{DSS} | drain-source leakage current | V _{DS} = 20 V; V _{GS} = 0 V | | | | |
| | | T _j = 25 °C | - | 0.05 | 1 | μA |
| I _{DSS} | drain-source leakage current | V _{DS} = 20 V; V _{GS} = 0 V | | | | |
| | | T _j = 150 °C | - | - | 0.5 | mA |
| I _{GSS} | gate-source leakage current | V _{GS} = ±8 V; V _{DS} = 0 V | - | 10 | 100 | nA |
| R _{DS(on)} | drain-source on-state resistance | V _{GS} = 4.5 V; I _D = 5 A; Figure 7 and 8 | - | 4.2 | 5 | mΩ |
| | | V _{GS} = 2.5 V; I _D = 5 A; Figure 7 and 8 | - | 4.8 | 5.7 | mΩ |
| | | V _{GS} = 1.8 V; I _D = 5 A; Figure 8 | - | 5.7 | 8.2 | mΩ |
| Dynamic characteristics | | | | | | |
| g _{fs} | forward transconductance | V _{DS} = 15 V; I _D = 10 A | - | 25 | - | S |
| Q _{g(tot)} | total gate charge | I _D = 30 A; V _{DD} = 10 V; V _{GS} = 2.5 V; Figure 13 | - | 32 | - | nC |
| Q _{gs} | gate-source charge | | - | 10 | - | nC |
| Q _{gd} | gate-drain (Miller) charge | | - | 13.2 | - | nC |
| C _{iss} | input capacitance | V _{GS} = 0 V; V _{DS} = 20 V; f = 1 MHz; Figure 11 | - | 4350 | - | pF |
| C _{oss} | output capacitance | | - | 825 | - | pF |
| C _{rss} | reverse transfer capacitance | | - | 550 | - | pF |
| t _{d(on)} | turn-on delay time | V _{DD} = 10 V; R _L = 10 Ω; V _{GS} = 4.5 V; R _G = 6 Ω | - | 65 | - | ns |
| t _r | rise time | | - | 32 | - | ns |
| t _{d(off)} | turn-off delay time | | - | 190 | - | ns |
| t _f | fall time | | - | 90 | - | ns |
| Source-drain diode | | | | | | |
| V _{SD} | source-drain (diode forward) voltage | I _S = 3 A; V _{GS} = 0 V; Figure 12 | - | 0.75 | 1.3 | V |
| t _{rr} | reverse recovery time | I _S = 10 A; dI _S /dt = -70 A/μs; V _{GS} = 0 V | - | 47 | - | ns |
| Q _r | recovery charge | | - | 17 | - | nC |



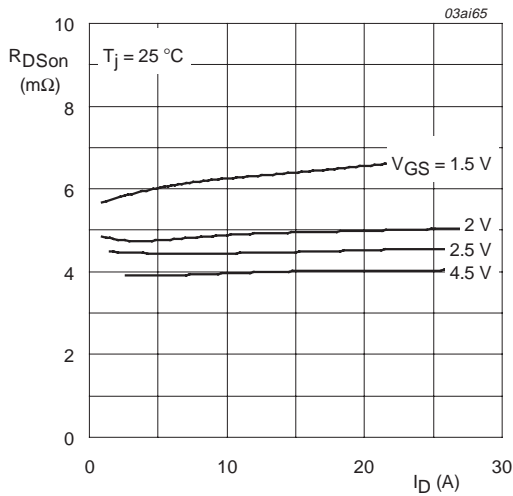
$T_j = 25\text{ °C}$

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



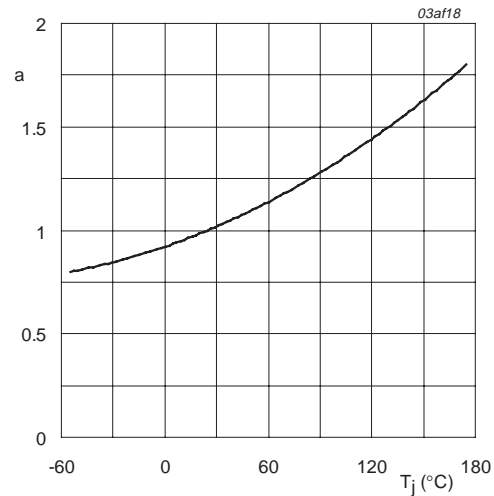
$T_j = 25\text{ °C}$ and 150 °C ; $V_{DS} > I_D \times R_{DSon}$

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



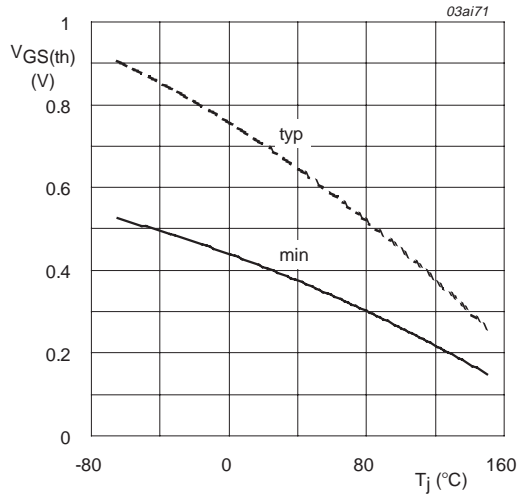
$T_j = 25\text{ °C}$

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



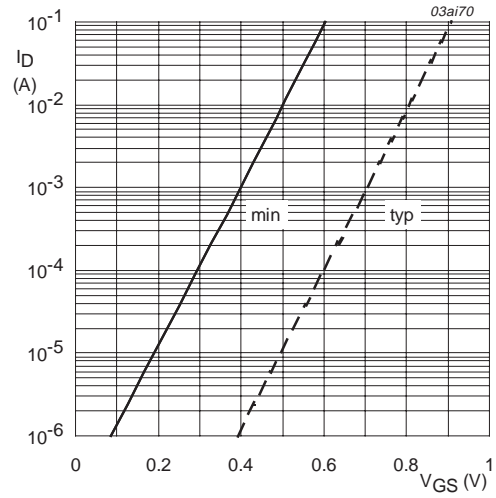
$$a = \frac{R_{DSon}}{R_{DSon}(25\text{ °C})}$$

Fig 8. Normalized drain-source on-state resistance factor as a function of junction temperature.



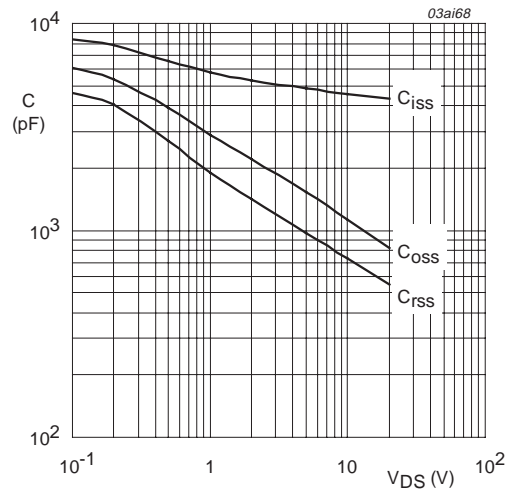
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



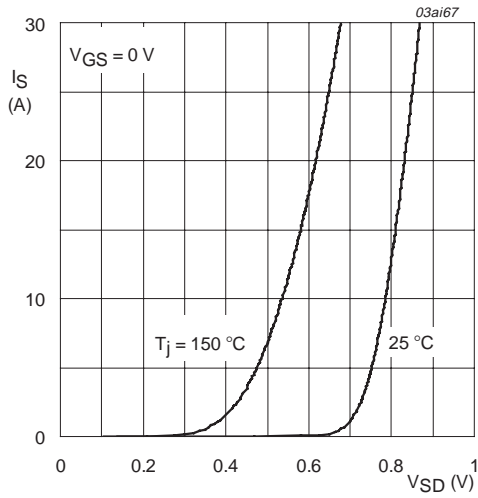
$T_j = 25 \text{ }^\circ\text{C}; V_{DS} = 5 \text{ V}$

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



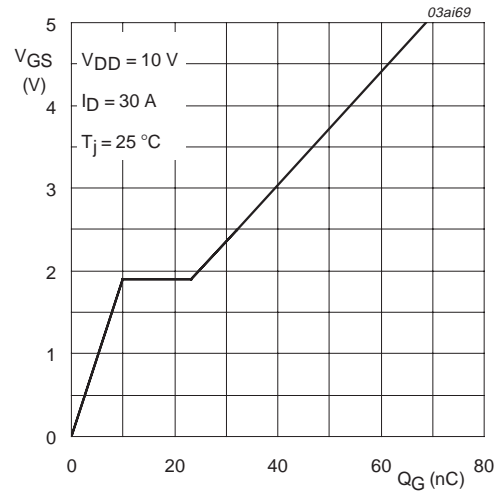
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Fig 11. Input, output and reverse transfer capacitances as a function of drain-source voltage; typical values.



$T_j = 25$ °C and 150 °C; $V_{GS} = 0$ V

Fig 12. Source (diode forward) current as a function of source-drain (diode forward) voltage; typical values.



$I_D = 30$ A; $V_{DD} = 10$ V

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

9. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

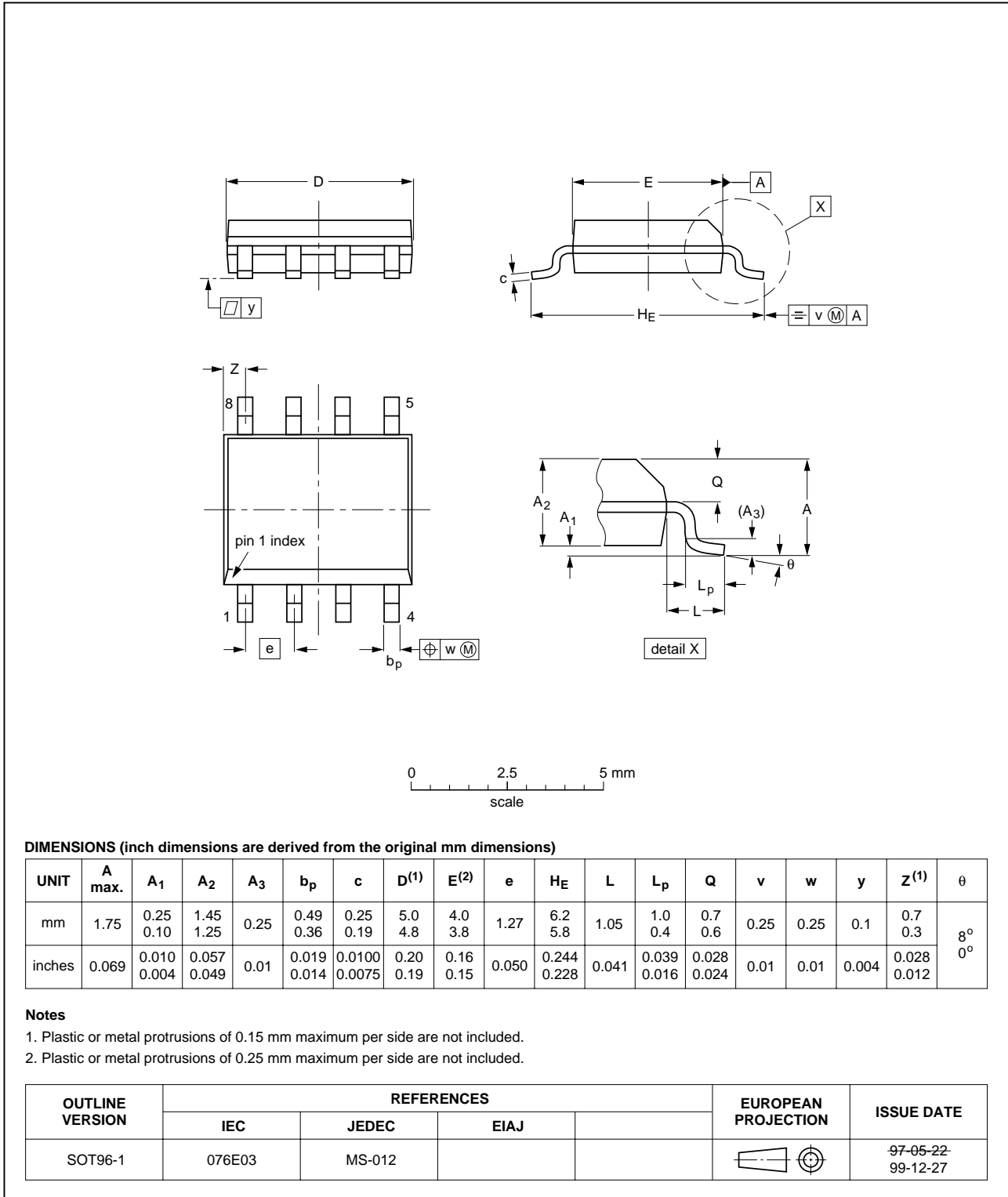


Fig 14. SOT96-1 (SO8).

10. Revision history

Table 6: Revision history

| Rev | Date | CPCN | Description |
|-----|----------|------|-------------------------------|
| 01 | 20020530 | - | Product data (9397 750 09631) |

11. Data sheet status

| Data sheet status ^[1] | Product status ^[2] | Definition |
|----------------------------------|-------------------------------|--|
| Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
| Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
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[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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Contents

| | | |
|-----|---------------------------------------|----|
| 1 | Description | 1 |
| 2 | Features | 1 |
| 3 | Applications | 1 |
| 4 | Pinning information | 1 |
| 5 | Quick reference data | 2 |
| 6 | Limiting values | 2 |
| 7 | Thermal characteristics | 4 |
| 7.1 | Transient thermal impedance | 4 |
| 8 | Characteristics | 5 |
| 9 | Package outline | 9 |
| 10 | Revision history | 10 |
| 11 | Data sheet status | 11 |
| 12 | Definitions | 11 |
| 13 | Disclaimers | 11 |
| 14 | Trademarks | 11 |

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Date of release: 30 May 2002

Document order number: 9397 750 09631



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