

1. Product profile

1.1 Description

N-channel enhancement mode field-effect transistor in a plastic package using TrenchMOS¹ technology.

Product availability:

PSMN063-150D in SOT428 (D-PAK).

1.2 Features

- TrenchMOS™ technology
- Fast Switching
- Very low on-state resistance
- Low thermal resistance

1.3 Applications

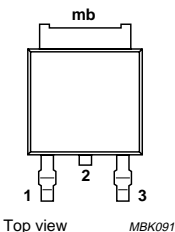
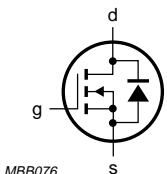
- DC to DC converters
- Switched mode power supplies

1.4 Quick reference data

- $V_{DS} = 150\text{ V}$
- $I_D = 29\text{ A}$
- $P_{tot} = 150\text{ W}$
- $R_{DSon} \leq 63\text{ m}\Omega$

2. Pinning information

Table 1: Pinning - SOT428 (D-PAK), simplified outline and symbol

| Pin | Description | Simplified outline | Symbol |
|-----|--|--|---|
| 1 | gate (g) |  <p>Top view MBK091</p> |  <p>MBB076</p> |
| 2 | drain (d) [1] | | |
| 3 | source (s) | | |
| mb | connected to drain (d) | | |

[1] It is not possible to make a connection to pin 2 of the SOT428 package.

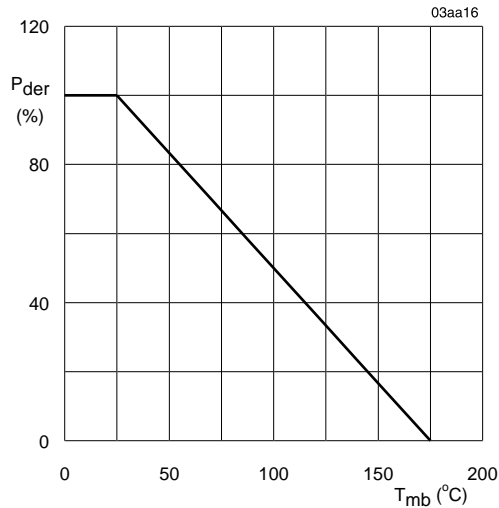
1. TrenchMOS™ is a trademark of Koninklijke Philips Electronics N.V.

3. Limiting values

Table 2: Limiting values

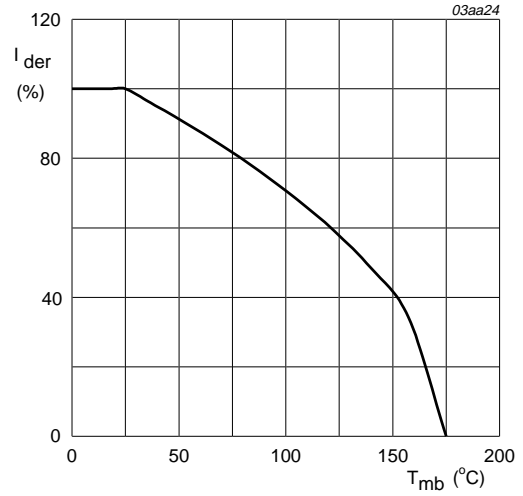
In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------------------------|-------------------------------------|---|-----|----------|------|
| V_{DS} | drain-source voltage (DC) | $T_j = 25$ to 175 °C | – | 150 | V |
| V_{DGR} | drain-gate voltage (DC) | $T_j = 25$ to 175 °C; $R_{GS} = 20$ k Ω | – | 150 | V |
| V_{GS} | gate-source voltage (DC) | | – | ± 20 | V |
| I_D | drain current (DC) | $T_{mb} = 25$ °C; $V_{GS} = 10$ V; Figure 2 and 3 | – | 29 | A |
| | | $T_{mb} = 100$ °C; $V_{GS} = 10$ V; Figure 2 and 3 | – | 20 | A |
| I_{DM} | peak drain current | $T_{mb} = 25$ °C; pulsed; $t_p \leq 10$ μ s; Figure 3 | – | 116 | A |
| P_{tot} | total power dissipation | $T_{mb} = 25$ °C; Figure 1 | – | 150 | W |
| T_{stg} | storage temperature | | –55 | +175 | °C |
| T_j | operating junction temperature | | –55 | +175 | °C |
| Source-drain diode | | | | | |
| I_S | source (diode forward) current (DC) | $T_{mb} = 25$ °C | – | 29 | A |
| I_{SM} | peak source (diode forward) current | $T_{mb} = 25$ °C; pulsed; $t_p \leq 10$ μ s | – | 116 | A |
| Avalanche ruggedness | | | | | |
| E_{AS} | non-repetitive avalanche energy | unclamped inductive load; $I_D = 26$ A; $t_p = 0.2$ ms; $V_{DD} \leq 25$ V; $R_{GS} = 50$ Ω ; $V_{GS} = 10$ V; starting $T_j = 25$ °C | – | 502 | mJ |
| I_{AS} | non-repetitive avalanche current | unclamped inductive load; $V_{DD} \leq 25$ V; $R_{GS} = 50$ Ω ; $V_{GS} = 10$ V; starting $T_j = 25$ °C | – | 29 | A |



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

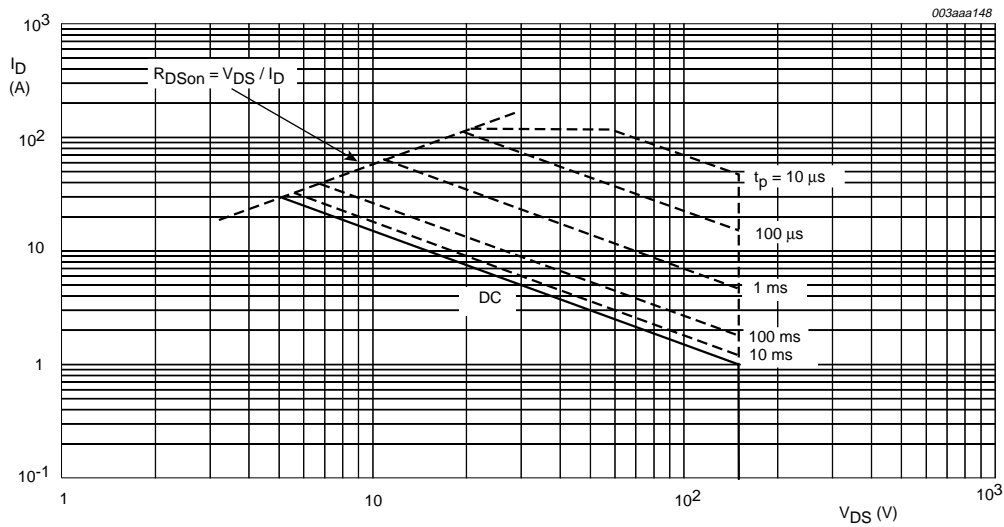
Fig 1. Normalized total power dissipation as a function of mounting base temperature.



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

$V_{GS} \geq 10\text{ V}$

Fig 2. Normalized continuous drain current as a function of mounting base temperature.



$T_{mb} = 25^{\circ}C$; I_{DM} is single pulse

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

4. Thermal characteristics

Table 3: Thermal characteristics

| Symbol | Parameter | Conditions | Value | Unit |
|----------------|---|-----------------------|-------|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Figure 4 | 1.0 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | Vertical in still air | 50 | K/W |

4.1 Transient thermal impedance

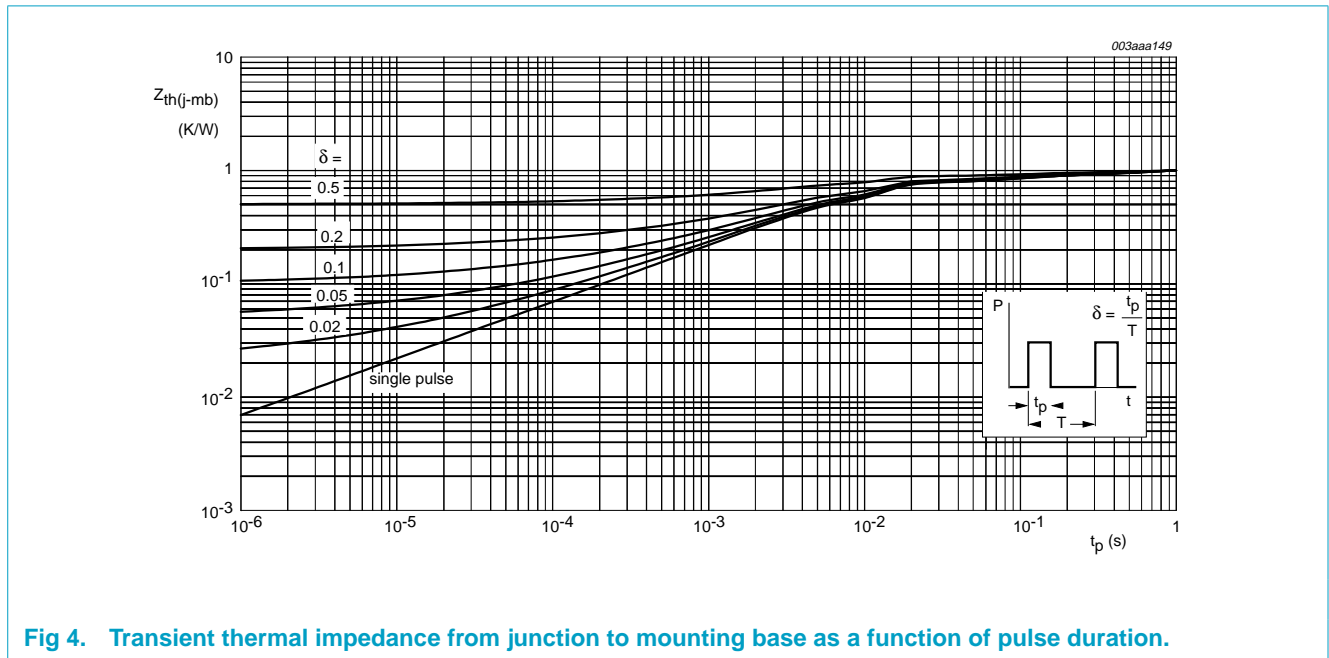
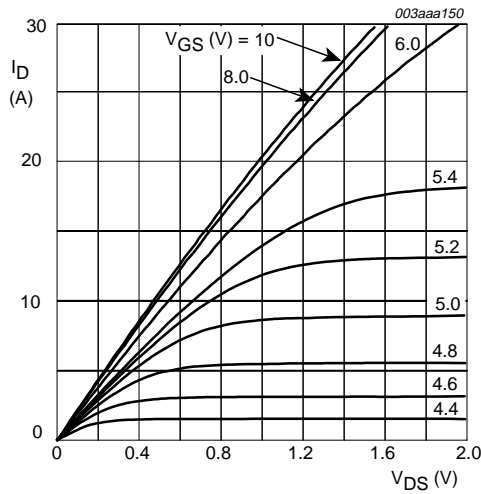


Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.

5. Characteristics

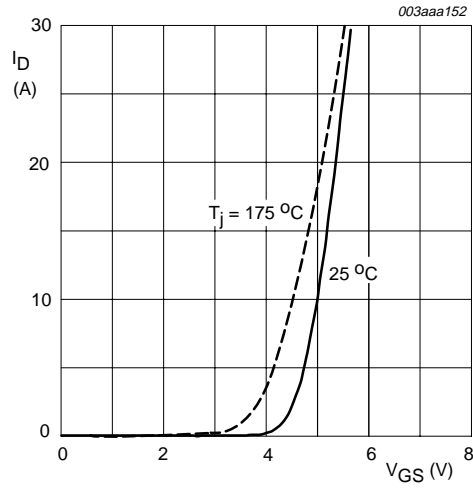
Table 4: Characteristics
 $T_j = 25\text{ }^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|--|-----|------|-----|---------------|
| Static characteristics | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D = 250\ \mu\text{A}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ }^\circ\text{C}$ | 150 | – | – | V |
| | | $T_j = -55\text{ }^\circ\text{C}$ | 133 | – | – | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D = 1\ \text{mA}$; $V_{DS} = V_{GS}$; Figure 9 | | | | |
| | | $T_j = 25\text{ }^\circ\text{C}$ | 2 | 3 | 4 | V |
| | | $T_j = 175\text{ }^\circ\text{C}$ | 1 | – | – | V |
| | | $T_j = -55\text{ }^\circ\text{C}$ | – | – | 6 | V |
| I_{DSS} | drain-source leakage current | $V_{DS} = 150\ \text{V}$; $V_{GS} = 0\ \text{V}$ $T_j = 25\text{ }^\circ\text{C}$ | – | 0.05 | 10 | μA |
| | | $T_j = 175\text{ }^\circ\text{C}$ | – | – | 500 | μA |
| I_{GSS} | gate-source leakage current | $V_{GS} = \pm 10\ \text{V}$; $V_{DS} = 0\ \text{V}$ | – | 0.02 | 100 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS} = 10\ \text{V}$; $I_D = 15\ \text{A}$; Figure 7 and 8 | | | | |
| | | $T_j = 25\text{ }^\circ\text{C}$ | – | 60 | 63 | m Ω |
| | | $T_j = 175\text{ }^\circ\text{C}$ | – | – | 176 | m Ω |
| Dynamic characteristics | | | | | | |
| $Q_{g(tot)}$ | total gate charge | $I_D = 30\ \text{A}$; $V_{DS} = 120\ \text{V}$; $V_{GS} = 10\ \text{V}$; Figure 14 | – | 55 | – | nC |
| Q_{gs} | gate-source charge | | – | 10 | – | nC |
| Q_{gd} | gate-drain (Miller) charge | | – | 20 | 27 | nC |
| C_{iss} | input capacitance | $V_{GS} = 0\ \text{V}$; $V_{DS} = 25\ \text{V}$; $f = 1\ \text{MHz}$; Figure 12 | – | 2390 | – | pF |
| C_{oss} | output capacitance | | – | 240 | – | pF |
| C_{rss} | reverse transfer capacitance | | – | 98 | – | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DD} = 75\ \text{V}$; $R_D = 2.7\ \Omega$; $V_{GS} = 10\ \text{V}$; $R_G = 5.6\ \Omega$ | – | 14 | – | ns |
| t_r | turn-on rise time | | – | 50 | – | ns |
| $t_{d(off)}$ | turn-off delay time | | – | 48 | – | ns |
| t_f | turn-off fall time | | – | 38 | – | ns |
| Source-drain diode | | | | | | |
| V_{SD} | source-drain (diode forward) voltage | $I_S = 25\ \text{A}$; $V_{GS} = 0\ \text{V}$; Figure 13 | – | 0.9 | 1.2 | V |
| t_{rr} | reverse recovery time | $I_S = 20\ \text{A}$; | – | 105 | – | ns |
| Q_r | recovered charge | $di_S/dt = -100\ \text{A}/\mu\text{s}$; $V_{GS} = 0\ \text{V}$; $V_{DS} = 25\ \text{V}$ | – | 0.55 | – | μC |



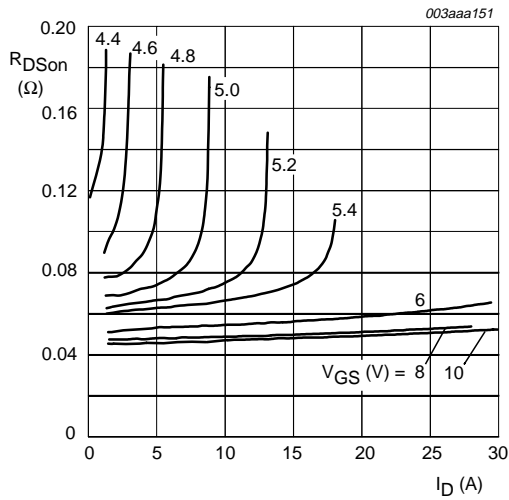
T_j = 25 °C

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



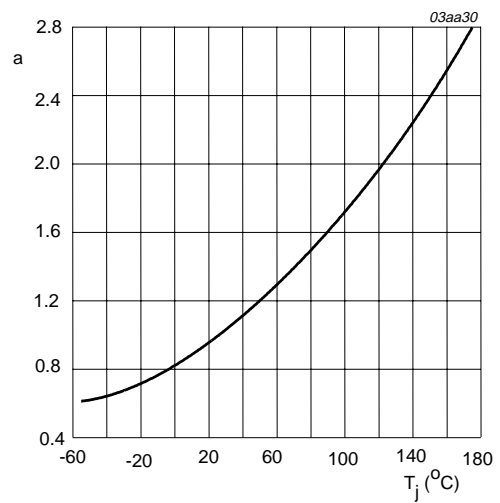
T_j = 25 °C and 175 °C; V_{DS} > I_D × R_{DSon}

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



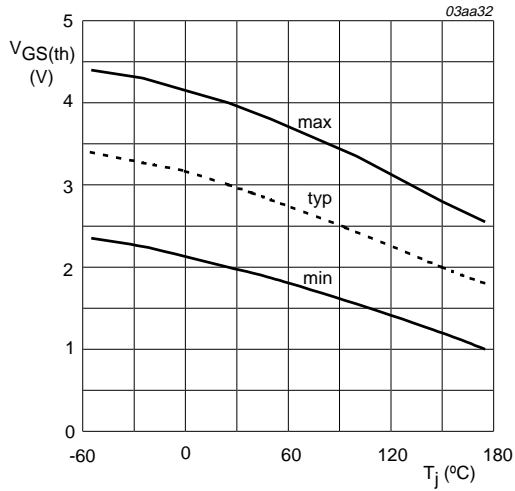
T_j = 25 °C

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



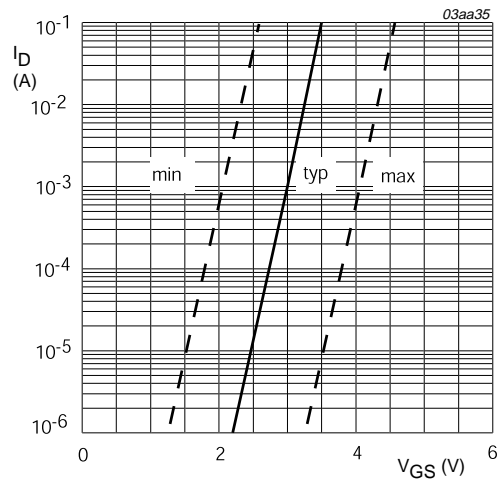
$$a = \frac{R_{DSon}}{R_{DSon(25^{\circ}C)}}$$

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



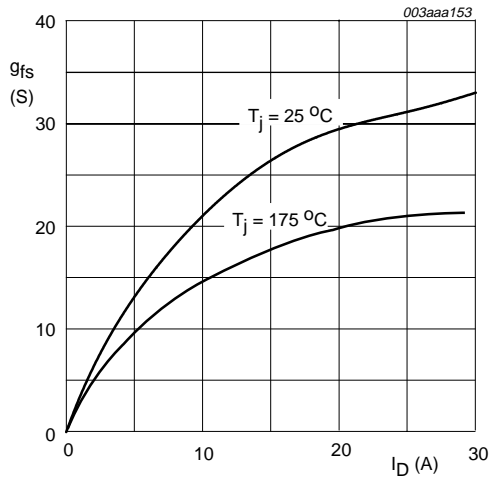
$I_D = 1 \text{ mA}; V_{DS} = V_{GS}$

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



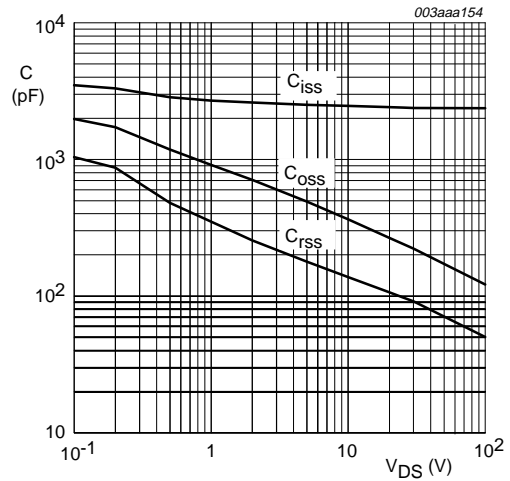
$T_j = 25 \text{ }^{\circ}C; V_{DS} = 5 \text{ V}$

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



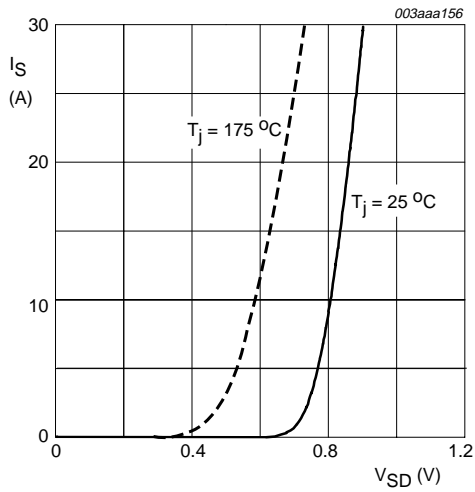
$T_j = 25 \text{ }^{\circ}C; V_{DS} > I_D \times R_{DS(on)}$

Fig 11. Forward transconductance as a function of drain current; typical values.



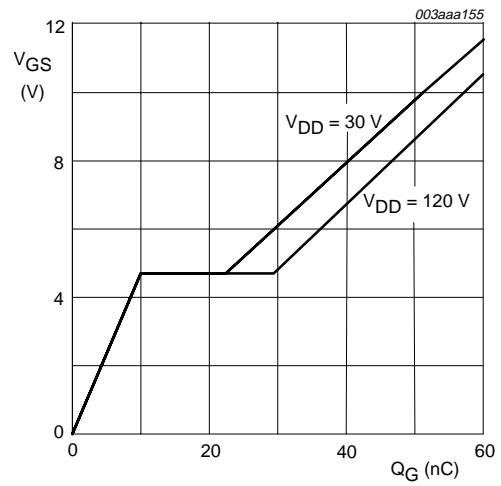
$V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

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



$T_j = 25^\circ\text{C}$ and 175°C ; $V_{GS} = 0\text{ V}$

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



$I_D = 30\text{ A}$; $V_{DD} = 30\text{ V}$ and 120 V

Fig 14. Gate-source voltage as a function of gate charge; typical values.

6. Package outline

Plastic single-ended surface mounted package (Philips version of D-PAK); 3 leads (one lead cropped)

SOT428

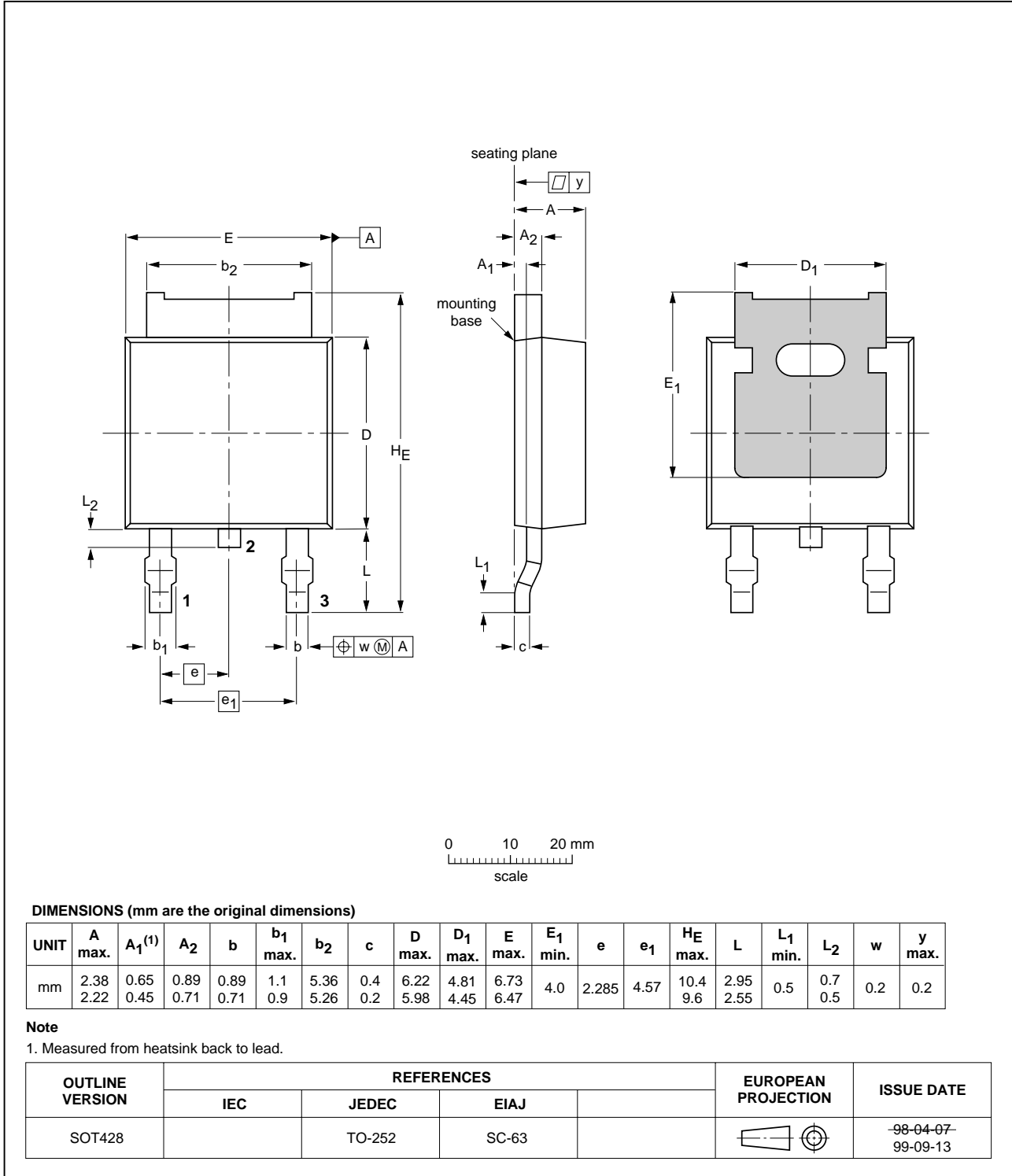


Fig 15. SOT428 (D-PAK).

7. Revision history

Table 5: Revision history

| Rev | Date | CPCN | Description |
|-----|----------|------|---|
| 03 | 20011031 | - | Product data; third version; supersedes second version PSMN063_150D_2 of 1 August 1999. <ul style="list-style-type: none">• Max value of Q_{gd} added in table 5. |
| 02 | 19990801 | - | Product specification; second version PSMN063_150D_2; supersedes initial Lotus Manuscript version of August 1999 Rev 1.000. |
| 01 | - | - | Initial version; not published. |

8. 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. |
| Product data | Production | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A. |

[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>.

9. Definitions

Short-form specification — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

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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