SiliconMAX

# PSMN015-110P

TrenchMOS™ Standard level FET

**Rev. 01 — 08 January 2004** **Product data**

## 1. Product profile

### 1.1 Description

SiliconMAX™ products use the latest Philips TrenchMOS™ technology to achieve the lowest possible on-state resistance in each package.

### 1.2 Features

- Low on-state resistance
- Low gate charge.

### 1.3 Applications

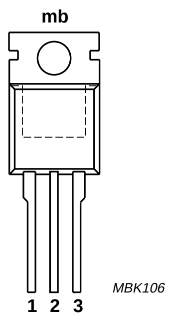
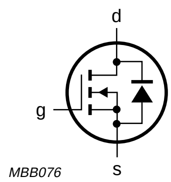
- DC-to-DC converters
- Switched-mode power supplies.

### 1.4 Quick reference data

- $V_{DS} \leq 110$ V
- $P_{tot} \leq 300$ W
- $I_D \leq 75$ A
- $R_{DSon} \leq 15$ mΩ

## 2. Pinning information

**Table 1: Pinning - SOT78, simplified outlines and symbol**

| Pin | Description | Simplified outline | Symbol |
|---|---|---|---|
| 1 | gate (g) | <br>SOT78 (TO-220AB) |  |
| 2 | drain (d) | | |
| 3 | source (s) | | |
| mb | mounting base; connected to drain (d) | | |

PHILIPS

## 3. Ordering information

**Table 2: Ordering information**

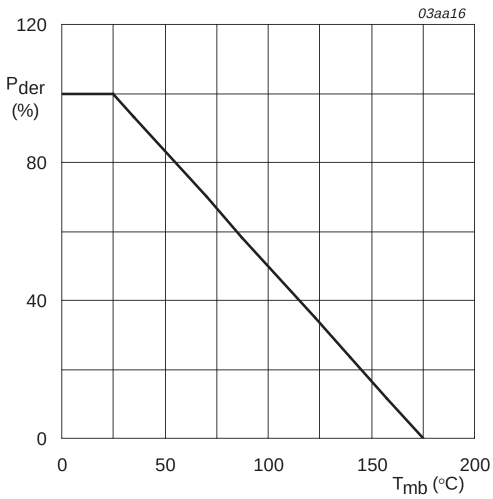
| Type number | Package | | |
|---|---|---|---|
| | Name | Description | Version |
| PSMN015-110P | TO-220AB | Plastic single-ended package; heatsink mounted; 1 mounting hole; 3 leads | SOT78 |

## 4. Limiting values

**Table 3: Limiting values**

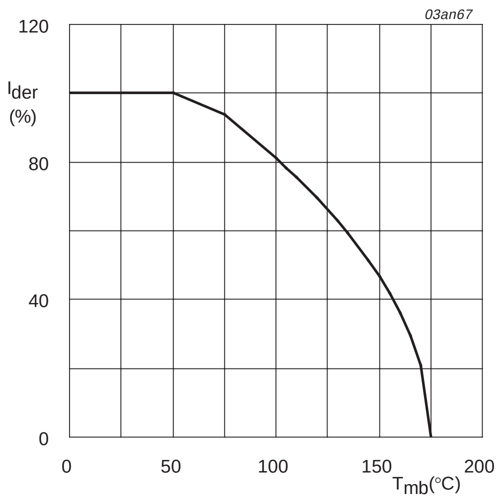
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage (DC) | 25 °C ≤ $T_j$ ≤ 175 °C | - | 110 | V |
| $V_{DGR}$ | drain-gate voltage (DC) | 25 °C ≤ $T_j$ ≤ 175 °C; $R_{GS}$ = 20 kΩ | - | 110 | 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 | - | 75 | A |
| | | $T_{mb}$ = 100 °C; $V_{GS}$ = 10 V; Figure 2 | - | 60.8 | A |
| $I_{DM}$ | peak drain current | $T_{mb}$ = 25 °C; pulsed; $t_p$ ≤ 10 µs; Figure 3 | - | 240 | A |
| $P_{tot}$ | total power dissipation | $T_{mb}$ = 25 °C; Figure 1 | - | 300 | W |
| $T_{stg}$ | storage temperature | | –55 | +175 | °C |
| $T_j$ | junction temperature | | –55 | +175 | °C |
| **Source-drain diode** | | | | | |
| $I_S$ | source (diode forward) current (DC) | $T_{mb}$ = 25 °C | - | 75 | A |
| $I_{SM}$ | peak source (diode forward) current | $T_{mb}$ = 25 °C; pulsed; $t_p$ ≤ 10 µs | - | 240 | A |
| **Avalanche ruggedness** | | | | | |
| $E_{DS(AL)S}$ | non-repetitive drain-source avalanche energy | unclamped inductive load; $I_D$ = 36 A; $t_p$ = 0.11 ms; $V_{DD}$ ≤ 50 V; $R_{GS}$ = 50 Ω; $V_{GS}$ = 10 V; starting $T_j$ = 25 °C | - | 320 | mJ |



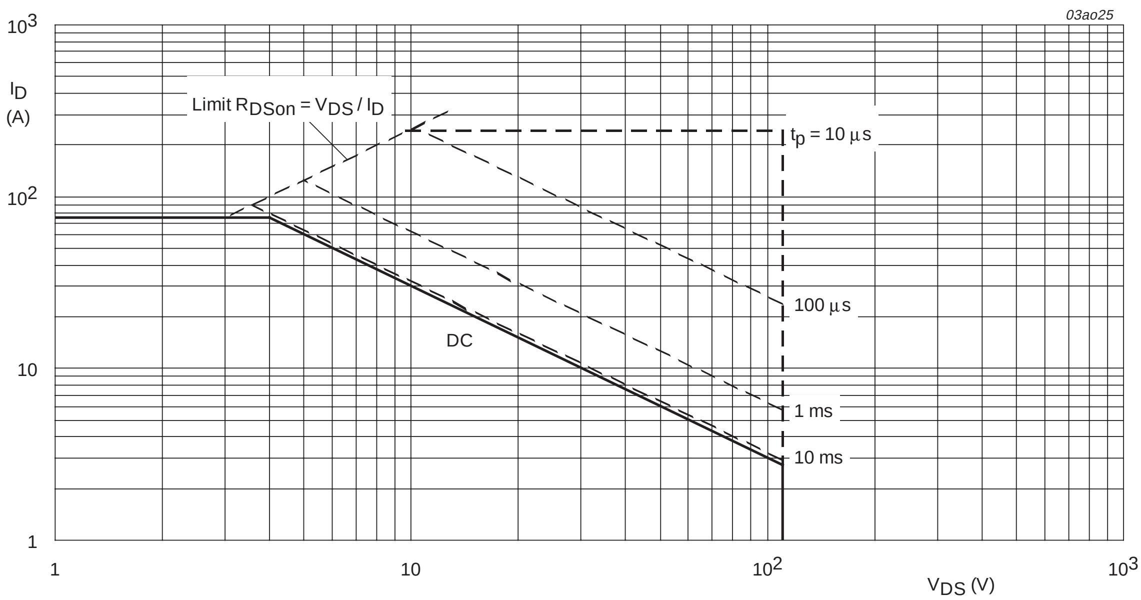

$$P_{der} = \frac{P_{tot}}{P_{tot(25^\circ C)}} \times 100\%$$

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




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

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




$T_{mb}$ = 25 °C; $I_{DM}$ is single pulse; $V_{GS}$ = 10 V.

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

# 5. Thermal characteristics

**Table 4: Thermal characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base | Figure 4 | - | - | 0.5 | K/W |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | vertical in still air | - | 60 | - | K/W |

## 5.1 Transient thermal impedance

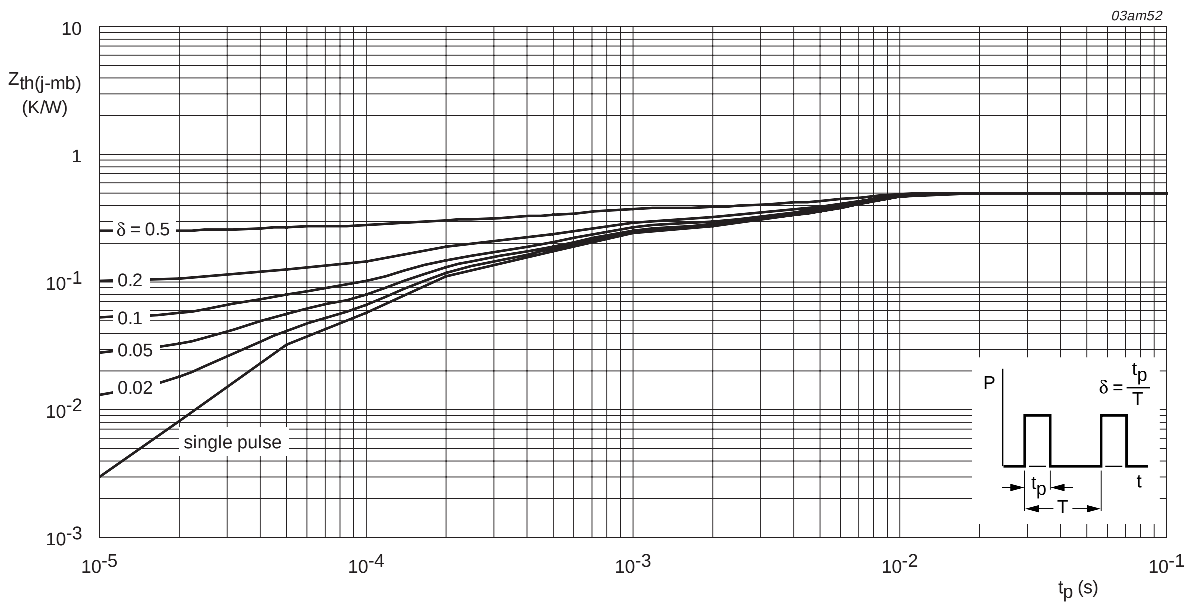


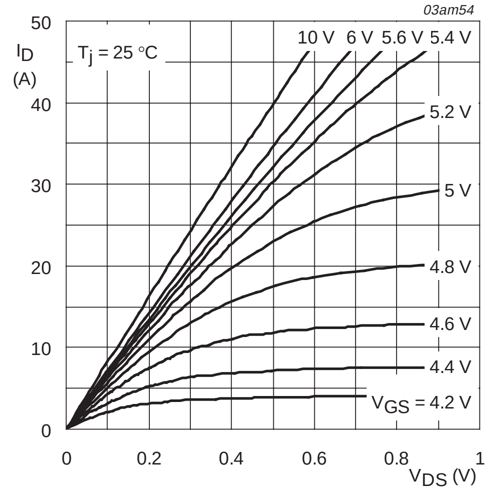

**Fig 4. Transient thermal impedance from junction to mounting base as a function of pulse duration.**

# 6. Characteristics

**Table 5: Characteristics**

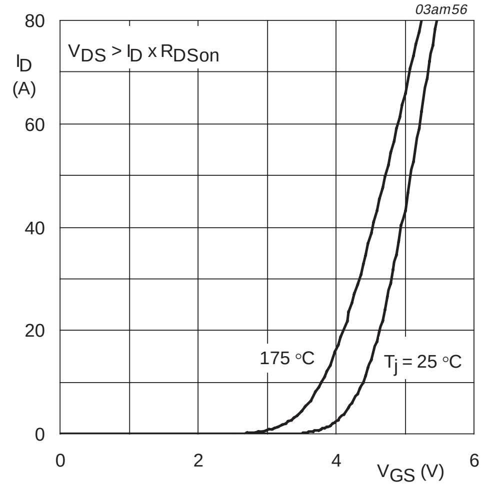
*$T_j$ = 25 °C unless otherwise specified*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $I_D$ = 250 µA; $V_{GS}$ = 0 V | | | | |
| | | $T_j$ = 25 °C | 110 | - | - | V |
| | | $T_j$ = –55 °C | 99 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$; Figure 9 | | | | |
| | | $T_j$ = 25 °C | 2 | 3 | 4 | V |
| | | $T_j$ = 175 °C | 1 | - | - | V |
| | | $T_j$ = –55 °C | - | - | 4.4 | V |
| $I_{DSS}$ | drain-source leakage current | $V_{DS}$ = 100 V; $V_{GS}$ = 0 V | | | | |
| | | $T_j$ = 25 °C | - | 0.05 | 10 | µA |
| | | $T_j$ = 175 °C | - | - | 500 | µA |
| $I_{GSS}$ | gate-source leakage current | $V_{GS}$ = ±20 V; $V_{DS}$ = 0 V | - | 2 | 100 | nA |
| $R_{DSon}$ | drain-source on-state resistance | $V_{GS}$ = 10 V; $I_D$ = 25 A; Figure 7 and 8 | | | | |
| | | $T_j$ = 25 °C | - | 12 | 15 | mΩ |
| | | $T_j$ = 175 °C | - | 32.4 | 40.5 | mΩ |
| **Dynamic characteristics** | | | | | | |
| $Q_{g(tot)}$ | total gate charge | $I_D$ = 75 A; $V_{DD}$ = 80 V; $V_{GS}$ = 10 V; Figure 13 | - | 90 | - | nC |
| $Q_{gs}$ | gate-source charge | | - | 20 | - | nC |
| $Q_{gd}$ | gate-drain (Miller) charge | | - | 35 | - | nC |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 25 V; f = 1 MHz; Figure 11 | - | 4900 | - | pF |
| $C_{oss}$ | output capacitance | | - | 390 | - | pF |
| $C_{rss}$ | reverse transfer capacitance | | - | 220 | - | pF |
| $t_{d(on)}$ | turn-on delay time | $V_{DD}$ = 50 V; $R_L$ = 1.8 Ω ; $V_{GS}$ = 10 V; $R_G$ = 5.6 Ω | - | 25 | - | ns |
| $t_r$ | rise time | | - | 65 | - | ns |
| $t_{d(off)}$ | turn-off delay time | | - | 95 | - | ns |
| $t_f$ | fall time | | - | 50 | - | ns |
| **Source-drain diode** | | | | | | |
| $V_{SD}$ | source-drain (diode forward) voltage | $I_S$ = 25 A; $V_{GS}$ = 0 V; Figure 12 | - | 0.8 | 1.1 | V |
| $t_{rr}$ | reverse recovery time | $I_S$ = 20 A; $dI_S/dt$ = –100 A/µs; $V_{GS}$ = 0 V | - | 80 | - | ns |
| $Q_r$ | recovered charge | | - | 115 | - | nC |



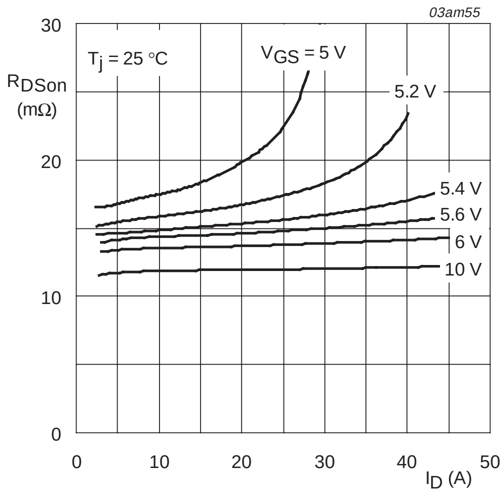

$T_j$ = 25 °C

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



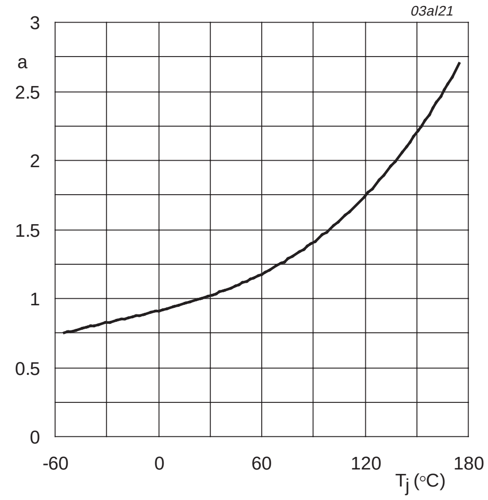

$T_j$ = 25 °C and 175 °C; $V_{DS} > I_D \times R_{DSon}$

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



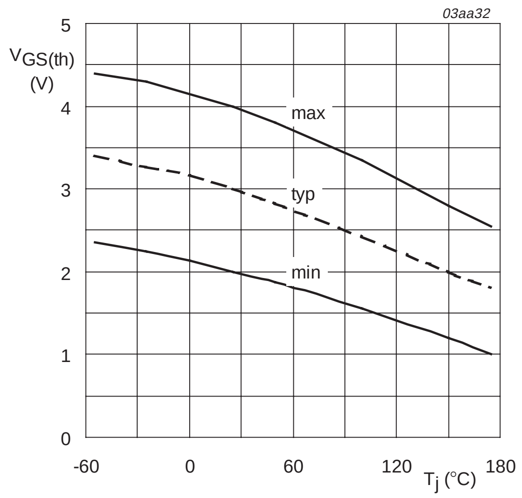

$T_j$ = 25 °C

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



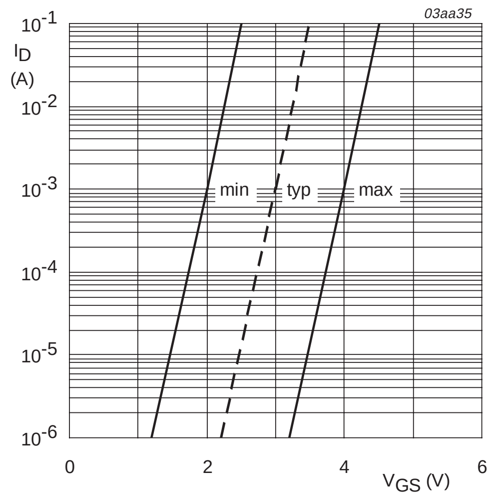

$$a = \frac{R_{DSon}}{R_{DSon(25^\circ C)}}$$

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



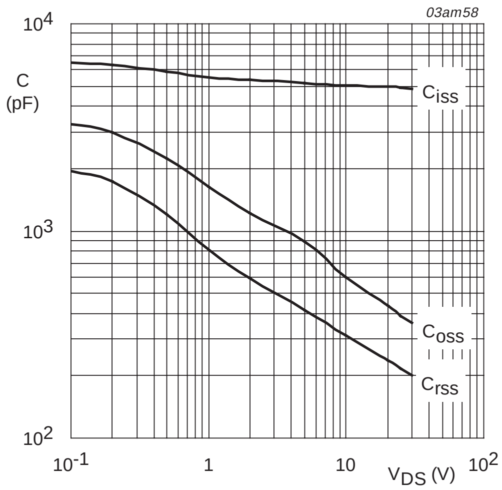

$I_D$ = 1 mA; $V_{DS}$ = $V_{GS}$

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



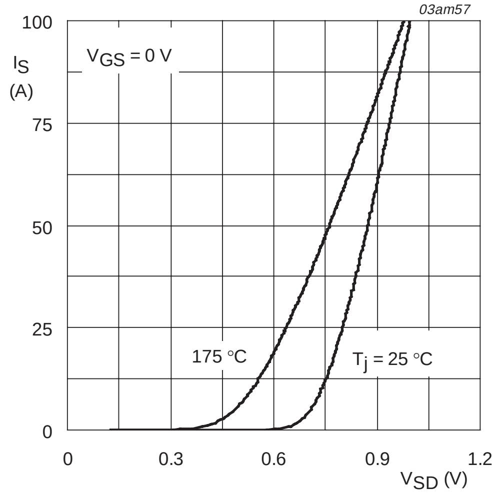

$T_j$ = 25 °C; $V_{DS}$ = 5 V

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



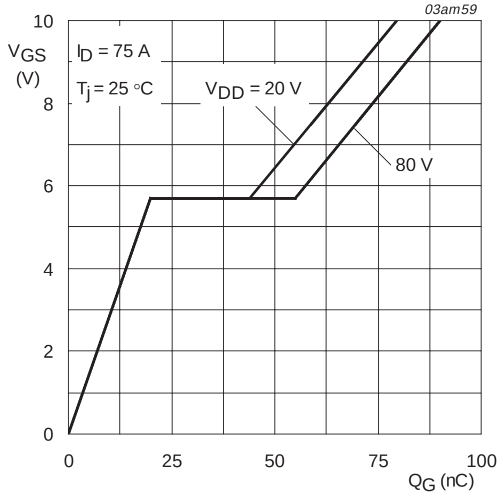

$V_{GS}$ = 0 V; f = 1 MHz

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




$T_j$ = 25 °C and 175 °C; $V_{GS}$ = 0 V

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

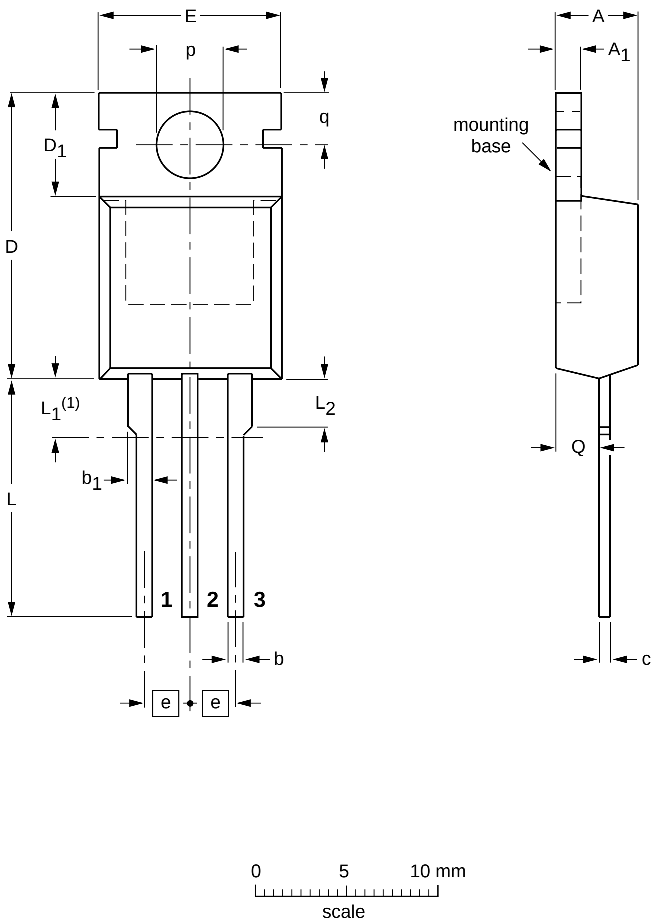



$I_D$ = 75 A; $V_{DD}$ = 20 V and 80 V

**Fig 13. Gate-source voltage as a function of gate charge; 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 | $b_1$ | c | D | $D_1$ | E | e | L | $L_1$(1) | $L_2$ max. | p | q | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 4.5<br>4.1 | 1.39<br>1.27 | 0.9<br>0.7 | 1.3<br>1.0 | 0.7<br>0.4 | 15.8<br>15.2 | 6.4<br>5.9 | 10.3<br>9.7 | 2.54 | 15.0<br>13.5 | 3.30<br>2.79 | 3.0 | 3.8<br>3.6 | 3.0<br>2.7 | 2.6<br>2.2 |

**Note**

1. Terminals in this zone are not tinned.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT78 | | 3-lead TO-220AB | SC-46 | | | ~~00-09-07~~<br>01-02-16 |

**Fig 14. SOT78 (TO-220AB).**

# 8. Revision history

**Table 6: Revision history**

| Rev | Date | CPCN | Description |
|---|---|---|---|
| 01 | 20040108 | HZG463a | Product data (9397 750 12544) |

## 9. Data sheet status

| Level | Data sheet status[1] | Product status[2][3] | Definition |
|---|---|---|---|
| I | 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. |
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[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.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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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





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