

BT1306-400D/600D

Logic level triac

Rev. 01 — 19 February 2004

Product data

1. Product profile

1.1 Description

Logic level sensitive gate triac intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

1.2 Features

- Sensitive gate in all four quadrants
- Low cost package.

1.3 Applications

- General purpose bidirectional switching
- Solid state relays
- Phase control applications
- Low power AC fan speed controllers.

1.4 Quick reference data

- $V_{DRM} \leq 600$ V (BT1306-600D)
- $V_{DRM} \leq 400$ V (BT1306-400D)
- $I_{TSM} \leq 8$ A
- $I_{T(RMS)} \leq 0.6$ A.

2. Pinning information

Table 1: Pinning - SOT54 (TO-92), simplified outline and symbol

| Pin | Description | Simplified outline | Symbol |
|-----|-----------------|--------------------|--------|
| 1 | main terminal 2 | | |
| 2 | gate | | |
| 3 | main terminal 1 | | |

MSB033

SOT54 (TO-92)

MBL305



PHILIPS

3. Ordering information

Table 2: Ordering information

| Type number | Package | | Version |
|-------------|---------|---|---------|
| | Name | Description | |
| BT1306-600D | TO-92 | Plastic single-ended leaded (through hole) package; 3 leads | SOT54 |
| BT1306-400D | TO-92 | Plastic single-ended leaded (through hole) package; 3 leads | SOT54 |

4. Limiting values

Table 3: Limiting values

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

| Symbol | Parameter | Conditions | Min | Max | Unit | |
|---------------------|--|--|--|------|------------------------|---|
| V_{DRM} | repetitive peak off-state voltage | | | | | |
| | | BT1306-600D | $25\text{ °C} \leq T_j \leq 125\text{ °C}$ | - | 600 | V |
| | | BT1306-400D | | - | 400 | V |
| $I_{\text{T(RMS)}}$ | on-state current (RMS value) | full sine wave; $T_{\text{lead}} \leq 65\text{ °C}$; Figure 1 and 2 | - | 0.6 | A | |
| I_{TSM} | non-repetitive peak on-state current | full sine wave; $T_j = 25\text{ °C}$ prior to surge; Figure 3 and 4 | | | | |
| | | $t = 20\text{ ms}$ | - | 8 | A | |
| | | $t = 16.7\text{ ms}$ | - | 8.8 | A | |
| I^2t | I^2t for fusing | $t = 10\text{ ms}$ | - | 0.32 | A^2s | |
| di_{T}/dt | repetitive rate of rise of on-state current after triggering | $I_{\text{TM}} = 1\text{ A}$; $I_{\text{G}} = 0.2\text{ A}$; $di_{\text{G}}/dt = 0.2\text{ A}/\mu\text{s}$ | | | | |
| | | T2+ G+ | - | 50 | $\text{A}/\mu\text{s}$ | |
| | | T2+ G- | - | 50 | $\text{A}/\mu\text{s}$ | |
| | | T2- G- | - | 50 | $\text{A}/\mu\text{s}$ | |
| | | T2- G+ | - | 10 | $\text{A}/\mu\text{s}$ | |
| I_{GM} | gate current (peak value) | $t = 2\text{ }\mu\text{s max}$ | - | 1 | A | |
| V_{GM} | gate voltage (peak value) | | - | 5 | V | |
| P_{GM} | gate power (peak value) | | - | 5 | W | |
| $P_{\text{G(AV)}}$ | average gate power | $t = 2\text{ }\mu\text{s max}$; $T_{\text{case}} \leq 80\text{ °C}$ | - | 0.1 | W | |
| T_{stg} | storage temperature | | -40 | +150 | $^{\circ}\text{C}$ | |
| T_j | junction temperature | | -40 | +125 | $^{\circ}\text{C}$ | |

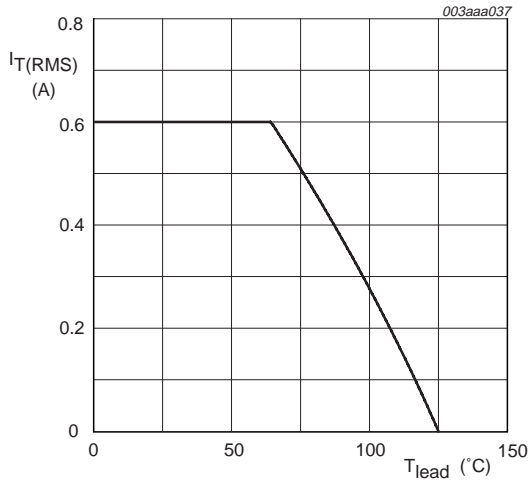
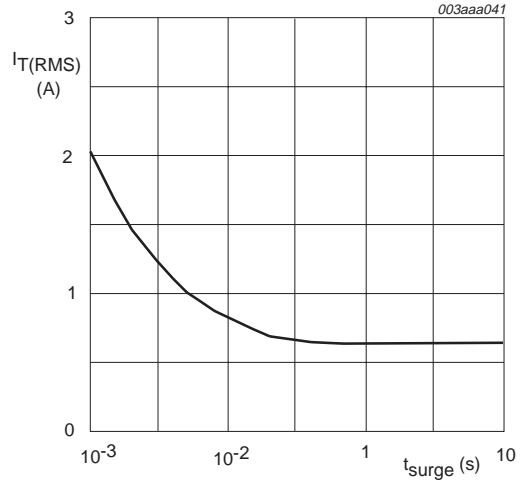
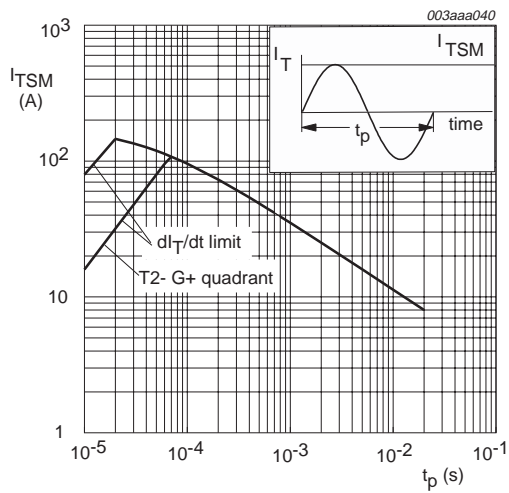


Fig 1. Maximum permissible on-state current (RMS value) as a function of lead temperature.



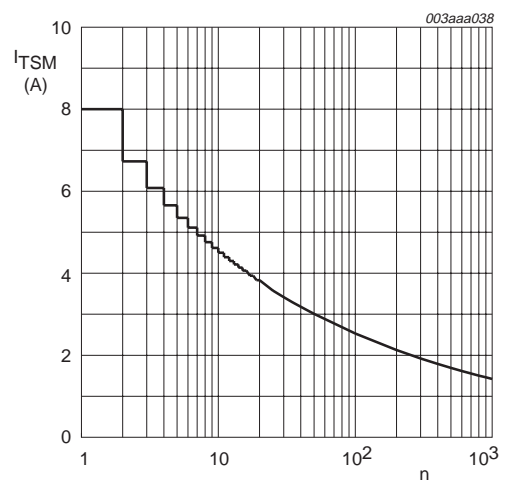
$f = 50 \text{ Hz}$
 $T_{\text{lead}} \leq 65 \text{ }^{\circ}\text{C}$

Fig 2. Maximum permissible repetitive on-state current (RMS value) as a function of surge duration for sinusoidal currents.



$t_p \leq 20 \text{ ms}$
 initial $T_j \leq 25 \text{ }^{\circ}\text{C}$

Fig 3. Maximum permissible non-repetitive peak on-state current as a function of pulse width for sinusoidal currents.



$n = \text{number of cycles}$
 $f = 50 \text{ Hz}$
 initial $T_j \leq 25 \text{ }^{\circ}\text{C}$

Fig 4. Maximum permissible non-repetitive peak on-state current as a function of number of cycles for sinusoidal currents; typical values.

5. Thermal characteristics

Table 4: Thermal characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|---|---|-----|-----|-----|------|
| $R_{th(j-lead)}$ | thermal resistance from junction to lead | full cycle | - | - | 60 | K/W |
| | | half cycle | | | 80 | |
| $R_{th(j-a)}$ | thermal resistance from junction to ambient | mounted on a printed-circuit board; lead length = 4 mm; Figure 5 | - | 150 | - | K/W |

5.1 Transient thermal impedance

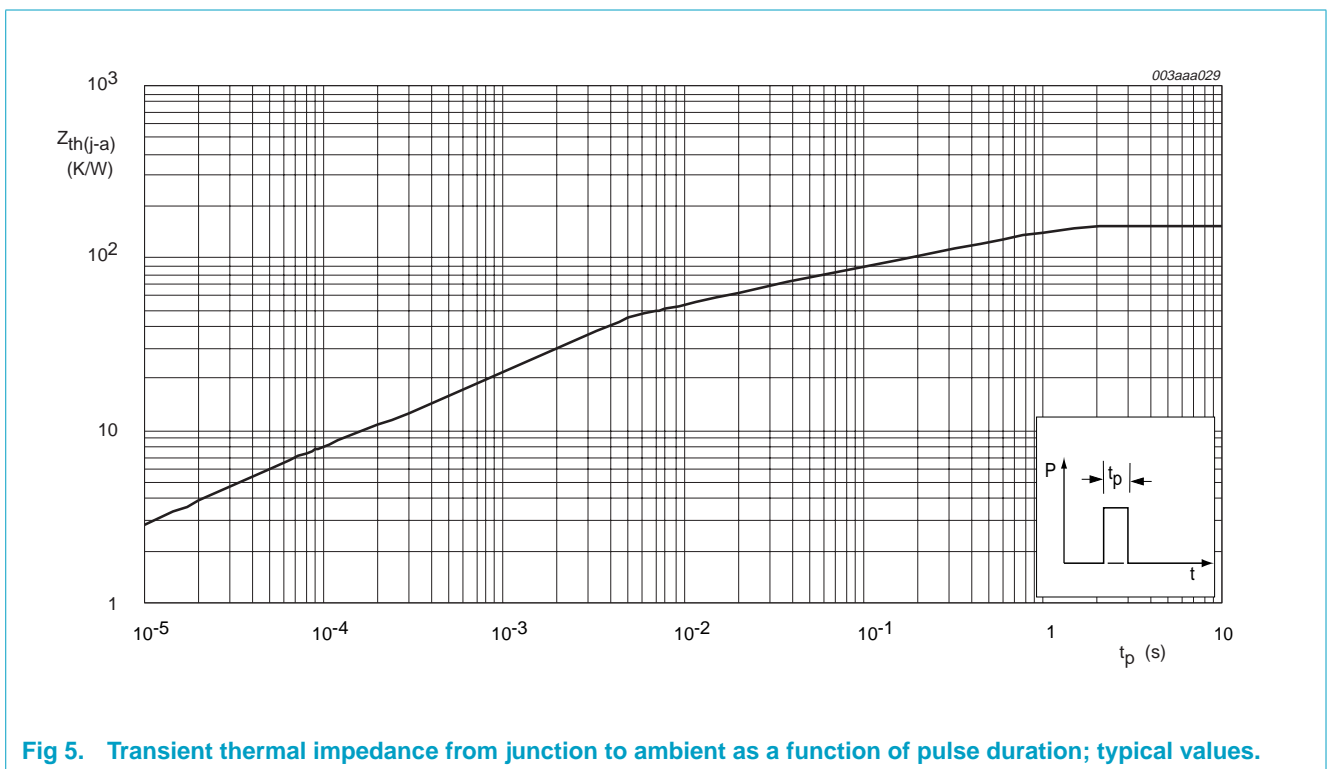


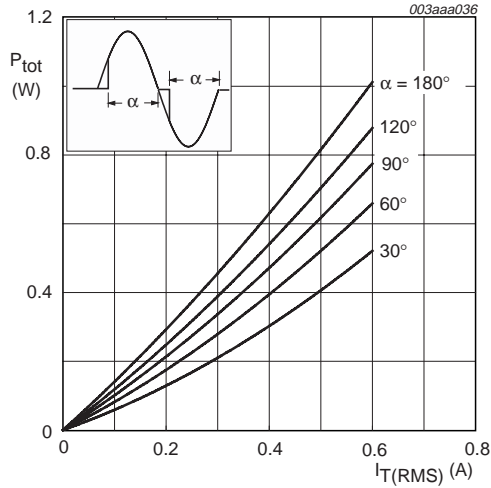
Fig 5. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values.

6. Characteristics

Table 5: Characteristics

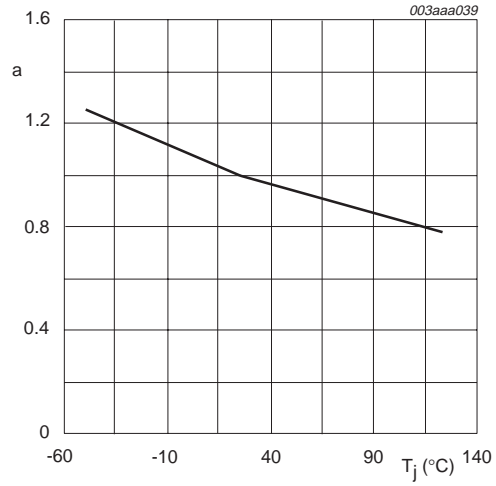
$T_j = 25\text{ °C}$ unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------------------------------|--|---|-----|-----|-----|------------------------|
| Static characteristics | | | | | | |
| I_{GT} | gate trigger current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 8 | | | | |
| | | T2+ G+ | - | 1 | 5 | mA |
| | | T2+ G- | - | 2 | 5 | mA |
| | | T2- G- | - | 2 | 5 | mA |
| | | T2- G+ | - | 4 | 7 | mA |
| I_L | latching current | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 9 | | | | |
| | | T2+ G+ | - | 1 | 10 | mA |
| | | T2+ G- | - | 5 | 10 | mA |
| | | T2- G- | - | 1 | 10 | mA |
| | | T2- G+ | - | 2 | 10 | mA |
| I_H | holding current | $V_D = 12\text{ V}$; $I_{GT} = 0.1\text{ A}$; Figure 10 | - | 1 | 10 | mA |
| V_T | on-state voltage | $I_T = 0.85\text{ A}$; Figure 11 | - | 1.4 | 1.9 | V |
| V_{GT} | gate trigger voltage | $V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; Figure 7 | - | 0.9 | 2 | V |
| | | $V_D = V_{DRM}$; $I_T = 0.1\text{ A}$; $T_j = 110\text{ °C}$ | 0.1 | 0.7 | - | V |
| I_D | off-state leakage current | $V_D = V_{DRM(max)}$; $T_j = 110\text{ °C}$ | - | 3 | 100 | μA |
| Dynamic characteristics | | | | | | |
| dV_D/dt | critical rate of rise of off-state voltage | $V_D = 67\%$ of $V_{DM(max)}$; $T_{case} = 110\text{ °C}$; exponential waveform; gate open circuit; Figure 12 | 30 | 45 | - | $\text{V}/\mu\text{s}$ |
| dV_{com}/dt | critical rate of rise of commutation voltage | $V_D = \text{rated } V_{DM}$; $T_{case} = 50\text{ °C}$; $I_{TM} = 0.84\text{ A}$; commutating $di/dt = 0.3\text{ A/ms}$ | - | 5 | - | $\text{V}/\mu\text{s}$ |
| t_{gt} | gate controlled turn-on time | $I_{TM} = 1.0\text{ A}$; $V_D = V_{DRM(max)}$; $I_G = 25\text{ mA}$; $di_G/dt = 5\text{ A}/\mu\text{s}$ | - | 2 | - | μs |



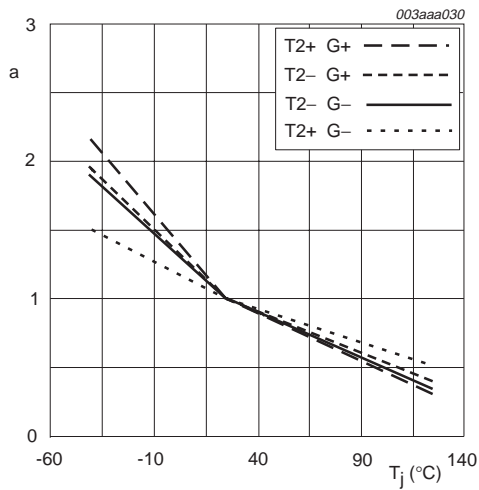
α = conduction angle

Fig 6. On-state dissipation as a function of on-state current (RMS value); maximum values.



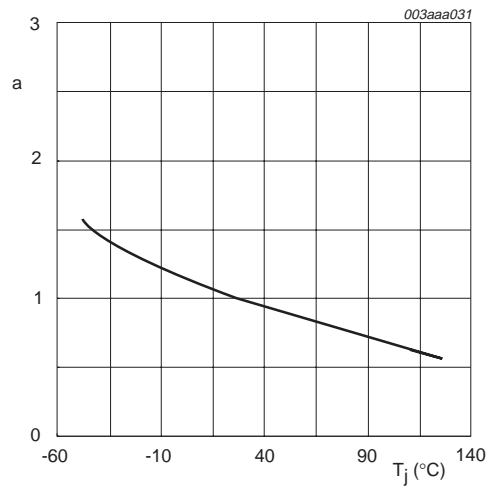
$$a = \frac{V_{GT}(T_j)}{V_{GT}(25^\circ C)}$$

Fig 7. Normalized gate trigger voltage as a function of junction temperature; typical values.



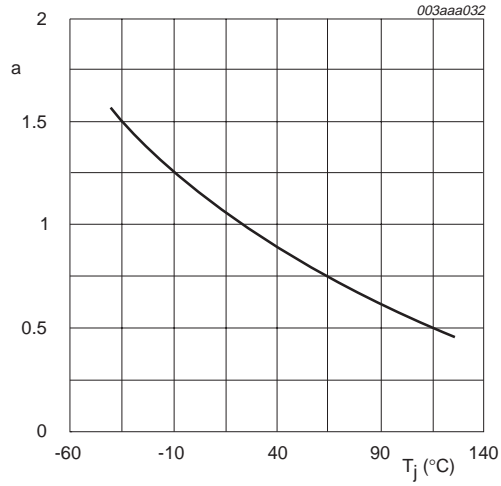
$$a = \frac{I_{GT}(T_j)}{I_{GT}(25^\circ C)}$$

Fig 8. Normalized gate trigger current as a function of junction temperature; typical values.



$$a = \frac{I_L(T_j)}{I_L(25^\circ C)}$$

Fig 9. Normalized latching current as a function of junction temperature; typical values.



$$a = \frac{I_H(T_j)}{I_H(25^\circ\text{C})}$$

Fig 10. Normalized holding current as a function of junction temperature; typical values

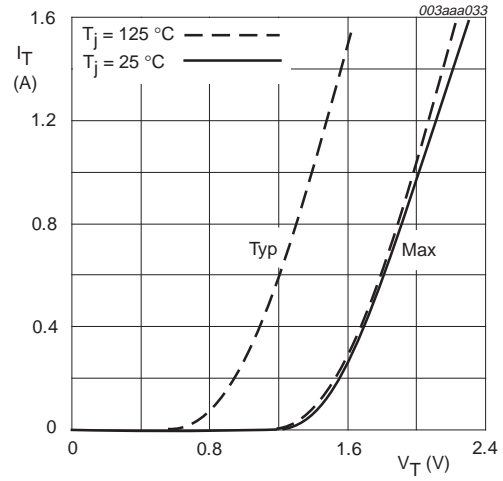


Fig 11. On-state current as a function of on-state voltage; typical and maximum values.

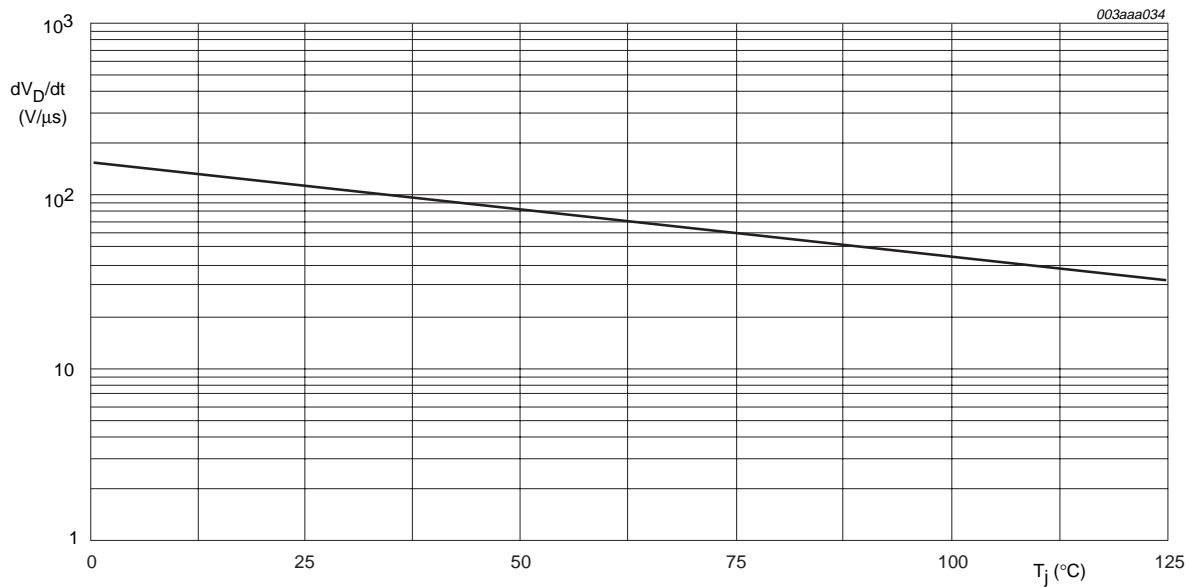


Fig 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values.

7. Package outline

Plastic single-ended leaded (through hole) package; 3 leads

SOT54

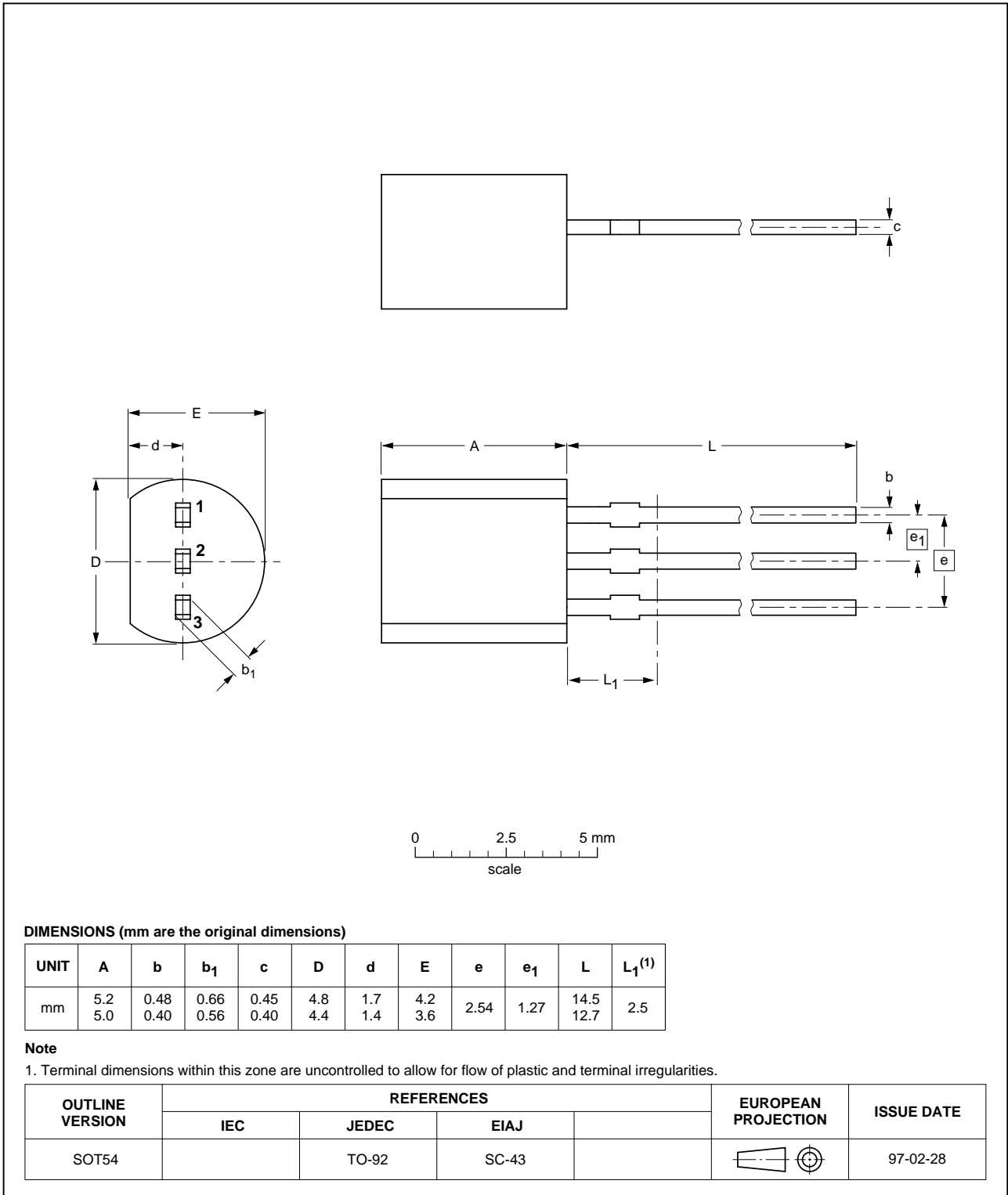


Fig 13. SOT54 (TO-92).

8. Revision history

Table 6: Revision history

| Rev | Date | CPCN | Description |
|-----|----------|------|-------------------------------|
| 01 | 20040219 | - | Product data (9397 750 12593) |

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. |
| II | 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. |
| III | 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. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[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>.

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

10. 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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

11. Disclaimers

Life support — These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products - including circuits, standard cells, and/or software - described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no licence or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Contact information

For additional information, please visit <http://www.semiconductors.philips.com>.

For sales office addresses, send e-mail to: sales.addresses@www.semiconductors.philips.com.

Fax: +31 40 27 24825

Contents

| | | |
|-----------|--------------------------------------|-----------|
| 1 | Product profile | 1 |
| 1.1 | Description | 1 |
| 1.2 | Features | 1 |
| 1.3 | Applications | 1 |
| 1.4 | Quick reference data | 1 |
| 2 | Pinning information | 1 |
| 3 | Ordering information | 2 |
| 4 | Limiting values | 2 |
| 5 | Thermal characteristics | 4 |
| 5.1 | Transient thermal impedance | 4 |
| 6 | Characteristics | 5 |
| 7 | Package outline | 8 |
| 8 | Revision history | 9 |
| 9 | Data sheet status | 10 |
| 10 | Definitions | 10 |
| 11 | Disclaimers | 10 |

© Koninklijke Philips Electronics N.V. 2004.
Printed in The Netherlands

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Date of release: 19 February 2004

Document order number: 9397 750 12593



PHILIPS

Let's make things better.