

# CBT3125

## Quadruple FET bus switch

Rev. 2 — 1 October 2018

Product data sheet

### 1. General description

The CBT3125 quadruple FET bus switch features independent line switches. Each switch is disabled when the associated output enable ( $\overline{nOE}$ ) input is HIGH.

### 2. Features and benefits

- Standard '125'-type pinout
- 5  $\Omega$  switch connection between two ports
- TTL-compatible input levels
- Latch-up performance exceeds 500 mA per JESD78
- ESD protection:
  - HBM JESD22-A114 exceeds 2000 V
  - MM JESD22-A115 exceeds 200 V
  - CDM JESD22-C101 exceeds 1000 V

### 3. Ordering information

Table 1. Ordering information

| Type number | Package           |         |   |          |
|-------------|-------------------|---------|---|----------|
|             | Temperature range | Name    | Description   | Version  |
| CBT3125D    | -40 °C to +85 °C  | SO14    | plastic small outline package; 14 leads;<br>body width 3.9 mm             | SOT108-1 |
| CBT3125DB   | -40 °C to +85 °C  | SSOP14  | plastic shrink small outline package; 14 leads;<br>body width 5.3 mm      | SOT337-1 |
| CBT3125PW   | -40 °C to +85 °C  | TSSOP14 | plastic thin shrink small outline package; 14 leads;<br>body width 4.4 mm | SOT402-1 |

## 4. Functional diagram

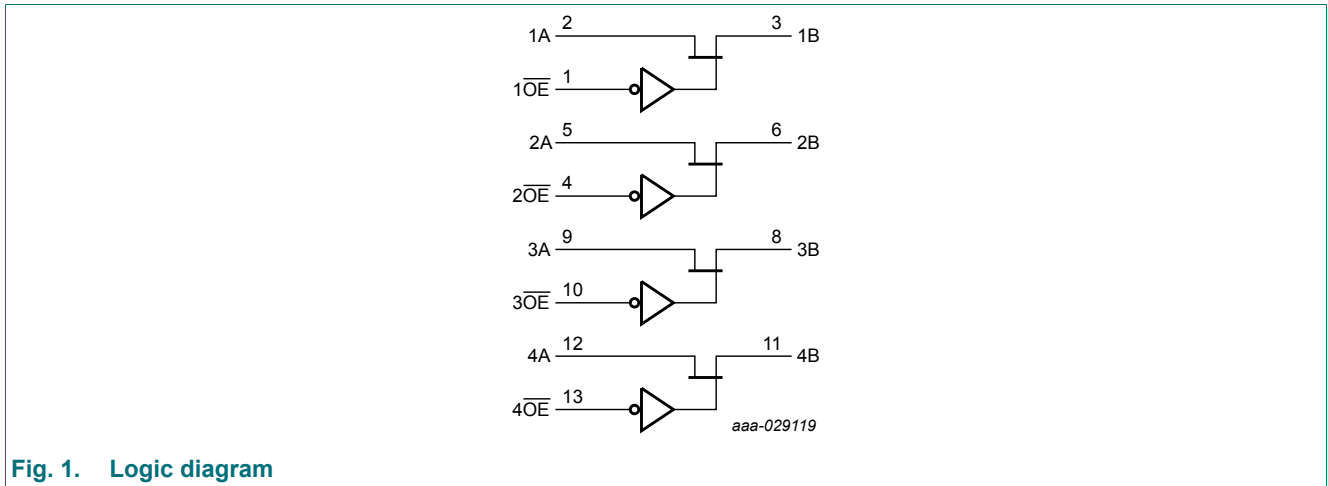


Fig. 1. Logic diagram

## 5. Pinning information

### 5.1. Pinning

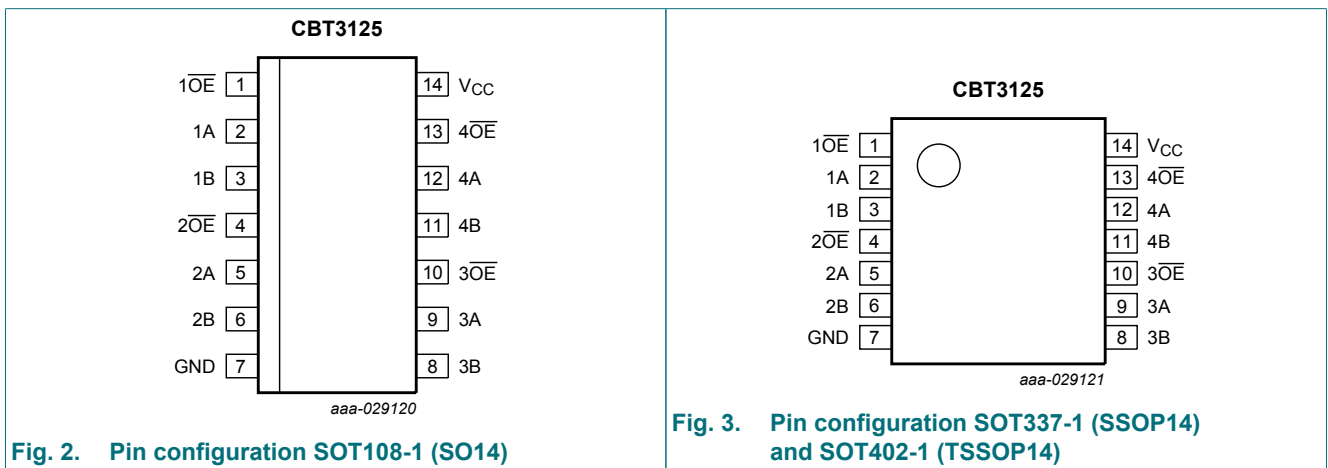


Fig. 2. Pin configuration SOT108-1 (SO14)

Fig. 3. Pin configuration SOT337-1 (SSOP14) and SOT402-1 (TSSOP14)

### 5.2. Pin description

Table 2. Pin description

| Symbol             | Pin          | Description                      |
|--------------------|--------------|----------------------------------|
| 1OE, 2OE, 3OE, 4OE | 1, 4, 10, 13 | output enable input (active LOW) |
| 1A, 2A, 3A, 4A     | 2, 5, 9, 12  | data input                       |
| 1B, 2B, 3B, 4B     | 3, 6, 8, 11  | data output                      |
| GND                | 7            | ground (0 V)                     |
| V <sub>CC</sub>    | 14           | supply voltage                   |

## 6. Functional description

**Table 3. Function table**

*H = HIGH voltage level; L = LOW voltage level.*

| Output enable input $\overline{nOE}$ | Function switch        |
|--------------------------------------|------------------------|
| L                                    | ON-state ( $nA = nB$ ) |
| H                                    | OFF-state              |

## 7. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134);  $T_{amb} = -40\text{ °C}$  to  $+85\text{ °C}$ .*

| Symbol    | Parameter              | Conditions             | Min  | Max  | Unit |
|-----------|------------------------|------------------------|------|------|------|
| $V_{CC}$  | supply voltage         |                        | -0.5 | +7.0 | V    |
| $V_I$     | input voltage          | [1]                    | -0.5 | +7.0 | V    |
| $I_O$     | output current         |                        | -    | 128  | mA   |
| $I_{IK}$  | input clamping current | $V_{I/O} < 0\text{ V}$ | -    | -50  | mA   |
| $T_{stg}$ | storage temperature    |                        | -65  | +150 | °C   |

[1] The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

## 8. Recommended operating conditions

**Table 5. Operating conditions**

| Symbol    | Parameter           | Conditions            | Min | Typ | Max | Unit |
|-----------|---------------------|-----------------------|-----|-----|-----|------|
| $V_{CC}$  | supply voltage      | [1]                   | 4.5 | -   | 5.5 | V    |
| $T_{amb}$ | ambient temperature | operating in free air | -40 | -   | +85 | °C   |

[1] All unused control inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation.

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                          | Conditions  | Min | Typ [1] | Max     | Unit          |
|-----------------|------------------------------------|---|-----|---------|---------|---------------|
| $V_{IH}$        | HIGH-level input voltage           | $n\overline{OE}$  | 2.0 | -       | -       | V             |
| $V_{IL}$        | LOW-level input voltage            | $n\overline{OE}$  | -   | -       | 0.8     | V             |
| $V_{IK}$        | input clamping voltage             | $V_{CC} = 4.5\text{ V}; I_I = -18\text{ mA}$  | -   | -       | -1.2    | V             |
| $I_I$           | input leakage current              | $V_{CC} = 5.5\text{ V}; V_I = \text{GND or } 5.5\text{ V}$  | -   | -       | $\pm 1$ | $\mu\text{A}$ |
| $I_{CC}$        | supply current                     | $V_{CC} = 5.5\text{ V}; I_O = 0\text{ mA}; V_I = V_{CC}\text{ or GND}$  | -   | -       | 3       | $\mu\text{A}$ |
| $\Delta I_{CC}$ | additional supply current          | $n\overline{OE}$ ; per input pin; $V_{CC} = 5.5\text{ V}$ ; one input at 3.4 V, other inputs at $V_{CC}$ or GND [2] | -   | -       | 2.5     | mA            |
| $V_{pass}$      | pass voltage                       | $V_I = V_{CC} = 5.0\text{ V}$   | -   | 3.8     | -       | V             |
| $C_I$           | input capacitance                  | $n\overline{OE}$ ; $V_I = 3\text{ V or } 0\text{ V}$  | -   | 1.7     | -       | pF            |
| $C_{io(off)}$   | off-state input/output capacitance | $V_O = 3\text{ V or } 0\text{ V}; n\overline{OE} = V_{CC}$  | -   | 3.4     | -       | pF            |
| $R_{ON}$        | ON resistance                      | $V_{CC} = 4.5\text{ V}; V_I = 0\text{ V}; I_I = 64\text{ mA}$ [3]   | -   | 5       | 7       | $\Omega$      |
|                 |                                    | $V_{CC} = 4.5\text{ V}; V_I = 0\text{ V}; I_I = 30\text{ mA}$ [3]   | -   | 5       | 7       | $\Omega$      |
|                 |                                    | $V_{CC} = 4.5\text{ V}; V_I = 2.4\text{ V}; I_I = -15\text{ mA}$ [3]  | -   | 10      | 15      | $\Omega$      |

[1] All typical values are measured at  $V_{CC} = 5\text{ V}$ , unless otherwise noted,  $T_{amb} = 25\text{ }^\circ\text{C}$ .

[2] This is the increase in supply current for each input that is at the specified TTL voltage level rather than  $V_{CC}$  or GND.

[3] Measured by the voltage level between the nA and the nB terminals at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (nA, nB) terminals.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

At recommended operating conditions; Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 6.

| Symbol    | Parameter         | Conditions   | Min | Typ | Max  | Unit |
|-----------|-------------------|--|-----|-----|------|------|
| $t_{pd}$  | propagation delay | nA to nB; nB to nA; see Fig. 4 [1] [2]                         | -   | -   | 0.25 | ns   |
| $t_{en}$  | enable time       | $n\overline{OE}$ to nA; $n\overline{OE}$ to nB; see Fig. 5 [2] | 1.0 | -   | 5.4  | ns   |
| $t_{dis}$ | disable time      | $n\overline{OE}$ to nA; $n\overline{OE}$ to nB; see Fig. 5 [2] | 1.0 | -   | 4.7  | ns   |

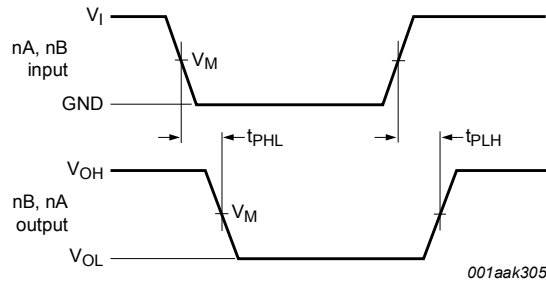
[1] The propagation delay is the calculated RC time constant of the typical ON resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

$t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ .

$t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ .

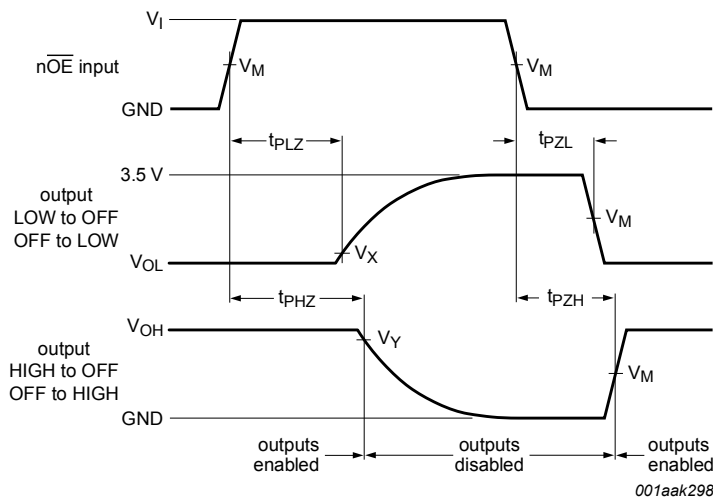
10.1. Waveforms and test circuit



Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 4. The data input (nA, nB) to output (nB, nA) propagation delay times



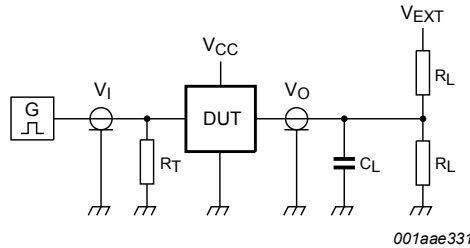
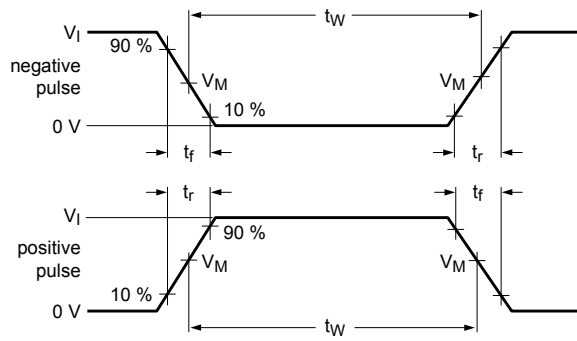
Measurement points are given in [Table 8](#).

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 5. Enable and disable times

Table 8. Measurement points

| Supply voltage                           | Input        |       | Output |                         |                         |
|--|--------------|-------|--------|-------------------------|-------------------------|
| $V_{CC}$                                 | $V_I$        | $V_M$ | $V_M$  | $V_X$                   | $V_Y$                   |
| $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | GND to 3.0 V | 1.5 V | 1.5 V  | $V_{OL} + 0.3\text{ V}$ | $V_{OH} - 0.3\text{ V}$ |



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Test data is given in [Table 9](#).

The outputs are measured one at a time with one transition per measurement.

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator ( $Z_o = 50 \Omega$ ).

$V_{EXT}$  = External voltage for measuring switching times.

**Fig. 6. Test circuit for measuring switching times**

**Table 9. Test data**

| Supply voltage                             | Input        |                       |                       | Load  |              | $V_{EXT}$          |                    |                    |
|--|--------------|-----------------------|-----------------------|-------|--------------|--------------------|--------------------|--------------------|
|  | $V_I$        | $t_r, t_f$            | $f_{max}$             | $C_L$ | $R_L$        | $t_{PLH}, t_{PHL}$ | $t_{PLZ}, t_{PZL}$ | $t_{PHZ}, t_{PZH}$ |
| $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | GND to 3.0 V | $\leq 2.5 \text{ ns}$ | $\leq 10 \text{ MHz}$ | 50 pF | 500 $\Omega$ | open               | 7.0 V              | open               |

# 11. Package outline

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

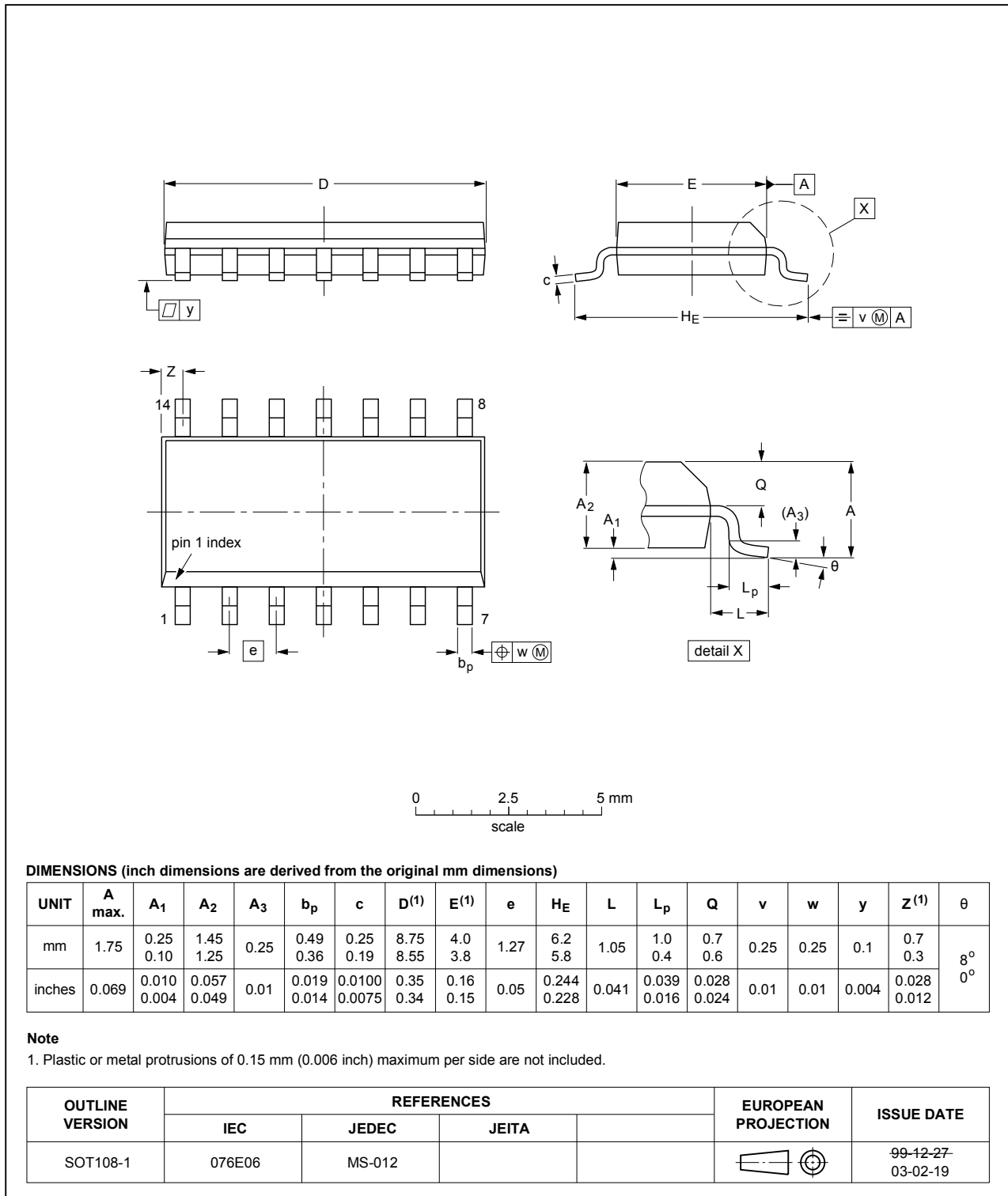


Fig. 7. Package outline SOT108-1 (SO14)

SSOP14: plastic shrink small outline package; 14 leads; body width 5.3 mm

SOT337-1

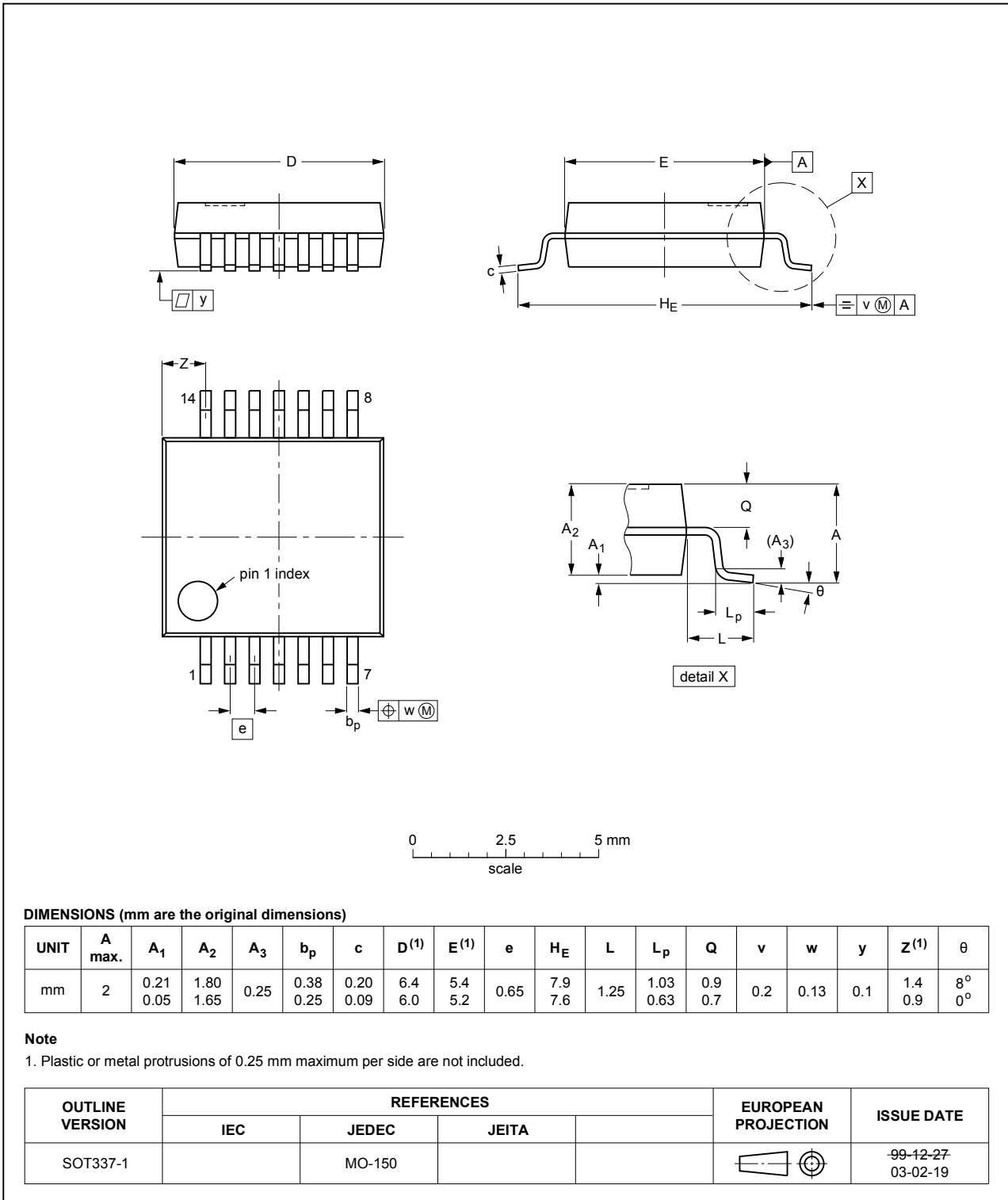


Fig. 8. Package outline SOT337-1 (SSOP14)



TSSOP14: plastic thin shrink small outline package; 14 leads; body width 4.4 mm

SOT402-1

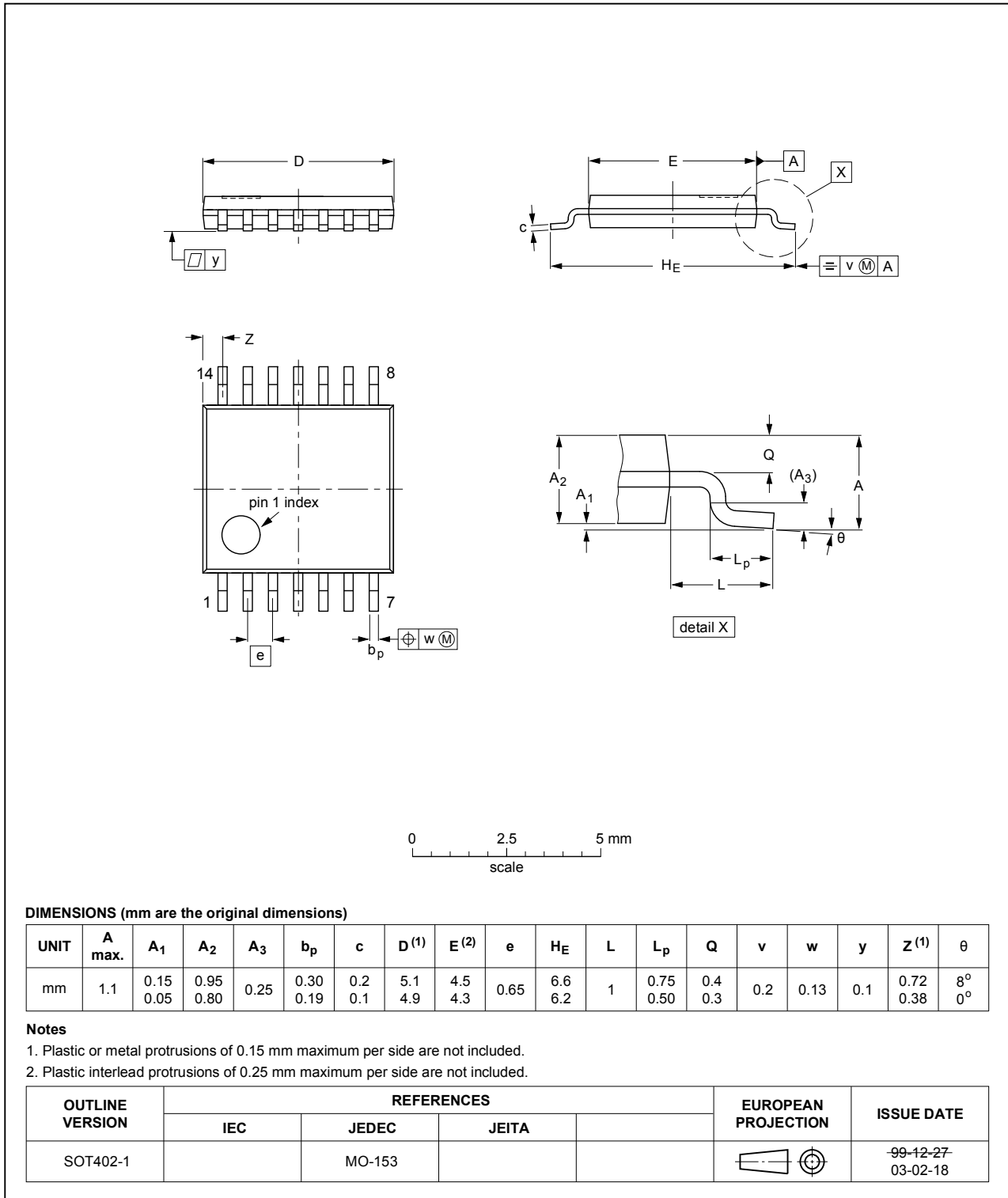


Fig. 9. Package outline SOT402-1 (TSSOP14)

## 12. Abbreviations

Table 10. Abbreviations

| Acronym | Description                 |
|---------|-----------------------------|
| CDM     | Charged Device Model        |
| DUT     | Device Under Test           |
| ESD     | ElectroStatic Discharge     |
| FET     | Field-Effect Transistor     |
| HBM     | Human Body Model            |
| MM      | Machine Model               |
| TTL     | Transistor-Transistor Logic |

## 13. Revision history

Table 11. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes  |
|----------------|--|--------------------|---------------|-------------|
| CBT3125 v.2    | 20181001   | Product data sheet | -             | CBT3125 v.1 |
| Modifications: | <ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number CBT3125DS (SOT519-1) removed.</li> </ul> |                    |               |             |
| CBT3125 v.1    | 20011212   | Product data sheet | -             | -           |

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| 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.                                     |

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- [2] The term 'short data sheet' is explained in section "Definitions".
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