

# 74ABT657

Octal transceiver with parity generator/checker; 3-state

Rev. 03 — 15 March 2010

Product data sheet

## 1. General description

The 74ABT657 high-performance BiCMOS device combines low static and dynamic power dissipation with high speed and high output drive.

The 74ABT657 is an octal transceiver featuring non-inverting buffers with 3-state outputs and an 8-bit parity generator/checker, and is intended for bus-oriented applications. The buffers have a guaranteed current sinking capability of 64 mA. The Transmit/Receive input (pin T/R) determines the direction of the data flow through the bidirectional transceivers. Transmit (active HIGH) enables data from A ports to B ports; Receive (active LOW) enables data from B ports to A ports.

When Output Enable input (pin  $\overline{OE}$ ) is HIGH, both A and B ports are high-impedance. The parity select input (pin ODD/ $\overline{EVEN}$ ) allows the user to generate either an odd or even parity output, depending on the system. Pin PARITY is an output from the generator/checker when transmitting from port A to port B (pin T/ $\overline{R}$  = HIGH) and an input when receiving from port B to port A port (pin T/ $\overline{R}$  = LOW).

In transmit mode (pin T/ $\overline{R}$  = HIGH) port A is polled to determine the number of HIGH inputs on port A. Pin PARITY output goes to the logic state determined by the setting of pin ODD/ $\overline{EVEN}$  and by the number of HIGH inputs on port A. For example, if pin ODD/ $\overline{EVEN}$  is set LOW (even parity) and the number of HIGH inputs on port A is odd, pin PARITY output goes HIGH, transmitting even parity. If the number of HIGH inputs on port A is even, pin PARITY output goes LOW, keeping even parity.

In receive mode (pin T/ $\overline{R}$  = LOW) port B is polled to determine the number of HIGH inputs on port B. If pin ODD/ $\overline{EVEN}$  is LOW (even parity) and the number of HIGH inputs on port B is:

- Odd and pin PARITY input is HIGH, pin  $\overline{ERROR}$  is HIGH, indicating no error
- Even and pin PARITY input is HIGH, pin  $\overline{ERROR}$  goes LOW, indicating an error

## 2. Features and benefits

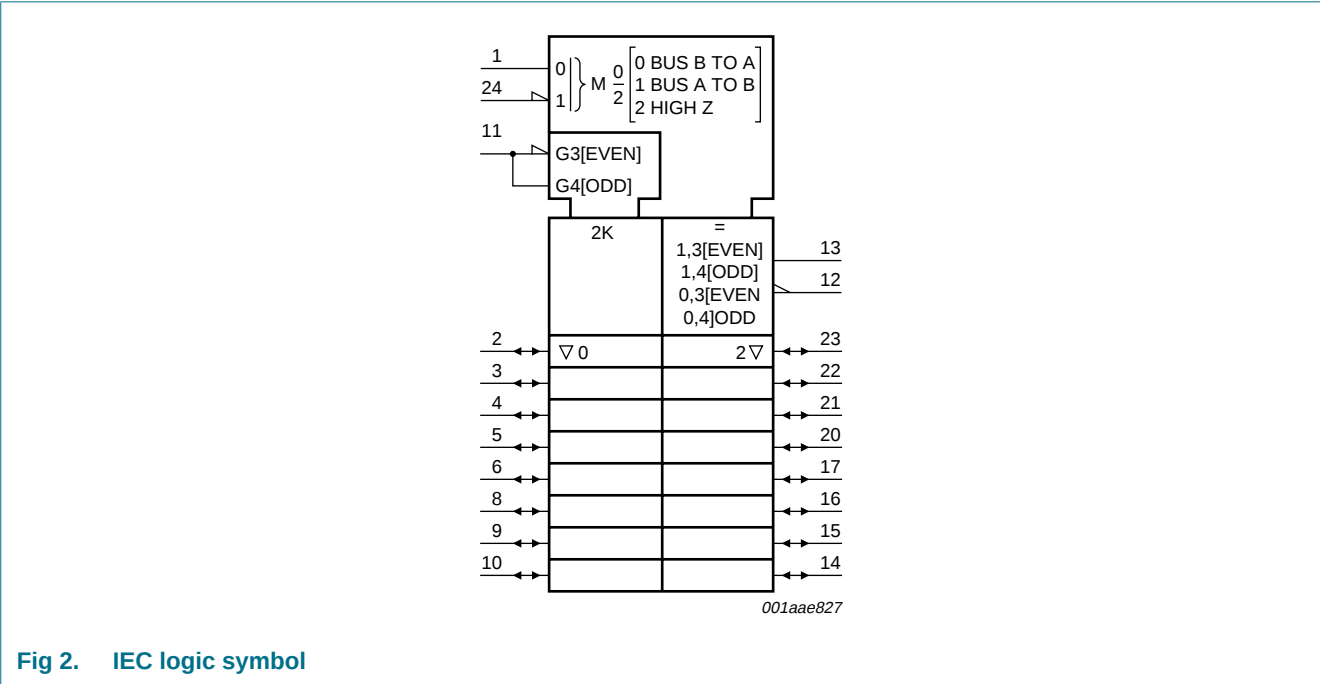
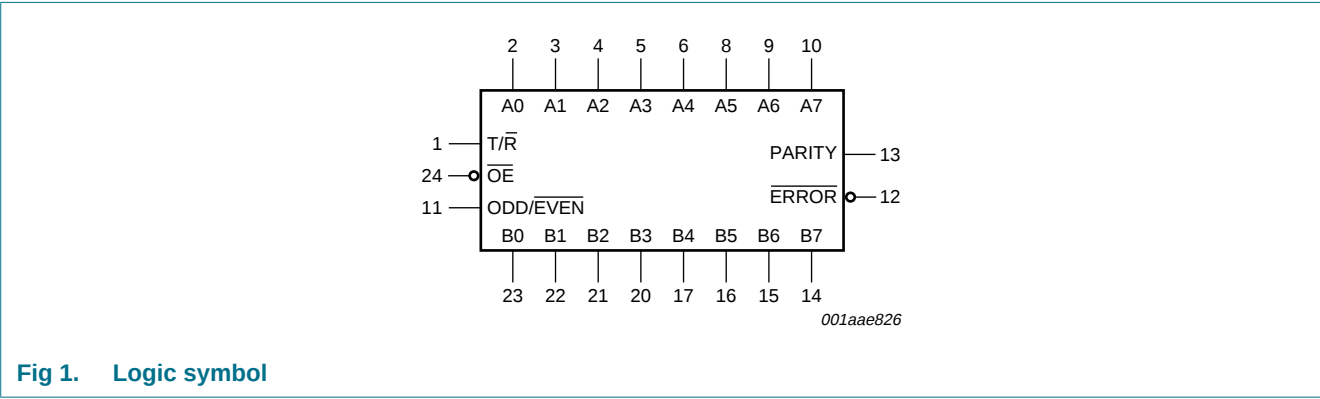
- Combinational functions in one package
- Low static and dynamic power dissipation with high speed and high output drive
- Output capability: +64 mA and –32 mA
- Power-up 3-state
- Latch-up protection exceeds 500 mA per JESD78B class II level A
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V



3. Ordering information

| Type number | Package           |         |                                                                        |          |
|-------------|-------------------|---------|------------------------------------------------------------------------|----------|
|             | Temperature range | Name    | Description                                                            | Version  |
| 74ABT657D   | −40 °C to +85 °C  | SO24    | plastic small outline package; 24 leads; body width 7.5 mm             | SOT137-1 |
| 74ABT657DB  | −40 °C to +85 °C  | SSOP24  | plastic shrink small outline package; 24 leads; body width 5.3 mm      | SOT340-1 |
| 74ABT657PW  | −40 °C to +85 °C  | TSSOP24 | plastic thin shrink small outline package; 24 leads; body width 4.4 mm | SOT355-1 |

4. Functional diagram



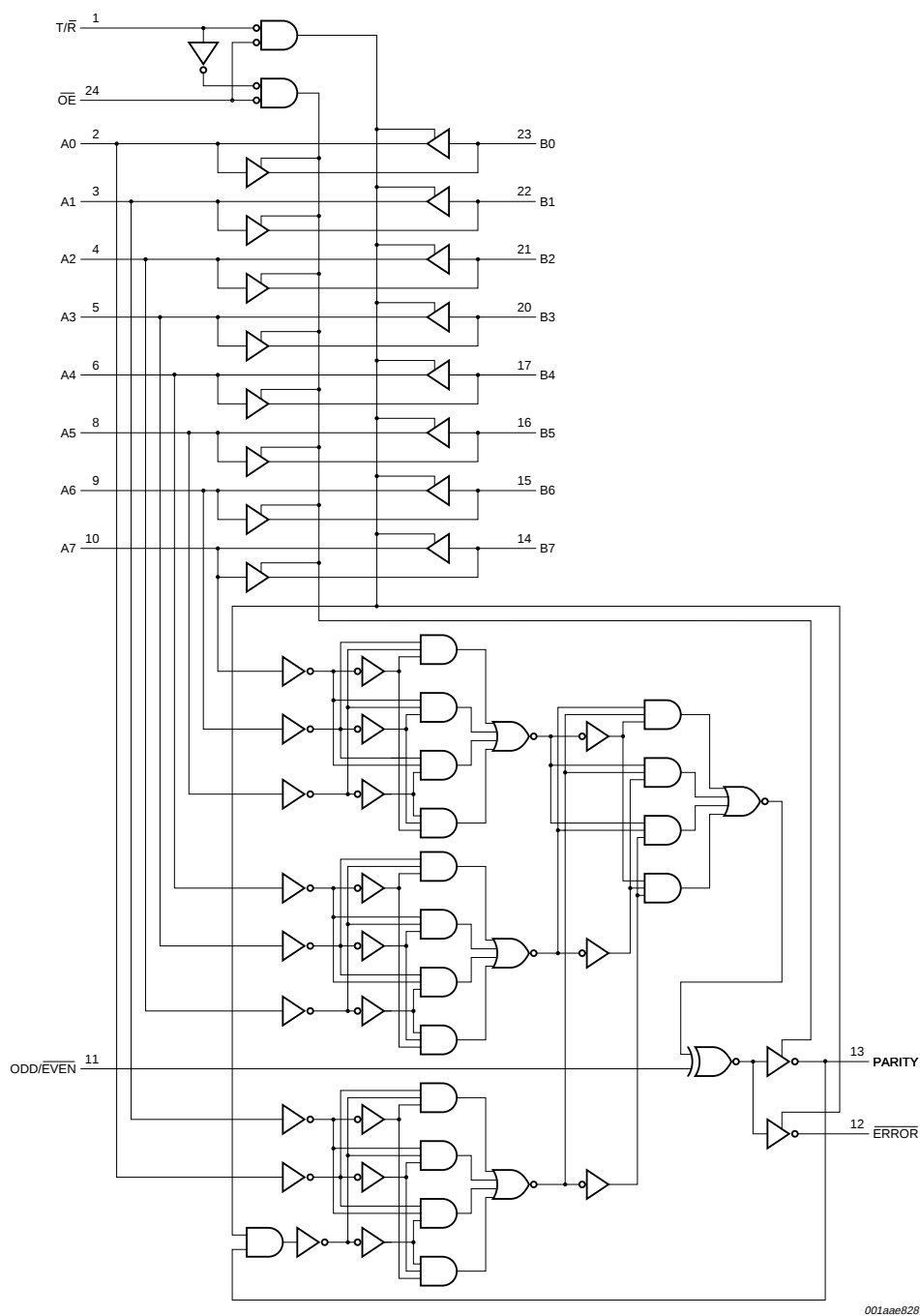


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

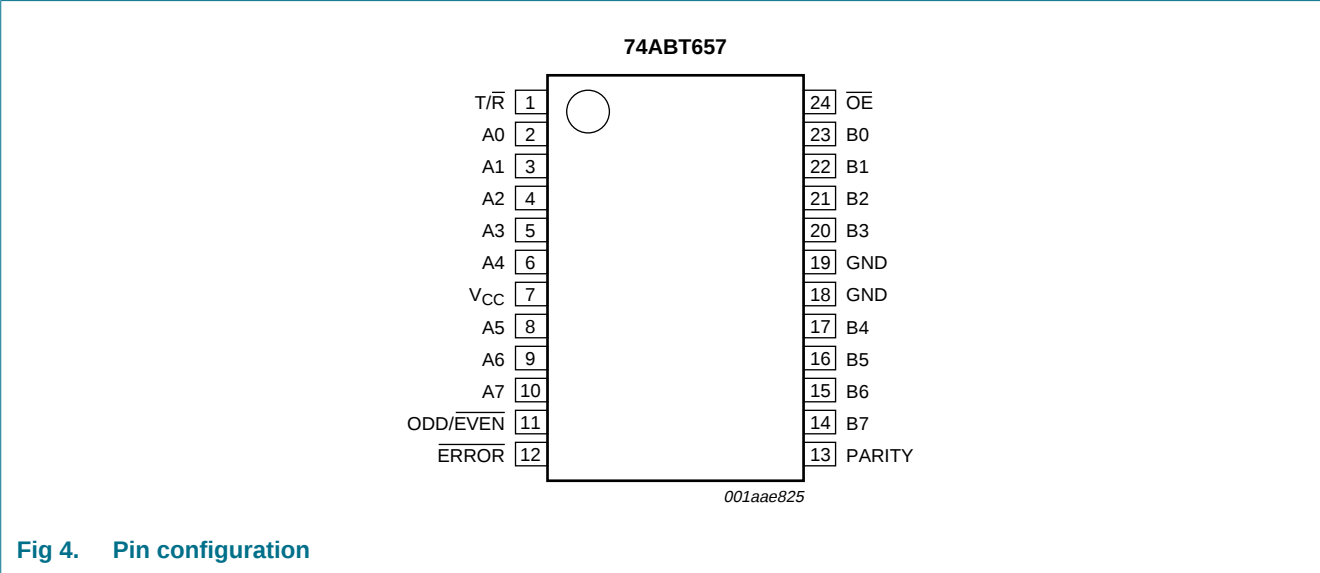


Fig 4. Pin configuration

5.2 Pin description

Table 2. Pin description

| Symbol          | Pin                            | Description                                          |
|-----------------|--------------------------------|------------------------------------------------------|
| T/R             | 1                              | transmit/receive input                               |
| A0 to A7        | 2, 3, 4, 5, 6, 8, 9, 10        | A port input/3-state output                          |
| V <sub>CC</sub> | 7                              | positive supply voltage                              |
| ODD/EVEN        | 11                             | parity select input                                  |
| ERROR           | 12                             | error output in receive mode                         |
| PARITY          | 13                             | parity output in transmit mode/input in receive mode |
| B0 to B7        | 23, 22, 21, 20, 17, 16, 15, 14 | B port input/3-state output                          |
| GND             | 18, 19                         | ground (0 V)                                         |
| OE              | 24                             | output enable input (active LOW)                     |

## 6. Functional description

### 6.1 Function selection

Table 3. Function selection<sup>[1]</sup>

| Number of inputs HIGH   | Inputs |     |          | Data I/O | Output |          |
|-------------------------|--------|-----|----------|----------|--------|----------|
|                         | OE     | T/R | ODD/EVEN | PARITY   | ERROR  | Mode     |
| 0, 2, 4, 6 and 8 (even) | L      | H   | H        | H        | Z      | transmit |
|                         | L      | H   | L        | L        | Z      | transmit |
|                         | L      | L   | H        | H        | H      | receive  |
|                         | L      | L   | H        | L        | L      | receive  |
|                         | L      | L   | L        | H        | L      | receive  |
|                         | L      | L   | L        | L        | H      | receive  |
| 1, 3, 5 and 7 (odd)     | L      | H   | H        | L        | Z      | transmit |
|                         | L      | H   | L        | H        | Z      | transmit |
|                         | L      | L   | H        | H        | L      | receive  |
|                         | L      | L   | H        | L        | H      | receive  |
|                         | L      | L   | L        | H        | H      | receive  |
|                         | L      | L   | L        | L        | L      | receive  |
| Don't care              | H      | X   | X        | Z        | Z      | 3-state  |

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 X = don't care;  
 Z = high-impedance OFF-state.

## 7. Limiting values

**Table 4. Limiting values**

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

| Symbol    | Parameter               | Conditions                        | Min      | Max  | Unit |
|-----------|-------------------------|-----------------------------------|----------|------|------|
| $V_{CC}$  | supply voltage          |                                   | -0.5     | +7.0 | V    |
| $V_I$     | input voltage           |                                   | [1] -1.2 | +7.0 | V    |
| $V_O$     | output voltage          | output in OFF-state or HIGH-state | [1] -0.5 | +5.5 | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                       | -18      | -    | mA   |
| $I_{OK}$  | output clamping current | $V_O < 0$ V                       | -50      | -    | mA   |
| $I_O$     | output current          | output in LOW-state               | -        | 128  | mA   |
| $T_j$     | junction temperature    |                                   | [2] -    | 150  | °C   |
| $T_{stg}$ | storage temperature     |                                   | -65      | +150 | °C   |

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

[2] The performance capability of a high-performance integrated circuit in conjunction with its thermal environment can create junction temperatures which are detrimental to reliability. The maximum junction temperature of this integrated circuit should not exceed 150 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions  | Min | Typ | Max      | Unit |
|---------------------|-------------------------------------|-------------|-----|-----|----------|------|
| $V_{CC}$            | supply voltage                      |             | 4.5 | -   | 5.5      | V    |
| $V_I$               | input voltage                       |             | 0   | -   | $V_{CC}$ | V    |
| $V_{IH}$            | HIGH-level input voltage            |             | 2.0 | -   | -        | V    |
| $V_{IL}$            | LOW-level input voltage             |             | -   | -   | 0.8      | V    |
| $I_{OH}$            | HIGH-level output current           |             | -32 | -   | -        | mA   |
| $I_{OL}$            | LOW-level output current            |             | -   | -   | 64       | mA   |
| $\Delta t/\Delta V$ | input transition rise and fall rate |             | 0   | -   | 5        | ns/V |
| $T_{amb}$           | ambient temperature                 | in free air | -40 | -   | +85      | °C   |

## 9. Static characteristics

**Table 6. Static characteristics**

| Symbol          | Parameter                          | Conditions                                                                                             | 25 °C |            |           | –40 °C to +85 °C |           | Unit                        |
|-----------------|------------------------------------|--------------------------------------------------------------------------------------------------------|-------|------------|-----------|------------------|-----------|-----------------------------|
|                 |                                    |                                                                                                        | Min   | Typ        | Max       | Min              | Max       |                             |
| $V_{IK}$        | input clamping voltage             | $V_{CC} = 4.5\text{ V}$ ; $I_{IK} = -18\text{ mA}$                                                     | –1.2  | –0.9       | –         | –1.2             | –         | V                           |
| $V_{OH}$        | HIGH-level output voltage          | $V_I = V_{IL}$ or $V_{IH}$                                                                             |       |            |           |                  |           |                             |
|                 |                                    | $V_{CC} = 4.5\text{ V}$ ; $I_{OH} = -3\text{ mA}$                                                      | 2.5   | 3.5        | –         | 2.5              | –         | V                           |
|                 |                                    | $V_{CC} = 5.0\text{ V}$ ; $I_{OH} = -3\text{ mA}$                                                      | 3.0   | 4.0        | –         | 3.0              | –         | V                           |
|                 |                                    | $V_{CC} = 4.5\text{ V}$ ; $I_{OH} = -32\text{ mA}$                                                     | 2.0   | 2.6        | –         | 2.0              | –         | V                           |
| $V_{OL}$        | LOW-level output voltage           | $V_{CC} = 4.5\text{ V}$ ; $I_{OL} = 64\text{ mA}$ ; $V_I = V_{IL}$ or $V_{IH}$                         | –     | 0.42       | 0.55      | –                | 0.55      | V                           |
| $I_I$           | input leakage current              | $V_{CC} = 5.5\text{ V}$ ; $V_I = \text{GND}$ or $5.5\text{ V}$                                         |       |            |           |                  |           |                             |
|                 |                                    | control pins                                                                                           | –     | $\pm 0.01$ | $\pm 1.0$ | –                | $\pm 1.0$ | $\mu\text{A}$               |
|                 |                                    | data pins                                                                                              | –     | $\pm 5$    | $\pm 100$ | –                | $\pm 100$ | $\mu\text{A}$               |
| $I_{OFF}$       | power-off leakage current          | $V_{CC} = 0\text{ V}$ ; $V_I$ or $V_O \leq 4.5\text{ V}$                                               | –     | $\pm 5.0$  | $\pm 100$ | –                | $\pm 100$ | $\mu\text{A}$               |
| $I_{O(pu/pd)}$  | power-up/power-down output current | $V_{CC} = 2.0\text{ V}$ ; $V_O = 0.5\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$ ; $\overline{OE}$ HIGH | [1]   | –          | $\pm 5.0$ | $\pm 50$         | –         | $\pm 50\text{ }\mu\text{A}$ |
| $I_{OZ}$        | OFF-state output current           | $V_{CC} = 5.5\text{ V}$ ; $V_I = V_{IL}$ or $V_{IH}$                                                   |       |            |           |                  |           |                             |
|                 |                                    | $V_O = 2.7\text{ V}$                                                                                   | –     | 5.0        | 50        | –                | 50        | $\mu\text{A}$               |
|                 |                                    | $V_O = 0.5\text{ V}$                                                                                   | –     | –5.0       | –50       | –                | –50       | $\mu\text{A}$               |
| $I_{LO}$        | output leakage current             | HIGH-state; $V_O = 5.5\text{ V}$ ; $V_{CC} = 5.5\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$            | –     | 5.0        | 50        | –                | 50        | $\mu\text{A}$               |
| $I_O$           | output current                     | $V_{CC} = 5.5\text{ V}$ ; $V_O = 2.5\text{ V}$                                                         | [2]   | –180       | –100      | –50              | –180      | –50 mA                      |
| $I_{CC}$        | supply current                     | $V_{CC} = 5.5\text{ V}$ ; $V_I = \text{GND}$ or $V_{CC}$                                               |       |            |           |                  |           |                             |
|                 |                                    | outputs HIGH-state                                                                                     | –     | 0.5        | 250       | –                | 250       | $\mu\text{A}$               |
|                 |                                    | outputs LOW-state                                                                                      | –     | 20         | 30        | –                | 30        | mA                          |
|                 |                                    | outputs disabled                                                                                       | –     | 0.5        | 250       | –                | 250       | $\mu\text{A}$               |
| $\Delta I_{CC}$ | additional supply current          | per input pin; $V_{CC} = 5.5\text{ V}$ ; one input at $3.4\text{ V}$ ; other inputs at $V_{CC}$ or GND | [3]   |            |           |                  |           |                             |
|                 |                                    | outputs enabled                                                                                        | –     | 0.5        | 1.5       | –                | 1.5       | mA                          |
|                 |                                    | outputs 3-state, one data input                                                                        | –     | 50         | 250       | –                | 250       | $\mu\text{A}$               |
|                 |                                    | outputs 3-state; one enable input                                                                      | –     | 0.5        | 1.5       | –                | 1.5       | mA                          |
| $C_I$           | input capacitance                  | $V_I = 0\text{ V}$ or $V_{CC}$                                                                         | –     | 4          | –         | –                | –         | pF                          |
| $C_{I/O}$       | input/output capacitance           | outputs disabled; $V_O = 0\text{ V}$ or $V_{CC}$                                                       | –     | 7          | –         | –                | –         | pF                          |

[1] This parameter is valid for any  $V_{CC}$  between 0 V and 2.1 V with a transition time of up to 10 ms. For  $V_{CC} = 2.1\text{ V}$  to  $V_{CC} = 5\text{ V} \pm 10\%$ , a transition time of up to 100  $\mu\text{s}$  is permitted.

[2] Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

[3] This is the increase in supply current for each input at 3.4 V.

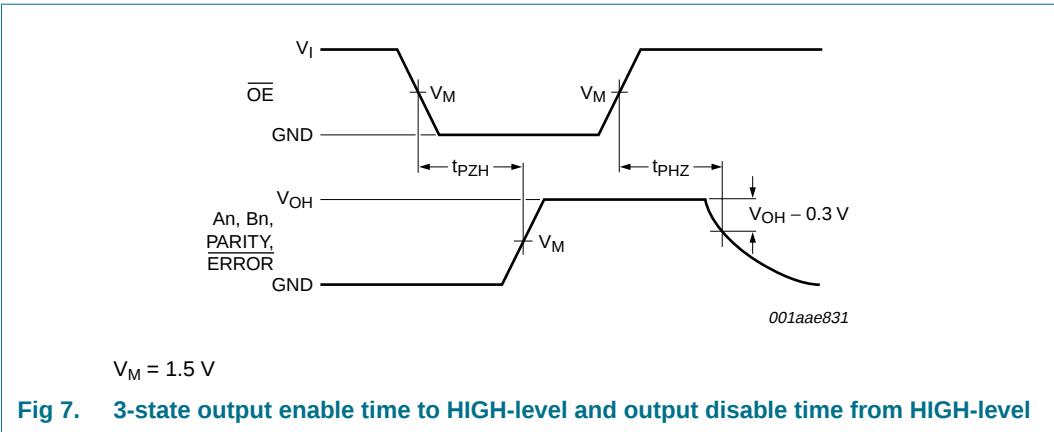
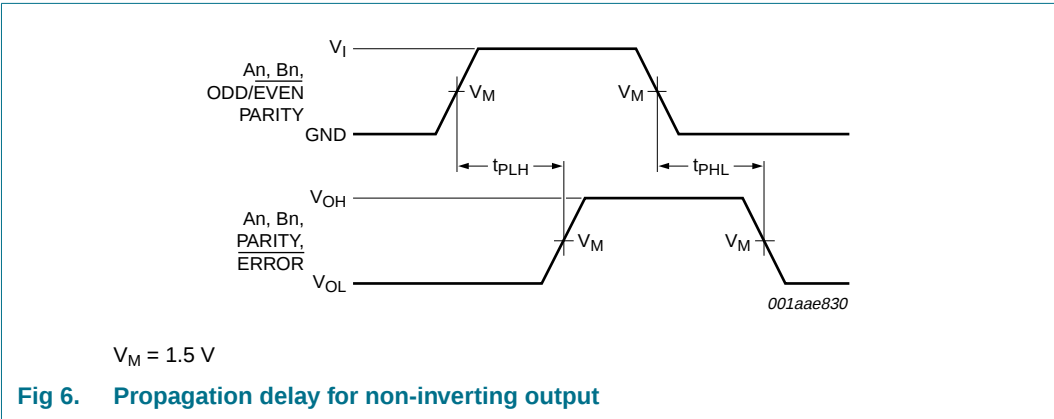
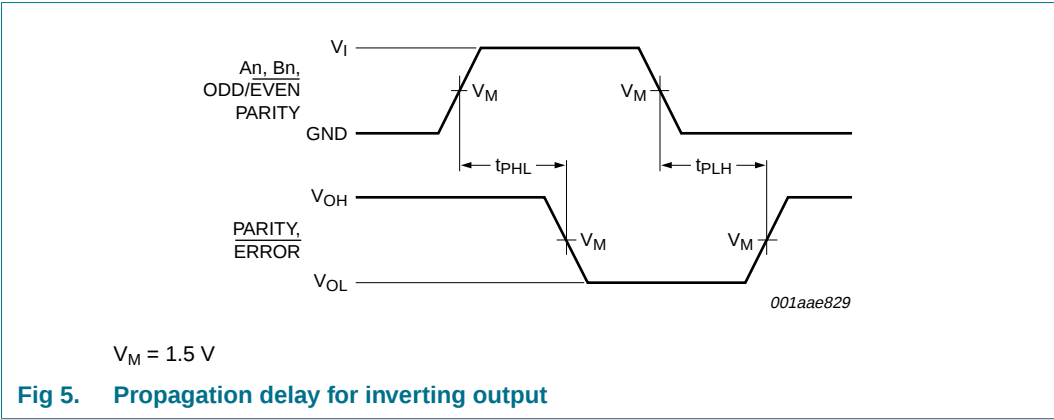
## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**  
*GND = 0 V; for test circuit, see Figure 9.*

| Symbol           | Parameter                           | Conditions                                       | 25 °C; V <sub>CC</sub> = 5.0 V |     |      | –40 °C to +85 °C;<br>V <sub>CC</sub> = 5.0 V ± 0.5 V |      | Unit |
|------------------|-------------------------------------|--------------------------------------------------|--------------------------------|-----|------|------------------------------------------------------|------|------|
|                  |                                     |                                                  | Min                            | Typ | Max  | Min                                                  | Max  |      |
| t <sub>PLH</sub> | LOW to HIGH propagation delay       | An to Bn or Bn to An; see Figure 6               | 1.1                            | 2.5 | 4.1  | 1.1                                                  | 4.6  | ns   |
|                  |                                     | An to PARITY; see Figure 5 and 6                 | 2.5                            | 5.1 | 6.7  | 2.5                                                  | 8.1  | ns   |
|                  |                                     | ODD/EVEN to PARITY and ERROR; see Figure 5 and 6 | 1.7                            | 3.5 | 4.6  | 1.7                                                  | 5.3  | ns   |
|                  |                                     | Bn to ERROR; see Figure 5 and 6                  | 3.9                            | 7.3 | 10.2 | 3.9                                                  | 12.3 | ns   |
|                  |                                     | PARITY to ERROR; see Figure 5 and 6              | 2.7                            | 4.5 | 5.9  | 2.7                                                  | 7.7  | ns   |
| t <sub>PHL</sub> | HIGH to LOW propagation delay       | An to Bn or Bn to An; see Figure 6               | 1.2                            | 3.0 | 3.9  | 1.2                                                  | 4.3  | ns   |
|                  |                                     | An to PARITY; see Figure 5 and 6                 | 2.8                            | 5.0 | 7.4  | 2.8                                                  | 8.9  | ns   |
|                  |                                     | ODD/EVEN to PARITY and ERROR; see Figure 5 and 6 | 1.9                            | 3.7 | 5.1  | 1.9                                                  | 5.8  | ns   |
|                  |                                     | Bn to ERROR; see Figure 5 and 6                  | 4.0                            | 7.9 | 10.5 | 4.0                                                  | 12.9 | ns   |
|                  |                                     | PARITY to ERROR; see Figure 5 and 6              | 3.2                            | 5.2 | 6.7  | 3.2                                                  | 8.1  | ns   |
| t <sub>PZH</sub> | OFF-state to HIGH propagation delay | see Figure 7 and 8 [1]                           | 1.3                            | 3.6 | 5.5  | 1.3                                                  | 6.5  | ns   |
| t <sub>PZL</sub> | OFF-state to LOW propagation delay  | see Figure 7 and 8 [1]                           | 1.9                            | 4.2 | 5.3  | 1.9                                                  | 6.5  | ns   |
| t <sub>PHZ</sub> | HIGH to OFF-state propagation delay | see Figure 7 and 8                               | 2.4                            | 3.6 | 5.6  | 2.4                                                  | 6.2  | ns   |
| t <sub>PLZ</sub> | LOW to OFF-state propagation delay  | see Figure 7 and 8                               | 2.2                            | 3.4 | 7.3  | 2.2                                                  | 7.8  | ns   |

- [1] These delay times reflect the 3-state recovery time only and do not include the delay through the buffers and the parity check circuitry which affect the ERROR output. To ensure **valid** information at the ERROR pin, time must be allowed for the signal to propagate through the drivers (B to A), through the parity check circuitry (same as A to PARITY), and to the ERROR output. **Valid** data at the ERROR pin ≥ (B to A) + (A to PARITY).

11. Waveforms



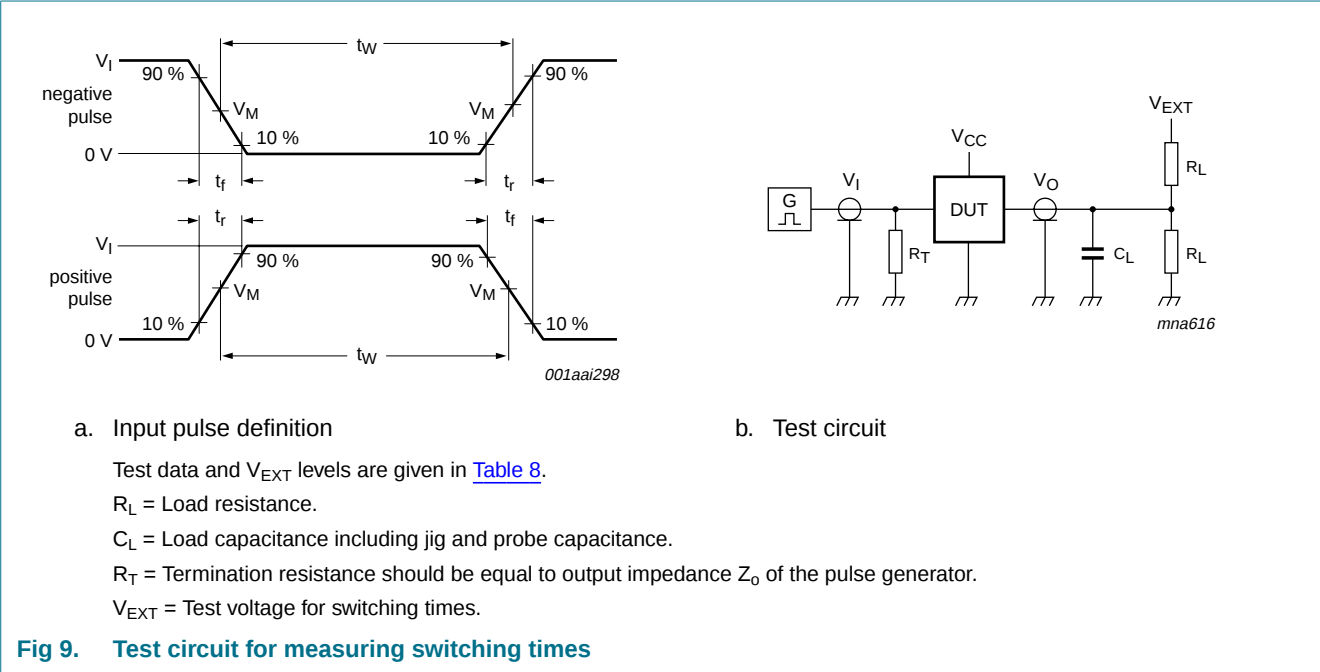
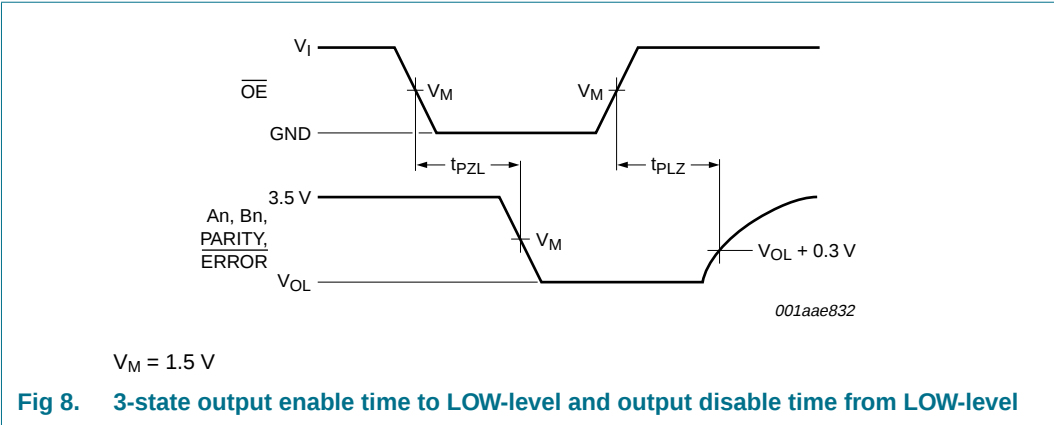


Table 8. Test data

| Input |       |        |               | Load  |              | $V_{EXT}$          |                    |                    |
|-------|-------|--------|---------------|-------|--------------|--------------------|--------------------|--------------------|
| $V_I$ | $f_I$ | $t_W$  | $t_r, t_f$    | $C_L$ | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 3.0 V | 1 MHz | 500 ns | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | open               | open               | 7.0 V              |

12. Package outline

SO24: plastic small outline package; 24 leads; body width 7.5 mm

SOT137-1

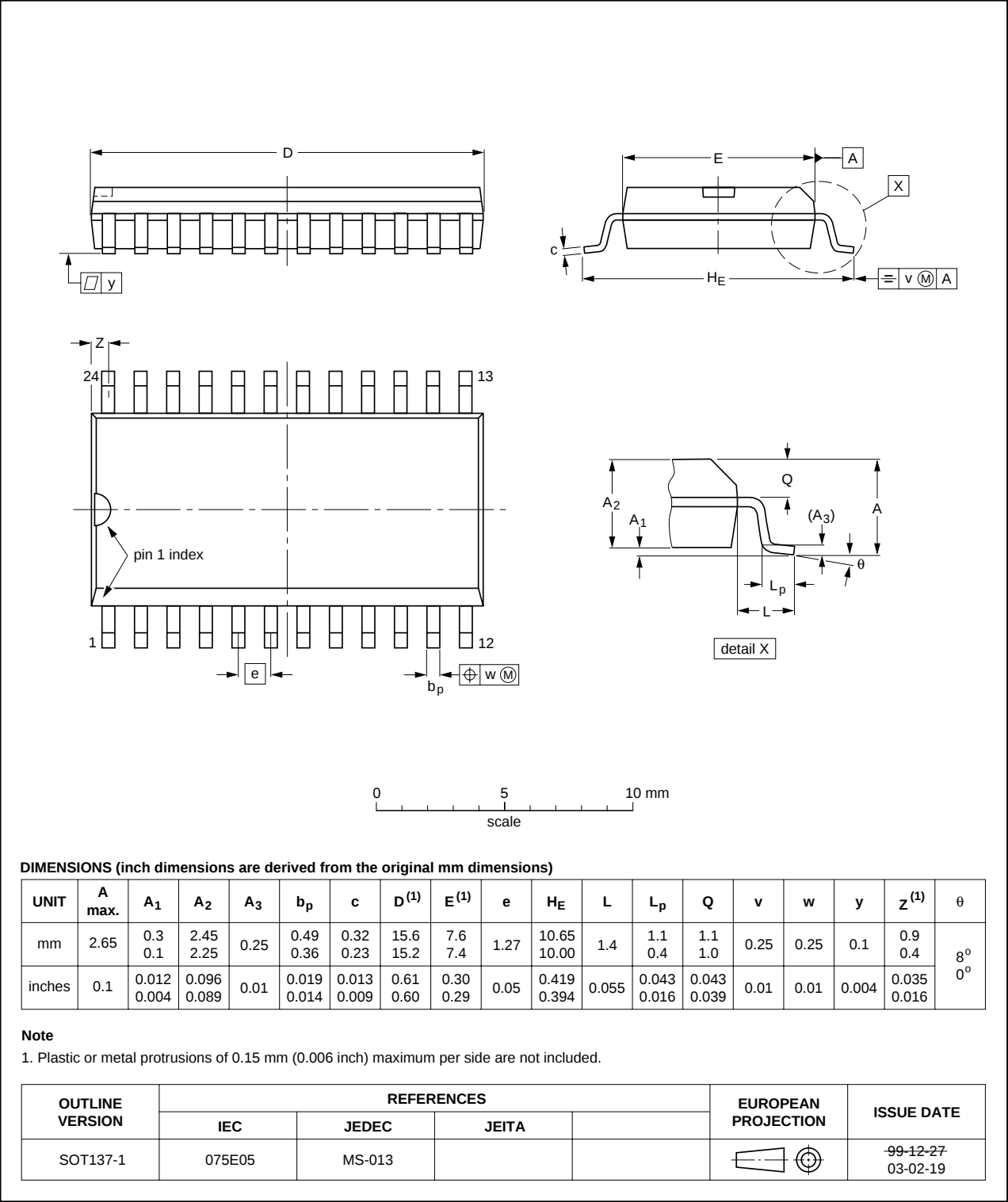


Fig 10. Package outline SOT137-1 (SO24)

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm

SOT340-1

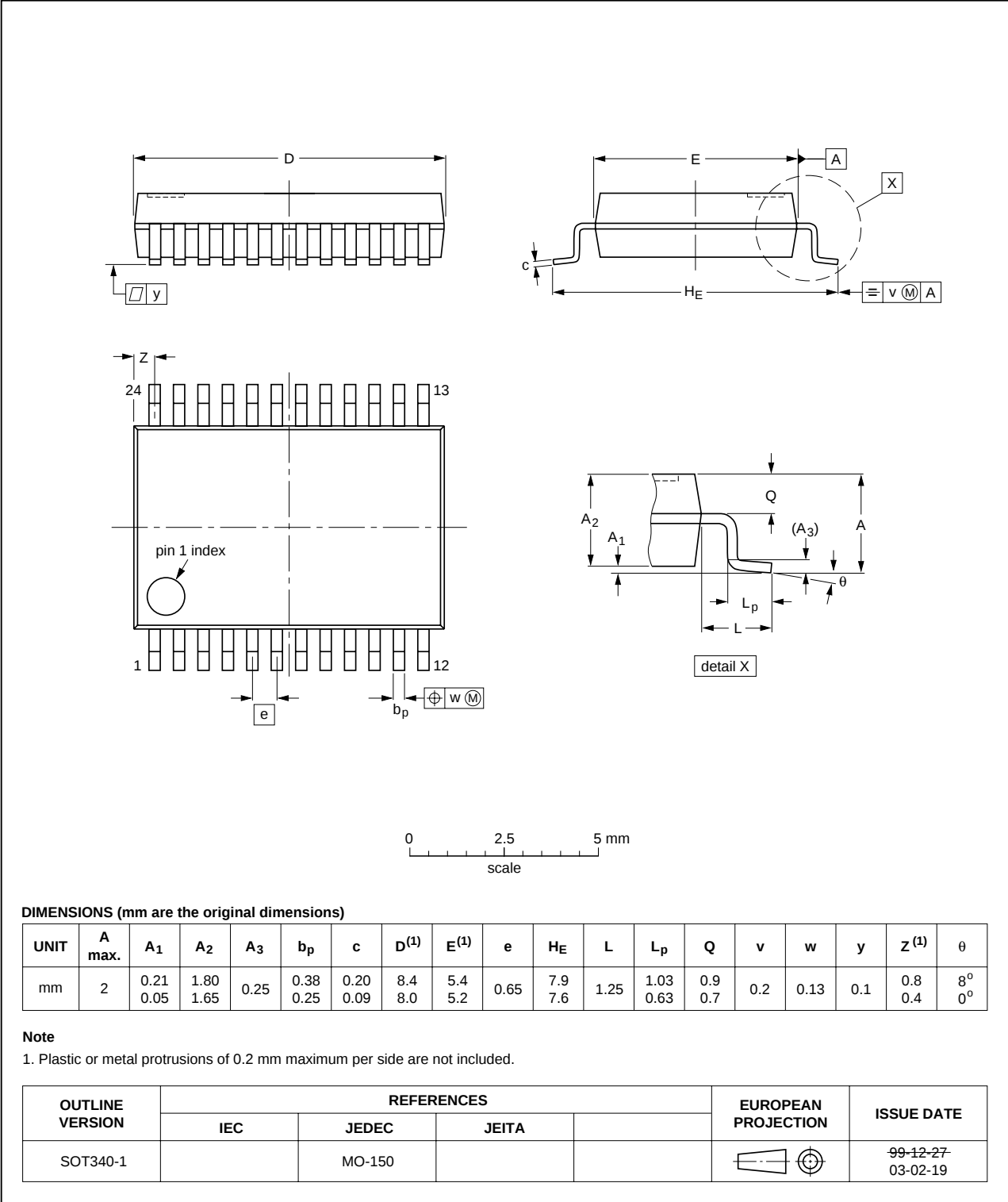


Fig 11. Package outline SOT340-1 (SSOP24)

TSSOP24: plastic thin shrink small outline package; 24 leads; body width 4.4 mm

SOT355-1

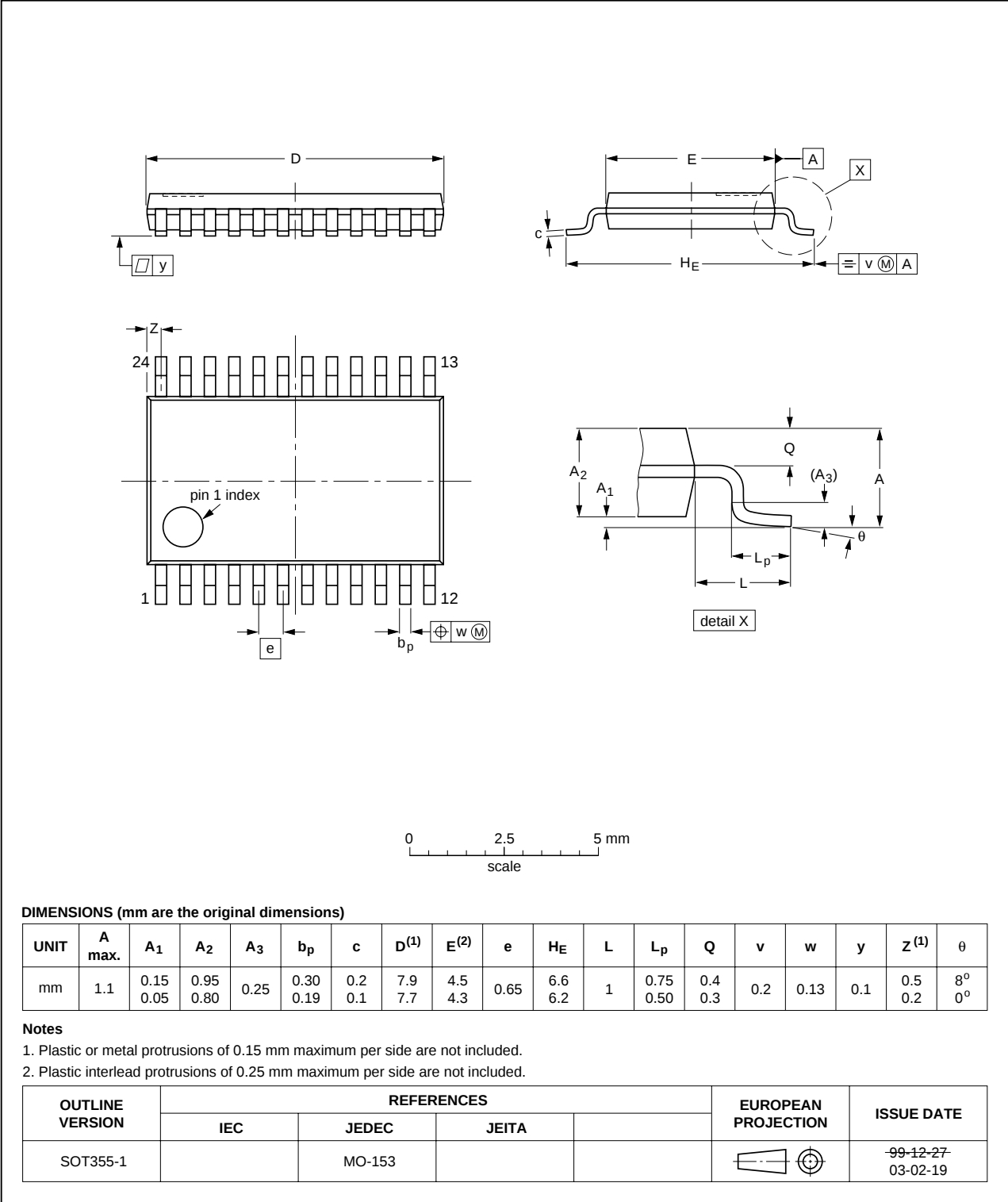


Fig 12. Package outline SOT355-1 (TSSOP24)

## 13. Abbreviations

Table 9. Abbreviations

| Acronym | Description                                     |
|---------|-------------------------------------------------|
| BICMOS  | Bipolar Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                               |
| ESD     | ElectroStatic Discharge                         |
| HBM     | Human Body Model                                |
| MM      | Machine Model                                   |

## 14. Revision history

Table 10. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                                                                                                           | Data sheet status     | Change notice | Supersedes |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------|
| 74ABT657_3     | 20100315                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet    | -             | 74ABT657_2 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>DIP 24 (SOT222-1) package removed from <a href="#">Section 3 "Ordering information"</a> and <a href="#">Section 12 "Package outline"</a>.</li></ul> |                       |               |            |
| 74ABT657_2     | 20041027                                                                                                                                                                                                                                                                                                                                                                                               | Product specification | -             | 74ABT657   |
| 74ABT657       | 19951211                                                                                                                                                                                                                                                                                                                                                                                               | Product specification | -             | -          |

## 15. Legal information

### 15.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

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

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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Date of release: 15 March 2010

Document identifier: 74ABT657\_3

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