

# 74LVT244B; 74LVTH244B

3.3 V octal buffer/line driver; 3-state

Rev. 03 — 3 March 2006

Product data sheet

## 1. General description

The 74LVT244B; 74LVTH244B is a high-performance BiCMOS product designed for  $V_{CC}$  operation at 3.3 V.

This device is an octal buffer that is ideal for driving bus lines. The device features two output enable inputs ( $\overline{1OE}$  and  $\overline{2OE}$ ), each controlling four of the 3-state outputs.

## 2. Features

- Octal bus interface
- 3-state buffers
- Speed upgrade of 74LVT244A
- Output capability: +64 mA and –32 mA
- TTL input and output switching levels
- Input and output interface capability to systems at 5 V supply
- Bus hold data inputs eliminate need for external pull-up resistors to hold unused inputs
- Power-up 3-state
- Live insertion and extraction permitted
- No bus current loading when output is tied to 5 V bus
- Latch-up protection:
  - ◆ JESD78: exceeds 500 mA
- ESD protection:
  - ◆ HBM EIA/JESD22-A114-C exceeds 2000 V
  - ◆ MM EIA/JESD22-A115-A 200 V

## 3. Quick reference data

Table 1. Quick reference data

$GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| Symbol    | Parameter                                      | Conditions                                     | Min | Typ | Max | Unit |
|-----------|------------------------------------------------|------------------------------------------------|-----|-----|-----|------|
| $t_{PLH}$ | LOW-to-HIGH propagation delay $nA_n$ to $nY_n$ | $C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$ | -   | 1.9 | -   | ns   |
| $t_{PHL}$ | HIGH-to-LOW propagation delay $nA_n$ to $nY_n$ | $C_L = 50\text{ pF}$ ; $V_{CC} = 3.3\text{ V}$ | -   | 2.0 | -   | ns   |

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Table 1. Quick reference data ...continued

 $GND = 0\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

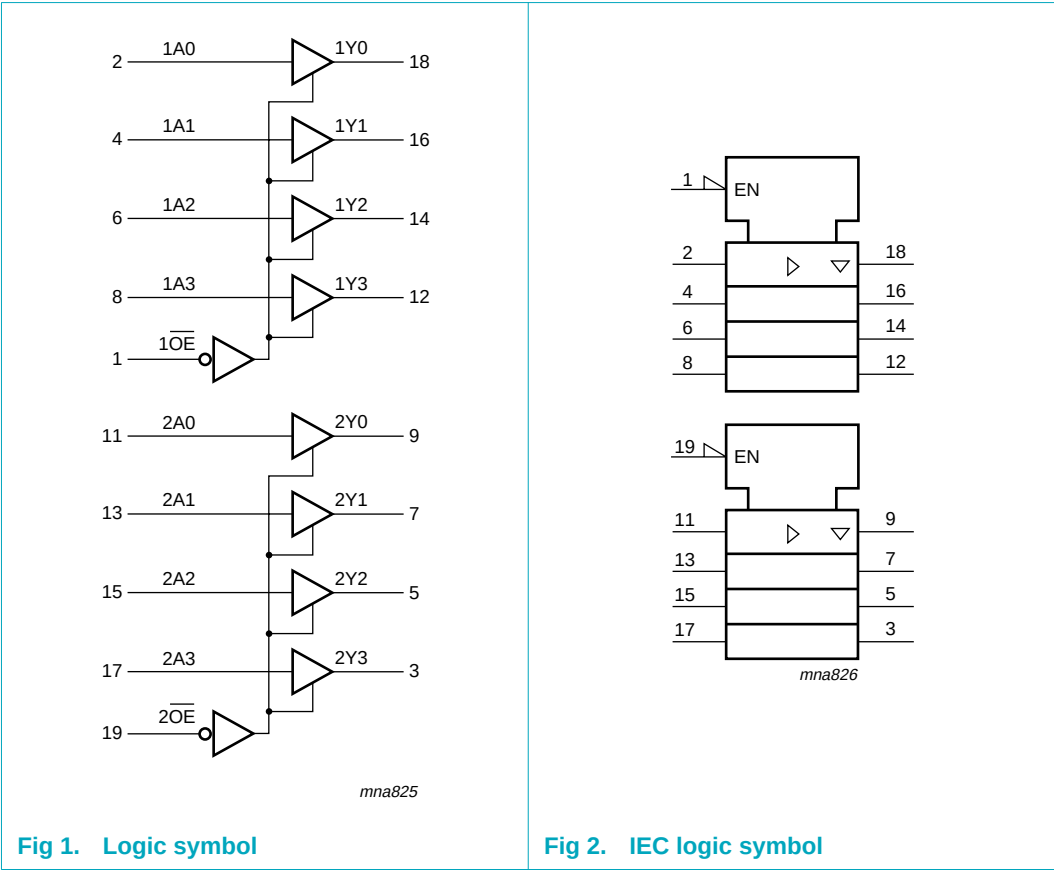
| Symbol   | Parameter                | Conditions                                                                                     | Min | Typ  | Max | Unit |
|----------|--------------------------|------------------------------------------------------------------------------------------------|-----|------|-----|------|
| $C_i$    | input capacitance        | $V_I = 0\text{ V}$ or $3.0\text{ V}$                                                           | -   | 4    | -   | pF   |
| $C_o$    | output capacitance       | outputs disabled;<br>$V_O = 0\text{ V}$ or $3.0\text{ V}$                                      | -   | 8    | -   | pF   |
| $I_{CC}$ | quiescent supply current | outputs disabled;<br>$V_{CC} = 3.6\text{ V}$ ; $I_O = 0\text{ A}$ ;<br>$V_I = GND$ or $V_{CC}$ | -   | 0.13 | -   | mA   |

## 4. Ordering information

Table 2. Ordering information

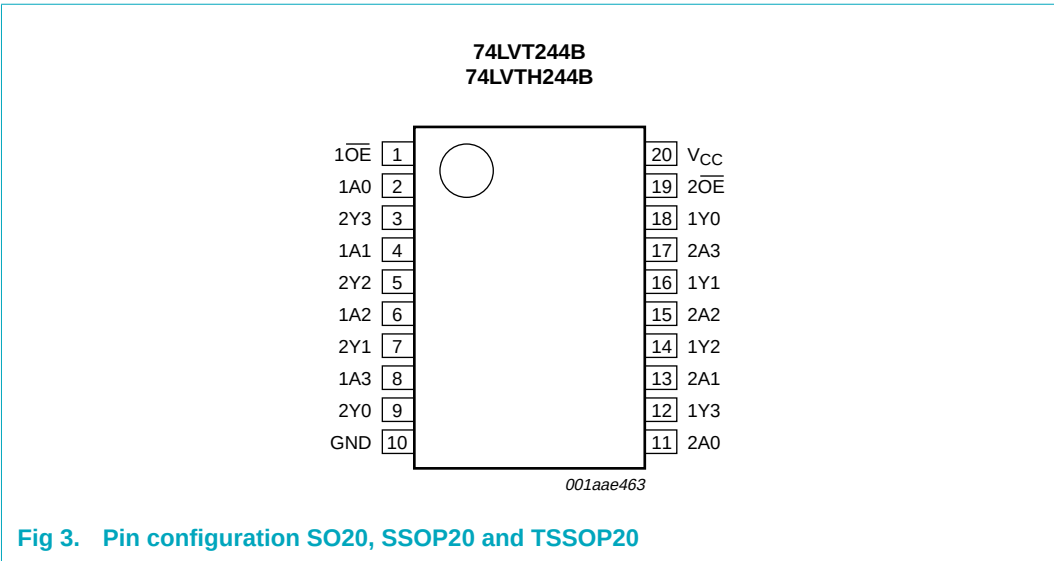
| Type number  | Package           |         |                                                                           |          |
|--------------|-------------------|---------|---------------------------------------------------------------------------|----------|
|              | Temperature range | Name    | Description                                                               | Version  |
| 74LVT244BD   | -40 °C to +85 °C  | SO20    | plastic small outline package; 20 leads;<br>body width 7.5 mm             | SOT163-1 |
| 74LVT244BDB  | -40 °C to +85 °C  | SSOP20  | plastic shrink small outline package; 20 leads;<br>body width 5.3 mm      | SOT339-1 |
| 74LVT244BPW  | -40 °C to +85 °C  | TSSOP20 | plastic thin shrink small outline package; 20 leads;<br>body width 4.4 mm | SOT360-1 |
| 74LVTH244BD  | -40 °C to +85 °C  | SO20    | plastic small outline package; 20 leads;<br>body width 7.5 mm             | SOT163-1 |
| 74LVTH244BDB | -40 °C to +85 °C  | SSOP20  | plastic shrink small outline package; 20 leads;<br>body width 5.3 mm      | SOT339-1 |
| 74LVTH244BPW | -40 °C to +85 °C  | TSSOP20 | plastic thin shrink small outline package; 20 leads;<br>body width 4.4 mm | SOT360-1 |

5. Functional diagram



6. Pinning information

6.1 Pinning



## 6.2 Pin description

Table 3. Pin description

| Symbol           | Pin | Description           |
|------------------|-----|-----------------------|
| $1\overline{OE}$ | 1   | 1 output enable input |
| 1A0              | 2   | 1 data input 0        |
| 2Y3              | 3   | 2 data output 3       |
| 1A1              | 4   | 1 data input 1        |
| 2Y2              | 5   | 2 data output 2       |
| 1A2              | 6   | 1 data input 2        |
| 2Y1              | 7   | 2 data output 1       |
| 1A3              | 8   | 1 data input 3        |
| 2Y0              | 9   | 2 data output 0       |
| GND              | 10  | ground (0 V)          |
| 2A0              | 11  | 2 data input 0        |
| 1Y3              | 12  | 1 data output 3       |
| 2A1              | 13  | 2 data input 1        |
| 1Y2              | 14  | 1 data output 2       |
| 2A2              | 15  | 2 data input 2        |
| 1Y1              | 16  | 1 data output 1       |
| 2A3              | 17  | 2 data input 3        |
| 1Y0              | 18  | 1 data output 0       |
| $2\overline{OE}$ | 19  | 2 output enable input |
| V <sub>CC</sub>  | 20  | supply voltage        |

## 7. Functional description

### 7.1 Function table

Table 4. Function table [\[1\]](#)

| Control          | Input | Output |
|------------------|-------|--------|
| $n\overline{OE}$ | nAn   | nYn    |
| L                | L     | L      |
|                  | H     | H      |
| H                | X     | Z      |

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

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter               | Conditions                        | Min                 | Max  | Unit |
|-----------|-------------------------|-----------------------------------|---------------------|------|------|
| $V_{CC}$  | supply voltage          |                                   | -0.5                | +4.6 | V    |
| $V_I$     | input voltage           |                                   | <sup>[1]</sup> -0.5 | +7.0 | V    |
| $V_O$     | output voltage          | output in OFF-state or HIGH-state | <sup>[1]</sup> -0.5 | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                       | -                   | -50  | mA   |
| $I_{OK}$  | output clamping current | $V_O < 0$ V                       | -                   | -50  | mA   |
| $I_O$     | output current          | output in LOW-state               | -                   | 128  | mA   |
|           |                         | output in HIGH-state              | -                   | -64  | mA   |
| $T_{stg}$ | storage temperature     |                                   | -65                 | +150 | °C   |
| $T_j$     | junction temperature    |                                   | <sup>[2]</sup> -    | 150  | °C   |

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

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

| Symbol              | Parameter                           | Conditions                                          | Min | Typ | Max | Unit |
|---------------------|-------------------------------------|-----------------------------------------------------|-----|-----|-----|------|
| $V_{CC}$            | supply voltage                      |                                                     | 2.7 | -   | 3.6 | V    |
| $V_I$               | input voltage                       |                                                     | 0   | -   | 5.5 | V    |
| $V_{IH}$            | HIGH-state input voltage            |                                                     | 2.0 | -   | -   | V    |
| $V_{IL}$            | LOW-state input voltage             |                                                     | -   | -   | 0.8 | V    |
| $I_{OH}$            | HIGH-state output current           |                                                     | -   | -   | -32 | mA   |
| $I_{OL}$            | LOW-state output current            | none                                                | -   | -   | 32  | mA   |
|                     |                                     | current duty cycle $\leq 50$ %;<br>$f_i \geq 1$ kHz | -   | -   | 64  | mA   |
| $T_{amb}$           | ambient temperature                 | in free-air                                         | -40 | -   | +85 | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | outputs enabled                                     | -   | -   | 10  | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

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

| Symbol                                        | Parameter                          | Conditions                                                                                                                                                   | Min                                                              | Typ                   | Max  | Unit  |
|-----------------------------------------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|-----------------------|------|-------|
| <b>T<sub>amb</sub> = –40 °C to +85 °C [1]</b> |                                    |                                                                                                                                                              |                                                                  |                       |      |       |
| V <sub>IK</sub>                               | input clamping voltage             | V <sub>CC</sub> = 2.7 V; I <sub>IK</sub> = –18 mA                                                                                                            | -                                                                | –0.9                  | –1.2 | V     |
| V <sub>OH</sub>                               | HIGH-state output voltage          | V <sub>CC</sub> = 2.7 V                                                                                                                                      |                                                                  |                       |      |       |
|                                               |                                    | I <sub>OH</sub> = –100 µA                                                                                                                                    | V <sub>CC</sub> – 2.0                                            | V <sub>CC</sub> – 2.1 | -    | V     |
|                                               |                                    | I <sub>OH</sub> = –8 mA                                                                                                                                      | 2.4                                                              | 2.5                   | -    | V     |
|                                               |                                    | V <sub>CC</sub> = 3.0 V                                                                                                                                      |                                                                  |                       |      |       |
| V <sub>OL</sub>                               | LOW-state output voltage           | I <sub>OH</sub> = –32 mA                                                                                                                                     | 2.0                                                              | 2.2                   | -    | V     |
|                                               |                                    | V <sub>CC</sub> = 2.7 V                                                                                                                                      |                                                                  |                       |      |       |
|                                               |                                    | I <sub>OL</sub> = 100 µA                                                                                                                                     | -                                                                | 0.1                   | 0.2  | V     |
|                                               |                                    | I <sub>OL</sub> = 24 mA                                                                                                                                      | -                                                                | 0.3                   | 0.5  | V     |
|                                               |                                    | V <sub>CC</sub> = 3.0 V                                                                                                                                      |                                                                  |                       |      |       |
|                                               |                                    | I <sub>OL</sub> = 16 mA                                                                                                                                      | -                                                                | 0.25                  | 0.4  | V     |
|                                               |                                    | I <sub>OL</sub> = 32 mA                                                                                                                                      | -                                                                | 0.3                   | 0.5  | V     |
| I <sub>LI</sub>                               | input leakage current              | I <sub>OL</sub> = 64 mA                                                                                                                                      | -                                                                | 0.4                   | 0.55 | V     |
|                                               |                                    | all pins                                                                                                                                                     | V <sub>CC</sub> = 0 V or 3.6 V; V <sub>I</sub> = 5.5 V           | -                     | 0.1  | 10 µA |
|                                               |                                    | control pins                                                                                                                                                 | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND | -                     | ±0.1 | ±1 µA |
|                                               |                                    | I/O data pins                                                                                                                                                | V <sub>CC</sub> = 3.6 V [2]                                      |                       |      |       |
|                                               |                                    | V <sub>I</sub> = V <sub>CC</sub>                                                                                                                             | -                                                                | 0.1                   | 1    | µA    |
| I <sub>OFF</sub>                              | power-off leakage current          | V <sub>I</sub> = 0 V                                                                                                                                         | -                                                                | –1                    | –5   | µA    |
|                                               |                                    | V <sub>CC</sub> = 0 V; V <sub>I</sub> or V <sub>O</sub> = 0 V to 4.5 V                                                                                       | -                                                                | 1                     | ±100 | µA    |
|                                               |                                    |                                                                                                                                                              |                                                                  |                       |      |       |
| I <sub>HOLD</sub>                             | bus hold current data input        | V <sub>CC</sub> = 3 V [3]                                                                                                                                    |                                                                  |                       |      |       |
|                                               |                                    | V <sub>I</sub> = 0.8 V                                                                                                                                       | 75                                                               | 130                   | -    | µA    |
|                                               |                                    | V <sub>I</sub> = 2.0 V                                                                                                                                       | –75                                                              | –140                  | -    | µA    |
|                                               |                                    | V <sub>CC</sub> = 0 V to 3.6 V                                                                                                                               |                                                                  |                       |      |       |
| I <sub>EX</sub>                               | external current into output       | V <sub>I</sub> = 3.6 V                                                                                                                                       | ±500                                                             | -                     | -    | µA    |
|                                               |                                    | output in HIGH-state when V <sub>O</sub> > V <sub>CC</sub> ; V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 3.3 V                                                 | -                                                                | 60                    | 125  | µA    |
| I <sub>O(pu/pd)</sub>                         | power-up/power-down output current | V <sub>CC</sub> ≤ 1.2 V; V <sub>O</sub> = 0.5 V to V <sub>CC</sub> ; V <sub>I</sub> = GND or V <sub>CC</sub> ; n <sub>O</sub> <sub>OE</sub> = don't care [4] | -                                                                | ±1                    | ±100 | µA    |
| I <sub>OZ</sub>                               | OFF-state output current           | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                 |                                                                  |                       |      |       |
|                                               |                                    | output HIGH: V <sub>O</sub> = 3.0 V                                                                                                                          | -                                                                | 1                     | 5    | µA    |
|                                               |                                    | output LOW: V <sub>O</sub> = 0.5 V                                                                                                                           | -                                                                | –1                    | –5   | µA    |
| I <sub>CC</sub>                               | quiescent supply current           | V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A                                                                      |                                                                  |                       |      |       |
|                                               |                                    | output HIGH                                                                                                                                                  | -                                                                | 0.13                  | 0.19 | mA    |
|                                               |                                    | output LOW                                                                                                                                                   | -                                                                | 2                     | 5    | mA    |
|                                               |                                    | outputs disabled [5]                                                                                                                                         | -                                                                | 0.13                  | 0.19 | mA    |

**Table 7.** Static characteristics ...continued

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

| Symbol          | Parameter                           | Conditions                                                                                                                          | Min   | Typ | Max | Unit |
|-----------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|------|
| $\Delta I_{CC}$ | additional quiescent supply current | per input pin; $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ ; one input at $V_{CC} - 0.6\text{ V}$ and other inputs at $V_{CC}$ or GND | [6] - | 0.1 | 0.2 | mA   |
| $C_i$           | input capacitance                   | $V_i = 0\text{ V}$ or $3.0\text{ V}$                                                                                                | -     | 4   | -   | pF   |
| $C_o$           | output capacitance                  | outputs disabled; $V_O = 0\text{ V}$ or $3.0\text{ V}$                                                                              | -     | 8   | -   | pF   |

[1] Typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .[2] Unused pins at  $V_{CC}$  or GND.

[3] This is the bus hold overdrive current required to force the input to the opposite logic state.

[4] This parameter is valid for any  $V_{CC}$  between 0 V and 1.2 V with a transition time of up to 10 ms. From  $V_{CC} = 1.2\text{ V}$  to  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$  a transition time of 100  $\mu\text{s}$  is permitted. This parameter is valid for  $T_{amb} = 25\text{ }^{\circ}\text{C}$  only.[5]  $I_{CC}$  is measured with outputs pulled to  $V_{CC}$  or GND.[6] This is the increase in supply current for each input at  $V_{CC} - 0.6\text{ V}$ .

## 11. Dynamic characteristics

**Table 8.** Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 6.

| Symbol                                                                       | Parameter                                                      | Conditions                                | Min | Typ | Max | Unit |
|------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------|-----|-----|-----|------|
| $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ [1] |                                                                |                                           |     |     |     |      |
| $t_{PLH}$                                                                    | LOW-to-HIGH propagation delay<br>nAn to nYn                    | see Figure 4                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 3.8 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.1 | 1.9 | 3.5 | ns   |
| $t_{PHL}$                                                                    | HIGH-to-LOW propagation delay<br>nAn to nYn                    | see Figure 4                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 3.6 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.3 | 2.0 | 3.3 | ns   |
| $t_{PZH}$                                                                    | output enable time to HIGH-level<br>$\overline{nOE}$ to nYn    | see Figure 5                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 5.3 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.1 | 2.8 | 4.5 | ns   |
| $t_{PZL}$                                                                    | output enable time to LOW-level<br>$\overline{nOE}$ to nYn     | see Figure 5                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 4.9 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.4 | 2.3 | 4.4 | ns   |
| $t_{PHZ}$                                                                    | output disable time from HIGH-level<br>$\overline{nOE}$ to nYn | see Figure 5                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 4.5 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.9 | 2.9 | 4.4 | ns   |
| $t_{PLZ}$                                                                    | output disable time from LOW-level<br>$\overline{nOE}$ to nYn  | see Figure 5                              |     |     |     |      |
|                                                                              |                                                                | $V_{CC} = 2.7\text{ V}$                   | -   | -   | 4.4 | ns   |
|                                                                              |                                                                | $V_{CC} = 3.0\text{ V}$ to $3.6\text{ V}$ | 1.8 | 2.5 | 4.4 | ns   |

[1] Typical values are measured at  $V_{CC} = 3.3\text{ V}$  and  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

12. Waveforms

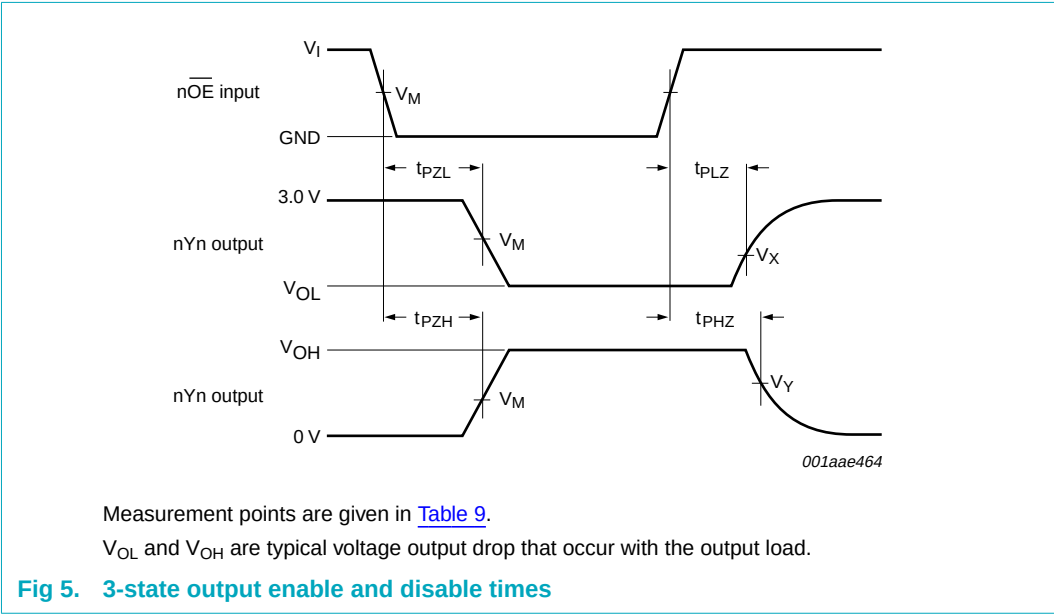
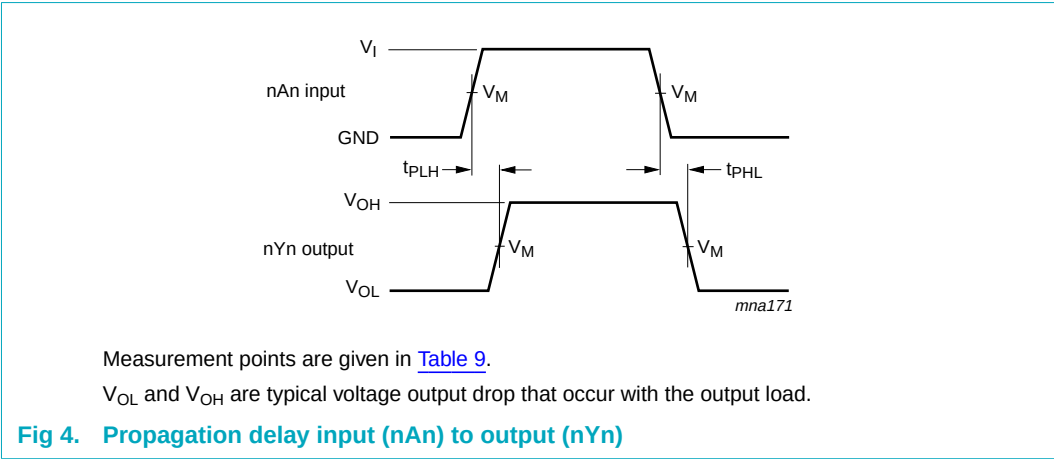


Table 9. Measurement points

| Input | Output |                          |                          |
|-------|--------|--------------------------|--------------------------|
| $V_M$ | $V_M$  | $V_X$                    | $V_Y$                    |
| 1.5 V | 1.5 V  | $V_{OL} + 0.3 \text{ V}$ | $V_{OH} - 0.3 \text{ V}$ |



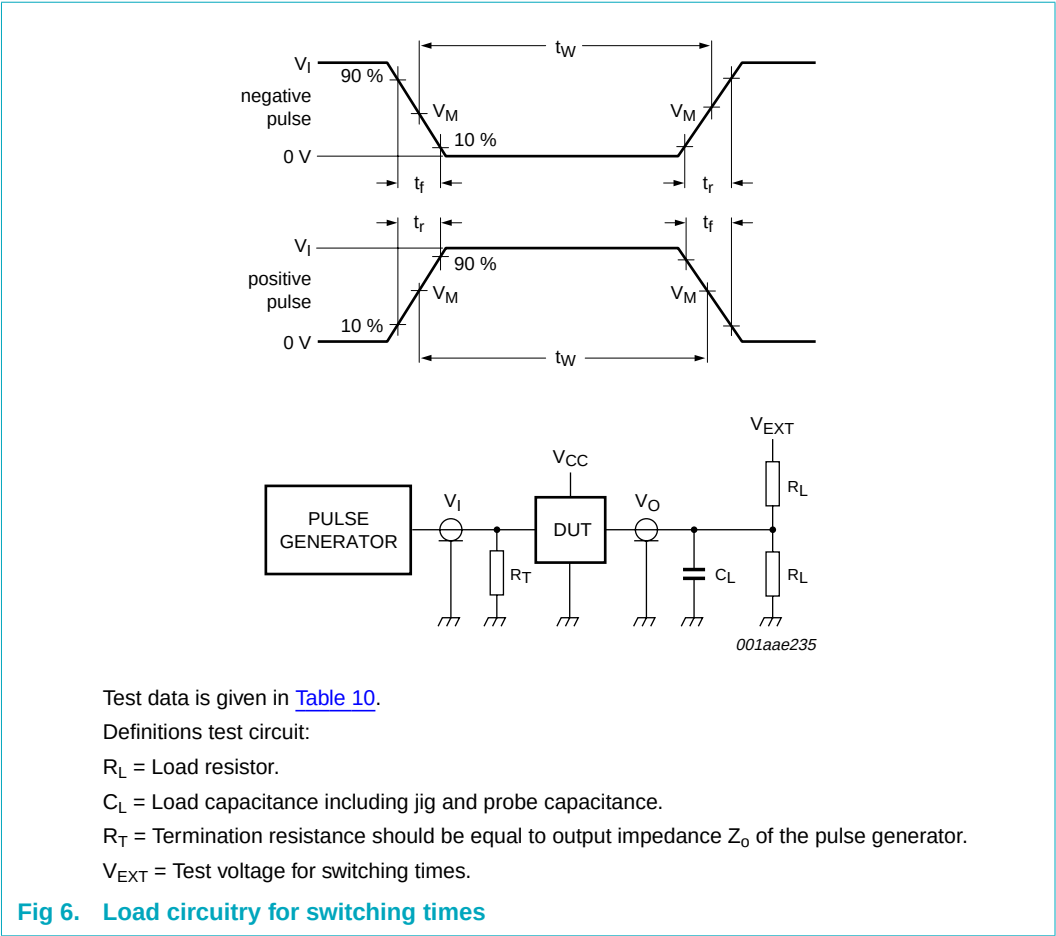


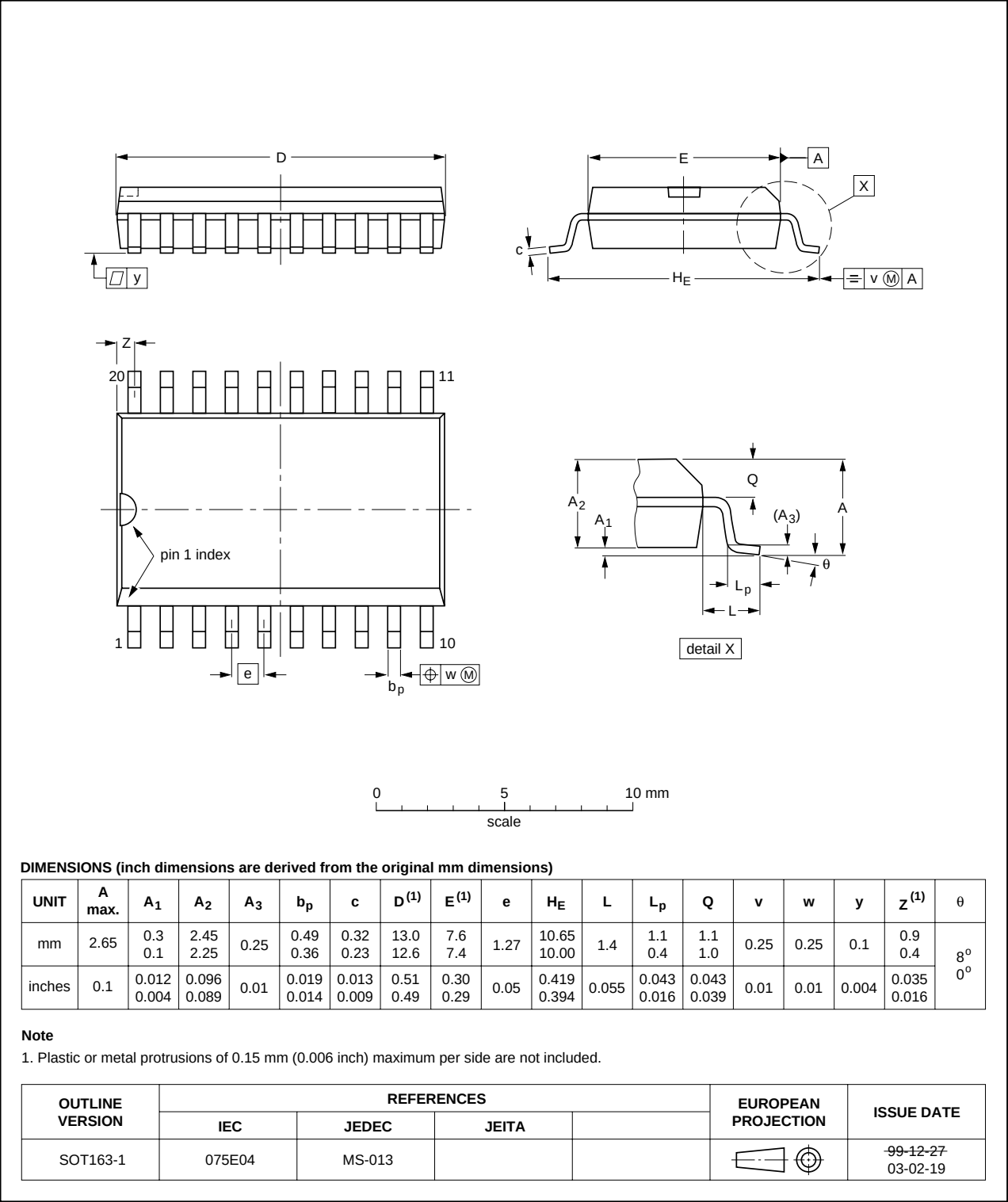
Table 10. Test data

| Input |               |        |               | Load  |              | $V_{EXT}$          |                    |                    |  |
|-------|---------------|--------|---------------|-------|--------------|--------------------|--------------------|--------------------|--|
| $V_I$ | $f_i$         | $t_W$  | $t_r, t_f$    | $C_L$ | $R_L$        | $t_{PHZ}, t_{PZH}$ | $t_{PLZ}, t_{PZL}$ | $t_{PLH}, t_{PHL}$ |  |
| 2.7 V | $\leq 10$ MHz | 500 ns | $\leq 2.5$ ns | 50 pF | 500 $\Omega$ | GND                | 6 V                | open               |  |

13. Package outline

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



SSOP20: plastic shrink small outline package; 20 leads; body width 5.3 mm

SOT339-1

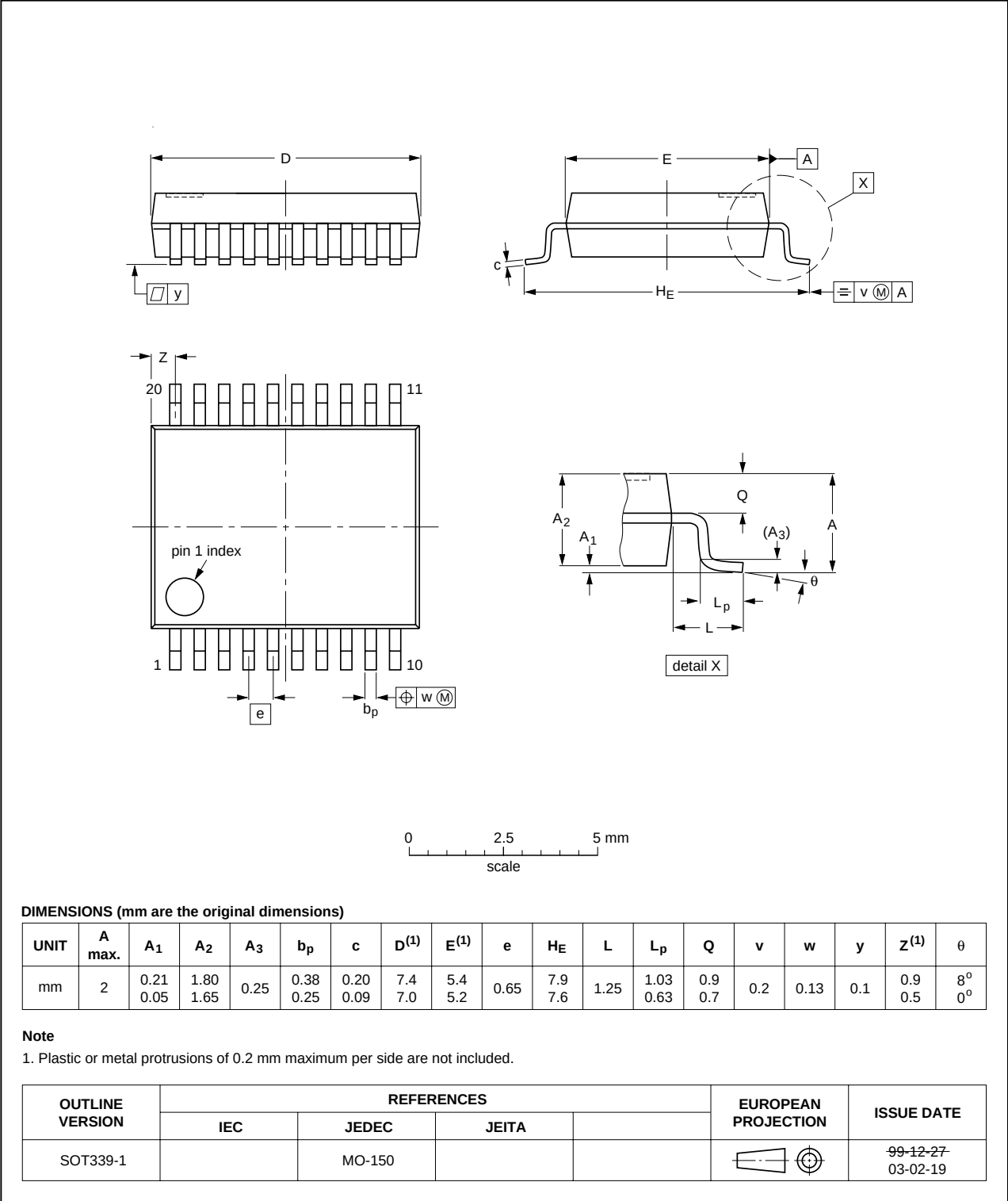


Fig 8. Package outline SOT339-1 (SSOP20)

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

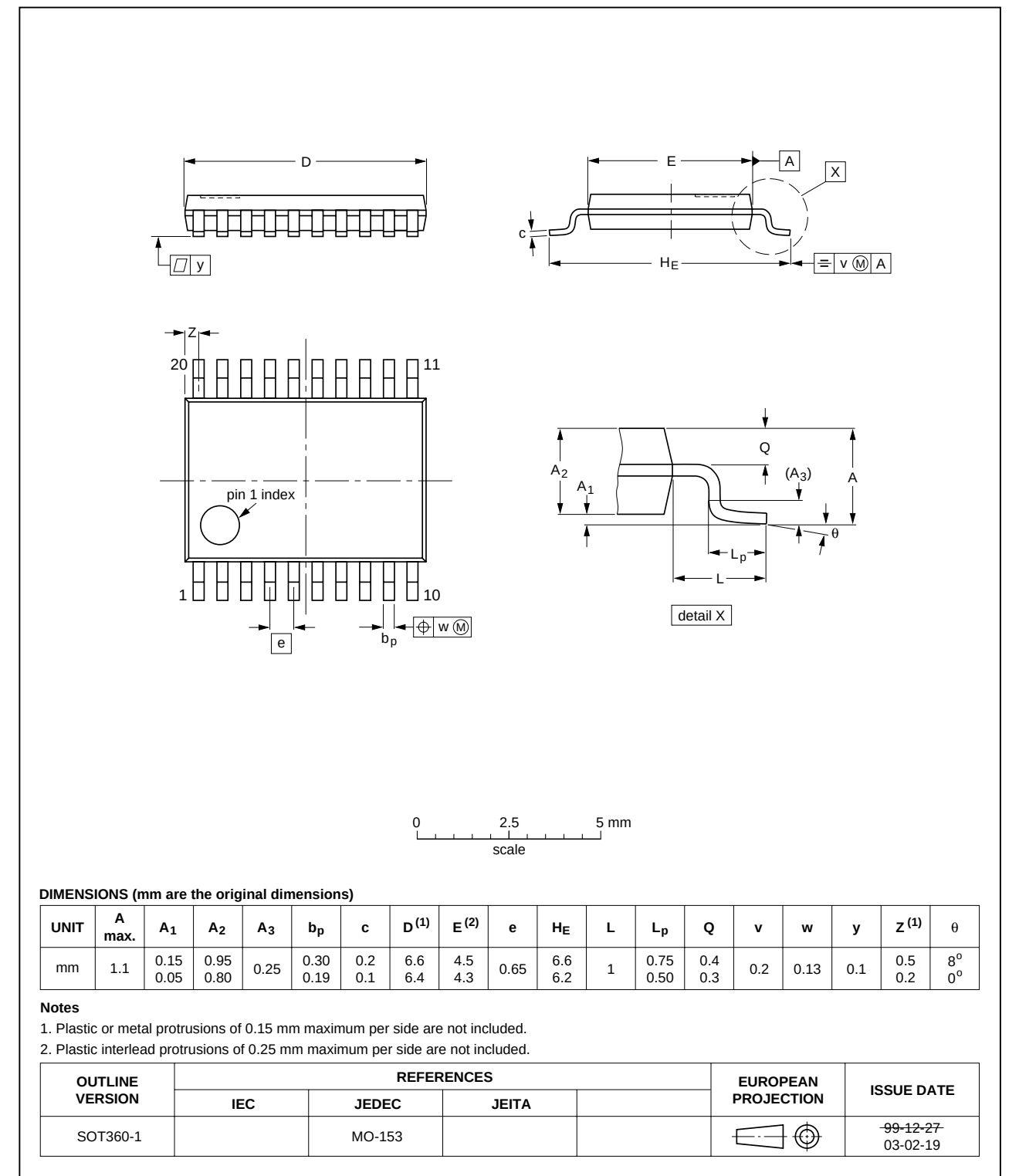


Fig 9. Package outline SOT360-1 (TSSOP20)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

| Document ID      | Release date                                                                                                                                                                                                                                                                                | Data sheet status     | Change notice | Supersedes                   |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------------------|
| 74LVT_LVTH244B_3 | 20060303                                                                                                                                                                                                                                                                                    | Product data sheet    | -             | 74LVT244B_2 (9397 750 11918) |
| Modifications:   | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new presentation and information standard of Philips Semiconductors.</li><li><a href="#">Section 4</a>: Added type numbers 74LVTH244BD, 74LVTH244BDB and 74LVTH244BPW.</li></ul> |                       |               |                              |
| 74LVT244B_2      | 20030919                                                                                                                                                                                                                                                                                    | Product specification | -             | 74LVT244B_1 (9397 750 04814) |
| 74LVT244B_1      | 19981101                                                                                                                                                                                                                                                                                    | Product specification | -             | -                            |

## 16. Legal information

### 16.1 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.semiconductors.philips.com>.

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Date of release: 3 March 2006

Document identifier: 74LVT\_LVTH244B\_3

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