

1. General description

The 74LV1T125 is a single, level translating buffer/line driver with 3-state output. The low threshold inputs support 1.8 V input logic at V_{CC} = 3.3 V and can be used in 1.8 V to 3.3 V level up translation. In addition, the 5 V tolerant input pins enable down translation (3.3 V to 2.5 V output at V_{CC} = 2.5 V). The 3-state output is controlled by the output enable input (\overline{OE}). A HIGH-level at \overline{OE} causes the output to assume a high-impedance OFF-state. The output level is referenced to the supply voltage and supports 1.8 V, 2.5 V, 3.3 V and 5.0 V CMOS levels. The wide V_{CC} range permits the generation of output levels to connect to controllers or processors.

2. Features and benefits

- Single supply voltage translator at 1.8 V, 2.5 V, 3.3 V and 5.0 V
- Up translation
 - 1.2 V to 1.8 V at V_{CC} = 1.8 V
 - 1.5 V to 2.5 V at V_{CC} = 2.5 V
 - 1.8 V to 3.3 V at V_{CC} = 3.3 V
 - 3.3 V to 5.0 V at V_{CC} = 5.0 V
- Down translation
 - 3.3 V to 1.8 V at V_{CC} = 1.8 V
 - 3.3 V to 2.5 V at V_{CC} = 2.5 V
 - 5.0 V to 3.3 V at V_{CC} = 3.3 V
- 5 V tolerant inputs
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Applications

- Portable applications
- PC and notebooks
- Industrial controller
- Telecom

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4. Ordering information

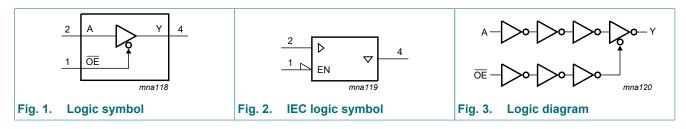
| Type number | Package | | | | | | | | | |
|--------------------|-------------------|--------|----------------------------------------------------------------------------------------------------------------------|------------------|--|--|--|--|--|--|
| | Temperature range | Name | Description | Version | | | | | | |
| 74LV1T125GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | <u>SOT353-1</u> | | | | | | |
| 74LV1T125GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | <u>SOT753</u> | | | | | | |
| <u>74LV1T125GX</u> | -40 °C to +125 °C | X2SON5 | plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm | <u>SOT1226-3</u> | | | | | | |

5. Marking

| Table 2. Marking | |
|------------------|-----------------|
| Type number | Marking code[1] |
| 74LV1T125GW | SN |
| 74LV1T125GV | SN |
| 74LV1T125GX | SN |

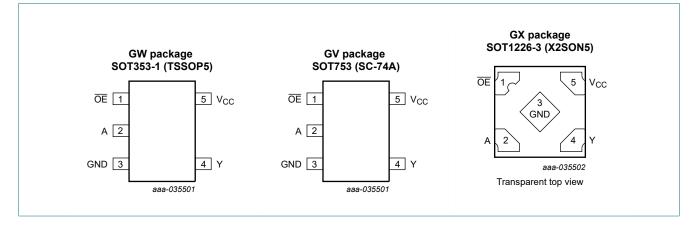
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information





7.2. Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|-----------------|-----|---------------------|
| OE | 1 | output enable input |
| A | 2 | data input |
| GND | 3 | ground (0 V) |
| Y | 4 | data output |
| V _{CC} | 5 | supply voltage |

8. Functional description

Table 4. Function table

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

| Input OE | Output | | | |
|-------------|--------|---|--|--|
| OE | A | Y | | |
| L | L | L | | |
| L | Н | Н | | |
| Н | x | Z | | |

9. 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 | Мах | Unit |
|------------------|-------------------------|------------------------------------------|------|-----------------------|------|
| V _{CC} | supply voltage | | -0.5 | +7.0 | V |
| VI | input voltage | [1] | -0.5 | +7.0 | V |
| Vo | output voltage | output HIGH, LOW or 3-state [2][3] | -0.5 | V _{CC} + 0.5 | V |
| | | output in power-off state [2] | -0.5 | 4.6 | V |
| I _{IK} | input clamping current | V _I < 0 V | -20 | - | mA |
| I _{OK} | output clamping current | $V_{O} < 0 V \text{ or } V_{O} > V_{CC}$ | - | ±20 | mA |
| I _O | output current | $V_{O} = 0 V \text{ to } V_{CC}$ | - | ±25 | mA |
| I _{CC} | supply current | | - | 50 | mA |
| I _{GND} | ground current | | -50 | - | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -40 °C to +125 °C [4] | - | 250 | mW |

[1] If the input current ratings are observed, the minimum input voltage ratings may be exceeded.

[2] If the output current ratings are observed, the output voltage ratings may be exceeded.

[3] This value is limited to 7 V maximum.

For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
 For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.
 For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

10. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Тур | Мах | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| V _{CC} | supply voltage | | 1.6 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | - | 5.5 | V |
| Vo | output voltage | | 0 | - | V _{CC} | V |
| T _{amb} | ambient temperature | | -40 | +25 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 1.8 V to 5.0 V | - | - | 20 | ns/V |

11. Static characteristics

Table 7. Static characteristics

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 ° | °C | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---------------------------|-----------------------------------|---------------------------------------------------------------|----------------------|-------|----------------------|-------|----------------------|-------|------|
| | | | Min | Max | Min | Max | Min | Мах | |
| VIH | HIGH-level | V _{CC} = 1.65 V to 1.8 V | 0.94 | - | 1.0 | - | 1.0 | - | V |
| | input voltage | V _{CC} = 2.0 V | 0.99 | - | 1.03 | - | 1.03 | - | V |
| | | V _{CC} = 2.25 V to 2.5 V | 1.135 | - | 1.18 | - | 1.18 | - | V |
| | | V _{CC} = 2.75 V | 1.21 | - | 1.23 | - | 1.23 | - | V |
| | | V _{CC} = 3.0 V to 3.3 V | 1.35 | - | 1.37 | - | 1.37 | - | V |
| | | V _{CC} = 3.6 V | 1.47 | - | 1.48 | - | 1.48 | - | V |
| | | V _{CC} = 4.5 V to 5.0 V | 2.02 | - | 2.03 | - | 2.03 | - | V |
| | | V _{CC} = 5.5 V | 2.10 | - | 2.11 | - | 2.11 | - | V |
| V _{IL} LOW-level | V _{CC} = 1.65 V to 2.0 V | - | 0.58 | - | 0.55 | - | 0.55 | V | |
| | input voltage | V _{CC} = 2.25 V to 2.75 V | - | 0.75 | - | 0.71 | - | 0.71 | V |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.80 | - | 0.65 | - | 0.65 | V |
| | | V _{CC} = 4.5 V to 5.5 V | - | 0.80 | - | 0.80 | - | 0.80 | V |
| V _{OH} | HIGH-level | V _I = V _{IH} or V _{IL} ; | | | | | | | |
| | output voltage | V _{CC} = 1.65 V to 5.5 V; I _O = -20 μA | V _{CC} -0.1 | - | V _{CC} -0.1 | - | V _{CC} -0.1 | - | V |
| | | V _{CC} = 1.65 V; I _O = -2 mA | 1.28 | - | 1.21 | - | 1.21 | - | V |
| | | V _{CC} = 1.8 V; I _O = -2 mA | 1.5 | - | 1.45 | - | 1.45 | - | V |
| | | V _{CC} = 2.3 V; I _O = -2.3 mA | 2.0 | - | 2.0 | - | 2.0 | - | V |
| | | V _{CC} = 2.3 V; I _O = -3 mA | 2.0 | - | 1.93 | - | 1.93 | - | V |
| | | V _{CC} = 2.5 V; I _O = -3 mA | 2.25 | - | 2.15 | - | 2.15 | - | V |
| | | V _{CC} = 3.0 V; I _O = -3 mA | 2.78 | - | 2.7 | - | 2.7 | - | V |
| | | V _{CC} = 3.0 V; I _O = -5.5 mA | 2.6 | - | 2.49 | - | 2.49 | - | V |
| | | V _{CC} = 3.3 V; I _O = -5.5 mA | 2.9 | - | 2.8 | - | 2.8 | - | V |
| | | V _{CC} = 4.5 V; I _O = -4 mA | 4.2 | - | 4.1 | - | 4.1 | - | V |
| | | V _{CC} = 4.5 V; I _O = -8 mA | 4.1 | - | 3.95 | - | 3.95 | - | V |
| | | V _{CC} = 5.0 V; I _O = -8 mA | 4.6 | - | 4.5 | - | 4.5 | - | V |
| V _{OL} | LOW-level | V _I = V _{IH} or V _{IL} | | | | | | | |
| | output voltage | V_{CC} = 1.65 V to 5.5 V; I _O = 20 µA | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | V _{CC} = 1.65 V; I _O = 2 mA | - | 0.2 | - | 0.25 | - | 0.25 | V |
| | | V _{CC} = 2.3 V; I _O = 2.3 mA | - | 0.1 | - | 0.15 | - | 0.15 | V |
| | | V _{CC} = 2.3 V; I _O = 3 mA | - | 0.15 | - | 0.2 | - | 0.2 | V |
| | | V _{CC} = 3.0 V; I _O = 3 mA | - | 0.1 | - | 0.15 | - | 0.15 | V |
| | | V _{CC} = 3.0 V; I _O = 5.5 mA | - | 0.2 | - | 0.252 | - | 0.252 | V |
| | | V _{CC} = 4.5 V; I _O = 4 mA | - | 0.15 | - | 0.2 | - | 0.2 | V |
| | | V _{CC} = 4.5 V; I _O = 8 mA | - | 0.3 | - | 0.35 | - | 0.35 | V |
| I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 0 V$ to 5.5 V | - | ±0.1 | - | ±1 | - | ±1 | μA |
| I _{OZ} | OFF-state output current | | - | ±0.25 | - | ±2.5 | - | ±2.5 | μA |

| Symbol | Parameter | Conditions | 25 °C | | -40 °C to +85 °C | | -40 °C to | Unit | |
|------------------|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------|------|------------------|-----|-----------|------|----|
| | | | Min | Max | Min | Max | Min | Max | 1 |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 1.8 V, 2.5 V, 3.3 V, 5.0 V | - | 1 | - | 10 | - | 10 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _{CC} = 1.8 V; V _I = 0.3 V or 1.1 V; I _O = 0 A; other pins at V _{CC} or GND | - | 10 | - | 10 | - | 10 | μA |
| | | per input pin; V _{CC} = 5.5 V; V _I = 0.3 V or 3.4 V; I _O = 0 A; other pins at V _{CC} or GND | - | 1.35 | - | 1.5 | - | 1.5 | mA |

12. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V. For test circuit, see Fig. 6.

| Symbol | Parameter | Conditions | | 25 °C | | -40 °C to | o +85 °C | -40 °C to | o +125 °C | Unit |
|------------------|--------------|-------------------------------------------------|-----|-------|------|-----------|----------|-----------|-----------|------|
| | | | Min | Тур | Max | Min | Max | Min | Max | 1 |
| t _{pd} | propagation | A to Y; see <u>Fig. 4</u> [1] | | | | | | | | |
| | delay | V _{CC} = 1.8 V; C _L = 15 pF | - | 6.5 | 9.6 | - | 10.8 | - | 11.6 | ns |
| | | V _{CC} = 1.8 V; C _L = 30 pF | - | 7.6 | 10.8 | - | 12.2 | - | 13.1 | ns |
| | | V _{CC} = 2.5 V; C _L = 15 pF | - | 4.6 | 6.6 | - | 7.5 | - | 8.0 | ns |
| | | V _{CC} = 2.5 V; C _L = 30 pF | - | 5.3 | 7.4 | - | 8.4 | - | 9.1 | ns |
| | | V _{CC} = 3.3 V; C _L = 15 pF | - | 3.8 | 5.4 | - | 6.0 | - | 6.4 | ns |
| | | V _{CC} = 3.3 V; C _L = 30 pF | - | 4.4 | 6.0 | - | 6.8 | - | 7.3 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 3.2 | 4.1 | - | 4.4 | - | 4.7 | ns |
| | | V _{CC} = 5.0 V; C _L = 30 pF | - | 3.6 | 4.6 | - | 5.1 | - | 5.4 | ns |
| t _{en} | enable time | OE to Y; see Fig. 5 [1] | | | | | | | | |
| | | V _{CC} = 1.8 V; C _L = 15 pF | - | 7.8 | 10.7 | - | 12.1 | - | 12.9 | ns |
| | | V _{CC} = 1.8 V; C _L = 30 pF | - | 9.0 | 12.6 | - | 14.3 | - | 15.3 | ns |
| | | V _{CC} = 2.5 V; C _L = 15 pF | - | 5.5 | 7.1 | - | 8.0 | - | 8.6 | ns |
| | | V _{CC} = 2.5 V; C _L = 30 pF | - | 6.3 | 8.3 | - | 9.3 | - | 10.0 | ns |
| | | V _{CC} = 3.3 V; C _L = 15 pF | - | 4.5 | 5.6 | - | 6.3 | - | 6.8 | ns |
| | | V _{CC} = 3.3 V; C _L = 30 pF | - | 5.1 | 6.4 | - | 7.2 | - | 7.7 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 3.2 | 4.1 | - | 4.6 | - | 4.8 | ns |
| | | V _{CC} = 5.0 V; C _L = 30 pF | - | 3.7 | 4.7 | - | 5.3 | - | 5.5 | ns |
| t _{dis} | disable time | OE to Y; see <u>Fig. 5</u> [1] | | | | | | | | |
| | | V _{CC} = 1.8 V; C _L = 15 pF | - | 7.6 | 9.7 | - | 10.7 | - | 11.3 | ns |
| | | V _{CC} = 1.8 V; C _L = 30 pF | - | 10.5 | 12.9 | - | 14.0 | - | 14.7 | ns |
| | | V _{CC} = 2.5 V; C _L = 15 pF | - | 5.5 | 7.0 | - | 7.7 | - | 8.1 | ns |
| | | V _{CC} = 2.5 V; C _L = 30 pF | - | 7.4 | 9.0 | - | 10.0 | - | 10.3 | ns |
| | | V _{CC} = 3.3 V; C _L = 15 pF | - | 4.5 | 5.8 | - | 6.4 | - | 6.7 | ns |
| | | V _{CC} = 3.3 V; C _L = 30 pF | - | 5.9 | 7.5 | - | 8.1 | - | 8.6 | ns |
| | | V _{CC} = 5.0 V; C _L = 15 pF | - | 4.0 | 5.5 | - | 5.9 | - | 6.2 | ns |
| | | V _{CC} = 5.0 V; C _L = 30 pF | - | 5.0 | 6.5 | - | 6.9 | - | 7.3 | ns |

Single supply translating buffer/line driver; 3-state

| Symbol | Parameter | Conditions | | 25 °C | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------|-----------------------|---------------------------------------------------------------------|-----|-------|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Тур | Мах | Min | Max | Min | Max | |
| CI | input capacitance | $V_I = V_{CC}$ or GND; $V_{CC} = 3.3 V$ | - | 1.5 | 10 | - | 10 | - | 10 | pF |
| Co | output capacitance | $V_{O} = V_{CC}$ or GND; $V_{CC} = 3.3 V$ | - | 2.5 | - | - | - | - | - | pF |
| C _{PD} | power dissipation | per buffer; V_I = GND to V_{CC} ; [2] C_L = 30 pF; f = 10 MHz | | | | | | | | |
| | capacitance | V _{CC} = 1.8 V | - | 4.1 | - | - | - | - | - | pF |
| | | V _{CC} = 2.5 V | - | 5.3 | - | - | - | - | - | pF |
| | | V _{CC} = 3.3 V | - | 6.9 | - | - | - | - | - | pF |
| | | V _{CC} = 5.0 V | - | 10.7 | - | - | - | - | - | pF |

[1] 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} . [2] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

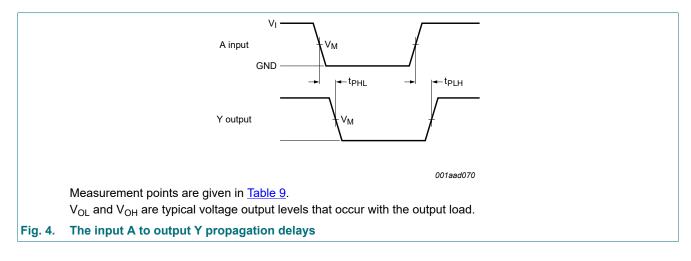
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

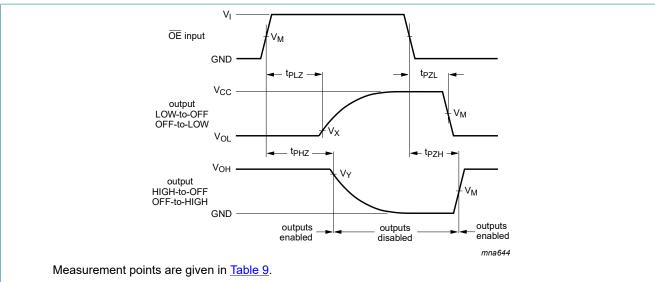
N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_0)$ = sum of the outputs.

12.1. Waveforms and test circuit



Single supply translating buffer/line driver; 3-state

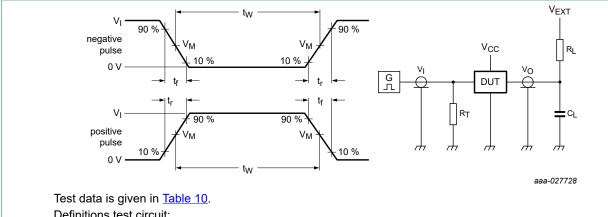


 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

3-state enable and disable times Fig. 5.

Table 9. Measurement points

| Input | Output | | |
|----------------------|---------------------|-------------------------|-------------------------|
| V _M | V _M | V _X | V _Y |
| 0.5 × V _I | $0.5 \times V_{CC}$ | V _{OL} + 0.3 V | V _{OH} - 0.3 V |



Definitions test circuit:

 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator;

- C_L = Load capacitance including jig and probe capacitance;
- R_L = Load resistance;

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

Test circuit for measuring switching times Fig. 6.

Table 10. Test data

| Supply voltage | ply voltage Input | | Load | | V _{EXT} | | | | |
|-----------------|-------------------|------------|------------------|--------------|------------------|-------------------------------------|-------------------------------------|-------------------------------------|--|
| V _{cc} | VI | Δt/ΔV[1] | f _{max} | CL | RL | t _{PLH} , t _{PHL} | t _{PZH} , t _{PHZ} | t _{PZL} , t _{PLZ} | |
| 1.8 V | V _{CC} | ≤ 1.0 ns/V | 15 MHz | 15 pF, 30 pF | 1 kΩ | open | GND | V _{CC} | |
| 2.5 V | V _{CC} | ≤ 1.0 ns/V | 25 MHz | 15 pF, 30 pF | 1 kΩ | open | GND | V _{CC} | |
| 3.3 V | 3 V | ≤ 1.0 ns/V | 50 MHz | 15 pF, 30 pF | 1 kΩ | open | GND | V _{CC} | |
| 5.0 V | 3 V | ≤ 1.0 ns/V | 50 MHz | 15 pF, 30 pF | 1 kΩ | open | GND | V _{CC} | |

dV/dt ≥ 1.0 V/ns [1]

13. Package outline

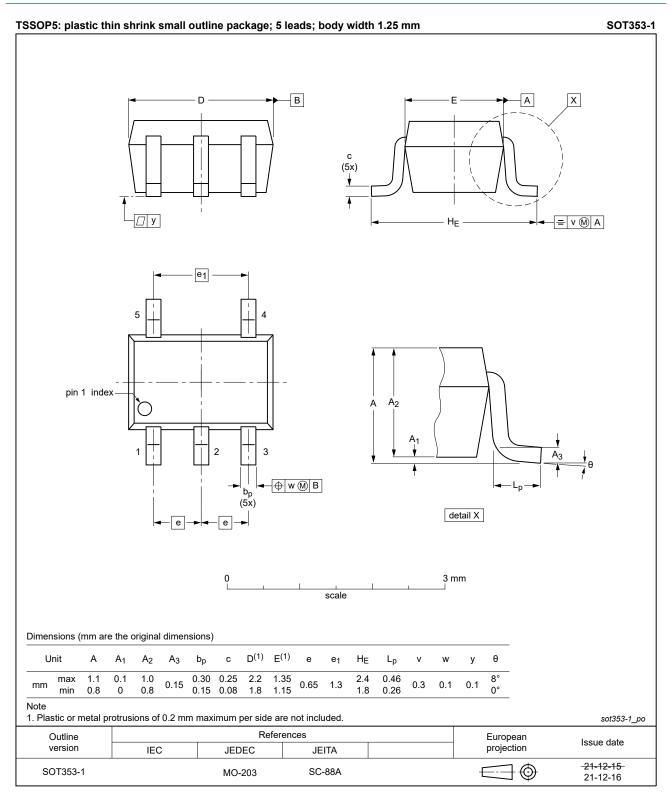


Fig. 7. Package outline SOT353-1 (TSSOP5)

Single supply translating buffer/line driver; 3-state

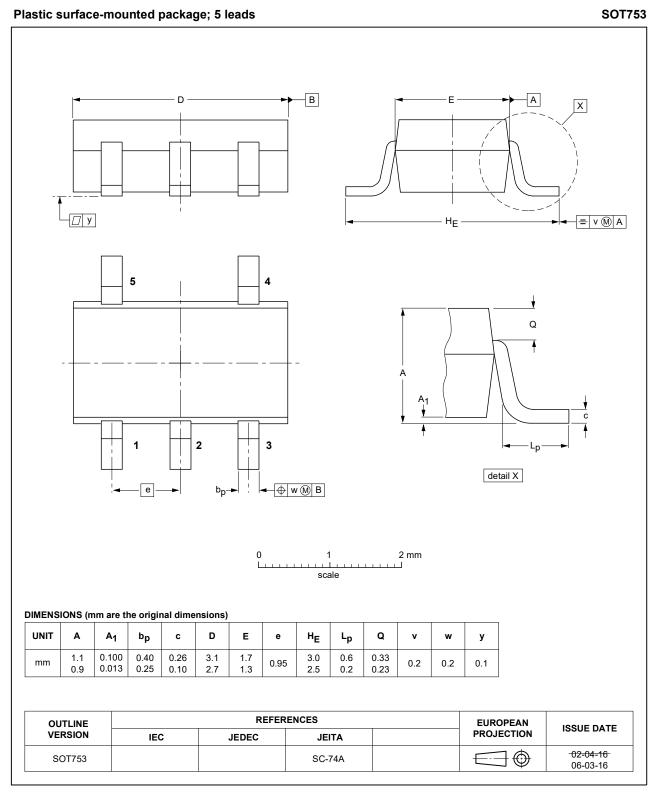


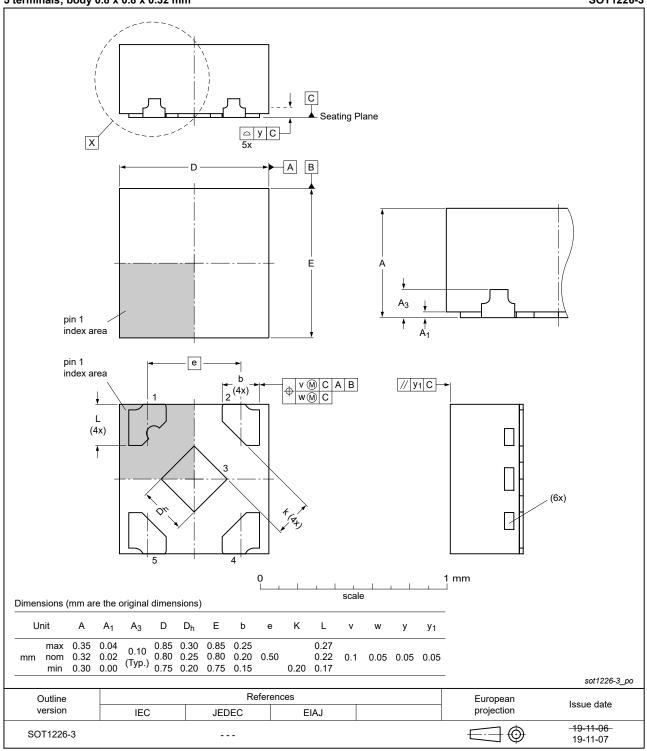
Fig. 8. Package outline SOT753 (SC-74A)

⁷⁴LV1T125

Single supply translating buffer/line driver; 3-state

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.32 mm

SOT1226-3





14. Abbreviations

| Acronym | Description |
|---------|-----------------------------------------|
| CDM | Charge Device Model |
| CMOS | Complementary Metal Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes | | |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|---------------|--|--|
| 74LV1T125 v.4.2 | 20231206 | Product data sheet | - | 74LV1T125 v.3 | | |
| Modifications: | Package SOT1226 (X2SON5) has changed to SOT1226-3 (X2SON5). <u>Section 2</u>: ESD specification updated according to the latest JEDEC standard. | | | | | |
| 74LV1T125 v.3 | 20220208 | Product data sheet | - | 74LV1T125 v.2 | | |
| Modifications: | • Fig. 7: Package outline for SOT353-1 (TSSOP5) package has changed. | | | | | |
| 74LV1T125 v.2 | 20191203 | Product data sheet | - | 74LV1T125 v.1 | | |
| Modifications: | Type number 74LV1T125GV (SOT753/SC-74A) added. <u>Table 5</u>: Derating values for P_{tot} total power dissipation updated. | | | | | |
| 74LV1T125 v.1 | 20171122 | Product data sheet | - | - | | |

16. Legal information

Data sheet status

| 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. |

 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 <u>https://www.nexperia.com</u>.

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Single supply translating buffer/line driver; 3-state

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