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74CBTLV1G125

Single bus switch

Rev. 5 — 10 November 2016

Product data sheet

1. General description

The 74CBTLV1G125 provides a single high-speed line switch. The switch is disabled when the output enable (\overline{OE}) input is high.

To ensure the high-impedance OFF-state during power-up or power-down, tie \overline{OE} to the V_{CC} through a pull-up resistor. The current-sinking capability of the driver determines the minimum value of the resistor.

Schmitt trigger action at control input makes the circuit tolerant to slower input rise and fall times across the entire V_{CC} range from 2.3 V to 3.6 V.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2. Features and benefits

- Supply voltage range from 2.3 V to 3.6 V
- High noise immunity
- Complies with JEDEC standard:
 - ◆ JESD8-5 (2.3 V to 2.7 V)
 - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
 - ◆ CDM JESD22-C101E exceeds 1000 V
- 5 Ω switch connection between two ports
- Rail to rail switching on data I/O ports
- CMOS low power consumption
- Latch-up performance meets requirements of JESD78 Class I
- I_{OFF} circuitry provides partial power-down mode operation
- Multiple package options
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|----------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74CBTLV1G125GW | –40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74CBTLV1G125GV | –40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74CBTLV1G125GM | –40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74CBTLV1G125GF | –40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm | SOT891 |
| 74CBTLV1G125GN | –40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm | SOT1115 |
| 74CBTLV1G125GS | –40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm | SOT1202 |

4. Marking

Table 2. Marking

| Type number | Marking code ^[1] |
|----------------|-----------------------------|
| 74CBTLV1G125GW | bM |
| 74CBTLV1G125GV | b25 |
| 74CBTLV1G125GM | bM |
| 74CBTLV1G125GF | bM |
| 74CBTLV1G125GN | bM |
| 74CBTLV1G125GS | bM |

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

5. Functional diagram



Fig 1. Logic symbol

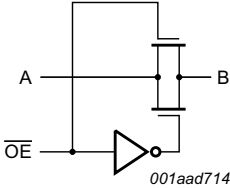
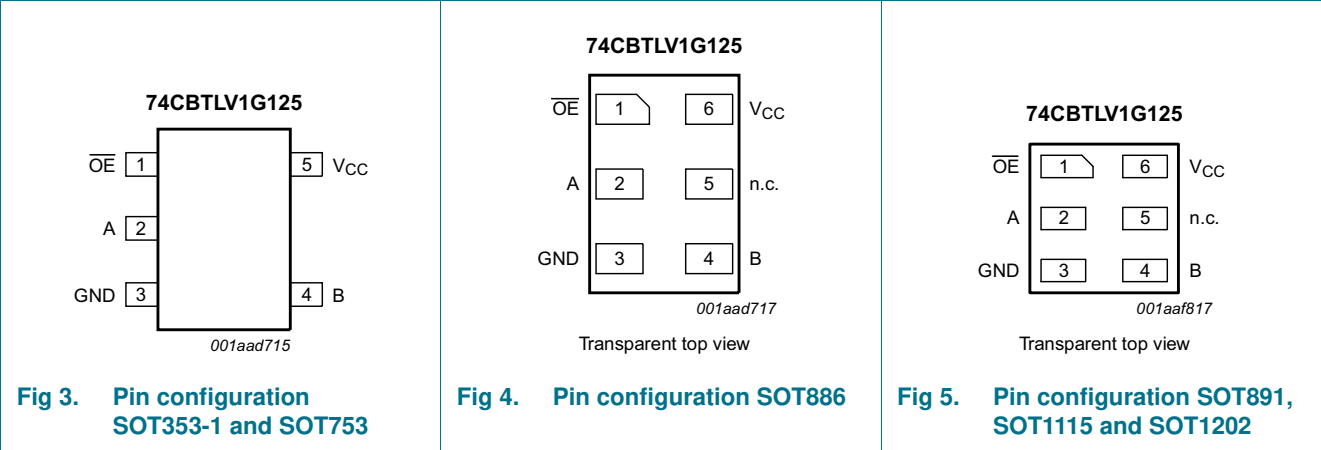


Fig 2. Logic diagram

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|--------|------------------|-------------------------------------|-------------------------------------|
| | SOT353-1, SOT753 | SOT886, SOT891, SOT1115 and SOT1202 | |
| OE | 1 | 1 | output enable input OE (active LOW) |
| A | 2 | 2 | data input or output A |
| GND | 3 | 3 | ground (0 V) |
| B | 4 | 4 | data input or output B |
| n.c. | - | 5 | not connected |
| VCC | 5 | 6 | supply voltage |

7. Functional description

7.1 Function table

Table 4. Function table^[1]

| Output enable input OE | Function switch |
|------------------------|-----------------|
| L | ON-state |
| H | OFF-state |

[1] H = HIGH voltage level; L = LOW voltage level.

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 | [1] | -0.5 | +4.6 | V |
| V_{SW} | switch voltage | enable and disable mode | -0.5 | $V_{CC} + 0.5$ | V |
| I_{IK} | input clamping current | $V_{IO} < -0.5$ V | -50 | - | mA |
| I_{SK} | switch clamping current | $V_I < -0.5$ V or $V_I > V_{CC} + 0.5$ V | - | ± 50 | mA |
| I_{SW} | switch current | $V_{SW} = 0$ V to V_{CC} | - | ± 128 | 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 [2] | - | 250 | mW |

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

[2] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-------------------------------------|-------------------------------|-----|-----|----------|------|
| V_{CC} | supply voltage | | 2.3 | - | 3.6 | V |
| V_I | input voltage | | 0 | - | 3.6 | V |
| V_{SW} | switch voltage | enable and disable mode | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.3$ V to 3.6 V [1] | 0 | - | 20 | ns/V |

[1] Applies to control signal levels.

10. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | Min | Typ ^[1] | Max | Unit |
|--------------------------------------|---------------------------|--|-----|--------------------|------|------|
| T _{amb} = −40 °C to +85 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | V |
| I _I | input leakage current | V _I = GND to V _{CC} ; V _{CC} = 3.6 V | - | - | ±1.0 | μA |
| I _{S(OFF)} | OFF-state leakage current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} – GND; V _{CC} = 3.6 V; see Figure 6 | - | ±0.1 | ±5 | μA |
| I _{S(ON)} | ON-state leakage current | V _I = V _{IH} or V _{IL} ; V _{CC} = 3.6 V; see Figure 7 | - | ±0.1 | ±5 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V | - | - | ±10 | μA |
| I _{CC} | supply current | V _I = GND or V _{CC} ; I _O = 0 A; V _{CC} = 3.6 V | - | - | 10 | μA |
| ΔI _{CC} | additional supply current | control input; V _I = V _{CC} – 0.6 V; V _{CC} = 3.6 V [2] | - | - | 300 | μA |
| C _I | input capacitance | control input; V _I = 0 V or 3 V | - | 2.5 | - | pF |
| C _{sw} | switch capacitance | OFF-state | - | 7.0 | - | pF |
| | | ON-state | - | 10.3 | - | pF |
| T _{amb} = −40 °C to +125 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | V |
| I _I | input leakage current | V _I = GND to V _{CC} ; V _{CC} = 3.6 V | - | - | ±100 | μA |
| I _{S(OFF)} | OFF-state leakage current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} – GND; V _{CC} = 3.6 V; see Figure 6 | - | - | ±200 | μA |
| I _{S(ON)} | ON-state leakage current | V _I = V _{IH} or V _{IL} ; V _{CC} = 3.6 V; see Figure 7 | - | - | ±200 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 0 V to 3.6 V; V _{CC} = 0 V | - | - | ±10 | μA |
| I _{CC} | supply current | V _I = GND or V _{CC} ; I _O = 0 A; V _{CC} = 3.6 V | - | - | 200 | μA |
| ΔI _{CC} | additional supply current | control input; V _I = V _{CC} – 0.6 V; V _{CC} = 3.6 V [2] | - | - | 5000 | μA |

[1] Typical values are measured at T_{amb} = 25 °C and at V_{CC} = 3.3 V.

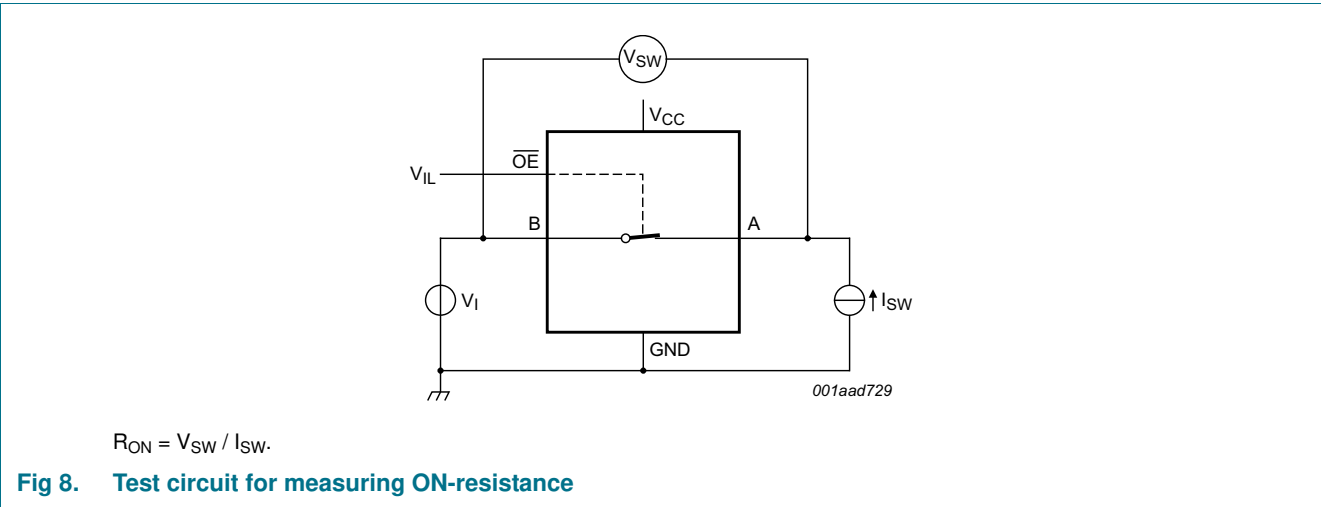
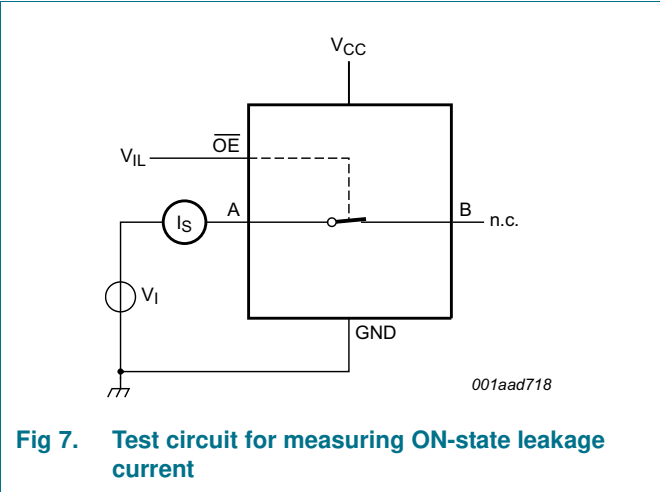
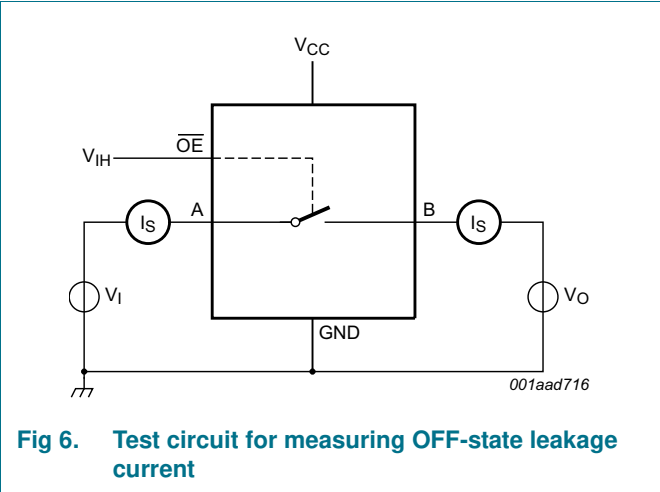
[2] One input at 3 V, other inputs at V_{CC} or GND.

Table 8. Resistance R_{ON}

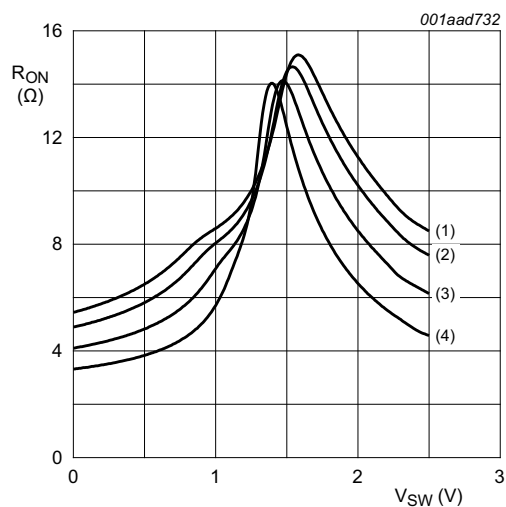
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); see test circuit [Figure 8](#).

| Symbol | Parameter | Conditions | −40 °C to +85 °C | | | −40 °C to +125 °C | | Unit |
|-----------------|---------------|--|------------------|--------------------|-----|-------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| R _{ON} | ON resistance | V _{CC} = 2.3 V; see Figure 9 ^[2] | | | | | | |
| | | I _{SW} = 64 mA; V _I = 0 V | - | 4.7 | 10 | - | 15.0 | Ω |
| | | I _{SW} = 24 mA; V _I = 0 V | - | 4.5 | 10 | - | 15.0 | Ω |
| | | I _{SW} = 15 mA; V _I = 1.7 V | - | 11 | 25 | - | 38.0 | Ω |
| | | V _{CC} = 3.0 V; see Figure 10 | | | | | | |
| | | I _{SW} = 64 mA; V _I = 0 V | - | 4.2 | 7 | - | 11.0 | Ω |
| | | I _{SW} = 24 mA; V _I = 0 V | - | 4.1 | 7 | - | 11.0 | Ω |
| | | I _{SW} = 15 mA; V _I = 2.4 V | - | 7.3 | 15 | - | 25.5 | Ω |

- [1] Typical values are measured at T_{amb} = 25 °C.
- [2] Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

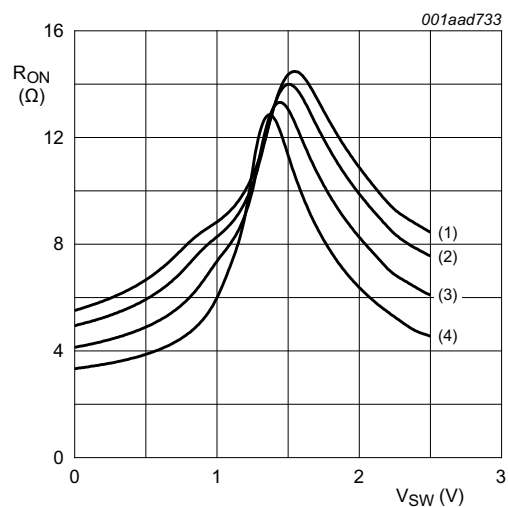


$R_{ON} = V_{SW} / I_{SW}$



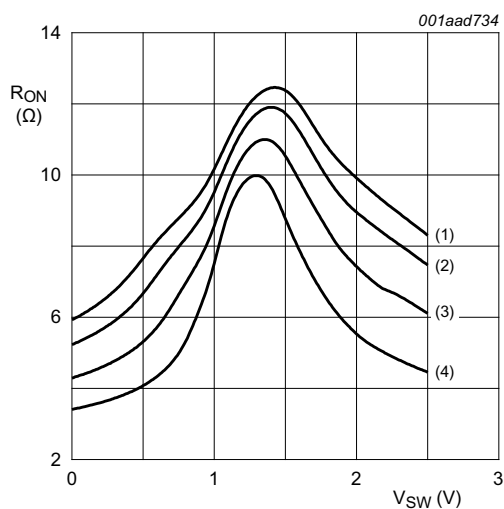
- (1) $T_{amb} = 125\text{ °C}$
- (2) $T_{amb} = 85\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = -40\text{ °C}$

a. $V_{CC} = 2.5\text{ V}$; $I_{SW} = 15\text{ mA}$; $V_{SW} = 1.7\text{ V}$



- (1) $T_{amb} = 125\text{ °C}$
- (2) $T_{amb} = 85\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = -40\text{ °C}$

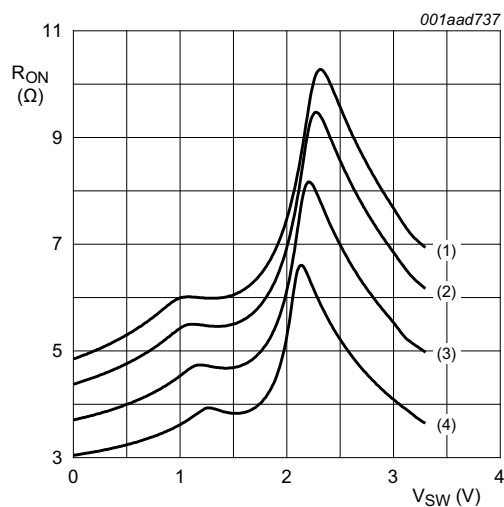
b. $V_{CC} = 2.5\text{ V}$; $I_{SW} = 24\text{ mA}$; $V_{SW} = 0\text{ V}$



- (1) $T_{amb} = 125\text{ °C}$
- (2) $T_{amb} = 85\text{ °C}$
- (3) $T_{amb} = 25\text{ °C}$
- (4) $T_{amb} = -40\text{ °C}$

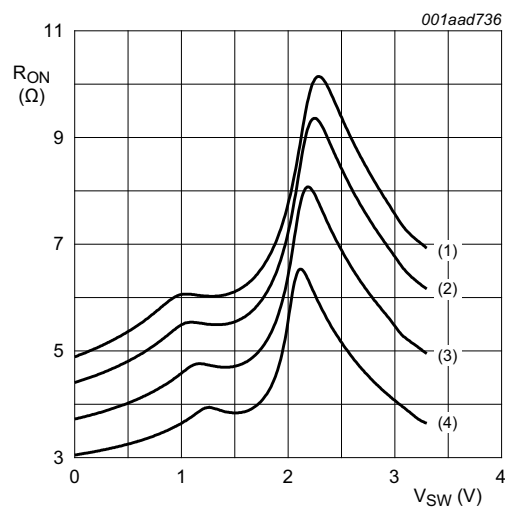
c. $V_{CC} = 2.5\text{ V}$; $I_{SW} = 64\text{ mA}$; $V_{SW} = 0\text{ V}$

Fig 9. Switch ON-resistance as a function of input voltage at $V_{CC} = 2.5\text{ V}$



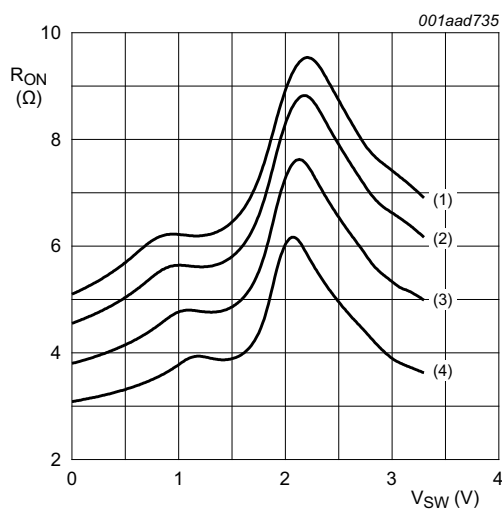
- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$

a. $V_{CC} = 3.3\text{ V}$; $I_{SW} = 15\text{ mA}$; $V_{SW} = 2.4\text{ V}$



- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$

b. $V_{CC} = 3.3\text{ V}$; $I_{SW} = 24\text{ mA}$; $V_{SW} = 0\text{ V}$



- (1) $T_{amb} = 125\text{ }^{\circ}\text{C}$
- (2) $T_{amb} = 85\text{ }^{\circ}\text{C}$
- (3) $T_{amb} = 25\text{ }^{\circ}\text{C}$
- (4) $T_{amb} = -40\text{ }^{\circ}\text{C}$

c. $V_{CC} = 3.3\text{ V}$; $I_{SW} = 64\text{ mA}$; $V_{SW} = 0\text{ V}$

Fig 10. Switch ON-resistance as a function of input voltage at $V_{CC} = 3.3\text{ V}$

11. Dynamic characteristics

Table 9. Dynamic characteristics
GND = 0 V; see Figure 13.

| Symbol | Parameter | Conditions | −40 °C to +85 °C | | | −40 °C to +125 °C | | Unit |
|------------------|-------------------|---|------------------|--------------------|------|-------------------|------|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| t _{pd} | propagation delay | A to B or B to A; see Figure 11; R _L = ∞ Ω ^{[2][3]} | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.21 | - | 0.32 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.16 | 0.25 | - | 0.39 | ns |
| t _{en} | enable time | \overline{OE} to A or B; see Figure 12; R _L = 500 Ω ^[4] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.50 | 4.00 | 1.0 | 5.00 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 2.05 | 4.00 | 1.0 | 5.00 | ns |
| t _{dis} | disable time | \overline{OE} to A or B; see Figure 12; R _L = 500 Ω ^[5] | | | | | | |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.80 | 5.00 | 1.0 | 6.30 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.0 | 3.40 | 4.10 | 1.0 | 5.40 | ns |

- [1] All typical values are measured at T_{amb} = 25 °C and at nominal V_{CC}.
- [2] The propagation delay is the calculated RC time constant of the maximum on-state resistance of the switch and the load capacitance, when driven by an ideal voltage source (zero output impedance).
- [3] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [4] t_{en} is the same as t_{PZH} and t_{PZL}.
- [5] t_{dis} is the same as t_{PHZ} and t_{PLZ}.

12. Waveforms

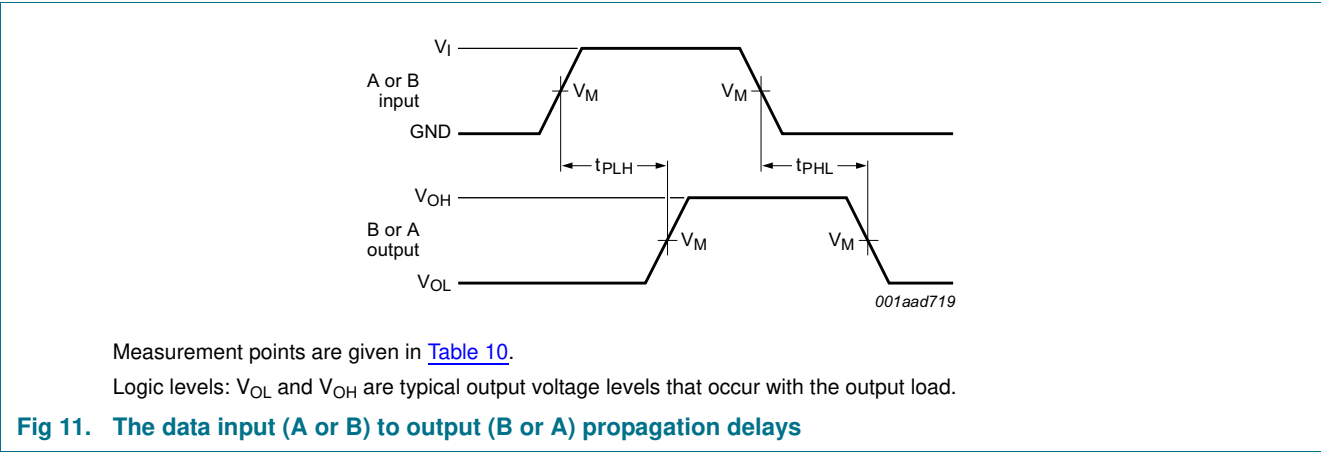
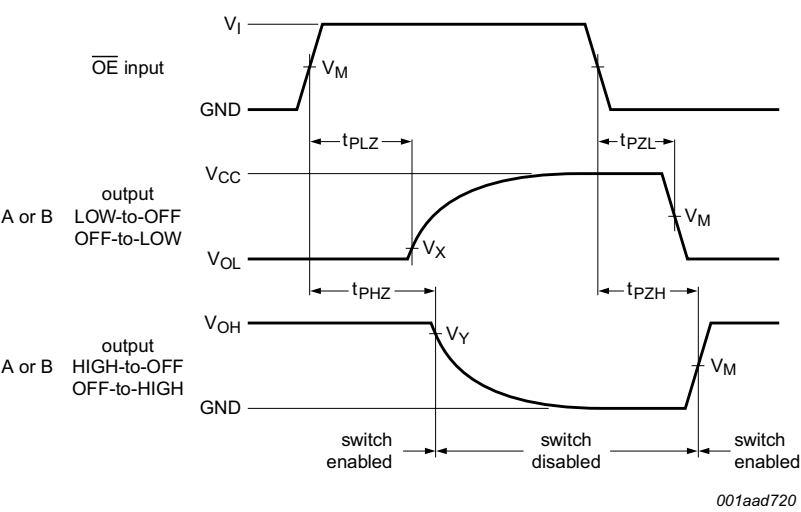


Table 10. Measurement points

| Supply voltage | Output | Inputs | | |
|-----------------|-----------------------|-----------------------|-----------------|---------------------------------|
| V _{CC} | V _M | V _M | V _I | t _r = t _f |
| 2.3 V to 3.6 V | 0.5 × V _{CC} | 0.5 × V _{CC} | V _{CC} | ≤ 2.0 ns |

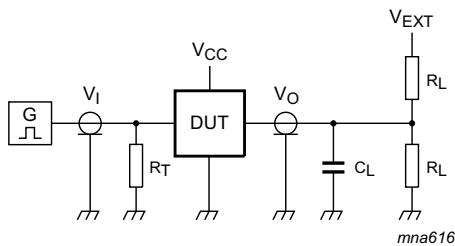


Measurement points are given in [Table 11](#).
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 12. Enable and disable times

Table 11. Measurement points

| Supply voltage | Input | Output | | |
|----------------|---------------------|---------------------|---------------------------|---------------------------|
| V_{CC} | V_M | V_M | V_X | V_Y |
| 2.3 V to 2.7 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.15 \text{ V}$ | $V_{OH} - 0.15 \text{ V}$ |
| 3.0 V to 3.6 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.3 \text{ V}$ | $V_{OH} - 0.3 \text{ V}$ |



Test data is given in [Table 12](#).
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 the output impedance Z_o of the pulse generator.
 V_{EXT} = Test voltage for switching times.

Fig 13. Test circuit for measuring switching times

Table 12. Test data

| Supply voltage | Load | V_{EXT} | | |
|----------------|-------|-----------------------|-----------------------|-----------------------|
| V_{CC} | C_L | t_{PLH} , t_{PHL} | t_{PZH} , t_{PHZ} | t_{PZL} , t_{PLZ} |
| 2.3 V to 2.7 V | 30 pF | open | GND | $2 \times V_{CC}$ |
| 3.0 V to 3.6 V | 50 pF | open | GND | $2 \times V_{CC}$ |

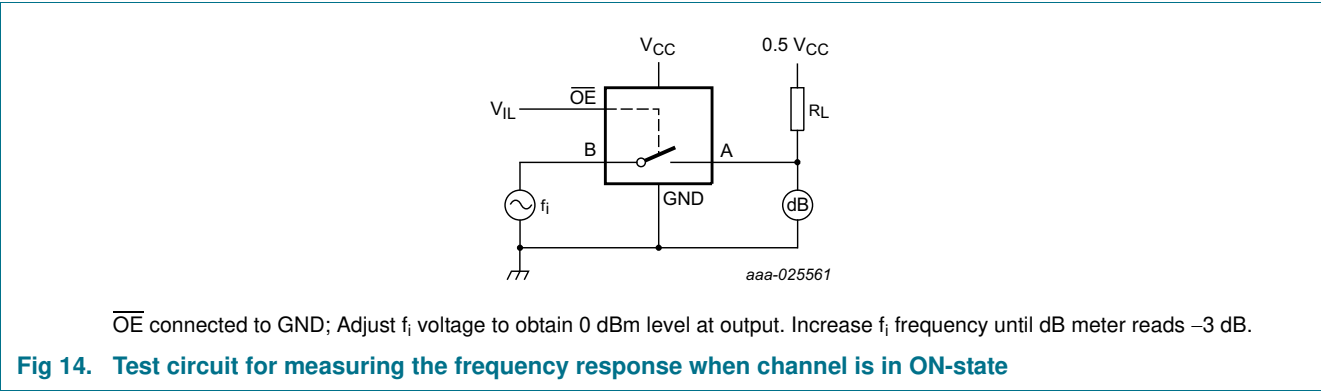
12.1 Additional dynamic characteristics

Table 13. Additional dynamic characteristics
At recommended operating conditions; voltages are referenced to GND (ground = 0 V); $V_I = \text{GND}$ or V_{CC} (unless otherwise specified); $t_r = t_f \leq 2.5 \text{ ns}$.

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | Unit |
|---------------------|--------------------------|--|--------------------------|-----|-----|------|
| | | | Min | Typ | Max | |
| f _(-3dB) | -3 dB frequency response | V _{CC} = 3.3 V; R _L = 50 Ω; see Figure 14 ^[1] | - | 263 | - | MHz |

[1] f_i is biased at 0.5V_{CC}.

12.2 Test circuits



13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

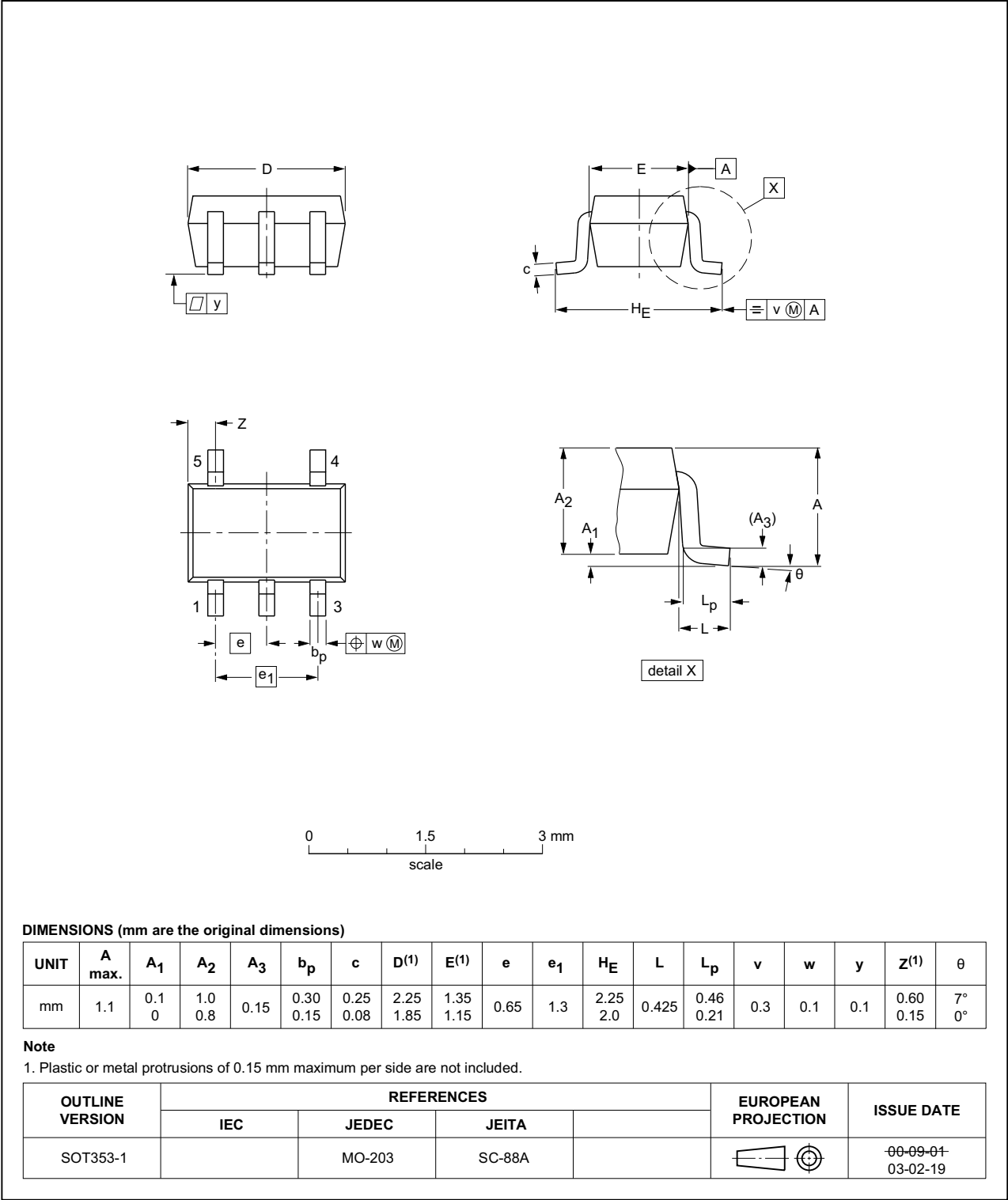


Fig 15. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

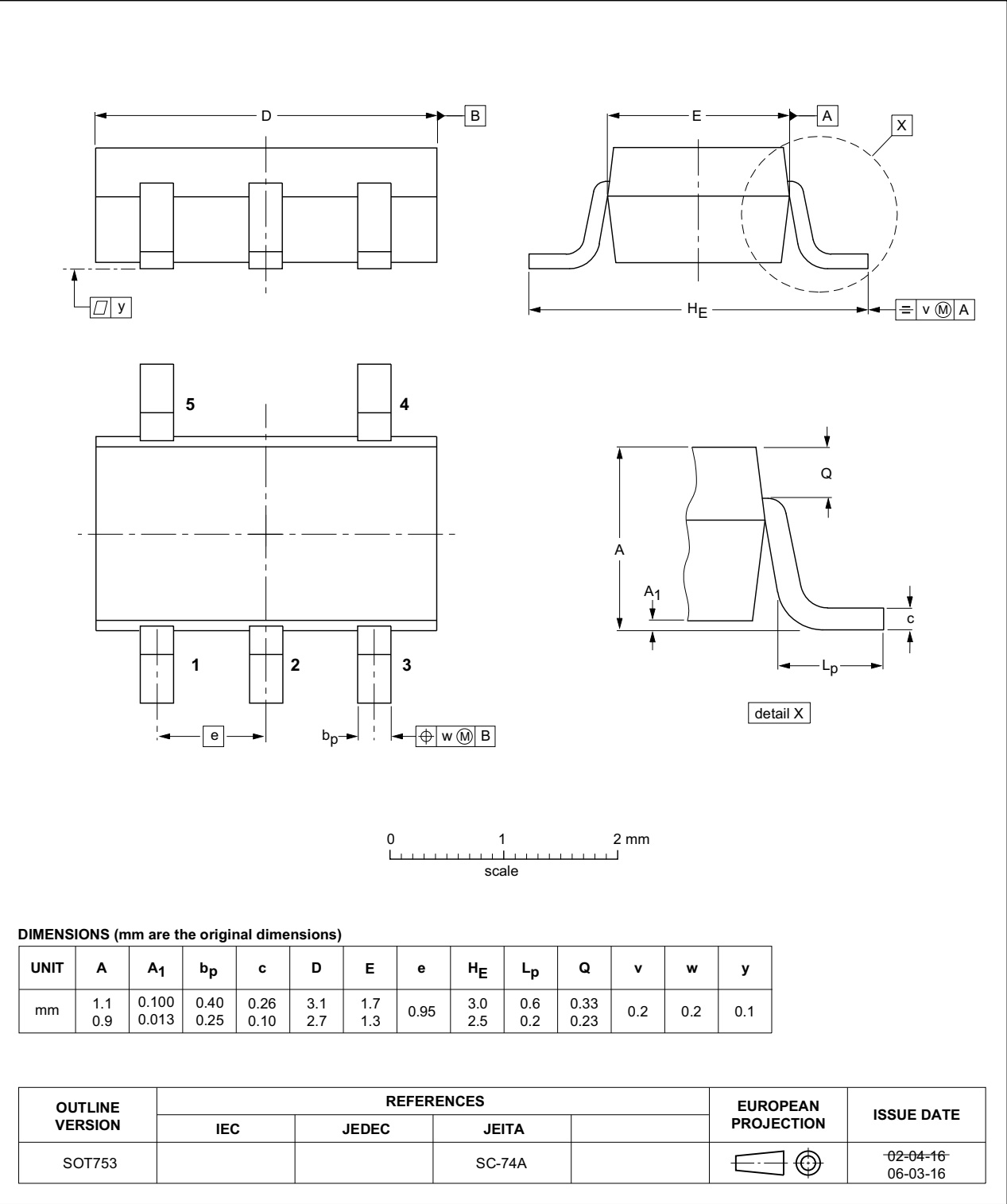


Fig 16. Package outline SOT753

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886

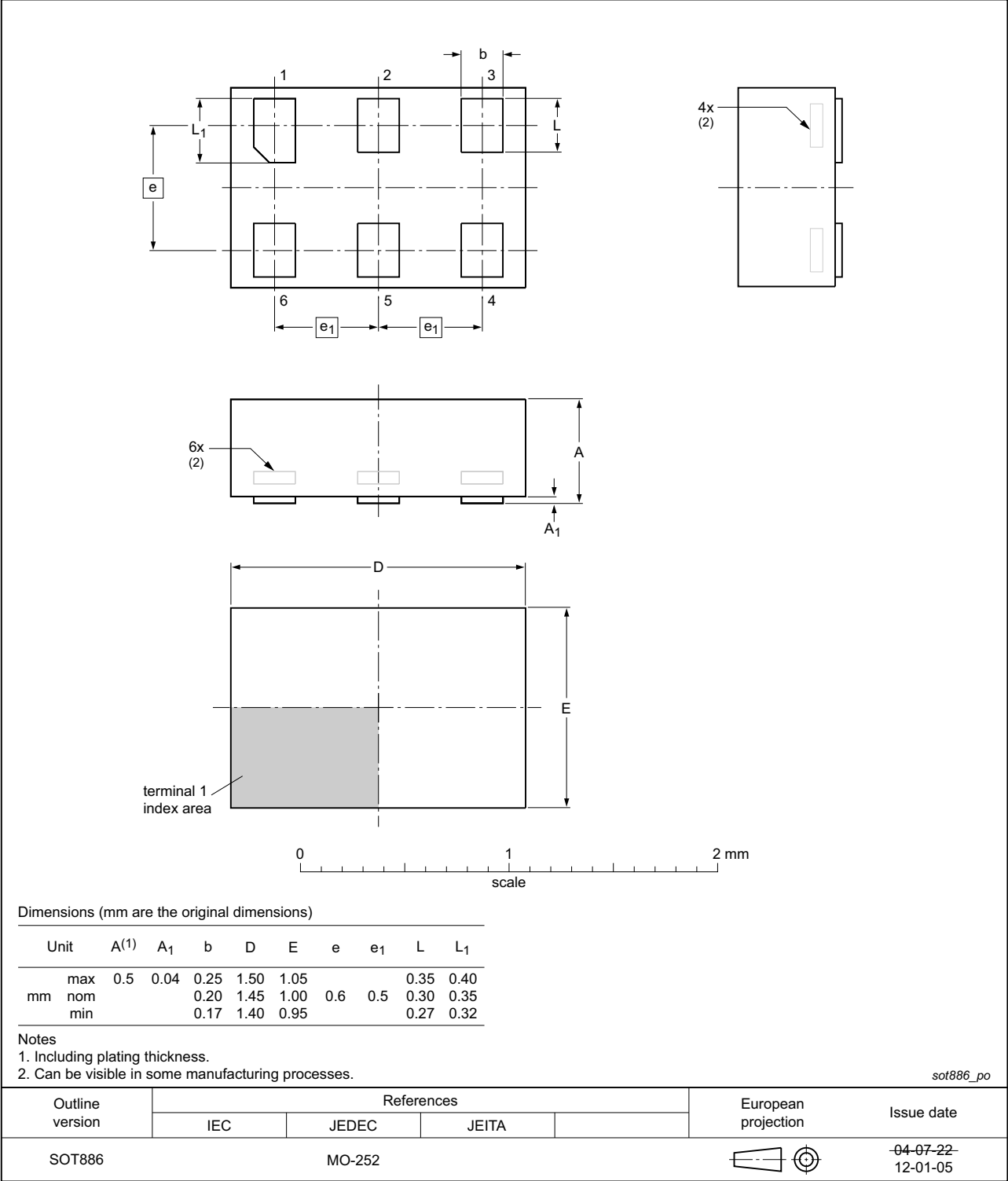


Fig 17. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm SOT891

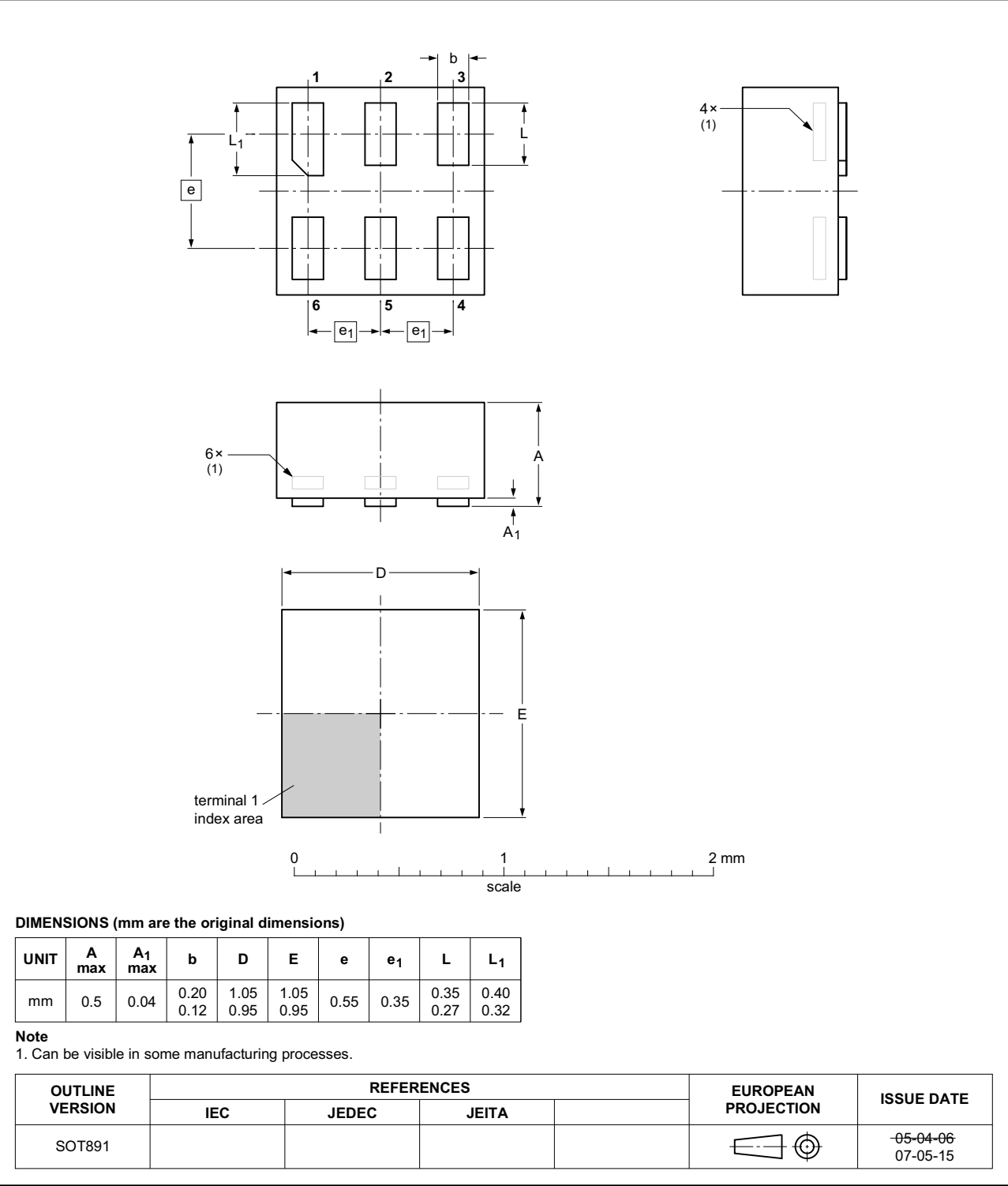


Fig 18. Package outline SOT891 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 0.9 x 1.0 x 0.35 mm

SOT1115

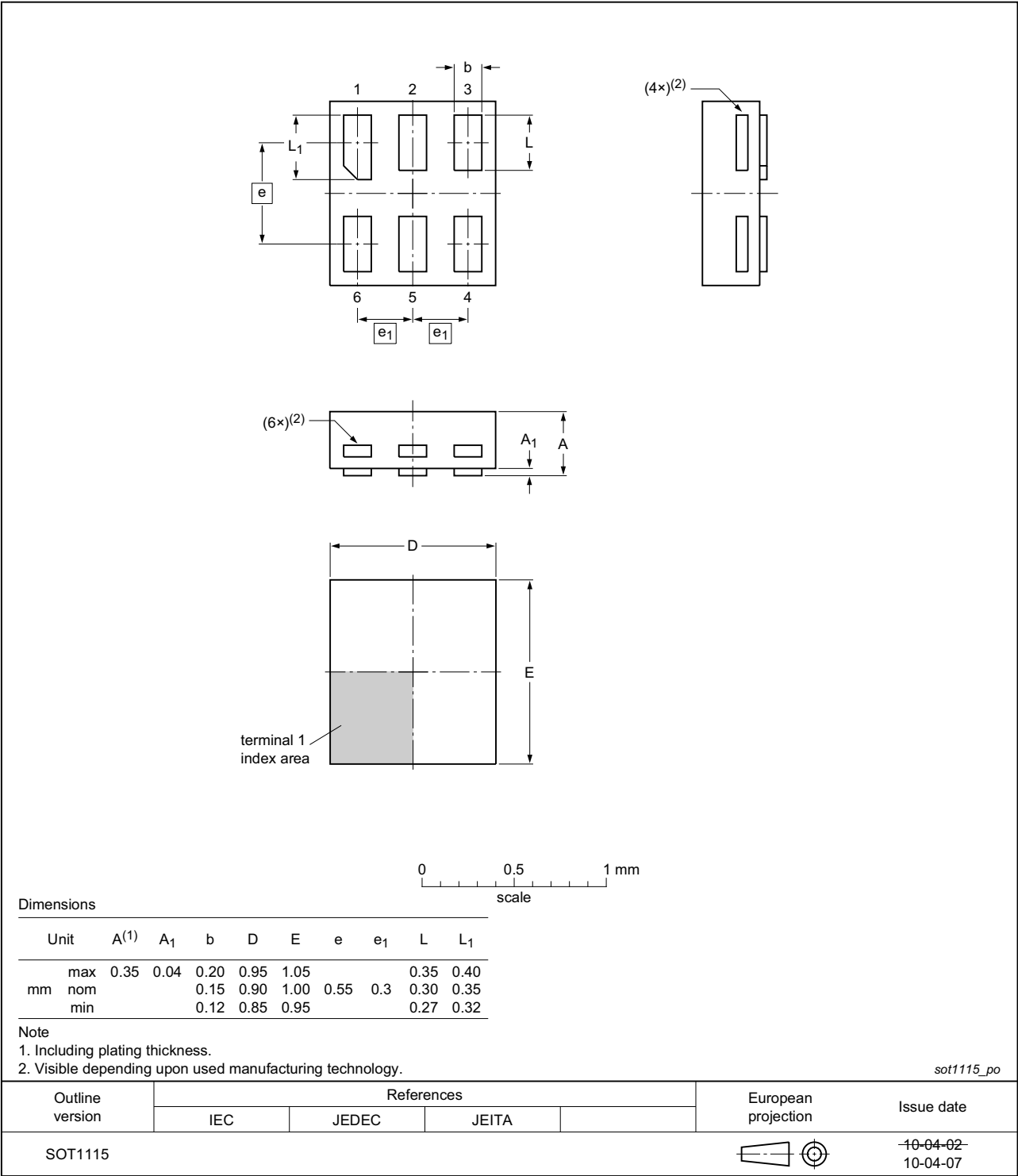


Fig 19. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads;
6 terminals; body 1.0 x 1.0 x 0.35 mm

SOT1202

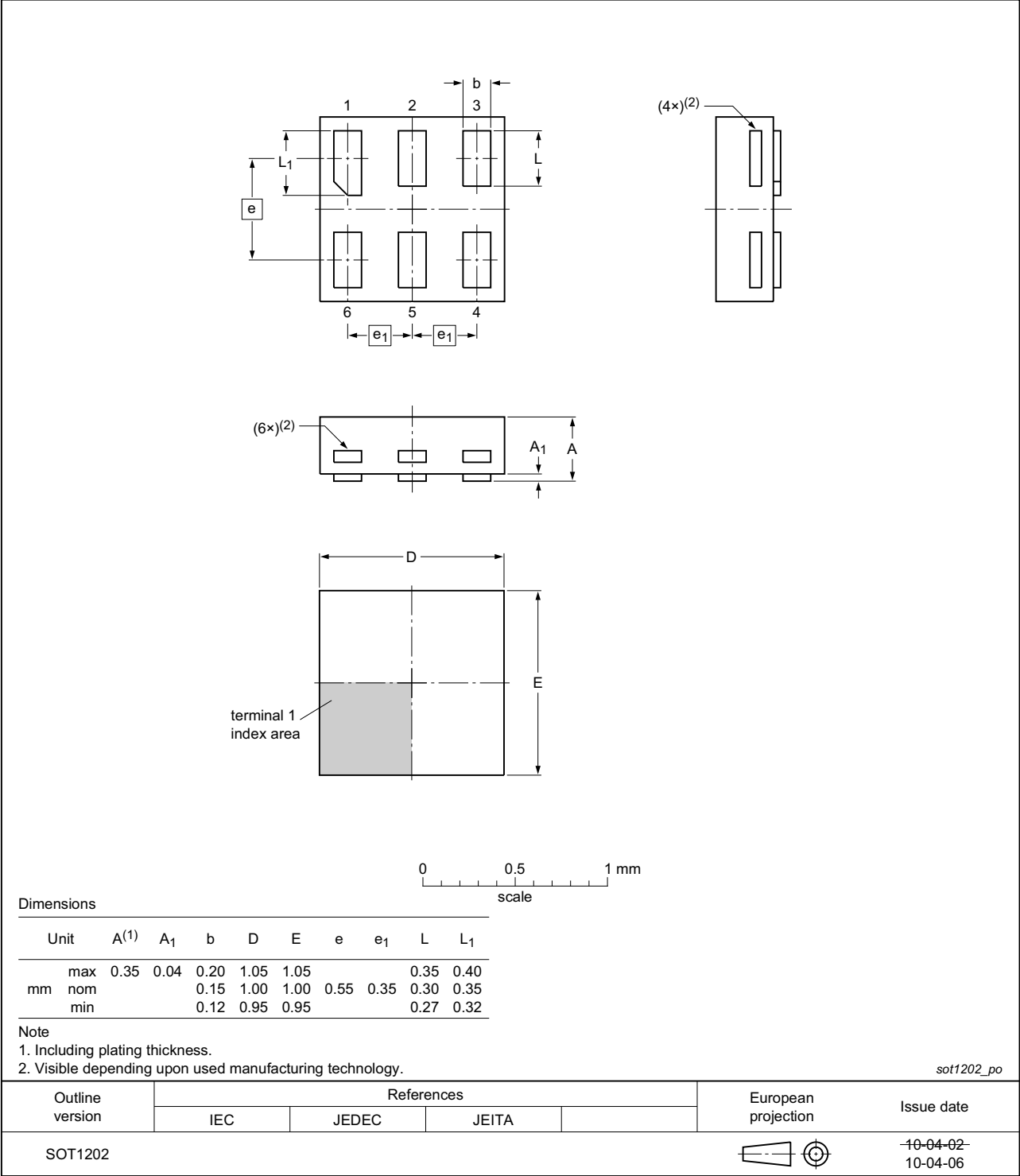


Fig 20. Package outline SOT1202 (XSON6)

14. Abbreviations

Table 14. Abbreviations

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

15. Revision history

Table 15. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|---|--------------------|---------------|------------------|
| 74CBTLV1G125 v.5 | 20161110 | Product data sheet | - | 74CBTLV1G125 v.4 |
| Modifications: | • Section 12.1 and Section 12.2 added. | | | |
| 74CBTLV1G125 v.4 | 20120905 | Product data sheet | - | 74CBTLV1G125 v.3 |
| Modifications: | • Package outline drawing of SOT886 (Figure 17) modified. | | | |
| 74CBTLV1G125 v.3 | 20111215 | Product data sheet | - | 74CBTLV1G125 v.2 |
| Modifications: | • Legal pages updated. | | | |
| 74CBTLV1G125 v.2 | 20100729 | Product data sheet | - | 74CBTLV1G125 v.1 |
| 74CBTLV1G125 v.1 | 20070223 | Product data sheet | - | - |

16. Legal information

16.1 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. |

[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.nexperia.com>.

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