

XC7SH125

Bus buffer/line driver; 3-state

Rev. 01 — 4 September 2009

Product data sheet

1. General description

XC7SH125 is a high-speed Si-gate CMOS device. It provides one non-inverting buffer/line driver with 3-state output. The 3-state output is controlled by the output enable input (\overline{OE}). A HIGH at \overline{OE} causes the output to assume a high-impedance OFF-state.

2. Features

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- SOT353-1, SOT753, SOT886, and SOT891 package options
- ESD protection:
 - ◆ HBM JESD22-A114E: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101C: exceeds 1000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|---|--------|---|----------|
| | Temperature range | Name | Description | Version |
| XC7SH125GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| XC7SH125GV | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| XC7SH125GM | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1.45 \times 0.5$ mm | SOT886 |
| XC7SH125GF | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body $1 \times 1 \times 0.5$ mm | SOT891 |

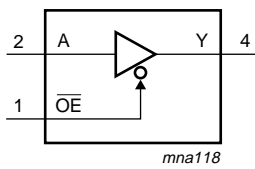
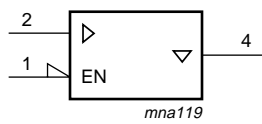
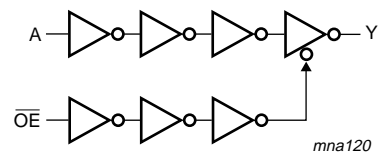
4. Marking

Table 2. Marking codes

| Type number | Marking ^[1] |
|-------------|------------------------|
| XC7SH125GW | fM |
| XC7SH125GV | f25 |
| XC7SH125GM | fM |
| XC7SH125GF | fM |

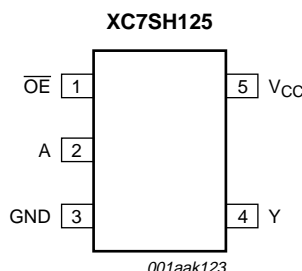
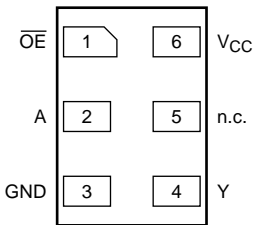
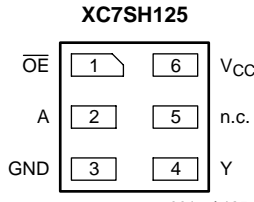
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

| | | |
|--|--|--|
|  <p><i>mna118</i></p> |  <p><i>mna119</i></p> |  <p><i>mna120</i></p> |
| Fig 1. Logic symbol | Fig 2. IEC logic symbol | Fig 3. Logic diagram |

6. Pinning information

6.1 Pinning

| | | |
|---|--|--|
|  <p><i>001aak123</i></p> | <p>XC7SH125</p>  <p><i>001aak124</i></p> <p>Transparent top view</p> | <p>XC7SH125</p>  <p><i>001aak125</i></p> <p>Transparent top view</p> |
| Fig 4. Pin configuration SOT353-1 and SOT753 | Fig 5. Pin configuration SOT886 | Fig 6. Pin configuration SOT891 |

6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|-----------------|---------------|---------------------|
| | SOT353-1/SOT753 | SOT886/SOT891 | |
| OE | 1 | 1 | output enable input |
| A | 2 | 2 | data input |
| GND | 3 | 3 | ground (0 V) |
| Y | 4 | 4 | data output |
| n.c. | - | 5 | not connected |
| V _{CC} | 5 | 6 | supply voltage |

7. Functional description

Table 4. Function table

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

| Inputs | | Output | |
|--------|---|--------|--|
| OE | A | Y | |
| L | L | L | |
| L | H | H | |
| H | X | Z | |

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 | +7.0 | V |
| V _I | input voltage | | -0.5 | +7.0 | V |
| I _{IK} | input clamping current | V _I < -0.5 V | [1] -20 | - | mA |
| I _{OK} | output clamping current | V _O < -0.5 V or V _O > V _{CC} + 0.5 V | [1] - | ±20 | mA |
| I _O | output current | -0.5 V < V _O < V _{CC} + 0.5 V | - | ±25 | mA |
| I _{CC} | supply current | | - | 75 | mA |
| I _{GND} | ground current | | -75 | - | 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 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

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---------------------|-------------------------------------|--|-----|-----|----------|------|
| V_{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | - | - | 100 | ns/V |
| | | $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | - | - | 20 | ns/V |

10. 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 | Typ | Max | Min | Max | Min | Max | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0 \text{ V}$ | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | $V_{CC} = 3.0 \text{ V}$ | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | $V_{CC} = 5.5 \text{ V}$ | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0 \text{ V}$ | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | $V_{CC} = 3.0 \text{ V}$ | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | $V_{CC} = 5.5 \text{ V}$ | - | - | 1.65 | - | 1.65 | - | 1.65 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = -50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$ | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | $I_O = -50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$ | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | $I_O = -50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O = -4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| | $I_O = -8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$ | 3.94 | - | - | 3.8 | - | 3.70 | - | V | |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = 50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| | $I_O = 8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$ | - | - | 0.36 | - | 0.44 | - | 0.55 | V | |
| I_{OZ} | OFF-state output current | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$ | - | - | 0.25 | - | 2.5 | - | 10 | μA |
| I_I | input leakage current | $V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$ | - | - | 1.0 | - | 10 | - | 40 | μA |
| C_I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |

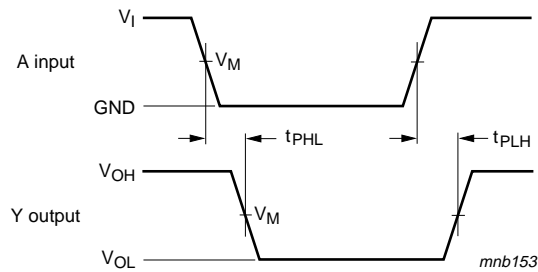
11. Dynamic characteristics

Table 8. Dynamic characteristics
GND = 0 V; For test circuit see Figure 9.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|-------------------------------|---|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| t _{pd} | propagation delay | A to Y; see Figure 7 [1] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V [2] | | | | | | | | |
| | | C _L = 15 pF | - | 4.7 | 8.0 | 1.0 | 9.5 | 1.0 | 11.5 | ns |
| | | C _L = 50 pF | - | 6.6 | 11.5 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.4 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| t _{en} | enable time | OE to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V [2] | | | | | | | | |
| | | C _L = 15 pF | - | 5.0 | 8.0 | 1.0 | 9.5 | 1.0 | 11.5 | ns |
| | | C _L = 50 pF | - | 6.9 | 11.5 | 1.0 | 13.0 | 1.0 | 14.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 3.6 | 5.1 | 1.0 | 6.0 | 1.0 | 6.5 | ns |
| t _{dis} | disable time | OE to Y; see Figure 8 [1] | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V [2] | | | | | | | | |
| | | C _L = 15 pF | - | 6.0 | 9.7 | 1.0 | 11.5 | 1.0 | 12.5 | ns |
| | | C _L = 50 pF | - | 8.3 | 13.2 | 1.0 | 15.0 | 1.0 | 16.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V [3] | | | | | | | | |
| | | C _L = 15 pF | - | 4.1 | 6.8 | 1.0 | 8.0 | 1.0 | 8.5 | ns |
| C _{PD} | power dissipation capacitance | per buffer; [4] | - | 9 | - | - | - | - | - | pF |
| | | C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} | | | | | | | | |

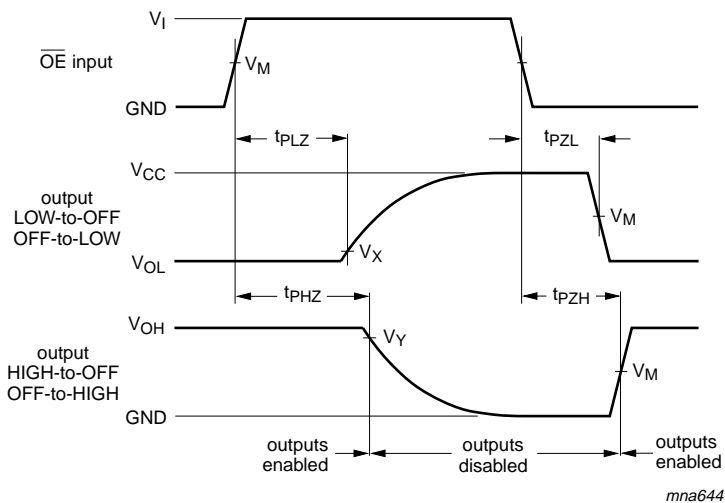
- [1] t_{pd} is the same as t_{PLH} and t_{PHL}.
t_{en} is the same as t_{PZL} and t_{PZH}.
t_{dis} is the same as t_{PLZ} and t_{PHZ}.
- [2] Typical values are measured at V_{CC} = 3.3 V.
- [3] Typical values are measured at V_{CC} = 5.0 V.
- [4] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
P_D = C_{PD} × V_{CC}² × f_i + Σ(C_L × V_{CC}² × 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 Volts.

12. Waveforms



Measurement points are given in [Table 9](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 7. Input (A) to output (Y) propagation delays

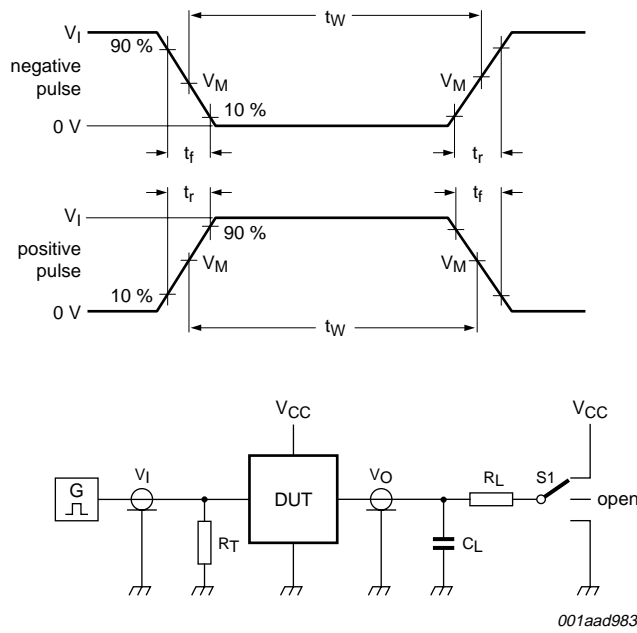


Measurement points are given in [Table 9](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 8. Enable and disable times

Table 9. Measurement points

| Type | Input | Output | | |
|----------|-------------|-------------|------------------|------------------|
| | V_M | V_M | V_X | V_Y |
| XC7SH125 | $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ | $V_{OH} - 0.3 V$ |



Test data is given in [Table 10](#).

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.

S1 = Test selection switch.

Fig 9. Test circuit for measuring switching times

Table 10. Test data

| Type | Input | | Load | | S1 position | | |
|----------|----------|-------------|--------------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PHL}, t_{PLH} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| XC7SH125 | V_{CC} | ≤ 3 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |

13. Package outline

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

SOT353-1

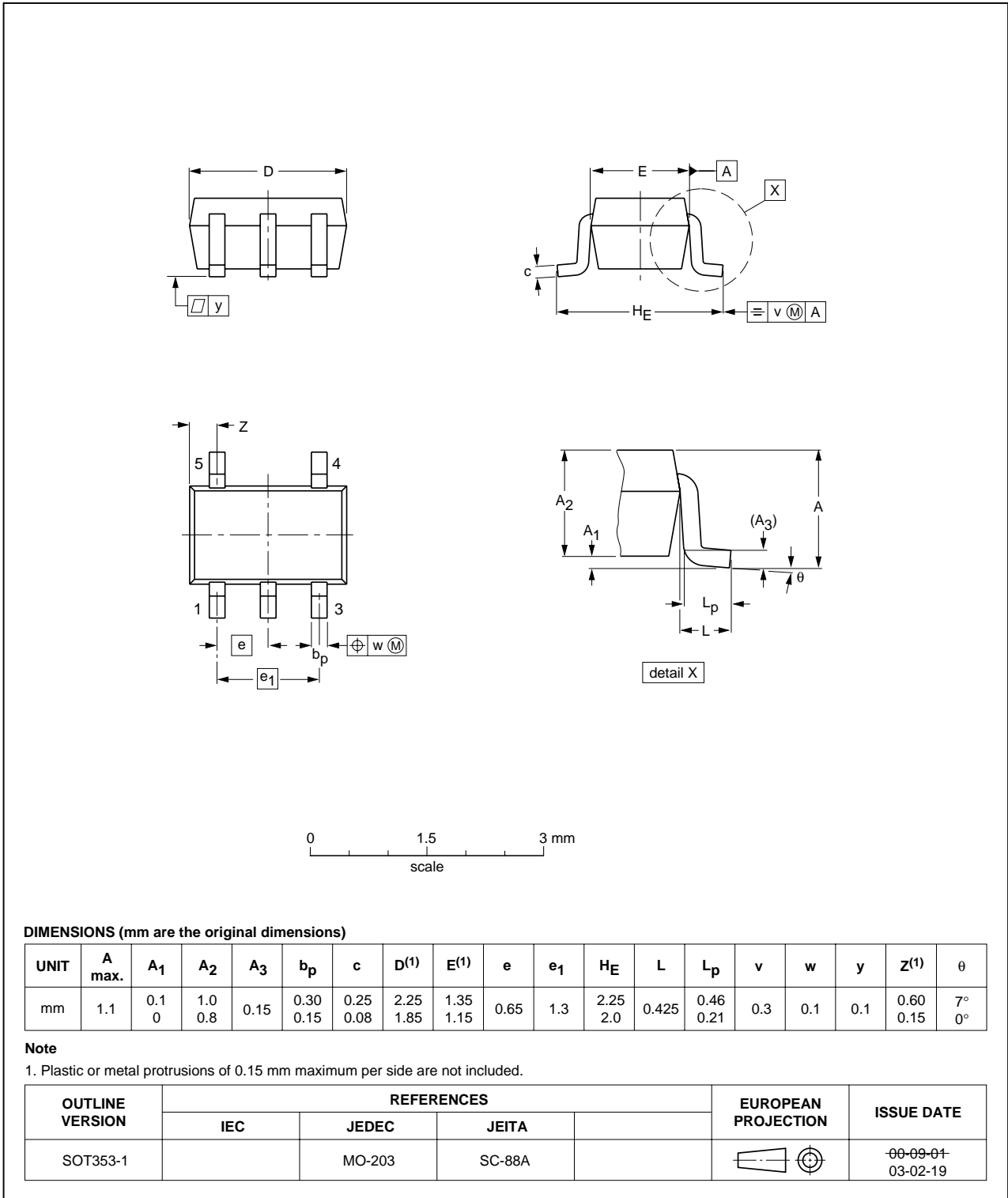


Fig 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

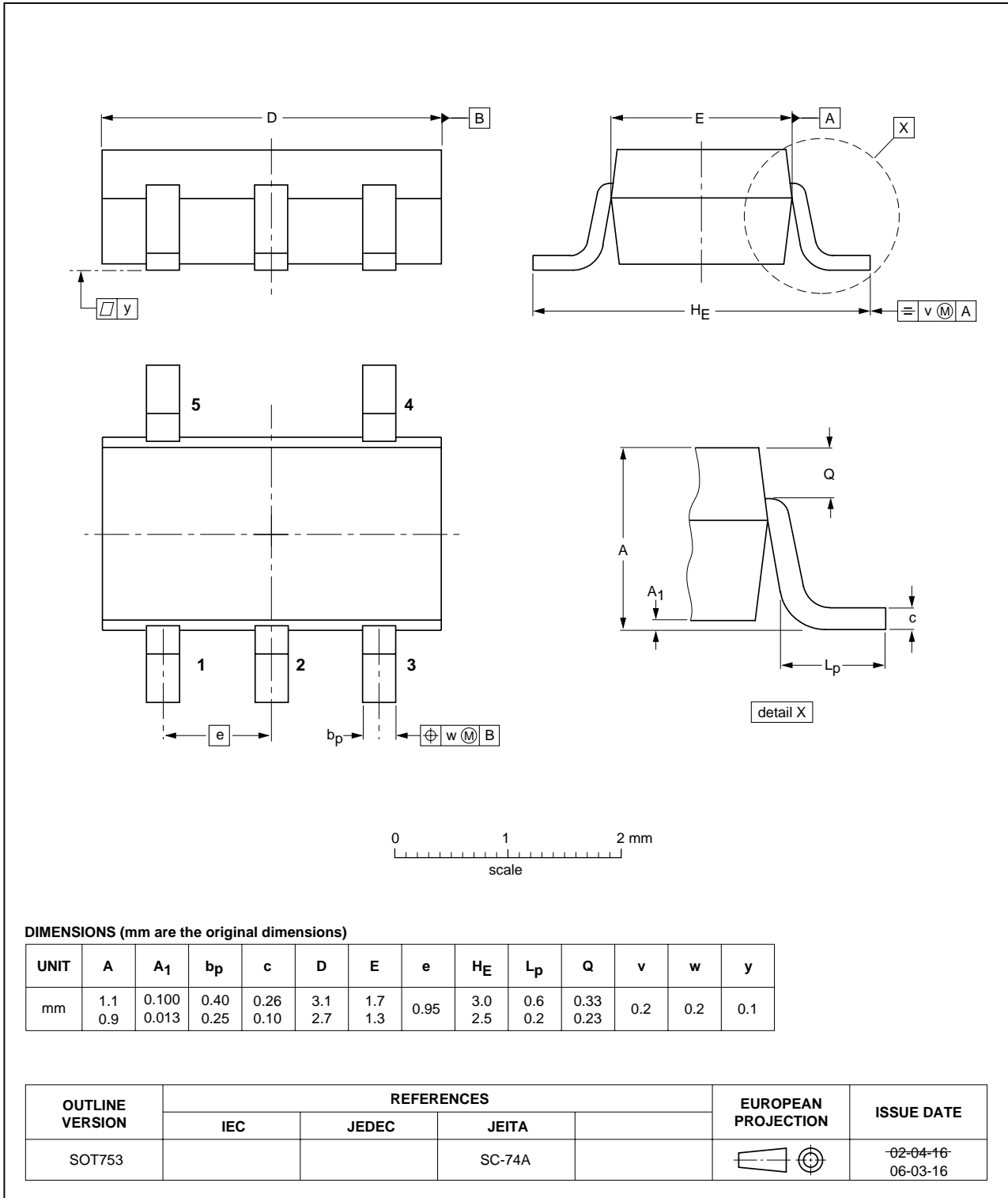


Fig 11. Package outline SOT753 (SC-74A)

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

SOT886

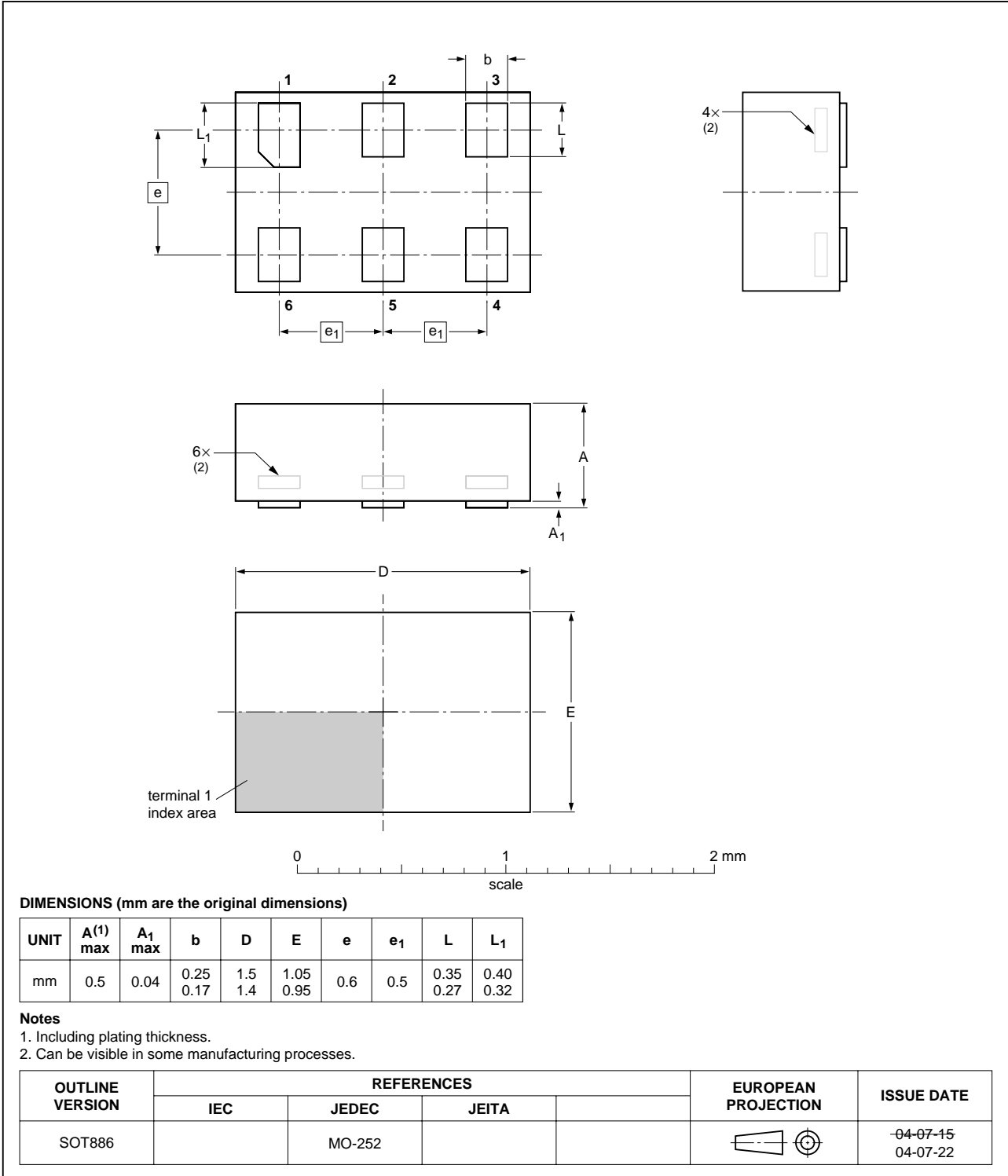


Fig 12. Package outline SOT886 (XSON6)

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

SOT891

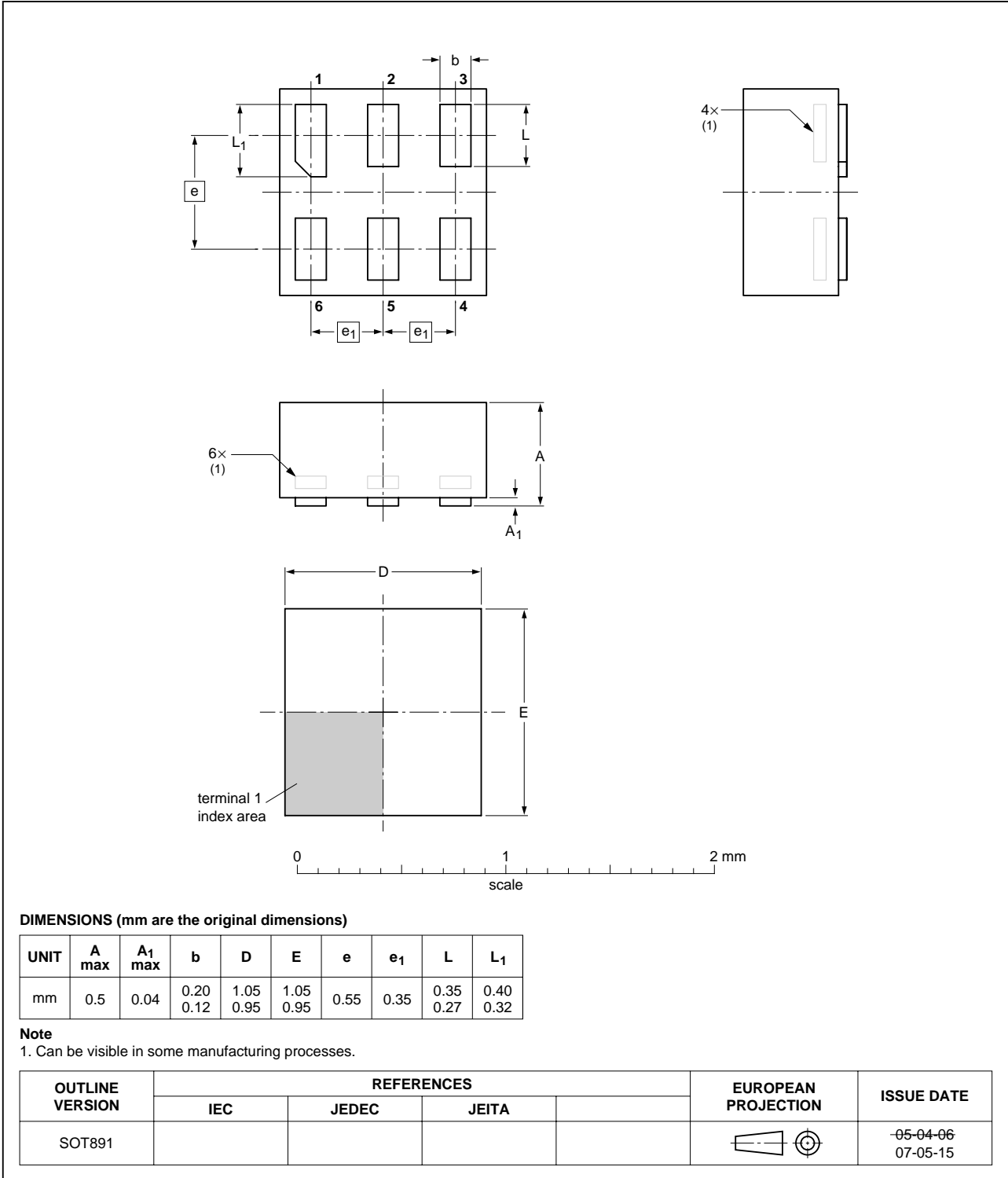


Fig 13. Package outline SOT891 (XSON6)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal Oxide Semiconductor |
| CDM | Charged Device Model |
| 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 |
|-------------|--------------|--------------------|---------------|------------|
| XC7SH125_1 | 20090904 | Product data sheet | - | - |

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16.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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