

# 74AUP1G09

## Low-power 2-input AND gate with open-drain

Rev. 4 — 28 June 2012

Product data sheet

## 1. General description

The 74AUP1G09 provides the single 2-input AND gate with an open-drain output. The output of the device is an open-drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

Schmitt trigger action at all inputs makes the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

This device ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range from 0.8 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

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu A$  (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of  $V_{CC}$
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from  $-40^{\circ}C$  to  $+85^{\circ}C$  and  $-40^{\circ}C$  to  $+125^{\circ}C$



3. Ordering information

Table 1. Ordering information

| Type number | Package           |        |                                                                                                                        |          |
|-------------|-------------------|--------|------------------------------------------------------------------------------------------------------------------------|----------|
|             | Temperature range | Name   | Description                                                                                                            | Version  |
| 74AUP1G09GW | −40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm                                                 | SOT353-1 |
| 74AUP1G09GM | −40 °C to +125 °C | XSON6  | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm                            | SOT886   |
| 74AUP1G09GF | −40 °C to +125 °C | XSON6  | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm                               | SOT891   |
| 74AUP1G09GN | −40 °C to +125 °C | XSON6  | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm                                  | SOT1115  |
| 74AUP1G09GS | −40 °C to +125 °C | XSON6  | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm                                  | SOT1202  |
| 74AUP1G09GX | −40 °C to +125 °C | X2SON5 | X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.35 mm | SOT1226  |

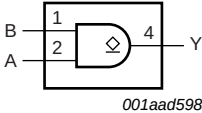
4. Marking

Table 2. Marking

| Type number | Marking code <sup>[1]</sup> |
|-------------|-----------------------------|
| 74AUP1G09GW | p9                          |
| 74AUP1G09GM | p9                          |
| 74AUP1G09GF | p9                          |
| 74AUP1G09GN | p9                          |
| 74AUP1G09GS | p9                          |
| 74AUP1G09GX | p9                          |

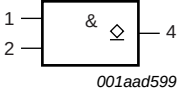
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



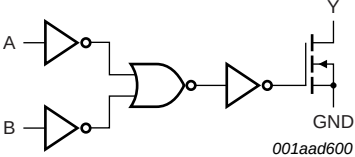
001aad598

Fig 1. Logic symbol



001aad599

Fig 2. IEC logic symbol



001aad600

Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

**Fig 4. Pin configuration SOT353-1**

**Fig 5. Pin configuration SOT886**

**Fig 6. Pin configuration SOT891, SOT1115 and SOT1202**

**Fig 7. Pin configuration SOT1226 (X2SON5)**

6.2 Pin description

Table 3. Pin description

| Symbol          | Pin               |       | Description    |
|-----------------|-------------------|-------|----------------|
|                 | TSSOP5 and X2SON5 | XSON6 |                |
| B               | 1                 | 1     | data input     |
| A               | 2                 | 2     | data input     |
| GND             | 3                 | 3     | ground (0 V)   |
| Y               | 4                 | 4     | data output    |
| n.c.            | -                 | 5     | not connected  |
| V <sub>CC</sub> | 5                 | 6     | supply voltage |

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

| Input |   | Output |
|-------|---|--------|
| A     | B | Y      |
| L     | L | L      |
| L     | H | L      |
| H     | L | L      |
| H     | H | Z      |

[1] H = HIGH voltage level; L = LOW voltage level; 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    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                     | -50                 | -    | mA   |
| $V_I$     | input voltage           |                                 | <sup>[1]</sup> -0.5 | +4.6 | V    |
| $I_{OK}$  | output clamping current | $V_O < 0$ V                     | -50                 | -    | mA   |
| $V_O$     | output voltage          | Active mode and Power-down mode | <sup>[1]</sup> -0.5 | +4.6 | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$         | -                   | +20  | 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   | <sup>[2]</sup> -    | 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 packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.

For XSON6 and X2SON5 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 | Max  | Unit |
|---------------------|-------------------------------------|---------------------------------|-----|------|------|
| $V_{CC}$            | supply voltage                      |                                 | 0.8 | 3.6  | V    |
| $V_I$               | input voltage                       |                                 | 0   | 3.6  | V    |
| $V_O$               | output voltage                      | Active mode and Power-down mode | 0   | 3.6  | V    |
| $T_{amb}$           | ambient temperature                 |                                 | -40 | +125 | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8$ V to 3.6 V       | 0   | 200  | 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 |
|-------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------|-----|---------------------|------|
| T <sub>amb</sub> = 25 °C            |                                      |                                                                                                              |                     |     |                     |      |
| V <sub>IH</sub>                     | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V                                                                                      | 0.7V <sub>CC</sub>  | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | 0.65V <sub>CC</sub> | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | 1.6                 | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | 2.0                 | -   | -                   | V    |
| V <sub>IL</sub>                     | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V                                                                                      | -                   | -   | 0.3V <sub>CC</sub>  | V    |
|                                     |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | -                   | -   | 0.35V <sub>CC</sub> | V    |
|                                     |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | -                   | -   | 0.7                 | V    |
|                                     |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | -                   | -   | 0.9                 | V    |
| V <sub>OL</sub>                     | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                          |                     |     |                     |      |
|                                     |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V                                                     | -                   | -   | 0.1                 | V    |
|                                     |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V                                                             | -                   | -   | 0.3V <sub>CC</sub>  | V    |
|                                     |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V                                                             | -                   | -   | 0.31                | V    |
|                                     |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V                                                            | -                   | -   | 0.31                | V    |
|                                     |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.31                | V    |
|                                     |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.44                | V    |
|                                     |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.31                | V    |
|                                     |                                      | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.44                | V    |
| I <sub>I</sub>                      | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                                | -                   | -   | ±0.1                | μA   |
| I <sub>OZ</sub>                     | OFF-state output current             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 3.6 V | -                   | -   | ±0.1                | μA   |
| I <sub>OFF</sub>                    | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                                       | -                   | -   | ±0.2                | μA   |
| ΔI <sub>OFF</sub>                   | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                              | -                   | -   | ±0.2                | μA   |
| I <sub>CC</sub>                     | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V             | -                   | -   | 0.5                 | μA   |
| ΔI <sub>CC</sub>                    | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V                      | -                   | -   | 40                  | μA   |
| C <sub>I</sub>                      | input capacitance                    | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>                                      | -                   | 0.8 | -                   | pF   |
| C <sub>O</sub>                      | output capacitance                   | output enabled; V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V                                                  | -                   | 1.7 | -                   | pF   |
|                                     |                                      | output disabled; V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V                                                 | -                   | 1.1 | -                   | pF   |
| T <sub>amb</sub> = –40 °C to +85 °C |                                      |                                                                                                              |                     |     |                     |      |
| V <sub>IH</sub>                     | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V                                                                                      | 0.7V <sub>CC</sub>  | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | 0.65V <sub>CC</sub> | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | 1.6                 | -   | -                   | V    |
|                                     |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | 2.0                 | -   | -                   | V    |
| V <sub>IL</sub>                     | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V                                                                                      | -                   | -   | 0.3V <sub>CC</sub>  | V    |
|                                     |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | -                   | -   | 0.35V <sub>CC</sub> | V    |
|                                     |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | -                   | -   | 0.7                 | V    |
|                                     |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | -                   | -   | 0.9                 | V    |

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

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

| Symbol                                     | Parameter                            | Conditions                                                                                                   | Min                 | Typ | Max                 | Unit |
|--------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------|-----|---------------------|------|
| V <sub>OL</sub>                            | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                          |                     |     |                     |      |
|                                            |                                      | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 0.8 V to 3.6 V                                                     | -                   | -   | 0.1                 | V    |
|                                            |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V                                                             | -                   | -   | 0.3V <sub>CC</sub>  | V    |
|                                            |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V                                                             | -                   | -   | 0.37                | V    |
|                                            |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V                                                            | -                   | -   | 0.35                | V    |
|                                            |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.33                | V    |
|                                            |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.45                | V    |
|                                            |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.33                | V    |
|                                            |                                      | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.45                | V    |
| I <sub>I</sub>                             | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                                | -                   | -   | ±0.5                | µA   |
| I <sub>OZ</sub>                            | OFF-state output current             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 3.6 V | -                   | -   | ±0.5                | µA   |
| I <sub>OFF</sub>                           | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                                       | -                   | -   | ±0.5                | µA   |
| ΔI <sub>OFF</sub>                          | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                              | -                   | -   | ±0.6                | µA   |
| I <sub>CC</sub>                            | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V             | -                   | -   | 0.9                 | µA   |
| ΔI <sub>CC</sub>                           | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V                      | -                   | -   | 50                  | µA   |
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                                      |                                                                                                              |                     |     |                     |      |
| V <sub>IH</sub>                            | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V                                                                                      | 0.75V <sub>CC</sub> | -   | -                   | V    |
|                                            |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | 0.7V <sub>CC</sub>  | -   | -                   | V    |
|                                            |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | 1.6                 | -   | -                   | V    |
|                                            |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | 2.0                 | -   | -                   | V    |
| V <sub>IL</sub>                            | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V                                                                                      | -                   | -   | 0.25V <sub>CC</sub> | V    |
|                                            |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V                                                                            | -                   | -   | 0.3V <sub>CC</sub>  | V    |
|                                            |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V                                                                             | -                   | -   | 0.7                 | V    |
|                                            |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V                                                                             | -                   | -   | 0.9                 | V    |
| V <sub>OL</sub>                            | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                          |                     |     |                     |      |
|                                            |                                      | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 0.8 V to 3.6 V                                                     | -                   | -   | 0.11                | V    |
|                                            |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V                                                             | -                   | -   | 0.33V <sub>CC</sub> | V    |
|                                            |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V                                                             | -                   | -   | 0.41                | V    |
|                                            |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V                                                            | -                   | -   | 0.39                | V    |
|                                            |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.36                | V    |
|                                            |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V                                                             | -                   | -   | 0.50                | V    |
|                                            |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.36                | V    |
|                                            |                                      | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                                             | -                   | -   | 0.50                | V    |
| I <sub>I</sub>                             | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                                | -                   | -   | ±0.75               | µA   |
| I <sub>OZ</sub>                            | OFF-state output current             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 3.6 V | -                   | -   | ±0.75               | µA   |
| I <sub>OFF</sub>                           | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                                       | -                   | -   | ±0.75               | µA   |

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

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

| Symbol           | Parameter                            | Conditions                                                          | Min | Typ | Max        | Unit    |
|------------------|--------------------------------------|---------------------------------------------------------------------|-----|-----|------------|---------|
| $\Delta I_{OFF}$ | additional power-off leakage current | $V_I$ or $V_O = 0$ V to 3.6 V;<br>$V_{CC} = 0$ V to 0.2 V           | -   | -   | $\pm 0.75$ | $\mu A$ |
| $I_{CC}$         | supply current                       | $V_I = GND$ or $V_{CC}$ ; $I_O = 0$ A;<br>$V_{CC} = 0.8$ V to 3.6 V | -   | -   | 1.4        | $\mu A$ |
| $\Delta I_{CC}$  | additional supply current            | $V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 3.3$ V               | -   | -   | 75         | $\mu A$ |

## 11. Dynamic characteristics

**Table 8.** Dynamic characteristicsVoltages are referenced to GND (ground = 0 V; for test circuit see [Figure 9](#))

| Symbol | Parameter | Conditions | 25 °C |                    |     | -40 °C to +125 °C |             |              | Unit |
|--------|-----------|------------|-------|--------------------|-----|-------------------|-------------|--------------|------|
|        |           |            | Min   | Typ <sup>[1]</sup> | Max | Min               | Max (85 °C) | Max (125 °C) |      |

### $C_L = 5$ pF

|          |                   |                                                          |     |      |      |     |      |      |    |
|----------|-------------------|----------------------------------------------------------|-----|------|------|-----|------|------|----|
| $t_{pd}$ | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |     |      |      |     |      |      |    |
|          |                   | $V_{CC} = 0.8$ V                                         | -   | 13.5 | -    | -   | -    | -    | ns |
|          |                   | $V_{CC} = 1.1$ V to 1.3 V                                | 1.9 | 4.6  | 10.4 | 1.8 | 11.4 | 12.6 | ns |
|          |                   | $V_{CC} = 1.4$ V to 1.6 V                                | 1.5 | 3.3  | 6.5  | 1.4 | 7.4  | 8.2  | ns |
|          |                   | $V_{CC} = 1.65$ V to 1.95 V                              | 1.2 | 2.9  | 5.1  | 1.1 | 5.9  | 6.5  | ns |
|          |                   | $V_{CC} = 2.3$ V to 2.7 V                                | 1.0 | 2.2  | 3.8  | 0.9 | 4.5  | 4.9  | ns |
|          |                   | $V_{CC} = 3.0$ V to 3.6 V                                | 0.9 | 2.3  | 4.0  | 0.8 | 4.5  | 4.9  | ns |

### $C_L = 10$ pF

|          |                   |                                                          |     |      |      |     |      |      |    |
|----------|-------------------|----------------------------------------------------------|-----|------|------|-----|------|------|----|
| $t_{pd}$ | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |     |      |      |     |      |      |    |
|          |                   | $V_{CC} = 0.8$ V                                         | -   | 16.3 | -    | -   | -    | -    | ns |
|          |                   | $V_{CC} = 1.1$ V to 1.3 V                                | 2.3 | 5.6  | 12.3 | 2.1 | 13.7 | 15.1 | ns |
|          |                   | $V_{CC} = 1.4$ V to 1.6 V                                | 1.8 | 4.1  | 7.6  | 1.7 | 8.8  | 9.7  | ns |
|          |                   | $V_{CC} = 1.65$ V to 1.95 V                              | 1.6 | 3.8  | 6.1  | 1.4 | 7.1  | 7.8  | ns |
|          |                   | $V_{CC} = 2.3$ V to 2.7 V                                | 1.4 | 2.9  | 4.6  | 1.2 | 5.4  | 5.9  | ns |
|          |                   | $V_{CC} = 3.0$ V to 3.6 V                                | 1.3 | 3.2  | 5.7  | 1.1 | 6.4  | 7.0  | ns |

### $C_L = 15$ pF

|          |                   |                                                          |     |      |      |     |      |      |    |
|----------|-------------------|----------------------------------------------------------|-----|------|------|-----|------|------|----|
| $t_{pd}$ | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |     |      |      |     |      |      |    |
|          |                   | $V_{CC} = 0.8$ V                                         | -   | 19.0 | -    | -   | -    | -    | ns |
|          |                   | $V_{CC} = 1.1$ V to 1.3 V                                | 2.6 | 6.6  | 14.2 | 2.4 | 15.8 | 17.4 | ns |
|          |                   | $V_{CC} = 1.4$ V to 1.6 V                                | 2.1 | 4.8  | 8.7  | 1.9 | 10.1 | 11.1 | ns |
|          |                   | $V_{CC} = 1.65$ V to 1.95 V                              | 1.9 | 4.6  | 7.6  | 1.7 | 8.5  | 9.3  | ns |
|          |                   | $V_{CC} = 2.3$ V to 2.7 V                                | 1.6 | 3.6  | 5.6  | 1.5 | 6.3  | 6.9  | ns |
|          |                   | $V_{CC} = 3.0$ V to 3.6 V                                | 1.6 | 4.1  | 7.5  | 1.4 | 8.3  | 9.1  | ns |

### $C_L = 30$ pF

**Table 8. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 9](#))

| Symbol                                                                                          | Parameter                     | Conditions                                                             | 25 °C |                    |      | –40 °C to +125 °C |             |              | Unit |
|-------------------------------------------------------------------------------------------------|-------------------------------|------------------------------------------------------------------------|-------|--------------------|------|-------------------|-------------|--------------|------|
|                                                                                                 |                               |                                                                        | Min   | Typ <sup>[1]</sup> | Max  | Min               | Max (85 °C) | Max (125 °C) |      |
| $t_{pd}$                                                                                        | propagation delay             | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>               |       |                    |      |                   |             |              |      |
|                                                                                                 |                               | $V_{CC} = 0.8\text{ V}$                                                | -     | 27.0               | -    | -                 | -           | -            | ns   |
|                                                                                                 |                               | $V_{CC} = 1.1\text{ V to }1.3\text{ V}$                                | 3.6   | 9.5                | 19.5 | 3.2               | 21.8        | 24.0         | ns   |
|                                                                                                 |                               | $V_{CC} = 1.4\text{ V to }1.6\text{ V}$                                | 2.9   | 7.0                | 11.5 | 2.6               | 13.6        | 15.0         | ns   |
|                                                                                                 |                               | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$                              | 2.6   | 7.0                | 12.1 | 2.3               | 13.3        | 14.6         | ns   |
|                                                                                                 |                               | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$                                | 2.4   | 5.4                | 8.9  | 2.1               | 9.9         | 10.9         | ns   |
|                                                                                                 |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                                | 2.3   | 6.5                | 12.7 | 2.1               | 13.9        | 15.3         | ns   |
| <b><math>C_L = 5\text{ pF}, 10\text{ pF}, 15\text{ pF}</math> and <math>30\text{ pF}</math></b> |                               |                                                                        |       |                    |      |                   |             |              |      |
| $C_{PD}$                                                                                        | power dissipation capacitance | $f_i = 1\text{ MHz}$ ; <sup>[3]</sup><br>$V_i = \text{GND to } V_{CC}$ |       |                    |      |                   |             |              |      |
|                                                                                                 |                               | $V_{CC} = 0.8\text{ V}$                                                | -     | 0.6                | -    | -                 | -           | -            | pF   |
|                                                                                                 |                               | $V_{CC} = 1.1\text{ V to }1.3\text{ V}$                                | -     | 0.7                | -    | -                 | -           | -            | pF   |
|                                                                                                 |                               | $V_{CC} = 1.4\text{ V to }1.6\text{ V}$                                | -     | 0.8                | -    | -                 | -           | -            | pF   |
|                                                                                                 |                               | $V_{CC} = 1.65\text{ V to }1.95\text{ V}$                              | -     | 0.9                | -    | -                 | -           | -            | pF   |
|                                                                                                 |                               | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$                                | -     | 1.1                | -    | -                 | -           | -            | pF   |
|                                                                                                 |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$                                | -     | 1.4                | -    | -                 | -           | -            | pF   |

[1] All typical values are measured at nominal  $V_{CC}$ .

[2]  $t_{pd}$  is the same as  $t_{pZL}$  and  $t_{pLZ}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

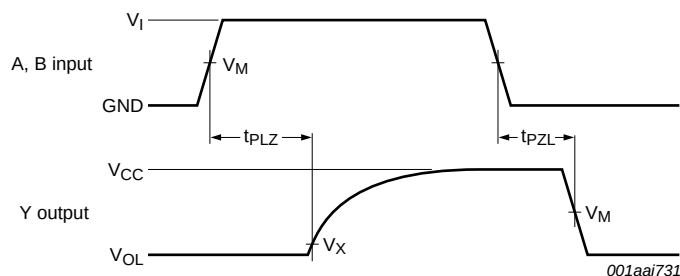
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N$  where:

$f_i$  = input frequency in MHz;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching.

## 12. Waveforms



Measurement points are given in [Table 9](#).

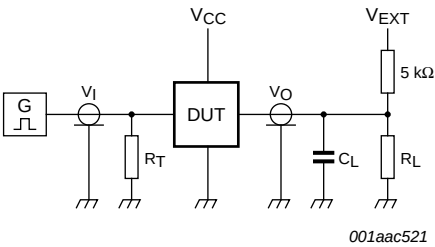
$V_{OL}$  is a typical output voltage level that occurs with the output load.

**Fig 8. The data input (A or B) to output (Y) propagation delays**



Table 9. Measurement points

| Supply voltage  | Input              | Output             |                          |
|-----------------|--------------------|--------------------|--------------------------|
| V <sub>CC</sub> | V <sub>M</sub>     | V <sub>M</sub>     | V <sub>X</sub>           |
| 0.8 V to 1.6 V  | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> | V <sub>OL</sub> + 0.1 V  |
| 1.65 V to 2.7 V | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> | V <sub>OL</sub> + 0.15 V |
| 3.0 V to 3.6 V  | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> | V <sub>OL</sub> + 0.3 V  |



Test data is given in [Table 10](#).  
Definitions for test circuit:  
R<sub>L</sub> = Load resistance.  
C<sub>L</sub> = Load capacitance including jig and probe capacitance.  
R<sub>T</sub> = Termination resistance should be equal to the output impedance Z<sub>o</sub> of the pulse generator.  
V<sub>EXT</sub> = External voltage for measuring switching times.

Fig 9. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage  | Load                         |                               | V <sub>EXT</sub>                    |                                     |                                     |
|-----------------|------------------------------|-------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| V <sub>CC</sub> | C <sub>L</sub>               | R <sub>L</sub> <sup>[1]</sup> | t <sub>PLH</sub> , t <sub>PHL</sub> | t <sub>PZH</sub> , t <sub>PHZ</sub> | t <sub>PZL</sub> , t <sub>PLZ</sub> |
| 0.8 V to 3.6 V  | 5 pF, 10 pF, 15 pF and 30 pF | 5 kΩ or 1 MΩ                  | open                                | GND                                 | 2V <sub>CC</sub>                    |

[1] For measuring enable and disable times R<sub>L</sub> = 5 kΩ.  
For measuring propagation delays, set-up and hold times, and pulse width, R<sub>L</sub> = 1 MΩ.

13. Package outline

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

SOT353-1

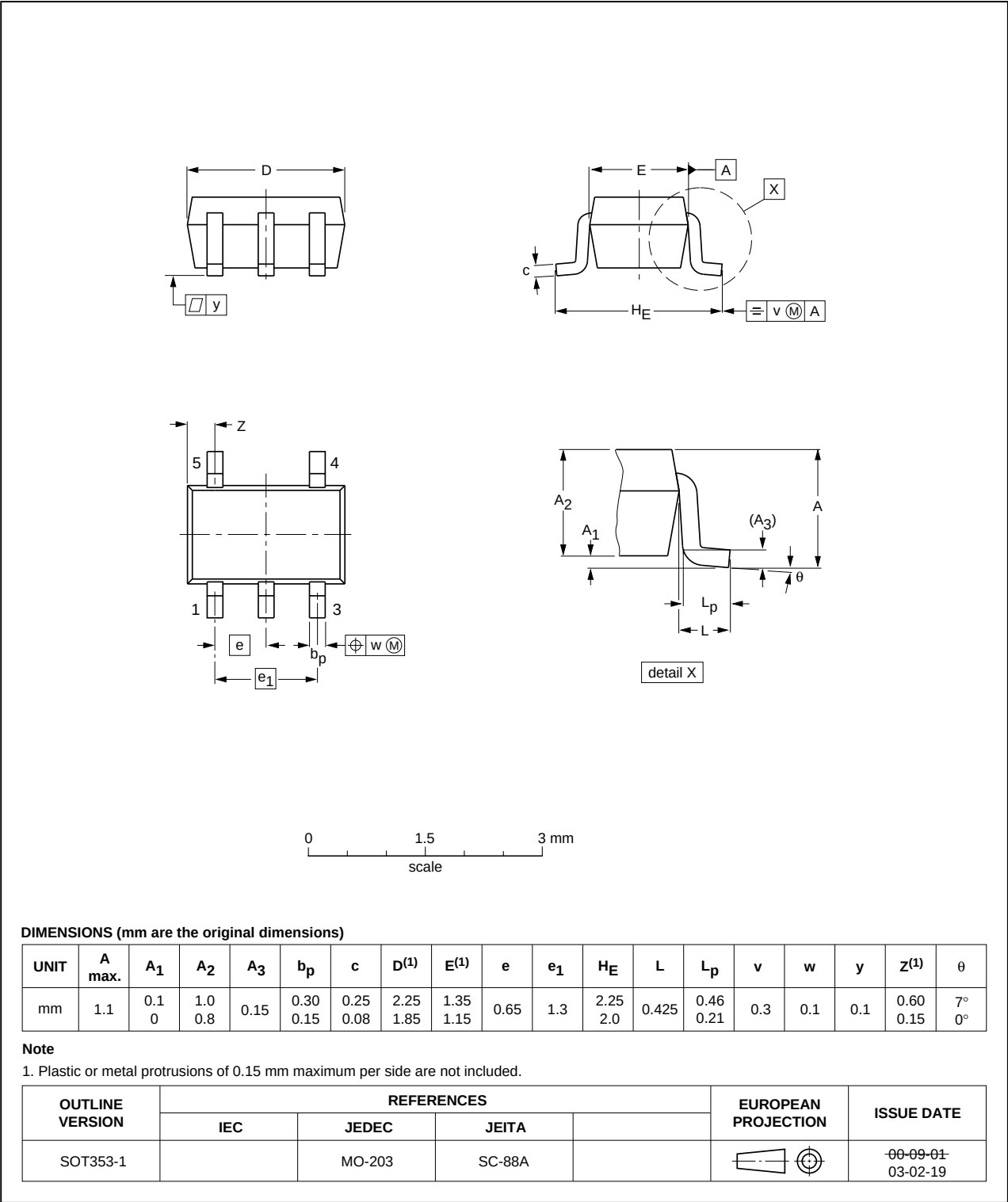


Fig 10. Package outline SOT353-1 (TSSOP5)

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

SOT886

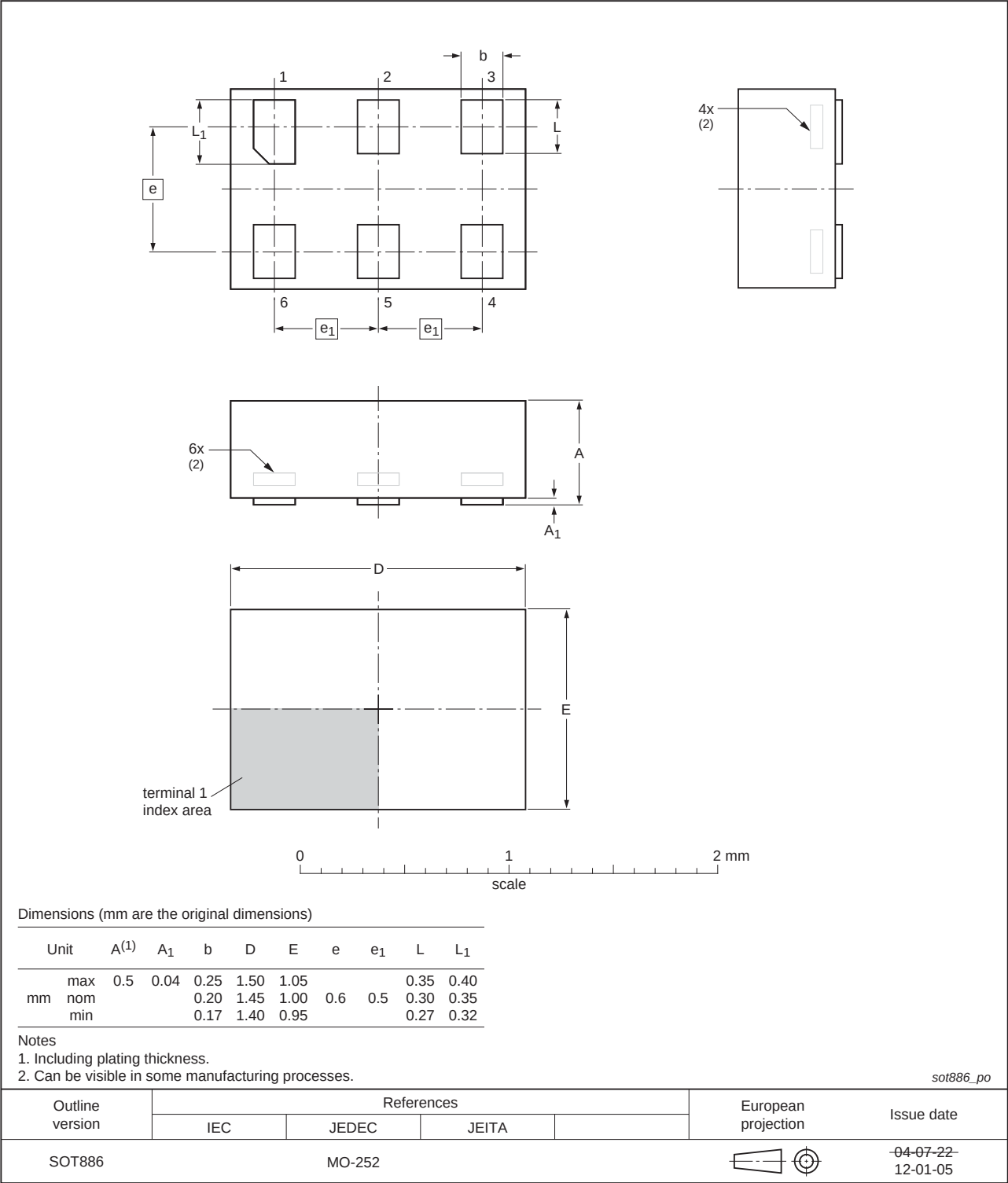


Fig 11. Package outline SOT886 (XSON6)

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

SOT891

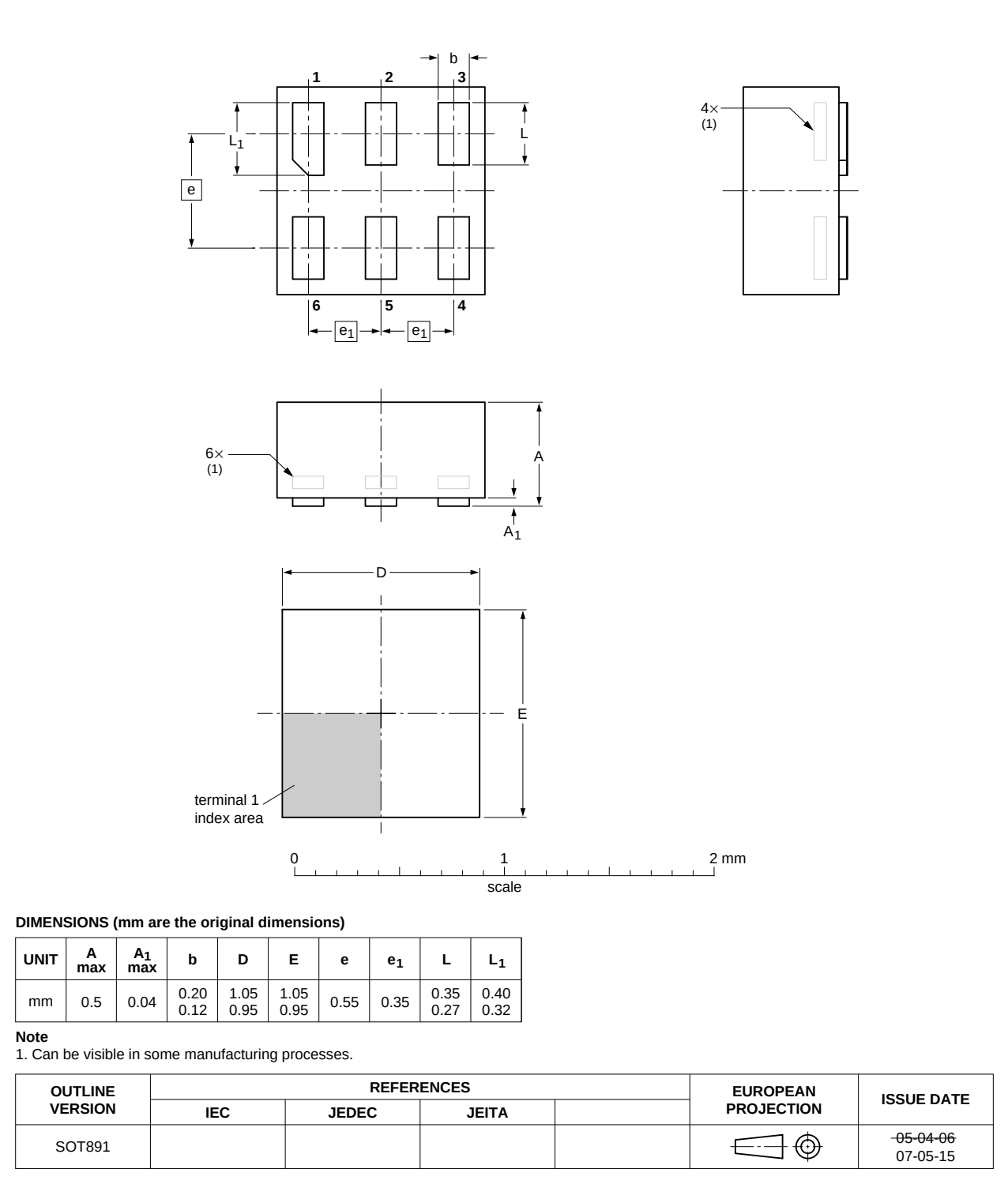


Fig 12. Package outline SOT891 (XSON6)

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

SOT1115

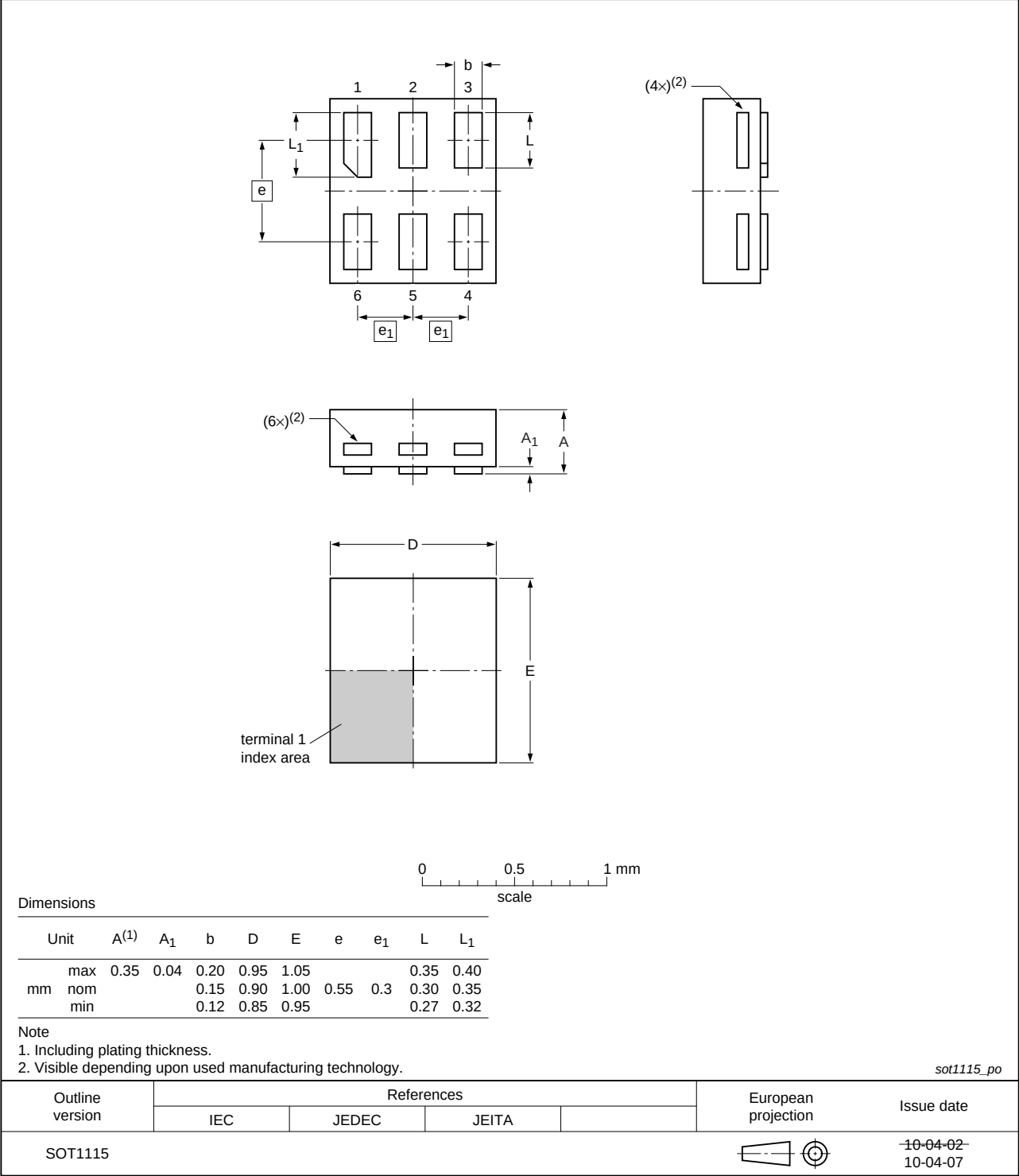


Fig 13. Package outline SOT1115 (XSON6)

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

SOT1202

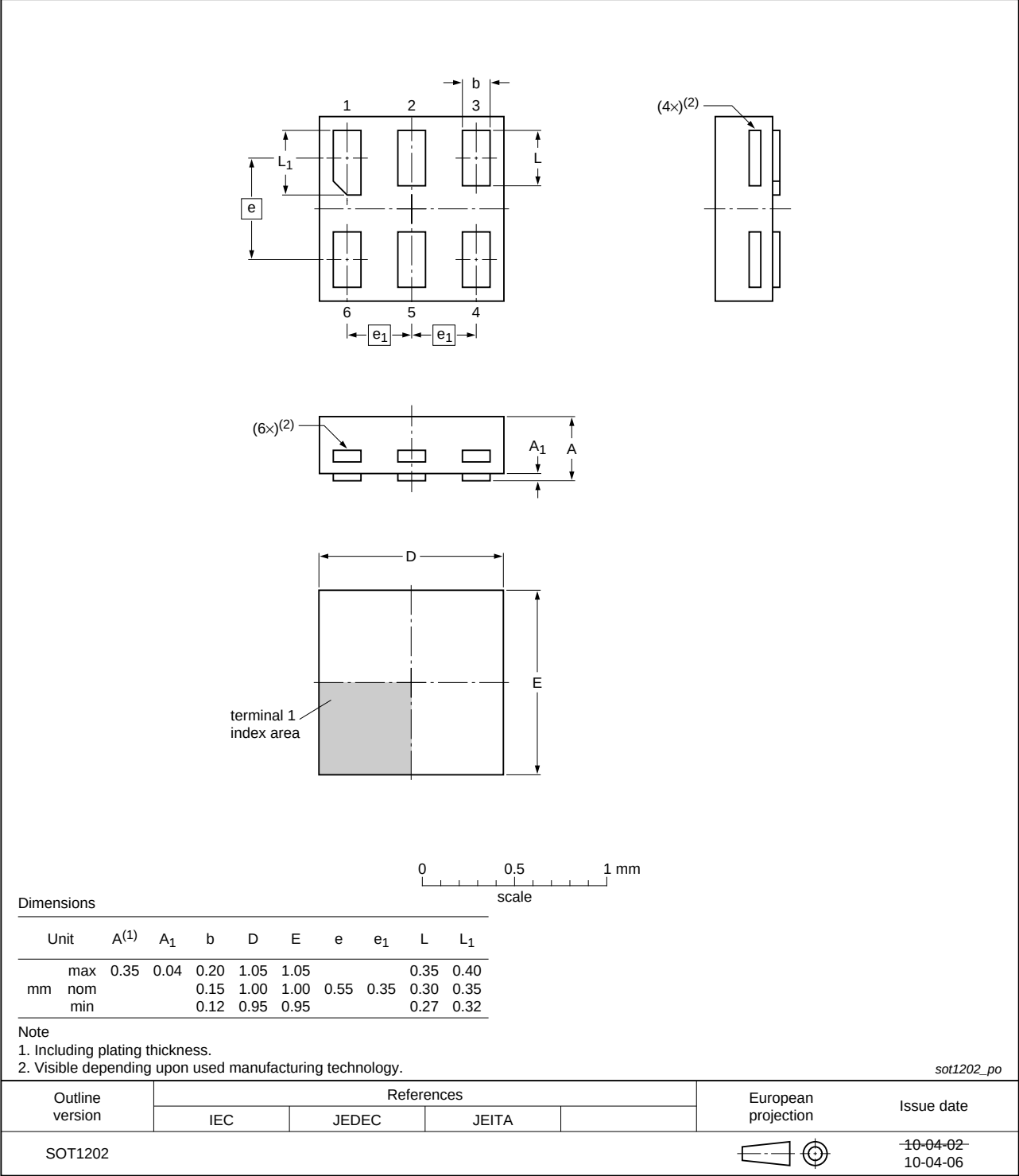


Fig 14. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;  
5 terminals; body 0.8 x 0.8 x 0.35 mm

SOT1226

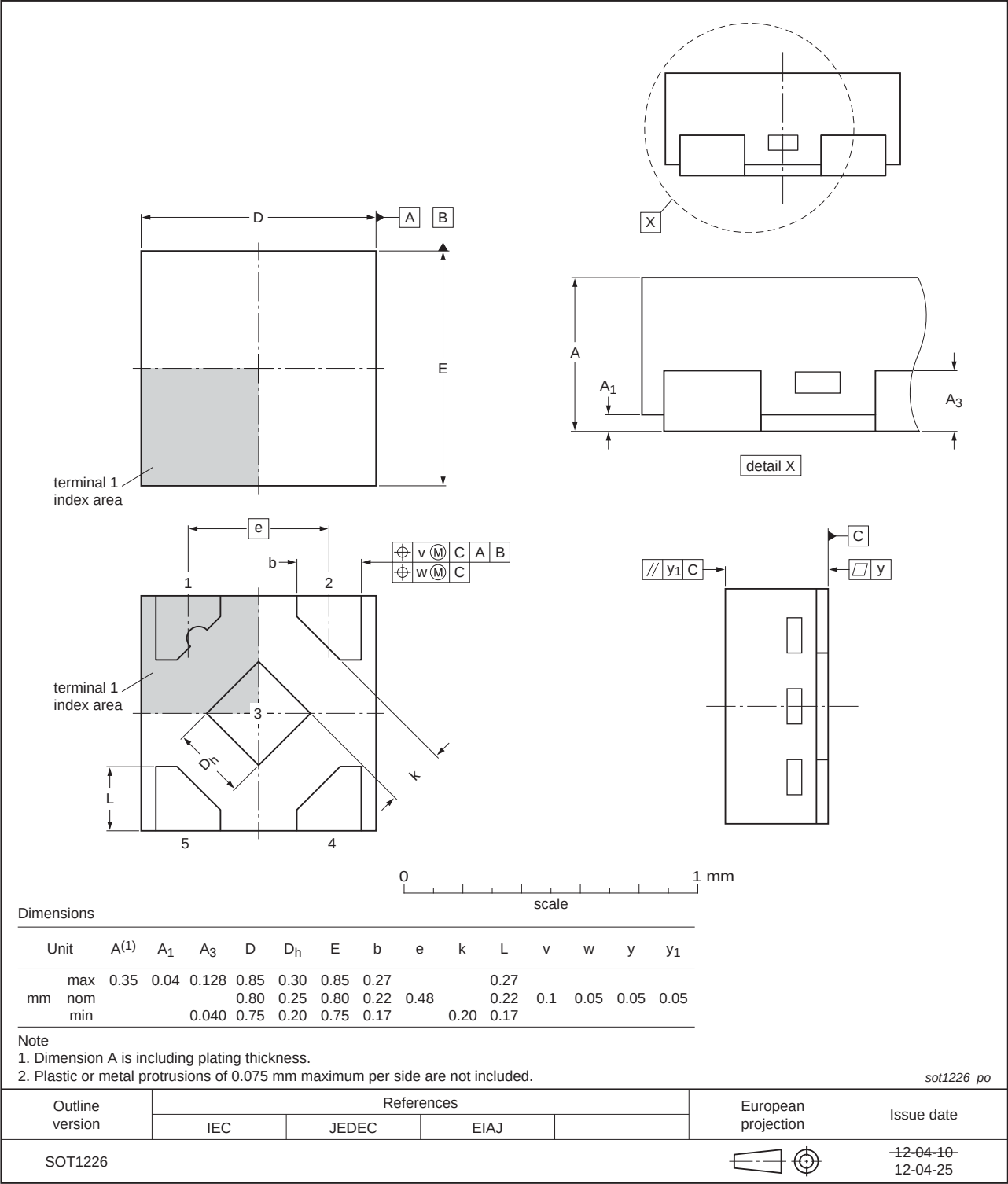


Fig 15. Package outline SOT1226 (X2SON5)

## 14. Abbreviations

Table 11. Abbreviations

| Acronym | Description             |
|---------|-------------------------|
| CDM     | Charged Device Model    |
| DUT     | Device Under Test       |
| ESD     | ElectroStatic Discharge |
| HBM     | Human Body Model        |
| MM      | Machine Model           |

## 15. Revision history

Table 12. Revision history

| Document ID    | Release date                                                                                                                                                            | Data sheet status  | Change notice | Supersedes    |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|---------------|
| 74AUP1G09 v.4  | 20120628                                                                                                                                                                | Product data sheet | -             | 74AUP1G09 v.3 |
| Modifications: | <ul style="list-style-type: none"><li>Added type number 74AUP1G09GX (SOT1226)</li><li>Package outline drawing of SOT886 (<a href="#">Figure 11</a>) modified.</li></ul> |                    |               |               |
| 74AUP1G09 v.3  | 20111128                                                                                                                                                                | Product data sheet | -             | 74AUP1G09 v.2 |
| Modifications: | <ul style="list-style-type: none"><li>Legal pages updated.</li></ul>                                                                                                    |                    |               |               |
| 74AUP1G09 v.2  | 20100709                                                                                                                                                                | Product data sheet | -             | 74AUP1G09 v.1 |
| 74AUP1G09 v.1  | 20090115                                                                                                                                                                | Product data sheet | -             | -             |



## 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.nxp.com>.

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## 18. Contents

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|           |                                               |           |
|-----------|-----------------------------------------------|-----------|
| <b>1</b>  | <b>General description</b> .....              | <b>1</b>  |
| <b>2</b>  | <b>Features and benefits</b> .....            | <b>1</b>  |
| <b>3</b>  | <b>Ordering information</b> .....             | <b>2</b>  |
| <b>4</b>  | <b>Marking</b> .....                          | <b>2</b>  |
| <b>5</b>  | <b>Functional diagram</b> .....               | <b>2</b>  |
| <b>6</b>  | <b>Pinning information</b> .....              | <b>3</b>  |
| 6.1       | Pinning .....                                 | 3         |
| 6.2       | Pin description .....                         | 3         |
| <b>7</b>  | <b>Functional description</b> .....           | <b>4</b>  |
| <b>8</b>  | <b>Limiting values</b> .....                  | <b>4</b>  |
| <b>9</b>  | <b>Recommended operating conditions</b> ..... | <b>4</b>  |
| <b>10</b> | <b>Static characteristics</b> .....           | <b>5</b>  |
| <b>11</b> | <b>Dynamic characteristics</b> .....          | <b>7</b>  |
| <b>12</b> | <b>Waveforms</b> .....                        | <b>8</b>  |
| <b>13</b> | <b>Package outline</b> .....                  | <b>10</b> |
| <b>14</b> | <b>Abbreviations</b> .....                    | <b>16</b> |
| <b>15</b> | <b>Revision history</b> .....                 | <b>16</b> |
| <b>16</b> | <b>Legal information</b> .....                | <b>17</b> |
| 16.1      | Data sheet status .....                       | 17        |
| 16.2      | Definitions .....                             | 17        |
| 16.3      | Disclaimers .....                             | 17        |
| 16.4      | Trademarks .....                              | 18        |
| <b>17</b> | <b>Contact information</b> .....              | <b>18</b> |
| <b>18</b> | <b>Contents</b> .....                         | <b>19</b> |

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