

# 74AUP1G09

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

Rev. 5 — 29 September 2017

Product data sheet

## 1 General description

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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

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- 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 °C to +85 °C and -40 °C to +125 °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 x 1.45 x 0.5 mm                            | SOT886   |
| 74AUP1G09GF | -40 °C to +125 °C | XSON6  | plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm                               | SOT891   |
| 74AUP1G09GN | -40 °C to +125 °C | XSON6  | extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm                                  | SOT1115  |
| 74AUP1G09GS | -40 °C to +125 °C | XSON6  | extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 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 x 0.8 x 0.35 mm | SOT1226  |

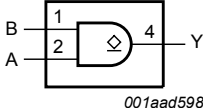
4 Marking

Table 2. Marking

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

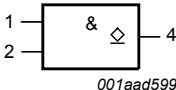
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5 Functional diagram



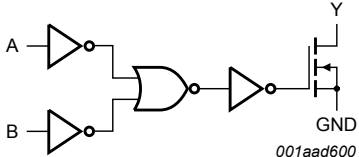
001aad598

Figure 1. Logic symbol



001aad599

Figure 2. IEC logic symbol



001aad600

Figure 3. Logic diagram

6 Pinning information

6.1 Pinning

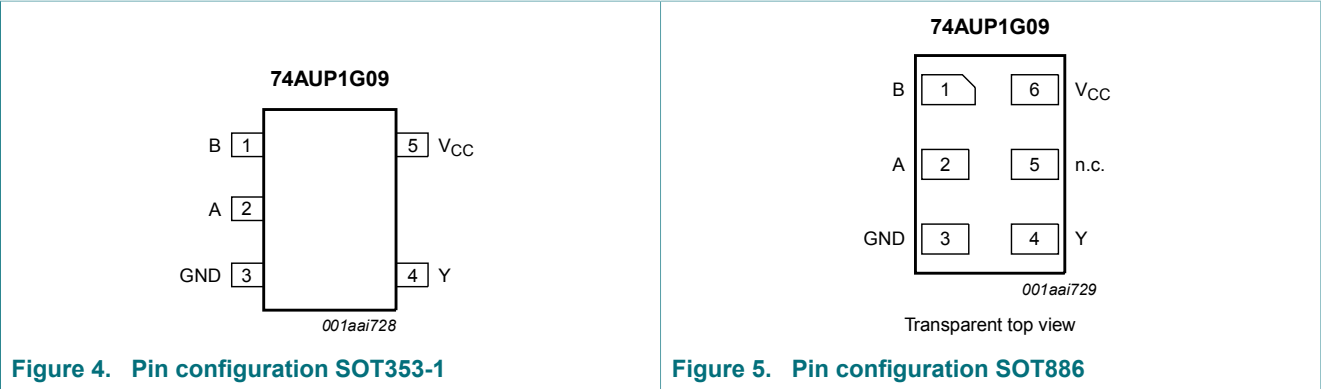


Figure 4. Pin configuration SOT353-1

Figure 5. Pin configuration SOT886

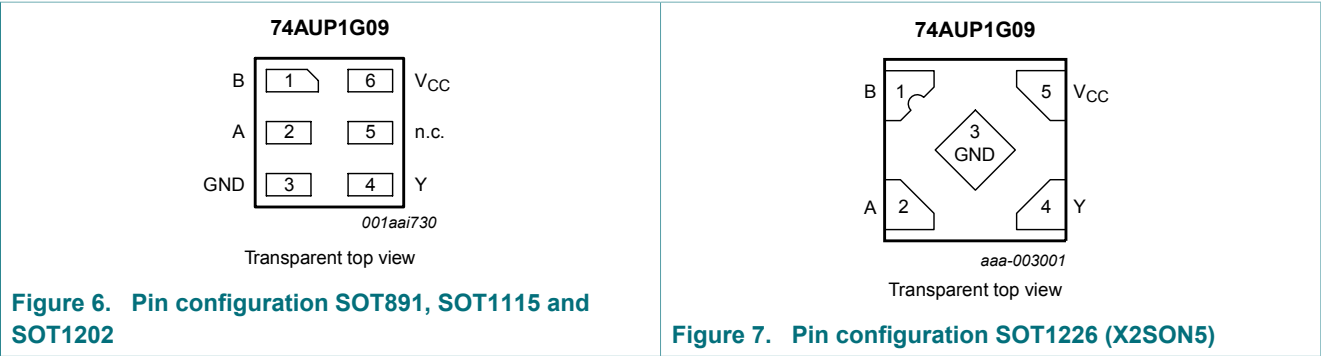


Figure 6. Pin configuration SOT891, SOT1115 and SOT1202

Figure 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 <sub>CC</sub>  | supply voltage          |                                         | -0.5 | +4.6 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                    | -50  | -    | mA   |
| V <sub>I</sub>   | input voltage           |                                         | -0.5 | +4.6 | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < 0 V                    | -50  | -    | mA   |
| V <sub>O</sub>   | output voltage          | Active mode and Power-down mode         | -0.5 | +4.6 | V    |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub> | -    | +20  | mA   |
| I <sub>CC</sub>  | supply current          |                                         | -    | +50  | mA   |
| I <sub>GND</sub> | ground current          |                                         | -50  | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                         | -65  | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C    | -    | 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<sub>tot</sub> derates linearly with 4.0 mW/K.

For XSON6 and X2SON5 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 9 Recommended operating conditions

Table 6. Recommended operating conditions

| Symbol           | Parameter                           | Conditions                       | Min | Max  | Unit |
|------------------|-------------------------------------|----------------------------------|-----|------|------|
| V <sub>CC</sub>  | supply voltage                      |                                  | 0.8 | 3.6  | V    |
| V <sub>I</sub>   | input voltage                       |                                  | 0   | 3.6  | V    |
| V <sub>O</sub>   | output voltage                      | Active mode and Power-down mode  | 0   | 3.6  | V    |
| T <sub>amb</sub> | ambient temperature                 |                                  | -40 | +125 | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 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 |
|--------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------|-----|---------------------|------|
| <b>T<sub>amb</sub> = 25 °C</b> |                                      |                                                                                                              |                     |     |                     |      |
| 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>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   |
|                                |                                      | 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   |

| Symbol                                    | Parameter                            | Conditions                                                                                                      | Min                 | Typ | Max                 | Unit |
|-------------------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------|-----|---------------------|------|
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                                      |                                                                                                                 |                     |     |                     |      |
| 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                                                                | -                   | -   | 0.37                | 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;<br>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;<br>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;<br>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   |

| Symbol                                     | Parameter                            | Conditions                                                                                                   | Min                 | Typ | Max                 | Unit |
|--------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------|---------------------|-----|---------------------|------|
| <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   |
| 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                              | -                   | -   | ±0.75               | 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             | -                   | -   | 1.4                 | 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                      | -                   | -   | 75                  | µA   |

## 11 Dynamic characteristics

**Table 8. Dynamic characteristics**

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<br>(85 °C) | Max<br>(125 °C) |      |
| C <sub>L</sub> = 5 pF  |                   |                                                          |       |                    |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |       |                    |      |                   |                |                 |      |
|                        |                   | V <sub>CC</sub> = 0.8 V                                  | -     | 13.5               | -    | -                 | -              | -               | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                         | 1.9   | 4.6                | 10.4 | 1.8               | 11.4           | 12.6            | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                         | 1.5   | 3.3                | 6.5  | 1.4               | 7.4            | 8.2             | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 1.2   | 2.9                | 5.1  | 1.1               | 5.9            | 6.5             | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 1.0   | 2.2                | 3.8  | 0.9               | 4.5            | 4.9             | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 0.9   | 2.3                | 4.0  | 0.8               | 4.5            | 4.9             | ns   |
| C <sub>L</sub> = 10 pF |                   |                                                          |       |                    |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |       |                    |      |                   |                |                 |      |
|                        |                   | V <sub>CC</sub> = 0.8 V                                  | -     | 16.3               | -    | -                 | -              | -               | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                         | 2.3   | 5.6                | 12.3 | 2.1               | 13.7           | 15.1            | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                         | 1.8   | 4.1                | 7.6  | 1.7               | 8.8            | 9.7             | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 1.6   | 3.8                | 6.1  | 1.4               | 7.1            | 7.8             | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 1.4   | 2.9                | 4.6  | 1.2               | 5.4            | 5.9             | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 1.3   | 3.2                | 5.7  | 1.1               | 6.4            | 7.0             | ns   |
| C <sub>L</sub> = 15 pF |                   |                                                          |       |                    |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |       |                    |      |                   |                |                 |      |
|                        |                   | V <sub>CC</sub> = 0.8 V                                  | -     | 19.0               | -    | -                 | -              | -               | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                         | 2.6   | 6.6                | 14.2 | 2.4               | 15.8           | 17.4            | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                         | 2.1   | 4.8                | 8.7  | 1.9               | 10.1           | 11.1            | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 1.9   | 4.6                | 7.6  | 1.7               | 8.5            | 9.3             | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 1.6   | 3.6                | 5.6  | 1.5               | 6.3            | 6.9             | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 1.6   | 4.1                | 7.5  | 1.4               | 8.3            | 9.1             | ns   |
| C <sub>L</sub> = 30 pF |                   |                                                          |       |                    |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | A or B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup> |       |                    |      |                   |                |                 |      |
|                        |                   | V <sub>CC</sub> = 0.8 V                                  | -     | 27.0               | -    | -                 | -              | -               | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                         | 3.6   | 9.5                | 19.5 | 3.2               | 21.8           | 24.0            | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                         | 2.9   | 7.0                | 11.5 | 2.6               | 13.6           | 15.0            | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                       | 2.6   | 7.0                | 12.1 | 2.3               | 13.3           | 14.6            | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                         | 2.4   | 5.4                | 8.9  | 2.1               | 9.9            | 10.9            | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                         | 2.3   | 6.5                | 12.7 | 2.1               | 13.9           | 15.3            | ns   |

| Symbol                                        | Parameter                     | Conditions                                                                     | 25 °C |                    |     | -40 °C to +125 °C |                |                 | Unit |
|-----------------------------------------------|-------------------------------|--------------------------------------------------------------------------------|-------|--------------------|-----|-------------------|----------------|-----------------|------|
|                                               |                               |                                                                                | Min   | Typ <sup>[1]</sup> | Max | Min               | Max<br>(85 °C) | Max<br>(125 °C) |      |
| C <sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF |                               |                                                                                |       |                    |     |                   |                |                 |      |
| C <sub>PD</sub>                               | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[3]</sup> |       |                    |     |                   |                |                 |      |
|                                               |                               | V <sub>CC</sub> = 0.8 V                                                        | -     | 0.6                | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                               | -     | 0.7                | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                               | -     | 0.8                | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                             | -     | 0.9                | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                               | -     | 1.1                | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                               | -     | 1.4                | -   | -                 | -              | -               | pF   |

[1] All typical values are measured at nominal V<sub>CC</sub>.

[2] t<sub>pd</sub> is the same as t<sub>PZL</sub> and t<sub>PLZ</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

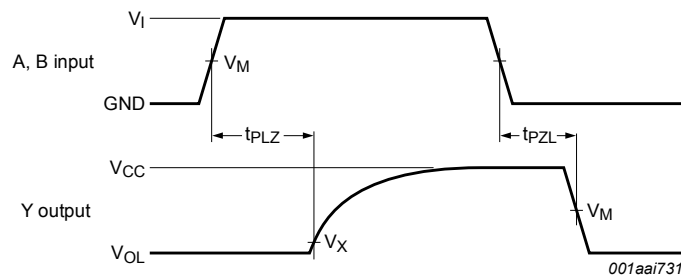
$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching.

## 11.1 Waveform and test circuit



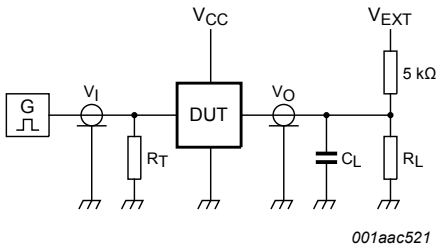
Measurement points are given in [Table 9](#).

V<sub>OL</sub> is a typical output voltage level that occurs with the output load.

**Figure 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:

$R_L$  = 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.

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

**Figure 9. Test circuit for measuring switching times**

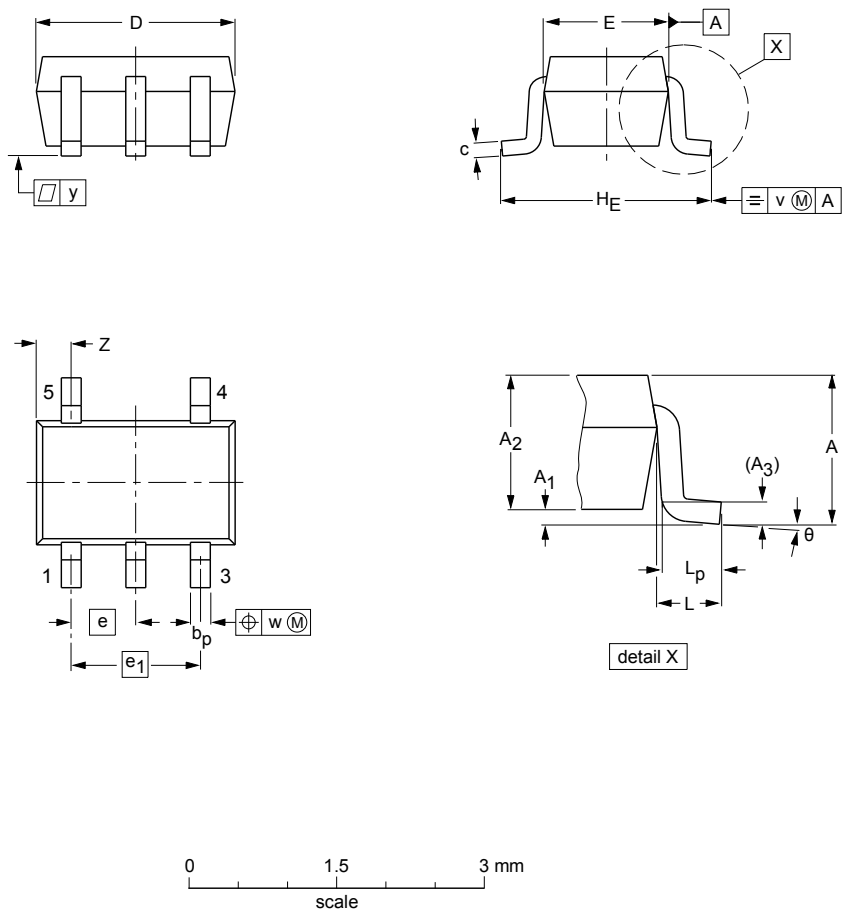
**Table 10. Test data**

| Supply voltage | Load                         |              | $V_{EXT}$             |                       |                       |
|----------------|------------------------------|--------------|-----------------------|-----------------------|-----------------------|
| $V_{CC}$       | $C_L$                        | $R_L$ [1]    | $t_{PLH}$ , $t_{PHL}$ | $t_{PZH}$ , $t_{PHZ}$ | $t_{PZL}$ , $t_{PLZ}$ |
| 0.8 V to 3.6 V | 5 pF, 10 pF, 15 pF and 30 pF | 5 kΩ or 1 MΩ | open                  | GND                   | $2V_{CC}$             |

[1] For measuring enable and disable times  $R_L = 5\text{ k}\Omega$ .  
For measuring propagation delays, set-up and hold times, and pulse width,  $R_L = 1\text{ M}\Omega$ .

12 Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm SOT353-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max. | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | e <sub>1</sub> | H <sub>E</sub> | L     | L <sub>p</sub> | v   | w   | y   | Z <sup>(1)</sup> | θ        |
|------|-----------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|----------------|-------|----------------|-----|-----|-----|------------------|----------|
| mm   | 1.1       | 0.1<br>0       | 1.0<br>0.8     | 0.15           | 0.30<br>0.15   | 0.25<br>0.08 | 2.25<br>1.85     | 1.35<br>1.15     | 0.65 | 1.3            | 2.25<br>2.0    | 0.425 | 0.46<br>0.21   | 0.3 | 0.1 | 0.1 | 0.60<br>0.15     | 7°<br>0° |

**Note**  
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE<br>VERSION | REFERENCES |        |        |  | EUROPEAN<br>PROJECTION | ISSUE DATE                      |
|--------------------|------------|--------|--------|--|------------------------|---------------------------------|
|                    | IEC        | JEDEC  | JEITA  |  |                        |                                 |
| SOT353-1           |            | MO-203 | SC-88A |  |                        | <del>00-09-01</del><br>03-02-19 |

Figure 10. Package outline SOT353-1 (TSSOP5)

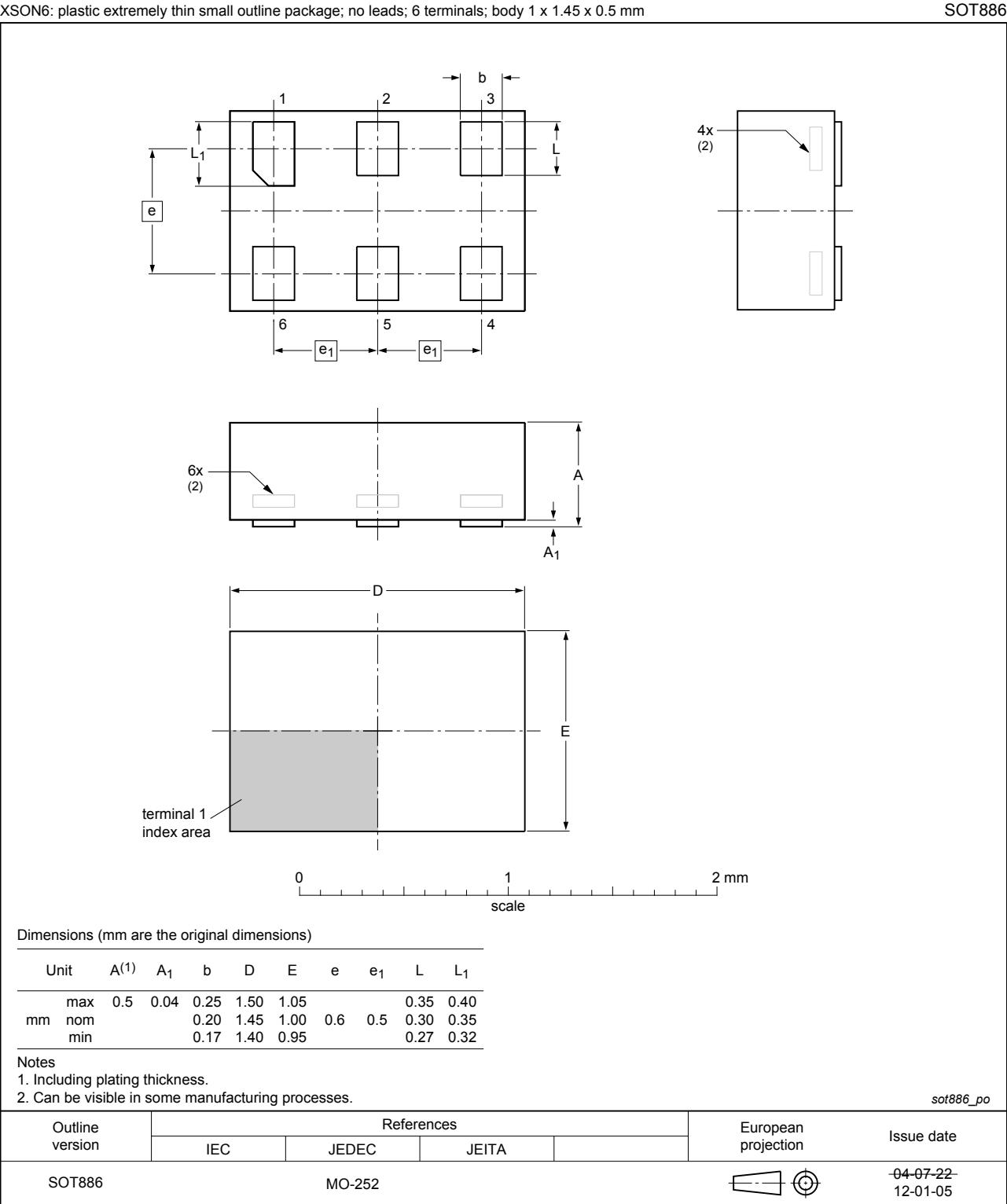
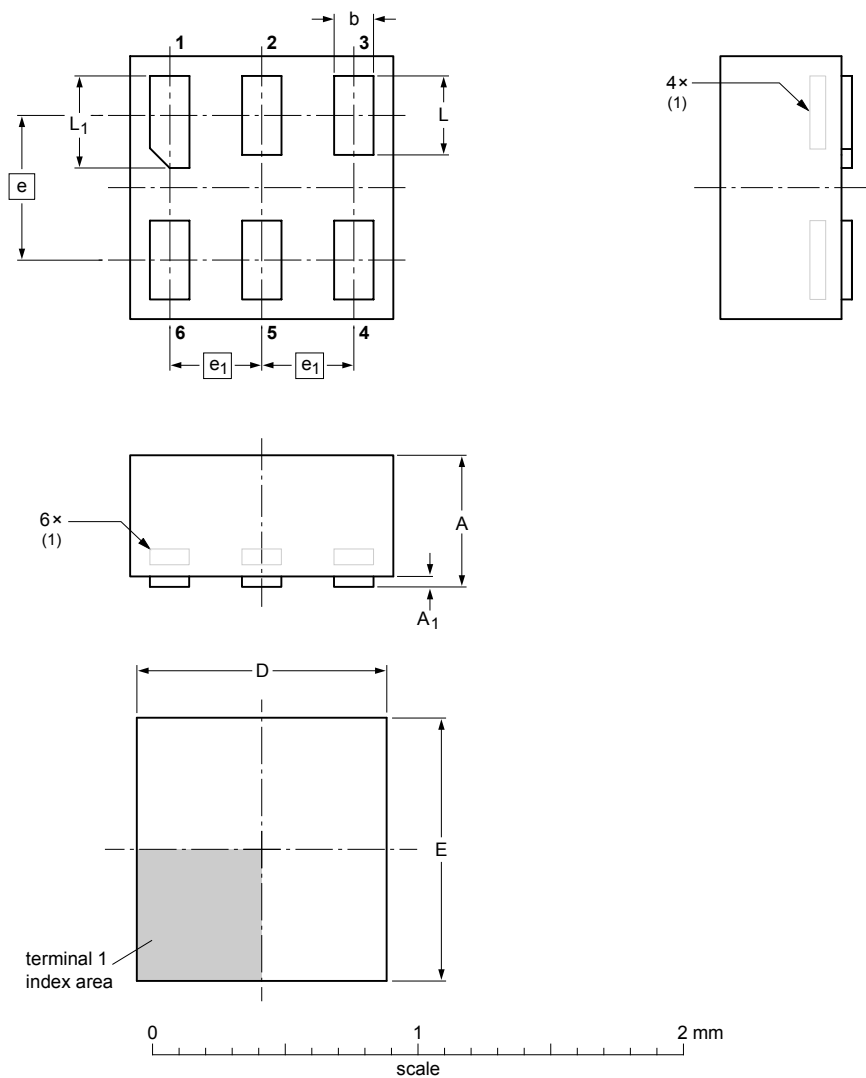


Figure 11. Package outline SOT886 (XSON6)

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



DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max | A <sub>1</sub><br>max | b            | D            | E            | e    | e <sub>1</sub> | L            | L <sub>1</sub> |
|------|----------|-----------------------|--------------|--------------|--------------|------|----------------|--------------|----------------|
| mm   | 0.5      | 0.04                  | 0.20<br>0.12 | 1.05<br>0.95 | 1.05<br>0.95 | 0.55 | 0.35           | 0.35<br>0.27 | 0.40<br>0.32   |

**Note**  
1. Can be visible in some manufacturing processes.

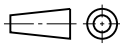
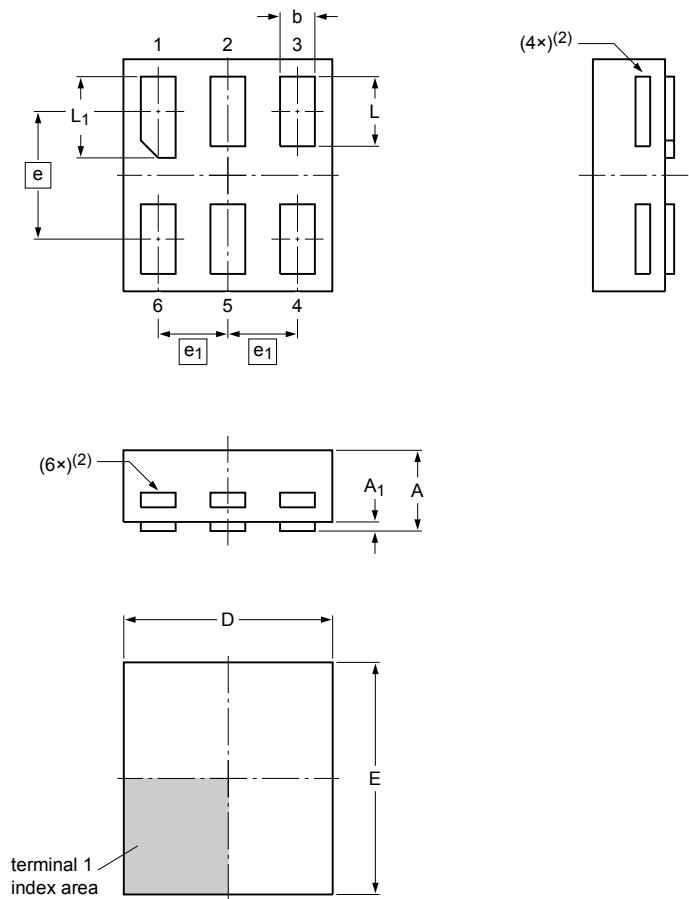
| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION                                                                | ISSUE DATE           |
|--------------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|----------------------|
|                    | IEC        | JEDEC | JEITA |  |                                                                                       |                      |
| SOT891             |            |       |       |  |  | 05-04-06<br>07-05-15 |

Figure 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



Dimensions

| Unit | A <sup>(1)</sup> | A <sub>1</sub> | b    | D    | E    | e    | e <sub>1</sub> | L    | L <sub>1</sub> |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| mm   | max              | 0.35           | 0.04 | 0.20 | 0.95 | 1.05 |                | 0.35 | 0.40           |
|      | nom              |                |      | 0.15 | 0.90 | 1.00 | 0.55           | 0.30 | 0.35           |
|      | min              |                |      | 0.12 | 0.85 | 0.95 |                | 0.27 | 0.32           |

Note

1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1115\_po

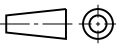
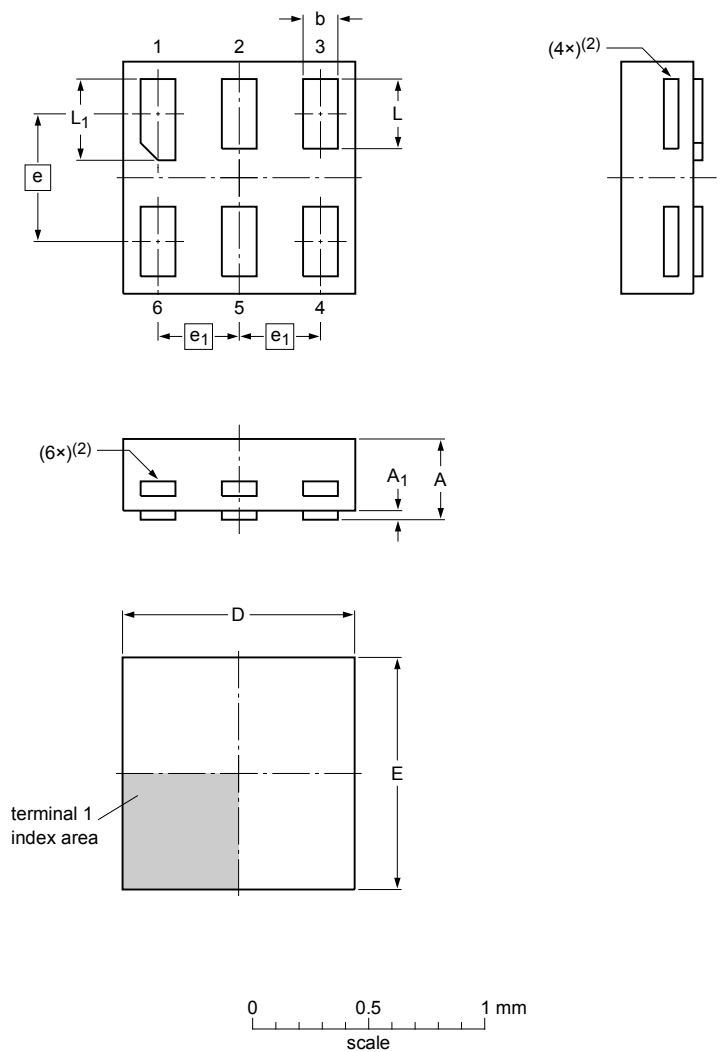
| Outline version | References |       |       |  | European projection                                                                   | Issue date             |
|-----------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|------------------------|
|                 | IEC        | JEDEC | JEITA |  |                                                                                       |                        |
| SOT1115         |            |       |       |  |  | -10-04-02-<br>10-04-07 |

Figure 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



Dimensions

| Unit | A <sup>(1)</sup> | A <sub>1</sub> | b    | D    | E    | e    | e <sub>1</sub> | L    | L <sub>1</sub> |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| mm   | max              | 0.35           | 0.04 | 0.20 | 1.05 | 1.05 |                | 0.35 | 0.40           |
|      | nom              |                |      | 0.15 | 1.00 | 1.00 | 0.55           | 0.30 | 0.35           |
|      | min              |                |      | 0.12 | 0.95 | 0.95 |                | 0.27 | 0.32           |

Note

1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1202\_po

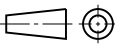
| Outline version | References |       |       |  | European projection                                                                   | Issue date             |
|-----------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|------------------------|
|                 | IEC        | JEDEC | JEITA |  |                                                                                       |                        |
| SOT1202         |            |       |       |  |  | -10-04-02-<br>10-04-06 |

Figure 14. Package outline SOT1202 (XSON6)

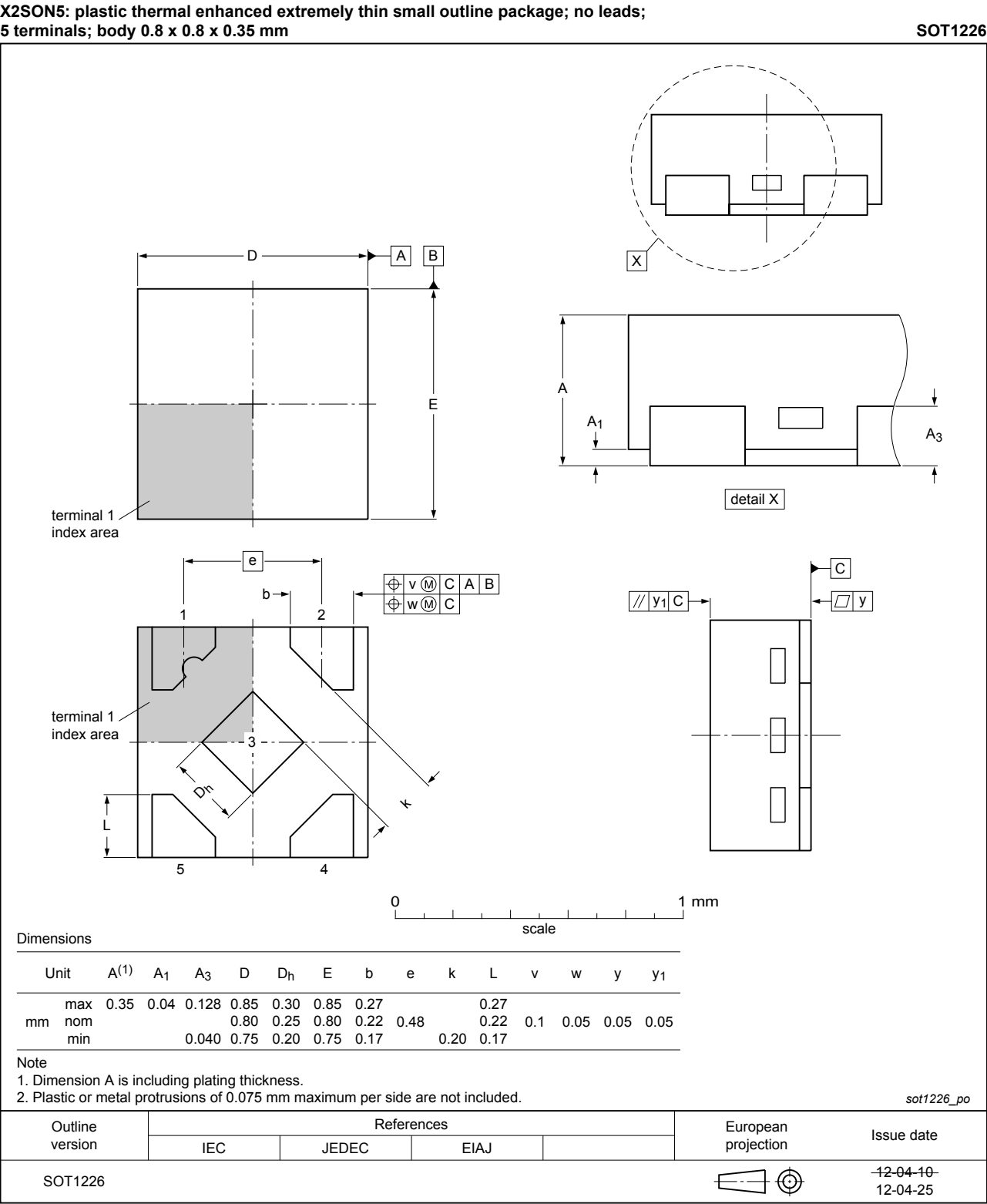


Figure 15. Package outline SOT1226 (X2SON5)

## 13 Abbreviations

Table 11. Abbreviations

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

## 14 Revision history

Table 12. Revision history

| Document ID    | Release date                                                                                                                                                                                                                           | Data sheet status  | Change notice | Supersedes    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|---------------|
| 74AUP1G09 v.5  | 20170929                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP1G09 v.4 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul> |                    |               |               |
| 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 | -             | -             |

## 15 Legal information

### 15.1 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".

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