

# 74AUP1T87

Low-power 2-input EXCLUSIVE-NOR gate with voltage-level translator

Rev. 1 — 28 November 2017

Product data sheet

## 1 General description

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The 74AUP1T87 provides the single 2-input EXCLUSIVE-NOR function. This device ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range from 2.3 V to 3.6 V.

The 74AUP1T87 is designed for logic-level translation applications with input switching levels that accept 1.8 V low-voltage CMOS signals, while operating from either a single 2.5 V or 3.3 V supply voltage.

The wide supply voltage range ensures normal operation as battery voltage drops from 3.6 V to 2.3 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.

Schmitt trigger inputs make the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range.

## 2 Features and benefits

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- Wide supply voltage range from 2.3 V to 3.6 V
- High noise immunity
- ESD protection:
  - HBM JESD22-A114F Class 3A exceeds 5000 V
  - CDM JESD22-C101E exceeds 1000 V
- Low static power consumption;  $I_{CC} = 1.5 \mu\text{A}$  (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           |        |  | Version  |
|-------------|-------------------|--------|--|----------|
|             | Temperature range | Name   | Description  |          |
| 74AUP1T87GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm   | SOT353-1 |
| 74AUP1T87GX | -40 °C to +125 °C | 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> |
|-------------|-----------------------------|
| 74AUP1T87GW | 5D                          |
| 74AUP1T87GX | 5D                          |

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

5 Functional diagram

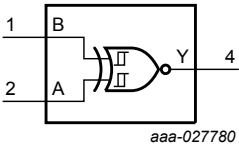


Figure 1. Logic symbol

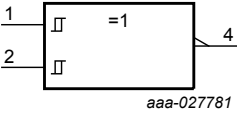


Figure 2. IEC logic symbol

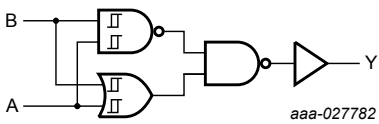


Figure 3. Logic diagram

6 Pinning information

6.1 Pinning

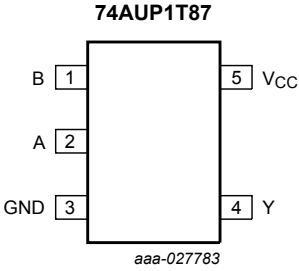


Figure 4. Pin configuration SOT353-1

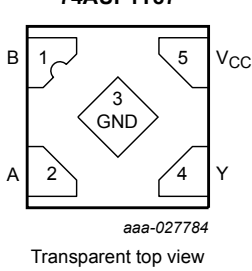


Figure 5. Pin configuration SOT1226 (X2SON5)

## 6.2 Pin description

Table 3. Pin description

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| B               | 1   | data input     |
| A               | 2   | data input     |
| GND             | 3   | ground (0 V)   |
| Y               | 4   | data output    |
| V <sub>CC</sub> | 5   | supply voltage |

## 7 Functional description

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

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

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

## 8 Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter               | Conditions                              | Min  | Max  | Unit |
|------------------|-------------------------|---|------|------|------|
| V <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 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 |
|-----------|---------------------|---------------------------------|-----|----------|------|
| $V_{CC}$  | supply voltage      |                                 | 2.3 | 3.6      | V    |
| $V_I$     | input voltage       |                                 | 0   | 3.6      | V    |
| $V_O$     | output voltage      | Active mode                     | 0   | $V_{CC}$ | V    |
|           |                     | Power-down mode; $V_{CC} = 0$ V | 0   | 3.6      | V    |
| $T_{amb}$ | ambient temperature |                                 | -40 | +125     | °C   |

## 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    |
|-------------------|--------------------------------------|--|----------------|-----|-----------|---------|
| $T_{amb} = 25$ °C |                                      |  |                |     |           |         |
| $V_{T+}$          | positive-going threshold voltage     | $V_{CC} = 2.3$ V to $2.7$ V  | 0.60           | -   | 1.10      | V       |
|                   |                                      | $V_{CC} = 3.0$ V to $3.6$ V  | 0.75           | -   | 1.16      | V       |
| $V_{T-}$          | negative-going threshold voltage     | $V_{CC} = 2.3$ V to $2.7$ V  | 0.35           | -   | 0.60      | V       |
|                   |                                      | $V_{CC} = 3.0$ V to $3.6$ V  | 0.50           | -   | 0.85      | V       |
| $V_H$             | hysteresis voltage                   | $(V_H = V_{T+} - V_{T-})$  |                |     |           |         |
|                   |                                      | $V_{CC} = 2.3$ V to $2.7$ V  | 0.23           | -   | 0.60      | V       |
|                   |                                      | $V_{CC} = 3.0$ V to $3.6$ V  | 0.25           | -   | 0.56      | V       |
| $V_{OH}$          | HIGH-level output voltage            | $V_I = V_{T+}$ or $V_{T-}$   |                |     |           |         |
|                   |                                      | $I_O = -20$ $\mu$ A; $V_{CC} = 2.3$ V to $3.6$ V                             | $V_{CC} - 0.1$ | -   | -         | V       |
|                   |                                      | $I_O = -2.3$ mA; $V_{CC} = 2.3$ V  | 2.05           | -   | -         | V       |
|                   |                                      | $I_O = -3.1$ mA; $V_{CC} = 2.3$ V  | 1.9            | -   | -         | V       |
|                   |                                      | $I_O = -2.7$ mA; $V_{CC} = 3.0$ V  | 2.72           | -   | -         | V       |
|                   |                                      | $I_O = -4.0$ mA; $V_{CC} = 3.0$ V  | 2.6            | -   | -         | V       |
| $V_{OL}$          | LOW-level output voltage             | $V_I = V_{T+}$ or $V_{T-}$   |                |     |           |         |
|                   |                                      | $I_O = 20$ $\mu$ A; $V_{CC} = 2.3$ V to $3.6$ V                              | -              | -   | 0.10      | V       |
|                   |                                      | $I_O = 2.3$ mA; $V_{CC} = 2.3$ V   | -              | -   | 0.31      | V       |
|                   |                                      | $I_O = 3.1$ mA; $V_{CC} = 2.3$ V   | -              | -   | 0.44      | V       |
|                   |                                      | $I_O = 2.7$ mA; $V_{CC} = 3.0$ V   | -              | -   | 0.31      | V       |
|                   |                                      | $I_O = 4.0$ mA; $V_{CC} = 3.0$ V   | -              | -   | 0.44      | V       |
| $I_I$             | input leakage current                | $V_I = \text{GND}$ to $3.6$ V; $V_{CC} = 0$ V to $3.6$ V                     | -              | -   | $\pm 0.1$ | $\mu$ A |
| $I_{OFF}$         | power-off leakage current            | $V_I$ or $V_O = 0$ V to $3.6$ V; $V_{CC} = 0$ V                              | -              | -   | $\pm 0.1$ | $\mu$ A |
| $\Delta I_{OFF}$  | 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                | -              | -   | $\pm 0.1$ | $\mu$ A |
| $I_{CC}$          | supply current                       | $V_I = \text{GND}$ or $V_{CC}$ ; $I_O = 0$ A;<br>$V_{CC} = 2.3$ V to $3.6$ V | -              | -   | 1.2       | $\mu$ A |

## Low-power 2-input EXCLUSIVE-NOR gate with voltage-level translator

| Symbol                                    | Parameter                            | Conditions  | Min                   | Typ | Max  | Unit |
|---|--------------------------------------|---|-----------------------|-----|------|------|
| 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                   | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V   | -                     | 1.7 | -    | pF   |
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                                      |   |                       |     |      |      |
| V <sub>T+</sub>                           | positive-going threshold voltage     | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.60                  | -   | 1.10 | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.75                  | -   | 1.19 | V    |
| V <sub>T-</sub>                           | negative-going threshold voltage     | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.35                  | -   | 0.60 | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.50                  | -   | 0.85 | V    |
| V <sub>H</sub>                            | hysteresis voltage                   | (V <sub>H</sub> = V <sub>T+</sub> - V <sub>T-</sub> )   |                       |     |      |      |
|   |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.10                  | -   | 0.60 | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.15                  | -   | 0.56 | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage            | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |                       |     |      |      |
|   |                                      | I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 2.3 V to 3.6 V   | V <sub>CC</sub> - 0.1 | -   | -    | V    |
|   |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V   | 1.97                  | -   | -    | V    |
|   |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V   | 1.85                  | -   | -    | V    |
|   |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V   | 2.67                  | -   | -    | V    |
|   |                                      | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V   | 2.55                  | -   | -    | V    |
| V <sub>OL</sub>                           | LOW-level output voltage             | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |                       |     |      |      |
|   |                                      | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.3 V to 3.6 V  | -                     | -   | 0.1  | 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>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                  | -                     | -   | ±0.5 | 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> = 2.3 V to 3.6 V | -                     | -   | 1.5  | µA   |
| ΔI <sub>CC</sub>                          | additional supply current            | V <sub>CC</sub> = 2.3 V to 2.7 V; I <sub>O</sub> = 0 A <sup>[1]</sup>                               | -                     | -   | 0.6  | µA   |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V; I <sub>O</sub> = 0 A <sup>[2]</sup>                               | -                     | -   | 10   | µA   |

## Low-power 2-input EXCLUSIVE-NOR gate with voltage-level translator

| Symbol                                     | Parameter                            | Conditions  | Min                    | Typ | Max   | Unit |
|--|--------------------------------------|---|------------------------|-----|-------|------|
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                                      |   |                        |     |       |      |
| V <sub>T+</sub>                            | positive-going threshold voltage     | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.60                   | -   | 1.10  | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.75                   | -   | 1.19  | V    |
| V <sub>T-</sub>                            | negative-going threshold voltage     | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.33                   | -   | 0.64  | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.46                   | -   | 0.85  | V    |
| V <sub>H</sub>                             | hysteresis voltage                   | (V <sub>H</sub> = V <sub>T+</sub> - V <sub>T-</sub> )   |                        |     |       |      |
|  |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.10                   | -   | 0.60  | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.15                   | -   | 0.56  | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage            | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |                        |     |       |      |
|  |                                      | I <sub>O</sub> = -20 µA; V <sub>CC</sub> = 2.3 V to 3.6 V   | V <sub>CC</sub> - 0.11 | -   | -     | V    |
|  |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V   | 1.77                   | -   | -     | V    |
|  |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V   | 1.67                   | -   | -     | V    |
|  |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V   | 2.40                   | -   | -     | V    |
|  |                                      | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V   | 2.30                   | -   | -     | V    |
| V <sub>OL</sub>                            | LOW-level output voltage             | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>   |                        |     |       |      |
|  |                                      | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.3 V to 3.6 V  | -                      | -   | 0.11  | 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>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;<br>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;<br>V <sub>CC</sub> = 2.3 V to 3.6 V | -                      | -   | 3.5   | µA   |
| ΔI <sub>CC</sub>                           | additional supply current            | V <sub>CC</sub> = 2.3 V to 2.7 V; I <sub>O</sub> = 0 A <sup>[1]</sup>                               | -                      | -   | 1.8   | µA   |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V; I <sub>O</sub> = 0 A <sup>[2]</sup>                               | -                      | -   | 18    | µA   |

[1] One input at 0.3 V or 1.1 V, other input at V<sub>CC</sub> or GND.

[2] One input at 0.45 V or 1.2 V, other input at V<sub>CC</sub> or GND.

## 11 Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

| Symbol  | Parameter         | Conditions   | 25 °C |                    |     | -40 °C to +125 °C |             |              | Unit |
|---|-------------------|--|-------|--------------------|-----|-------------------|-------------|--------------|------|
|   |                   |  | Min   | Typ <sup>[1]</sup> | Max | Min               | Max (85 °C) | Max (125 °C) |      |
| V <sub>CC</sub> = 2.3 V to 2.7 V; V <sub>I</sub> = 1.65 V to 1.95 V |                   |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup> |       |                    |     |                   |             |              |      |
|   |                   | C <sub>L</sub> = 5 pF                                  | 2.1   | 3.6                | 5.5 | 0.5               | 6.8         | 7.5          | ns   |
|   |                   | C <sub>L</sub> = 10 pF                                 | 2.6   | 4.2                | 6.2 | 1.0               | 7.9         | 8.7          | ns   |
|   |                   | C <sub>L</sub> = 15 pF                                 | 2.9   | 4.7                | 6.8 | 1.0               | 8.7         | 9.6          | ns   |
|   |                   | C <sub>L</sub> = 30 pF                                 | 4.0   | 5.9                | 8.1 | 1.5               | 10.8        | 11.9         | ns   |
| V <sub>CC</sub> = 2.3 V to 2.7 V; V <sub>I</sub> = 2.3 V to 2.7 V   |                   |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup> |       |                    |     |                   |             |              |      |
|   |                   | C <sub>L</sub> = 5 pF                                  | 1.7   | 3.5                | 5.6 | 0.5               | 6.0         | 6.6          | ns   |
|   |                   | C <sub>L</sub> = 10 pF                                 | 2.1   | 4.1                | 6.3 | 1.0               | 7.1         | 7.9          | ns   |
|   |                   | C <sub>L</sub> = 15 pF                                 | 2.5   | 4.6                | 6.8 | 1.0               | 7.9         | 8.7          | ns   |
|   |                   | C <sub>L</sub> = 30 pF                                 | 3.5   | 5.7                | 8.2 | 1.5               | 10.0        | 11.0         | ns   |
| V <sub>CC</sub> = 2.3 V to 2.7 V; V <sub>I</sub> = 3.0 V to 3.6 V   |                   |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup> |       |                    |     |                   |             |              |      |
|   |                   | C <sub>L</sub> = 5 pF                                  | 1.4   | 3.2                | 5.1 | 0.5               | 5.5         | 6.1          | ns   |
|   |                   | C <sub>L</sub> = 10 pF                                 | 1.8   | 3.8                | 5.7 | 1.0               | 6.5         | 7.2          | ns   |
|   |                   | C <sub>L</sub> = 15 pF                                 | 2.1   | 4.3                | 6.3 | 1.0               | 7.4         | 8.2          | ns   |
|   |                   | C <sub>L</sub> = 30 pF                                 | 3.2   | 5.5                | 7.7 | 1.5               | 9.5         | 10.5         | ns   |
| V <sub>CC</sub> = 3.0 V to 3.6 V; V <sub>I</sub> = 1.65 V to 1.95 V |                   |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup> |       |                    |     |                   |             |              |      |
|   |                   | C <sub>L</sub> = 5 pF                                  | 2.1   | 3.0                | 4.0 | 0.5               | 8.0         | 8.8          | ns   |
|   |                   | C <sub>L</sub> = 10 pF                                 | 2.5   | 3.6                | 4.8 | 1.0               | 8.5         | 9.4          | ns   |
|   |                   | C <sub>L</sub> = 15 pF                                 | 2.8   | 4.0                | 5.4 | 1.0               | 9.1         | 10.1         | ns   |
|   |                   | C <sub>L</sub> = 30 pF                                 | 3.7   | 5.2                | 7.0 | 1.5               | 9.8         | 10.8         | ns   |
| V <sub>CC</sub> = 3.0 V to 3.6 V; V <sub>I</sub> = 2.3 V to 2.7 V   |                   |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup> |       |                    |     |                   |             |              |      |
|   |                   | C <sub>L</sub> = 5 pF                                  | 1.6   | 2.9                | 4.4 | 0.5               | 5.3         | 5.9          | ns   |
|   |                   | C <sub>L</sub> = 10 pF                                 | 2.0   | 3.5                | 5.1 | 1.0               | 6.1         | 6.8          | ns   |
|   |                   | C <sub>L</sub> = 15 pF                                 | 2.4   | 3.9                | 5.6 | 1.0               | 6.8         | 7.5          | ns   |
|   |                   | C <sub>L</sub> = 30 pF                                 | 3.5   | 5.1                | 6.9 | 1.5               | 8.5         | 9.4          | ns   |

| Symbol  | Parameter                     | Conditions   | 25 °C |                    |     | -40 °C to +125 °C |             |              | Unit |
|---|-------------------------------|--|-------|--------------------|-----|-------------------|-------------|--------------|------|
|   |                               |  | Min   | Typ <sup>[1]</sup> | Max | Min               | Max (85 °C) | Max (125 °C) |      |
| V <sub>CC</sub> = 3.0 V to 3.6 V; V <sub>I</sub> = 3.0 V to 3.6 V |                               |  |       |                    |     |                   |             |              |      |
| t <sub>pd</sub>   | propagation delay             | A, B to Y; see <a href="#">Figure 6</a> <sup>[2]</sup>                         |       |                    |     |                   |             |              |      |
|   |                               | C <sub>L</sub> = 5 pF  | 1.3   | 2.8                | 4.5 | 0.5               | 4.7         | 5.2          | ns   |
|   |                               | C <sub>L</sub> = 10 pF   | 1.7   | 3.4                | 5.1 | 1.0               | 5.7         | 6.3          | ns   |
|   |                               | C <sub>L</sub> = 15 pF   | 2.1   | 3.9                | 5.7 | 1.0               | 6.2         | 6.9          | ns   |
|   |                               | C <sub>L</sub> = 30 pF   | 3.1   | 5.0                | 7.0 | 1.5               | 7.8         | 8.6          | ns   |
| T <sub>amb</sub> = 25 °C  |                               |  |       |                    |     |                   |             |              |      |
| 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> = 2.3 V to 2.7 V   | -     | 4                  | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 3.0 V to 3.6 V   | -     | 5                  | -   | -                 | -           | -            | pF   |

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

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

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

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

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

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

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



11.1 Waveforms and test circuit

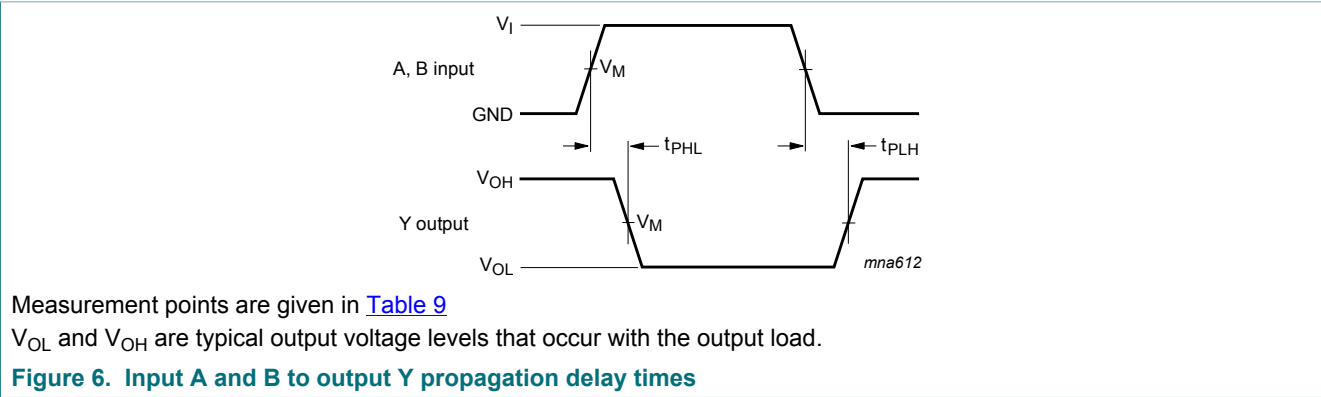


Table 9. Measurement points

| Supply voltage | Output              | Input            |                 |               |
|----------------|---------------------|------------------|-----------------|---------------|
| $V_{CC}$       | $V_M$               | $V_M$            | $V_I$           | $t_r = t_f$   |
| 2.3 V to 3.6 V | $0.5 \times V_{CC}$ | $0.5 \times V_I$ | 1.65 V to 3.6 V | $\leq 3.0$ ns |

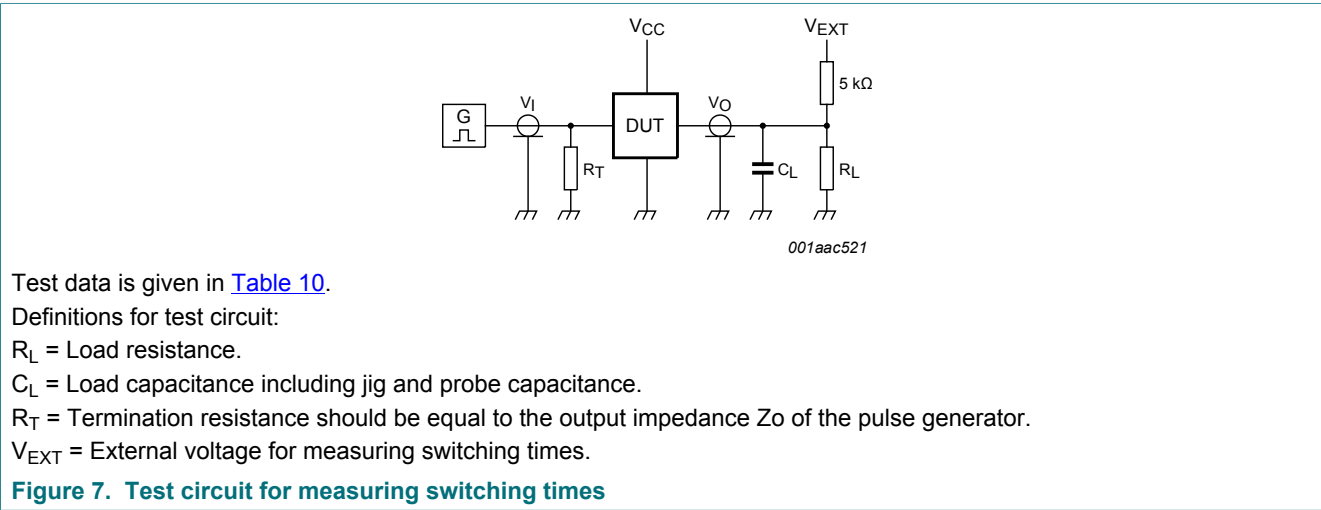


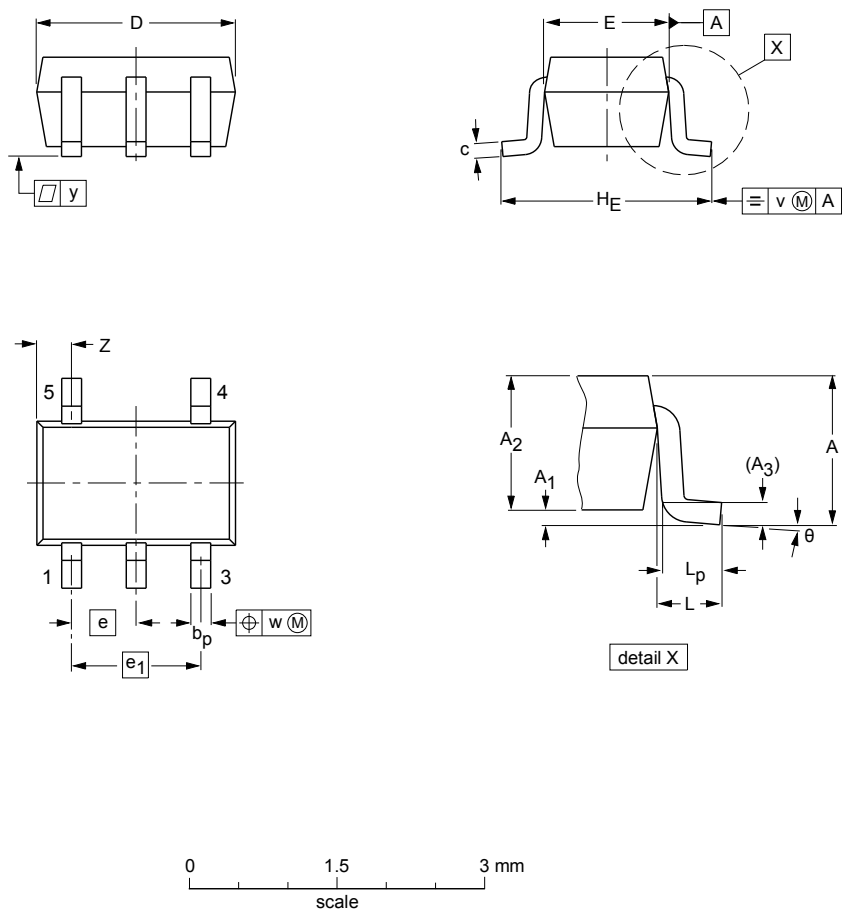
Table 10. Test data

| Supply voltage | Load                         |              | $V_{EXT}$          |                    |                    |  |
|----------------|------------------------------|--------------|--------------------|--------------------|--------------------|--|
| $V_{CC}$       | $C_L$                        | $R_L$ [1]    | $t_{PLH}, t_{PHL}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |  |
| 2.3 V to 3.6 V | 5 pF, 10 pF, 15 pF and 30 pF | 5 kΩ or 1 MΩ | open               | GND                | $2 \times V_{CC}$  |  |

[1] For measuring enable and disable times  $R_L = 5$  kΩ.  
For measuring propagation delays, setup and hold times and pulse width  $R_L = 1$  MΩ.

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 |  |                        | 00-09-01<br>03-02-19 |

Figure 8. Package outline SOT353-1 (TSSOP5)

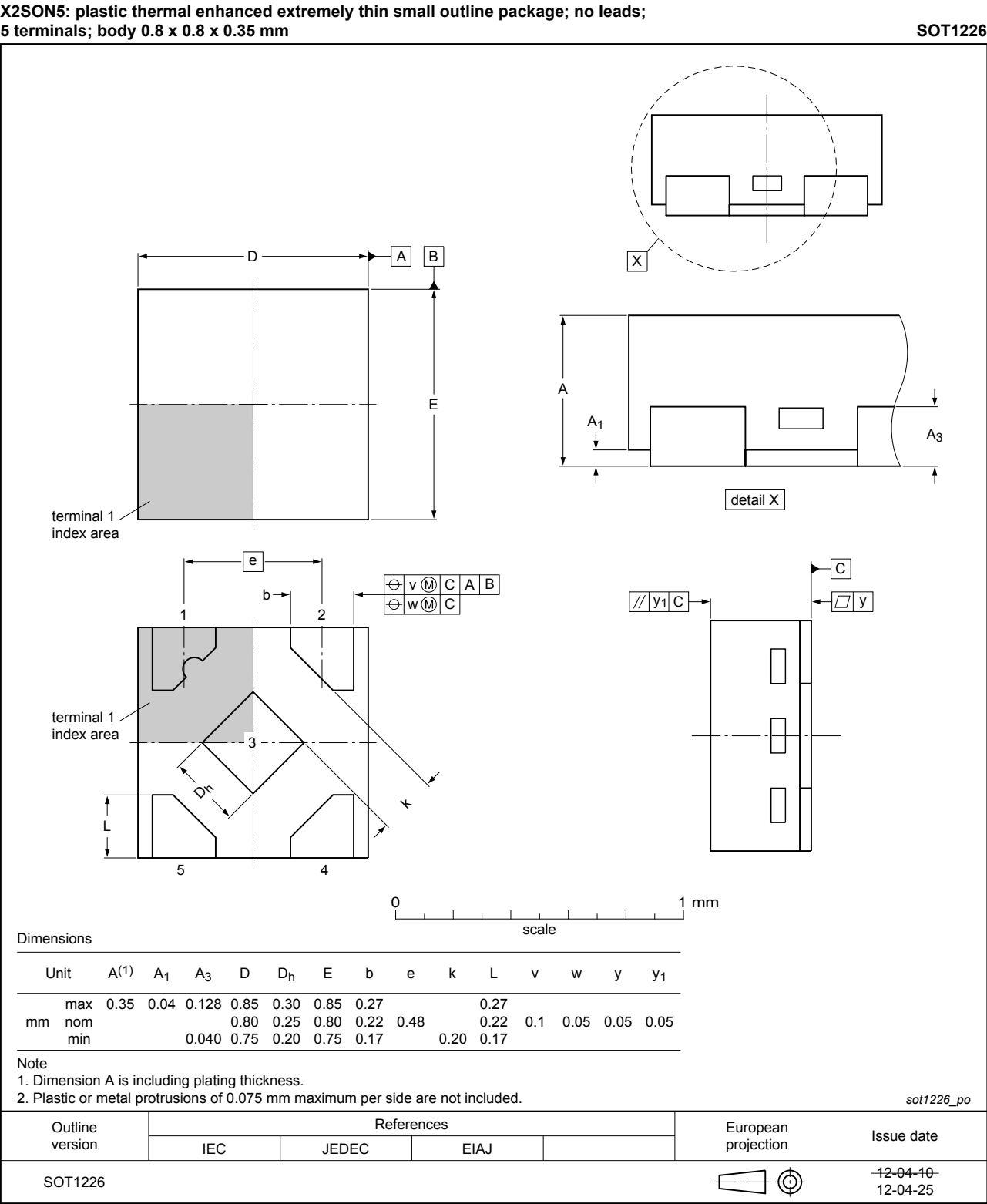


Figure 9. Package outline SOT1226 (X2SON5)

## 13 Abbreviations

Table 11. Abbreviations

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

## 14 Revision history

Table 12. Revision history

| Document ID   | Release date | Data sheet status  | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| 74AUP1T87 v.1 | 20171128     | 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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Low-power 2-input EXCLUSIVE-NOR gate with voltage-level translator

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Date of release: 28 November 2017  
Document identifier: 74AUP1T87



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