

# 74AUP2G86

Low-power dual 2-input EXCLUSIVE-OR gate

Rev. 9 — 28 March 2019

Product data sheet

## 1. General description

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The 74AUP2G86 provides the dual 2-input EXCLUSIVE-OR function.

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 a 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;  $I_{CC} = 0.9 \mu\text{A}$  (maximum)
- Latch-up performance exceeds 100 mA per JESD78 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   |          |
| 74AUP2G86DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm                  | SOT765-1 |
| 74AUP2G86GT | -40 °C to +125 °C | XSON8  | plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm | SOT833-1 |
| 74AUP2G86GF | -40 °C to +125 °C | XSON8  | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm         | SOT1089  |
| 74AUP2G86GM | -40 °C to +125 °C | XQFN8  | plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm   | SOT902-2 |
| 74AUP2G86GN | -40 °C to +125 °C | XSON8  | extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm       | SOT1116  |
| 74AUP2G86GS | -40 °C to +125 °C | XSON8  | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm      | SOT1203  |

### 4. Marking

Table 2. Marking codes

| Type number | Marking code [1] |
|-------------|------------------|
| 74AUP2G86DC | p86              |
| 74AUP2G86GT | p86              |
| 74AUP2G86GF | pH               |
| 74AUP2G86GM | p86              |
| 74AUP2G86GN | pH               |
| 74AUP2G86GS | pH               |

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

### 5. Functional diagram

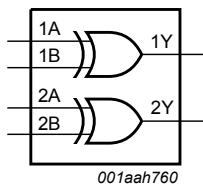


Fig. 1. Logic symbol

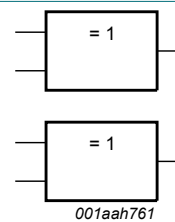


Fig. 2. IEC logic symbol

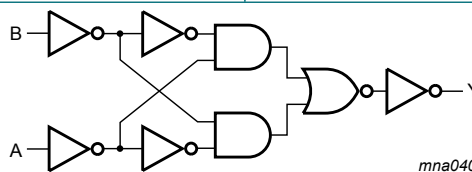
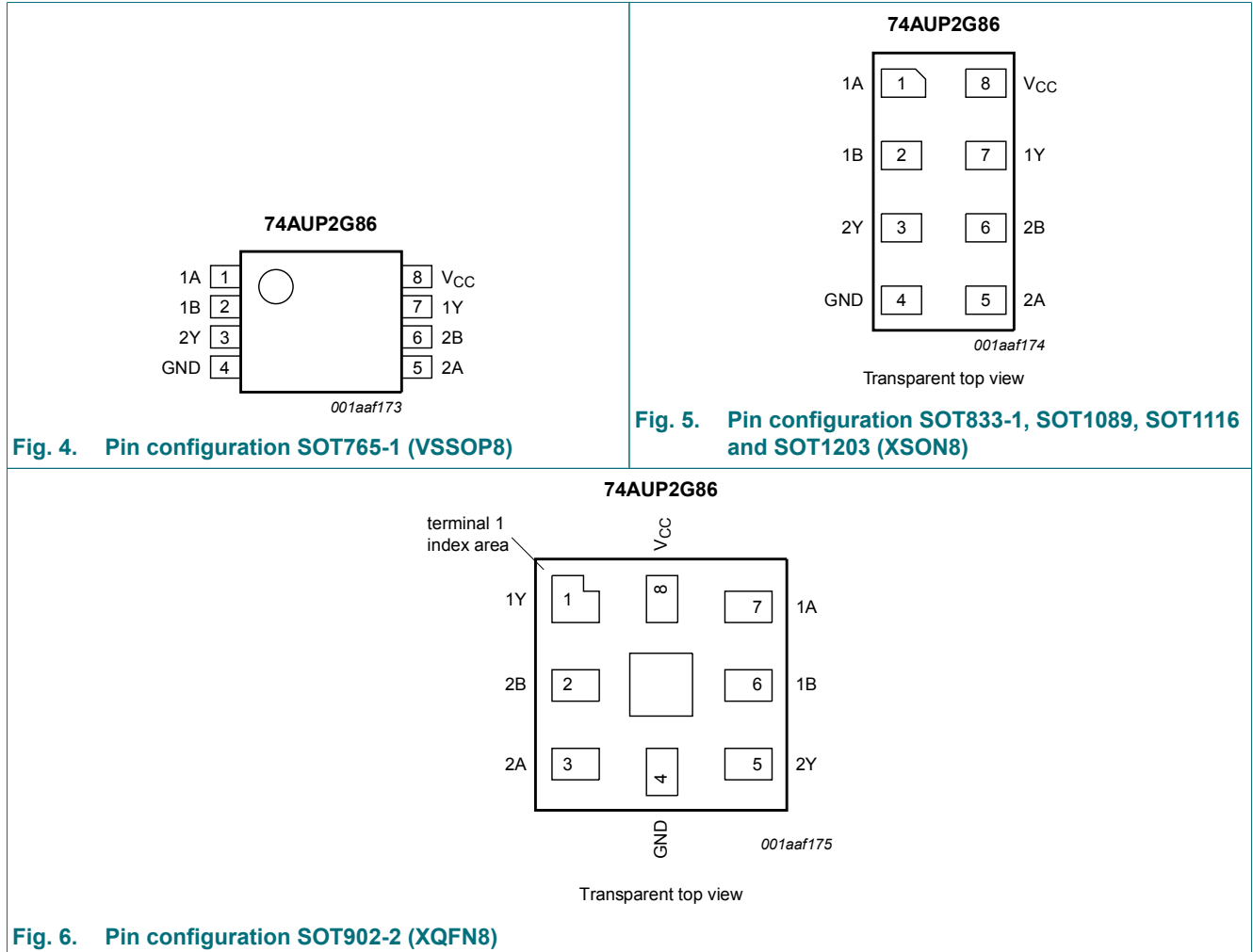


Fig. 3. Logic diagram (one gate)

## 6. Pinning information

### 6.1. Pinning



### 6.2. Pin description

Table 3. Pin description

| Symbol          | Pin  |          | Description    |
|-----------------|--|----------|----------------|
|                 | SOT765-1, SOT833-1, SOT1089, SOT1116 and SOT1203 | SOT902-2 |                |
| 1A, 2A          | 1, 5   | 7, 3     | data input     |
| 1B, 2B          | 2, 6   | 6, 2     | data input     |
| GND             | 4  | 4        | ground (0 V)   |
| 1Y, 2Y          | 7, 3   | 1, 5     | data output    |
| V <sub>CC</sub> | 8  | 8        | supply voltage |

## 7. Functional description

**Table 4. Function table**

*H = HIGH voltage level;*

*L = LOW voltage level.*

| Input |    | Output |
|-------|----|--------|
| nA    | nB | nY     |
| L     | L  | L      |
| L     | H  | H      |
| H     | L  | H      |
| H     | H  | L      |

## 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  | $V_I < 0\text{ V}$                              | -50  | -    | mA   |
| $V_I$     | input voltage           | [1]   | -0.5 | +4.6 | V    |
| $I_{OK}$  | output clamping current | $V_O < 0\text{ V}$                              | -50  | -    | mA   |
| $V_O$     | output voltage          | Active mode and Power-down mode [1]             | -0.5 | +4.6 | V    |
| $I_O$     | output current          | $V_O = 0\text{ V to }V_{CC}$                    | -    | ±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 | $T_{amb} = -40\text{ °C to }+125\text{ °C}$ [2] | -    | 250  | mW   |

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

[2] For VSSOP8 packages: above 110 °C the value of  $P_{tot}$  derates linearly with 8.0 mW/K.

For XSON8 and XQFN8 packages: above 118 °C the value of  $P_{tot}$  derates linearly with 7.8 mW/K.

## 9. Recommended operating conditions

**Table 6. 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                             | 0   | $V_{CC}$ | V    |
|                     |                                     | Power-down mode; $V_{CC} = 0\text{ V}$  | 0   | 3.6      | V    |
| $T_{amb}$           | ambient temperature                 |   | -40 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8\text{ V to }3.6\text{ V}$ | 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  | 0.70V <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  | -                     | -   | 0.30V <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>OH</sub>                | HIGH-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  | V <sub>CC</sub> - 0.1 | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.75V <sub>CC</sub>   | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.11                  | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.32                  | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 2.05                  | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.9                   | -   | -                   | V    |
|                                |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.72                  | -   | -                   | 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> 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 [1]      | -                     | -   | 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>                          | -                     | 0.6 | -                   | pF   |
| C <sub>O</sub>                 | output capacitance                   | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V  | -                     | 1.3 | -                   | 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  | 0.70V <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  | -                     | -   | 0.30V <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>OH</sub>                            | HIGH-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  | V <sub>CC</sub> - 0.1 | -   | -                   | V    |
|  |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.7V <sub>CC</sub>    | -   | -                   | V    |
|  |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.03                  | -   | -                   | V    |
|  |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.30                  | -   | -                   | 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    |
| 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>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   |
|  |                                      | 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 [1]      | -                     | -   | 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  | 0.70V <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  | -                     | -   | 0.30V <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    |

| Symbol            | Parameter                            | Conditions   | Min                    | Typ | Max                 | Unit |
|-------------------|--------------------------------------|--|------------------------|-----|---------------------|------|
| V <sub>OH</sub>   | HIGH-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  | V <sub>CC</sub> - 0.11 | -   | -                   | V    |
|                   |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.6V <sub>CC</sub>     | -   | -                   | V    |
|                   |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 0.93                   | -   | -                   | V    |
|                   |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.17                   | -   | -                   | 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>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>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 [1]      | -                      | -   | 75                  | μA   |

[1] One input at V<sub>CC</sub> - 0.6 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 Fig. 8.

| Symbol                      | Parameter         | Conditions                         | 25 °C |         |      | -40 °C to +125 °C |             |              | Unit |
|-----------------------------|-------------------|------------------------------------|-------|---------|------|-------------------|-------------|--------------|------|
|                             |                   |                                    | Min   | Typ [1] | Max  | Min               | Max (85 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 5 pF</b> |                   |                                    |       |         |      |                   |             |              |      |
| t <sub>pd</sub>             | propagation delay | nA or nB to nY; see Fig. 7 [2]     |       |         |      |                   |             |              |      |
|                             |                   | V <sub>CC</sub> = 0.8 V            | -     | 21.2    | -    | -                 | -           | -            | ns   |
|                             |                   | V <sub>CC</sub> = 1.1 V to 1.3 V   | 2.3   | 5.9     | 13.1 | 2.1               | 14.3        | 15.8         | ns   |
|                             |                   | V <sub>CC</sub> = 1.4 V to 1.6 V   | 1.8   | 4.1     | 7.7  | 1.6               | 8.8         | 9.7          | ns   |
|                             |                   | V <sub>CC</sub> = 1.65 V to 1.95 V | 1.5   | 3.3     | 5.9  | 1.4               | 6.9         | 7.6          | ns   |
|                             |                   | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.2   | 2.6     | 4.4  | 1.1               | 5.3         | 5.9          | ns   |
|                             |                   | V <sub>CC</sub> = 3.0 V to 3.6 V   | 1.0   | 2.3     | 4.0  | 0.9               | 4.7         | 5.2          | ns   |

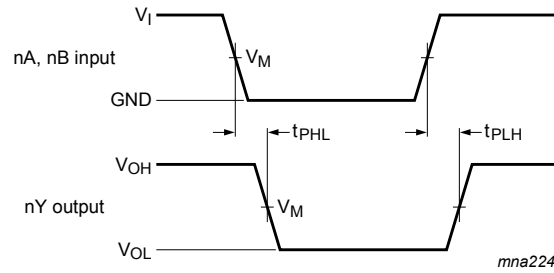
| Symbol  | Parameter                     | Conditions   | 25 °C |         |      | -40 °C to +125 °C |             |              | Unit |
|---|-------------------------------|--|-------|---------|------|-------------------|-------------|--------------|------|
|   |                               |  | Min   | Typ [1] | Max  | Min               | Max (85 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 10 pF</b>                        |                               |  |       |         |      |                   |             |              |      |
| t <sub>pd</sub>                                     | propagation delay             | nA or nB to nY; see Fig. 7 [2]                         |       |         |      |                   |             |              |      |
|   |                               | V <sub>CC</sub> = 0.8 V                                | -     | 24.7    | -    | -                 | -           | -            | ns   |
|   |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                       | 2.6   | 6.8     | 14.8 | 2.4               | 16.2        | 17.9         | ns   |
|   |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                       | 2.2   | 4.8     | 8.7  | 1.9               | 10.0        | 11.0         | ns   |
|   |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                     | 1.8   | 3.9     | 6.7  | 1.7               | 8.0         | 8.8          | ns   |
|   |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                       | 1.5   | 3.1     | 5.2  | 1.4               | 6.2         | 6.9          | ns   |
| V <sub>CC</sub> = 3.0 V to 3.6 V                    | 1.3                           | 2.9  | 4.8   | 1.3     | 5.6  | 6.2               | ns          |              |      |
| <b>C<sub>L</sub> = 15 pF</b>                        |                               |  |       |         |      |                   |             |              |      |
| t <sub>pd</sub>                                     | propagation delay             | nA or nB to nY; see Fig. 7 [2]                         |       |         |      |                   |             |              |      |
|   |                               | V <sub>CC</sub> = 0.8 V                                | -     | 28.2    | -    | -                 | -           | -            | ns   |
|   |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                       | 3.0   | 7.6     | 16.5 | 2.7               | 18.1        | 20.0         | ns   |
|   |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                       | 2.4   | 5.3     | 9.6  | 2.2               | 11.3        | 12.5         | ns   |
|   |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                     | 2.1   | 4.4     | 7.5  | 1.9               | 9.0         | 9.9          | ns   |
|   |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                       | 1.8   | 3.6     | 5.9  | 1.6               | 7.0         | 7.7          | ns   |
| V <sub>CC</sub> = 3.0 V to 3.6 V                    | 1.6                           | 3.3  | 5.4   | 1.5     | 6.4  | 7.1               | ns          |              |      |
| <b>C<sub>L</sub> = 30 pF</b>                        |                               |  |       |         |      |                   |             |              |      |
| t <sub>pd</sub>                                     | propagation delay             | nA or nB to nY; see Fig. 7 [2]                         |       |         |      |                   |             |              |      |
|   |                               | V <sub>CC</sub> = 0.8 V                                | -     | 38.5    | -    | -                 | -           | -            | ns   |
|   |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                       | 3.9   | 9.9     | 21.5 | 3.5               | 24.1        | 26.6         | ns   |
|   |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                       | 3.2   | 6.9     | 12.5 | 2.8               | 14.8        | 16.3         | ns   |
|   |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                     | 2.8   | 5.7     | 9.8  | 2.5               | 11.7        | 12.9         | ns   |
|   |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                       | 2.4   | 4.7     | 7.6  | 2.2               | 9.1         | 10.1         | ns   |
| V <sub>CC</sub> = 3.0 V to 3.6 V                    | 2.2                           | 4.4  | 7.1   | 2.1     | 8.3  | 9.2               | ns          |              |      |
| <b>C<sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF</b> |                               |  |       |         |      |                   |             |              |      |
| C <sub>PD</sub>                                     | power dissipation capacitance | f = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [3] |       |         |      |                   |             |              |      |
|   |                               | V <sub>CC</sub> = 0.8 V                                | -     | 2.7     | -    | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                       | -     | 2.9     | -    | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                       | -     | 3.0     | -    | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                     | -     | 3.1     | -    | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                       | -     | 3.6     | -    | -                 | -           | -            | pF   |
| V <sub>CC</sub> = 3.0 V to 3.6 V                    | -                             | 4.2  | -     | -       | -    | -                 | 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;  
 Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.



11.1. Waveforms and test circuit



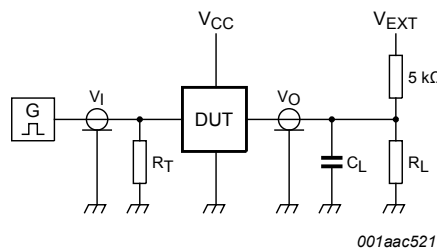
Measurement points are given in [Table 9](#).

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

Fig. 7. The data input (nA or nB) to output (nY) propagation delays

Table 9. Measurement points

| Supply voltage | Output              | Input               |          |               |
|----------------|---------------------|---------------------|----------|---------------|
| $V_{CC}$       | $V_M$               | $V_M$               | $V_I$    | $t_r = t_f$   |
| 0.8 V to 3.6 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{CC}$ | $\leq 3.0$ ns |



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.

Fig. 8. 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                | $2 \times V_{CC}$  |

[1] For measuring enable and disable times  $R_L = 5$  kΩ.

For measuring propagation delays, set-up and hold times and pulse width  $R_L = 1$  MΩ.

## 12. Package outline

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1



Fig. 9. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1



Fig. 10. Package outline SOT833-1 (XSON8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1 x 0.5 mm

SOT1089



Fig. 11. Package outline SOT1089 (XSON8)

**XQFN8: plastic, extremely thin quad flat package; no leads;**  
**8 terminals; body 1.6 x 1.6 x 0.5 mm**

SOT902-2



Fig. 12. Package outline SOT902-2 (XQFN8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.2 x 1.0 x 0.35 mm

SOT1116



Fig. 13. Package outline SOT1116 (XSON8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1.0 x 0.35 mm

SOT1203



Fig. 14. Package outline SOT1203 (XSON8)

## 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    |
|----------------|---|--------------------|---------------|---------------|
| 74AUP2G86 v.9  | 20190328  | Product data sheet | -             | 74AUP2G86 v.8 |
| 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> <li>Type number 74AUP2G86GD (SOT996-2) removed.</li> <li>Package outline drawing <a href="#">SOT765-1</a> (VSSOP8) updated.</li> <li>Package outline drawing <a href="#">SOT902-2</a> (XQFN8) updated.</li> </ul> |                    |               |               |
| 74AUP2G86 v.8  | 20130124  | Product data sheet | -             | 74AUP2G86 v.7 |
| Modifications: | <ul style="list-style-type: none"> <li>For type number 74AUP2G86GD XSON8U has changed to XSON8.</li> </ul>  |                    |               |               |
| 74AUP2G86 v.7  | 20120614  | Product data sheet | -             | 74AUP2G86 v.6 |
| 74AUP2G86 v.6  | 20111208  | Product data sheet | -             | 74AUP2G86 v.5 |
| 74AUP2G86 v.5  | 20100727  | Product data sheet | -             | 74AUP2G86 v.4 |
| 74AUP2G86 v.4  | 20090629  | Product data sheet | -             | 74AUP2G86 v.3 |
| 74AUP2G86 v.3  | 20090504  | Product data sheet | -             | 74AUP2G86 v.2 |
| 74AUP2G86 v.2  | 20080319  | Product data sheet | -             | 74AUP2G86 v.1 |
| 74AUP2G86 v.1  | 20061009  | Product data sheet | -             | -             |



## 15. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at <https://www.nexperia.com>.

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