

74AUP1G74

Low-power D-type flip-flop with set and reset; positive-edge trigger

Rev. 11 — 3 July 2017

Product data sheet

1 General description

The 74AUP1G74 provides a low-power, low-voltage single positive-edge triggered D-type flip-flop with individual data (D), clock (CP), set (\overline{SD}) and reset (\overline{RD}) inputs and complementary Q and \overline{Q} outputs. The \overline{SD} and \overline{RD} are asynchronous active LOW inputs and operate independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D input must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

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

This device ensures a very low static and dynamic power consumption across the entire V_{CC} range from 0.8 V to 3.6 V.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

2 Features and benefits

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
 - JESD8-12 (0.8 V to 1.3 V)
 - JESD8-11 (0.9 V to 1.65 V)
 - JESD8-7 (1.2 V to 1.95 V)
 - JESD8-5 (1.8 V to 2.7 V)
 - JESD8-B (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F Class 3A exceeds 5000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101E exceeds 1000 V
- Low static power consumption; $I_{CC} = 0.9 \mu\text{A}$ (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 | | | |
|-------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74AUP1G74DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74AUP1G74GT | -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 |
| 74AUP1G74GF | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm | SOT1089 |
| 74AUP1G74GM | -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 |
| 74AUP1G74GN | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm | SOT1116 |
| 74AUP1G74GS | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm | SOT1203 |
| 74AUP1G74GX | -40 °C to +125 °C | X2SON8 | plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 × 0.8 × 0.35 mm | SOT1233 |

4 Marking

Table 2. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| 74AUP1G74DC | p74 |
| 74AUP1G74GT | p74 |
| 74AUP1G74GF | 54 |
| 74AUP1G74GM | p74 |
| 74AUP1G74GN | 54 |
| 74AUP1G74GS | 54 |
| 74AUP1G74GX | 54 |

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

5 Functional diagram

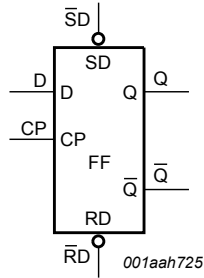


Figure 1. Logic symbol

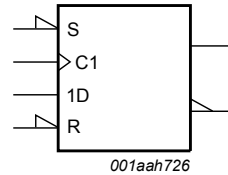


Figure 2. IEC logic symbol

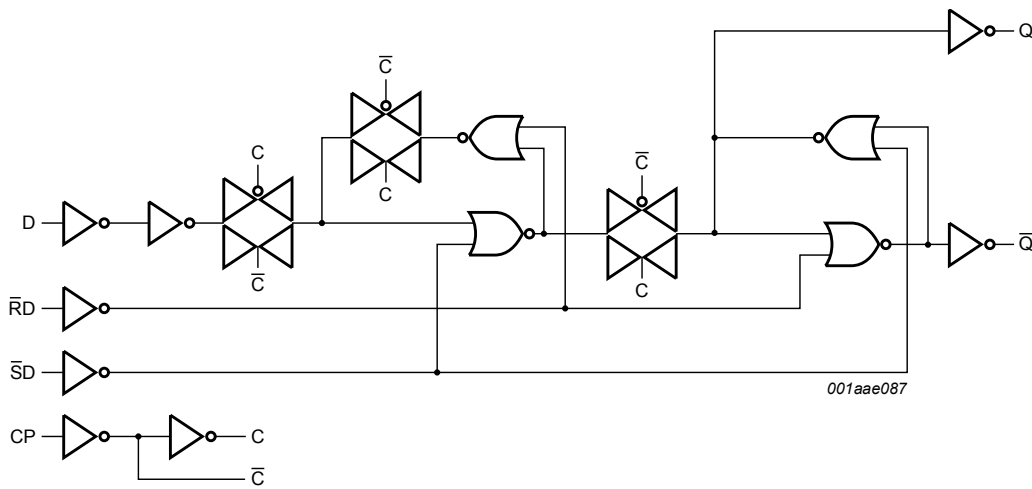


Figure 3. Logic diagram

6 Pinning information

6.1 Pinning

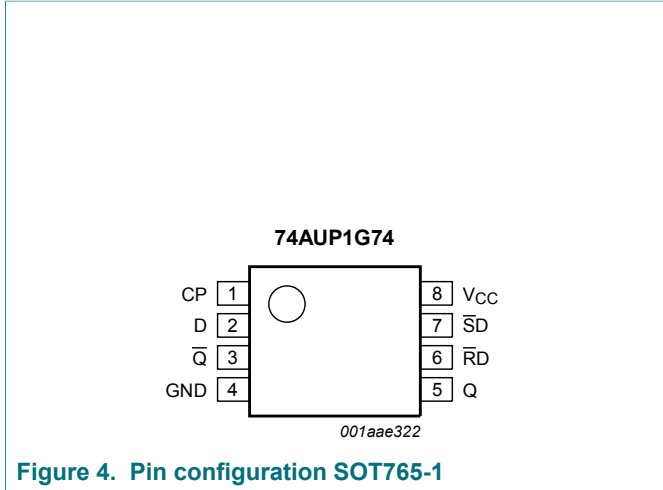


Figure 4. Pin configuration SOT765-1

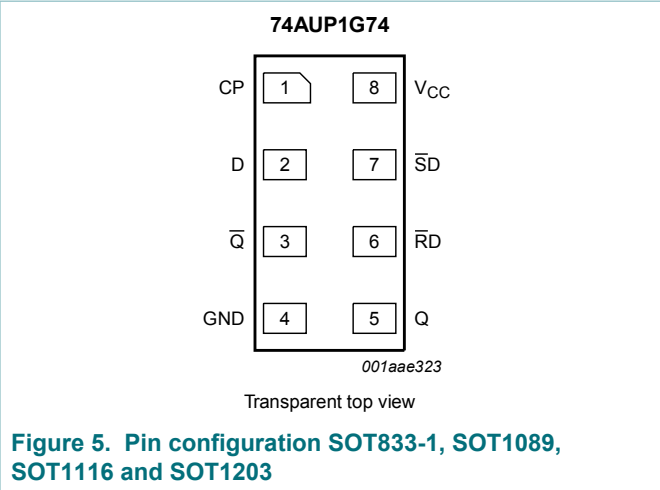


Figure 5. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203

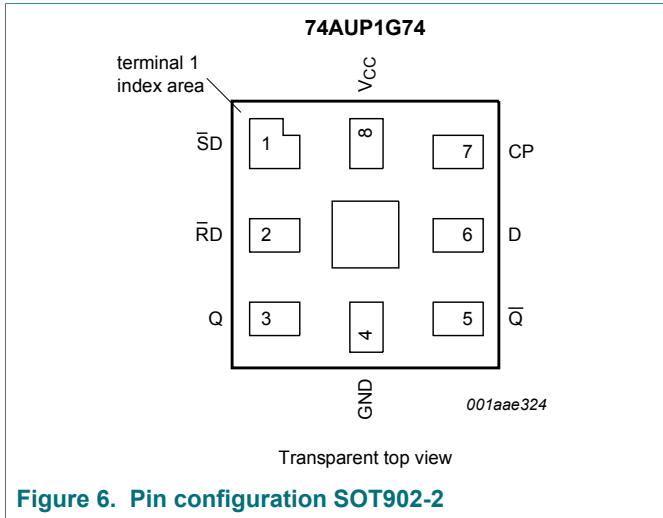


Figure 6. Pin configuration SOT902-2

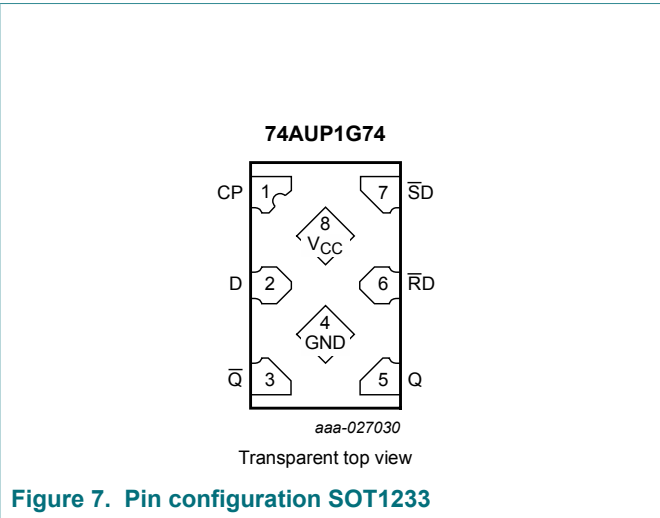


Figure 7. Pin configuration SOT1233

6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|---|----------|---------------------------------------|
| | SOT765-1, SOT833-1, SOT1089, SOT1116, SOT1203 and SOT1233 | SOT902-2 | |
| CP | 1 | 7 | clock input |
| D | 2 | 6 | data input |
| \bar{Q} | 3 | 5 | complement output |
| GND | 4 | 4 | ground (0 V) |
| Q | 5 | 3 | true output |
| \bar{RD} | 6 | 2 | asynchronous reset input (active LOW) |
| \bar{SD} | 7 | 1 | asynchronous set input (active LOW) |
| V _{CC} | 8 | 8 | supply voltage |

7 Functional description

Table 4. Function table for asynchronous operation ^[1]

| Input | | | | Output | |
|------------|------------|----|---|--------|-----------|
| \bar{SD} | \bar{RD} | CP | D | Q | \bar{Q} |
| L | H | X | X | H | L |
| H | L | X | X | L | H |
| L | L | X | X | H | H |

[1] H = HIGH voltage level;
L = LOW voltage level;
X = don't care.

Table 5. Function table for synchronous operation ^[1]

| Input | | | | Output | |
|------------|------------|----|---|------------------|--------------------------|
| \bar{SD} | \bar{RD} | CP | D | Q _{n+1} | \bar{Q} _{n+1} |
| H | H | ↑ | L | L | H |
| H | H | ↑ | H | H | L |

[1] H = HIGH voltage level;
L = LOW voltage level;
X = don't care;
↑ = LOW-to-HIGH CP transition;
Q_{n+1} = state after the next LOW-to-HIGH CP transition.

8 Limiting values

Table 6. 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 |
| V_I | input voltage | [1] | -0.5 | +4.6 | V |
| V_O | output voltage | Active mode and Power-down mode [1] | -0.5 | +4.6 | V |
| I_{IK} | input clamping current | $V_I < 0$ V | -50 | - | mA |
| I_{OK} | output clamping current | $V_O < 0$ V | -50 | - | mA |
| I_O | output current | $V_O = 0$ V to V_{CC} | - | ± 20 | mA |
| I_{CC} | supply current | | - | +50 | mA |
| I_{GND} | ground current | | -50 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +125 °C [2] | - | 250 | mW |

[1] The minimum 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.

For X2SON8 package: above 118 °C the value of P_{tot} derates linearly with 7.7 mW/K.

9 Recommended operating conditions

Table 7. 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; $V_{CC} = 0$ V | 0 | 3.6 | V |
| T_{amb} | ambient temperature | | -40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8$ V to 3.6 V | - | 200 | ns/V |

10 Static characteristics

Table 8. Static characteristics

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|--------------------------------------|---|----------------------|-----|----------------------|---------------|
| $T_{amb} = 25\text{ °C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 0.8\text{ V}$ | $0.70 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 0.9\text{ V to }1.95\text{ V}$ | $0.65 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.6 | - | - | V |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 0.8\text{ V}$ | - | - | $0.30 \times V_{CC}$ | V |
| | | $V_{CC} = 0.9\text{ V to }1.95\text{ V}$ | - | - | $0.35 \times V_{CC}$ | V |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | - | 0.7 | V |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ | - | - | 0.9 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}\text{ or }V_{IL}$ | | | | |
| | | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 0.8\text{ V to }3.6\text{ V}$ | $V_{CC} - 0.1$ | - | - | V |
| | | $I_O = -1.1\text{ mA}; V_{CC} = 1.1\text{ V}$ | $0.75 \times V_{CC}$ | - | - | V |
| | | $I_O = -1.7\text{ mA}; V_{CC} = 1.4\text{ V}$ | 1.11 | - | - | V |
| | | $I_O = -1.9\text{ mA}; V_{CC} = 1.65\text{ V}$ | 1.32 | - | - | V |
| | | $I_O = -2.3\text{ mA}; V_{CC} = 2.3\text{ V}$ | 2.05 | - | - | V |
| | | $I_O = -3.1\text{ mA}; V_{CC} = 2.3\text{ V}$ | 1.9 | - | - | V |
| | | $I_O = -2.7\text{ mA}; V_{CC} = 3.0\text{ V}$ | 2.72 | - | - | V |
| | | $I_O = -4.0\text{ mA}; V_{CC} = 3.0\text{ V}$ | 2.6 | - | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}\text{ or }V_{IL}$ | | | | |
| | | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 0.8\text{ V to }3.6\text{ V}$ | - | - | 0.1 | V |
| | | $I_O = 1.1\text{ mA}; V_{CC} = 1.1\text{ V}$ | - | - | $0.3 \times V_{CC}$ | V |
| | | $I_O = 1.7\text{ mA}; V_{CC} = 1.4\text{ V}$ | - | - | 0.31 | V |
| | | $I_O = 1.9\text{ mA}; V_{CC} = 1.65\text{ V}$ | - | - | 0.31 | V |
| | | $I_O = 2.3\text{ mA}; V_{CC} = 2.3\text{ V}$ | - | - | 0.31 | V |
| | | $I_O = 3.1\text{ mA}; V_{CC} = 2.3\text{ V}$ | - | - | 0.44 | V |
| | | $I_O = 2.7\text{ mA}; V_{CC} = 3.0\text{ V}$ | - | - | 0.31 | V |
| $I_O = 4.0\text{ mA}; V_{CC} = 3.0\text{ V}$ | - | - | 0.44 | V | | |
| I_I | input leakage current | $V_I = \text{GND to }3.6\text{ V}; V_{CC} = 0\text{ V to }3.6\text{ V}$ | - | - | ± 0.1 | μA |
| I_{OFF} | power-off leakage current | $V_I\text{ or }V_O = 0\text{ V to }3.6\text{ V}; V_{CC} = 0\text{ V}$ | - | - | ± 0.2 | μA |
| ΔI_{OFF} | additional power-off leakage current | $V_I\text{ or }V_O = 0\text{ V to }3.6\text{ V}; V_{CC} = 0\text{ V to }0.2\text{ V}$ | - | - | ± 0.2 | μA |
| I_{CC} | supply current | $V_I = \text{GND or }V_{CC}; I_O = 0\text{ A}; V_{CC} = 0.8\text{ V to }3.6\text{ V}$ | - | - | 0.5 | μA |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|--------------------------------------|--|----------------------|-----|----------------------|---------------|
| ΔI_{CC} | additional supply current | $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 3.3 \text{ V}$; per pin ^[1] | - | - | 40 | μA |
| C_I | input capacitance | $V_{CC} = 0 \text{ V to } 3.6 \text{ V}$; $V_I = \text{GND or } V_{CC}$ | - | 0.6 | - | pF |
| C_O | output capacitance | $V_O = \text{GND}$; $V_{CC} = 0 \text{ V}$ | - | 1.3 | - | pF |
| $T_{\text{amb}} = -40 \text{ }^\circ\text{C to } +85 \text{ }^\circ\text{C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 0.8 \text{ V}$ | $0.70 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 0.9 \text{ V to } 1.95 \text{ V}$ | $0.65 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ | 1.6 | - | - | V |
| | | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 0.8 \text{ V}$ | - | - | $0.30 \times V_{CC}$ | V |
| | | $V_{CC} = 0.9 \text{ V to } 1.95 \text{ V}$ | - | - | $0.35 \times V_{CC}$ | V |
| | | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ | - | - | 0.7 | V |
| | | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ | - | - | 0.9 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH} \text{ or } V_{IL}$ | | | | |
| | | $I_O = -20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$ | $V_{CC} - 0.1$ | - | - | V |
| | | $I_O = -1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$ | $0.7 \times V_{CC}$ | - | - | V |
| | | $I_O = -1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$ | 1.03 | - | - | V |
| | | $I_O = -1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$ | 1.30 | - | - | V |
| | | $I_O = -2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | 1.97 | - | - | V |
| | | $I_O = -3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | 1.85 | - | - | V |
| | | $I_O = -2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | 2.67 | - | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH} \text{ or } V_{IL}$ | | | | |
| | | $I_O = 20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$ | - | - | 0.1 | V |
| | | $I_O = 1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$ | - | - | $0.3 \times V_{CC}$ | V |
| | | $I_O = 1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$ | - | - | 0.37 | V |
| | | $I_O = 1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$ | - | - | 0.35 | V |
| | | $I_O = 2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | - | - | 0.33 | V |
| | | $I_O = 3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | - | - | 0.45 | V |
| | | $I_O = 2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | - | - | 0.33 | V |
| I_I | input leakage current | $V_I = \text{GND to } 3.6 \text{ V}$; $V_{CC} = 0 \text{ V to } 3.6 \text{ V}$ | - | - | ± 0.5 | μA |
| | | $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}$; $V_{CC} = 0 \text{ V}$ | - | - | ± 0.5 | μA |
| I_{OFF} | power-off leakage current | $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}$; $V_{CC} = 0 \text{ V}$ | - | - | ± 0.5 | μA |
| ΔI_{OFF} | additional power-off leakage current | $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}$; $V_{CC} = 0 \text{ V to } 0.2 \text{ V}$ | - | - | ± 0.6 | μA |
| I_{CC} | supply current | $V_I = \text{GND or } V_{CC}$; $I_O = 0 \text{ A}$; $V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$ | - | - | 0.9 | μA |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---------------------------|---|----------------------|-----|----------------------|---------------|
| ΔI_{CC} | additional supply current | $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 3.3 \text{ V}$; per pin | - | - | 50 | μA |
| $T_{\text{amb}} = -40 \text{ }^\circ\text{C}$ to $+125 \text{ }^\circ\text{C}$ | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 0.8 \text{ V}$ | $0.75 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 0.9 \text{ V}$ to 1.95 V | $0.70 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3 \text{ V}$ to 2.7 V | 1.6 | - | - | V |
| | | $V_{CC} = 3.0 \text{ V}$ to 3.6 V | 2.0 | - | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 0.8 \text{ V}$ | - | - | $0.25 \times V_{CC}$ | V |
| | | $V_{CC} = 0.9 \text{ V}$ to 1.95 V | - | - | $0.30 \times V_{CC}$ | V |
| | | $V_{CC} = 2.3 \text{ V}$ to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC} = 3.0 \text{ V}$ to 3.6 V | - | - | 0.9 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = -20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V | $V_{CC} - 0.11$ | - | - | V |
| | | $I_O = -1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$ | $0.6 \times V_{CC}$ | - | - | V |
| | | $I_O = -1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$ | 0.93 | - | - | V |
| | | $I_O = -1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$ | 1.17 | - | - | V |
| | | $I_O = -2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | 1.77 | - | - | V |
| | | $I_O = -3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | 1.67 | - | - | V |
| | | $I_O = -2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | 2.40 | - | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = 20 \mu\text{A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V | - | - | 0.11 | V |
| | | $I_O = 1.1 \text{ mA}$; $V_{CC} = 1.1 \text{ V}$ | - | - | $0.33 \times V_{CC}$ | V |
| | | $I_O = 1.7 \text{ mA}$; $V_{CC} = 1.4 \text{ V}$ | - | - | 0.41 | V |
| | | $I_O = 1.9 \text{ mA}$; $V_{CC} = 1.65 \text{ V}$ | - | - | 0.39 | V |
| | | $I_O = 2.3 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | - | - | 0.36 | V |
| | | $I_O = 3.1 \text{ mA}$; $V_{CC} = 2.3 \text{ V}$ | - | - | 0.50 | V |
| | | $I_O = 2.7 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$ | - | - | 0.36 | V |
| I_I | input leakage current | $V_I = \text{GND}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$ to 3.6 V | - | - | ± 0.75 | μA |
| | | V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$ | - | - | ± 0.75 | μA |
| I_{OFF} | power-off leakage current | V_I or $V_O = 0 \text{ V}$ to 3.6 V ; $V_{CC} = 0 \text{ V}$ to 0.2 V | - | - | ± 0.75 | μA |
| I_{CC} | supply current | $V_I = \text{GND}$ or V_{CC} ; $I_O = 0 \text{ A}$; $V_{CC} = 0.8 \text{ V}$ to 3.6 V | - | - | 1.4 | μA |
| ΔI_{CC} | additional supply current | $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 3.3 \text{ V}$; per pin | - | - | 75 | μA |

[1] One input at $V_{CC} - 0.6 \text{ V}$, other input at V_{CC} or GND.

11 Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 10](#).

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | Unit | |
|------------------------------------|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|-----|------|--------------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | | Max (125 °C) |
| C _L = 5 pF | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Q, \bar{Q} ; see Figure 8 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 25.4 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.9 | 6.7 | 14.0 | 2.6 | 14.2 | 2.6 | 14.2 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.4 | 4.5 | 7.6 | 2.3 | 8.3 | 2.3 | 8.6 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 1.9 | 3.5 | 5.7 | 1.7 | 6.5 | 1.7 | 6.8 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | 2.6 | 3.8 | 1.4 | 4.4 | 1.4 | 4.7 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.5 | 2.2 | 3.1 | 1.2 | 3.4 | 1.2 | 3.7 | ns |
| | | $\bar{S}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 19.6 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.7 | 5.6 | 11.0 | 2.5 | 11.4 | 2.5 | 11.5 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.4 | 4.0 | 6.3 | 2.2 | 6.9 | 2.2 | 7.3 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 2.0 | 3.3 | 4.9 | 1.7 | 5.6 | 1.7 | 5.9 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 1.9 | 2.7 | 3.7 | 1.7 | 4.0 | 1.7 | 4.2 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.8 | 2.5 | 3.2 | 1.5 | 3.6 | 1.5 | 3.8 | ns |
| | | $\bar{R}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 19.2 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.6 | 5.5 | 11.0 | 2.5 | 11.3 | 2.5 | 11.5 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.3 | 3.9 | 6.3 | 2.2 | 6.8 | 2.2 | 7.3 | ns |
| V _{CC} = 1.65 V to 1.95 V | 1.9 | 3.2 | 5.0 | 1.8 | 5.6 | 1.8 | 5.9 | ns | | |
| V _{CC} = 2.3 V to 2.7 V | 1.9 | 2.6 | 3.6 | 1.7 | 4.1 | 1.7 | 4.3 | ns | | |
| V _{CC} = 3.0 V to 3.6 V | 1.8 | 2.4 | 3.3 | 1.5 | 3.6 | 1.5 | 3.8 | ns | | |
| f _{max} | maximum frequency | CP; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 53 | - | - | - | - | MHz | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 203 | - | 170 | - | 170 | - | MHz |
| | | V _{CC} = 1.4 V to 1.6 V | - | 347 | - | 310 | - | 300 | - | MHz |
| | | V _{CC} = 1.65 V to 1.95 V | - | 435 | - | 400 | - | 390 | - | MHz |
| | | V _{CC} = 2.3 V to 2.7 V | - | 550 | - | 490 | - | 480 | - | MHz |
| | | V _{CC} = 3.0 V to 3.6 V | - | 619 | - | 550 | - | 510 | - | MHz |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | Unit | |
|------------------------------------|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|-----|------|--------------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | | Max (125 °C) |
| C _L = 10 pF | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Q, \bar{Q} ; see Figure 8 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 28.9 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 3.1 | 7.5 | 15.8 | 2.9 | 16.1 | 2.9 | 16.1 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.7 | 5.1 | 8.7 | 2.4 | 9.4 | 2.4 | 9.8 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 2.5 | 4.1 | 6.5 | 2.2 | 7.2 | 2.2 | 7.6 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 2.0 | 3.2 | 4.6 | 1.8 | 5.3 | 1.8 | 5.6 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 1.8 | 2.8 | 3.8 | 1.6 | 4.1 | 1.6 | 4.4 | ns |
| | | $\bar{S}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 23.2 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.9 | 6.5 | 12.9 | 2.8 | 13.3 | 2.8 | 13.5 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.7 | 4.6 | 7.5 | 2.3 | 7.9 | 2.3 | 8.3 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 2.6 | 3.9 | 5.6 | 2.3 | 6.3 | 2.3 | 6.6 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 2.3 | 3.2 | 4.4 | 2.0 | 4.8 | 2.0 | 5.2 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 2.2 | 3.0 | 3.9 | 1.9 | 4.2 | 1.9 | 4.4 | ns |
| | | $\bar{R}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 22.7 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.8 | 6.4 | 12.8 | 2.7 | 13.2 | 2.7 | 13.4 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 2.6 | 4.5 | 7.5 | 2.3 | 8.1 | 2.3 | 8.4 | ns |
| V _{CC} = 1.65 V to 1.95 V | 2.5 | 3.3 | 5.8 | 2.3 | 6.3 | 2.3 | 6.7 | ns | | |
| V _{CC} = 2.3 V to 2.7 V | 2.2 | 3.2 | 4.4 | 2.0 | 4.9 | 2.0 | 5.2 | ns | | |
| V _{CC} = 3.0 V to 3.6 V | 2.0 | 2.9 | 4.0 | 1.9 | 4.3 | 1.9 | 4.5 | ns | | |
| f _{max} | maximum frequency | CP; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 52 | - | - | - | - | MHz | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 192 | - | 150 | - | 150 | - | MHz |
| | | V _{CC} = 1.4 V to 1.6 V | - | 324 | - | 280 | - | 230 | - | MHz |
| | | V _{CC} = 1.65 V to 1.95 V | - | 421 | - | 310 | - | 250 | - | MHz |
| | | V _{CC} = 2.3 V to 2.7 V | - | 486 | - | 370 | - | 360 | - | MHz |
| | | V _{CC} = 3.0 V to 3.6 V | - | 550 | - | 410 | - | 360 | - | MHz |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | | Unit |
|------------------------------------|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|-----|--------------|------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | Max (125 °C) | |
| C _L = 15 pF | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Q, \bar{Q} ; see Figure 8 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 32.4 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 3.5 | 8.3 | 17.6 | 3.3 | 17.8 | 3.3 | 18.0 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.2 | 5.6 | 9.5 | 2.8 | 10.5 | 2.8 | 11.1 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 2.7 | 4.6 | 7.2 | 2.5 | 8.1 | 2.5 | 8.6 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 2.4 | 3.6 | 5.2 | 2.2 | 5.8 | 2.2 | 6.2 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 2.2 | 3.2 | 4.4 | 2.0 | 4.9 | 2.0 | 5.2 | ns |
| | | $\bar{S}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 26.7 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 3.3 | 7.3 | 14.7 | 3.1 | 15.2 | 3.1 | 15.4 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.2 | 5.2 | 8.3 | 2.9 | 9.0 | 2.9 | 9.5 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 2.8 | 4.3 | 6.4 | 2.5 | 7.1 | 2.5 | 7.5 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 2.8 | 3.7 | 5.1 | 2.2 | 5.5 | 2.2 | 5.8 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 2.5 | 3.5 | 4.6 | 2.4 | 5.0 | 2.4 | 5.2 | ns |
| | | $\bar{R}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 26.1 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 3.2 | 7.2 | 14.5 | 3.1 | 15.0 | 3.1 | 15.2 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.1 | 5.1 | 8.4 | 2.7 | 9.2 | 2.7 | 9.7 | ns |
| V _{CC} = 1.65 V to 1.95 V | 2.7 | 4.3 | 6.5 | 2.6 | 7.3 | 2.6 | 7.7 | ns | | |
| V _{CC} = 2.3 V to 2.7 V | 2.6 | 3.6 | 5.0 | 2.4 | 5.5 | 2.4 | 5.8 | ns | | |
| V _{CC} = 3.0 V to 3.6 V | 2.4 | 3.4 | 4.6 | 2.3 | 5.0 | 2.3 | 5.2 | ns | | |
| f _{max} | maximum frequency | CP; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 50 | - | - | - | - | MHz | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 181 | - | 120 | - | 120 | - | MHz |
| | | V _{CC} = 1.4 V to 1.6 V | - | 301 | - | 190 | - | 160 | - | MHz |
| | | V _{CC} = 1.65 V to 1.95 V | - | 407 | - | 240 | - | 190 | - | MHz |
| | | V _{CC} = 2.3 V to 2.7 V | - | 422 | - | 300 | - | 270 | - | MHz |
| | | V _{CC} = 3.0 V to 3.6 V | - | 481 | - | 320 | - | 300 | - | MHz |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | Unit | |
|------------------------------------|-------------------|--|--------------------------|--------------------|------|--------------------------------------|-------------|-----|------|--------------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | | Max (125 °C) |
| C _L = 30 pF | | | | | | | | | | |
| t _{pd} | propagation delay | CP to Q, \bar{Q} ; see Figure 8 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 42.7 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 4.2 | 10.6 | 22.5 | 4.0 | 23.0 | 4.0 | 23.3 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.7 | 7.2 | 12.0 | 3.7 | 13.3 | 3.7 | 14.0 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 3.5 | 5.8 | 9.2 | 3.4 | 10.4 | 3.4 | 11.0 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 3.3 | 4.7 | 6.6 | 3.0 | 7.3 | 3.0 | 7.8 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 3.0 | 4.3 | 5.8 | 2.8 | 6.8 | 2.8 | 7.3 | ns |
| | | $\bar{S}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 37.0 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 4.0 | 9.5 | 19.8 | 3.8 | 20.8 | 3.8 | 21.1 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.8 | 6.7 | 10.9 | 3.7 | 12.0 | 3.7 | 12.7 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 3.7 | 5.6 | 8.4 | 3.5 | 9.3 | 3.5 | 9.9 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 3.7 | 4.8 | 6.6 | 3.2 | 7.2 | 3.2 | 7.6 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 3.4 | 4.6 | 6.0 | 3.1 | 6.8 | 3.1 | 7.1 | ns |
| | | $\bar{R}D$ to Q, \bar{Q} ; see Figure 9 . ^[2] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 36.4 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 3.9 | 9.4 | 19.5 | 3.8 | 20.2 | 3.8 | 20.5 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 3.6 | 6.6 | 10.9 | 3.7 | 12.0 | 3.7 | 12.6 | ns |
| V _{CC} = 1.65 V to 1.95 V | 3.5 | 5.5 | 8.5 | 3.5 | 9.5 | 3.5 | 10.1 | ns | | |
| V _{CC} = 2.3 V to 2.7 V | 3.5 | 4.7 | 6.5 | 3.2 | 7.1 | 3.2 | 7.6 | ns | | |
| V _{CC} = 3.0 V to 3.6 V | 3.3 | 4.4 | 6.1 | 3.1 | 7.1 | 3.1 | 7.5 | ns | | |
| f _{max} | maximum frequency | CP; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 28 | - | - | - | - | MHz | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 145 | - | 70 | - | 70 | - | MHz |
| | | V _{CC} = 1.4 V to 1.6 V | - | 185 | - | 120 | - | 110 | - | MHz |
| | | V _{CC} = 1.65 V to 1.95 V | - | 270 | - | 150 | - | 120 | - | MHz |
| | | V _{CC} = 2.3 V to 2.7 V | - | 290 | - | 190 | - | 170 | - | MHz |
| | | V _{CC} = 3.0 V to 3.6 V | - | 315 | - | 200 | - | 190 | - | MHz |

Low-power D-type flip-flop with set and reset; positive-edge trigger

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | Unit | |
|---|---------------|--|--------------------------|--------------------|-----|--------------------------------------|-------------|------|------|--------------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | | Max (125 °C) |
| C _L = 5 pF, 10 pF, 15 pF and 30 pF | | | | | | | | | | |
| t _{su} | set-up time | D to CP HIGH; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 3.4 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | - | 0.6 | - | 1.2 | - | 1.2 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | 0.3 | - | 0.6 | - | 0.6 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | 0.4 | - | 0.5 | - | 0.5 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | 0.2 | - | 0.4 | - | 0.4 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.3 | - | 0.4 | - | 0.4 | - | ns |
| | | D to CP LOW; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 3.0 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | - | 0.5 | - | 1.2 | - | 1.2 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | 0.3 | - | 0.7 | - | 0.7 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | 0.4 | - | 0.7 | - | 0.7 | - | ns |
| V _{CC} = 2.3 V to 2.7 V | - | 0.5 | - | 0.7 | - | 0.7 | - | ns | | |
| V _{CC} = 3.0 V to 3.6 V | - | 0.6 | - | 0.8 | - | 0.8 | - | ns | | |
| t _h | hold time | D to CP; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 0.8 V | - | -1.9 | - | - | - | - | - | ns |
| | | V _{CC} = 1.1 V to 1.3 V | - | -0.3 | - | 0.5 | - | 0.5 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | -0.2 | - | 0.2 | - | 0.2 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | -0.2 | - | 0.1 | - | 0.1 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | -0.2 | - | 0.1 | - | 0.1 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | -0.2 | - | 0.1 | - | 0.1 | - | ns |
| t _{rec} | recovery time | RD; see Figure 9 | | | | | | | | |
| | | V _{CC} = 1.1 V to 1.3 V | - | -0.5 | - | -0.9 | - | -0.9 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | -0.2 | - | -0.6 | - | -0.6 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | -0.2 | - | -0.4 | - | -0.4 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | -0.1 | - | -0.1 | - | -0.1 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | -0.1 | - | -0.1 | - | -0.1 | - | ns |
| | | SD; see Figure 9 . | | | | | | | | |
| | | V _{CC} = 1.1 V to 1.3 V | - | -0.5 | - | -0.3 | - | -0.3 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | -0.4 | - | -0.1 | - | -0.1 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | -0.3 | - | 0 | - | 0 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | -0.2 | - | 0.1 | - | 0.1 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | -0.1 | - | 0.1 | - | 0.1 | - | ns |

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +125 °C | | | Unit | |
|----------------------------------|-------------------------------------|---|--------------------------|--------------------|-----|--------------------------------------|-------------|------|------|--------------|
| | | | Min | Typ ^[1] | Max | Min | Max (85 °C) | Min | | Max (125 °C) |
| t _w | pulse width | CP HIGH or LOW; see Figure 8 . | | | | | | | | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 2.1 | - | 2.7 | - | 2.7 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | 1.1 | - | 1.5 | - | 1.5 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | 0.9 | - | 1.6 | - | 1.6 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | 0.6 | - | 1.7 | - | 1.7 | - | ns |
| | | V _{CC} = 3.0 V to 3.6 V | - | 0.6 | - | 1.9 | - | 1.9 | - | ns |
| | | SD or RD LOW; see Figure 9 . | | | | | | | | |
| | | V _{CC} = 1.1 V to 1.3 V | - | 4.2 | - | 11.3 | - | 11.5 | - | ns |
| | | V _{CC} = 1.4 V to 1.6 V | - | 2.3 | - | 6.2 | - | 6.4 | - | ns |
| | | V _{CC} = 1.65 V to 1.95 V | - | 1.8 | - | 4.8 | - | 5.0 | - | ns |
| | | V _{CC} = 2.3 V to 2.7 V | - | 1.2 | - | 3.3 | - | 3.5 | - | ns |
| V _{CC} = 3.0 V to 3.6 V | - | 1.1 | - | 2.6 | - | 2.8 | - | ns | | |
| C _{PD} | power dissipation capacitance | f _i = 1 MHz; V _I = GND to V _{CC} ^[3] | | | | | | | | |
| | | V _{CC} = 0.8 V | - | 2.8 | - | - | - | - | - | pF |
| | | V _{CC} = 1.1 V to 1.3 V | - | 2.9 | - | - | - | - | - | pF |
| | | V _{CC} = 1.4 V to 1.6 V | - | 3.0 | - | - | - | - | - | pF |
| | | V _{CC} = 1.65 V to 1.95 V | - | 3.0 | - | - | - | - | - | pF |
| | | V _{CC} = 2.3 V to 2.7 V | - | 3.5 | - | - | - | - | - | pF |
| | | V _{CC} = 3.0 V to 3.6 V | - | 3.9 | - | - | - | - | - | pF |

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

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] C_{PD} is used to determine the dynamic power dissipation (P_D 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_i = input frequency in MHz;

f_o = output frequency in MHz;

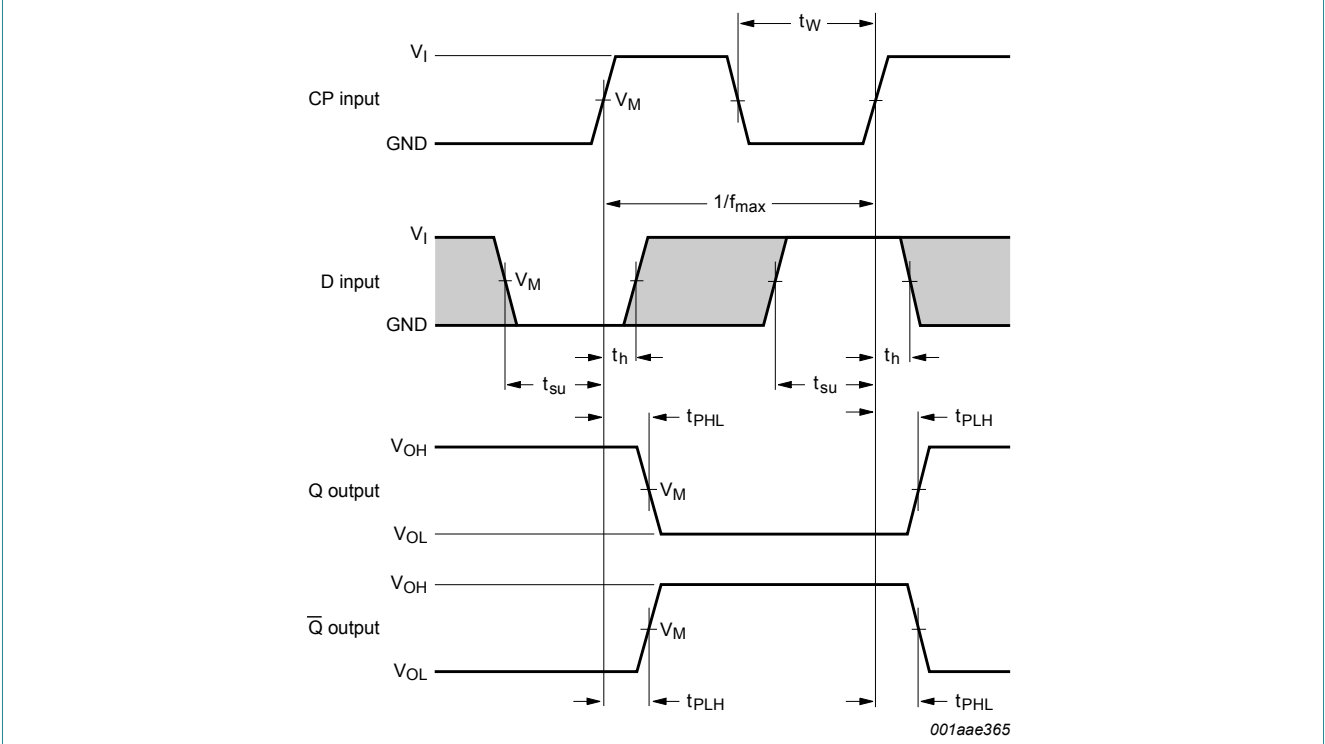
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1 Waveforms and test circuit

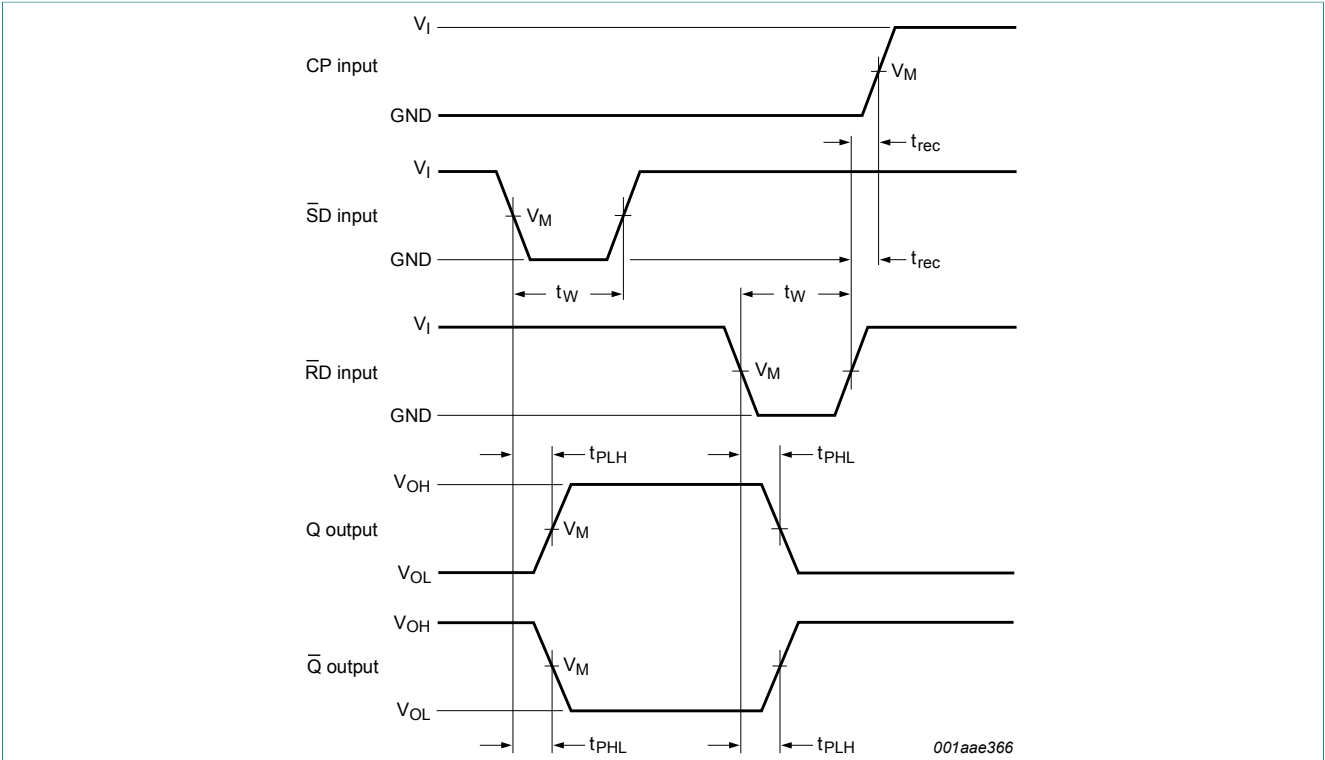


Measurement points are given in [Table 10](#).

The shaded areas indicate when the input is permitted to change for predictable output performance.

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

Figure 8. The clock input (CP) to output (Q, Q̄) propagation delays, the data input (D) to clock input (CP) set-up and hold times and the clock input (CP) pulse width and maximum frequency



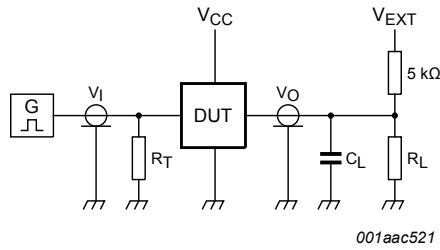
Measurement points are given in [Table 10](#).

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

Figure 9. The set input (S̄D) and reset input (R̄D) to output (Q, Q̄) propagation delays, the set input (S̄D) and reset input (R̄D) pulse widths and the reset input (R̄D) to clock input (CP) recovery time

Table 10. 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 × V _{CC} | 0.5 × V _{CC} | V _{CC} | ≤ 3.0 ns |



Test data is given in [Table 11](#).

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 10. Test circuit for measuring switching times

Table 11. Test data

| Supply voltage | Load | | V_{EXT} | | |
|----------------|------------------------------|--------------|--------------------|--------------------|--------------------|
| | 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 $R_L = 5 \text{ k}\Omega$
 For measuring propagation delays, setup and hold times and pulse width $R_L = 1 \text{ M}\Omega$.

12 Package outline

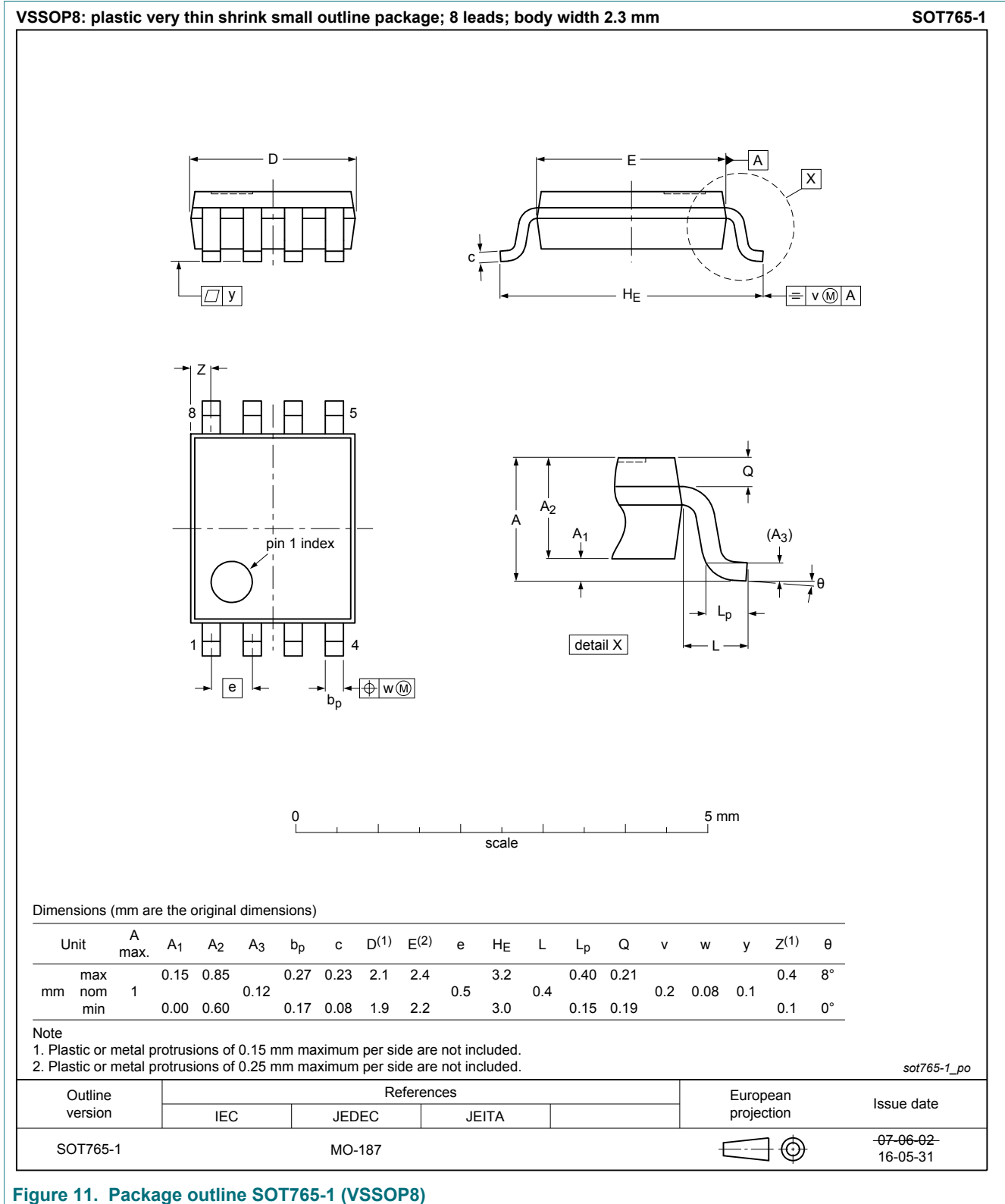
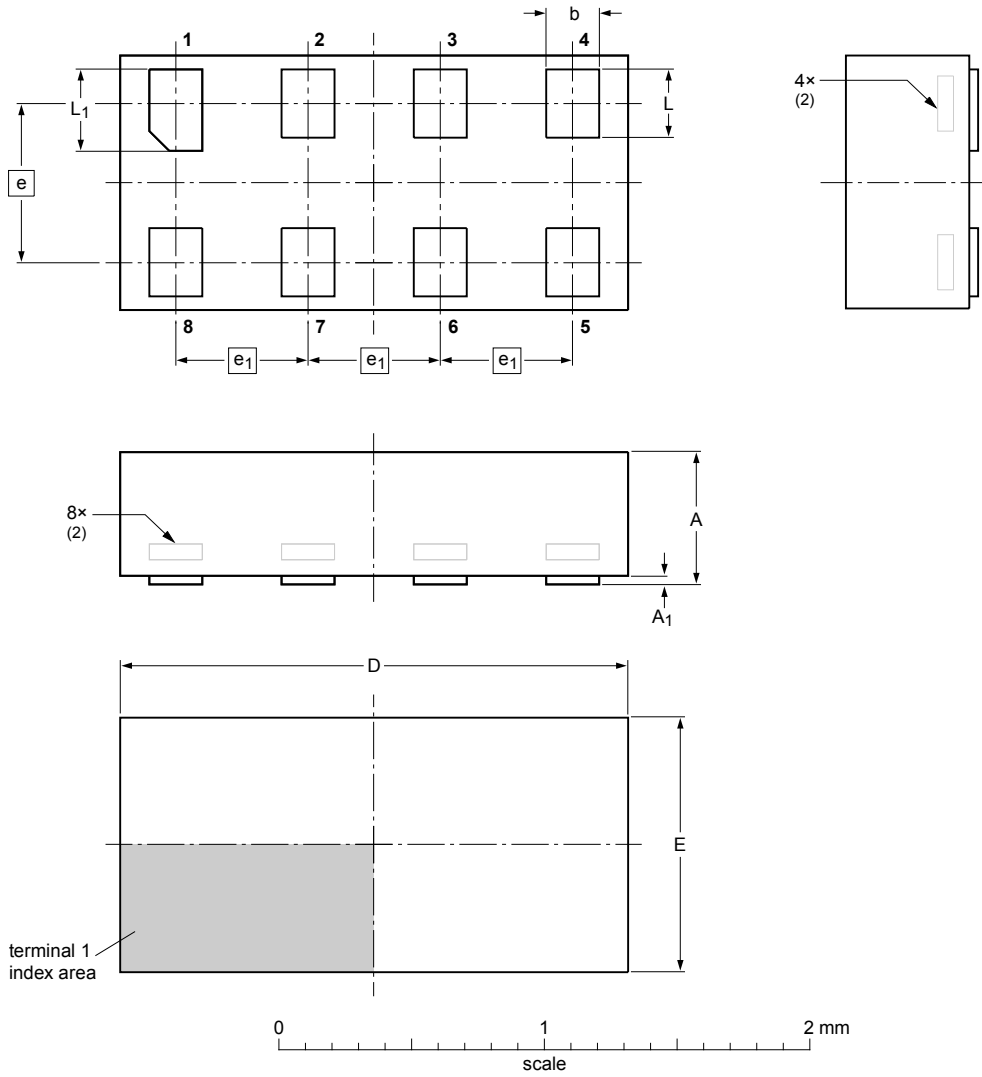


Figure 11. Package outline SOT765-1 (VSSOP8)

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

SOT833-1



DIMENSIONS (mm are the original dimensions)

| UNIT | A ⁽¹⁾ max | A ₁ max | b | D | E | e | e ₁ | L | L ₁ |
|------|----------------------|--------------------|--------------|------------|--------------|-----|----------------|--------------|----------------|
| mm | 0.5 | 0.04 | 0.25 0.17 | 2.0 1.9 | 1.05 0.95 | 0.6 | 0.5 | 0.35 0.27 | 0.40 0.32 |

Notes

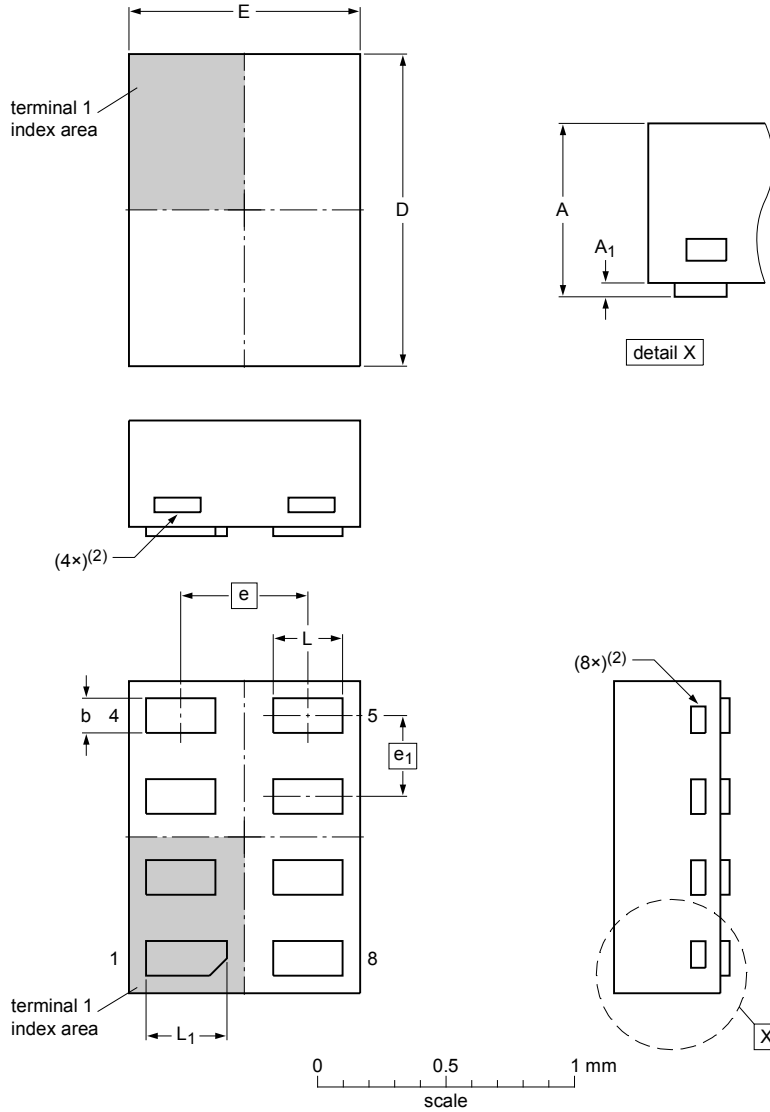
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

| OUTLINE VERSION | REFERENCES | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|--------|-------|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | |
| SOT833-1 | --- | MO-252 | --- | | 07-11-14 07-12-07 |

Figure 12. 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



Dimensions

| Unit | A ⁽¹⁾ | A ₁ | b | D | E | e | e ₁ | L | L ₁ |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| max | 0.5 | 0.04 | 0.20 | 1.40 | 1.05 | | | 0.35 | 0.40 |
| mm | nom | | 0.15 | 1.35 | 1.00 | 0.55 | 0.35 | 0.30 | 0.35 |
| | min | | 0.12 | 1.30 | 0.95 | | | 0.27 | 0.32 |

Note

- Including plating thickness.
- Visible depending upon used manufacturing technology.

sot1089_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|--------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT1089 | | MO-252 | | | | 10-04-09 10-04-12 |

Figure 13. 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

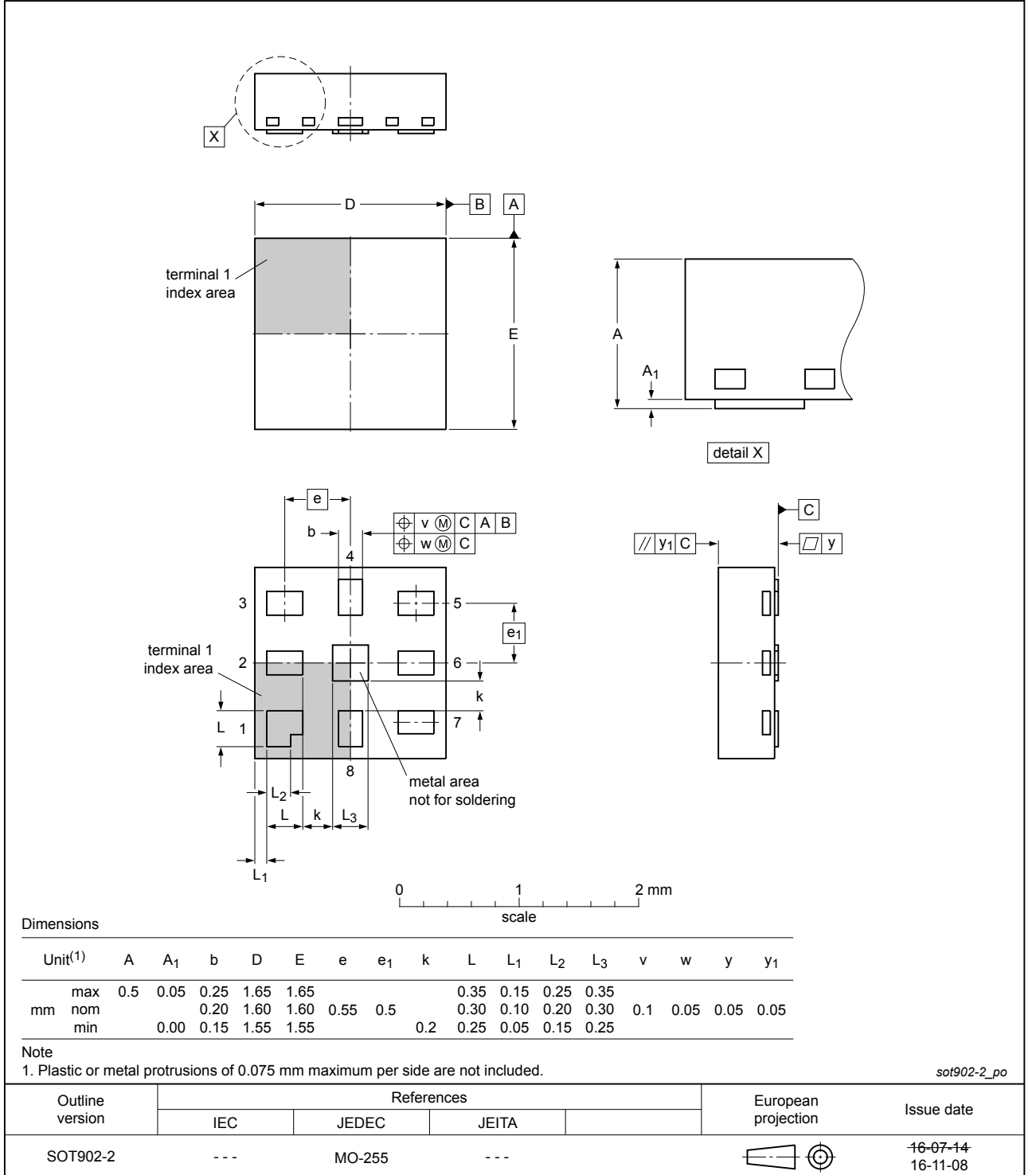
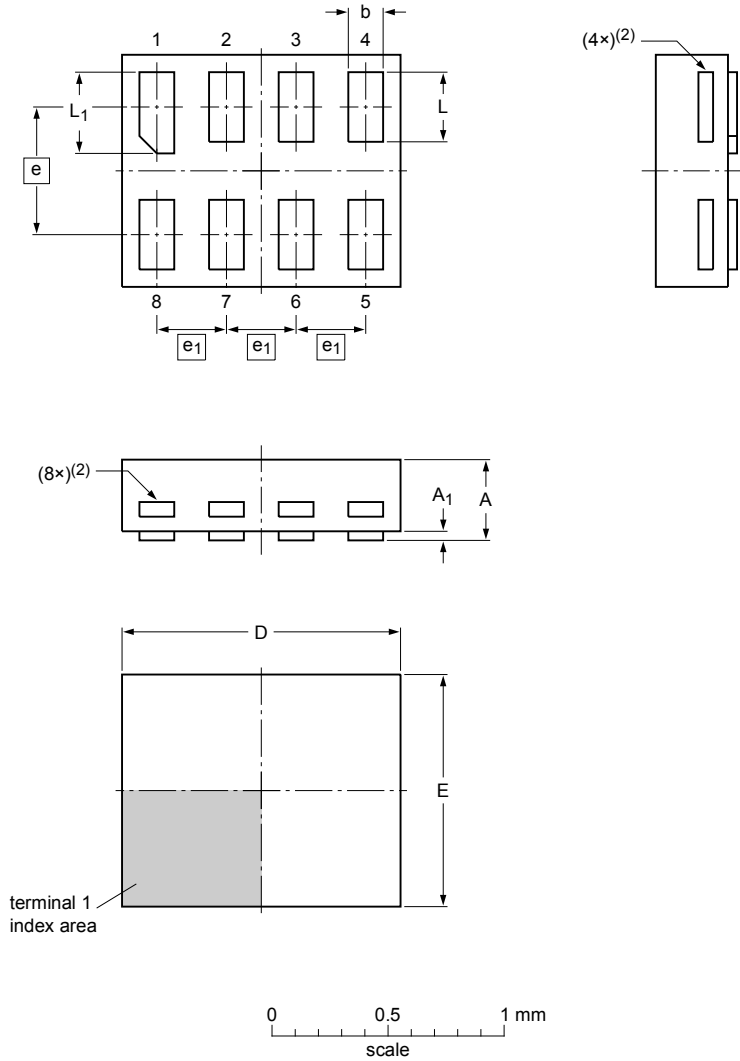


Figure 14. Package outline SOT902-2 (XQFN8)

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

SOT1116



Dimensions

| Unit | A ⁽¹⁾ | A ₁ | b | D | E | e | e ₁ | L | L ₁ |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| max | 0.35 | 0.04 | 0.20 | 1.25 | 1.05 | | | 0.35 | 0.40 |
| nom | | | 0.15 | 1.20 | 1.00 | 0.55 | 0.3 | 0.30 | 0.35 |
| min | | | 0.12 | 1.15 | 0.95 | | | 0.27 | 0.32 |

Note

- Including plating thickness.
- Visible depending upon used manufacturing technology.

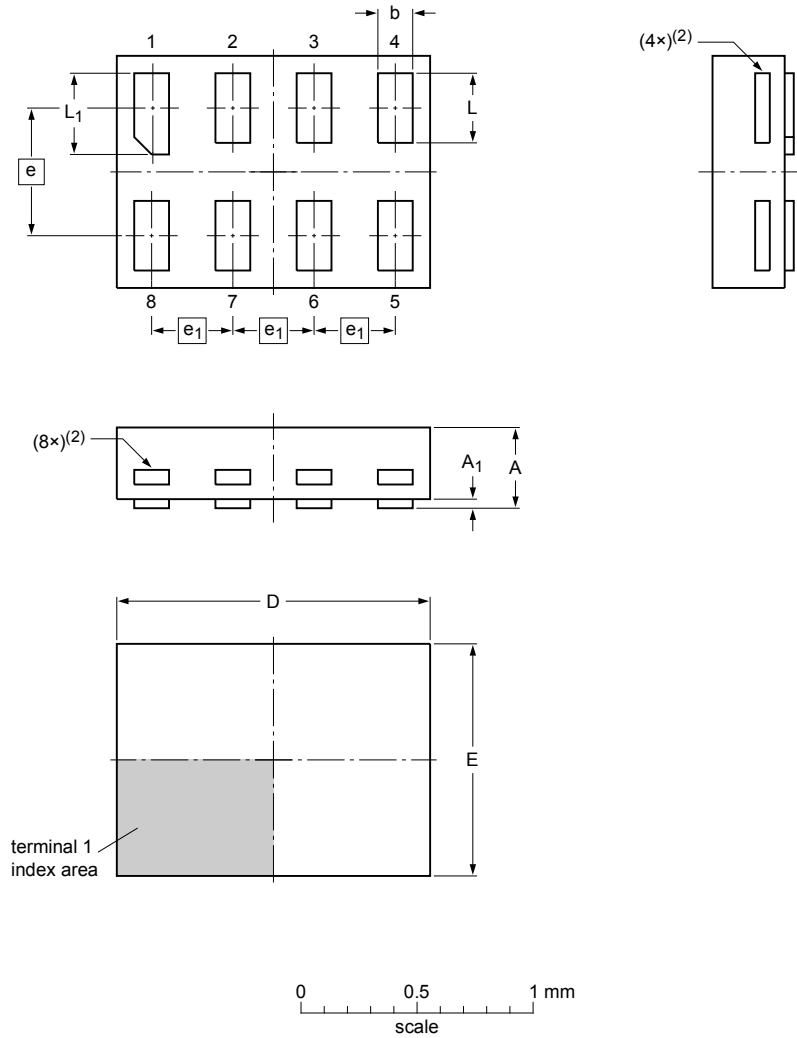
sot1116_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|-------|-------|--|---------------------|------------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT1116 | | | | | | -10-04-02- 10-04-07 |

Figure 15. 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



Dimensions

| Unit | A ⁽¹⁾ | A ₁ | b | D | E | e | e ₁ | L | L ₁ |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| mm | max 0.35 | 0.04 | 0.20 | 1.40 | 1.05 | 0.35 | 0.40 | 0.35 | 0.40 |
| | nom 0.15 | 1.35 | 1.00 | 0.55 | 0.35 | 0.30 | 0.35 | | |
| | min 0.12 | 1.30 | 0.95 | 0.27 | 0.32 | | | | |

Note

- Including plating thickness.
- Visible depending upon used manufacturing technology.

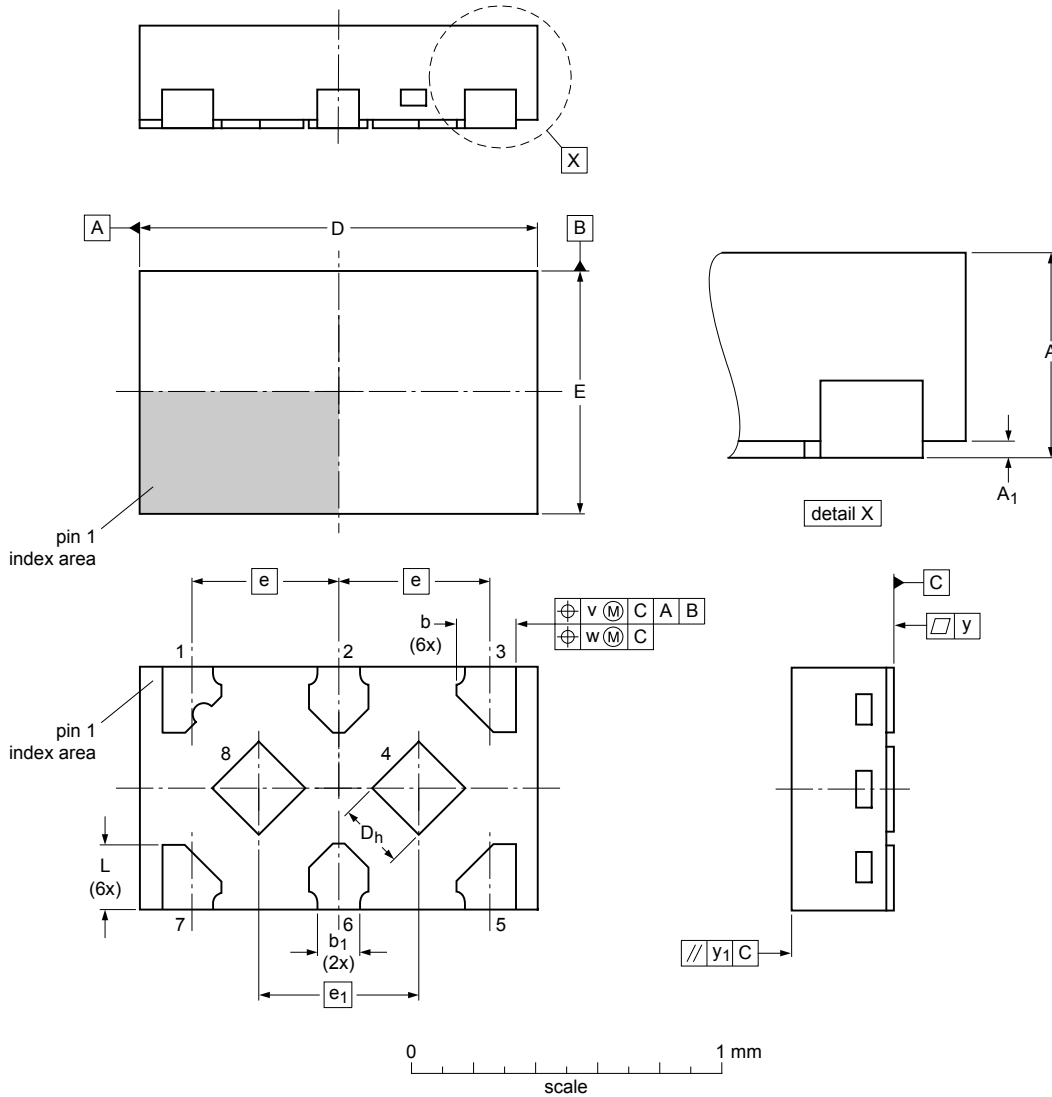
sot1203_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|-------|-------|--|---------------------|------------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT1203 | | | | | | -10-04-02- 10-04-06 |

Figure 16. Package outline SOT1203 (XSON8)

X2SON8: plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 x 0.8 x 0.35 mm

SOT1233



Dimensions (mm are the original dimensions)

| Unit | A | A ₁ | b | b ₁ | D | D _h | E | e | e ₁ | L | v | w | y | y ₁ |
|------|------|----------------|------|----------------|------|----------------|------|-----|----------------|------|-----|------|------|----------------|
| max | 0.35 | 0.04 | 0.25 | | 1.40 | 0.27 | 0.85 | | | 0.27 | | | | |
| nom | 0.32 | | 0.20 | 0.15 | 1.35 | 0.22 | 0.80 | 0.5 | 0.54 | 0.22 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | 0.30 | 0.00 | 0.15 | (ref) | 1.30 | 0.17 | 0.75 | | | 0.17 | | | | |

sot1233_po

| Outline version | References | | | | European projection | Issue date |
|-----------------|------------|-------|-------|--|---------------------|----------------------|
| | IEC | JEDEC | JEITA | | | |
| SOT1233 | | --- | | | | 16-04-21 17-01-05 |

Figure 17. Package outline SOT1233 (X2SON8)

13 Abbreviations

Table 12. 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 13. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|---|--------------------|---------------|----------------|
| 74AUP1G74 v.11 | 20170703 | Product data sheet | - | 74AUP1G74 v.10 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Figure 7 and Figure 17 (drawings SOT1233/X2SON8) updated Type number 74AUP1G74GD removed. | | | |
| 74AUP1G74 v.10 | 20161028 | Product data sheet | - | 74AUP1G74 v.9 |
| Modifications: | <ul style="list-style-type: none"> Added type number 74AUP1G74GX (SOT1233/X2SON8) | | | |
| 74AUP1G74 v.9 | 20140106 | Product data sheet | - | 74AUP1G74 v.8 |
| Modifications: | <ul style="list-style-type: none"> Conditions for f_{max} corrected (errata). | | | |
| 74AUP1G74 v.8 | 20130123 | Product data sheet | - | 74AUP1G74 v.7 |
| Modifications: | <ul style="list-style-type: none"> For type number 74AUP1G74GD XSON8U has changed to XSON8. | | | |
| 74AUP1G74 v.7 | 20120522 | Product data sheet | - | 74AUP1G74 v.6 |
| 74AUP1G74 v.6 | 20111128 | Product data sheet | - | 74AUP1G74 v.5 |
| 74AUP1G74 v.5 | 20100726 | Product data sheet | - | 74AUP1G74 v.4 |
| 74AUP1G74 v.4 | 20080603 | Product data sheet | - | 74AUP1G74 v.3 |
| 74AUP1G74 v.3 | 20080207 | Product data sheet | - | 74AUP1G74 v.2 |
| 74AUP1G74 v.2 | 20070515 | Product data sheet | - | 74AUP1G74 v.1 |
| 74AUP1G74 v.1 | 20060825 | Product data sheet | - | - |

15 Legal information

15.1 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 URL <http://www.nexperia.com>.

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