# 74AUP1G74

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

Rev. 12 — 20 June 2022 Product data sheet

## 1. General description

The 74AUP1G74 is a 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. Data at the D-input that meets the set-up and hold time requirements on the LOW-to-HIGH clock transition will be stored in the flip-flop and appear at the Q output.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device ensures 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 potentially 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
- CMOS low power dissipation
- High noise immunity
- Overvoltage tolerant inputs to 3.6 V
- Low static power consumption; $I_{CC}$ = 0.9 µA (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Low noise overshoot and undershoot < 10 % of $V_{CC}$
- $I_{OFF}$ circuitry provides partial Power-down mode operation
- 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)
  - JESD8C (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F Class 3A exceeds 5 kV
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101E exceeds 1 kV
- 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 × 0.32 mm | SOT1233-2 |

# 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

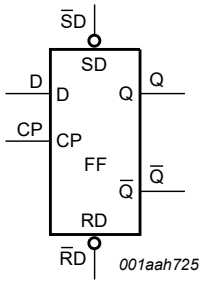



Fig. 1. Logic symbol

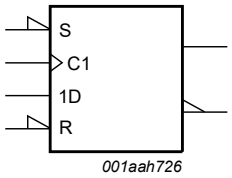



Fig. 2. IEC logic symbol

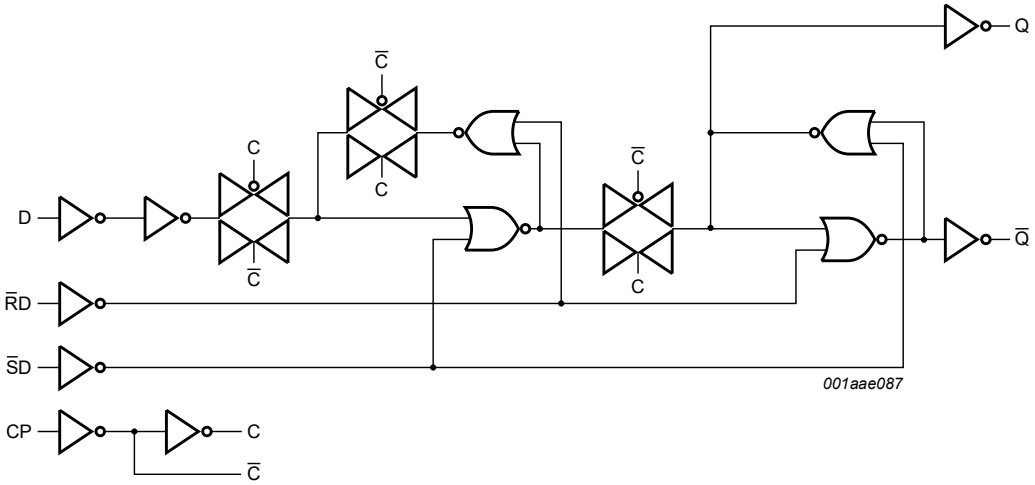



Fig. 3. Logic diagram

# 6. Pinning information

## 6.1. Pinning

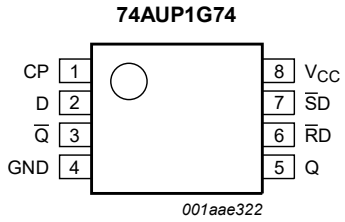
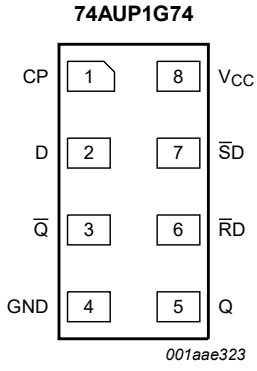
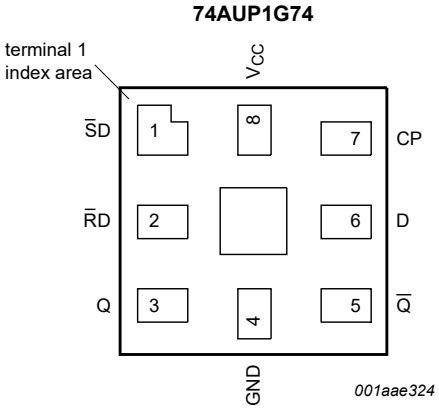



Fig. 4. Pin configuration SOT765-1 (VSSOP8)



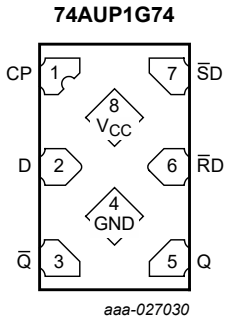

Transparent top view

Fig. 5. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203 (XSON8)




Transparent top view

Fig. 6. Pin configuration SOT902-2 (XQFN8)




Transparent top view

Fig. 7. Pin configuration SOT1233-2 (X2SON8)

## 6.2. Pin description

Table 3. Pin description

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

# 7. Functional description

**Table 4. Function table for asynchronous operation**

*H = HIGH voltage level; L = LOW voltage level; X = don't care.*

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

**Table 5. Function table for synchronous operation**

*H = HIGH voltage level; L = LOW voltage level; ↑ = LOW-to-HIGH CP transition;*
*$\overline{Q}_{n+1}$, $Q_{n+1}$ = state after the next LOW-to-HIGH CP transition.*

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

# 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 | | | | |
| | | SOT765-1 (VSSOP8) | [2] | - | 250 | mW |
| | | SOT833-1 (XSON8) | [3] | - | 250 | mW |
| | | SOT1089 (XSON8) | [4] | - | 250 | mW |
| | | SOT902-2 (XQFN8) | [5] | - | 250 | mW |
| | | SOT1116 (XSON8) | [6] | - | 250 | mW |
| | | SOT1203 (XSON8) | [7] | - | 250 | mW |
| | | SOT1233-2 (X2SON8) | [8] | - | 300 | mW |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] For SOT765-1 (VSSOP8) package: $P_{tot}$ derates linearly with 4.9 mW/K above 99 °C.
[3] For SOT833-1 (XSON8) package: $P_{tot}$ derates linearly with 3.1 mW/K above 68 °C.
[4] For SOT1089 (XSON8) package: $P_{tot}$ derates linearly with 4.0 mW/K above 88 °C.
[5] For SOT902-2 (XQFN8) packages: $P_{tot}$ derates linearly with 4.1 mW/K above 89 °C.
[6] For SOT1116 (XSON8) package: $P_{tot}$ derates linearly with 4.2 mW/K above 90 °C.
[7] For SOT1203 (XSON8) package: $P_{tot}$ derates linearly with 3.6 mW/K above 81 °C.
[8] For SOT1233-2 (X2SON8) package: $P_{tot}$ derates linearly with 7.7 mW/K above 118 °C.

# 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 |
| Δt/ΔV | 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 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 0.8 V | 0.70 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.6 | - | - | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.0 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 0.8 V | - | - | 0.30 × $V_{CC}$ | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | - | - | 0.9 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 μA; $V_{CC}$ = 0.8 V to 3.6 V | $V_{CC}$ - 0.1 | - | - | V |
| | | $I_O$ = -1.1 mA; $V_{CC}$ = 1.1 V | 0.75 × $V_{CC}$ | - | - | V |
| | | $I_O$ = -1.7 mA; $V_{CC}$ = 1.4 V | 1.11 | - | - | V |
| | | $I_O$ = -1.9 mA; $V_{CC}$ = 1.65 V | 1.32 | - | - | 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 | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 μA; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 0.1 | V |
| | | $I_O$ = 1.1 mA; $V_{CC}$ = 1.1 V | - | - | 0.3 × $V_{CC}$ | V |
| | | $I_O$ = 1.7 mA; $V_{CC}$ = 1.4 V | - | - | 0.31 | V |
| | | $I_O$ = 1.9 mA; $V_{CC}$ = 1.65 V | - | - | 0.31 | 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 | $V_I$ = GND to 3.6 V; $V_{CC}$ = 0 V to 3.6 V | - | - | ±0.1 | μA |
| $I_{OFF}$ | power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V | - | - | ±0.2 | μA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta I_{OFF}$ | additional power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V to 0.2 V | - | - | ±0.2 | µA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 0.5 | µA |
| $\Delta I_{CC}$ | additional supply current | $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 3.3 V; per pin [1] | - | - | 40 | µA |
| $C_I$ | input capacitance | $V_{CC}$ = 0 V to 3.6 V; $V_I$ = GND or $V_{CC}$ | - | 0.6 | - | pF |
| $C_O$ | output capacitance | $V_O$ = GND; $V_{CC}$ = 0 V | - | 1.3 | - | pF |
| **$T_{amb}$ = -40 °C to +85 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 0.8 V | 0.70 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.6 | - | - | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.0 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 0.8 V | - | - | 0.30 × $V_{CC}$ | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | - | - | 0.9 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 µA; $V_{CC}$ = 0.8 V to 3.6 V | $V_{CC}$ - 0.1 | - | - | V |
| | | $I_O$ = -1.1 mA; $V_{CC}$ = 1.1 V | 0.7 × $V_{CC}$ | - | - | V |
| | | $I_O$ = -1.7 mA; $V_{CC}$ = 1.4 V | 1.03 | - | - | V |
| | | $I_O$ = -1.9 mA; $V_{CC}$ = 1.65 V | 1.30 | - | - | V |
| | | $I_O$ = -2.3 mA; $V_{CC}$ = 2.3 V | 1.97 | - | - | V |
| | | $I_O$ = -3.1 mA; $V_{CC}$ = 2.3 V | 1.85 | - | - | V |
| | | $I_O$ = -2.7 mA; $V_{CC}$ = 3.0 V | 2.67 | - | - | V |
| | | $I_O$ = -4.0 mA; $V_{CC}$ = 3.0 V | 2.55 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 µA; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 0.1 | V |
| | | $I_O$ = 1.1 mA; $V_{CC}$ = 1.1 V | - | - | 0.3 × $V_{CC}$ | V |
| | | $I_O$ = 1.7 mA; $V_{CC}$ = 1.4 V | - | - | 0.37 | V |
| | | $I_O$ = 1.9 mA; $V_{CC}$ = 1.65 V | - | - | 0.35 | V |
| | | $I_O$ = 2.3 mA; $V_{CC}$ = 2.3 V | - | - | 0.33 | V |
| | | $I_O$ = 3.1 mA; $V_{CC}$ = 2.3 V | - | - | 0.45 | V |
| | | $I_O$ = 2.7 mA; $V_{CC}$ = 3.0 V | - | - | 0.33 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 3.0 V | - | - | 0.45 | V |
| $I_I$ | input leakage current | $V_I$ = GND to 3.6 V; $V_{CC}$ = 0 V to 3.6 V | - | - | ±0.5 | µA |
| $I_{OFF}$ | power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V | - | - | ±0.5 | µA |
| $\Delta I_{OFF}$ | additional power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V to 0.2 V | - | - | ±0.6 | µA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 0.9 | µA |
| $\Delta I_{CC}$ | additional supply current | $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 3.3 V; per pin [1] | - | - | 50 | µA |

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = -40 °C to +125 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 0.8 V | 0.75 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | 0.70 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.6 | - | - | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.0 | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 0.8 V | - | - | 0.25 × $V_{CC}$ | V |
| | | $V_{CC}$ = 0.9 V to 1.95 V | - | - | 0.30 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 3.0 V to 3.6 V | - | - | 0.9 | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = -20 µA; $V_{CC}$ = 0.8 V to 3.6 V | $V_{CC}$ - 0.11 | - | - | V |
| | | $I_O$ = -1.1 mA; $V_{CC}$ = 1.1 V | 0.6 × $V_{CC}$ | - | - | V |
| | | $I_O$ = -1.7 mA; $V_{CC}$ = 1.4 V | 0.93 | - | - | V |
| | | $I_O$ = -1.9 mA; $V_{CC}$ = 1.65 V | 1.17 | - | - | V |
| | | $I_O$ = -2.3 mA; $V_{CC}$ = 2.3 V | 1.77 | - | - | V |
| | | $I_O$ = -3.1 mA; $V_{CC}$ = 2.3 V | 1.67 | - | - | V |
| | | $I_O$ = -2.7 mA; $V_{CC}$ = 3.0 V | 2.40 | - | - | V |
| | | $I_O$ = -4.0 mA; $V_{CC}$ = 3.0 V | 2.30 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 20 µA; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 0.11 | V |
| | | $I_O$ = 1.1 mA; $V_{CC}$ = 1.1 V | - | - | 0.33 × $V_{CC}$ | V |
| | | $I_O$ = 1.7 mA; $V_{CC}$ = 1.4 V | - | - | 0.41 | V |
| | | $I_O$ = 1.9 mA; $V_{CC}$ = 1.65 V | - | - | 0.39 | V |
| | | $I_O$ = 2.3 mA; $V_{CC}$ = 2.3 V | - | - | 0.36 | V |
| | | $I_O$ = 3.1 mA; $V_{CC}$ = 2.3 V | - | - | 0.50 | V |
| | | $I_O$ = 2.7 mA; $V_{CC}$ = 3.0 V | - | - | 0.36 | V |
| | | $I_O$ = 4.0 mA; $V_{CC}$ = 3.0 V | - | - | 0.50 | V |
| $I_I$ | input leakage current | $V_I$ = GND to 3.6 V; $V_{CC}$ = 0 V to 3.6 V | - | - | ±0.75 | µA |
| $I_{OFF}$ | power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V | - | - | ±0.75 | µA |
| $\Delta I_{OFF}$ | additional power-off leakage current | $V_I$ or $V_O$ = 0 V to 3.6 V; $V_{CC}$ = 0 V to 0.2 V | - | - | ±0.75 | µA |
| $I_{CC}$ | supply current | $V_I$ = GND or $V_{CC}$; $I_O$ = 0 A; $V_{CC}$ = 0.8 V to 3.6 V | - | - | 1.4 | µA |
| $\Delta I_{CC}$ | additional supply current | $V_I$ = $V_{CC}$ - 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 3.3 V; per pin [1] | - | - | 75 | µA |

[1] One input at $V_{CC}$ - 0.6 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 Fig. 10.*

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = -40 °C to +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| **$C_L$ = 5 pF** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | CP to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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 Fig. 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 |

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = -40 °C to +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| **$C_L$ = 10 pF** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | CP to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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 Fig. 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 |

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = -40 °C to +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| **$C_L$ = 15 pF** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | CP to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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 Fig. 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 |

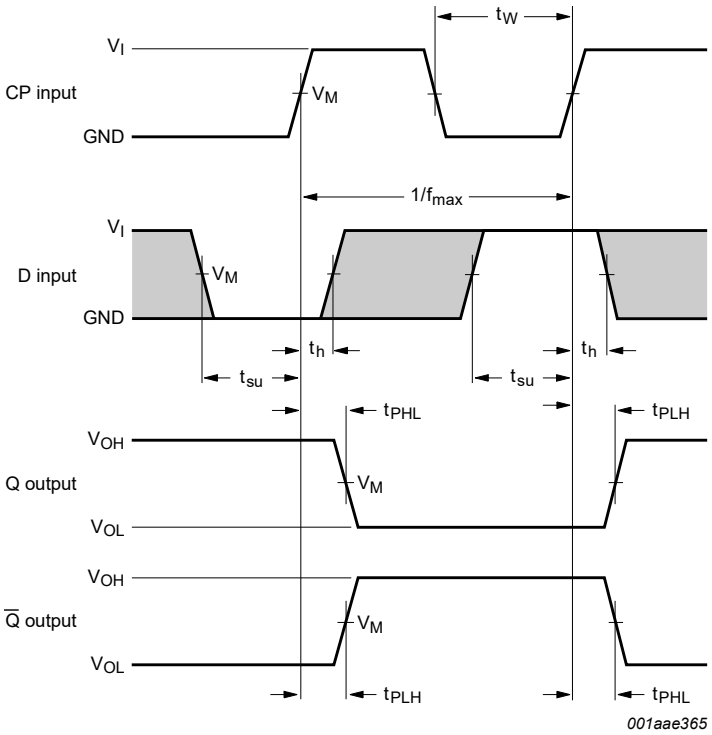
| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = -40 °C to +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| **$C_L$ = 30 pF** | | | | | | | | | | |
| $t_{pd}$ | propagation delay | CP to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{SD}$ to Q, $\overline{Q}$; see Fig. 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 |
| | | $\overline{RD}$ to Q, $\overline{Q}$; see Fig. 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 Fig. 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 |

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = -40 °C to +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| **$C_L$ = 5 pF, 10 pF, 15 pF and 30 pF** | | | | | | | | | | |
| $t_{su}$ | set-up time | D to CP HIGH; see Fig. 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 Fig. 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 Fig. 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 | $\overline{RD}$; see Fig. 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 |
| | | $\overline{SD}$; see Fig. 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 +85 °C | | $T_{amb}$ = -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | Min | Max | |
| $t_W$ | pulse width | CP HIGH or LOW; see Fig. 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 |
| | | $\overline{SD}$ or $\overline{RD}$ LOW; see Fig. 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

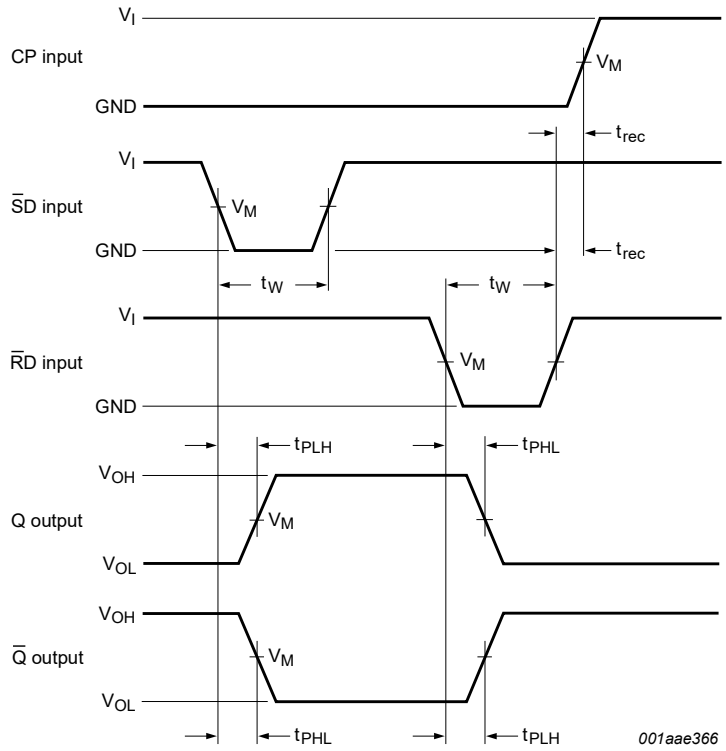



Measurement points are given in Table 10.

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.

**Fig. 8. The clock input (CP) to output (Q, $\overline{Q}$) 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**



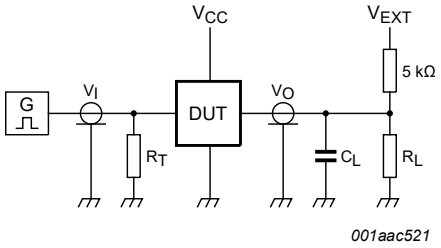

Measurement points are given in Table 10.

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

**Fig. 9. The set input ($\overline{SD}$) and reset input ($\overline{RD}$) to output (Q, $\overline{Q}$) propagation delays, the set input ($\overline{SD}$) and reset input ($\overline{RD}$) pulse widths and the reset input ($\overline{RD}$) 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 Zo of the pulse generator;

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

**Fig. 10. Test circuit for measuring switching times**

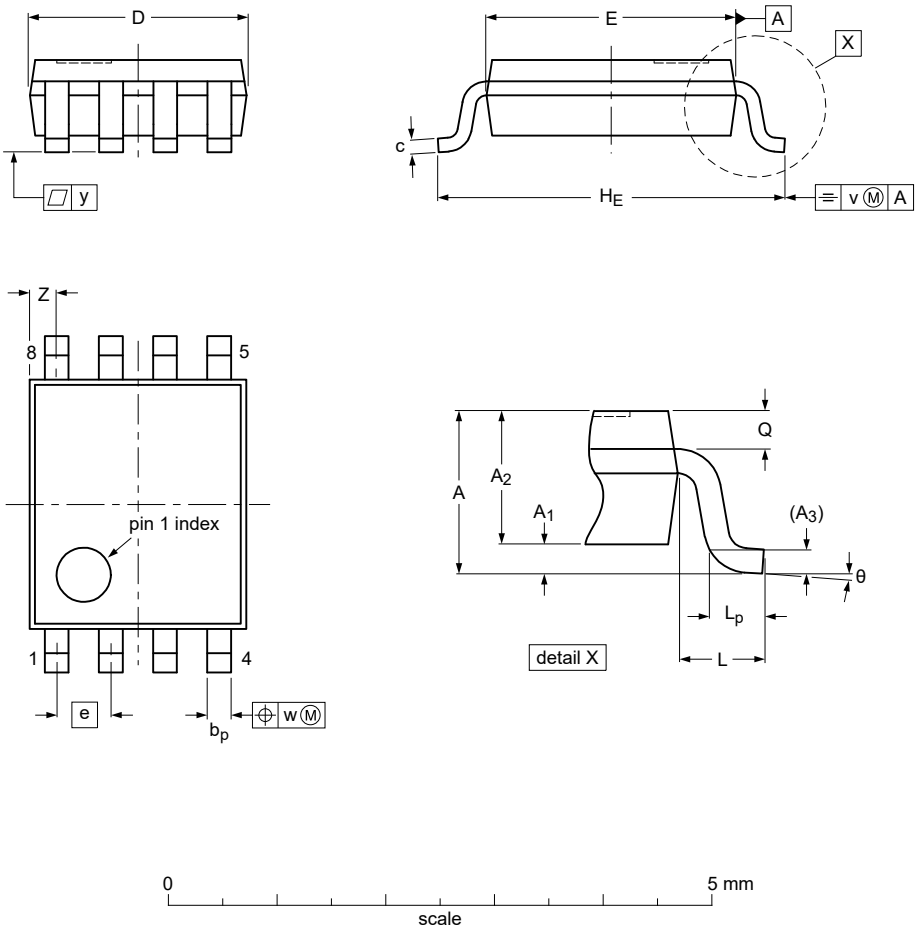
**Table 11. Test data**

| 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 × $V_{CC}$ |

[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

**VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm** **SOT765-1**




Dimensions (mm are the original dimensions)

| Unit | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(2)}$ | e | $H_E$ | L | $L_p$ | Q | v | w | y | $Z^{(1)}$ | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| max | | 0.15 | 0.85 | | 0.27 | 0.23 | 2.1 | 2.4 | | 3.2 | | 0.40 | 0.21 | | | | 0.4 | 8° |
| mm nom | 1 | | | 0.12 | | | | | 0.5 | | 0.4 | | | 0.2 | 0.08 | 0.1 | | |
| min | | 0.00 | 0.60 | | 0.17 | 0.08 | 1.9 | 2.2 | | 3.0 | | 0.15 | 0.19 | | | | 0.1 | 0° |

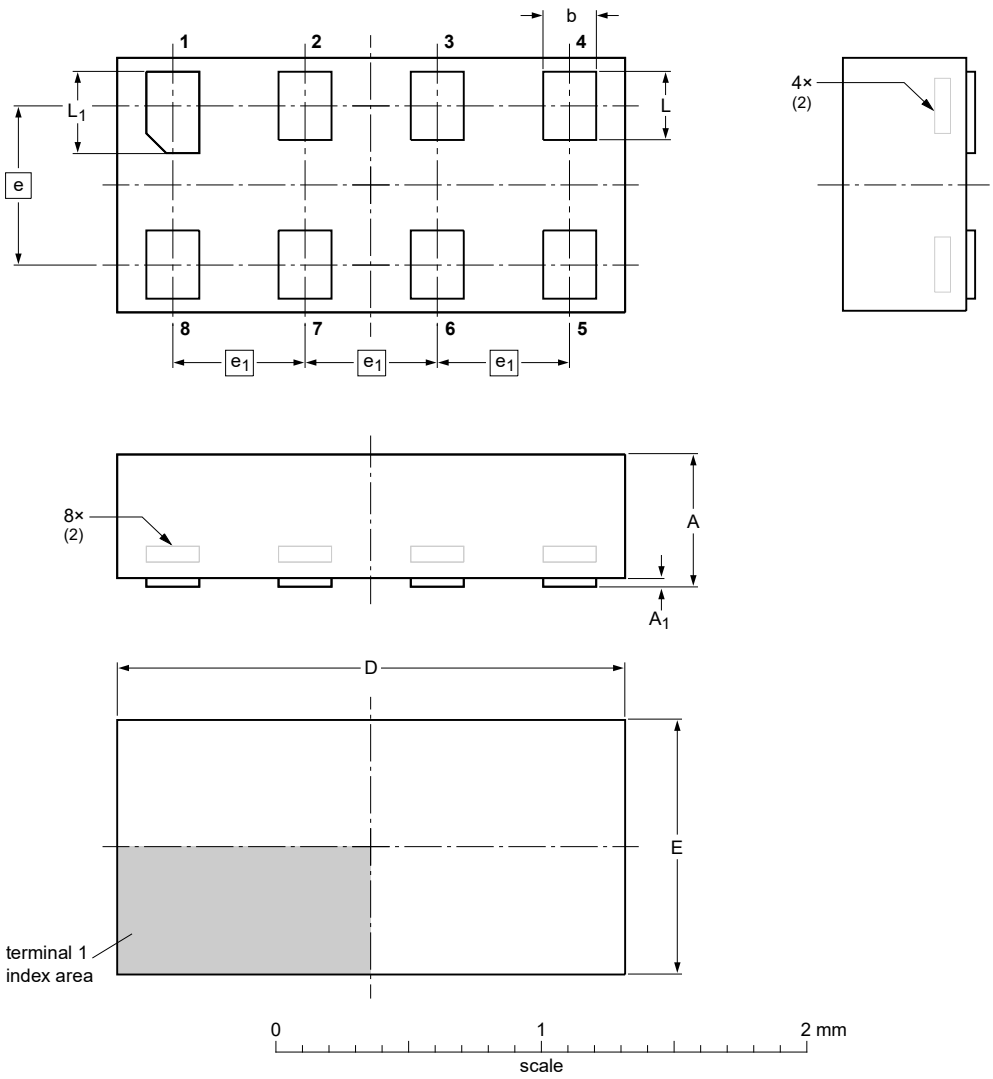
Note
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

*sot765-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT765-1 | | MO-187 | | | | ~~07-06-02~~ 16-05-31 |

**Fig. 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<br>0.17 | 2.0<br>1.9 | 1.05<br>0.95 | 0.6 | 0.5 | 0.35<br>0.27 | 0.40<br>0.32 |

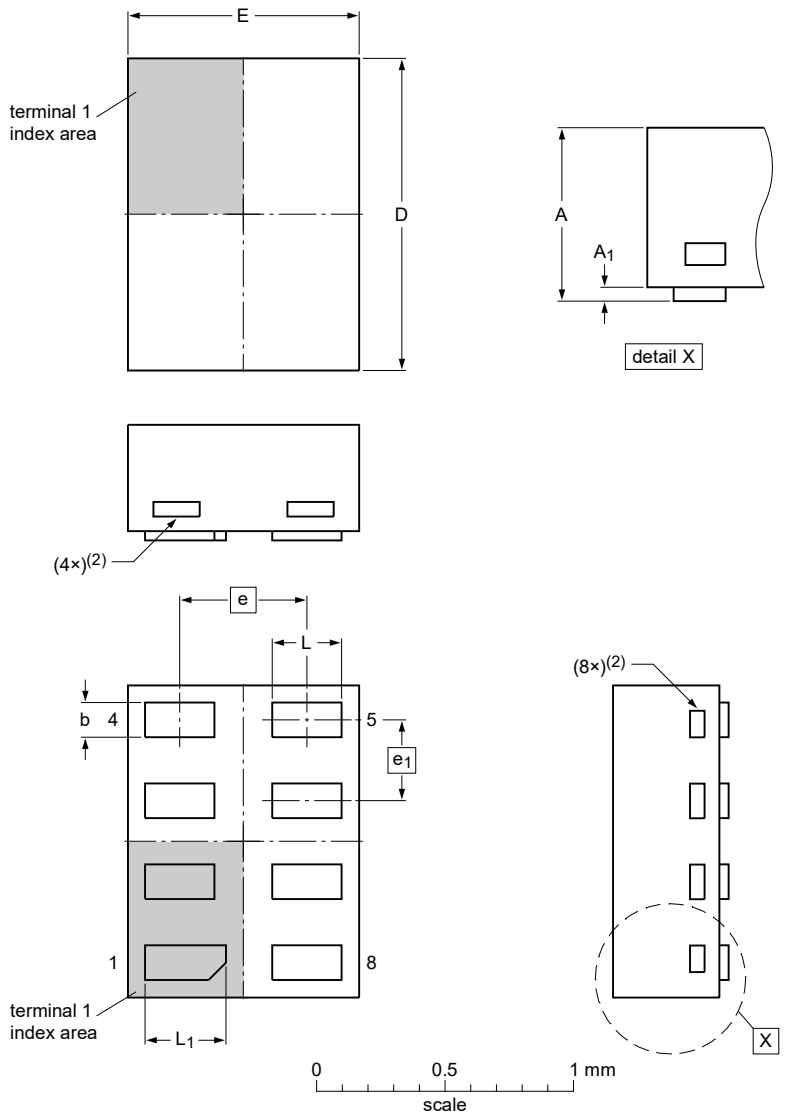
**Notes**

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~~<br>07-12-07 |

**Fig. 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 | $L_1$ |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.5 | 0.04 | 0.20 | 1.40 | 1.05 | | | 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 |

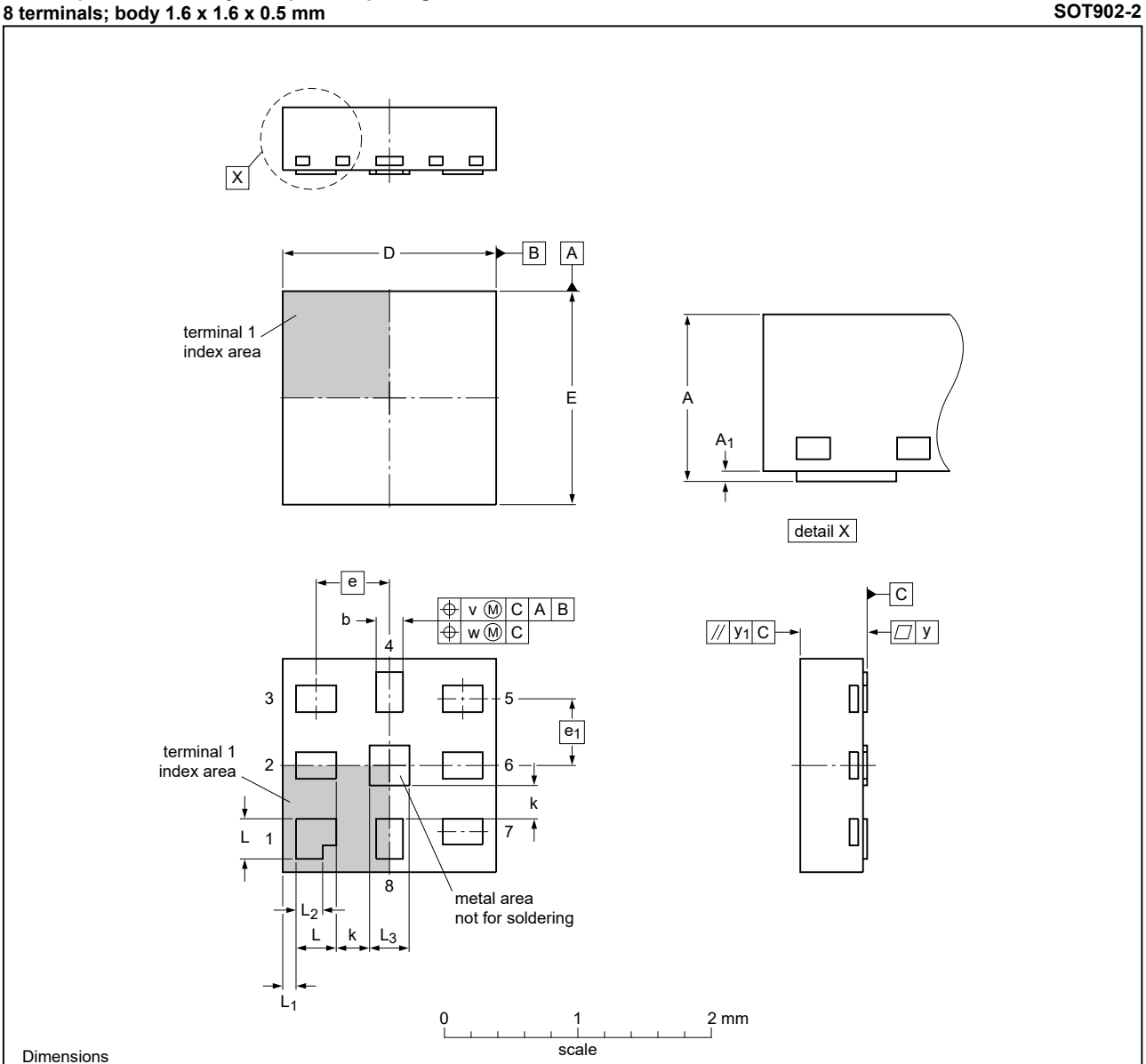
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1089_po*

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

**Fig. 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**




Dimensions

| Unit[1] | | A | $A_1$ | b | D | E | e | $e_1$ | k | L | $L_1$ | $L_2$ | $L_3$ | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.5 | 0.05 | 0.25 | 1.65 | 1.65 | | | | 0.35 | 0.15 | 0.25 | 0.35 | | | | |
| | nom | | | 0.20 | 1.60 | 1.60 | 0.55 | 0.5 | | 0.30 | 0.10 | 0.20 | 0.30 | 0.1 | 0.05 | 0.05 | 0.05 |
| | min | | 0.00 | 0.15 | 1.55 | 1.55 | | | 0.2 | 0.25 | 0.05 | 0.15 | 0.25 | | | | |

Note

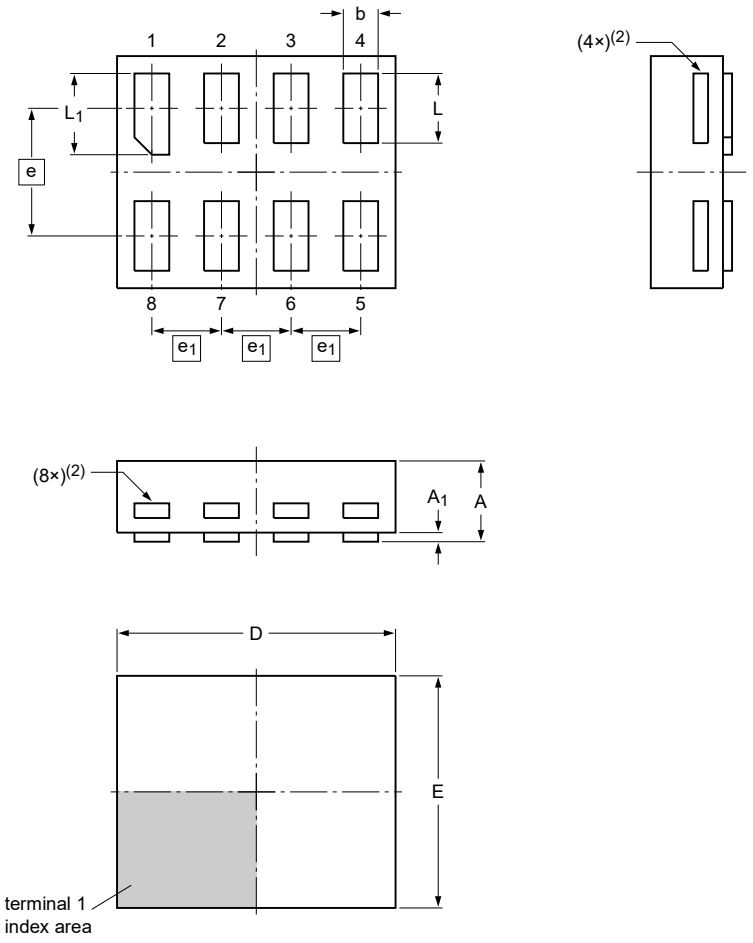
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot902-2_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT902-2 | - - - | MO-255 | - - - | | | ~~16-07-14~~ 16-11-08 |

**Fig. 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 | $L_1$ |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | 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 |

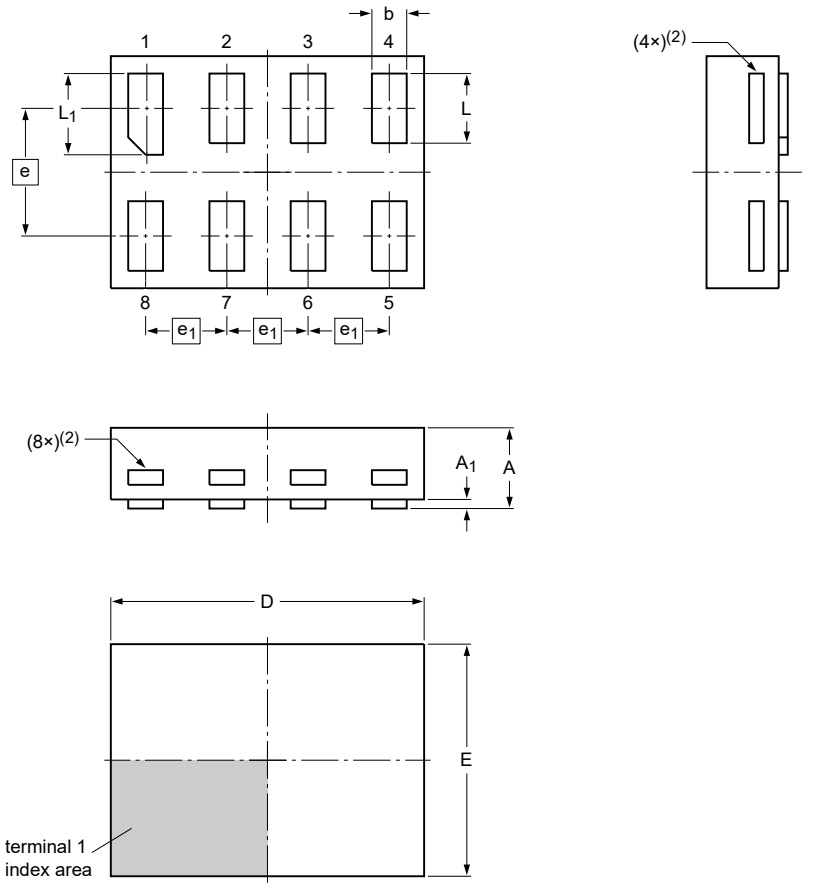
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1116_po*

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

**Fig. 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 |
| | 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 |

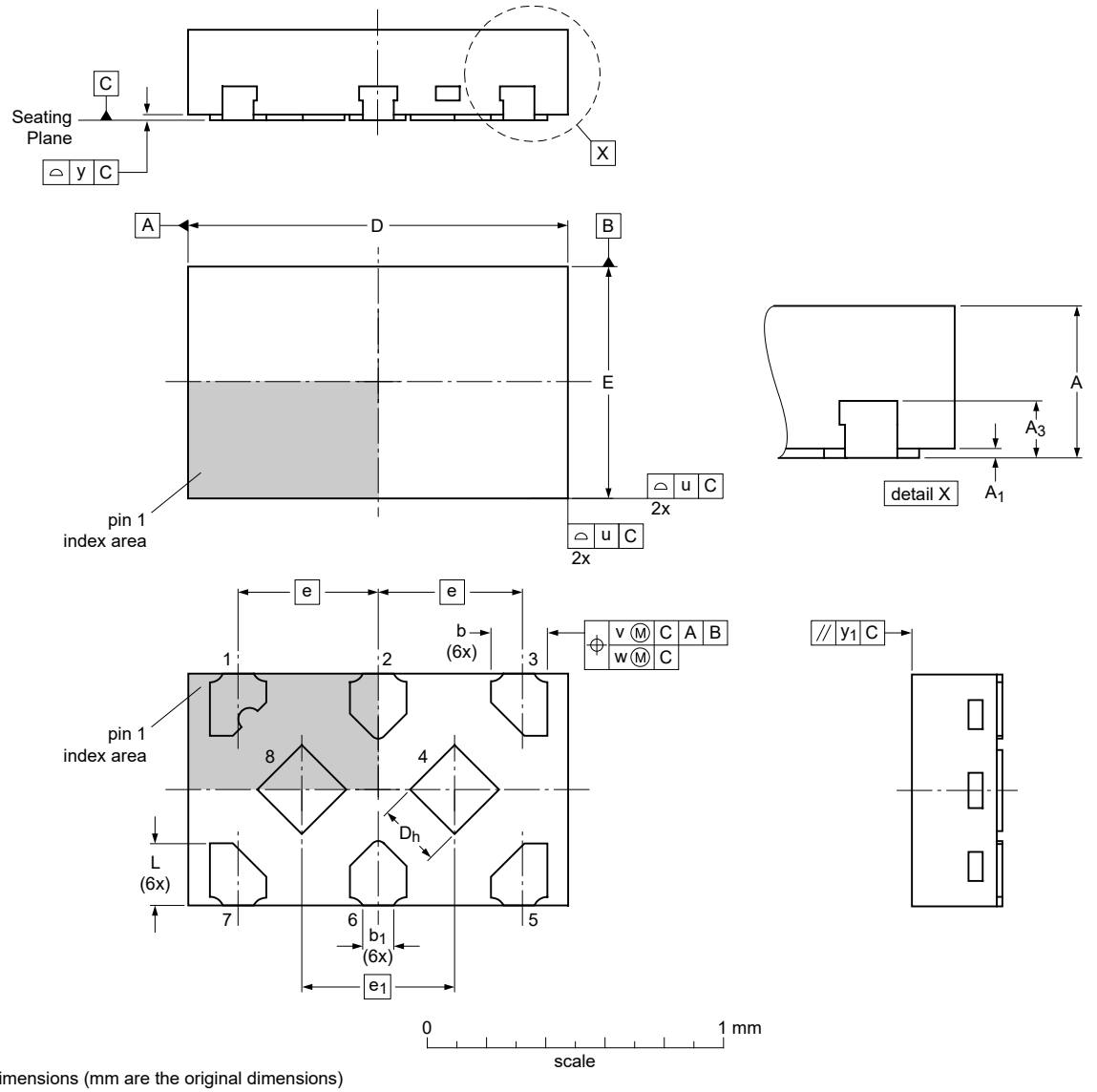
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1203_po*

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

**Fig. 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 0.32 mm** **SOT1233-2**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | $A_3$ | b | $b_1$ | D | $D_h$ | E | e | $e_1$ | L | u | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.35 | 0.04 | 0.10 (Typ.) | 0.25 | 0.11 (ref) | 1.35 | 0.27 | 0.80 | 0.50 | 0.54 | 0.27 | 0.05 | 0.10 | 0.05 | 0.05 | 0.05 |
| | nom | 0.32 | 0.02 | | 0.20 | | | 0.22 | | | | 0.22 | | | | | |
| | min | 0.30 | 0.00 | | 0.15 | | | 0.17 | | | | 0.17 | | | | | |

*sot1233-2_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1233-2 | | --- | | | | 19-11-12 |

**Fig. 17. Package outline SOT1233-2 (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.12 | 20220620 | Product data sheet | - | 74AUP1G74 v.11 |
| Modifications: | • SOT1233 (X2SON8) package changed to SOT1233-2 (X2SON8) package.<br>• Section 1 and Section 2 updated.<br>• Table 6: Derating values for $P_{tot}$ total power dissipation have been updated. | | | |
| 74AUP1G74 v.11 | 20170703 | Product data sheet | - | 74AUP1G74 v.10 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Fig. 7 and Fig. 17 (drawings SOT1233/X2SON8) updated<br>• Type number 74AUP1G74GD removed. | | | |
| 74AUP1G74 v.10 | 20161028 | Product data sheet | - | 74AUP1G74 v.9 |
| Modifications: | • Added type number 74AUP1G74GX (SOT1233/X2SON8) | | | |
| 74AUP1G74 v.9 | 20140106 | Product data sheet | - | 74AUP1G74 v.8 |
| Modifications: | • Conditions for $f_{max}$ corrected (errata). | | | |
| 74AUP1G74 v.8 | 20130123 | Product data sheet | - | 74AUP1G74 v.7 |
| Modifications: | • 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

## 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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**Date of release: 20 June 2022**