# 74AUP2G132

## Low-power dual 2-input NAND Schmitt trigger

Rev. 4 — 4 November 2010 Product data sheet

## 1. General description

The 74AUP2G132 provides the dual 2-input NAND Schmitt trigger function which accept standard input signals. They are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

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.

The inputs switch at different points for positive and negative-going signals. The difference between the positive voltage $V_{T+}$ and the negative voltage $V_{T-}$ is defined as the input hysteresis voltage $V_H$.

## 2. Features and benefits

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- 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 μA (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. Applications

- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

## 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74AUP2G132DC | −40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74AUP2G132GT | −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 |
| 74AUP2G132GF | −40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm | SOT1089 |
| 74AUP2G132GD | −40 °C to +125 °C | XSON8U | plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 × 2 × 0.5 mm | SOT996-2 |
| 74AUP2G132GM | −40 °C to +125 °C | XQFN8U | plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 × 1.6 × 0.5 mm | SOT902-1 |
| 74AUP2G132GN | −40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm | SOT1116 |
| 74AUP2G132GS | −40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm | SOT1203 |

## 5. Marking

**Table 2. Marking codes**

| Type number | Marking code[1] |
|---|---|
| 74AUP2G132DC | aE2 |
| 74AUP2G132GT | aE2 |
| 74AUP2G132GF | aE |
| 74AUP2G132GD | aE2 |
| 74AUP2G132GM | aE2 |
| 74AUP2G132GN | aE |
| 74AUP2G132GS | aE |

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

## 6. Functional diagram

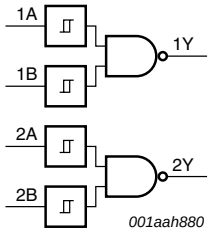



**Fig 1. Logic symbol**

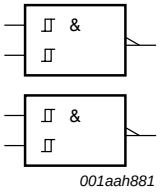



**Fig 2. IEC logic symbol**

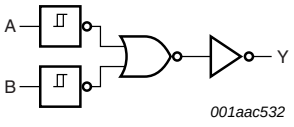



**Fig 3. Logic diagram (one gate)**

# 7. Pinning information

## 7.1 Pinning

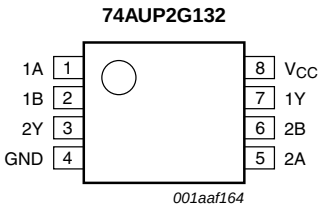



Fig 4. Pin configuration SOT765-1

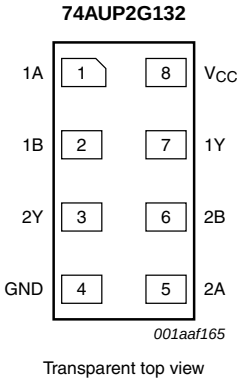



Fig 5. Pin configuration SOT833-1, SOT1089, SOT1116 and SOT1203

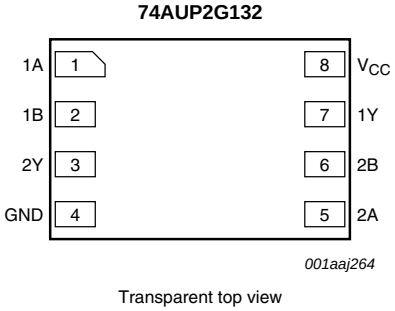



Fig 6. Pin configuration SOT996-2

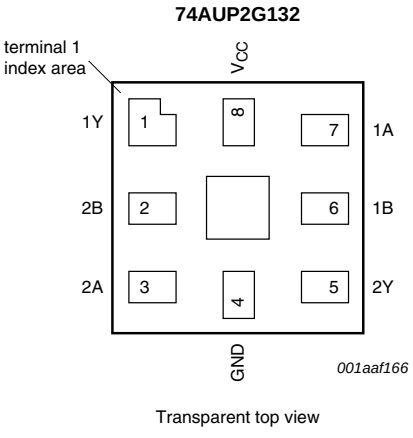



Fig 7. Pin configuration SOT902-1

## 7.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|---|---|---|---|
| | SOT765-1, SOT833-1, SOT1089, SOT996-2, SOT1116 and SOT1203 | SOT902-1 | |
| 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 |
| $V_{CC}$ | 8 | 8 | supply voltage |

## 8. Functional description

**Table 4. Function table[1]**

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

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

## 9. 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 | $V_I < 0$ V | | −50 | - | mA |
| $V_I$ | input voltage | | [1] | −0.5 | +4.6 | V |
| $I_{OK}$ | output clamping current | $V_O < 0$ 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 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, XSON8U and XQFN8U packages: above 118 °C the value of $P_{tot}$ derates linearly with 7.8 mW/K.

## 10. 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 V | 0 | 3.6 | V |
| $T_{amb}$ | ambient temperature | | −40 | +125 | °C |

## 11. Static characteristics

**Table 7. Static characteristics**

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

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **$T_{amb}$ = 25 °C** | | | | | | | |
| $V_{OH}$ | HIGH-level output voltage | $V_I = V_{T+}$ or $V_{T-}$ | | | | | |
| | | $I_O$ = –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 | $V_I = V_{T+}$ or $V_{T-}$ | | | | | |
| | | $I_O$ = 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 |
| $\Delta I_{OFF}$ | 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 | [1] | - | - | 40 | μA |
| $C_I$ | input capacitance | $V_I$ = GND or $V_{CC}$; $V_{CC}$ = 0 V to 3.6 V | | - | 1.1 | - | pF |
| $C_O$ | output capacitance | $V_O$ = GND; $V_{CC}$ = 0 V | | - | 1.7 | - | pF |
| **$T_{amb}$ = –40 °C to +85 °C** | | | | | | | |
| $V_{OH}$ | HIGH-level output voltage | $V_I = V_{T+}$ or $V_{T-}$ | | | | | |
| | | $I_O$ = –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 |

**Table 7. Static characteristics** *…continued*

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{OL}$ | LOW-level output voltage | $V_I = V_{T+}$ or $V_{T-}$ | | | | |
| | | $I_O$ = 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 [1] | - | - | 50 | μA |
| **$T_{amb}$ = −40 °C to +125 °C** | | | | | | |
| $V_{OH}$ | HIGH-level output voltage | $V_I = V_{T+}$ or $V_{T-}$ | | | | |
| | | $I_O$ = −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 | $V_I = V_{T+}$ or $V_{T-}$ | | | | |
| | | $I_O$ = 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 |

**Table 7. Static characteristics** *...continued*

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

| 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 | | - | - | ±0.75 | 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 | [1] | - | - | 75 | μA |

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

## 12. Dynamic characteristics

**Table 8. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V; for test circuit see Figure 9.*

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = −40 °C to +125 °C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max (85 °C) | Max (125 °C) | |
| **$C_L$ = 5 pF** | | | | | | | | | |
| $t_{pd}$ | propagation delay | nA or nB to nY; see Figure 8 [2] | | | | | | | |
| | | $V_{CC}$ = 0.8 V | - | 22.5 | - | - | - | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 2.6 | 6.3 | 13.4 | 2.4 | 15.1 | 16.6 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 2.2 | 4.6 | 8.2 | 1.9 | 9.7 | 10.7 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 1.9 | 3.9 | 6.6 | 1.7 | 7.9 | 8.7 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | 3.2 | 5.3 | 1.5 | 6.2 | 6.8 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.6 | 2.9 | 4.7 | 1.4 | 5.6 | 6.2 | ns |
| **$C_L$ = 10 pF** | | | | | | | | | |
| $t_{pd}$ | propagation delay | nA or nB to nY; see Figure 8 [2] | | | | | | | |
| | | $V_{CC}$ = 0.8 V | - | 26.1 | - | - | - | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 3.0 | 7.2 | 15.4 | 2.7 | 17.3 | 19.0 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 2.5 | 5.2 | 9.3 | 2.2 | 11.0 | 12.1 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 2.3 | 4.5 | 7.5 | 2.0 | 9.0 | 9.9 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 2.1 | 3.8 | 6.1 | 1.8 | 7.2 | 7.9 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.0 | 3.5 | 5.5 | 1.8 | 6.5 | 7.2 | ns |
| **$C_L$ = 15 pF** | | | | | | | | | |
| $t_{pd}$ | propagation delay | nA or nB to nY; see Figure 8 [2] | | | | | | | |
| | | $V_{CC}$ = 0.8 V | - | 29.6 | - | - | - | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 3.3 | 8.0 | 17.2 | 3.0 | 19.4 | 21.3 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 2.8 | 5.8 | 10.4 | 2.5 | 12.3 | 13.5 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 2.6 | 5.0 | 8.3 | 2.3 | 10.0 | 11.0 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 2.3 | 4.2 | 6.7 | 2.1 | 7.9 | 8.7 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.2 | 3.9 | 6.1 | 2.0 | 7.3 | 8.0 | ns |

**Table 8. Dynamic characteristics** *…continued*

*Voltages are referenced to GND (ground = 0 V; for test circuit see Figure 9.*

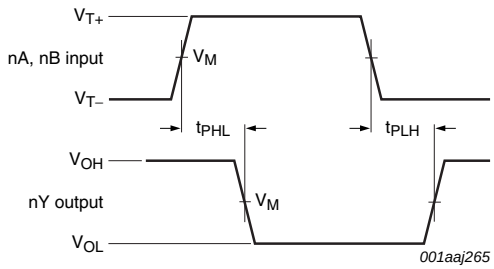
| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = −40 °C to +125 °C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max (85 °C) | Max (125 °C) | |
| **$C_L$ = 30 pF** | | | | | | | | | |
| $t_{pd}$ | propagation delay | nA or nB to nY; see Figure 8 [2] | | | | | | | |
| | | $V_{CC}$ = 0.8 V | - | 39.9 | - | - | - | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 4.3 | 10.2 | 22.6 | 3.8 | 25.4 | 27.9 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 3.6 | 7.3 | 13.3 | 3.2 | 15.8 | 17.4 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 3.2 | 6.3 | 10.6 | 2.9 | 12.8 | 14.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 3.0 | 5.3 | 8.5 | 2.7 | 10.1 | 11.1 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.8 | 5.0 | 7.8 | 2.7 | 9.2 | 10.1 | ns |
| **$C_L$ = 5 pF, 10 pF, 15 pF and 30 pF** | | | | | | | | | |
| $C_{PD}$ | power dissipation capacitance | $f_i$ = 1 MHz; $V_I$ = GND to $V_{CC}$ [3] | | | | | | | |
| | | $V_{CC}$ = 0.8 V | - | 2.6 | - | - | - | - | 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 | - | 3.2 | - | - | - | - | pF |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | 3.8 | - | - | - | - | pF |
| | | $V_{CC}$ = 3.0 V to 3.6 V | - | 4.4 | - | - | - | - | 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 the outputs.

## 13. Waveforms



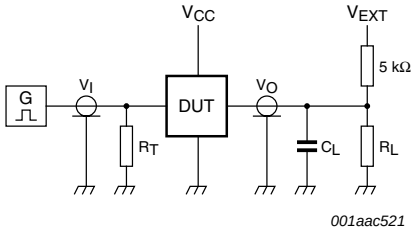

Measurement points are given in Table 9.

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

**Fig 8. 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 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{CC}$ | ≤ 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 9. Load circuitry for 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, setup and hold times and pulse width $R_L$ = 1 MΩ.

## 14. Transfer characteristics

**Table 11. Transfer characteristics**

*Voltages are referenced to GND (ground = 0 V; for test circuit see Figure 9.*

| Symbol | Parameter | Conditions | $T_{amb}$ = 25 °C | | | $T_{amb}$ = −40 °C to +125 °C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max (85 °C) | Max (125 °C) | |
| $V_{T+}$ | positive-going threshold voltage | see Figure 10 and Figure 11 | | | | | | | |
| | | $V_{CC}$ = 0.8 V | 0.30 | - | 0.60 | 0.30 | 0.60 | 0.62 | V |
| | | $V_{CC}$ = 1.1 V | 0.53 | - | 0.90 | 0.53 | 0.90 | 0.92 | V |
| | | $V_{CC}$ = 1.4 V | 0.74 | - | 1.11 | 0.74 | 1.11 | 1.13 | V |
| | | $V_{CC}$ = 1.65 V | 0.91 | - | 1.29 | 0.91 | 1.29 | 1.31 | V |
| | | $V_{CC}$ = 2.3 V | 1.37 | - | 1.77 | 1.37 | 1.77 | 1.80 | V |
| | | $V_{CC}$ = 3.0 V | 1.88 | - | 2.29 | 1.88 | 2.29 | 2.32 | V |
| $V_{T-}$ | negative-going threshold voltage | see Figure 10 and Figure 11 | | | | | | | |
| | | $V_{CC}$ = 0.8 V | 0.10 | - | 0.60 | 0.10 | 0.60 | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.26 | - | 0.65 | 0.26 | 0.65 | 0.65 | V |
| | | $V_{CC}$ = 1.4 V | 0.39 | - | 0.75 | 0.39 | 0.75 | 0.75 | V |
| | | $V_{CC}$ = 1.65 V | 0.47 | - | 0.84 | 0.47 | 0.84 | 0.84 | V |
| | | $V_{CC}$ = 2.3 V | 0.69 | - | 1.04 | 0.69 | 1.04 | 1.04 | V |
| | | $V_{CC}$ = 3.0 V | 0.88 | - | 1.24 | 0.88 | 1.24 | 1.24 | V |
| $V_H$ | hysteresis voltage | ($V_{T+} - V_{T-}$); see Figure 10, Figure 11, Figure 12 and Figure 13 | | | | | | | |
| | | $V_{CC}$ = 0.8 V | 0.07 | - | 0.50 | 0.07 | 0.50 | 0.50 | V |
| | | $V_{CC}$ = 1.1 V | 0.08 | - | 0.46 | 0.08 | 0.46 | 0.46 | V |
| | | $V_{CC}$ = 1.4 V | 0.18 | - | 0.56 | 0.18 | 0.56 | 0.56 | V |
| | | $V_{CC}$ = 1.65 V | 0.27 | - | 0.66 | 0.27 | 0.66 | 0.66 | V |
| | | $V_{CC}$ = 2.3 V | 0.53 | - | 0.92 | 0.53 | 0.92 | 0.92 | V |
| | | $V_{CC}$ = 3.0 V | 0.79 | - | 1.31 | 0.79 | 1.31 | 1.31 | V |

## 15. Waveforms transfer characteristics

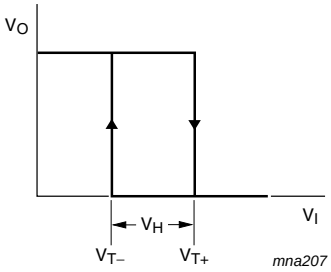
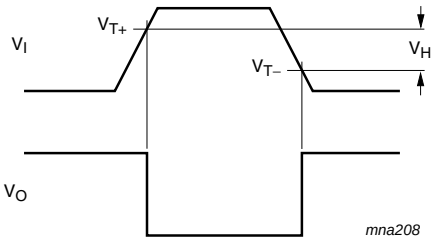
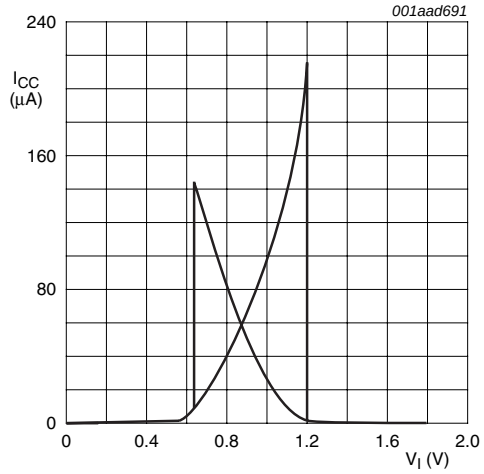



**Fig 10. Transfer characteristic**



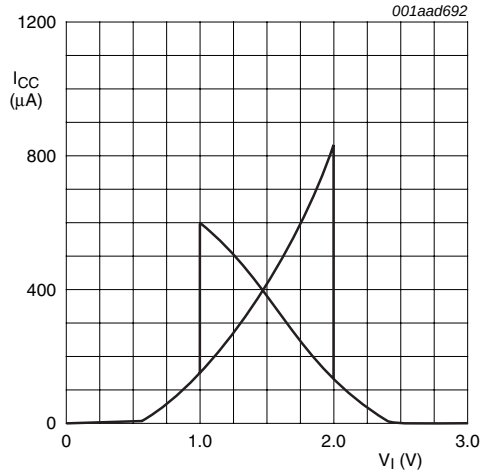

$V_{T+}$ and $V_{T-}$ limits at 70 % and 20 %.

**Fig 11. Definition of $V_{T+}$, $V_{T-}$ and $V_H$**




$V_{CC}$ = 3.0 V.

**Fig 12. Typical transfer characteristics; $V_{CC}$ = 1.8 V**




$V_{CC}$ = 3.0 V.

**Fig 13. Typical transfer characteristics; $V_{CC}$ = 3.0 V**

## 16. Application information

The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

$P_{add}$ = additional power dissipation (μW);

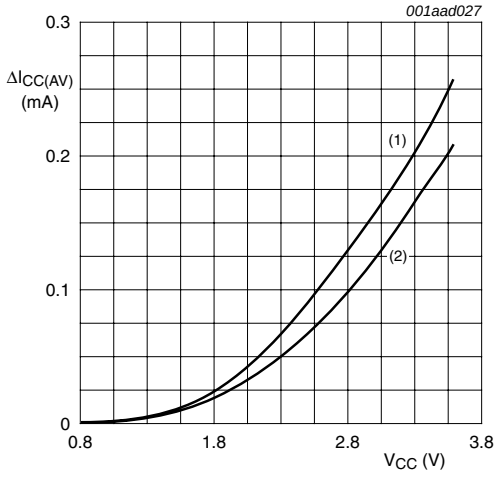
$f_i$ = input frequency (MHz);

$t_r$ = input rise time (ns); 10 % to 90 %;

$t_f$ = input fall time (ns); 90 % to 10 %;

$\Delta I_{CC(AV)}$ = average additional supply current (μA).

Average $\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Figure 14.




(1) Positive-going edge.

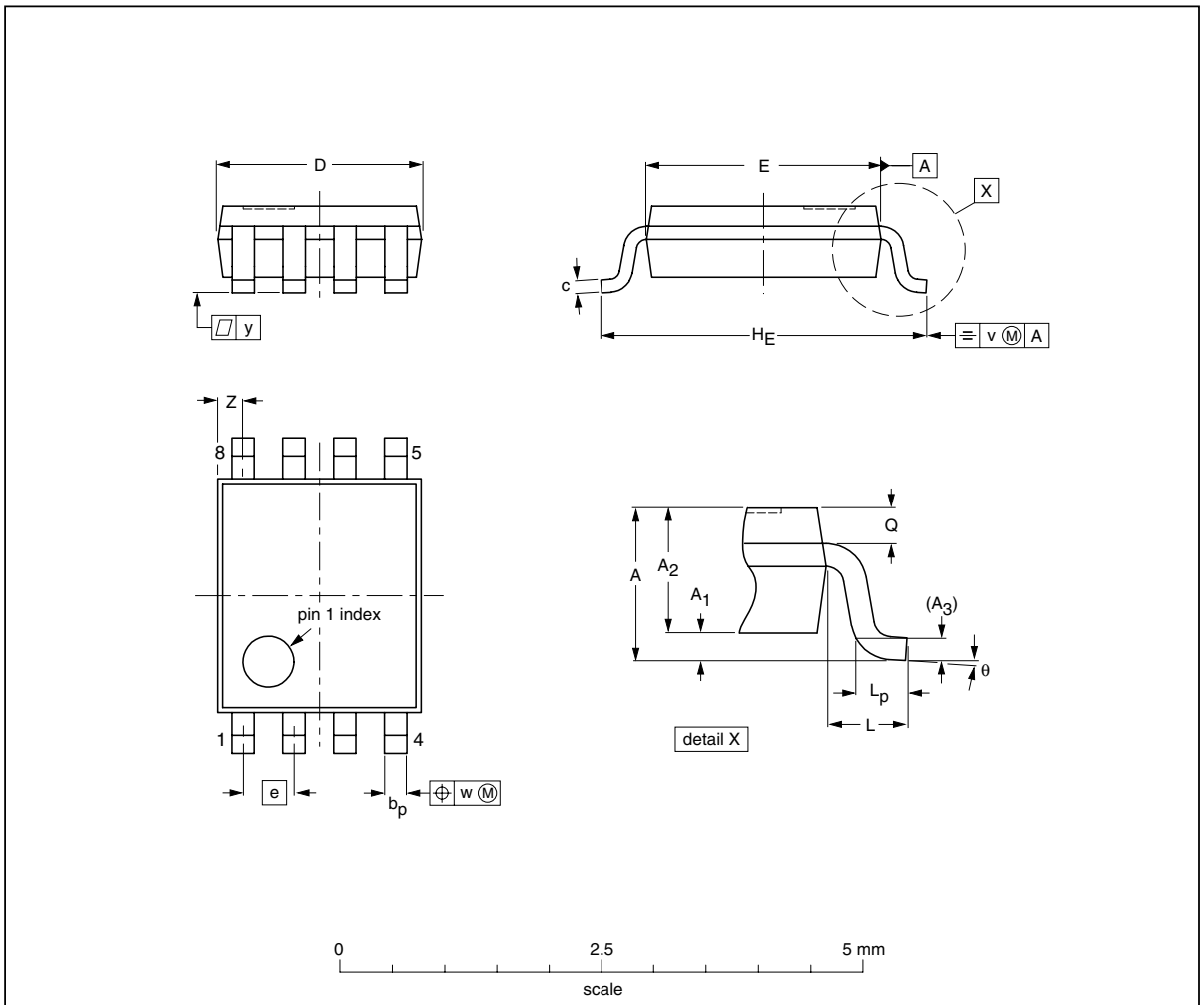
(2) Negative-going edge.

Linear change of $V_I$ between 0.8 V and 2.0 V. All values given are typical, unless otherwise specified.

**Fig 14. Average $I_{CC}$ as a function of $V_{CC}$**

## 17. 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1 | 0.15<br>0.00 | 0.85<br>0.60 | 0.12 | 0.27<br>0.17 | 0.23<br>0.08 | 2.1<br>1.9 | 2.4<br>2.2 | 0.5 | 3.2<br>3.0 | 0.4 | 0.40<br>0.15 | 0.21<br>0.19 | 0.2 | 0.13 | 0.1 | 0.4<br>0.1 | 8°<br>0° |

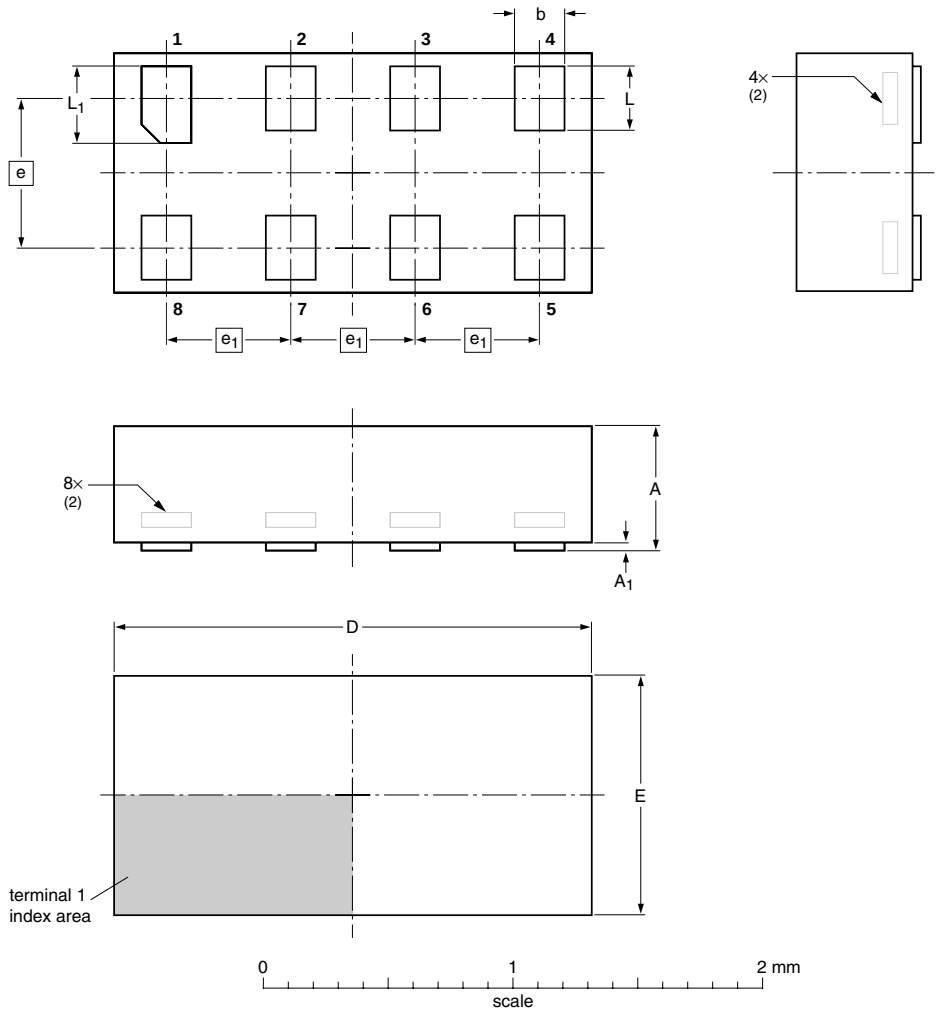
**Notes**

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.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT765-1 | | MO-187 | | | | 02-06-07 |

**Fig 15. 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 | A1 max | b | D | E | e | e1 | L | L1 |
|---|---|---|---|---|---|---|---|---|---|
| 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 |

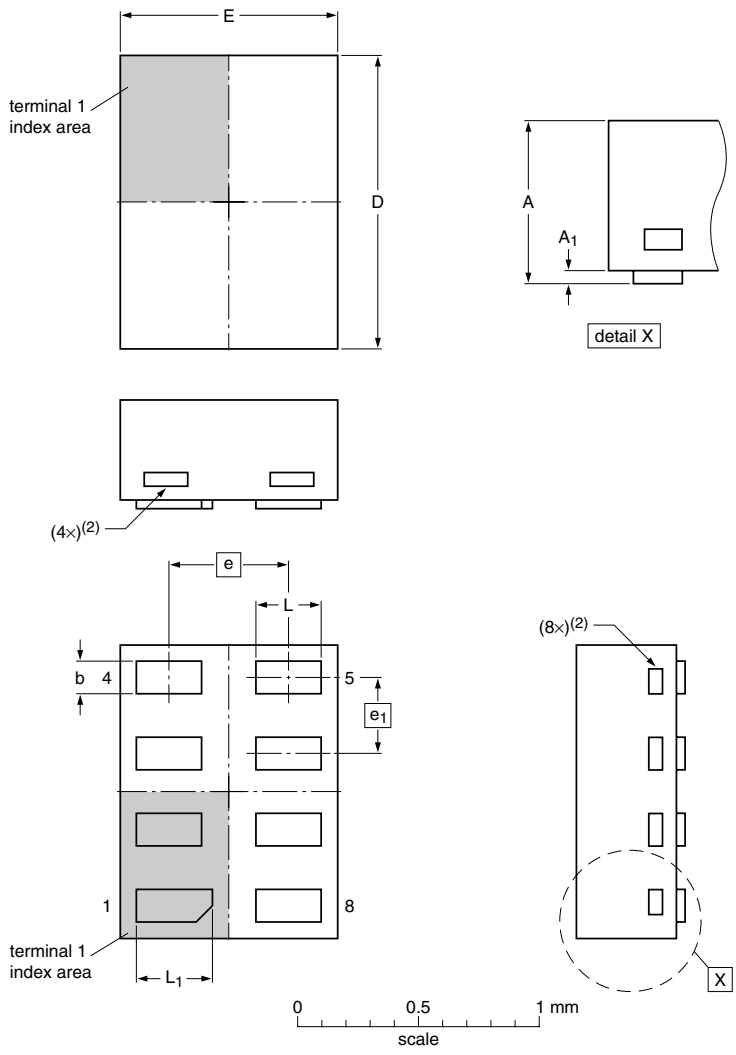
**Notes**

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 16. 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) | A1 | b | D | E | e | e1 | L | L1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

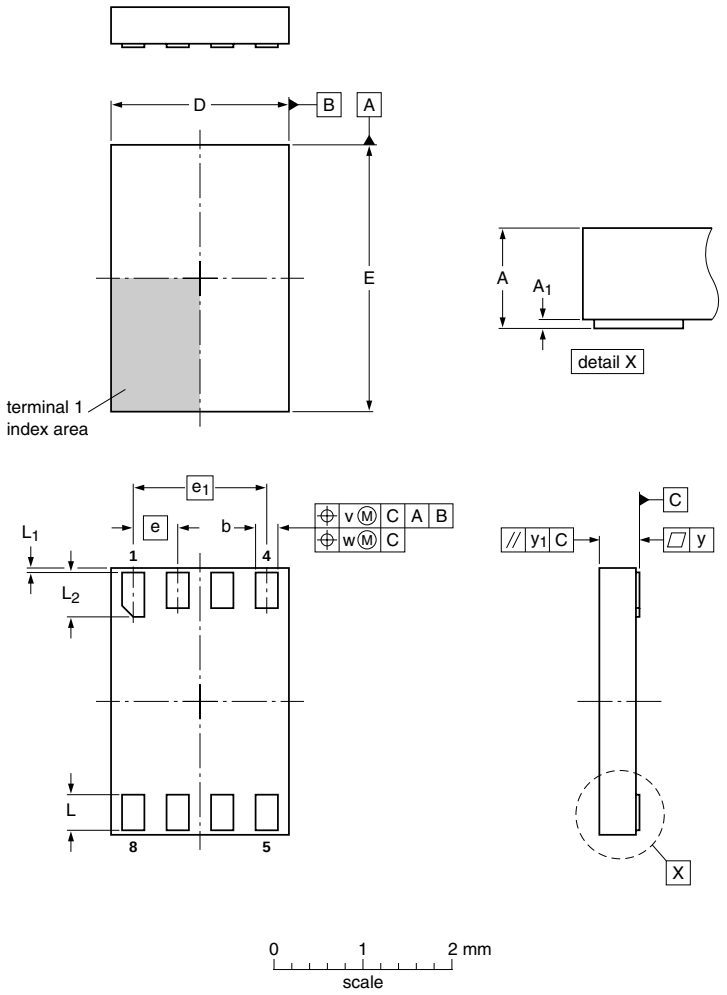
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1089_po*

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

**Fig 17. Package outline SOT1089 (XSON8)**

**XSON8U: plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 x 2 x 0.5 mm** **SOT996-2**



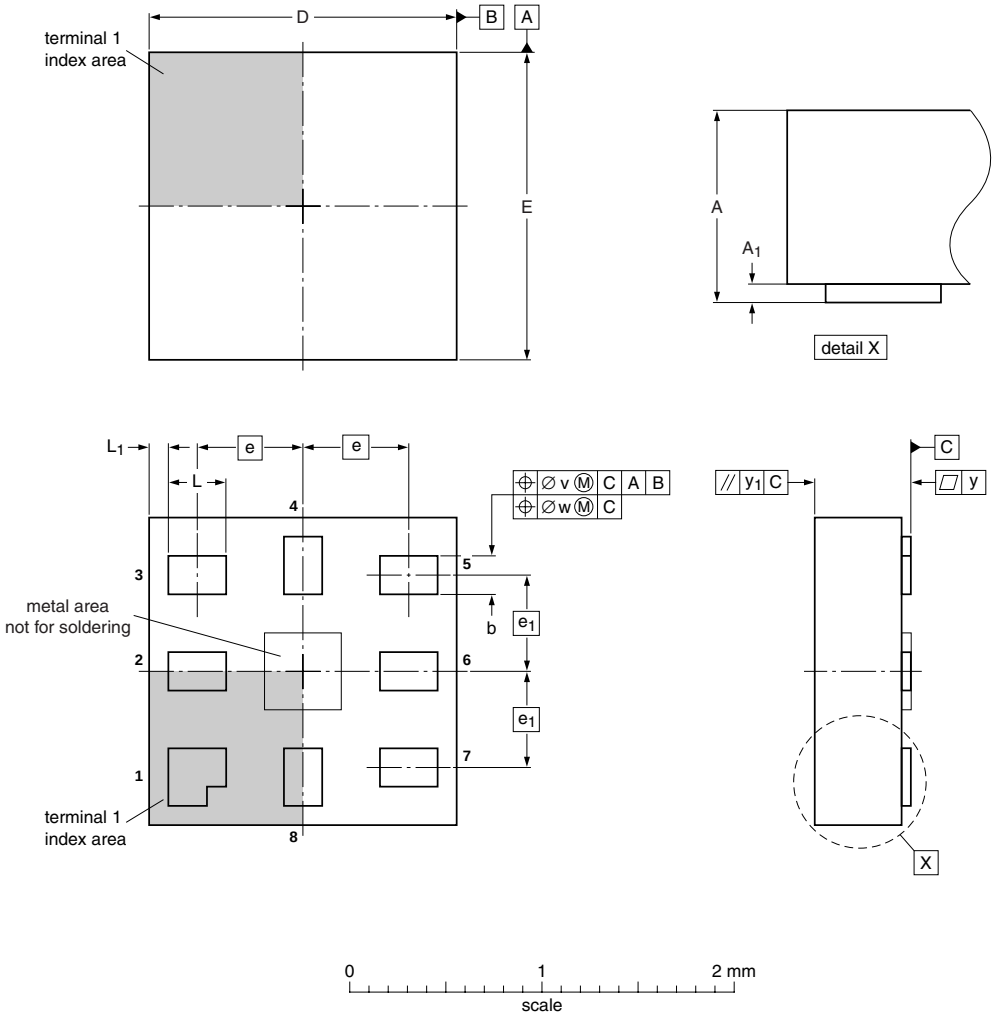

**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max | $A_1$ | b | D | E | e | $e_1$ | L | $L_1$ | $L_2$ | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 0.5 | 0.05<br>0.00 | 0.35<br>0.15 | 2.1<br>1.9 | 3.1<br>2.9 | 0.5 | 1.5 | 0.5<br>0.3 | 0.15<br>0.05 | 0.6<br>0.4 | 0.1 | 0.05 | 0.05 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT996-2 | - - - | | - - - | | | ~~07-12-18~~<br>07-12-21 |

**Fig 18. Package outline SOT996-2 (XSON8U)**

**XQFN8U: plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 x 1.6 x 0.5 mm** **SOT902-1**



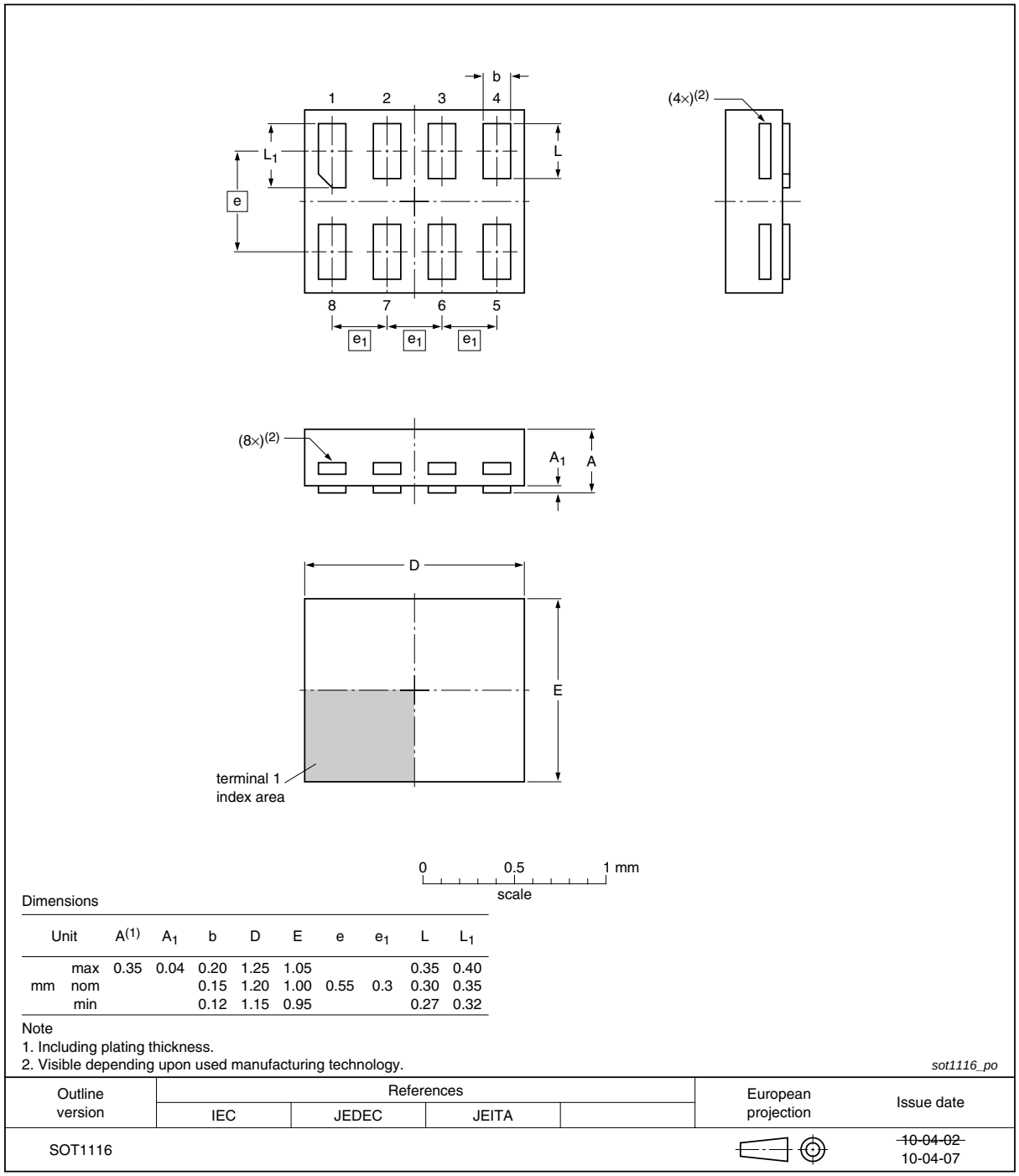

**DIMENSIONS (mm are the original dimensions)**

| UNIT | A max | $A_1$ | b | D | E | e | $e_1$ | L | $L_1$ | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 0.5 | 0.05<br>0.00 | 0.25<br>0.15 | 1.65<br>1.55 | 1.65<br>1.55 | 0.55 | 0.5 | 0.35<br>0.25 | 0.15<br>0.05 | 0.1 | 0.05 | 0.05 | 0.05 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT902-1 | - - - | MO-255 | - - - | | | ~~05-11-25~~<br>07-11-14 |

**Fig 19. Package outline SOT902-1 (XQFN8U)**

**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) | A1 | b | D | E | e | e1 | L | L1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

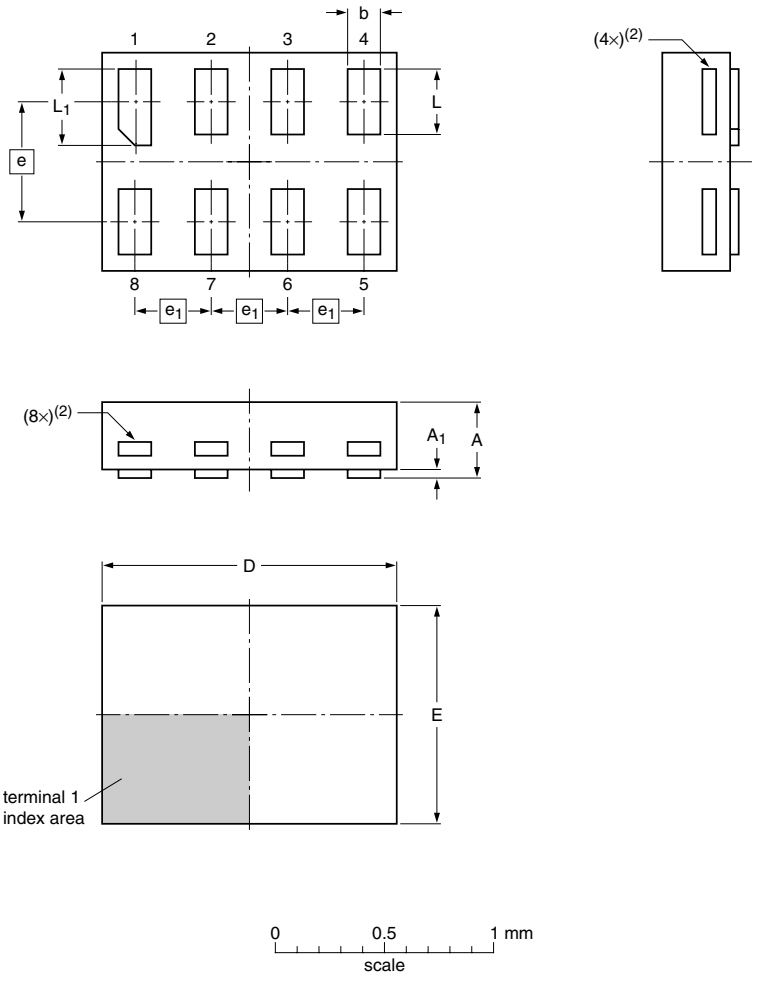
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1116_po*

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

**Fig 20. 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) | A1 | b | D | E | e | e1 | L | L1 |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 21. Package outline SOT1203 (XSON8)**

## 18. Abbreviations

**Table 12. Abbreviations**

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

## 19. Revision history

**Table 13. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74AUP2G132 v.4 | 20101104 | Product data sheet | - | 74AUP2G132 v.3 |
| Modifications: | • Added type number 74AUP2G132GF (SOT1089/XSON8 package).<br>• Added type number 74AUP2G132GN (SOT1116/XSON8 package).<br>• Added type number 74AUP2G132GS (SOT1203/XSON8 package). | | | |
| 74AUP2G132 v.3 | 20081215 | Product data sheet | - | 74AUP2G132 v.2 |
| 74AUP2G132 v.2 | 20080314 | Product data sheet | - | 74AUP2G132 v.1 |
| 74AUP2G132 v.1 | 20061018 | Product data sheet | - | - |

# 20. Legal information

## 20.1 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.nxp.com.

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