# 74AUP1G14

## Low-power Schmitt-trigger inverter

**Rev. 01 — 20 July 2005** **Product data sheet**

## 1. General description

The 74AUP1G14 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

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.

The 74AUP1G14 provides a single inverting Schmitt-trigger which accepts standard input signals. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The inputs switch at different points for positive and negative-going signals. The difference between the positive voltage $V_{(th)LH}$ and the negative voltage $V_{(th)HL}$ is defined as the input hysteresis voltage $V_{hys}$.

## 2. Features

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- ESD protection:
  - HBM JESD22-A114-C exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101-C 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

PHILIPS

## 4. Quick reference data

**Table 1: Quick reference data**

*GND = 0 V; $T_{amb}$ = 25 °C; $t_r$ = $t_f$ ≤ 3 ns.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 0.8 V | | - | 20.3 | - | ns |
| | | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 1.1 V to 1.3 V | | 3.0 | 5.9 | 11.7 | ns |
| | | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 1.4 V to 1.6 V | | 2.6 | 4.3 | 7.6 | ns |
| | | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 1.65 V to 1.95 V | | 2.2 | 3.7 | 6.2 | ns |
| | | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 2.3 V to 2.7 V | | 2.0 | 3.1 | 4.8 | ns |
| | | $C_L$ = 5 pF; $R_L$ = 1 MΩ; $V_{CC}$ = 3.0 V to 3.6 V | | 1.9 | 2.8 | 4.0 | ns |
| $C_i$ | input capacitance | | | - | 0.8 | - | pF |
| $C_{PD}$ | power dissipation capacitance | $V_{CC}$ = 1.8 V; f = 10 MHz | [1] [2] | - | 4.6 | - | pF |
| | | $V_{CC}$ = 3.3 V; f = 10 MHz | [1] [2] | - | 6.1 | - | pF |

[1] $C_{PD}$ 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.

[2] The condition is $V_I$ = GND to $V_{CC}$.

## 5. Ordering information

**Table 2: Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74AUP1G14GW | –40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74AUP1G14GM | –40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |

## 6. Marking

**Table 3: Marking**

| Type number | Marking code |
|---|---|
| 74AUP1G14GW | pF |
| 74AUP1G14GM | pF |

# 7. Functional diagram

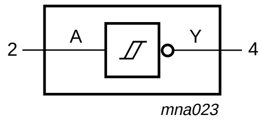



**Fig 1. Logic symbol**

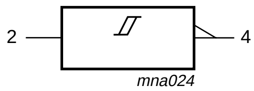



**Fig 2. IEC logic symbol**

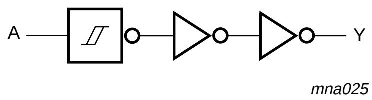



**Fig 3. Logic diagram**

# 8. Pinning information

## 8.1 Pinning

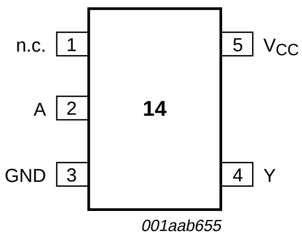



**Fig 4. Pin configuration SOT353-1 (TSSOP5)**

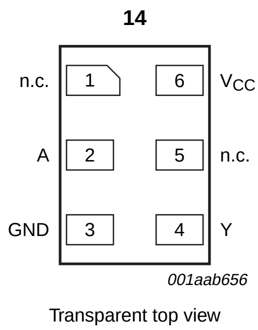



**Fig 5. Pin configuration SOT886 (XSON6)**

## 8.2 Pin description

**Table 4: Pin description**

| Symbol | Pin | | Description |
|---|---|---|---|
| | TSSOP5 | XSON6 | |
| n.c. | 1 | 1 | not connected |
| A | 2 | 2 | data input A |
| GND | 3 | 3 | ground (0 V) |
| Y | 4 | 4 | data output Y |
| n.c. | - | 5 | not connected |
| $V_{CC}$ | 5 | 6 | supply voltage |

# 9. Functional description

## 9.1 Function table

**Table 5: Function table [1]**

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

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

# 10. 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 |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | | - | –50 | mA |
| $V_I$ | input voltage | | [1] | –0.5 | +4.6 | V |
| $I_{OK}$ | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | | - | ±50 | mA |
| $V_O$ | output voltage | active mode | [1] | –0.5 | $V_{CC}$ + 0.5 | V |
| | | Power-down mode | [1] | –0.5 | +4.6 | V |
| $I_O$ | output current | $V_O$ = 0 V to $V_{CC}$ | | - | ±20 | mA |
| $I_{CC}$ | quiescent 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 input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For TSSOP5 packages: above 87.5 °C the value of $P_{tot}$ derates linearly with 4.0 mW/K.
For XSON6 packages: above 45 °C the value of $P_{tot}$ derates linearly with 2.4 mW/K.

## 11. Recommended operating conditions

**Table 7: Recommended 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 |

## 12. 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** | | | | | | |
| $V_{OH}$ | HIGH-state 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-state 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 |
| $I_{LI}$ | 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 |
| $I_{CC}$ | quiescent 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 quiescent supply current | $V_I = V_{CC}$ – 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 3.3 V | - | - | 40 | µA |
| $C_i$ | input capacitance | $V_I$ = GND or $V_{CC}$; $V_{CC}$ = 0 V to 3.6 V | - | 0.8 | - | pF |
| $C_o$ | output capacitance | $V_O$ = GND; $V_{CC}$ = 0 V | - | 1.7 | - | pF |

**Table 8: Static characteristics** *...continued*

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{amb}$ = –40 °C to +85 °C | | | | | | |
| $V_{OH}$ | HIGH-state 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-state 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 |
| $I_{LI}$ | 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 |
| $I_{CC}$ | quiescent 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 quiescent supply current | $V_I = V_{CC}$ – 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 3.3 V | - | - | 50 | µA |
| $T_{amb}$ = –40 °C to +125 °C | | | | | | |
| $V_{OH}$ | HIGH-state 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 |

**Table 8: 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-state output voltage | $V_I = V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O = 20\ \mu A$; $V_{CC} = 0.8$ V to 3.6 V | - | - | 0.11 | V |
| | | $I_O = 1.1$ mA; $V_{CC} = 1.1$ V | - | - | $0.33 \times V_{CC}$ | 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 |
| $I_{LI}$ | 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 |
| $I_{CC}$ | quiescent 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 quiescent supply current | $V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 3.3$ V | - | - | 75 | µA |

## 13. Dynamic characteristics

**Table 9: Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7*

| Symbol | Parameter | Conditions | Min | Typ [1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = 25 °C; $C_L$ = 5 pF** | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | |
| | | $V_{CC} = 0.8$ V | - | 20.3 | - | ns |
| | | $V_{CC} = 1.1$ V to 1.3 V | 3.0 | 5.9 | 11.7 | ns |
| | | $V_{CC} = 1.4$ V to 1.6 V | 2.6 | 4.3 | 7.6 | ns |
| | | $V_{CC} = 1.65$ V to 1.95 V | 2.2 | 3.7 | 6.2 | ns |
| | | $V_{CC} = 2.3$ V to 2.7 V | 2.0 | 3.1 | 4.8 | ns |
| | | $V_{CC} = 3.0$ V to 3.6 V | 1.9 | 2.8 | 4.0 | ns |
| **$T_{amb}$ = 25 °C; $C_L$ = 10 pF** | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | |
| | | $V_{CC} = 0.8$ V | - | 23.9 | - | ns |
| | | $V_{CC} = 1.1$ V to 1.3 V | 3.5 | 6.7 | 13.4 | ns |
| | | $V_{CC} = 1.4$ V to 1.6 V | 3.0 | 5.0 | 8.7 | ns |
| | | $V_{CC} = 1.65$ V to 1.95 V | 2.7 | 4.3 | 7.0 | ns |
| | | $V_{CC} = 2.3$ V to 2.7 V | 2.4 | 3.6 | 5.5 | ns |
| | | $V_{CC} = 3.0$ V to 3.6 V | 2.4 | 3.4 | 4.6 | ns |

**Table 9: Dynamic characteristics** *...continued*
*Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7*

| Symbol | Parameter | Conditions | | Min | Typ [1] | Max | Unit |
|---|---|---|---|---|---|---|---|
| **$T_{amb}$ = 25 °C; $C_L$ = 15 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 0.8 V | | - | 27.3 | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | | 3.9 | 7.5 | 14.0 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | | 3.3 | 5.5 | 9.7 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | | 3.0 | 4.7 | 7.9 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | 2.8 | 4.1 | 5.9 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | | 2.7 | 3.8 | 5.0 | ns |
| **$T_{amb}$ = 25 °C; $C_L$ = 30 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 0.8 V | | - | 37.7 | - | ns |
| | | $V_{CC}$ = 1.1 V to 1.3 V | | 5.1 | 9.8 | 17.8 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | | 4.3 | 7.1 | 12.3 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | | 3.9 | 6.0 | 10.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | 3.6 | 5.2 | 7.4 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | | 3.5 | 4.9 | 6.3 | ns |
| **$T_{amb}$ = 25 °C** | | | | | | | |
| $C_{PD}$ | power dissipation capacitance | f = 10 MHz | [2] [3] | | | | |
| | | $V_{CC}$ = 0.8 V | | - | 3.4 | - | pF |
| | | $V_{CC}$ = 1.1 V to 1.3 V | | - | 3.9 | - | pF |
| | | $V_{CC}$ = 1.4 V to 1.6 V | | - | 4.2 | - | pF |
| | | $V_{CC}$ = 1.65 V to 1.95 V | | - | 4.6 | - | pF |
| | | $V_{CC}$ = 2.3 V to 2.7 V | | - | 5.4 | - | pF |
| | | $V_{CC}$ = 3.0 V to 3.6 V | | - | 6.1 | - | pF |

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

[2] $C_{PD}$ 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.

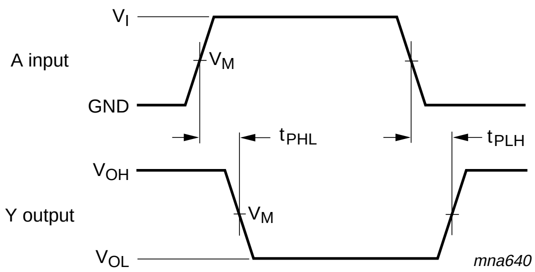
[3] The condition is $V_I$ = GND to $V_{CC}$.

**Table 10: Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7*

| Symbol | Parameter | Conditions | –40 °C to +85 °C | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | |
| **$C_L$ = 5 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 2.2 | 13.6 | 2.2 | 15.0 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 1.8 | 8.9 | 1.8 | 9.8 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 1.9 | 7.3 | 1.9 | 8.1 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | 5.9 | 1.7 | 6.5 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.7 | 4.9 | 1.7 | 5.4 | ns |
| **$C_L$ = 10 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 2.5 | 15.8 | 2.5 | 17.4 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 2.2 | 10.3 | 2.2 | 11.4 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 2.3 | 8.4 | 2.3 | 9.3 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 2.1 | 6.8 | 2.1 | 7.5 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.1 | 5.6 | 2.1 | 6.2 | ns |
| **$C_L$ = 15 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 2.8 | 17.3 | 2.8 | 19.1 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 2.9 | 11.5 | 2.9 | 12.7 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 2.6 | 9.4 | 2.6 | 10.4 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 2.5 | 7.4 | 2.5 | 8.2 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 2.4 | 6.1 | 2.4 | 6.8 | ns |
| **$C_L$ = 30 pF** | | | | | | | |
| $t_{PHL}$, $t_{PLH}$ | propagation delay A to Y | see Figure 6 | | | | | |
| | | $V_{CC}$ = 1.1 V to 1.3 V | 4.5 | 20.5 | 4.5 | 22.6 | ns |
| | | $V_{CC}$ = 1.4 V to 1.6 V | 3.8 | 14.7 | 3.8 | 16.2 | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 3.4 | 12.0 | 3.4 | 13.2 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 3.3 | 8.8 | 3.3 | 9.7 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 3.2 | 7.3 | 3.2 | 8.1 | ns |

## 14. Waveforms



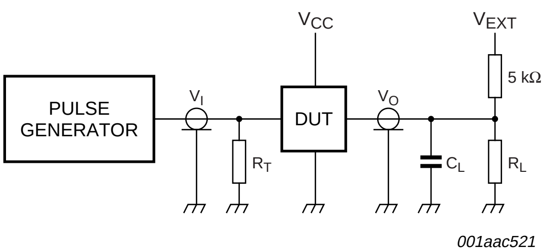

Measurement points are given in Table 11.

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

**Fig 6. The data input (A) to output (Y) propagation delays**

**Table 11: 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 12.

Definitions for test circuit:

$R_L$ = Load resistor

$C_L$ = Load capacitance including jig and probe capacitance

$R_T$ = Termination resistance should be equal to the output impedance $Z_o$ of the pulse generator

**Fig 7. Load circuitry for switching times**

**Table 12: 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.

## 15. Transfer characteristics

**Table 13: Transfer characteristics**

*Voltages are referenced to GND (ground = 0 V; for test circuit see Figure 7*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $T_{amb}$ = 25 °C | | | | | | |
| $V_{(th)LH}$ | positive-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.30 | - | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.53 | - | 0.90 | V |
| | | $V_{CC}$ = 1.4 V | 0.74 | - | 1.11 | V |
| | | $V_{CC}$ = 1.65 V | 0.91 | - | 1.29 | V |
| | | $V_{CC}$ = 2.3 V | 1.37 | - | 1.77 | V |
| | | $V_{CC}$ = 3.0 V | 1.88 | - | 2.29 | V |
| $V_{(th)HL}$ | negative-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.10 | - | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.26 | - | 0.65 | V |
| | | $V_{CC}$ = 1.4 V | 0.39 | - | 0.75 | V |
| | | $V_{CC}$ = 1.65 V | 0.47 | - | 0.84 | V |
| | | $V_{CC}$ = 2.3 V | 0.69 | - | 1.04 | V |
| | | $V_{CC}$ = 3.0 V | 0.88 | - | 1.24 | V |
| $V_{hys}$ | hysteresis voltage ($V_{(th)LH} - V_{(th)HL}$) | see Figure 8, Figure 9, Figure 10 and Figure 11 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.07 | - | 0.50 | V |
| | | $V_{CC}$ = 1.1 V | 0.08 | - | 0.46 | V |
| | | $V_{CC}$ = 1.4 V | 0.18 | - | 0.56 | V |
| | | $V_{CC}$ = 1.65 V | 0.27 | - | 0.66 | V |
| | | $V_{CC}$ = 2.3 V | 0.53 | - | 0.92 | V |
| | | $V_{CC}$ = 3.0 V | 0.79 | - | 1.31 | V |
| $T_{amb}$ = −40 °C to +85 °C | | | | | | |
| $V_{(th)LH}$ | positive-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.30 | - | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.53 | - | 0.90 | V |
| | | $V_{CC}$ = 1.4 V | 0.74 | - | 1.11 | V |
| | | $V_{CC}$ = 1.65 V | 0.91 | - | 1.29 | V |
| | | $V_{CC}$ = 2.3 V | 1.37 | - | 1.77 | V |
| | | $V_{CC}$ = 3.0 V | 1.88 | - | 2.29 | V |
| $V_{(th)HL}$ | negative-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.10 | - | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.26 | - | 0.65 | V |
| | | $V_{CC}$ = 1.4 V | 0.39 | - | 0.75 | V |
| | | $V_{CC}$ = 1.65 V | 0.47 | - | 0.84 | V |
| | | $V_{CC}$ = 2.3 V | 0.69 | - | 1.04 | V |
| | | $V_{CC}$ = 3.0 V | 0.88 | - | 1.24 | V |

**Table 13: Transfer characteristics** *…continued*

*Voltages are referenced to GND (ground = 0 V; for test circuit see Figure 7*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{hys}$ | hysteresis voltage ($V_{(th)LH} - V_{(th)HL}$) | see Figure 8, Figure 9, Figure 10 and Figure 11 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.07 | - | 0.50 | V |
| | | $V_{CC}$ = 1.1 V | 0.08 | - | 0.46 | V |
| | | $V_{CC}$ = 1.4 V | 0.18 | - | 0.56 | V |
| | | $V_{CC}$ = 1.65 V | 0.27 | - | 0.66 | V |
| | | $V_{CC}$ = 2.3 V | 0.53 | - | 0.92 | V |
| | | $V_{CC}$ = 3.0 V | 0.79 | - | 1.31 | V |
| **$T_{amb}$ = −40 °C to +125 °C** | | | | | | |
| $V_{(th)LH}$ | positive-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.30 | - | 0.62 | V |
| | | $V_{CC}$ = 1.1 V | 0.53 | - | 0.92 | V |
| | | $V_{CC}$ = 1.4 V | 0.74 | - | 1.13 | V |
| | | $V_{CC}$ = 1.65 V | 0.91 | - | 1.31 | V |
| | | $V_{CC}$ = 2.3 V | 1.37 | - | 1.80 | V |
| | | $V_{CC}$ = 3.0 V | 1.88 | - | 2.32 | V |
| $V_{(th)HL}$ | negative-going threshold voltage | see Figure 8 and Figure 9 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.10 | - | 0.60 | V |
| | | $V_{CC}$ = 1.1 V | 0.26 | - | 0.65 | V |
| | | $V_{CC}$ = 1.4 V | 0.39 | - | 0.75 | V |
| | | $V_{CC}$ = 1.65 V | 0.47 | - | 0.84 | V |
| | | $V_{CC}$ = 2.3 V | 0.69 | - | 1.04 | V |
| | | $V_{CC}$ = 3.0 V | 0.88 | - | 1.24 | V |
| $V_{hys}$ | hysteresis voltage ($V_{(th)LH} - V_{(th)HL}$) | see Figure 8, Figure 9, Figure 10 and Figure 11 | | | | |
| | | $V_{CC}$ = 0.8 V | 0.07 | - | 0.50 | V |
| | | $V_{CC}$ = 1.1 V | 0.08 | - | 0.46 | V |
| | | $V_{CC}$ = 1.4 V | 0.18 | - | 0.56 | V |
| | | $V_{CC}$ = 1.65 V | 0.27 | - | 0.66 | V |
| | | $V_{CC}$ = 2.3 V | 0.53 | - | 0.92 | V |
| | | $V_{CC}$ = 3.0 V | 0.79 | - | 1.31 | V |

## 16. Waveforms transfer characteristics

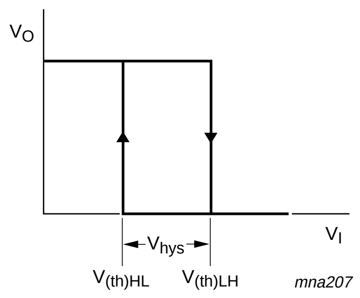
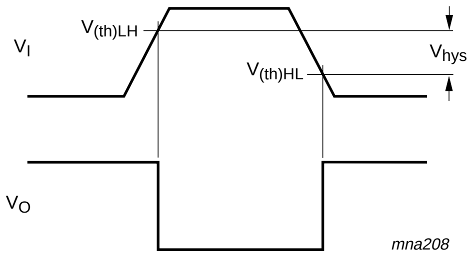



Fig 8. Transfer characteristic




$V_{(th)LH}$ and $V_{(th)HL}$ limits at 70 % and 20 %.

Fig 9. Definition of $V_{(th)LH}$, $V_{(th)HL}$ and $V_{hys}$

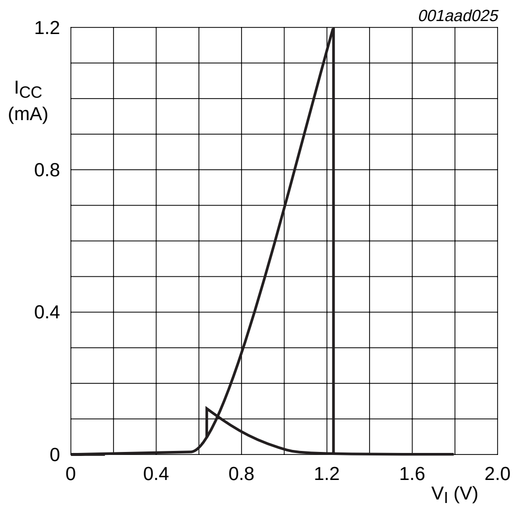



Fig 10. Typical transfer characteristics; $V_{CC}$ = 1.8 V

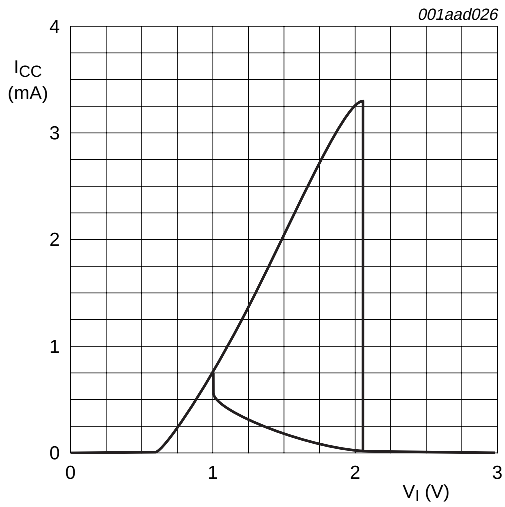



**Fig 11. Typical transfer characteristics; $V_{CC}$ = 3.0 V**

## 17. Application information

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

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

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

$f_i$ = input frequency (MHz);

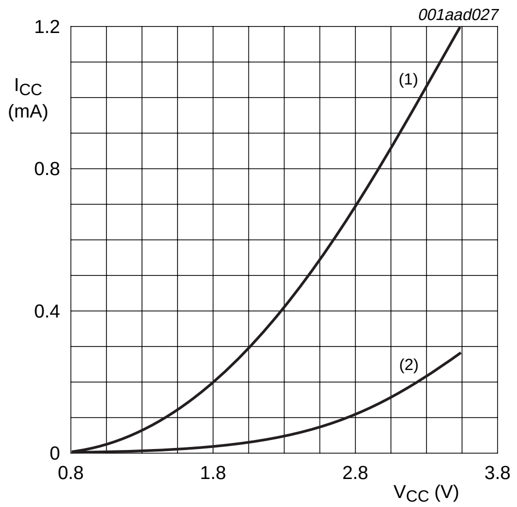
$t_r$ = input rise time (ns); 10 % to 90 %;

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

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

Average $I_{CC}$ differs with positive or negative input transitions, as shown in Figure 12.

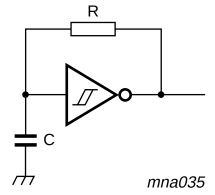
An example of a relaxation circuit using the 74AUP1G14 is shown in Figure 13.




(1) Positive-going edge.

(2) Negative-going edge.

**Fig 12. Average $I_{CC}$ as a function of $V_{CC}$**




$$f = \frac{1}{T} \approx \frac{1}{a \times RC}$$

Average values for variable a are given in Table 14.

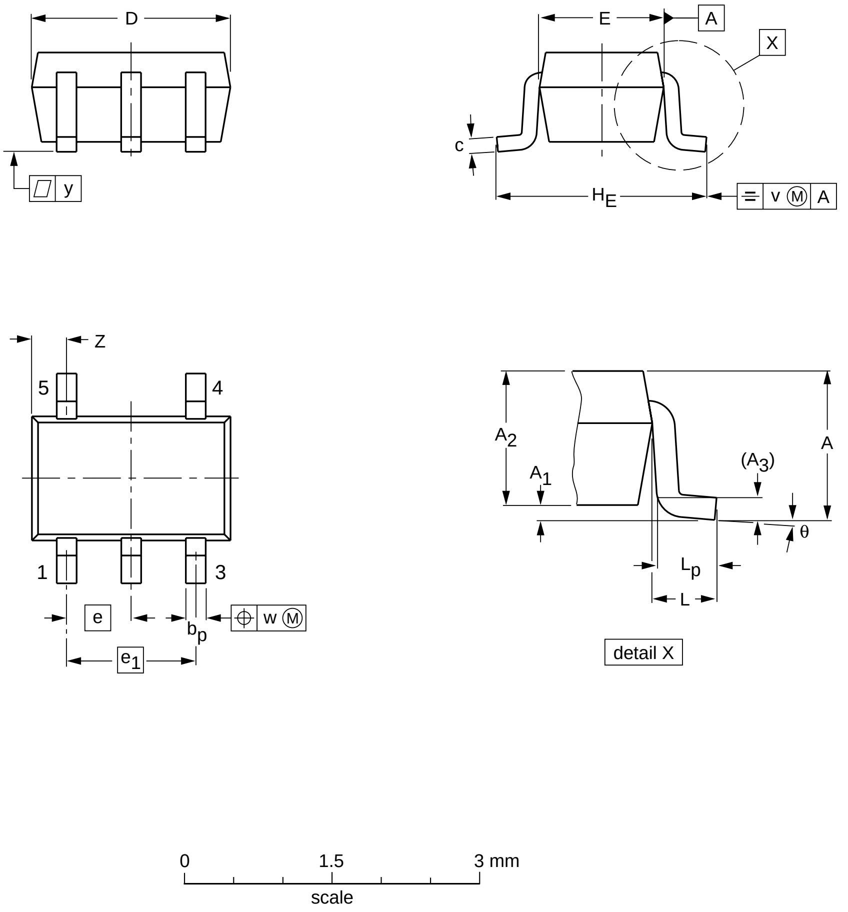
**Fig 13. Relaxation oscillator**

**Table 14: Variable values**

| Supply voltage | Variable a |
|---|---|
| 1.1 V | 1.28 |
| 1.5 V | 1.22 |
| 1.8 V | 1.24 |
| 2.8 V | 1.34 |
| 3.3 V | 1.45 |

## 18. Package outline

**TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm** **SOT353-1**




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

| UNIT | A max. | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | D(1) | E(1) | e | $e_1$ | $H_E$ | L | $L_p$ | v | w | y | Z(1) | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.1 | 0.1<br>0 | 1.0<br>0.8 | 0.15 | 0.30<br>0.15 | 0.25<br>0.08 | 2.25<br>1.85 | 1.35<br>1.15 | 0.65 | 1.3 | 2.25<br>2.0 | 0.425 | 0.46<br>0.21 | 0.3 | 0.1 | 0.1 | 0.60<br>0.15 | 7°<br>0° |

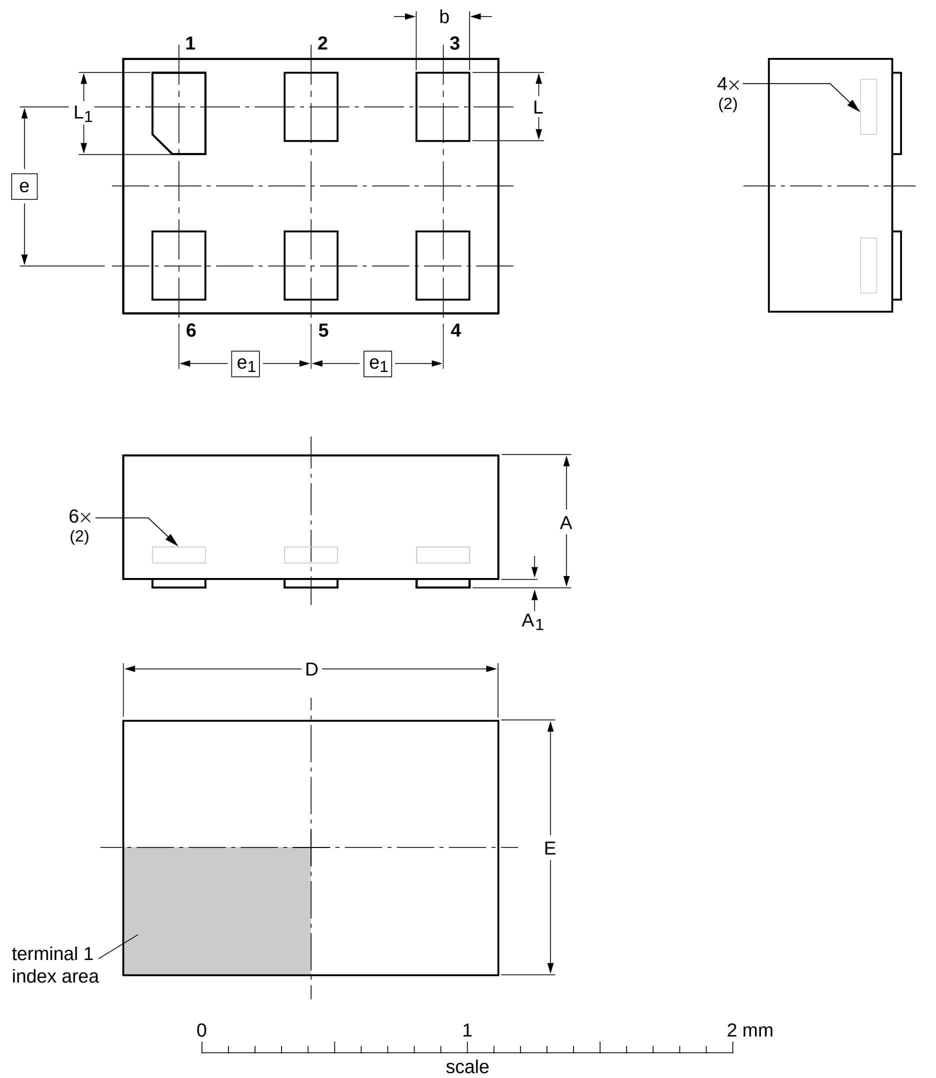
**Note**

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

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT353-1 | | MO-203 | SC-88A | | | ~~00-09-01~~<br>03-02-19 |

**Fig 14. Package outline SOT353-1 (TSSOP5)**

**XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm** **SOT886**




**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 | 1.5<br>1.4 | 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 | | | |
| SOT886 | | MO-252 | | | | ~~04-07-15~~<br>04-07-22 |

**Fig 15. Package outline SOT886 (XSON6)**

## 19. Abbreviations

**Table 15: Abbreviations**

| Acronym | Description |
|---|---|
| CMOS | Complementary Metal Oxide Semiconductor |
| TTL | Transistor Transistor Logic |
| HBM | Human Body Model |
| ESD | ElectroStatic Discharge |
| MM | Machine Model |
| CDM | Charged Device Model |

## 20. Revision history

**Table 16: Revision history**

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|---|---|---|---|---|---|
| 74AUP1G14_1 | 20050720 | Product data sheet | - | 9397 750 14676 | - |

## 21. Data sheet status

| Level | Data sheet status [1] | Product status [2] [3] | Definition |
|---|---|---|---|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
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[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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## 26. Contents





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