

# 74AUP1G80

Low-power D-type flip-flop; positive-edge trigger

Rev. 01 — 20 October 2006

Product data sheet

## 1. General description

The 74AUP1G80 is a high-performance, low-power, low-voltage, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

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

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

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

The 74AUP1G80 provides the single positive-edge triggered D-type flip-flop. Information on the data input is transferred to the  $\bar{Q}$  output on the LOW-to-HIGH transition of the clock pulse. The input pin D must be stable one set-up time prior to the LOW-to-HIGH clock transition for predictable operation.

## 2. Features

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114-D exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101-C exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu\text{A}$  (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Low noise overshoot and undershoot < 10 % of  $V_{CC}$
- $I_{OFF}$  circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from  $-40 \text{ }^\circ\text{C}$  to  $+85 \text{ }^\circ\text{C}$  and  $-40 \text{ }^\circ\text{C}$  to  $+125 \text{ }^\circ\text{C}$

### 3. Ordering information

Table 1. Ordering information

| Type number | Package           |        |   | Version  |
|-------------|-------------------|--------|---|----------|
|             | Temperature range | Name   | Description   |          |
| 74AUP1G80GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm                      | SOT353-1 |
| 74AUP1G80GM | -40 °C to +125 °C | XSON6  | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886   |
| 74AUP1G80GF | -40 °C to +125 °C | XSON6  | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm    | SOT891   |

### 4. Marking

Table 2. Marking

| Type number | Marking code |
|-------------|--------------|
| 74AUP1G80GW | pT           |
| 74AUP1G80GM | pT           |
| 74AUP1G80GF | pT           |

### 5. Functional diagram

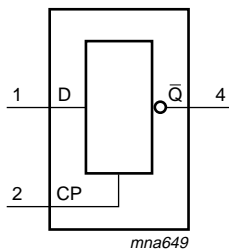


Fig 1. Logic symbol

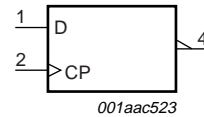


Fig 2. IEC logic symbol

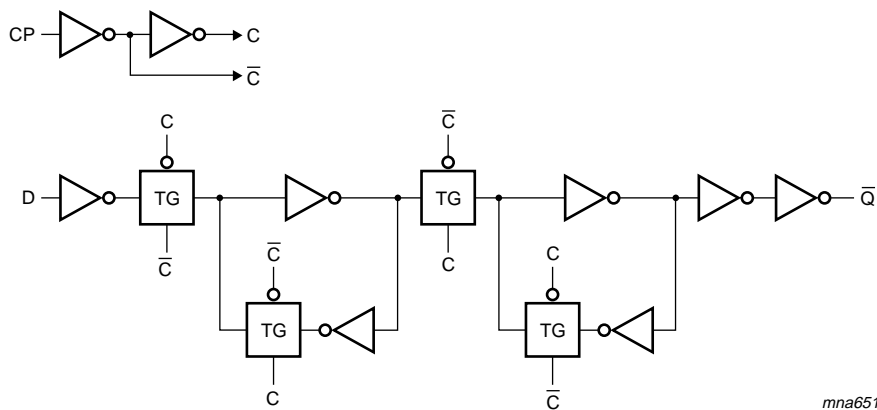
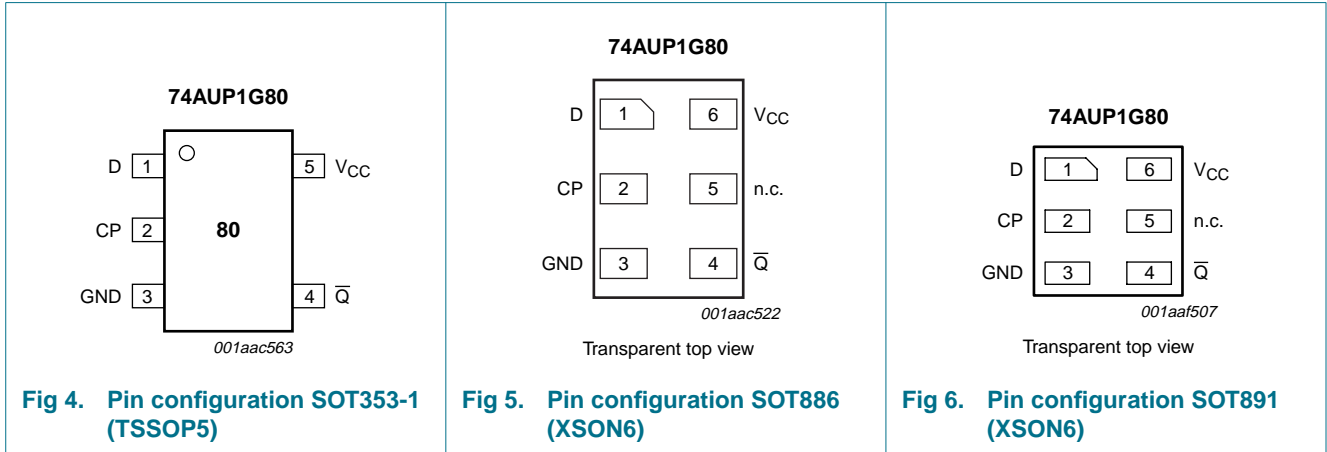


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3. Pin description

| Symbol          | Pin    |       | Description           |
|-----------------|--------|-------|-----------------------|
|                 | TSSOP5 | XSON6 |                       |
| D               | 1      | 1     | data input D          |
| CP              | 2      | 2     | clock pulse input CP  |
| GND             | 3      | 3     | ground (0 V)          |
| $\bar{Q}$       | 4      | 4     | data output $\bar{Q}$ |
| n.c.            | -      | 5     | not connected         |
| V <sub>CC</sub> | 5      | 6     | supply voltage        |

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

| Input |   |  | Output    |
|-------|---|--|-----------|
| CP    | D |  | $\bar{Q}$ |
| ↑     | L |  | H         |
| ↑     | H |  | L         |
| L     | X |  | $\bar{q}$ |

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 ↑ = LOW-to-HIGH CP transition;  
 X = don't care;  
 $\bar{q}$  = lower case letter indicates the state of referenced input, one set-up time prior to the LOW-to-HIGH CP transition.

## 8. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter               | Conditions                      | Min      | Max  | Unit |
|-----------|-------------------------|---------------------------------|----------|------|------|
| $V_{CC}$  | supply voltage          |                                 | -0.5     | +4.6 | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ 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 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.

## 9. Recommended operating conditions

**Table 6. 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 and Power-down mode | 0   | 3.6  | V    |
| $T_{amb}$           | ambient temperature                 |                                 | -40 | +125 | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8$ V to 3.6 V       | 0   | 200  | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

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

| Symbol                         | Parameter                            | Conditions   | Min                    | Typ | Max                    | Unit |
|--------------------------------|--------------------------------------|--|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = 25 °C</b> |                                      |  |                        |     |                        |      |
| V <sub>IH</sub>                | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V  | 0.70 × V <sub>CC</sub> | -   | -                      | V    |
|                                |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.65 × V <sub>CC</sub> | -   | -                      | V    |
|                                |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -   | -                      | V    |
|                                |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -   | -                      | V    |
| V <sub>IL</sub>                | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V  | -                      | -   | 0.30 × V <sub>CC</sub> | V    |
|                                |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -   | 0.35 × V <sub>CC</sub> | V    |
|                                |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -   | 0.7                    | V    |
|                                |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -   | 0.9                    | V    |
| V <sub>OH</sub>                | HIGH-level output voltage            | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|                                |                                      | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.1  | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.11                   | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.32                   | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 2.05                   | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.9                    | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.72                   | -   | -                      | V    |
|                                |                                      | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V  | 2.6                    | -   | -                      | V    |
| V <sub>OL</sub>                | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|                                |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -   | 0.1                    | V    |
|                                |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -   | 0.3 × V <sub>CC</sub>  | V    |
|                                |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -   | 0.31                   | V    |
|                                |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -   | 0.31                   | V    |
|                                |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.31                   | V    |
|                                |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.44                   | V    |
|                                |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.31                   | V    |
|                                |                                      | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.44                   | V    |
| I <sub>I</sub>                 | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -   | ±0.1                   | μA   |
| I <sub>OFF</sub>               | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -   | ±0.2                   | μA   |
| ΔI <sub>OFF</sub>              | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -   | ±0.2                   | μA   |
| I <sub>CC</sub>                | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 0.5                    | μA   |
| ΔI <sub>CC</sub>               | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | <a href="#">[1]</a> -  | -   | 40                     | μA   |
| C <sub>I</sub>                 | input capacitance                    | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>                          | -                      | 1.5 | -                      | pF   |
| C <sub>O</sub>                 | output capacitance                   | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V  | -                      | 3.0 | -                      | pF   |

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

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

| Symbol                                    | Parameter                            | Conditions   | Min                    | Typ | Max                    | Unit |
|---|--------------------------------------|--|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                                      |  |                        |     |                        |      |
| V <sub>IH</sub>                           | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V  | 0.70 × V <sub>CC</sub> | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.65 × V <sub>CC</sub> | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -   | -                      | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -   | -                      | V    |
| V <sub>IL</sub>                           | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V  | -                      | -   | 0.30 × V <sub>CC</sub> | V    |
|   |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -   | 0.35 × V <sub>CC</sub> | V    |
|   |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -   | 0.7                    | V    |
|   |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -   | 0.9                    | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage            | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|   |                                      | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.1  | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.7 × V <sub>CC</sub>  | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 1.03                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.30                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 1.97                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.85                   | -   | -                      | V    |
|   |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.67                   | -   | -                      | V    |
| V <sub>OL</sub>                           | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|   |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -   | 0.1                    | V    |
|   |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -   | 0.3 × V <sub>CC</sub>  | V    |
|   |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -   | 0.37                   | V    |
|   |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -   | 0.35                   | V    |
|   |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.33                   | V    |
|   |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.45                   | V    |
|   |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.33                   | V    |
| I <sub>I</sub>                            | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -   | ±0.5                   | μA   |
| I <sub>OFF</sub>                          | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -   | ±0.5                   | μA   |
| ΔI <sub>OFF</sub>                         | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -   | ±0.6                   | μA   |
| I <sub>CC</sub>                           | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 0.9                    | μA   |
| ΔI <sub>CC</sub>                          | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | [1]                    | -   | 50                     | μA   |

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

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

| Symbol                                     | Parameter                            | Conditions   | Min                    | Typ | Max                    | Unit |
|--|--------------------------------------|--|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                                      |  |                        |     |                        |      |
| V <sub>IH</sub>                            | HIGH-level input voltage             | V <sub>CC</sub> = 0.8 V  | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | 0.70 × V <sub>CC</sub> | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.6                    | -   | -                      | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | 2.0                    | -   | -                      | V    |
| V <sub>IL</sub>                            | LOW-level input voltage              | V <sub>CC</sub> = 0.8 V  | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
|  |                                      | V <sub>CC</sub> = 0.9 V to 1.95 V  | -                      | -   | 0.30 × V <sub>CC</sub> | V    |
|  |                                      | V <sub>CC</sub> = 2.3 V to 2.7 V   | -                      | -   | 0.7                    | V    |
|  |                                      | V <sub>CC</sub> = 3.0 V to 3.6 V   | -                      | -   | 0.9                    | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage            | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|  |                                      | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V  | V <sub>CC</sub> - 0.11 | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.1 mA; V <sub>CC</sub> = 1.1 V  | 0.6 × V <sub>CC</sub>  | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.7 mA; V <sub>CC</sub> = 1.4 V  | 0.93                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -1.9 mA; V <sub>CC</sub> = 1.65 V   | 1.17                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -2.3 mA; V <sub>CC</sub> = 2.3 V  | 1.77                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -3.1 mA; V <sub>CC</sub> = 2.3 V  | 1.67                   | -   | -                      | V    |
|  |                                      | I <sub>O</sub> = -2.7 mA; V <sub>CC</sub> = 3.0 V  | 2.40                   | -   | -                      | V    |
| V <sub>OL</sub>                            | LOW-level output voltage             | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |                        |     |                        |      |
|  |                                      | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.8 V to 3.6 V   | -                      | -   | 0.11                   | V    |
|  |                                      | I <sub>O</sub> = 1.1 mA; V <sub>CC</sub> = 1.1 V   | -                      | -   | 0.33 × V <sub>CC</sub> | V    |
|  |                                      | I <sub>O</sub> = 1.7 mA; V <sub>CC</sub> = 1.4 V   | -                      | -   | 0.41                   | V    |
|  |                                      | I <sub>O</sub> = 1.9 mA; V <sub>CC</sub> = 1.65 V  | -                      | -   | 0.39                   | V    |
|  |                                      | I <sub>O</sub> = 2.3 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.36                   | V    |
|  |                                      | I <sub>O</sub> = 3.1 mA; V <sub>CC</sub> = 2.3 V   | -                      | -   | 0.50                   | V    |
|  |                                      | I <sub>O</sub> = 2.7 mA; V <sub>CC</sub> = 3.0 V   | -                      | -   | 0.36                   | V    |
| I <sub>I</sub>                             | input leakage current                | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                    | -                      | -   | ±0.75                  | μA   |
| I <sub>OFF</sub>                           | power-off leakage current            | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V                           | -                      | -   | ±0.75                  | μA   |
| ΔI <sub>OFF</sub>                          | additional power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 0.2 V                  | -                      | -   | ±0.75                  | μA   |
| I <sub>CC</sub>                            | supply current                       | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 1.4                    | μA   |
| ΔI <sub>CC</sub>                           | additional supply current            | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V          | [1]                    | -   | 75                     | μA   |

[1] One input at V<sub>CC</sub> - 0.6 V, other input at V<sub>CC</sub> or GND.

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 9](#))

| Symbol                       | Parameter         | Conditions  | 25 °C |                    |      | –40 °C to +125 °C |             |              |              | Unit |
|------------------------------|-------------------|---|-------|--------------------|------|-------------------|-------------|--------------|--------------|------|
|                              |                   |   | Min   | Typ <sup>[1]</sup> | Max  | Min (85 °C)       | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 5 pF</b>  |                   |   |       |                    |      |                   |             |              |              |      |
| t <sub>pd</sub>              | propagation delay | CP to $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup> | -     | 20.9               | -    | -                 | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 20.9               | -    | -                 | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | 2.9   | 6.0                | 12.9 | 2.6               | 14.3        | 2.6          | 15.7         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | 1.9   | 4.2                | 7.6  | 2.0               | 8.9         | 2.0          | 9.8          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | 1.7   | 3.4                | 5.9  | 1.6               | 7.0         | 1.6          | 7.7          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | 1.4   | 2.6                | 4.3  | 1.2               | 5.6         | 1.2          | 6.2          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | 1.2   | 2.2                | 3.6  | 1.0               | 4.4         | 1.0          | 4.8          | ns   |
| f <sub>max</sub>             | maximum frequency | CP; see <a href="#">Figure 8</a>                              | -     | 53                 | -    | -                 | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 53                 | -    | -                 | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | -     | 203                | -    | 170               | -           | 170          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | -     | 347                | -    | 310               | -           | 300          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | -     | 435                | -    | 400               | -           | 390          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | -     | 550                | -    | 490               | -           | 480          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | -     | 619                | -    | 550               | -           | 510          | -            | MHz  |
| <b>C<sub>L</sub> = 10 pF</b> |                   |   |       |                    |      |                   |             |              |              |      |
| t <sub>pd</sub>              | propagation delay | CP to $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup> | -     | 24.6               | -    | -                 | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 24.6               | -    | -                 | -           | -            | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | 3.3   | 6.9                | 14.9 | 3.0               | 16.5        | 3.0          | 18.1         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | 2.6   | 4.8                | 8.8  | 2.3               | 10.3        | 2.3          | 11.3         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | 2.3   | 3.9                | 6.8  | 2.0               | 8.1         | 2.0          | 8.9          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | 1.9   | 3.1                | 5.1  | 1.7               | 6.3         | 1.7          | 6.9          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | 1.8   | 2.7                | 4.4  | 1.4               | 4.9         | 1.4          | 5.4          | ns   |
| f <sub>max</sub>             | maximum frequency | CP; see <a href="#">Figure 8</a>                              | -     | 52                 | -    | -                 | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 52                 | -    | -                 | -           | -            | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | -     | 192                | -    | 150               | -           | 150          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | -     | 324                | -    | 280               | -           | 230          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | -     | 421                | -    | 310               | -           | 250          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | -     | 486                | -    | 370               | -           | 360          | -            | MHz  |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | -     | 550                | -    | 410               | -           | 360          | -            | MHz  |



**Table 8. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 9](#))

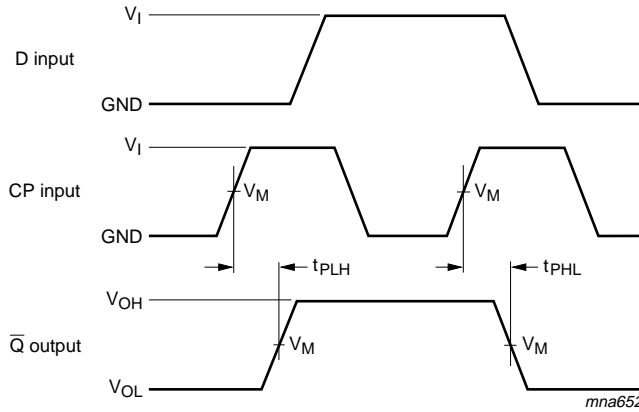
| Symbol  | Parameter         | Conditions  | 25 °C |                    |      | –40 °C to +125 °C |             |              |              | Unit |
|---|-------------------|---|-------|--------------------|------|-------------------|-------------|--------------|--------------|------|
|   |                   |   | Min   | Typ <sup>[1]</sup> | Max  | Min (85 °C)       | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 15 pF</b>                        |                   |   |       |                    |      |                   |             |              |              |      |
| t <sub>pd</sub>                                     | propagation delay | CP to $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup> |       |                    |      |                   |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 28.2               | -    | -                 | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | 3.0   | 7.6                | 16.7 | 3.4               | 18.6        | 3.4          | 20.5         | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | 3.0   | 5.3                | 9.8  | 2.6               | 11.5        | 2.6          | 12.7         | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | 2.6   | 4.4                | 7.6  | 2.3               | 9.1         | 2.3          | 10.0         | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | 2.2   | 3.5                | 5.7  | 2.0               | 6.9         | 2.0          | 7.6          | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | 1.9   | 3.1                | 5.0  | 1.8               | 5.5         | 1.8          | 6.1          | ns   |
| f <sub>max</sub>                                    | maximum frequency | CP; see <a href="#">Figure 8</a>                              |       |                    |      |                   |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 50                 | -    | -                 | -           | -            | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | -     | 181                | -    | 120               | -           | 120          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | -     | 301                | -    | 190               | -           | 160          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | -     | 407                | -    | 240               | -           | 190          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | -     | 422                | -    | 300               | -           | 270          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | -     | 481                | -    | 320               | -           | 300          | -            | MHz  |
| <b>C<sub>L</sub> = 30 pF</b>                        |                   |   |       |                    |      |                   |             |              |              |      |
| t <sub>pd</sub>                                     | propagation delay | CP to $\bar{Q}$ ; see <a href="#">Figure 7</a> <sup>[2]</sup> |       |                    |      |                   |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 38.8               | -    | -                 | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | 4.9   | 9.8                | 20.7 | 4.4               | 24.7        | 4.4          | 27.2         | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | 4.0   | 6.8                | 12.7 | 3.5               | 15.0        | 3.5          | 16.5         | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | 3.5   | 5.6                | 9.9  | 2.2               | 11.9        | 2.2          | 13.0         | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | 3.1   | 4.5                | 7.5  | 2.8               | 9.3         | 2.8          | 10.2         | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | 2.9   | 4.1                | 6.4  | 2.7               | 7.5         | 2.7          | 8.3          | ns   |
| f <sub>max</sub>                                    | maximum frequency | CP; see <a href="#">Figure 8</a>                              |       |                    |      |                   |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 28                 | -    | -                 | -           | -            | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | -     | 128                | -    | 70                | -           | 70           | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | -     | 206                | -    | 120               | -           | 110          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | -     | 262                | -    | 150               | -           | 120          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | -     | 269                | -    | 190               | -           | 170          | -            | MHz  |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | -     | 309                | -    | 200               | -           | 190          | -            | MHz  |
| <b>C<sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF</b> |                   |   |       |                    |      |                   |             |              |              |      |
| t <sub>su(H)</sub>                                  | set-up time HIGH  | D to CP; see <a href="#">Figure 8</a>                         |       |                    |      |                   |             |              |              |      |
|   |                   | V <sub>CC</sub> = 0.8 V                                       | -     | 2.5                | -    | -                 | -           | -            | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                              | -     | 0.5                | -    | 2.2               | -           | 2.2          | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                              | -     | 0.3                | -    | 1.1               | -           | 1.1          | -            | ns   |
|   |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                            | -     | 0.3                | -    | 0.8               | -           | 0.8          | -            | ns   |
|   |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                              | -     | 0.2                | -    | 0.6               | -           | 0.6          | -            | ns   |
|   |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                              | -     | 0.2                | -    | 0.4               | -           | 0.4          | -            | ns   |

**Table 8. Dynamic characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 9](#))

| Symbol             | Parameter                           | Conditions  | 25 °C |                    |     | –40 °C to +125 °C |             |              |              | Unit |
|--------------------|-------------------------------------|---|-------|--------------------|-----|-------------------|-------------|--------------|--------------|------|
|                    |                                     |   | Min   | Typ <sup>[1]</sup> | Max | Min (85 °C)       | Max (85 °C) | Min (125 °C) | Max (125 °C) |      |
| t <sub>su(L)</sub> | set-up time<br>LOW                  | D to CP; see <a href="#">Figure 8</a>   |       |                    |     |                   |             |              |              |      |
|                    |                                     | V <sub>CC</sub> = 0.8 V   | -     | 1.7                | -   | -                 | -           | -            | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.1 V to 1.3 V  | -     | 0.3                | -   | 2.0               | -           | 2.0          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.4 V to 1.6 V  | -     | 0.2                | -   | 1.3               | -           | 1.3          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.65 V to 1.95 V  | -     | 0.2                | -   | 1.1               | -           | 1.1          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 2.3 V to 2.7 V  | -     | 0.3                | -   | 0.8               | -           | 0.8          | -            | ns   |
| t <sub>h</sub>     | hold time                           | D to CP; see <a href="#">Figure 8</a>   |       |                    |     |                   |             |              |              |      |
|                    |                                     | V <sub>CC</sub> = 0.8 V   | -     | -2.1               | -   | -                 | -           | -            | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.1 V to 1.3 V  | -     | -0.4               | -   | 0.2               | -           | 0.2          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.4 V to 1.6 V  | -     | -0.3               | -   | 0.1               | -           | 0.1          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.65 V to 1.95 V  | -     | -0.2               | -   | 0                 | -           | 0            | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 2.3 V to 2.7 V  | -     | -0.2               | -   | 0                 | -           | 0            | -            | ns   |
| t <sub>w</sub>     | pulse width                         | CP HIGH or LOW;<br>see <a href="#">Figure 8</a>                                   |       |                    |     |                   |             |              |              |      |
|                    |                                     | V <sub>CC</sub> = 0.8 V   | -     | 5.2                | -   | -                 | -           | -            | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.1 V to 1.3 V  | -     | 1.0                | -   | 3.0               | -           | 3.0          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.4 V to 1.6 V  | -     | 0.8                | -   | 2.0               | -           | 2.0          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 1.65 V to 1.95 V  | -     | 0.6                | -   | 2.0               | -           | 2.0          | -            | ns   |
|                    |                                     | V <sub>CC</sub> = 2.3 V to 2.7 V  | -     | 0.5                | -   | 2.0               | -           | 2.0          | -            | ns   |
| C <sub>PD</sub>    | power<br>dissipation<br>capacitance | f <sub>i</sub> = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[3]</sup> |       |                    |     |                   |             |              |              |      |
|                    |                                     | V <sub>CC</sub> = 0.8 V   | -     | 1.8                | -   | -                 | -           | -            | -            | pF   |
|                    |                                     | V <sub>CC</sub> = 1.1 V to 1.3 V  | -     | 1.8                | -   | -                 | -           | -            | -            | pF   |
|                    |                                     | V <sub>CC</sub> = 1.4 V to 1.6 V  | -     | 1.9                | -   | -                 | -           | -            | -            | pF   |
|                    |                                     | V <sub>CC</sub> = 1.65 V to 1.95 V  | -     | 2.0                | -   | -                 | -           | -            | -            | pF   |
|                    |                                     | V <sub>CC</sub> = 2.3 V to 2.7 V  | -     | 2.4                | -   | -                 | -           | -            | -            | pF   |
|                    |                                     | V <sub>CC</sub> = 3.0 V to 3.6 V  | -     | 2.9                | -   | -                 | -           | -            | pF           |      |

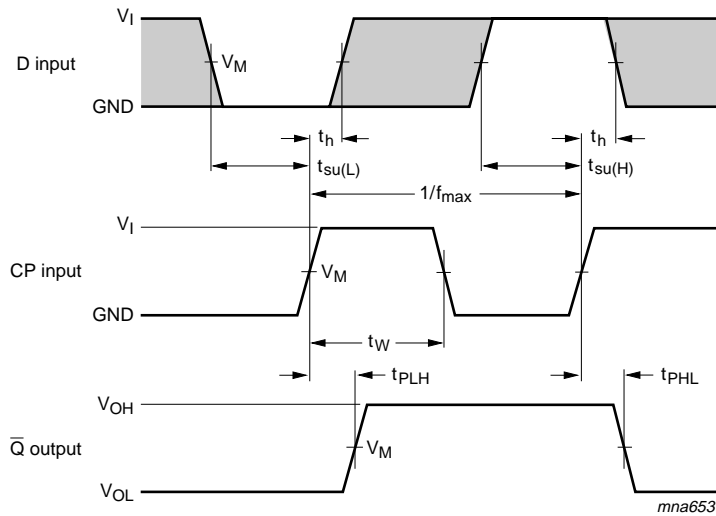
[1] All typical values are measured at nominal V<sub>CC</sub>.  
 [2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
 [3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:  
 f<sub>i</sub> = input frequency in MHz;  
 f<sub>o</sub> = output frequency in MHz;  
 C<sub>L</sub> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

12. Waveforms



Measurement points are given in [Table 9](#).  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 7. The clock input (CP) to output ( $\bar{Q}$ ) propagation delays**

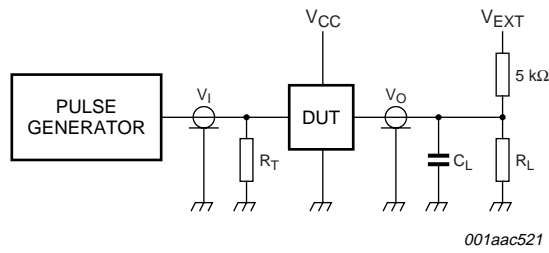


Measurement points are given in [Table 9](#).  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 8. The clock input (CP) to output ( $\bar{Q}$ ) propagation delays, clock pulse width, D to CP set-up and hold times and the maximum input clock frequency**

**Table 9. Measurement points**

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



Test data is given in [Table 10](#).

Definitions for test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

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

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

**Fig 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  $R_L = 5 \text{ k}\Omega$ , for measuring propagation delays, setup and hold times and pulse width  $R_L = 1 \text{ M}\Omega$ .

13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

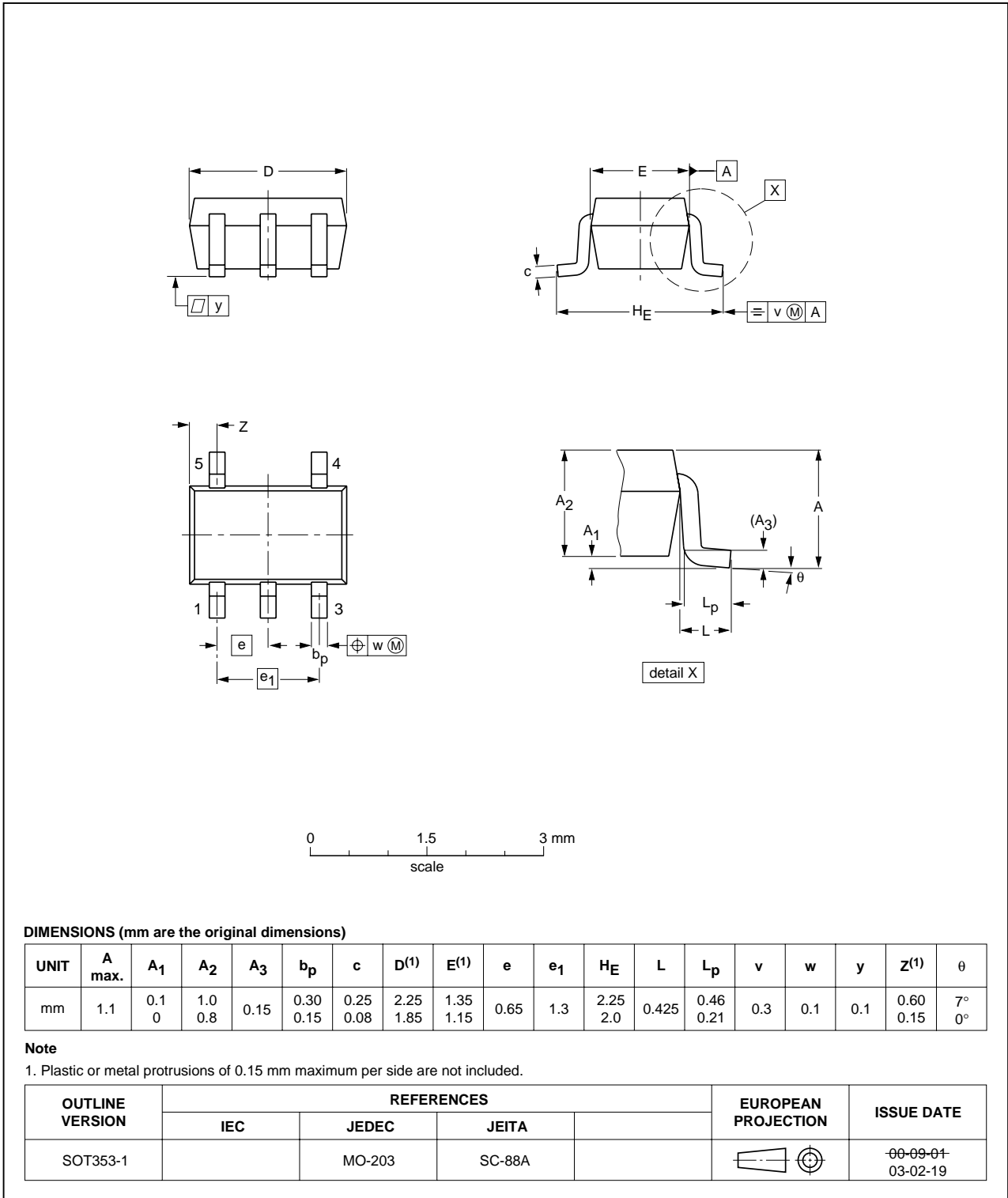


Fig 10. Package outline SOT353-1 (TSSOP5)

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

SOT886

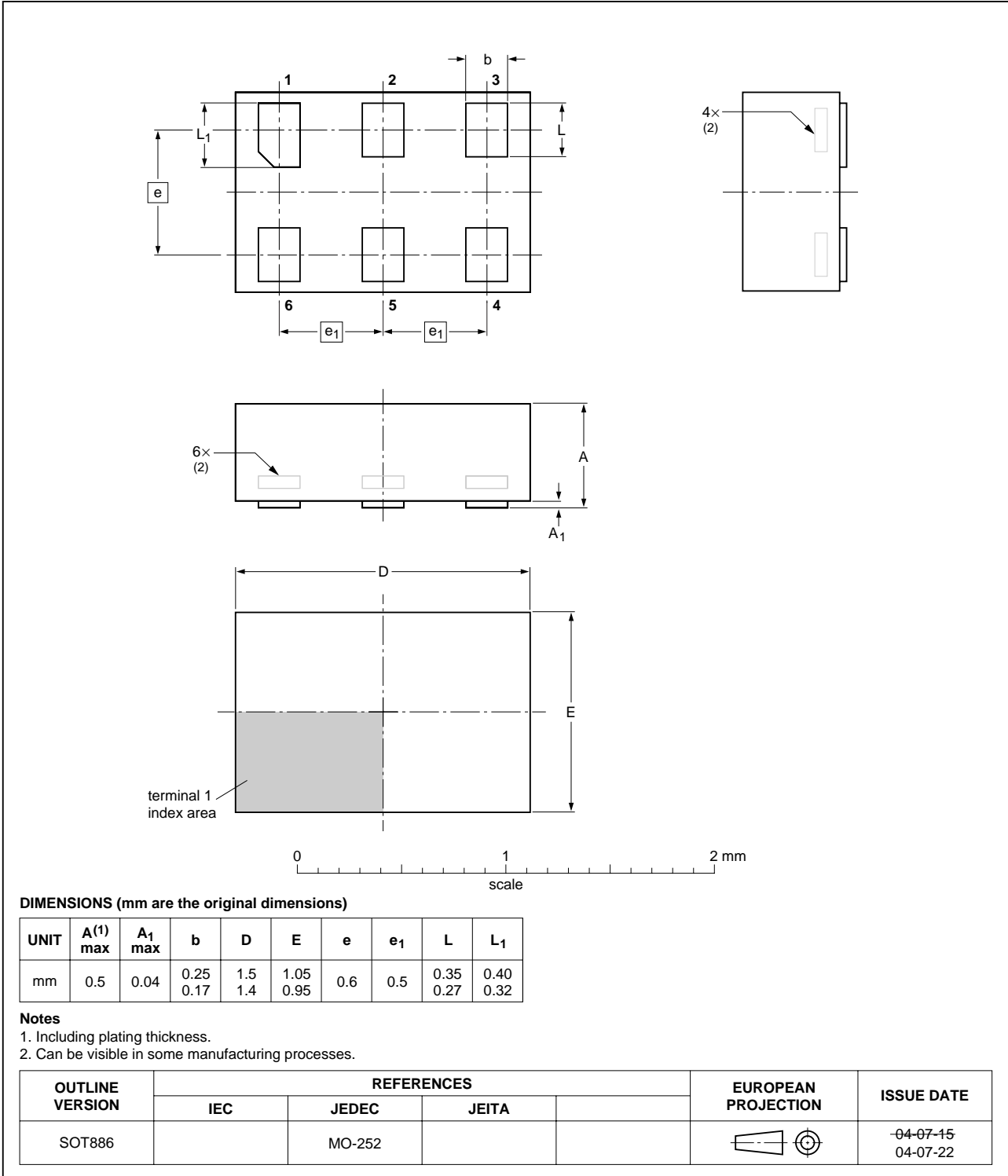


Fig 11. Package outline SOT886 (XSON6)

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

SOT891

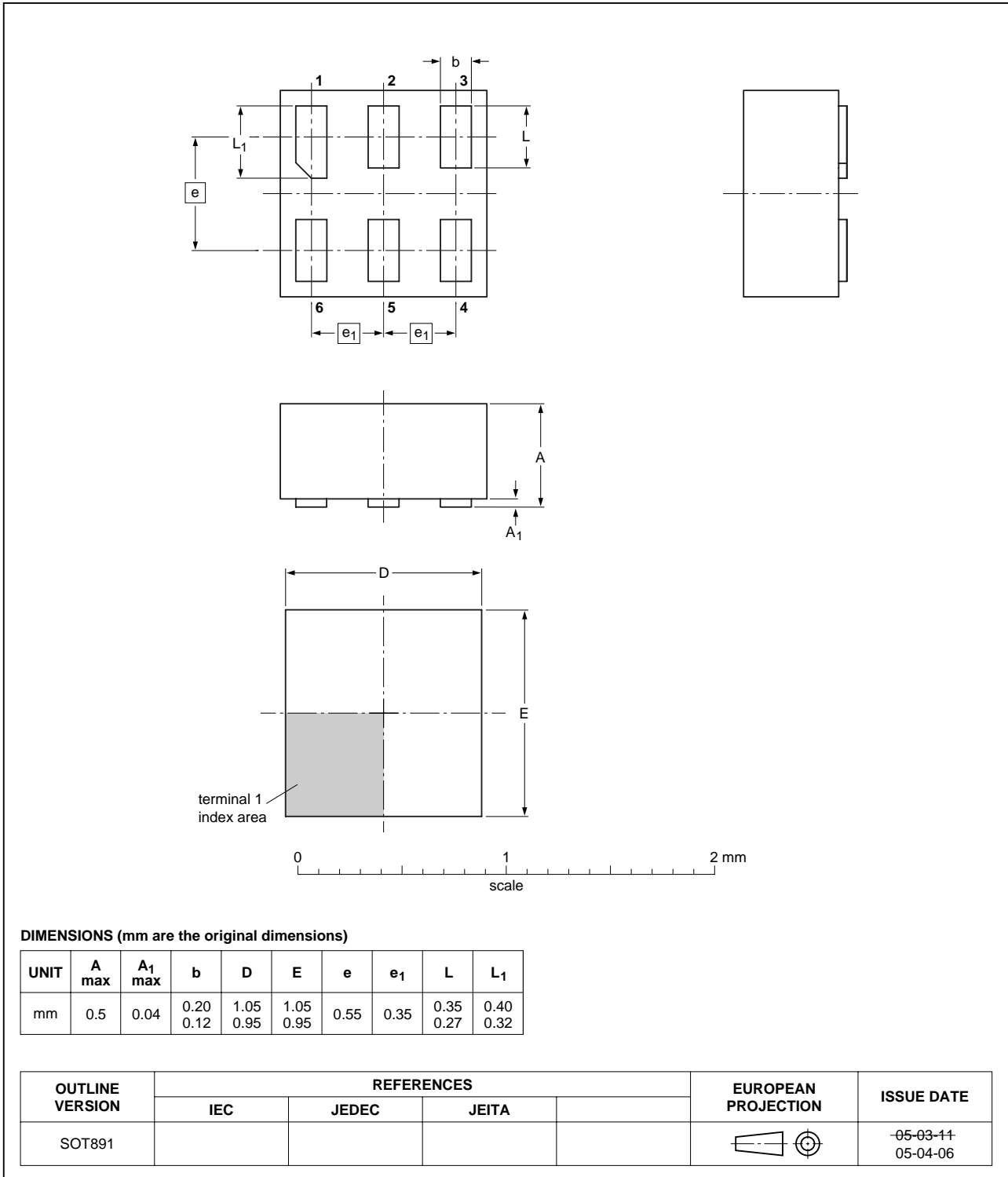


Fig 12. Package outline SOT891 (XSON6)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status  | Change notice | Supersedes |
|-------------|--------------|--------------------|---------------|------------|
| 74AUP1G80_1 | 20061020     | Product data sheet | -             | -          |



## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | 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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