

# 74AUP1G175

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

Rev. 5 — 3 July 2012

Product data sheet

## 1. General description

The 74AUP1G175 provides a low-power, low-voltage positive-edge triggered D-type flip-flop with individual data (D) input, clock (CP) input, master reset (MR) input, and Q output. The master reset (MR) is an asynchronous active LOW input and operates independently of the clock input. Information on the data input is transferred to the Q output on the LOW-to-HIGH transition of the clock pulse. The D input must be stable one set-up time prior to the LOW-to-HIGH clock transition, for predictable operation.

Schmitt trigger action at all inputs makes the circuit tolerant to slower input rise and fall times across the entire  $V_{CC}$  range from 0.8 V to 3.6 V. This device ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range from 0.8 V to 3.6 V.

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

## 2. Features and benefits

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- Complies with JEDEC standards:
  - ◆ JESD8-12 (0.8 V to 1.3 V)
  - ◆ JESD8-11 (0.9 V to 1.65 V)
  - ◆ JESD8-7 (1.2 V to 1.95 V)
  - ◆ JESD8-5 (1.8 V to 2.7 V)
  - ◆ JESD8-B (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu A$  (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           |       |                                                                                             |         |
|--------------|-------------------|-------|---------------------------------------------------------------------------------------------|---------|
|              | Temperature range | Name  | Description                                                                                 | Version |
| 74AUP1G175GW | −40 °C to +125 °C | SC-88 | plastic surface-mounted package; 6 leads                                                    | SOT363  |
| 74AUP1G175GM | −40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886  |
| 74AUP1G175GF | −40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm    | SOT891  |
| 74AUP1G175GN | −40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm       | SOT1115 |
| 74AUP1G175GS | −40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm       | SOT1202 |

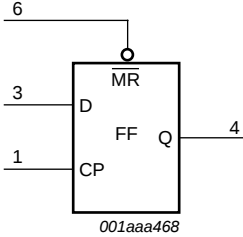
4. Marking

Table 2. Marking

| Type number  | Marking code <sup>[1]</sup> |
|--------------|-----------------------------|
| 74AUP1G175GW | aT                          |
| 74AUP1G175GM | aT                          |
| 74AUP1G175GF | aT                          |
| 74AUP1G175GN | aT                          |
| 74AUP1G175GS | aT                          |

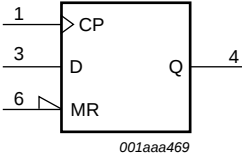
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



The logic symbol for the 74AUP1G175 is a rectangular block labeled 'FF' (flip-flop). It has three inputs: 'D' (pin 3), 'CP' (pin 1), and 'MR' (pin 6, active-low, indicated by a bubble). It has one output: 'Q' (pin 4). The symbol is identified by the number '001aaa468' at the bottom.

**Fig 1. Logic symbol**



The IEC logic symbol for the 74AUP1G175 is a rectangular block. It has three inputs: 'CP' (pin 1, clock, indicated by a triangle), 'D' (pin 3), and 'MR' (pin 6, active-low, indicated by a bubble). It has one output: 'Q' (pin 4). The symbol is identified by the number '001aaa469' at the bottom.

**Fig 2. IEC logic symbol**

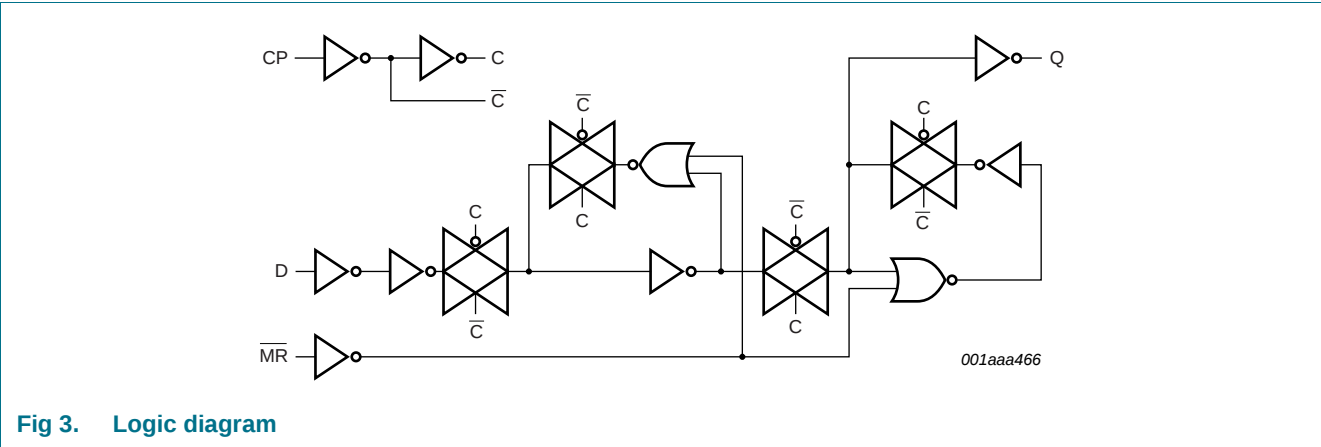


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

Fig 4. Pin configuration SOT363

Fig 5. Pin configuration SOT886

Fig 6. Pin configuration SOT891, SOT1115 and SOT1202

6.2 Pin description

Table 3. Pin description

| Symbol                 | Pin | Description                               |
|------------------------|-----|-------------------------------------------|
| CP                     | 1   | clock input (LOW-to-HIGH, edge-triggered) |
| GND                    | 2   | ground (0 V)                              |
| D                      | 3   | data input                                |
| Q                      | 4   | flip-flop output                          |
| V <sub>CC</sub>        | 5   | supply voltage                            |
| $\overline{\text{MR}}$ | 6   | master reset input (active LOW)           |

## 7. Functional description

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

| Operating mode | Input |    |   | Output |
|----------------|-------|----|---|--------|
|                | MR    | CP | D | Q      |
| Reset (clear)  | L     | X  | X | L      |
| Load '1'       | H     | ↑  | h | H      |
| Load '0'       | H     | ↑  | l | L      |

- [1] H = HIGH voltage level;  
 h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition;  
 L = LOW voltage level;  
 l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition;  
 ↑ = LOW-to-HIGH CP transition;  
 X = don't care.

## 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 <sub>CC</sub>  | supply voltage          |                                         | -0.5                | +4.6 | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < 0 V                    | -50                 | -    | mA   |
| V <sub>I</sub>   | input voltage           |                                         | <sup>[1]</sup> -0.5 | +4.6 | V    |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < 0 V                    | -50                 | -    | mA   |
| V <sub>O</sub>   | output voltage          | Active mode and Power-down mode         | <sup>[1]</sup> -0.5 | +4.6 | V    |
| I <sub>O</sub>   | output current          | V <sub>O</sub> = 0 V to V <sub>CC</sub> | -                   | ±20  | mA   |
| I <sub>CC</sub>  | supply current          |                                         | -                   | 50   | mA   |
| I <sub>GND</sub> | ground current          |                                         | -50                 | -    | mA   |
| T <sub>stg</sub> | storage temperature     |                                         | -65                 | +150 | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C    | <sup>[2]</sup> -    | 250  | mW   |

- [1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 [2] For SC-88 packages: above 87.5 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K.  
 For XSON6 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 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                     | 0   | $V_{CC}$ | V    |
|                     |                                     | Power-down mode; $V_{CC} = 0$ V | 0   | 3.6      | V    |
| $T_{amb}$           | ambient temperature                 |                                 | -40 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.8$ V to 3.6 V       | -   | 200      | ns/V |

## 10. Static characteristics

**Table 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 |                           |                                                |                      |     |                      |      |
| $V_{IH}$          | HIGH-level input voltage  | $V_{CC} = 0.8$ V                               | $0.70 \times V_{CC}$ | -   | -                    | V    |
|                   |                           | $V_{CC} = 0.9$ V to 1.95 V                     | $0.65 \times V_{CC}$ | -   | -                    | V    |
|                   |                           | $V_{CC} = 2.3$ V to 2.7 V                      | 1.6                  | -   | -                    | V    |
|                   |                           | $V_{CC} = 3.0$ V to 3.6 V                      | 2.0                  | -   | -                    | V    |
| $V_{IL}$          | LOW-level input voltage   | $V_{CC} = 0.8$ V                               | -                    | -   | $0.30 \times V_{CC}$ | V    |
|                   |                           | $V_{CC} = 0.9$ V to 1.95 V                     | -                    | -   | $0.35 \times V_{CC}$ | V    |
|                   |                           | $V_{CC} = 2.3$ V to 2.7 V                      | -                    | -   | 0.7                  | V    |
|                   |                           | $V_{CC} = 3.0$ V to 3.6 V                      | -                    | -   | 0.9                  | V    |
| $V_{OH}$          | HIGH-level output voltage | $V_I = V_{IH}$ or $V_{IL}$                     |                      |     |                      |      |
|                   |                           | $I_O = -20$ $\mu$ A; $V_{CC} = 0.8$ V to 3.6 V | $V_{CC} - 0.1$       | -   | -                    | V    |
|                   |                           | $I_O = -1.1$ mA; $V_{CC} = 1.1$ V              | $0.75 \times V_{CC}$ | -   | -                    | V    |
|                   |                           | $I_O = -1.7$ mA; $V_{CC} = 1.4$ V              | 1.11                 | -   | -                    | V    |
|                   |                           | $I_O = -1.9$ mA; $V_{CC} = 1.65$ V             | 1.32                 | -   | -                    | V    |
|                   |                           | $I_O = -2.3$ mA; $V_{CC} = 2.3$ V              | 2.05                 | -   | -                    | V    |
|                   |                           | $I_O = -3.1$ mA; $V_{CC} = 2.3$ V              | 1.9                  | -   | -                    | V    |
|                   |                           | $I_O = -2.7$ mA; $V_{CC} = 3.0$ V              | 2.72                 | -   | -                    | V    |
|                   |                           | $I_O = -4.0$ mA; $V_{CC} = 3.0$ V              | 2.6                  | -   | -                    | V    |
| $V_{OL}$          | LOW-level output voltage  | $V_I = V_{IH}$ or $V_{IL}$                     |                      |     |                      |      |
|                   |                           | $I_O = 20$ $\mu$ A; $V_{CC} = 0.8$ V to 3.6 V  | -                    | -   | 0.1                  | V    |
|                   |                           | $I_O = 1.1$ mA; $V_{CC} = 1.1$ V               | -                    | -   | $0.3 \times V_{CC}$  | 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    |

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

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

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

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

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

| Symbol                                                                        | Parameter                            | Conditions                                                                                         | Min                  | Typ | Max                  | Unit          |
|-------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------------------------------------------------------------|----------------------|-----|----------------------|---------------|
| $I_{CC}$                                                                      | supply current                       | $V_I = \text{GND or } V_{CC}; I_O = 0 \text{ A};$<br>$V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$    | -                    | -   | 0.9                  | $\mu\text{A}$ |
| $\Delta I_{CC}$                                                               | additional supply current            | $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$<br>$V_{CC} = 3.3 \text{ V}$                     | [1] -                | -   | 50                   | $\mu\text{A}$ |
| <b><math>T_{\text{amb}} = -40^\circ\text{C to } +125^\circ\text{C}</math></b> |                                      |                                                                                                    |                      |     |                      |               |
| $V_{IH}$                                                                      | HIGH-level input voltage             | $V_{CC} = 0.8 \text{ V}$                                                                           | $0.75 \times V_{CC}$ | -   | -                    | V             |
|                                                                               |                                      | $V_{CC} = 0.9 \text{ V to } 1.95 \text{ V}$                                                        | $0.70 \times V_{CC}$ | -   | -                    | V             |
|                                                                               |                                      | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                                                         | 1.6                  | -   | -                    | V             |
|                                                                               |                                      | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                                                         | 2.0                  | -   | -                    | V             |
| $V_{IL}$                                                                      | LOW-level input voltage              | $V_{CC} = 0.8 \text{ V}$                                                                           | -                    | -   | $0.25 \times V_{CC}$ | V             |
|                                                                               |                                      | $V_{CC} = 0.9 \text{ V to } 1.95 \text{ V}$                                                        | -                    | -   | $0.30 \times V_{CC}$ | V             |
|                                                                               |                                      | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                                                         | -                    | -   | 0.7                  | V             |
|                                                                               |                                      | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                                                         | -                    | -   | 0.9                  | V             |
| $V_{OH}$                                                                      | HIGH-level output voltage            | $V_I = V_{IH} \text{ or } V_{IL}$                                                                  |                      |     |                      |               |
|                                                                               |                                      | $I_O = -20 \mu\text{A}; V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$                                  | $V_{CC} - 0.11$      | -   | -                    | V             |
|                                                                               |                                      | $I_O = -1.1 \text{ mA}; V_{CC} = 1.1 \text{ V}$                                                    | $0.6 \times V_{CC}$  | -   | -                    | V             |
|                                                                               |                                      | $I_O = -1.7 \text{ mA}; V_{CC} = 1.4 \text{ V}$                                                    | 0.93                 | -   | -                    | V             |
|                                                                               |                                      | $I_O = -1.9 \text{ mA}; V_{CC} = 1.65 \text{ V}$                                                   | 1.17                 | -   | -                    | V             |
|                                                                               |                                      | $I_O = -2.3 \text{ mA}; V_{CC} = 2.3 \text{ V}$                                                    | 1.77                 | -   | -                    | V             |
|                                                                               |                                      | $I_O = -3.1 \text{ mA}; V_{CC} = 2.3 \text{ V}$                                                    | 1.67                 | -   | -                    | V             |
|                                                                               |                                      | $I_O = -2.7 \text{ mA}; V_{CC} = 3.0 \text{ V}$                                                    | 2.40                 | -   | -                    | V             |
|                                                                               |                                      | $I_O = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$                                                    | 2.30                 | -   | -                    | V             |
| $V_{OL}$                                                                      | LOW-level output voltage             | $V_I = V_{IH} \text{ or } V_{IL}$                                                                  |                      |     |                      |               |
|                                                                               |                                      | $I_O = 20 \mu\text{A}; V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$                                   | -                    | -   | 0.11                 | V             |
|                                                                               |                                      | $I_O = 1.1 \text{ mA}; V_{CC} = 1.1 \text{ V}$                                                     | -                    | -   | $0.33 \times V_{CC}$ | V             |
|                                                                               |                                      | $I_O = 1.7 \text{ mA}; V_{CC} = 1.4 \text{ V}$                                                     | -                    | -   | 0.41                 | V             |
|                                                                               |                                      | $I_O = 1.9 \text{ mA}; V_{CC} = 1.65 \text{ V}$                                                    | -                    | -   | 0.39                 | V             |
|                                                                               |                                      | $I_O = 2.3 \text{ mA}; V_{CC} = 2.3 \text{ V}$                                                     | -                    | -   | 0.36                 | V             |
|                                                                               |                                      | $I_O = 3.1 \text{ mA}; V_{CC} = 2.3 \text{ V}$                                                     | -                    | -   | 0.50                 | V             |
|                                                                               |                                      | $I_O = 2.7 \text{ mA}; V_{CC} = 3.0 \text{ V}$                                                     | -                    | -   | 0.36                 | V             |
|                                                                               |                                      | $I_O = 4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$                                                     | -                    | -   | 0.50                 | V             |
| $I_I$                                                                         | input leakage current                | $V_I = \text{GND to } 3.6 \text{ V}; V_{CC} = 0 \text{ V to } 3.6 \text{ V}$                       | -                    | -   | $\pm 0.75$           | $\mu\text{A}$ |
| $I_{OFF}$                                                                     | power-off leakage current            | $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC} = 0 \text{ V}$                        | -                    | -   | $\pm 0.75$           | $\mu\text{A}$ |
| $\Delta I_{OFF}$                                                              | additional power-off leakage current | $V_I \text{ or } V_O = 0 \text{ V to } 3.6 \text{ V};$<br>$V_{CC} = 0 \text{ V to } 0.2 \text{ V}$ | -                    | -   | $\pm 0.75$           | $\mu\text{A}$ |
| $I_{CC}$                                                                      | supply current                       | $V_I = \text{GND or } V_{CC}; I_O = 0 \text{ A};$<br>$V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$    | -                    | -   | 1.4                  | $\mu\text{A}$ |
| $\Delta I_{CC}$                                                               | additional supply current            | $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$<br>$V_{CC} = 3.3 \text{ V}$                     | [1] -                | -   | 75                   | $\mu\text{A}$ |

[1] One input at  $V_{CC} - 0.6 \text{ V}$ , other input at  $V_{CC}$  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               | Max (85 °C) | Max (125 °C) |      |
| C <sub>L</sub> = 5 pF |                   |                                       |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>       | propagation delay | CP to Q; see <a href="#">Figure 7</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                       |                   | V <sub>CC</sub> = 0.8 V               | -                   | 21.1               | -    | -                 | -           | -            | ns   |
|                       |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 2.4                 | 5.9                | 11.7 | 2.2               | 11.9        | 12.0         | ns   |
|                       |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 2.0                 | 4.1                | 6.8  | 1.8               | 7.3         | 7.6          | ns   |
|                       |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 1.6                 | 3.3                | 5.4  | 1.3               | 5.9         | 6.2          | ns   |
|                       |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 1.3                 | 2.5                | 3.6  | 1.1               | 4.0         | 4.2          | ns   |
|                       |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.2                 | 2.1                | 2.9  | 1.0               | 3.3         | 3.5          | ns   |
|                       |                   | MR to Q; see <a href="#">Figure 8</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                       |                   | V <sub>CC</sub> = 0.8 V               | -                   | 17.4               | -    | -                 | -           | -            | ns   |
|                       |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 2.4                 | 5.2                | 9.7  | 2.2               | 10.0        | 12.0         | ns   |
|                       |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 2.3                 | 3.8                | 5.2  | 2.1               | 6.4         | 6.6          | ns   |
|                       |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 1.8                 | 3.1                | 4.9  | 1.7               | 5.4         | 5.6          | ns   |
|                       |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 1.8                 | 2.6                | 3.6  | 1.5               | 4.0         | 4.0          | ns   |
|                       |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.6                 | 2.4                | 3.1  | 1.3               | 3.3         | 3.6          | ns   |
| f <sub>max</sub>      | maximum frequency | CP; see <a href="#">Figure 7</a>      |                     |                    |      |                   |             |              |      |
|                       |                   | V <sub>CC</sub> = 0.8 V               | -                   | 50                 | -    | -                 | -           | -            | MHz  |
|                       |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | -                   | 200                | -    | 170               | -           | -            | MHz  |
|                       |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | -                   | 345                | -    | 310               | -           | -            | MHz  |
|                       |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | -                   | 435                | -    | 400               | -           | -            | MHz  |
|                       |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | -                   | 550                | -    | 490               | -           | -            | MHz  |
|                       |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | -                   | 615                | -    | 550               | -           | -            | 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               | Max (85 °C) | Max (125 °C) |      |
| C <sub>L</sub> = 10 pF |                   |                                       |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>        | propagation delay | CP to Q; see <a href="#">Figure 7</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -                   | 24.7               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 2.6                 | 6.8                | 13.3 | 2.4               | 13.6        | 13.6         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 2.3                 | 4.8                | 7.9  | 2.0               | 8.4         | 8.7          | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 2.1                 | 3.9                | 6.1  | 1.8               | 6.6         | 6.9          | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 1.7                 | 3.0                | 4.3  | 1.5               | 4.7         | 5.0          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 1.6                 | 2.7                | 3.6  | 1.3               | 4.0         | 4.2          | ns   |
|                        |                   | MR to Q; see <a href="#">Figure 8</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -                   | 21.0               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 2.6                 | 6.2                | 11.5 | 2.6               | 11.7        | 13.6         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 2.5                 | 4.4                | 6.1  | 2.4               | 7.6         | 7.8          | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 2.5                 | 3.7                | 5.7  | 2.2               | 6.3         | 6.3          | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 2.1                 | 3.2                | 4.3  | 1.9               | 4.7         | 4.9          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 2.0                 | 3.0                | 3.9  | 1.8               | 4.1         | 4.3          | ns   |
| f <sub>max</sub>       | maximum frequency | CP; see <a href="#">Figure 7</a>      |                     |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -                   | 50                 | -    | -                 | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | -                   | 190                | -    | 150               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | -                   | 320                | -    | 280               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | -                   | 420                | -    | 310               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | -                   | 485                | -    | 370               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | -                   | 550                | -    | 410               | -           | -            | MHz  |
| C <sub>L</sub> = 15 pF |                   |                                       |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>        | propagation delay | CP to Q; see <a href="#">Figure 7</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -                   | 28.1               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 3.0                 | 7.6                | 14.8 | 2.8               | 15.2        | 15.4         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 2.7                 | 5.3                | 8.7  | 2.3               | 9.4         | 9.9          | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 2.3                 | 4.4                | 6.8  | 2.1               | 7.4         | 7.9          | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 2.1                 | 3.5                | 5.0  | 1.9               | 5.3         | 5.6          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 2.0                 | 3.1                | 4.3  | 1.7               | 4.7         | 4.9          | ns   |
|                        |                   | MR to Q; see <a href="#">Figure 8</a> | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -                   | 24.6               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 3.2                 | 7.0                | 13.2 | 2.9               | 13.5        | 15.2         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 3.1                 | 5.0                | 6.8  | 2.6               | 8.6         | 9.1          | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 2.5                 | 4.3                | 6.5  | 2.5               | 7.2         | 7.4          | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 2.6                 | 3.7                | 5.0  | 2.2               | 5.4         | 5.5          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 2.4                 | 3.5                | 4.4  | 2.1               | 4.8         | 5.0          | 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               | Max (85 °C) | Max (125 °C) |      |
| f <sub>max</sub>       | maximum frequency | CP; see <a href="#">Figure 7</a>      |       |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -     | 50                 | -    | -                 | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | -     | 180                | -    | 120               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | -     | 300                | -    | 190               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | -     | 405                | -    | 240               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | -     | 420                | -    | 300               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | -     | 480                | -    | 320               | -           | -            | MHz  |
| C <sub>L</sub> = 30 pF |                   |                                       |       |                    |      |                   |             |              |      |
| t <sub>pd</sub>        | propagation delay | CP to Q; see <a href="#">Figure 7</a> |       |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -     | 38.4               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 3.6   | 9.8                | 19.5 | 3.4               | 20.6        | 21.0         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 3.3   | 6.9                | 11.2 | 3.2               | 12.4        | 13.0         | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 3.1   | 5.7                | 8.8  | 2.9               | 9.6         | 10.2         | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 3.0   | 4.6                | 6.4  | 2.6               | 6.9         | 7.3          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 2.8   | 4.2                | 5.7  | 2.5               | 6.5         | 6.9          | ns   |
|                        |                   | MR to Q; see <a href="#">Figure 8</a> |       |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -     | 35.1               | -    | -                 | -           | -            | ns   |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | 3.9   | 9.3                | 18.0 | 3.7               | 18.6        | 19.8         | ns   |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | 3.9   | 6.6                | 8.9  | 3.6               | 11.6        | 12.2         | ns   |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | 3.6   | 5.6                | 8.6  | 3.4               | 9.6         | 9.7          | ns   |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | 3.5   | 4.8                | 6.4  | 2.9               | 7.2         | 7.2          | ns   |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | 3.3   | 4.6                | 5.7  | 3.1               | 6.4         | 6.9          | ns   |
| f <sub>max</sub>       | maximum frequency | CP; see <a href="#">Figure 7</a>      |       |                    |      |                   |             |              |      |
|                        |                   | V <sub>CC</sub> = 0.8 V               | -     | 35                 | -    | -                 | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.1 V to 1.3 V      | -     | 130                | -    | 70                | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.4 V to 1.6 V      | -     | 200                | -    | 120               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 1.65 V to 1.95 V    | -     | 240                | -    | 150               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 2.3 V to 2.7 V      | -     | 275                | -    | 190               | -           | -            | MHz  |
|                        |                   | V <sub>CC</sub> = 3.0 V to 3.6 V      | -     | 300                | -    | 200               | -           | -            | 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               | Max<br>(85 °C) | Max<br>(125 °C) |      |
| C <sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF |                  |                                               |       |                    |     |                   |                |                 |      |
| t <sub>W</sub>                                | pulse width      | CP; HIGH or LOW; see <a href="#">Figure 7</a> |       |                    |     |                   |                |                 |      |
|                                               |                  | V <sub>CC</sub> = 0.8 V                       | -     | 5.25               | -   | -                 | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.1 V to 1.3 V              | -     | 1.6                | -   | 1.5               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.4 V to 1.6 V              | -     | 1.0                | -   | 0.9               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.65 V to 1.95 V            | -     | 0.75               | -   | 0.7               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 2.3 V to 2.7 V              | -     | 0.6                | -   | 0.4               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 3.0 V to 3.6 V              | -     | 0.55               | -   | 0.4               | -              | -               | ns   |
|                                               |                  | MR; LOW; see <a href="#">Figure 8</a>         |       |                    |     |                   |                |                 |      |
|                                               |                  | V <sub>CC</sub> = 0.8 V                       | -     | 9.0                | -   | -                 | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.1 V to 1.3 V              | -     | 3.0                | -   | 4.9               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.4 V to 1.6 V              | -     | 1.75               | -   | 2.5               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.65 V to 1.95 V            | -     | 1.35               | -   | 1.8               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 2.3 V to 2.7 V              | -     | 0.9                | -   | 1.1               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 3.0 V to 3.6 V              | -     | 0.8                | -   | 0.8               | -              | -               | ns   |
| t <sub>rec</sub>                              | recovery time    | MR; see <a href="#">Figure 8</a>              |       |                    |     |                   |                |                 |      |
|                                               |                  | V <sub>CC</sub> = 0.8 V                       | -     | -                  | -   | -                 | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.1 V to 1.3 V              | -     | –1.1               | -   | –1.2              | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.4 V to 1.6 V              | -     | –2.0               | -   | –0.8              | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.65 V to 1.95 V            | -     | –0.5               | -   | –0.7              | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 2.3 V to 2.7 V              | -     | –0.9               | -   | –0.4              | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 3.0 V to 3.6 V              | -     | –1.0               | -   | –0.2              | -              | -               | ns   |
| t <sub>su(H)</sub>                            | set-up time HIGH | D to CP; see <a href="#">Figure 7</a>         |       |                    |     |                   |                |                 |      |
|                                               |                  | V <sub>CC</sub> = 0.8 V                       | -     | -                  | -   | -                 | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.1 V to 1.3 V              | -     | 0.5                | -   | 1.2               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.4 V to 1.6 V              | -     | 0.4                | -   | 0.8               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.65 V to 1.95 V            | -     | 0.3                | -   | 0.6               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 2.3 V to 2.7 V              | -     | 0.3                | -   | 0.5               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 3.0 V to 3.6 V              | -     | 0.2                | -   | 0.5               | -              | -               | ns   |
| t <sub>su(L)</sub>                            | set-up time LOW  | D to CP; see <a href="#">Figure 7</a>         |       |                    |     |                   |                |                 |      |
|                                               |                  | V <sub>CC</sub> = 0.8 V                       | -     | -                  | -   | -                 | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.1 V to 1.3 V              | -     | 0.8                | -   | 1.7               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.4 V to 1.6 V              | -     | 0.6                | -   | 1.1               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 1.65 V to 1.95 V            | -     | 0.4                | -   | 0.9               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 2.3 V to 2.7 V              | -     | 0.4                | -   | 0.9               | -              | -               | ns   |
|                                               |                  | V <sub>CC</sub> = 3.0 V to 3.6 V              | -     | 0.5                | -   | 0.9               | -              | -               | 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               | Max (85 °C) | Max (125 °C) |      |
| $t_h$    | hold time                     | D to CP; see <a href="#">Figure 7</a>                   |       |                    |     |                   |             |              |      |
|          |                               | $V_{CC} = 0.8 \text{ V}$                                | -     | -                  | -   | -                 | -           | -            | ns   |
|          |                               | $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$              | -     | -0.7               | -   | 0.2               | -           | -            | ns   |
|          |                               | $V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$              | -     | -0.5               | -   | 0                 | -           | -            | ns   |
|          |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$            | -     | -0.5               | -   | 0                 | -           | -            | ns   |
|          |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$              | -     | -0.3               | -   | 0                 | -           | -            | ns   |
|          |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$              | -     | -0.4               | -   | 0                 | -           | -            | ns   |
| $C_{PD}$ | power dissipation capacitance | $f_i = 1 \text{ MHz};$<br>$V_I = \text{GND to } V_{CC}$ |       |                    |     |                   |             |              |      |
|          |                               | $V_{CC} = 0.8 \text{ V}$                                | -     | 1.6                | -   | -                 | -           | -            | pF   |
|          |                               | $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$              | -     | 1.7                | -   | -                 | -           | -            | pF   |
|          |                               | $V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$              | -     | 1.8                | -   | -                 | -           | -            | pF   |
|          |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$            | -     | 1.9                | -   | -                 | -           | -            | pF   |
|          |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$              | -     | 2.2                | -   | -                 | -           | -            | pF   |
|          |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$              | -     | 2.7                | -   | -                 | -           | -            | 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  $\mu\text{W}$ ).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  where:

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

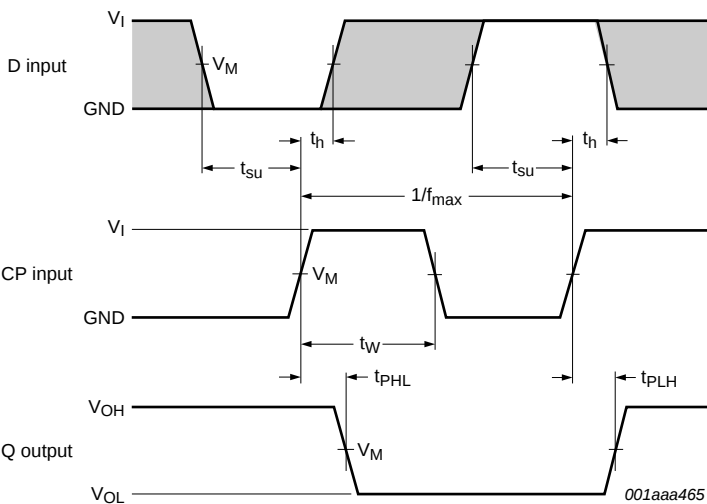
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

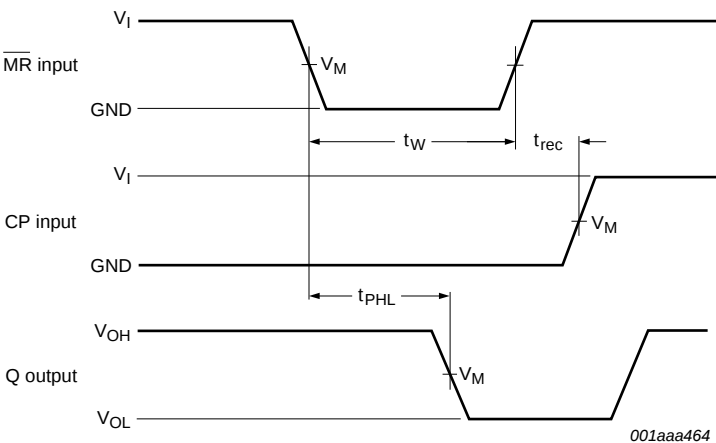
$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

12. Waveforms



Measurement points are given in [Table 9](#).  
The shaded areas indicate when the input is permitted to change for predictable output performance.  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 7. The clock input (CP) to output (Q) propagation delays, the clock pulse width, the D to CP set-up, the CP to D hold times and the maximum input clock frequency**

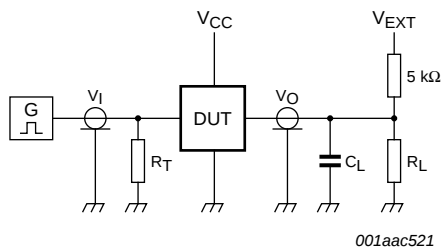


Measurement points are given in [Table 9](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 8. The master reset ( $\overline{MR}$ ) input to output (Q) propagation delays, the master reset pulse width and the  $\overline{MR}$  to CP recovery time**

**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. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage | Load                         |                           | $V_{EXT}$             |                       |                       |
|----------------|------------------------------|---------------------------|-----------------------|-----------------------|-----------------------|
| $V_{CC}$       | $C_L$                        | $R_L$ <a href="#">[1]</a> | $t_{PLH}$ , $t_{PHL}$ | $t_{PZH}$ , $t_{PHZ}$ | $t_{PZL}$ , $t_{PLZ}$ |
| 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

Plastic surface-mounted package; 6 leadsSOT363

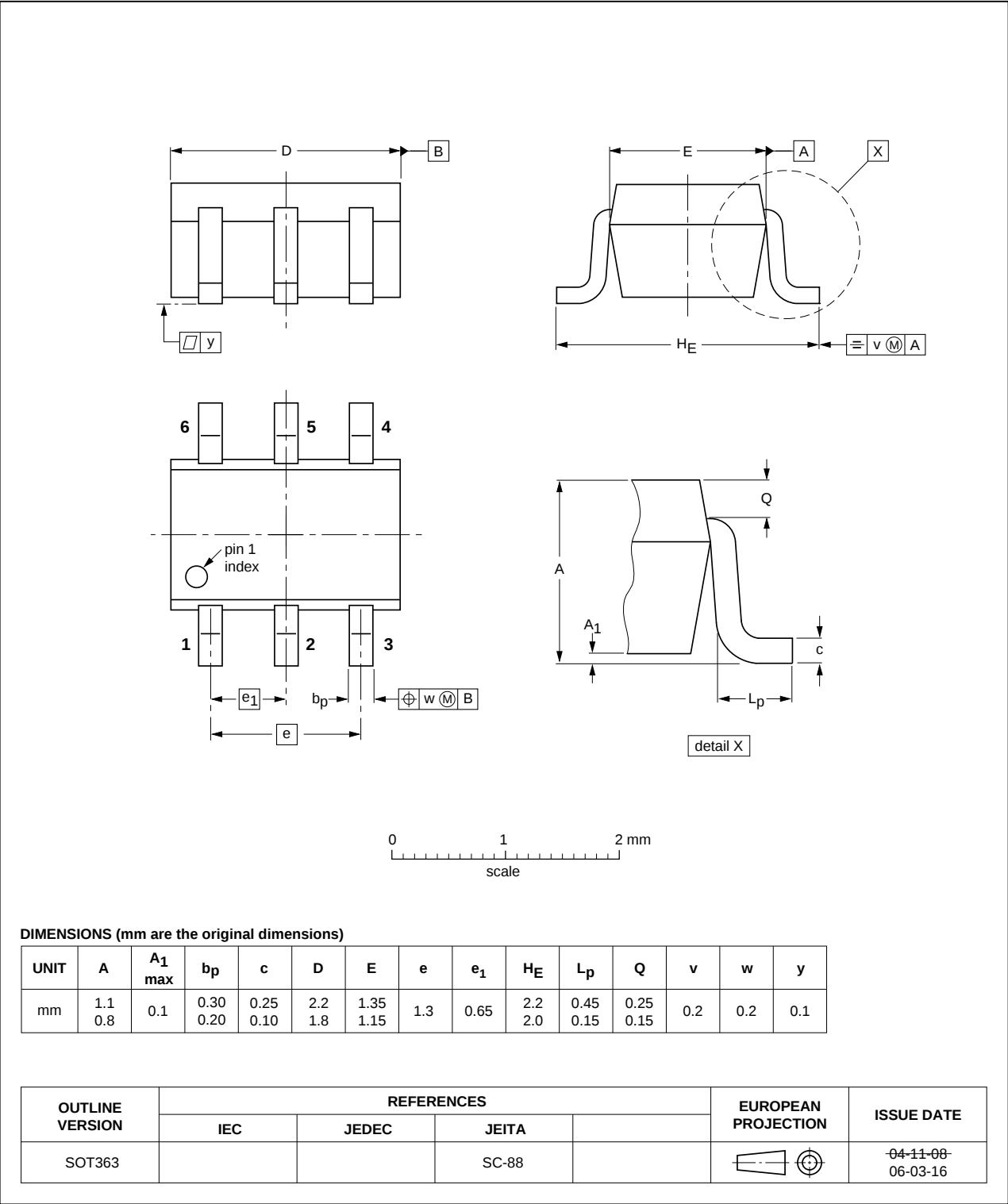


Fig 10. Package outline SOT363 (SC-88)

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

SOT886

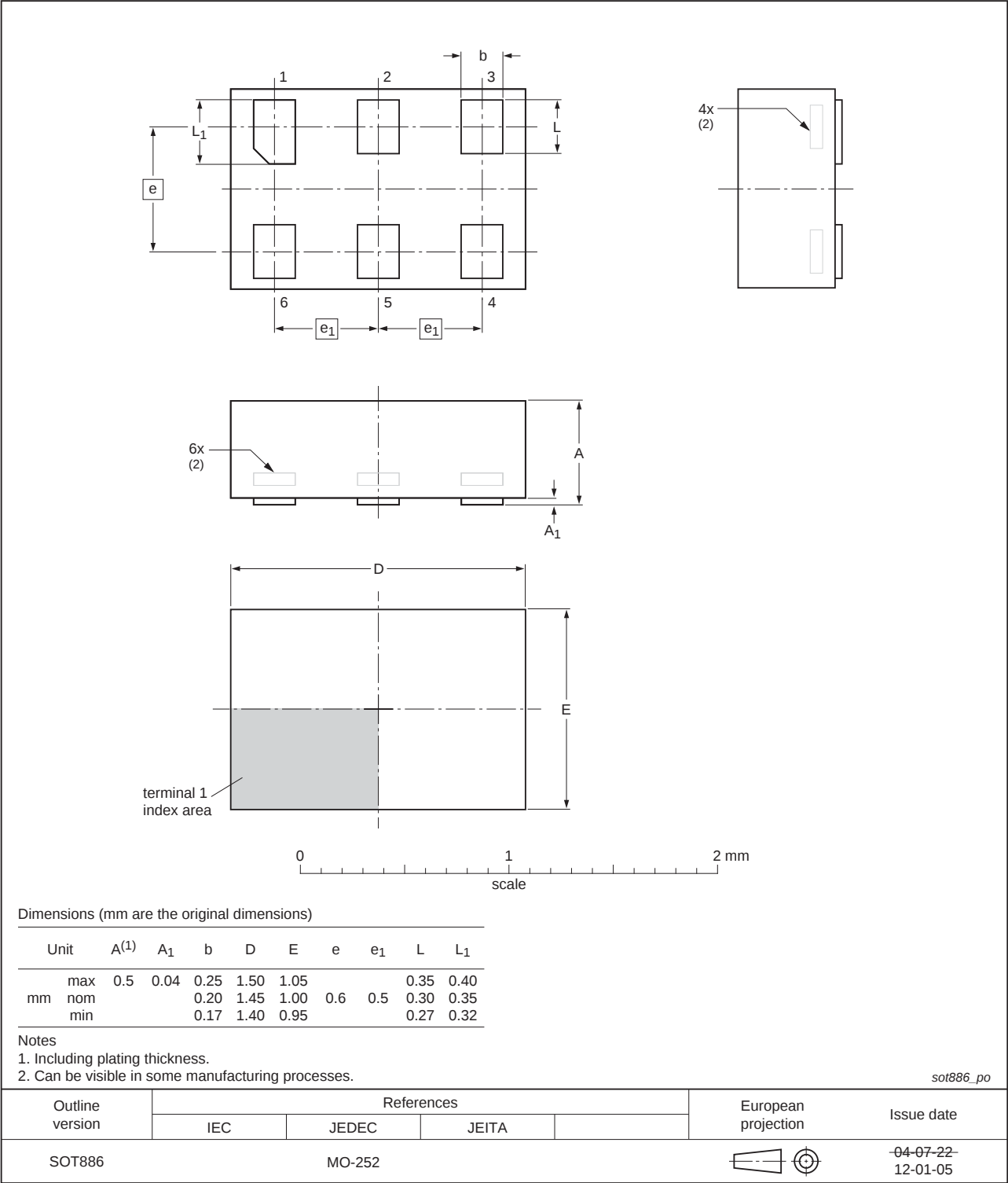


Fig 11. Package outline SOT886 (XSON6)

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

SOT891

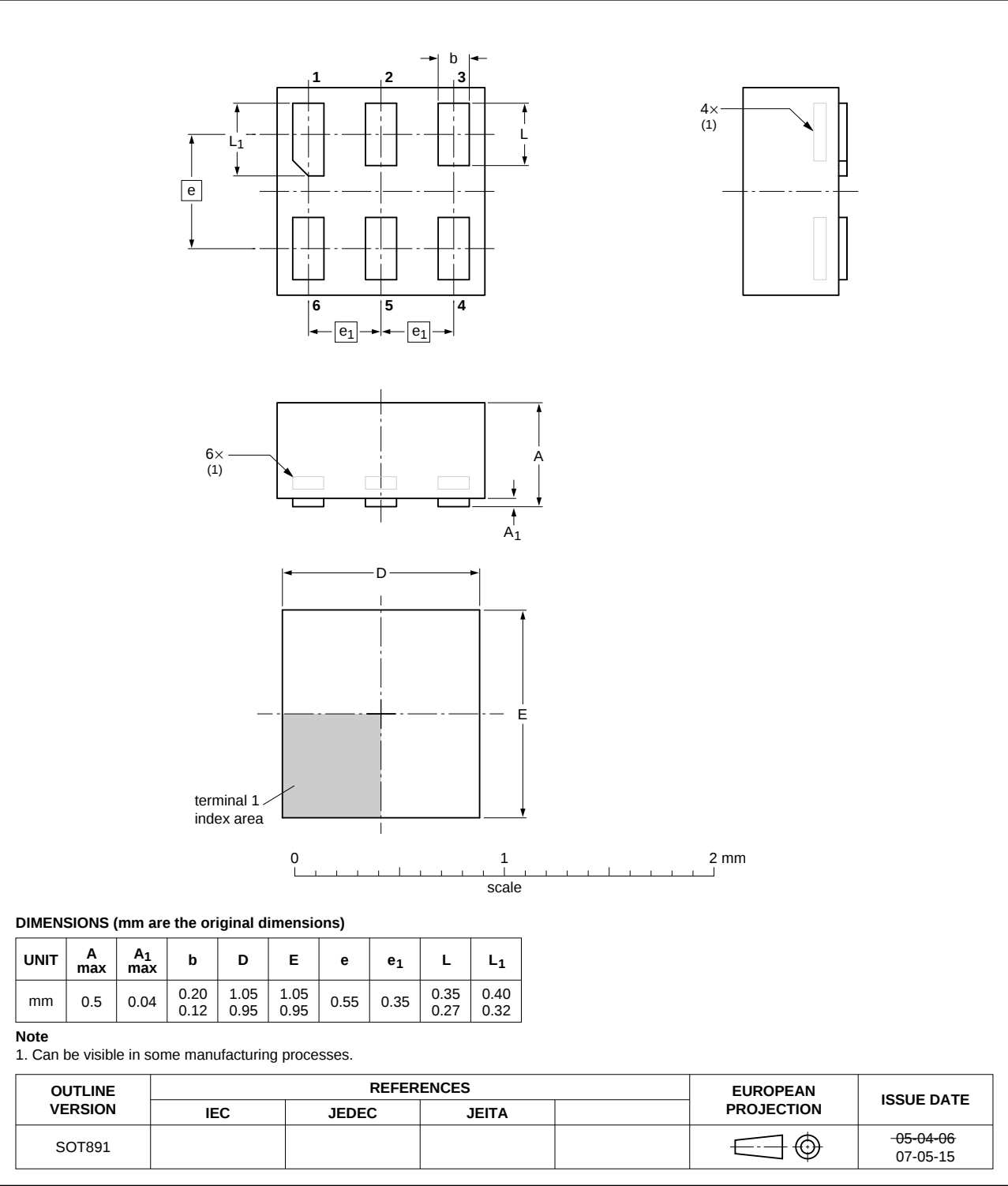
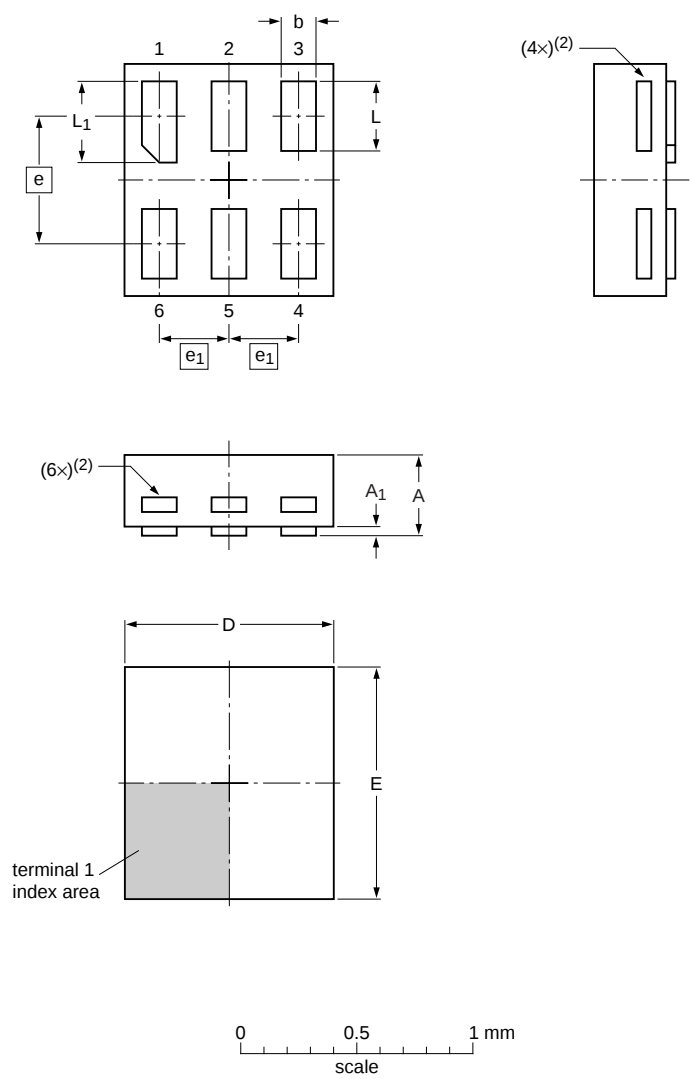


Fig 12. Package outline SOT891 (XSON6)

XSON6: extremely thin small outline package; no leads;  
6 terminals; body 0.9 x 1.0 x 0.35 mm

SOT1115



Dimensions

| Unit | A <sup>(1)</sup> | A <sub>1</sub> | b    | D    | E    | e    | e <sub>1</sub> | L    | L <sub>1</sub> |
|------|------------------|----------------|------|------|------|------|----------------|------|----------------|
| mm   | max              | 0.35           | 0.04 | 0.20 | 0.95 | 1.05 |                | 0.35 | 0.40           |
|      | nom              |                |      | 0.15 | 0.90 | 1.00 | 0.55           | 0.30 | 0.35           |
|      | min              |                |      | 0.12 | 0.85 | 0.95 |                | 0.27 | 0.32           |

Note

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

sot1115\_po

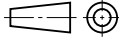
| Outline version | References |       |       |  | European projection                                                                   | Issue date                      |
|-----------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|---------------------------------|
|                 | IEC        | JEDEC | JEITA |  |                                                                                       |                                 |
| SOT1115         |            |       |       |  |  | <del>10-04-02</del><br>10-04-07 |

Fig 13. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads;  
6 terminals; body 1.0 x 1.0 x 0.35 mm

SOT1202

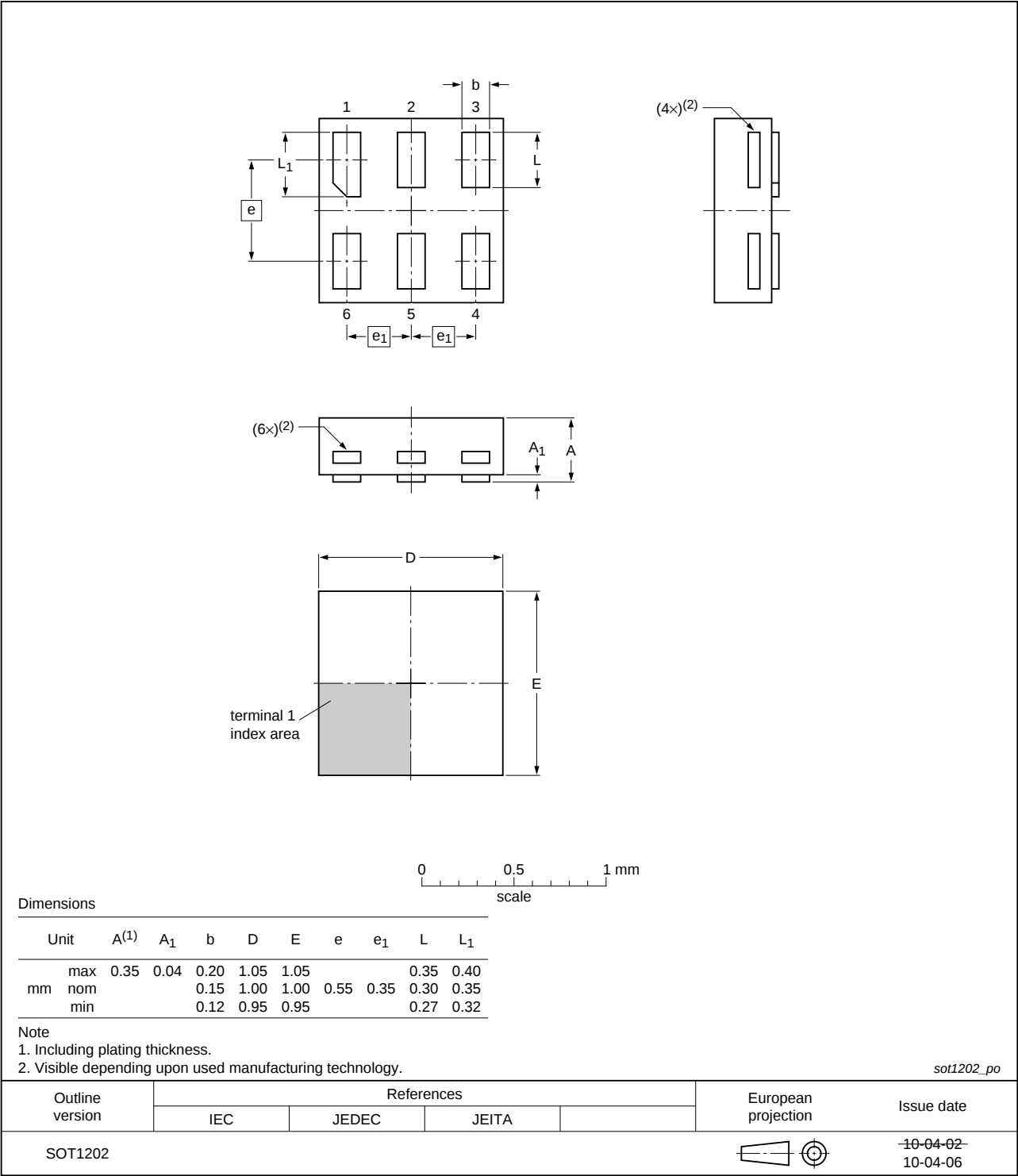


Fig 14. Package outline SOT1202 (XSON6)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

| Document ID    | Release date                                                                | Data sheet status  | Change notice | Supersedes     |
|----------------|-----------------------------------------------------------------------------|--------------------|---------------|----------------|
| 74AUP1G175 v.5 | 20120703                                                                    | Product data sheet | -             | 74AUP1G175 v.4 |
| Modifications: | • Package outline drawing of SOT886 ( <a href="#">Figure 11</a> ) modified. |                    |               |                |
| 74AUP1G175 v.4 | 20111124                                                                    | Product data sheet | -             | 74AUP1G175 v.3 |
| Modifications: | • Legal pages updated.                                                      |                    |               |                |
| 74AUP1G175 v.3 | 20100930                                                                    | Product data sheet | -             | 74AUP1G175 v.2 |
| 74AUP1G175 v.2 | 20080228                                                                    | Product data sheet | -             | 74AUP1G175 v.1 |
| 74AUP1G175 v.1 | 20061115                                                                    | 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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Date of release: 3 July 2012

Document identifier: 74AUP1G175