

# 74AUP1Z125

Low-power X-tal driver with enable and internal resistor;  
3-state

Rev. 3 — 9 September 2010

Product data sheet

## 1. General description

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The 74AUP1Z125 combines the functions of the 74AUP1GU04 and 74AUP1G125 with enable circuitry and an internal bias resistor to provide a device optimized for use in crystal oscillator applications.

When not in use the  $\overline{EN}$  input can be driven HIGH, pulling up the X1 input and putting the device in a low power disable mode. Schmitt trigger action at the  $\overline{EN}$  input 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 is fully specified for partial power-down applications using  $I_{OFF}$  at output Y. The  $I_{OFF}$  circuitry disables the output Y, preventing the damaging backflow current through the device when it is powered down.

The integration of the two devices into the 74AUP1Z125 produces the benefits of a compact footprint, lower power dissipation and stable operation over a wide range of frequency and temperature.

## 2. Features and benefits

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- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- ESD protection:
  - ◆ HBM JESD22-A114F Class 3A exceeds 5000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101E exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD78B 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 at output Y
- 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   |         |
| 74AUP1Z125GW | -40 °C to +125 °C | SC-88 | plastic surface-mounted package; 6 leads  | SOT363  |
| 74AUP1Z125GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886  |
| 74AUP1Z125GF | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm    | SOT891  |
| 74AUP1Z125GN | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm       | SOT1115 |
| 74AUP1Z125GS | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm       | SOT1202 |

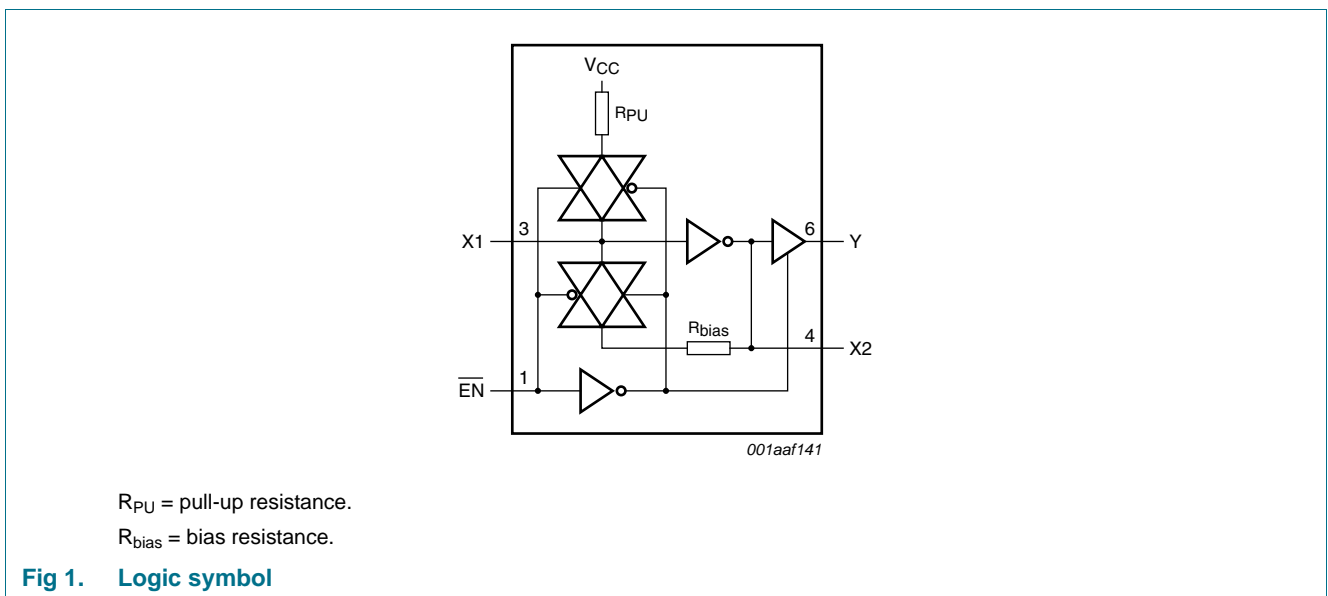
### 4. Marking

Table 2. Marking

| Type number  | Marking code <sup>[1]</sup> |
|--------------|-----------------------------|
| 74AUP1Z125GW | 55                          |
| 74AUP1Z125GM | 55                          |
| 74AUP1Z125GF | 55                          |
| 74AUP1Z125GN | 55                          |
| 74AUP1Z125GS | 55                          |

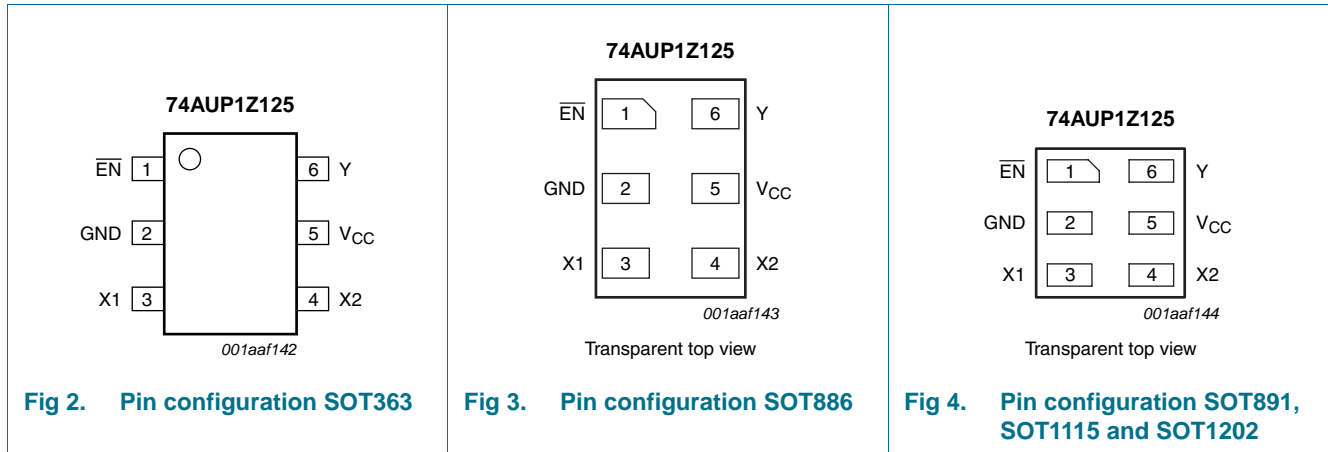
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3. Pin description

| Symbol                 | Pin | Description               |
|------------------------|-----|---------------------------|
| $\overline{\text{EN}}$ | 1   | enable input (active LOW) |
| GND                    | 2   | ground (0 V)              |
| X1                     | 3   | data input                |
| X2                     | 4   | unbuffered output         |
| V <sub>CC</sub>        | 5   | supply voltage            |
| Y                      | 6   | data output               |

## 7. Functional description

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

| Input                  |    | Output |   |  |
|------------------------|----|--------|---|--|
| $\overline{\text{EN}}$ | X1 | X2     | Y |  |
| L                      | L  | H      | H |  |
| L                      | H  | L      | L |  |
| H                      | L  | H      | Z |  |
| H                      | H  | L      | Z |  |

[1] H = HIGH voltage level;  
 L = LOW voltage level;  
 Z = high-impedance OFF-state.

## 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 $V_{CC}$         | -        | $\pm 20$ | 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 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  $P_{tot}$  derates linearly with 4.0 mW/K.

For XSON6 packages: above 118 °C the value of  $P_{tot}$  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                      |                           | 0   | $V_{CC}$ | 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 |
|--------------------------------|---------------------------|---|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = 25 °C</b> |                           |   |                        |     |                        |      |
| V <sub>IH</sub>                | HIGH-level input voltage  | X1 input  |                        |     |                        |      |
|                                |                           | V <sub>CC</sub> = 0.8 V to 3.6 V  | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
|                                |                           | EN input  |                        |     |                        |      |
|                                |                           | 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>IL</sub>                | LOW-level input voltage   | X1 input  |                        |     |                        |      |
|                                |                           | V <sub>CC</sub> = 0.8 V to 3.6 V  | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
|                                |                           | EN input  |                        |     |                        |      |
|                                |                           | 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>OH</sub>                | HIGH-level output voltage | Y output; V <sub>I</sub> at X1 input = 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    |
|                                |                           | X2 output; V <sub>I</sub> = GND or V <sub>CC</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    |

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

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

| Symbol            | Parameter                            | Conditions  | Min               | Typ | Max                   | Unit |  |
|-------------------|--------------------------------------|---|-------------------|-----|-----------------------|------|--|
| V <sub>OL</sub>   | LOW-level output voltage             | Y output; V <sub>I</sub> at X1 input = 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    |  |
|                   |                                      | X2 output; V <sub>I</sub> = GND or V <sub>CC</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                | X1 input  |                   |     |                       |      |  |
|                   |                                      | V <sub>I</sub> = $\overline{\text{EN}}$ = V <sub>CC</sub> ; V <sub>CC</sub> = 0 V to 3.6 V                        | -                 | -   | ±0.1                  | μA   |  |
|                   |                                      | $\overline{\text{EN}}$ input  |                   |     |                       |      |  |
|                   |                                      | V <sub>I</sub> = GND to 3.6 V;<br>V <sub>CC</sub> = 0 V to 3.6 V  | -                 | -   | ±0.1                  | μA   |  |
| I <sub>pu</sub>   | pull-up current                      | X1 input; $\overline{\text{EN}}$ = V <sub>CC</sub>  |                   |     |                       |      |  |
|                   |                                      | V <sub>I</sub> = GND; V <sub>CC</sub> = 0.8 V to 3.6 V  | -                 | -   | 15                    | μA   |  |
| I <sub>OZ</sub>   | OFF-state output current             | Y output; V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V; $\overline{\text{EN}}$ = V <sub>CC</sub> | -                 | -   | ±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  | <a href="#">1</a> | -   | ±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                                   | <a href="#">1</a> | -   | ±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                  | -                 | -   | 75                    | μA   |  |
| ΔI <sub>CC</sub>  | additional supply current            | $\overline{\text{EN}}$ input  |                   |     |                       |      |  |
|                   |                                      | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V                           | -                 | -   | 40                    | μA   |  |
| C <sub>I</sub>    | input capacitance                    | X1 input  |                   |     |                       |      |  |
|                   |                                      | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>   | -                 | 1.3 | -                     | pF   |  |
|                   |                                      | $\overline{\text{EN}}$ input  |                   |     |                       |      |  |
|                   |                                      | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>   | -                 | 0.8 | -                     | 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 |
|---|--------------------------|---|------------------------|------|------------------------|------|
| C <sub>O</sub>                            | output capacitance       | X2 output   |                        |      |                        |      |
|   |                          | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V   | -                      | 1.5  | -                      | pF   |
|   |                          | Y output  |                        |      |                        |      |
|   |                          | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V   | -                      | 1.7  | -                      | pF   |
| g <sub>fs</sub>                           | forward transconductance | see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>   |                        |      |                        |      |
|   |                          | V <sub>CC</sub> = 0.8 V   | -                      | -    | -                      | mA/V |
|   |                          | V <sub>CC</sub> = 1.1 V to 1.3 V  | 0.2                    | -    | 9.9                    | mA/V |
|   |                          | V <sub>CC</sub> = 1.4 V to 1.6 V  | 3.9                    | -    | 17.7                   | mA/V |
|   |                          | V <sub>CC</sub> = 1.65 V to 1.95 V  | 7.9                    | -    | 24.3                   | mA/V |
|   |                          | V <sub>CC</sub> = 2.3 V to 2.7 V  | 18                     | -    | 30.7                   | mA/V |
|   |                          | V <sub>CC</sub> = 3.0 V to 3.6 V  | 20.5                   | -    | 32.4                   | mA/V |
| R <sub>bias</sub>                         | bias resistance          | $\overline{\text{EN}}$ = GND; f <sub>i</sub> = 0 Hz; V <sub>I</sub> = 0 V or V <sub>CC</sub> ; See <a href="#">Figure 5</a> ; for frequency behavior see <a href="#">Figure 6</a> | 1.08                   | 1.62 | 3.08                   | MΩ   |
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                          |   |                        |      |                        |      |
| V <sub>IH</sub>                           | HIGH-level input voltage | X1 input  |                        |      |                        |      |
|   |                          | V <sub>CC</sub> = 0.8 V to 3.6 V  | 0.75 × V <sub>CC</sub> | -    | -                      | V    |
|   |                          | $\overline{\text{EN}}$ input  |                        |      |                        |      |
|   |                          | 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>IL</sub>                           | LOW-level input voltage  | X1 input  |                        |      |                        |      |
|   |                          | V <sub>CC</sub> = 0.8 V to 3.6 V  | -                      | -    | 0.25 × V <sub>CC</sub> | V    |
|   |                          | $\overline{\text{EN}}$ input  |                        |      |                        |      |
|   |                          | 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    |

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

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

| Symbol   | Parameter                 | Conditions  | Min                      | Typ   | Max                   | Unit |     |   |
|--|---------------------------|---|--------------------------|---|-----------------------|------|-----|---|
| V <sub>OH</sub>  | HIGH-level output voltage | Y output; V <sub>I</sub> at X1 input = 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    |     |   |
|  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                         | 2.55                     | -   | -                     | V    |     |   |
|  |                           | X2 output; V <sub>I</sub> = GND or V <sub>CC</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    |     |   |
|  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                         | 2.55                     | -   | -                     | V    |     |   |
|  |                           | V <sub>OL</sub>   | LOW-level output voltage | Y output; V <sub>I</sub> at X1 input = 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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V         | -                         |   |                          | -   | 0.45                  | V    |     |   |
| X2 output; V <sub>I</sub> = GND or V <sub>CC</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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V         | -                         |   |                          | -   | 0.45                  | 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                | X1 input<br>$V_I = \overline{EN} = V_{CC}; V_{CC} = 0 \text{ V to } 3.6 \text{ V}$  | -    | -   | $\pm 0.5$ | $\mu\text{A}$    |
|                  |                                      | $\overline{EN}$ input<br>$V_I = \text{GND to } 3.6 \text{ V}; V_{CC} = 0 \text{ V to } 3.6 \text{ V}$   | -    | -   | $\pm 0.5$ | $\mu\text{A}$    |
| $I_{pu}$         | pull-up current                      | X1 input; $\overline{EN} = V_{CC}$<br>$V_I = \text{GND}; V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$  | -    | -   | 15        | $\mu\text{A}$    |
| $I_{OZ}$         | OFF-state output current             | Y output; $V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC} = 0 \text{ V to } 3.6 \text{ V}; \overline{EN} = V_{CC}$   | -    | -   | $\pm 0.5$ | $\mu\text{A}$    |
| $I_{OFF}$        | power-off leakage current            | $V_I$ or $V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC} = 0 \text{ V}$  | [1]  | -   | $\pm 0.5$ | $\mu\text{A}$    |
| $\Delta I_{OFF}$ | additional power-off leakage current | $V_I$ or $V_O = 0 \text{ V to } 3.6 \text{ V}; V_{CC} = 0 \text{ V to } 0.2 \text{ V}$  | [1]  | -   | $\pm 0.6$ | $\mu\text{A}$    |
| $I_{CC}$         | supply current                       | $V_I = \text{GND or } V_{CC}; I_O = 0 \text{ A}; V_{CC} = 0.8 \text{ V to } 3.6 \text{ V}$  | -    | -   | 75        | $\mu\text{A}$    |
| $\Delta I_{CC}$  | additional supply current            | $\overline{EN}$ input<br>$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}; V_{CC} = 3.3 \text{ V}$  | -    | -   | 50        | $\mu\text{A}$    |
|                  |                                      |   |      |     |           |                  |
| $g_{fs}$         | forward transconductance             | see <a href="#">Figure 10</a> and <a href="#">Figure 11</a><br>$V_{CC} = 0.8 \text{ V}$   | -    | -   | -         | $\text{mA/V}$    |
|                  |                                      | $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$  | -    | -   | 10.8      | $\text{mA/V}$    |
|                  |                                      | $V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$  | 1.8  | -   | 21.2      | $\text{mA/V}$    |
|                  |                                      | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$  | 7.5  | -   | 29.9      | $\text{mA/V}$    |
|                  |                                      | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$  | 15.0 | -   | 38.0      | $\text{mA/V}$    |
|                  |                                      | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$  | 17.8 | -   | 39.2      | $\text{mA/V}$    |
| $R_{bias}$       | bias resistance                      | $\overline{EN} = \text{GND}; f_i = 0 \text{ Hz}; V_I = 0 \text{ V or } V_{CC}$ ; See <a href="#">Figure 5</a> ; for frequency behavior see <a href="#">Figure 6</a> | 1.07 | -   | 3.11      | $\text{M}\Omega$ |

**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  | X1 input  |                        |     |                        |      |
|  |                           | V <sub>CC</sub> = 0.8 V to 3.6 V  | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
|  |                           | $\overline{\text{EN}}$ input  |                        |     |                        |      |
|  |                           | 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>IL</sub>                            | LOW-level input voltage   | X1 input  |                        |     |                        |      |
|  |                           | V <sub>CC</sub> = 0.8 V to 3.6 V  | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
|  |                           | $\overline{\text{EN}}$ input  |                        |     |                        |      |
|  |                           | 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>OH</sub>                            | HIGH-level output voltage | Y output; V <sub>I</sub> at X1 input = 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    |
|  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                         | 2.30                   | -   | -                      | V    |
|  |                           | X2 output; V <sub>I</sub> = GND or V <sub>CC</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    |
|  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V                         | 2.30                   | -   | -                      | V    |

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

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

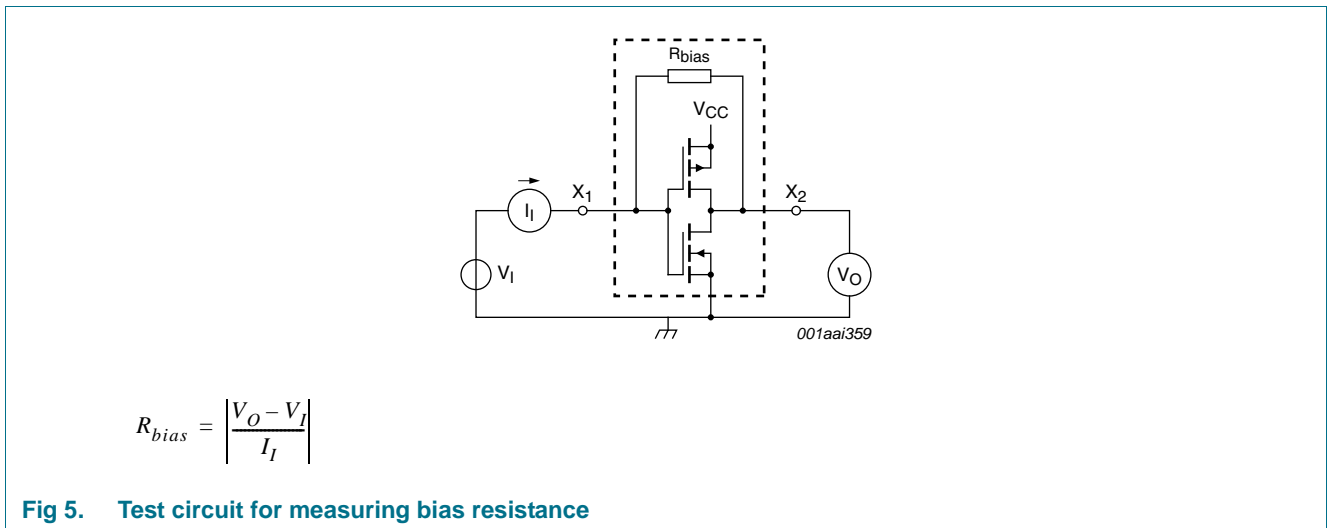
| Symbol            | Parameter                            | Conditions  | Min               | Typ | Max                    | Unit |  |
|-------------------|--------------------------------------|---|-------------------|-----|------------------------|------|--|
| V <sub>OL</sub>   | LOW-level output voltage             | Y output; 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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V  | -                 | -   | 0.50                   | V    |  |
|                   |                                      | X2 output; V <sub>I</sub> = GND or V <sub>CC</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>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V  | -                 | -   | 0.50                   | V    |  |
| I <sub>I</sub>    | input leakage current                | X1 input  |                   |     |                        |      |  |
|                   |                                      | V <sub>I</sub> = $\overline{\text{EN}}$ = V <sub>CC</sub> ; V <sub>CC</sub> = 0 V to 3.6 V                        | -                 | -   | ±0.75                  | μA   |  |
|                   |                                      | $\overline{\text{EN}}$ input  |                   |     |                        |      |  |
|                   |                                      | V <sub>I</sub> = GND to 3.6 V;<br>V <sub>CC</sub> = 0 V to 3.6 V  | -                 | -   | ±0.75                  | μA   |  |
| I <sub>pu</sub>   | pull-up current                      | X1 input; $\overline{\text{EN}}$ = V <sub>CC</sub>  |                   |     |                        |      |  |
|                   |                                      | V <sub>I</sub> = GND; V <sub>CC</sub> = 0.8 V to 3.6 V  | -                 | -   | 15                     | μA   |  |
| I <sub>OZ</sub>   | OFF-state output current             | Y output; V <sub>O</sub> = 0 V to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V; $\overline{\text{EN}}$ = V <sub>CC</sub> | -                 | -   | ±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  | <a href="#">1</a> | -   | ±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                                   | <a href="#">1</a> | -   | ±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                  | -                 | -   | 75                     | μA   |  |
| ΔI <sub>CC</sub>  | additional supply current            | $\overline{\text{EN}}$ input  |                   |     |                        |      |  |
|                   |                                      | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 3.3 V                           | -                 | -   | 75                     | μA   |  |

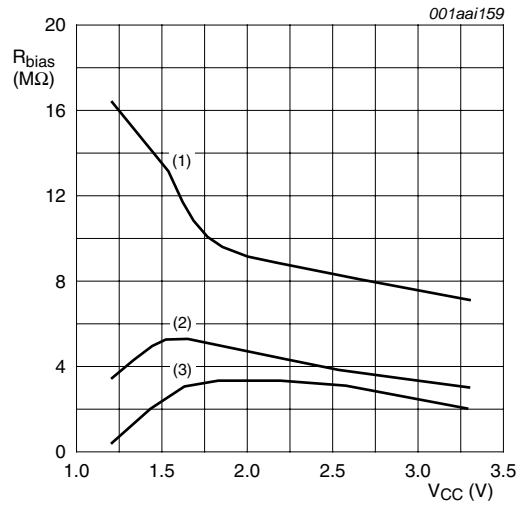
**Table 7. Static characteristics ...continued**

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

| Symbol            | Parameter                | Conditions   | Min  | Typ | Max  | Unit |
|-------------------|--------------------------|--|------|-----|------|------|
| g <sub>fs</sub>   | forward transconductance | see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>  |      |     |      |      |
|                   |                          | V <sub>CC</sub> = 0.8 V  | -    | -   | -    | mA/V |
|                   |                          | V <sub>CC</sub> = 1.1 V to 1.3 V   | -    | -   | 10.8 | mA/V |
|                   |                          | V <sub>CC</sub> = 1.4 V to 1.6 V   | 1.8  | -   | 21.2 | mA/V |
|                   |                          | V <sub>CC</sub> = 1.65 V to 1.95 V   | 6.9  | -   | 29.9 | mA/V |
|                   |                          | V <sub>CC</sub> = 2.3 V to 2.7 V   | 13.4 | -   | 38.0 | mA/V |
|                   |                          | V <sub>CC</sub> = 3.0 V to 3.6 V   | 15.8 | -   | 39.2 | mA/V |
| R <sub>bias</sub> | bias resistance          | $\overline{EN} = \text{GND}$ ; f <sub>i</sub> = 0 Hz; V <sub>I</sub> = 0 V or V <sub>CC</sub> ; See <a href="#">Figure 5</a> ; for frequency behavior see <a href="#">Figure 6</a> | 1.07 | -   | 3.11 | MΩ   |

[1] Only for output Y and input  $\overline{EN}$ .





- (1)  $f_i = 30 \text{ kHz}$ .
- (2)  $f_i = 1 \text{ MHz}$ .
- (3)  $f_i = 10 \text{ MHz}$ .

Fig 6. Typical bias resistance versus supply voltage

## 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) |      |
| <b>C<sub>L</sub> = 5 pF</b> |                   |   |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>             | propagation delay | X1 to X2; see <a href="#">Figure 7</a>                    | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                             |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 6.2                | -    | -                 | -           | -            | ns   |
|                             |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 0.9                 | 2.3                | 4.4  | 0.9               | 4.8         | 5.3          | ns   |
|                             |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 0.7                 | 1.7                | 3.1  | 0.6               | 3.4         | 3.8          | ns   |
|                             |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 0.5                 | 1.4                | 2.6  | 0.5               | 2.9         | 3.2          | ns   |
|                             |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 0.4                 | 1.1                | 2.0  | 0.4               | 2.3         | 2.6          | ns   |
|                             |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 0.3                 | 1.0                | 1.8  | 0.3               | 2.1         | 2.4          | ns   |
|                             |                   | X1 to Y; see <a href="#">Figure 7</a>                     | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                             |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 18.5               | -    | -                 | -           | -            | ns   |
|                             |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 2.8                 | 5.9                | 12.5 | 3.2               | 14.8        | 16.3         | ns   |
|                             |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.2                 | 4.2                | 7.7  | 2.6               | 9.1         | 10.1         | ns   |
|                             |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 1.9                 | 3.5                | 6.2  | 2.2               | 7.8         | 8.6          | ns   |
|                             |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.6                 | 2.9                | 4.8  | 1.9               | 6.2         | 6.9          | ns   |
|                             |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.4                 | 2.6                | 4.1  | 1.7               | 4.7         | 5.2          | ns   |
| t <sub>en</sub>             | enable time       | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[3]</a> |                    |      |                   |             |              |      |
|                             |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 31.2               | -    | -                 | -           | -            | ns   |
|                             |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 3.1                 | 6.1                | 13.8 | 2.9               | 16.3        | 18.0         | ns   |
|                             |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.5                 | 4.3                | 8.2  | 2.3               | 9.7         | 10.7         | ns   |
|                             |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.1                 | 3.6                | 6.5  | 2.0               | 7.6         | 8.4          | ns   |
|                             |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.8                 | 2.9                | 4.8  | 1.7               | 5.8         | 6.4          | ns   |
|                             |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.7                 | 2.6                | 4.1  | 1.7               | 4.7         | 5.2          | ns   |
| t <sub>dis</sub>            | disable time      | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[4]</a> |                    |      |                   |             |              |      |
|                             |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 11.1               | -    | -                 | -           | -            | ns   |
|                             |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 2.5                 | 4.5                | 9.0  | 2.9               | 9.4         | 10.4         | ns   |
|                             |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.0                 | 3.3                | 6.4  | 2.3               | 6.7         | 7.4          | ns   |
|                             |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 1.9                 | 3.2                | 6.0  | 2.0               | 6.4         | 7.1          | ns   |
|                             |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.4                 | 2.3                | 4.4  | 1.7               | 4.7         | 5.2          | ns   |
|                             |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.7                 | 2.6                | 4.4  | 1.7               | 4.9         | 5.4          | 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               | Max (85 °C) | Max (125 °C) |      |
| <b>C<sub>L</sub> = 10 pF</b> |                   |   |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>              | propagation delay | X1 to X2; see <a href="#">Figure 7</a>                    | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 9.6                | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 1.2                 | 3.1                | 6.1  | 1.2               | 6.8         | 7.5          | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 1.0                 | 2.3                | 4.0  | 0.9               | 4.6         | 5.1          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 0.8                 | 1.9                | 3.3  | 0.7               | 3.8         | 4.2          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 0.6                 | 1.5                | 2.7  | 0.6               | 3.1         | 3.5          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 0.5                 | 1.3                | 2.4  | 0.5               | 2.7         | 3.0          | ns   |
|                              |                   | X1 to Y; see <a href="#">Figure 7</a>                     | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 21.4               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 3.2                 | 6.7                | 14.3 | 3.6               | 16.2        | 17.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.1                 | 4.9                | 8.9  | 3.0               | 10.1        | 11.2         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 1.9                 | 4.1                | 6.9  | 2.6               | 8.0         | 8.8          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.1                 | 3.4                | 5.4  | 2.3               | 6.6         | 7.3          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.8                 | 3.1                | 4.8  | 2.1               | 5.6         | 6.2          | ns   |
| t <sub>en</sub>              | enable time       | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[3]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 34.4               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 3.6                 | 6.9                | 15.5 | 3.4               | 16.0        | 17.6         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.3                 | 5.0                | 9.3  | 2.2               | 9.6         | 10.6         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.0                 | 4.2                | 7.2  | 1.9               | 7.9         | 8.7          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.8                 | 3.4                | 5.5  | 1.7               | 6.4         | 7.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.7                 | 3.2                | 4.9  | 1.7               | 5.5         | 6.1          | ns   |
| t <sub>dis</sub>             | disable time      | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[4]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 13.0               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 3.4                 | 5.7                | 10.4 | 3.4               | 10.8        | 11.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.1                 | 4.2                | 7.6  | 2.2               | 8.0         | 8.8          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.2                 | 4.3                | 7.3  | 1.9               | 7.6         | 8.4          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.6                 | 3.1                | 5.3  | 1.7               | 5.5         | 6.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.1                 | 3.8                | 6.0  | 1.7               | 6.5         | 7.2          | 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) |      |
| <b>C<sub>L</sub> = 15 pF</b> |                   |   |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>              | propagation delay | X1 to X2; see <a href="#">Figure 7</a>                    | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 13.0               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 1.6                 | 3.8                | 7.9  | 1.4               | 8.8         | 9.7          | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 1.3                 | 2.8                | 4.9  | 1.1               | 5.7         | 6.3          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 1.0                 | 2.3                | 4.0  | 0.9               | 4.7         | 5.2          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 0.8                 | 1.9                | 3.2  | 0.8               | 3.7         | 4.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 0.7                 | 1.6                | 2.9  | 0.7               | 3.3         | 3.7          | ns   |
|                              |                   | X1 to Y; see <a href="#">Figure 7</a>                     | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 24.2               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 3.6                 | 7.5                | 16.1 | 4.0               | 17.6        | 19.4         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 3.0                 | 5.4                | 9.7  | 3.3               | 10.6        | 11.7         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.2                 | 4.6                | 7.7  | 2.9               | 9.0         | 9.9          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.0                 | 3.9                | 6.1  | 2.6               | 7.3         | 8.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.0                 | 3.6                | 5.4  | 2.3               | 5.9         | 6.5          | ns   |
| t <sub>en</sub>              | enable time       | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[3]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 37.5               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 4.0                 | 7.7                | 17.2 | 3.7               | 17.5        | 19.3         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 3.0                 | 5.5                | 10.0 | 2.5               | 10.2        | 11.3         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.3                 | 4.7                | 7.9  | 2.1               | 9.2         | 10.2         | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.0                 | 3.9                | 6.2  | 2.0               | 7.4         | 8.2          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.0                 | 3.6                | 5.5  | 1.9               | 6.0         | 6.6          | ns   |
| t <sub>dis</sub>             | disable time      | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[4]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 14.8               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 4.3                 | 6.8                | 11.2 | 3.7               | 12.4        | 13.7         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 3.0                 | 5.1                | 8.1  | 2.5               | 8.9         | 9.8          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 3.0                 | 5.4                | 8.0  | 2.1               | 9.3         | 10.3         | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.1                 | 3.9                | 6.1  | 2.0               | 7.3         | 8.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.9                 | 5.1                | 7.2  | 1.9               | 7.9         | 8.7          | 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) |      |
| <b>C<sub>L</sub> = 30 pF</b> |                   |   |                     |                    |      |                   |             |              |      |
| t <sub>pd</sub>              | propagation delay | X1 to X2; see <a href="#">Figure 7</a>                    | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 23.2               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 2.4                 | 6.0                | 13.1 | 2.2               | 14.8        | 16.3         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 2.0                 | 4.2                | 7.6  | 1.8               | 9.0         | 9.9          | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 1.7                 | 3.6                | 6.1  | 1.5               | 7.2         | 8.0          | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 1.4                 | 2.9                | 4.8  | 1.3               | 5.7         | 6.3          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 1.2                 | 2.5                | 4.3  | 1.1               | 5.1         | 5.7          | ns   |
|                              |                   | X1 to Y; see <a href="#">Figure 7</a>                     | <a href="#">[2]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 32.6               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 4.8                 | 9.6                | 21.0 | 5.0               | 21.7        | 23.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 4.0                 | 6.9                | 12.4 | 4.3               | 13.5        | 14.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 2.9                 | 5.9                | 9.8  | 3.8               | 10.7        | 11.8         | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.7                 | 5.0                | 7.5  | 3.3               | 8.2         | 9.1          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.7                 | 4.7                | 6.8  | 3.1               | 7.7         | 8.5          | ns   |
| t <sub>en</sub>              | enable time       | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[3]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 47.1               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 5.2                 | 9.9                | 21.0 | 4.8               | 21.7        | 23.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 4.0                 | 7.1                | 12.4 | 3.1               | 13.5        | 14.9         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 3.0                 | 6.0                | 9.9  | 2.8               | 10.7        | 11.8         | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 2.7                 | 5.0                | 7.7  | 2.6               | 8.1         | 9.0          | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 2.7                 | 4.8                | 6.8  | 2.6               | 7.7         | 8.5          | ns   |
| t <sub>dis</sub>             | disable time      | $\overline{\text{EN}}$ to Y; see <a href="#">Figure 8</a> | <a href="#">[4]</a> |                    |      |                   |             |              |      |
|                              |                   | V <sub>CC</sub> = 0.8 V                                   | -                   | 20.3               | -    | -                 | -           | -            | ns   |
|                              |                   | V <sub>CC</sub> = 1.1 V to 1.3 V                          | 6.0                 | 10.2               | 15.3 | 4.8               | 16.5        | 18.2         | ns   |
|                              |                   | V <sub>CC</sub> = 1.4 V to 1.6 V                          | 4.4                 | 7.8                | 11.2 | 3.1               | 12.3        | 13.6         | ns   |
|                              |                   | V <sub>CC</sub> = 1.65 V to 1.95 V                        | 5.1                 | 8.8                | 12.5 | 2.8               | 13.3        | 14.7         | ns   |
|                              |                   | V <sub>CC</sub> = 2.3 V to 2.7 V                          | 3.6                 | 6.3                | 8.6  | 2.6               | 9.5         | 10.5         | ns   |
|                              |                   | V <sub>CC</sub> = 3.0 V to 3.6 V                          | 5.2                 | 8.8                | 11.5 | 2.6               | 13.0        | 14.3         | ns   |

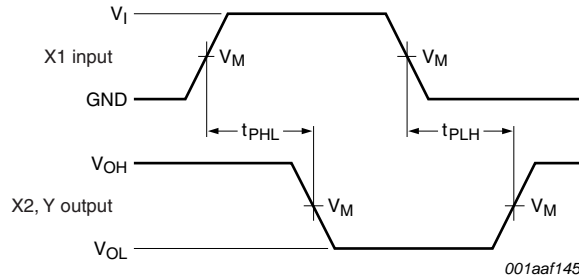
**Table 8. Dynamic characteristics ...continued**

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) |      |
| <b>C<sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF</b> |                               |   |       |                    |     |                   |             |              |      |
| C <sub>PD</sub>                                     | power dissipation capacitance | f <sub>i</sub> = 1 MHz; $\overline{EN}$ = GND;<br>V <sub>I</sub> = GND to V <sub>CC</sub> |       | [5][6]             |     |                   |             |              |      |
|   |                               | V <sub>CC</sub> = 0.8 V   | -     | 7.1                | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.1 V to 1.3 V  | -     | 12.9               | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.4 V to 1.6 V  | -     | 19.2               | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 1.65 V to 1.95 V  | -     | 19.9               | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 2.3 V to 2.7 V  | -     | 21.6               | -   | -                 | -           | -            | pF   |
|   |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  | -     | 24.3               | -   | -                 | -           | -            | 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] t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>.
- [4] t<sub>dis</sub> is the same as t<sub>PHZ</sub> and t<sub>PLZ</sub>.
- [5] 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.
- [6] Feedback current is included in C<sub>PD</sub>.

12. Waveforms

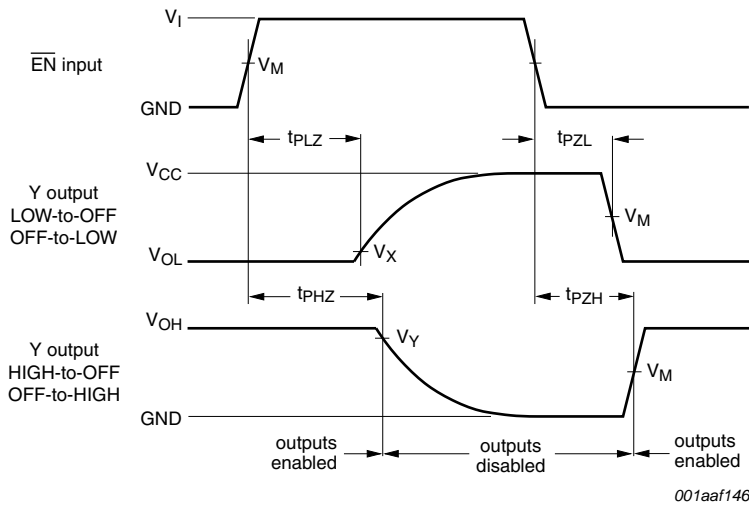


Measurement points are given in [Table 9](#).  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 7. The input (X1) to output (X2, Y) propagation delays**

**Table 9. Measurement points**

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

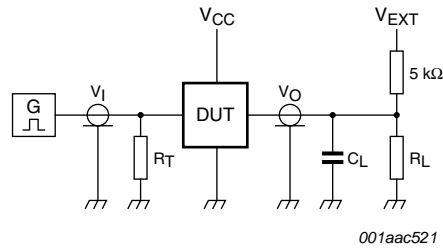


Measurement points are given in [Table 10](#).  
 Logic levels:  $V_{OL}$  and  $V_{OH}$  are typical output voltage drop that occur with the output load.

**Fig 8. Enable and disable times**

**Table 10. Measurement points**

| Supply voltage  | Input               | Output              |                   |                   |
|-----------------|---------------------|---------------------|-------------------|-------------------|
| $V_{CC}$        | $V_M$               | $V_M$               | $V_X$             | $V_Y$             |
| 0.8 V to 1.6 V  | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.1$ V  | $V_{OH} - 0.1$ V  |
| 1.65 V to 2.7 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.15$ V | $V_{OH} - 0.15$ V |
| 3.0 V to 3.6 V  | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $V_{OL} + 0.3$ V  | $V_{OH} - 0.3$ V  |



Test data is given in [Table 11](#).

Definitions for test circuit:

$R_L$  = Load resistance.

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

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

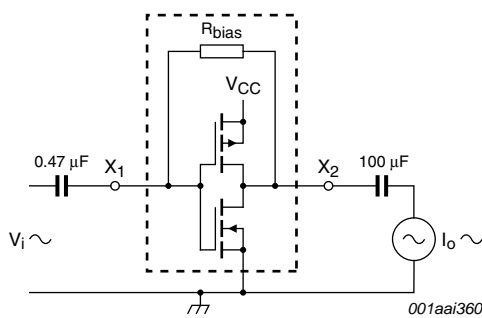
$V_{EXT}$  = External voltage for measuring switching times.

**Fig 9. Test circuit for measuring switching times**

**Table 11. Test data**

| Supply voltage | Load                         |              | $V_{EXT}$             |                       |                       |
|----------------|------------------------------|--------------|-----------------------|-----------------------|-----------------------|
| $V_{CC}$       | $C_L$                        | $R_L$ [1]    | $t_{PLH}$ , $t_{PHL}$ | $t_{PZH}$ , $t_{PHZ}$ | $t_{PZL}$ , $t_{PLZ}$ |
| 0.8 V to 3.6 V | 5 pF, 10 pF, 15 pF and 30 pF | 5 kΩ or 1 MΩ | open                  | GND                   | $2 \times V_{CC}$     |

[1] For measuring enable and disable times  $R_L = 5 \text{ k}\Omega$ , for measuring propagation delays, setup and hold times and pulse width  $R_L = 1 \text{ M}\Omega$ .

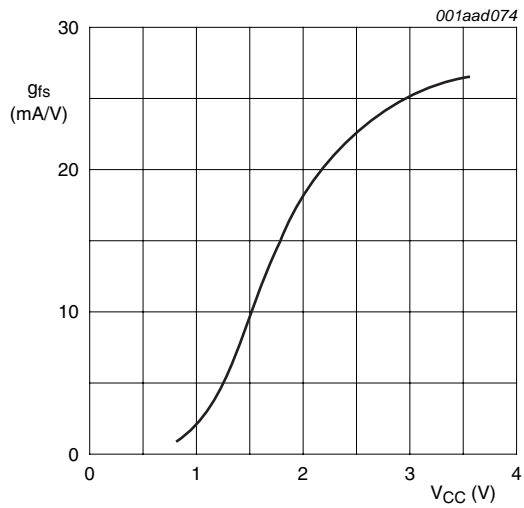


$$g_{fs} = \frac{\Delta I_O}{\Delta V_I}$$

$f_i = 1 \text{ kHz}$ .

$V_O$  is constant.

**Fig 10. Test set-up for measuring forward transconductance**



$T_{amb} = 25 \text{ }^\circ\text{C}$ .

**Fig 11. Typical forward transconductance as a function of supply voltage**

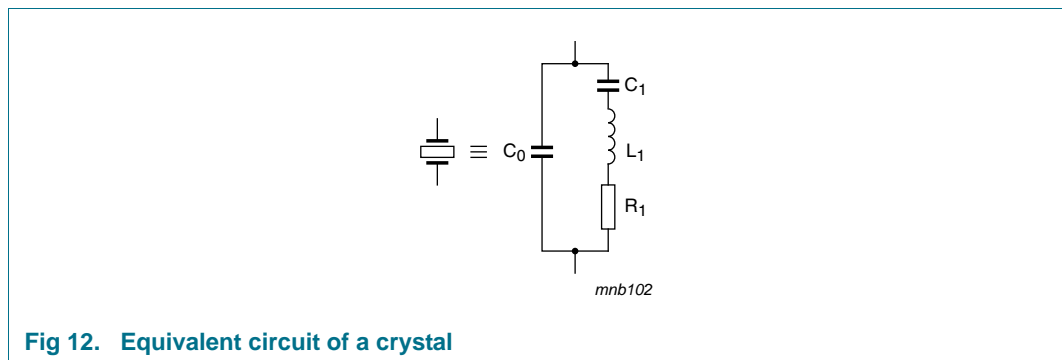
## 13. Application information

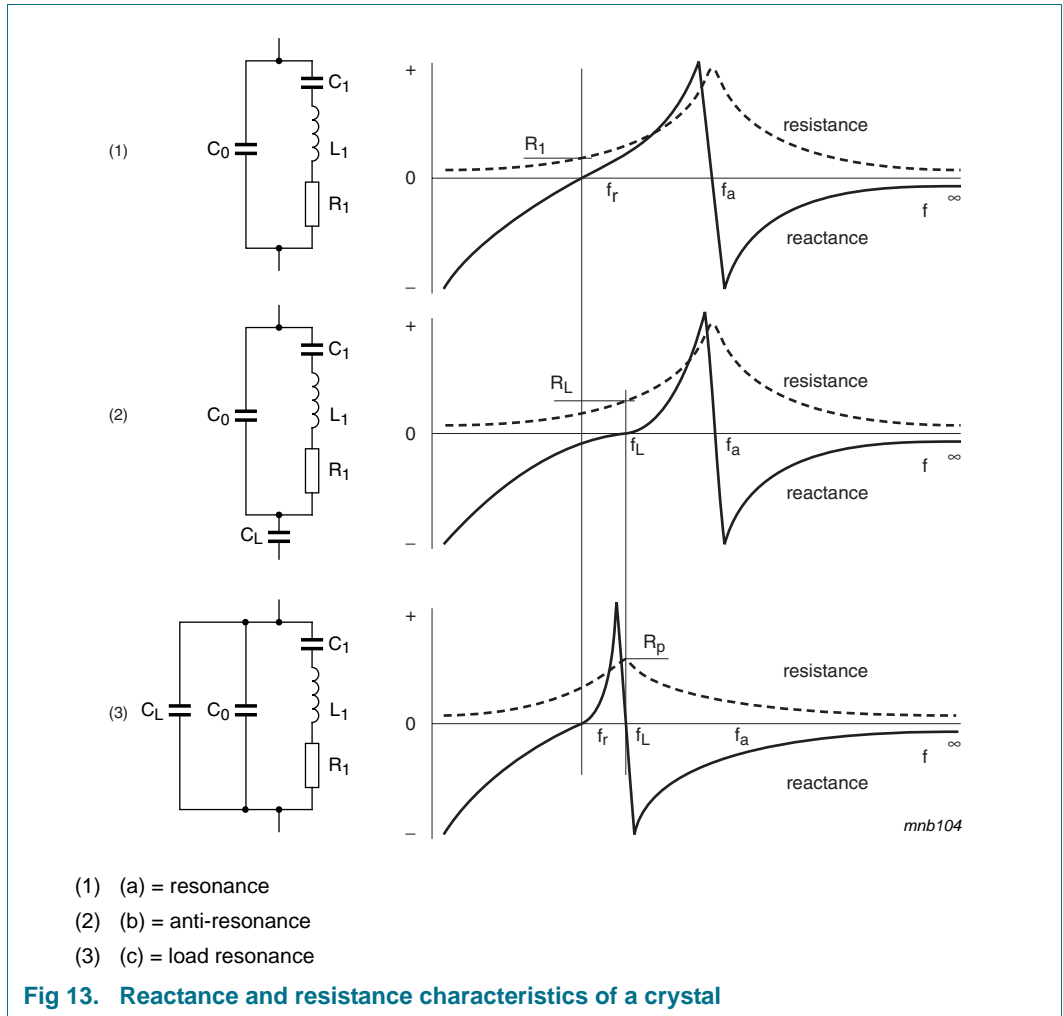
Crystal controlled oscillator circuits are widely used in clock pulse generators because of their excellent frequency stability and wide operating frequency range. The use of the 74AUP1Z125 provides the additional advantages of low power dissipation, stable operation over a wide range of frequency and temperature and a very small footprint. This application information describes crystal characteristics, design and testing of crystal oscillator circuits based on the 74AUP1Z125.

### 13.1 Crystal characteristics

[Figure 12](#) is the equivalent circuit of a quartz crystal.

The reactive and resistive component of the impedance of the crystal alone and the crystal with a series and a parallel capacitance is shown in [Figure 13](#).





13.1.1 Design

Figure 14 shows the recommended way to connect a crystal to the 74AUP1Z125. This circuit is basically a Pierce oscillator circuit in which the crystal is operating at its fundamental frequency and is tuned by the parallel load capacitance of C<sub>1</sub> and C<sub>2</sub>. C<sub>1</sub> and C<sub>2</sub> are in series with the crystal. They should be approximately equal. R<sub>1</sub> is the drive-limiting resistor and is set to approximately the same value as the reactance of C<sub>1</sub> at the crystal frequency (R<sub>1</sub> = X<sub>C1</sub>). This will result in an input to the crystal of 50 % of the rail-to-rail output of X2. This keeps the drive level into the crystal within drive specifications (the designer should verify this). Overdriving the crystal can cause damage.

The internal bias resistor provides negative feedback and sets a bias point of the inverter near mid-supply, operating the 74AUP1GU04 in the high gain linear region.

To calculate the values of C<sub>1</sub> and C<sub>2</sub>, the designer can use the formula:

$$C_L = \frac{C_1 \times C_2}{C_1 + C_2} + C_s$$

C<sub>L</sub> is the load capacitance as specified by the crystal manufacturer, C<sub>s</sub> is the stray capacitance of the circuit (for the 74AUP1Z125 this is equal to an input capacitance of 1.5 pF).

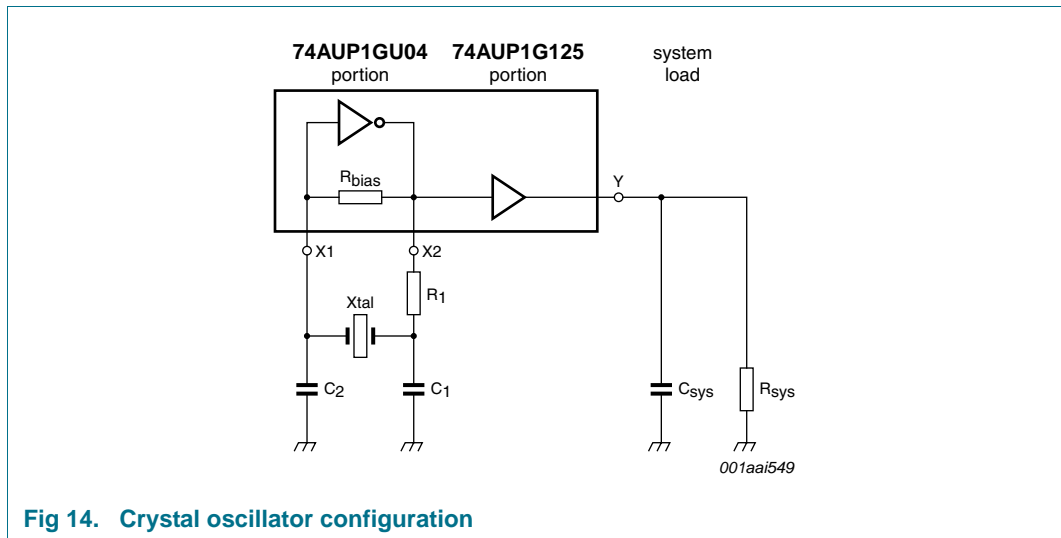


Fig 14. Crystal oscillator configuration

### 13.1.2 Testing

After the calculations are performed for a particular crystal, the oscillator circuit should be tested. The following simple checks will verify the prototype design of a crystal controlled oscillator circuit. Perform them after laying out the board:

- Test the oscillator over worst-case conditions (lowest supply voltage, worst-case crystal and highest operating temperature). Adding series and parallel resistors can simulate a worse case crystal.
- Insure that the circuit does not oscillate without the crystal.
- Check the frequency stability over a supply range greater than that which is likely to occur during normal operation.
- Check that the start-up time is within system requirements.

As the 74AUP1Z125 isolates the system loading, once the design is optimized, the single layout may work in multiple applications for any given crystal.

14. Package outline

Plastic surface-mounted package; 6 leads

SOT363

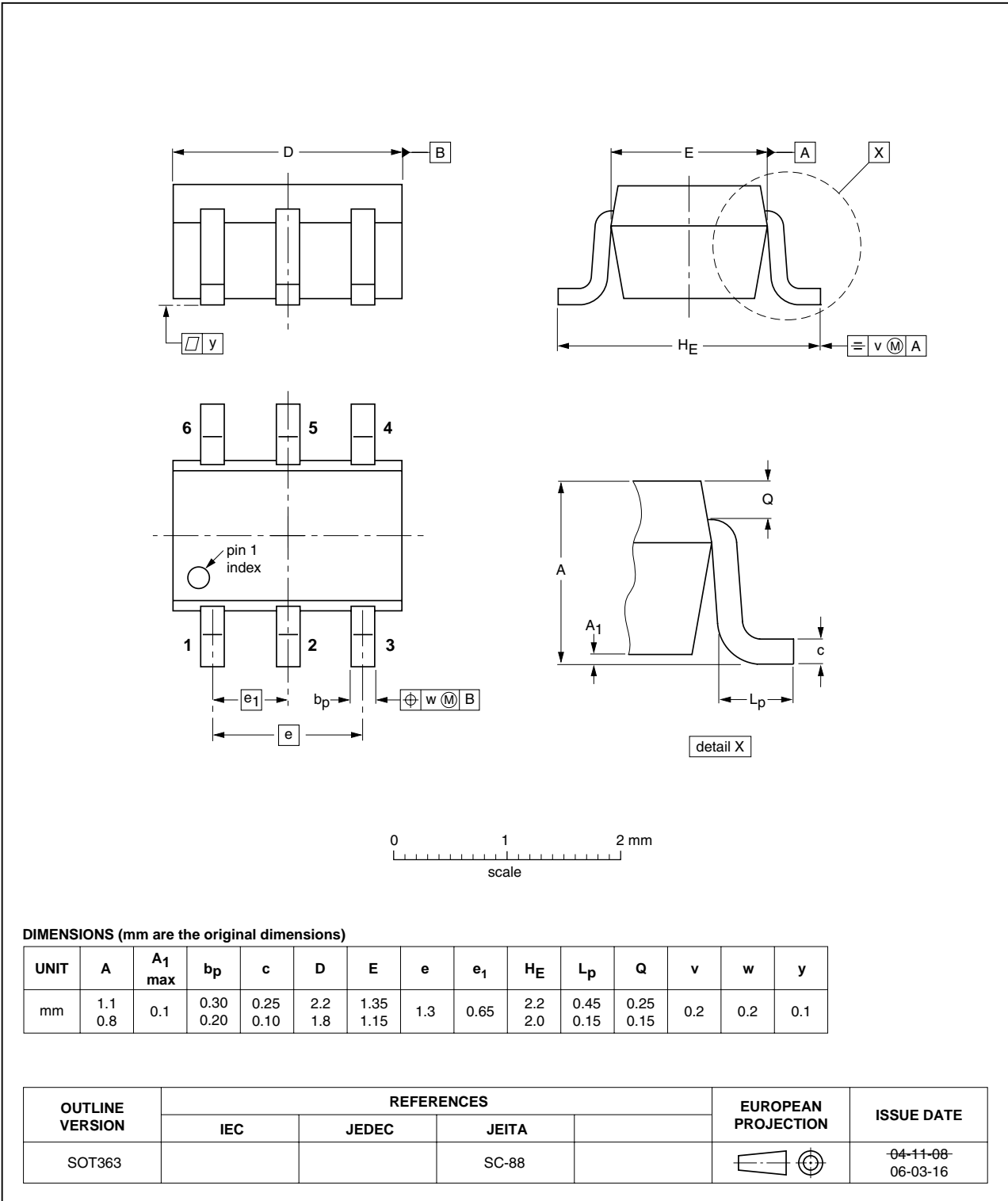


Fig 15. Package outline SOT363 (SC-88)



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

SOT886

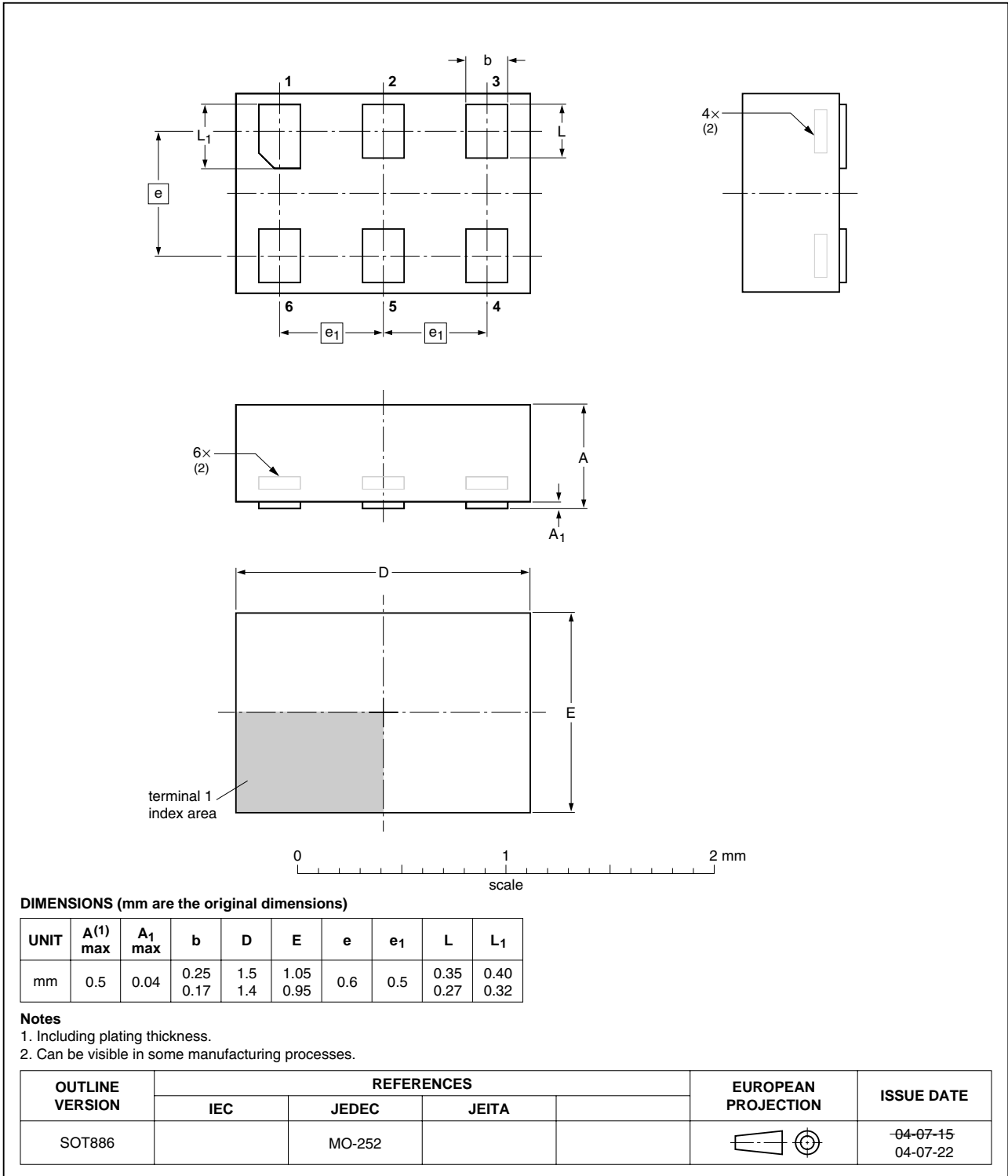


Fig 16. Package outline SOT886 (XSON6)

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

SOT891

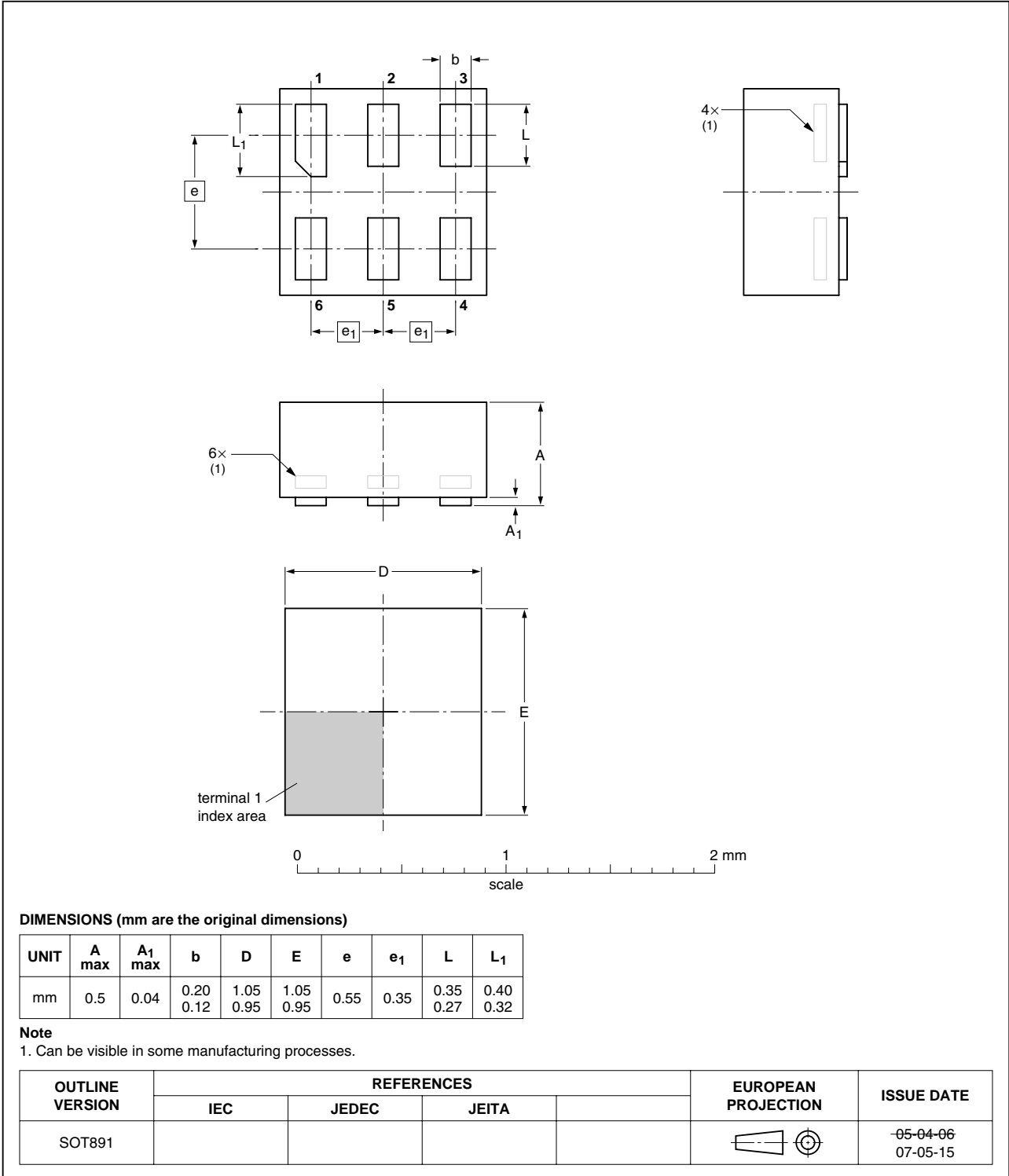


Fig 17. Package outline SOT891 (XSON6)

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

SOT1115

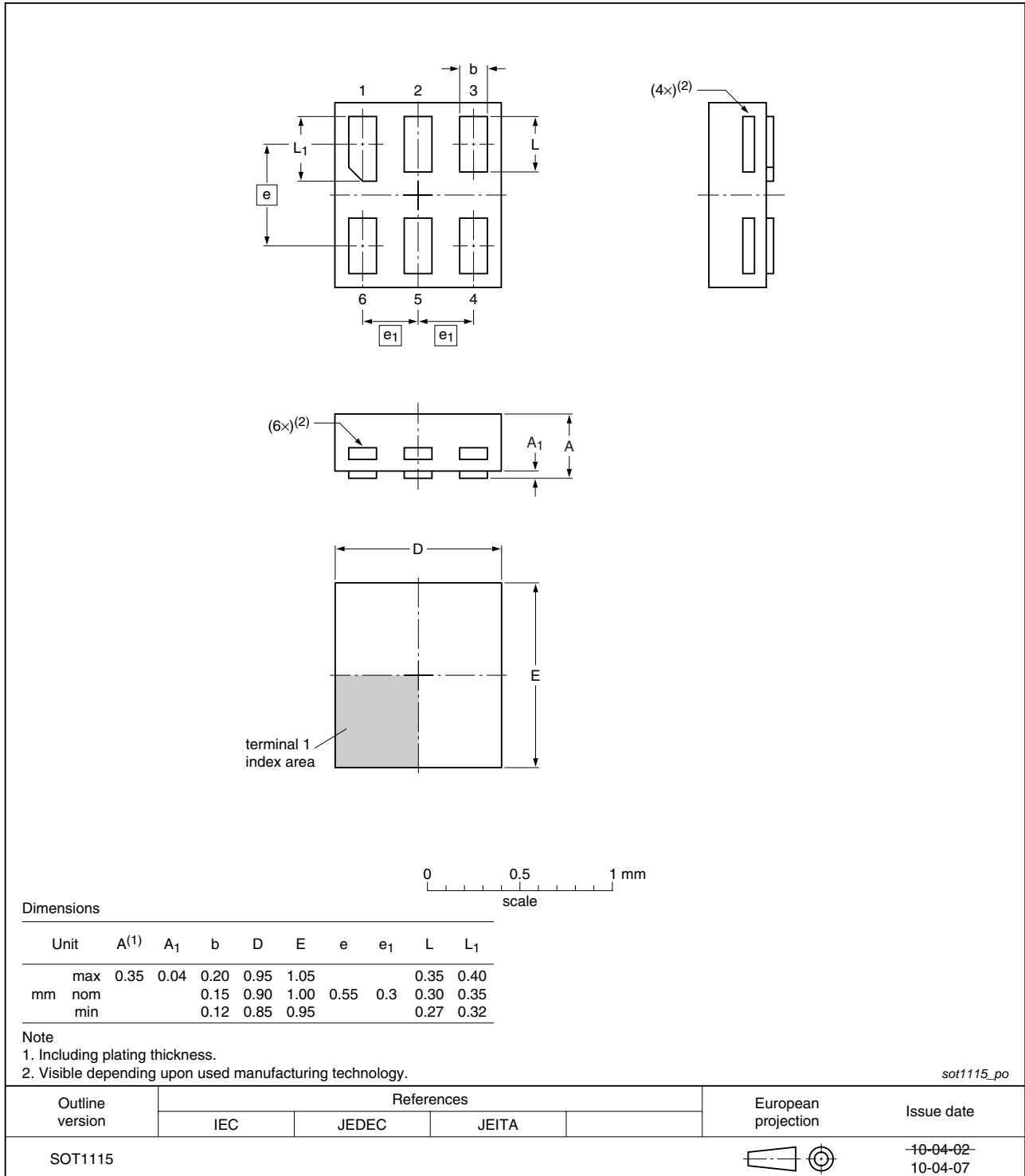


Fig 18. Package outline SOT1115 (XSON6)

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

SOT1202

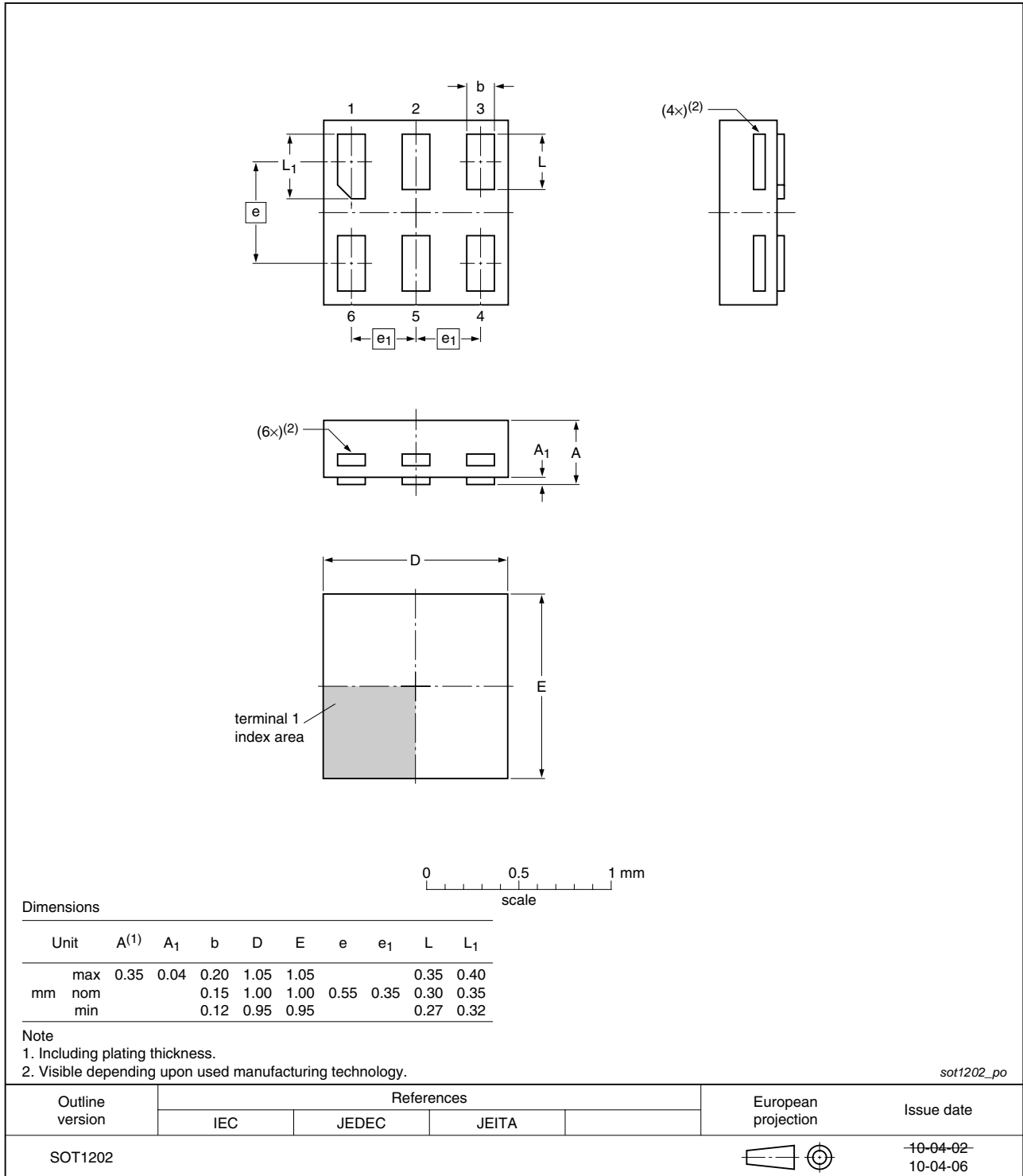


Fig 19. Package outline SOT1202 (XSON6)

## 15. Abbreviations

Table 12. Abbreviations

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

## 16. Revision history

Table 13. Revision history

| Document ID    | Release date   | Data sheet status  | Change notice | Supersedes     |
|----------------|--|--------------------|---------------|----------------|
| 74AUP1Z125 v.3 | 20100909   | Product data sheet | -             | 74AUP1Z125 v.2 |
| Modifications: | <ul style="list-style-type: none"> <li>Added type number 74AUP1Z125GN (SOT1115/XSON6 package).</li> <li>Added type number 74AUP1Z125GS (SOT1202/XSON6 package).</li> </ul> |                    |               |                |
| 74AUP1Z125 v.2 | 20080807   | Product data sheet | -             | 74AUP1Z125 v.1 |
| 74AUP1Z125 v.1 | 20060803   | Product data sheet | -             | -              |

## 17. Legal information

### 17.1 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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## 19. Contents

|           |   |           |
|-----------|---|-----------|
| <b>1</b>  | <b>General description</b> .....              | <b>1</b>  |
| <b>2</b>  | <b>Features and benefits</b> .....            | <b>1</b>  |
| <b>3</b>  | <b>Ordering information</b> .....             | <b>2</b>  |
| <b>4</b>  | <b>Marking</b> .....                          | <b>2</b>  |
| <b>5</b>  | <b>Functional diagram</b> .....               | <b>2</b>  |
| <b>6</b>  | <b>Pinning information</b> .....              | <b>3</b>  |
| 6.1       | Pinning .....                                 | 3         |
| 6.2       | Pin description .....                         | 3         |
| <b>7</b>  | <b>Functional description</b> .....           | <b>3</b>  |
| <b>8</b>  | <b>Limiting values</b> .....                  | <b>4</b>  |
| <b>9</b>  | <b>Recommended operating conditions</b> ..... | <b>4</b>  |
| <b>10</b> | <b>Static characteristics</b> .....           | <b>5</b>  |
| <b>11</b> | <b>Dynamic characteristics</b> .....          | <b>14</b> |
| <b>12</b> | <b>Waveforms</b> .....                        | <b>19</b> |
| <b>13</b> | <b>Application information</b> .....          | <b>21</b> |
| 13.1      | Crystal characteristics .....                 | 21        |
| 13.1.1    | Design .....                                  | 22        |
| 13.1.2    | Testing .....                                 | 23        |
| <b>14</b> | <b>Package outline</b> .....                  | <b>24</b> |
| <b>15</b> | <b>Abbreviations</b> .....                    | <b>29</b> |
| <b>16</b> | <b>Revision history</b> .....                 | <b>29</b> |
| <b>17</b> | <b>Legal information</b> .....                | <b>30</b> |
| 17.1      | Data sheet status .....                       | 30        |
| 17.2      | Definitions .....                             | 30        |
| 17.3      | Disclaimers .....                             | 30        |
| 17.4      | Trademarks .....                              | 31        |
| <b>18</b> | <b>Contact information</b> .....              | <b>31</b> |
| <b>19</b> | <b>Contents</b> .....                         | <b>32</b> |

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