

# 74AUP2GU04

## Low-power dual unbuffered inverter

Rev. 6 — 28 January 2019

Product data sheet

## 1. General description

The 74AUP2GU04 provides two unbuffered inverting gates.

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.

## 2. Features and benefits

- Wide supply voltage range from 0.8 V to 3.6 V
- High noise immunity
- ESD protection:
  - HBM JESD22-A114F Class 3A exceeds 5000 V
  - MM JESD22-A115-A exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Low static power consumption;  $I_{CC} = 0.9 \mu A$  (maximum)
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 3.6 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3. Ordering information

Table 1. Ordering information

| Type number  | Package           |       |                                                                                             |         |
|--------------|-------------------|-------|---------------------------------------------------------------------------------------------|---------|
|              | Temperature range | Name  | Description                                                                                 | Version |
| 74AUP2GU04GW | -40 °C to +125 °C | SC-88 | plastic surface-mounted package; 6 leads                                                    | SOT363  |
| 74AUP2GU04GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm | SOT886  |
| 74AUP2GU04GF | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm    | SOT891  |
| 74AUP2GU04GN | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm       | SOT1115 |
| 74AUP2GU04GS | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm       | SOT1202 |

## 4. Marking

Table 2. Marking

| Type number  | Marking code <sup>[1]</sup> |
|--------------|-----------------------------|
| 74AUP2GU04GW | aD                          |
| 74AUP2GU04GM | aD                          |
| 74AUP2GU04GF | aD                          |

| Type number  | Marking code[1] |
|--------------|-----------------|
| 74AUP2GU04GN | aD              |
| 74AUP2GU04GS | aD              |

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

5. Functional diagram

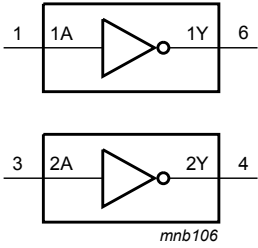


Fig. 1. Logic symbol

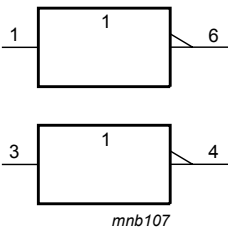


Fig. 2. IEC logic symbol

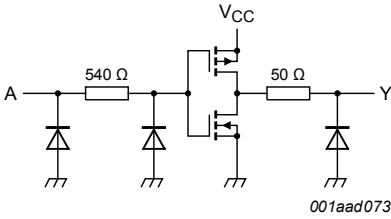


Fig. 3. Logic diagram (one gate)

6. Pinning information

6.1. Pinning

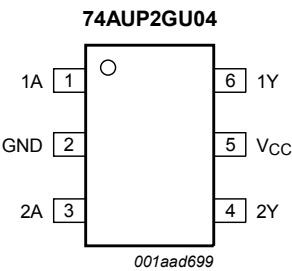


Fig. 4. Pin configuration SOT363

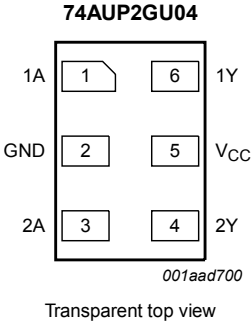


Fig. 5. Pin configuration SOT886

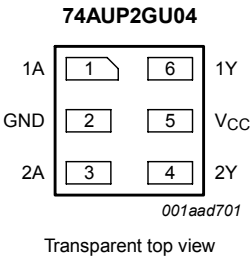


Fig. 6. Pin configuration SOT891, SOT1115 and SOT1202

6.2. Pin description

Table 3. Pin description

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| 1A              | 1   | data input     |
| GND             | 2   | ground (0 V)   |
| 2A              | 3   | data input     |
| 2Y              | 4   | data output    |
| V <sub>CC</sub> | 5   | supply voltage |
| 1Y              | 6   | data output    |

## 7. Functional description

**Table 4. Function table**

*H = HIGH voltage level; L = LOW voltage level.*

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

## 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          | [2]                               | -0.5 | $V_{CC} + 0.5$ | 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 [3] | -    | 250            | mW   |

[1] The minimum input voltage ratings may be exceeded if the input current ratings are observed.

[2] The output voltage ratings may be exceeded if the output current ratings are observed.

[3] 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 | 0   | 200      | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

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

| Symbol                                    | Parameter                 | Conditions                                                                                          | Min                    | Typ | Max                    | Unit |
|-------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------|------------------------|-----|------------------------|------|
| <b>T<sub>amb</sub> = 25 °C</b>            |                           |                                                                                                     |                        |     |                        |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | 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    |
| V <sub>OL</sub>                           | LOW-level output voltage  | 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     | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                       | -                      | -   | ±0.1                   | µA   |
| I <sub>CC</sub>                           | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 0.5                    | µA   |
| C <sub>I</sub>                            | input capacitance         | V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND or V <sub>CC</sub>                             | -                      | 1.5 | -                      | pF   |
| C <sub>O</sub>                            | output capacitance        | V <sub>O</sub> = GND; V <sub>CC</sub> = 0 V                                                         | -                      | 1.8 | -                      | pF   |
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                           |                                                                                                     |                        |     |                        |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | 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    |

| Symbol                                     | Parameter                 | Conditions                                                                                          | Min                    | Typ | Max                    | Unit |
|--------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------|------------------------|-----|------------------------|------|
| V <sub>OL</sub>                            | LOW-level output voltage  | 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    |
| I <sub>I</sub>                             | input leakage current     | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                       | -                      | -   | ±0.5                   | µA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 0.9                    | µA   |
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                           |                                                                                                     |                        |     |                        |      |
| V <sub>IH</sub>                            | HIGH-level input voltage  | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | 0.75 × V <sub>CC</sub> | -   | -                      | V    |
| V <sub>IL</sub>                            | LOW-level input voltage   | V <sub>CC</sub> = 0.8 V to 3.6 V                                                                    | -                      | -   | 0.25 × V <sub>CC</sub> | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage | 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    |
| V <sub>OL</sub>                            | LOW-level output voltage  | 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     | V <sub>I</sub> = GND to 3.6 V; V <sub>CC</sub> = 0 V to 3.6 V                                       | -                      | -   | ±0.75                  | µA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 0.8 V to 3.6 V | -                      | -   | 1.4                    | µA   |

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

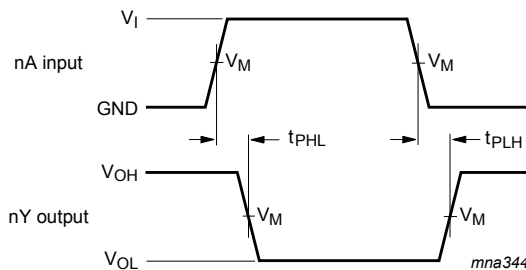
Voltages are referenced to GND (ground = 0 V); for test circuit see [Fig. 8](#).

| Symbol                 | Parameter         | Conditions                               | 25 °C |        |      | -40 °C to +125 °C |                |                 | Unit |
|------------------------|-------------------|------------------------------------------|-------|--------|------|-------------------|----------------|-----------------|------|
|                        |                   |                                          | Min   | Typ[1] | Max  | Min               | Max<br>(85 °C) | Max<br>(125 °C) |      |
| C <sub>L</sub> = 5 pF  |                   |                                          |       |        |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | nA to nY; see <a href="#">Fig. 7</a> [2] |       |        |      |                   |                |                 |      |
|                        |                   | 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   |
| C <sub>L</sub> = 10 pF |                   |                                          |       |        |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | nA to nY; see <a href="#">Fig. 7</a> [2] |       |        |      |                   |                |                 |      |
|                        |                   | 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   |
| C <sub>L</sub> = 15 pF |                   |                                          |       |        |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | nA to nY; see <a href="#">Fig. 7</a> [2] |       |        |      |                   |                |                 |      |
|                        |                   | 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   |
| C <sub>L</sub> = 30 pF |                   |                                          |       |        |      |                   |                |                 |      |
| t <sub>pd</sub>        | propagation delay | nA to nY; see <a href="#">Fig. 7</a> [2] |       |        |      |                   |                |                 |      |
|                        |                   | 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   |

| Symbol                                        | Parameter                     | Conditions                                                             | 25 °C |        |     | -40 °C to +125 °C |                |                 | Unit |
|-----------------------------------------------|-------------------------------|------------------------------------------------------------------------|-------|--------|-----|-------------------|----------------|-----------------|------|
|                                               |                               |                                                                        | Min   | Typ[1] | Max | Min               | Max<br>(85 °C) | Max<br>(125 °C) |      |
| C <sub>L</sub> = 5 pF, 10 pF, 15 pF and 30 pF |                               |                                                                        |       |        |     |                   |                |                 |      |
| C <sub>PD</sub>                               | power dissipation capacitance | f <sub>i</sub> = 1 MHz; V <sub>I</sub> = GND to V <sub>CC</sub> [3][4] |       |        |     |                   |                |                 |      |
|                                               |                               | V <sub>CC</sub> = 0.8 V                                                | -     | 1.1    | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.1 V to 1.3 V                                       | -     | 1.1    | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.4 V to 1.6 V                                       | -     | 1.3    | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 1.65 V to 1.95 V                                     | -     | 1.5    | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 2.3 V to 2.7 V                                       | -     | 3.0    | -   | -                 | -              | -               | pF   |
|                                               |                               | V <sub>CC</sub> = 3.0 V to 3.6 V                                       | -     | 4.5    | -   | -                 | -              | -               | 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] All specified values are the average typical values over all stated loads.  
 [4] 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> = 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.

## 11.1. Waveforms and test circuit



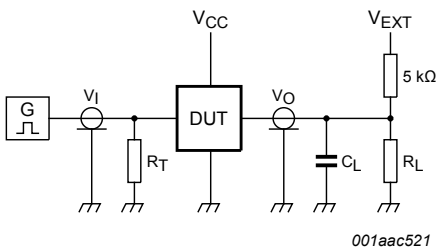
Measurement points are given in [Table 9](#).

Logic levels: V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage drops that occur with the output load.

**Fig. 7. The data input (nA) to output (nY) propagation delays**

**Table 9. Measurement points**

| Supply voltage  | Output                | Input                 |                 |                                 |
|-----------------|-----------------------|-----------------------|-----------------|---------------------------------|
| V <sub>CC</sub> | V <sub>M</sub>        | V <sub>M</sub>        | V <sub>I</sub>  | t <sub>r</sub> = t <sub>f</sub> |
| 0.8 V to 3.6 V  | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> | V <sub>CC</sub> | ≤ 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. 8. Test circuit for measuring switching times

Table 10. Test data

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

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

12. Additional characteristics

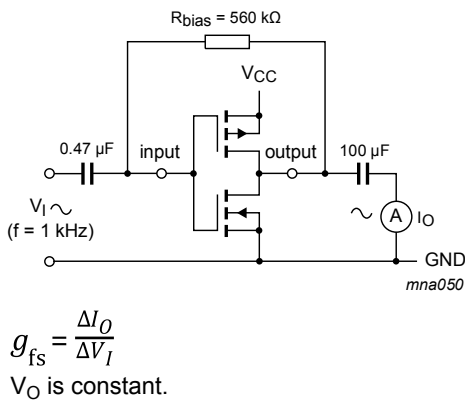


Fig. 9. Test set-up for measuring forward transconductance

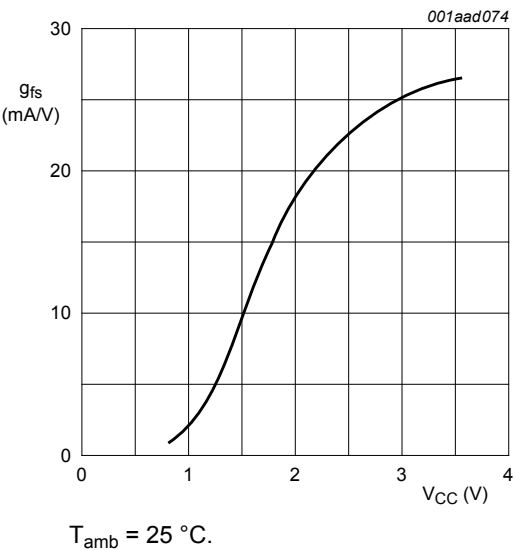


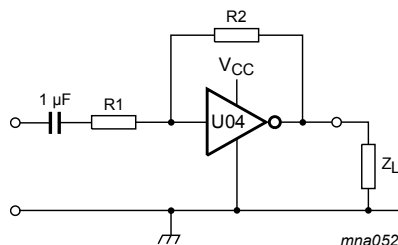
Fig. 10. Typical forward transconductance as a function of supply voltage

## 13. Application information

Some applications for the 74AUP2GU04 are:

- Linear amplifier (see [Fig. 11](#))
- Crystal oscillator (see [Fig. 12](#))

**Remark:** All values given are typical values unless otherwise specified.



$$Z_L > 10 \text{ k}\Omega.$$

$$R1 \geq 3 \text{ k}\Omega.$$

$$R2 \leq 1 \text{ M}\Omega.$$

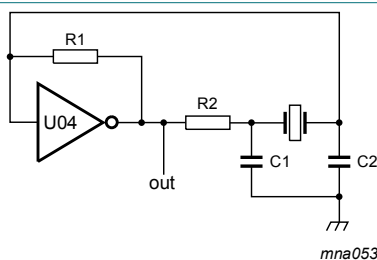
$$\text{Open loop amplification: } A_{OL} = 20.$$

$$\text{Voltage amplification: } A_V = -\frac{A_{OL}}{1 + \frac{R1}{R2}(1 + A_{OL})}.$$

$$V_{O(p-p)} = V_{CC} - 1.5 \text{ V centered at } 0.5 \times V_{CC}.$$

$$\text{Unity gain bandwidth product is } 5 \text{ MHz}.$$

**Fig. 11. Linear amplifier application**



$$C1 = 47 \text{ pF}.$$

$$C2 = 22 \text{ pF}.$$

$$R1 = 1 \text{ M}\Omega \text{ to } 10 \text{ M}\Omega.$$

R2 optimum value depends on the frequency and required stability against changes in  $V_{CC}$  or average minimum  $I_{CC}$  ( $I_{CC} = 2 \text{ mA}$  at  $V_{CC} = 3.3 \text{ V}$  and  $f = 10 \text{ MHz}$ ).

**Fig. 12. Crystal oscillator application**

14. Package outline

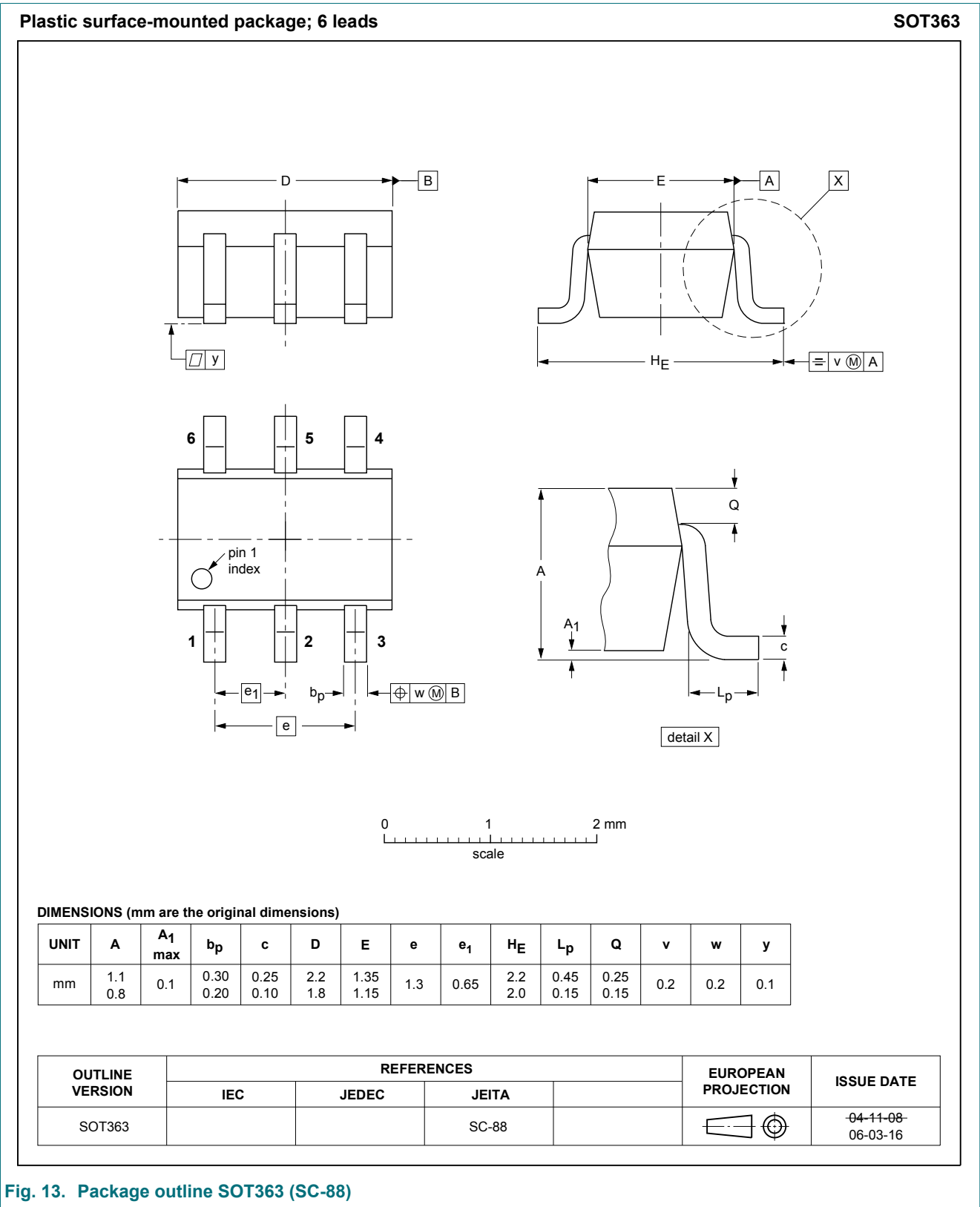
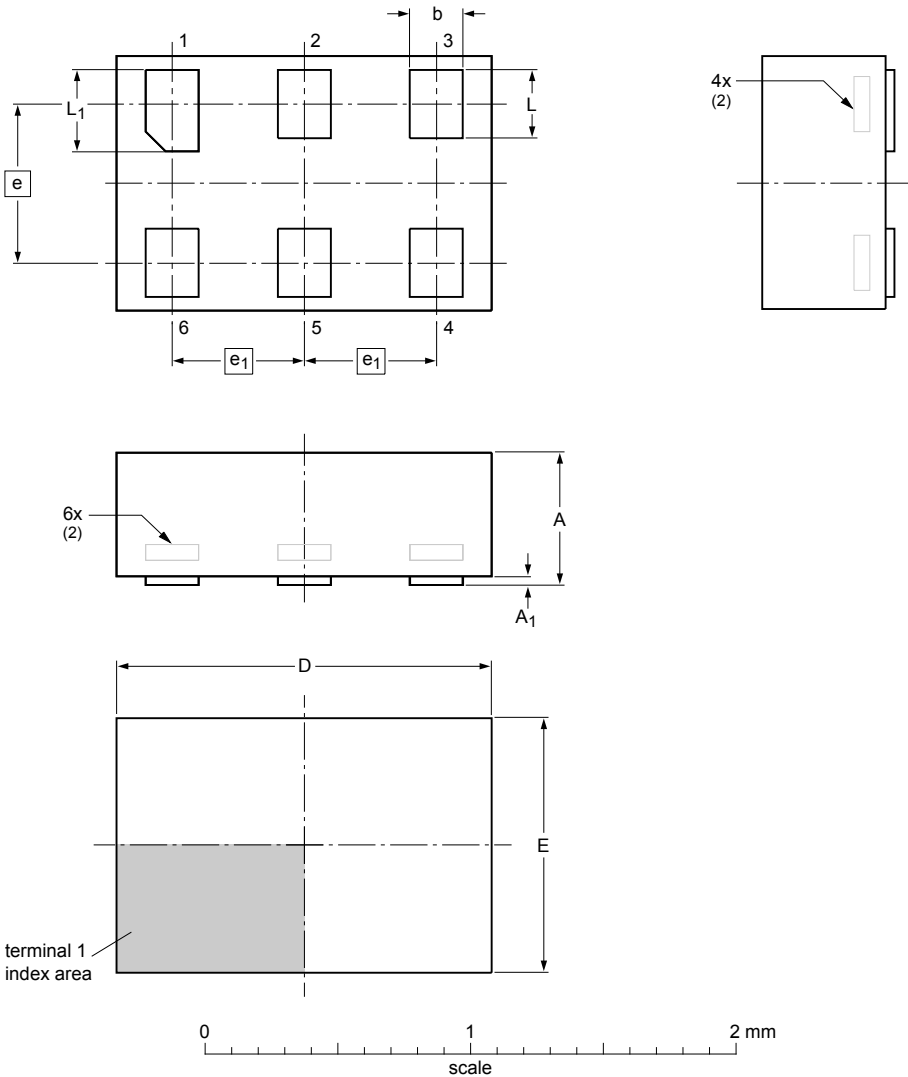


Fig. 13. Package outline SOT363 (SC-88)

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

SOT886



Dimensions (mm are the original 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              | 0.5            | 0.04 | 0.25 | 1.50 | 1.05 |                | 0.35 | 0.40           |
|      | nom              |                |      | 0.20 | 1.45 | 1.00 | 0.6            | 0.30 | 0.35           |
|      | min              |                |      | 0.17 | 1.40 | 0.95 |                | 0.27 | 0.32           |

- Notes
- 1. Including plating thickness.
  - 2. Can be visible in some manufacturing processes.

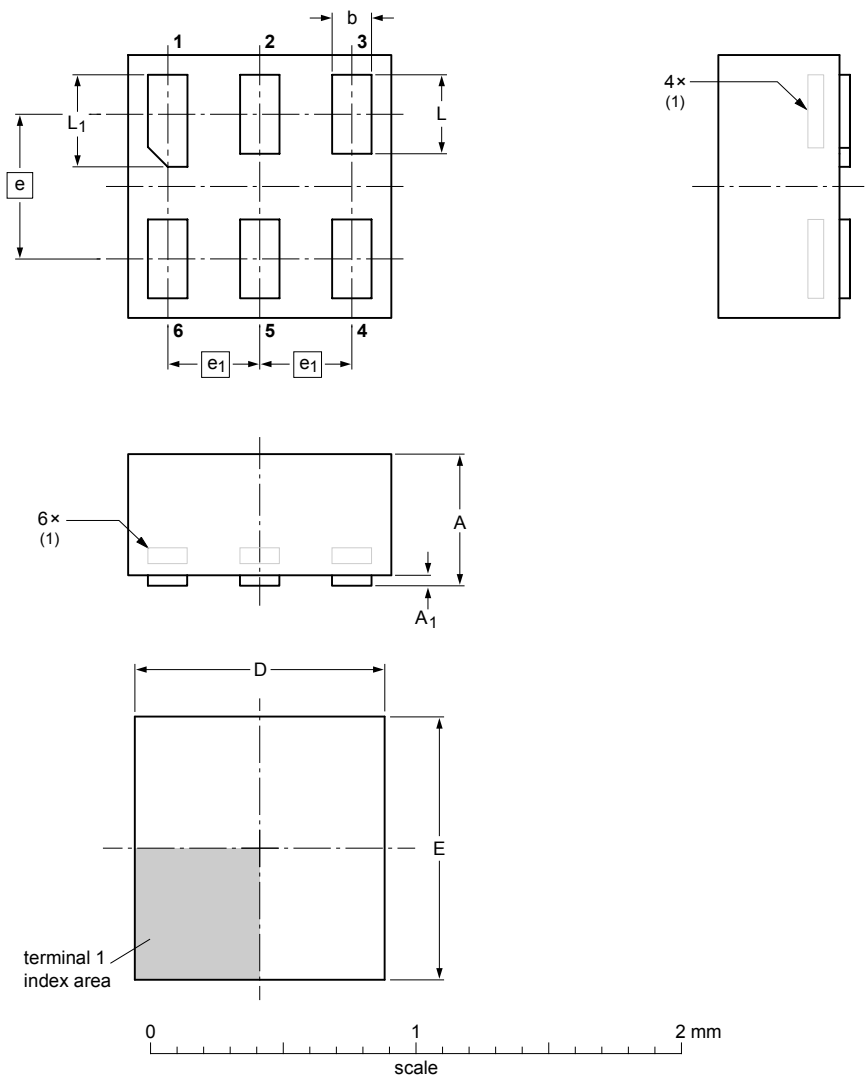
sot886\_po

| Outline version | References |        |       |  | European projection | Issue date             |
|-----------------|------------|--------|-------|--|---------------------|------------------------|
|                 | IEC        | JEDEC  | JEITA |  |                     |                        |
| SOT886          |            | MO-252 |       |  |                     | -04-07-22-<br>12-01-05 |

Fig. 14. Package outline SOT886 (XSON6)

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

SOT891



DIMENSIONS (mm are the original dimensions)

| UNIT | A <sub>max</sub> | A <sub>1max</sub> | b            | D            | E            | e    | e <sub>1</sub> | L            | L <sub>1</sub> |
|------|------------------|-------------------|--------------|--------------|--------------|------|----------------|--------------|----------------|
| mm   | 0.5              | 0.04              | 0.20<br>0.12 | 1.05<br>0.95 | 1.05<br>0.95 | 0.55 | 0.35           | 0.35<br>0.27 | 0.40<br>0.32   |

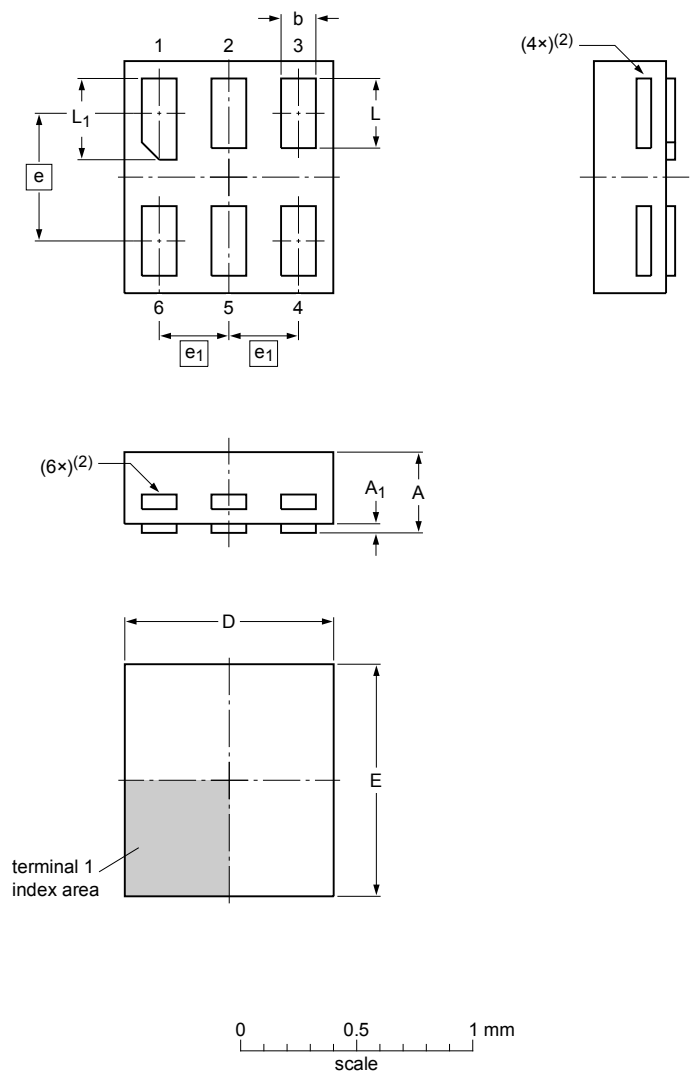
**Note**  
1. Can be visible in some manufacturing processes.

| OUTLINE<br>VERSION | REFERENCES |       |       |  | EUROPEAN<br>PROJECTION | ISSUE DATE            |
|--------------------|------------|-------|-------|--|------------------------|-----------------------|
|                    | IEC        | JEDEC | JEITA |  |                        |                       |
| SOT891             |            |       |       |  |                        | -05-04-06<br>07-05-15 |

Fig. 15. 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.

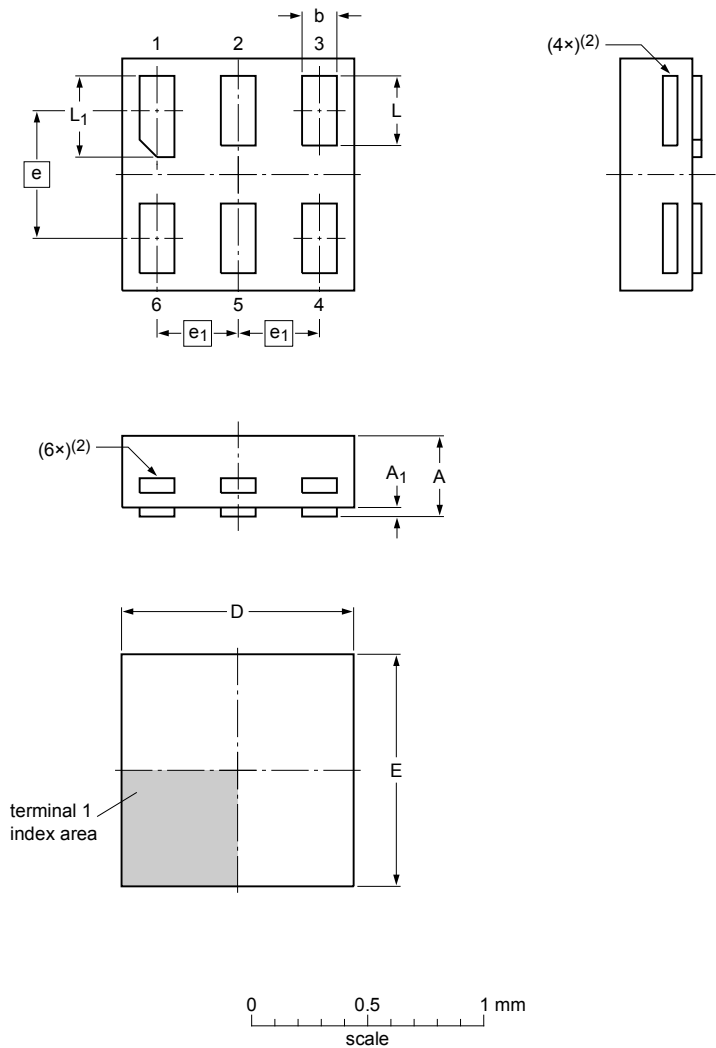
sot1115\_po

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

Fig. 16. 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



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 | 1.05 | 1.05 |                | 0.35 | 0.40           |
|      | nom              |                |      | 0.15 | 1.00 | 1.00 | 0.55           | 0.30 | 0.35           |
|      | min              |                |      | 0.12 | 0.95 | 0.95 |                | 0.27 | 0.32           |

Note

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

sot1202\_po

| Outline version | References |       |       |  | European projection                                                                   | Issue date           |
|-----------------|------------|-------|-------|--|---------------------------------------------------------------------------------------|----------------------|
|                 | IEC        | JEDEC | JEITA |  |                                                                                       |                      |
| SOT1202         |            |       |       |  |  | 10-04-02<br>10-04-06 |

Fig. 17. Package outline SOT1202 (XSON6)

## 15. Abbreviations

Table 11. 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 12. Revision history

| Document ID    | Release date                                                                                                                                                                                                                           | Data sheet status  | Change notice | Supersedes     |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|----------------|
| 74AUP2GU04 v.6 | 20190128                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP2GU04 v.5 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>Legal texts have been adapted to the new company name where appropriate.</li></ul> |                    |               |                |
| 74AUP2GU04 v.5 | 20131011                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP2GU04 v.4 |
| Modifications: | <ul style="list-style-type: none"><li>Package outline drawing of SOT886 (<a href="#">Fig. 14</a>) modified.</li></ul>                                                                                                                  |                    |               |                |
| 74AUP2GU04 v.4 | 20111207                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP2GU04 v.3 |
| Modifications: | <ul style="list-style-type: none"><li>Legal pages updated.</li></ul>                                                                                                                                                                   |                    |               |                |
| 74AUP2GU04 v.3 | 20101110                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP2GU04 v.2 |
| 74AUP2GU04 v.2 | 20090703                                                                                                                                                                                                                               | Product data sheet | -             | 74AUP2GU04 v.1 |
| 74AUP2GU04 v.1 | 20061215                                                                                                                                                                                                                               | Product data sheet | -             | -              |

## 17. Legal information

### Data sheet status

| Document status<br>[1][2]      | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
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| 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".
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