

# 74AHC2G08; 74AHCT2G08

Dual 2-input AND gate

Rev. 5 — 27 November 2013

Product data sheet

## 1. General description

The 74AHC2G08; 74AHCT2G08 is a high-speed Si-gate CMOS device.

The 74AHC2G08; 74AHCT2G08 provides two 2-input AND gates.

## 2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
  - ◆ CDM JESD22-C101C exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+80\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

| Type number                 | Package                                                         |        |                                                                                                             |          |
|-----------------------------|-----------------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------|----------|
|                             | Temperature range                                               | Name   | Description                                                                                                 | Version  |
| 74AHC2G08DP<br>74AHCT2G08DP | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP8 | plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm                     | SOT505-2 |
| 74AHC2G08DC<br>74AHCT2G08DC | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm                                  | SOT765-1 |
| 74AHC2G08GD<br>74AHCT2G08GD | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | XSON8  | plastic extremely thin small outline package; no leads; 8 terminals; body $3 \times 2 \times 0.5\text{ mm}$ | SOT996-2 |



## 4. Marking

Table 2. Marking

| Type number  | Marking code <sup>[1]</sup> |
|--------------|-----------------------------|
| 74AHC2G08DP  | A08                         |
| 74AHCT2G08DP | C08                         |
| 74AHC2G08DC  | A08                         |
| 74AHCT2G08DC | C08                         |
| 74AHC2G08GD  | A08                         |
| 74AHCT2G08GD | C08                         |

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

## 5. Functional diagram

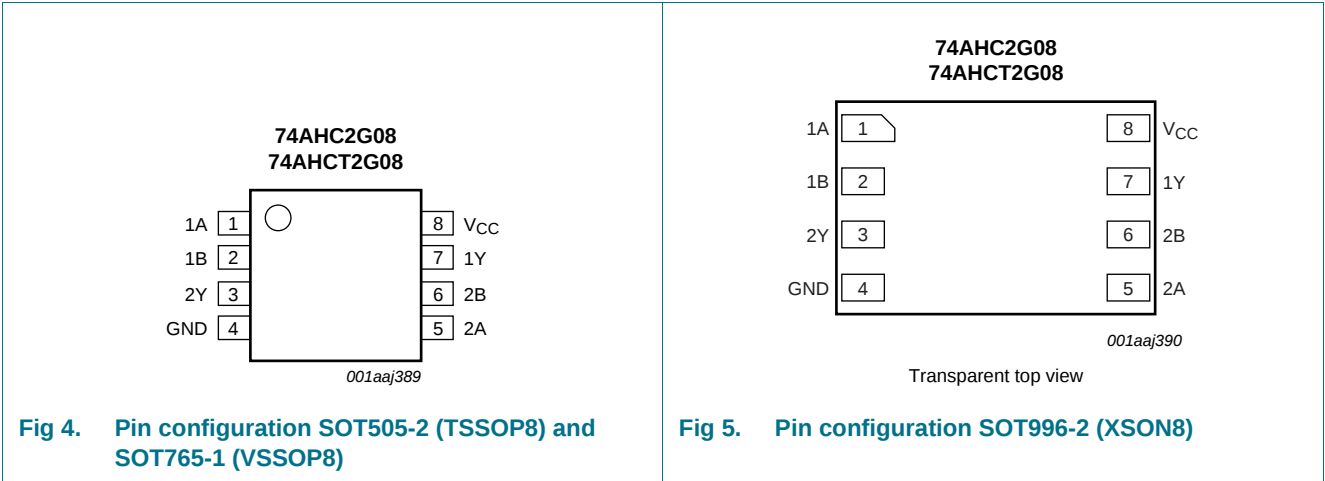
**Fig 1. Logic symbol.**

**Fig 2. IEC logic symbol.**

**Fig 3. Logic diagram (one gate).**

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

| Symbol          | Pin  | Description    |
|-----------------|------|----------------|
| 1A, 2A          | 1, 5 | data input     |
| 1B, 2B          | 2, 6 | data input     |
| GND             | 4    | ground (0 V)   |
| 1Y, 2Y          | 7, 3 | data output    |
| V <sub>CC</sub> | 8    | supply voltage |

7. Functional description

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

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

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

## 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    | +7.0 | V    |
| $V_I$     | input voltage           |                                          | -0.5    | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V                           | [1] -20 | -    | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V | [1] -   | ±20  | mA   |
| $I_O$     | output current          | $-0.5$ V < $V_O$ < $V_{CC} + 0.5$ V      | -       | ±25  | mA   |
| $I_{CC}$  | supply current          |                                          | -       | 75   | mA   |
| $I_{GND}$ | ground current          |                                          | -75     | -    | 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 TSSOP8 package: above 55 °C the value of  $P_{tot}$  derates linearly with 2.5 mW/K.

For VSSOP8 package: above 110 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

For XSON8 package: above 45 °C the value of  $P_{tot}$  derates linearly with 2.4 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V).

| Symbol              | Parameter                           | Conditions               | 74AHC2G08 |     |          | 74AHCT2G08 |     |          | Unit |
|---------------------|-------------------------------------|--------------------------|-----------|-----|----------|------------|-----|----------|------|
|                     |                                     |                          | Min       | Typ | Max      | Min        | Typ | Max      |      |
| $V_{CC}$            | supply voltage                      |                          | 2.0       | 5.0 | 5.5      | 4.5        | 5.0 | 5.5      | V    |
| $V_I$               | input voltage                       |                          | 0         | -   | 5.5      | 0          | -   | 5.5      | V    |
| $V_O$               | output voltage                      |                          | 0         | -   | $V_{CC}$ | 0          | -   | $V_{CC}$ | V    |
| $T_{amb}$           | ambient temperature                 |                          | -40       | +25 | +125     | -40        | +25 | +125     | °C   |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 3.3$ V ± 0.3 V | -         | -   | 100      | -          | -   | -        | ns/V |
|                     |                                     | $V_{CC} = 5.0$ V ± 0.5 V | -         | -   | 20       | -          | -   | 20       | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                 | Conditions                                                                                | 25 °C |     |      | –40 °C to +85 °C |      | –40 °C to +125 °C |      | Unit |
|-----------------|---------------------------|-------------------------------------------------------------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                 |                           |                                                                                           | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 74AHC2G08       |                           |                                                                                           |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                   | 1.5   | -   | -    | 1.5              | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 3.0 V                                                                   | 2.1   | -   | -    | 2.1              | -    | 2.1               | -    | V    |
|                 |                           | V <sub>CC</sub> = 5.5 V                                                                   | 3.85  | -   | -    | 3.85             | -    | 3.85              | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                   | -     | -   | 0.5  | -                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 3.0 V                                                                   | -     | -   | 0.9  | -                | 0.9  | -                 | 0.9  | V    |
|                 |                           | V <sub>CC</sub> = 5.5 V                                                                   | -     | -   | 1.65 | -                | 1.65 | -                 | 1.65 | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                       |       |     |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = –50 μA; V <sub>CC</sub> = 2.0 V                                          | 1.9   | 2.0 | -    | 1.9              | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = –50 μA; V <sub>CC</sub> = 3.0 V                                          | 2.9   | 3.0 | -    | 2.9              | -    | 2.9               | -    | V    |
|                 |                           | I <sub>O</sub> = –50 μA; V <sub>CC</sub> = 4.5 V                                          | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = –4.0 mA; V <sub>CC</sub> = 3.0 V                                         | 2.58  | -   | -    | 2.48             | -    | 2.40              | -    | V    |
|                 |                           | I <sub>O</sub> = –8.0 mA; V <sub>CC</sub> = 4.5 V                                         | 3.94  | -   | -    | 3.8              | -    | 3.70              | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                       |       |     |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 2.0 V                                           | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V                                           | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V                                           | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V                                          | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
|                 |                           | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V                                          | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V                          | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub> | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V | -     | -   | 1.0  | -                | 10   | -                 | 40   | μA   |
| C <sub>I</sub>  | input capacitance         |                                                                                           | -     | 1.5 | 10   | -                | 10   | -                 | 10   | pF   |
| 74AHCT2G08      |                           |                                                                                           |       |     |      |                  |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                          | 2.0   | -   | -    | 2.0              | -    | 2.0               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                          | -     | -   | 0.8  | -                | 0.8  | -                 | 0.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V             |       |     |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = –50 μA                                                                   | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = –8.0 mA                                                                  | 3.94  | -   | -    | 3.8              | -    | 3.70              | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 4.5 V             |       |     |      |                  |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 50 μA                                                                    | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 8.0 mA                                                                   | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V                          | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |

**Table 7. Static characteristics ...continued**  
 Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                 | Conditions                                                                                         | 25 °C |     |      | –40 °C to +85 °C |     | –40 °C to +125 °C |     | Unit    |
|-----------------|---------------------------|----------------------------------------------------------------------------------------------------|-------|-----|------|------------------|-----|-------------------|-----|---------|
|                 |                           |                                                                                                    | Min   | Typ | Max  | Min              | Max | Min               | Max |         |
| $I_{CC}$        | supply current            | $V_I = V_{CC}$ or GND; $I_O = 0$ A;<br>$V_{CC} = 5.5$ V                                            | -     | -   | 1.0  | -                | 10  | -                 | 40  | $\mu$ A |
| $\Delta I_{CC}$ | additional supply current | per input pin; $V_I = 3.4$ V;<br>other inputs at $V_{CC}$ or GND;<br>$I_O = 0$ A; $V_{CC} = 5.5$ V | -     | -   | 1.35 | -                | 1.5 | -                 | 1.5 | mA      |
| $C_I$           | input capacitance         |                                                                                                    | -     | 1.5 | 10   | -                | 10  | -                 | 10  | pF      |

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**  
 GND = 0 V; for test circuit see [Figure 7](#).

| Symbol          | Parameter                     | Conditions                                                                                                                    | 25 °C |     |      | −40 °C to +85 °C |      | −40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                 |                               |                                                                                                                               | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 74AHC2G08       |                               |                                                                                                                               |       |     |      |                  |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Figure 6</a> <a href="#">[1]</a>                                                                |       |     |      |                  |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V <a href="#">[2]</a>                                                                          |       |     |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                                                        | -     | 4.6 | 8.8  | 1.0              | 10.5 | 1.0               | 12.0 | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                                                        | -     | 6.5 | 12.3 | 1.0              | 14.0 | 1.0               | 16.0 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V <a href="#">[3]</a>                                                                          |       |     |      |                  |      |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                                                        | -     | 3.2 | 5.9  | 1.0              | 7.0  | 1.0               | 8.0  | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                                                        | -     | 4.6 | 7.9  | 1.0              | 9.0  | 1.0               | 10.5 | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per buffer; <a href="#">[4]</a><br>C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> | -     | 17  | -    | -                | -    | -                 | -    | pF   |

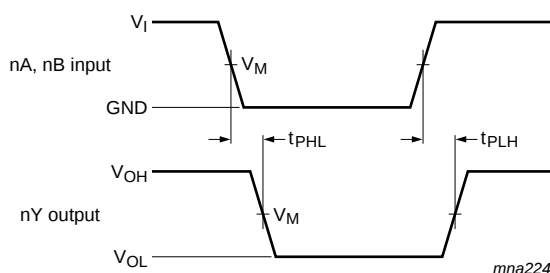
**Table 8. Dynamic characteristics ...continued**  
*GND = 0 V; for test circuit see Figure 7.*

| Symbol          | Parameter                     | Conditions                                                                                                | 25 °C               |     |     | –40 °C to +85 °C |     | –40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------|-----|-----|------------------|-----|-------------------|------|------|
|                 |                               |                                                                                                           | Min                 | Typ | Max | Min              | Max | Min               | Max  |      |
| 74AHCT2G08      |                               |                                                                                                           |                     |     |     |                  |     |                   |      |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Figure 6</a>                                                                | <a href="#">[1]</a> |     |     |                  |     |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                          | <a href="#">[3]</a> |     |     |                  |     |                   |      |      |
|                 |                               | C <sub>L</sub> = 15 pF                                                                                    | -                   | 3.6 | 6.2 | 1.0              | 7.1 | 1.0               | 8.0  | ns   |
|                 |                               | C <sub>L</sub> = 50 pF                                                                                    | -                   | 5.1 | 7.9 | 1.0              | 9.0 | 1.0               | 10.5 | ns   |
| C <sub>PD</sub> | power dissipation capacitance | per buffer;<br>C <sub>L</sub> = 50 pF; f <sub>i</sub> = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> | <a href="#">[4]</a> | -   | 19  | -                | -   | -                 | -    | pF   |

- [1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [2] Typical values are measured at  $V_{CC} = 3.3 \text{ V}$ .
- [3] Typical values are measured at  $V_{CC} = 5.0 \text{ V}$ .
- [4]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$
  - $f_i$  = input frequency in MHz;
  - $f_o$  = output frequency in MHz;
  - $C_L$  = output load capacitance in pF;
  - $V_{CC}$  = supply voltage in V;
  - $N$  = number of inputs switching;
  - $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## 12. Waveforms



**Fig 6. The input (nA and nB) to output (nY) propagation delays.**

### Table 9. Measurement points

| Type       | Input       | Output      |
|------------|-------------|-------------|
|            | $V_M$       | $V_M$       |
| 74AHC2G08  | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74AHCT2G08 | 1.5 V       | $0.5V_{CC}$ |

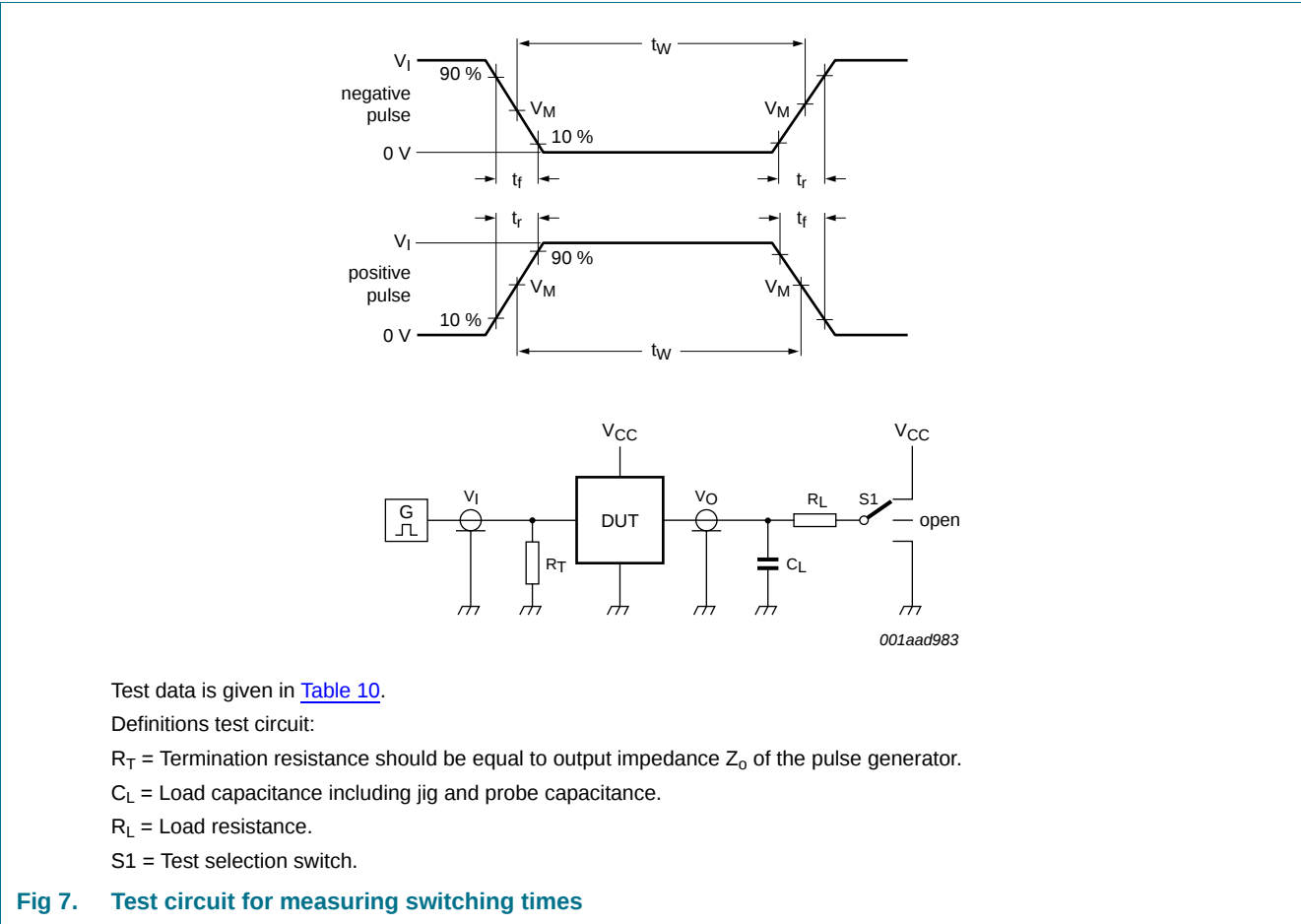


Table 10. Test data

| Type       | Input    |                    | Load         |              | S1 position        |                    |                    |
|------------|----------|--------------------|--------------|--------------|--------------------|--------------------|--------------------|
|            | $V_I$    | $t_r, t_f$         | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ | $t_{PZH}, t_{PHZ}$ | $t_{PZL}, t_{PLZ}$ |
| 74AHC2G08  | $V_{CC}$ | $\leq 3\text{ ns}$ | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74AHCT2G08 | 3 V      | $\leq 3\text{ ns}$ | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

13. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm    SOT505-2

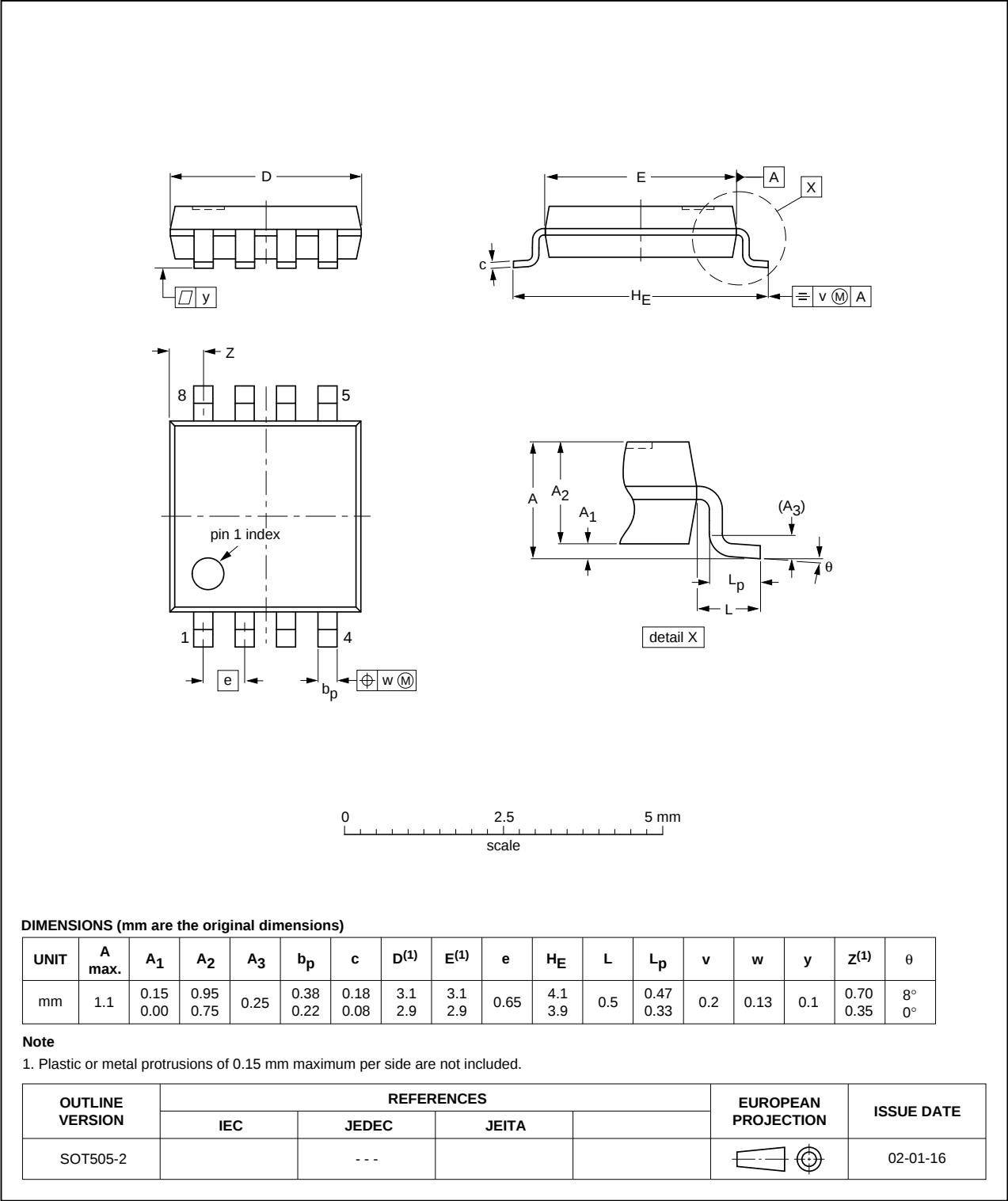


Fig 8. Package outline SOT505-2 (TSSOP8)

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

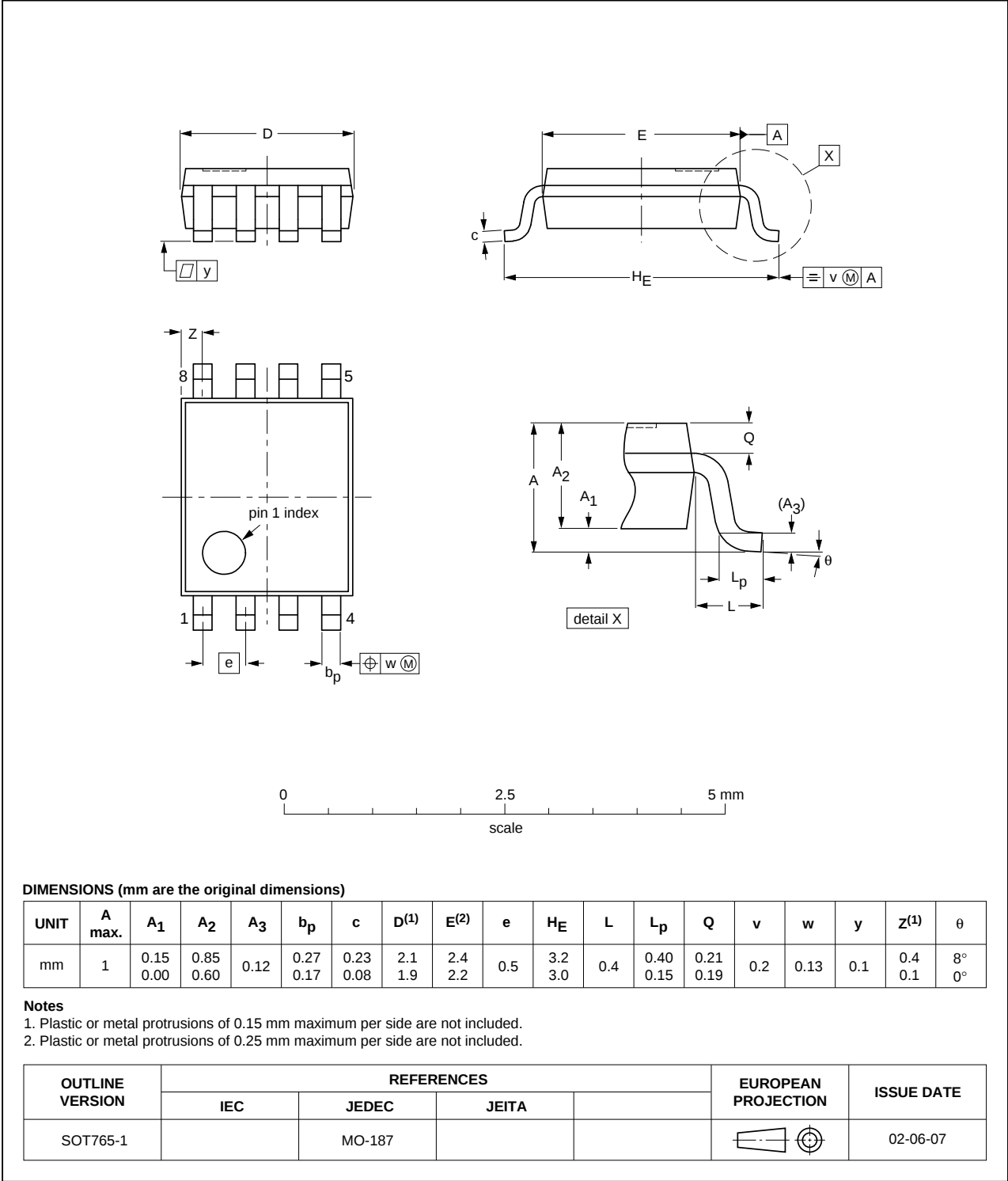


Fig 9. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads;  
8 terminals; body 3 x 2 x 0.5 mm

SOT996-2

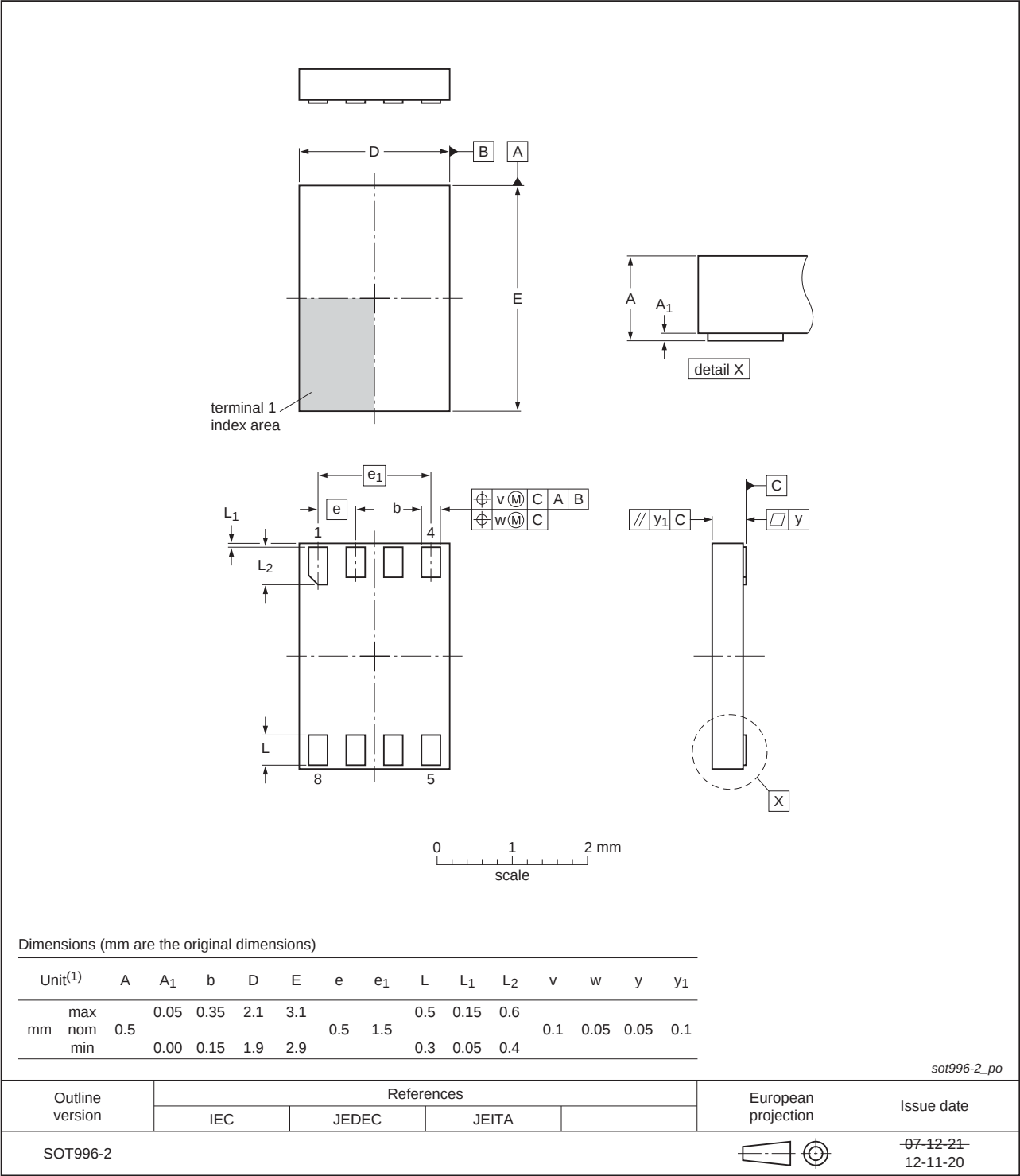


Fig 10. Package outline SOT996-2 (XSON8)

## 14. Revision history

**Table 11.** Revision history

| Document ID        | Release date                                                                | Data sheet status     | Change notice | Supersedes         |
|--------------------|-----------------------------------------------------------------------------|-----------------------|---------------|--------------------|
| 74AHC_AHCT2G08 v.5 | 20131127                                                                    | Product data sheet    | -             | 74AHC_AHCT2G08 v.4 |
| Modifications:     | • General description updated (errata).                                     |                       |               |                    |
| 74AHC_AHCT2G08 v.4 | 20130513                                                                    | Product data sheet    | -             | 74AHC_AHCT2G08 v.3 |
| Modifications:     | • For type number 74AHC2G08GD and 74AHCT2G08GD XSON8U has changed to XSON8. |                       |               |                    |
| 74AHC_AHCT2G08 v.3 | 20090112                                                                    | Product data sheet    | -             | 74AHC_AHCT2G08 v.2 |
| 74AHC_AHCT2G08 v.2 | 20041018                                                                    | Product data sheet    | -             | 74AHC_AHCT2G08 v.1 |
| 74AHC_AHCT2G08 v.1 | 20040206                                                                    | Product specification | -             | -                  |

## 15. Legal information

### 15.1 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>.

### 15.2 Definitions

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