

# 74HC2G08; 74HCT2G08

## Dual 2-input AND gate

Rev. 04 — 7 May 2009

Product data sheet

## 1. General description

The 74HC2G08 and 74HCT2G08 are high-speed Si-gate CMOS devices. They provide two 2-input AND gates.

The HC device has CMOS input switching levels and supply voltage range 2 V to 6 V.

The HCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

## 2. Features

- Wide supply voltage range from 2.0 V to 6.0 V
- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114E exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- 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  |
| 74HC2G08DP<br>74HCT2G08DP | -40 °C to +125 °C | TSSOP8 | plastic thin shrink small outline package; 8 leads;<br>body width 3 mm; lead length 0.5 mm              | SOT505-2 |
| 74HC2G08DC<br>74HCT2G08DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads;<br>body width 2.3 mm                           | SOT765-1 |
| 74HC2G08GD<br>74HCT2G08GD | -40 °C to +125 °C | XSON8U | plastic extremely thin small outline package; no leads;<br>8 terminals; UTLP based; body 3 × 2 × 0.5 mm | SOT996-2 |

4. Marking

Table 2. Marking code

| Type number | Marking code |
|-------------|--------------|
| 74HC2G08DP  | H08          |
| 74HCT2G08DP | T08          |
| 74HC2G08DC  | H08          |
| 74HCT2G08DC | T08          |
| 74HC2G08GD  | H08          |
| 74HCT2G08GD | T08          |

5. Functional diagram

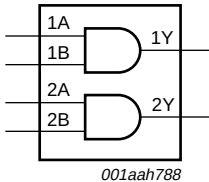


Fig 1. Logic symbol

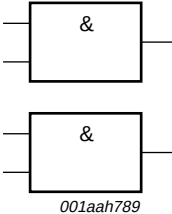


Fig 2. IEC logic symbol

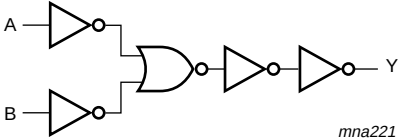
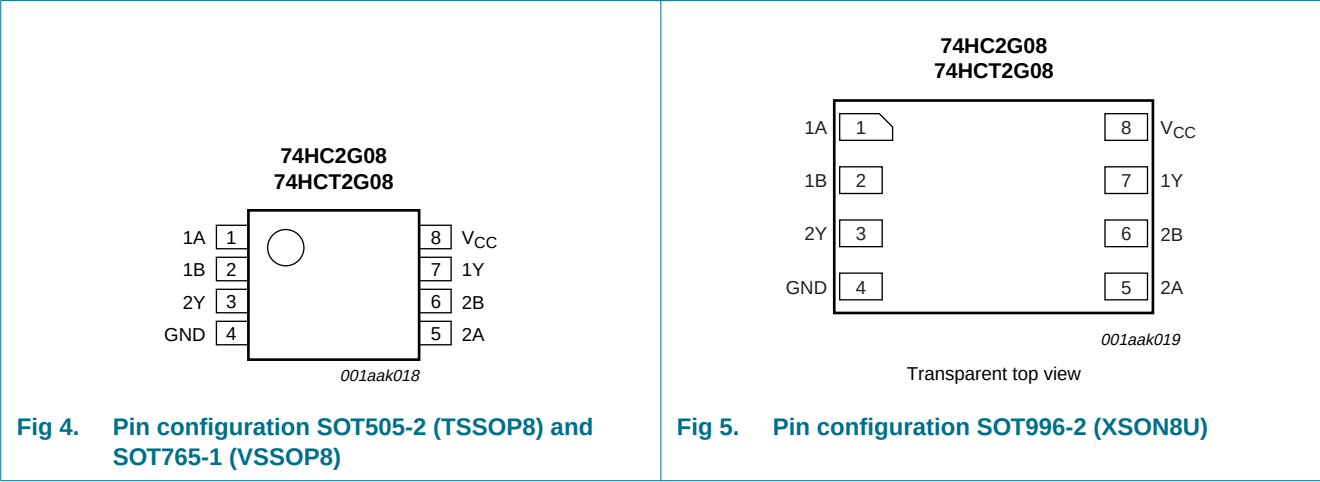


Fig 3. Logic diagram (one gate)

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    |
| $I_{IK}$  | input clamping current    | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | [1] -   | ±20  | mA   |
| $I_{OK}$  | output clamping current   | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | [1] -   | ±20  | mA   |
| $I_O$     | output current            | $V_O = -0.5\text{ V}$ to $(V_{CC} + 0.5\text{ V})$     | [1] -   | 25   | mA   |
| $I_{CC}$  | supply current            |                                                        | [1] -   | 50   | mA   |
| $I_{GND}$ | ground current            |                                                        | [1] -50 | -    | mA   |
| $T_{stg}$ | storage temperature       |                                                        | -65     | +150 | °C   |
| $P_D$     | dynamic power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$          | [2] -   | 300  | 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 XSON8U package: above 118 °C the value of  $P_{Tot}$  derates linearly with 7.8 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

| Symbol              | Parameter                           | Conditions              | 74HC2G08 |      |          | 74HCT2G08 |      |          | Unit |
|---------------------|-------------------------------------|-------------------------|----------|------|----------|-----------|------|----------|------|
|                     |                                     |                         | Min      | Typ  | Max      | Min       | Typ  | Max      |      |
| $V_{CC}$            | supply voltage                      |                         | 2.0      | 5.0  | 6.0      | 4.5       | 5.0  | 5.5      | V    |
| $V_I$               | input voltage                       |                         | 0        | -    | $V_{CC}$ | 0         | -    | $V_{CC}$ | 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 | $V_{CC} = 2.0\text{ V}$ | -        | -    | 625      | -         | -    | -        | ns/V |
|                     |                                     | $V_{CC} = 4.5\text{ V}$ | -        | 1.67 | 139      | -         | 1.67 | 139      | ns/V |
|                     |                                     | $V_{CC} = 6.0\text{ V}$ | -        | -    | 83       | -         | -    | -        | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

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

| Symbol          | Parameter                 | Conditions                                                                                            | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|-----------------|---------------------------|-------------------------------------------------------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                 |                           |                                                                                                       | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| 74HC2G08        |                           |                                                                                                       |                  |                    |      |                   |      |      |
| V <sub>IH</sub> | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                               | 1.5              | 1.2                | -    | 1.5               | -    | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                               | 3.15             | 2.4                | -    | 3.15              | -    | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                               | 4.2              | 3.2                | -    | 4.2               | -    | V    |
| V <sub>IL</sub> | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                               | -                | 0.8                | 0.5  | -                 | 0.5  | V    |
|                 |                           | V <sub>CC</sub> = 4.5 V                                                                               | -                | 2.1                | 1.35 | -                 | 1.35 | V    |
|                 |                           | V <sub>CC</sub> = 6.0 V                                                                               | -                | 2.8                | 1.8  | -                 | 1.8  | V    |
| V <sub>OH</sub> | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                   |                  |                    |      |                   |      |      |
|                 |                           | I <sub>O</sub> = –20 µA; V <sub>CC</sub> = 2.0 V                                                      | 1.9              | 2.0                | -    | 1.9               | -    | V    |
|                 |                           | I <sub>O</sub> = –20 µA; V <sub>CC</sub> = 4.5 V                                                      | 4.4              | 4.5                | -    | 4.4               | -    | V    |
|                 |                           | I <sub>O</sub> = –20 µA; V <sub>CC</sub> = 6.0 V                                                      | 5.9              | 6.0                | -    | 5.9               | -    | V    |
|                 |                           | I <sub>O</sub> = –4.0 mA; V <sub>CC</sub> = 4.5 V                                                     | 4.13             | 4.32               | -    | 3.7               | -    | V    |
|                 |                           | I <sub>O</sub> = –5.2 mA; V <sub>CC</sub> = 6.0 V                                                     | 5.63             | 5.81               | -    | 5.2               | -    | V    |
| V <sub>OL</sub> | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                   |                  |                    |      |                   |      |      |
|                 |                           | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 2.0 V                                                       | -                | 0                  | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V                                                       | -                | 0                  | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 6.0 V                                                       | -                | 0                  | 0.1  | -                 | 0.1  | V    |
|                 |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                                      | -                | 0.15               | 0.33 | -                 | 0.4  | V    |
|                 |                           | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V                                                      | -                | 0.16               | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>  | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                                      | -                | -                  | ±1.0 | -                 | ±1.0 | µA   |
| I <sub>CC</sub> | supply current            | per input pin; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -                | -                  | 10   | -                 | 20   | µA   |
| C <sub>I</sub>  | input capacitance         |                                                                                                       | -                | 1.5                | -    | -                 | -    | pF   |

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

| Symbol           | Parameter                 | Conditions                                                                                                  | –40 °C to +85 °C |                    |      | –40 °C to +125 °C |      | Unit |
|------------------|---------------------------|-------------------------------------------------------------------------------------------------------------|------------------|--------------------|------|-------------------|------|------|
|                  |                           |                                                                                                             | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| 74HCT2G08        |                           |                                                                                                             |                  |                    |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                            | 2.0              | 1.6                | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                            | -                | 1.2                | 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>                                                         |                  |                    |      |                   |      |      |
|                  |                           | I <sub>O</sub> = –20 µA; V <sub>CC</sub> = 4.5 V                                                            | 4.4              | 4.5                | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = –4.0 mA; V <sub>CC</sub> = 4.5 V                                                           | 4.13             | 4.32               | -    | 3.7               | -    | V    |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                         |                  |                    |      |                   |      |      |
|                  |                           | I <sub>O</sub> = 20 µA; V <sub>CC</sub> = 4.5 V                                                             | -                | 0                  | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V                                                            | -                | 0.15               | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                                            | -                | -                  | ±1.0 | -                 | ±1.0 | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V                      | -                | -                  | 10   | -                 | 20   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> – 2.1 V; I <sub>O</sub> = 0 A | -                | -                  | 375  | -                 | 410  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                             | -                | 1.5                | -    | -                 | -    | pF   |

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

## 11. Dynamic characteristics

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

| Symbol          | Parameter                     | Conditions                                      | −40 °C to +85 °C |                    |     | −40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|-------------------------------------------------|------------------|--------------------|-----|-------------------|-----|------|
|                 |                               |                                                 | Min              | Typ <sup>[1]</sup> | Max | Min               | Max |      |
| 74HC2G08        |                               |                                                 |                  |                    |     |                   |     |      |
| t <sub>pd</sub> | propagation delay             | nA and nB to nY; see <a href="#">Figure 6</a>   | <sup>[2]</sup>   |                    |     |                   |     |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                         | -                | 26                 | 95  | -                 | 110 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                         | -                | 9                  | 19  | -                 | 22  | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF | -                | 9                  | -   | -                 | -   | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                         | -                | 8                  | 16  | -                 | 20  | ns   |
| t <sub>t</sub>  | transition time               | see <a href="#">Figure 6</a>                    | <sup>[3]</sup>   |                    |     |                   |     |      |
|                 |                               | V <sub>CC</sub> = 2.0 V                         | -                | 20                 | 95  | -                 | 125 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V                         | -                | 7                  | 19  | -                 | 25  | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V                         | -                | 6                  | 16  | -                 | 20  | ns   |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub>         | <sup>[4]</sup>   | -                  | 10  | -                 | -   | pF   |

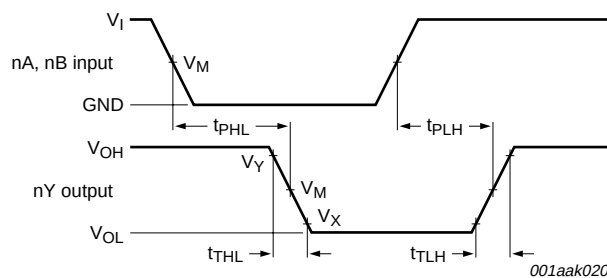
**Table 8.** Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 7](#).

| Symbol          | Parameter                     | Conditions                                            | −40 °C to +85 °C    |                    |     | −40 °C to +125 °C |     | Unit |    |
|-----------------|-------------------------------|-------------------------------------------------------|---------------------|--------------------|-----|-------------------|-----|------|----|
|                 |                               |                                                       | Min                 | Typ <sup>[1]</sup> | Max | Min               | Max |      |    |
| 74HCT2G08       |                               |                                                       |                     |                    |     |                   |     |      |    |
| t <sub>pd</sub> | propagation delay             | nA and nB to nY; see <a href="#">Figure 6</a>         | <a href="#">[2]</a> |                    |     |                   |     |      |    |
|                 |                               | V <sub>CC</sub> = 4.5 V                               | -                   | 14                 | 30  | -                 | 36  | ns   |    |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF       | -                   | 14                 | -   | -                 | -   | ns   |    |
| t <sub>t</sub>  | transition time               | V <sub>CC</sub> = 4.5 V; see <a href="#">Figure 6</a> | <a href="#">[3]</a> | -                  | 7   | 19                | -   | 22   | ns |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> − 1.5 V       | <a href="#">[4]</a> | -                  | 10  | -                 | -   | -    | pF |

- [1] All typical values are measured at  $T_{amb} = 25\text{ °C}$ .
- [2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .
- [3]  $t_t$  is the same as  $t_{TLH}$  and  $t_{THL}$ .
- [4]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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 outputs.

## 12. Waveforms



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

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 6.** Propagation delay data input (nA, nB) to data output (nY) and transition time output (nY)**Table 9.** Measurement points

| Type      | Input       | Output      |             |             |
|-----------|-------------|-------------|-------------|-------------|
|           | $V_M$       | $V_M$       | $V_X$       | $V_Y$       |
| 74HC2G08  | $0.5V_{CC}$ | $0.5V_{CC}$ | $0.1V_{CC}$ | $0.9V_{CC}$ |
| 74HCT2G08 | 1.3 V       | 1.3 V       | $0.1V_{CC}$ | $0.9V_{CC}$ |

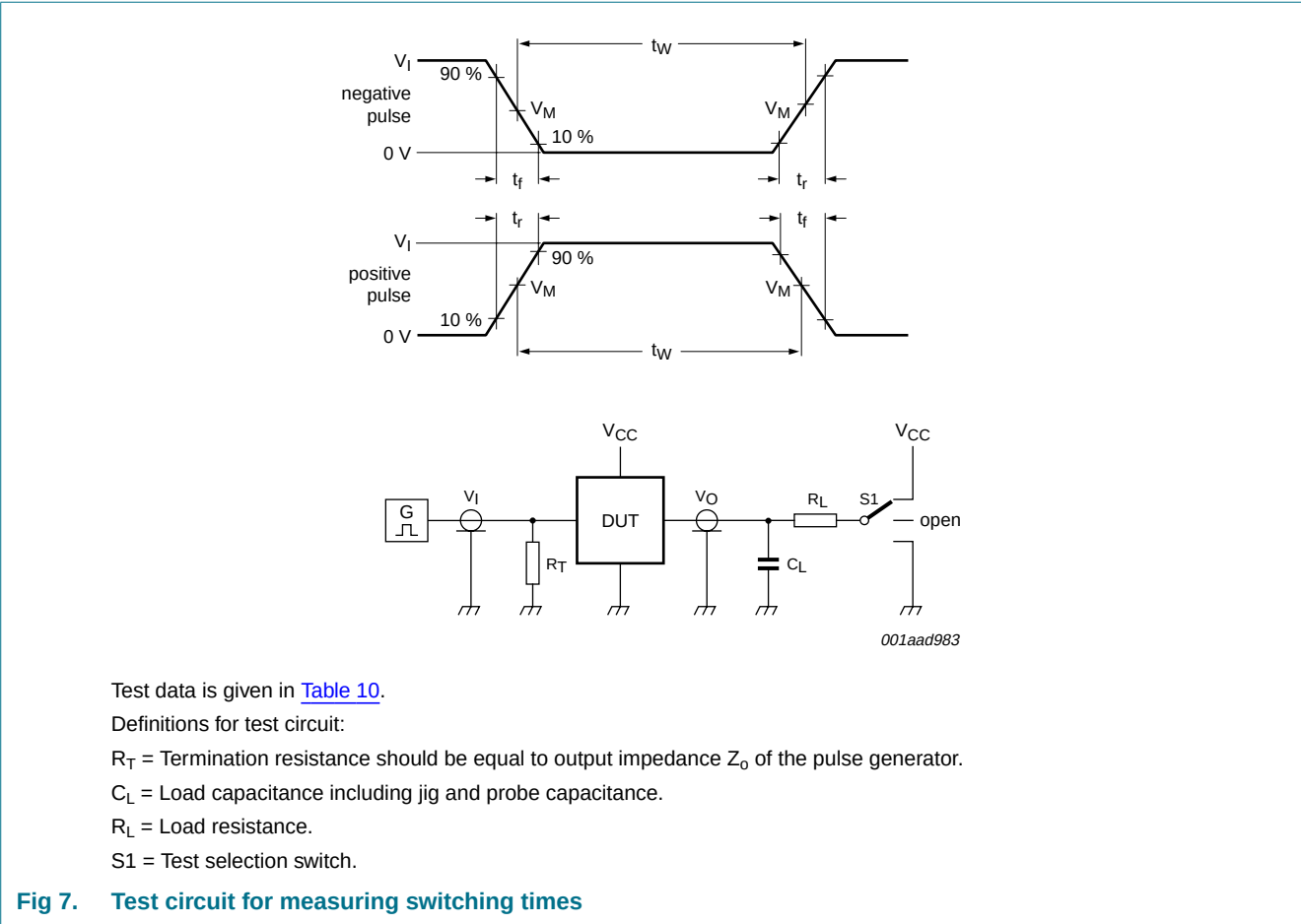


Table 10. Test data

| Type      | Input           |             | Load         |              | S1 position        |
|-----------|-----------------|-------------|--------------|--------------|--------------------|
|           | $V_I$           | $t_r, t_f$  | $C_L$        | $R_L$        | $t_{PHL}, t_{PLH}$ |
| 74HC2G08  | GND to $V_{CC}$ | $\leq 6$ ns | 15 pF, 50 pF | 1 k $\Omega$ | open               |
| 74HCT2G08 | GND to 3 V      | $\leq 6$ ns | 15 pF, 50 pF | 1 k $\Omega$ | open               |



13. Package outline

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

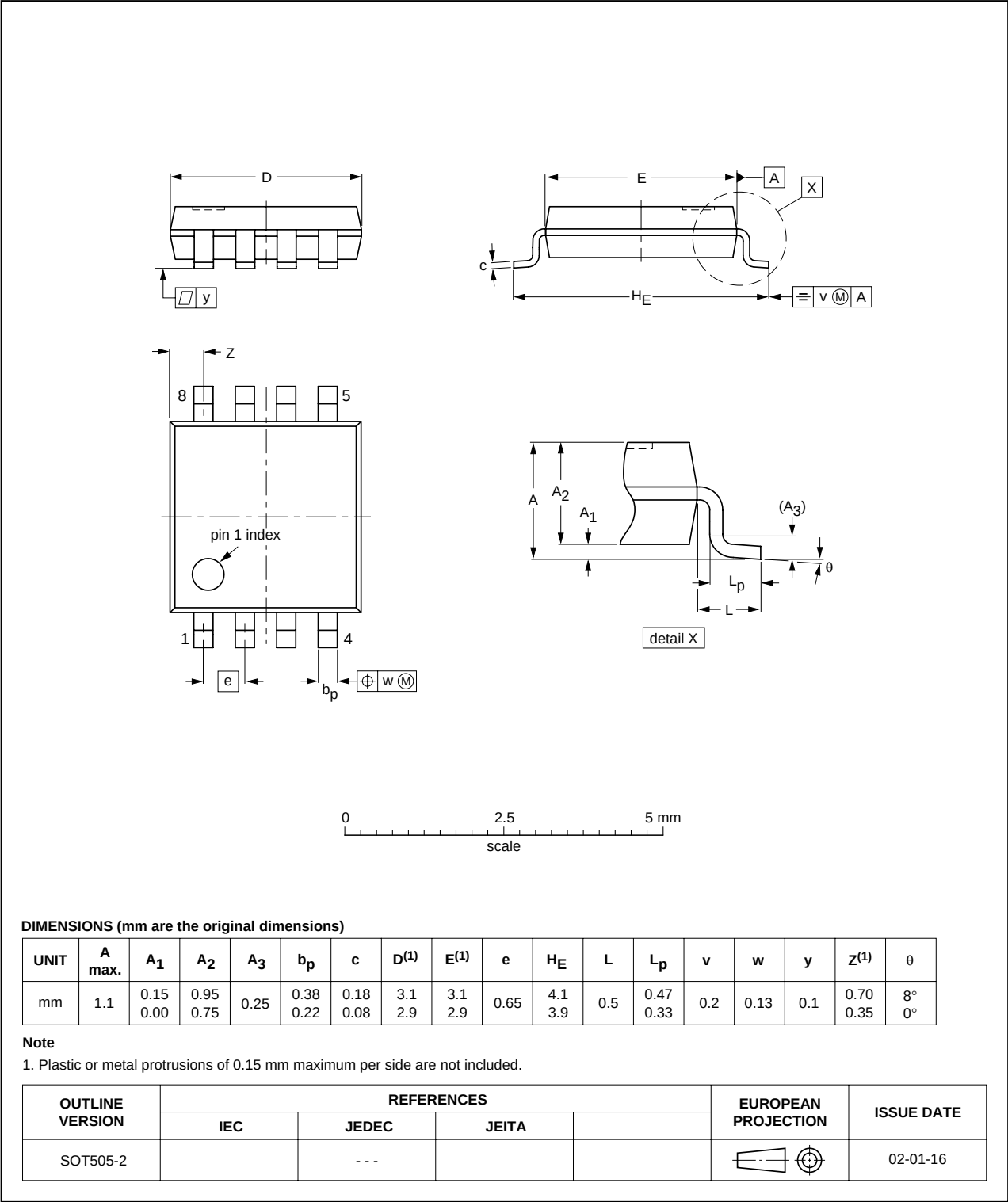


Fig 8. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

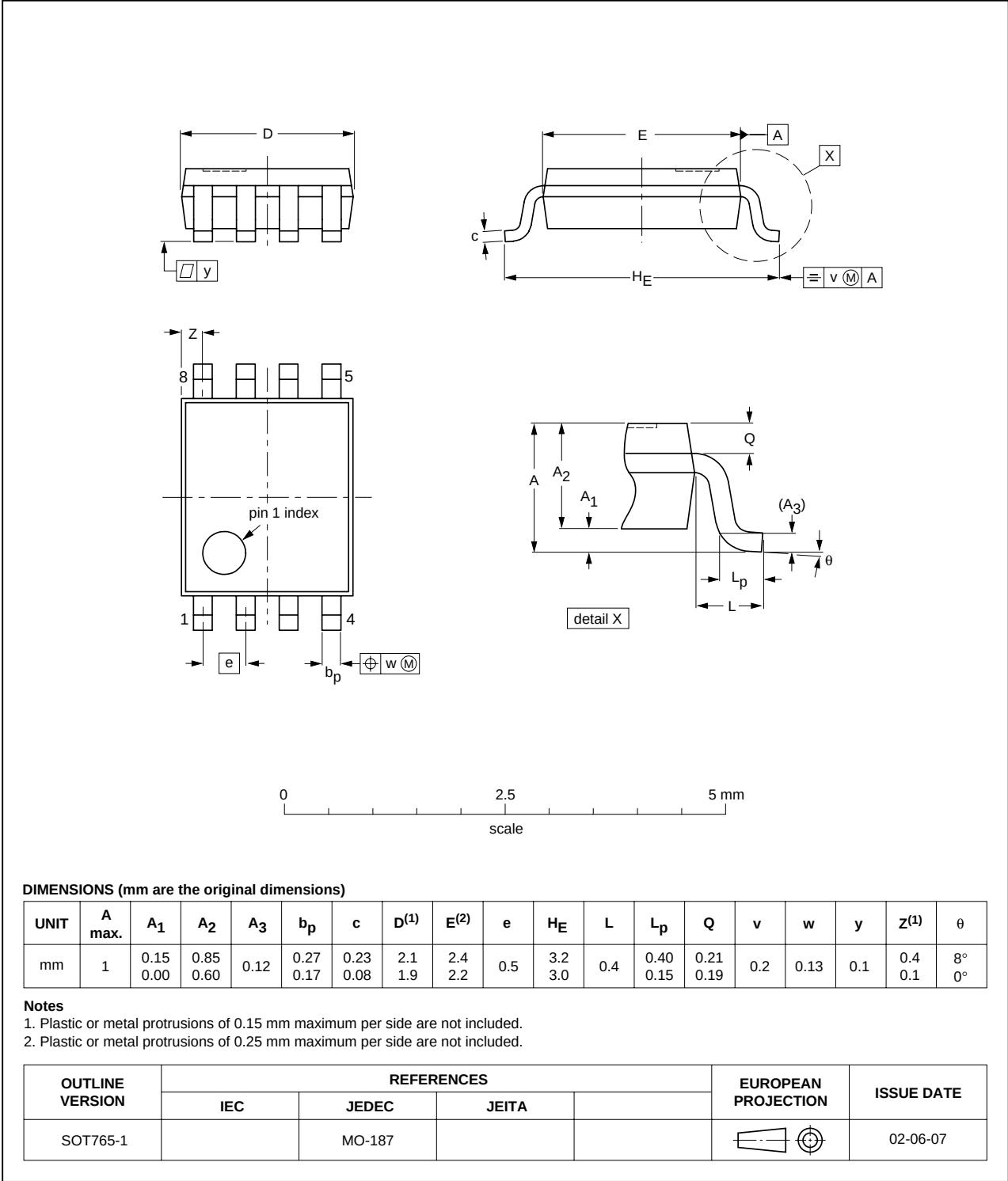


Fig 9. Package outline SOT765-1 (VSSOP8)

XSON8U: plastic extremely thin small outline package; no leads;  
8 terminals; UTLP based; body 3 x 2 x 0.5 mm

SOT996-2

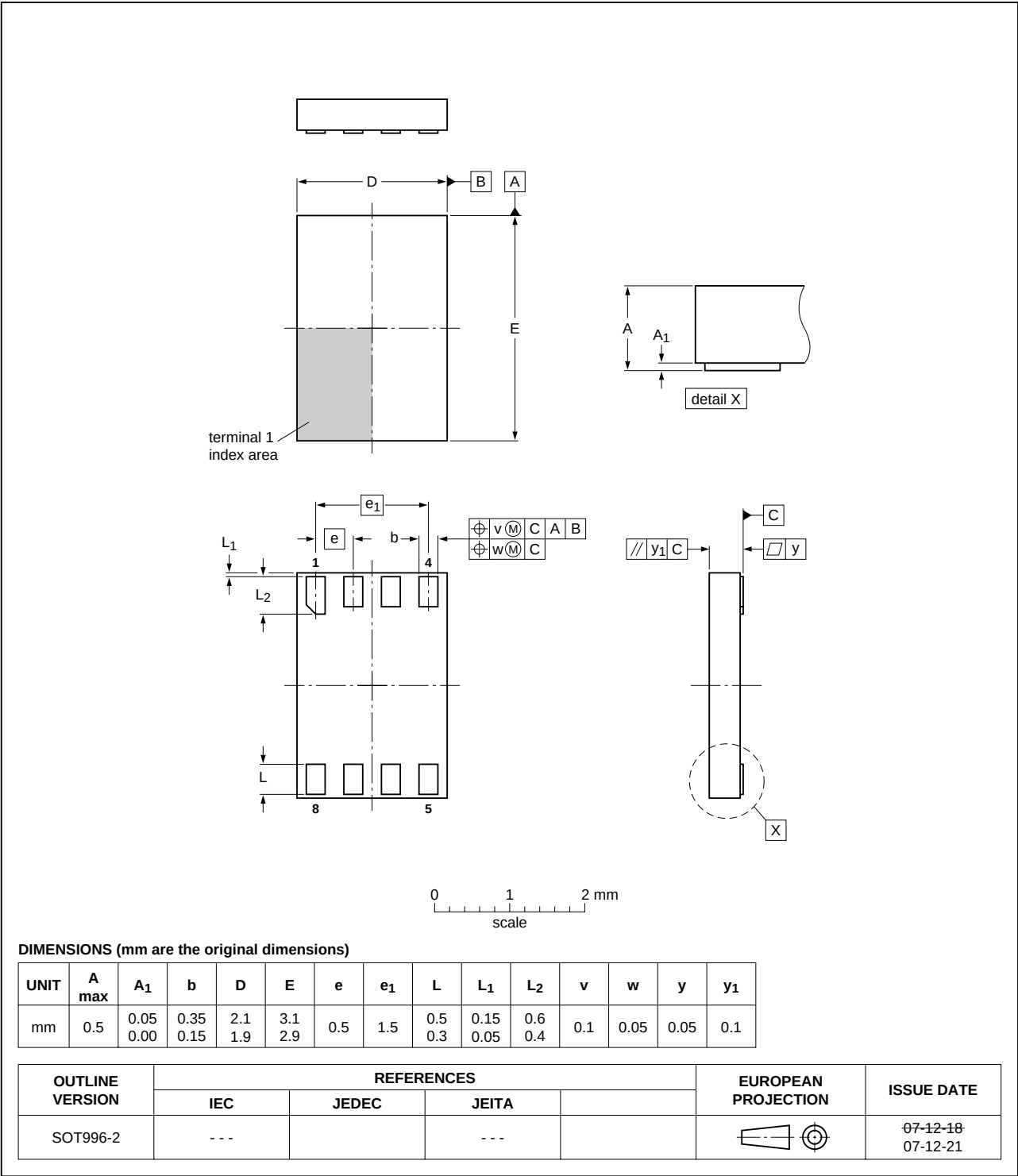


Fig 10. Package outline SOT996-2 (XSON8U)

## 14. Abbreviations

Table 11. Abbreviations

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

## 15. Revision history

Table 12. Revision history

| Document ID    | Release date                                                                                                                                                                                                                                                                                                               | Data sheet status     | Change notice | Supersedes     |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|----------------|
| 74HC_HCT2G08_4 | 20090507                                                                                                                                                                                                                                                                                                                   | Product data sheet    | -             | 74HC_HCT2G08_3 |
| Modifications: | <ul style="list-style-type: none"><li>The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li><li>Legal texts have been adapted to the new company name where appropriate.</li><li>Added type number 74HC2G08GD and 74HCT2G08GD (XSON8U package)</li></ul> |                       |               |                |
| 74HC_HCT2G08_3 | 20031022                                                                                                                                                                                                                                                                                                                   | Product specification | -             | 74HC_HCT2G08_2 |
| 74HC_HCT2G08_2 | 20030203                                                                                                                                                                                                                                                                                                                   | Product specification | -             | 74HC_HCT2G08_1 |
| 74HC_HCT2G08_1 | 20020710                                                                                                                                                                                                                                                                                                                   | Product specification | -             | -              |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition                                                                            |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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