

# 74AHC2G08-Q100; 74AHCT2G08-Q100

Dual 2-input AND gate

Rev. 5 — 1 September 2023

Product data sheet

## 1. General description

The 74AHC2G08-Q100; 74AHCT2G08-Q100 is a dual 2-input AND gate. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Symmetrical output impedance
- Balanced propagation delays
- Wide supply voltage range from 2.0 to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- Input levels:
  - For 74AHC2G08-Q100: CMOS level
  - For 74AHCT2G08-Q100: TTL level
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

## 3. Ordering information

Table 1. Ordering information

| Type number                                                           | Package           |        |                                                                                         |                          |
|-----------------------------------------------------------------------|-------------------|--------|-----------------------------------------------------------------------------------------|--------------------------|
|                                                                       | Temperature range | Name   | Description                                                                             | Version                  |
| <a href="#">74AHC2G08DP-Q100</a><br><a href="#">74AHCT2G08DP-Q100</a> | -40 °C to +125 °C | TSSOP8 | plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm | <a href="#">SOT505-2</a> |
| <a href="#">74AHC2G08DC-Q100</a><br><a href="#">74AHCT2G08DC-Q100</a> | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm              | <a href="#">SOT765-1</a> |

4. Marking

Table 2. Marking

| Type number       | Marking code <sup>[1]</sup> |
|-------------------|-----------------------------|
| 74AHC2G08DP-Q100  | A08                         |
| 74AHCT2G08DP-Q100 | C08                         |
| 74AHC2G08DC-Q100  | A08                         |
| 74AHCT2G08DC-Q100 | 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

**DP package**  
**SOT505-2 (TSSOP8)**

aaa-036501

**DC package**  
**SOT765-1 (VSSOP8)**

aaa-036500

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**

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

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

## 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 SOT505-2 (TSSOP8) package:  $P_{tot}$  derates linearly with 4.6 mW/K above 96 °C.  
For SOT765-1 (VSSOP8) package:  $P_{tot}$  derates linearly with 4.9 mW/K above 99 °C.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

| Symbol              | Parameter                           | Conditions               | 74AHC2G08-Q100 |     |          | 74AHCT2G08-Q100 |     |          | 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-Q100  |                           |                                                                                        |       |     |      |                  |      |                   |      |      |
| 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    |
| V <sub>OL</sub> | LOW-level output voltage  | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V                                      | 3.94  | -   | -    | 3.8              | -    | 3.70              | -    | V    |
|                 |                           | 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>I</sub>  | input leakage current     | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V                                       | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
|                 |                           | V <sub>I</sub> = 5.5 V or GND; 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; V <sub>CC</sub> = 5.5 V | -     | -   | 1.0  | -                | 10   | -                 | 40   | µA   |
| C <sub>I</sub>  | input capacitance         |                                                                                        | -     | 1.5 | 10   | -                | 10   | -                 | 10   | pF   |

| Symbol           | Parameter                 | Conditions                                                                                                                   | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                  |                           |                                                                                                                              | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 74AHCT2G08-Q100  |                           |                                                                                                                              |       |     |      |                  |      |                   |      |      |
| 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; 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; V <sub>CC</sub> = 5.5 V                                       | -     | -   | 1.0  | -                | 10   | -                 | 40   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input pin; V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V | -     | -   | 1.35 | -                | 1.5  | -                 | 1.5  | mA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                              | -     | 1.5 | 10   | -                | 10   | -                 | 10   | pF   |

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

GND = 0 V; for test circuit see Fig. 5.

| Symbol          | Parameter                     | Conditions                                                                                                                    | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                 |                               |                                                                                                                               | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| 74AHC2G08-Q100  |                               |                                                                                                                               |       |     |      |                  |      |                   |      |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Fig. 4</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; C <sub>L</sub> = 50 pF; <a href="#">[4]</a><br>f <sub>i</sub> = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> | -     | 17  | -    | -                | -    | -                 | -    | pF   |

| Symbol          | Parameter                     | Conditions                                                                                                    | 25 °C |     |     | -40 °C to +85 °C |     | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|---------------------------------------------------------------------------------------------------------------|-------|-----|-----|------------------|-----|-------------------|------|------|
|                 |                               |                                                                                                               | Min   | Typ | Max | Min              | Max | Min               | Max  |      |
| 74AHCT2G08-Q100 |                               |                                                                                                               |       |     |     |                  |     |                   |      |      |
| t <sub>pd</sub> | propagation delay             | nA, nB to nY; see <a href="#">Fig. 4</a> [1]                                                                  |       |     |     |                  |     |                   |      |      |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V [3]                                                                          |       |     |     |                  |     |                   |      |      |
|                 |                               | 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; C <sub>L</sub> = 50 pF;<br>f <sub>i</sub> = 1 MHz;<br>V <sub>I</sub> = GND to V <sub>CC</sub> [4] | -     | 19  | -   | -                | -   | -                 | -    | pF   |

- [1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
 [2] Typical values are measured at V<sub>CC</sub> = 3.3 V.  
 [3] Typical values are measured at V<sub>CC</sub> = 5.0 V.  
 [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> = output load capacitance in pF;  
 V<sub>CC</sub> = supply voltage in V;  
 N = number of inputs switching;  
 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

11.1. Waveform and test circuit

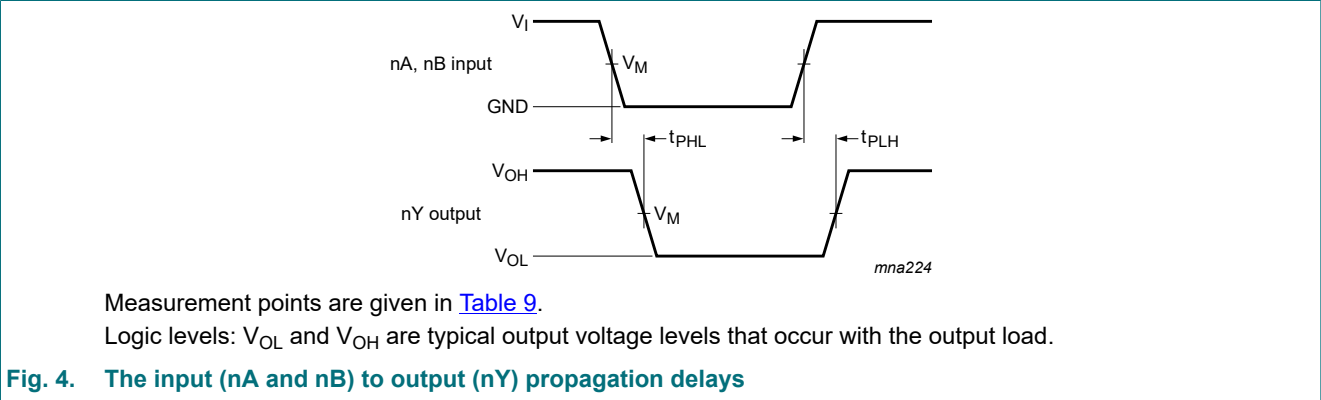


Table 9. Measurement points

| Type            | Input              | Output             |
|-----------------|--------------------|--------------------|
|                 | V <sub>M</sub>     | V <sub>M</sub>     |
| 74AHC2G08-Q100  | 0.5V <sub>CC</sub> | 0.5V <sub>CC</sub> |
| 74AHCT2G08-Q100 | 1.5 V              | 0.5V <sub>CC</sub> |

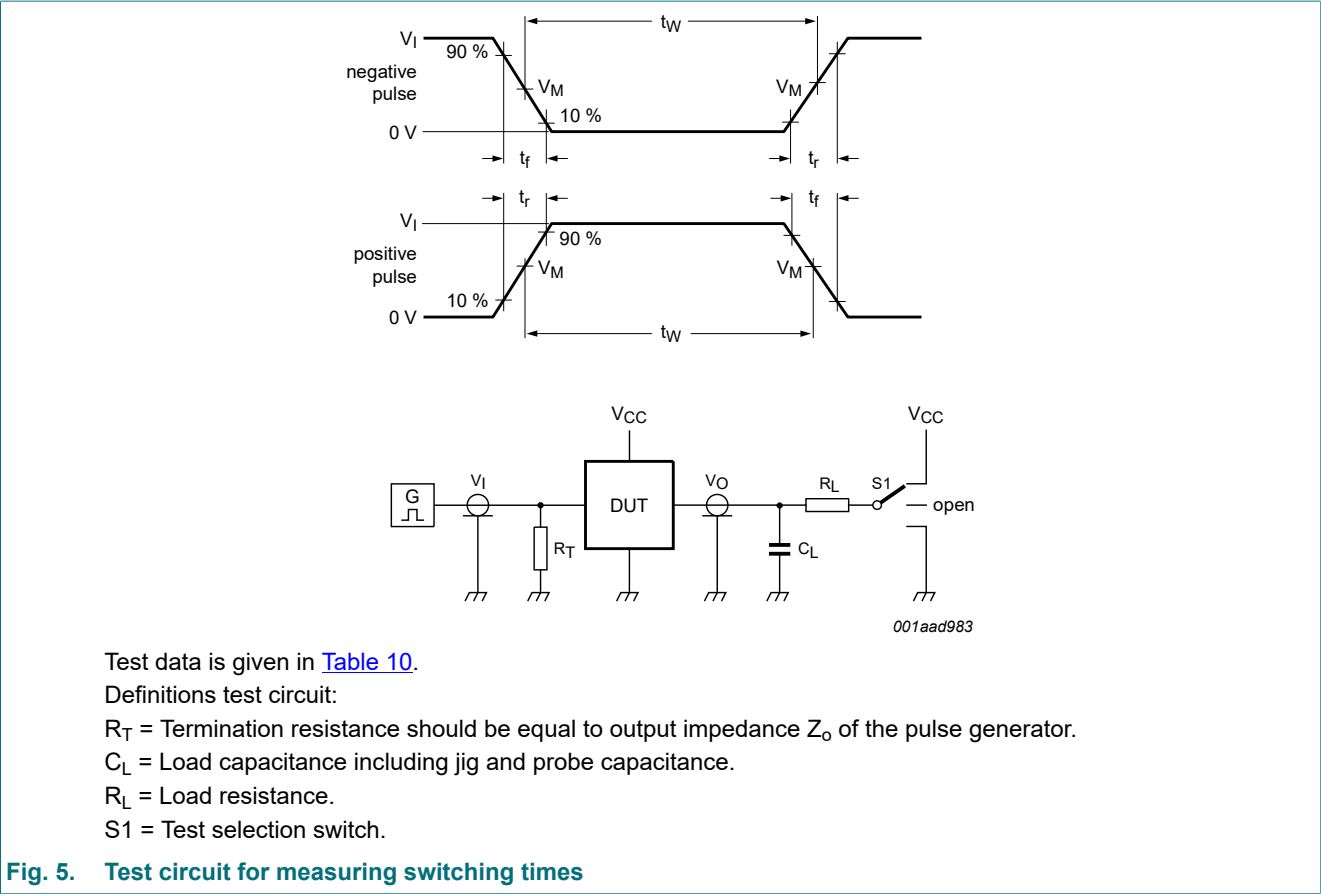


Fig. 5. Test circuit for measuring switching times

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-Q100  | $V_{CC}$ | $\leq 3\text{ ns}$ | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |
| 74AHCT2G08-Q100 | 3 V      | $\leq 3\text{ ns}$ | 15 pF, 50 pF | 1 k $\Omega$ | open               | GND                | $V_{CC}$           |

12. Package outline

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

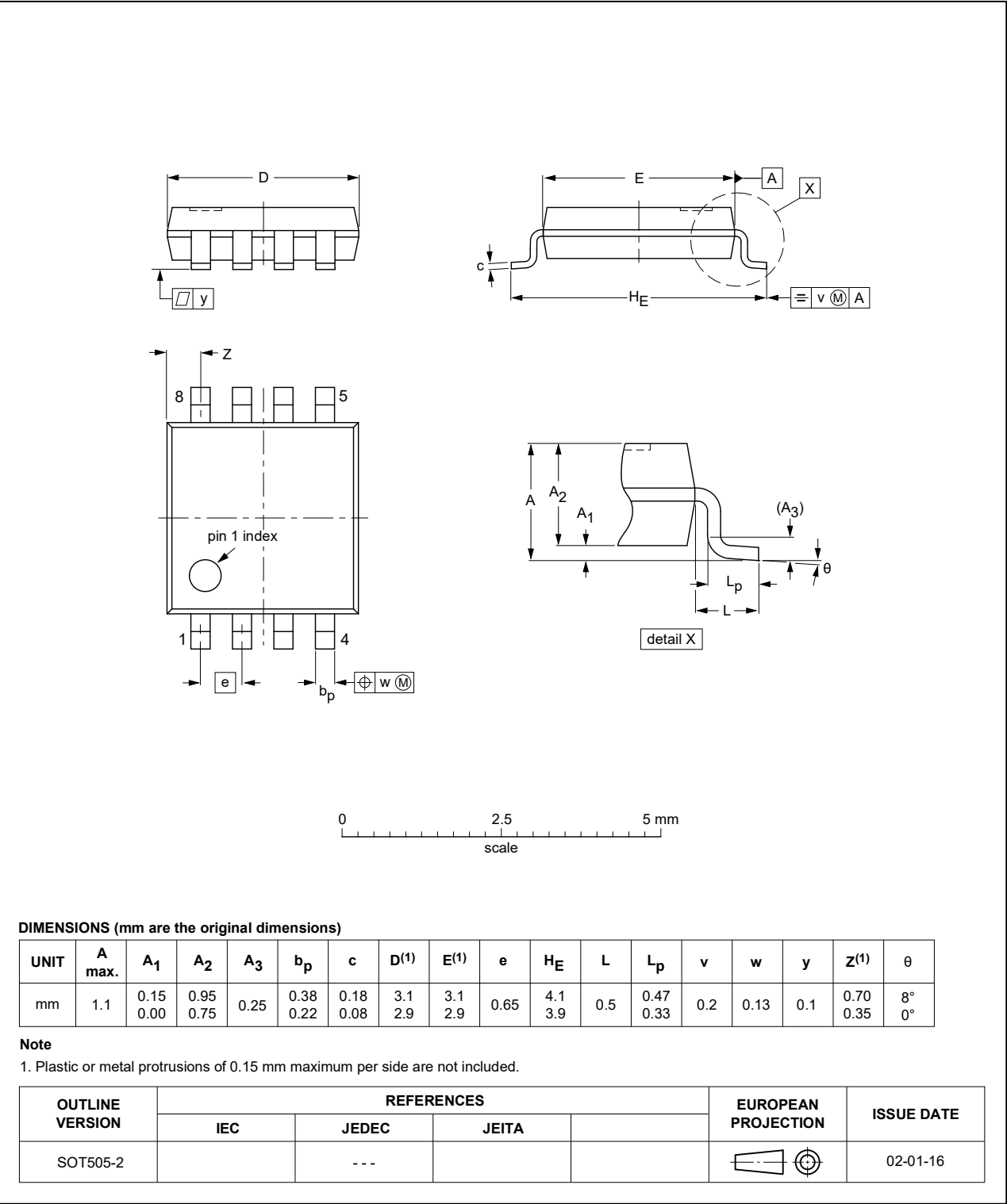


Fig. 6. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

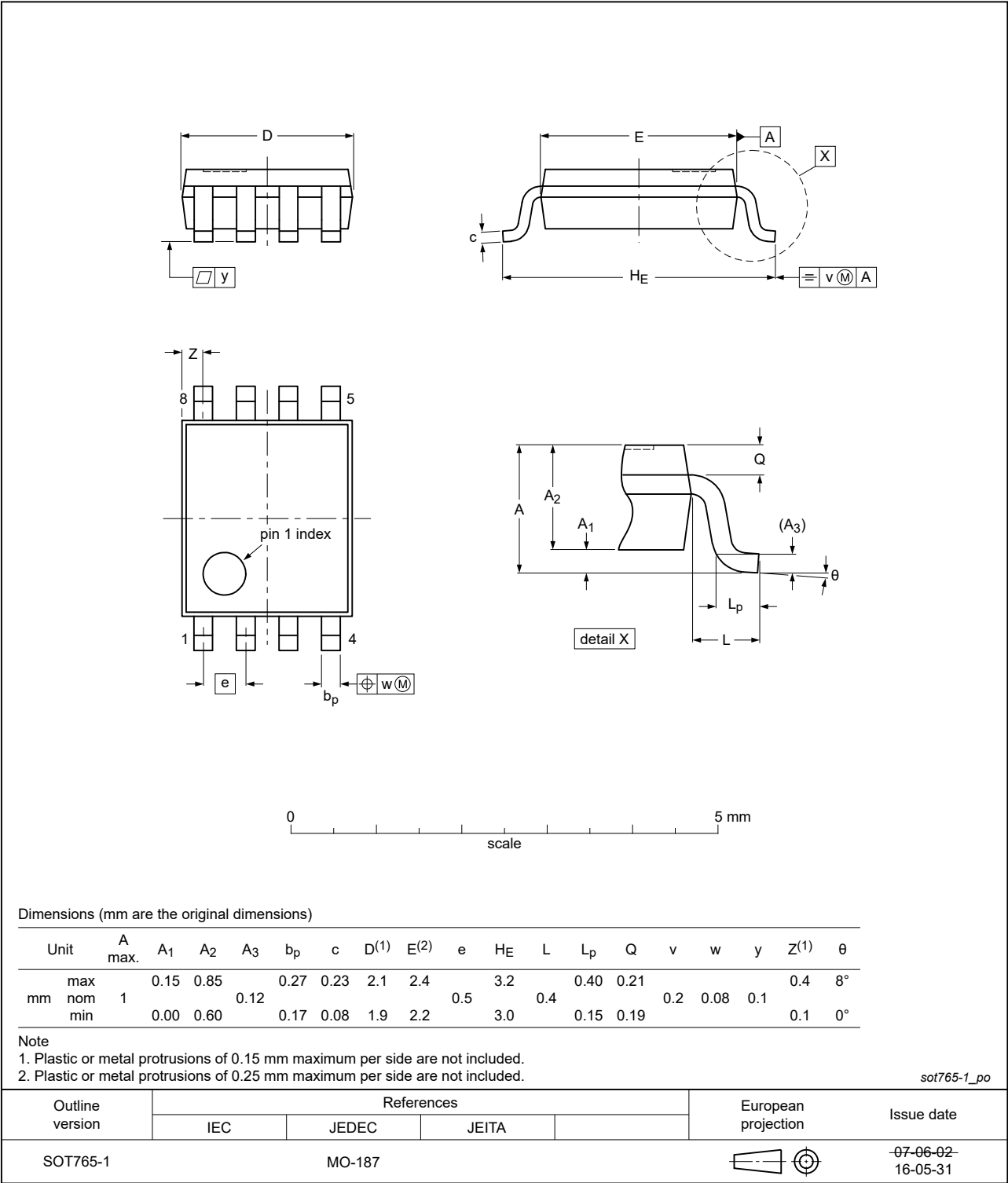


Fig. 7. Package outline SOT765-1 (VSSOP8)

## 13. Abbreviations

Table 11. Abbreviations

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

## 14. Revision history

Table 12. Revision history

| Document ID             | Release date                                                                                                                                                                                                                                                                                                                                                                                                                      | Data sheet status  | Change notice | Supersedes              |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-------------------------|
| 74AHC_AHCT2G08_Q100 v.5 | 20230901                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT2G08_Q100 v.4 |
| Modifications:          | <ul style="list-style-type: none"> <li>• <a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li> </ul>                                                                                                                                                                                                      |                    |               |                         |
| 74AHC_AHCT2G08_Q100 v.4 | 20180321                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT2G08_Q100 v.3 |
| 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> <li>• <a href="#">Table 5</a>: total power dissipation derating factors have changed.</li> <li>• Type number 74AHC2G08GD-Q100 and 74AHCT2G08GD-Q100 (SOT996-2/XSON8) removed .</li> </ul> |                    |               |                         |
| 74AHC_AHCT2G08_Q100 v.3 | 20151120                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT2G08_Q100 v.2 |
| Modifications:          | <ul style="list-style-type: none"> <li>• Added type number 74AHC2G08GD-Q100 and 74AHCT2G08GD-Q100 (SOT996-2/XSON8).</li> </ul>                                                                                                                                                                                                                                                                                                    |                    |               |                         |
| 74AHC_AHCT2G08_Q100 v.2 | 20140121                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | 74AHC_AHCT2G08_Q100 v.1 |
| 74AHC_AHCT2G08_Q100 v.1 | 20131113                                                                                                                                                                                                                                                                                                                                                                                                                          | Product data sheet | -             | -                       |

## 15. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | 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 <https://www.nexperia.com>.

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Date of release: 1 September 2023