

# 74HC3G06; 74HCT3G06

Triple inverter with open-drain outputs

Rev. 5 — 1 May 2019

Product data sheet

## 1. General description

The 74HC3G06; 74HCT3G06 is a triple inverter with open-drain outputs. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

## 2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - For 74HC3G06: CMOS level
  - For 74HCT3G06: TTL level
- Complies with JEDEC standard no. 7A
- High noise immunity
- Low power dissipation
- ESD protection:
  - HBM JESD22-A114F 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  |
| 74HC3G06DC  | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package;<br>8 leads; body width 2.3 mm | SOT765-1 |
| 74HCT3G06DC |                   |        |                                                                               |          |

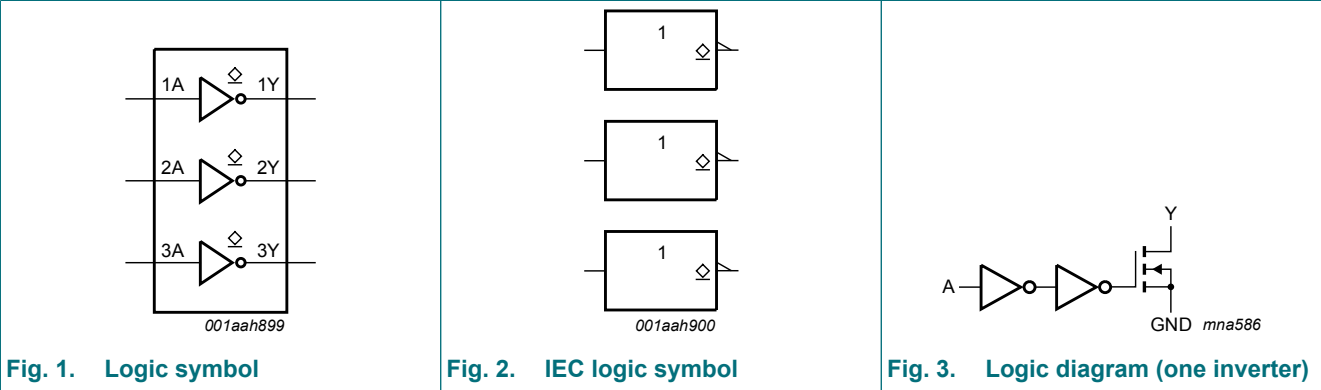
## 4. Marking

Table 2. Marking code

| Type number | Marking code [1] |
|-------------|------------------|
| 74HC3G06DC  | H06              |
| 74HCT3G06DC | T06              |

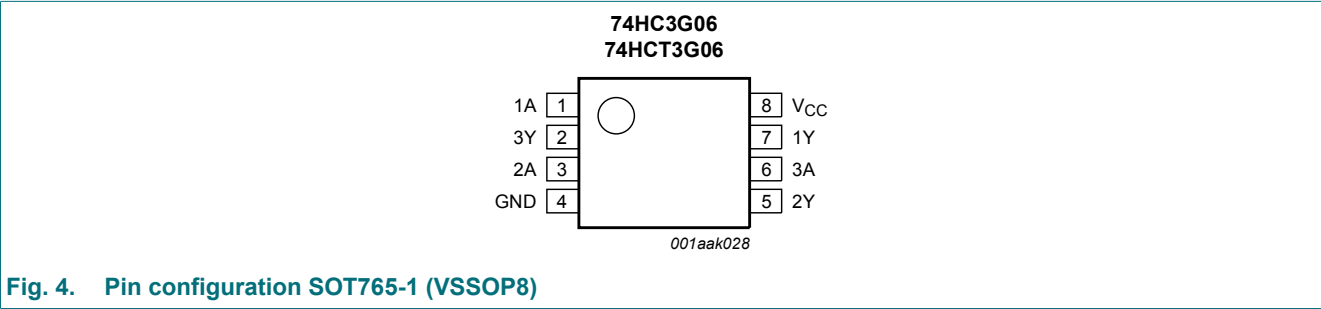
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table

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

| Input nA | Output nY |
|----------|-----------|
| L        | Z         |
| 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 | 7.0            | V    |
| $I_{IK}$  | input clamping current    | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ [1] | -    | $\pm 20$       | mA   |
| $I_{OK}$  | output clamping current   | $V_O < -0.5\text{ V}$ [1]                                  | -20  | -              | mA   |
| $V_O$     | output voltage            | active mode [1]                                            | -0.5 | $V_{CC} + 0.5$ | V    |
|           |                           | high-impedance mode [1]                                    | -0.5 | 7.0            | V    |
| $I_O$     | output current            | $V_O = -0.5\text{ V}$ to $7.0\text{ V}$ [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 VSSOP8 package: above 110 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

| Symbol              | Parameter                           | Conditions              | 74HC3G06 |      |          | 74HCT3G06 |      |          | 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        | -    | 6.0      | 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 | $V_{CC} = 2.0\text{ V}$ | -        | -    | 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). All typical values are measured at  $T_{amb} = 25\text{ °C}$ .

| Symbol          | Parameter                | Conditions              | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|-----------------|--------------------------|-------------------------|------------------|---------|------|-------------------|------|------|
|                 |                          |                         | Min              | Typ [1] | Max  | Min               | Max  |      |
| 74HC3G06        |                          |                         |                  |         |      |                   |      |      |
| 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    |

| Symbol           | Parameter                 | Conditions                                                                                                     | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|----------------------------------------------------------------------------------------------------------------|------------------|---------|------|-------------------|------|------|
|                  |                           |                                                                                                                | Min              | Typ [1] | Max  | Min               | Max  |      |
| 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                                               | -                | -       | ±0.1 | -                 | ±1.0 | µA   |
| I <sub>LO</sub>  | output leakage current    | V <sub>I</sub> = V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND                                     | -                | -       | ±5.0 | -                 | ±10  | µA   |
| I <sub>CC</sub>  | supply current            | per input pin; V <sub>CC</sub> = 6.0 V;<br>V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A       | -                | -       | 10   | -                 | 20   | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                                | -                | 1.5     | -    | -                 | -    | pF   |
| <b>74HCT3G06</b> |                           |                                                                                                                |                  |         |      |                   |      |      |
| 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>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>LO</sub>  | output leakage current    | V <sub>I</sub> = V <sub>IL</sub> ; V <sub>O</sub> = V <sub>CC</sub> or GND                                     | -                | -       | ±5.0 | -                 | ±10  | µA   |
| I <sub>CC</sub>  | supply current            | per input pin; V <sub>CC</sub> = 5.5 V;<br>V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A       | -                | -       | 10   | -                 | 20   | µA   |
| ΔI <sub>CC</sub> | additional supply current | per input; V <sub>CC</sub> = 4.5 V to 5.5 V;<br>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] 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); all typical values are measured at T<sub>amb</sub> = 25 °C; for test circuit see Fig. 6.

| Symbol           | Parameter                          | Conditions                           | -40 °C to +85 °C |     |     | -40 °C to +125 °C |     | Unit |
|------------------|------------------------------------|--------------------------------------|------------------|-----|-----|-------------------|-----|------|
|                  |                                    |                                      | Min              | Typ | Max | Min               | Max |      |
| 74HC3G06         |                                    |                                      |                  |     |     |                   |     |      |
| t <sub>PZL</sub> | OFF-state to LOW propagation delay | nA to nY; see <a href="#">Fig. 5</a> |                  |     |     |                   |     |      |
|                  |                                    | V <sub>CC</sub> = 2.0 V              | -                | 22  | 95  | -                 | 125 | ns   |
|                  |                                    | V <sub>CC</sub> = 4.5 V              | -                | 9   | 18  | -                 | 25  | ns   |
|                  |                                    | V <sub>CC</sub> = 6.0 V              | -                | 8   | 16  | -                 | 20  | ns   |

| Symbol           | Parameter                          | Conditions                                  | -40 °C to +85 °C |     |     | -40 °C to +125 °C |     | Unit |
|------------------|------------------------------------|---------------------------------------------|------------------|-----|-----|-------------------|-----|------|
|                  |                                    |                                             | Min              | Typ | Max | Min               | Max |      |
| t <sub>PLZ</sub> | LOW to OFF-state propagation delay | nA to nY; see Fig. 5                        |                  |     |     |                   |     |      |
|                  |                                    | V <sub>CC</sub> = 2.0 V                     | -                | 24  | 95  | -                 | 125 | ns   |
|                  |                                    | V <sub>CC</sub> = 4.5 V                     | -                | 11  | 20  | -                 | 27  | ns   |
|                  |                                    | V <sub>CC</sub> = 6.0 V                     | -                | 10  | 19  | -                 | 23  | ns   |
| t <sub>THL</sub> | HIGH to LOW output transition time | nY; see Fig. 5                              |                  |     |     |                   |     |      |
|                  |                                    | V <sub>CC</sub> = 2.0 V                     | -                | 18  | 95  | -                 | 125 | ns   |
|                  |                                    | V <sub>CC</sub> = 4.5 V                     | -                | 6   | 19  | -                 | 25  | ns   |
|                  |                                    | V <sub>CC</sub> = 6.0 V                     | -                | 5   | 16  | -                 | 20  | ns   |
| C <sub>PD</sub>  | power dissipation capacitance      | V <sub>I</sub> = GND to V <sub>CC</sub> [1] | -                | 4   | -   | -                 | -   | pF   |

| 74HCT3G06        |                                    |                                                     |   |    |    |   |    |    |
|------------------|------------------------------------|-----------------------------------------------------|---|----|----|---|----|----|
| t <sub>PZL</sub> | OFF-state to LOW propagation delay | nA to nY; see Fig. 5                                |   |    |    |   |    |    |
|                  |                                    | V <sub>CC</sub> = 4.5 V                             | - | 9  | 24 | - | 29 | ns |
| t <sub>PLZ</sub> | LOW to OFF-state propagation delay | nA to nY; see Fig. 5                                |   |    |    |   |    |    |
|                  |                                    | V <sub>CC</sub> = 4.5 V                             | - | 12 | 27 | - | 32 | ns |
| t <sub>THL</sub> | HIGH to LOW output transition time | V <sub>CC</sub> = 4.5 V; see Fig. 5                 | - | 6  | 19 | - | 22 | ns |
| C <sub>PD</sub>  | power dissipation capacitance      | V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [1] | - | 4  |    | - | -  | pF |

[1] 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;

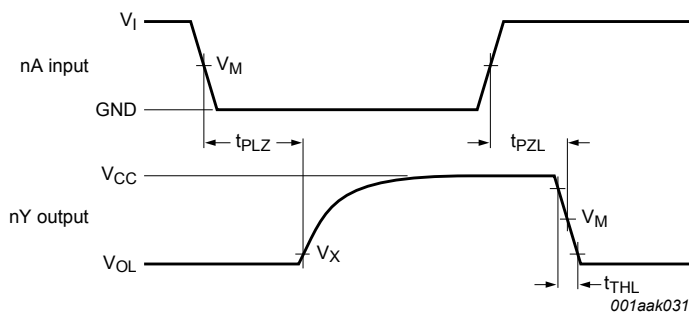
C<sub>L</sub> = output load capacitance in pF;

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 outputs.

## 11.1. Waveforms and test circuit



Measurement points are given in Table 9.

V<sub>OL</sub> is the typical output voltage level that occurs with the output load.

**Fig. 5.** The input (nA) to output (nY) propagation delays

Table 9. Measurement points

| Type      | Input               | Output              |                     |
|-----------|---------------------|---------------------|---------------------|
|           | $V_M$               | $V_M$               | $V_X$               |
| 74HC3G06  | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ | $0.1 \times V_{CC}$ |
| 74HCT3G06 | 1.3 V               | 1.3 V               | $0.1 \times V_{CC}$ |

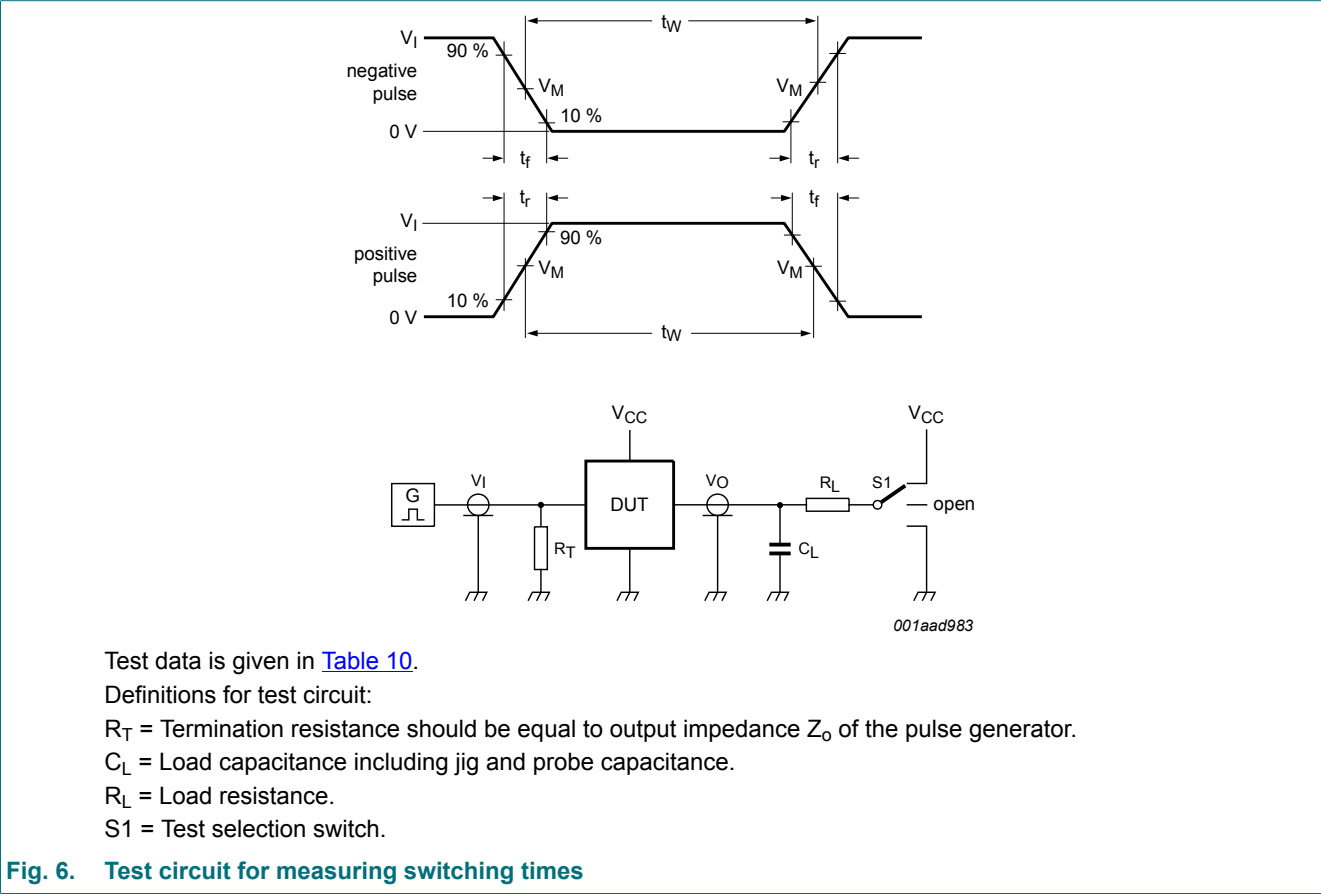


Fig. 6. Test circuit for measuring switching times

Table 10. Test data

| Type      | Input           |             | Load  |              | S1 position        |
|-----------|-----------------|-------------|-------|--------------|--------------------|
|           | $V_I$           | $t_r, t_f$  | $C_L$ | $R_L$        | $t_{pZL}, t_{pLZ}$ |
| 74HC3G06  | GND to $V_{CC}$ | $\leq 6$ ns | 50 pF | 1 k $\Omega$ | $V_{CC}$           |
| 74HCT3G06 | GND to 3 V      | $\leq 6$ ns | 50 pF | 1 k $\Omega$ | $V_{CC}$           |

12. Package outline

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm SOT765-1

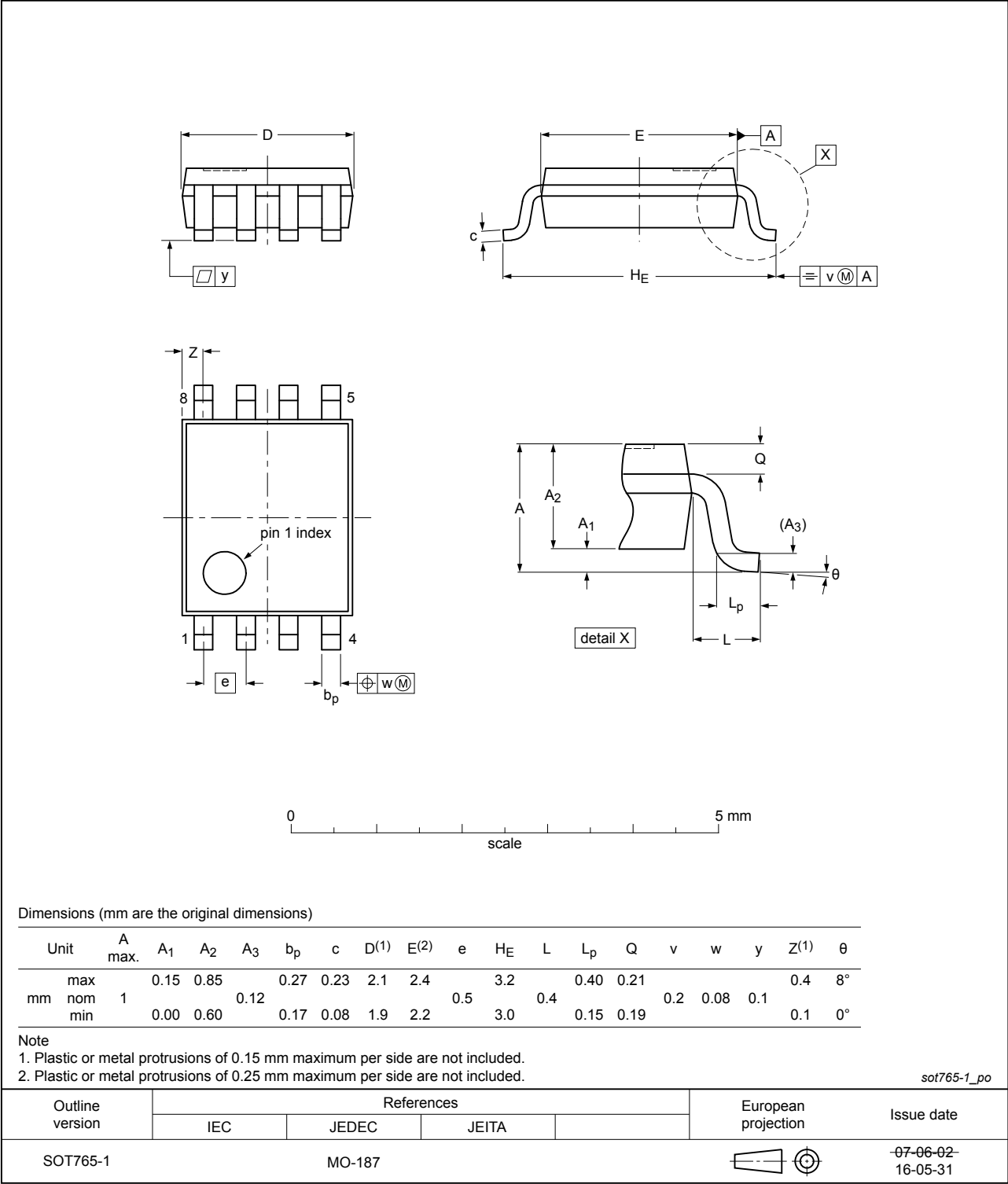


Fig. 7. Package outline SOT765-1 (VSSOP8)

## 13. Abbreviations

Table 11. Abbreviations

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

## 14. Revision history

Table 12. Revision history

| Document ID      | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Data sheet status     | Change notice | Supersedes       |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------|
| 74HC_HCT3G06 v.5 | 20190501                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT3G06 v.4 |
| 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>Type numbers 74HC3G06DP and 74HCT3G06DP (SOT505-2) removed.</li> <li>Type numbers 74HC3G06GD and 74HCT3G06GD (SOT996-2) removed.</li> <li>Package outline drawing <a href="#">SOT765-1</a> (VSSOP8) updated.</li> </ul> |                       |               |                  |
| 74HC_HCT3G06 v.4 | 20131219                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT3G06 v.3 |
| Modifications:   | <ul style="list-style-type: none"> <li>For type numbers 74HC3G06GD and 74HCT3G06GD XSON8U has changed to XSON8.</li> </ul>                                                                                                                                                                                                                                                                                                                                      |                       |               |                  |
| 74HC_HCT3G06 v.3 | 20090511                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product data sheet    | -             | 74HC_HCT3G06 v.2 |
| 74HC_HCT3G06 v.2 | 20031202                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product specification | -             | 74HC_HCT3G06 v.1 |
| 74HC_HCT3G06 v.1 | 20030515                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Product specification | -             | -                |



## 15. Legal information

### Data sheet status

| Document status<br>[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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