

74AHC3G04; 74AHCT3G04

Inverter

Rev. 4 — 19 November 2018

Product data sheet

1. General description

The 74AHC3G04; 74AHCT3G04 are high-speed Si-gate CMOS devices. They provide three inverting buffers.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

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

2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- ESD protection:
 - HBM JESD22-A114F exceeds 2 000 V
 - MM JESD22-A115-A exceeds 200 V
 - CDM JESD22-C101C exceeds 1 000 V
- Low power dissipation
- Balanced propagation delays
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|--------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74AHC3G04DP | -40 °C to +125 °C | TSSOP8 | plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm | SOT505-2 |
| 74AHC3G04DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74AHCT3G04DC | | | | |

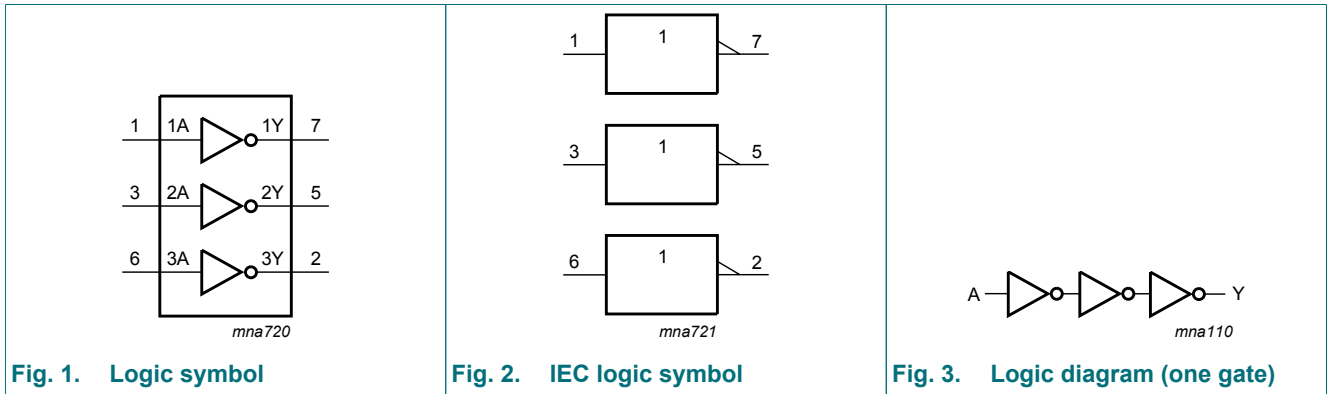
4. Marking

Table 2. Marking codes

| Type number | Marking code ^[1] |
|--------------|-----------------------------|
| 74AHC3G04DP | A04 |
| 74AHC3G04DC | A04 |
| 74AHCT3G04DC | C04 |

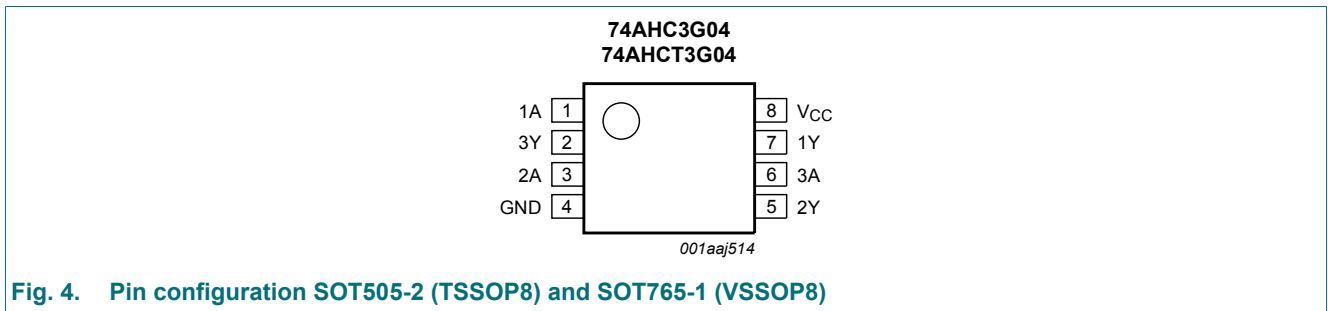
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

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 _{CC} | 8 | supply voltage |

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

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

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|------|----------|------|
| V_{CC} | supply voltage | | -0.5 | +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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74AHC3G04 | | | 74AHCT3G04 | | | 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 | |
| 74AHC3G04 | | | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0$ V | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | $V_{CC} = 3.0$ V | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | $V_{CC} = 5.5$ V | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0$ V | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | $V_{CC} = 3.0$ V | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | $V_{CC} = 5.5$ V | - | - | 1.65 | - | 1.65 | - | 1.65 | V |

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-------------------|---------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = -50 µA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -50 µA; V _{CC} = 3.0 V | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | I _O = -50 µA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 3.0 V | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| | | I _O = -8.0 mA; V _{CC} = 4.5 V | 3.94 | - | - | 3.8 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 50 µA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 µA; V _{CC} = 3.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 µA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 3.0 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| | | I _O = 8.0 mA; V _{CC} = 4.5 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | µA |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |
| 74AHCT3G04 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = -50 µA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -8.0 mA | 3.94 | - | - | 3.8 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 50 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | µA |
| ΔI _{CC} | additional supply current | per input pin; V _I = 3.4 V; other inputs at V _{CC} or GND; 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

$GND = 0\text{ V}$; for test circuit see Fig. 6.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-------------------|-------------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74AHC3G04 | | | | | | | | | | |
| t_{pd} | propagation delay | nA to nY; see Fig. 5 [1] | | | | | | | | |
| | | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ [2] | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 4.3 | 7.1 | 1.0 | 8.5 | 1.0 | 11.0 | ns |
| | | $C_L = 50\text{ pF}$ | - | 6.1 | 10.6 | 1.0 | 12.0 | 1.0 | 14.5 | ns |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ [3] | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.1 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| C_{PD} | power dissipation capacitance | $C_L = 50\text{ pF}$; [4] | - | 9 | - | - | - | - | - | pF |
| | | $f_i = 1\text{ MHz}$; $V_i = GND\text{ to }V_{CC}$ | | | | | | | | |
| 74AHCT3G04 | | | | | | | | | | |
| t_{pd} | propagation delay | nA to nY; See Fig. 5; [1][3] | | | | | | | | |
| | | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | | | | | | | | |
| | | $C_L = 15\text{ pF}$ | - | 3.4 | 6.7 | 1.0 | 7.5 | 1.0 | 8.5 | ns |
| C_{PD} | power dissipation capacitance | $C_L = 50\text{ pF}$; [4] | - | 10 | - | - | - | - | - | pF |
| | | $f_i = 1\text{ MHz}$; $V_i = GND\text{ to }V_{CC}$ | | | | | | | | |

[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 μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f_i = input frequency in MHz;

f_o = output frequency in MHz;

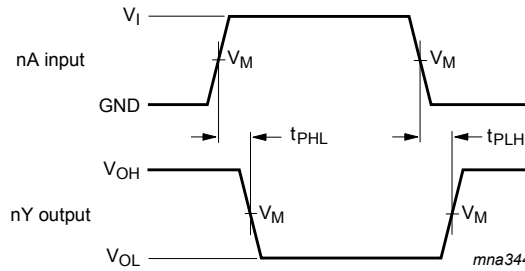
C_L = output load capacitance in pF;

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.

11.1. Waveforms and test circuit



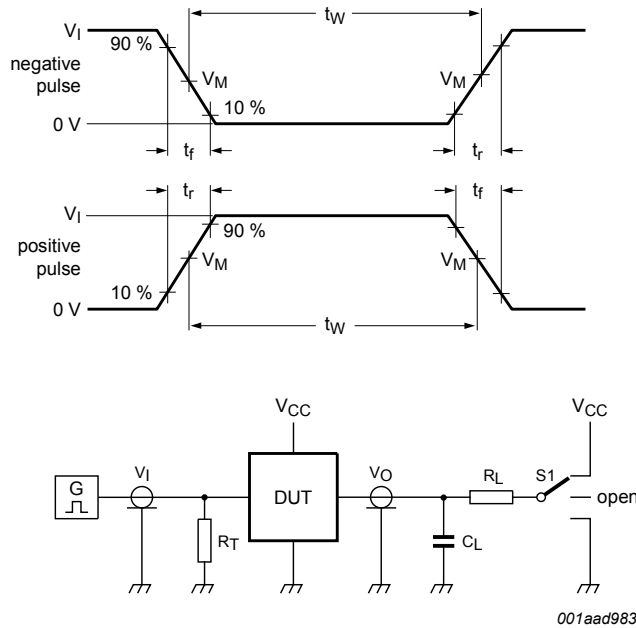
Measurement points are given in [Table 9](#).

Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur 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 |
| 74AHC3G04 | $0.5V_{CC}$ | $0.5V_{CC}$ |
| 74AHCT3G04 | 1.5 V | $0.5V_{CC}$ |



Test data is given in [Table 10](#).

Definitions test circuit:

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

C_L = Load capacitance including jig and probe capacitance; R_L = Load resistance; S1 = Test selection switch.

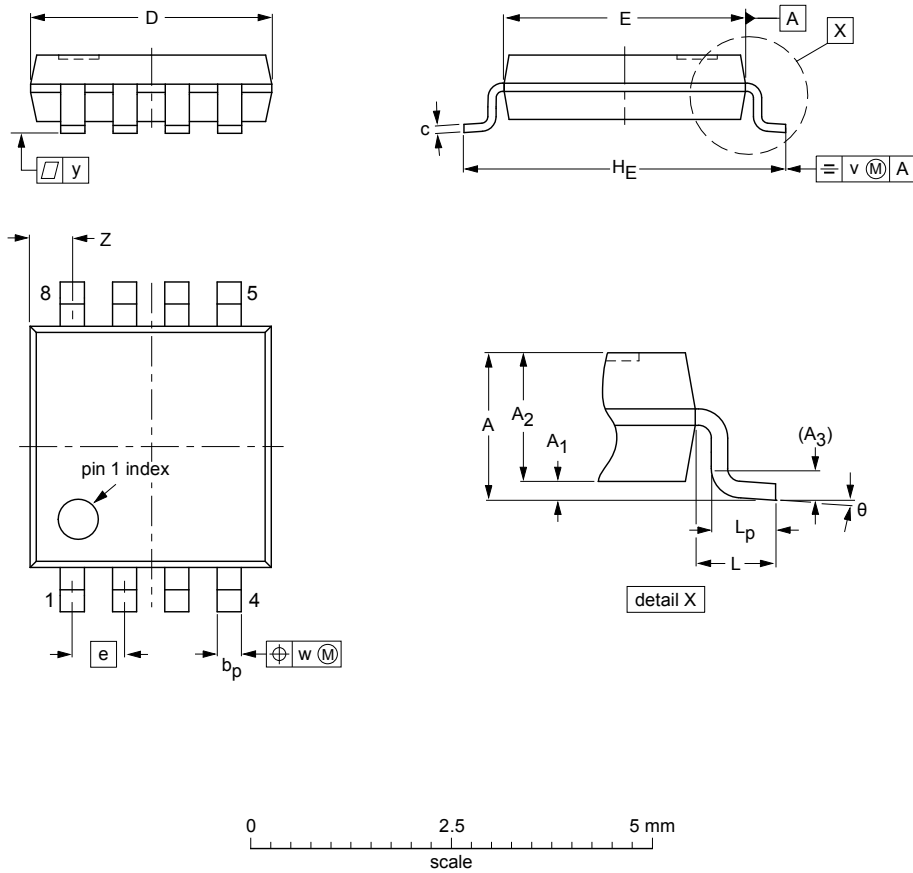
Fig. 6. Test circuit for measuring switching times

Table 10. Test data

| Type | Input | | Load | | S1 position | | |
|------------|----------|-------------|--------------|--------------|--------------------|--------------------|--------------------|
| | V_I | t_r, t_f | C_L | R_L | t_{PHL}, t_{PLH} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| 74AHC3G04 | V_{CC} | ≤ 3 ns | 15 pF, 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74AHCT3G04 | 3 V | ≤ 3 ns | 15 pF, 50 pF | 1 k Ω | 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



DIMENSIONS (mm are the original dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | v | w | y | Z ⁽¹⁾ | θ |
|------|--------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|-----|----------------|-----|------|-----|------------------|----------|
| mm | 1.1 | 0.15 0.00 | 0.95 0.75 | 0.25 | 0.38 0.22 | 0.18 0.08 | 3.1 2.9 | 3.1 2.9 | 0.65 | 4.1 3.9 | 0.5 | 0.47 0.33 | 0.2 | 0.13 | 0.1 | 0.70 0.35 | 8° 0° |

Note

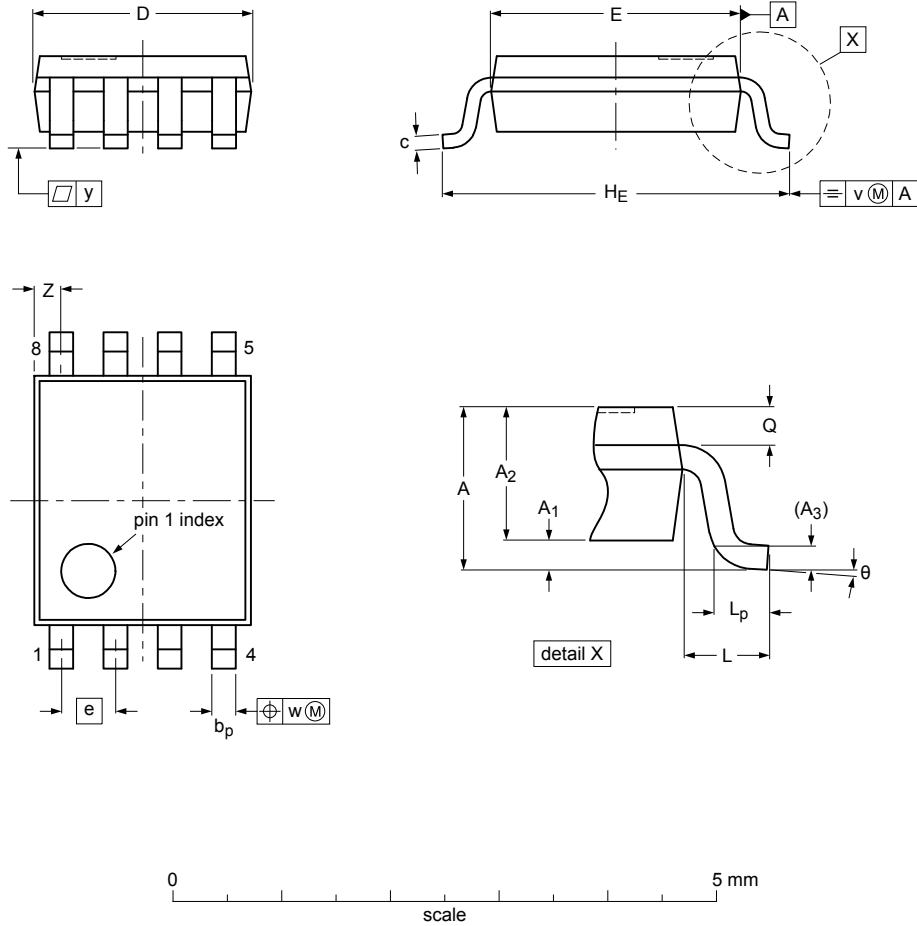
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|-------|--|---------------------|------------|
| | IEC | JEDEC | JEITA | | | |
| SOT505-2 | | --- | | | | 02-01-16 |

Fig. 7. Package outline SOT505-2 (TSSOP8)

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

SOT765-1



Dimensions (mm are the original dimensions)

| Unit | A _{max.} | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽²⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|------|-------------------|----------------|----------------|----------------|----------------|------|------------------|------------------|-----|----------------|-----|----------------|------|-----|------|-----|------------------|----|
| max | | 0.15 | 0.85 | | 0.27 | 0.23 | 2.1 | 2.4 | | 3.2 | | 0.40 | 0.21 | | | | 0.4 | 8° |
| mm | nom | 1 | | 0.12 | | | | | 0.5 | | 0.4 | | | 0.2 | 0.08 | 0.1 | | |
| | min | | 0.00 | 0.60 | 0.17 | 0.08 | 1.9 | 2.2 | | 3.0 | | 0.15 | 0.19 | | | | 0.1 | 0° |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

sot765-1_po

| Outline version | References | | | European projection | Issue date |
|-----------------|------------|--------|-------|---------------------|-------------------|
| | IEC | JEDEC | JEITA | | |
| SOT765-1 | | MO-187 | | | 07-06-02-16-05-31 |

Fig. 8. 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 |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

14. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------|---|-----------------------|---------------|--------------------|
| 74AHC_AHCT3G04 v.4 | 20181119 | Product data sheet | - | 74AHC_AHCT3G04 v.3 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74AHCT3G04DP, 74AHCT3G04GD and 74AHC3G04GD removed. | | | |
| 74AHC_AHCT3G04 v.3 | 20130326 | Product data sheet | - | 74AHC_AHCT3G04 v.2 |
| Modifications: | <ul style="list-style-type: none"> For type numbers 74AHC3G04GD and 74AHCT3G04GD, XSON8U has changed to XSON8. | | | |
| 74AHC_AHCT3G04 v.2 | 20090126 | Product data sheet | - | 74AHC_AHCT3G04 v.1 |
| 74AHC_AHCT3G04 v.1 | 20031106 | Product specification | - | - |

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".
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