

74HC3G04-Q100; 74HCT3G04-Q100

Inverter

Rev. 2 — 18 November 2013

Product data sheet

1. General description

The 74HC3G04-Q100; 74HCT3G04-Q100 is a triple inverter. Inputs include clamp diodes that enable the use of current limiting resistors to interface inputs to voltages in excess of V_{CC} .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade at 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 $-40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$
- Input levels:
 - ◆ For 74HC3G04-Q100: CMOS level
 - ◆ For 74HCT3G04-Q100: TTL level
- 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:
 - ◆ MIL-STD-883, method 3015 exceeds 2000 V
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V ($C = 200\text{ pF}$, $R = 0\text{ }\Omega$)



3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------------------------------|-------------------|--------|--|----------|
| | Temperature range | Name | Description | |
| 74HC3G04DP-Q100 74HCT3G04DP-Q100 | -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 |
| 74HC3G04DC-Q100 74HCT3G04DC-Q100 | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74HC3G04GD-Q100 74HCT3G04GD-Q100 | -40 °C to +125 °C | XSON8 | plastic extremely thin small outline package; no leads; 8 terminals; body 3 × 2 × 0.5 mm | SOT996-2 |

4. Marking

Table 2. Marking codes

| Type number | Marking code ^[1] |
|------------------|-----------------------------|
| 74HC3G04DP-Q100 | H04 |
| 74HCT3G04DP-Q100 | T04 |
| 74HC3G04DC-Q100 | H04 |
| 74HCT3G04DC-Q100 | T04 |
| 74HC3G04GD-Q100 | H04 |
| 74HCT3G04GD-Q100 | T04 |

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

5. Functional diagram

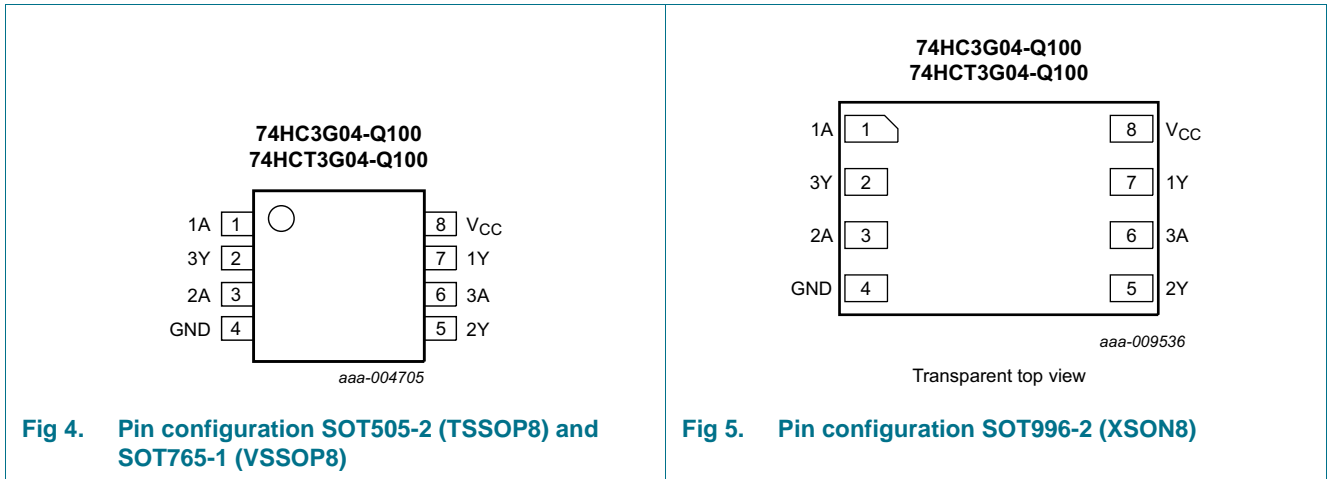
Fig 1. Logic symbol

Fig 2. IEC logic symbol

Fig 3. Logic diagram (one gate)

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|-----------------|---------|----------------|
| 1A, 2A, 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^[1]

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

[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 V or V _I > V _{CC} + 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 | V _O = -0.5 V to (V _{CC} + 0.5 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 °C to +125 °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 XSON8 package: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74HC3G04-Q100 | | | 74HCT3G04-Q100 | | | 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 |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | V _{CC} = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 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 $T_{amb} = 25\text{ }^{\circ}\text{C}$.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|----------------------|---------------------------|--|-------|------|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HC3G04-Q100 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | 3.15 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | 4.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | 2.8 | 1.8 | - | 1.8 | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = -20 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -20 μA; V _{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 4.5 V | 4.18 | 4.32 | - | 4.13 | - | 3.7 | - | V |
| | | I _O = -5.2 mA; V _{CC} = 6.0 V | 5.68 | 5.81 | - | 5.63 | - | 5.2 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 20 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | I _O = 5.2 mA; V _{CC} = 6.0 V | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | μA |
| I _{CC} | supply current | per input pin; V _{CC} = 6.0 V; V _I = V _{CC} or GND; I _O = 0 A; | - | - | 1.0 | - | 10 | - | 20 | μA |
| C _I | input capacitance | | - | 1.5 | - | - | - | - | - | pF |

Table 7. Static characteristics ...continued

Voltages are referenced to GND (ground = 0 V). All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------------|---------------------------|---|-------|------|-----------|------------------|-----------|-------------------|-----------|---------------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HCT3G04-Q100 | | | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | 2.0 | 1.6 | - | 2.0 | - | 2.0 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ | - | 1.2 | 0.8 | - | 0.8 | - | 0.8 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | $I_O = -4.0\text{ mA}; V_{CC} = 4.5\text{ V}$ | 4.18 | 4.32 | - | 4.13 | - | 3.7 | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | | | |
| | | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | $I_O = 4.0\text{ mA}; V_{CC} = 4.5\text{ V}$ | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ | - | - | ± 0.1 | - | ± 1.0 | - | ± 1.0 | μA |
| I_{CC} | supply current | per input pin; $V_{CC} = 5.5\text{ V}; V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; | - | - | 1.0 | - | 10 | - | 20 | μA |
| ΔI_{CC} | additional supply current | per input; $V_{CC} = 4.5\text{ V to }5.5\text{ V}; V_I = V_{CC} - 2.1\text{ V}; I_O = 0\text{ A}$ | - | - | 300 | - | 375 | - | 410 | μA |
| C_I | input capacitance | | - | 1.5 | - | - | - | - | - | pF |

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); all typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$; for test circuit, see [Figure 7](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|----------------------|-------------------------------|--|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HC3G04-Q100 | | | | | | | | | | |
| t_{pd} | propagation delay | nA to nY; see Figure 6 [1] | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 22 | 75 | - | 90 | - | 110 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 8 | 15 | - | 18 | - | 22 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 6 | 13 | - | 16 | - | 20 | ns |
| t_t | transition time | see Figure 6 [2] | | | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | - | 18 | 75 | - | 95 | - | 125 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | - | 6 | 15 | - | 19 | - | 25 | ns |
| | | $V_{CC} = 6.0\text{ V}$ | - | 5 | 13 | - | 16 | - | 20 | ns |
| C_{PD} | power dissipation capacitance | $V_I = \text{GND to } V_{CC}$ [3] | - | 9 | - | - | - | - | - | pF |

Table 8. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); all typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$; for test circuit, see [Figure 7](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|-----------------------|-------------------------------|---|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| 74HCT3G04-Q100 | | | | | | | | | | |
| t_{pd} | propagation delay | nA to nY; see Figure 6 [1] $V_{CC} = 4.5\text{ V}$ | - | 10 | 18 | - | 23 | - | 29 | ns |
| t_t | transition time | $V_{CC} = 4.5\text{ V}$; see Figure 6 [2] | - | 6 | 15 | - | 19 | - | 22 | ns |
| C_{PD} | power dissipation capacitance | $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$ [3] | - | 9 | - | - | - | - | - | pF |

[1] t_{pd} is the same as t_{PLH} and t_{PHL} .

[2] t_t is the same as t_{TLH} and t_{THL} .

[3] 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;

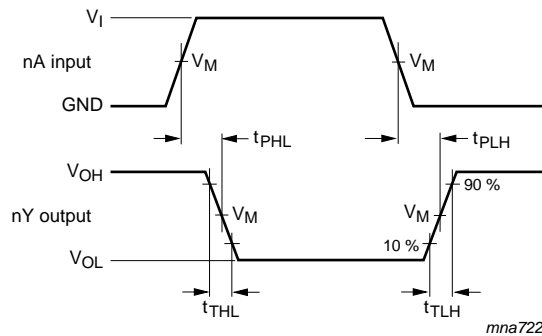
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

12. Waveforms



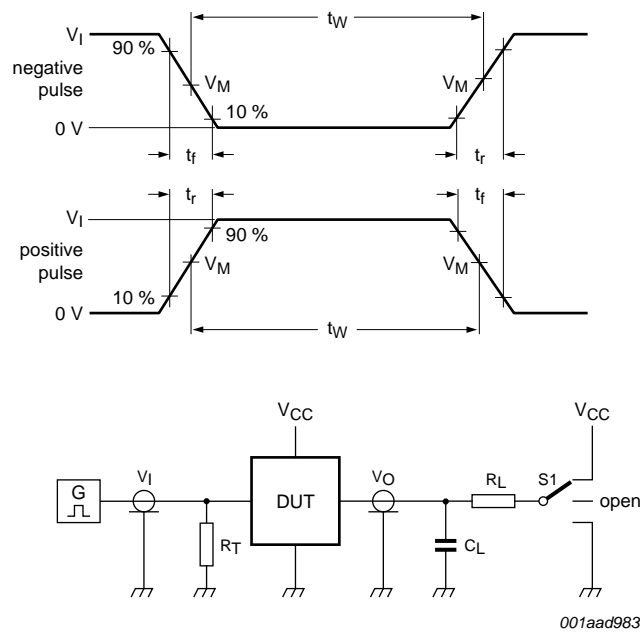
Measurement points are given in [Table 9](#).

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

Fig 6. The data input (nA) to output (nY) propagation delays

Table 9. Measurement points

| Type | Input | Output |
|----------------|---------------------|---------------------|
| | V_M | V_M |
| 74HC3G04-Q100 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74HCT3G04-Q100 | 1.3 V | 1.3 V |



001aad983

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

Definitions for 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 7. 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} |
| 74HC3G04-Q100 | V_{CC} | ≤ 6 ns | 50 pF | 1 k Ω | open |
| 74HCT3G04-Q100 | 3 V | ≤ 6 ns | 50 pF | 1 k Ω | open |

13. Package outline

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

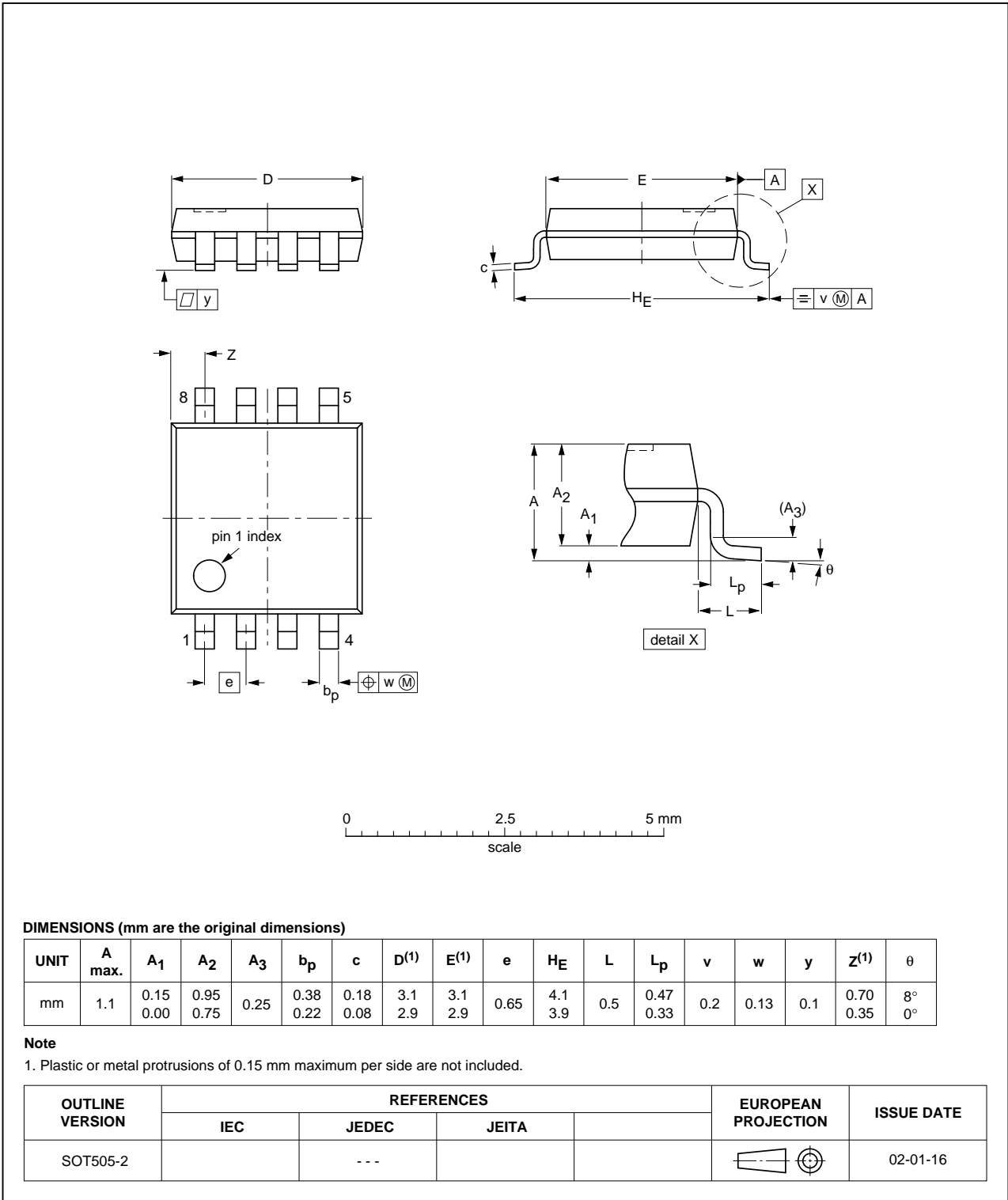


Fig 8. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

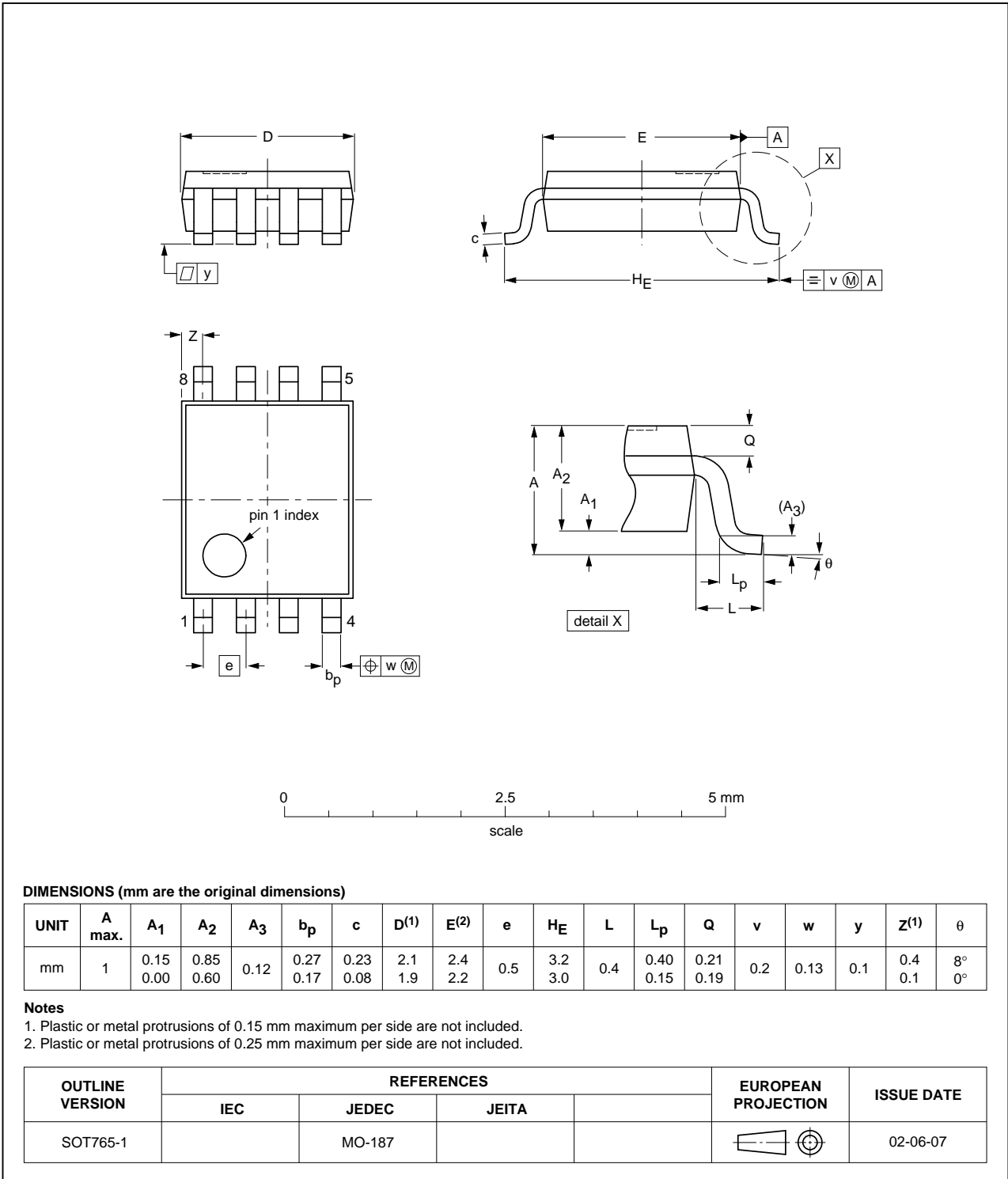


Fig 9. Package outline SOT765-1 (VSSOP8)

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

SOT996-2



Fig 10. Package outline SOT996-2 (XSON8)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MIL | Military |
| 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_HCT3G04_Q100 v.2 | 20131118 | Product data sheet | - | 74HC_HCT3G04_Q100 v.1 |
| Modifications: | <ul style="list-style-type: none"> Added type numbers 74HC3G04GD-Q100 and 74HCT3G04GD-Q100 (XSON8 package) | | | |
| 74HC_HCT3G04_Q100 v.1 | 20120827 | Product data sheet | - | - |

16. Legal information

16.1 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. |
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[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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Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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