# 74LVC3G16

## Triple buffer

Rev. 2 — 11 October 2016 Product data sheet

## 1. General description

The 74LVC3G16 provides three buffers.

The inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of the 74LVC3G16 as a translator in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using $I_{OFF}$. The $I_{OFF}$ circuitry disables the output, preventing a damaging backflow current through the device when it is powered down.

## 2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant input/output for interfacing with 5 V logic
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- ±24 mA output drive ($V_{CC}$ = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Multiple package options
- 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 |
| 74LVC3G16DP | −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 |
| 74LVC3G16GF | −40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm | SOT1089 |
| 74LVC3G16GM | −40 °C to +125 °C | XQFN8 | plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm | SOT902-2 |

## 4. Marking

**Table 2. Marking codes**

| Type number | Marking code[1] |
|---|---|
| 74LVC3G16DP | YU |
| 74LVC3G16GF | YU |
| 74LVC3G16GM | YU |

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

## 5. Functional diagram

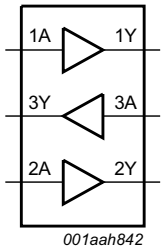



Fig 1. Logic symbol

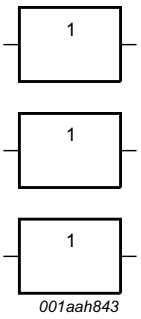



Fig 2. IEC logic symbol

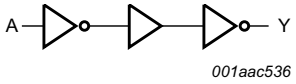



Fig 3. Logic diagram (one gate)

# 6. Pinning information

## 6.1 Pinning

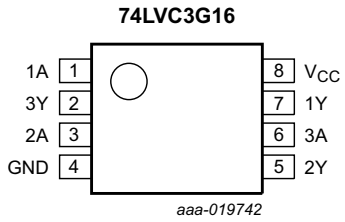



Fig 4. Pin configuration SOT505-2 (TSSOP8)

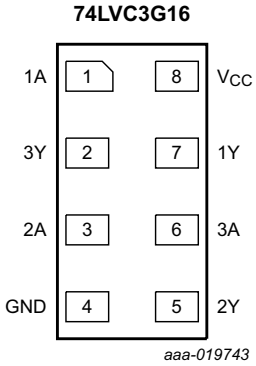



Fig 5. Pin configuration SOT1089 (XSON8)

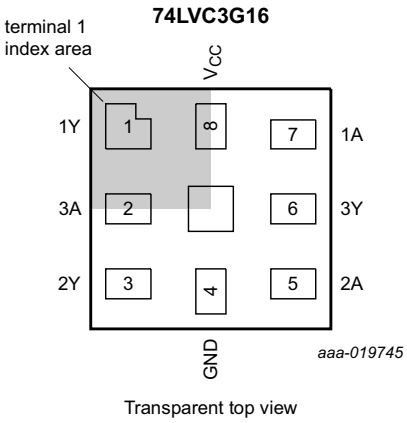



Fig 6. Pin configuration SOT902-2 (XQFN8)

## 6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|---|---|---|---|
| | SOT505-2 and SOT1089 | SOT902-2 | |
| 1A, 2A, 3A | 1, 3, 6 | 7, 5, 2 | data input |
| 1Y, 2Y, 3Y | 7, 5, 2 | 1, 3, 6 | data output |
| GND | 4 | 4 | ground (0 V) |
| $V_{CC}$ | 8 | 8 | supply voltage |

# 7. Functional description

**Table 4. Function table[1]**

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

[1] H = HIGH voltage level; L = LOW voltage level.

# 8. Limiting values

**Table 5. Limiting values**

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

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | –0.5 | +6.5 | V |
| $I_{IK}$ | input clamping current | $V_I < 0$ V | –50 | - | mA |
| $V_I$ | input voltage | [1] | –0.5 | +6.5 | V |
| $I_{OK}$ | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V | - | ±50 | mA |
| $V_O$ | output voltage | Active mode [1] | –0.5 | $V_{CC}$ + 0.5 | V |
| | | Power-down mode [1][2] | –0.5 | +6.5 | V |
| $I_O$ | output current | $V_O$ = 0 V to $V_{CC}$ | - | ±50 | mA |
| $I_{CC}$ | supply current | | - | 100 | mA |
| $I_{GND}$ | ground current | | –100 | - | mA |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = –40 °C to +125 °C [3] | - | 250 | mW |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] When $V_{CC}$ = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation.

[3] For TSSOP8 package: above 55 °C the value of $P_{tot}$ derates linearly with 2.5 mW/K.
For XSON8, XQFN8 packages: above 118 °C the value of $P_{tot}$ derates linearly with 7.8 mW/K.

# 9. Recommended operating conditions

**Table 6. Operating conditions**

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | supply voltage | | 1.65 | 5.5 | V |
| $V_I$ | input voltage | | 0 | 5.5 | V |
| $V_O$ | output voltage | Active mode | 0 | $V_{CC}$ | V |
| | | Power-down mode; $V_{CC}$ = 0 V | 0 | 5.5 | V |
| $T_{amb}$ | ambient temperature | | –40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC}$ = 1.65 V to 2.7 V | - | 20 | ns/V |
| | | $V_{CC}$ = 2.7 V to 5.5 V | - | 10 | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = –40 °C to +85 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.0 | - | - | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | 0.7 × $V_{CC}$ | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.3 × $V_{CC}$ | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = –100 μA; $V_{CC}$ = 1.65 V to 5.5 V | $V_{CC}$ – 0.1 | - | - | V |
| | | $I_O$ = –4 mA; $V_{CC}$ = 1.65 V | 1.2 | - | - | V |
| | | $I_O$ = –8 mA; $V_{CC}$ = 2.3 V | 1.9 | - | - | V |
| | | $I_O$ = –12 mA; $V_{CC}$ = 2.7 V | 2.2 | - | - | V |
| | | $I_O$ = –24 mA; $V_{CC}$ = 3.0 V | 2.3 | - | - | V |
| | | $I_O$ = –32 mA; $V_{CC}$ = 4.5 V | 3.8 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 100 μA; $V_{CC}$ = 1.65 V to 5.5 V | - | - | 0.1 | V |
| | | $I_O$ = 4 mA; $V_{CC}$ = 1.65 V | - | - | 0.45 | V |
| | | $I_O$ = 8 mA; $V_{CC}$ = 2.3 V | - | - | 0.3 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | - | - | 0.4 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | - | 0.55 | V |
| | | $I_O$ = 32 mA; $V_{CC}$ = 4.5 V | - | - | 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 | ±5 | μA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 5.5 V | - | ±0.1 | ±10 | μA |
| $I_{CC}$ | supply current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.65 V to 5.5 V; $I_O$ = 0 A | - | 0.1 | 10 | μA |
| $\Delta I_{CC}$ | additional supply current | per pin; $V_{CC}$ = 2.3 V to 5.5 V; $V_I$ = $V_{CC}$ – 0.6 V; $I_O$ = 0 A | - | 5 | 500 | μA |
| $C_I$ | input capacitance | $V_{CC}$ = 3.3 V; $V_I$ = GND to $V_{CC}$ | - | 2.5 | - | pF |

**Table 7. Static characteristics** *…continued*

*At recommended operating conditions; voltages are referenced to GND (ground = 0 V).*

| Symbol | Parameter | Conditions | Min | Typ[1] | Max | Unit |
|---|---|---|---|---|---|---|
| **$T_{amb}$ = –40 °C to +125 °C** | | | | | | |
| $V_{IH}$ | HIGH-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | 0.65 × $V_{CC}$ | - | - | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.0 | - | - | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | 0.7 × $V_{CC}$ | - | - | V |
| $V_{IL}$ | LOW-level input voltage | $V_{CC}$ = 1.65 V to 1.95 V | - | - | 0.35 × $V_{CC}$ | V |
| | | $V_{CC}$ = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | $V_{CC}$ = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | $V_{CC}$ = 4.5 V to 5.5 V | - | - | 0.3 × $V_{CC}$ | V |
| $V_{OH}$ | HIGH-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = –100 μA; $V_{CC}$ = 1.65 V to 5.5 V | $V_{CC}$ – 0.1 | - | - | V |
| | | $I_O$ = –4 mA; $V_{CC}$ = 1.65 V | 0.95 | - | - | V |
| | | $I_O$ = –8 mA; $V_{CC}$ = 2.3 V | 1.7 | - | - | V |
| | | $I_O$ = –12 mA; $V_{CC}$ = 2.7 V | 1.9 | - | - | V |
| | | $I_O$ = –24 mA; $V_{CC}$ = 3.0 V | 2.0 | - | - | V |
| | | $I_O$ = –32 mA; $V_{CC}$ = 4.5 V | 3.4 | - | - | V |
| $V_{OL}$ | LOW-level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | |
| | | $I_O$ = 100 μA; $V_{CC}$ = 1.65 V to 5.5 V | - | - | 0.1 | V |
| | | $I_O$ = 4 mA; $V_{CC}$ = 1.65 V | - | - | 0.7 | V |
| | | $I_O$ = 8 mA; $V_{CC}$ = 2.3 V | - | - | 0.45 | V |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | - | - | 0.6 | V |
| | | $I_O$ = 24 mA; $V_{CC}$ = 3.0 V | - | - | 0.8 | V |
| | | $I_O$ = 32 mA; $V_{CC}$ = 4.5 V | - | - | 0.8 | V |
| $I_I$ | input leakage current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 0 V to 5.5 V | - | - | ±20 | μA |
| $I_{OFF}$ | power-off leakage current | $V_{CC}$ = 0 V; $V_I$ or $V_O$ = 5.5 V | - | - | ±20 | μA |
| $I_{CC}$ | supply current | $V_I$ = 5.5 V or GND; $V_{CC}$ = 1.65 V to 5.5 V; $I_O$ = 0 A | - | - | 40 | μA |
| $\Delta I_{CC}$ | additional supply current | per pin; $V_{CC}$ = 2.3 V to 5.5 V; $V_I$ = $V_{CC}$ – 0.6 V; $I_O$ = 0 A | - | - | 5000 | μA |

[1] All typical values are measured at $V_{CC}$ = 3.3 V and $T_{amb}$ = 25 °C.

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

*Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 8.*

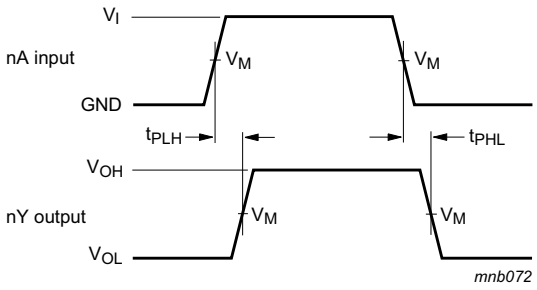
| Symbol | Parameter | Conditions | –40 °C to +85 °C | | | –40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Max | |
| $t_{pd}$ | propagation delay | nA to nY; see Figure 7 [2] | | | | | | |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 1.0 | 3.8 | 8.6 | 1.0 | 10.8 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 0.5 | 2.4 | 4.4 | 0.5 | 5.5 | ns |
| | | $V_{CC}$ = 2.7 V | 0.5 | 2.5 | 5.0 | 0.5 | 6.3 | ns |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 0.5 | 2.2 | 4.1 | 0.5 | 5.1 | ns |
| | | $V_{CC}$ = 4.5 V to 5.5 V | 0.5 | 1.9 | 3.2 | 0.5 | 4.0 | ns |
| $C_{PD}$ | power dissipation capacitance | $V_I$ = GND to $V_{CC}$; $V_{CC}$ = 3.3 V [3] | - | 14 | - | - | - | pF |

[1] Typical values are measured at $T_{amb}$ = 25 °C and $V_{CC}$ = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

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

[3] $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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.

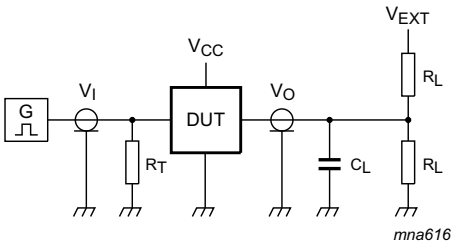
## 12. AC waveforms




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 7. The data input (nA) to output (nY) propagation delays**




Test data is given in Table 10.

Definitions for test circuit:

$R_L$ = Load resistance.

$C_L$ = Load capacitance including jig and probe capacitance.

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

$V_{EXT}$ = External voltage for measuring switching times.

**Fig 8. Test circuit for measuring switching times**

**Table 9. Measurement points**

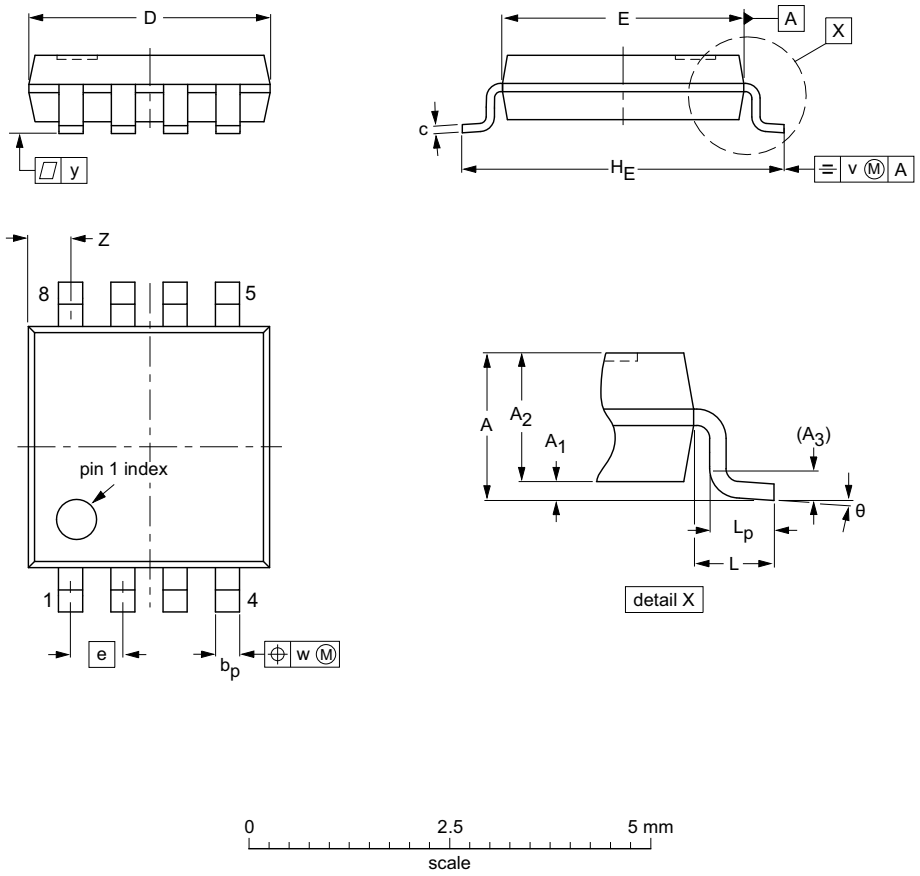
| Supply voltage | Input | Output |
|---|---|---|
| $V_{CC}$ | $V_M$ | $V_M$ |
| 1.65 V to 1.95 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3 V to 2.7 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7 V | 1.5 V | 1.5 V |
| 3.0 V to 3.6 V | 1.5 V | 1.5 V |
| 4.5 V to 5.5 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

**Table 10. Test data**

| Supply voltage | Input | | Load | | $V_{EXT}$ |
|---|---|---|---|---|---|
| $V_{CC}$ | $V_I$ | $t_r = t_f$ | $C_L$ | $R_L$ | $t_{PLH}$, $t_{PHL}$ |
| 1.65 V to 1.95 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 1 kΩ | open |
| 2.3 V to 2.7 V | $V_{CC}$ | ≤ 2.0 ns | 30 pF | 500 Ω | open |
| 2.7 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |
| 3.0 V to 3.6 V | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω | open |
| 4.5 V to 5.5 V | $V_{CC}$ | ≤ 2.5 ns | 50 pF | 500 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**




**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<br>0.00 | 0.95<br>0.75 | 0.25 | 0.38<br>0.22 | 0.18<br>0.08 | 3.1<br>2.9 | 3.1<br>2.9 | 0.65 | 4.1<br>3.9 | 0.5 | 0.47<br>0.33 | 0.2 | 0.13 | 0.1 | 0.70<br>0.35 | 8°<br>0° |

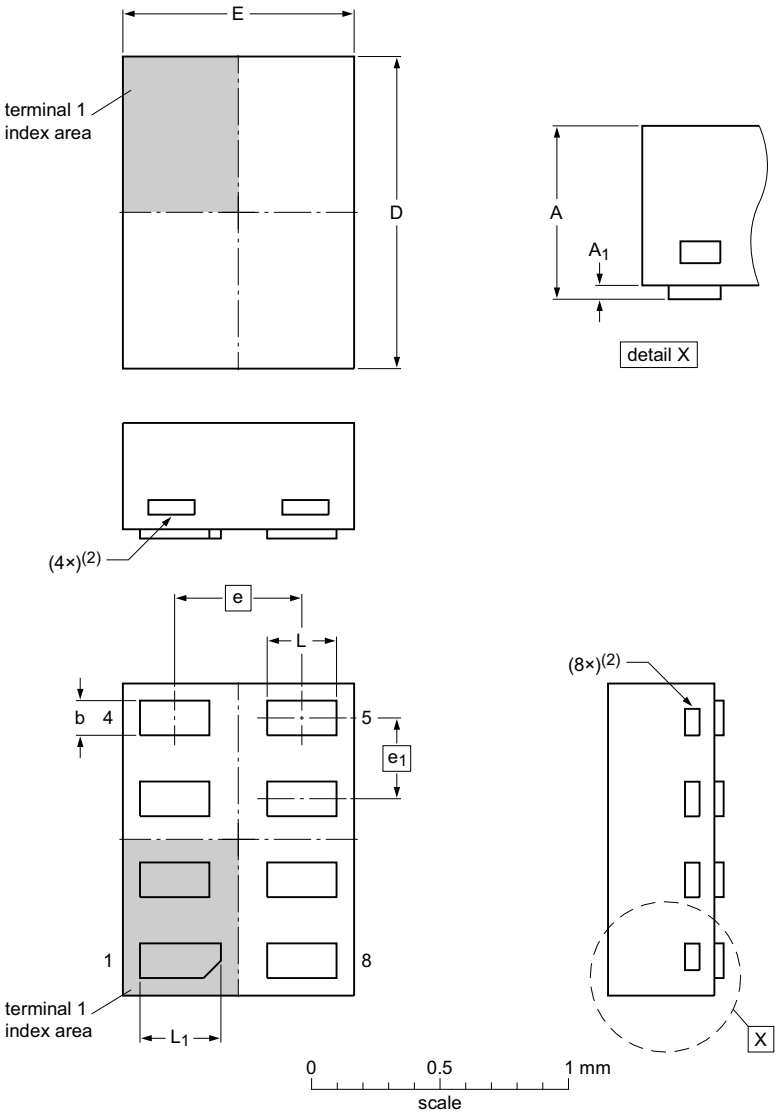
**Note**

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 9. Package outline SOT505-2 (TSSOP8)**

**XSON8: extremely thin small outline package; no leads;**
**8 terminals; body 1.35 x 1 x 0.5 mm** **SOT1089**




Dimensions

| Unit | | $A^{(1)}$ | $A_1$ | b | D | E | e | $e_1$ | L | $L_1$ |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.5 | 0.04 | 0.20 | 1.40 | 1.05 | | | 0.35 | 0.40 |
| | nom | | | 0.15 | 1.35 | 1.00 | 0.55 | 0.35 | 0.30 | 0.35 |
| | min | | | 0.12 | 1.30 | 0.95 | | | 0.27 | 0.32 |

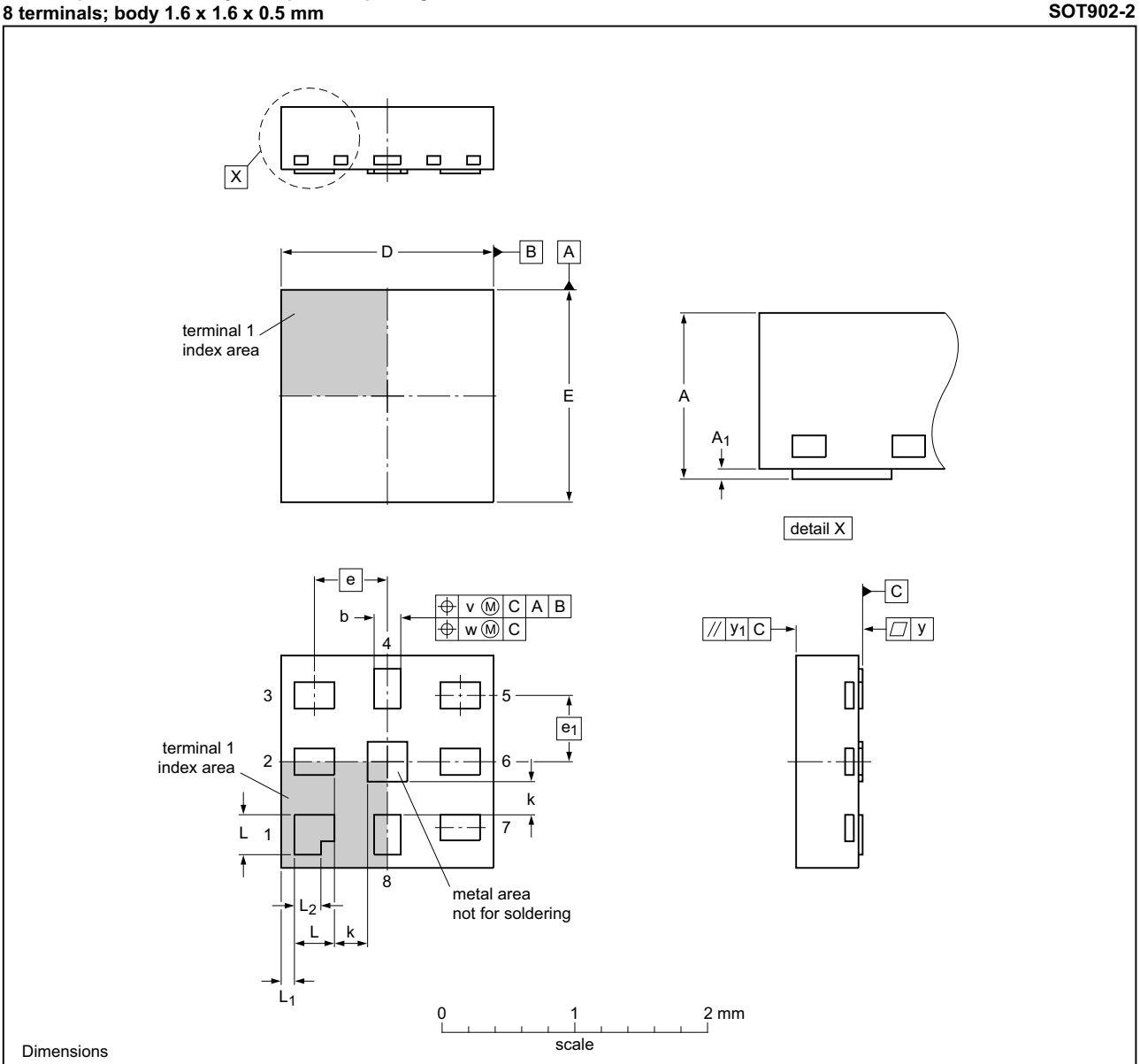
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

*sot1089_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1089 | | MO-252 | | | | ~~10-04-09~~ 10-04-12 |

**Fig 10. Package outline SOT1089 (XSON8)**

**XQFN8: plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 x 1.6 x 0.5 mm** **SOT902-2**




Dimensions

| Unit(1) | | A | $A_1$ | b | D | E | e | $e_1$ | k | L | $L_1$ | $L_2$ | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 0.5 | 0.05 | 0.25 | 1.65 | 1.65 | | | | 0.35 | 0.15 | 0.25 | | | | |
| | nom | | | 0.20 | 1.60 | 1.60 | 0.55 | 0.5 | | 0.30 | 0.10 | 0.20 | 0.1 | 0.05 | 0.05 | 0.05 |
| | min | | 0.00 | 0.15 | 1.55 | 1.55 | | | 0.2 | 0.25 | 0.05 | 0.15 | | | | |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

*sot902-2_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT902-2 | - - - | MO-255 | - - - | | | ~~16-07-12~~ 16-07-14 |

**Fig 11. Package outline SOT902-2 (XQFN8)**

## 14. Abbreviations

**Table 11. Abbreviations**

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

## 15. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| 74LVC3G16 v.2 | 20161011 | Product data sheet | - | 74LVC3G16 v.1 |
| Modifications: | • Type numbers 74LVC3G16DC, 74LVC3G16GD, 74LVC3G16GN, 74LVC3G16GS and 74LVC3G16GT removed. | | | |
| 74LVC3G16 v.1 | 20151110 | 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. |
| 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 URL http://www.nexperia.com.

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## 17. Contact information

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For sales office addresses, please send an email to: **salesaddresses@nexperia.com**

## 18. Contents





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**Date of release: 11 October 2016**

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