

74LVC3G14

Triple inverting Schmitt trigger with 5 V tolerant input

Rev. 03 — 31 January 2005

Product data sheet

1. General description

The 74LVC3G14 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL-families.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device as 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 the damaging backflow current through the device when it is powered down.

The 74LVC3G14 provides three inverting buffers with Schmitt-trigger action. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

2. Features

- 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
- ESD protection:
 - ◆ HBM EIA/JESD22-A114-B exceeds 2000 V
 - ◆ MM EIA/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. Applications

- Wave and pulse shaper for highly noisy environment
- Astable multivibrator
- Monostable multivibrator.

PHILIPS

4. Quick reference data

Table 1: Quick reference data

$GND = 0\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------------------|--|---|--------|------|-----|------|
| t_{PHL} , t_{PLH} | propagation delay input nA to output nY | $V_{CC} = 1.8\text{ V}$; $C_L = 30\text{ pF}$; $R_L = 1\text{ k}\Omega$ | - | 4.2 | - | ns |
| | | $V_{CC} = 2.5\text{ V}$; $C_L = 30\text{ pF}$; $R_L = 500\text{ }\Omega$ | - | 3.0 | - | ns |
| | | $V_{CC} = 2.7\text{ V}$; $C_L = 50\text{ pF}$; $R_L = 500\text{ }\Omega$ | - | 3.8 | - | ns |
| | | $V_{CC} = 3.3\text{ V}$; $C_L = 50\text{ pF}$; $R_L = 500\text{ }\Omega$ | - | 3.2 | - | ns |
| | | $V_{CC} = 5.0\text{ V}$; $C_L = 50\text{ pF}$; $R_L = 500\text{ }\Omega$ | - | 2.4 | - | ns |
| C_I | input capacitance | | - | 3.5 | - | pF |
| C_{PD} | power dissipation capacitance per buffer | $V_{CC} = 3.3\text{ V}$ | [1][2] | 18.1 | - | pF |

[1] 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.

[2] The condition is $V_I = GND$ to V_{CC} .

5. Ordering information

Table 2: Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|--------|--|----------|
| | Temperature range | Name | Description | |
| 74LVC3G14DP | -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 |
| 74LVC3G14DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74LVC3G14GT | -40 °C to +125 °C | XSON8 | plastic extremely thin small outline package; no leads; 8 terminals; body $1 \times 1.95 \times 0.5\text{ mm}$ | SOT833-1 |

6. Marking

Table 3: Marking codes

| Type number | Marking code |
|-------------|--------------|
| 74LVC3G14DP | V14 |
| 74LVC3G14DC | V14 |
| 74LVC3G14GT | V14 |

7. Functional diagram

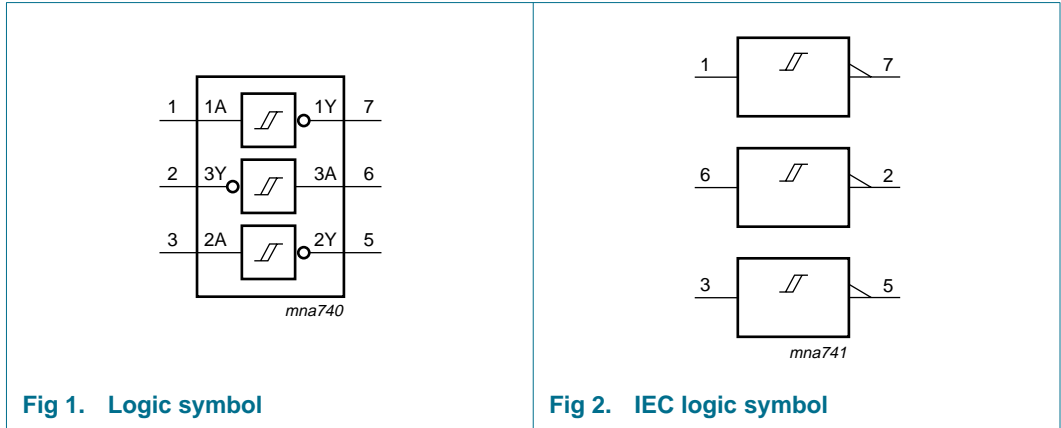


Fig 1. Logic symbol

Fig 2. IEC logic symbol

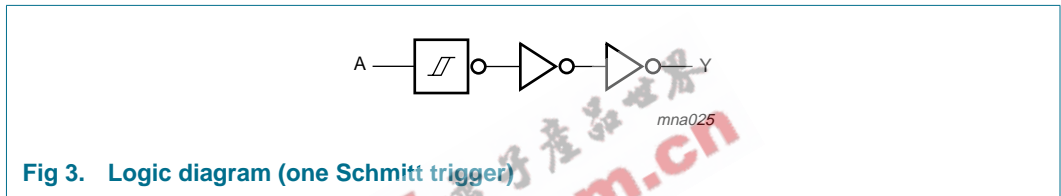


Fig 3. Logic diagram (one Schmitt trigger)

8. Pinning information

8.1 Pinning

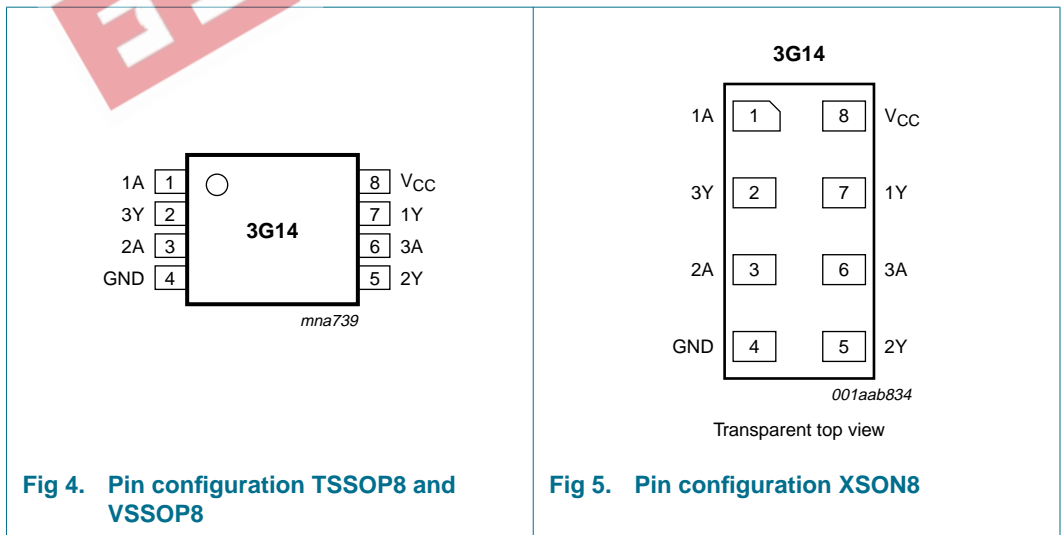


Fig 4. Pin configuration TSSOP8 and VSSOP8

Fig 5. Pin configuration XSON8

8.2 Pin description

Table 4: Pin description

| Symbol | Pin | Description |
|-----------------|-----|----------------|
| 1A | 1 | data input |
| 3Y | 2 | data output |
| 2A | 3 | data input |
| GND | 4 | ground (0 V) |
| 2Y | 5 | data output |
| 3A | 6 | data input |
| 1Y | 7 | data output |
| V _{CC} | 8 | supply voltage |

9. Functional description

9.1 Function table

Table 5: Function table ^[1]

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

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

10. Limiting values

Table 6: 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 diode current | V _I < 0 V | - | -50 | mA |
| V _I | input voltage | | [1] -0.5 | +6.5 | V |
| I _{OK} | output diode current | V _O > V _{CC} or V _O < 0 V | - | ±50 | mA |
| V _O | output voltage | enable mode | [1][2] -0.5 | V _{CC} + 0.5 | V |
| | | Power-down mode | [1][2] -0.5 | +6.5 | V |
| I _O | output source or sink current | V _O = 0 V to V _{CC} | - | ±50 | mA |
| I _{CC} , I _{GND} | V _{CC} or GND current | | - | ±100 | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | power dissipation | T _{amb} = -40 °C to +125 °C | - | 300 | mW |

[1] The 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 condition.

11. Recommended operating conditions

Table 7: Recommended operating conditions

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-----------|---------------------|------------|------|-----|----------|------|
| V_{CC} | supply voltage | | 1.65 | - | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | V |
| V_O | output voltage | | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | - | +125 | °C |

12. Static characteristics

Table 8: Static characteristics

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|-------------------------------------|--|----------------|-----------|----------|---------------|
| $T_{amb} = -40\text{ °C to }+85\text{ °C}$ [1] | | | | | | |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = 100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | - | - | 0.1 | V |
| | | $I_O = 4\text{ mA}$; $V_{CC} = 1.65\text{ V}$ | - | - | 0.45 | V |
| | | $I_O = 8\text{ mA}$; $V_{CC} = 2.3\text{ V}$ | - | - | 0.3 | V |
| | | $I_O = 12\text{ mA}$; $V_{CC} = 2.7\text{ V}$ | - | - | 0.4 | V |
| | | $I_O = 24\text{ mA}$; $V_{CC} = 3.0\text{ V}$ | - | - | 0.55 | V |
| | | $I_O = 32\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | - | 0.55 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = -100\text{ }\mu\text{A}$; $V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | $V_{CC} - 0.1$ | - | - | V |
| | | $I_O = -4\text{ mA}$; $V_{CC} = 1.65\text{ V}$ | 1.2 | - | - | V |
| | | $I_O = -8\text{ mA}$; $V_{CC} = 2.3\text{ V}$ | 1.9 | - | - | V |
| | | $I_O = -12\text{ mA}$; $V_{CC} = 2.7\text{ V}$ | 2.2 | - | - | V |
| | | $I_O = -24\text{ mA}$; $V_{CC} = 3.0\text{ V}$ | 2.3 | - | - | V |
| | | $I_O = -32\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | 3.8 | - | - | V |
| I_{LI} | input leakage current | $V_I = 5.5\text{ V or GND}$; $V_{CC} = 5.5\text{ V}$ | - | ± 0.1 | ± 5 | μA |
| I_{off} | power-off leakage current | V_I or $V_O = 5.5\text{ V}$; $V_{CC} = 0\text{ V}$ | - | ± 0.1 | ± 10 | μA |
| I_{CC} | quiescent supply current | $V_I = V_{CC}$ or GND ; $I_O = 0\text{ A}$; $V_{CC} = 5.5\text{ V}$ | - | 0.1 | 10 | μA |
| ΔI_{CC} | additional quiescent supply per pin | $V_I = V_{CC} - 0.6\text{ V}$; $I_O = 0\text{ A}$; $V_{CC} = 2.3\text{ V to }5.5\text{ V}$ | - | 5 | 500 | μA |
| C_I | input capacitance | | - | 3.5 | - | pF |

Table 8: Static characteristics ...continued

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

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|-------------------------------------|--|----------------|-----|----------|---------------|
| $T_{amb} = -40\text{ }^{\circ}\text{C to }+125\text{ }^{\circ}\text{C}$ | | | | | | |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = 100\text{ }\mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | - | - | 0.1 | V |
| | | $I_O = 4\text{ mA}; V_{CC} = 1.65\text{ V}$ | - | - | 0.70 | V |
| | | $I_O = 8\text{ mA}; V_{CC} = 2.3\text{ V}$ | - | - | 0.45 | V |
| | | $I_O = 12\text{ mA}; V_{CC} = 2.7\text{ V}$ | - | - | 0.60 | V |
| | | $I_O = 24\text{ mA}; V_{CC} = 3.0\text{ V}$ | - | - | 0.80 | V |
| | | $I_O = 32\text{ mA}; V_{CC} = 4.5\text{ V}$ | - | - | 0.80 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | |
| | | $I_O = -100\text{ }\mu\text{A}; V_{CC} = 1.65\text{ V to }5.5\text{ V}$ | $V_{CC} - 0.1$ | - | - | V |
| | | $I_O = -4\text{ mA}; V_{CC} = 1.65\text{ V}$ | 0.95 | - | - | V |
| | | $I_O = -8\text{ mA}; V_{CC} = 2.3\text{ V}$ | 1.7 | - | - | V |
| | | $I_O = -12\text{ mA}; V_{CC} = 2.7\text{ V}$ | 1.9 | - | - | V |
| | | $I_O = -24\text{ mA}; V_{CC} = 3.0\text{ V}$ | 2.0 | - | - | V |
| | | $I_O = -32\text{ mA}; V_{CC} = 4.5\text{ V}$ | 3.4 | - | - | V |
| I_{LI} | input leakage current | $V_I = 5.5\text{ V or GND}; V_{CC} = 5.5\text{ V}$ | - | - | ± 20 | μA |
| I_{off} | power-off leakage current | V_I or $V_O = 5.5\text{ V}; V_{CC} = 0\text{ V}$ | - | - | ± 20 | μA |
| I_{CC} | quiescent supply current | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}; V_{CC} = 5.5\text{ V}$ | - | - | 40 | μA |
| ΔI_{CC} | additional quiescent supply per pin | $V_I = V_{CC} - 0.6\text{ V}; I_O = 0\text{ A}; V_{CC} = 2.3\text{ V to }5.5\text{ V}$ | - | - | 5000 | μA |

[1] All typical values are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$.

13. Dynamic characteristics

Table 9: Dynamic characteristics
GND = 0 V; see Figure 7 for test circuit.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|--|------------------------------------|---------|-----|------|------|
| T_{amb} = -40 °C to +85 °C [1] | | | | | | |
| t _{PHL} , t _{PLH} | propagation delay input nA to output nY | see Figure 6 | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | 4.2 | 11.0 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.5 | 3.0 | 6.5 | ns |
| | | V _{CC} = 2.7 V | 0.5 | 3.8 | 7.0 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.5 | 3.2 | 6.0 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.5 | 2.4 | 4.3 | ns |
| C _{PD} | power dissipation capacitance per buffer | V _{CC} = 3.3 V | [2] [3] | - | 18.1 | - pF |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| t _{PHL} , t _{PLH} | propagation delay input nA to output nY | see Figure 6 | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | - | 12.0 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.5 | - | 7.2 | ns |
| | | V _{CC} = 2.7 V | 0.5 | - | 7.7 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.5 | - | 6.7 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.5 | - | 4.7 | ns |

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

[2] 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.

[3] The condition is V_I = GND to V_{CC}.

14. Waveforms

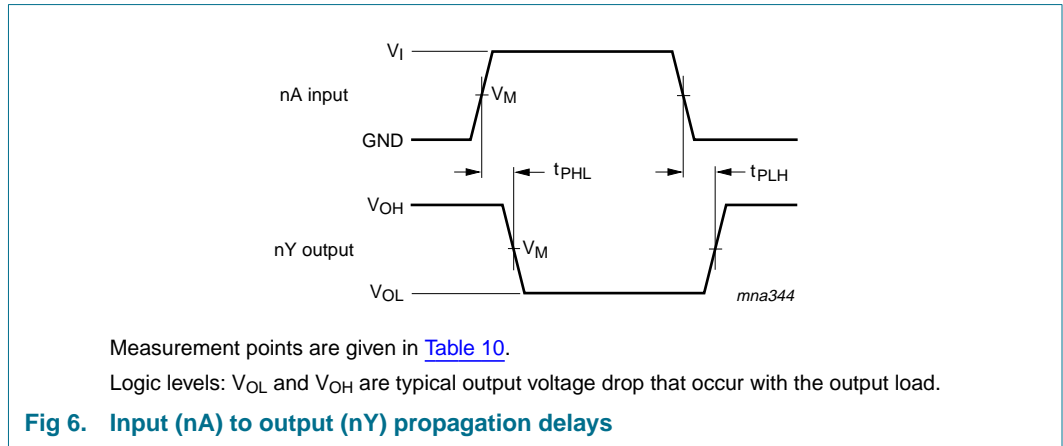


Table 10: Measurement points

| 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 | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

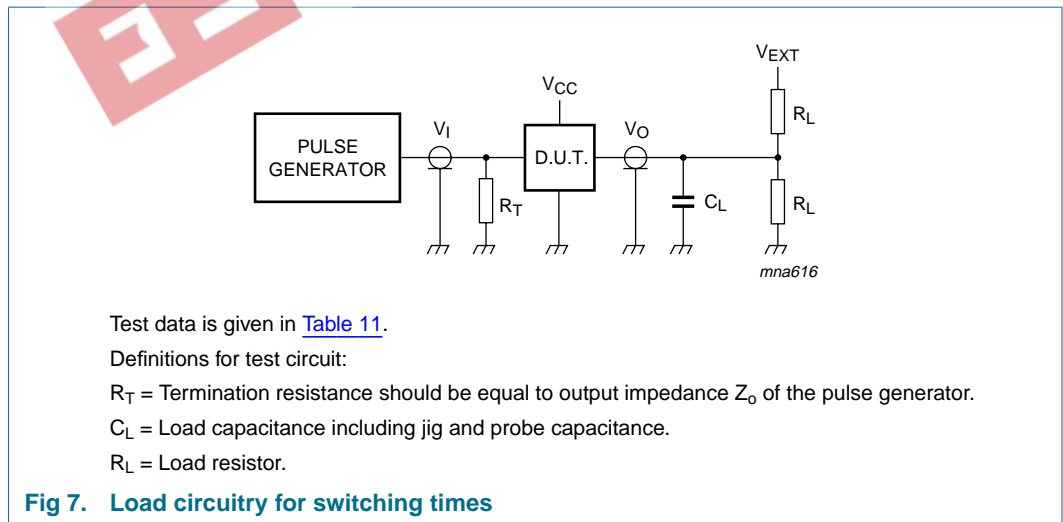


Table 11: Test data

| 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 |

15. Transfer characteristics

Table 12: Transfer characteristics

Voltages are referenced to GND (ground = 0 V); see [Figure 8](#) and [9](#).

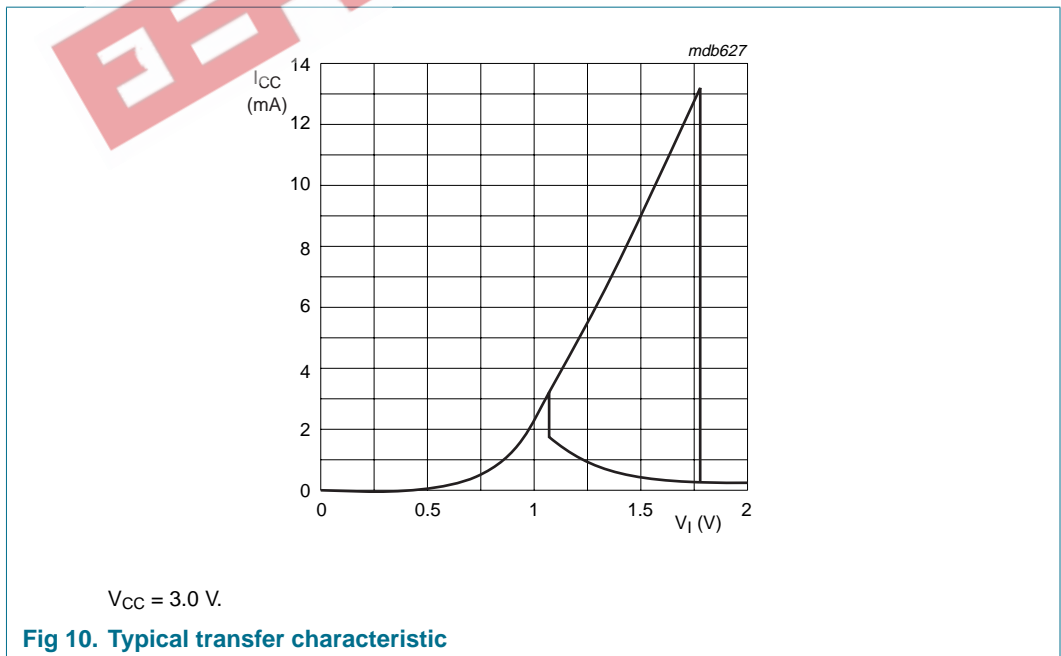
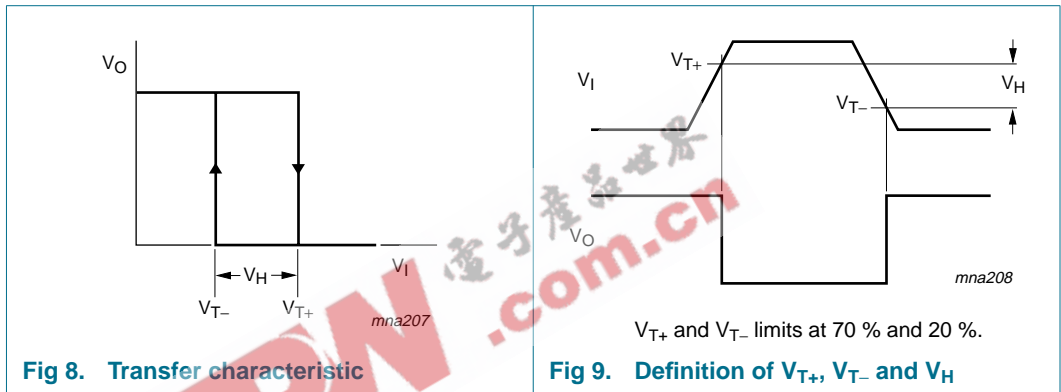
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|--|------|------|------|------|
| T_{amb} = -40 °C to +85 °C [1] | | | | | | |
| V _{T+} | positive-going threshold | V _{CC} = 1.8 V | 0.70 | 1.10 | 1.50 | V |
| | | V _{CC} = 2.3 V | 1.00 | 1.40 | 1.80 | V |
| | | V _{CC} = 3.0 V; see Figure 10 | 1.30 | 1.76 | 2.20 | V |
| | | V _{CC} = 4.5 V | 1.90 | 2.47 | 3.10 | V |
| | | V _{CC} = 5.5 V | 2.20 | 2.91 | 3.60 | V |
| V _{T-} | negative-going threshold | V _{CC} = 1.8 V | 0.25 | 0.61 | 0.90 | V |
| | | V _{CC} = 2.3 V | 0.40 | 0.80 | 1.15 | V |
| | | V _{CC} = 3.0 V; see Figure 10 | 0.60 | 1.04 | 1.50 | V |
| | | V _{CC} = 4.5 V | 1.00 | 1.55 | 2.00 | V |
| | | V _{CC} = 5.5 V | 1.20 | 1.86 | 2.30 | V |
| V _H | hysteresis (V _{T+} - V _{T-}) | V _{CC} = 1.8 V | 0.15 | 0.49 | 1.00 | V |
| | | V _{CC} = 2.3 V | 0.25 | 0.60 | 1.10 | V |
| | | V _{CC} = 3.0 V | 0.40 | 0.73 | 1.20 | V |
| | | V _{CC} = 4.5 V | 0.60 | 0.92 | 1.50 | V |
| | | V _{CC} = 5.5 V | 0.70 | 1.02 | 1.70 | V |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V _{T+} | positive-going threshold | V _{CC} = 1.8 V | 0.70 | - | 1.70 | V |
| | | V _{CC} = 2.3 V | 1.00 | - | 2.00 | V |
| | | V _{CC} = 3.0 V | 1.30 | - | 2.40 | V |
| | | V _{CC} = 4.5 V | 1.90 | - | 3.30 | V |
| | | V _{CC} = 5.5 V | 2.20 | - | 3.80 | V |
| V _{T-} | negative-going threshold | V _{CC} = 1.8 V | 0.25 | - | 1.10 | V |
| | | V _{CC} = 2.3 V | 0.40 | - | 1.35 | V |
| | | V _{CC} = 3.0 V | 0.60 | - | 1.70 | V |
| | | V _{CC} = 4.5 V | 1.00 | - | 2.20 | V |
| | | V _{CC} = 5.5 V | 1.20 | - | 2.50 | V |

Table 12: Transfer characteristics ...continued
 Voltages are referenced to GND (ground = 0 V); see [Figure 8](#) and [9](#).

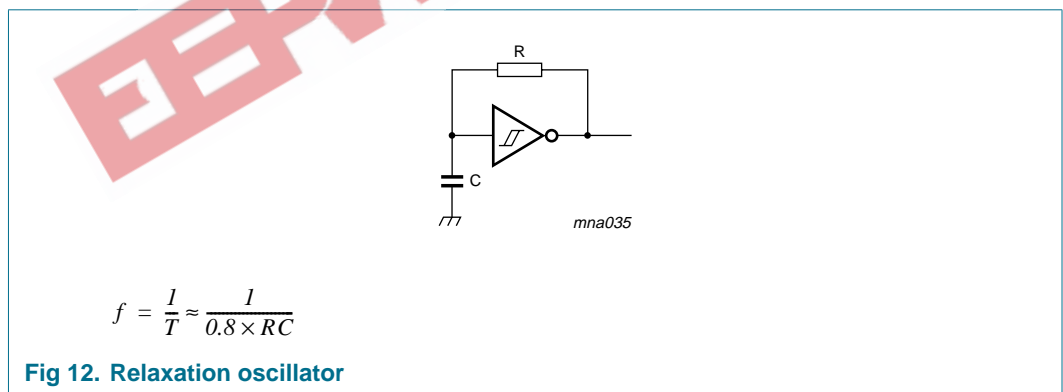
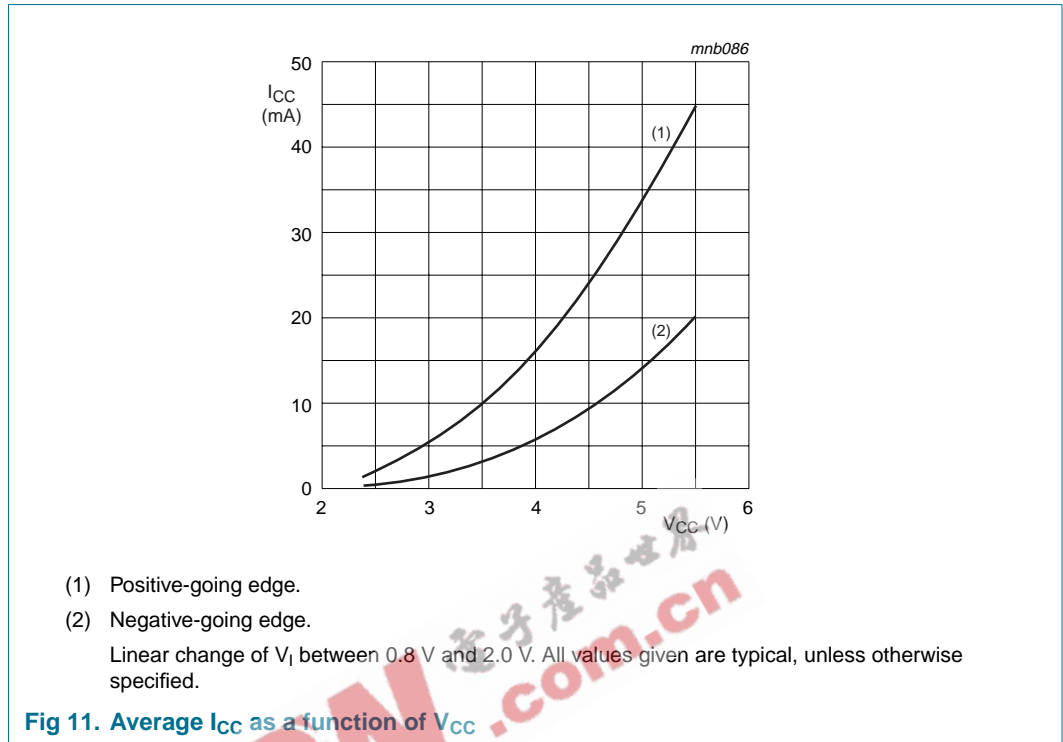
| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|----------------------------------|-------------------------|------|-----|------|------|
| V_H | hysteresis ($V_{T+} - V_{T-}$) | $V_{CC} = 1.8\text{ V}$ | 0.15 | - | 1.20 | V |
| | | $V_{CC} = 2.3\text{ V}$ | 0.25 | - | 1.30 | V |
| | | $V_{CC} = 3.0\text{ V}$ | 0.40 | - | 1.40 | V |
| | | $V_{CC} = 4.5\text{ V}$ | 0.60 | - | 1.70 | V |
| | | $V_{CC} = 5.5\text{ V}$ | 0.70 | - | 1.90 | V |

[1] All typical values are measured at $T_{amb} = 25\text{ }^\circ\text{C}$.

16. Waveforms transfer characteristics



17. Application information



18. Package outline

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

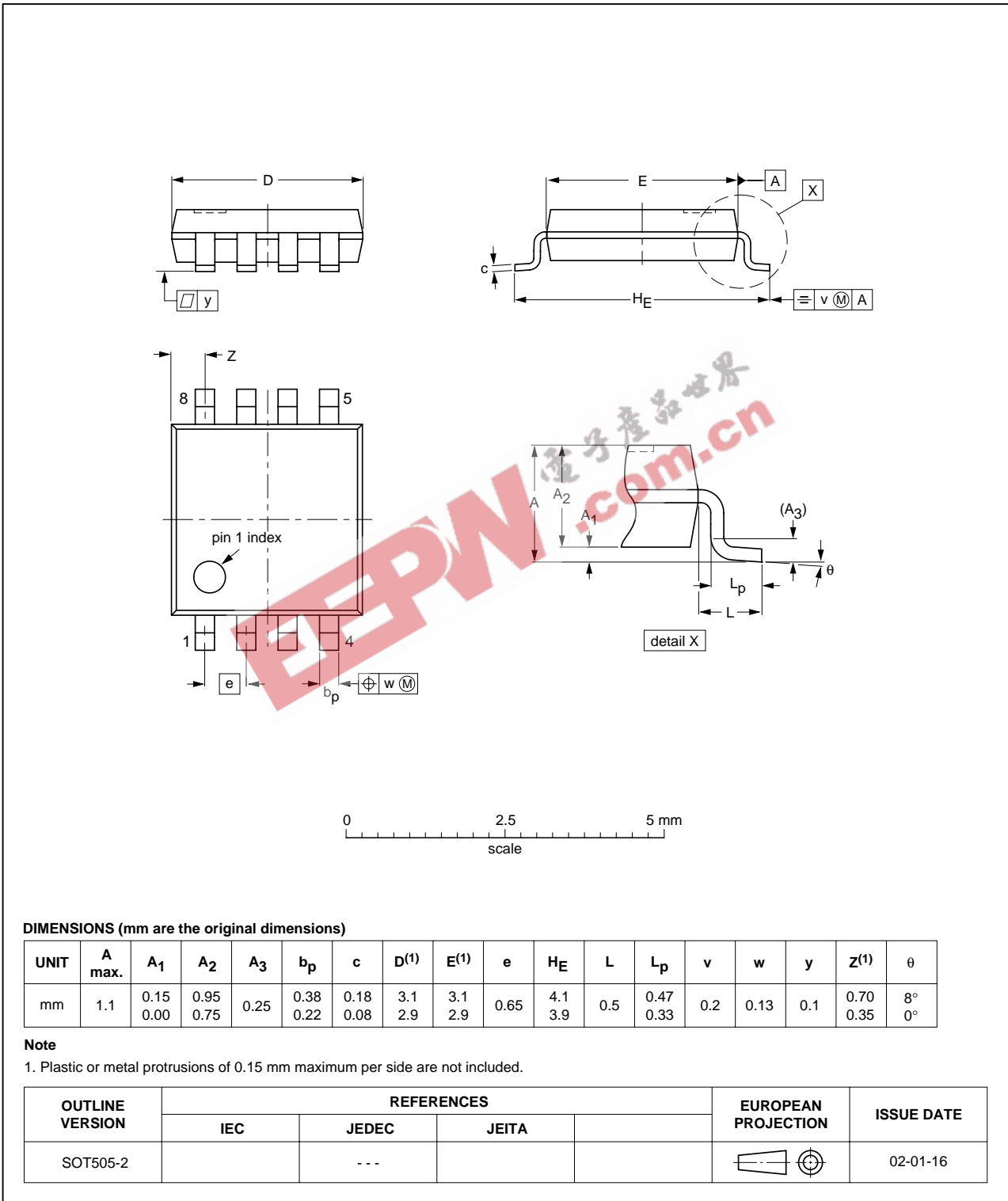


Fig 13. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

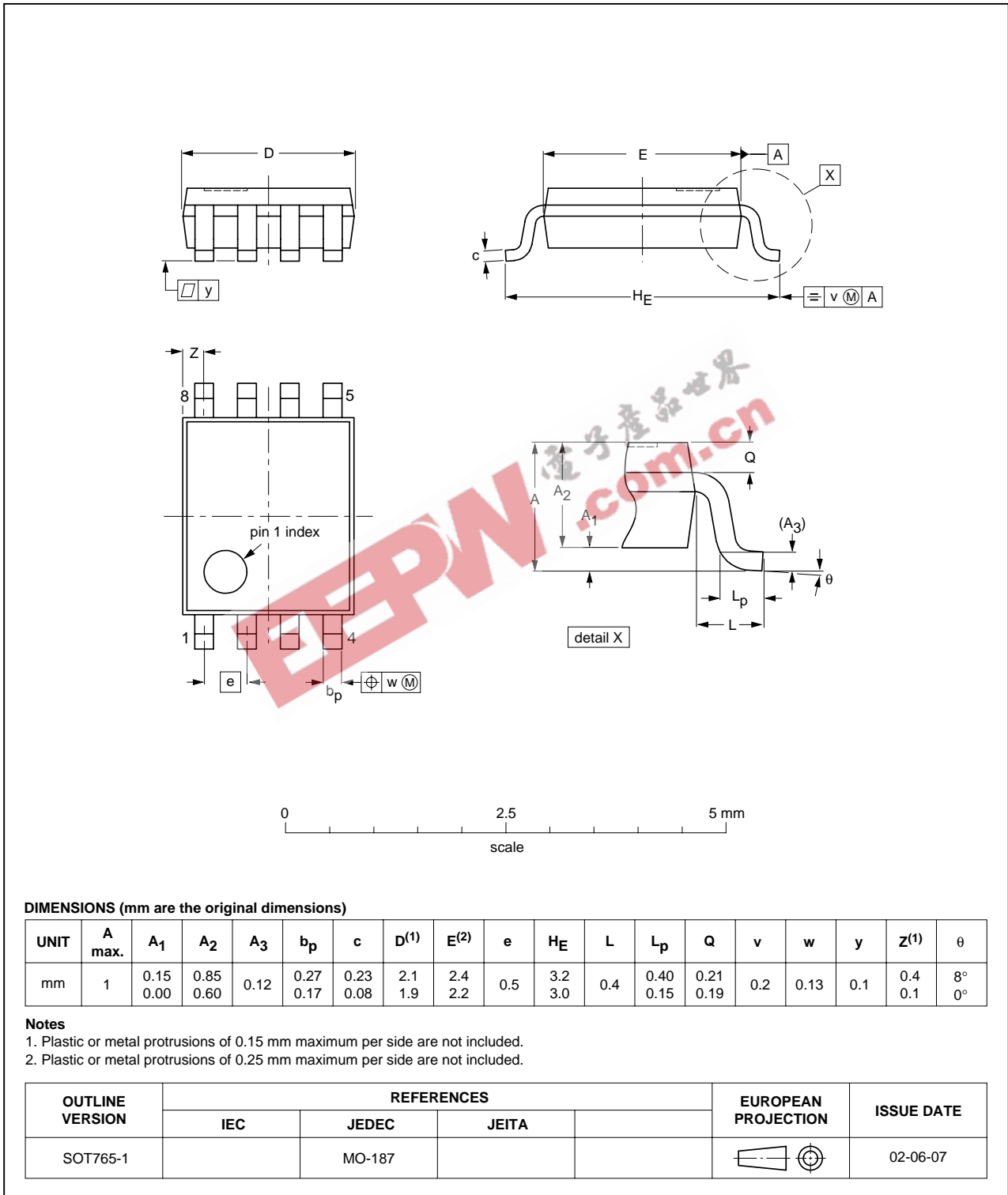


Fig 14. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1

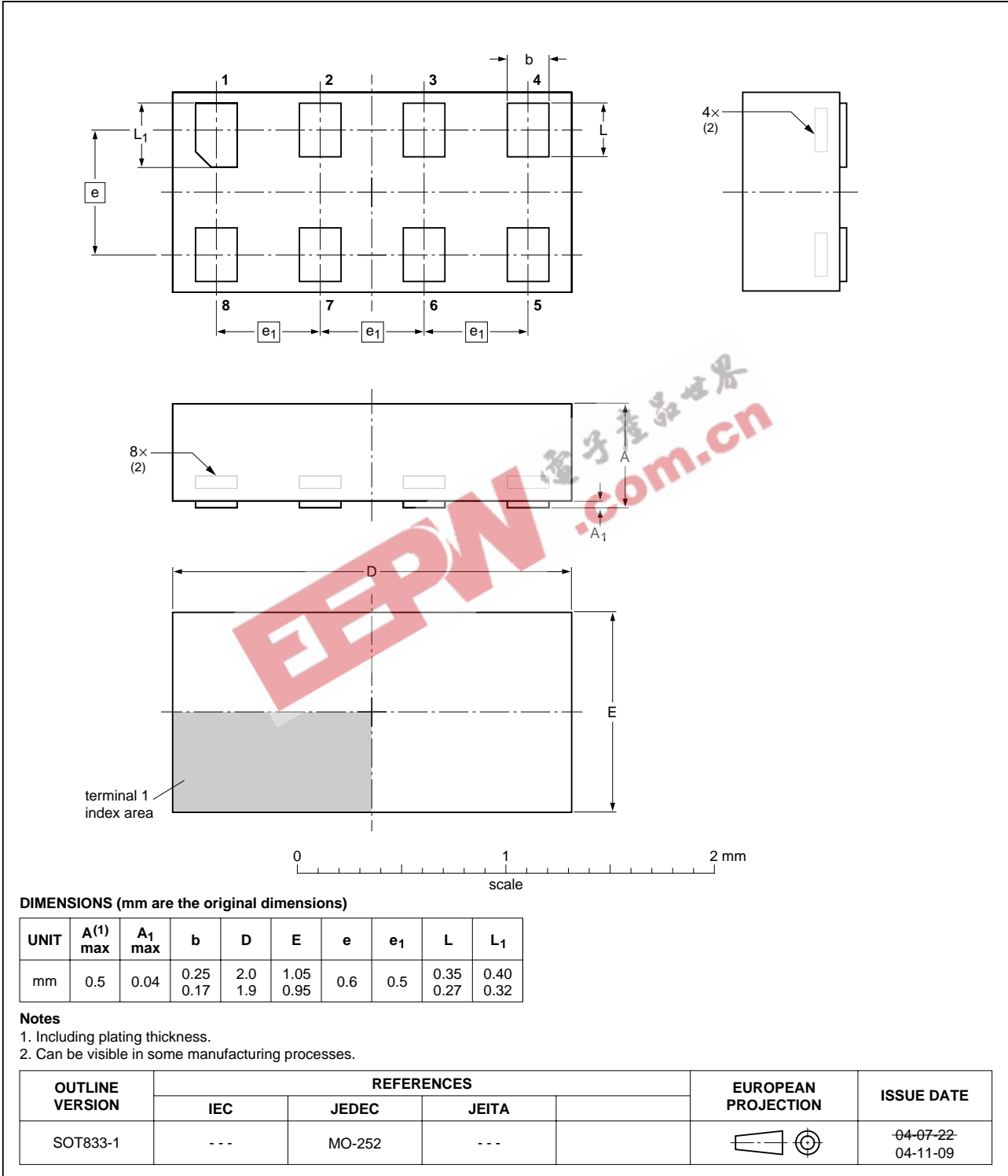


Fig 15. Package outline SOT833-1 (XSON8)

19. Revision history

Table 13: Revision history

| Document ID | Release date | Data sheet status | Change notice | Doc. number | Supersedes |
|----------------|------------------------------------|--------------------|---------------|----------------|-------------|
| 74LVC3G14_3 | 20050131 | Product data sheet | - | 9397 750 14543 | 74LVC3G14_2 |
| Modifications: | • Changed: type number 74LVC3G14GT | | | | |
| 74LVC3G14_2 | 20041027 | Product data sheet | - | 9397 750 13792 | 74LVC3G14_1 |
| 74LVC3G14_1 | 20040510 | Product data sheet | - | 9397 750 13139 | - |

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20. Data sheet status

| Level | Data sheet status ^[1] | Product status ^[2] ^[3] | Definition |
|-------|----------------------------------|--|--|
| I | Objective data | Development | This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice. |
| II | Preliminary data | Qualification | This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. |
| III | Product data | Production | This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). |

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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