

# 74LVC3G14

Triple inverting Schmitt trigger with 5 V tolerant input

Rev. 03 — 31 January 2005

Product data sheet

## 1. General description

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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

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- 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.
- $\pm 24$  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

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- 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  $\mu\text{W}$ ).

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

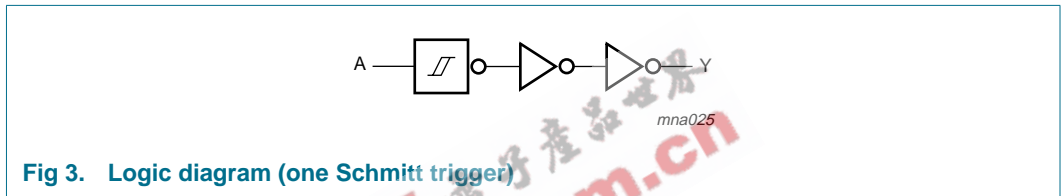
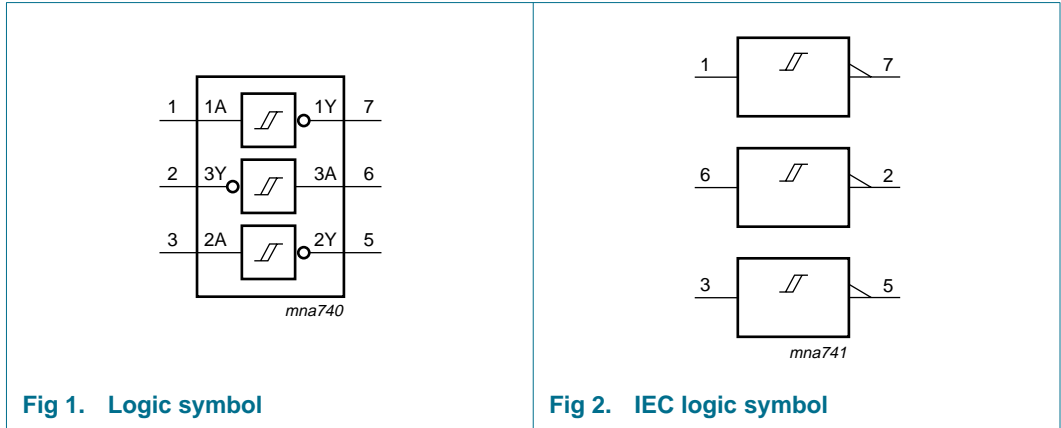
Type number	Package			Version
	Temperature range	Name	Description	
74LVC3G14DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74LVC3G14DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 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**

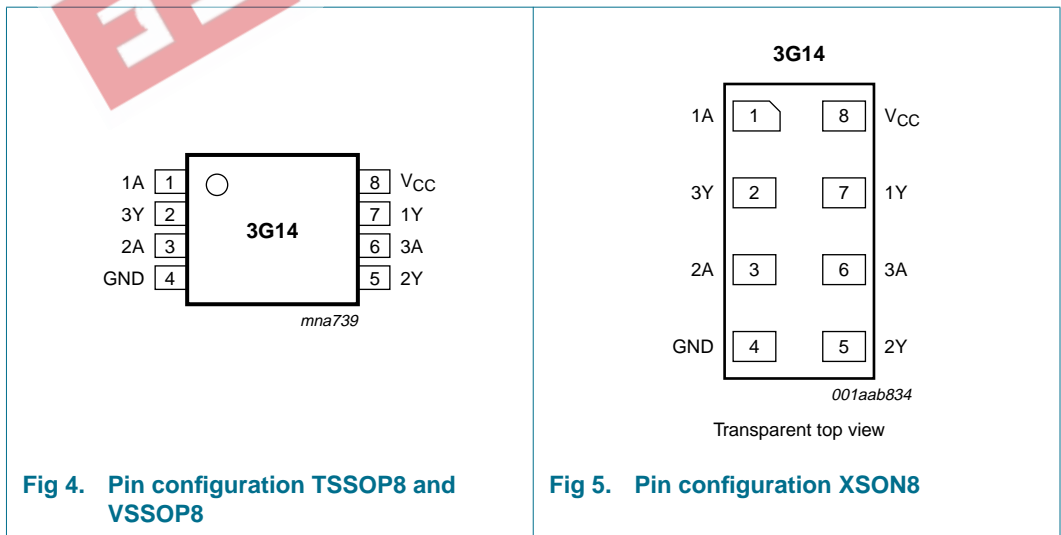
Type number	Marking code
74LVC3G14DP	V14
74LVC3G14DC	V14
74LVC3G14GT	V14

## 7. Functional diagram



## 8. Pinning information

### 8.1 Pinning



## 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 <sub>CC</sub>	8	supply voltage

## 9. Functional description

### 9.1 Function table

Table 5: Function table <sup>[1]</sup>

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 <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input diode current	V <sub>I</sub> < 0 V	-	-50	mA
V <sub>I</sub>	input voltage		[1] -0.5	+6.5	V
I <sub>OK</sub>	output diode current	V <sub>O</sub> > V <sub>CC</sub> or V <sub>O</sub> < 0 V	-	±50	mA
V <sub>O</sub>	output voltage	enable mode	[1][2] -0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode	[1][2] -0.5	+6.5	V
I <sub>O</sub>	output source or sink current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±50	mA
I <sub>CC</sub> , I <sub>GND</sub>	V <sub>CC</sub> or GND current		-	±100	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	power dissipation	T <sub>amb</sub> = -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<sub>CC</sub> = 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	$V_I = 5.5\text{ V or GND}$ ; $V_{CC} = 5.5\text{ V}$	-	$\pm 0.1$	$\pm 5$	$\mu\text{A}$
$I_{off}$	power-off leakage current	$V_I$ or $V_O = 5.5\text{ V}$ ; $V_{CC} = 0\text{ V}$	-	$\pm 0.1$	$\pm 10$	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or $\text{GND}$ ; $I_O = 0\text{ A}$ ; $V_{CC} = 5.5\text{ V}$	-	0.1	10	$\mu\text{A}$
$\Delta I_{CC}$	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	$\mu\text{A}$
$C_I$	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
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
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> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.80	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.80	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>				
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	0.95	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.7	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	1.9	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.0	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.4	-	-	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 5.5 V	-	-	±20	μA
I <sub>off</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	-	±20	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	40	μA
ΔI <sub>CC</sub>	additional quiescent supply per pin	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.3 V to 5.5 V	-	-	5000	μA

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

### 13. Dynamic characteristics

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

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

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

[2]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$  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  $V_I = \text{GND to } V_{CC}$ .

14. Waveforms

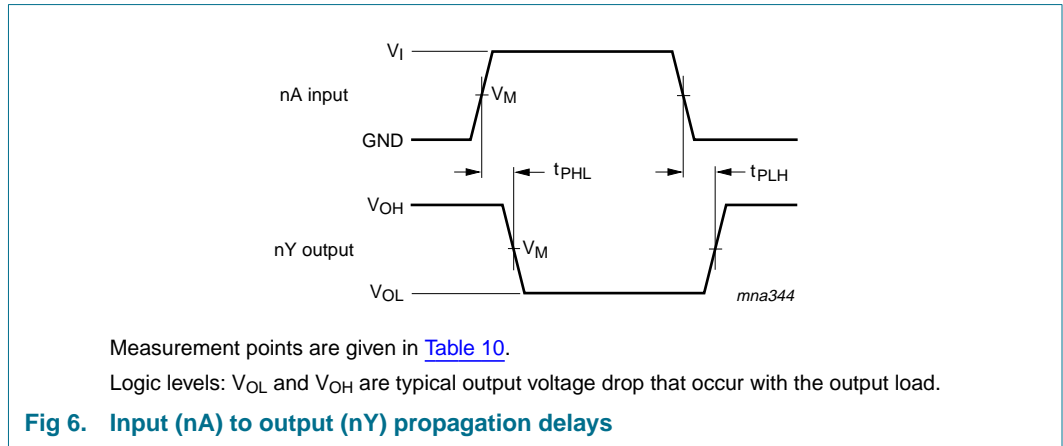


Table 10: Measurement points

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

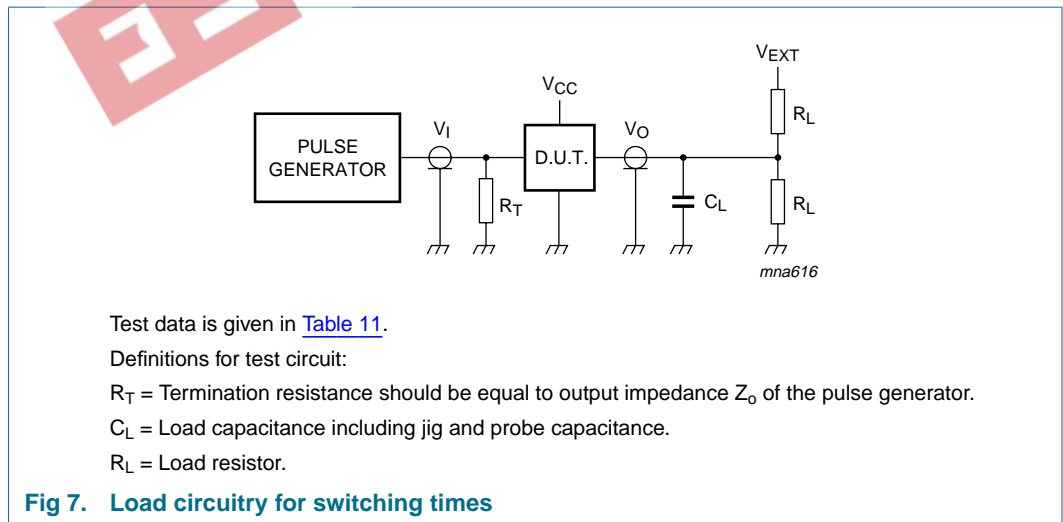




Table 11: Test data

Supply voltage	Input		Load		V <sub>EXT</sub>
V <sub>CC</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 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](#).

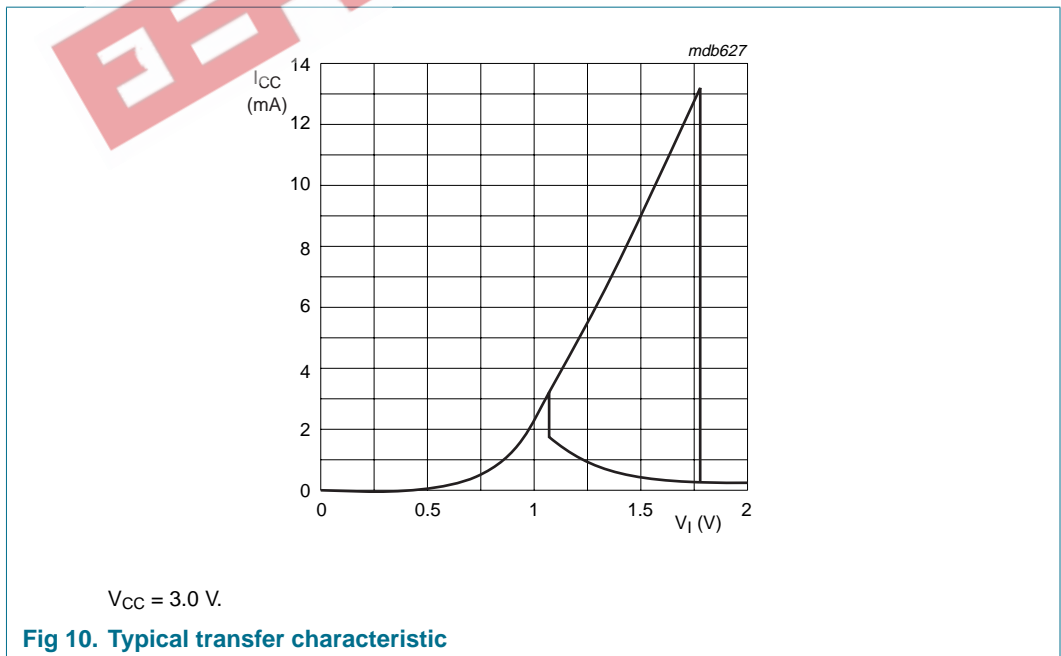
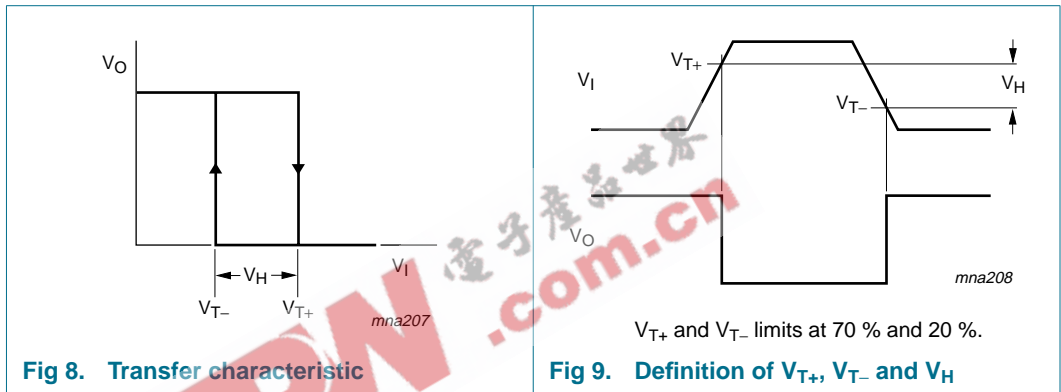
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C [1]</b>						
V <sub>T+</sub>	positive-going threshold	V <sub>CC</sub> = 1.8 V	0.70	1.10	1.50	V
		V <sub>CC</sub> = 2.3 V	1.00	1.40	1.80	V
		V <sub>CC</sub> = 3.0 V; see <a href="#">Figure 10</a>	1.30	1.76	2.20	V
		V 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

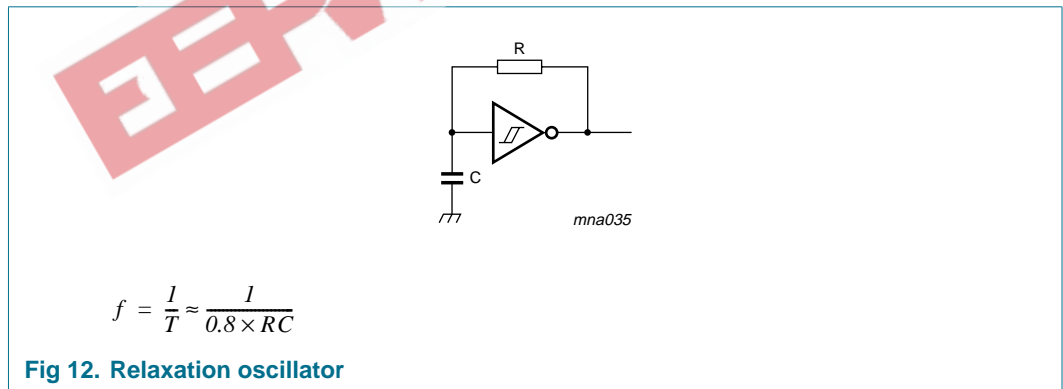
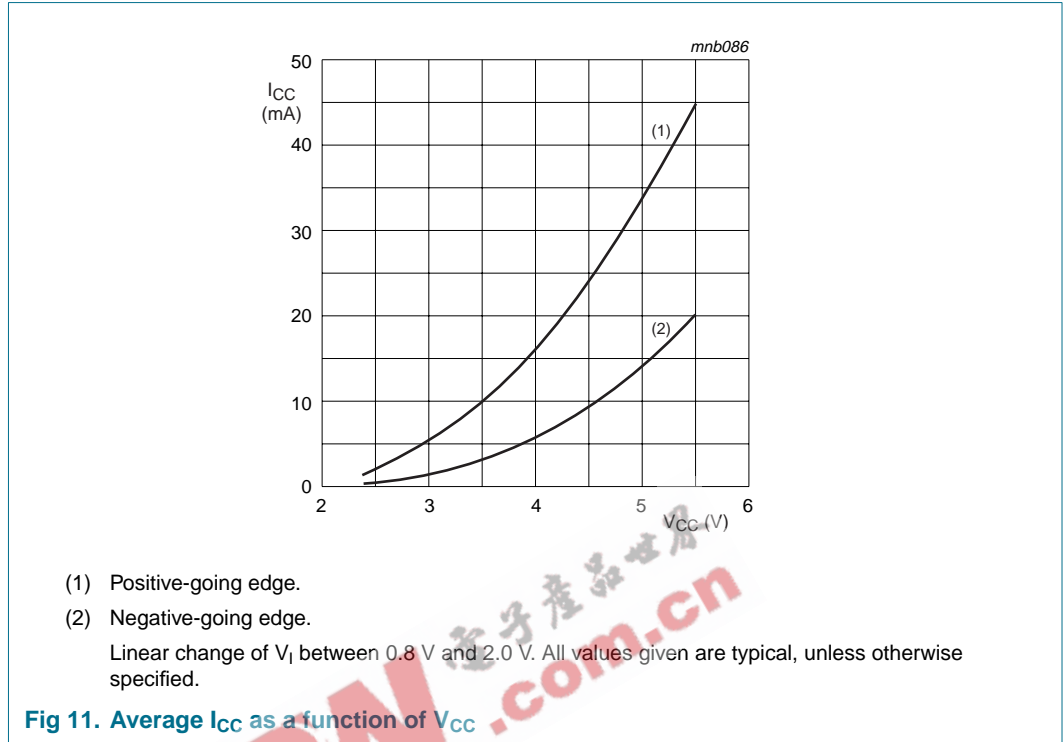
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_H$	hysteresis ( $V_{T+} - V_{T-}$ )	$V_{CC} = 1.8\text{ V}$	0.15	-	1.20	V
		$V_{CC} = 2.3\text{ V}$	0.25	-	1.30	V
		$V_{CC} = 3.0\text{ V}$	0.40	-	1.40	V
		$V_{CC} = 4.5\text{ V}$	0.60	-	1.70	V
		$V_{CC} = 5.5\text{ V}$	0.70	-	1.90	V

[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

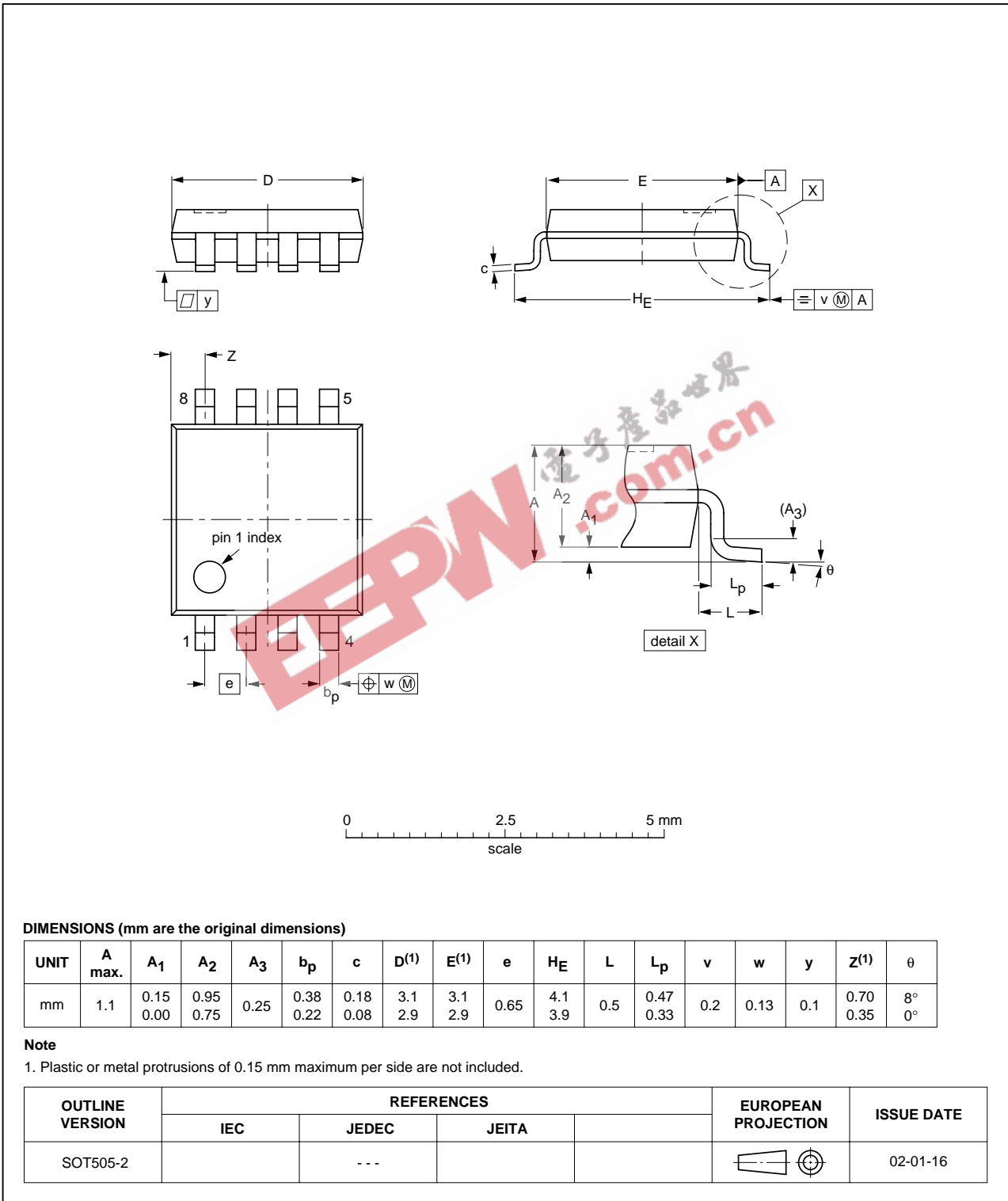


Fig 13. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

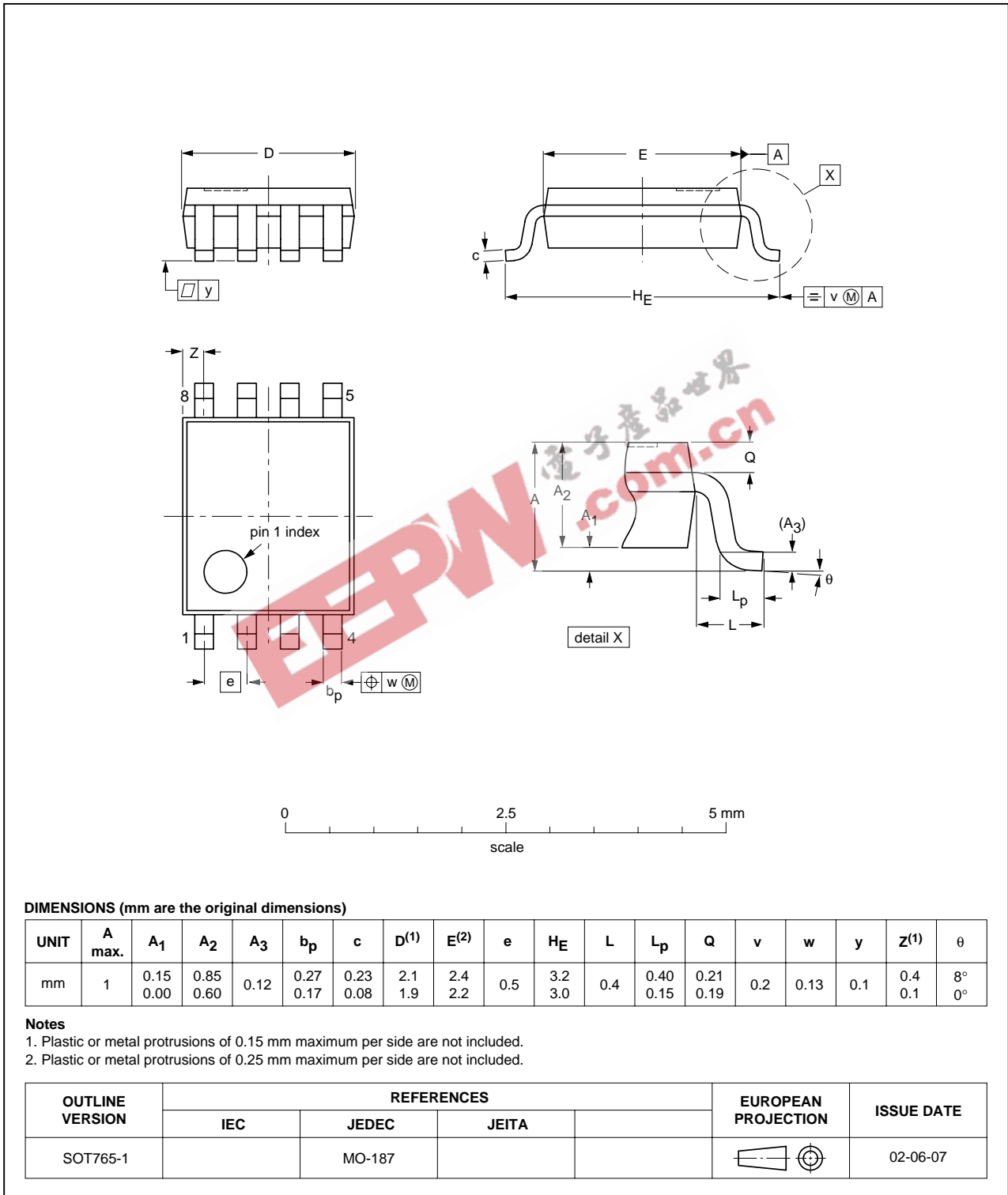


Fig 14. Package outline SOT765-1 (VSSOP8)

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

SOT833-1

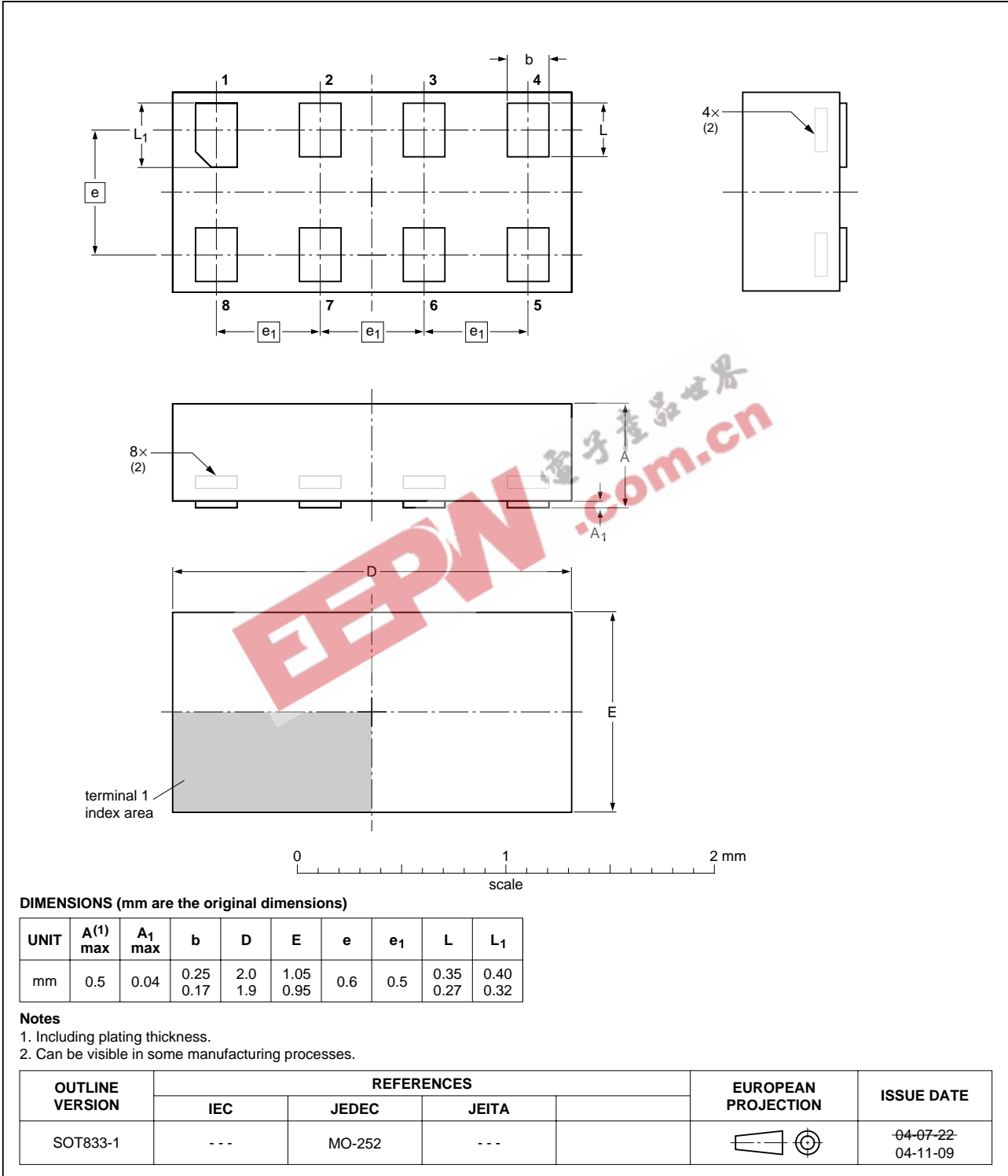


Fig 15. Package outline SOT833-1 (XSON8)

## 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 <sup>[1]</sup>	Product status <sup>[2]</sup> <sup>[3]</sup>	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.
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[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>.

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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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