

# 74LVC3G06

Triple inverter with open-drain output

Rev. 03 — 01 February 2005

Product data sheet

## 1. General description

The 74LVC3G06 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 in a mixed 3.3 V and 5 V environment.

Schmitt trigger action at all inputs makes the circuit tolerant for slower input rise and fall time.

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 74LVC3G06 provides three inverting buffers.

The output of this device is an open drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

## 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
- Complies with JEDEC standard:
  - ◆ JESD8-7 (1.65 V to 1.95 V)
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V).
- 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
- Inputs accept voltages up to 5 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.

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### 3. 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
$t_{PLZ}$ , $t_{PZL}$	propagation delay input nA to output nY	$V_{CC} = 1.8\text{ V}$ ; $C_L = 30\text{ pF}$ ; $R_L = 1\text{ k}\Omega$	-	2.6	-	ns
		$V_{CC} = 2.5\text{ V}$ ; $C_L = 30\text{ pF}$ ; $R_L = 500\text{ }\Omega$	-	1.6	-	ns
		$V_{CC} = 2.7\text{ V}$ ; $C_L = 50\text{ pF}$ ; $R_L = 500\text{ }\Omega$	-	2.2	-	ns
		$V_{CC} = 3.3\text{ V}$ ; $C_L = 50\text{ pF}$ ; $R_L = 500\text{ }\Omega$	-	2.0	-	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 50\text{ pF}$ ; $R_L = 500\text{ }\Omega$	-	1.4	-	ns
$C_I$	input capacitance		-	2.5	-	pF
$C_{PD}$	power dissipation capacitance per gate	$V_{CC} = 3.3\text{ V}$	[1] [2]	5.9	-	pF

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

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

$N$  = number of inputs switching;

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

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

### 4. Ordering information

**Table 2: Ordering information**

Type number	Package			
	Temperature range	Name	Description	Version
74LVC3G06DP	-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
74LVC3G06DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74LVC3G06GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1

### 5. Marking

**Table 3: Marking**

Type number	Marking code
74LVC3G06DP	V06
74LVC3G06DC	V06
74LVC3G06GT	V06

## 6. Functional diagram

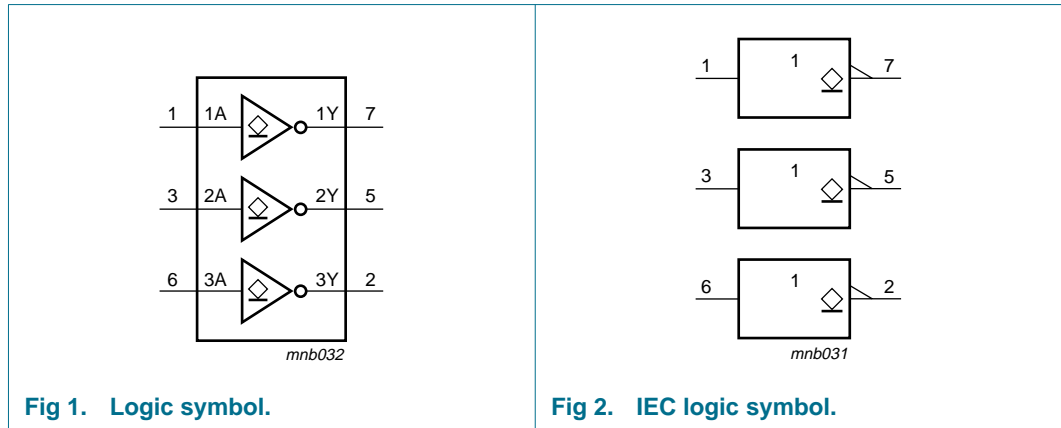


Fig 1. Logic symbol.

Fig 2. IEC logic symbol.

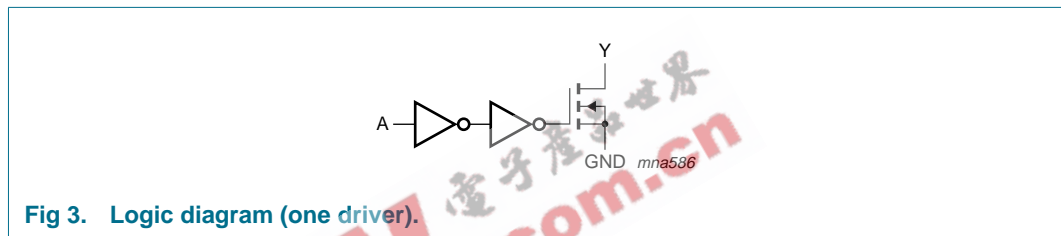


Fig 3. Logic diagram (one driver).

## 7. Pinning information

### 7.1 Pinning

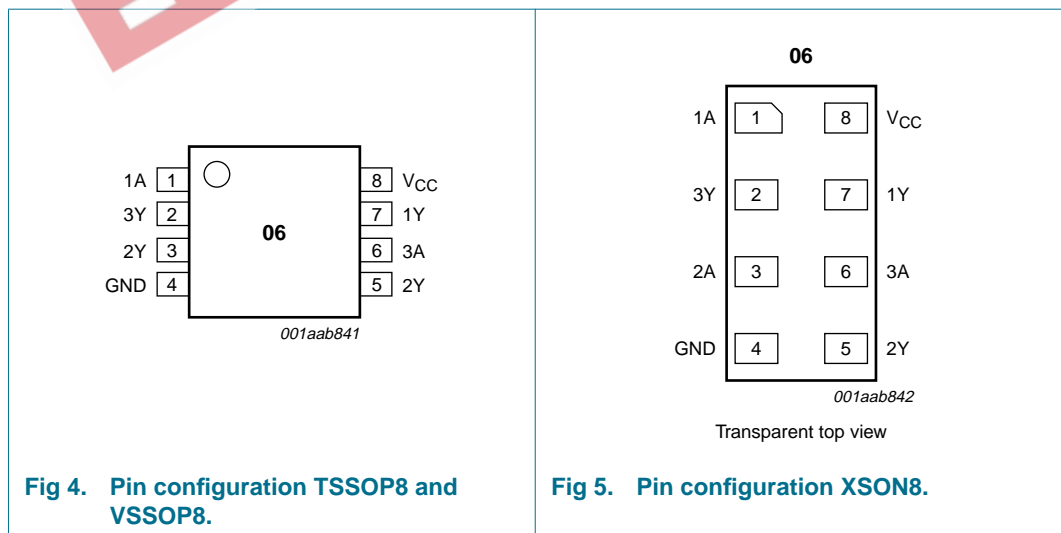


Fig 4. Pin configuration TSSOP8 and VSSOP8.

Fig 5. Pin configuration XSON8.

## 7.2 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

## 8. Functional description

### 8.1 Function table

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

Input nA	Output nY
L	Z
H	L

- [1] H = HIGH voltage level;  
L = LOW voltage level;  
Z = high-impedance OFF-state.

## 9. 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		<sup>[1]</sup> -0.5	+6.5	V
I <sub>OK</sub>	output diode current	V <sub>O</sub> < 0 V	-	-50	mA
V <sub>O</sub>	output voltage	active mode	<sup>[1]</sup> -0.5	+6.5	V
		Power-down mode	<sup>[1][2]</sup> -0.5	+6.5	V
I <sub>O</sub>	output sink current	V <sub>O</sub> = 0 V to 6.5 V	-	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 operation.

## 10. 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	active mode	0	-	$V_{CC}$	V
		Power-down mode; $V_{CC} = 0$ V	0	-	5.5	V
$T_{amb}$	ambient temperature		-40	-	+125	°C
$t_r, t_f$	input rise and fall times	$V_{CC} = 1.65$ V to 2.7 V	0	-	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 V	0	-	10	ns/V

## 11. 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
<b><math>T_{amb} = -40</math> °C to <math>+85</math> °C [1]</b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65 \times V_{CC}$	-	-	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	$0.7 \times V_{CC}$	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35 \times V_{CC}$	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	-	-	$0.3 \times V_{CC}$	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_O = 100$ $\mu$ A; $V_{CC} = 1.65$ 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		
$I_{LI}$	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 1.65$ V to 5.5 V	[2] -	$\pm 0.1$	$\pm 5$	$\mu$ A
$I_{OZ}$	3-state output OFF-state current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5$ V	-	$\pm 0.1$	$\pm 10$	$\mu$ A
$I_{off}$	power-off leakage current	$V_I$ or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	$\pm 0.1$	$\pm 10$	$\mu$ A
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	0.1	10	$\mu$ A
$\Delta I_{CC}$	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	[2] -	5	500	$\mu$ A

**Table 8: Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_I$	input capacitance		-	2.5	-	pF
<b><math>T_{amb} = -40\text{ }^{\circ}\text{C}</math> to <math>+125\text{ }^{\circ}\text{C}</math></b>						
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	$0.65 \times V_{CC}$	-	-	V
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	1.7	-	-	V
		$V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$	2.0	-	-	V
		$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$	$0.7 \times V_{CC}$	-	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65\text{ V}$ to $1.95\text{ V}$	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3\text{ V}$ to $2.7\text{ V}$	-	-	0.7	V
		$V_{CC} = 2.7\text{ V}$ to $3.6\text{ V}$	-	-	0.8	V
		$V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$	-	-	$0.3 \times V_{CC}$	V
$V_{OL}$	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
$I_{LI}$	input leakage current	$V_I = 5.5\text{ V}$ or GND; $V_{CC} = 1.65\text{ V}$ to $5.5\text{ V}$	-	-	$\pm 20$	$\mu\text{A}$
$I_{OZ}$	3-state output OFF-state current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$	-	-	$\pm 10$	$\mu\text{A}$
$I_{off}$	power-off leakage current	$V_I$ or $V_O = 5.5\text{ V}$ ; $V_{CC} = 0\text{ V}$	-	-	$\pm 20$	$\mu\text{A}$
$I_{CC}$	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 5.5\text{ V}$	-	-	40	$\mu\text{A}$
$\Delta I_{CC}$	additional quiescent supply current 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	$\mu\text{A}$

[1] All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .[2] These typical values are measured at  $V_{CC} = 3.3\text{ V}$ .

## 12. Dynamic characteristics

**Table 9: Dynamic characteristics**

$GND = 0\text{ V}$ ; 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>						
$t_{PLZ}$ , $t_{PZL}$	propagation delay input nA to output nY	see <a href="#">Figure 6</a>				
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	1.0	2.6	6.5	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.5	1.6	3.9	ns
		$V_{CC} = 2.7\text{ V}$	1.0	2.2	4.2	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	0.5	2.0	3.4	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	0.5	1.4	2.9	ns
$C_{PD}$	power dissipation capacitance per gate	$V_{CC} = 3.3\text{ V}$	[2] [3] -	5.9	-	pF
<b><math>T_{amb} = -40\text{ °C to }+125\text{ °C}</math></b>						
$t_{PLZ}$ , $t_{PZL}$	propagation delay input nA to output nY	see <a href="#">Figure 6</a>				
		$V_{CC} = 1.65\text{ V to }1.95\text{ V}$	1.0	-	8.2	ns
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.5	-	4.9	ns
		$V_{CC} = 2.7\text{ V}$	1.0	-	5.3	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$	0.5	-	4.3	ns
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	0.5	-	3.7	ns

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

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

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

$N$  = number of inputs switching;

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

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

13. Waveforms

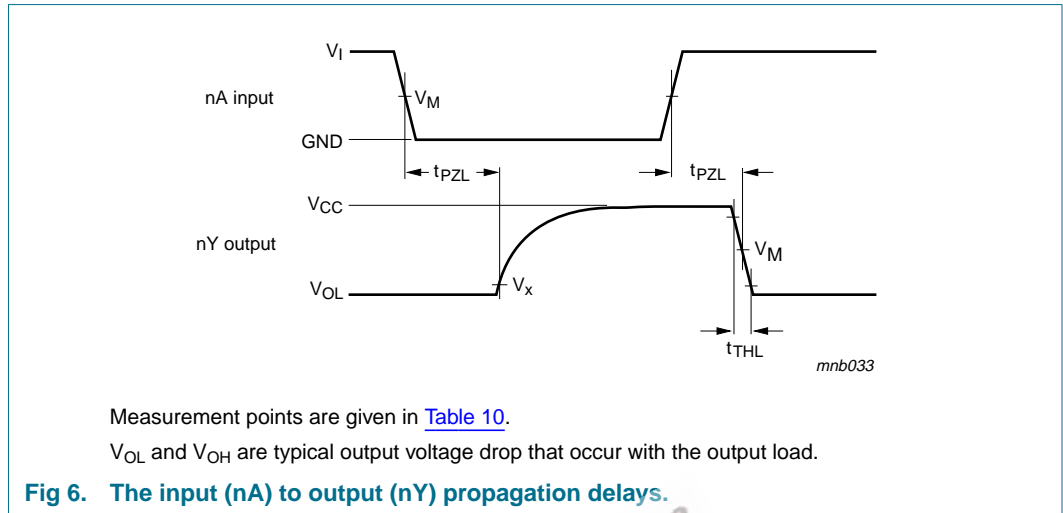


Table 10: Measurement points

Supply voltage	Input			Output	
$V_{CC}$	$V_M$	$V_I$	$t_r = t_f$	$V_M$	$V_X$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns	$0.5 \times V_{CC}$	$V_{OL} + 0.15$ V
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.0$ ns	$0.5 \times V_{CC}$	$V_{OL} + 0.15$ V
2.7 V	1.5 V	2.7 V	$\leq 2.5$ ns	1.5 V	$V_{OL} + 0.3$ V
3.0 V to 3.6 V	1.5 V	2.7 V	$\leq 2.5$ ns	1.5 V	$V_{OL} + 0.3$ V
4.5 V to 5.5 V	$0.5 \times V_{CC}$	$V_{CC}$	$\leq 2.5$ ns	$0.5 \times V_{CC}$	$V_{OL} + 0.3$ V

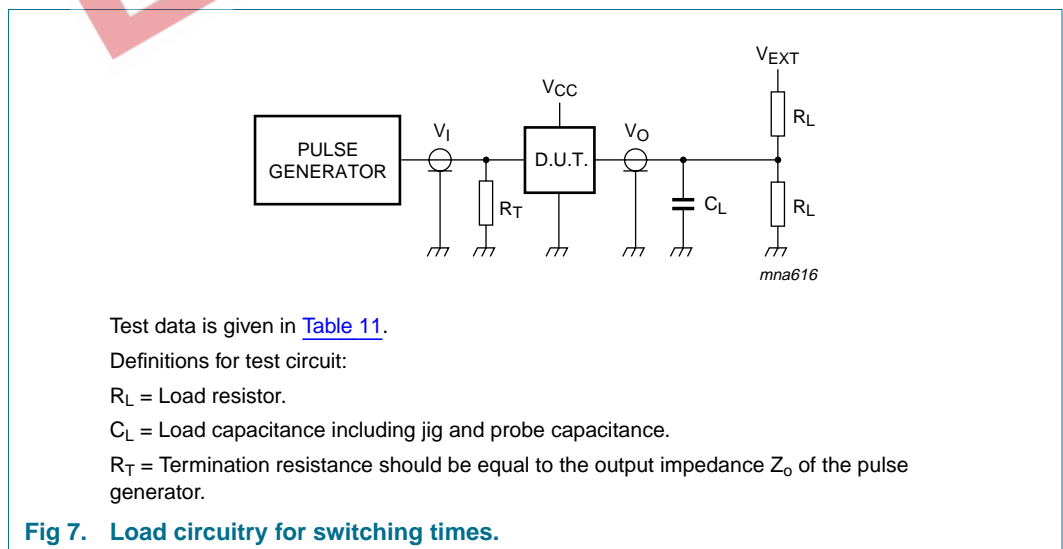




Table 11: Test data

Supply voltage	Input	Load		$V_{EXT}$
$V_{CC}$	$V_I$	$C_L$	$R_L$	$t_{PZL}, t_{PLZ}$
1.65 V to 1.95 V	$V_{CC}$	30 pF	1 k $\Omega$	$2 \times V_{CC}$
2.3 V to 2.7 V	$V_{CC}$	30 pF	500 $\Omega$	$2 \times V_{CC}$
2.7 V	2.7 V	50 pF	500 $\Omega$	6 V
3.0 V to 3.6 V	2.7 V	50 pF	500 $\Omega$	6 V
4.5 V to 5.5 V	$V_{CC}$	50 pF	500 $\Omega$	$2 \times V_{CC}$

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14. Package outline

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

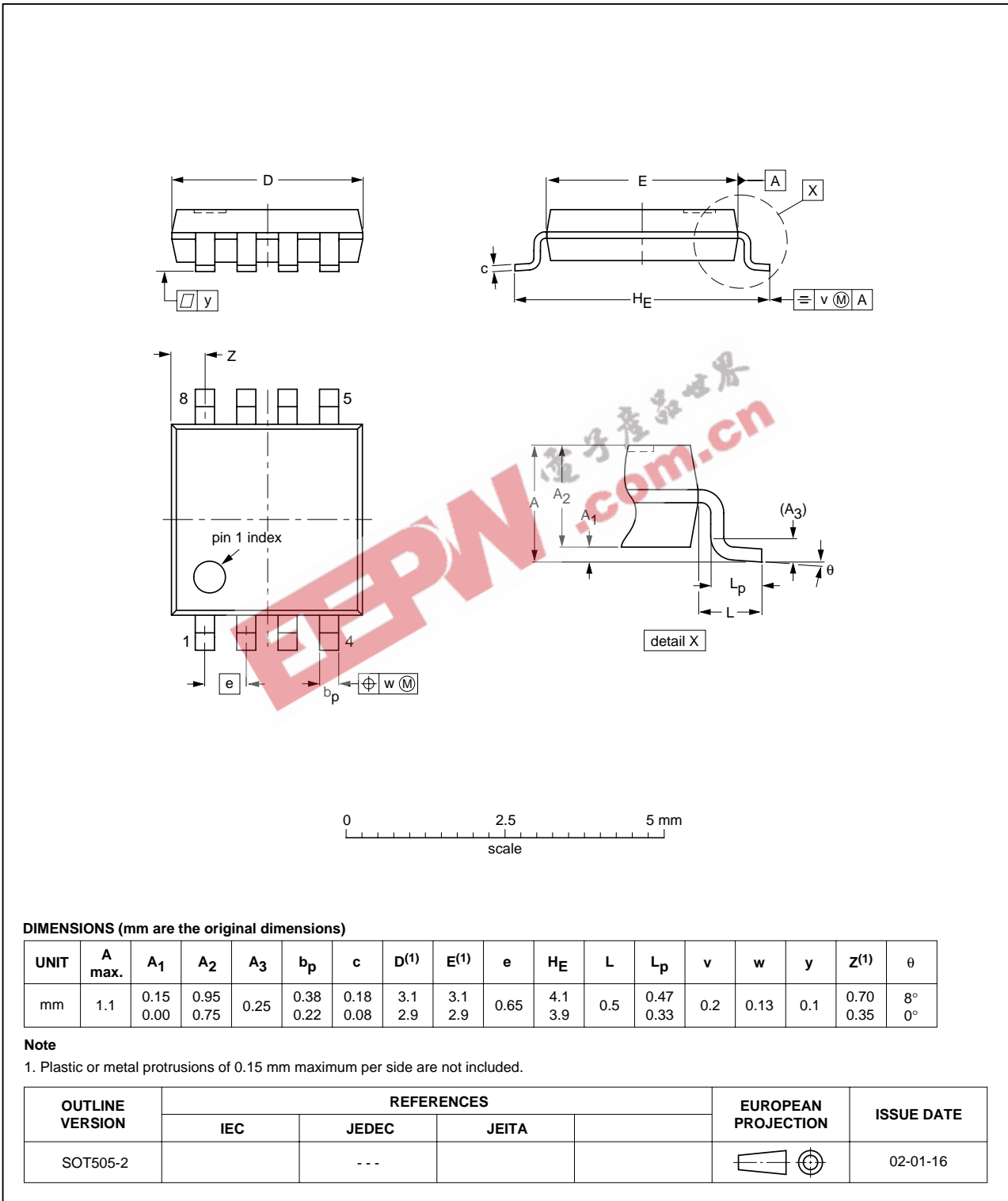


Fig 8. Package outline SOT505-2 (TSSOP8).

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

SOT765-1

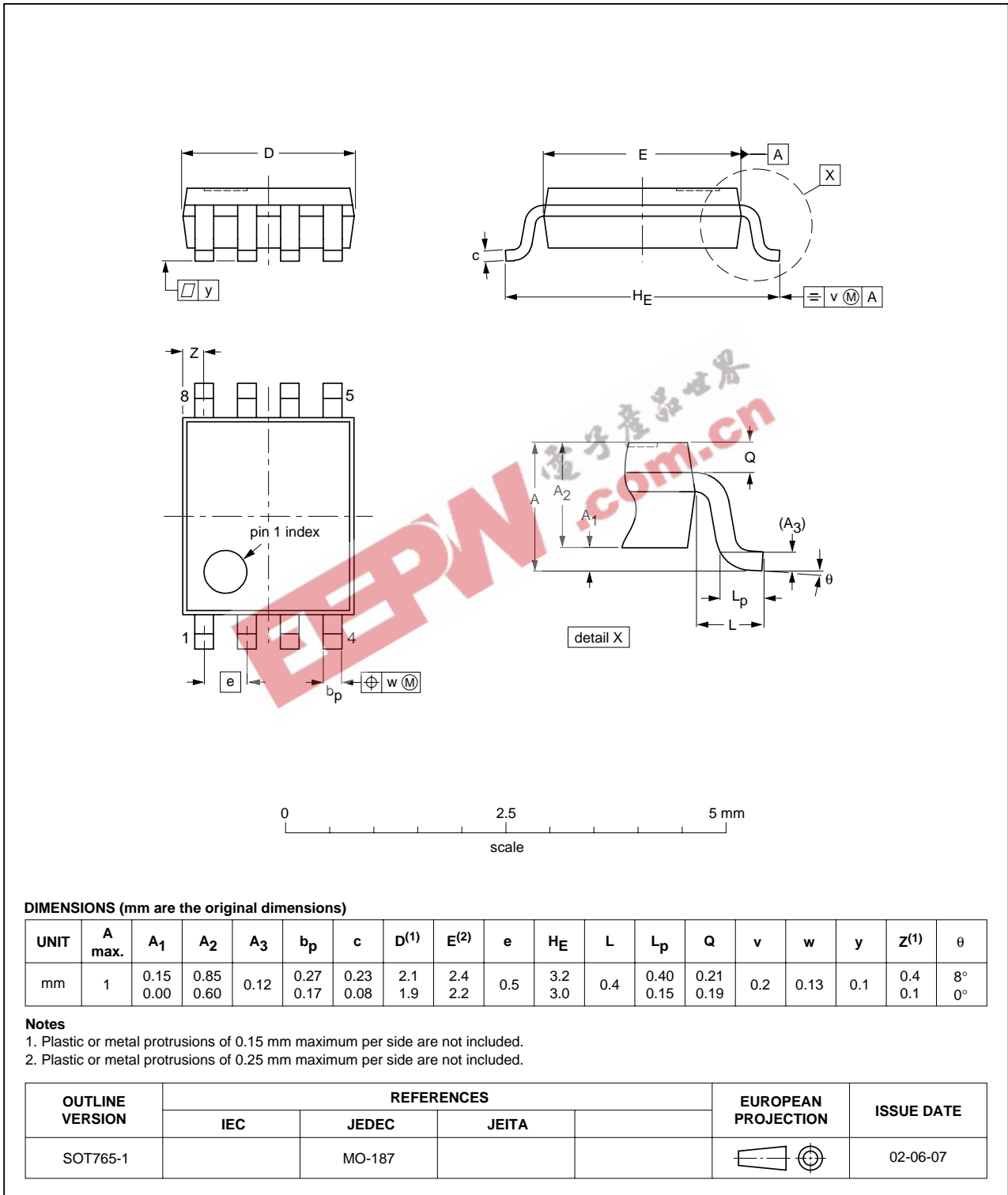


Fig 9. Package outline SOT765-1 (VSSOP8).

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

SOT833-1

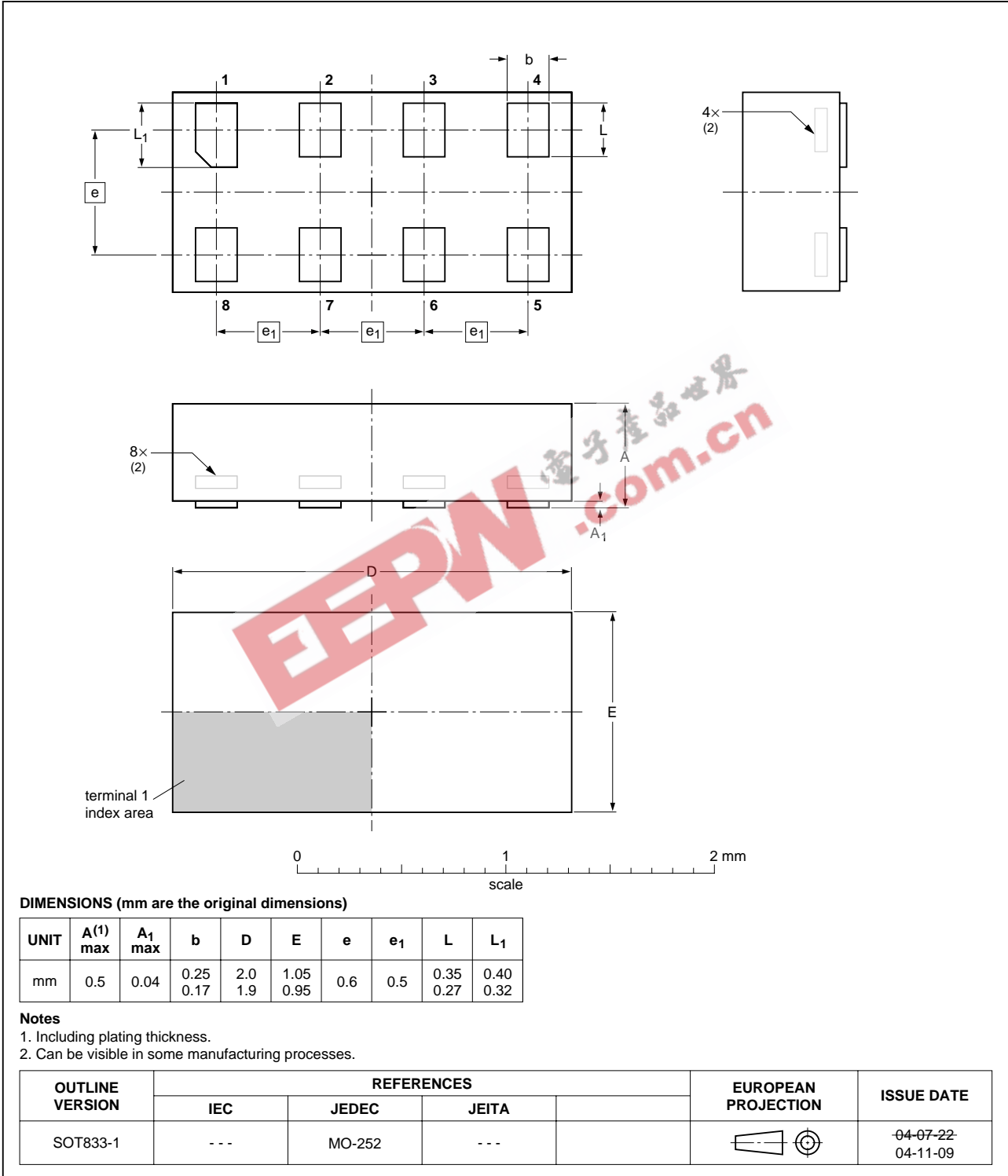


Fig 10. Package outline SOT833-1 (XSON8).

## 15. Revision history

**Table 12: Revision history**

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74LVC3G06_3	20050201	Product data sheet	-	9397 750 14541	74LVC3G06_2
Modifications:	• Changed: type number 74LVC3G06GT (SOT833-1).				
74LVC3G06_2	20041021	Product data sheet	-	9397 750 13789	74LVC3G06_1
74LVC3G06_1	20040607	Product data sheet	-	9397 750 13266	-

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## 16. 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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[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.

## 17. Definitions

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**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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## 20. Contents

1	General description . . . . .	1
2	Features . . . . .	1
3	Quick reference data . . . . .	2
4	Ordering information . . . . .	2
5	Marking . . . . .	2
6	Functional diagram . . . . .	3
7	Pinning information . . . . .	3
7.1	Pinning . . . . .	3
7.2	Pin description . . . . .	4
8	Functional description . . . . .	4
8.1	Function table . . . . .	4
9	Limiting values . . . . .	4
10	Recommended operating conditions . . . . .	5
11	Static characteristics . . . . .	5
12	Dynamic characteristics . . . . .	7
13	Waveforms . . . . .	8
14	Package outline . . . . .	10
15	Revision history . . . . .	13
16	Data sheet status . . . . .	14
17	Definitions . . . . .	14
18	Disclaimers . . . . .	14
19	Contact information . . . . .	14

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