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 V; T_{amb} = 25 °C.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PHL}, t_{PLH}	propagation delay input nA to output nY	V_{CC} = 1.8 V; C_L = 30 pF; R_L = 1 kΩ	-	4.2	-	ns
		V_{CC} = 2.5 V; C_L = 30 pF; R_L = 500 Ω	-	3.0	-	ns
		V_{CC} = 2.7 V; C_L = 50 pF; R_L = 500 Ω	-	3.8	-	ns
		V_{CC} = 3.3 V; C_L = 50 pF; R_L = 500 Ω	-	3.2	-	ns
		V_{CC} = 5.0 V; C_L = 50 pF; R_L = 500 Ω	-	2.4	-	ns
C_I	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 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				
	Temperature range	Name	Description		Version
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 × 1.95 × 0.5 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

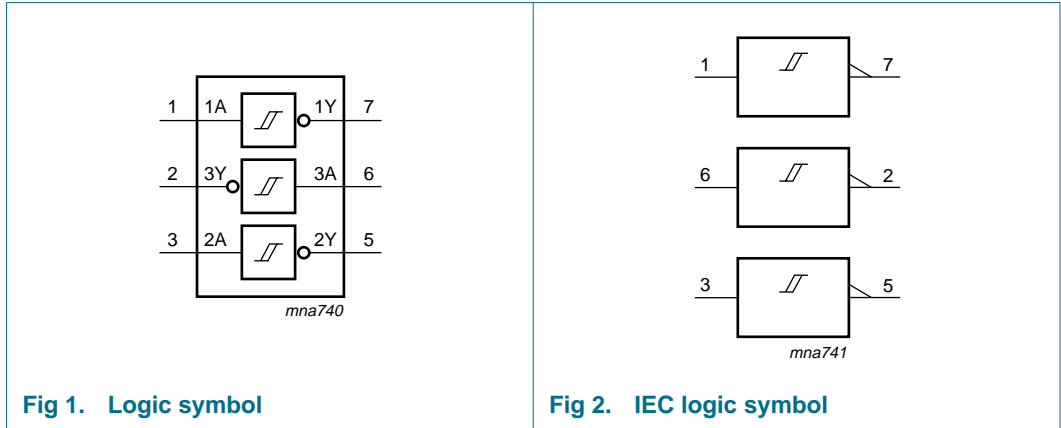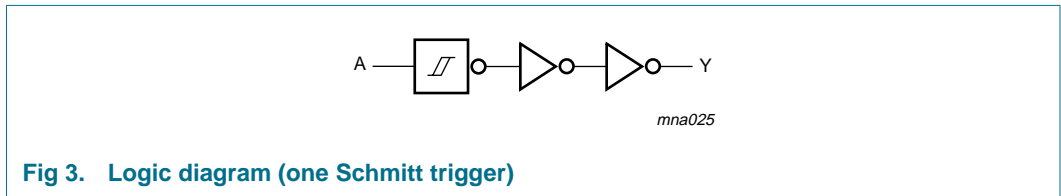**Fig 2. IEC logic symbol**

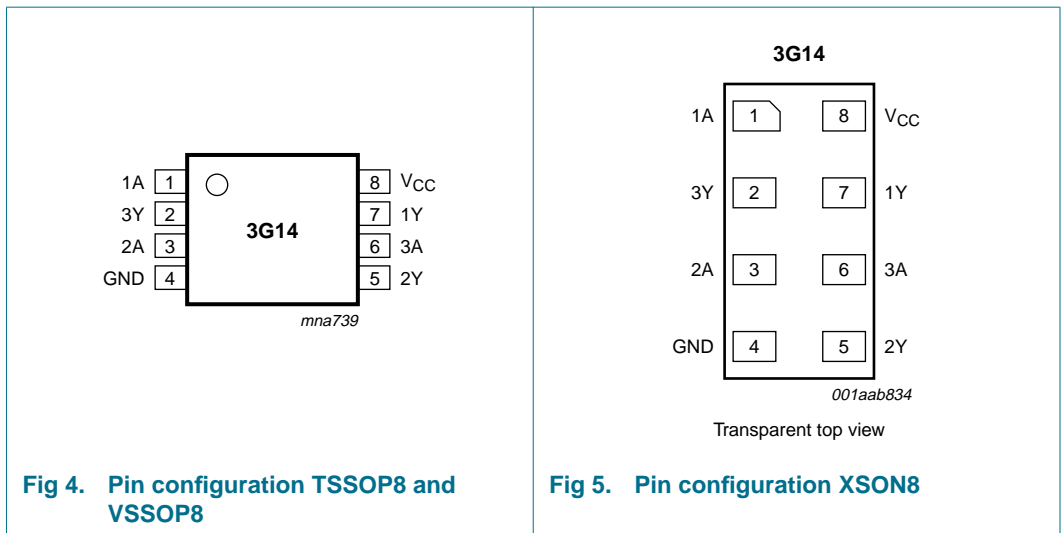**Fig 3. Logic diagram (one Schmitt trigger)**

8. Pinning information

8.1 Pinning

Fig 4. Pin configuration TSSOP8 and VSSOP8

Transparent top view

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 °C to +85 °C [1]						
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
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
I_{LI}	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 5.5$ V	-	±0.1	±5	µA
I_{off}	power-off leakage current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	±0.1	±10	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	0.1	10	µA
ΔI_{CC}	additional quiescent supply per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 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 °C to +125 °C						
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	-	-	0.70	V
		I_O = 8 mA; V_{CC} = 2.3 V	-	-	0.45	V
		I_O = 12 mA; V_{CC} = 2.7 V	-	-	0.60	V
		I_O = 24 mA; V_{CC} = 3.0 V	-	-	0.80	V
		I_O = 32 mA; V_{CC} = 4.5 V	-	-	0.80	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
I_{LI}	input leakage current	V_I = 5.5 V or GND; V_{CC} = 5.5 V	-	-	±20	μA
I_{off}	power-off leakage current	V_I or V_O = 5.5 V; V_{CC} = 0 V	-	-	±20	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	40	μA
ΔI_{CC}	additional quiescent supply per pin	$V_I = V_{CC}$ − 0.6 V; I_O = 0 A; V_{CC} = 2.3 V to 5.5 V	-	-	5000	μA

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

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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

Measurement points are given in Table 10.

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

Fig 6. Input (nA) to output (nY) propagation delays
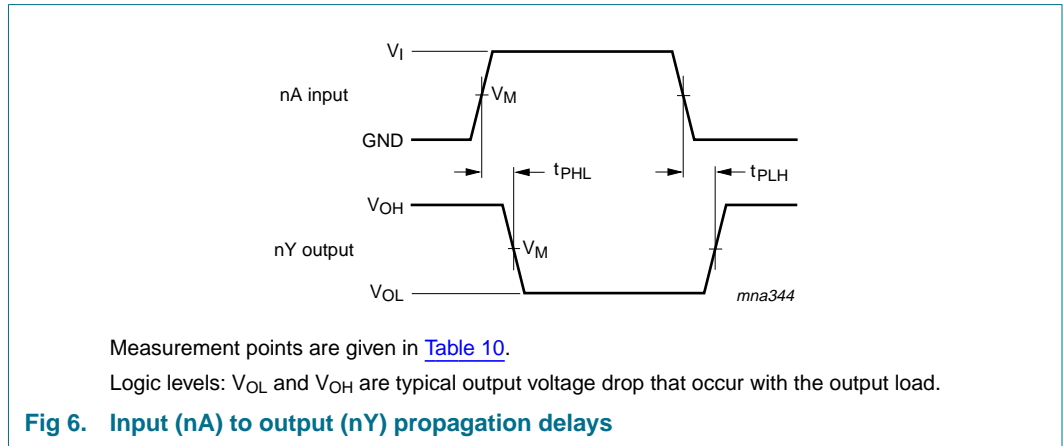
Table 10: Measurement points

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

Test data is given in Table 11.

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 resistor.

Fig 7. Load circuitry for switching times
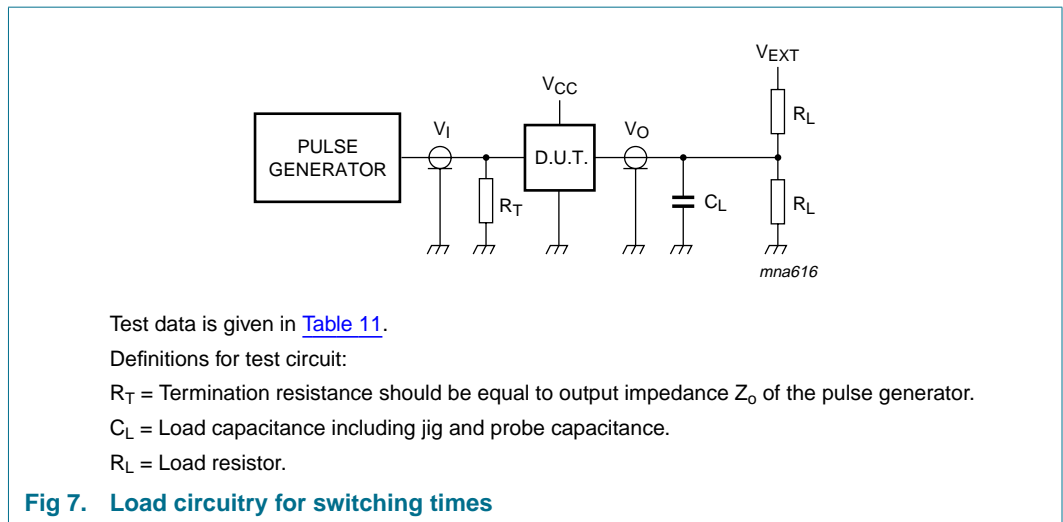
Table 11: Test data

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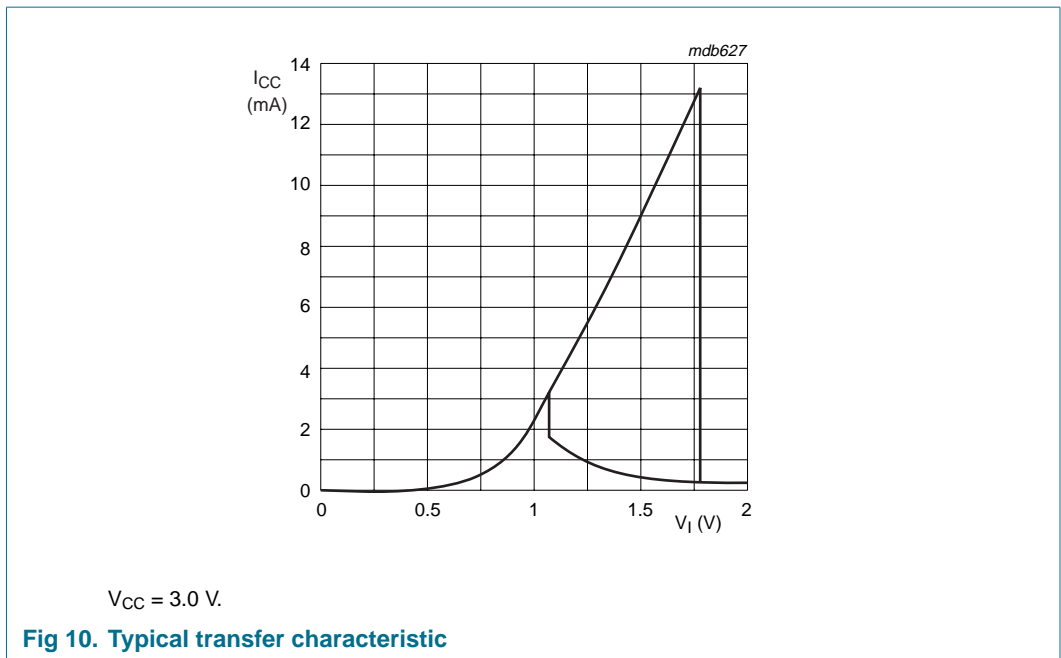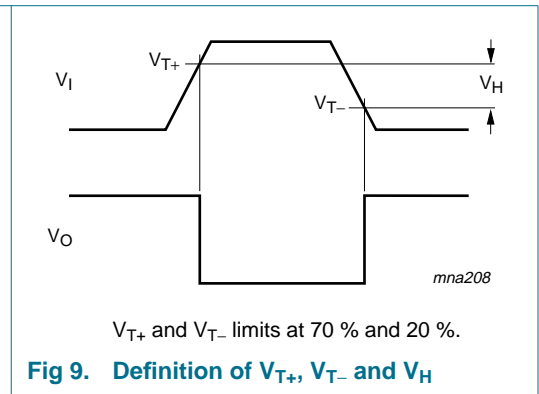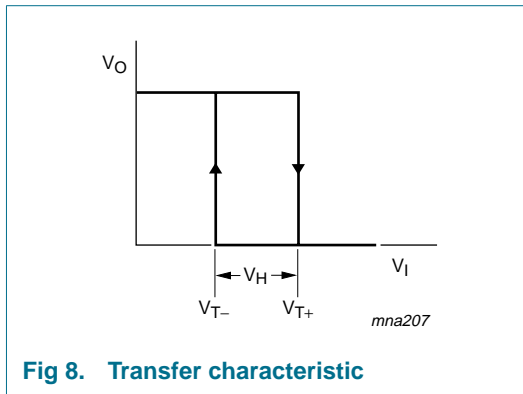*Voltages are referenced to GND (ground = 0 V); see Figure 8 and 9.*

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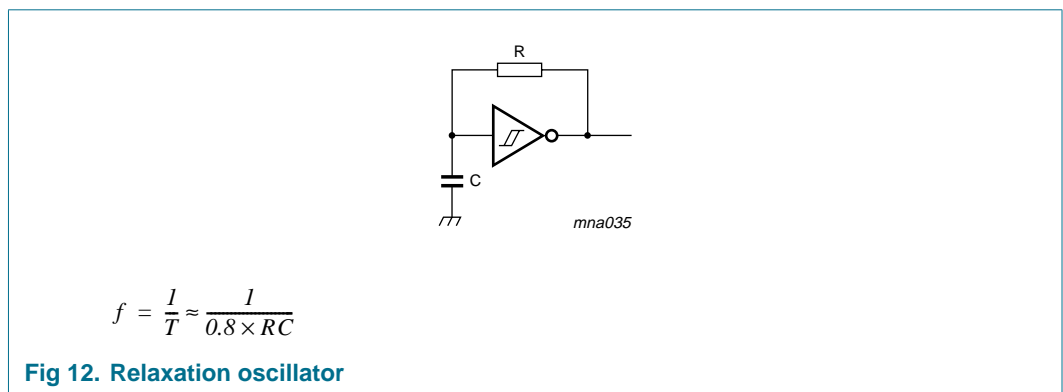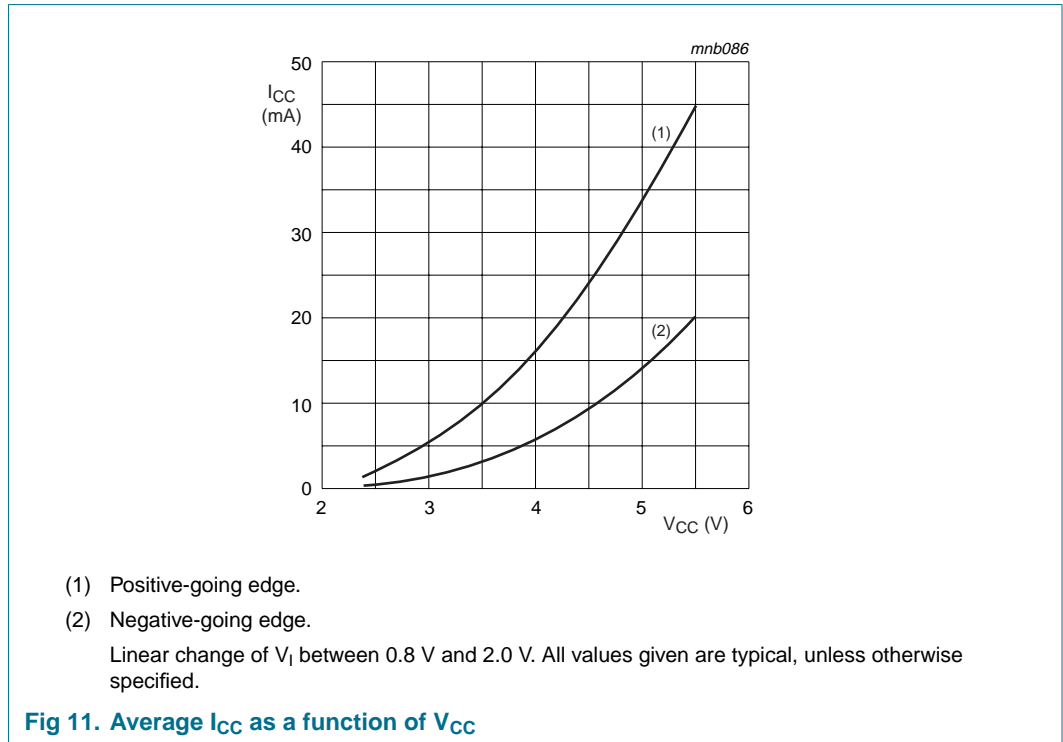*Voltages are referenced to GND (ground = 0 V); see Figure 8 and 9.*

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

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

16. Waveforms transfer characteristics

Fig 8.   Transfer characteristic

V_{T+} and V_{T-} limits at 70 % and 20 %.

Fig 9.   Definition of V_{T+}, V_{T-} and V_H

V_{CC} = 3.0 V.

Fig 10. Typical transfer characteristic

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17. Application information

(1) Positive-going edge.

(2) Negative-going edge.

Linear change of V_I between 0.8 V and 2.0 V. All values given are typical, unless otherwise specified.

Fig 11. Average I_{CC} as a function of V_{CC}

$$f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$$

Fig 12. Relaxation oscillator

18. Package outline

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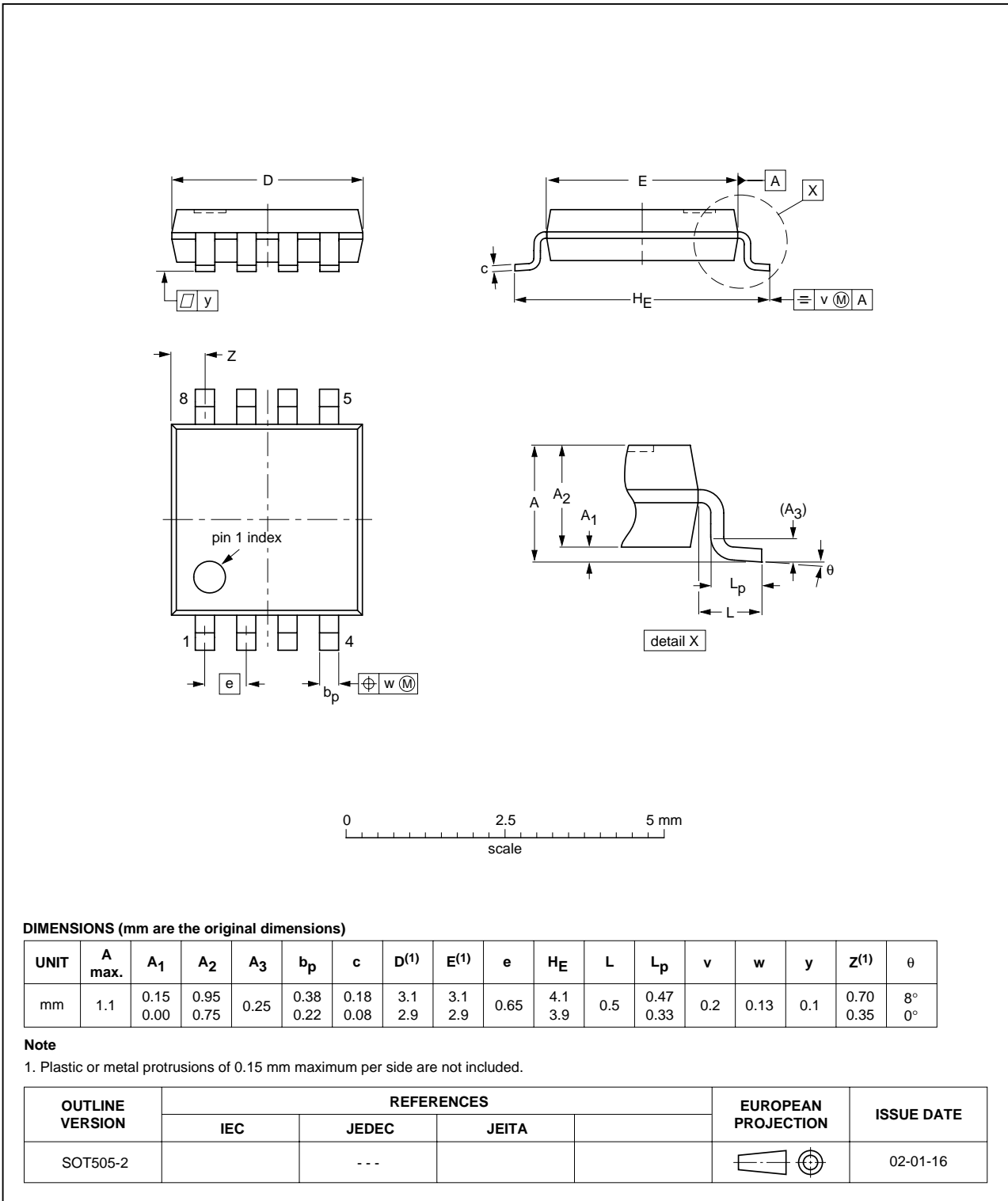

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D(1)	E(1)	e	Hₑ	L	Lₚ	v	w	y	Z(1)	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 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 13. Package outline SOT505-2 (TSSOP8)

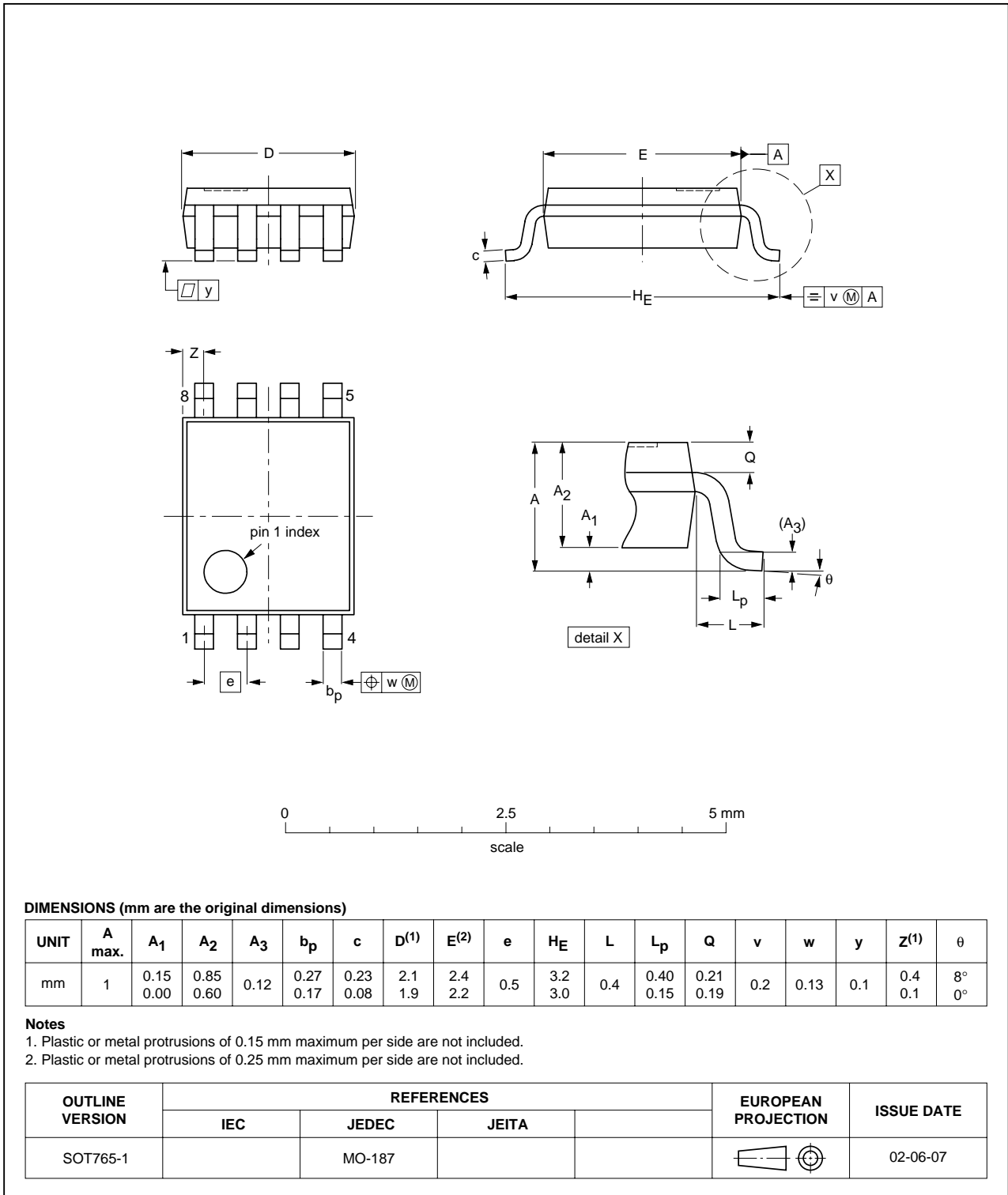**VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm**   **SOT765-1**

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E	L	L_p	Q	v	w	y	$Z^{(1)}$	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

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

DIMENSIONS (mm are the original dimensions)

UNIT	A(1) max	A1 max	b	D	E	e	e1	L	L1
mm	0.5	0.04	0.25 0.17	2.0 1.9	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

Notes
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT833-1	- - -	MO-252	- - -			~~04-07-22~~ 04-11-09
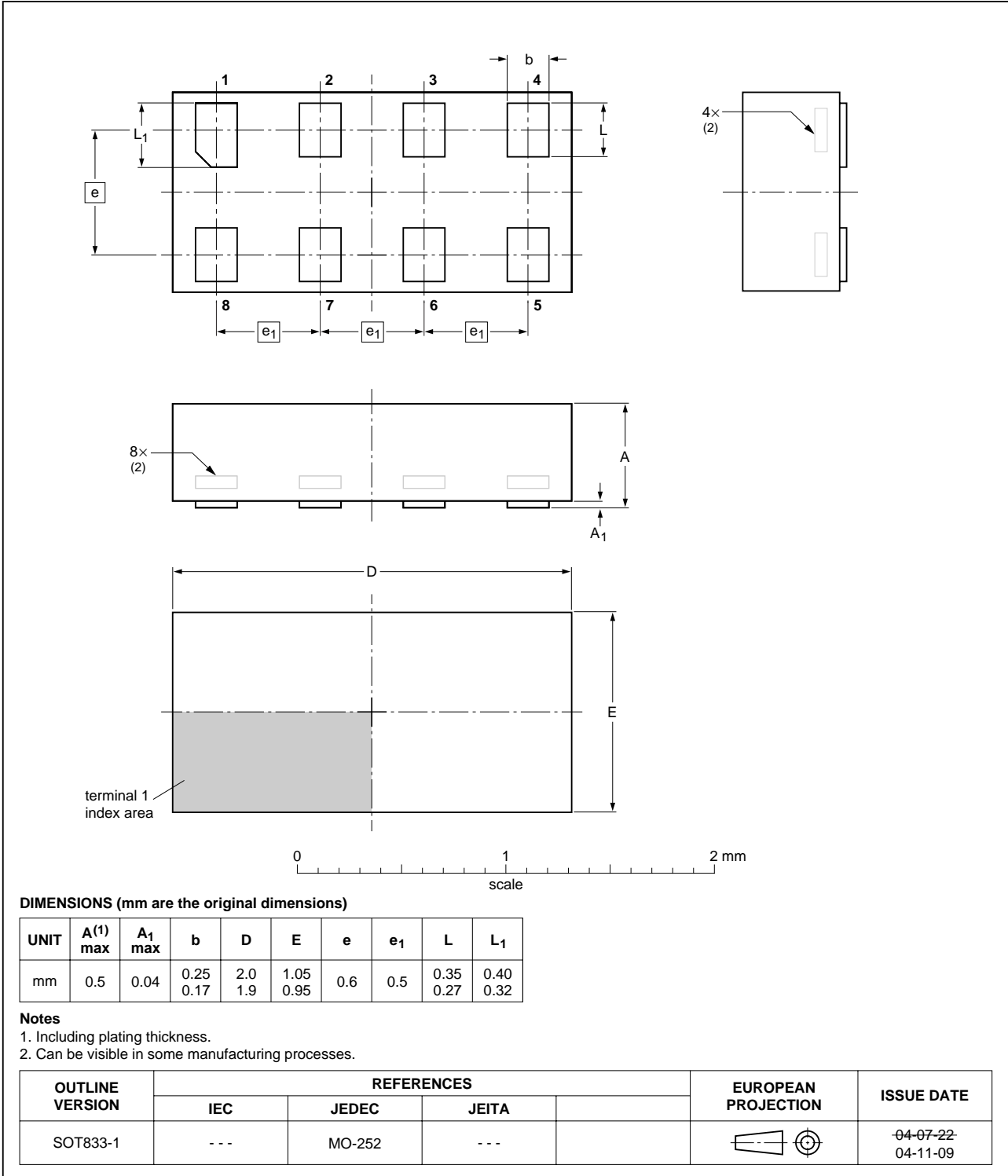
Fig 15. Package outline SOT833-1 (XSON8)

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	-

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.

21. 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.

Application information — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

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23. Contact information

For additional information, please visit: **http://www.semiconductors.philips.com**

For sales office addresses, send an email to: **sales.addresses@www.semiconductors.philips.com**

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Product data sheet

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