# 74LV1T126

# Single supply translating buffer/line driver; 3-state

Rev. 2 — 3 December 2019

Product data sheet

### 1. General description

The 74LV1T126 is a single, level translating buffer/line driver with 3-state output. The low threshold inputs support 1.8 V input logic at  $V_{CC}$  = 3.3 V and can be used in 1.8 V to 3.3 V level up translation. In addition, the 5 V tolerant input pins enable down translation (3.3 V to 2.5 V output at  $V_{CC}$  = 2.5 V). The 3-state output is controlled by the output enable input (OE). A LOW-level at OE causes the output to assume a high-impedance OFF-state. The output level is referenced to the supply voltage and supports 1.8 V, 2.5 V, 3.3 V and 5.0 V CMOS levels. The wide  $V_{CC}$  range permits the generation of output levels to connect to controllers or processors.

### 2. Features and benefits

- Single supply voltage translator at 1.8 V, 2.5 V, 3.3 V and 5.0 V
- Up translation
  - 1.2 V to 1.8 V at V<sub>CC</sub> = 1.8 V
  - 1.5 V to 2.5 V at V<sub>CC</sub> = 2.5 V
  - 1.8 V to 3.3 V at  $V_{CC}$  = 3.3 V
  - 3.3 V to 5.0 V at V<sub>CC</sub> = 5.0 V
- Down translation
  - 3.3 V to 1.8 V at V<sub>CC</sub> = 1.8 V
  - 3.3 V to 2.5 V at V<sub>CC</sub> = 2.5 V
  - 5.0 V to 3.3 V at V<sub>CC</sub> = 3.3 V
- 5 V tolerant inputs
- Latch-up performance exceeds 250 mA per JESD 78 Class II
- ESD protection:
  - HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2 kV
  - CDM JESD22-C101 exceeds 1 kV
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

## 3. Applications

- Portable applications
- PC and notebooks
- · Industrial controller
- Telecom



### Single supply translating buffer/line driver; 3-state

## 4. Ordering information

**Table 1. Ordering information** 

Type number	Package									
	Temperature range	Name	Description	Version						
74LV1T126GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1						
74LV1T126GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753						
74LV1T126GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm	SOT1226						

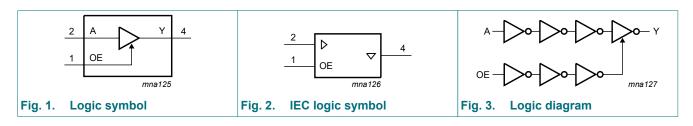
## 5. Marking

Table 2. Marking

Type number	Marking code[1]
74LV1T126GW	SP
74LV1T126GV	SP
74LV1T126GX	SP

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

## 6. Functional diagram



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## 7. Pinning information

### 7.1. Pinning



### 7.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
OE	1	output enable input
A	2	data input
GND	3	ground (0 V)
Υ	4	data output
V <sub>CC</sub>	5	supply voltage

## 8. Functional description

#### **Table 4. Function table**

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care; \ Z = high-impedance \ OFF-state.$ 

Input	Output	
OE	A	Υ
Н	L	L
Н	Н	Н
L	X	Z

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## 9. 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 <sub>CC</sub>	supply voltage		-0.5	+7.0	V
VI	input voltage	[1]	-0.5	+7.0	V
Vo	output voltage	output HIGH, LOW or 3-state [2][3]	-0.5	V <sub>CC</sub> + 0.5	V
		output in power-off state [2]	-0.5	4.6	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-20	-	mA
I <sub>OK</sub>	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$	-	±20	mA
I <sub>O</sub>	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±25	mA
I <sub>CC</sub>	supply current		-	50	mA
I <sub>GND</sub>	ground current		-50	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C [4]	-	250	mW

<sup>[1]</sup> If the input current ratings are observed, the minimum input voltage ratings may be exceeded.

## 10. Recommended operating conditions

#### Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V <sub>CC</sub>	supply voltage		1.6	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.8 V to 5.0 V	-	-	20	ns/V

<sup>[2]</sup> If the output current ratings are observed, the output voltage ratings may be exceeded.

<sup>[3]</sup> This value is limited to 7 V maximum.

<sup>[4]</sup> For SOT353-1 package: above 74 °C the value of P<sub>tot</sub> derates linearly with 3.3 mW/K. For SOT753 package: above 85 °C the value of P<sub>tot</sub> derates linearly with 3.8 mW/K. For SOT1226 package: above 67 °C the value of P<sub>tot</sub> derates linearly with 3.0 mW/K.

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## 11. Static characteristics

**Table 7. Static characteristics** 

Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	25 °	C	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Max	Min	Max	Min	Max	
V <sub>IH</sub>	HIGH-level	V <sub>CC</sub> = 1.65 V to 1.8 V	0.94	-	1.0	-	1.0	-	٧
	input voltage	V <sub>CC</sub> = 2.0 V	0.99	-	1.03	-	1.03	-	٧
		V <sub>CC</sub> = 2.25 V to 2.5 V	1.135	-	1.18	-	1.18	-	٧
		V <sub>CC</sub> = 2.75 V	1.21	-	1.23	-	1.23	-	٧
		V <sub>CC</sub> = 3.0 V to 3.3 V	1.35	-	1.37	-	1.37	-	V
		V <sub>CC</sub> = 3.6 V	1.47	-	1.48	-	1.48	-	٧
		V <sub>CC</sub> = 4.5 V to 5.0 V	2.02	-	2.03	-	2.03	-	٧
		V <sub>CC</sub> = 5.5 V	2.10	-	2.11	-	2.11	-	V
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 1.65 V to 2.0 V	-	0.58	-	0.55	-	0.55	V
	input voltage	V <sub>CC</sub> = 2.25 V to 2.75 V	-	0.75	-	0.71	-	0.71	V
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	0.80	-	0.65	-	0.65	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	0.80	-	0.80	-	0.80	V
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$ ;							
output voltage	V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = -20 μA	V <sub>CC</sub> -0.1	-	V <sub>CC</sub> -0.1	-	V <sub>CC</sub> -0.1	-	V	
		V <sub>CC</sub> = 1.65 V; I <sub>O</sub> = -2 mA	1.28	-	1.21	-	1.21	-	V
		V <sub>CC</sub> = 1.8 V; I <sub>O</sub> = -2 mA	1.5	-	1.45	-	1.45	-	٧
		$V_{CC} = 2.3 \text{ V}; I_{O} = -2.3 \text{ mA}$	2.0	-	2.0	-	2.0	-	V
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = -3 mA	2.0	-	1.93	-	1.93	-	٧
		$V_{CC} = 2.5 \text{ V}; I_{O} = -3 \text{ mA}$	2.25	-	2.15	-	2.15	-	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = -3 \text{ mA}$	2.78	-	2.7	-	2.7	-	٧
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -5.5 mA	2.6	-	2.49	-	2.49	-	٧
		$V_{CC} = 3.3 \text{ V}; I_{O} = -5.5 \text{ mA}$	2.9	-	2.8	-	2.8	-	٧
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -4 mA	4.2	-	4.1	-	4.1	-	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = -8 \text{ mA}$	4.1	-	3.95	-	3.95	-	٧
		V <sub>CC</sub> = 5.0 V; I <sub>O</sub> = -8 mA	4.6	-	4.5	-	4.5	-	٧
V <sub>OL</sub>	LOW-level	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>							
	output voltage	V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 20 μA	-	0.1	-	0.1	-	0.1	V
		V <sub>CC</sub> = 1.65 V; I <sub>O</sub> = 2 mA	-	0.2	-	0.25	-	0.25	٧
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = 2.3 mA	-	0.1	-	0.15	-	0.15	V
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = 3 mA	-	0.15	-	0.2	-	0.2	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 3 \text{ mA}$	-	0.1	-	0.15	-	0.15	٧
		$V_{CC} = 3.0 \text{ V}; I_{O} = 5.5 \text{ mA}$	-	0.2	-	0.252	-	0.252	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = 4 mA	-	0.15	-	0.2	-	0.2	٧
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = 8 mA	-	0.3	-	0.35	-	0.35	V
lı	input leakage current	$V_I = V_{CC}$ or GND; $V_{CC} = 0$ V to 5.5 V	-	±0.1	-	±1	-	±1	μΑ
l <sub>oz</sub>	OFF-state output current		-	±0.25	-	±2.5	-	±2.5	μA

## Single supply translating buffer/line driver; 3-state

Symbol	Parameter	Conditions	25 '	25 °C		-40 °C to +85 °C		-40 °C to +125 °C	
			Min	Max	Min	Max	Min	Max	
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.8 V, 2.5 V, 3.3 V, 5.0 V	-	1	-	10	-	10	μΑ
ΔI <sub>CC</sub>	additional supply current	per input pin; $V_{CC}$ = 1.8 V; $V_I$ = 0.3 V or 1.1 V; $I_O$ = 0 A; other pins at $V_{CC}$ or GND	-	10	-	10	-	10	μΑ
		per input pin; $V_{CC}$ = 5.5 V; $V_I$ = 0.3 V or 3.4 V; $I_O$ = 0 A; other pins at $V_{CC}$ or GND	-	1.35	-	1.5	-	1.5	mA

## 12. Dynamic characteristics

**Table 8. Dynamic characteristics** 

GND = 0 V. For test circuit, see Fig. 8.

Symbol	Parameter	neter Conditions		25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation	A to Y; see <u>Fig. 6</u> [1]								
	delay	V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 15 pF	-	6.5	9.6	-	10.8	-	11.6	ns
		V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 30 pF	-	7.6	10.8	-	12.2	-	13.2	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 15 pF	-	4.6	6.6	-	7.5	-	8.0	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 30 pF	-	5.3	7.4	-	8.4	-	9.1	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 15 pF	-	3.8	5.4	-	6.0	-	6.4	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 30 pF	-	4.4	6.0	-	6.8	-	7.3	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	3.2	4.1	-	4.4	-	4.7	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 30 pF	-	3.6	4.6	-	5.1	-	5.4	ns
t <sub>en</sub>	enable time	OE to Y; see Fig. 7 [1]								
		V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 15 pF	-	5.7	9.0	-	10.3	-	11.1	ns
		V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 30 pF	-	6.8	10.9	-	12.5	-	13.5	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 15 pF	-	3.9	5.8	-	6.7	-	7.3	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 30 pF	-	4.7	7.0	-	8.1	-	8.7	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 15 pF	-	3.1	4.5	-	5.2	-	5.6	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 30 pF	-	3.8	5.4	-	6.1	-	6.7	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	2.9	3.9	-	4.4	-	4.8	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 30 pF	-	3.4	4.5	-	5.1	-	5.5	ns
t <sub>dis</sub>	disable time	OE to Y; see Fig. 7 [1]								
		V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 15 pF	-	9.7	12.4	-	13.6	-	14.5	ns
		V <sub>CC</sub> = 1.8 V; C <sub>L</sub> = 30 pF	-	12.5	15.3	-	16.6	-	17.5	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 15 pF	-	7.0	8.5	-	9.5	-	10.0	ns
		V <sub>CC</sub> = 2.5 V; C <sub>L</sub> = 30 pF	-	8.9	10.5	-	11.5	-	12.0	ns
		V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 15 pF	-	5.7	6.9	-	7.5	-	7.9	ns
	V <sub>CC</sub> = 3.3 V; C <sub>L</sub> = 30 pF	-	7.2	8.4	-	9.0	-	9.4	ns	
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	4.3	5.3	-	5.6	-	5.8	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 30 pF	-	5.2	6.2	-	6.5	-	6.8	ns
C <sub>I</sub>	input capacitance	$V_I = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	1.5	10	-	10	-	10	pF

#### Single supply translating buffer/line driver; 3-state

Symbol	Parameter	Conditions		25 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
Co	output capacitance	$V_O = V_{CC}$ or GND; $V_{CC} = 3.3 \text{ V}$	-	2.5	-	-	-	-	-	pF
C <sub>PD</sub> power dissipation	dissipation	per buffer; $V_I$ = GND to $V_{CC}$ ; [2] $C_L$ = 30 pF; f = 10 MHz								
	capacitance	V <sub>CC</sub> = 1.8 V	-	4.4	-	-	-	-	-	pF
		V <sub>CC</sub> = 2.5 V	-	5.6	-	-	-	-	-	pF
		V <sub>CC</sub> = 3.3 V	-	7.4	-	-	-	-	-	pF
		V <sub>CC</sub> = 5.0 V	-	11.6	-	-	-	-	-	pF

- [1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ ,  $t_{en}$  is the same as  $t_{PZL}$  and  $t_{PZH}$ ,  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ . [2]  $C_{PD}$  is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ 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<sub>o</sub> = output frequency in MHz;

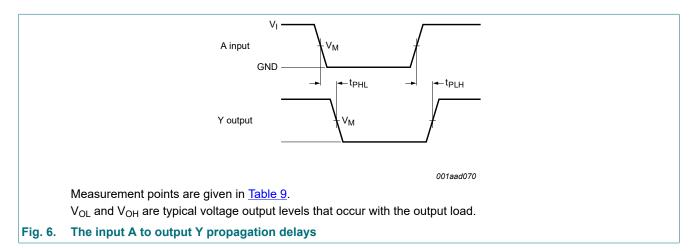
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

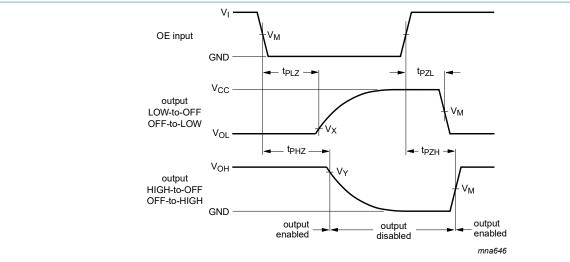
N = number of inputs switching;

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

#### 12.1. Waveforms and test circuit



#### Single supply translating buffer/line driver; 3-state



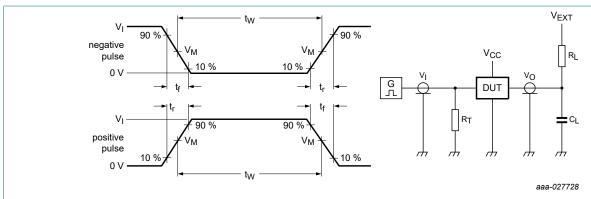
Measurement points are given in Table 9.

 $\ensuremath{V_{\text{OL}}}$  and  $\ensuremath{V_{\text{OH}}}$  are typical voltage output levels that occur with the output load.

Fig. 7. 3-state enable and disable times

**Table 9. Measurement points** 

Input	Output	utput						
V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>					
0.5V <sub>I</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.3 V	V <sub>OH</sub> - 0.3 V					



Test data is given in Table 10.

Definitions test circuit:

 $R_{T}$  = Termination resistance should be equal to output impedance  $Z_{o}$  of the pulse generator

C<sub>L</sub> = Load capacitance including jig and probe capacitance

R<sub>L</sub> = Load resistance

V<sub>EXT</sub> = External voltage for measuring switching times

Fig. 8. Test circuit for measuring switching times

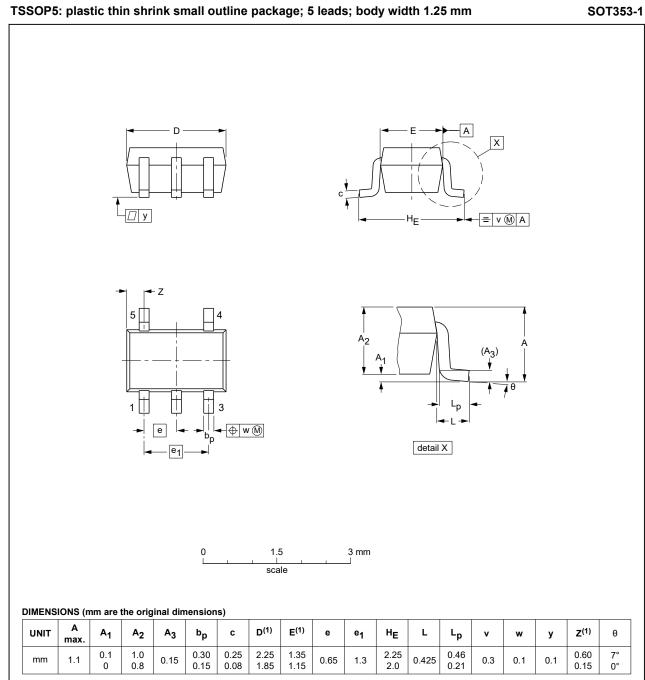
Table 10. Test data

Supply voltage	upply voltage Input			Load		V <sub>EXT</sub>		
V <sub>CC</sub>	VI	Δt/ΔV [1]	f <sub>max</sub>	CL	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZH</sub> , t <sub>PHZ</sub>	t <sub>PZL</sub> , t <sub>PLZ</sub>
1.8 V	V <sub>CC</sub>	≤ 1.0 ns/V	15 MHz	15 pF, 30 pF	1 kΩ	open	GND	V <sub>CC</sub>
2.5 V	V <sub>CC</sub>	≤ 1.0 ns/V	25 MHz	15 pF, 30 pF	1 kΩ	open	GND	V <sub>CC</sub>
3.3 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1 kΩ	open	GND	V <sub>CC</sub>
5.0 V	3 V	≤ 1.0 ns/V	50 MHz	15 pF, 30 pF	1 kΩ	open	GND	V <sub>CC</sub>

[1] dV/dt ≥ 1.0 V/ns

### Single supply translating buffer/line driver; 3-state

## 13. Package outline



#### Note

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

OUTLINE VERSION	REFERENCES				EUROPEAN	ISSUE DATE
	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT353-1		MO-203	SC-88A			<del>00-09-01</del> 03-02-19

Fig. 9. Package outline SOT353-1 (TSSOP5)

### Single supply translating buffer/line driver; 3-state

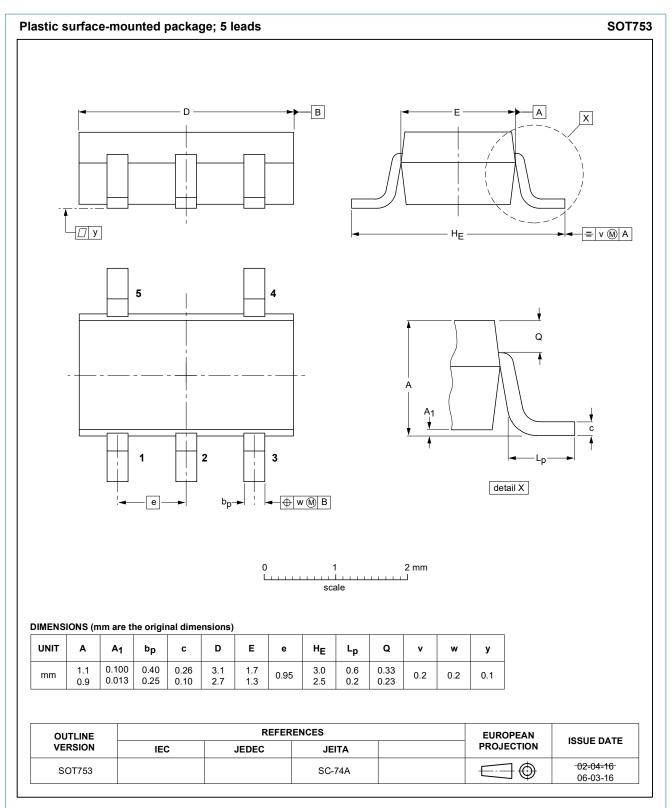


Fig. 10. Package outline SOT753 (SC-74A)

#### Single supply translating buffer/line driver; 3-state

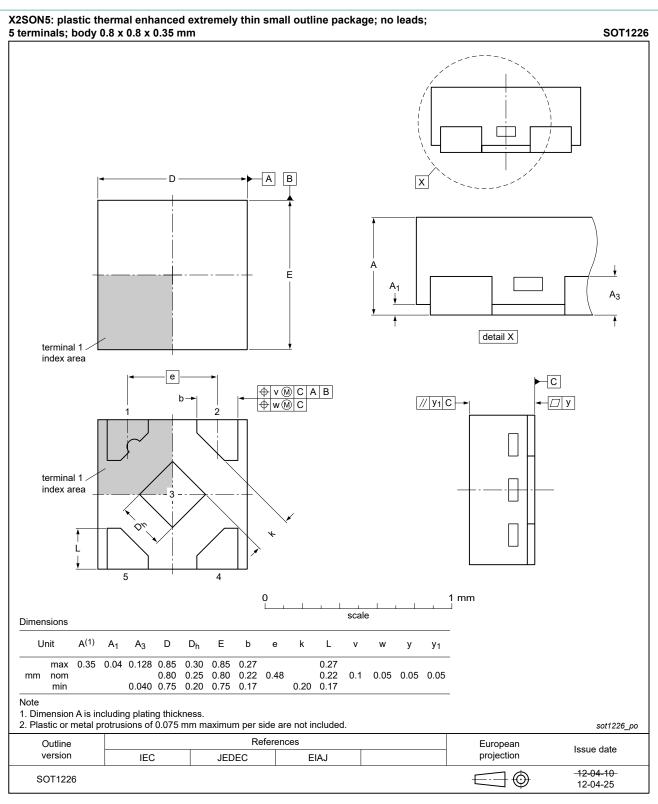


Fig. 11. Package outline SOT1226 (X2SON5)

## Single supply translating buffer/line driver; 3-state

### 14. Abbreviations

#### **Table 11. Abbreviations**

Acronym	Description
CDM	Charge Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model

## 15. Revision history

### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV1T126 v.2	20191203	Product data sheet	-	74LV1T126 v.1
Modifications:	<ul> <li>Type number 74LV1T126GV (SOT753/SC-74A) added.</li> <li><u>Table 5</u>: Derating values for P<sub>tot</sub> total power dissipation updated.</li> </ul>			
74LV1T126 v.1	20171128	Product data sheet	-	-

### 16. Legal information

#### **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.

- Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
- 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 <a href="https://www.nexperia.com">https://www.nexperia.com</a>.

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