

# 74LV1T126

Single supply translating buffer/line driver; 3-state

Rev. 2 — 3 December 2019

Product data sheet

## 1. General description

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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

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- 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  $V_{CC} = 1.8$  V
  - 1.5 V to 2.5 V at  $V_{CC} = 2.5$  V
  - 1.8 V to 3.3 V at  $V_{CC} = 3.3$  V
  - 3.3 V to 5.0 V at  $V_{CC} = 5.0$  V
- Down translation
  - 3.3 V to 1.8 V at  $V_{CC} = 1.8$  V
  - 3.3 V to 2.5 V at  $V_{CC} = 2.5$  V
  - 5.0 V to 3.3 V at  $V_{CC} = 3.3$  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

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

## 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
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

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

## 6. Functional diagram

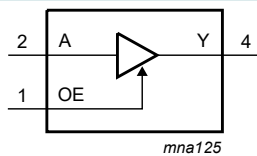


Fig. 1. Logic symbol

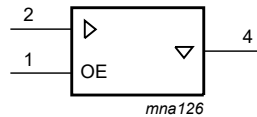


Fig. 2. IEC logic symbol

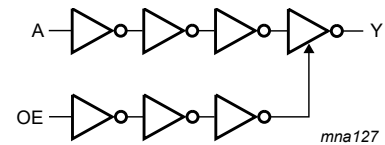


Fig. 3. Logic diagram

## 7. Pinning information

### 7.1. Pinning

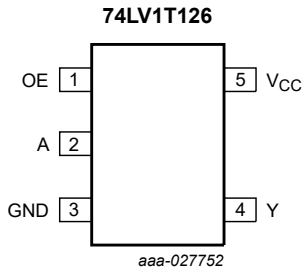


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

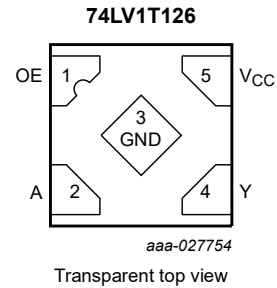


Fig. 5. Pin configuration SOT1226 (X2SON5)

### 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)
Y	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	Y
H	L	L
H	H	H
L	X	Z

## 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
$V_{CC}$	supply voltage		-0.5	+7.0	V
$V_I$	input voltage	[1]	-0.5	+7.0	V
$V_O$	output voltage	output HIGH, LOW or 3-state [2][3]	-0.5	$V_{CC} + 0.5$	V
		output in power-off state [2]	-0.5	4.6	V
$I_{IK}$	input clamping current	$V_I < 0$ V	-20	-	mA
$I_{OK}$	output clamping current	$V_O < 0$ V or $V_O > V_{CC}$	-	$\pm 20$	mA
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 25$	mA
$I_{CC}$	supply current		-	50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C [4]	-	250	mW

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

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

[3] This value is limited to 7 V maximum.

[4] For SOT353-1 package: above 74 °C the value of  $P_{tot}$  derates linearly with 3.3 mW/K.

For SOT753 package: above 85 °C the value of  $P_{tot}$  derates linearly with 3.8 mW/K.

For SOT1226 package: above 67 °C the value of  $P_{tot}$  derates linearly with 3.0 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		1.6	5.0	5.5	V
$V_I$	input voltage		0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.8$ V to 5.0 V	-	-	20	ns/V

## 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 input voltage	V <sub>CC</sub> = 1.65 V to 1.8 V	0.94	-	1.0	-	1.0	-	V
		V <sub>CC</sub> = 2.0 V	0.99	-	1.03	-	1.03	-	V
		V <sub>CC</sub> = 2.25 V to 2.5 V	1.135	-	1.18	-	1.18	-	V
		V <sub>CC</sub> = 2.75 V	1.21	-	1.23	-	1.23	-	V
		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	-	V
		V <sub>CC</sub> = 4.5 V to 5.0 V	2.02	-	2.03	-	2.03	-	V
		V <sub>CC</sub> = 5.5 V	2.10	-	2.11	-	2.11	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 2.0 V	-	0.58	-	0.55	-	0.55	V
		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 output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ;							
		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	-	V
		V <sub>CC</sub> = 2.3 V; I <sub>O</sub> = -2.3 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	-	V
		V <sub>CC</sub> = 2.5 V; I <sub>O</sub> = -3 mA	2.25	-	2.15	-	2.15	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -3 mA	2.78	-	2.7	-	2.7	-	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = -5.5 mA	2.6	-	2.49	-	2.49	-	V
		V <sub>CC</sub> = 3.3 V; I <sub>O</sub> = -5.5 mA	2.9	-	2.8	-	2.8	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -4 mA	4.2	-	4.1	-	4.1	-	V
		V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = -8 mA	4.1	-	3.95	-	3.95	-	V
V <sub>CC</sub> = 5.0 V; I <sub>O</sub> = -8 mA	4.6	-	4.5	-	4.5	-	V		
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>							
		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	V
		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 <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 3 mA	-	0.1	-	0.15	-	0.15	V
		V <sub>CC</sub> = 3.0 V; I <sub>O</sub> = 5.5 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	V
V <sub>CC</sub> = 4.5 V; I <sub>O</sub> = 8 mA	-	0.3	-	0.35	-	0.35	V		
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	±0.1	-	±1	-	±1	µA
I <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 °C		-40 °C to +85 °C		-40 °C to +125 °C		Unit
			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	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>CC</sub> = 1.8 V; V <sub>I</sub> = 0.3 V or 1.1 V; I <sub>O</sub> = 0 A; other pins at V <sub>CC</sub> or GND	-	10	-	10	-	10	μA
		per input pin; V <sub>CC</sub> = 5.5 V; V <sub>I</sub> = 0.3 V or 3.4 V; I <sub>O</sub> = 0 A; other pins at V <sub>CC</sub> 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	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Fig. 6 [1]								
		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
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
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
C <sub>I</sub>	input capacitance	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 3.3 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	Typ	Max	Min	Max	Min	Max	
C <sub>O</sub>	output capacitance	V <sub>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 3.3 V	-	2.5	-	-	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	per buffer; V <sub>I</sub> = GND to V <sub>CC</sub> ; C <sub>L</sub> = 30 pF; f = 10 MHz [2]								
		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<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>, t<sub>en</sub> is the same as t<sub>PZL</sub> and t<sub>PZH</sub>, t<sub>dis</sub> is the same as t<sub>PLZ</sub> and t<sub>PHZ</sub>.

[2] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

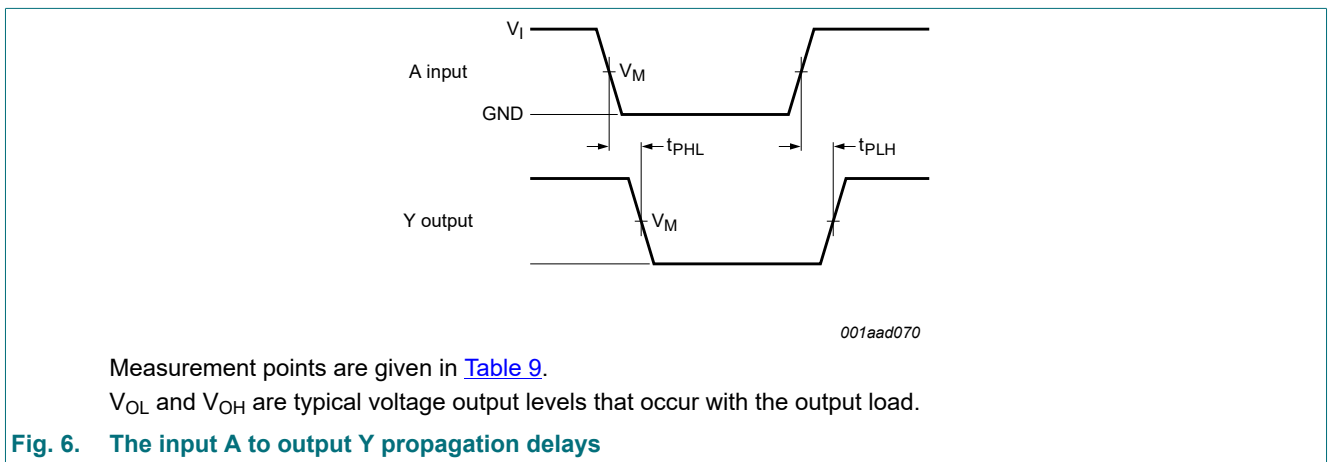
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

### 12.1. Waveforms and test circuit



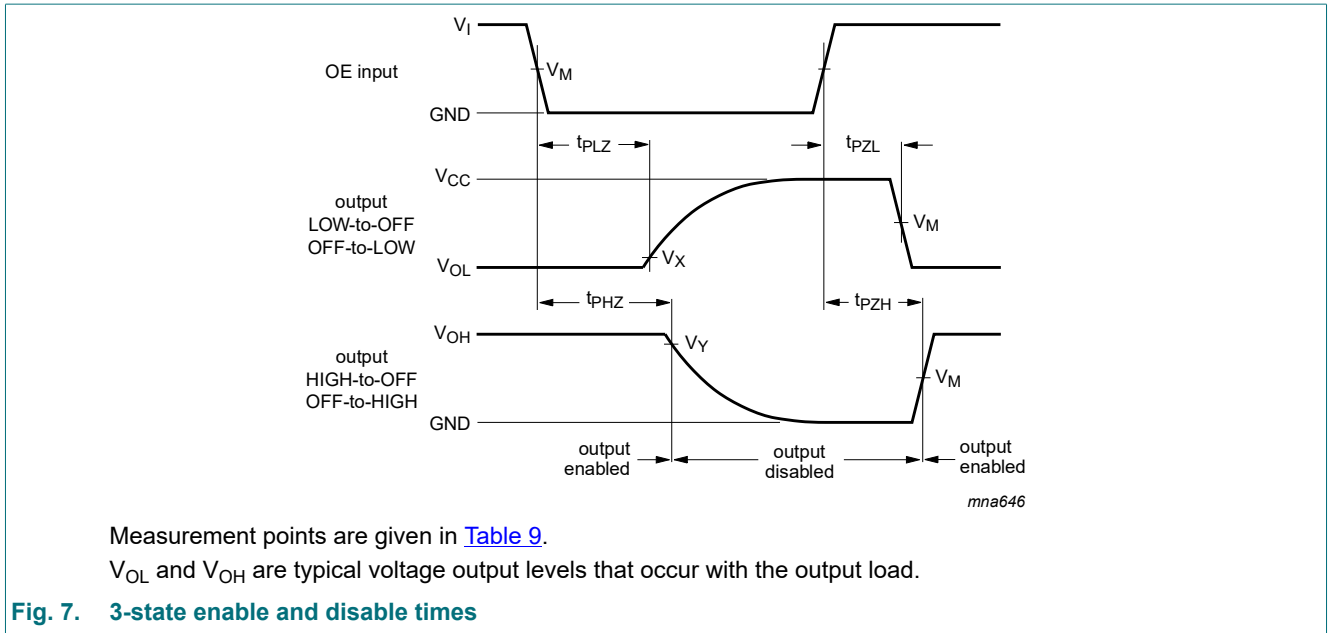


Table 9. Measurement points

Input	Output		
$V_M$	$V_M$	$V_X$	$V_Y$
$0.5V_I$	$0.5V_{CC}$	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$

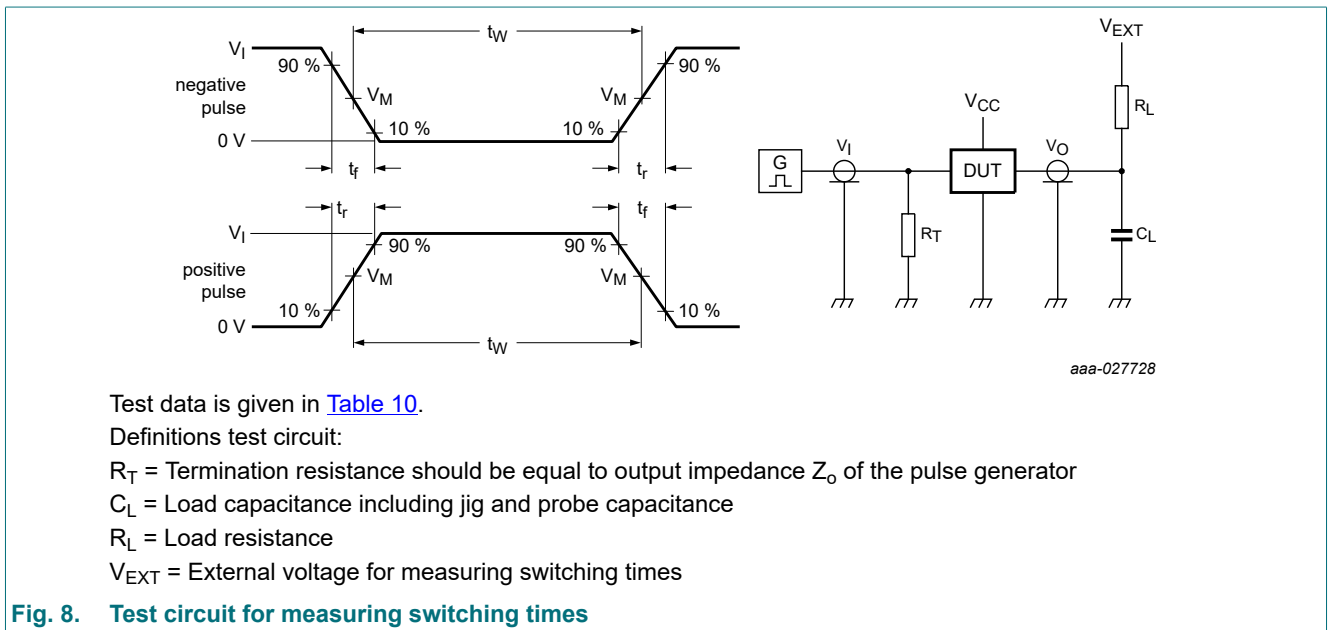


Table 10. Test data

Supply voltage	Input			Load		$V_{EXT}$		
$V_{CC}$	$V_I$	$\Delta t/\Delta V$ [1]	$f_{max}$	$C_L$	$R_L$	$t_{PLH}, t_{PHL}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
1.8 V	$V_{CC}$	$\leq 1.0 \text{ ns/V}$	15 MHz	15 pF, 30 pF	1 k $\Omega$	open	GND	$V_{CC}$
2.5 V	$V_{CC}$	$\leq 1.0 \text{ ns/V}$	25 MHz	15 pF, 30 pF	1 k $\Omega$	open	GND	$V_{CC}$
3.3 V	3 V	$\leq 1.0 \text{ ns/V}$	50 MHz	15 pF, 30 pF	1 k $\Omega$	open	GND	$V_{CC}$
5.0 V	3 V	$\leq 1.0 \text{ ns/V}$	50 MHz	15 pF, 30 pF	1 k $\Omega$	open	GND	$V_{CC}$

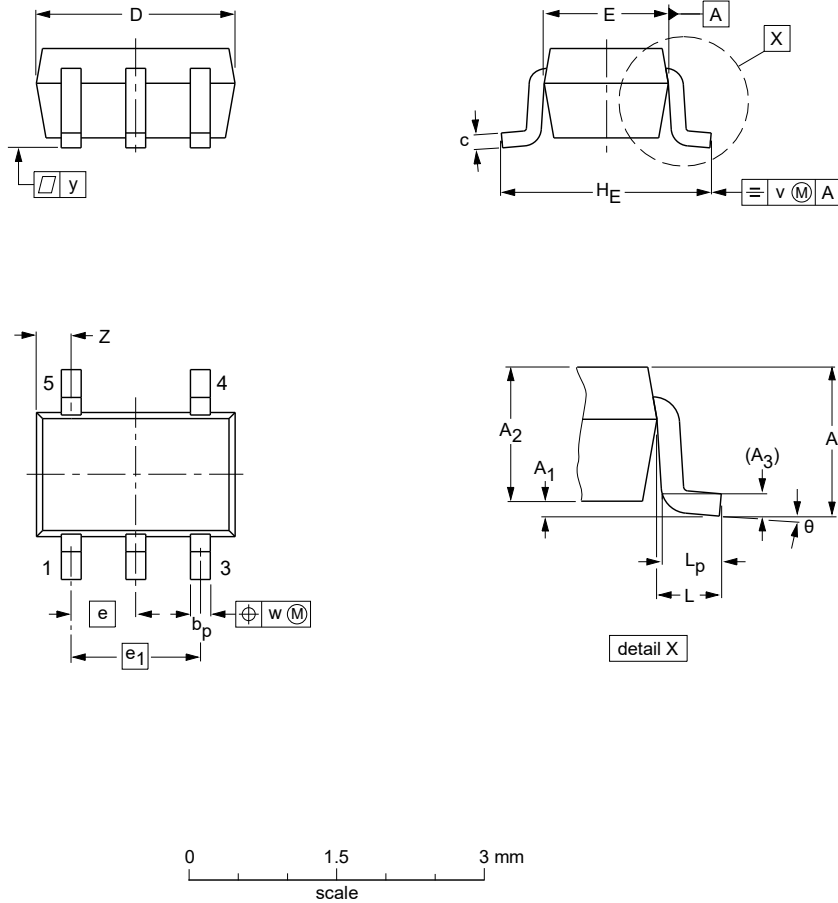
[1]  $dV/dt \geq 1.0 \text{ V/ns}$



13. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 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			
SOT353-1		MO-203	SC-88A			00-09-01 03-02-19

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

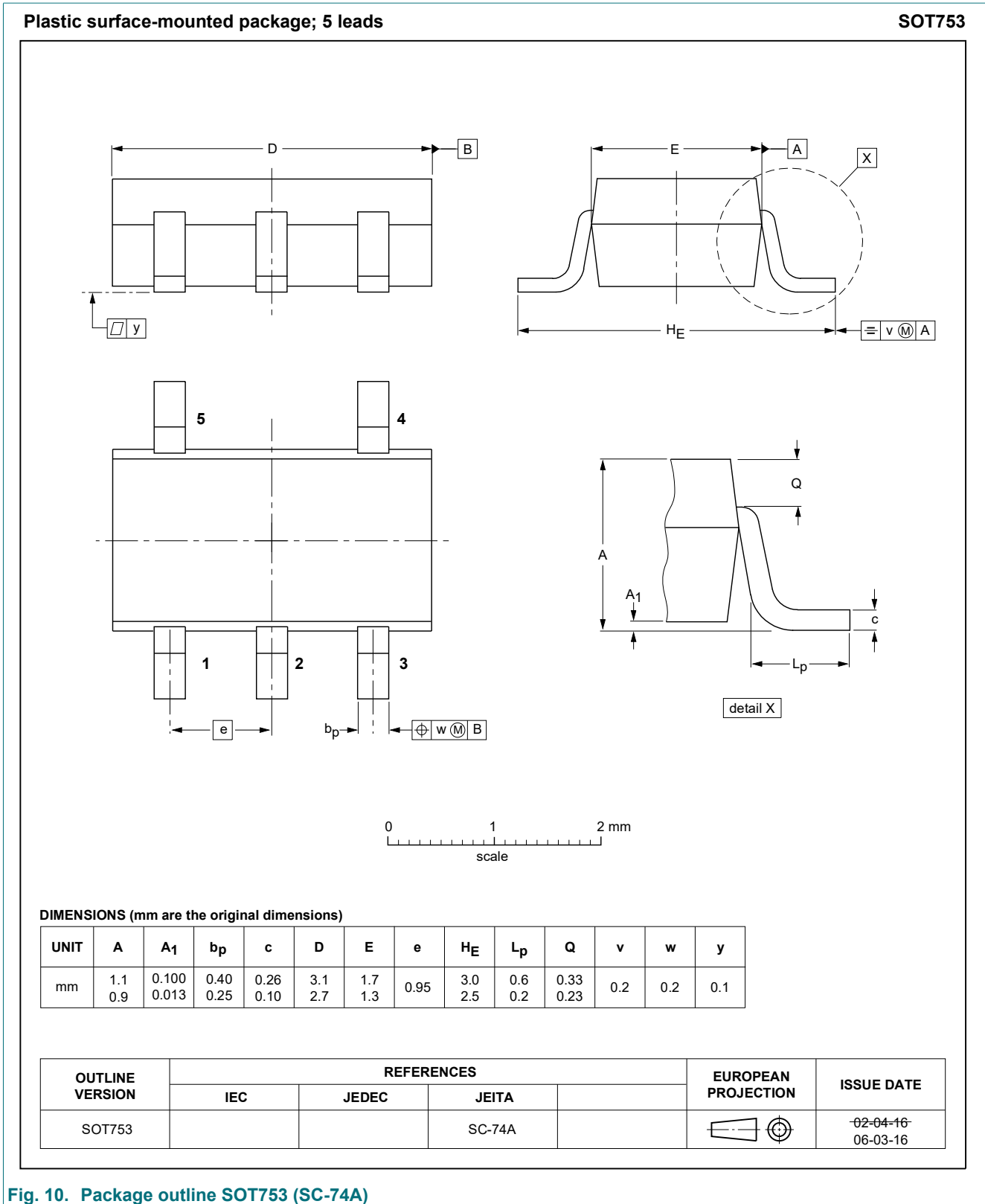
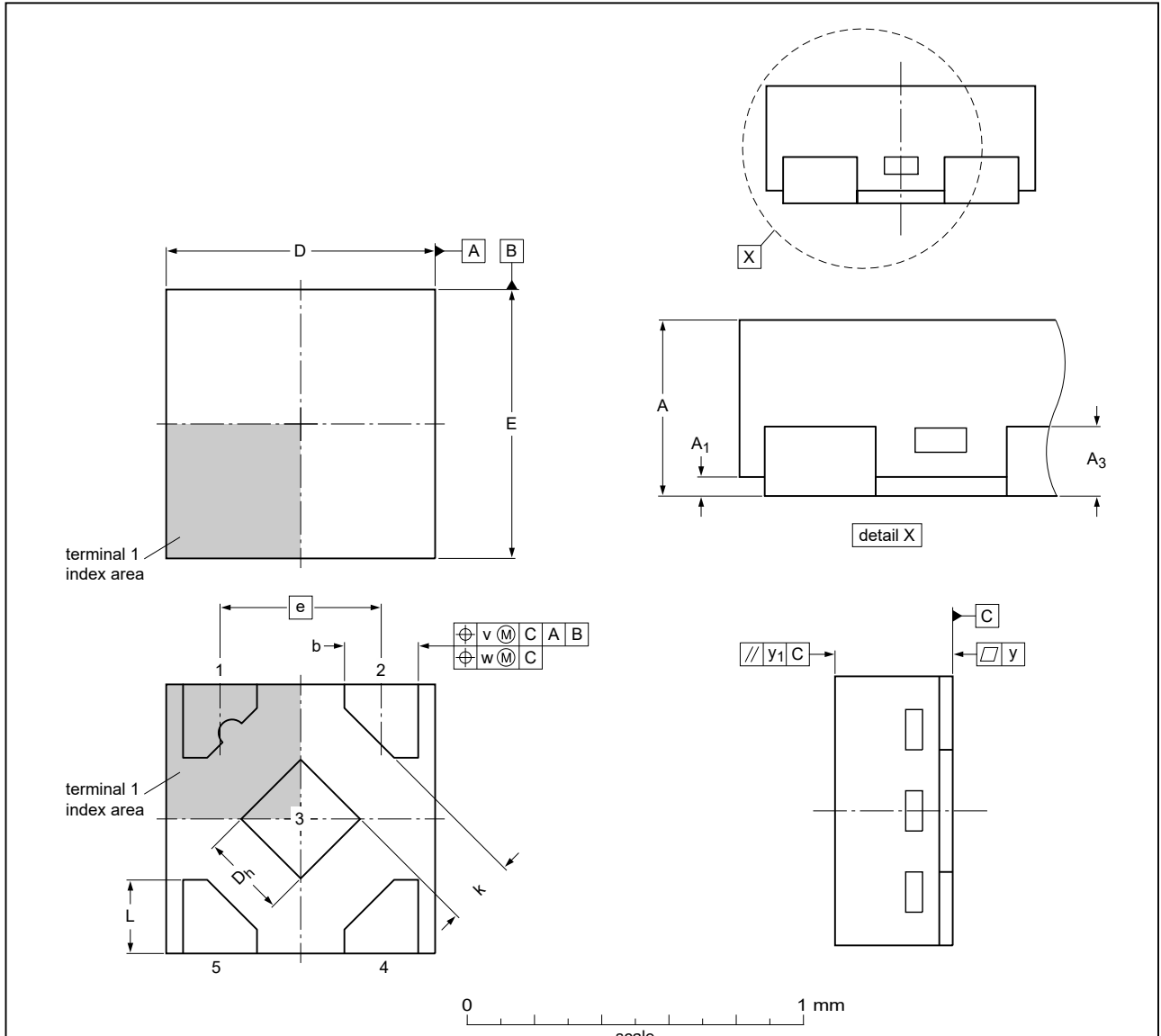


Fig. 10. Package outline SOT753 (SC-74A)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;  
5 terminals; body 0.8 x 0.8 x 0.35 mm

SOT1226



Dimensions

Unit	A <sup>(1)</sup>	A <sub>1</sub>	A <sub>3</sub>	D	D <sub>h</sub>	E	b	e	k	L	v	w	y	y <sub>1</sub>
max	0.35	0.04	0.128	0.85	0.30	0.85	0.27			0.27				
nom				0.80	0.25	0.80	0.22	0.48		0.22	0.1	0.05	0.05	0.05
min			0.040	0.75	0.20	0.75	0.17		0.20	0.17				

Note

- Dimension A is including plating thickness.
- Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1226\_po

Outline version	References			European projection	Issue date
	IEC	JEDEC	EIAJ		
SOT1226					<del>12-04-10</del> 12-04-25

Fig. 11. Package outline SOT1226 (X2SON5)

## 14. Abbreviations

Table 11. Abbreviations

Acronym	Description
CDM	Charge Device Model
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	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 style="list-style-type: none"> <li>Type number 74LV1T126GV (SOT753/SC-74A) added.</li> <li><a href="#">Table 5</a>: Derating values for <math>P_{tot}</math> 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.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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