

74LV153

Dual 4-input multiplexer

Rev. 5 — 12 December 2011

Product data sheet

1. General description

The 74LV153 is a low-voltage Si-gate CMOS device that is pin and function compatible with 74HC153 and 74HCT153.

The 74LV153 provides a dual 4-input multiplexer which selects 2 bits of data from up to four sources selected by common data select inputs (S_0 , S_1). The two 4-input multiplexer circuits have individual active LOW output enable inputs ($1\bar{E}$, $2\bar{E}$) which can be used to strobe the outputs independently. The outputs ($1Y$, $2Y$) are forced LOW when the corresponding output enable inputs are HIGH. The 74LV153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch, is determined by the logic levels applied to S_0 and S_1 . The logic equations for the outputs are:

$$1Y = 1\bar{E} \times (1I_0 \times \bar{S}_1 \times \bar{S}_0 + 1I_1 \times \bar{S}_1 \times S_0 + 1I_2 \times S_1 \times \bar{S}_0 + 1I_3 \times S_1 \times S_0)$$

$$2Y = 2\bar{E} \times (2I_0 \times \bar{S}_1 \times \bar{S}_0 + 2I_1 \times \bar{S}_1 \times S_0 + 2I_2 \times S_1 \times \bar{S}_0 + 2I_3 \times S_1 \times S_0)$$

The 74LV153 can be used to move data to a common output bus from a group of registers. The state of the select inputs would determine the particular register from which the data came. An alternative application is a function generator. The device can generate two functions or three variables. This is useful for implementing highly irregular random logic.

2. Features and benefits

- Wide operating voltage: 1.0 V to 3.6 V
- Accepts TTL input levels between $V_{CC} = 2.7$ V and $V_{CC} = 3.6$ V
- Typical output ground bounce < 0.8 V at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C
- Typical HIGH-level output voltage (V_{OH}) undershoot: > 2 V at $V_{CC} = 3.3$ V and $T_{amb} = 25$ °C
- Non-inverting outputs
- Separate enable input for each output
- Common select inputs
- Permits multiplexing from n lines to 1 line
- Enable line provided for cascading (n lines to 1 line)
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and from -40 °C to $+125$ °C

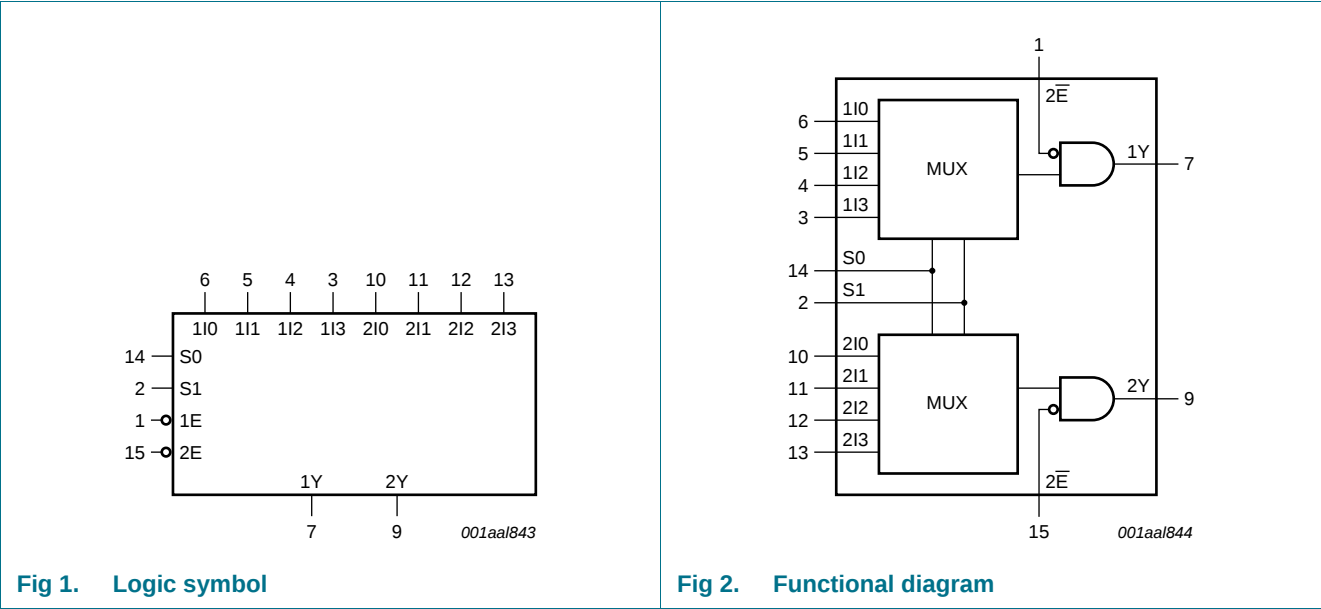


3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LV153N	−40 °C to +125 °C	DIP16	plastic dual in-line package; 16 leads (300 mil)	SOT38-4
74LV153D	−40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LV153DB	−40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74LV153PW	−40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1

4. Functional diagram



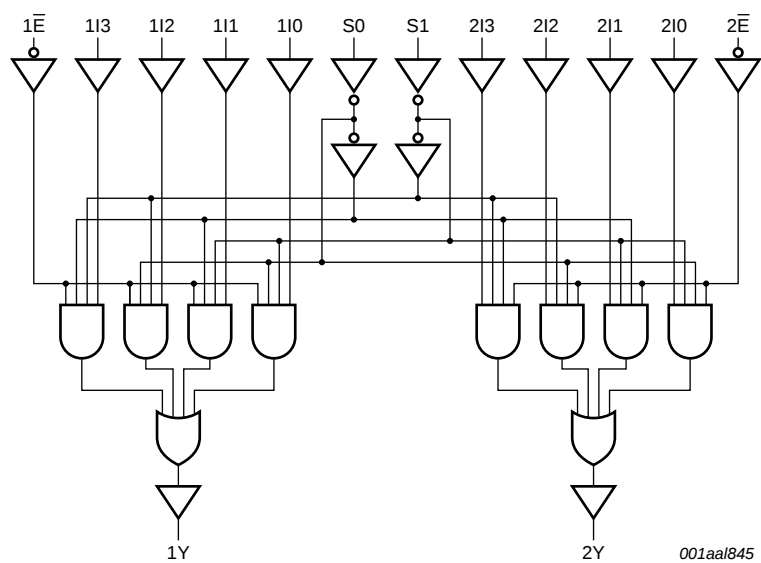


Fig 3. Logic diagram

5. Pinning information

5.1 Pinning

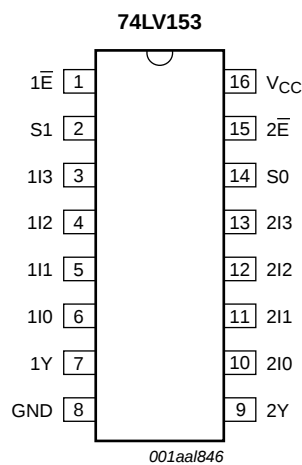


Fig 4. Pin configuration DIP16, SO16

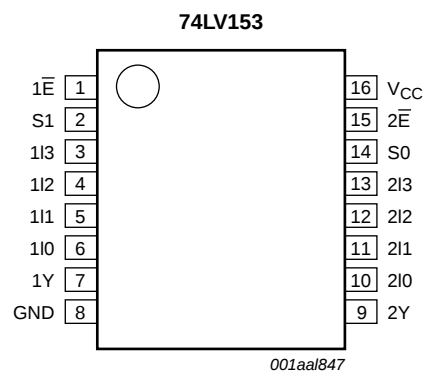


Fig 5. Pin configuration (T)SSOP16

5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
1 $\overline{E}$, 2 $\overline{E}$	1, 15	output enable inputs (active LOW)
S0, S1	14, 2	data select inputs
1I0, 1I1, 1I2, 1I3	6, 5, 4, 3	data inputs source 1
1Y	7	multiplexer output source 1
GND	8	ground (0 V)
2Y	9	multiplexer output source 2
2I0, 2I1, 2I2, 2I3	10, 11, 12, 13	data inputs source 2
V _{CC}	16	supply voltage

6. Functional description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care.

select inputs		data inputs				output enable	output
S0	S1	nI0	nI1	nI2	nI3	n $\overline{E}$	nY
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
H	L	X	L	X	X	L	L
H	L	X	H	X	X	L	H
L	H	X	X	L	X	L	L
L	H	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

7. Limiting values

Table 4. 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	+4.6	V
I _{IK}	input clamping current	V _I < -0.5 V or V _I > V _{CC} + 0.5 V	1 -	±20	mA
I _{OK}	output clamping current	V _O < -0.5 V or V _O > V _{CC} + 0.5 V	1 -	±50	mA
I _O	output current	V _O = -0.5 V to (V _{CC} + 0.5 V)	-	±25	mA
I _{CC}	supply current		-	50	mA
I _{GND}	ground current		-50	-	mA
T _{stg}	storage temperature		-65	+150	°C

Table 4. Limiting values ...continued

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C			
	DIP16 package		[2] -	750	mW
	SO16 package		[3] -	500	mW
	(T)SSOP16 package		[4] -	500	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] P_{tot} derates linearly with 12 mW/K above 70 °C.

[3] P_{tot} derates linearly with 8 mW/K above 70 °C.

[4] P_{tot} derates linearly with 5.5 mW/K above 60 °C.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{CC}	supply voltage	[1]	1.0	3.3	3.6	V
V _I	input voltage		0	-	V _{CC}	V
V _O	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
Δt/ΔV	input transition rise and fall rate	V _{CC} = 1.0 V to 2.0 V	-	-	500	ns/V
		V _{CC} = 2.0 V to 2.7 V	-	-	200	ns/V
		V _{CC} = 2.7 V to 3.6 V	-	-	100	ns/V

[1] The static characteristics are guaranteed from V_{CC} = 1.2 V to V_{CC} = 5.5 V, but LV devices are guaranteed to function down to V_{CC} = 1.0 V (with input levels GND or V_{CC}).

9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	–40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
V _{IH}	HIGH-level input voltage	V _{CC} = 1.2 V	0.9	-	-	0.9	-	V
		V _{CC} = 2.0 V	1.4	-	-	1.4	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.2 V	-	-	0.3	-	0.3	V
		V _{CC} = 2.0 V	-	-	0.6	-	0.6	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
V _{OH}	HIGH-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = –100 µA; V _{CC} = 1.2 V	-	1.2	-	-	-	V
		I _O = –100 µA; V _{CC} = 2.0 V	1.8	2.0	-	1.8	-	V
		I _O = –100 µA; V _{CC} = 2.7 V	2.5	2.7	-	2.5	-	V
		I _O = –100 µA; V _{CC} = 3.0 V	2.8	3.0	-	2.8	-	V
		I _O = –6 mA; V _{CC} = 3.0 V	2.4	2.82	-	2.2	-	V
V _{OL}	LOW-level output voltage	V _I = V _{IH} or V _{IL}						
		I _O = 100 µA; V _{CC} = 1.2 V	-	0	-	-	-	V
		I _O = 100 µA; V _{CC} = 2.0 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 2.7 V	-	0	0.2	-	0.2	V
		I _O = 100 µA; V _{CC} = 3.0 V	-	0	0.2	-	0.2	V
		I _O = 6 mA; V _{CC} = 3.0 V	-	0.25	0.40	-	0.50	V
I _I	input leakage current	V _I = V _{CC} or GND; V _{CC} = 3.6 V	-	-	1.0	-	1.0	µA
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 3.6 V	-	-	20.0	-	160	µA
ΔI _{CC}	additional supply current	per input; V _I = V _{CC} – 0.6 V; V _{CC} = 2.7 V to 3.6 V	-	-	500	-	850	µA
C _I	input capacitance		-	3.5	-	-	-	pF

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

10. Dynamic characteristics

Table 7. Dynamic characteristics

GND = 0 V; For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	–40 °C to +85 °C			–40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	1In to 1Y and 2In to 2Y; see Figure 6						
		$V_{CC} = 1.2\text{ V}$	-	85	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	29	56	-	66	ns
		$V_{CC} = 2.7\text{ V}$	-	21	41	-	49	ns
		$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	16	33	-	39	ns
		Sn to nY; see Figure 6						
		$V_{CC} = 1.2\text{ V}$	-	90	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	31	58	-	70	ns
		$V_{CC} = 2.7\text{ V}$	-	23	43	-	51	ns
		$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	17	34	-	41	ns
		n $\bar{E}$ to nY; see Figure 6						
		$V_{CC} = 1.2\text{ V}$	-	60	-	-	-	ns
		$V_{CC} = 2.0\text{ V}$	-	20	39	-	46	ns
		$V_{CC} = 2.7\text{ V}$	-	15	29	-	34	ns
		$V_{CC} = 3.3\text{ V}; C_L = 15\text{ pF}$	-	10	-	-	-	ns
		$V_{CC} = 3.0\text{ V to }3.6\text{ V}$ ^[3]	-	11	23	-	27	ns
C_{PD}	power dissipation capacitance	$C_L = 50\text{ pF}; f_i = 1\text{ MHz}; V_i = \text{GND to }V_{CC}$ ^[4]	-	30	-	-	-	pF

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

[2] t_{pd} is the same as t_{PLH} and t_{PHL} .

[3] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3\text{ V}$) unless otherwise stated.

[4] 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

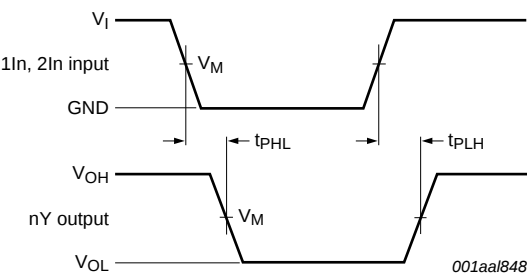
C_L = output load capacitance in pF

V_{CC} = supply voltage in V

N = number of inputs switching

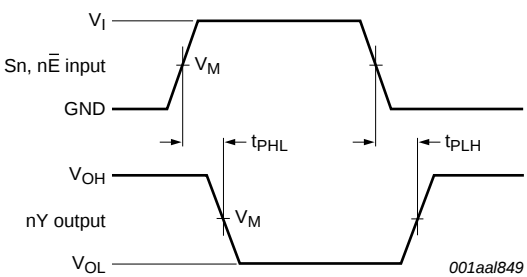
$\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of the outputs.

11. Waveforms



Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 6. The input (1In, 2In) to output (1Y, 2Y) propagation delays

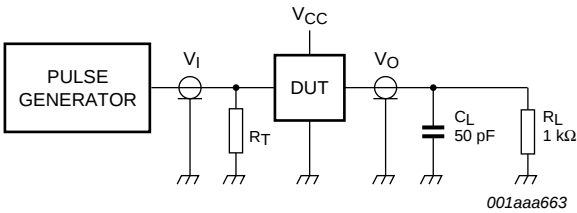


Measurement points are given in [Table 8](#).
 V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Fig 7. The input (Sn, nE) to output (nY) propagation delays

Table 8. Measurement points

Supply voltage	Input	Output
V_{CC}	V_M	V_M
< 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
2.7 V to 3.6 V	1.5 V	1.5 V



Test data is given in [Table 9](#).
Definitions test circuit:
 R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.
 R_L = Load resistance.
 C_L = Load capacitance including jig and probe capacitance.

Fig 8. Test circuit for measuring switching times

Table 9. Test data

Supply voltage	Input	
V_{CC}	V_I	t_r, t_f
< 2.7 V	V_{CC}	≤ 2.5 ns
2.7 V to 3.6 V	2.7 V	≤ 2.5 ns

12. Package outline

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

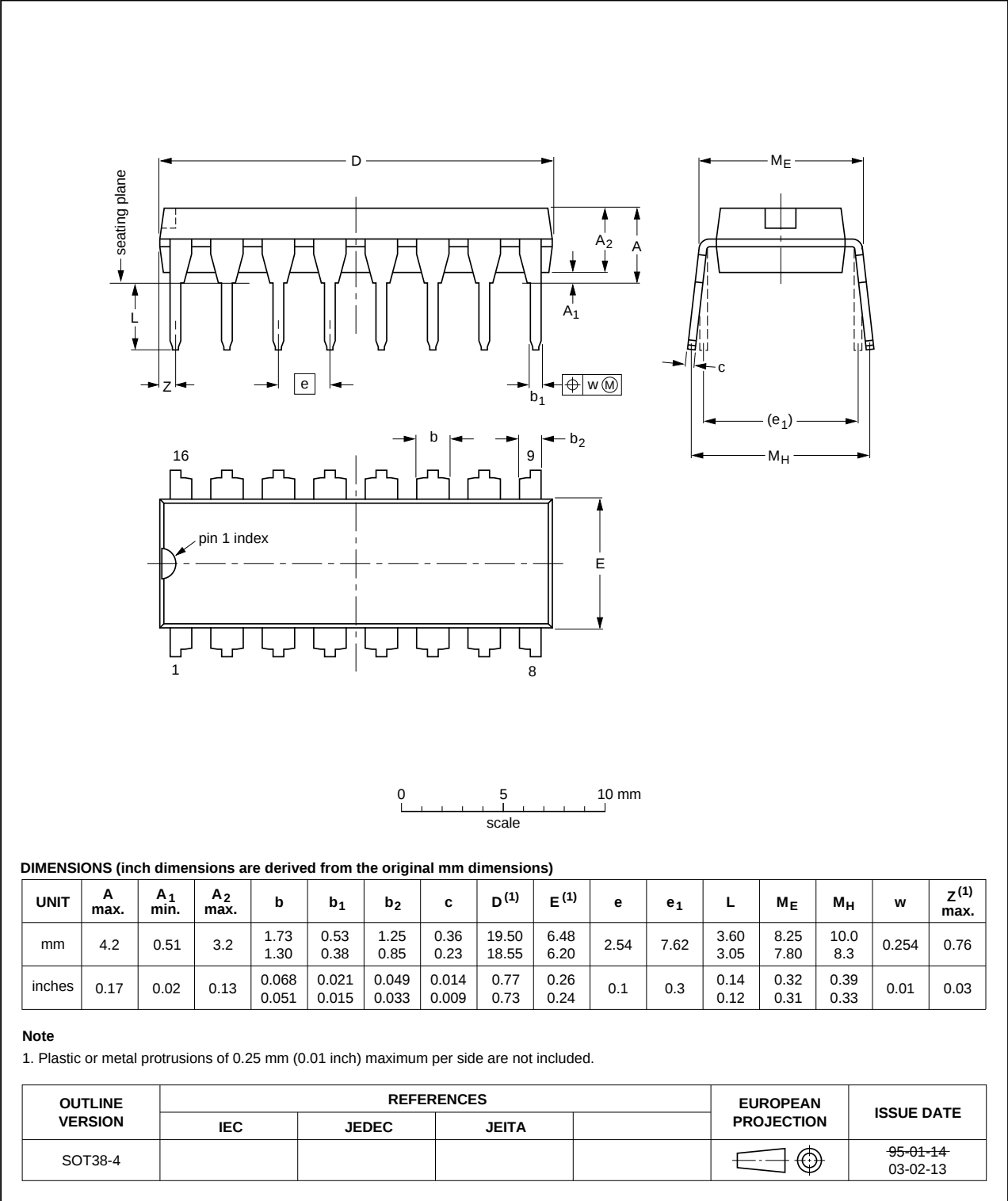
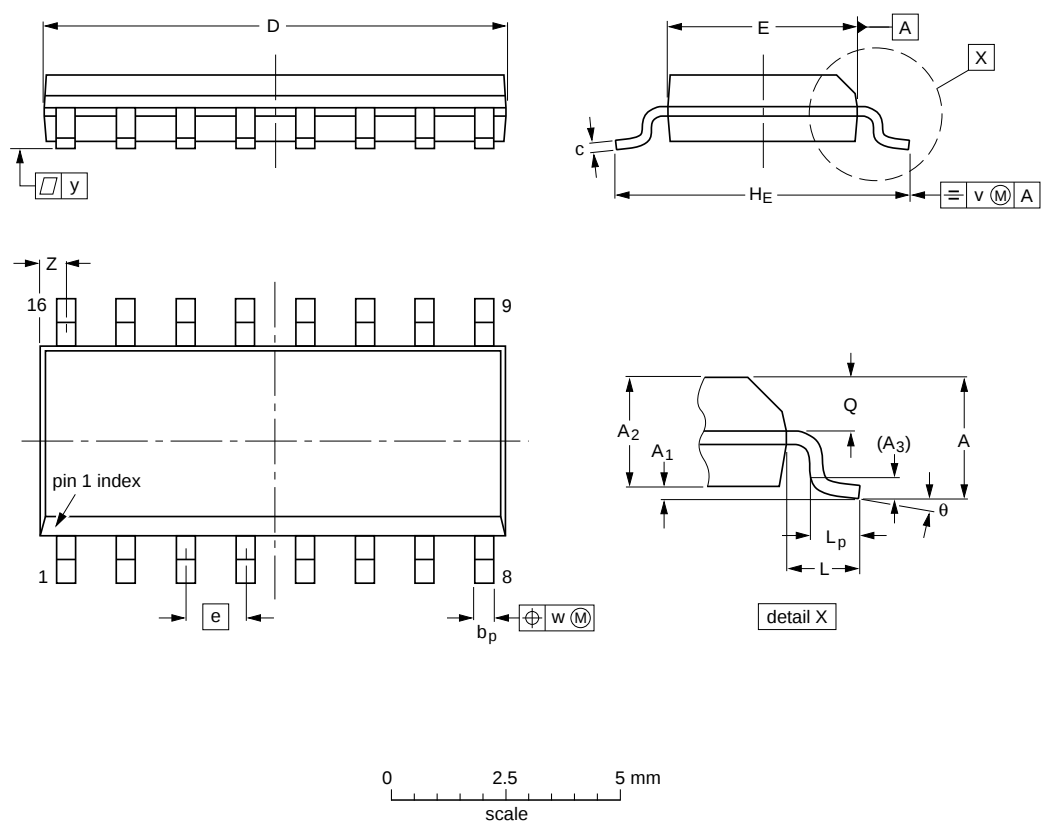


Fig 9. Package outline SOT38-4 (DIP16)

SO16: plastic small outline package; 16 leads; body width 3.9 mm

SOT109-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _E	L	L _p	Q	v	w	y	z ⁽¹⁾	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT109-1	076E07	MS-012				99-12-27 03-02-19

Fig 10. Package outline SOT109-1 (SO16)

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1

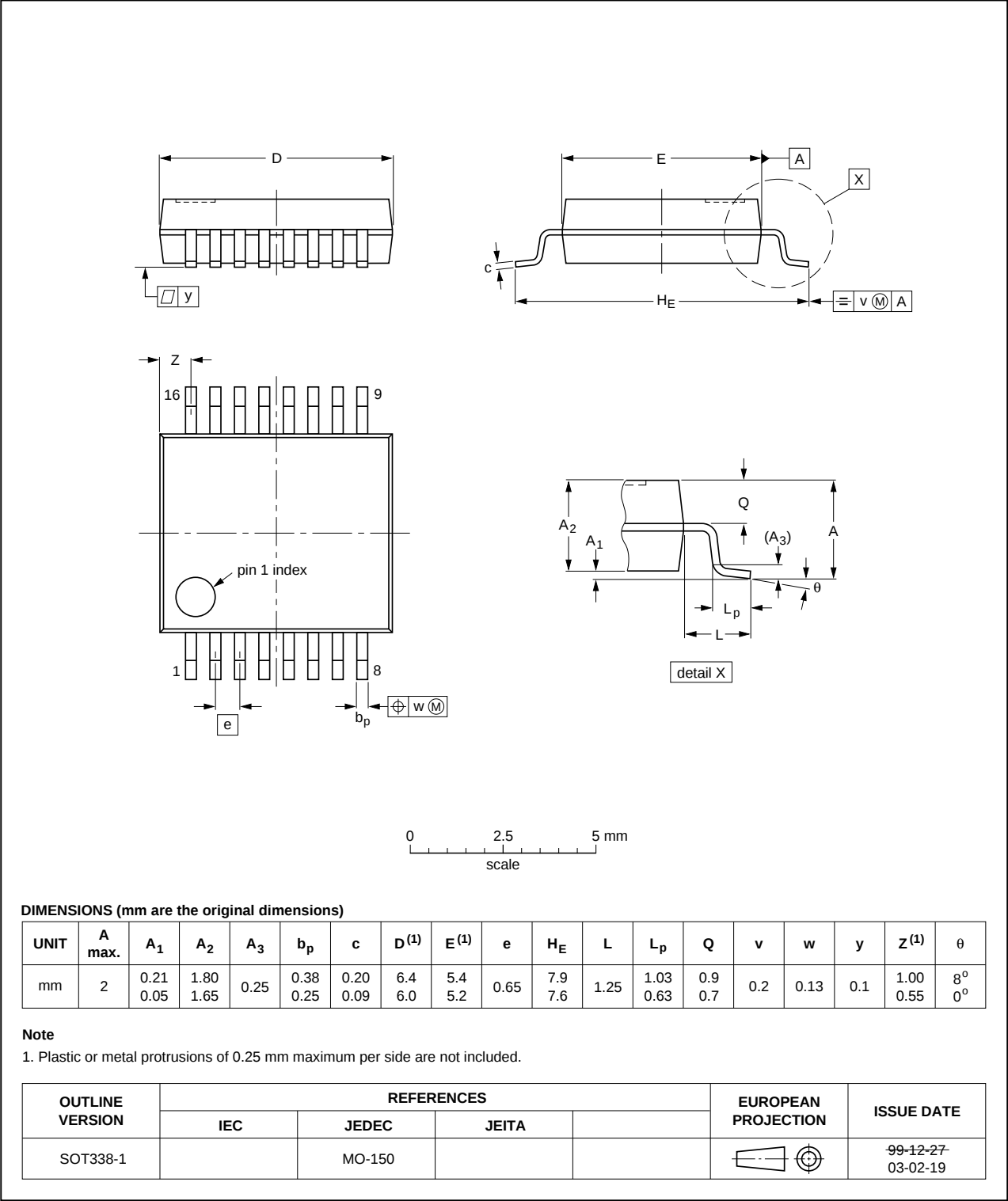


Fig 11. Package outline SOT338-1 (SSOP16)

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1

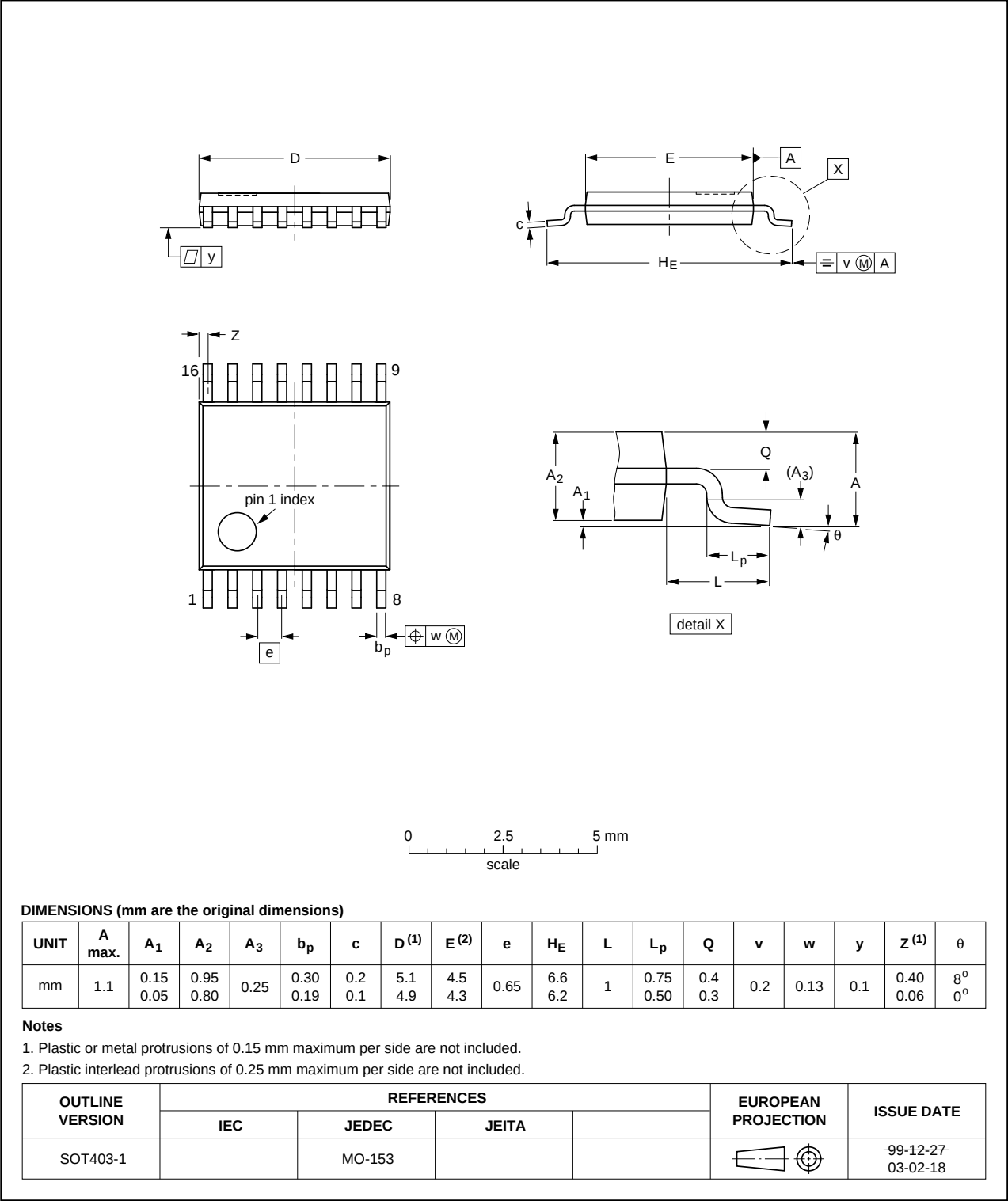


Fig 12. Package outline SOT403-1 (TSSOP16)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LV153 v.5	20111212	Product data sheet	-	74LV153 v.4
Modifications:	• Legal pages updated.			
74LV153 v.4	20100429	Product data sheet	-	74LV153 v.3
74LV153 v.3	19980428	Product specification	-	74LV153 v.2
74LV153 v.2	19970515	Product specification	-	-

15. Legal information

15.1 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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