# 74LVC157A

# Quad 2-input multiplexer Rev. 7 — 25 November 2011

Product data sheet

#### **General description** 1.

The 74LVC157A is a quad 2-input multiplexer which select four bits of data from two sources under the control of a common select input (S). The four outputs present the selected data in the true (non-inverted) form. The enable input (E) is active LOW. When pin E is HIGH, all of the outputs (1Y to 4Y) are forced LOW regardless of all the other input conditions. Moving the data from two groups of registers to four common output buses is a common use of the 74LVC157A. The state of the common data select input (S) determines the particular register from which the data comes. It can also be used as function generator.

It is useful for implementing highly irregular logic by generating any 4 of the 16 different functions of two variables with one variable common.

The device is the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to pin S.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V applications.

#### 2. Features and benefits

- 5 V tolerant inputs for interfacing with 5 V logic
- Wide supply voltage range from 1.2 V to 3.6 V
- CMOS low power consumption
- Direct interface with TTL levels
- Complies with JEDEC standard:
  - ◆ JESD8-7A (1.65 V to 1.95 V)
  - ◆ JESD8-5A (2.3 V to 2.7 V)
  - ◆ JESD8-C/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-B exceeds 200 V
  - CDM JESD22-C101E exceeds 1000 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

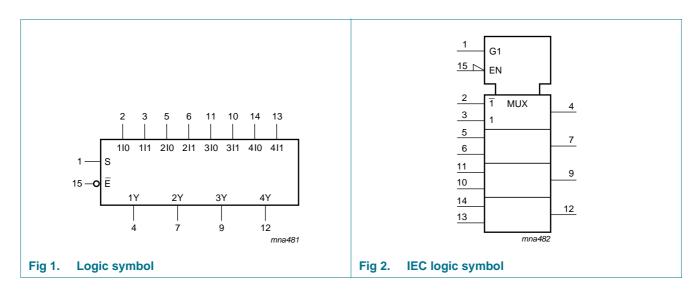


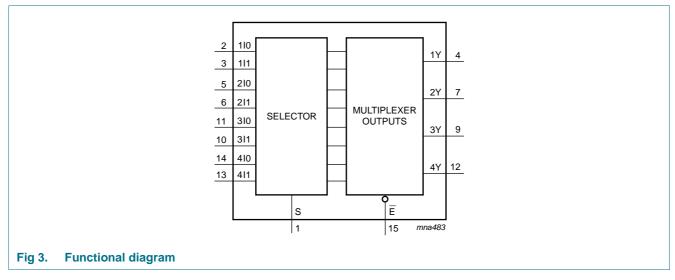
## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC157AD	–40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LVC157ADB	–40 °C to +125 °C	SSOP16	plastic shrink small outline package; 16 leads; body width 5.3 mm	SOT338-1
74LVC157APW	–40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74LVC157ABQ	–40 °C to +125 °C	DHVQFN16	plastic dual In-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 $\times$ 3.5 $\times$ 0.85 mm	SOT763-1

## 4. Functional diagram





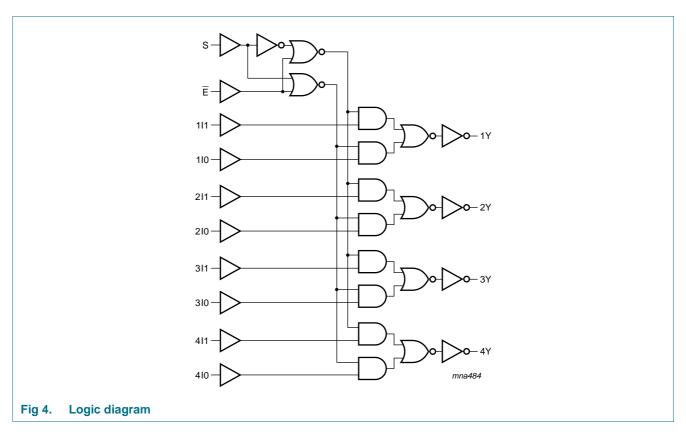
74LVC157A

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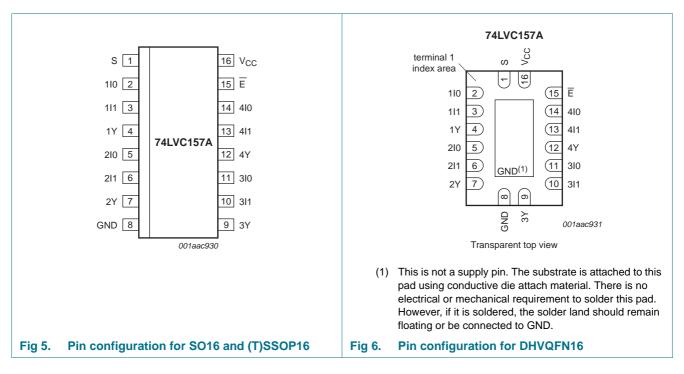
NXP Semiconductors 74LVC157A

**Quad 2-input multiplexer** 



## 5. Pinning information

## 5.1 Pinning



## 5.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
S	1	common data select input
110	2	data input from source 0
111	3	data input from source 1
1Y	4	multiplexer output
210	5	data input from source 0
2 1	6	data input from source 1
2Y	7	multiplexer output
GND	8	ground (0 V)
3Y	9	multiplexer output
3l1	10	data input from source 1
310	11	data input from source 0
4Y	12	multiplexer output
411	13	data input from source 1
410	14	data input from source 0
Ē	15	enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

# 6. Functional description

Table 3. Function table[1]

Input									
Ē	S	nI0	nl1	nY					
Н	X	X	X	L					
L	L	L	X	L					
L	L	Н	X	Н					
L	Н	X	L	L					
L	Н	X	Н	Н					

<sup>[1]</sup> H = HIGH voltage level; L = LOW voltage level; X = don't care

## 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	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0	-50	-	mA
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
I <sub>OK</sub>	output clamping current	$V_O > V_{CC}$ or $V_O < 0$	-	±50	mA
Vo	output voltage		<u>[2]</u> –0.5	$V_{CC} + 0.5$	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[3] _	500	mW

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

## 8. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
$V_{CC}$	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
$V_{I}$	input voltage		0	-	5.5	V
Vo	output voltage		0	-	$V_{CC}$	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	0	-	20	ns/V
	rate	$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	0	-	10	ns/V

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

<sup>[3]</sup> For SO16 packages: above 70 °C the value of  $P_D$  derates linearly with 8 mW/K. For (T)SSOP16 packages: above 60 °C the value of  $P_D$  derates linearly with 5.5 mW/K. For DHVQFN16 packages: above 60 °C the value of  $P_D$  derates linearly with 4.5 mW/K.

## 9. Static characteristics

Table 6. Static characteristics

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

Symbol	Parameter	Conditions	-40	°C to +8	35 °C	-40 °C to	o +125 °C	Unit	
			Min	Typ[1]	Max	Min	Max		
$V_{IH}$	HIGH-level	V <sub>CC</sub> = 1.2 V	1.08	-	-	1.08	-	V	
	input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	$0.65 \times V_{CC}$	-	V	
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V	
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V	
V <sub>IL</sub>	LOW-level	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V	
	input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	-	$0.35 \times V_{CC}$	V	
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V	
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V	
V <sub>OH</sub>	HIGH-level	$V_I = V_{IH}$ or $V_{IL}$							
	output voltage	$I_O = -100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	V <sub>CC</sub> - 0.2	-	-	$V_{CC}-0.3$	-	V	
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	1.05	-	V	
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.8	-	-	1.65	-	V	
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	2.05	-	V	
		$I_{O} = -18 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.4	-	-	2.25	-	V	
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.2	-	-	2.0	-	V	
V <sub>OL</sub>	LOW-level	$V_I = V_{IH}$ or $V_{IL}$							
	output voltage	$I_O = 100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 3.6 \text{ V}$	-	-	0.2	-	0.3	V	
		$I_O = 4 \text{ mA}$ ; $V_{CC} = 1.65 \text{ V}$	-	-	0.45	-	0.65	V	
		$I_O = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.6	-	0.8	V	
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	-	0.6	V	
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.8	V	
l <sub>l</sub>	input leakage current	$V_{CC}$ = 3.6 V; $V_I$ = 5.5 V or GND	-	±0.1	±5	-	±20	μΑ	
I <sub>CC</sub>	supply current	$V_{CC} = 3.6 \text{ V}; V_I = V_{CC} \text{ or GND};$ $I_O = 0 \text{ A}$	-	0.1	10	-	40	μΑ	
Δl <sub>CC</sub>	additional supply current	per input pin; $V_{CC} = 2.7 \text{ V to } 3.6 \text{ V};$ $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}$	-	5	500	-	5000	μА	
Cı	input capacitance	$V_{CC} = 0 \text{ V to } 3.6 \text{ V};$ $V_{I} = \text{GND to } V_{CC}$	-	5.0	-	-	-	pF	

<sup>[1]</sup> All typical values are measured at  $V_{CC}$  = 3.3 V (unless stated otherwise) and  $T_{amb}$  = 25 °C.

## 10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 9.

Symbol	Parameter	Conditions		<b>-40</b>	°C to +8	5 °C	-40 °C to	+125 °C	Unit
				Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nI0, nI1 to nY; see Figure 8	[2]		'	ı	'		
		V <sub>CC</sub> = 1.2 V		-	16	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	4.8	10.2	1.0	11.8	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.5	2.8	5.8	1.5	6.7	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	2.9	5.9	1.0	7.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.5	5.2	1.0	6.5	ns
		E to nY; see Figure 7	[2]						
		V <sub>CC</sub> = 1.2 V		-	17	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		0.5	4.8	12.8	0.5	14.7	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.5	2.8	7.2	1.5	8.3	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	2.9	7.8	1.0	10.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.6	6.5	1.0	8.5	ns
		S to nY; see Figure 8	[2]						
		$V_{CC} = 1.2 \text{ V}$		-	16	-	-	-	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	5.1	12.4	1.0	14.3	ns
		$V_{CC}$ = 2.3 V to 2.7 V		1.5	3.0	7.0	1.5	8.1	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	3.1	7.3	1.0	9.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.7	6.3	1.0	8.0	ns
t <sub>sk(o)</sub>	output skew time	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	[3]	-	-	1.0	-	1.5	ns
$C_PD$	power dissipation	per input; $V_I = GND$ to $V_{CC}$	<u>[4]</u>						
	capacitance	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	9.4	-	-	-	pF
		$V_{CC}$ = 2.3 V to 2.7 V		-	12.8	-	-	-	pF
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		-	15.9	-	-	-	pF

<sup>[1]</sup> Typical values are measured at  $T_{amb}$  = 25 °C and  $V_{CC}$  = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

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

N = number of inputs switching

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

<sup>[2]</sup>  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

<sup>[3]</sup> Skew between any two outputs of the same package switching in the same direction. This parameter is guaranteed by design.

<sup>[4]</sup>  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

## 11. Waveforms

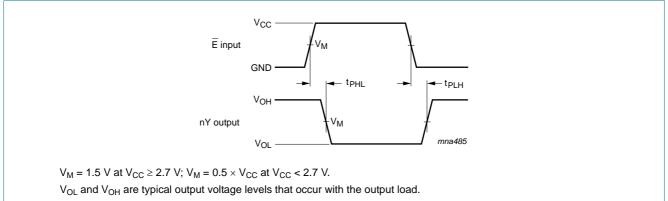


Fig 7. Enable input (E) to output (nY) propagation delays

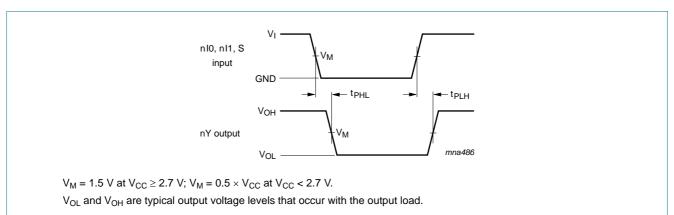
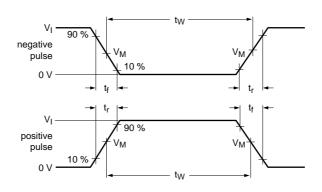
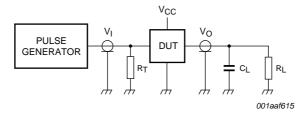


Fig 8. Data inputs (nl0, nl1) and common data select input (S) to output (nY) propagation delays





Test data is given in Table 8. Definitions for test circuit:

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

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator.

Fig 9. Test circuit for measuring switching times

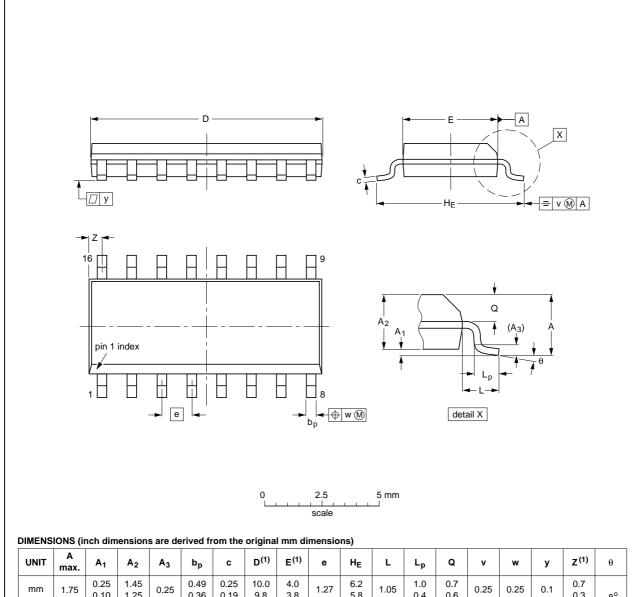
Table 8. Test data

Supply voltage	Input		Load	Load			
	VI	t <sub>r</sub> , t <sub>f</sub>	CL	R <sub>L</sub>			
1.2 V	V <sub>CC</sub>	≤ 2 ns	30 pF	1 kΩ			
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2 ns	30 pF	1 kΩ			
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2 ns	30 pF	500 Ω			
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω			
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω			

## 12. Package outline

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

SOT109-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	Ф	HE	٦	Lp	Q	>	w	у	Z <sup>(1)</sup>	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°
inches	0.069	0.010 0.004	0.057 0.049	0.01		0.0100 0.0075	0.39 0.38	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016		0.01	0.01	0.004	0.028 0.012	0°

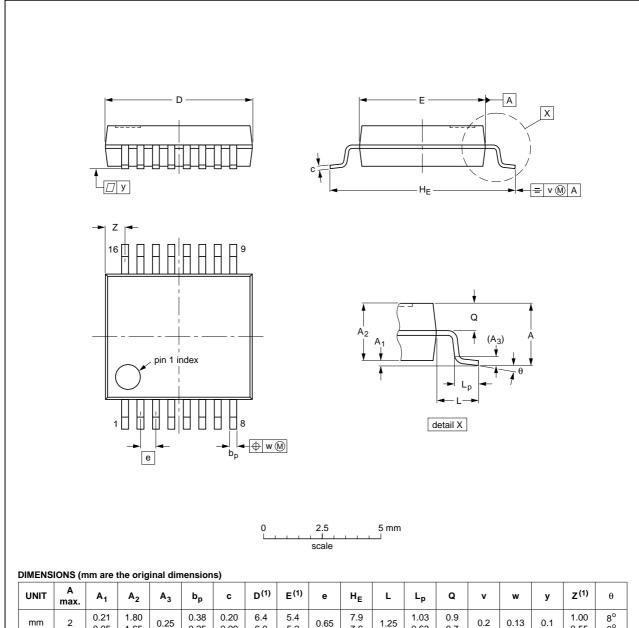
1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE	
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE
SOT109-1	076E07	MS-012			<del>99-12-27</del> 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



UN	IT I	A nax.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	HE	L	Lp	Q	v	w	у	Z <sup>(1)</sup>	θ
mı		2	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	6.4 6.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	1.00 0.55	8° 0°

#### Note

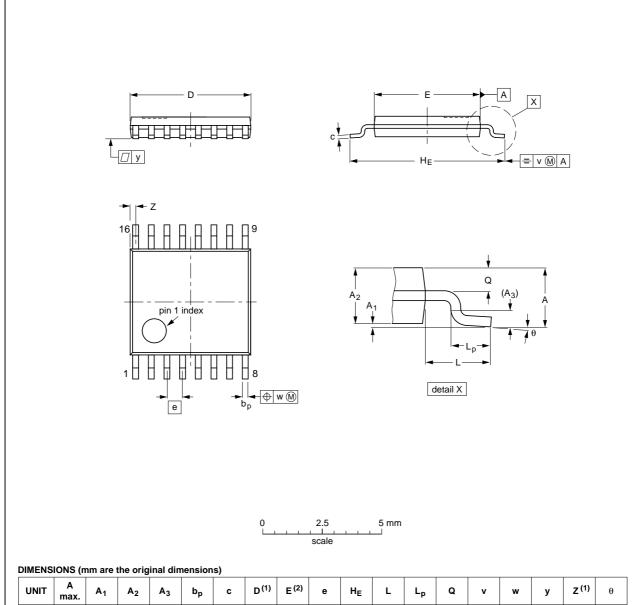
1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA	PROJECTION	ISSUE DATE	
SOT338-1		MO-150			<del>99-12-27</del> 03-02-19	
						,

Fig 11. Package outline SOT338-1 (SSOP16)

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

SOT403-1



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	<b>A</b> <sub>3</sub>	bp	С	D <sup>(1)</sup>	E <sup>(2)</sup>	е	HE	L	Lp	Q	v	w	у	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.05	0.95 0.80	0.25	0.30 0.19	0.2 0.1	5.1 4.9	4.5 4.3	0.65	6.6 6.2	1	0.75 0.50	0.4 0.3	0.2	0.13	0.1	0.40 0.06	8° 0°

#### Notes

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

OUTLINE		REFER	EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT403-1		MO-153				<del>99-12-27</del> 03-02-18

Fig 12. Package outline SOT403-1 (TSSOP16)

DHVQFN16: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 16 terminals; body 2.5 x 3.5 x 0.85 mm SOT763-1

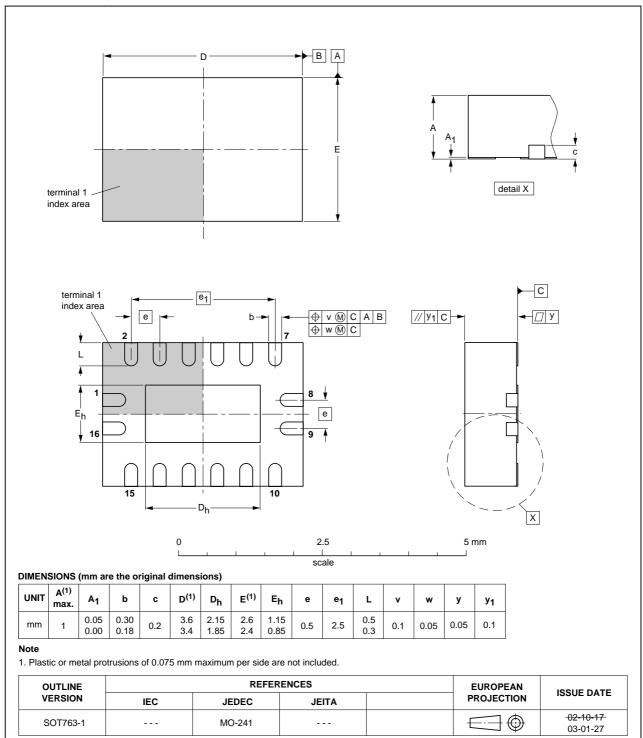


Fig 13. Package outline SOT763-1 (DHVQFN16)

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## 13. Abbreviations

#### Table 9. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

## 14. Revision history

#### Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes				
74LVC157A v.7	20111125	Product data sheet	-	74LVC157A v.6				
Modifications:	• <u>Table 7</u> : maxim	num values for lower voltage	e ranges changed (erra	ata).				
74LVC157A v.6	20111027	Product data sheet	-	74LVC157A v.5				
Modifications:	<ul> <li>The format of this document has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> </ul>							
	<ul> <li>Legal texts have</li> </ul>	ve been adapted to the new	company name where	e appropriate.				
	• <u>Table 4</u> , <u>Table</u>	<u>5, Table 6, Table 7, and Tab</u>	le 8: values added for	lower voltage ranges.				
74LVC157A v.5	031202	Product specification	-	74LVC157A v.4				
74LVC157A v.4	030617	Product specification	-	74LVC157A v.3				
74LVC157A v.3	020315	Product specification	-	74LVC157A v.2				
74LVC157A v.2	980729	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"
- [3] 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 URL <a href="http://www.nxp.com">http://www.nxp.com</a>.

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For more information, please visit: http://www.nxp.com

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