

# 74LVC157A-Q100

## Quad 2-input multiplexer

Rev. 3 — 19 March 2020

Product data sheet

## 1. General description

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The 74LVC157A-Q100 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 ( $\bar{E}$ ) is active LOW. When pin  $\bar{E}$  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-Q100. 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and -40 °C to +125 °C
- 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:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-B exceeds 200 V (C = 200 pF, R = 0 Ω)
- DHVQFN package with Side-Wettable Flanks enabling Automatic Optical Inspection (AOI) of solder joints

### 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC157AD-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74LVC157APW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74LVC157ABQ-Q100	-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 × 3.5 × 0.85 mm	SOT763-1

### 4. Functional diagram

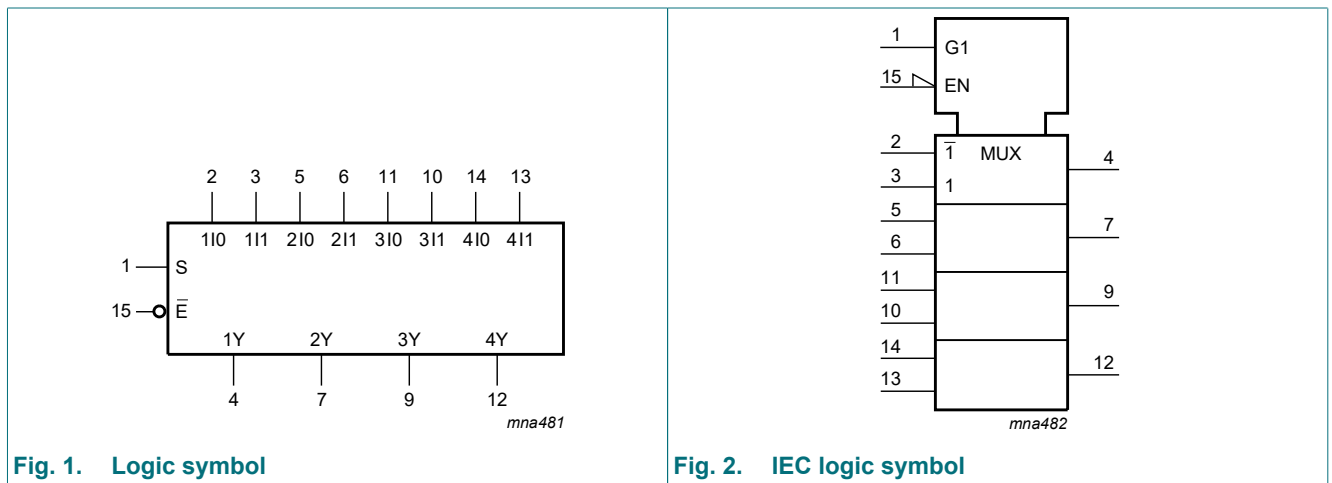


Fig. 1. Logic symbol

Fig. 2. IEC logic symbol

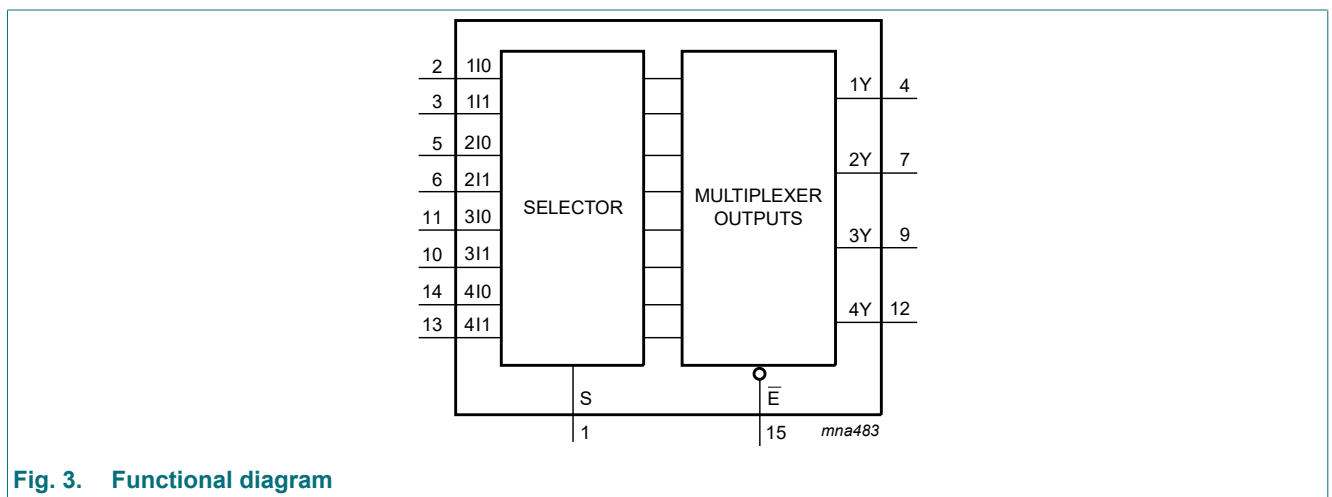


Fig. 3. Functional diagram

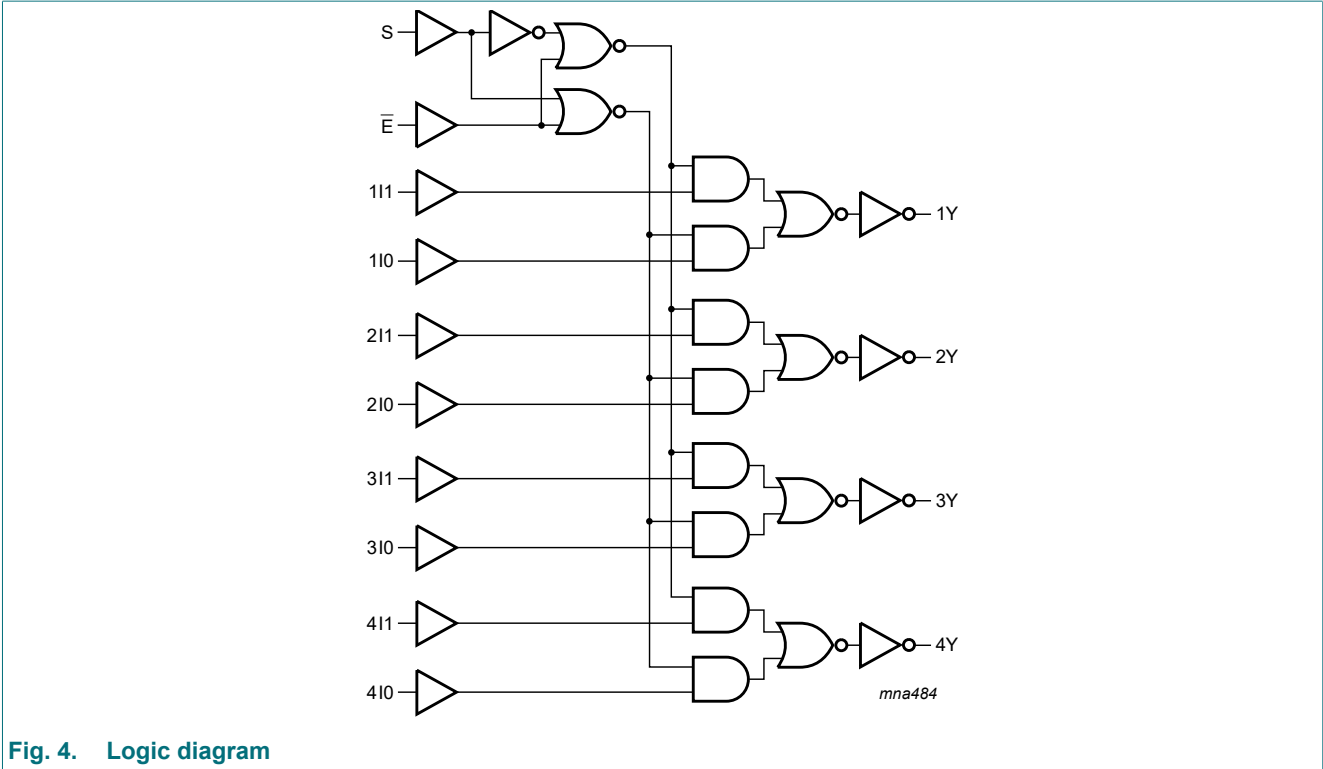


Fig. 4. Logic diagram

## 5. Pinning information

### 5.1. Pinning

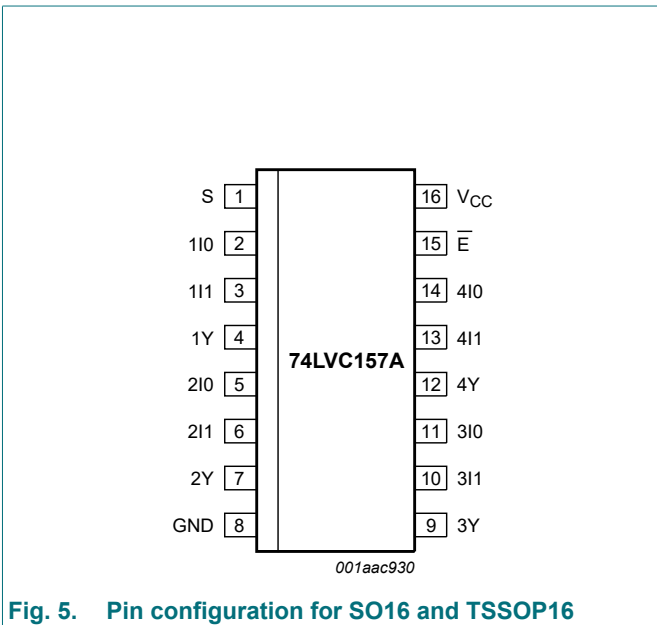


Fig. 5. Pin configuration for SO16 and TSSOP16

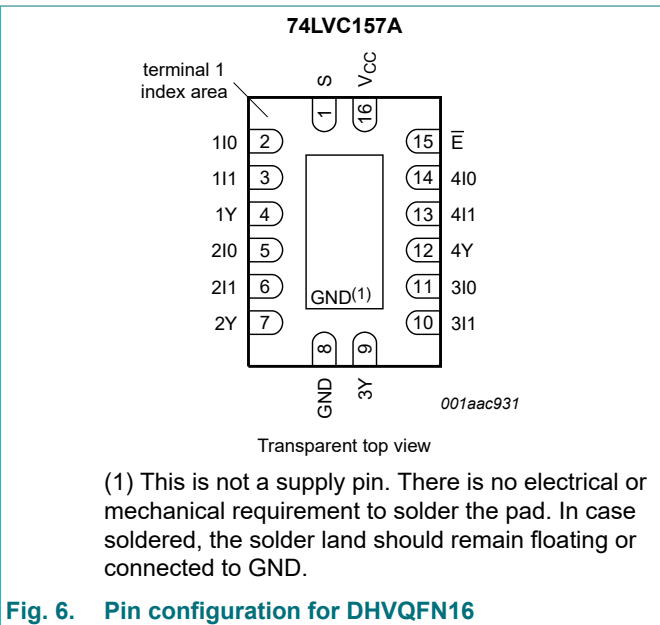


Fig. 6. Pin configuration for DHVQFN16

## 5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
S	1	common data select input
1I0	2	data input from source 0
1I1	3	data input from source 1
1Y	4	multiplexer output
2I0	5	data input from source 0
2I1	6	data input from source 1
2Y	7	multiplexer output
GND	8	ground (0 V)
3Y	9	multiplexer output
3I1	10	data input from source 1
3I0	11	data input from source 0
4Y	12	multiplexer output
4I1	13	data input from source 1
4I0	14	data input from source 0
$\bar{E}$	15	enable input (active LOW)
V <sub>CC</sub>	16	supply voltage

## 6. Functional description

Table 3. Function table

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

Input				Output
$\bar{E}$	S	nI0	nI1	nY
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	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	+6.5	V
$I_{IK}$	input clamping current	$V_I < 0$	-50	-	mA
$V_I$	input voltage	[1]	-0.5	+6.5	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$	-	$\pm 50$	mA
$V_O$	output voltage	[2]	-0.5	$V_{CC} + 0.5$	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C [3]	-	500	mW

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

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

[3] For SOT109-1 (SO16) package:  $P_{tot}$  derates linearly with 12.4 mW/K above 110 °C.

For SOT403-1 (TSSOP16) package:  $P_{tot}$  derates linearly with 8.5 mW/K above 91 °C.

For SOT763-1 (DHVQFN16) package:  $P_{tot}$  derates linearly with 11.2 mW/K above 106 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CC}$	supply voltage		1.65	-	3.6	V
		functional	1.2	-	-	V
$V_I$	input voltage		0	-	5.5	V
$V_O$	output voltage		0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	0	-	20	ns/V
		$V_{CC} = 2.7$ V to 3.6 V	0	-	10	ns/V

## 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 +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.2 V	1.08	-	-	1.08	-	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 x V <sub>CC</sub>	-	-	0.65 x V <sub>CC</sub>	-	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 input voltage	V <sub>CC</sub> = 1.2 V	-	-	0.12	-	0.12	V
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 x V <sub>CC</sub>	-	0.35 x V <sub>CC</sub>	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 output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	V <sub>CC</sub> - 0.2	-	-	V <sub>CC</sub> - 0.3	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	1.05	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.8	-	-	1.65	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	2.05	-	V
		I <sub>O</sub> = -18 mA; V <sub>CC</sub> = 3.0 V	2.4	-	-	2.25	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>						
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 1.65 V to 3.6 V	-	-	0.2	-	0.3	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.65	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.6	-	0.8	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = 5.5 V or GND	-	±0.1	±5	-	±20	μA
I <sub>CC</sub>	supply current	V <sub>CC</sub> = 3.6 V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	0.1	10	-	40	μA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.7 V to 3.6 V; I <sub>O</sub> = 0 A	-	5	500	-	5000	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 0 V to 3.6 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	5.0	-	-	-	pF

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V (unless stated otherwise) and T<sub>amb</sub> = 25 °C.

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nI0, nI1 to nY; see Fig. 7 [2]						
		V <sub>CC</sub> = 1.2 V	-	16	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	4.8	10.2	1.0	11.8	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	2.8	5.8	1.5	6.7	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.9	5.9	1.0	7.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.5	5.2	1.0	6.5	ns
		$\bar{E}$ to nY; see Fig. 8 [2]						
		V <sub>CC</sub> = 1.2 V	-	17	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	0.5	4.8	12.8	0.5	14.7	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	2.8	7.2	1.5	8.3	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.9	7.8	1.0	10.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.6	6.5	1.0	8.5	ns
		S to nY; see Fig. 7 [2]						
		V <sub>CC</sub> = 1.2 V	-	16	-	-	-	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	5.1	12.4	1.0	14.3	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.5	3.0	7.0	1.5	8.1	ns
		V <sub>CC</sub> = 2.7 V	1.0	3.1	7.3	1.0	9.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	1.0	2.7	6.3	1.0	8.0	ns
t <sub>sk(o)</sub>	output skew time	V <sub>CC</sub> = 3.0 V to 3.6 V [3]	-	-	1.0	-	1.5	ns
C <sub>PD</sub>	power dissipation capacitance	per input; V <sub>I</sub> = GND to V <sub>CC</sub> [4]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	9.4	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	12.8	-	-	-	pF
		V <sub>CC</sub> = 3.0 V to 3.6 V	-	15.9	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.2 V, 1.8 V, 2.5 V, 2.7 V, and 3.3 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

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

[4] 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

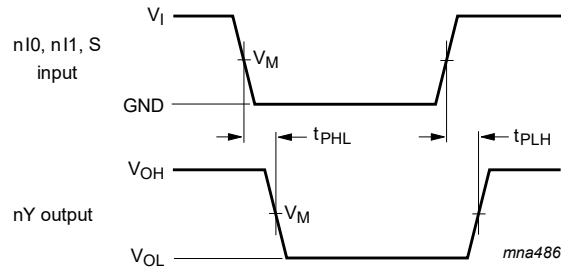
C<sub>L</sub> = output load capacitance in pF

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

N = number of inputs switching

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

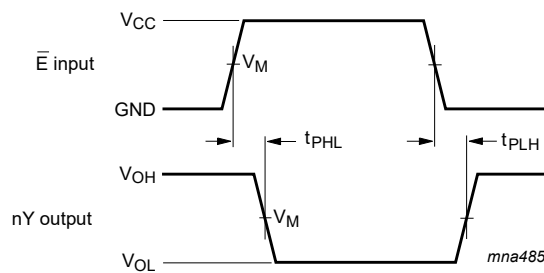
10.1. Waveforms and test circuit



$V_M = 1.5 \text{ V}$  at  $V_{CC} \geq 2.7 \text{ V}$ ;  $V_M = 0.5 \times V_{CC}$  at  $V_{CC} < 2.7 \text{ V}$ .

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

**Fig. 7. Data inputs (nI0, nI1) and common data select input (S) to output (nY) propagation delays**

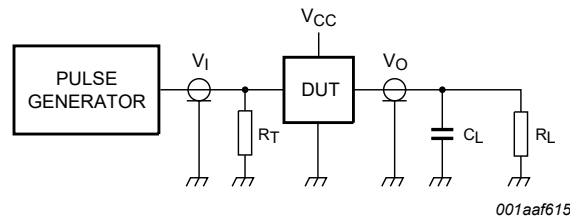
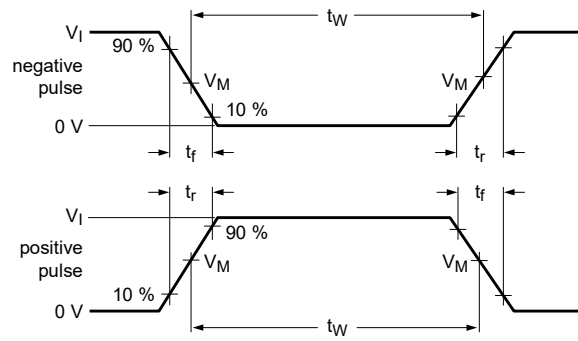


$V_M = 1.5 \text{ V}$  at  $V_{CC} \geq 2.7 \text{ V}$ ;  $V_M = 0.5 \times V_{CC}$  at  $V_{CC} < 2.7 \text{ V}$ .

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

**Fig. 8. Enable input (E-bar) to output (nY) propagation delays**





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Test data is given in [Table 8](#). Definitions for test circuit:

$R_L$  = Load resistance.

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

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

**Fig. 9. Test circuit for measuring switching times**

**Table 8. Test data**

Supply voltage	Input		Load	
	$V_I$	$t_r, t_f$	$C_L$	$R_L$
1.2 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$
1.65 V to 1.95 V	$V_{CC}$	$\leq 2$ ns	30 pF	1 k $\Omega$
2.3 V to 2.7 V	$V_{CC}$	$\leq 2$ ns	30 pF	500 $\Omega$
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$

### 11. Package outline

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

SOT109-1

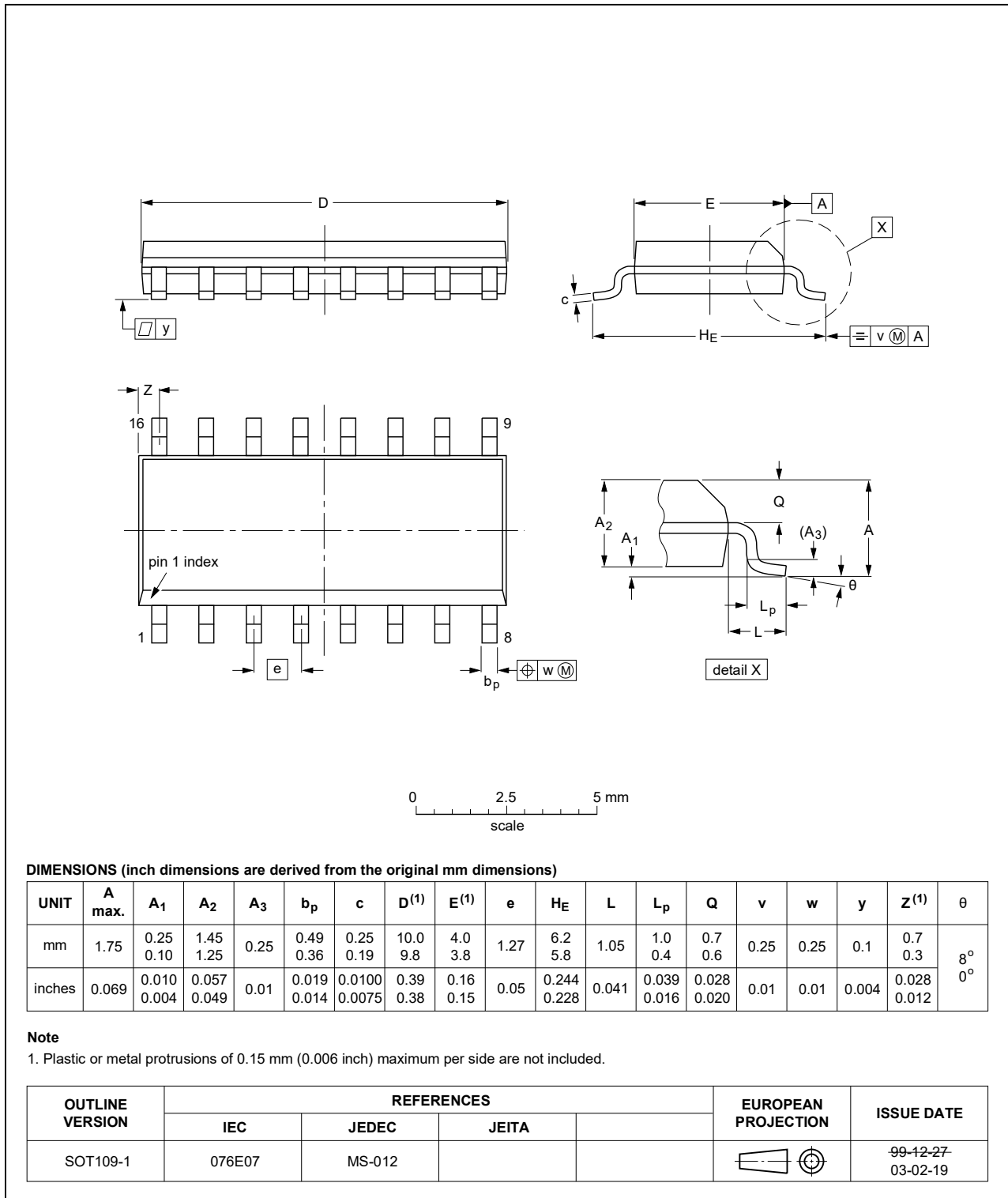


Fig. 10. Package outline SOT109-1 (SO16)

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

SOT403-1

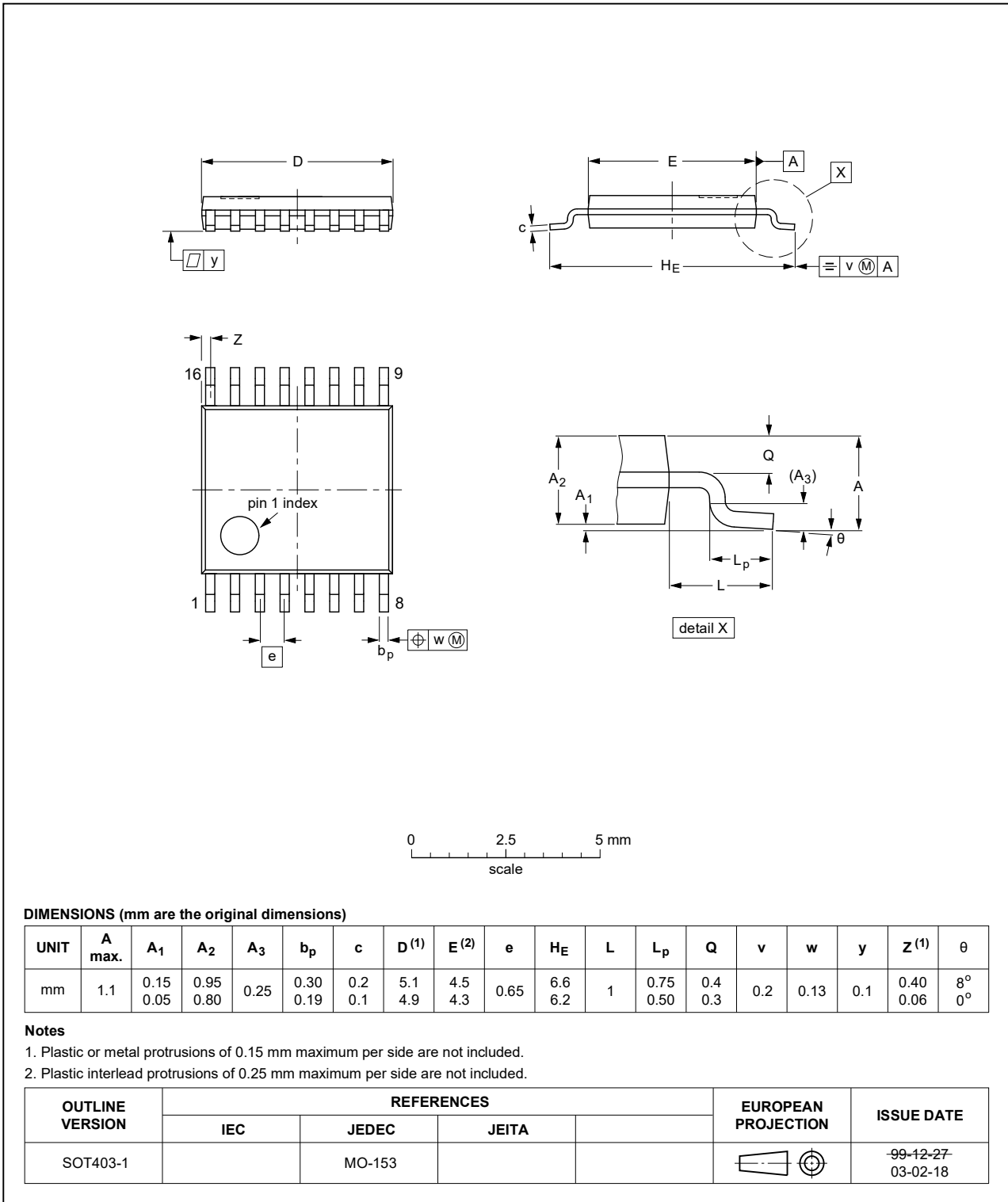


Fig. 11. Package outline SOT403-1 (TSSOP16)

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

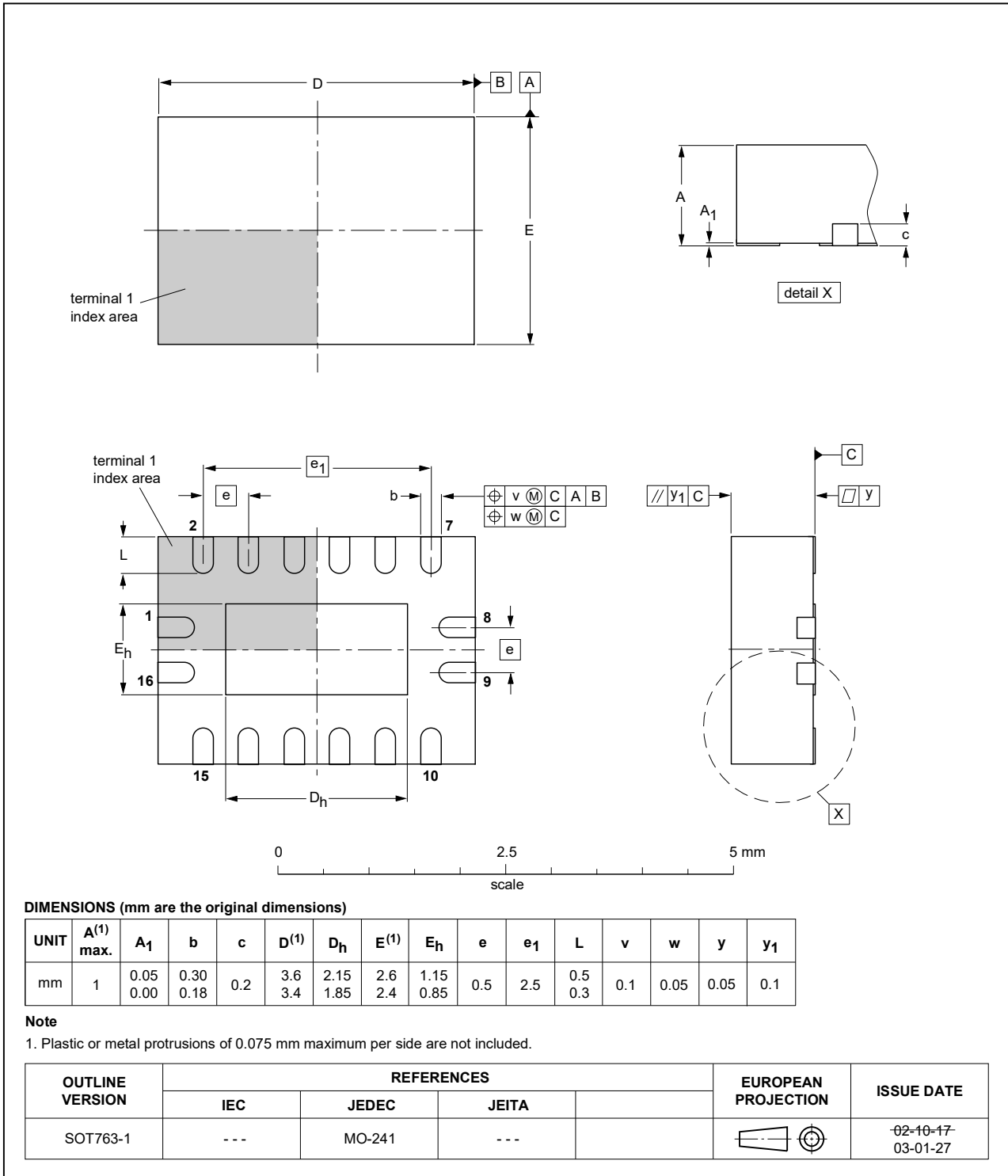


Fig. 12. Package outline SOT763-1 (DHVQFN16)

## 12. Abbreviations

Table 9. Abbreviations

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

## 13. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC157A_Q100 v.3	20200319	Product data sheet	-	74LVC157A_Q100 v.2
Modifications:	<ul style="list-style-type: none"> <li>• <a href="#">Table 4</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li>• Type number 74LVC157ADB-Q100 removed.</li> </ul>			
74LVC157A_Q100 v.2	20130502	Product data sheet	-	74LVC157A_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>• 74LVC157ADB-Q100 added.-</li> </ul>			
74LVC157A_Q100 v.1	20120807	Product data sheet	-	-

## 14. 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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