

# 74HC257-Q100; 74HCT257-Q100

Quad 2-input multiplexer; 3-state

Rev. 2 — 9 February 2021

Product data sheet

## 1. General description

The 74HC257-Q100; 74HCT257-Q100 is a quad 2-input multiplexer with 3-state outputs. Inputs include clamp diodes. It enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

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

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- CMOS low power dissipation
- High noise immunity
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- Non-inverting data path
- 3-state outputs interface directly with system bus
- Input levels:
  - For 74HC257-Q100: CMOS level
  - For 74HCT257-Q100: TTL level

ESD protection:

- MIL-STD-883, method 3015 exceeds 2000 V
- HBM JESD22-A114F exceeds 2000 V
- MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0  $\Omega$ )

## 3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74HC257D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT257D-Q100				
74HC257PW-Q100	-40 °C to +125 °C	TSSOP16	plastic thin shrink small outline package; 16 leads; body width 4.4 mm	SOT403-1
74HCT257PW-Q100				

### 4. Functional diagram

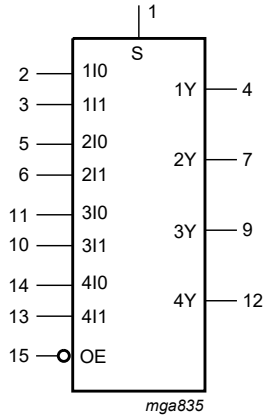


Fig. 1. Logic symbol

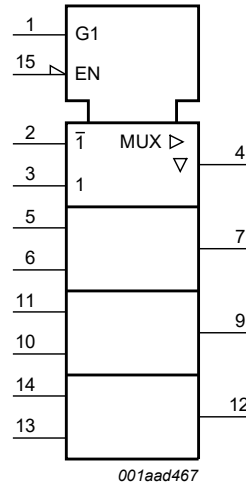


Fig. 2. IEC logic symbol

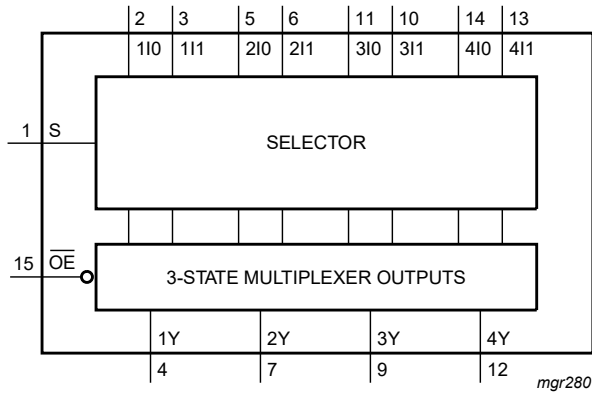


Fig. 3. Functional diagram

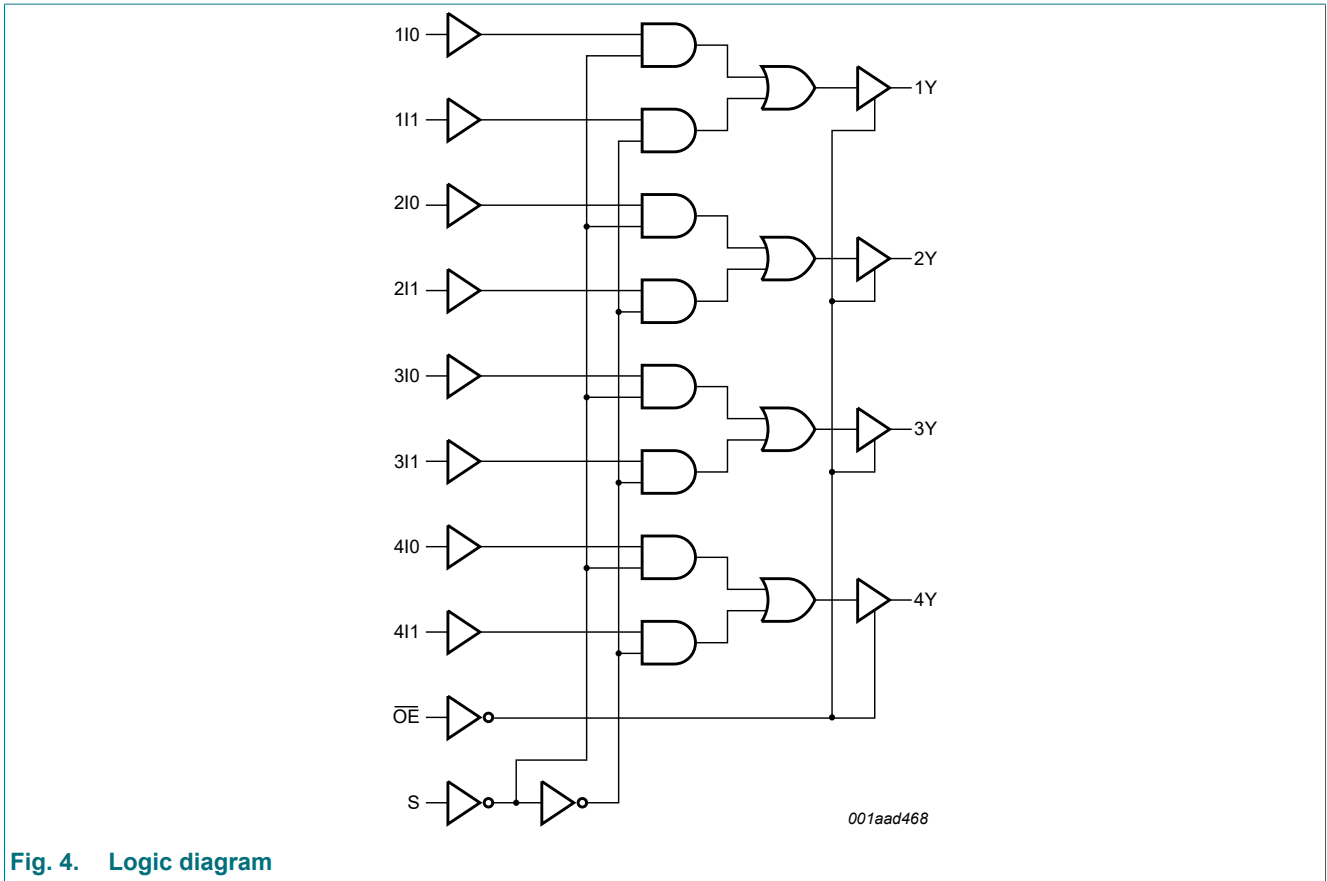


Fig. 4. Logic diagram

## 5. Pinning information

### 5.1. Pinning

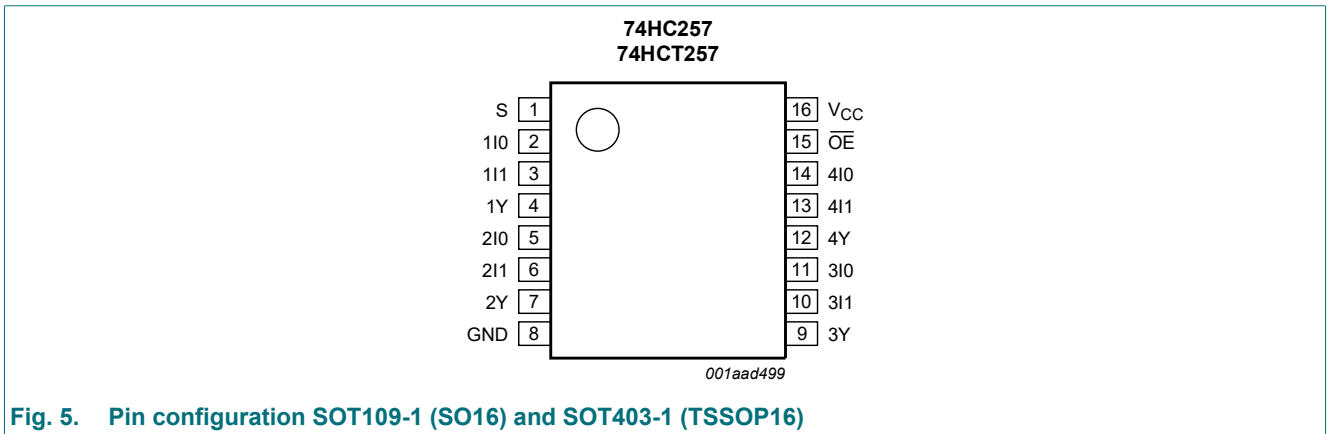


Fig. 5. Pin configuration SOT109-1 (SO16) and SOT403-1 (TSSOP16)

## 5.2. Pin description

Table 2. Pin description

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

## 6. Function description

Table 3. Function table

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

Control		Input		Output
$\overline{OE}$	S	nI0	nI1	nY
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	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 <sub>CC</sub>	supply voltage		-0.5	+7	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1]	-	±20	mA
I <sub>O</sub>	output current	V <sub>O</sub> = -0.5 V to V <sub>CC</sub> + 0.5 V	-	±35	mA
I <sub>CC</sub>	supply current		-	+70	mA
I <sub>GND</sub>	ground current		-70	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	[2]	-	500	mW

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

[2] For SOT109-1 (SO16) package: P<sub>tot</sub> derates linearly with 12.4 mW/K above 110 °C.  
For SOT403-1 (TSSOP16) package: P<sub>tot</sub> derates linearly with 8.5 mW/K above 91 °C.

## 8. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC257-Q100			74HCT257-Q100			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$V_O$	output voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	V
$T_{amb}$	ambient temperature		-40	+25	+125	-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 2.0\text{ V}$	-	-	625	-	-	-	ns/V
		$V_{CC} = 4.5\text{ V}$	-	1.67	139	-	1.67	139	ns/V
		$V_{CC} = 6.0\text{ V}$	-	-	83	-	-	-	ns/V

## 9. Static characteristics

**Table 6. Static characteristics**

At recommended operating conditions; 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	Typ	Max	Min	Max	Min	Max	
<b>74HC257-Q100</b>										
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 2.0\text{ V}$	1.5	1.2	-	1.5	-	1.5	-	V
		$V_{CC} = 4.5\text{ V}$	3.15	2.4	-	3.15	-	3.15	-	V
		$V_{CC} = 6.0\text{ V}$	4.2	3.2	-	4.2	-	4.2	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 2.0\text{ V}$	-	0.8	0.5	-	0.5	-	0.5	V
		$V_{CC} = 4.5\text{ V}$	-	2.1	1.35	-	1.35	-	1.35	V
		$V_{CC} = 6.0\text{ V}$	-	2.8	1.8	-	1.8	-	1.8	V
$V_{OH}$	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 2.0\text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 4.5\text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -20\text{ }\mu\text{A}$ ; $V_{CC} = 6.0\text{ V}$	5.9	6.0	-	5.9	-	5.9	-	V
		$I_O = -6.0\text{ mA}$ ; $V_{CC} = 4.5\text{ V}$	3.98	4.32	-	3.84	-	3.7	-	V
$V_{OL}$	LOW-level output voltage	$I_O = -7.8\text{ mA}$ ; $V_{CC} = 6.0\text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V
		$V_I = V_{IH}$ or $V_{IL}$								
		$I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 2.0\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 4.5\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 20\text{ }\mu\text{A}$ ; $V_{CC} = 6.0\text{ V}$	-	0	0.1	-	0.1	-	0.1	V
$I_I$	input leakage current	$I_O = 6.0\text{ mA}$ ; $V_{CC} = 4.5\text{ V}$	-	0.15	0.26	-	0.33	-	0.4	V
		$I_O = 7.8\text{ mA}$ ; $V_{CC} = 6.0\text{ V}$	-	0.16	0.26	-	0.33	-	0.4	V
		$V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$	-	-	$\pm 0.1$	-	$\pm 1.0$	-	$\pm 1.0$	$\mu\text{A}$
$I_{OZ}$	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_{CC} = 6.0\text{ V}$ ; $V_O = V_{CC}$ or GND	-	-	$\pm 0.5$	-	$\pm 5.0$	-	$\pm 10.0$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 6.0\text{ V}$	-	-	8.0	-	80	-	160	$\mu\text{A}$

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>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF
<b>74HCT257-Q100</b>										
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	2.0	1.6	-	2.0	-	2.0	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 4.5 V to 5.5 V	-	1.2	0.8	-	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> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -20 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -6 mA	3.98	4.32	-	3.84	-	3.7	-	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> = 4.5 V								
		I <sub>O</sub> = 20 µA	-	0	0.1	-	0.33	-	0.4	V
		I <sub>O</sub> = 6.0 mA	-	0.15	0.26	-	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	±0.1	-	±1.0	-	±1.0	µA
I <sub>OZ</sub>	OFF-state output current	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; V <sub>CC</sub> = 5.5 V; V <sub>O</sub> = V <sub>CC</sub> or GND	-	-	±0.5	-	±5.0	-	±10	µA
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> = 5.5 V	-	-	8.0	-	80	-	160	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; other inputs at V <sub>CC</sub> or GND; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A								
		per input pin: nI0, nI1	-	40	144	-	180	-	196	µA
		$\overline{OE}$ input	-	135	486	-	608	-	662	µA
		S input	-	70	252	-	315	-	343	µA
C <sub>I</sub>	input capacitance		-	3.5	-	-	-	-	-	pF

## 10. Dynamic characteristics

**Table 7. Dynamic characteristics**

Voltages are referenced to GND (ground = 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	
<b>74HC257-Q100</b>										
$t_{pd}$	propagation delay	nI0 to nY or nI1 to nY; see Fig. 6 [1]								
		$V_{CC} = 2.0\text{ V}$	-	36	110	-	140	-	165	ns
		$V_{CC} = 4.5\text{ V}$	-	13	22	-	28	-	33	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	-	11	-	-	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$	-	10	19	-	24	-	28	ns
		S to nY; see Fig. 6								
		$V_{CC} = 2.0\text{ V}$	-	47	150	-	190	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	17	30	-	38	-	45	ns
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	-	14	-	-	-	-	ns	
		$V_{CC} = 6.0\text{ V}$	-	14	26	-	33	-	38	ns
$t_{en}$	enable time	$\overline{OE}$ to nY; see Fig. 7 [2]								
		$V_{CC} = 2.0\text{ V}$	-	33	150	-	190	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	12	30	-	38	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	10	26	-	33	-	38	ns
$t_{dis}$	disable time	$\overline{OE}$ to nY; see Fig. 7 [3]								
		$V_{CC} = 2.0\text{ V}$	-	41	150	-	190	-	225	ns
		$V_{CC} = 4.5\text{ V}$	-	15	30	-	38	-	45	ns
		$V_{CC} = 6.0\text{ V}$	-	12	26	-	33	-	38	ns
$t_t$	transition time	see Fig. 6 [4]								
		$V_{CC} = 2.0\text{ V}$	-	14	60	-	75	-	90	ns
		$V_{CC} = 4.5\text{ V}$	-	5	12	-	15	-	18	ns
		$V_{CC} = 6.0\text{ V}$	-	4	10	-	13	-	15	ns
$C_{PD}$	power dissipation capacitance	per multiplexer; $V_I = \text{GND to } V_{CC}$ [5]	-	45	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>74HCT257-Q100</b>										
t <sub>pd</sub>	propagation delay	nI0 to nY or nI1 to nY; see Fig. 6 [1]								
		V <sub>CC</sub> = 4.5 V	-	16	30	-	38	-	45	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	13	-	-	-	-	-	ns
		S to nY; see Fig. 6								
		V <sub>CC</sub> = 4.5 V	-	20	35	-	44	-	53	ns
		V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF	-	17	-	-	-	-	ns	
t <sub>en</sub>	enable time	$\overline{OE}$ to nY; V <sub>CC</sub> = 4.5 V; see Fig. 7 [2]	-	15	30	-	38	-	45	ns
t <sub>dis</sub>	disable time	$\overline{OE}$ to nY; V <sub>CC</sub> = 4.5 V; see Fig. 7 [3]	-	16	30	-	38	-	45	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 4.5 V; see Fig. 6 [4]	-	5	12	-	15	-	18	ns
C <sub>PD</sub>	power dissipation capacitance	per multiplexer; V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [5]	-	45	-	-	-	-	-	pF

[1] t<sub>pd</sub> is the same as t<sub>PHL</sub>, t<sub>PLH</sub>.

[2] t<sub>en</sub> is the same as t<sub>PZH</sub>, t<sub>PZL</sub>.

[3] t<sub>dis</sub> is the same as t<sub>PHZ</sub>, t<sub>PLZ</sub>.

[4] t<sub>t</sub> is the same as t<sub>THL</sub>, t<sub>TLH</sub>.

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

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

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;

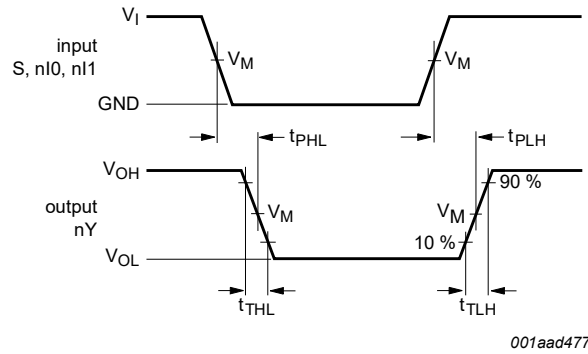
V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

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



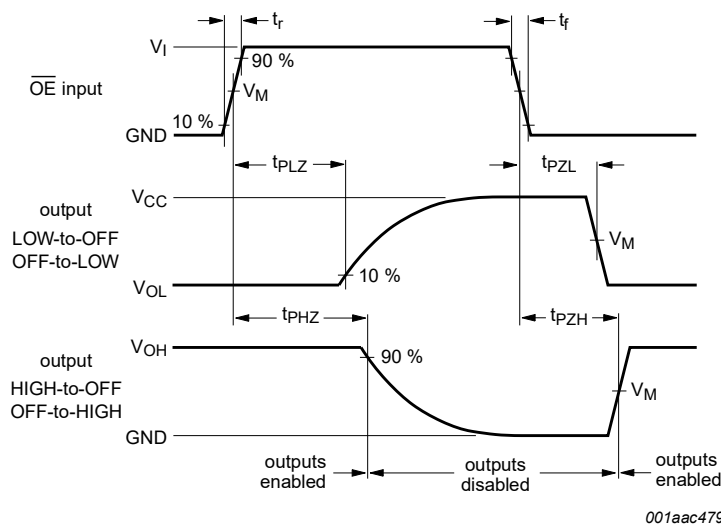
10.1. Waveforms and test circuit



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. Propagation delays input (S, nI0, nI1) to output (nY) and output (nY) transition times**



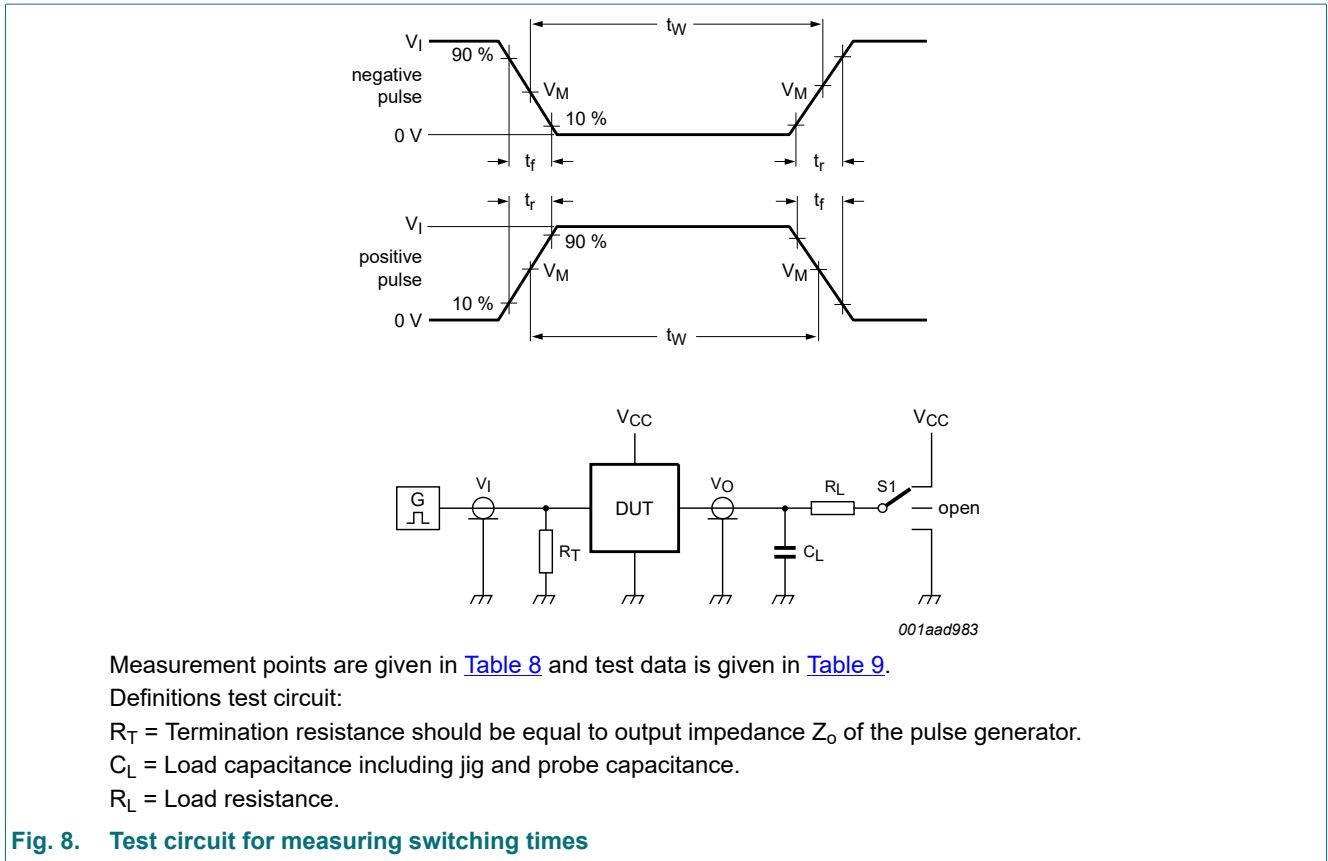
Measurement points are given in [Table 8](#).

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

**Fig. 7. 3-state output enable and disable times**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC257-Q100	$0.5V_{CC}$	$0.5V_{CC}$
74HCT257-Q100	1.3 V	1.3 V



**Table 9. Test data**

Type	Input		Load		Switch position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC257-Q100	$V_{CC}$	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT257-Q100	3 V	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$

### 11. Package outline

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

SOT109-1

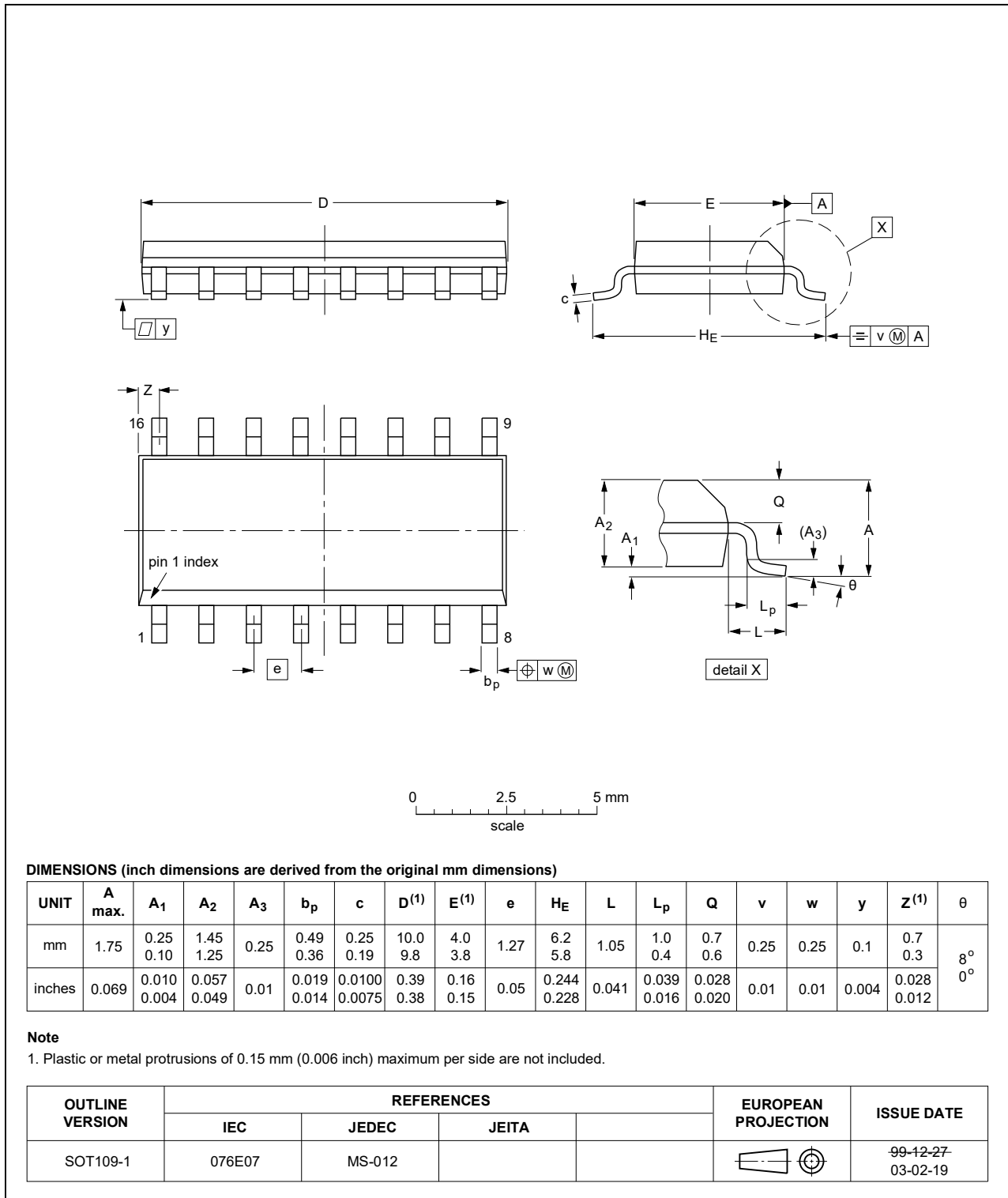


Fig. 9. Package outline SOT109-1 (SO16)

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

SOT403-1

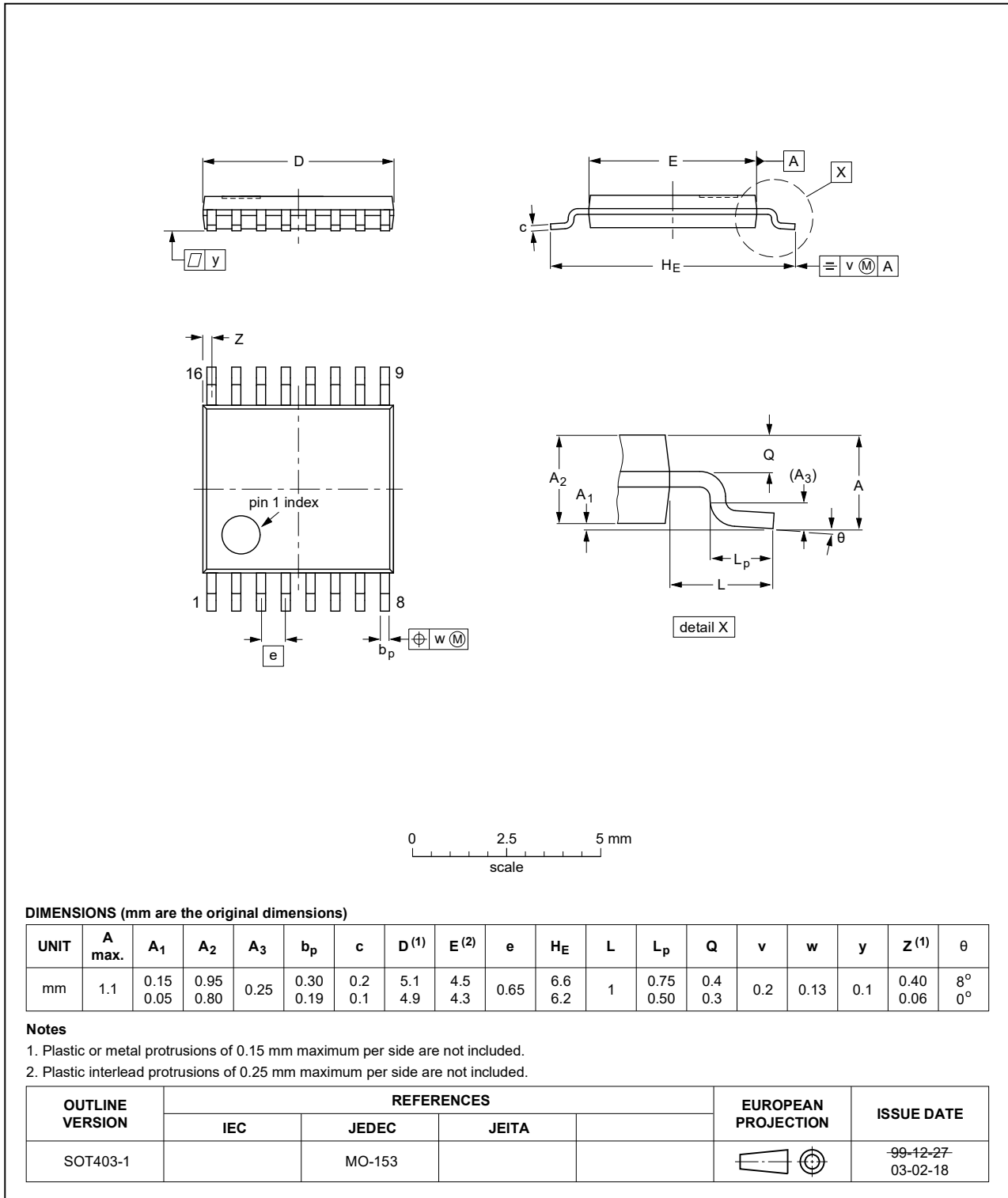


Fig. 10. Package outline SOT403-1 (TSSOP16)

## 12. Abbreviations

Table 10. Abbreviations

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

## 13. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT257_Q100 v.2	20210209	Product data sheet	-	74HC_HCT257_Q100 v.1
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Section 2</a> updated.</li> <li><a href="#">Section 7</a>: Derating values for <math>P_{tot}</math> total power dissipation have changed.</li> <li><a href="#">Section 10</a>: Conditions for <math>I_{OZ}</math> have changed for 74HCT257-Q100. (errata)</li> </ul>			
74HC_HCT257_Q100 v.1	20150727	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".
- [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 <https://www.nexperia.com>.

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