

# 74HC253-Q100; 74HCT253-Q100

Dual 4-input multiplexer; 3-state

Rev. 1 — 17 July 2012

Product data sheet

## 1. General description

The 74HC253-Q100; 74HCT253-Q100 are high-speed Si-gate CMOS devices and are pin compatible with Low-power Schottky TTL (LSTTL).

The 74HC253-Q100; 74HCT253-Q100 provides a dual 4-input multiplexer with 3-state outputs which selects 2 bits of data from up to four sources selected by common data select inputs (S0, S1). The two 4-input multiplexer circuits have individual active LOW output enable inputs ( $\overline{1OE}$ ,  $\overline{2OE}$ ).

The 74HC253-Q100 and 74HCT253-Q100 are the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels applied to S0 and S1. The outputs are forced to a high-impedance OFF-state when  $\overline{nOE}$  is HIGH.

The logic equations for the outputs are:

$$1Y = \overline{1OE} \cdot (1I0 \cdot \overline{S1} \cdot \overline{S0} + 1I1 \cdot \overline{S1} \cdot S0 + 1I2 \cdot S1 \cdot \overline{S0} + 1I3 \cdot S1 \cdot S0)$$

$$2Y = \overline{2OE} \cdot (2I0 \cdot \overline{S1} \cdot \overline{S0} + 2I1 \cdot \overline{S1} \cdot S0 + 2I2 \cdot S1 \cdot \overline{S0} + 2I3 \cdot S1 \cdot S0)$$

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  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- Common select inputs
- Separate output enable inputs
- Input levels:
  - ◆ For 74HC253-Q100: CMOS level
  - ◆ For 74HCT253-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. Applications

- Data selectors
- Data multiplexers

## 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74HC253D-Q100	-40 °C to +125 °C	SO16	plastic small outline package; 16 leads; body width 3.9 mm	SOT109-1
74HCT253D-Q100				

## 5. Functional diagram

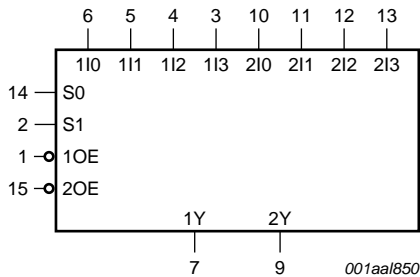


Fig 1. Logic symbol

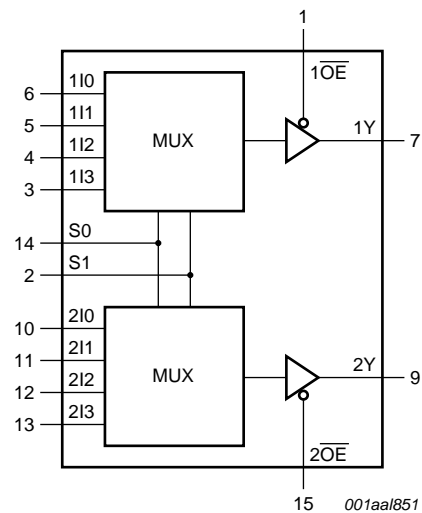


Fig 2. Functional diagram

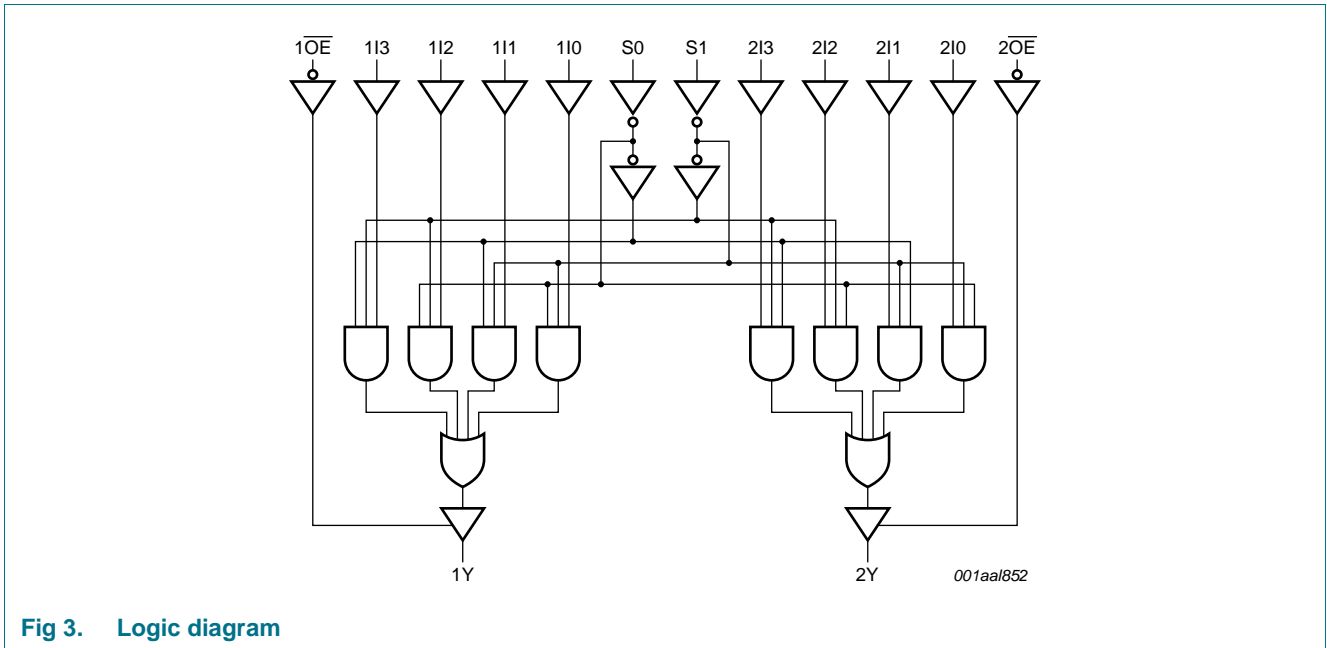


Fig 3. Logic diagram

## 6. Pinning information

### 6.1 Pinning

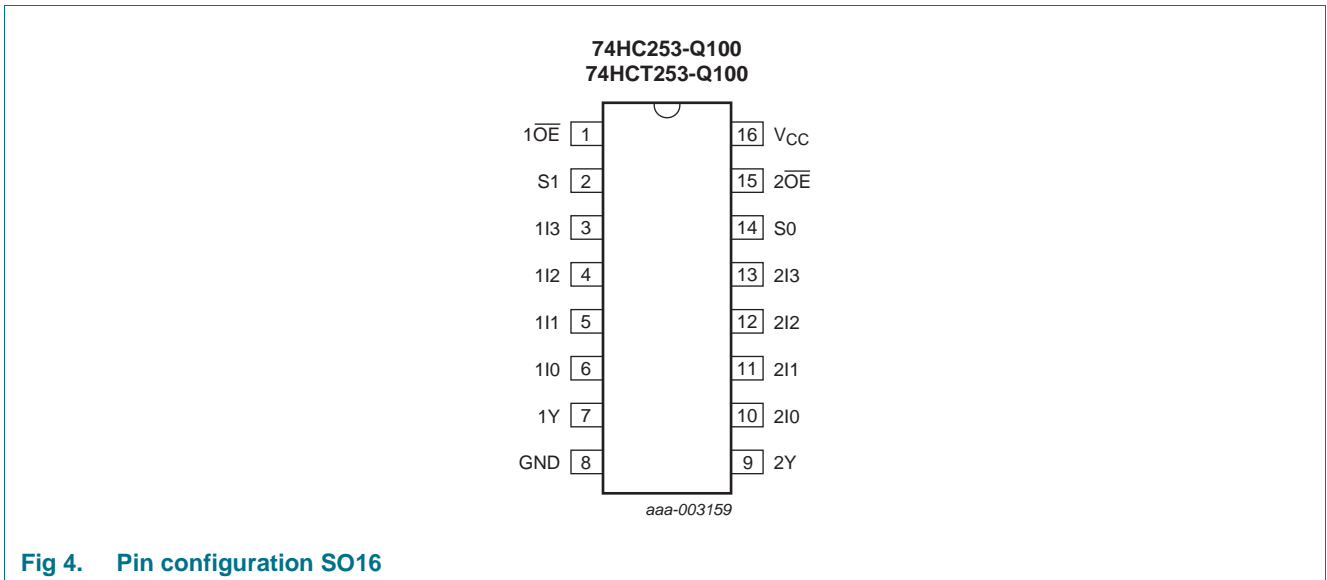


Fig 4. Pin configuration SO16

## 6.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
$1\overline{OE}, 2\overline{OE}$	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 <sub>CC</sub>	16	supply voltage

## 7. Functional description

Table 3. Function table<sup>[1]</sup>

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

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

## 8. 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	+7.0	V
I <sub>IK</sub>	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	[1] -	±20	mA
I <sub>OK</sub>	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	[1] -	±50	mA
I <sub>O</sub>	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$	-	±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

**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	$T_{amb} = -40\text{ °C to }+125\text{ °C}$ SO16 package	[2] -	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 8 mW/K above 70 °C.

## 9. Recommended operating conditions

**Table 5. Recommended operating conditions**

Voltages are referenced to GND (ground = 0 V)

Symbol	Parameter	Conditions	74HC253-Q100			74HCT253-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	-	+125	-40	-	+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

## 10. 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>74HC253-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
		$I_O = -7.8\text{ mA}; V_{CC} = 6.0\text{ V}$	5.48	5.81	-	5.34	-	5.2	-	V

**Table 6. Static characteristics ...continued**

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	
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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 6.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.26	-	0.33	-	0.4	V
		I <sub>O</sub> = 7.8 mA; V <sub>CC</sub> = 6.0 V	-	0.16	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> = 6.0 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>O</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	±0.5	-	±5.0	-	±10.0	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> = 6.0 V	-	-	8.0	-	80	-	160	μA
C <sub>I</sub>	input capacitance		-	3.5	-					pF
<b>74HCT253-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	-	0.1	-	0.1	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 per input pin; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	-	-	±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; 1In, 2In inputs	-	40	144	-	180	-	196	μA
		per input pin; nOE input	-	110	396	-	495	-	539	μA
		per input pin; Sn input	-	110	396	-	495	-	539	μA
C <sub>I</sub>	input capacitance		-	3.5	-					pF

## 11. Dynamic characteristics

**Table 7. Dynamic characteristics**

 Voltages are referenced to GND (ground = 0 V); For test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit	
			Typ	Max	Max	Max		
<b>74HC253-Q100</b>								
$t_{pd}$	propagation delay	1In to 1Y or 2In to 2Y; see <a href="#">Figure 5</a> <a href="#">[1]</a>						
		$V_{CC} = 2.0\text{ V}$	55	175	220	265	ns	
		$V_{CC} = 4.5\text{ V}$	20	35	44	53	ns	
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	17	-	-	-	ns	
		$V_{CC} = 6.0\text{ V}$	16	30	37	45	ns	
		Sn to nY; see <a href="#">Figure 5</a>						
		$V_{CC} = 2.0\text{ V}$	58	175	220	265	ns	
		$V_{CC} = 4.5\text{ V}$	21	35	44	53	ns	
$t_{en}$	enable time	$n\overline{OE}$ to nY; see <a href="#">Figure 6</a> <a href="#">[2]</a>						
		$V_{CC} = 2.0\text{ V}$	30	100	125	150	ns	
		$V_{CC} = 4.5\text{ V}$	11	20	25	30	ns	
		$V_{CC} = 6.0\text{ V}$	9	17	21	26	ns	
$t_{dis}$	disable time	$n\overline{OE}$ to nY; see <a href="#">Figure 6</a> <a href="#">[3]</a>						
		$V_{CC} = 2.0\text{ V}$	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 <a href="#">Figure 5</a> <a href="#">[4]</a>						
		$V_{CC} = 2.0\text{ V}$	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; $V_I = \text{GND to } V_{CC}$ <a href="#">[5]</a>	55	-			pF	
<b>74HCT253-Q100</b>								
$t_{pd}$	propagation delay	1In to 1Y or 2In to 2Y; see <a href="#">Figure 5</a> <a href="#">[1]</a>						
		$V_{CC} = 4.5\text{ V}$	20	38	48	57	ns	
		$V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$	17	-	-	-	ns	
		Sn to nY; see <a href="#">Figure 5</a>						
		$V_{CC} = 4.5\text{ V}$	22	40	50	60	ns	
$t_{en}$	enable time	$n\overline{OE}$ to nY; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a> <a href="#">[2]</a>	14	30	38	45	ns	

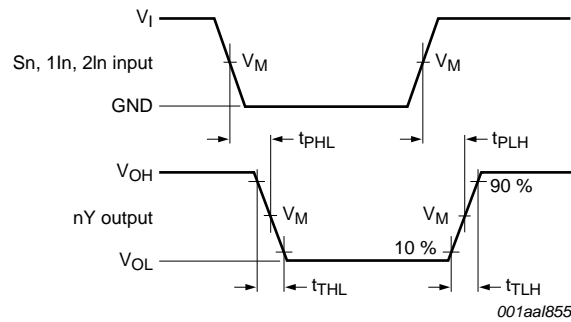
**Table 7. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); For test circuit see [Figure 7](#).

Symbol	Parameter	Conditions	25 °C		-40 °C to +85 °C	-40 °C to +125 °C	Unit
			Typ	Max	Max	Max	
$t_{dis}$	disable time	nOE to nY; $V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 6</a>	13	30	38	45	ns
$t_t$	transition time	$V_{CC} = 4.5\text{ V}$ ; see <a href="#">Figure 5</a>	5	12	15	18	ns
$C_{PD}$	power dissipation capacitance	per multiplexer; $V_I = \text{GND to } V_{CC}$	55	-			pF

- [1]  $t_{pd}$  is the same as  $t_{PHL}$ ,  $t_{PLH}$ .
- [2]  $t_{en}$  is the same as  $t_{PZH}$ ,  $t_{PZL}$ .
- [3]  $t_{dis}$  is the same as  $t_{PHZ}$ ,  $t_{PLZ}$ .
- [4]  $t_t$  is the same as  $t_{THL}$ ,  $t_{TLH}$ .
- [5]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$  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;  
 $\sum(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs.

## 12. Waveforms

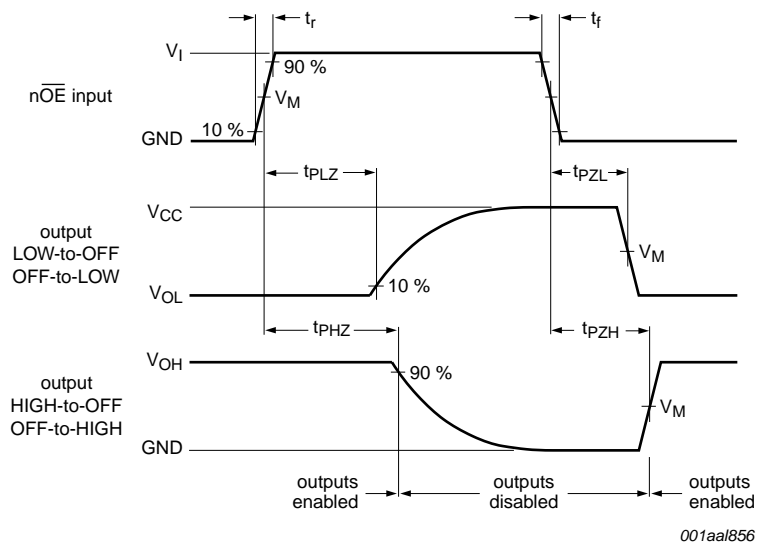


Measurement points are given in [Table 8](#).

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

**Fig 5. Propagation delays input (Sn, 1In, 2In) to output (nY) and output (nY) transition times**



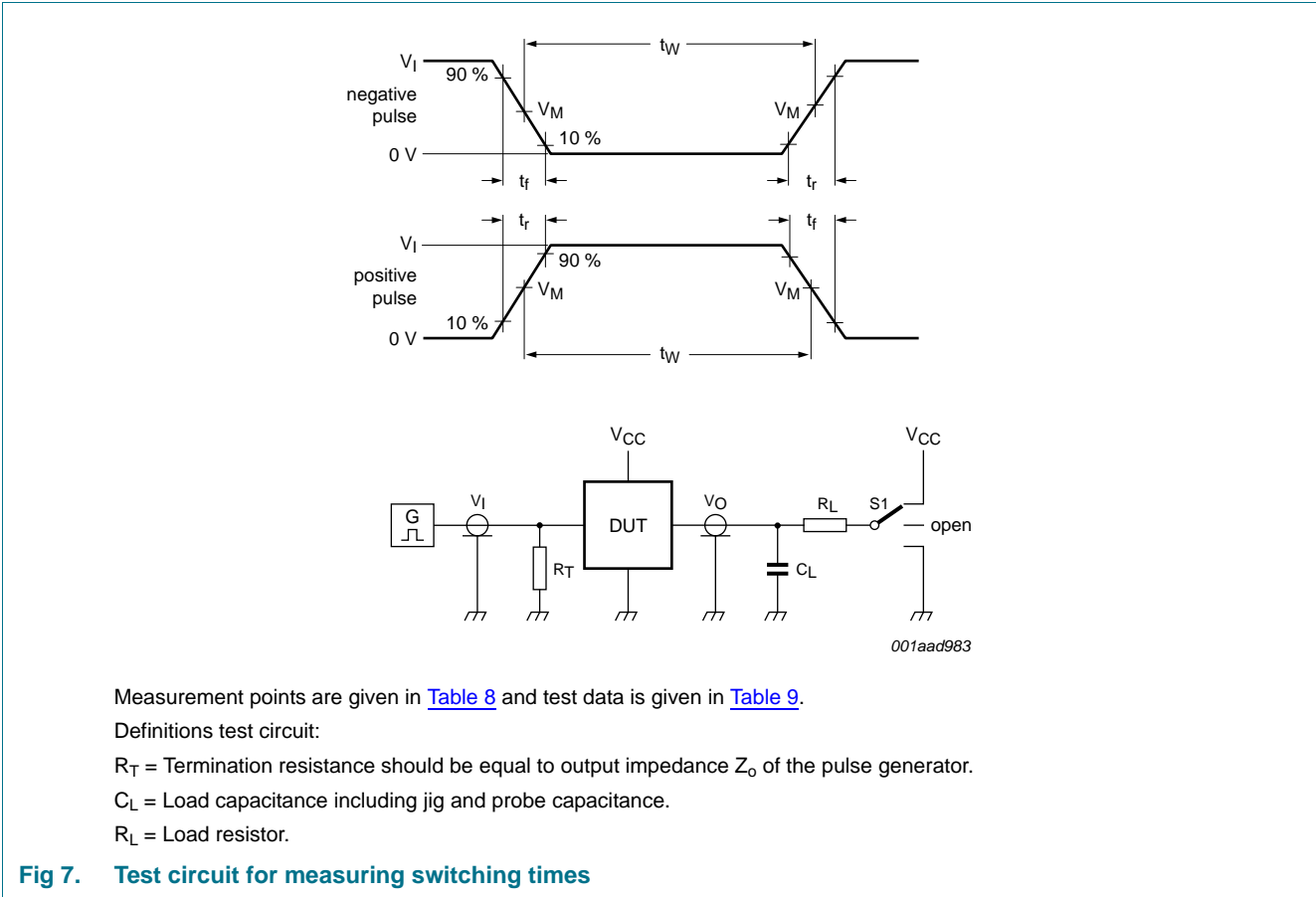


Measurement points are given in [Table 8](#).  
 $V_{OL}$  and  $V_{OH}$  are typical voltage output levels that occur with the output load.

**Fig 6. 3-state output enable and disable times**

**Table 8. Measurement points**

Type	Input	Output
	$V_M$	$V_M$
74HC253-Q100	$0.5V_{CC}$	$0.5V_{CC}$
74HCT253-Q100	1.3 V	1.3 V



**Table 9. Test data**

Type	Input		Load		Switch position		
	$V_I$	$t_r, t_f$	$C_L$	$R_L$	$t_{PHL}, t_{PLH}$	$t_{PZH}, t_{PHZ}$	$t_{PZL}, t_{PLZ}$
74HC253-Q100	$V_{CC}$	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$
74HCT253-Q100	3 V	6 ns	50 pF	1 k $\Omega$	open	GND	$V_{CC}$

13. Package outline

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

SOT109-1

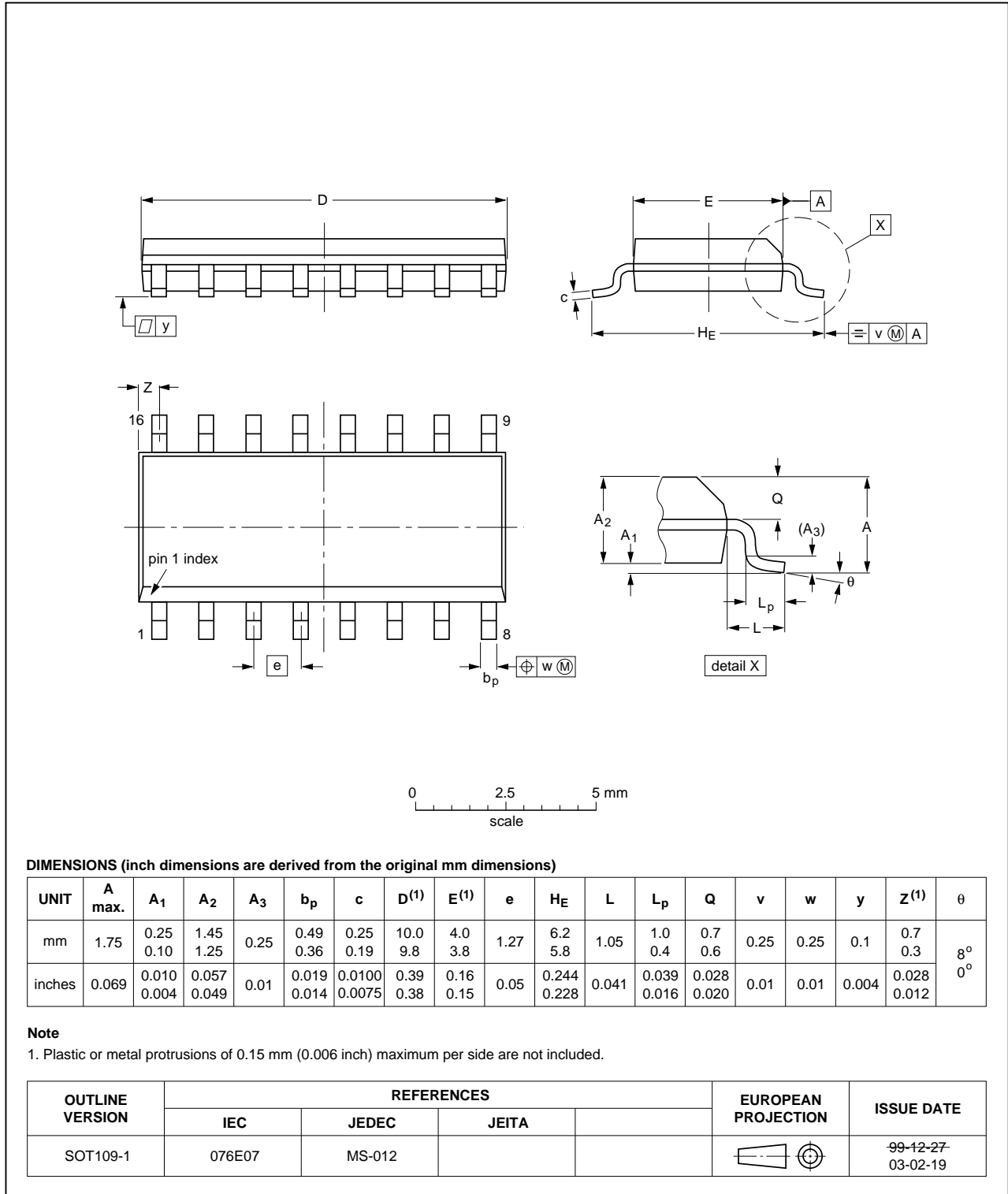


Fig 8. Package outline SOT109-1 (SO16)

## 14. 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
MIL	Military

## 15. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT253_Q100 v.1	20120717	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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 <http://www.nxp.com>.

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