

74HC253; 74HCT253

Dual 4-input multiplexer; 3-state

Rev. 6 — 1 February 2016

Product data sheet

1. General description

The 74HC253; 74HCT253 is a dual 4-bit multiplexer, each with four binary inputs (nI0 to nI3), an output enable input (nOE) and shared select inputs (S0 and S1). One of the four binary inputs is selected by the select inputs and routed to the output nY. A HIGH on nOE causes the outputs to assume a high-impedance OFF-state. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of V_{cc}.

2. Features and benefits

- 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: CMOS level
 - ◆ For 74HCT253: TTL level
- 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. Applications

- Data selectors
- Data multiplexers

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4. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74HC253D | −40 °C to +125 °C | SO16 | plastic small outline package; 16 leads; body width 3.9 mm | SOT109-1 |
| 74HCT253D | | | | |
| 74HC253DB | −40 °C to +125 °C | SSOP16 | plastic shrink small outline package; 16 leads; body width 5.3 mm | SOT338-1 |
| 74HCT253DB | | | | |

5. Functional diagram

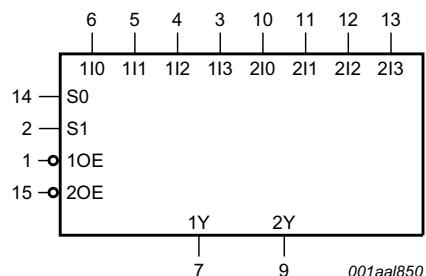


Fig 1. Logic symbol

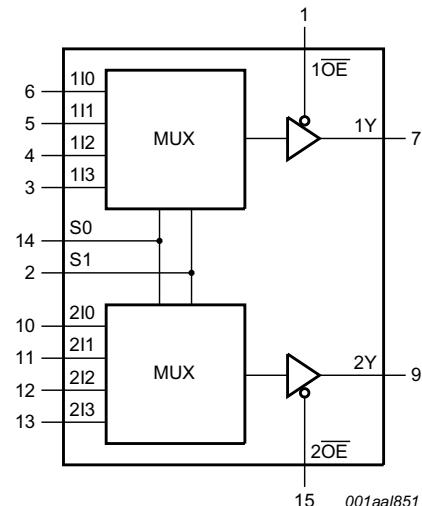


Fig 2. Functional diagram

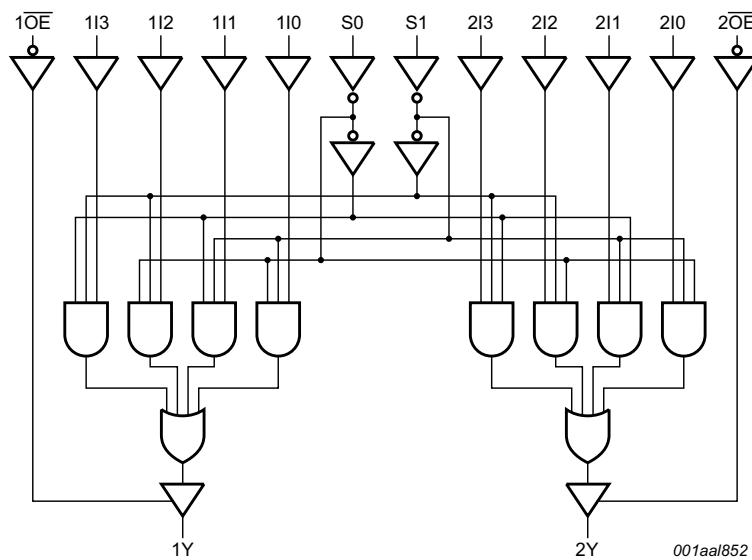


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

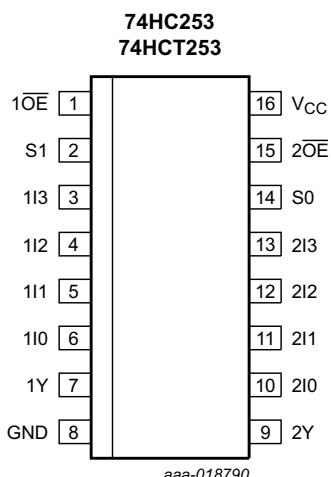


Fig 4. Pin configuration SO16

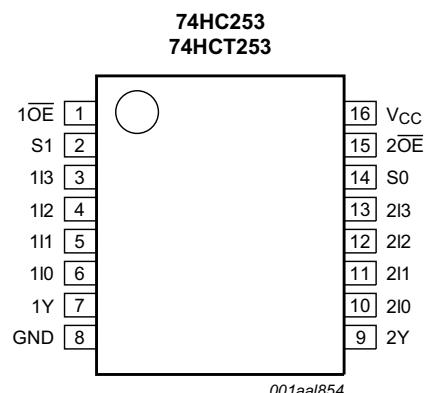


Fig 5. Pin configuration SSOP16

6.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|--------------------|----------------|-----------------------------------|
| 1OE, 2OE | 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 |

7. Functional description

Table 3. Function table^[1]

| select Inputs | | data inputs | | | | output enable | output |
|---------------|----|-------------|-----|-----|-----|---------------|--------|
| S0 | S1 | 1I0 | 1I1 | 1I2 | 1I3 | 2OE | 1Y |
| 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 _{CC} | supply voltage | | -0.5 | +7.0 | 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 | -0.5 V < V _O < V _{CC} + 0.5 V | - | ±35 | mA |
| I _{CC} | supply current | | - | 70 | mA |
| I _{GND} | ground current | | -70 | - | 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 | | | |
| | | SO16 package | [2] | - | 500 mW |
| | | SSOP16 package | [3] | - | 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.[3] P_{tot} derates linearly with 5.5 mW/K above 60 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V)

| Symbol | Parameter | Conditions | 74HC253 | | | 74HCT253 | | | 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 |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 2.0 V | - | - | 625 | - | - | - | ns/V |
| | | V _{CC} = 4.5 V | - | 1.67 | 139 | - | 1.67 | 139 | ns/V |
| | | V _{CC} = 6.0 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 | |
| 74HC253 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | 3.15 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | 4.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | - | 1.35 | V |
| | | V _{CC} = 6.0 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 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -20 μA; V _{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | 5.9 | - | V |
| | | I _O = -6.0 mA; V _{CC} = 4.5 V | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| | | I _O = -7.8 mA; V _{CC} = 6.0 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 _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 20 µA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 µA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 20 µA; V _{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 6.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| | | I _O = 7.8 mA; V _{CC} = 6.0 V | - | 0.16 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | µA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 6.0 V | - | - | ±0.5 | - | ±5.0 | - | ±10.0 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 8.0 | - | 80 | - | 160 | µA |
| C _I | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

74HCT253

| | | | | | | | | | | |
|------------------|---------------------------|--|------|------|------|------|------|-----|------|----|
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = −20 µA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = −6 mA | 3.98 | 4.32 | - | 3.84 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 20 µA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 6.0 mA | - | 0.15 | 0.26 | - | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.1 | - | ±1.0 | - | ±1.0 | µA |
| I _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.5 | - | ±5.0 | - | ±10 | µA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 8.0 | - | 80 | - | 160 | µA |
| ΔI _{CC} | additional supply current | V _I = V _{CC} − 2.1 V; other inputs at V _{CC} or GND; V _{CC} = 4.5 V to 5.5 V; I _O = 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 _I | 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 8](#).

| Symbol | Parameter | Conditions | 25 °C | | –40 °C to +85 °C | –40 °C to +125 °C | Unit |
|-----------------|-------------------------------|---|-------|-----|------------------|-------------------|------|
| | | | Typ | Max | Max | Max | |
| 74HC253 | | | | | | | |
| t_{pd} | propagation delay | 1In to 1Y or 2In to 2Y; see Figure 6 [1] | | | | | |
| | | $V_{CC} = 2.0$ V | 55 | 175 | 220 | 265 | ns |
| | | $V_{CC} = 4.5$ V | 20 | 35 | 44 | 53 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | 17 | - | - | - | ns |
| | | $V_{CC} = 6.0$ V | 16 | 30 | 37 | 45 | ns |
| | | Sn to nY; see Figure 6 | | | | | |
| | | $V_{CC} = 2.0$ V | 58 | 175 | 220 | 265 | ns |
| | | $V_{CC} = 4.5$ V | 21 | 35 | 44 | 53 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | 18 | - | - | - | ns |
| | | $V_{CC} = 6.0$ V | 17 | 30 | 37 | 45 | ns |
| t_{en} | enable time | \overline{nOE} to nY; see Figure 7 [2] | | | | | |
| | | $V_{CC} = 2.0$ V | 30 | 100 | 125 | 150 | ns |
| | | $V_{CC} = 4.5$ V | 11 | 20 | 25 | 30 | ns |
| | | $V_{CC} = 6.0$ V | 9 | 17 | 21 | 26 | ns |
| t_{dis} | disable time | \overline{nOE} to nY; see Figure 7 [3] | | | | | |
| | | $V_{CC} = 2.0$ V | 41 | 150 | 190 | 225 | ns |
| | | $V_{CC} = 4.5$ V | 15 | 30 | 38 | 45 | ns |
| | | $V_{CC} = 6.0$ V | 12 | 26 | 33 | 38 | ns |
| t_t | transition time | see Figure 6 [4] | | | | | |
| | | $V_{CC} = 2.0$ V | 14 | 60 | 75 | 90 | ns |
| | | $V_{CC} = 4.5$ V | 5 | 12 | 15 | 18 | ns |
| | | $V_{CC} = 6.0$ V | 4 | 10 | 13 | 15 | ns |
| C_{PD} | power dissipation capacitance | per multiplexer; $V_I = \text{GND}$ to V_{CC} [5] | 55 | - | - | - | pF |
| 74HCT253 | | | | | | | |
| t_{pd} | propagation delay | 1In to 1Y or 2In to 2Y; see Figure 6 [1] | | | | | |
| | | $V_{CC} = 4.5$ V | 20 | 38 | 48 | 57 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | 17 | - | - | - | ns |
| | | Sn to nY; see Figure 6 | | | | | |
| | | $V_{CC} = 4.5$ V | 22 | 40 | 50 | 60 | ns |
| | | $V_{CC} = 5.0$ V; $C_L = 15$ pF | 19 | - | | | ns |
| | | nOE to nY; $V_{CC} = 4.5$ V; see Figure 7 [2] | 14 | 30 | 38 | 45 | ns |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Table 7. Dynamic characteristics ...continuedVoltages are referenced to GND (ground = 0 V); For test circuit see [Figure 8](#).

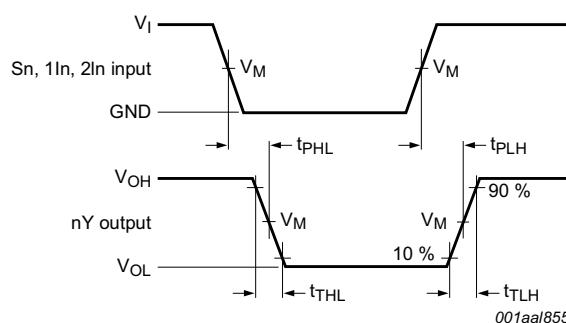
| Symbol | Parameter | Conditions | 25 °C | | -40 °C to +85 °C | -40 °C to +125 °C | Unit |
|-----------|-------------------------------|---|-------|-----|------------------|-------------------|------|
| | | | Typ | Max | Max | Max | |
| t_{dis} | disable time | $n\overline{OE}$ to nY ; $V_{CC} = 4.5$ V; [3] see Figure 7 | 13 | 30 | 38 | 45 | ns |
| t_t | transition time | $V_{CC} = 4.5$ V; see Figure 6 | 5 | 12 | 15 | 18 | ns |
| C_{PD} | power dissipation capacitance | per multiplexer; [5] $V_I = \text{GND to } V_{CC} - 1.5$ V | 55 | - | - | - | pF |

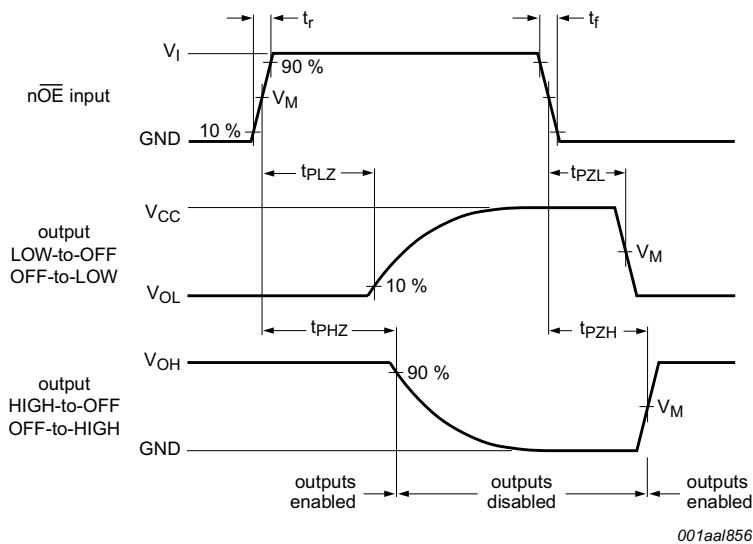
[1] t_{pd} is the same as t_{PHL} , t_{PLH} .[2] t_{en} is the same as t_{PZH} , t_{PZL} .[3] t_{dis} is the same as t_{PHZ} , t_{PLZ} .[4] t_t is the same as t_{THL} , t_{TLH} .[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ 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 6. Propagation delays input (Sn, 1In, 2In) to output (nY) and output (nY) transition times**



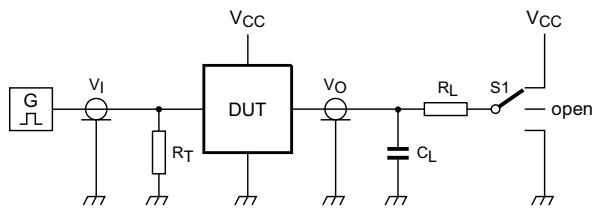
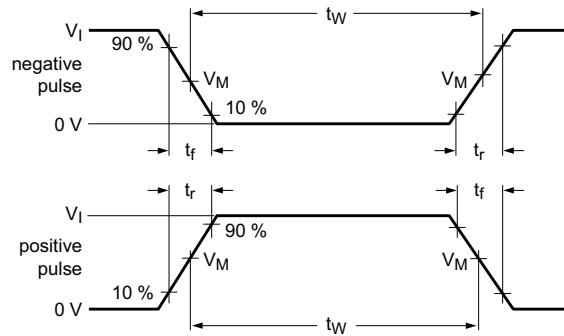
Measurement points are given in [Table 8](#).

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

Fig 7. 3-state output enable and disable times

Table 8. Measurement points

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



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

C_L = Load capacitance including jig and probe capacitance.

R_L = Load resistor.

Fig 8. Test circuit for measuring switching times

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 | V_{CC} | 6 ns | 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT253 | 3 V | 6 ns | 50 pF | 1 k Ω | open | GND | V_{CC} |

13. Package outline

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

SOT109-1

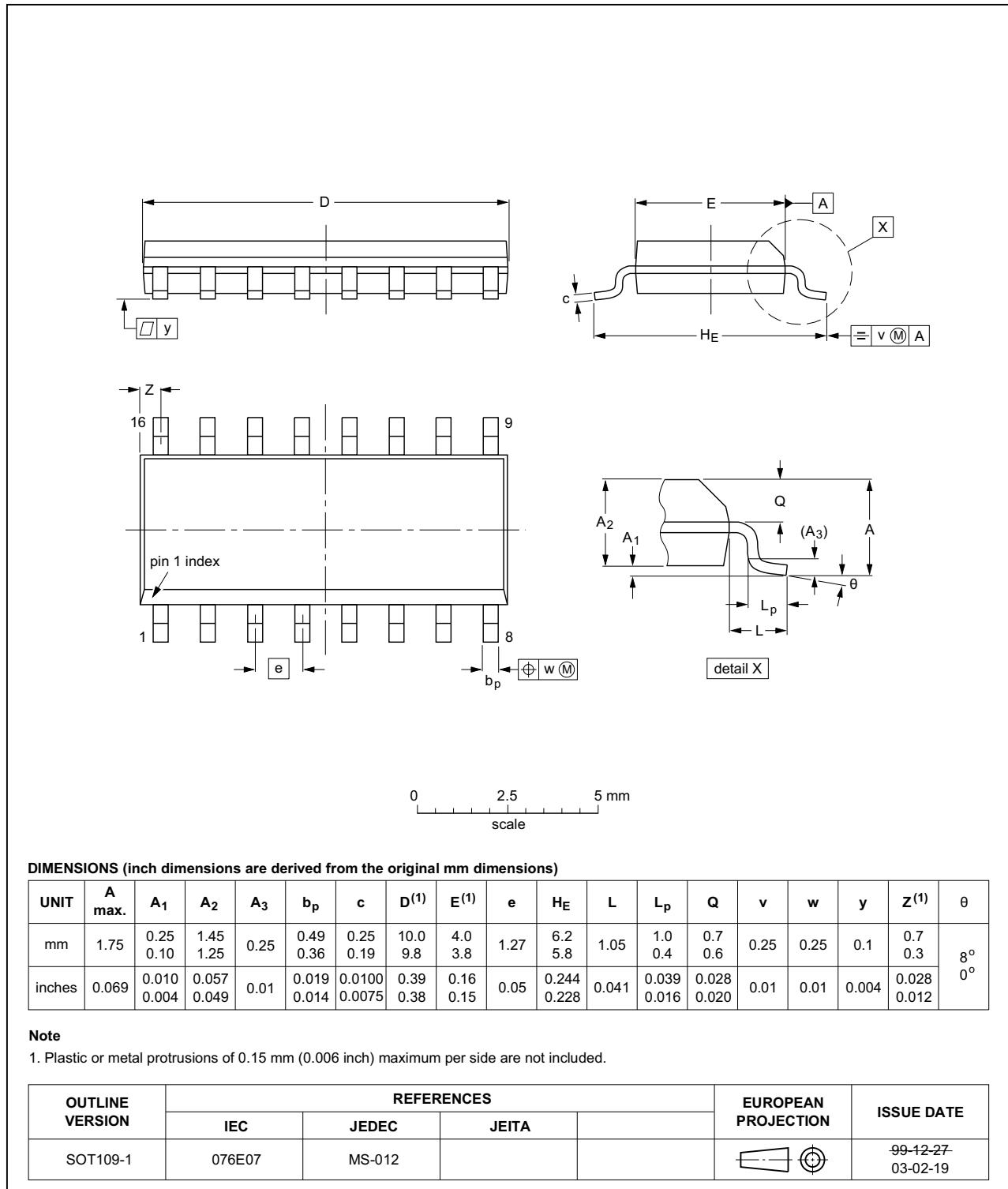


Fig 9. Package outline SOT109-1 (SO16)

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

SOT338-1

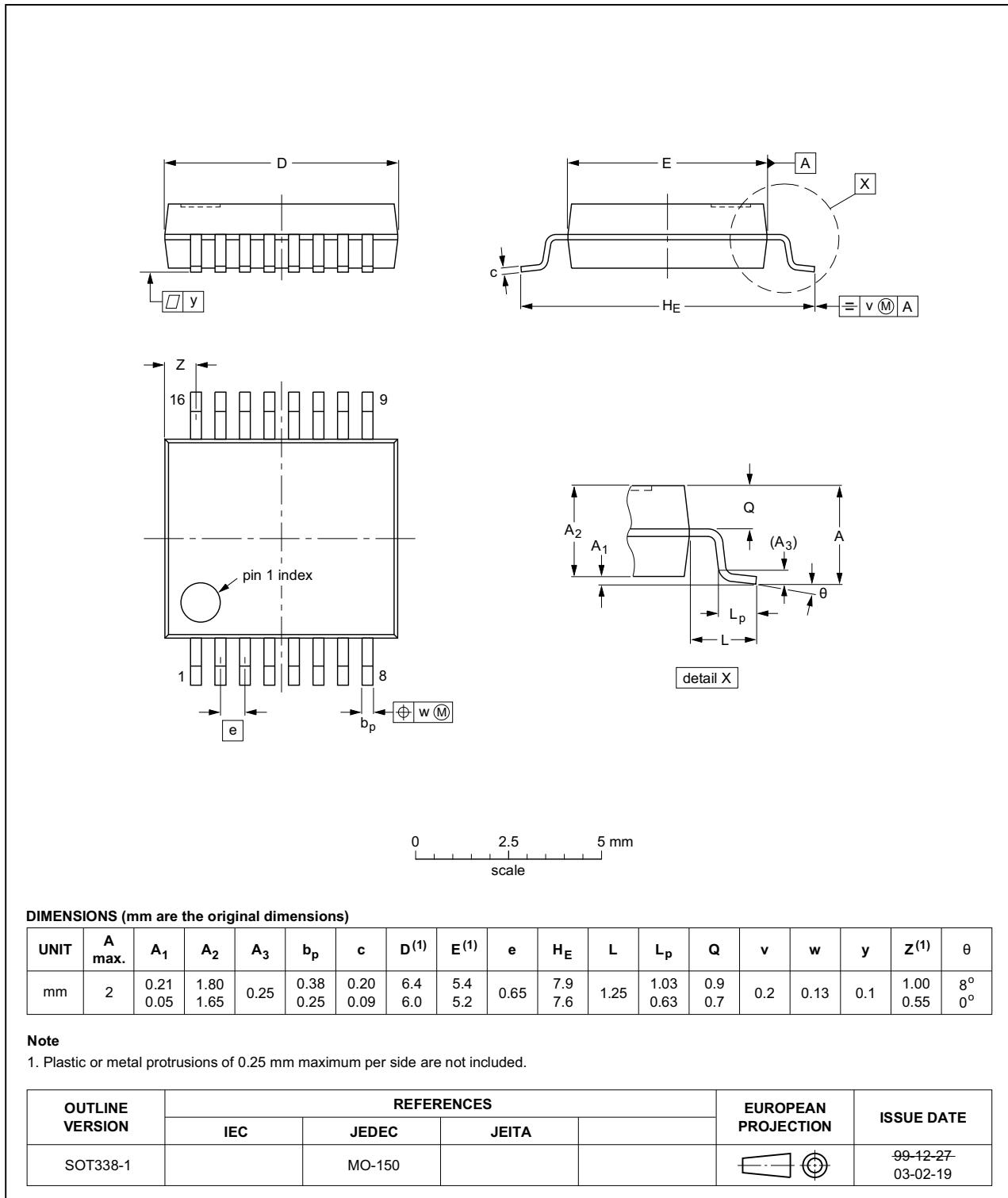


Fig 10. Package outline SOT338-1 (SSOP16)

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 |

15. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------------|---|-----------------------|---------------|---------------------|
| 74HC_HCT253 v.6 | 20160201 | Product data sheet | - | 74HC_HCT253 v.5 |
| Modifications: | <ul style="list-style-type: none"> Type numbers 74HC253N and 74HCT253N (SOT38-4) removed. | | | |
| 74HC_HCT253 v.5 | 20150121 | Product data sheet | - | 74HC_HCT253 v.4 |
| Modifications: | <ul style="list-style-type: none"> Table 7: Power dissipation capacitance condition for 74HCT253 is corrected. | | | |
| 74HC_HCT253 v.4 | 20111212 | Product data sheet | - | 74HC_HCT253 v.3 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74HC_HCT253 v.3 | 20100422 | Product data sheet | - | 74HC_HCT253_CNV v.2 |
| 74HC_HCT253_CNV v.2 | 970828 | Product specification | - | - |

16. Legal information

16.1 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 <http://www.nexperia.com>.

16.2 Definitions

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