

74HC257-Q100; 74HCT257-Q100

Quad 2-input multiplexer; 3-state

Rev. 1 — 27 July 2015

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

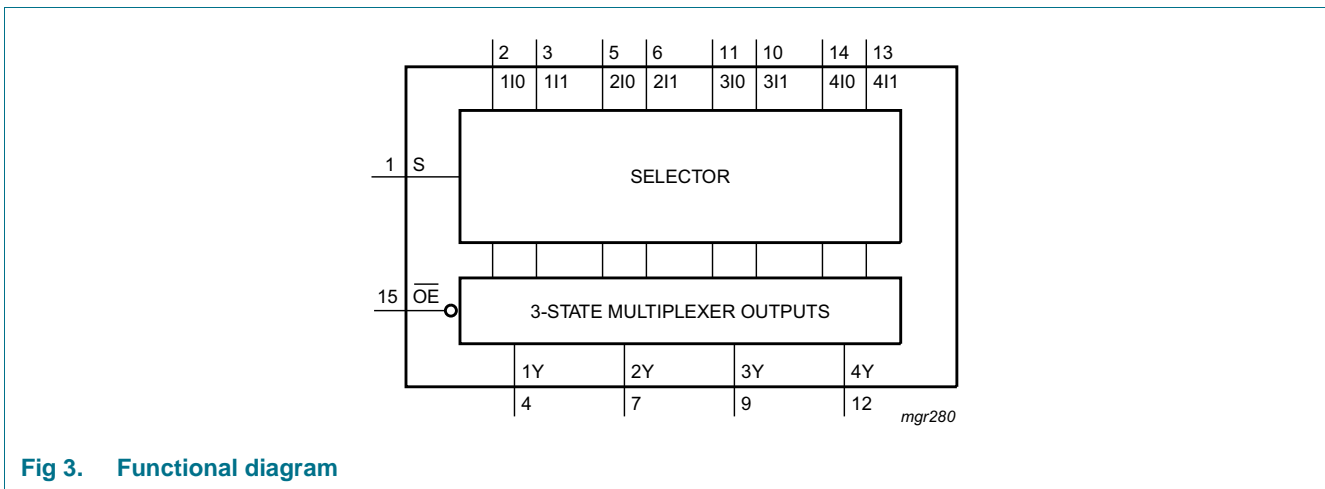
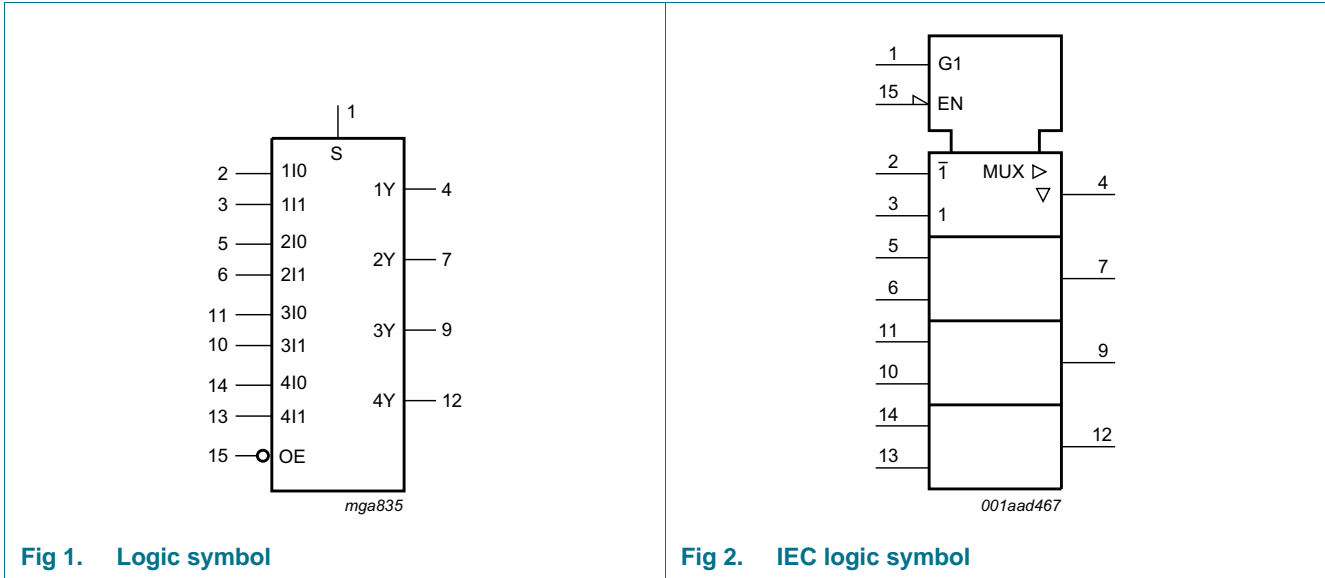
- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - ◆ Specified from -40 °C to $+85\text{ °C}$ and from -40 °C to $+125\text{ °C}$
- Non-inverting data path
- 3-state outputs interface directly with system bus
- Complies with JEDEC standard no. 7A
- Input levels:
 - ◆ For 74HC257: CMOS level
 - ◆ For 74HCT257: 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 ($C = 200\text{ pF}$, $R = 0\ \Omega$)
- Specified from -40 °C to $+85\text{ °C}$ and from -40 °C to $+125\text{ °C}$

3. Ordering information

Table 1. Ordering information

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

4. Functional diagram



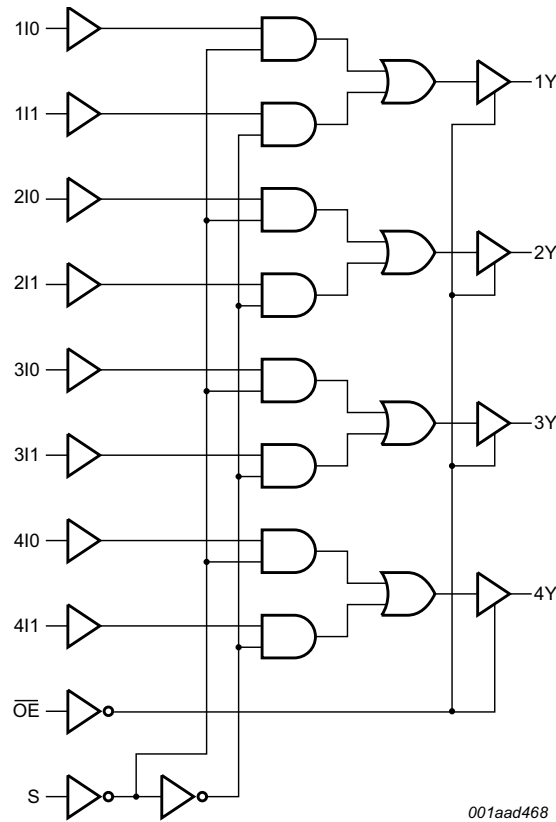


Fig 4. Logic diagram

5. Pinning information

5.1 Pinning

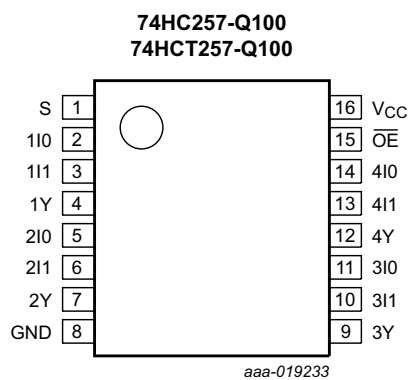


Fig 5. Pin configuration SO16 and TSSOP16

5.2 Pin description

Table 2. Pin description

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

6. Functional description

6.1 Function table

Table 3. Function table^[1]

| Control | | Input | | Output |
|------------------------|---|-------|-----|--------|
| $\overline{\text{OE}}$ | 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 |

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

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 | +7 | 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] | - | ±20 | mA |
| I _O | output current | V _O = -0.5 V to 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 |
| P _{tot} | total power dissipation | SO16 package ^[2] | - | 500 | mW |
| | | TSSOP16 package ^[3] | - | 500 | mW |

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

[2] For SO16 packages: above 70 °C, P_{tot} derates linearly with 8 mW/K.

[3] For TSSOP16 packages: above 60 °C, P_{tot} derates linearly with 5.5 mW/K.

8. Recommended operating conditions

Table 5. Recommended operating conditions

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

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 | |
| 74HC257-Q100 | | | | | | | | | | |
| 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 _{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 |
| 74HCT257-Q100 | | | | | | | | | | |
| 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 | - | 0.33 | - | 0.4 | 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 _{CC} = 5.5 V; V _O = V _{CC} or GND per input pin; other inputs at V _{CC} or GND; I _O = 0 A | - | - | ±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; nI0, nI1 inputs | - | 40 | 144 | - | 180 | - | 196 | μA |
| | | per input pin; $\overline{\text{OE}}$ input | - | 135 | 486 | - | 608 | - | 662 | μA |
| | | per input pin; S input | - | 70 | 252 | - | 315 | - | 343 | μA |
| C _i | input capacitance | | - | 3.5 | - | - | - | - | - | pF |

10. 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 | |
| 74HC257-Q100 | | | | | | | |
| t_{pd} | propagation delay | nI0 to nY or nI1 to nY; see Figure 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 Figure 6 | | | | | |
| | | $V_{CC} = 2.0\text{ V}$ | 47 | 150 | 190 | 225 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 17 | 30 | 38 | 45 | ns |
| t_{en} | enable time | \overline{OE} to nY; see Figure 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 Figure 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 Figure 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 |
| 74HCT257-Q100 | | | | | | | |
| t_{pd} | propagation delay | nI0 to nY or nI1 to nY; see Figure 6 ^[1] | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | 16 | 30 | 38 | 45 | ns |
| | | $V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$ | 13 | - | - | - | ns |
| | | S to nY; see Figure 6 | | | | | |
| | | $V_{CC} = 4.5\text{ V}$ | 20 | 35 | 44 | 53 | ns |
| t_{en} | enable time | \overline{OE} to nY; $V_{CC} = 4.5\text{ V}$; see Figure 7 ^[2] | 15 | 30 | 38 | 45 | ns |
| | | $V_{CC} = 5.0\text{ V}; C_L = 15\text{ pF}$ | 17 | - | - | - | ns |
| t_{dis} | disable time | \overline{OE} to nY; $V_{CC} = 4.5\text{ V}$; see Figure 7 ^[3] | 16 | 30 | 38 | 45 | ns |
| t_t | transition time | $V_{CC} = 4.5\text{ V}$; see Figure 6 ^[4] | 5 | 12 | 15 | 18 | ns |

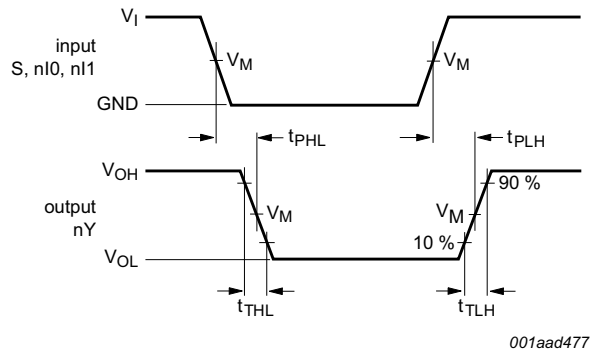
Table 7. Dynamic characteristics ...continued

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 | |
| C _{PD} | power dissipation capacitance | per multiplexer; V _I = GND to V _{CC} - 1.5 V [5] | 45 | - | - | - | 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.

11. Waveforms



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



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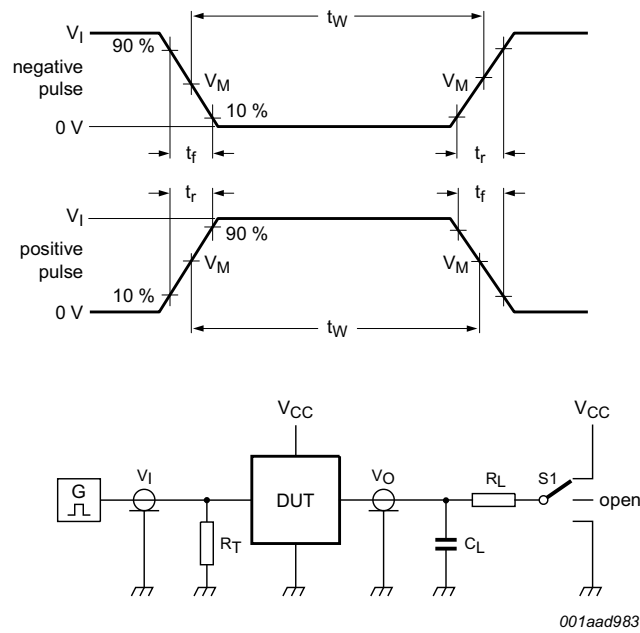
Measurement points are given in [Table 8](#).

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 |



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} |
| 74HC257-Q100 | V_{CC} | 6 ns | 50 pF | 1 k Ω | open | GND | V_{CC} |
| 74HCT257-Q100 | 3 V | 6 ns | 50 pF | 1 k Ω | open | GND | V_{CC} |

12. Package outline

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

SOT109-1

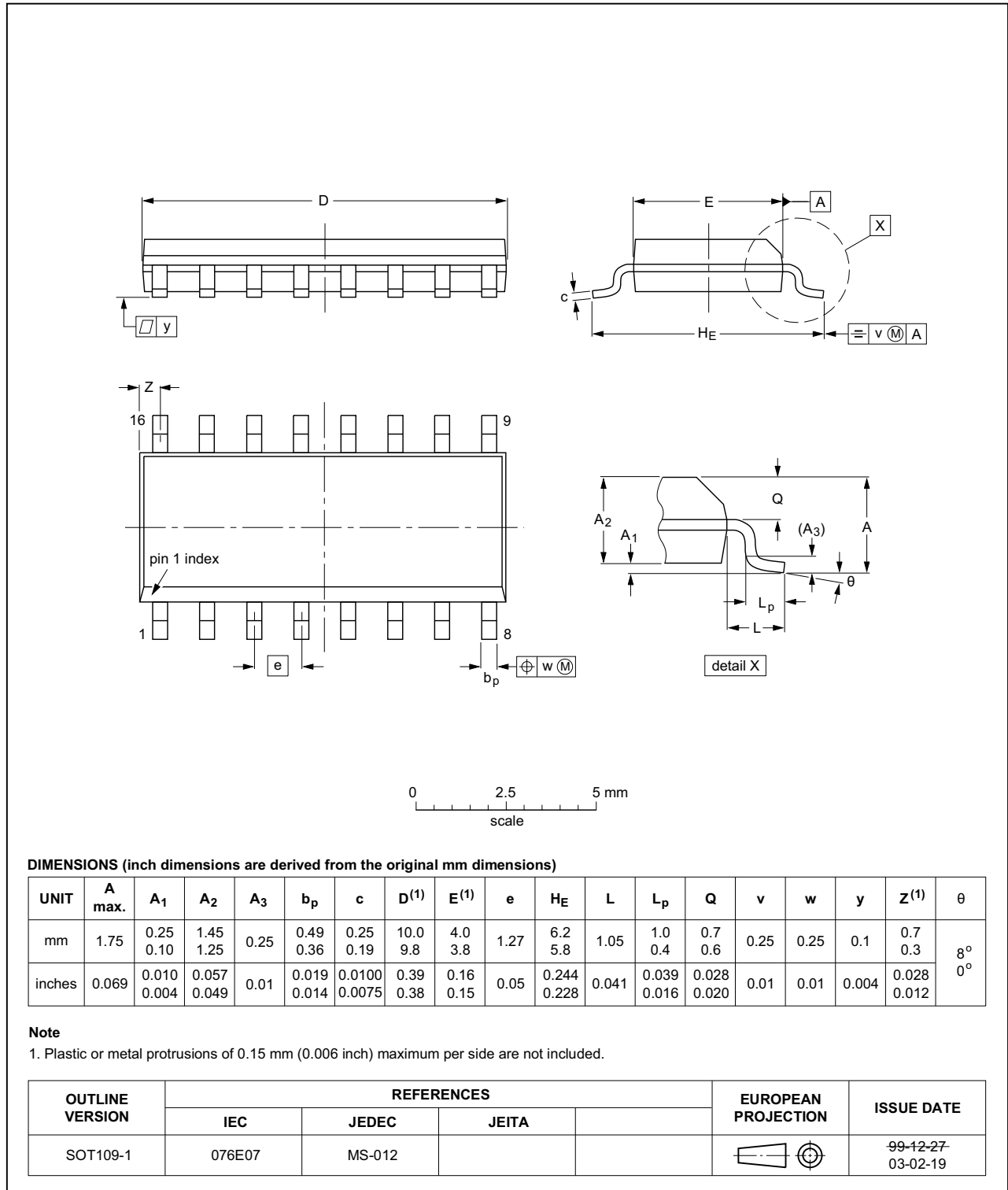


Fig 9. Package outline SOT109-1 (SO16)

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

SOT403-1

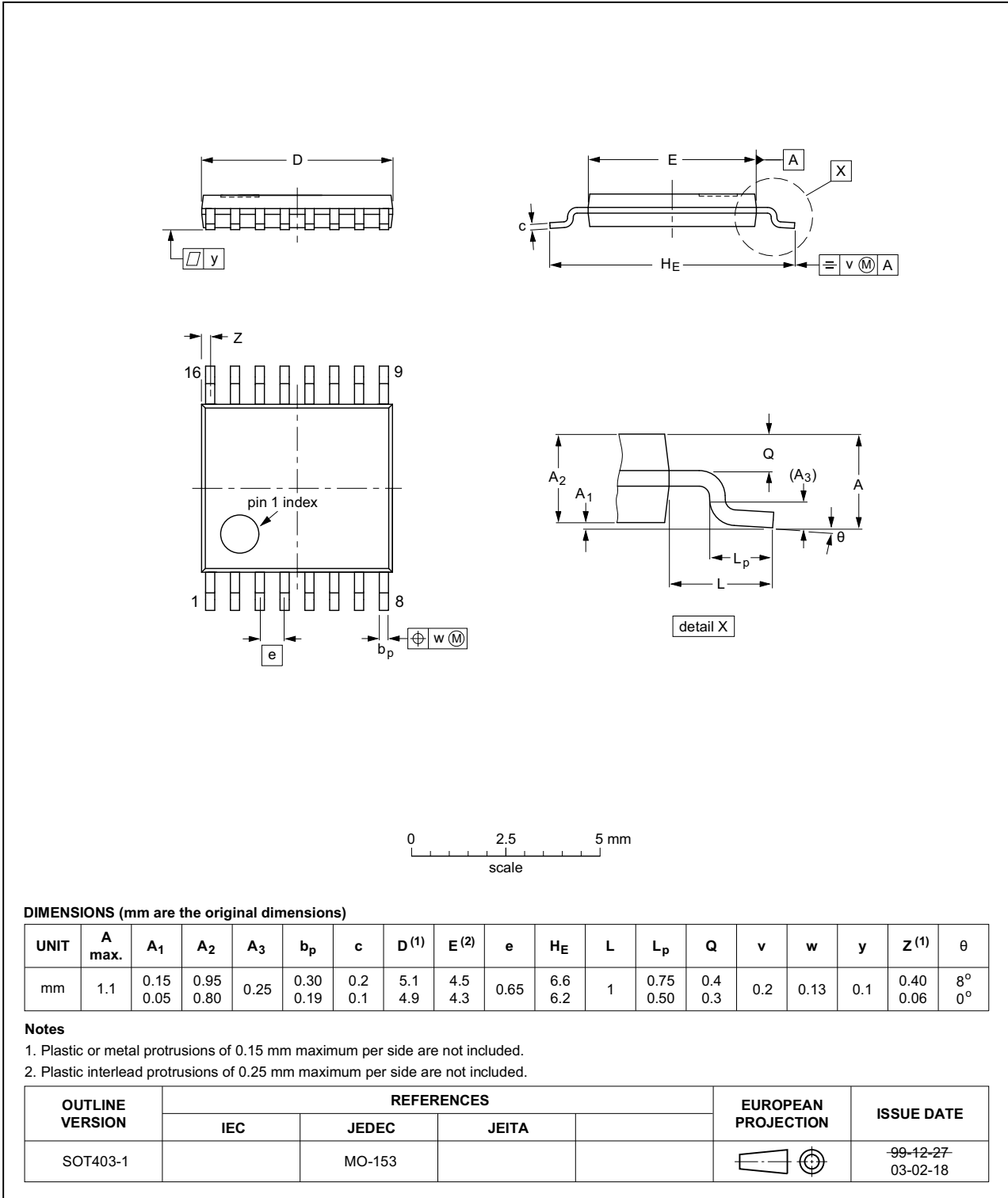


Fig 10. Package outline SOT403-1 (TSSOP16)

13. 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 |

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------------|--------------|--------------------|---------------|------------|
| 74HC_HCT257_Q100 v.1 | 20150727 | Product data sheet | - | - |

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

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