

74HC153D

1. Functional Description

- Dual 4-Channel Multiplexer

2. General

The 74HC153D is high speed CMOS DUAL 4-CHANNEL MULTIPLEXERS fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

Input data (1C0~1C2, 2C0~2C3) are selected by the two address inputs, A and B.

Separate strobe inputs ($\overline{1G}$, $\overline{2G}$) are provided for each of the two four-line sections. They can be used to inhibit the data outputs. The output is set low, when the strobe inputs are low.

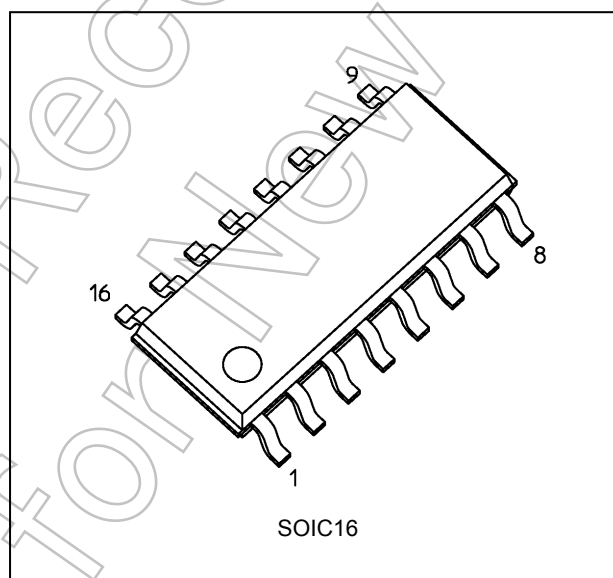
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

3. Features

- (1) Wide operating temperature range: $T_{opr} = -40$ to 125 °C (Note 1)
- (2) High speed: $t_{pd} = 12$ ns (typ.) at $V_{CC} = 5$ V
- (3) Low power dissipation: $I_{CC} = 4.0$ μ A (max) at $T_a = 25$ °C
- (4) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (5) Wide operating voltage range: $V_{CC(opr)} = 2.0$ to 6.0 V

Note 1: Operating Range spec of $T_{opr} = -40$ °C to 125 °C is applicable only for the products which manufactured after July 2020.

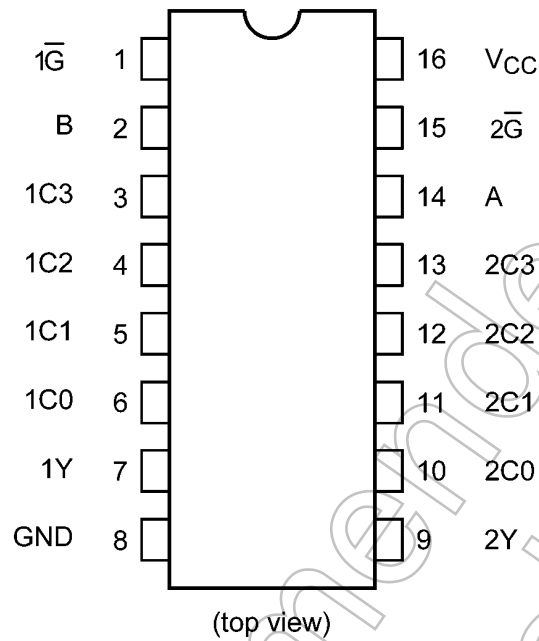
4. Packaging



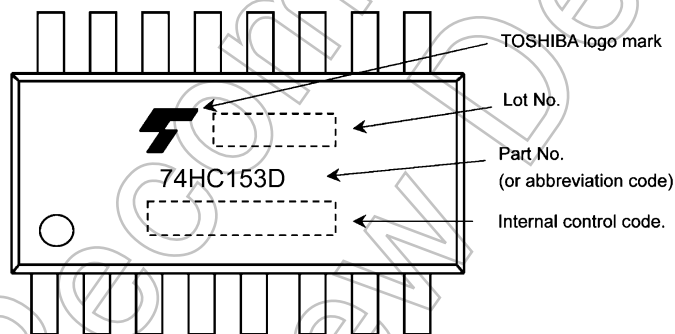
Start of commercial production

2020-07

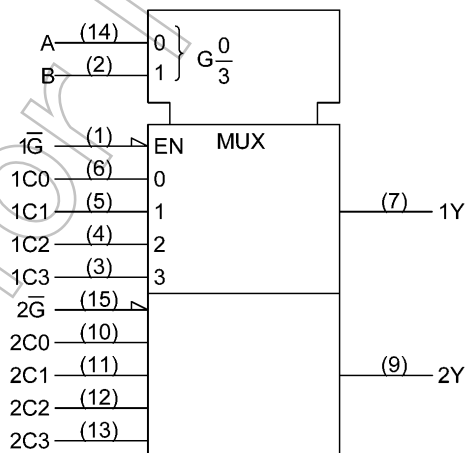
5. Pin Assignment



6. Marking



7. IEC Logic Symbol

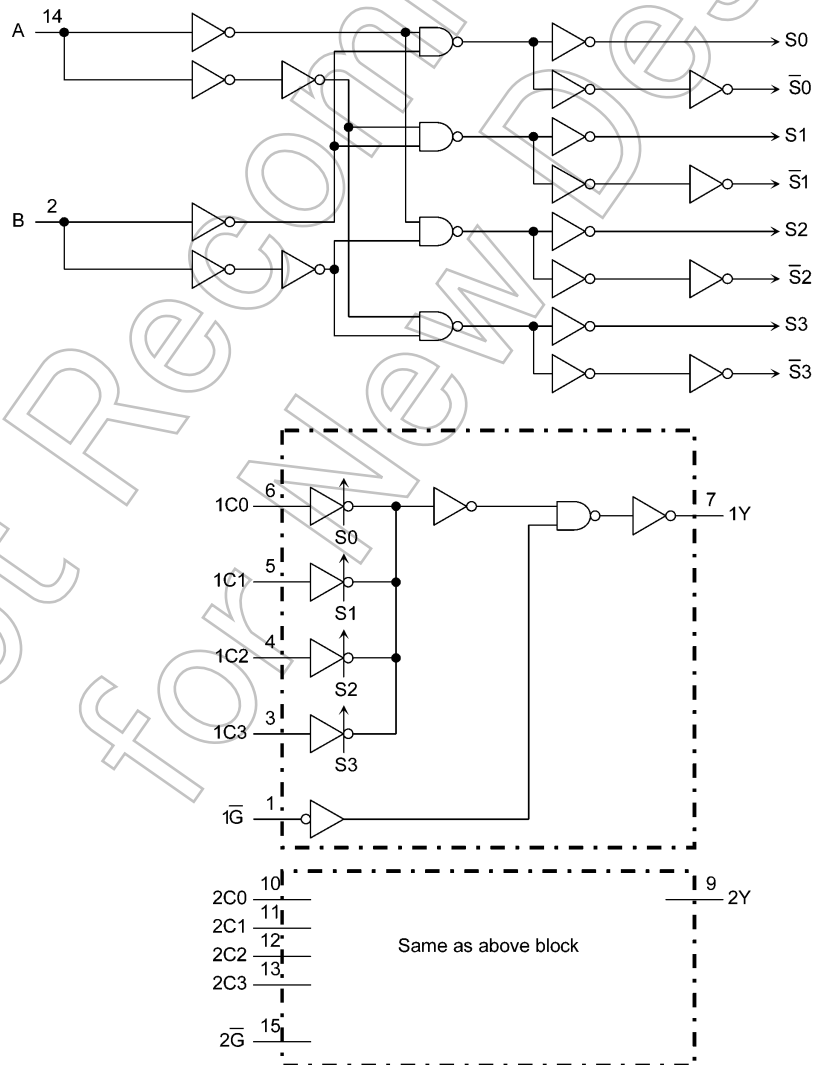


8. Truth Table

| Select Inputs | | Data Inputs | | | | Strobe | Output |
|---------------|---|-------------|----|----|----|-----------|--------|
| B | A | C0 | C1 | C2 | C3 | \bar{G} | Y |
| X | X | X | X | X | X | H | L |
| L | L | L | X | X | X | L | L |
| L | L | H | X | X | X | L | H |
| L | H | X | L | X | X | L | L |
| L | H | X | H | X | X | L | H |
| H | L | X | X | L | X | L | L |
| H | L | X | X | H | X | L | H |
| H | H | X | X | X | L | L | L |
| H | H | X | X | X | H | L | H |

X: Don't care

9. System Diagram



10. Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Note | Rating | Unit |
|--------------------------|-----------|----------|------------------------|------|
| Supply voltage | V_{CC} | | -0.5 to 7.0 | V |
| Input voltage | V_{IN} | | -0.5 to $V_{CC} + 0.5$ | V |
| Output voltage | V_{OUT} | | -0.5 to $V_{CC} + 0.5$ | V |
| Input diode current | I_{IK} | | ± 20 | mA |
| Output diode current | I_{OK} | | ± 20 | mA |
| Output current | I_{OUT} | | ± 25 | mA |
| V_{CC} /ground current | I_{CC} | | ± 50 | mA |
| Power dissipation | P_D | (Note 1) | 500 | mW |
| Storage temperature | T_{stg} | | -65 to 150 | °C |

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: P_D derates linearly with -8 mW/°C above 85 °C

11. Operating Ranges (Note)

| Characteristics | Symbol | Test Condition | Note | Rating | Unit |
|---------------------------|------------|-------------------------|----------|---------------|------|
| Supply voltage | V_{CC} | | | 2.0 to 6.0 | V |
| Input voltage | V_{IN} | | | 0 to V_{CC} | V |
| Output voltage | V_{OUT} | | | 0 to V_{CC} | V |
| Operating temperature | T_{opr} | | (Note 1) | -40 to 125 | °C |
| Input rise and fall times | t_r, t_f | $V_{CC} = 2.0\text{ V}$ | | 0 to 1000 | ns |
| | | $V_{CC} = 4.5\text{ V}$ | | 0 to 500 | |
| | | $V_{CC} = 6.0\text{ V}$ | | 0 to 400 | |

Note: The operating ranges are required to ensure the normal operation of the device. Unused inputs must be tied to either V_{CC} or GND.

Note 1: Operating Range spec of $T_{opr} = -40\text{ °C}$ to 125 °C is applicable only for the products which manufactured after July 2020.

12. Electrical Characteristics

12.1. DC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Min | Typ. | Max | Unit | |
|---------------------------|----------|-------------------------------|-----------------------------------|------|------|-----------|---------------|---|
| High-level input voltage | V_{IH} | — | 2.0 | 1.50 | — | — | V | |
| | | | 4.5 | 3.15 | — | — | | |
| | | | 6.0 | 4.20 | — | — | | |
| Low-level input voltage | V_{IL} | — | 2.0 | — | — | 0.50 | V | |
| | | | 4.5 | — | — | 1.35 | | |
| | | | 6.0 | — | — | 1.80 | | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\text{ }\mu\text{A}$ | 2.0 | 1.9 | 2.0 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | |
| | | | $I_{OH} = -4\text{ mA}$ | 4.5 | 4.18 | 4.31 | — | |
| | | | | 6.0 | 5.68 | 5.80 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20\text{ }\mu\text{A}$ | 2.0 | — | 0.0 | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | |
| | | | $I_{OL} = 4\text{ mA}$ | 4.5 | — | 0.17 | 0.26 | |
| | | | | 6.0 | — | 0.18 | 0.26 | |
| Input leakage current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | ± 0.1 | μA | |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | — | 4.0 | μA | |

12.2. DC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Min | Max | Unit | |
|---------------------------|----------|-------------------------------|-----------------------------------|------|-----------|---------------|---|
| High-level input voltage | V_{IH} | — | 2.0 | 1.50 | — | V | |
| | | | 4.5 | 3.15 | — | | |
| | | | 6.0 | 4.20 | — | | |
| Low-level input voltage | V_{IL} | — | 2.0 | — | 0.50 | V | |
| | | | 4.5 | — | 1.35 | | |
| | | | 6.0 | — | 1.80 | | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20\text{ }\mu\text{A}$ | 2.0 | 1.9 | — | V |
| | | | | 4.5 | 4.4 | — | |
| | | | $I_{OH} = -4\text{ mA}$ | 4.5 | 4.13 | — | |
| | | | | 6.0 | 5.63 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20\text{ }\mu\text{A}$ | 2.0 | — | 0.1 | V |
| | | | | 4.5 | — | 0.1 | |
| | | | | 6.0 | — | 0.1 | |
| | | | $I_{OL} = 4\text{ mA}$ | 4.5 | — | 0.33 | |
| | | | | 6.0 | — | 0.33 | |
| Input leakage current | I_{IN} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | ± 1.0 | μA | |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | 6.0 | — | 40.0 | μA | |

12.3. DC Characteristics (Note) (Unless otherwise specified, $T_a = -40$ to 125 °C)

| Characteristics | Symbol | Test Condition | | V_{CC} (V) | Min | Max | Unit |
|---------------------------|----------|-------------------------------|------------------------|--------------|------|-----------|---------|
| High-level input voltage | V_{IH} | — | | 2.0 | 1.50 | — | V |
| | | | | 4.5 | 3.15 | — | |
| | | | | 6.0 | 4.20 | — | |
| Low-level input voltage | V_{IL} | — | | 2.0 | — | 0.50 | V |
| | | | | 4.5 | — | 1.35 | |
| | | | | 6.0 | — | 1.80 | |
| High-level output voltage | V_{OH} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OH} = -20$ μ A | 2.0 | 1.9 | — | V |
| | | | | 4.5 | 4.4 | — | |
| | | | | 6.0 | 5.9 | — | |
| | | | $I_{OH} = -4$ mA | 4.5 | 3.7 | — | |
| | | | | 6.0 | 5.2 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20$ μ A | 2.0 | — | 0.1 | V |
| | | | | 4.5 | — | 0.1 | |
| | | | | 6.0 | — | 0.1 | |
| | | | $I_{OL} = 4$ mA | 4.5 | — | 0.4 | |
| | | | | 6.0 | — | 0.4 | |
| Input leakage current | I_{IN} | $V_{IN} = V_{CC}$ or GND | | 6.0 | — | ± 1.0 | μ A |
| Quiescent supply current | I_{CC} | $V_{IN} = V_{CC}$ or GND | | 6.0 | — | 80.0 | μ A |

Note: Operating Range spec of $T_{opr} = -40$ °C to 125 °C is applicable only for the products which manufactured after July 2020.

12.4. AC Characteristics

(Unless otherwise specified, $C_L = 15$ pF, $V_{CC} = 5$ V, $T_a = 25$ °C, Input: $t_r = t_f = 6$ ns)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|--------------------|----------------|-----|------|-----|------|
| Output transition time | t_{TLH}, t_{THL} | — | — | 4 | 8 | ns |
| Propagation delay time (Cn - Y) | t_{PLH}, t_{PHL} | — | — | 12 | 19 | ns |
| Propagation delay time (A, B - Y) | t_{PLH}, t_{PHL} | — | — | 17 | 26 | ns |
| Propagation delay time (\bar{G} - Y) | t_{PLH}, t_{PHL} | — | — | 8 | 16 | ns |

12.5. AC Characteristics

(Unless otherwise specified, $C_L = 50\text{pF}$, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | Note | V_{CC} (V) | Min | Typ. | Max | Unit |
|---|--------------------|----------|--------------|-----|------|-----|------|
| Output transition time | t_{TLH}, t_{THL} | | 2.0 | — | 30 | 75 | ns |
| | | | 4.5 | — | 8 | 15 | |
| | | | 6.0 | — | 7 | 13 | |
| Propagation delay time (Cn - Y) | t_{PLH}, t_{PHL} | | 2.0 | — | 48 | 115 | ns |
| | | | 4.5 | — | 15 | 23 | |
| | | | 6.0 | — | 12 | 20 | |
| Propagation delay time (A, B - Y) | t_{PLH}, t_{PHL} | | 2.0 | — | 68 | 150 | ns |
| | | | 4.5 | — | 20 | 30 | |
| | | | 6.0 | — | 16 | 26 | |
| Propagation delay time (\bar{G} - Y) | t_{PLH}, t_{PHL} | | 2.0 | — | 31 | 95 | ns |
| | | | 4.5 | — | 11 | 19 | |
| | | | 6.0 | — | 9 | 16 | |
| Input capacitance | C_{IN} | | — | — | 5 | — | pF |
| Power dissipation capacitance | C_{PD} | (Note 1) | — | — | 58 | — | pF |

Note 1: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation.

$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$$

12.6. AC Characteristics

(Unless otherwise specified, $C_L = 50\text{ pF}$, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | V_{CC} (V) | Min | Max | Unit |
|---|--------------------|--------------|-----|-----|------|
| Output transition time | t_{TLH}, t_{THL} | 2.0 | — | 95 | ns |
| | | 4.5 | — | 19 | |
| | | 6.0 | — | 16 | |
| Propagation delay time (Cn - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 145 | ns |
| | | 4.5 | — | 29 | |
| | | 6.0 | — | 25 | |
| Propagation delay time (A, B - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 190 | ns |
| | | 4.5 | — | 38 | |
| | | 6.0 | — | 33 | |
| Propagation delay time (\bar{G} - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 120 | ns |
| | | 4.5 | — | 24 | |
| | | 6.0 | — | 20 | |

12.7. AC Characteristics (Note)

(Unless otherwise specified, $C_L = 50 \text{ pF}$, $T_a = -40 \text{ to } 125 \text{ }^\circ\text{C}$, Input: $t_r = t_f = 6 \text{ ns}$)

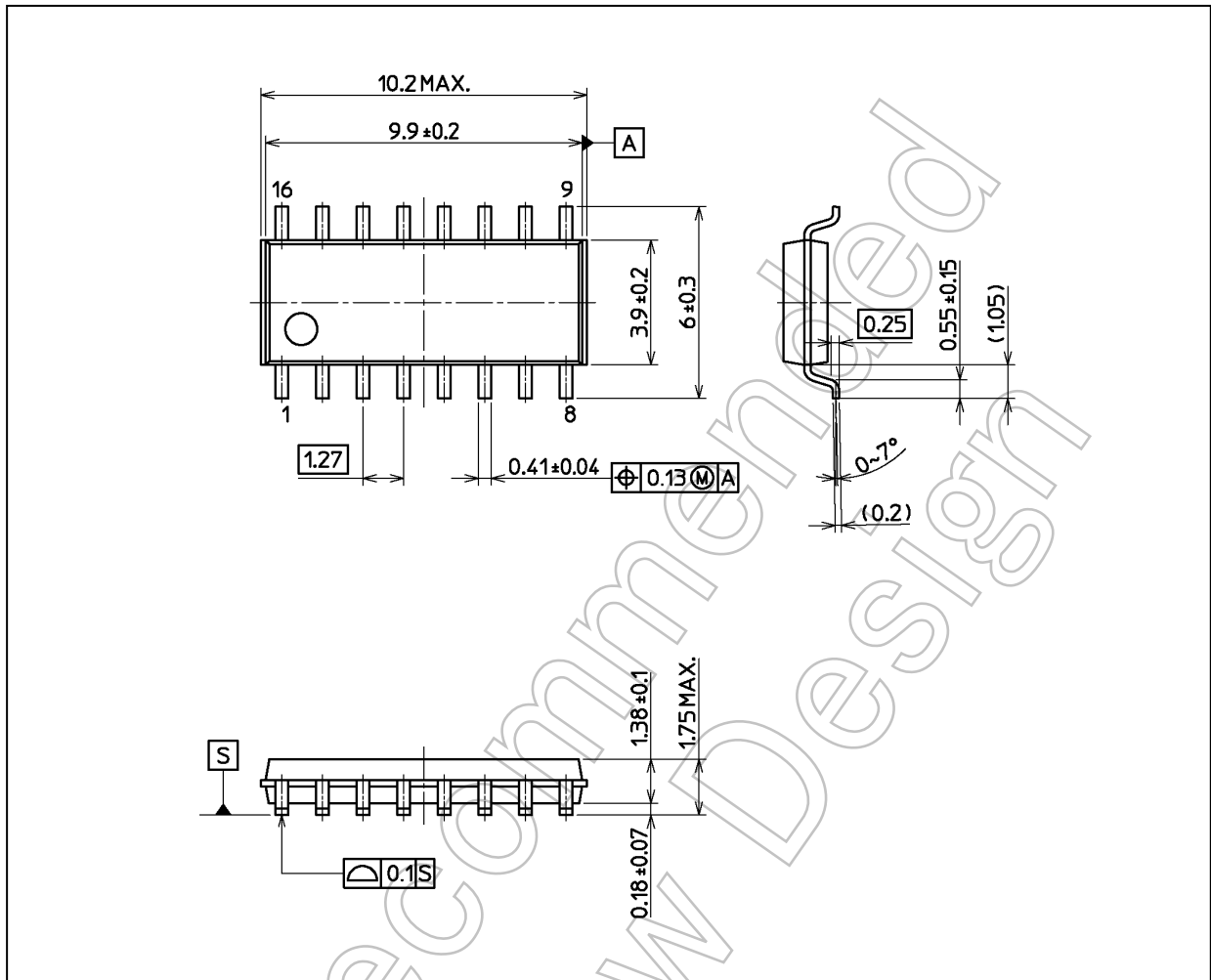
| Characteristics | Symbol | V_{CC} (V) | Min | Max | Unit |
|---|--------------------|--------------|-----|-----|------|
| Output transition time | t_{TLH}, t_{THL} | 2.0 | — | 110 | ns |
| | | 4.5 | — | 22 | |
| | | 6.0 | — | 18 | |
| Propagation delay time (Cn - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 165 | ns |
| | | 4.5 | — | 33 | |
| | | 6.0 | — | 29 | |
| Propagation delay time (A, B - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 220 | ns |
| | | 4.5 | — | 44 | |
| | | 6.0 | — | 38 | |
| Propagation delay time (\bar{G} - Y) | t_{PLH}, t_{PHL} | 2.0 | — | 140 | ns |
| | | 4.5 | — | 28 | |
| | | 6.0 | — | 23 | |

Note: Operating Range spec of $T_{opr} = -40 \text{ }^\circ\text{C}$ to $125 \text{ }^\circ\text{C}$ is applicable only for the products which manufactured after July 2020.

Not Recommended for New Design

Package Dimensions

Unit: mm



Weight: 0.15 g (typ.)

| |
|------------------|
| Package Name(s) |
| Nickname: SOIC16 |

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