CMOS Digital Integrated Circuits Silicon Monolithic

# 74HC157D

## 1. Functional Description

- Quad 2-Channel Multiplexer

## 2. General

The 74HC157D is high speed CMOS 2-CHANNEL MULTIPLEXER fabricated with silicon gate $C^2MOS$ technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

When $\overline{\text{STROBE}}$ is held high, selection of data is inhibited and all the outputs become low.

The SELECT decoding determines whether the A or B inputs get transferred to their corresponding Y outputs.

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: $t_{pd}$ = 10 ns (typ.) at $V_{CC}$ = 5 V

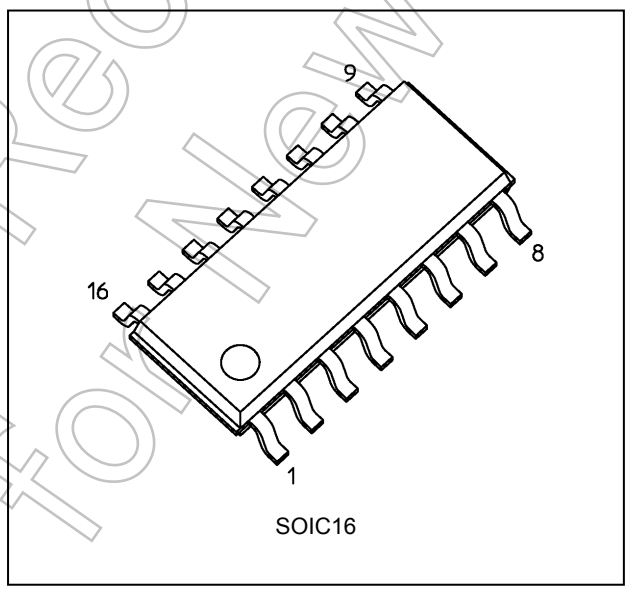
(3) Low power dissipation: $I_{CC}$ = 4.0 μA (max) at $T_a$ = 25 °C

(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

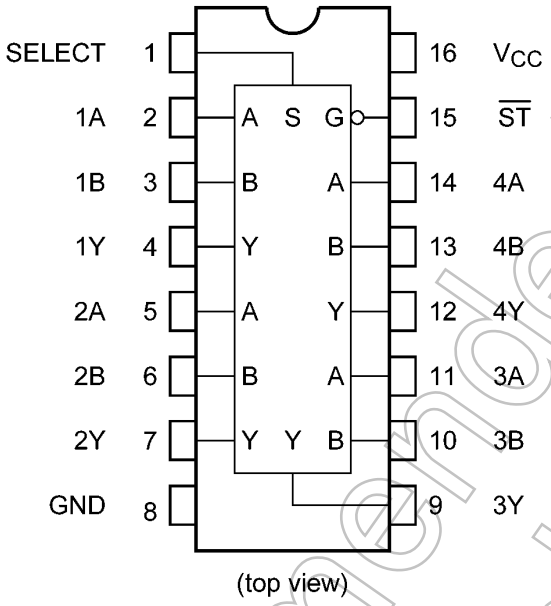



SOIC16



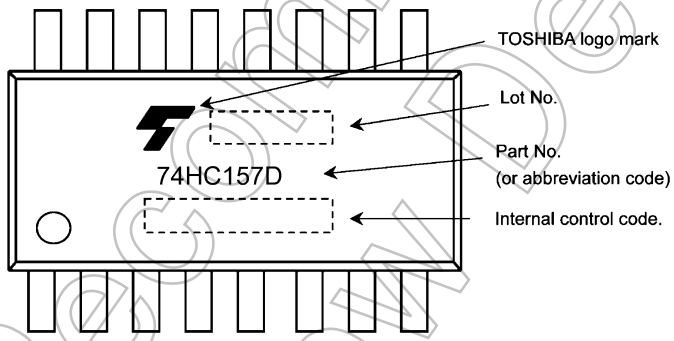
Start of commercial production
2020-07

## 5. Pin Assignment

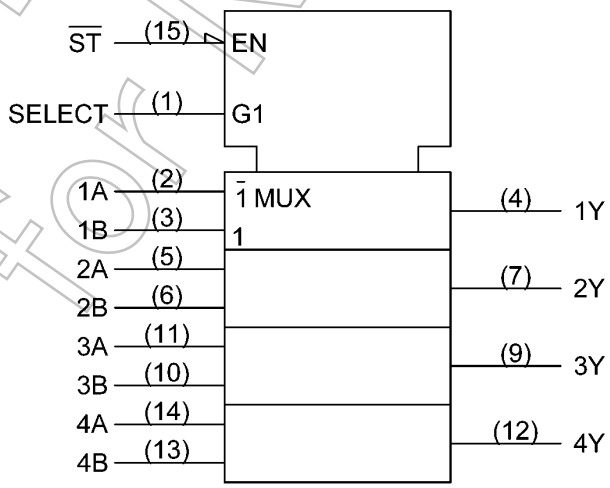



(top view)

## 6. Marking




## 7. IEC Logic Symbol

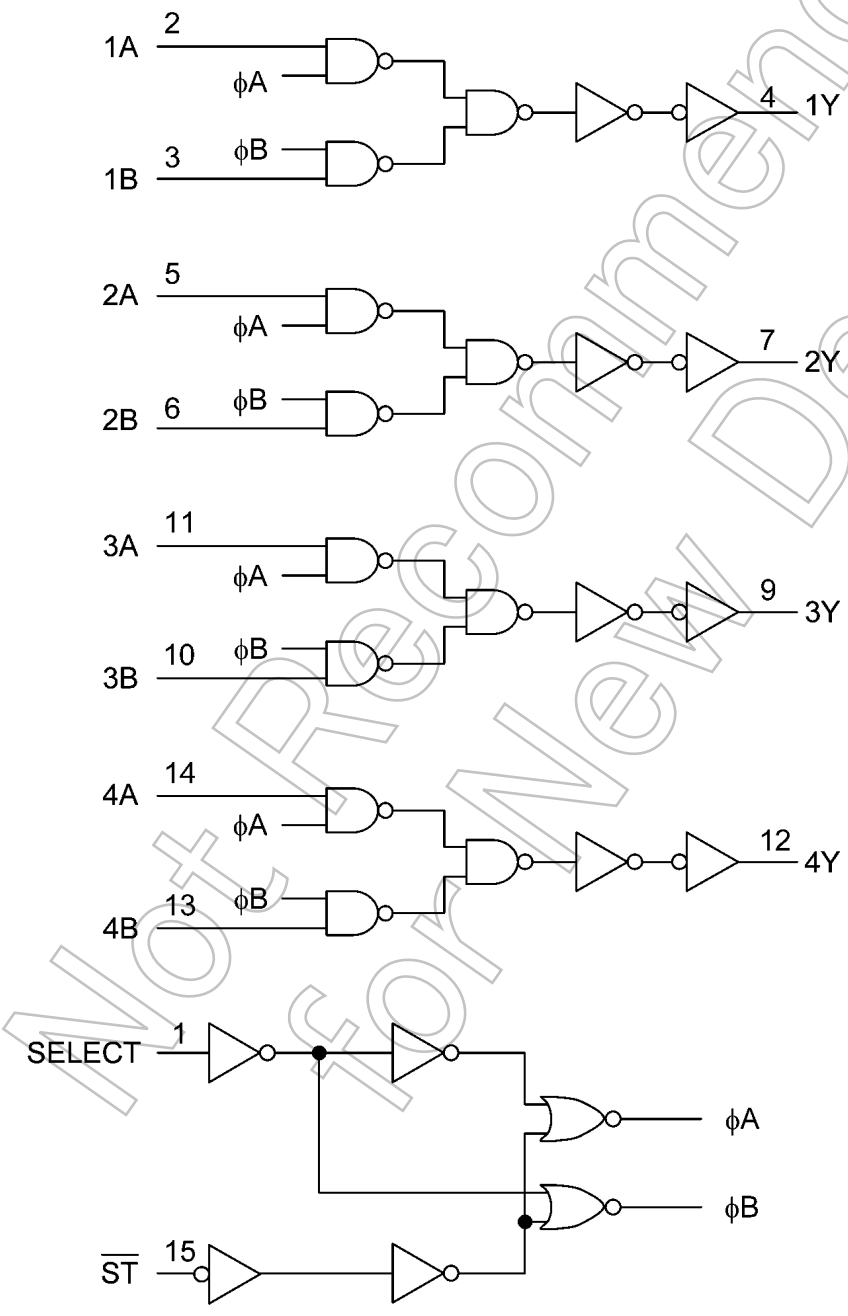


## 8. Truth Table

| $\overline{ST}$ | SELECT | A | B | OUTPUT |
|---|---|---|---|---|
| H | X | X | X | L |
| L | L | L | X | L |
| L | L | H | X | H |
| L | H | X | L | L |
| L | H | X | H | 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 V | | 0 to 1000 | ns |
| | | $V_{CC}$ = 4.5 V | | 0 to 500 | |
| | | $V_{CC}$ = 6.0 V | | 0 to 400 | |

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

Note 1: Operating Range spec of $T_{opr}$ = -40 °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 °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 μA | 2.0 | 1.9 | 2.0 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | |
| | | | $I_{OH}$ = -4 mA | 4.5 | 4.18 | 4.31 | — | |
| | | | $I_{OH}$ = -5.2 mA | 6.0 | 5.68 | 5.80 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 2.0 | — | 0.0 | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | |
| | | | $I_{OL}$ = 4 mA | 4.5 | — | 0.17 | 0.26 | |
| | | | $I_{OL}$ = 5.2 mA | 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 to 85 °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 μA | 2.0 | 1.9 | — | V |
| | | | | 4.5 | 4.4 | — | |
| | | | | 6.0 | 5.9 | — | |
| | | | $I_{OH}$ = -4 mA | 4.5 | 4.13 | — | |
| | | | $I_{OH}$ = -5.2 mA | 6.0 | 5.63 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 2.0 | — | 0.1 | V |
| | | | | 4.5 | — | 0.1 | |
| | | | | 6.0 | — | 0.1 | |
| | | | $I_{OL}$ = 4 mA | 4.5 | — | 0.33 | |
| | | | $I_{OL}$ = 5.2 mA | 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 μA | 2.0 | 1.9 | — | V |
| | | | | 4.5 | 4.4 | — | |
| | | | | 6.0 | 5.9 | — | |
| | | | $I_{OH}$ = -4 mA | 4.5 | 3.7 | — | |
| | | | $I_{OH}$ = -5.2 mA | 6.0 | 5.2 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 μA | 2.0 | — | 0.1 | V |
| | | | | 4.5 | — | 0.1 | |
| | | | | 6.0 | — | 0.1 | |
| | | | $I_{OL}$ = 4 mA | 4.5 | — | 0.4 | |
| | | | $I_{OL}$ = 5.2 mA | 6.0 | — | 0.4 | |
| 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 | — | 80.0 | μA |

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 (A, B - Y) | $t_{PLH}$,$t_{PHL}$ | — | — | 10 | 16 | ns |
| Propagation delay time (SELECT - Y) | $t_{PLH}$,$t_{PHL}$ | — | — | 13 | 21 | ns |
| Propagation delay time ($\overline{ST}$ - Y) | $t_{PLH}$,$t_{PHL}$ | — | — | 10 | 19 | ns |

## 12.5. AC Characteristics
### (Unless otherwise specified, $C_L$ = 50 pF, $T_a$ = 25 °C, Input: $t_r = t_f$ = 6 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 (A, B - Y) | $t_{PLH}$,$t_{PHL}$ | | 2.0 | — | 36 | 100 | ns |
| | | | 4.5 | — | 12 | 20 | |
| | | | 6.0 | — | 10 | 17 | |
| Propagation delay time (SELECT - Y) | $t_{PLH}$,$t_{PHL}$ | | 2.0 | — | 50 | 125 | ns |
| | | | 4.5 | — | 16 | 25 | |
| | | | 6.0 | — | 14 | 21 | |
| Propagation delay time ($\overline{ST}$ - Y) | $t_{PLH}$,$t_{PHL}$ | | 2.0 | — | 36 | 115 | ns |
| | | | 4.5 | — | 12 | 23 | |
| | | | 6.0 | — | 10 | 20 | |
| Input capacitance | $C_{IN}$ | | — | — | 5 | — | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 1) | — | — | 57 | — | 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.

$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per bit)

## 12.6. AC Characteristics
### (Unless otherwise specified, $C_L$ = 50 pF, $T_a$ = -40 to 85 °C, Input: $t_r = t_f$ = 6 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 (A, B - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 125 | ns |
| | | 4.5 | — | 25 | |
| | | 6.0 | — | 21 | |
| Propagation delay time (SELECT - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 155 | ns |
| | | 4.5 | — | 31 | |
| | | 6.0 | — | 26 | |
| Propagation delay time ($\overline{ST}$ - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 145 | ns |
| | | 4.5 | — | 29 | |
| | | 6.0 | — | 25 | |

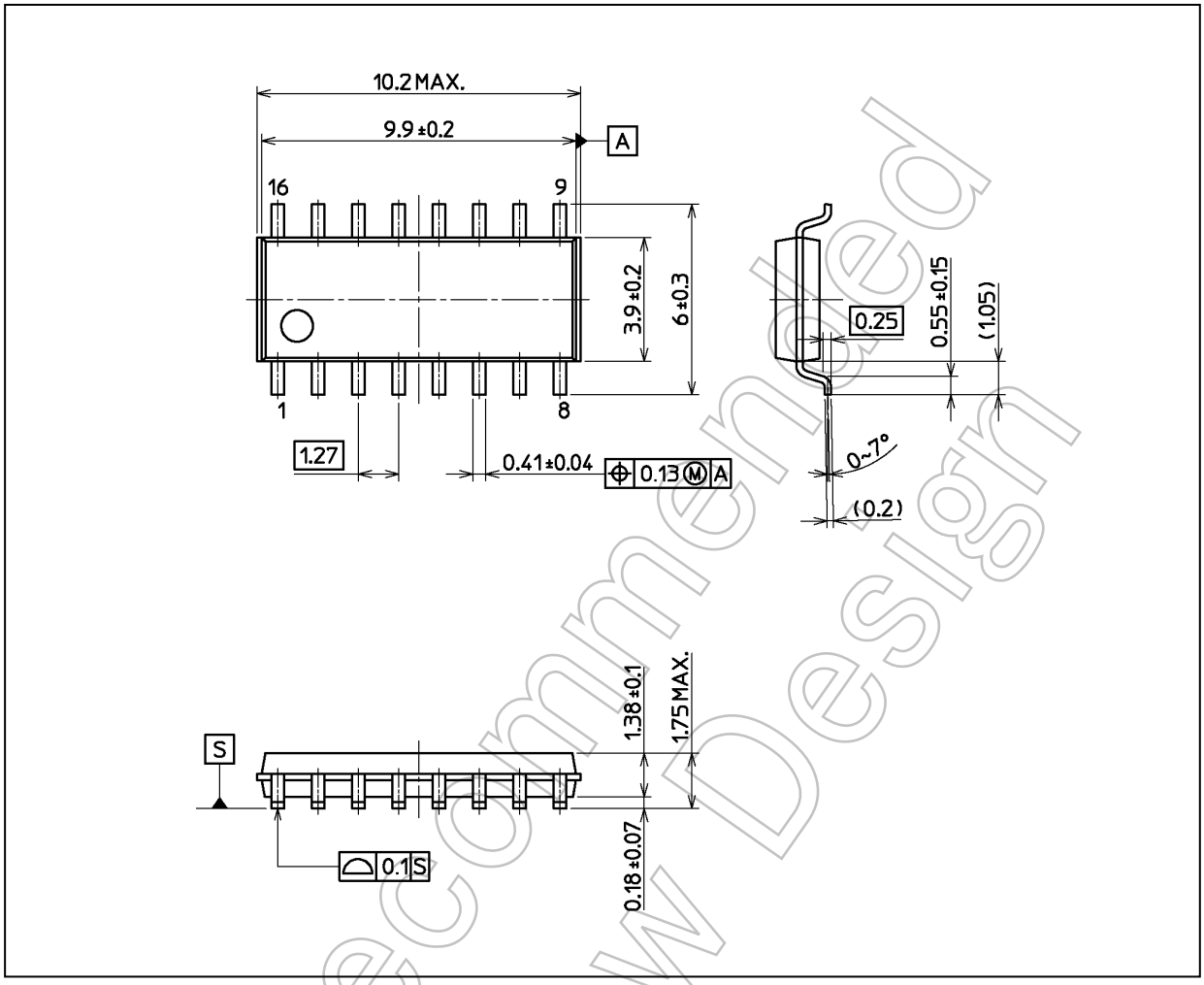
## 12.7. AC Characteristics (Note)
**(Unless otherwise specified, $C_L$ = 50 pF, $T_a$ = -40 to 125 °C, Input: $t_r = t_f$ = 6 ns)**

| 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 (A, B - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 145 | ns |
| | | 4.5 | — | 29 | |
| | | 6.0 | — | 24 | |
| Propagation delay time (SELECT - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 175 | ns |
| | | 4.5 | — | 35 | |
| | | 6.0 | — | 30 | |
| Propagation delay time ($\overline{ST}$ - Y) | $t_{PLH}$,$t_{PHL}$ | 2.0 | — | 165 | ns |
| | | 4.5 | — | 33 | |
| | | 6.0 | — | 29 | |

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

## Package Dimensions

Unit: mm




Weight: 0.15 g (typ.)

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

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