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74HC374D

1. Functional Description

- Octal D-Type Flip Flop with 3-State Outputs

2. General

The 74HC374D is a high speed CMOS OCTAL FLIP-FLOP with 3-STATE OUTPUT fabricated with silicon gate C²MOS technology.

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

These 8-bit D-type flip-flops are controlled by a clock input (CK) and an output enable input (\overline{OE}).

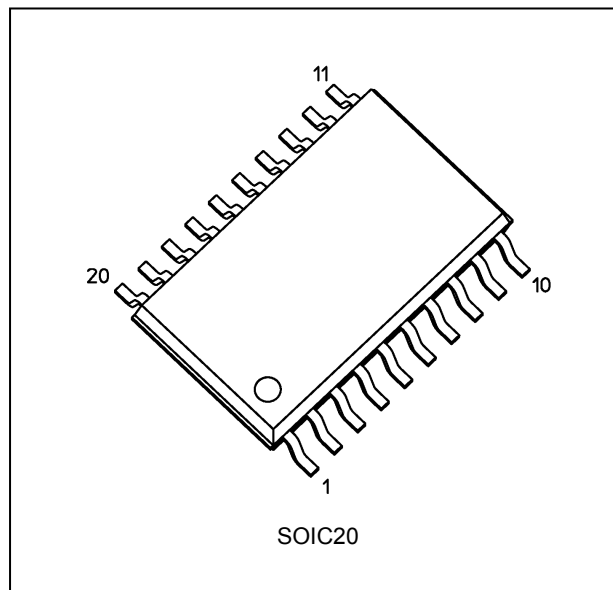
When the input is high, the eight outputs are in a high impedance state.

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

3. Features

- (1) High speed: $f_{MAX} = 90$ MHz (typ.) at $V_{CC} = 6.0$ V
- (2) Low power dissipation: $I_{CC} = 4.0$ μ A (max) at $T_a = 25$ °C
- (3) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (4) Wide operating voltage range: $V_{CC(opr)} = 2.0$ V to 6.0 V

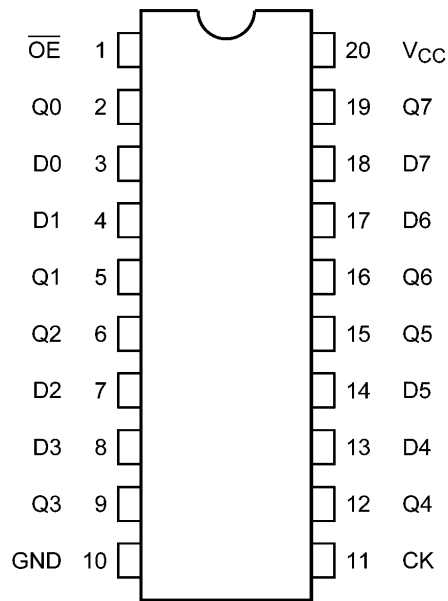
4. Packaging



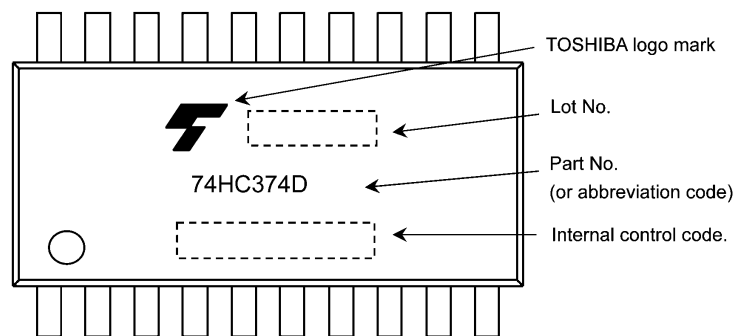
Start of commercial production

2016-03

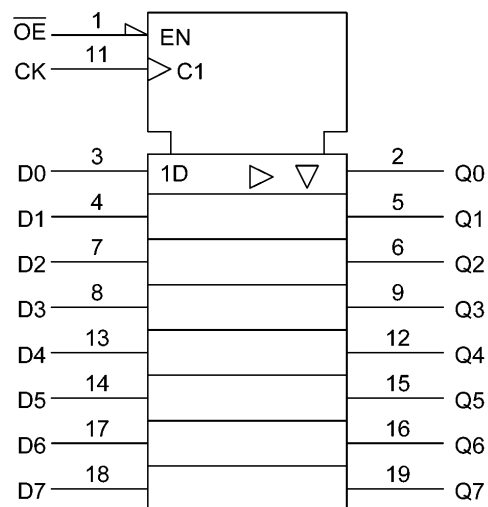
5. Pin Assignment






6. Marking



7. IEC Logic Symbol

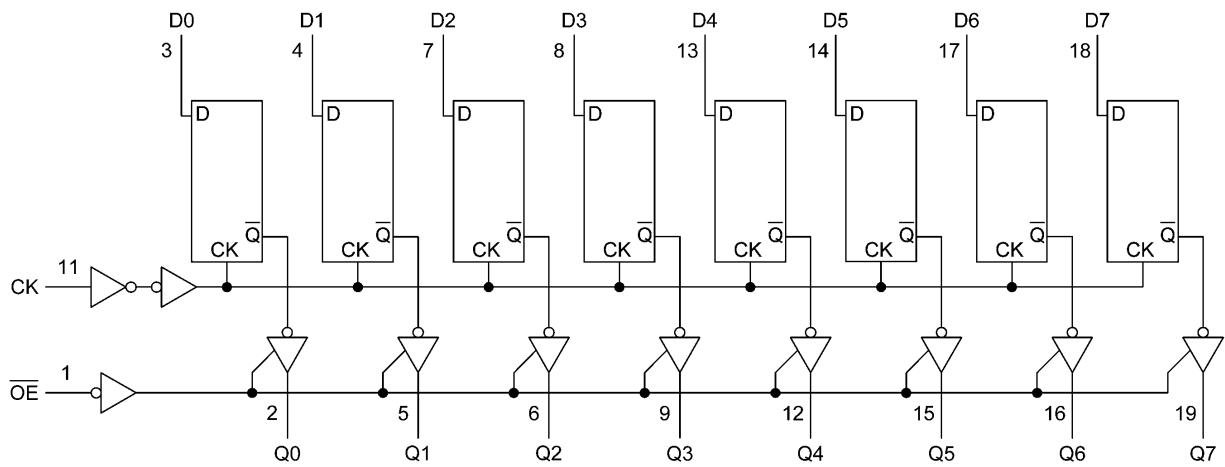


8. Truth Table

| Inputs | | | Output |
|-----------------|---|---|--------|
| \overline{OE} | CK | D | |
| H | X | X | Z |
| L |  | X | Qn |
| L |  | L | L |
| L |  | H | H |

X: Don't care
 Z: High impedance
 Qn: No change

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} | | ± 35 | mA |
| V_{CC} /ground current | I_{CC} | | ± 75 | 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 | 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} | — | -40 to 125 | °C |
| Input rise and fall times | t_r, t_f | — | 0 to 50 | μs |

Note: The operating ranges must be maintained to ensure the normal operation of the device.

Unused inputs must be tied to either V_{CC} or GND.

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 | — | |
| | | | 6.0 | 5.9 | 6.0 | — | | |
| | | | $I_{OH} = -6\text{ mA}$ | 4.5 | 4.18 | 4.31 | — | |
| | | | $I_{OH} = -7.8\text{ mA}$ | 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 | |
| | | | $I_{OL} = 6\text{ mA}$ | 4.5 | — | 0.17 | 0.26 | |
| | | | $I_{OL} = 7.8\text{ mA}$ | 6.0 | — | 0.18 | 0.26 | |
| 3-state output OFF-state leakage current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | | 6.0 | — | — | ± 0.5 | μA |
| 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 $I_O = 0\text{ A}$ | | 6.0 | — | — | 4.0 | μA |

12.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ 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 | — | |
| | | | 6.0 | 5.9 | — | | |
| | | | $I_{OH} = -6\text{ mA}$ | 4.5 | 4.13 | — | |
| | | | $I_{OH} = -7.8\text{ mA}$ | 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 | |
| | | | $I_{OL} = 6\text{ mA}$ | 4.5 | — | 0.33 | |
| | | | $I_{OL} = 7.8\text{ mA}$ | 6.0 | — | 0.33 | |
| 3-state output OFF-state leakage current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | | 6.0 | — | ± 5.0 | μA |
| 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 $I_O = 0\text{ A}$ | | 6.0 | — | 40.0 | μA |

12.3. DC Characteristics (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} | $I_{OH} = -20 \mu A$ | 2.0 | 1.9 | — | V |
| | | | | 4.5 | 4.4 | — | |
| | | | | 6.0 | 5.9 | — | |
| | | | $I_{OH} = -6 \text{ mA}$ | 4.5 | 3.7 | — | |
| Low-level output voltage | V_{OL} | $V_{IN} = V_{IH}$ or V_{IL} | $I_{OL} = 20 \mu A$ | 2.0 | — | 0.1 | V |
| | | | | 4.5 | — | 0.1 | |
| | | | | 6.0 | — | 0.1 | |
| | | | $I_{OL} = 6 \text{ mA}$ | 4.5 | — | 0.4 | |
| | | | $I_{OL} = 7.8 \text{ mA}$ | 6.0 | — | 0.4 | |
| 3-state output OFF-state leakage current | I_{OZ} | $V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND | 6.0 | — | ± 10.0 | μA | |
| 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 $I_O = 0 \text{ A}$ | 6.0 | — | 160.0 | μA | |

12.4. Timing Requirements (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Typ. | Limit | Unit |
|--------------------------|----------------------|----------------|--------------|------|-------|------|
| Minimum pulse width (CK) | $t_{w(L)}, t_{w(H)}$ | — | 2.0 | — | 75 | ns |
| | | | 4.5 | — | 15 | |
| | | | 6.0 | — | 13 | |
| Minimum setup time (Dn) | t_s | — | 2.0 | — | 75 | ns |
| | | | 4.5 | — | 15 | |
| | | | 6.0 | — | 13 | |
| Minimum hold time (Dn) | t_h | — | 2.0 | — | 0 | ns |
| | | | 4.5 | — | 0 | |
| | | | 6.0 | — | 0 | |
| Clock frequency | f | — | 2.0 | — | 6 | MHz |
| | | | 4.5 | — | 31 | |
| | | | 6.0 | — | 36 | |

12.5. Timing Requirements (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Limit | Unit |
|--------------------------|----------------------|----------------|--------------|-------|------|
| Minimum pulse width (CK) | $t_{w(L)}, t_{w(H)}$ | — | 2.0 | 95 | ns |
| | | | 4.5 | 19 | |
| | | | 6.0 | 16 | |
| Minimum setup time (Dn) | t_s | — | 2.0 | 95 | ns |
| | | | 4.5 | 19 | |
| | | | 6.0 | 16 | |
| Minimum hold time (Dn) | t_h | — | 2.0 | 0 | ns |
| | | | 4.5 | 0 | |
| | | | 6.0 | 0 | |
| Clock frequency | f | — | 2.0 | 5 | MHz |
| | | | 4.5 | 25 | |
| | | | 6.0 | 29 | |

12.6. Timing Requirements (Unless otherwise specified, $T_a = -40\text{ to }125\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | Test Condition | V_{CC} (V) | Limit | Unit |
|--------------------------|----------------------|----------------|--------------|-------|------|
| Minimum pulse width (CK) | $t_{w(L)}, t_{w(H)}$ | — | 2.0 | 120 | ns |
| | | | 4.5 | 24 | |
| | | | 6.0 | 20 | |
| Minimum setup time (Dn) | t_s | — | 2.0 | 120 | ns |
| | | | 4.5 | 24 | |
| | | | 6.0 | 20 | |
| Minimum hold time (Dn) | t_h | — | 2.0 | 0 | ns |
| | | | 4.5 | 0 | |
| | | | 6.0 | 0 | |
| Clock frequency | f | — | 2.0 | 4 | MHz |
| | | | 4.5 | 20 | |
| | | | 6.0 | 24 | |

12.7. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

| Characteristics | Symbol | Note | Test Condition | C_L (pF) | V_{CC} (V) | Min | Typ. | Max | Unit |
|-------------------------------|--------------------|----------|--------------------------|------------|--------------|-----|------|-----|------|
| Output transition time | t_{TLH}, t_{THL} | | — | 50 | 2.0 | — | 20 | 60 | ns |
| | | | | | 4.5 | — | 6 | 12 | |
| | | | | | 6.0 | — | 5 | 10 | |
| Propagation delay time (CK-Q) | t_{PLH}, t_{PHL} | | — | 50 | 2.0 | — | 45 | 140 | ns |
| | | | | | 4.5 | — | 15 | 28 | |
| | | | | | 6.0 | — | 13 | 24 | |
| | | | | 150 | 2.0 | — | 60 | 190 | |
| | | | | | 4.5 | — | 20 | 38 | |
| | | | | | 6.0 | — | 17 | 32 | |
| Output enable time | t_{PZL}, t_{PZH} | | $R_L = 1\text{ k}\Omega$ | 50 | 2.0 | — | 39 | 135 | ns |
| | | | | | 4.5 | — | 13 | 27 | |
| | | | | | 6.0 | — | 11 | 23 | |
| | | | | 150 | 2.0 | — | 54 | 185 | |
| | | | | | 4.5 | — | 18 | 37 | |
| | | | | | 6.0 | — | 15 | 31 | |
| Output disable time | t_{PLZ}, t_{PHZ} | | $R_L = 1\text{ k}\Omega$ | 50 | 2.0 | — | 30 | 135 | ns |
| | | | | | 4.5 | — | 13 | 27 | |
| | | | | | 6.0 | — | 12 | 23 | |
| Maximum clock frequency | f_{MAX} | | — | 50 | 2.0 | 6 | 18 | — | MHz |
| | | | | | 4.5 | 31 | 75 | — | |
| | | | | | 6.0 | 36 | 90 | — | |
| Input capacitance | C_{IN} | | — | | | — | 3 | — | pF |
| Output capacitance | C_{OUT} | | — | | | — | 4 | — | pF |
| Power dissipation capacitance | C_{PD} | (Note 1) | — | | | — | 11 | — | 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.

$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8 \text{ (per latch)}$$

And the total C_{PD} when n pcs of latch operate can be gained by the following equation.

$$C_{PD} \text{ (total)} = 22 + 16 \times n$$

12.8. AC Characteristics
 (Unless otherwise specified, $T_a = -40$ to 85 °C, Input: $t_r = t_f = 6$ ns)

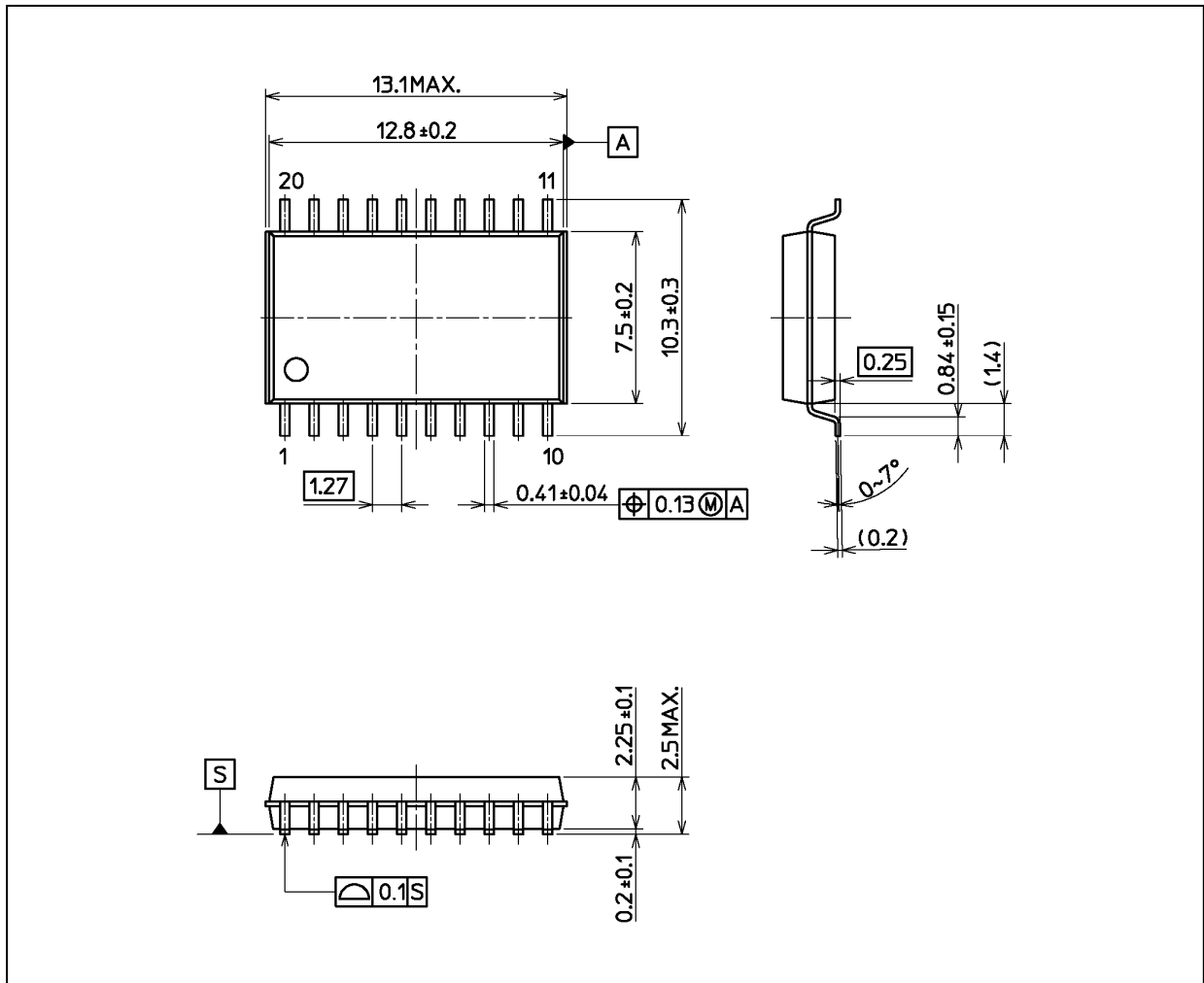
| Characteristics | Symbol | Test Condition | C_L (pF) | V_{CC} (V) | Min | Max | Unit |
|-------------------------------|--------------------|----------------------|------------|--------------|-----|-----|------|
| Output transition time | t_{TLH}, t_{THL} | — | 50 | 2.0 | — | 75 | ns |
| | | | | 4.5 | — | 15 | |
| | | | | 6.0 | — | 13 | |
| Propagation delay time (CK-Q) | t_{PLH}, t_{PHL} | — | 50 | 2.0 | — | 175 | ns |
| | | | | 4.5 | — | 35 | |
| | | | | 6.0 | — | 30 | |
| | | | 150 | 2.0 | — | 240 | |
| | | | | 4.5 | — | 48 | |
| | | | | 6.0 | — | 41 | |
| Output enable time | t_{PZL}, t_{PZH} | $R_L = 1$ k Ω | 50 | 2.0 | — | 170 | ns |
| | | | | 4.5 | — | 34 | |
| | | | | 6.0 | — | 29 | |
| | | | 150 | 2.0 | — | 230 | |
| | | | | 4.5 | — | 46 | |
| | | | | 6.0 | — | 39 | |
| Output disable time | t_{PLZ}, t_{PHZ} | $R_L = 1$ k Ω | 50 | 2.0 | — | 170 | ns |
| | | | | 4.5 | — | 34 | |
| | | | | 6.0 | — | 29 | |
| Maximum clock frequency | f_{MAX} | — | 50 | 2.0 | 5 | — | MHz |
| | | | | 4.5 | 25 | — | |
| | | | | 6.0 | 29 | — | |

12.9. AC Characteristics
 (Unless otherwise specified, $T_a = -40$ to 125 °C, Input: $t_r = t_f = 6$ ns)

| Characteristics | Symbol | Test Condition | C_L (pF) | V_{CC} (V) | Min | Max | Unit |
|-------------------------------|--------------------|----------------------|------------|--------------|-----|-----|------|
| Output transition time | t_{TLH}, t_{THL} | — | 50 | 2.0 | — | 90 | ns |
| | | | | 4.5 | — | 18 | |
| | | | | 6.0 | — | 15 | |
| Propagation delay time (CK-Q) | t_{PLH}, t_{PHL} | — | 50 | 2.0 | — | 250 | ns |
| | | | | 4.5 | — | 50 | |
| | | | | 6.0 | — | 43 | |
| | | | 150 | 2.0 | — | 285 | |
| | | | | 4.5 | — | 57 | |
| | | | | 6.0 | — | 48 | |
| Output enable time | t_{PZL}, t_{PZH} | $R_L = 1$ k Ω | 50 | 2.0 | — | 205 | ns |
| | | | | 4.5 | — | 41 | |
| | | | | 6.0 | — | 35 | |
| | | | 150 | 2.0 | — | 280 | |
| | | | | 4.5 | — | 56 | |
| | | | | 6.0 | — | 48 | |
| Output disable time | t_{PLZ}, t_{PHZ} | $R_L = 1$ k Ω | 50 | 2.0 | — | 205 | ns |
| | | | | 4.5 | — | 41 | |
| | | | | 6.0 | — | 35 | |
| Maximum clock frequency | f_{MAX} | — | 50 | 2.0 | 4 | — | MHz |
| | | | | 4.5 | 20 | — | |
| | | | | 6.0 | 24 | — | |

Package Dimensions

Unit: mm



Weight: 0.51 g (typ.)

| |
|------------------|
| Package Name(s) |
| Nickname: SOIC20 |

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