

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74AC373P, TC74AC373F, TC74AC373FT

Octal D-Type Latch with 3-State Output

The TC74AC373 is an advanced high speed CMOS OCTAL LATCH with 3-STATE OUTPUT fabricated with silicon gate and double-layer metal wiring C²MOS technology.

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

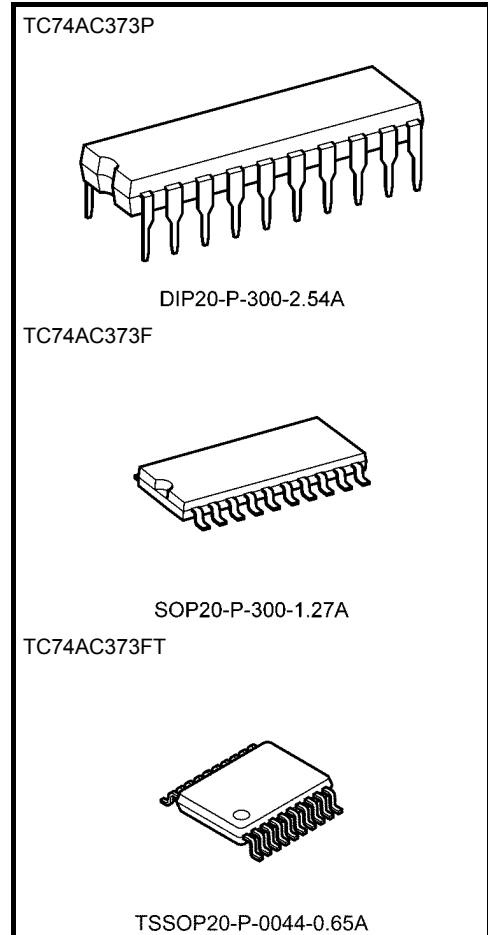
These 8-bit D-type latches are controlled by a latch enable input (\overline{LE}) and a output enable input (\overline{OE}).

When the \overline{OE} 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.

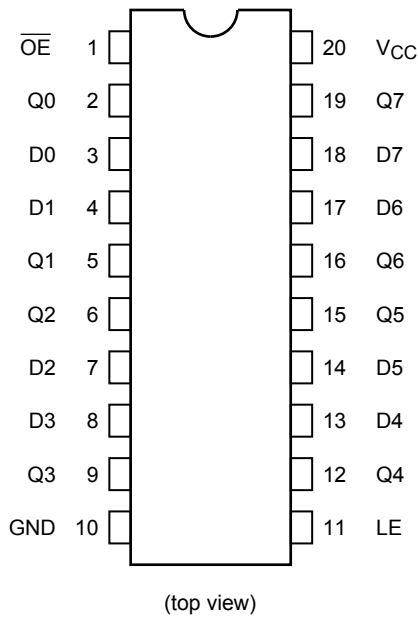
Features

- High speed: $t_{pd} = 4.8 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 8 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$
Capability of driving 50Ω transmission lines.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Pin and function compatible with 74F373

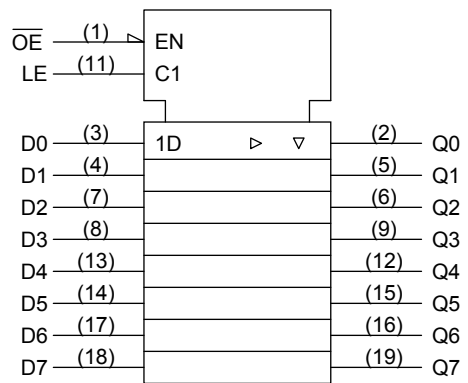


| | |
|----------------------|-----------------|
| Weight | |
| DIP20-P-300-2.54A | : 1.30 g (typ.) |
| SOP20-P-300-1.27A | : 0.22 g (typ.) |
| TSSOP20-P-0044-0.65A | : 0.08 g (typ.) |

Pin Assignment



IEC Logic Symbol



Truth Table

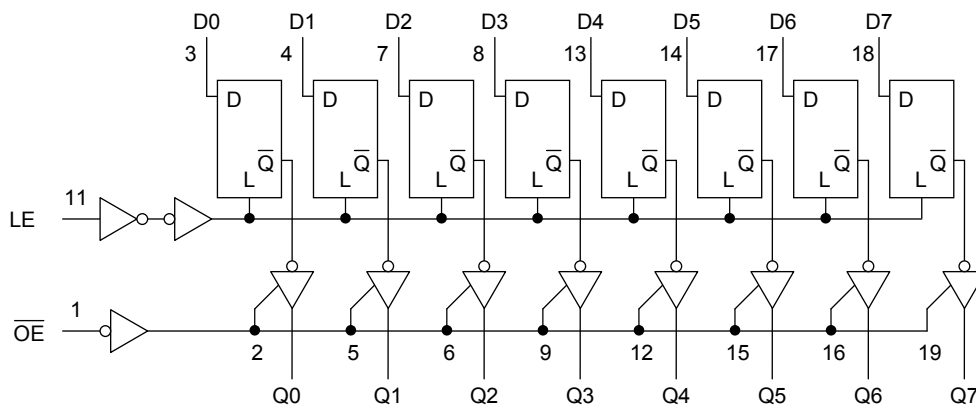
| Inputs | | | Output |
|-----------------|----|---|--------|
| \overline{OE} | LE | D | Q |
| H | X | X | Z |
| L | L | X | Q_n |
| L | H | L | L |
| L | H | H | H |

X: Don't care

Z: High impedance

Q_n : Q outputs are latched at the time when the LE input is taken to a low logic level.

System Diagram



Absolute Maximum Ratings (Note 1)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|------------------------------------|--------------------|
| Supply voltage range | V_{CC} | -0.5 to 7.0 | V |
| DC input voltage | V_{IN} | -0.5 to $V_{CC} + 0.5$ | V |
| DC output voltage | V_{OUT} | -0.5 to $V_{CC} + 0.5$ | V |
| Input diode current | I_{IK} | ± 20 | mA |
| Output diode current | I_{OK} | ± 50 | mA |
| DC output current | I_{OUT} | ± 50 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 200 | mA |
| Power dissipation | P_D | 500 (DIP) (Note 2)/180 (SOP/TSSOP) | mW |
| Storage temperature | T_{stg} | -65 to 150 | $^{\circ}\text{C}$ |

Note 1: 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 2: 500 mW in the range of $T_a = -40$ to 65°C . From $T_a = 65$ to 85°C a derating factor of -10 mW/ $^{\circ}\text{C}$ should be applied up to 300 mW.

Operating Ranges (Note)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|---|--------------------|
| Supply voltage | V_{CC} | 2.0 to 5.5 | 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 85 | $^{\circ}\text{C}$ |
| Input rise and fall time | dt/dV | 0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V) | ns/V |

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

Electrical Characteristics

DC Characteristics

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|----------------------------------|-----------------|---|--|---------------------|------|------|------------------|------|------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| High-level input voltage | V _{IH} | — | | 2.0 | 1.50 | — | — | 1.50 | — | V |
| | | | | 3.0 | 2.10 | — | — | 2.10 | — | |
| | | | | 5.5 | 3.85 | — | — | 3.85 | — | |
| Low-level input voltage | V _{IL} | — | | 2.0 | — | — | 0.50 | — | 0.50 | V |
| | | | | 3.0 | — | — | 0.90 | — | 0.90 | |
| | | | | 5.5 | — | — | 1.65 | — | 1.65 | |
| High-level output voltage | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | I _{OH} = -4 mA I _{OH} = -24 mA I _{OH} = -75 mA (Note) | 3.0 | 2.58 | — | — | 2.48 | — | |
| | | | | 4.5 | 3.94 | — | — | 3.80 | — | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50 μA | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | I _{OL} = 12 mA I _{OL} = 24 mA I _{OL} = 75 mA (Note) | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | | 4.5 | — | — | 0.36 | — | 0.44 | |
| 5.5 | — | — | — | — | 1.65 | — | | | | |
| 3-state output off-state current | I _{OZ} | V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND | 5.5 | — | — | ±0.5 | — | ±5.0 | μA | |
| Input leakage current | I _{IN} | V _{IN} = V _{CC} or GND | 5.5 | — | — | ±0.1 | — | ±1.0 | μA | |
| Quiescent supply current | I _{CC} | V _{IN} = V _{CC} or GND | 5.5 | — | — | 8.0 | — | 80.0 | μA | |

Note: This spec indicates the capability of driving 50 Ω transmission lines.

One output should be tested at a time for a 10 ms maximum duration.

Timing Requirements (input: t_r = t_f = 3 ns)

| Characteristics | Symbol | Test Condition | | Ta = 25°C | Ta = -40 to 85°C | Unit | |
|--------------------------|--------------------|----------------|--|---------------------|------------------|------|-------|
| | | | | V _{CC} (V) | Limit | | Limit |
| Minimum pulse width (LE) | t _w (H) | — | | 3.3 ± 0.3 | 7.0 | 7.0 | ns |
| | | | | 5.0 ± 0.5 | 5.0 | 5.0 | |
| Minimum set-up time | t _s | — | | 3.3 ± 0.3 | 6.0 | 6.0 | ns |
| | | | | 5.0 ± 0.5 | 3.5 | 3.5 | |
| Minimum hold time | t _h | — | | 3.3 ± 0.3 | 1.0 | 1.0 | ns |
| | | | | 5.0 ± 0.5 | 1.0 | 1.0 | |

AC Characteristics ($C_L = 50 \text{ pF}$, $R_L = 500 \text{ } \Omega$, input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|----------------------------------|------------------|----------------|---------------------|-----|------|------------------|-----|------|-----|
| | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| Propagation delay time (LE-Q) | t _{pLH} | — | 3.3 ± 0.3 | — | 7.7 | 13.2 | 1.0 | 15.0 | ns |
| | t _{pHL} | | 5.0 ± 0.5 | — | 6.1 | 8.7 | 1.0 | 10.0 | |
| Propagation delay time (D-Q) | t _{pLH} | — | 3.3 ± 0.3 | — | 7.6 | 12.9 | 1.0 | 14.7 | ns |
| | t _{pHL} | | 5.0 ± 0.5 | — | 5.8 | 8.3 | 1.0 | 9.5 | |
| Output enable time | t _{pZL} | — | 3.3 ± 0.3 | — | 7.6 | 12.9 | 1.0 | 14.7 | ns |
| | t _{pZH} | | 5.0 ± 0.5 | — | 6.1 | 8.7 | 1.0 | 10.0 | |
| Output disable time | t _{pLZ} | — | 3.3 ± 0.3 | — | 7.0 | 11.0 | 1.0 | 12.5 | ns |
| | t _{pHZ} | | 5.0 ± 0.5 | — | 5.4 | 7.5 | 1.0 | 8.5 | |
| Input capacitance | C _{IN} | — | — | 5 | 10 | — | 10 | pF | |
| Output capacitance | C _{OUT} | — | — | 10 | — | — | — | pF | |
| Power dissipation capacitance | C _{PD} | (Note) | — | 38 | — | — | — | pF | |

Note: 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:

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

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

$$C_{PD (total)} = 26 + 12 \cdot n$$

Package Dimensions

DIP20-P-300-2.54A

Unit : mm



Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)

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