CMOS Digital Integrated Circuits Silicon Monolithic

# 74VHCV373FT

## 1. Functional Description

- Octal Schmitt D-Type Latch with 3-State Outputs

## 2. General

The 74VHCV373FT is an advanced high speed CMOS OCTAL LATCH with 3-STATE OUTPUT fabricated with silicon gate CMOS technology.

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

This 8-bit D-type latch is controlled by a latch enable input (LE) and an output enable input ($\overline{OE}$).

When the $\overline{OE}$ input is high, the eight outputs are in a high impedance state.

Input pin have hysteresis between the positive-going and negative-going thresholds. Thus the 74VHCV373FT are capable of squaring up transitions of slowly changing input signals and provides an improved noise immunity.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

Note: Output in off-state

## 3. Features

(1) AEC-Q100 (Rev. H) (Note 1)

(2) Wide operating temperature range: $T_{opr}$ = -40 to 125 °C

(3) High speed: $t_{pd}$ = 5.4 ns (typ.) at $V_{CC}$ = 5.0 V

(4) Low power dissipation: $I_{CC}$ = 2.0 μA (max) at $T_a$ = 25 °C

(5) Wide operating voltage range: $V_{CC(opr)}$ = 1.8 V to 5.5 V

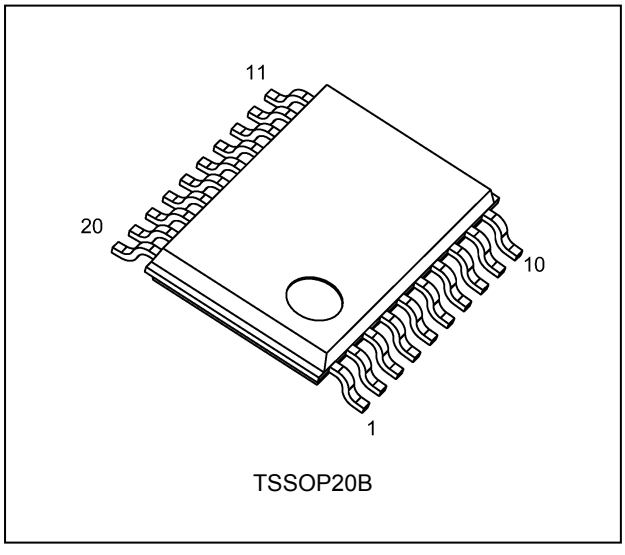
(6) Output current: $|I_{OH}|/I_{OL}$ = 16 mA (min)($V_{CC}$ = 4.5 V)

(7) Power-down protection is provided on all inputs and outputs.

(8) Pin and function compatible with the 74 series (74AC/HC/AHC/LV etc.) 373 type.

Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

## 4. Packaging




TSSOP20B

Start of commercial production

2015-02

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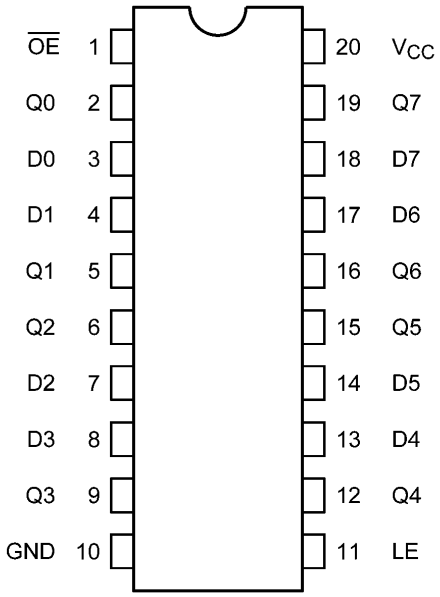
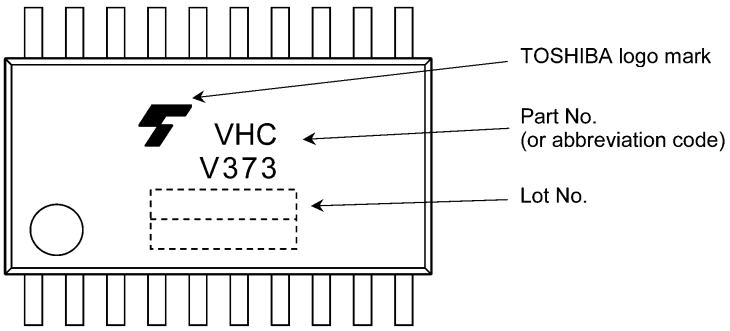
## 5. Pin Assignment




## 6. Marking




## 7. Truth Table

| INPUT $\overline{OE}$ | INPUT LE | INPUT D | OUTPUT |
|---|---|---|---|
| H | X | X | Z |
| L | L | X | Qn |
| L | H | L | L |
| L | H | H | H |

X: Don't care
Z: High impedance
Qn: Q outputs are latched at the time when the LE input is taken to low logic level.

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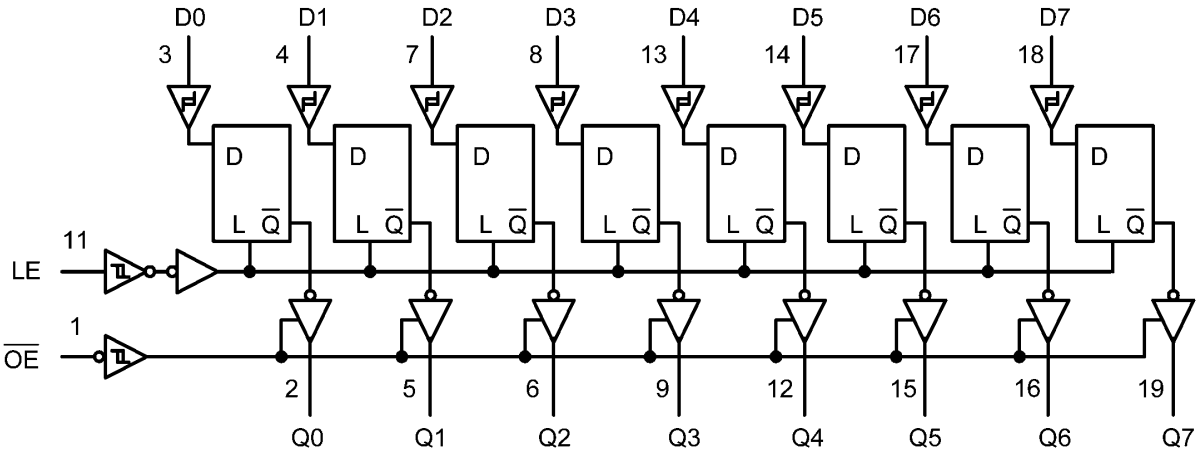
## 8. System Diagram



## 9. 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 7.0 | V |
| Output voltage | $V_{OUT}$ | (Note 1) | -0.5 to 7.0 | V |
| | | (Note 2) | -0.5 to $V_{CC}$ + 0.5 | |
| Input diode current | $I_{IK}$ | | -50 | mA |
| Output diode current | $I_{OK}$ | (Note 3) | ±50 | mA |
| Output current | $I_{OUT}$ | | ±50 | mA |
| Power dissipation | $P_D$ | (Note 4) | 180 | mW |
| $V_{CC}$/ground current | $I_{CC}/I_{GND}$ | | ±100 | mA |
| 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: Output in OFF state.

Note 2: High (H) or Low (L) state. $I_{OUT}$ absolute maximum rating must be observed.

Note 3: $V_{OUT}$ < GND, $V_{OUT}$ > $V_{CC}$

Note 4: 180 mW in the range of $T_a$ = -40 to 85 °C. From $T_a$ = 85 to 125 °C a derating factor of -3.25 mW/°C shall be applied until 50 mW.

## 10. Operating Ranges (Note)

| Characteristics | Symbol | Test Condition | Note | Rating | Unit |
|---|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | — | | 1.8 to 5.5 | V |
| Input voltage | $V_{IN}$ | — | | 0 to 5.5 | V |
| Output voltage | $V_{OUT}$ | — | (Note 1) | 0 to 5.5 | V |
| | | | (Note 2) | 0 to $V_{CC}$ | |
| Operating temperature | $T_{opr}$ | — | | -40 to 125 | °C |
| Input rise and fall times | dt/dv | $V_{CC}$ = 3.3 ± 0.3 V | | 0 to 20 | ms/V |
| | | $V_{CC}$ = 5.0 ± 0.5 V | | 0 to 1 | |

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.

Note 1: Output in OFF state.

Note 2: High (H) or Low (L) state.

## 11. Electrical Characteristics

### 11.1. DC Characteristics (Unless otherwise specified, $T_a$ = 25 °C)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Positive threshold voltage | $V_P$ | — | | 1.8 | — | — | 1.65 | V |
| | | | | 2.3 | — | — | 1.85 | |
| | | | | 3.0 | — | — | 2.20 | |
| | | | | 4.5 | — | — | 3.15 | |
| | | | | 5.5 | — | — | 3.85 | |
| Negative threshold voltage | $V_N$ | — | | 1.8 | 0.15 | — | — | V |
| | | | | 2.3 | 0.45 | — | — | |
| | | | | 3.0 | 0.90 | — | — | |
| | | | | 4.5 | 1.35 | — | — | |
| | | | | 5.5 | 1.65 | — | — | |
| Hysteresis voltage | $V_H$ | — | | 1.8 | 0.15 | — | 1.05 | V |
| | | | | 2.3 | 0.20 | — | 1.10 | |
| | | | | 3.0 | 0.30 | — | 1.20 | |
| | | | | 4.5 | 0.40 | — | 1.40 | |
| | | | | 5.5 | 0.50 | — | 1.60 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = -50 μA | 1.8 | 1.7 | 1.8 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | |
| | | | | 4.5 | 4.4 | 4.5 | — | |
| | | | $I_{OH}$ = -8 mA | 3.0 | 2.58 | — | — | |
| | | | $I_{OH}$ = -16 mA | 4.5 | 3.94 | — | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 1.8 | — | 0.0 | 0.1 | V |
| | | | | 3.0 | — | 0.0 | 0.1 | |
| | | | | 4.5 | — | 0.0 | 0.1 | |
| | | | $I_{OL}$ = 8 mA | 3.0 | — | — | 0.36 | |
| | | | $I_{OL}$ = 16 mA | 4.5 | — | — | 0.44 | |
| 3-state output OFF-state leakage current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = 0 to 5.5 V | | 1.8 to 5.5 | — | — | ±0.5 | μA |
| Power-OFF leakage current | $I_{OFF}$ | $V_{IN}$/$V_{OUT}$ = 5.5 V | | 0 | — | — | 0.5 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 0 to 5.5 | — | — | ±0.1 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | — | 2.0 | μA |

## 11.2. DC Characteristics (Unless otherwise specified, $T_a$ = -40 to 85 °C)

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| Positive threshold voltage | $V_P$ | — | | 1.8 | — | 1.65 | V |
| | | | | 2.3 | — | 1.85 | |
| | | | | 3.0 | — | 2.20 | |
| | | | | 4.5 | — | 3.15 | |
| | | | | 5.5 | — | 3.85 | |
| Negative threshold voltage | $V_N$ | — | | 1.8 | 0.15 | — | V |
| | | | | 2.3 | 0.45 | — | |
| | | | | 3.0 | 0.90 | — | |
| | | | | 4.5 | 1.35 | — | |
| | | | | 5.5 | 1.65 | — | |
| Hysteresis voltage | $V_H$ | — | | 1.8 | 0.15 | 1.05 | V |
| | | | | 2.3 | 0.20 | 1.10 | |
| | | | | 3.0 | 0.30 | 1.20 | |
| | | | | 4.5 | 0.40 | 1.40 | |
| | | | | 5.5 | 0.50 | 1.60 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = -50 μA | 1.8 | 1.7 | — | V |
| | | | | 3.0 | 2.9 | — | |
| | | | | 4.5 | 4.4 | — | |
| | | | $I_{OH}$ = -8 mA | 3.0 | 2.48 | — | |
| | | | $I_{OH}$ = -16 mA | 4.5 | 3.80 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 1.8 | — | 0.1 | V |
| | | | | 3.0 | — | 0.1 | |
| | | | | 4.5 | — | 0.1 | |
| | | | $I_{OL}$ = 8 mA | 3.0 | — | 0.44 | |
| | | | $I_{OL}$ = 16 mA | 4.5 | — | 0.55 | |
| 3-state output OFF-state leakage current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = 0 to 5.5 V | | 1.8 to 5.5 | — | ±5.0 | μA |
| Power-OFF leakage current | $I_{OFF}$ | $V_{IN}$/$V_{OUT}$ = 5.5 V | | 0 | — | 5.0 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 0 to 5.5 | — | ±1.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | 20.0 | μA |

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

| Characteristics | Symbol | Test Condition | | $V_{CC}$ (V) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|
| Positive threshold voltage | $V_P$ | — | | 1.8 | — | 1.65 | V |
| | | | | 2.3 | — | 1.85 | |
| | | | | 3.0 | — | 2.20 | |
| | | | | 4.5 | — | 3.15 | |
| | | | | 5.5 | — | 3.85 | |
| Negative threshold voltage | $V_N$ | — | | 1.8 | 0.15 | — | V |
| | | | | 2.3 | 0.45 | — | |
| | | | | 3.0 | 0.90 | — | |
| | | | | 4.5 | 1.35 | — | |
| | | | | 5.5 | 1.65 | — | |
| Hysteresis voltage | $V_H$ | — | | 1.8 | 0.15 | 1.05 | V |
| | | | | 2.3 | 0.20 | 1.10 | |
| | | | | 3.0 | 0.30 | 1.20 | |
| | | | | 4.5 | 0.40 | 1.40 | |
| | | | | 5.5 | 0.50 | 1.60 | |
| High-level output voltage | $V_{OH}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = -50 μA | 1.8 | 1.7 | — | V |
| | | | | 3.0 | 2.9 | — | |
| | | | | 4.5 | 4.4 | — | |
| | | | $I_{OH}$ = -8 mA | 3.0 | 2.40 | — | |
| | | | $I_{OH}$ = -16 mA | 4.5 | 3.70 | — | |
| Low-level output voltage | $V_{OL}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 50 μA | 1.8 | — | 0.1 | V |
| | | | | 3.0 | — | 0.1 | |
| | | | | 4.5 | — | 0.1 | |
| | | | $I_{OL}$ = 8 mA | 3.0 | — | 0.55 | |
| | | | $I_{OL}$ = 16 mA | 4.5 | — | 0.65 | |
| 3-state output OFF-state leakage current | $I_{OZ}$ | $V_{IN}$ = $V_{IH}$ or $V_{IL}$<br>$V_{OUT}$ = 0 to 5.5 V | | 1.8 to 5.5 | — | ±20.0 | μA |
| Power-OFF leakage current | $I_{OFF}$ | $V_{IN}$/$V_{OUT}$ = 5.5 V | | 0 | — | 20.0 | μA |
| Input leakage current | $I_{IN}$ | $V_{IN}$ = 5.5 V or GND | | 0 to 5.5 | — | ±2.0 | μA |
| Quiescent supply current | $I_{CC}$ | $V_{IN}$ = $V_{CC}$ or GND | | 5.5 | — | 40.0 | μA |

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### 11.4. Timing Requirements (Unless otherwise specified, $T_a$ = 25 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | $V_{CC}$ (V) | Typ. | Limit | Unit |
|---|---|---|---|---|---|
| Minimum pulse width (LE) | $t_{w(H)}$ | 2.5 ± 0.2 | — | 6.0 | ns |
| | | 3.3 ± 0.3 | — | 5.0 | |
| | | 5.0 ± 0.5 | — | 5.0 | |
| Minimum setup time | $t_S$ | 2.5 ± 0.2 | — | 4.5 | ns |
| | | 3.3 ± 0.3 | — | 4.0 | |
| | | 5.0 ± 0.5 | — | 4.0 | |
| Minimum hold time | $t_h$ | 2.5 ± 0.2 | — | 1.5 | ns |
| | | 3.3 ± 0.3 | — | 1.0 | |
| | | 5.0 ± 0.5 | — | 1.0 | |

### 11.5. Timing Requirements (Unless otherwise specified, $T_a$ = -40 to 85 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | $V_{CC}$ (V) | Limit | Unit |
|---|---|---|---|---|
| Minimum pulse width (LE) | $t_{w(H)}$ | 2.5 ± 0.2 | 6.5 | ns |
| | | 3.3 ± 0.3 | 5.0 | |
| | | 5.0 ± 0.5 | 5.0 | |
| Minimum setup time | $t_S$ | 2.5 ± 0.2 | 5.0 | ns |
| | | 3.3 ± 0.3 | 4.0 | |
| | | 5.0 ± 0.5 | 4.0 | |
| Minimum hold time | $t_h$ | 2.5 ± 0.2 | 1.5 | ns |
| | | 3.3 ± 0.3 | 1.0 | |
| | | 5.0 ± 0.5 | 1.0 | |

### 11.6. Timing Requirements (Unless otherwise specified, $T_a$ = -40 to 125 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | $V_{CC}$ (V) | Limit | Unit |
|---|---|---|---|---|
| Minimum pulse width (LE) | $t_{w(H)}$ | 2.5 ± 0.2 | 6.5 | ns |
| | | 3.3 ± 0.3 | 5.0 | |
| | | 5.0 ± 0.5 | 5.0 | |
| Minimum setup time | $t_S$ | 2.5 ± 0.2 | 5.5 | ns |
| | | 3.3 ± 0.3 | 4.0 | |
| | | 5.0 ± 0.5 | 4.0 | |
| Minimum hold time | $t_h$ | 2.5 ± 0.2 | 1.5 | ns |
| | | 3.3 ± 0.3 | 1.0 | |
| | | 5.0 ± 0.5 | 1.0 | |

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## 11.7. AC Characteristics (Unless otherwise specified, $T_a$ = 25 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | Note | Test Condition | $V_{CC}$ (V) | $C_L$ (pF) | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Propagation delay time (LE-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | — | 10.7 | 15.7 | ns |
| | | | | | 50 | — | 13.5 | 19.3 | |
| | | | | 3.3 ± 0.3 | 15 | — | 7.4 | 11.0 | |
| | | | | | 50 | — | 9.5 | 14.5 | |
| | | | | 5.0 ± 0.5 | 15 | — | 5.4 | 7.2 | |
| | | | | | 50 | — | 7.1 | 9.2 | |
| Propagation delay time (D-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | — | 13.0 | 17.7 | ns |
| | | | | | 50 | — | 15.5 | 21.1 | |
| | | | | 3.3 ± 0.3 | 15 | — | 8.8 | 12.9 | |
| | | | | | 50 | — | 10.8 | 15.5 | |
| | | | | 5.0 ± 0.5 | 15 | — | 6.2 | 7.2 | |
| | | | | | 50 | — | 8.0 | 9.3 | |
| 3-state output enable time | $t_{PZL}$,$t_{PZH}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 15 | — | 9.4 | 15.8 | ns |
| | | | | | 50 | — | 12.3 | 18.8 | |
| | | | | 3.3 ± 0.3 | 15 | — | 6.5 | 11.4 | |
| | | | | | 50 | — | 8.7 | 14.9 | |
| | | | | 5.0 ± 0.5 | 15 | — | 4.5 | 8.1 | |
| | | | | | 50 | — | 6.2 | 10.1 | |
| 3-state output disable time | $t_{PLZ}$,$t_{PHZ}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 50 | — | 14.5 | 17.4 | ns |
| | | | | 3.3 ± 0.3 | 50 | — | 10.9 | 13.2 | |
| | | | | 5.0 ± 0.5 | 50 | — | 8.0 | 9.2 | |
| Output skew | $t_{osLH}$,$t_{osHL}$ | (Note 1) | — | 2.5 ± 0.2 | 50 | — | — | 1.5 | ns |
| | | | | 3.3 ± 0.3 | 50 | — | — | 1.5 | |
| | | | | 5.0 ± 0.5 | 50 | — | — | 1.0 | |
| Input capacitance | $C_{IN}$ | | — | | | — | 4 | 10 | pF |
| Output capacitance | $C_{OUT}$ | | — | | | — | 6 | — | pF |
| Power dissipation capacitance | $C_{PD}$ | (Note 2) | — | | | — | 21 | — | pF |

Note 1: Parameter guaranteed by design. ($t_{osLH}$ = $|t_{PLH}m - t_{PLH}n|$, $t_{osHL}$ = $|t_{PHL}m - t_{PHL}n|$)

Note 2: $C_{PD}$ 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.

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

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

$C_{PD}$ (total) = 11 + 10 × n

## 11.8. AC Characteristics
### (Unless otherwise specified, $T_a$ = -40 to 85 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | Note | Test Condition | $V_{CC}$ (V) | $C_L$ (pF) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Propagation delay time (LE-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | 1.0 | 19.0 | ns |
| | | | | | 50 | 1.0 | 22.0 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 13.0 | |
| | | | | | 50 | 1.0 | 16.5 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 8.5 | |
| | | | | | 50 | 1.0 | 10.5 | |
| Propagation delay time (D-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | 1.0 | 20.1 | ns |
| | | | | | 50 | 1.0 | 24.1 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 14.8 | |
| | | | | | 50 | 1.0 | 17.7 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 8.5 | |
| | | | | | 50 | 1.0 | 10.6 | |
| 3-state output enable time | $t_{PZL}$,$t_{PZH}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 15 | 1.0 | 19.0 | ns |
| | | | | | 50 | 1.0 | 22.0 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 13.5 | |
| | | | | | 50 | 1.0 | 17.0 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 9.5 | |
| | | | | | 50 | 1.0 | 11.5 | |
| 3-state output disable time | $t_{PLZ}$,$t_{PHZ}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 50 | 1.0 | 19.0 | ns |
| | | | | 3.3 ± 0.3 | 50 | 1.0 | 15.0 | |
| | | | | 5.0 ± 0.5 | 50 | 1.0 | 10.5 | |
| Output skew | $t_{osLH}$,$t_{osHL}$ | (Note 1) | — | 2.5 ± 0.2 | 50 | — | 1.5 | ns |
| | | | | 3.3 ± 0.3 | 50 | — | 1.5 | |
| | | | | 5.0 ± 0.5 | 50 | — | 1.0 | |
| Input capacitance | $C_{IN}$ | | — | | | — | 10 | pF |

Note 1: Parameter guaranteed by design. ($t_{osLH}$ = $|t_{PLH}m-t_{PLH}n|$, $t_{osHL}$ = $|t_{PHL}m-t_{PHL}n|$)

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## 11.9. AC Characteristics (Unless otherwise specified, $T_a$ = -40 to 125 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | Note | Test Condition | $V_{CC}$ (V) | $C_L$ (pF) | Min | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| Propagation delay time (LE-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | 1.0 | 21.5 | ns |
| | | | | | 50 | 1.0 | 24.0 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 15.0 | |
| | | | | | 50 | 1.0 | 18.5 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 9.5 | |
| | | | | | 50 | 1.0 | 11.5 | |
| Propagation delay time (D-Q) | $t_{PLH}$,$t_{PHL}$ | | — | 2.5 ± 0.2 | 15 | 1.0 | 22.0 | ns |
| | | | | | 50 | 1.0 | 26.5 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 16.0 | |
| | | | | | 50 | 1.0 | 19.5 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 10.0 | |
| | | | | | 50 | 1.0 | 12.0 | |
| 3-state output enable time | $t_{PZL}$,$t_{PZH}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 15 | 1.0 | 21.5 | ns |
| | | | | | 50 | 1.0 | 24.5 | |
| | | | | 3.3 ± 0.3 | 15 | 1.0 | 15.5 | |
| | | | | | 50 | 1.0 | 19.0 | |
| | | | | 5.0 ± 0.5 | 15 | 1.0 | 11.0 | |
| | | | | | 50 | 1.0 | 13.0 | |
| 3-state output disable time | $t_{PLZ}$,$t_{PHZ}$ | | $R_L$ = 1 kΩ | 2.5 ± 0.2 | 50 | 1.0 | 20.5 | ns |
| | | | | 3.3 ± 0.3 | 50 | 1.0 | 16.5 | |
| | | | | 5.0 ± 0.5 | 50 | 1.0 | 11.5 | |
| Output skew | $t_{osLH}$,$t_{osHL}$ | (Note 1) | — | 2.5 ± 0.2 | 50 | — | 1.5 | ns |
| | | | | 3.3 ± 0.3 | 50 | — | 1.5 | |
| | | | | 5.0 ± 0.5 | 50 | — | 1.0 | |
| Input capacitance | $C_{IN}$ | | — | | | — | 10 | pF |

Note 1: Parameter guaranteed by design. ($t_{osLH} = |t_{PLH}m - t_{PLH}n|$, $t_{osHL} = |t_{PHL}m - t_{PHL}n|$)

## 11.10. Noise Characteristics (Unless otherwise specified, $T_a$ = 25 °C, Input: $t_r = t_f$ = 3 ns)

| Characteristics | Symbol | Test Condition | $V_{CC}$ (V) | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$ | $C_L$ = 50 pF | 3.3 | 0.3 | — | V |
| | | | 5.0 | 0.7 | — | |
| Quiet output minimum dynamic $V_{OL}$ | $V_{OLV}$ | $C_L$ = 50 pF | 3.3 | -0.1 | — | V |
| | | | 5.0 | -0.4 | — | |
| Minimum high-level dynamic input voltage | $V_{IHD}$ | $C_L$ = 50 pF | 5.0 | — | 3.5 | V |
| Maximum low-level dynamic input voltage | $V_{ILD}$ | $C_L$ = 50 pF | 5.0 | — | 1.5 | V |

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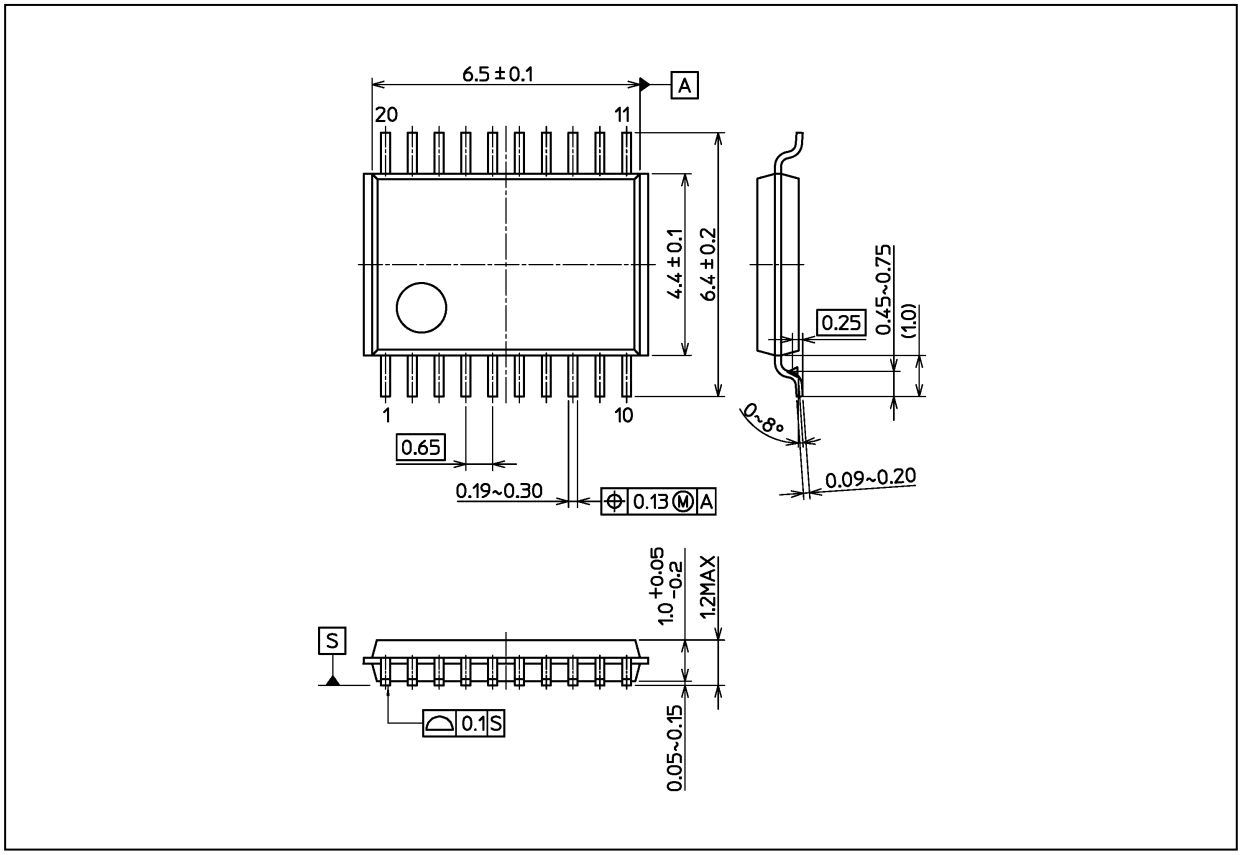
## Package Dimensions

Unit: mm




Weight: 0.071 g (typ.)

| Package Name(s) |
| --- |
| Nickname: TSSOP20B |

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