

# 74LCX74FT

## 1. Functional Description

- Low-Voltage Dual D-Type Flip-Flop with 5-V Tolerant Inputs and Outputs

## 2. General

The 74LCX74FT is a high-performance CMOS D-type flip-flop. Designed for use in 3.3 V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

The device is designed for low-voltage (3.3 V)  $V_{CC}$  applications, but it could be used to interface to 5 V supply environment for inputs.

The signal level applied to the D input is transferred to Q output during the positive going transition of the CK pulse.

$\overline{CLR}$  and  $\overline{PR}$  are independent of the CK and are accomplished by setting the appropriate input low.

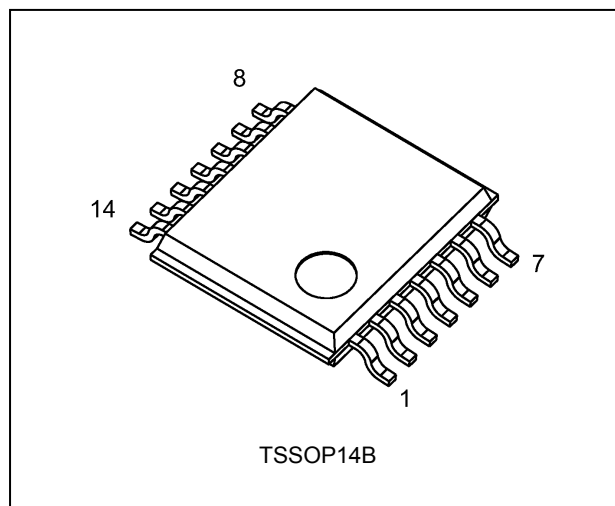
All inputs are equipped with protection circuits against static discharge.

## 3. Features

- (1) AEC-Q100 (Rev. H) (Note 1)
- (2) Wide operating temperature range:  $T_{opr} = -40$  to  $125$  °C
- (3) Low-voltage operation:  $V_{CC} = 1.65$  to  $3.6$  V
- (4) High-speed operation:  $t_{pd} = 8.0$  ns (max) ( $V_{CC} = 3.3 \pm 0.3$  V)
- (5) Output current:  $|I_{OH}|/I_{OL} = 24$  mA (min) ( $V_{CC} = 3.0$  V)
- (6) Power-down protection provided on all inputs and outputs
- (7) Pin and function compatible with the 74 series (74LVC/ALVC/ etc.) 74 type

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

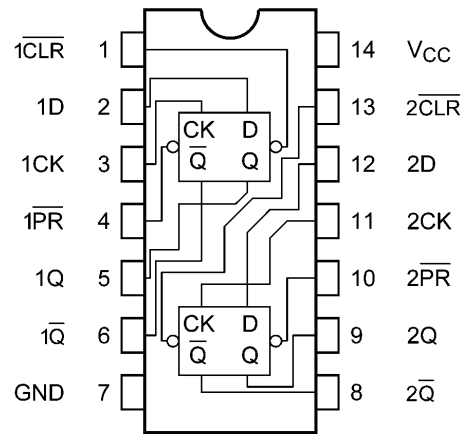
## 4. Packaging



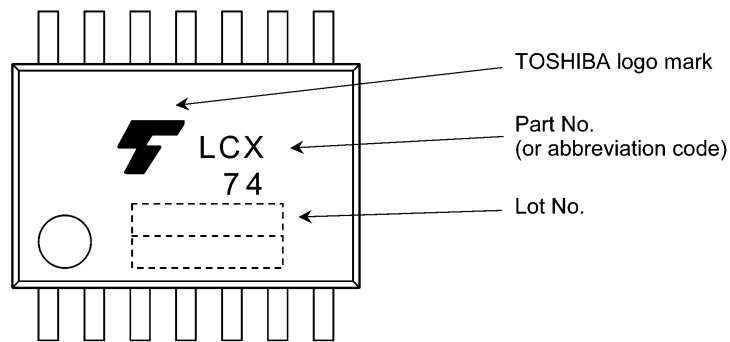
Start of commercial production

2014-06

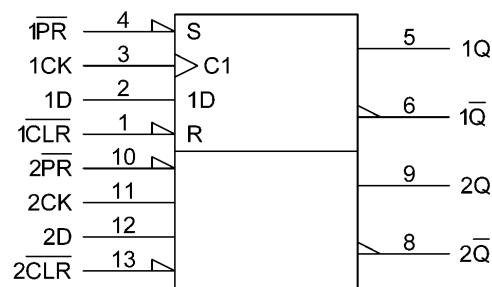
**5. Pin Assignment**



**6. Marking**



**7. IEC Logic Symbol**



**8. Truth Table**

| Inputs |    |   |    | Outputs        |                 | Function  |
|--------|----|---|----|----------------|-----------------|-----------|
| CLR    | PR | D | CK | Q              | Q̄              |           |
| L      | H  | X | X  | L              | H               | Clear     |
| H      | L  | X | X  | H              | L               | Preset    |
| L      | L  | X | X  | H              | H               | —         |
| H      | H  | L | ↑  | L              | H               | —         |
| H      | H  | H | ↑  | H              | L               | —         |
| H      | H  | X | ↓  | Q <sub>n</sub> | Q̄ <sub>n</sub> | No change |

X: Don't care

**9. Absolute Maximum Ratings (Note)**

| Characteristics          | Symbol           | Note     | Rating                 | Unit        |
|--------------------------|------------------|----------|------------------------|-------------|
| Supply voltage           | $V_{CC}$         |          | -0.5 to 6.5            | V           |
| Input voltage            | $V_{IN}$         |          | -0.5 to 6.5            | V           |
| Output voltage           | $V_{OUT}$        | (Note 1) | -0.5 to 6.5            | V           |
|                          |                  | (Note 2) | -0.5 to $V_{CC} + 0.5$ |             |
| Input diode current      | $I_{IK}$         |          | -50                    | mA          |
| Output diode current     | $I_{OK}$         | (Note 3) | $\pm 50$               | mA          |
| Output current           | $I_{OUT}$        |          | $\pm 50$               | mA          |
| Power dissipation        | $P_D$            | (Note 4) | 180                    | mW          |
| $V_{CC}$ /ground current | $I_{CC}/I_{GND}$ |          | $\pm 100$              | mA          |
| Storage temperature      | $T_{stg}$        |          | -65 to 150             | $^{\circ}C$ |

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:  $V_{CC} = 0\text{ V}$

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  $85\text{ }^{\circ}C$ . From  $T_a = 85$  to  $125\text{ }^{\circ}C$  a derating factor of  $-3.25\text{ mW}/^{\circ}C$  shall be applied until 50 mW.

**10. Operating Ranges (Note)**

| Characteristics           | Symbol           | Note     | Rating        | Unit        |
|---------------------------|------------------|----------|---------------|-------------|
| Supply voltage            | $V_{CC}$         |          | 1.65 to 3.6   | V           |
|                           |                  | (Note 1) | 1.5 to 3.6    |             |
| Input voltage             | $V_{IN}$         |          | 0 to 5.5      | V           |
| Output voltage            | $V_{OUT}$        | (Note 2) | 0 to 5.5      | V           |
|                           |                  | (Note 3) | 0 to $V_{CC}$ |             |
| Output current            | $I_{OH}, I_{OL}$ | (Note 4) | $\pm 24$      | mA          |
|                           | $I_{OH}, I_{OL}$ | (Note 5) | $\pm 12$      |             |
| Operating temperature     | $T_{opr}$        |          | -40 to 125    | $^{\circ}C$ |
| Input rise and fall times | $dt/dv$          | (Note 6) | 0 to 10       | ns/V        |

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: Data retention only.

Note 2:  $V_{CC} = 0\text{ V}$

Note 3: High or low state

Note 4:  $V_{CC} = 3.0$  to  $3.6\text{ V}$

Note 5:  $V_{CC} = 2.7$  to  $3.0\text{ V}$

Note 6:  $V_{IN} = 0.8$  to  $2.0\text{ V}$ ,  $V_{CC} = 3.0\text{ V}$

**11. Electrical Characteristics**

**11.1. 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  | $V_{IH}$        | —   | 1.65 to 2.3                        | $V_{CC} \times 0.9$ | —                   | V             |   |
|                           |                 |   | 2.3 to 2.7                         | 1.7                 | —                   |               |   |
|                           |                 |   | 2.7 to 3.6                         | 2.0                 | —                   |               |   |
| Low-level input voltage   | $V_{IL}$        | —   | 1.65 to 2.3                        | —                   | $V_{CC} \times 0.1$ | V             |   |
|                           |                 |   | 2.3 to 2.7                         | —                   | 0.7                 |               |   |
|                           |                 |   | 2.7 to 3.6                         | —                   | 0.8                 |               |   |
| High-level output voltage | $V_{OH}$        | $V_{IN} = V_{IH}$ or $V_{IL}$                     | $I_{OH} = -100\text{ }\mu\text{A}$ | 1.65 to 3.6         | $V_{CC} - 0.2$      | —             | V |
|                           |                 |   | $I_{OH} = -4\text{ mA}$            | 1.65                | 1.05                | —             |   |
|                           |                 |   | $I_{OH} = -8\text{ mA}$            | 2.3                 | 1.7                 | —             |   |
|                           |                 |   | $I_{OH} = -12\text{ mA}$           | 2.7                 | 2.2                 | —             |   |
|                           |                 |   | $I_{OH} = -18\text{ mA}$           | 3.0                 | 2.4                 | —             |   |
|                           |                 |   | $I_{OH} = -24\text{ mA}$           | 3.0                 | 2.2                 | —             |   |
| Low-level output voltage  | $V_{OL}$        | $V_{IN} = V_{IH}$ or $V_{IL}$                     | $I_{OL} = 100\text{ }\mu\text{A}$  | 1.65 to 3.6         | —                   | 0.2           | V |
|                           |                 |   | $I_{OL} = 4\text{ mA}$             | 1.65                | —                   | 0.45          |   |
|                           |                 |   | $I_{OL} = 8\text{ mA}$             | 2.3                 | —                   | 0.7           |   |
|                           |                 |   | $I_{OL} = 12\text{ mA}$            | 2.7                 | —                   | 0.4           |   |
|                           |                 |   | $I_{OL} = 16\text{ mA}$            | 3.0                 | —                   | 0.4           |   |
|                           |                 |   | $I_{OL} = 24\text{ mA}$            | 3.0                 | —                   | 0.55          |   |
| Input leakage current     | $I_{IN}$        | $V_{IN} = 0$ to $5.5\text{ V}$                    | 1.65 to 3.6                        | —                   | $\pm 5.0$           | $\mu\text{A}$ |   |
| Power-OFF leakage current | $I_{OFF}$       | $V_{IN}/V_{OUT} = 5.5\text{ V}$                   | 0                                  | —                   | 10.0                | $\mu\text{A}$ |   |
| Quiescent supply current  | $I_{CC}$        | $V_{IN} = V_{CC}$ or GND                          | 1.65 to 3.6                        | —                   | 10.0                | $\mu\text{A}$ |   |
|                           | $I_{CC}$        | $V_{IN} = 3.6$ to $5.5\text{ V}$                  | 1.65 to 3.6                        | —                   | $\pm 10.0$          |               |   |
| Quiescent supply current  | $\Delta I_{CC}$ | $V_{IH} = V_{CC} - 0.6\text{ V}$<br>(per 1 input) | 2.7 to 3.6                         | —                   | 500                 | $\mu\text{A}$ |   |

**11.2. 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  | $V_{IH}$        | —  | 1.65 to 2.3           | $V_{CC} \times 0.9$ | —                   | V       |   |
|                           |                 |  | 2.3 to 2.7            | 1.7                 | —                   |         |   |
|                           |                 |  | 2.7 to 3.6            | 2.0                 | —                   |         |   |
| Low-level input voltage   | $V_{IL}$        | —  | 1.65 to 2.3           | —                   | $V_{CC} \times 0.1$ | V       |   |
|                           |                 |  | 2.3 to 2.7            | —                   | 0.7                 |         |   |
|                           |                 |  | 2.7 to 3.6            | —                   | 0.8                 |         |   |
| High-level output voltage | $V_{OH}$        | $V_{IN} = V_{IH}$ or $V_{IL}$              | $I_{OH} = -100 \mu A$ | 1.65 to 3.6         | $V_{CC} - 0.2$      | —       | V |
|                           |                 |  | $I_{OH} = -4$ mA      | 1.65                | 0.9                 | —       |   |
|                           |                 |  | $I_{OH} = -8$ mA      | 2.3                 | 1.55                | —       |   |
|                           |                 |  | $I_{OH} = -12$ mA     | 2.7                 | 2.0                 | —       |   |
|                           |                 |  | $I_{OH} = -18$ mA     | 3.0                 | 2.2                 | —       |   |
|                           |                 |  | $I_{OH} = -24$ mA     | 3.0                 | 2.0                 | —       |   |
| Low-level output voltage  | $V_{OL}$        | $V_{IN} = V_{IH}$ or $V_{IL}$              | $I_{OL} = 100 \mu A$  | 1.65 to 3.6         | —                   | 0.2     | V |
|                           |                 |  | $I_{OL} = 4$ mA       | 1.65                | —                   | 0.65    |   |
|                           |                 |  | $I_{OL} = 8$ mA       | 2.3                 | —                   | 0.9     |   |
|                           |                 |  | $I_{OL} = 12$ mA      | 2.7                 | —                   | 0.6     |   |
|                           |                 |  | $I_{OL} = 16$ mA      | 3.0                 | —                   | 0.6     |   |
|                           |                 |  | $I_{OL} = 24$ mA      | 3.0                 | —                   | 0.75    |   |
| Input leakage current     | $I_{IN}$        | $V_{IN} = 0$ to $5.5$ V                    | 1.65 to 3.6           | —                   | $\pm 20.0$          | $\mu A$ |   |
| Power-OFF leakage current | $I_{OFF}$       | $V_{IN}/V_{OUT} = 5.5$ V                   | 0                     | —                   | 40.0                | $\mu A$ |   |
| Quiescent supply current  | $I_{CC}$        | $V_{IN} = V_{CC}$ or GND                   | 1.65 to 3.6           | —                   | 40.0                | $\mu A$ |   |
|                           | $I_{CC}$        | $V_{IN} = 3.6$ to $5.5$ V                  | 1.65 to 3.6           | —                   | $\pm 40.0$          |         |   |
| Quiescent supply current  | $\Delta I_{CC}$ | $V_{IH} = V_{CC} - 0.6$ V<br>(per 1 input) | 2.7 to 3.6            | —                   | 5.0                 | mA      |   |

**11.3. AC Characteristics (Unless otherwise specified,  $T_a = -40$  to  $85$  °C)**

| Characteristics                                | Symbol               | Note     | Test Condition                                      | $V_{CC}$ (V) | Min  | Max  | Unit |
|--|----------------------|----------|---|--------------|------|------|------|
| Maximum clock frequency                        | $f_{MAX}$            |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | 1.8 ± 0.15   | 50   | —    | MHz  |
|  |                      |          |   | 2.5 ± 0.2    | 100  | —    |      |
|  |                      |          |   | 2.7          | 100  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 150  | —    |      |
| Propagation delay time (CK-Q, $\bar{Q}$ )      | $t_{PLH}, t_{PHL}$   |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | 1.8 ± 0.15   | —    | 22.0 | ns   |
|  |                      |          |   | 2.5 ± 0.2    | —    | 9.0  |      |
|  |                      |          |   | 2.7          | —    | 8.0  |      |
|  |                      |          |   | 3.3 ± 0.3    | 1.5  | 7.0  |      |
| Propagation delay time (CLR, PR-Q, $\bar{Q}$ ) | $t_{PLH}, t_{PHL}$   |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.3 | 1.8 ± 0.15   | —    | 22.0 | ns   |
|  |                      |          |   | 2.5 ± 0.2    | —    | 9.0  |      |
|  |                      |          |   | 2.7          | —    | 8.0  |      |
|  |                      |          |   | 3.3 ± 0.3    | 1.5  | 7.0  |      |
| Minimum pulse width (CK)                       | $t_{w(L)}, t_{w(H)}$ |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | 1.8 ± 0.15   | 10.0 | —    | ns   |
|  |                      |          |   | 2.5 ± 0.2    | 5.0  | —    |      |
|  |                      |          |   | 2.7          | 3.3  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 3.3  | —    |      |
| Minimum pulse width (CLR, PR)                  | $t_{w(L)}$           |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.3 | 1.8 ± 0.15   | 10.0 | —    | ns   |
|  |                      |          |   | 2.5 ± 0.2    | 5.0  | —    |      |
|  |                      |          |   | 2.7          | 3.6  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 3.3  | —    |      |
| Minimum setup time                             | $t_s$                |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | 1.8 ± 0.15   | 10.0 | —    | ns   |
|  |                      |          |   | 2.5 ± 0.2    | 5.0  | —    |      |
|  |                      |          |   | 2.7          | 2.5  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 2.5  | —    |      |
| Minimum hold time                              | $t_h$                |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | 1.8 ± 0.15   | 1.5  | —    | ns   |
|  |                      |          |   | 2.5 ± 0.2    | 1.5  | —    |      |
|  |                      |          |   | 2.7          | 1.5  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 1.5  | —    |      |
| Minimum removal time                           | $t_{rem}$            |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.2 | 1.8 ± 0.15   | 10.0 | —    | ns   |
|  |                      |          |   | 2.5 ± 0.2    | 5.0  | —    |      |
|  |                      |          |   | 2.7          | 3.0  | —    |      |
|  |                      |          |   | 3.3 ± 0.3    | 2.5  | —    |      |
| Output skew                                    | $t_{osLH}, t_{osHL}$ | (Note 1) | —   | 2.7          | —    | —    | ns   |
|  |                      |          |   | 3.3 ± 0.3    | —    | 1.0  |      |

Note 1: Parameter guaranteed by design. ( $t_{osLH} = |t_{PLHM} - t_{PLHN}|$ ,  $t_{osHL} = |t_{PHLM} - t_{PHLN}|$ )

**11.4. AC Characteristics (Unless otherwise specified,  $T_a = -40$  to  $125$  °C)**

| Characteristics                                | Symbol               | Note     | Test Condition                                      | $V_{CC}$ (V)   | Min   | Max  | Unit |
|--|----------------------|----------|---|----------------|-------|------|------|
| Maximum clock frequency                        | $f_{MAX}$            |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | $1.8 \pm 0.15$ | 45.0  | —    | MHz  |
|  |                      |          |   | $2.5 \pm 0.2$  | 90.0  | —    |      |
|  |                      |          |   | 2.7            | 90.0  | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 135.0 | —    |      |
| Propagation delay time (CK-Q, $\bar{Q}$ )      | $t_{PLH}, t_{PHL}$   |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | $1.8 \pm 0.15$ | —     | 24.5 | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | —     | 10.0 |      |
|  |                      |          |   | 2.7            | —     | 9.0  |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 1.5   | 8.0  |      |
| Propagation delay time (CLR, PR-Q, $\bar{Q}$ ) | $t_{PLH}, t_{PHL}$   |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.3 | $1.8 \pm 0.15$ | —     | 24.5 | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | —     | 10.0 |      |
|  |                      |          |   | 2.7            | —     | 9.0  |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 1.5   | 8.0  |      |
| Minimum pulse width (CK)                       | $t_{w(L)}, t_{w(H)}$ |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | $1.8 \pm 0.15$ | 10.0  | —    | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | 5.0   | —    |      |
|  |                      |          |   | 2.7            | 3.3   | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 3.3   | —    |      |
| Minimum pulse width (CLR, PR)                  | $t_{w(L)}$           |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.3 | $1.8 \pm 0.15$ | 10.0  | —    | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | 5.0   | —    |      |
|  |                      |          |   | 2.7            | 3.6   | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 3.3   | —    |      |
| Minimum setup time                             | $t_s$                |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | $1.8 \pm 0.15$ | 10.0  | —    | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | 5.0   | —    |      |
|  |                      |          |   | 2.7            | 2.5   | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 2.5   | —    |      |
| Minimum hold time                              | $t_h$                |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.1 | $1.8 \pm 0.15$ | 1.5   | —    | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | 1.5   | —    |      |
|  |                      |          |   | 2.7            | 1.5   | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 1.5   | —    |      |
| Minimum removal time                           | $t_{rem}$            |          | See 11.7 AC Test Circuit, Table 11.8.1, Fig. 11.8.2 | $1.8 \pm 0.15$ | 10.0  | —    | ns   |
|  |                      |          |   | $2.5 \pm 0.2$  | 5.0   | —    |      |
|  |                      |          |   | 2.7            | 3.0   | —    |      |
|  |                      |          |   | $3.3 \pm 0.3$  | 2.5   | —    |      |
| Output skew                                    | $t_{osLH}, t_{osHL}$ | (Note 1) | —   | 2.7            | —     | —    | ns   |
|  |                      |          |   | $3.3 \pm 0.3$  | —     | 1.0  |      |

Note 1: Parameter guaranteed by design. ( $t_{osLH} = |t_{PLHM} - t_{PLHN}|$ ,  $t_{osHL} = |t_{PHLM} - t_{PHLN}|$ )

**11.5. Dynamic Switching Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ , Input:  $t_r = t_f = 2.5\text{ ns}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 500\text{ }\Omega$ )**

| Characteristics                       | Symbol      | Test Condition                                  | $V_{CC}$ (V) | Typ. | Unit |
|---------------------------------------|-------------|---|--------------|------|------|
| Quiet output maximum dynamic $V_{OL}$ | $V_{OLP}$   | $V_{IH} = 3.3\text{ V}$ , $V_{IL} = 0\text{ V}$ | 3.3          | 0.8  | V    |
| Quiet output minimum dynamic $V_{OL}$ | $ V_{OLV} $ | $V_{IH} = 3.3\text{ V}$ , $V_{IL} = 0\text{ V}$ | 3.3          | 0.8  | V    |

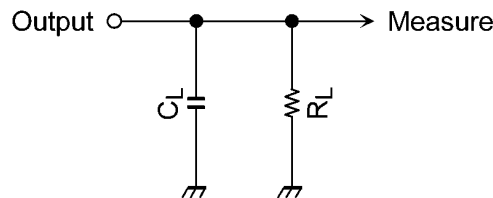
**11.6. Capacitive Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

| Characteristics               | Symbol    | Note     | Test Condition           | $V_{CC}$ (V) | Typ. | Unit |
|-------------------------------|-----------|----------|--------------------------|--------------|------|------|
| Input capacitance             | $C_{IN}$  |          | —                        | 3.3          | 7    | pF   |
| Output capacitance            | $C_{OUT}$ |          | —                        | 0            | 8    | pF   |
| Power dissipation capacitance | $C_{PD}$  | (Note 1) | $f_{IN} = 10\text{ MHz}$ | 3.3          | 25   | 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.

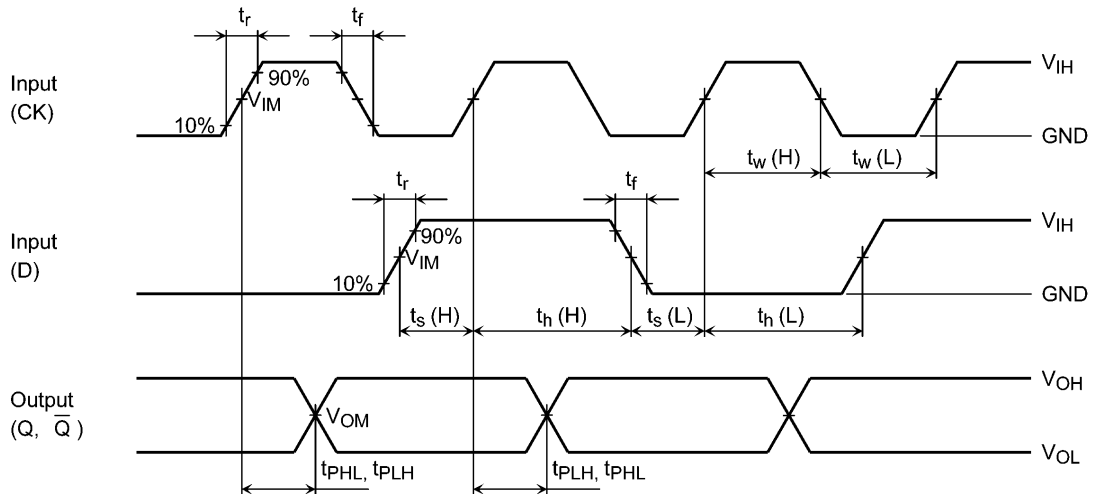
$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/2 \text{ (per 1 bit)}$$

**11.7. AC Test Circuit**

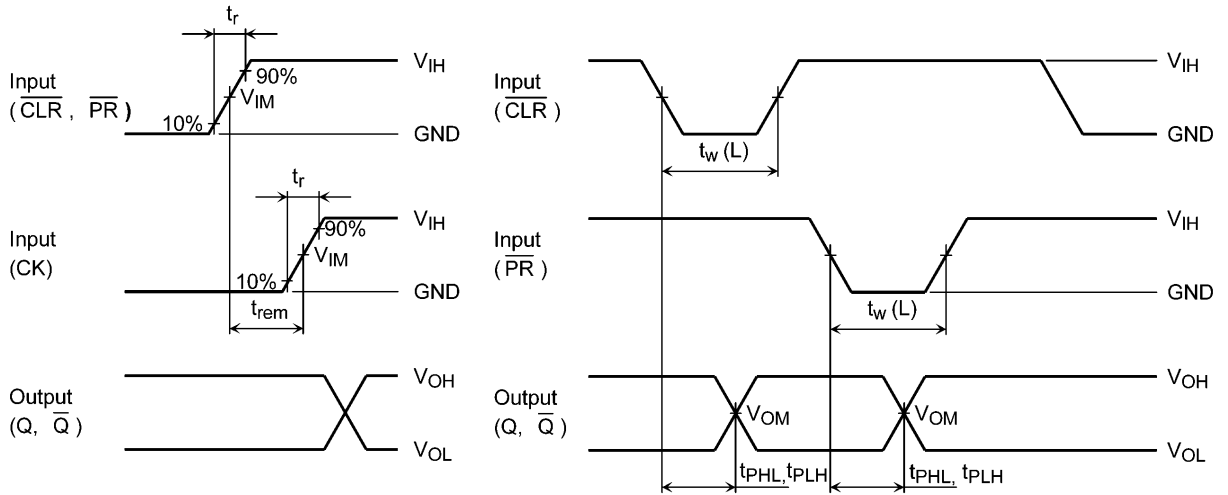




**11.8. AC Waveform**



**Fig. 11.8.1 t<sub>PLH</sub>, t<sub>PHL</sub>, t<sub>w</sub>, t<sub>s</sub>, t<sub>h</sub>**



**Fig. 11.8.2 t<sub>rem</sub>**

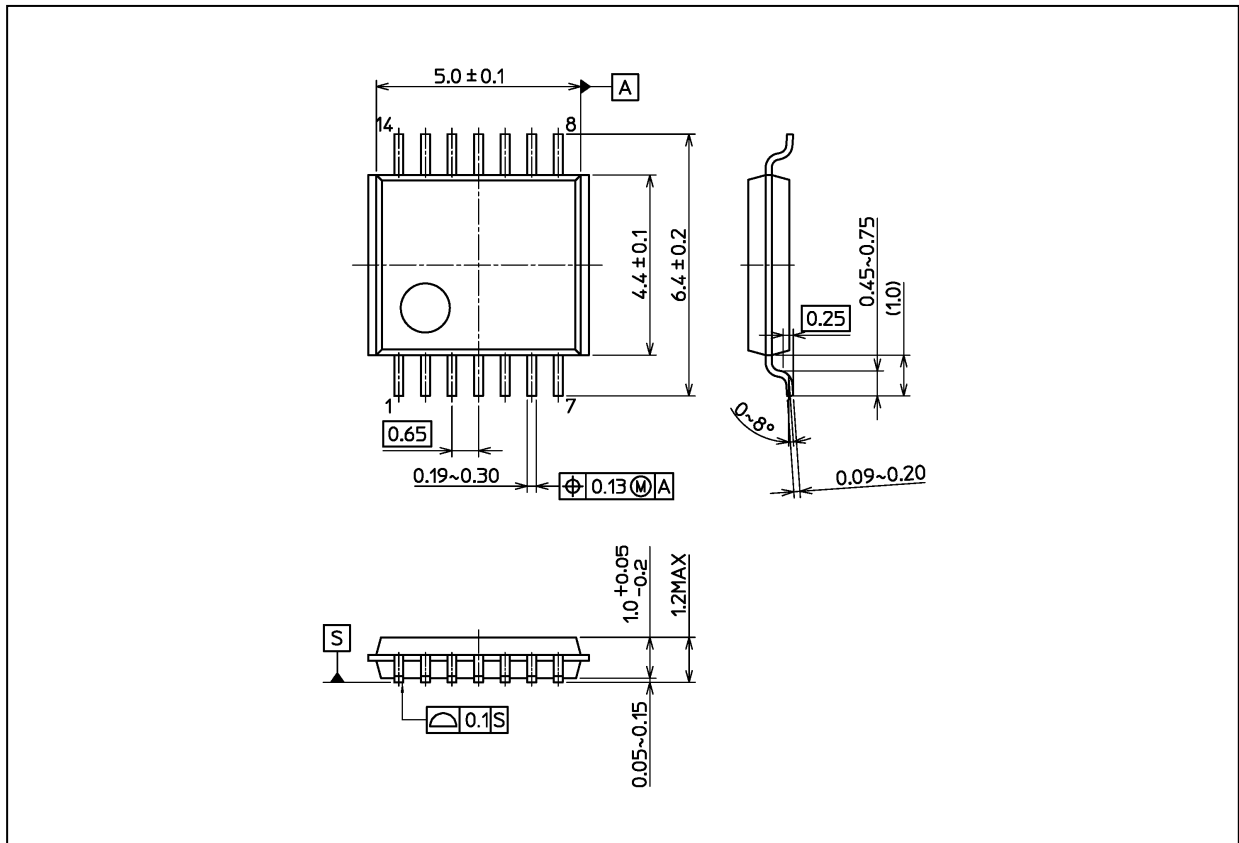
**Fig. 11.8.3 t<sub>PLH</sub>, t<sub>PHL</sub>**

**Table 11.8.1 AC Waveform Symbols**

|        | Symbol                          | V <sub>CC</sub> = 3.3 ± 0.3 V<br>V <sub>CC</sub> = 2.7 V | V <sub>CC</sub> = 2.5 ± 0.2 V | V <sub>CC</sub> = 1.8 ± 0.15 V |
|--------|---------------------------------|--|-------------------------------|--------------------------------|
| Input  | V <sub>IH</sub>                 | 2.7 V  | V <sub>CC</sub>               | V <sub>CC</sub>                |
|        | V <sub>IM</sub>                 | 1.5 V  | V <sub>CC</sub> /2            | V <sub>CC</sub> /2             |
|        | t <sub>r</sub> , t <sub>f</sub> | 2.5 ns   | 2.0 ns                        | 2.0 ns                         |
| Output | V <sub>OM</sub>                 | 1.5 V  | V <sub>OH</sub> /2            | V <sub>OH</sub> /2             |
| Load   | C <sub>L</sub>                  | 50 pF  | 30 pF                         | 30 pF                          |
|        | R <sub>L</sub>                  | 500 Ω  | 500 Ω                         | 1 kΩ                           |

Package Dimensions

Unit: mm



Weight: 0.054 g (typ.)

|                    |
|--------------------|
| Package Name(s)    |
| Nickname: TSSOP14B |

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