

Preliminary

TOSHIBA CMOS Digital Integrated Circuit
Silicon Monolithic

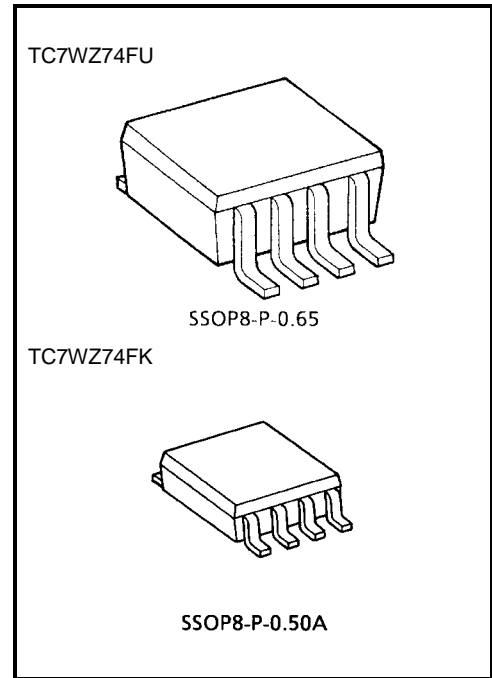
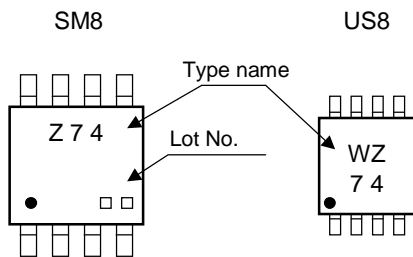
TC7WZ74FU, TC7WZ74FK

D-Type Flip Flop with Preset and Clear

Features

- High output current: ± 24 mA (min) @ $V_{CC} = 3$ V
- Propagation delay time: t_{pd} 2.8 ns (typ.) @ $V_{CC} = 3$ V, 50 pF
- Operating voltage range: $V_{CC(opr)} = 1.65 \sim 5.5$ V
- High latch-up immunity: ± 500 mA or more
- High ESD: ± 200 V or more (JEITA)
 ± 2000 V or more (MIL)
- Power down protection is provided on all inputs.
- Electrical characteristics when $V_{CC} = 3.3$ V is the same as TC74LCX series.

Marking

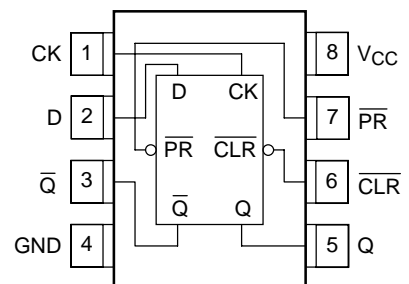


Weight
 SSOP8-P-0.65 : 0.02 g (typ.)
 SSOP8-P-0.50A : 0.01 g (typ.)

Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|------------------------|------|
| Supply voltage range | V_{CC} | -0.5~6 | V |
| DC input voltage | V_{IN} | -0.5~6 | V |
| DC output voltage | V_{OUT} | -0.5~6 | V |
| Input diode current | I_{IK} | -20 | mA |
| Output diode current | I_{OK} | -20 | mA |
| DC output current | I_{OUT} | ± 50 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 50 | mA |
| Power dissipation | P_D | 300 (SM8) 200 (US8) | mW |
| Storage temperature | T_{stg} | -65~150 | °C |
| Lead temperature (10s) | T_L | 260 | °C |

Pin Assignment (top view)

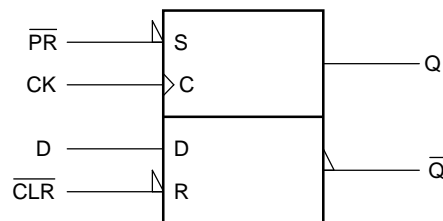


Truth Table

| Inputs | | | | Outputs | | Function |
|-------------------------|------------------------|---|--------------|---------|-----------------------|-----------|
| $\overline{\text{CLR}}$ | $\overline{\text{PR}}$ | D | CK | Q | $\overline{\text{Q}}$ | |
| L | H | X | X | L | H | Clear |
| H | L | X | X | H | L | Preset |
| L | L | X | X | H | H | — |
| H | H | L | \uparrow | L | H | — |
| H | H | H | \uparrow | H | L | — |
| H | H | X | \downarrow | Qn | Qn | No Change |

X: Don't care

Logic Diagram



Recommended Operating Conditions

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|--|------|
| Supply voltage | V_{CC} | 1.65~5.5 | V |
| | | 1.5~5.5 (Note 1) | |
| Input voltage | V_{IN} | 0~5.5 | V |
| Output voltage | V_{OUT} | 0~5.5 (Note 2) | V |
| | | 0~ V_{CC} (Note 3) | |
| Operating temperature | T_{opr} | -40~85 | °C |
| Input rise and fall time | dt/dv | 0~20 ($V_{CC} = 1.8 \text{ V} \pm 0.15 \text{ V}$, 2.5 $\text{V} \pm 0.2 \text{ V}$) | ns/V |
| | | 0~10 ($V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$) | |
| | | 0~5 ($V_{CC} = 5.5 \text{ V} \pm 0.5 \text{ V}$) | |

Note 1: Data retention only

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

Note 3: High or low

Electrical Characteristics

DC Characteristics

| Characteristics | | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40~85°C | | Unit | | |
|--------------------------|------------|------------------|---|---------------------------|--------------------------|---------------------------|------|---------------------------|---------------------------|------|---------------------------|------|
| | | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max | |
| Input voltage | High level | V _{IH} | — | — | 1.65~1.8 | 0.75 × V _{CC} | — | — | 0.75 × V _{CC} | V | | |
| | | | | | 2.3~5.5 | 0.7 × V _{CC} | — | — | 0.7 × V _{CC} | | | |
| | Low level | V _{IL} | — | — | 1.65~1.8 | — | — | 0.25 × V _{CC} | — | | 0.25 × V _{CC} | |
| | | | | | 2.3~5.5 | — | — | 0.3 × V _{CC} | — | | 0.3 × V _{CC} | |
| Output voltage | High level | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = -100 μA | 1.65 | 1.55 | 1.65 | — | 1.55 | — | V | |
| | | | | | 2.3 | 2.2 | 2.3 | — | 2.2 | — | | |
| | | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | | |
| | | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | |
| | | | | | I _{OL} = -4 mA | 1.65 | 1.29 | 1.52 | — | 1.29 | | — |
| | | | | | I _{OL} = -8 mA | 2.3 | 1.9 | 2.15 | — | 1.9 | | — |
| | | | | | I _{OL} = -16 mA | 3.0 | 2.4 | 2.8 | — | 2.4 | | — |
| | | | | | I _{OL} = -24 mA | 3.0 | 2.3 | 2.68 | — | 2.3 | | — |
| | Low level | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 100 μA | 1.8 | — | 0 | 0.1 | — | 0.1 | V | |
| | | | | | 2.3 | — | 0 | 0.1 | — | 0.1 | | |
| | | | | | 3.0 | — | 0 | 0.1 | — | 0.1 | | |
| | | | | | 4.5 | — | 0 | 0.1 | — | 0.1 | | |
| | | | | | I _{OL} = 4 mA | 1.65 | — | 0.08 | 0.24 | — | | 0.24 |
| | | | | | I _{OL} = 8 mA | 2.3 | — | 0.1 | 0.3 | — | | 0.3 |
| | | | | | I _{OL} = 16 mA | 3.0 | — | 0.15 | 0.4 | — | | 0.4 |
| | | | | | I _{OL} = 24 mA | 3.0 | — | 0.22 | 0.55 | — | | 0.55 |
| Input leakage current | | I _{IN} | V _{IN} = 5.5 V or GND | 0~5.5 | — | — | ±1 | — | ±10 | μA | | |
| Power OFF leak current | | I _{OFF} | V _{IN} or V _{OUT} = 5.5 V | 0.0 | — | — | 1 | — | 10 | μA | | |
| Quiescent supply current | | I _{CC} | V _{IN} = 5.5 V or GND | 1.65~5.5 | — | — | 1 | — | 10 | μA | | |

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | Ta = 25°C | | | Ta = -40~85°C | | Unit | |
|--|--|--|---------------------|-----|------|---------------|-----|------|-----|
| | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| Maximum clock frequency | f _{MAX} | C _L = 50 pF, R _L = 500 Ω | 1.8 ± 0.15 | 51 | — | — | 38 | — | MHz |
| | | | 2.5 ± 0.2 | 130 | — | — | 100 | — | |
| | | | 3.3 ± 0.3 | 200 | — | — | 150 | — | |
| | | | 5.0 ± 0.5 | 200 | — | — | 180 | — | |
| Propagation delay time (CK-Q, \bar{Q}) | t _{pLH} | C _L = 15 pF, R _L = 1 MΩ | 1.8 ± 0.15 | 2.5 | 10.0 | 18.0 | 2.1 | 23.0 | ns |
| | | | 2.5 ± 0.2 | 2.0 | 4.9 | 7.5 | 1.7 | 9.0 | |
| | | | 3.3 ± 0.3 | 1.5 | 3.3 | 4.8 | 1.3 | 5.6 | |
| | t _{pHL} | C _L = 50 pF, R _L = 500 Ω | 5.0 ± 0.5 | 1.0 | 2.4 | 3.5 | 1.0 | 3.9 | |
| | | | 3.3 ± 0.3 | 2.0 | 4.3 | 5.7 | 1.5 | 7.0 | |
| | | | 5.0 ± 0.5 | 1.5 | 2.8 | 4.0 | 1.3 | 4.4 | |
| Propagation delay time (\bar{CLR} , \bar{PR} -Q, \bar{Q}) | t _{pLH} | C _L = 15 pF, R _L = 1 MΩ | 1.8 ± 0.15 | 2.5 | 10.0 | 17.0 | 2.1 | 21.0 | ns |
| | | | 2.5 ± 0.2 | 2.0 | 5.0 | 7.3 | 1.7 | 8.8 | |
| | | | 3.3 ± 0.3 | 1.5 | 3.4 | 4.8 | 1.3 | 5.6 | |
| | t _{pHL} | C _L = 50 pF, R _L = 500 Ω | 5.0 ± 0.5 | 1.5 | 2.2 | 3.5 | 1.0 | 3.9 | |
| | | | 3.3 ± 0.3 | 2.0 | 4.3 | 5.7 | 1.5 | 7.0 | |
| | | | 5.0 ± 0.5 | 1.0 | 3.1 | 3.9 | 1.0 | 4.3 | |
| Minimum setup time | t _s | C _L = 50 pF, R _L = 500 Ω | 2.5 ± 0.2 | 3.4 | — | — | 4.1 | — | ns |
| | | | 3.3 ± 0.3 | 2.1 | — | — | 2.5 | — | |
| | | | 5.0 ± 0.5 | 1.5 | — | — | 1.7 | — | |
| Minimum hold time | t _h | C _L = 50 pF, R _L = 500 Ω | 2.5 ± 0.2 | 2.4 | — | — | 2.9 | — | ns |
| | | | 3.3 ± 0.3 | 1.4 | — | — | 1.5 | — | |
| | | | 5.0 ± 0.5 | 1.0 | — | — | 1.1 | — | |
| Minimum pulse width (CK) | t _W (L) t _W (H) | C _L = 50 pF, R _L = 500 Ω | 2.5 ± 0.2 | 3.0 | — | — | 3.6 | — | ns |
| | | | 3.3 ± 0.3 | 3.0 | — | — | 3.3 | — | |
| | | | 5.0 ± 0.5 | 3.0 | — | — | 3.2 | — | |
| Minimum pulse width (\bar{CLR} , \bar{PR}) | t _W (L) | C _L = 50 pF, R _L = 500 Ω | 2.5 ± 0.2 | 3.0 | — | — | 3.6 | — | ns |
| | | | 3.3 ± 0.3 | 3.0 | — | — | 3.3 | — | |
| | | | 5.0 ± 0.5 | 3.0 | — | — | 3.2 | — | |
| Minimum removal time | t _{rem} | C _L = 50 pF, R _L = 500 Ω | 2.5 ± 0.2 | 3.6 | — | — | 4.4 | — | ns |
| | | | 3.3 ± 0.3 | 2.2 | — | — | 2.5 | — | |
| | | | 5.0 ± 0.5 | 1.3 | — | — | 1.4 | — | |
| Input capacitance | C _{IN} | — | 0~0.5 | — | 3.0 | — | — | pF | |
| Output capacitance | C _{OUT} | — | 0~0.5 | — | 5.0 | — | — | pF | |
| Power dissipation capacitance | C _{PD} | (Note 4) | 3.3 | — | 30 | — | — | — | pF |
| | | | 5.5 | — | 47 | — | — | — | |

Note 4: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

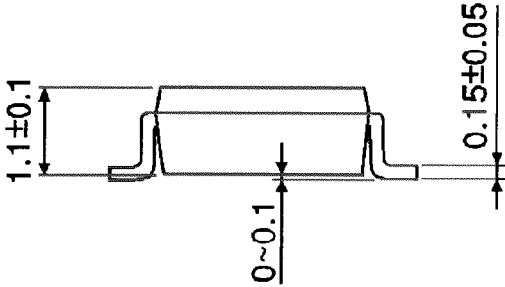
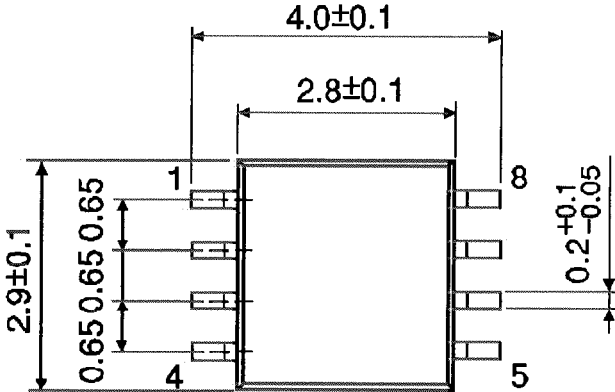
Average operating current can be obtained by the equation:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

Package Dimensions

SSOP8-P-0.65

Unit : mm

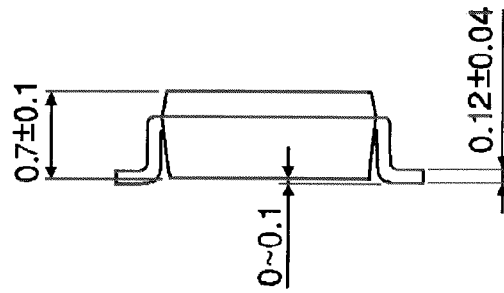
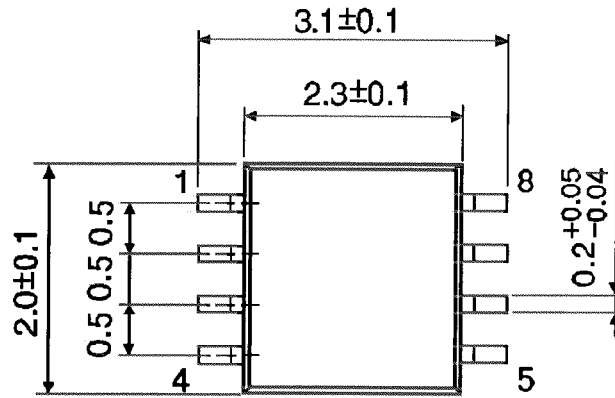


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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