

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

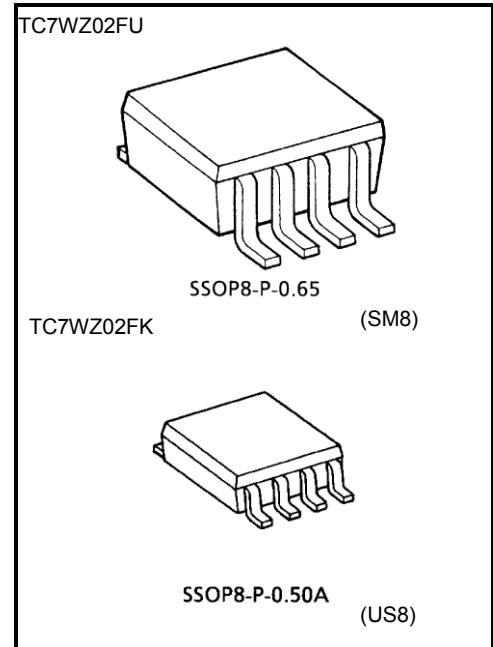
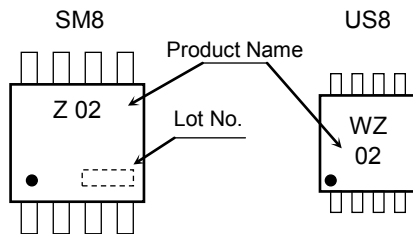
TC7WZ02FU, TC7WZ02FK

Dual 2-Input NOR Gate

Features

- High output current : ± 24 mA (min) at $V_{CC} = 3$ V
- Super high speed operation : $t_{pd} = 2.4$ ns (typ.)
at $V_{CC} = 5$ V, 50 pF
- Operating voltage range : $V_{CC} = 1.65$ to 5.5 V
- 5.5-V tolerant inputs
- 5.5-V power down protection outputs
- Matches the performance of TC74LCX series when operated at 3.3 V V_{CC}

Marking

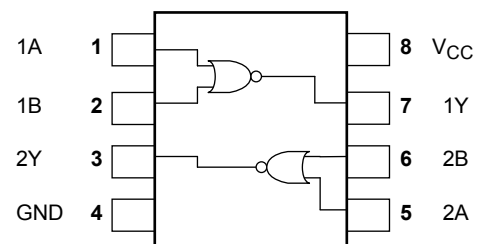


Weight
SSOP8-P-0.65 : 0.02 g (typ.)
SSOP8-P-0.50A : 0.01 g (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|-----------------------------------|------------------|
| Supply voltage | V_{CC} | -0.5 to 6 | V |
| DC input voltage | V_{IN} | -0.5 to 6 | V |
| DC output voltage | V_{OUT} | -0.5 to 6 (Note 1) | V |
| | | -0.5 to $V_{CC} + 0.5$ (Note 2) | |
| Input diode current | I_{IK} | -20 | mA |
| Output diode current | I_{OK} | -20 (Note 3) | 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 to 150 | $^\circ\text{C}$ |
| Lead temperature (10s) | T_L | 260 | $^\circ\text{C}$ |

Pin Assignment (top view)



Note: 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).

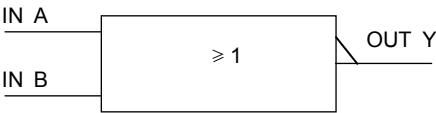
Note 1: $V_{CC} = 0$ V

Note 2: High or Low state. Do not exceed I_{OUT} of absolute maximum ratings.

Note 3: $V_{OUT} < GND$

Start of commercial production
2000-08

IEC Logic Symbol



Truth Table

| A | B | Y |
|---|---|---|
| L | L | H |
| L | H | L |
| H | L | L |
| H | H | L |

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|--------------------------|------------------|--|------|
| Supply voltage | V _{CC} | 1.65 to 5.5 | V |
| | | 1.5 to 5.5 (Note 4) | |
| Input voltage | V _{IN} | 0 to 5.5 | V |
| Output voltage | V _{OUT} | 0 to 5.5 (Note 5) | V |
| | | 0 to V _{CC} (Note 6) | |
| Operating temperature | T _{opr} | −40 to 85 | °C |
| Input rise and fall time | dt/dv | 0 to 20 (V _{CC} = 1.80 V ± 0.15 V, 2.5 V ± 0.2 V) | ns/V |
| | | 0 to 10 (V _{CC} = 3.3 V ± 0.3 V) | |
| | | 0 to 5 (V _{CC} = 5.0 V ± 0.5 V) | |

- Note 4: Data retention only
- Note 5: V_{CC} = 0 V
- Note 6: High or low state

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 | | | | | |
| Input voltage | High level | V _{IH} | — | 1.65 to 1.95 | V _{CC} × 0.75 | — | — | V _{CC} × 0.75 | — | V | | | | | | |
| | | | | 2.3 to 5.5 | V _{CC} × 0.7 | — | — | V _{CC} × 0.7 | — | | | | | | | |
| | Low level | V _{IL} | — | 1.65 to 1.95 | — | — | V _{CC} × 0.25 | — | V _{CC} × 0.25 | | | | | | | |
| | | | | 2.3 to 5.5 | — | — | V _{CC} × 0.3 | — | V _{CC} × 0.3 | | | | | | | |
| Output voltage | High level | V _{OH} | V _{IN} = V _{IL} | I _{OH} = -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 _{OH} = -4 mA | 1.65 | 1.29 | 1.52 | — | 1.29 | — | | | | | | |
| | | | | I _{OH} = -8 mA | 2.3 | 1.9 | 2.15 | — | 1.9 | — | | | | | | |
| | | | | I _{OH} = -16 mA | 3.0 | 2.4 | 2.8 | — | 2.4 | — | | | | | | |
| | | | | I _{OH} = -24 mA | 3.0 | 2.3 | 2.68 | — | 2.3 | — | | | | | | |
| | | | | I _{OH} = -32 mA | 4.5 | 3.8 | 4.2 | — | 3.8 | — | | | | | | |
| | Low level | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 100 μA | 1.65 | — | 0 | 0.1 | — | 0.1 | | | | | | |
| | | | | | 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 | | | | | | |
| | | | | I _{OL} = 32 mA | 4.5 | — | 0.22 | 0.55 | — | 0.55 | | | | | | |
| | | | | Input leakage current | | I _{IN} | V _{IN} = 5.5 V or GND | | 0 to 5.5 | — | | — | ±1 | — | ±10 | μA |
| | | | | Power off leakage 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 to 5.5 | — | — | 1 | — | 10 | μA | | | | | |

AC Characteristics (unless otherwise specified, 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 | t _{pLH} t _{pHL} | C _L = 15 pF, R _L = 1 MΩ | 1.8 ± 0.15 | 2.0 | 5.4 | 9.8 | 2.0 | 10.0 | ns |
| | | | 2.5 ± 0.2 | 1.2 | 3.3 | 5.4 | 1.2 | 5.8 | |
| | | | 3.3 ± 0.3 | 0.8 | 2.5 | 3.8 | 0.8 | 4.1 | |
| | | | 5.0 ± 0.5 | 0.5 | 2.0 | 3.0 | 0.5 | 3.3 | |
| | | C _L = 50 pF, R _L = 500 Ω | 3.3 ± 0.3 | 1.2 | 3.1 | 4.6 | 1.2 | 5.0 | |
| | | | 5.0 ± 0.5 | 0.8 | 2.4 | 3.7 | 0.8 | 4.0 | |
| Input capacitance | C _{IN} | — | 0 to 5.5 | — | 3.0 | — | — | — | pF |
| Power dissipation capacitance | C _{PD} | (Note 7) | 3.3 | — | 18 | — | — | — | pF |
| | | | 5.5 | — | 24 | — | — | — | |

Note 7: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

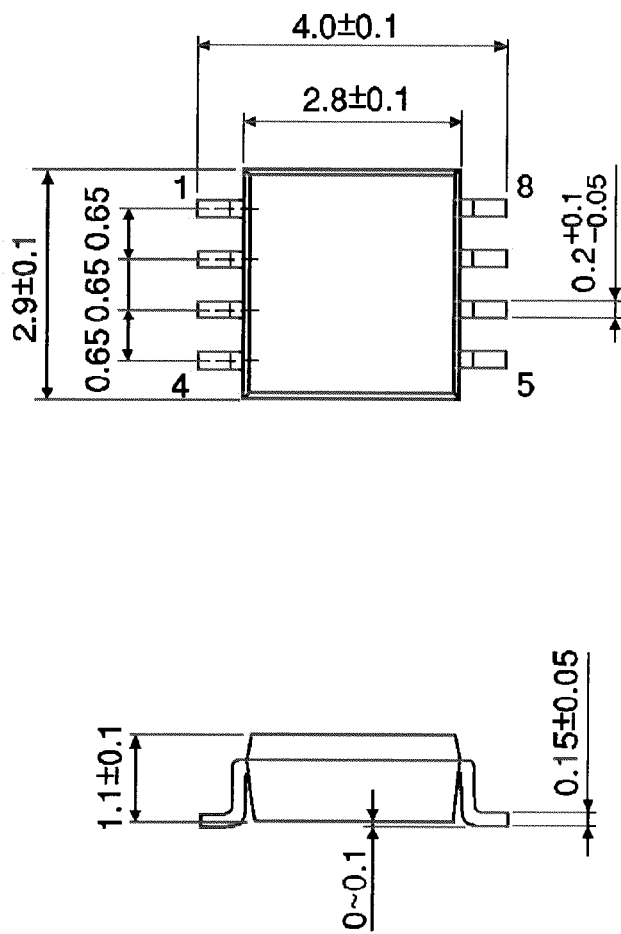
Average operating current can be obtained by the equation:

$$I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

Package Dimensions

SSOP8-P-0.65

Unit : mm

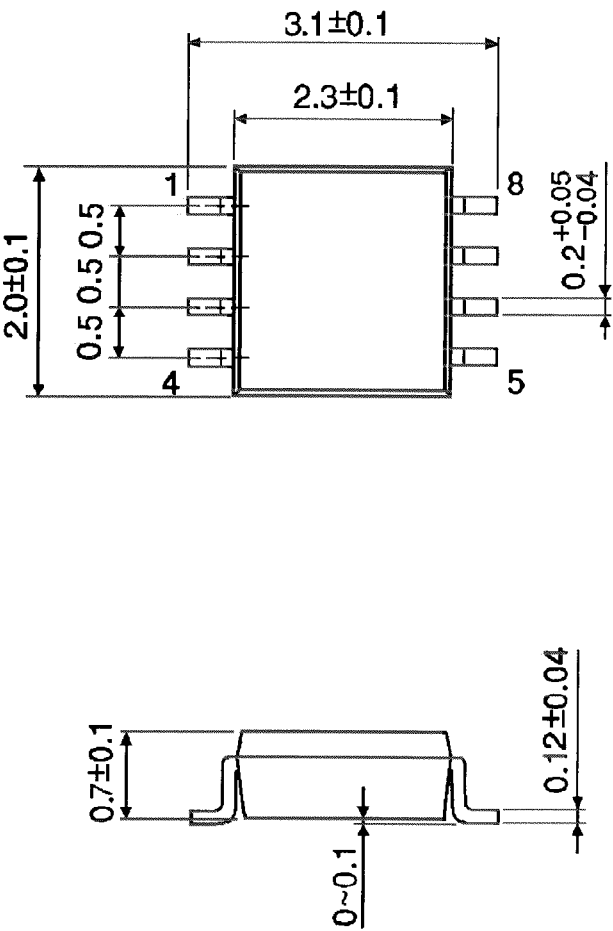


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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