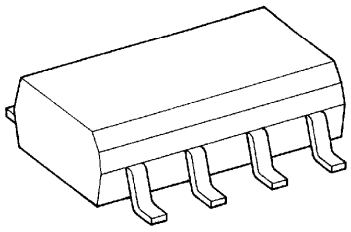
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7W02F, TC7W02FU, TC7W02FK

## DUAL 2-INPUT NOR GATE

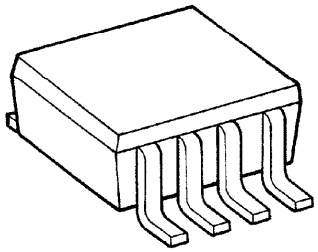
The TC7W02 is a high speed $C^2MOS$ 2-INPUT NOR GATE fabricated with silicon gate $C^2MOS$ technology.
It achives the high speed operation similar to equivalent LSTTL while maintaining the $C^2MOS$ low power dissipation.
The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC7W02F



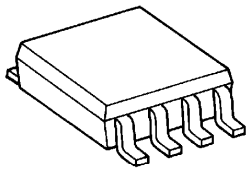
SOP8-P-1.27

TC7W02FU



SSOP8-P-0.65

TC7W02FK

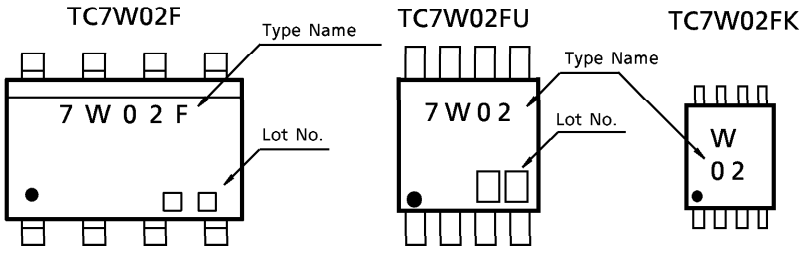


SSOP8-P-0.50A

### FEATURES

- High Speed ..... $t_{pd}$ = 6ns (Typ.) at $V_{CC}$ = 5V
- Low Power Dissipation ..... $I_{CC}$ = 1$\mu$A (Max.) at Ta = 25°C
- High Noise Immunity ..... $V_{NIH} = V_{NIL}$ = 28% $V_{CC}$ (Min.)
- Output Drive Capability ..... 10 LSTTL Loads
- Symmetrical Output Impedance ... $|I_{OH}| = I_{OL}$ = 4mA (Min.)
- Balanced Propagation Delays ..... $t_{pLH} \fallingdotseq t_{pHL}$
- Wide Operating Voltage Range ... $V_{CC\,(opr)}$ = 2~6V

### MARKING

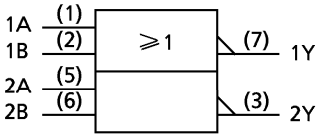



Weight
SOP8-P-1.27 : 0.05g (Typ.)
SSOP8-P-0.65 : 0.02g (Typ.)
SSOP8-P-0.50A : 0.01g (Typ.)

**MAXIMUM RATINGS** (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage Range | $V_{CC}$ | −0.5~7 | V |
| DC Input Voltage | $V_{IN}$ | −0.5~$V_{CC}$ + 0.5 | V |
| DC Output Voltage | $V_{OUT}$ | −0.5~$V_{CC}$ + 0.5 | V |
| Input Diode Current | $I_{IK}$ | ±20 | mA |
| Output Diode Current | $I_{OK}$ | ±20 | mA |
| DC Output Current | $I_{OUT}$ | ±25 | mA |
| DC $V_{CC}$ / Ground Current | $I_{CC}$ | ±25 | mA |
| Power Dissipation | $P_D$ | 300 | mW |
| Storage Temperature | $T_{stg}$ | −65~150 | °C |
| Lead Temperature (10s) | $T_L$ | 260 | °C |

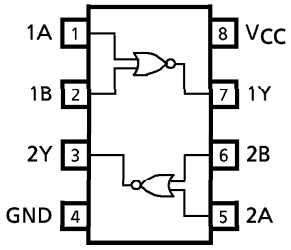
**LOGIC DIAGRAM**




**TRUTH TABLE**

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

**PIN ASSIGNMENT** (TOP VIEW)




**RECOMMENDED OPERATING CONDITIONS**

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply Voltage Range | $V_{CC}$ | 2~6 | V |
| Input Voltage | $V_{IN}$ | 0~$V_{CC}$ | V |
| Output Voltage | $V_{OUT}$ | 0~$V_{CC}$ | V |
| Operating Temperature | $T_{opr}$ | −40~85 | °C |
| Input Rise and Fall Time | $t_r$, $t_f$ | 0~1000 ($V_{CC}$ = 2.0V)<br>0~ 500 ($V_{CC}$ = 4.5V)<br>0~ 400 ($V_{CC}$ = 6.0V) | ns |

**DC ELECTRICAL CHARACTERISTICS**

| CHARACTERISTIC | SYMBOL | TEST CONDITION | | $V_{CC}$ | Ta = 25°C MIN. | TYP. | MAX. | Ta = −40~85°C MIN. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|
| High-Level Input Voltage | $V_{IH}$ | — | | 2.0 | 1.5 | — | — | 1.5 | — | V |
| | | | | 4.5 | 3.15 | — | — | 3.15 | — | |
| | | | | 6.0 | 4.2 | — | — | 4.2 | — | |
| Low-Level Input Voltage | $V_{IL}$ | — | | 2.0 | — | — | 0.5 | — | 0.5 | V |
| | | | | 4.5 | — | — | 1.35 | — | 1.35 | |
| | | | | 6.0 | — | — | 1.8 | — | 1.8 | |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IL}$ | $I_{OH} = -20\mu A$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | | $I_{OH} = -4mA$ | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | $I_{OH} = -5.2mA$ | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| Low-Level Output Voltage | $V_{OL}$ | $V_{IN} = V_{IH}$ or $V_{IL}$ | $I_{OL} = 20\mu A$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V |
| | | | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | |
| | | | $I_{OL} = 4mA$ | 4.5 | — | 0.17 | 0.26 | — | 0.33 | |
| | | | $I_{OL} = 5.2mA$ | 6.0 | — | 0.18 | 0.26 | — | 0.33 | |
| Input Leakage Current | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND | | 6.0 | — | — | ±0.1 | — | ±1.0 | $\mu A$ |
| Quiescent Supply Current | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND | | 6.0 | — | — | 1.0 | — | 10.0 | |

**AC ELECTRICAL CHARACTERISTICS** ($C_L = 15pF$, $V_{CC} = 5V$, Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION | Ta = 25°C MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Output Transition Time | $t_{TLH}$ $t_{THL}$ | — | — | 4 | 8 | ns |
| Propagation Delay Time | $t_{pLH}$ $t_{pHL}$ | — | — | 6 | 12 | ns |

**AC ELECTRICAL CHARACTERISTICS** ($C_L = 50pF$, Input $t_r = t_f = 6ns$)

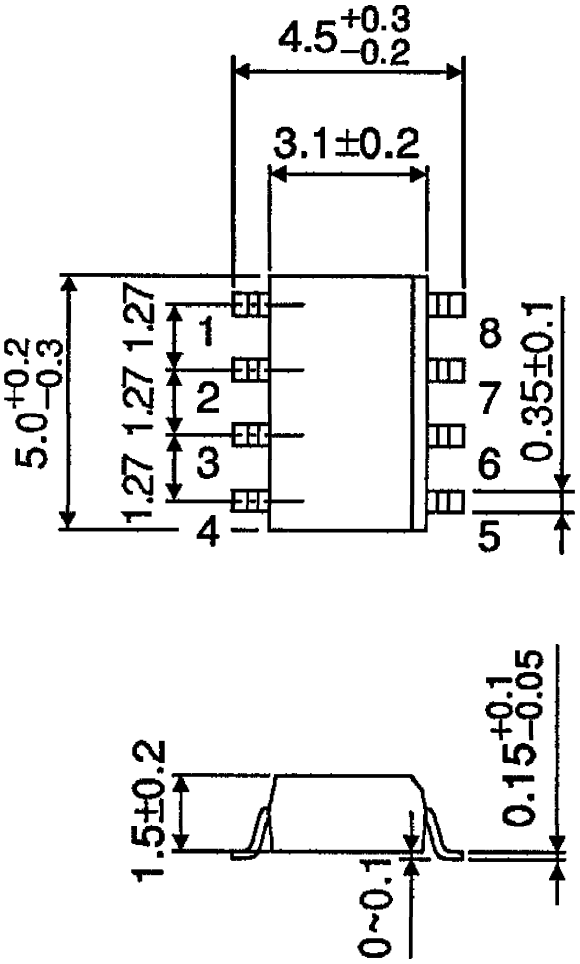
| CHARACTERISTIC | SYMBOL | TEST CONDITION | $V_{CC}$ | Ta = 25°C MIN. | TYP. | MAX. | Ta = −40~85°C MIN. | MAX. | UNIT |
|---|---|---|---|---|---|---|---|---|---|
| Output Transition Time | $t_{TLH}$ $t_{THL}$ | — | 2.0 | — | 25 | 75 | — | 95 | ns |
| | | | 4.5 | — | 7 | 15 | — | 19 | |
| | | | 6.0 | — | 6 | 13 | — | 16 | |
| Propagation Delay Time | $t_{pLH}$ $t_{pHL}$ | — | 2.0 | — | 27 | 75 | — | 95 | ns |
| | | | 4.5 | — | 9 | 15 | — | 19 | |
| | | | 6.0 | — | 8 | 13 | — | 16 | |
| Input Capacitance | $C_{IN}$ | — | | — | 5 | 10 | — | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$ | (Note 1) | | — | 21 | — | — | — | |

Note 1 : $C_{PD}$ is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit).
Average operating current can be obtained by the equation hereunder.

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

**PACKAGE DIMENSIONS**

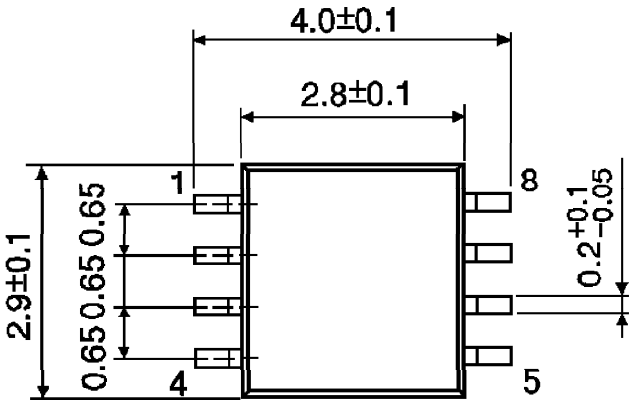
SOP8-P-1.27 Unit : mm

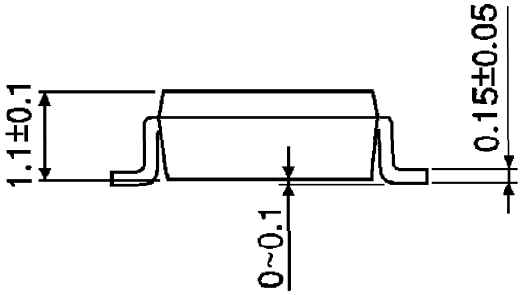



Weight : 0.05g (Typ.)

**PACKAGE DIMENSIONS**

SSOP8-P-0.65 Unit : mm



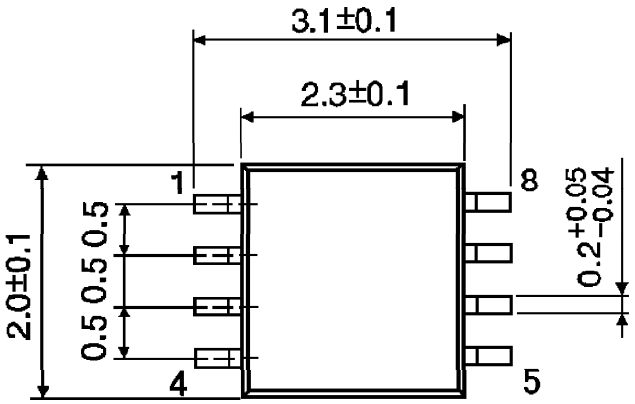



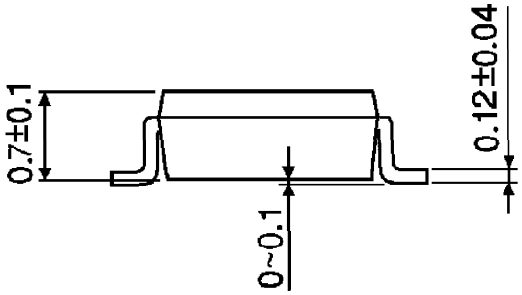

Weight : 0.02g (Typ.)

**PACKAGE DIMENSIONS**

SSOP8-P-0.50A

Unit : mm




Weight : 0.01g (Typ.)

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000707EBA

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