

# TC7SL02F, TC7SL02FU

## 2-INPUT NOR GATE

The TC7SL02 is a low voltage operative C<sup>2</sup>MOS 2-INPUT NOR GATE fabricated with silicon gate C<sup>2</sup>MOS technology.

Operating voltage ( $V_{CC(opr)}$ ) is 1~3V equivalent to 1pc or 2pcs of dry cell battery and it achieves low power dissipation.

The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.

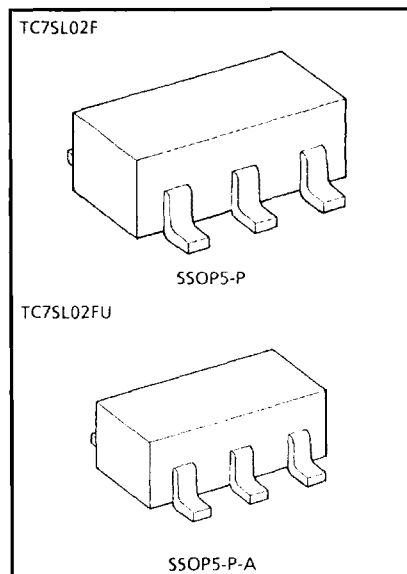
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### FEATURES

- High Speed .....  $t_{pd} = 10\text{ns (Typ.)}$   
at  $V_{CC} = 3\text{V}$
- Low Power Dissipation .....  $I_{CC} = 1\mu\text{A (Max.)}$   
at  $T_a = 25^\circ\text{C}$
- High Noise Immunity .....  $V_{NIH} = V_{NIL}$   
 $= 28\% V_{CC} \text{ (Min.)}$
- Symmetrical Output Impedance .....  $|I_{OH}| = I_{OL} = 1\text{mA}$
- Balanced Propagation Delay Time .....  $t_{pLH} \approx t_{pHL}$
- Low Voltage Operating .....  $V_{CC(opr)} = 1\sim 3.6\text{V}$

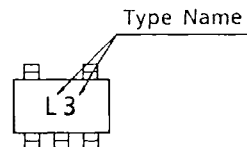
### MAXIMUM RATINGS

| CHARACTERISTIC              | SYMBOL    | RATING               | UNIT |
|-----------------------------|-----------|----------------------|------|
| Supply Voltage Range        | $V_{CC}$  | -0.5~5               | 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         | $I_{IK}$  | $\pm 20$             | mA   |
| Output Diode Current        | $I_{OK}$  | $\pm 20$             | mA   |
| DC Output Current           | $I_{OUT}$ | $\pm 12.5$           | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 25$             | mA   |
| Power Dissipation           | $P_D$     | 200                  | mW   |
| Storage Temperature         | $T_{stg}$ | -65~150              | °C   |
| Lead Temperature (10s)      | $T_L$     | 260                  | °C   |

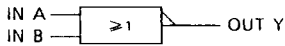


Weight SSOP5-P : 0.016g (Typ.)  
SSOP5-P-A : 0.006g (Typ.)

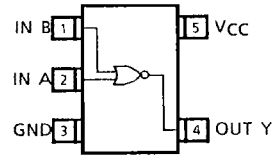
### MARKING



## LOGIC DIAGRAM



## PIN CONNECTION (TOP VIEW)



## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC           | SYMBOL     | RATING                     | UNIT |
|--------------------------|------------|----------------------------|------|
| Supply Voltage           | $V_{CC}$   | 1~3.6                      | 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 ( $V_{CC} = 1.0V$ ) | ns   |
|                          |            | 0~500 ( $V_{CC} = 1.5V$ )  |      |
|                          |            | 0~400 ( $V_{CC} = 3.0V$ )  |      |

## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC            | SYMBOL   | TEST CIRCUIT | TEST CONDITION                   | $V_{CC}$                             | $T_a = 25^\circ C$ |      |           | $T_a = -40 \sim 85^\circ C$ |           | UNIT    |   |
|---------------------------|----------|--------------|----------------------------------|--------------------------------------|--------------------|------|-----------|-----------------------------|-----------|---------|---|
|                           |          |              |                                  |                                      | MIN.               | TYP. | MAX.      | MIN.                        | MAX.      |         |   |
| High-Level Input Voltage  | $V_{IH}$ | —            | —                                | 1.0                                  | 0.75               | —    | —         | 0.75                        | —         | V       |   |
|                           |          |              |                                  | 1.5                                  | 1.05               | —    | —         | 1.05                        | —         |         |   |
|                           |          |              |                                  | 3.0                                  | 2.10               | —    | —         | 2.10                        | —         |         |   |
| Low-Level Input Voltage   | $V_{IL}$ | —            | —                                | 1.0                                  | —                  | —    | 0.25      | —                           | 0.25      | V       |   |
|                           |          |              |                                  | 1.5                                  | —                  | —    | 0.45      | —                           | 0.45      |         |   |
|                           |          |              |                                  | 3.0                                  | —                  | —    | 0.90      | —                           | 0.90      |         |   |
| High-Level Output Voltage | $V_{OH}$ | —            | $V_{IN} = V_{IL}$                | $I_{OH} = -20\mu A$                  | 1.0                | 0.9  | 1.0       | —                           | 0.9       | —       | V |
|                           |          |              |                                  |                                      | 1.5                | 1.4  | 1.5       | —                           | 1.4       | —       |   |
|                           |          |              |                                  |                                      | 3.0                | 2.9  | 3.0       | —                           | 2.9       | —       |   |
|                           |          |              |                                  | $I_{OH} = -1mA$<br>$I_{OH} = -2.6mA$ | 1.5                | 1.07 | 1.23      | —                           | 0.99      | —       |   |
|                           |          |              |                                  | 3.0                                  | 2.61               | 2.68 | —         | 2.55                        | —         |         |   |
| Low-Level Output Voltage  | $V_{OL}$ | —            | $V_{IN} = V_{IH}$<br>or $V_{IL}$ | $I_{OL} = 20\mu A$                   | 1.0                | —    | 0.0       | 0.1                         | —         | 0.1     | V |
|                           |          |              |                                  |                                      | 1.5                | —    | 0.0       | 0.1                         | —         | 0.1     |   |
|                           |          |              |                                  |                                      | 3.0                | —    | 0.0       | 0.1                         | —         | 0.1     |   |
|                           |          |              |                                  | $I_{OL} = 1mA$<br>$I_{OL} = 2.6mA$   | 1.5                | —    | 0.23      | 0.31                        | —         | 0.37    |   |
|                           |          |              |                                  | 3.0                                  | —                  | 0.23 | 0.31      | —                           | 0.33      |         |   |
| Input Leakage Current     | $I_{IN}$ | —            | $V_{IN} = V_{CC}$ or GND         | 3.6                                  | —                  | —    | $\pm 0.1$ | —                           | $\pm 1.0$ | $\mu A$ |   |
| Quiescent Supply Current  | $I_{CC}$ | —            | $V_{IN} = V_{CC}$ or GND         | 3.6                                  | —                  | —    | 1.0       | —                           | 10.0      |         |   |

# TC7SLO2F, TC7SLO2FU

AC ELECTRICAL CHARACTERISTICS ( $C_L = 15\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ ,  $V_{CC} = 3.3 \pm 0.3\text{V}$ )

| CHARACTERISTIC         | SYMBOL    | TEST CIRCUIT | TEST CONDITION | Ta = 25°C |      |      | UNIT |
|------------------------|-----------|--------------|----------------|-----------|------|------|------|
|                        |           |              |                | MIN.      | TYP. | MAX. |      |
| Output Transition Time | $t_{TLH}$ | —            | —              | —         | 5.0  | 9.0  | ns   |
|                        | $t_{THL}$ | —            | —              | —         | 5.0  | 9.0  |      |
| Propagation Delay Time | $t_{PLH}$ | —            | —              | —         | 7.5  | 13.0 | ns   |
|                        | $t_{PHL}$ | —            | —              | —         | 7.5  | 13.0 |      |

AC ELECTRICAL CHARACTERISTICS ( $C_L = 25\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

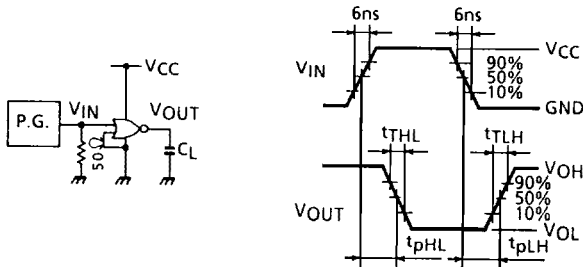
| CHARACTERISTIC                | SYMBOL    | TEST CIRCUIT | TEST CONDITION | $V_{CC}$ | Ta = 25°C |      |      | Ta = -40~85°C |      | UNIT |
|-------------------------------|-----------|--------------|----------------|----------|-----------|------|------|---------------|------|------|
|                               |           |              |                |          | MIN.      | TYP. | MAX. | MIN.          | MAX. |      |
| Output Transition Time        | $t_{TLH}$ | —            | —              | 1.0      | —         | 70   | 170  | —             | 240  | ns   |
|                               | $t_{THL}$ |              |                | 1.5      | —         | 25   | 45   | —             | 55   |      |
|                               |           |              |                | 3.0      | —         | 10   | 15   | —             | 20   |      |
| Propagation Delay Time        | $t_{PLH}$ | —            | —              | 1.0      | —         | 70   | 170  | —             | 210  | ns   |
|                               | $t_{PHL}$ |              |                | 1.5      | —         | 25   | 45   | —             | 55   |      |
|                               |           |              |                | 3.0      | —         | 10   | 15   | —             | 20   |      |
| Input Capacitance             | $C_{IN}$  | —            | —              | —        | 5         | 10   | —    | 10            | pF   |      |
| Power Dissipation Capacitance | $C_{PD}$  | —            | Note (1)       | —        | 10        | —    | —    | —             |      |      |

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

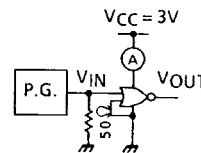
Average operating current can be obtained by the equation as follows.

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

## SWITCHING CHARACTERISTICS TEST CIRCUIT



## $I_{CC(\text{opr})}$ TEST CIRCUIT



Input waveform is the same as that in case of switching characteristics test.