

**TC7WU04F, TC7WU04FU, TC7WU04FK**

**3 INVERTER**

The TC7WU04 is a high speed C<sup>2</sup>MOS INVERTER fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves the high speed operation similar to equivalent LSTTL while maintaining the C<sup>2</sup>MOS low power dissipation.

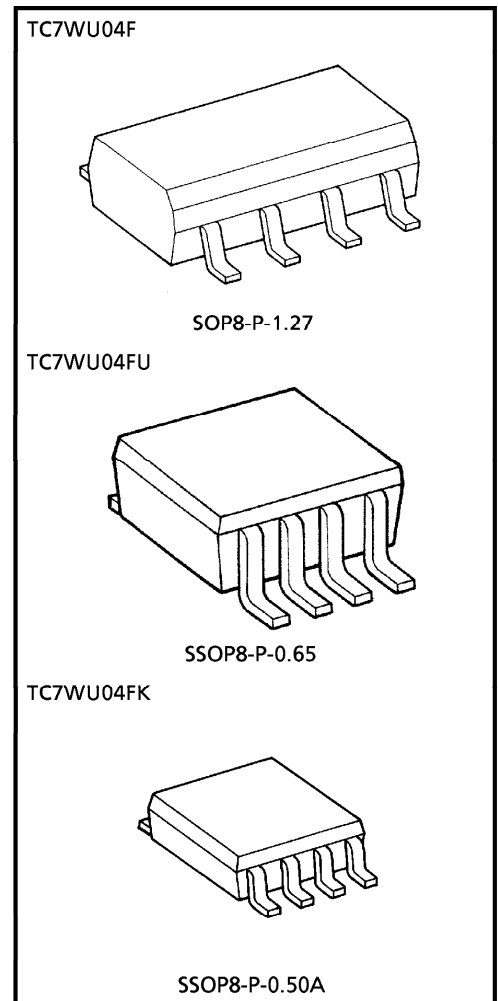
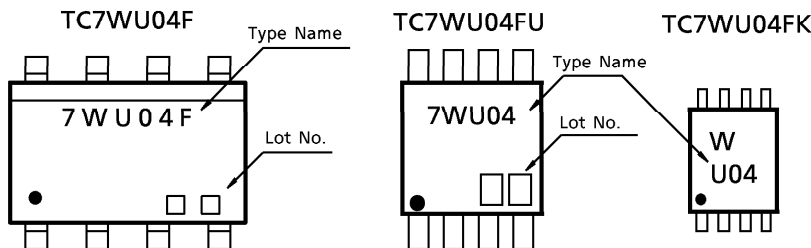
As the internal circuit is composed of single stage inverter, it can be applied for crystal oscillation.

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

**FEATURES**

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

**MARKING**



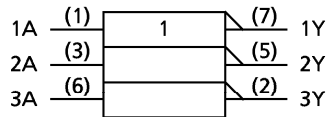
Weight

|               |                |
|---------------|----------------|
| 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 <sub>CC</sub>  | -0.5~7                    | V    |
| DC Input Voltage                   | V <sub>IN</sub>  | -0.5~V <sub>CC</sub> +0.5 | V    |
| DC Output Voltage                  | V <sub>OUT</sub> | -0.5~V <sub>CC</sub> +0.5 | V    |
| Input Diode Current                | I <sub>IK</sub>  | ±20                       | mA   |
| Output Diode Current               | I <sub>OK</sub>  | ±20                       | mA   |
| DC Output Current                  | I <sub>OUT</sub> | ±25                       | mA   |
| DC V <sub>CC</sub> /Ground Current | I <sub>CC</sub>  | ±25                       | mA   |
| Power Dissipation                  | P <sub>D</sub>   | 300                       | mW   |
| Storage Temperature                | T <sub>stg</sub> | -65~150                   | °C   |
| Lead Temperature (10s)             | T <sub>L</sub>   | 260                       | °C   |

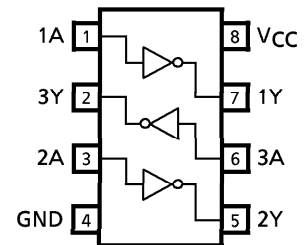
**LOGIC DIAGRAM**



**TRUTH TABLE**

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

**PIN ASSIGNMENT (TOP VIEW)**



**RECOMMENDED OPERATING CONDITIONS**

| CHARACTERISTIC        | SYMBOL           | RATING            | UNIT |
|-----------------------|------------------|-------------------|------|
| Supply Voltage        | V <sub>CC</sub>  | 2~6               | V    |
| Input Voltage         | V <sub>IN</sub>  | 0~V <sub>CC</sub> | V    |
| Output Voltage        | V <sub>OUT</sub> | 0~V <sub>CC</sub> | V    |
| Operating Temperature | T <sub>opr</sub> | -40~85            | °C   |

## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC            | SYMBOL          | TEST CONDITION                           |  | Ta = 25°C       |      |      | Ta = -40~85°C |      | UNIT |      |
|---------------------------|-----------------|--|--|-----------------|------|------|---------------|------|------|------|
|                           |                 |  |  | V <sub>CC</sub> | MIN. | TYP. | MAX.          | MIN. |      | MAX. |
| High-Level Input Voltage  | V <sub>IH</sub> | —  |  | 2.0             | 1.7  | —    | —             | 1.7  | —    | V    |
|                           |                 |  |  | 4.5             | 3.6  | —    | —             | 3.6  | —    |      |
|                           |                 |  |  | 6.0             | 4.8  | —    | —             | 4.8  | —    |      |
| Low-Level Input Voltage   | V <sub>IL</sub> | —  |  | 2.0             | —    | —    | 0.3           | —    | 0.3  | V    |
|                           |                 |  |  | 4.5             | —    | —    | 0.9           | —    | 0.9  |      |
|                           |                 |  |  | 6.0             | —    | —    | 1.2           | —    | 1.2  |      |
| High-Level Output Voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IL</sub>        | I <sub>OH</sub> = -20μA                            | 2.0             | 1.8  | 2.0  | —             | 1.8  | —    | V    |
|                           |                 |  |  | 4.5             | 4.0  | 4.5  | —             | 4.0  | —    |      |
|                           |                 |  |  | 6.0             | 5.5  | 5.9  | —             | 5.5  | —    |      |
|                           |                 | V <sub>IN</sub> = GND                    | I <sub>OH</sub> = -4mA<br>I <sub>OH</sub> = -5.2mA | 4.5             | 4.18 | 4.31 | —             | 4.13 | —    |      |
|                           |                 |  |  | 6.0             | 5.68 | 5.80 | —             | 5.63 | —    |      |
|                           |                 |  |  | 6.0             | —    | —    | —             | —    | —    |      |
| Low-Level Output Voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub>        | I <sub>OL</sub> = 20μA                             | 2.0             | —    | 0.0  | 0.2           | —    | 0.2  | V    |
|                           |                 |  |  | 4.5             | —    | 0.0  | 0.5           | —    | 0.5  |      |
|                           |                 |  |  | 6.0             | —    | 0.1  | 0.5           | —    | 0.5  |      |
|                           |                 | V <sub>IN</sub> = V <sub>CC</sub>        | I <sub>OL</sub> = 4mA<br>I <sub>OL</sub> = 5.2mA   | 4.5             | —    | 0.17 | 0.26          | —    | 0.33 |      |
|                           |                 |  |  | 6.0             | —    | 0.18 | 0.26          | —    | 0.33 |      |
|                           |                 |  |  | 6.0             | —    | —    | —             | —    | —    |      |
| Input Leakage Current     | I <sub>IN</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND |  | 6.0             | —    | —    | ±0.1          | —    | ±1.0 | μA   |
| Quiescent Supply Current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND |  | 6.0             | —    | —    | 1.0           | —    | 10.0 |      |

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C)

| CHARACTERISTIC         | SYMBOL           | TEST CONDITION |  | Ta = 25°C |      |      | UNIT |
|------------------------|------------------|----------------|--|-----------|------|------|------|
|                        |                  |                |  | MIN.      | TYP. | MAX. |      |
| Output Transition Time | t <sub>TLH</sub> | —              |  | —         | 4    | 8    | ns   |
|                        | t <sub>THL</sub> | —              |  | —         | 4    | 8    |      |
| Propagation Delay Time | t <sub>pLH</sub> | —              |  | —         | 4    | 8    | ns   |
|                        | t <sub>pHL</sub> | —              |  | —         | 4    | 8    |      |

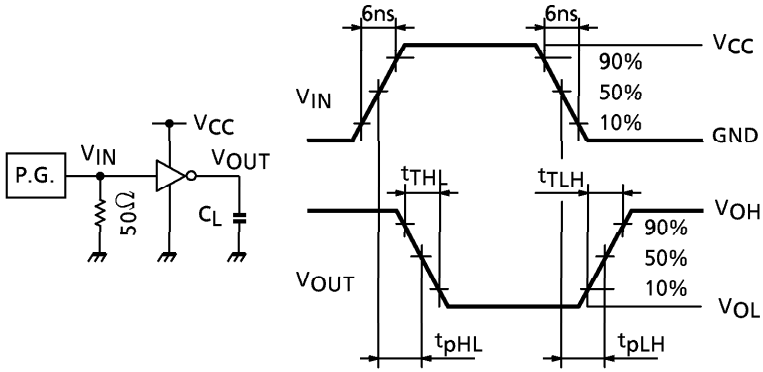
AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

| CHARACTERISTIC                | SYMBOL                               | TEST CONDITION |  | Ta = 25°C       |      |      | Ta = -40~85°C |      | UNIT |      |
|-------------------------------|--------------------------------------|----------------|--|-----------------|------|------|---------------|------|------|------|
|                               |                                      |                |  | V <sub>CC</sub> | MIN. | TYP. | MAX.          | MIN. |      | MAX. |
| Output Transition Time        | t <sub>TLH</sub><br>t <sub>THL</sub> | —              |  | 2.0             | —    | 30   | 75            | —    | 95   | ns   |
|                               |                                      |                |  | 4.5             | —    | 8    | 15            | —    | 19   |      |
|                               |                                      |                |  | 6.0             | —    | 7    | 13            | —    | 16   |      |
| Propagation Delay Time        | t <sub>pLH</sub><br>t <sub>pHL</sub> | —              |  | 2.0             | —    | 18   | 60            | —    | 75   | ns   |
|                               |                                      |                |  | 4.5             | —    | 6    | 12            | —    | 15   |      |
|                               |                                      |                |  | 6.0             | —    | 5    | 10            | —    | 13   |      |
| Input Capacitance             | C <sub>IN</sub>                      | —              |  | —               | 9    | 15   | —             | 15   | pF   |      |
| Power Dissipation Capacitance | C <sub>PD</sub>                      | (Note 1)       |  | —               | 13   | —    | —             | —    |      |      |

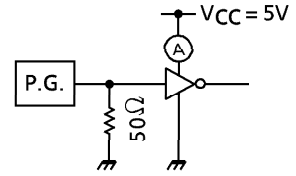
Note 1 : C<sub>PD</sub> is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to Test Circuit). Average operating current can be obtained by the equation hereunder.

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 3 \text{ (per gate)}$$

**SWITCHING CHARACTERISTICS TEST CIRCUIT**



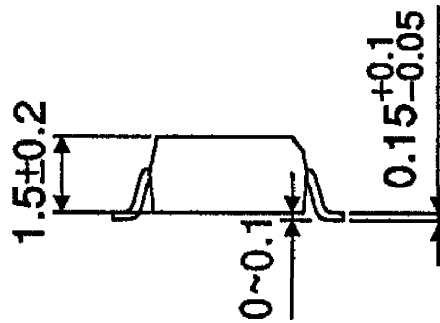
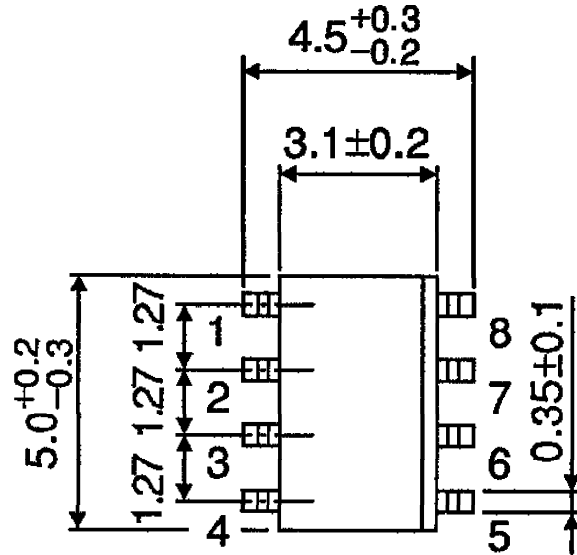
**OPERATING CURRENT CONSUMPTION TEST CIRCUIT**



This input waveform is equal to SWITCHING CHARACTERISTICS TEST CIRCUIT input waveform.

PACKAGE DIMENSIONS  
SOP8-P-1.27

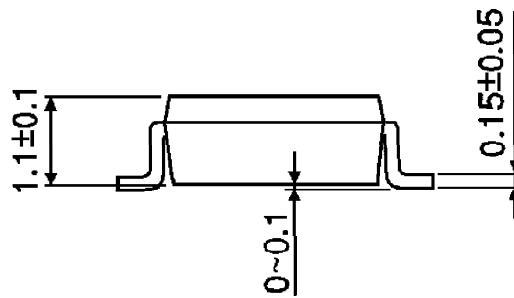
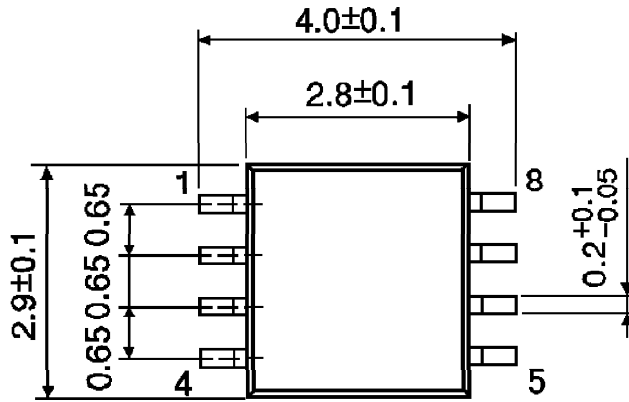
Unit : mm



Weight : 0.05g (Typ.)

PACKAGE DIMENSIONS  
SSOP8-P-0.65

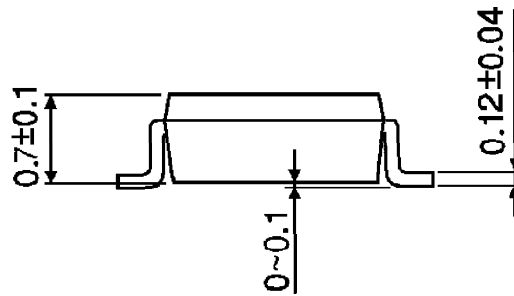
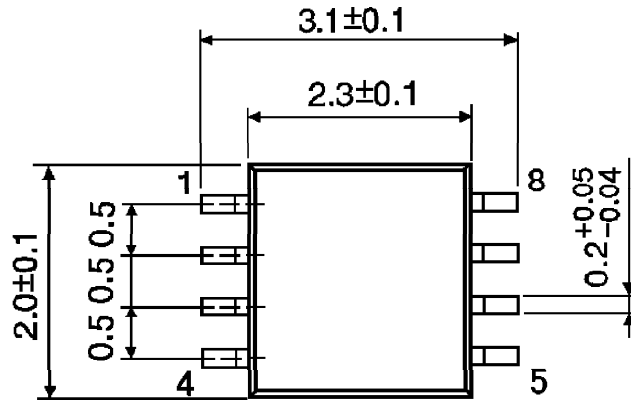
Unit : mm



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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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А