

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7W08F, TC7W08FU

DUAL 2-INPUT AND GATE

The TC7W08 is a high speed C<sup>2</sup>MOS 2-INPUT AND GATE 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.

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

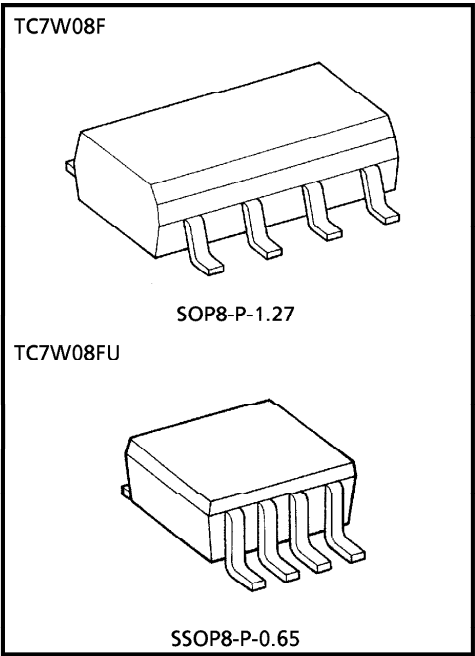
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

FEATURES

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

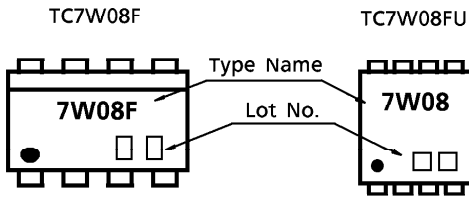
MAXIMUM RATINGS (Ta = 25°C)

| 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   |



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

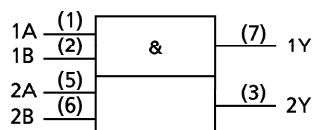
MARKING



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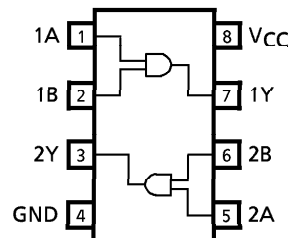
## LOGIC DIAGRAM



## TRUTH TABLE

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

## PIN ASSIGNMENT (TOP VIEW)



## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC           | SYMBOL     | RATING   | UNIT |
|--------------------------|------------|--|------|
| Supply Voltage           | $V_{CC}$   | 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                   | $T_a = 25^\circ\text{C}$                           |                    |                   |                    | $T_a = -40 \sim 85^\circ\text{C}$ |                    | UNIT          |
|---------------------------|----------|----------------------------------|--|--------------------|-------------------|--------------------|-----------------------------------|--------------------|---------------|
|                           |          |                                  | $V_{CC}$   | MIN.               | TYP.              | MAX.               | MIN.                              | MAX.               |               |
| High-Level Input Voltage  | $V_{IH}$ | —                                | 2.0<br>4.5<br>6.0                                  | 1.5<br>3.15<br>4.2 | —<br>—<br>—       | —<br>—<br>—        | 1.5<br>3.15<br>4.2                | —<br>—<br>—        | V             |
| Low-Level Input Voltage   | $V_{IL}$ | —                                | 2.0<br>4.5<br>6.0                                  | —<br>—<br>—        | —<br>—<br>—       | 0.5<br>1.35<br>1.8 | —<br>—<br>—                       | 0.5<br>1.35<br>1.8 | V             |
| High-Level Output Voltage | $V_{OH}$ | $V_{IN} = V_{IH}$                | $I_{OH} = -20\mu\text{A}$                          | 2.0<br>4.5<br>6.0  | 1.9<br>4.4<br>5.9 | 2.0<br>4.5<br>6.0  | —<br>—<br>—                       | 1.9<br>4.4<br>5.9  | V             |
|                           |          |                                  |  | 4.5<br>6.0         | 4.18<br>5.68      | 4.31<br>5.80       | —<br>—                            | 4.13<br>5.63       |               |
|                           |          |                                  | $I_{OH} = -4\text{mA}$<br>$I_{OH} = -5.2\text{mA}$ | 2.0<br>4.5<br>6.0  | —<br>—<br>—       | 0.0<br>0.0<br>0.0  | 0.1<br>0.1<br>0.1                 | —<br>—<br>—        | V             |
|                           |          |                                  |  | 4.5<br>6.0         | —<br>—            | 0.17<br>0.18       | 0.26<br>0.26                      | —<br>—             |               |
| Low-Level Output Voltage  | $V_{OL}$ | $V_{IN} = V_{IH}$<br>or $V_{IL}$ | $I_{OL} = 20\mu\text{A}$                           | 2.0<br>4.5<br>6.0  | —<br>—<br>—       | 0.0<br>0.0<br>0.0  | 0.1<br>0.1<br>0.1                 | —<br>—<br>—        | V             |
|                           |          |                                  |  | 4.5<br>6.0         | —<br>—            | 0.17<br>0.18       | 0.26<br>0.26                      | —<br>—             |               |
|                           |          |                                  | $I_{OL} = 4\text{mA}$<br>$I_{OL} = 5.2\text{mA}$   | 2.0<br>4.5<br>6.0  | —<br>—<br>—       | 0.0<br>0.0<br>0.0  | 0.1<br>0.1<br>0.1                 | —<br>—<br>—        |               |
|                           |          |                                  |  | 4.5<br>6.0         | —<br>—            | 0.17<br>0.18       | 0.26<br>0.26                      | —<br>—             |               |
| Input Leakage Current     | $I_{IN}$ | $V_{IN} = V_{CC}$ or GND         | 6.0  | —                  | —                 | $\pm 0.1$          | —                                 | $\pm 1.0$          | $\mu\text{A}$ |
| Quiescent Supply Current  | $I_{CC}$ | $V_{IN} = V_{CC}$ or GND         | 6.0  | —                  | —                 | 1.0                | —                                 | 10.0               |               |

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**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ )

| CHARACTERISTIC         | SYMBOL                 | TEST CONDITION | $T_a = 25^\circ\text{C}$ |      |      | UNIT |
|------------------------|------------------------|----------------|--------------------------|------|------|------|
|                        |                        |                | MIN.                     | TYP. | MAX. |      |
| Output Transition Time | $t_{TLH}$<br>$t_{THL}$ | —              | —                        | 4    | 8    | ns   |
| Propagation Delay Time | $t_{pLH}$<br>$t_{pHL}$ | —              | —                        | 6    | 12   | ns   |

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

| CHARACTERISTIC                | SYMBOL       | TEST CONDITION | Ta = 25°C |      |      |      | Ta = - 40~85°C |      | UNIT |
|-------------------------------|--------------|----------------|-----------|------|------|------|----------------|------|------|
|                               |              |                | VCC       | MIN. | TYP. | MAX. | MIN.           | MAX. |      |
| Output Transition Time        | tTLH<br>tTHL | —              | 2.0       | —    | 25   | 75   | —              | 95   | ns   |
|                               |              |                | 4.5       | —    | 7    | 15   | —              | 19   |      |
|                               |              |                | 6.0       | —    | 6    | 13   | —              | 16   |      |
| Propagation Delay Time        | tPLH<br>tPHL | —              | 2.0       | —    | 27   | 75   | —              | 95   | ns   |
|                               |              |                | 4.5       | —    | 8    | 15   | —              | 19   |      |
|                               |              |                | 6.0       | —    | 7    | 13   | —              | 16   |      |
| Input Capacitance             | CIN          | —              |           | —    | 5    | 10   | —              | 10   | pF   |
| Power Dissipation Capacitance | CPD          | (Note 1)       |           | —    | 19   | —    | —              | —    |      |

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.

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