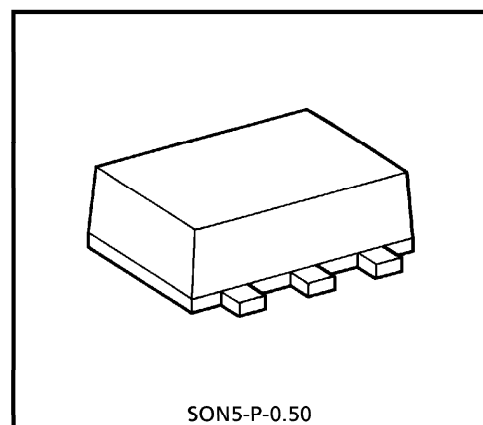


# TC7SZ04AFE

## INVERTER

### FEATURES

- High Output Drive :  $\pm 24$  mA (Typ.)  
@ $V_{CC} = 3$  V
- Super High Speed Operation :  $t_{pD}$  2.4 ns (Typ.)  
@ $V_{CC} = 5$  V, 50 pF
- Operation Voltage Range :  $V_{CC}(\text{opr}) = 1.8 \sim 5.5$  V
- Supply Voltage Data Retention :  $V_{CC} = 1.5 \sim 5.5$  V
- Latch-up Performance :  $\pm 500$  mA
- ESD Performance : Human Body Model  $> \pm 2000$  V  
Machine Model  $> \pm 200$  V
- Power Down Protection is provided on all inputs.
- Matches the Performance of TC74LCX Series when Operated at 3.3 V  $V_{CC}$
- Input Rise and Fall Time ( $t_r$ ,  $t_f$ ) (Recommended Operation Condition)  
@ $V_{CC} = 1.8$  V,  $2.5$  V  $\pm 0.2$  V : 0~20 ns/V  
@ $V_{CC} = 3.3$  V  $\pm 0.3$  V : 0~10 ns/V  
@ $V_{CC} = 5.5$  V  $\pm 0.5$  V : 0~5 ns/V



SON5-P-0.50  
Weight : 0.003 g (Typ.)

### MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC              | SYMBOL    | RATING                   | UNIT |
|-----------------------------|-----------|--------------------------|------|
| Supply Voltage Range        | $V_{CC}$  | $-0.5 \sim 6$            | V    |
| DC Input Voltage            | $V_{IN}$  | $-0.5 \sim 6$            | V    |
| DC Output Voltage           | $V_{OUT}$ | $-0.5 \sim V_{CC} + 0.5$ | V    |
| Input Diode Current         | $I_{IK}$  | $\pm 20$                 | mA   |
| Output Diode Current        | $I_{OK}$  | $\pm 20$                 | mA   |
| DC Output Current           | $I_{OUT}$ | $\pm 50$                 | mA   |
| DC $V_{CC}$ /Ground Current | $I_{CC}$  | $\pm 50$                 | mA   |
| Power Dissipation           | $P_D$     | 150                      | mW   |
| Storage Temperature         | $T_{stg}$ | $-65 \sim 150$           | °C   |
| Lead Temperature (10 s)     | $T_L$     | 260                      | °C   |

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## DC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC            | SYMBOL          | TEST CONDITION                           |                           | V <sub>CC</sub><br>(V) | Ta = 25°C                 |      |                           | Ta = -40~85°C             |                           | UNIT |
|---------------------------|-----------------|------------------------------------------|---------------------------|------------------------|---------------------------|------|---------------------------|---------------------------|---------------------------|------|
|                           |                 |                                          |                           |                        | MIN.                      | TYP. | MAX.                      | MIN.                      | MAX.                      |      |
| High-Level Input Voltage  | V <sub>IH</sub> |                                          |                           | 1.8                    | 0.75<br>× V <sub>CC</sub> | —    | —                         | 0.75<br>× V <sub>CC</sub> | —                         | V    |
|                           |                 |                                          |                           | 2.3 –<br>5.5           | 0.7 ×<br>V <sub>CC</sub>  | —    | —                         | 0.7 ×<br>V <sub>CC</sub>  | —                         |      |
| Low-Level Input Voltage   | V <sub>IL</sub> |                                          |                           | 1.8                    | —                         | —    | 0.25<br>× V <sub>CC</sub> | —                         | 0.25<br>× V <sub>CC</sub> | V    |
|                           |                 |                                          |                           | 2.3 –<br>5.5           | —                         | —    | 0.3 ×<br>V <sub>CC</sub>  | —                         | 0.3 ×<br>V <sub>CC</sub>  |      |
| High-Level Output Voltage | V <sub>OH</sub> | V <sub>IN</sub> = V <sub>IL</sub>        | I <sub>OH</sub> = -100 μA | 1.8                    | 1.7                       | 1.8  | —                         | 1.7                       | —                         | 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 <sub>OH</sub> = -8 mA   | 2.3                    | 1.9                       | 2.15 | —                         | 1.9                       | —                         |      |
|                           |                 |                                          | I <sub>OH</sub> = -16 mA  | 3.0                    | 2.4                       | 2.8  | —                         | 2.4                       | —                         |      |
|                           |                 |                                          | I <sub>OH</sub> = -24 mA  | 3.0                    | 2.3                       | 2.68 | —                         | 2.3                       | —                         |      |
|                           |                 |                                          | I <sub>OH</sub> = -32 mA  | 4.5                    | 3.8                       | 4.2  | —                         | 3.8                       | —                         |      |
| Low-Level Output Voltage  | V <sub>OL</sub> | V <sub>IN</sub> = V <sub>IH</sub>        | I <sub>OL</sub> = 100 μA  | 1.8                    | —                         | 0    | 0.1                       | —                         | 0.1                       | V    |
|                           |                 |                                          |                           | 2.3                    | —                         | 0    | 0.1                       | —                         | 0.1                       |      |
|                           |                 |                                          |                           | 3.0                    | —                         | 0    | 0.1                       | —                         | 0.1                       |      |
|                           |                 |                                          |                           | 4.5                    | —                         | 0    | 0.1                       | —                         | 0.1                       |      |
|                           |                 |                                          | I <sub>OL</sub> = 8 mA    | 2.3                    | —                         | 0.1  | 0.3                       | —                         | 0.3                       |      |
|                           |                 |                                          | I <sub>OL</sub> = 16 mA   | 3.0                    | —                         | 0.15 | 0.4                       | —                         | 0.4                       |      |
|                           |                 |                                          | I <sub>OL</sub> = 24 mA   | 3.0                    | —                         | 0.22 | 0.55                      | —                         | 0.55                      |      |
|                           |                 |                                          | I <sub>OL</sub> = 32 mA   | 4.5                    | —                         | 0.22 | 0.55                      | —                         | 0.55                      |      |
| Input Leakage Current     | I <sub>IN</sub> | V <sub>IN</sub> = 5.5 V or GND           |                           | 0 –<br>5.5             | —                         | —    | ± 1                       | —                         | ± 10                      | μA   |
| Quiescent Supply Current  | I <sub>CC</sub> | V <sub>IN</sub> = V <sub>CC</sub> or GND |                           | 5.5                    | —                         | —    | 2                         | —                         | 20                        | μA   |

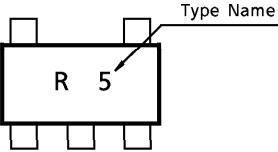
AC ELECTRICAL CHARACTERISTICS (Input  $t_r = t_f = 3\text{ ns}$ )

| CHARACTERISTIC                | SYMBOL                 | TEST CONDITION                                      | $V_{CC}$ (V)  | $T_a = 25^{\circ}\text{C}$ |      |      | $T_a = -40\sim 85^{\circ}\text{C}$ |      | UNIT |
|-------------------------------|------------------------|-----------------------------------------------------|---------------|----------------------------|------|------|------------------------------------|------|------|
|                               |                        |                                                     |               | MIN.                       | TYP. | MAX. | MIN.                               | MAX. |      |
| Propagation Delay Time        | $t_{PLH}$<br>$t_{PHL}$ | $C_L = 15\text{ pF}$ ,<br>$R_L = 1\text{ M}\Omega$  | 1.8           | 2.0                        | 4.4  | 9.5  | 2.0                                | 10.0 | ns   |
|                               |                        |                                                     | $2.5 \pm 0.2$ | 0.8                        | 2.9  | 6.5  | 0.8                                | 7.0  |      |
|                               |                        |                                                     | $3.3 \pm 0.3$ | 0.5                        | 2.1  | 4.5  | 0.5                                | 4.7  |      |
|                               |                        |                                                     | $5.0 \pm 0.5$ | 0.5                        | 1.8  | 3.9  | 0.5                                | 4.1  |      |
|                               |                        | $C_L = 50\text{ pF}$ ,<br>$R_L = 500\text{ }\Omega$ | $3.3 \pm 0.3$ | 1.5                        | 2.9  | 5.0  | 1.5                                | 5.2  |      |
|                               |                        |                                                     | $5.0 \pm 0.5$ | 0.8                        | 2.4  | 4.3  | 0.8                                | 4.5  |      |
| Input Capacitance             | $C_{IN}$               |                                                     | 0 – 5.5       | —                          | 4    | —    | —                                  | —    | pF   |
| Power Dissipation Capacitance | $C_{PD}$               | (Note 1)                                            | 3.3           | —                          | 21   | —    | —                                  | —    | pF   |
|                               |                        |                                                     | 5.5           | —                          | 34   | —    | —                                  | —    |      |

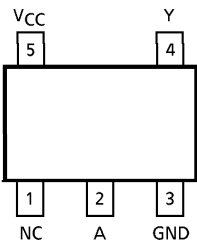
(Note 1) :  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.  
Average operating current can be obtained by the equation.

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

MARKING



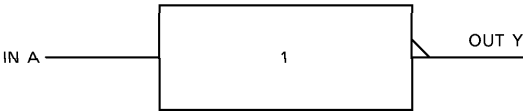
PIN ASSIGNMENT (TOP VIEW)



TRUTH TABLE

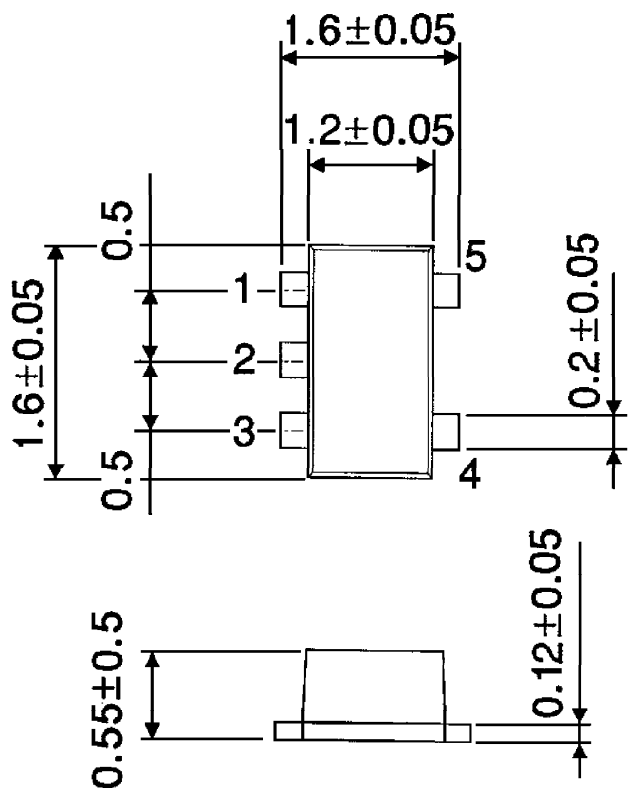
| A | Y |
|---|---|
| L | H |
| H | L |

LOGIC DIAGRAM



PACKAGE DIMENSIONS  
SON5-P-0.50

Unit : mm



Weight : 0.003 g (Typ.)