

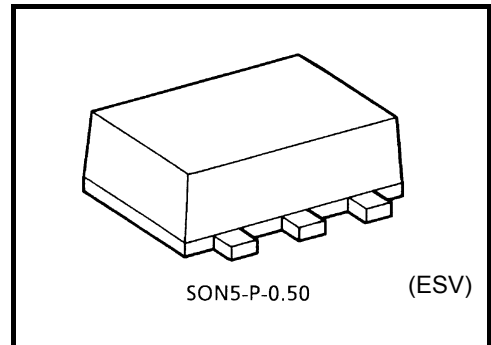
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZU04FE

Inverter (Unbuffered)

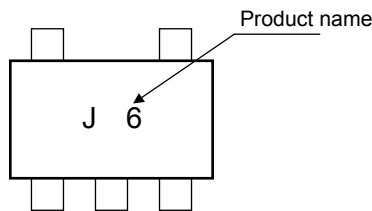
Features

- High output current: ± 32 mA (min) at $V_{CC} = 4.5$ V
- Low quiescent power: $I_{CC} < 1\mu\text{A}$ (max)
at $V_{CC} = 5.5$ V, $T_a = 25^\circ\text{C}$
- Operation voltage range: $V_{CC}(\text{opr}) = 1.65$ to 5.5 V
- 5.5-V tolerant input



Weight : 0.003 g (typ.)

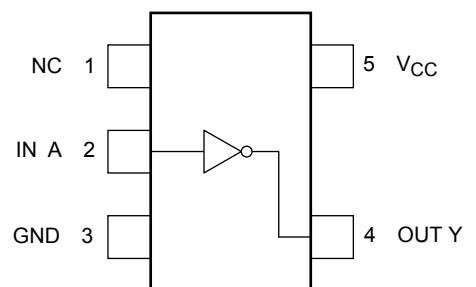
Marking



Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|------------------------|------------------|
| Supply voltage | V_{CC} | -0.5 to 6 | V |
| DC input voltage | V_{IN} | -0.5 to 6 | V |
| DC output voltage | V_{OUT} | -0.5 to $V_{CC} + 0.5$ | V |
| Input diode current | I_{IK} | -20 | mA |
| Output diode current | I_{OK} | ± 20 (Note 1) | mA |
| DC output current | I_{OUT} | ± 50 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 50 | mA |
| Power dissipation | P_D | 150 | mW |
| Storage temperature | T_{stg} | -65 to 150 | $^\circ\text{C}$ |

Pin Assignment (top view)

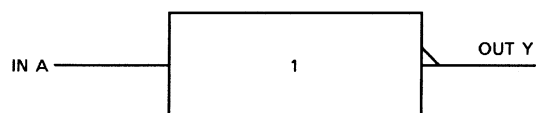


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

IEC Logic Symbol



Truth Table

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

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|-----------------------|-----------|---------------------|------|
| Supply voltage | V_{CC} | 1.65 to 5.5 | V |
| | | 1.5 to 5.5 (Note 2) | |
| Input voltage | V_{IN} | 0 to 5.5 | V |
| Output voltage | V_{OUT} | 0 to V_{CC} | V |
| Operating temperature | T_{opr} | -40 to 85 | °C |

Note 2: Data retention only

Electrical Characteristics

DC Characteristics

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---------------------------|--------------------------|--|---------------------------|---------------------|----------------------|------|----------------------|----------------------|----------------------|-----|
| | | | | V _{CC} (V) | Min | Typ. | Max | Min | | Max |
| High-level input voltage | V _{IH} | — | | 1.65 to 1.95 | $V_{CC} \times 0.85$ | — | — | $V_{CC} \times 0.85$ | — | V |
| | | | | 2.3 to 5.5 | $V_{CC} \times 0.8$ | — | — | $V_{CC} \times 0.8$ | — | |
| Low-level input voltage | V _{IL} | — | | 1.65 to 1.95 | — | — | $V_{CC} \times 0.15$ | — | $V_{CC} \times 0.15$ | V |
| | | | | 2.3 to 5.5 | — | — | $V_{CC} \times 0.2$ | — | $V_{CC} \times 0.2$ | |
| High-level output voltage | V _{OH} | V _{IN} = V _{IL} | I _{OH} = -100 μA | 1.65 | 1.45 | 1.64 | — | 1.45 | — | V |
| | | | | 2.3 | 2.1 | 2.3 | — | 2.1 | — | |
| | | | | 3.0 | 2.7 | 3.0 | — | 2.7 | — | |
| | | | | 4.5 | 4.0 | 4.4 | — | 4.0 | — | |
| | V _{IN} = GND | I _{OH} = -4 mA | 1.65 | 1.29 | 1.52 | — | 1.29 | — | | |
| | | | I _{OH} = -8 mA | 2.3 | 1.9 | 2.14 | — | 1.9 | — | |
| | | | I _{OH} = -12 mA | 3.0 | 2.4 | 2.75 | — | 2.4 | — | |
| | | | I _{OH} = -16 mA | 3.0 | 2.3 | 2.61 | — | 2.3 | — | |
| V _{IN} = GND | I _{OH} = -32 mA | 4.5 | 3.8 | 4.13 | — | 3.8 | — | | | |
| | | V _{IN} = V _{IH} | I _{OL} = 100 μA | 1.65 | — | 0 | 0.2 | — | 0.2 | |
| | | | | 2.3 | — | 0 | 0.2 | — | 0.2 | |
| | | | | 3.0 | — | 0 | 0.3 | — | 0.3 | |
| | | | | 4.5 | — | 0 | 0.5 | — | 0.5 | |
| | | V _{IN} = V _{CC} | I _{OL} = 4 mA | 1.65 | — | 0.08 | 0.24 | — | 0.24 | |
| I _{OL} = 8 mA | 2.3 | | | — | 0.1 | 0.3 | — | 0.3 | | |
| I _{OL} = 12 mA | 3.0 | | | — | 0.17 | 0.4 | — | 0.4 | | |
| I _{OL} = 16 mA | 3.0 | | | — | 0.25 | 0.55 | — | 0.55 | | |
| I _{OH} = 32 mA | 4.5 | | | — | 0.26 | 0.55 | — | 0.55 | | |
| Input leakage current | I _{IN} | V _{IN} = 5.5 V or GND | | 0 to 5.5 | — | — | ±1 | — | ±10 | μA |
| Quiescent supply current | I _{CC} | V _{IN} = V _{CC} or GND | | 5.5 | — | — | 1 | — | 10 | μA |

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3 \text{ ns}$)

| Characteristics | Symbol | Test Condition | V _{CC} (V) | Ta = 25°C | | | Ta = -40 to 85°C | | Unit |
|-------------------------------|---|--|---------------------|-----------|------|-----|------------------|-----|------|
| | | | | Min | Typ. | Max | Min | Max | |
| Propagation delay time | t _{PLH} | C _L = 15 pF, R _L = 1 MΩ | 1.8 ± 0.15 | 1.0 | — | 8.5 | 1.0 | 9.0 | ns |
| | | | 2.5 ± 0.2 | 0.8 | — | 6.2 | 0.8 | 6.5 | |
| | t _{PHL} | | 3.3 ± 0.3 | 0.5 | — | 4.5 | 0.5 | 4.8 | |
| | 5.0 ± 0.5 | | 0.5 | — | 3.9 | 0.5 | 4.1 | | |
| | C _L = 50 pF, R _L = 500 Ω | | 3.3 ± 0.3 | 1.0 | — | 6.0 | 1.0 | 6.5 | |
| | | | 5.0 ± 0.5 | 0.8 | — | 5.0 | 0.8 | 5.5 | |
| Input capacitance | C _{IN} | — | 0 to 5.5 | — | 5 | — | — | pF | |
| Power dissipation capacitance | C _{PD} | (Note 3) | 3.3 | — | 10 | — | — | — | pF |
| | | | 5.5 | — | 25 | — | — | — | |

Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

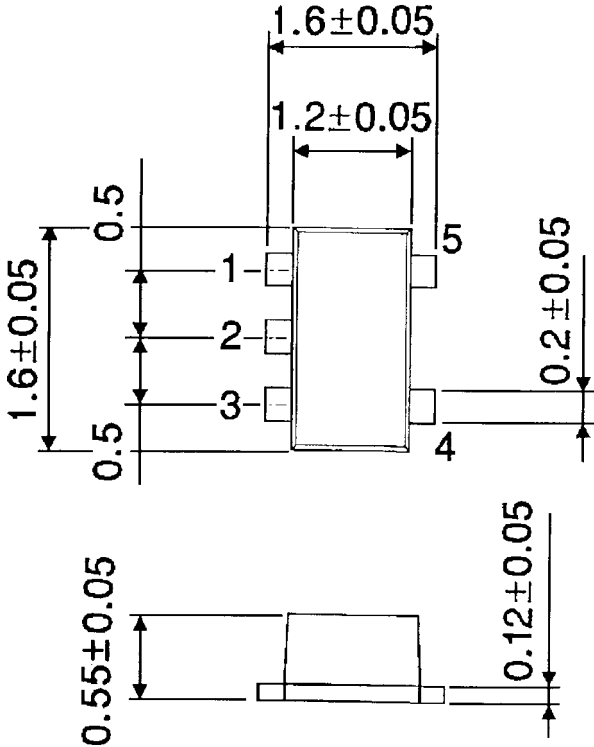
Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50

Unit : mm



Weight: 0.003 g (typ.)

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