

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

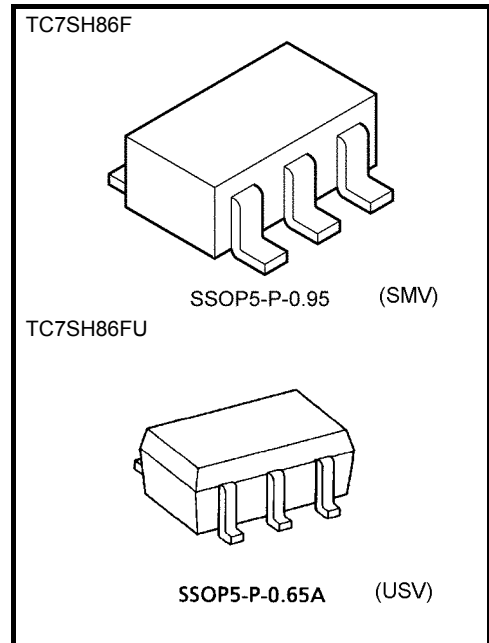
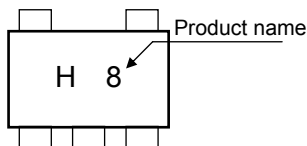
TC7SH86F, TC7SH86FU

2-Input EXCLUSIVE OR Gate

Features

- High speed operation : $t_{pd} = 4.8 \text{ ns (typ.)}$ at $V_{CC} = 5V, 15pF$
- Low power dissipation : $I_{CC} = 2\mu A \text{ (max)}$ at $T_a = 25^\circ C$
- High noise immunity : $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- 5.5-V tolerant inputs.
- Balanced Propagation Delay : $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} = 2 \text{ to } 5.5 \text{ V}$

Marking



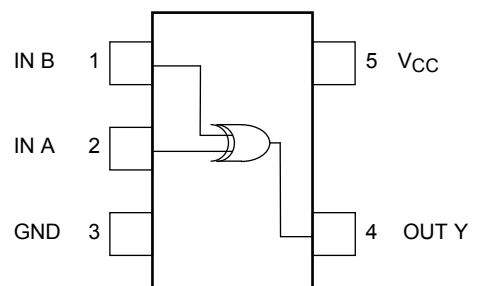
Weight

- SSOP5-P-0.95 : 0.016 g (typ.)
- SSOP5-P-0.65A : 0.006 g (typ.)

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

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|-------------------------|------------|
| Supply voltage | V_{CC} | - 0.5 to 7 | V |
| DC input voltage | V_{IN} | - 0.5 to 7 | 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} | ± 25 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 50 | mA |
| Power dissipation | P_D | 200 | mW |
| Storage temperature | T_{stg} | - 65 to 150 | $^\circ C$ |
| Lead temperature (10s) | T_L | 260 | $^\circ C$ |

Pin Assignment (top view)

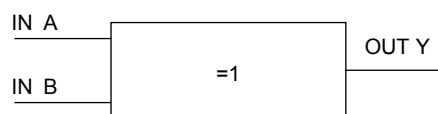


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 | B | Y |
|---|---|---|
| L | L | L |
| L | H | H |
| H | L | H |
| H | H | L |

Operating Ranges

| Characteristics | Symbol | Rating | Unit |
|--------------------------|-----------|---|------|
| Supply voltage | V_{CC} | 2 to 5.5 | V |
| 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 |
| Input rise and fall time | dt/dv | 0 to 100 ($V_{CC} = 3.3 V \pm 0.3 V$) | ns/V |
| | | 0 to 20 ($V_{CC} = 5.0 V \pm 0.5 V$) | |

Electrical Characteristics

DC Characteristics

| Characteristics | Symbol | Test Condition | V _{CC} (V) | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | |
|---------------------------|-----------------|---|--------------------------|-----------------------|------|-----------------------|-----------------------|-----------------------|------|---|
| | | | | Min | Typ. | Max | Min | Max | | |
| High-level input voltage | V _{IH} | — | 2.0 | 1.5 | — | — | 1.5 | — | V | |
| | | | 3.0 to 5.5 | V _{CC} × 0.7 | — | — | V _{CC} × 0.7 | — | | |
| Low-level input voltage | V _{IL} | — | 2.0 | — | — | 0.5 | — | 0.5 | V | |
| | | | 3.0 to 5.5 | — | — | V _{CC} × 0.3 | — | V _{CC} × 0.3 | | |
| High-level output voltage | V _{OH} | V _{IN} = V _{IH} or V _{IL} | I _{OH} = -50 μA | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V |
| | | | | 3.0 | 2.9 | 3.0 | — | 2.9 | — | |
| | | | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | |
| | | | I _{OH} = -4 mA | 3.0 | 2.58 | — | — | 2.48 | — | |
| 4.5 | 3.94 | — | | — | 3.80 | — | | | | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 50 μA | 2.0 | — | 0 | 0.1 | — | 0.1 | V |
| | | | | 3.0 | — | 0 | 0.1 | — | 0.1 | |
| | | | | 4.5 | — | 0 | 0.1 | — | 0.1 | |
| | | | I _{OL} = 4 mA | 3.0 | — | — | 0.36 | — | 0.44 | |
| | | | | 4.5 | — | — | 0.36 | — | 0.44 | |
| Input leakage current | I _{IN} | V _{IN} = 5.5 V or GND | 0 to 5.5 | — | — | ±0.1 | — | ±1.0 | μA | |
| Quiescent supply current | I _{CC} | V _{IN} = V _{CC} or GND | 5.5 | — | — | 2.0 | — | 20.0 | μA | |

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

| Characteristics | Symbol | Test Condition | | Ta = 25°C | | | Ta = -40 to 85°C | | Unit |
|-------------------------------|------------------|---------------------|---------------------|-----------|------|------|------------------|------|------|
| | | V _{CC} (V) | C _L (pF) | Min | Typ. | Max | Min | Max | |
| Propagation delay time | t _{pLH} | 3.3 ± 0.3 | 15 | — | 7.0 | 11.0 | 1.0 | 13.0 | ns |
| | | | 50 | — | 9.5 | 14.5 | 1.0 | 16.5 | |
| | t _{pHL} | 5.0 ± 0.5 | 15 | — | 4.8 | 6.8 | 1.0 | 8.0 | |
| | | | 50 | — | 6.3 | 8.8 | 1.0 | 10.0 | |
| Input capacitance | C _{IN} | | | — | 4 | 10 | — | 10 | pF |
| Power dissipation capacitance | C _{PD} | (Note 2) | | — | 18 | — | — | — | pF |

Note 2: 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.

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

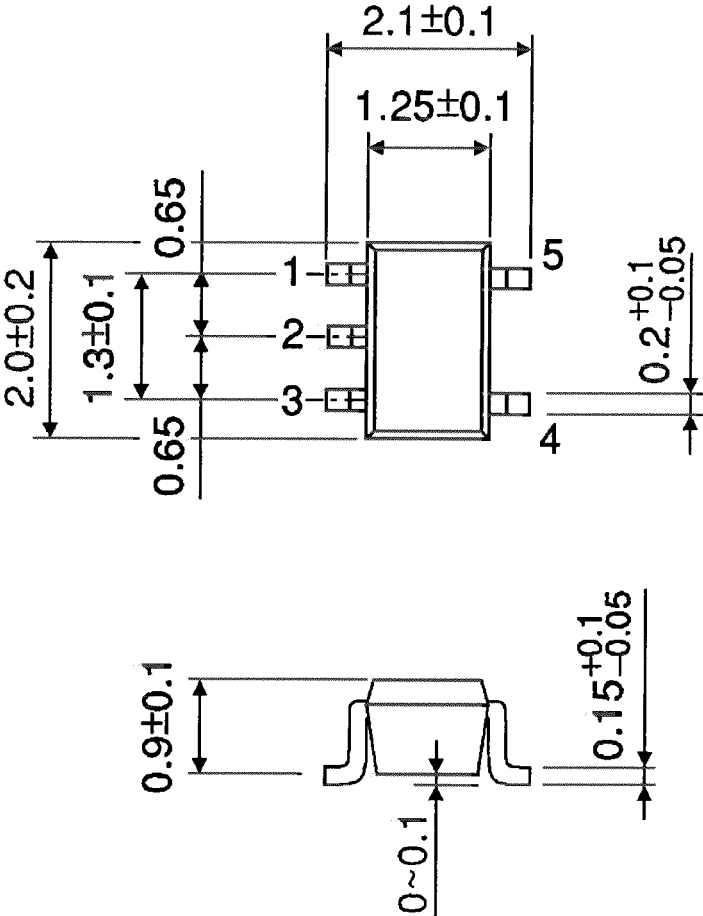


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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