

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC02FN

Quad 2-Input NOR Gate

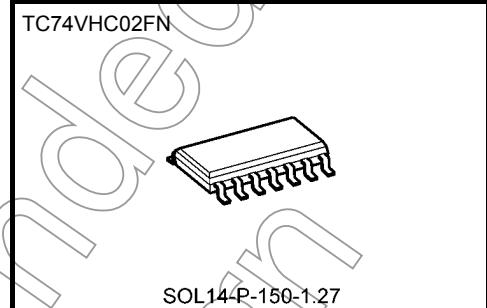
The TC74VHC02 is an advanced high speed CMOS 2-INPUT NOR GATE fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

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

An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Note: xxxFN (JEDEC SOP) is not available in Japan.



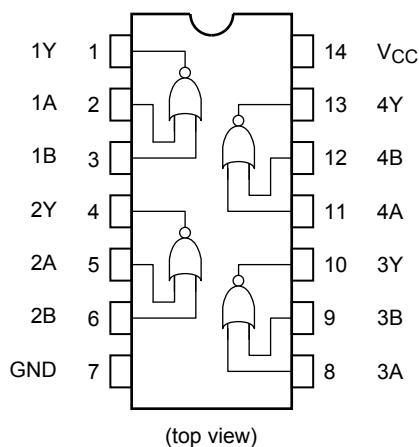
SOL14-P-150-1.27

Weight
SOL14-P-150-1.27 : 0.12 g (typ.)

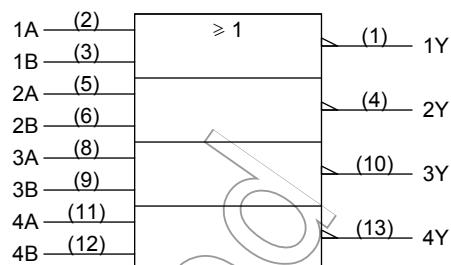
Features

- High speed: $t_{pd} = 3.6$ ns (typ.) at $V_{CC} = 5$ V
- Low power dissipation: $I_{CC} = 2$ μ A (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\%$ V_{CC} (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 V to 5.5 V
- Low noise: $VO_{LP} = 0.8$ V (max)
- Pin and function compatible with 74ALS02

Pin Assignment



IEC Logic Symbol



Truth Table

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

Absolute Maximum Ratings (Note)

| Characteristics | Symbol | Rating | Unit |
|-----------------------------|-----------|------------------------|------|
| Supply voltage range | V_{CC} | -0.5 to 7.0 | V |
| DC input voltage | V_{IN} | -0.5 to 7.0 | 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 | mA |
| DC output current | I_{OUT} | ± 25 | mA |
| DC V_{CC} /ground current | I_{CC} | ± 50 | mA |
| Power dissipation | P_D | 180 | mW |
| Storage temperature | T_{STG} | -65 to 150 | °C |

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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.).

Operating Ranges (Note)

| Characteristics | Symbol | Rating | Unit |
|--------------------------|------------------|---|------|
| Supply voltage | V _{CC} | 2.0 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 ± 0.3 V) 0 to 20 (V _{CC} = 5 ± 0.5 V) | ns/V |

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

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} | — | 2.0 3.0 to 5.5 | 1.50 V _{CC} × 0.7 | — — | — — | 1.50 V _{CC} × 0.7 | — — | V |
| Low-level input voltage | V _{IL} | — | 2.0 3.0 to 5.5 | — — | — — | 0.50 V _{CC} × 0.3 | — — | 0.50 V _{CC} × 0.3 | V |
| High-level output voltage | V _{OH} | V _{IN} = V _{IL} I _{OH} = -50 µA | 2.0 3.0 4.5 | 1.9 2.9 4.4 | 2.0 3.0 4.5 | — — — | 1.9 2.9 4.4 | — — — | V |
| | | I _{OH} = -4 mA I _{OH} = -8 mA | 3.0 4.5 | 2.58 3.94 | — — | — — | 2.48 3.80 | — — | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 µA | 2.0 3.0 4.5 | — — — | 0.0 0.0 0.0 | 0.1 0.1 0.1 | — — — | 0.1 0.1 0.1 | V |
| | | I _{OL} = 4 mA I _{OL} = 8 mA | 3.0 4.5 | — — | — — | 0.36 0.36 | — — | 0.44 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 (input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | | | $T_a = 25^\circ\text{C}$ | | | $T_a = -40$ 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 | — | 5.6 | 7.9 | 1.0 | 9.5 | ns | |
| | | | | 50 | — | 8.1 | 11.4 | 1.0 | 13.0 | | |
| | t_{PHL} | — | 5.0 ± 0.5 | 15 | — | 3.6 | 5.5 | 1.0 | 6.5 | | |
| | | | | 50 | — | 5.1 | 7.5 | 1.0 | 8.5 | | |
| Input capacitance | C_{IN} | — | | | — | 4 | 10 | — | 10 | pF | |
| Power dissipation capacitance | C_{PD} | (Note) | | | — | 15 | — | — | — | pF | |

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

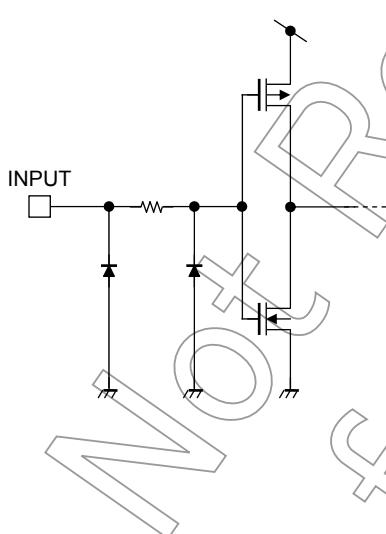
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

Noise Characteristics (input: $t_r = t_f = 3$ ns)

| Characteristics | Symbol | Test Condition | | | $T_a = 25^\circ\text{C}$ | | Unit |
|--|-----------|----------------|--------------|------|--------------------------|---|------|
| | | | V_{CC} (V) | Typ. | Limit | | |
| Quiet output maximum dynamic V_{OL} | V_{OLP} | $C_L = 50$ pF | 5.0 | 0.3 | 0.8 | V | |
| Quiet output minimum dynamic V_{OL} | V_{OLV} | $C_L = 50$ pF | 5.0 | -0.3 | -0.8 | V | |
| Minimum high level dynamic input voltage | V_{IHD} | $C_L = 50$ pF | 5.0 | — | 3.5 | V | |
| Maximum low level dynamic input voltage | V_{ILD} | $C_L = 50$ pF | 5.0 | — | 1.5 | V | |

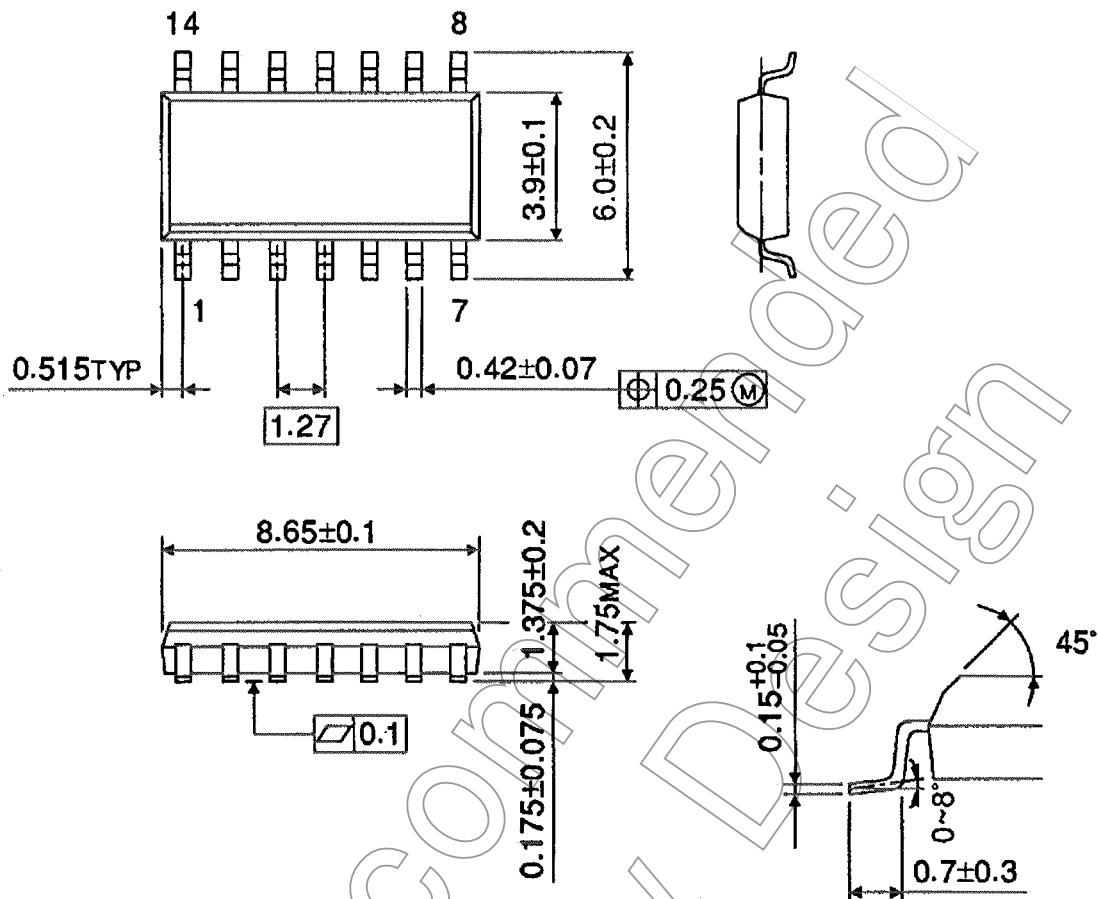
Input Equivalent Circuit



Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

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