



Is Now Part of



**ON Semiconductor®**

To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



March 2015

# MM74HC02

## Quad 2-Input NOR Gate

### Features

- Typical Propagation Delay: 8 ns
- Wide Power Supply Range: 2 V to 6 V
- Low Quiescent Supply Current: 20  $\mu$ A Maximum (74HC Series)
- Moisture Level Sensitivity 1
- Low Input Current: 1  $\mu$ A Maximum
- High Output Current: 4 mA Minimum

### General Description

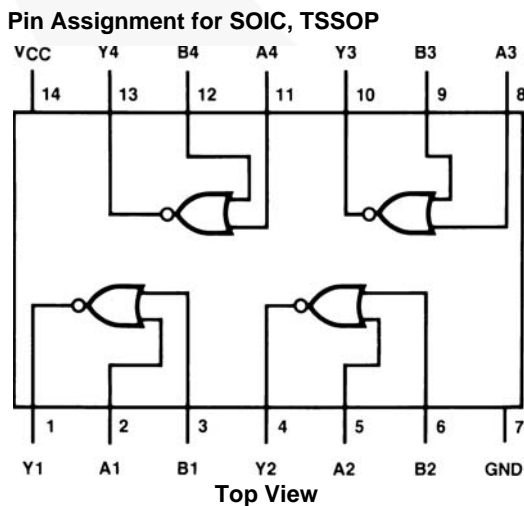
The MM74HC02 NOR gates utilize advanced silicon-gate CMOS technology to achieve operating speeds similar to LS-TTL gates with the low power consumption of standard CMOS integrated circuits. All gates have buffered outputs, providing high noise immunity and the ability to drive 10 LS-TTL loads. The 74HC logic family is functionally as well as pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

### Ordering Information

| Part Number  | Top Mark  | Package   | Packing Method |
|--------------|-----------|-----------|----------------|
| MM74HC02M    | MM74HC02M | SOIC 14L  | Rail           |
| MM74HC02MX   | MM74HC02M | SOIC 14L  | Tape and Reel  |
| MM74HC02MTC  | HC02      | TSSOP 14L | Rail           |
| MM74HC02MTCX | HC02      | TSSOP 14L | Tape and Reel  |

All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram



### Logic Diagram



## Absolute Maximum Ratings<sup>(1)</sup>

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol           | Parameter                               | Value                | Unit |
|------------------|---|----------------------|------|
| $V_{CC}$         | Supply Voltage                          | -0.5 to +7.0         | V    |
| $V_{IN}$         | DC Input Voltage                        | -1.5 to $V_{CC}+1.5$ | V    |
| $V_{OUT}$        | DC Output Voltage                       | -0.5 to $V_{CC}+0.5$ | V    |
| $I_{IK}, I_{OK}$ | Clamp Diode Current                     | $\pm 20$             | mA   |
| $I_{OUT}$        | DC Output Current, per pin              | $\pm 25$             | mA   |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per pin     | $\pm 50$             | mA   |
| $T_{STG}$        | Storage Temperature Range               | -65 to +150          | °C   |
| $P_D$            | Power Dissipation                       | <sup>(2)</sup>       | 600  |
|                  |   | S.O. Package only    | 500  |
| $T_L$            | Lead Temperature (Soldering 10 seconds) | 260                  | °C   |

### Notes:

1. Unless otherwise specified all voltages are referenced to ground.
2. Power dissipation temperature derating - plastic "N" package: -12 mW/°C from 65°C to 85°C.

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

| Symbol            | Parameter                   | Min.                    | Max.     | Unit |
|-------------------|-----------------------------|-------------------------|----------|------|
| $V_{CC}$          | Supply Voltage              | 2                       | 6        | V    |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage  | 0                       | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature Range | -40                     | 85       | °C   |
| $t_r, t_f$        | Input Rise or Fall Times    | $V_{CC} = 2.0\text{ V}$ | 1000     | ns   |
|                   |                             | $V_{CC} = 4.5\text{ V}$ | 500      |      |
|                   |                             | $V_{CC} = 6.0\text{ V}$ | 400      |      |

DC Electrical Characteristics<sup>(3)</sup>

| Symbol          | Parameter                         | V <sub>CC</sub> (V) | Conditions   | T <sub>A</sub> = 25°C |                   | T <sub>A</sub> = -40<br>to 85°C | T <sub>A</sub> = -55<br>to 125°C | Unit |
|-----------------|-----------------------------------|---------------------|--|-----------------------|-------------------|---------------------------------|----------------------------------|------|
|                 |                                   |                     |  | Typ.                  | Guaranteed Limits |                                 |                                  |      |
| V <sub>IH</sub> | Minimum HIGH Level Input Voltage  | 2.0                 |  |                       | 1.50              | 1.50                            | 1.50                             | V    |
|                 |                                   | 4.5                 |  |                       | 3.15              | 3.15                            | 3.15                             |      |
|                 |                                   | 6.0                 |  |                       | 4.20              | 4.20                            | 4.20                             |      |
| V <sub>IL</sub> | Maximum LOW Level Input Voltage   | 2.0                 |  |                       | 0.50              | 0.50                            | 0.50                             | V    |
|                 |                                   | 4.5                 |  |                       | 1.35              | 1.35                            | 1.35                             |      |
|                 |                                   | 6.0                 |  |                       | 1.80              | 1.80                            | 1.80                             |      |
| V <sub>OH</sub> | Minimum HIGH Level Output Voltage | 2.0                 | V <sub>IN</sub> = V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 20 μA                     | 2.0                   | 1.9               | 1.9                             | 1.9                              | V    |
|                 |                                   | 4.5                 |  | 4.5                   | 4.4               | 4.4                             | 4.4                              |      |
|                 |                                   | 6.0                 |  | 6.0                   | 5.9               | 5.9                             | 5.9                              |      |
|                 |                                   | 4.5                 | V <sub>IN</sub> = V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0 mA                    | 4.20                  | 3.98              | 3.84                            | 3.70                             |      |
|                 |                                   | 6.0                 | V <sub>IN</sub> = V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 5.2 mA                    | 5.70                  | 5.48              | 5.34                            | 5.20                             |      |
| V <sub>OL</sub> | Minimum LOW Level Output Voltage  | 2.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 20 μA  | 0                     | 0.1               | 0.1                             | 0.1                              | V    |
|                 |                                   | 4.5                 |  | 0                     | 0.1               | 0.1                             | 0.1                              |      |
|                 |                                   | 6.0                 |  | 0                     | 0.1               | 0.1                             | 0.1                              |      |
|                 |                                   | 4.5                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 4.0 mA | 0.20                  | 0.26              | 0.33                            | 0.40                             |      |
|                 |                                   | 6.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> ,<br> I <sub>OUT</sub>   ≤ 5.2 mA | 0.20                  | 0.26              | 0.33                            | 0.40                             |      |
| I <sub>IN</sub> | Maximum Input Current             | 6.0                 | V <sub>IN</sub> = V <sub>CC</sub> or GND   |                       | ±0.1              | ±0.1                            | ±0.1                             | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current  | 6.0                 | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA                    |                       | 2.0               | 20                              | 40                               | μA   |

**Note:**

3. For a power supply of 5 V ±10% the worst case output voltages (V<sub>OH</sub>, and V<sub>OL</sub>) occur for HC at 4.5 V. Thus the 4.5V values should be used when designing with this supply. Worst case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5 V and 4.5 V respectively. (The V<sub>IH</sub> value at 5.5 V is 3.85 V.) The worst case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occur for CMOS at the higher voltage and so the 6.0 V values should be used.

**AC Electrical Characteristics** $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ ,  $C_L = 15\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$ 

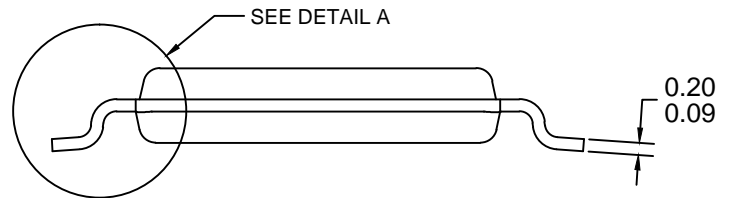
| Symbol                | Parameter                 | Conditions | Typ. | Guaranteed Limit | Unit |
|-----------------------|---------------------------|------------|------|------------------|------|
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay |            | 8    | 15               | ns   |

**AC Electrical Characteristics** $V_{CC} = 2.0\text{ V to }6.0\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $t_r = t_f = 6\text{ ns}$  (unless otherwise specified)

| Symbol                | Parameter                                    | $V_{CC}$ (V) | Conditions | $T_A = 25^\circ\text{C}$ |                   | $T_A = -40$ | $T_A = -55$           | Unit |
|-----------------------|--|--------------|------------|--------------------------|-------------------|-------------|-----------------------|------|
|                       |  |              |            | Typ.                     | Guaranteed Limits |             | to $85^\circ\text{C}$ |      |
| $t_{PHL}$ , $t_{PLH}$ | Maximum Propagation Delay                    | 2.0          |            | 45                       | 90                | 113         | 134                   | ns   |
|                       |  | 4.5          |            | 9                        | 18                | 23          | 27                    |      |
|                       |  | 6.0          |            | 8                        | 15                | 19          | 23                    |      |
| $t_{TLH}$ , $t_{THL}$ | Maximum Output Rise and Fall Time            | 2.0          |            | 30                       | 75                | 95          | 110                   | ns   |
|                       |  | 4.5          |            | 8                        | 15                | 19          | 22                    |      |
|                       |  | 6.0          |            | 7                        | 13                | 16          | 19                    |      |
| $C_{PD}$              | Power Dissipation Capacitance <sup>(4)</sup> |              | (per gate) | 20                       |                   |             |                       | pF   |
| $C_{IN}$              | Maximum Input Capacitance                    |              |            | 5                        | 10                | 10          | 10                    | pF   |

**Note:**

4.  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .



**NOTES:**

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 2009.
- E. LANDPATTERN STANDARD: SOP65P640X110-14M.
- F. DRAWING FILE NAME: MKT-MTC14rev7.





NOTES:

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009
- D. DRAWING FILENAME: MKT-M14Arev14



ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local  
Sales Representative