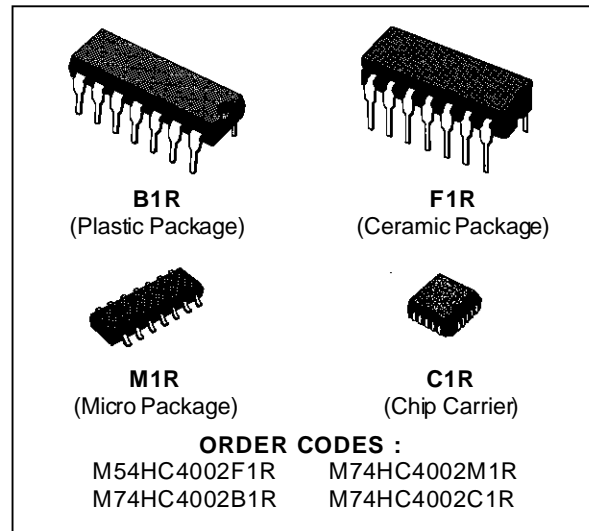


DUAL 4 INPUT NOR GATE

- HIGH SPEED
 $t_{PD} = 10 \text{ ns (TYP.) AT } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION
 $I_{CC} = 1 \mu\text{A (MAX.) AT } T_A = 25^\circ \text{ C}$
- HIGH NOISE IMMUNITY
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY
10 LSTTL LOADS
- SYMMETRICAL OUTPUT IMPEDANCE
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.)}$
- BALANCED PROPAGATION DELAYS
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
 $V_{CC} \text{ (OPR)} = 2 \text{ V TO } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE WITH 4002B



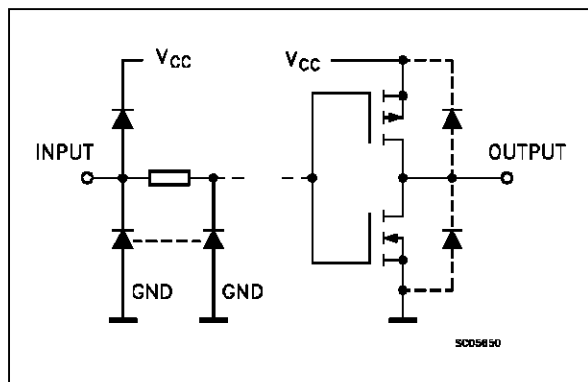
DESCRIPTION

The M54/74HC4002 is a high speed CMOS DUAL 4-INPUT NOR GATE fabricated in silicon gate C²MOS technology.

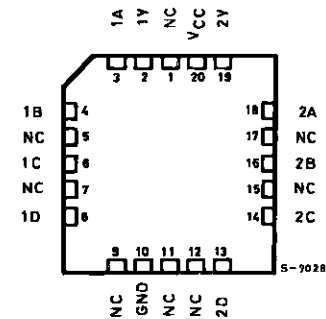
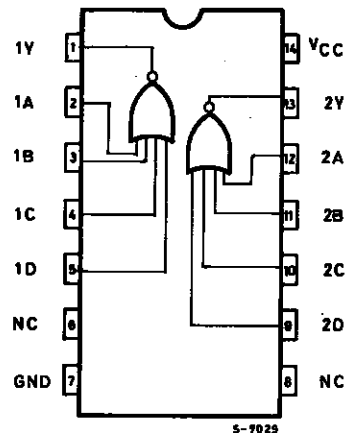
It has the same high speed performance of LSTTL combined with true CMOS low power consumption. The internal circuit is composed of 3 stages including buffer output, which ensures high noise immunity and stable output.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN CONNECTIONS (top view)



NC =
No Internal
Connection

M54/M74HC4002

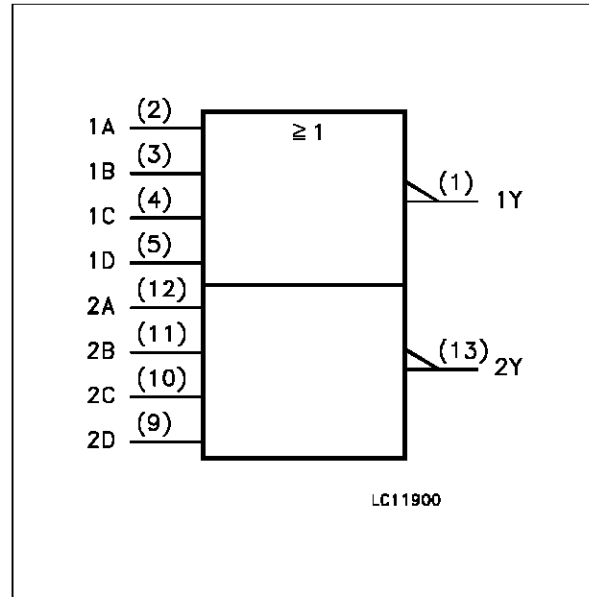
TRUTH TABLE

| nA | nB | nC | nD | nY |
|----|----|----|----|----|
| L | L | L | L | H |
| H | X | X | X | L |
| X | H | X | X | L |
| X | X | H | X | L |
| X | X | X | H | L |

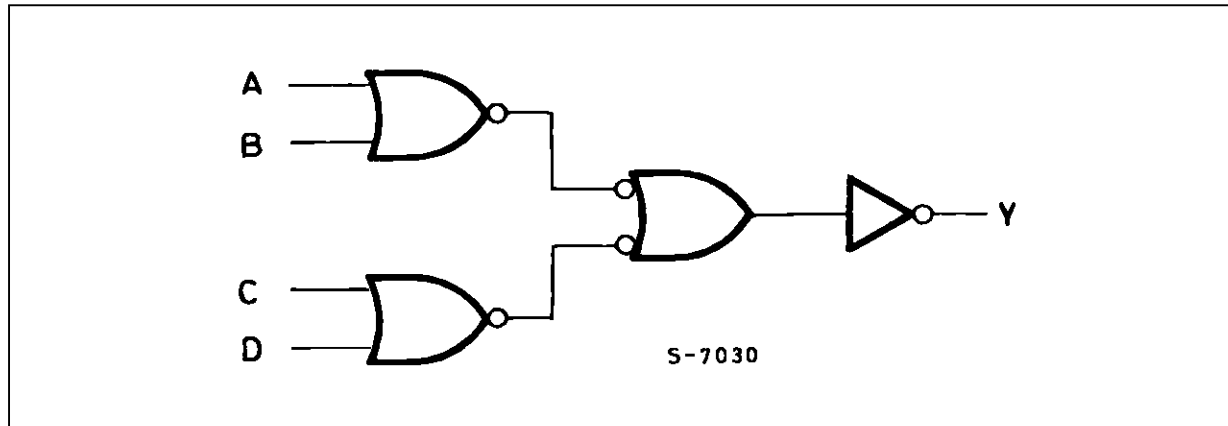
PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|--------|-----------------|-------------------------|
| 1, 13 | 1Y to 2Y | Data Outputs |
| 2, 9 | 1A to 2A | Data Inputs |
| 3, 10 | 1B to 2B | Data Inputs |
| 4, 11 | 1C to 2C | Data Inputs |
| 5, 12 | 1D to 4D | Data Inputs |
| 6, 8 | NC | Not Connected |
| 7 | GND | Ground (0V) |
| 14 | V _{CC} | Positive Supply Voltage |

IEC LOGIC SYMBOL



SCHEMATIC CIRCUIT (Per Gate)



ABSOLUTE MAXIMUM RATING

| Symbol | Parameter | Value | Unit |
|-------------------------------------|--|-------------------------------|------|
| V _{CC} | Supply Voltage | -0.5 to +7 | V |
| V _I | DC Input Voltage | -0.5 to V _{CC} + 0.5 | V |
| V _O | DC Output Voltage | -0.5 to V _{CC} + 0.5 | V |
| I _{IK} | DC Input Diode Current | ± 20 | mA |
| I _{OK} | DC Output Diode Current | ± 20 | mA |
| I _O | DC Output Source Sink Current Per Output Pin | ± 25 | mA |
| I _{CC} or I _{GND} | DC V _{CC} or Ground Current | ± 50 | mA |
| P _D | Power Dissipation | 500 (*) | mW |
| T _{stg} | Storage Temperature | -65 to +150 | °C |
| T _L | Lead Temperature (10 sec) | 300 | °C |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.
 (*) 500 mW: ± 65 °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|------------|---|---------------------------|--|
| V_{CC} | Supply Voltage | 2 to 6 | V |
| V_I | Input Voltage | 0 to V_{CC} | V |
| V_O | Output Voltage | 0 to V_{CC} | V |
| T_{op} | Operating Temperature: M54HC Series M74HC Series | -55 to +125 -40 to +85 | $^{\circ}\text{C}$ $^{\circ}\text{C}$ |
| t_r, t_f | Input Rise and Fall Time | $V_{CC} = 2\text{ V}$ | 0 to 1000 |
| | | $V_{CC} = 4.5\text{ V}$ | 0 to 500 |
| | | $V_{CC} = 6\text{ V}$ | 0 to 400 |

DC SPECIFICATIONS

| Symbol | Parameter | Test Conditions | | Value | | | | | | Unit | | | |
|----------|---------------------------|-----------------|----------------------------------|---|------|------------------------|--|---------|---|---------|---------------|---|------|
| | | | | $T_A = 25\text{ }^{\circ}\text{C}$ 54HC and 74HC | | | $-40\text{ to }85\text{ }^{\circ}\text{C}$ 74HC | | $-55\text{ to }125\text{ }^{\circ}\text{C}$ 54HC | | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | | |
| V_{IH} | High Level Input Voltage | 2.0 | | | 1.5 | | | 1.5 | | 1.5 | | V | |
| | | 4.5 | | | 3.15 | | | 3.15 | | 3.15 | | | |
| | | 6.0 | | | 4.2 | | | 4.2 | | 4.2 | | | |
| V_{IL} | Low Level Input Voltage | 2.0 | | | | | 0.5 | | 0.5 | | 0.5 | V | |
| | | 4.5 | | | | | 1.35 | | 1.35 | | 1.35 | | |
| | | 6.0 | | | | | 1.8 | | 1.8 | | 1.8 | | |
| V_{OH} | High Level Output Voltage | 2.0 | $V_I = V_{IH}$ or V_{IL} | $I_O = -20\text{ }\mu\text{A}$ | 1.9 | 2.0 | | 1.9 | | 1.9 | | V | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | 4.4 | | | |
| | | 6.0 | | | 5.9 | 6.0 | | 5.9 | | 5.9 | | | |
| | | 4.5 | | 4.18 | 4.31 | | 4.13 | | 4.10 | | | | |
| | | 6.0 | | | | $I_O = -5.2\text{ mA}$ | | 5.68 | | 5.8 | | | 5.63 |
| V_{OL} | Low Level Output Voltage | 2.0 | $V_I = V_{IH}$ or V_{IL} | $I_O = 20\text{ }\mu\text{A}$ | | 0.0 | 0.1 | | 0.1 | | 0.1 | V | |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | | |
| | | 6.0 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | | |
| | | 4.5 | | 4.0 | mA | | 0.17 | 0.26 | | 0.33 | | | 0.40 |
| | | 6.0 | | | | $I_O = 5.2\text{ mA}$ | | 0.18 | 0.26 | | 0.33 | | |
| I_I | Input Leakage Current | 6.0 | $V_I = V_{CC}$ or GND | | | ± 0.1 | | ± 1 | | ± 1 | μA | | |
| I_{CC} | Quiescent Supply Current | 6.0 | $V_I = V_{CC}$ or GND | | | 1 | | 10 | | 20 | μA | | |

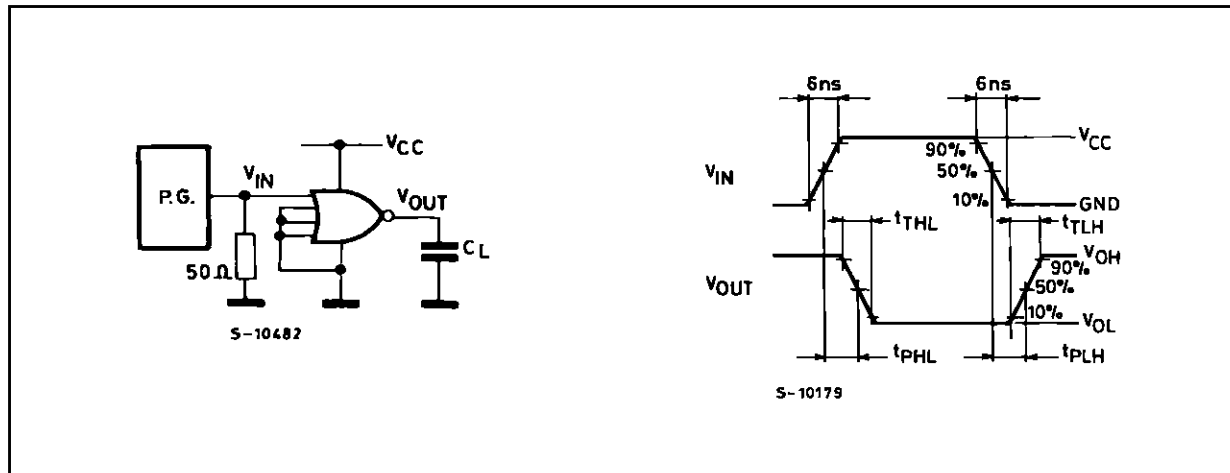
M54/M74HC4002

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

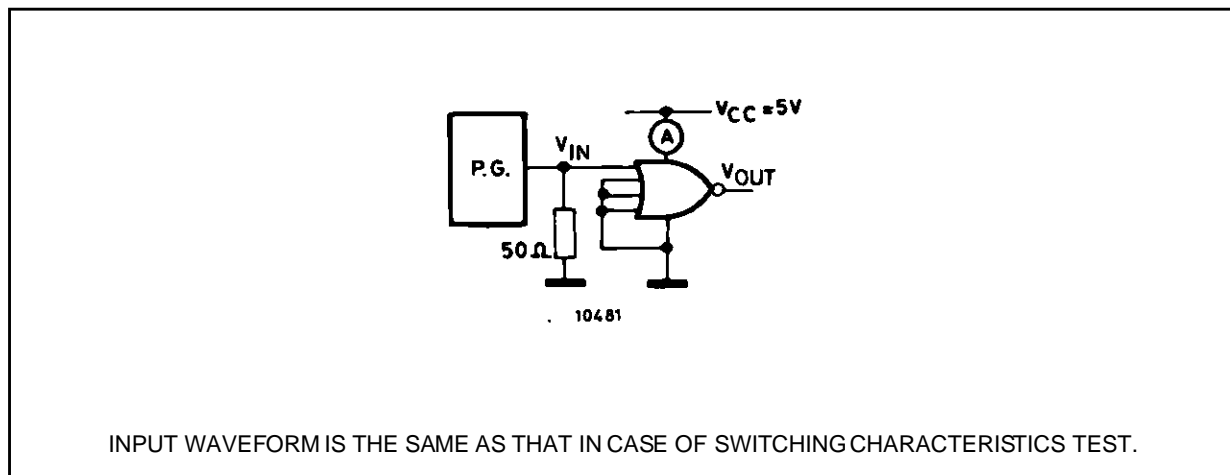
| Symbol | Parameter | Test Conditions | | Value | | | | | | Unit | |
|--------------------------------------|-------------------------------|---------------------|--|---|------|------|----------------------|------|-----------------------|------|------|
| | | V _{CC} (V) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{TLH} t _{THL} | Output Transition Time | 2.0 | | | 30 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 8 | 15 | | 19 | | 22 | |
| | | 6.0 | | | 7 | 13 | | 16 | | 19 | |
| t _{PLH} t _{PHL} | Propagation Delay Time | 2.0 | | | 48 | 100 | | 125 | | 150 | ns |
| | | 4.5 | | | 12 | 20 | | 25 | | 30 | |
| | | 6.0 | | | 10 | 17 | | 21 | | 26 | |
| C _{IN} | Input Capacitance | | | | 5 | 10 | | 10 | | 10 | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | | 20 | | | | | | pF |

(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. I_{CC(opr)} = C_{PD} • V_{CC} • f_{IN} + I_{CC/4} (per Gate)

SWITCHING CHARACTERISTICS TEST CIRCUIT



TEST CIRCUIT I_{CC} (Opr.)



Plastic DIP14 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 15.24 | | | 0.600 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | 1.27 | | 2.54 | 0.050 | | 0.100 |



Ceramic DIP14/1 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7.0 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 15.24 | | | 0.600 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| H | 1.17 | | 1.52 | 0.046 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 1.52 | | 2.54 | 0.060 | | 0.100 |
| N | | | 10.3 | | | 0.406 |
| P | 7.8 | | 8.05 | 0.307 | | 0.317 |
| Q | | | 5.08 | | | 0.200 |



P053C

SO14 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.003 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 8.55 | | 8.75 | 0.336 | | 0.344 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 7.62 | | | 0.300 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.68 | | | 0.026 |
| S | 8° (max.) | | | | | |



PLCC20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 9.78 | | 10.03 | 0.385 | | 0.395 |
| B | 8.89 | | 9.04 | 0.350 | | 0.356 |
| D | 4.2 | | 4.57 | 0.165 | | 0.180 |
| d1 | | 2.54 | | | 0.100 | |
| d2 | | 0.56 | | | 0.022 | |
| E | 7.37 | | 8.38 | 0.290 | | 0.330 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 5.08 | | | 0.200 | |
| F | | 0.38 | | | 0.015 | |
| G | | | 0.101 | | | 0.004 |
| M | | 1.27 | | | 0.050 | |
| M1 | | 1.14 | | | 0.045 | |



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