

MC14070B, MC14077B

CMOS SSI

Quad Exclusive “OR” and “NOR” Gates

The MC14070B quad exclusive OR gate and the MC14077B quad exclusive NOR gate are constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These complementary MOS logic gates find primary use where low power dissipation and/or high noise immunity is desired.

Features

- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- All Outputs Buffered
- Capable of Driving Two Low-Power TTL Loads or One Low-Power Schottky TTL Load Over the Rated Temperature Range
- Double Diode Protection on All Inputs
- MC14070B – Replacement for CD4030B and CD4070B Types
- MC14077B – Replacement for CD4077B Type
- These Devices are Pb-Free and are RoHS Compliant
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|-------------------|---|------------------------|------|
| V_{DD} | DC Supply Voltage Range | -0.5 to +18.0 | V |
| V_{in}, V_{out} | Input or Output Voltage Range (DC or Transient) | -0.5 to $V_{DD} + 0.5$ | V |
| I_{in}, I_{out} | Input or Output Current (DC or Transient) per Pin | ± 10 | mA |
| P_D | Power Dissipation, per Package (Note 1) | 500 | mW |
| T_A | Ambient Temperature Range | -55 to +125 | °C |
| T_{stg} | Storage Temperature Range | -65 to +150 | °C |
| T_L | Lead Temperature (8-Second Soldering) | 260 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Temperature Derating:

Plastic “P and D/DW” Packages: - 7.0 mW/°C From 65°C To 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

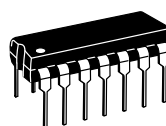
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.



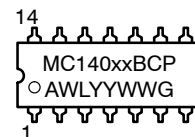
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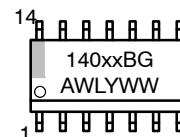
MARKING DIAGRAMS



PDIP-14
P SUFFIX
CASE 646



SOIC-14
D SUFFIX
CASE 751A



xx = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week
G = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 3 of this data sheet.

MC14070B, MC14077B

PIN ASSIGNMENT

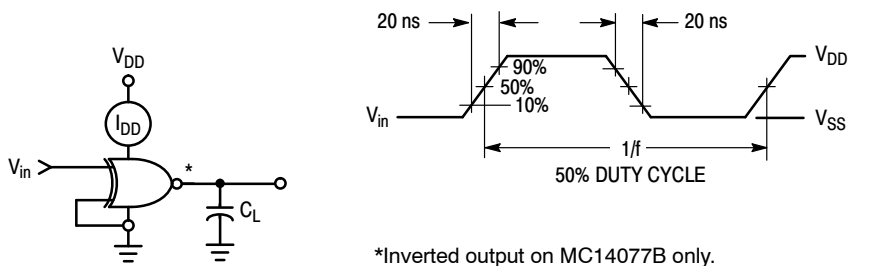
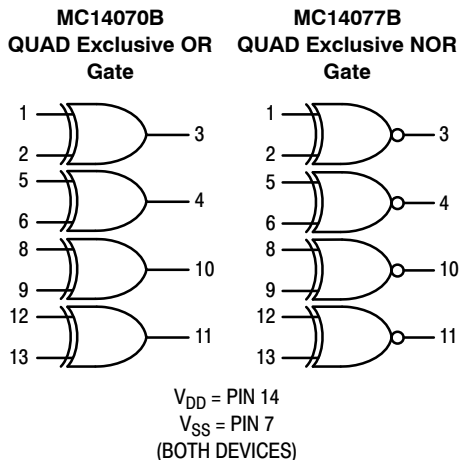
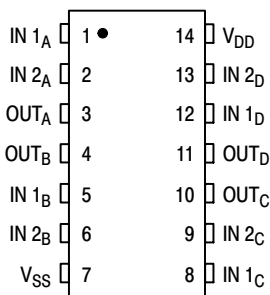


Figure 1. Power Dissipation Test Circuit and Waveform

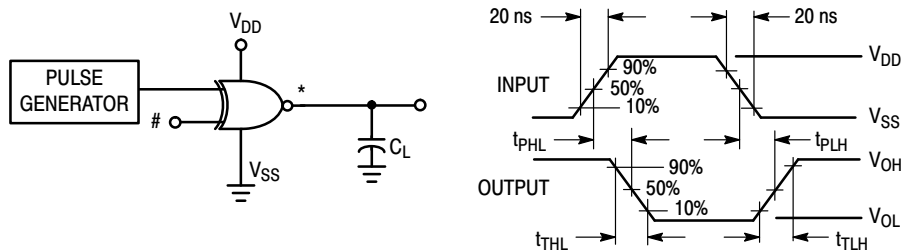


Figure 2. Switching Time Test Circuit and Waveforms

MC14070B, MC14077B

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------|--------------------|
| MC14070BCPG | PDIP-14 (Pb-Free) | 500 Units / Rail |
| MC14070BDG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC14070BDR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| NLV14070BDR2G* | | |
| MC14077BCPG | PDIP-14 (Pb-Free) | 500 Units / Rail |
| MC14077BDG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC14077BDR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| NLV14077BDR2G* | | |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

MC14070B, MC14077B

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Characteristic | Symbol | V _{DD} Vdc | - 55°C | | 25°C | | | 125°C | | Unit |
|--|--|------------------------|---|------|-------|-----------------|------|-------|------|------|
| | | | Min | Max | Min | Typ (Note 2) | Max | Min | Max | |
| Output Voltage V _{in} = V _{DD} or 0 V _{in} = 0 or V _{DD} | "0" Level V _{OL} | 5.0 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | Vdc |
| | | 10 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| | | 15 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| | "1" Level V _{OH} | 5.0 | 4.95 | - | 4.95 | 5.0 | - | 4.95 | - | Vdc |
| | | 10 | 9.95 | - | 9.95 | 10 | - | 9.95 | - | |
| | | 15 | 14.95 | - | 14.95 | 15 | - | 14.95 | - | |
| Input Voltage (V _O = 4.5 or 0.5 Vdc) (V _O = 9.0 or 1.0 Vdc) (V _O = 13.5 or 1.5 Vdc) (V _O = 0.5 or 4.5 Vdc) (V _O = 1.0 or 9.0 Vdc) (V _O = 1.5 or 13.5 Vdc) | "0" Level V _{IL} | 5.0 | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | Vdc |
| | | 10 | - | 3.0 | - | 4.50 | 3.0 | - | 3.0 | |
| | | 15 | - | 4.0 | - | 6.75 | 4.0 | - | 4.0 | |
| | "1" Level V _{IH} | 5.0 | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | Vdc |
| | | 10 | 7.0 | - | 7.0 | 5.50 | - | 7.0 | - | |
| | | 15 | 11 | - | 11 | 8.25 | - | 11 | - | |
| Output Drive Current (V _{OH} = 2.5 Vdc) (V _{OH} = 4.6 Vdc) (V _{OH} = 9.5 Vdc) (V _{OH} = 13.5 Vdc) (V _{OL} = 0.4 Vdc) (V _{OL} = 0.5 Vdc) (V _{OL} = 1.5 Vdc) | Source I _{OH} | 5.0 | -3.0 | - | -2.4 | -4.2 | - | -1.7 | - | mAdc |
| | | 5.0 | -0.64 | - | -0.51 | -0.88 | - | -0.36 | - | |
| | | 10 | -1.6 | - | -1.3 | -2.25 | - | -0.9 | - | |
| | Sink I _{OL} | 5.0 | 0.64 | - | 0.51 | 0.88 | - | 0.36 | - | mAdc |
| | | 10 | 1.6 | - | 1.3 | 2.25 | - | 0.9 | - | |
| | | 15 | 4.2 | - | 3.4 | 8.8 | - | 2.4 | - | |
| Input Current | I _{in} | 15 | - | ±0.1 | - | ±0.00001 | ±0.1 | - | ±1.0 | μAdc |
| Input Capacitance (V _{in} = 0) | C _{in} | - | - | - | - | 5.0 | 7.5 | - | - | pF |
| Quiescent Current (Per Package) | I _{DD} | 5.0 | - | 0.25 | - | 0.0005 | 0.25 | - | 7.5 | μAdc |
| | | 10 | - | 0.5 | - | 0.0010 | 0.5 | - | 15 | |
| | | 15 | - | 1.0 | - | 0.0015 | 1.0 | - | 30 | |
| Total Supply Current (Notes 3 & 4) (Dynamic plus Quiescent, Per Package) (C _L = 50 pF on all outputs, all buffers switching) | I _T | 5.0 10 15 | I _T = (0.3 μA/kHz) f + I _{DD} I _T = (0.6 μA/kHz) f + I _{DD} I _T = (0.9 μA/kHz) f + I _{DD} | | | | | | μAdc | |
| Output Rise and Fall Times (Note 3) (C _L = 50 pF) t _{TLH} , t _{THL} = (1.35 ns/pF) C _L + 33 ns t _{TLH} , t _{THL} = (0.60 ns/pF) C _L + 20 ns t _{TLH} , t _{THL} = (0.40 ns/pF) C _L + 20 ns | t _{TLH} , t _{THL} | 5.0 | - | - | - | 100 | 200 | - | - | ns |
| | | 10 | - | - | - | 50 | 100 | - | - | |
| | | 15 | - | - | - | 40 | 80 | - | - | |
| | | | | | | | | | | |
| Propagation Delay Times (Note 3) (C _L = 50 pF) t _{PLH} , t _{PHL} = (0.90 ns/pF) C _L + 130 ns t _{PLH} , t _{PHL} = (0.36 ns/pF) C _L + 57 ns t _{PLH} , t _{PHL} = (0.26 ns/pF) C _L + 37 ns | t _{PLH} , t _{PHL} | 5.0 | - | - | - | 175 | 350 | - | - | ns |
| | | 10 | - | - | - | 75 | 150 | - | - | |
| | | 15 | - | - | - | 55 | 110 | - | - | |
| | | | | | | | | | | |

2. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

3. The formulas given are for the typical characteristics only at 25°C.

4. To calculate total supply current at loads other than 50 pF:

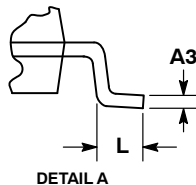
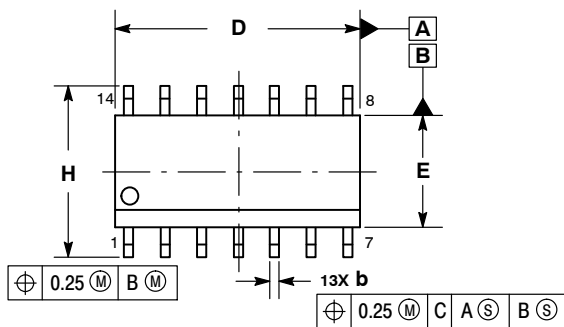
$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) \text{ Vfk}$$

where: I_T is in μH (per package), C_L in pF, V = (V_{DD} - V_{SS}) in volts, f in kHz is input frequency, and k = 0.002.

MC14070B, MC14077B

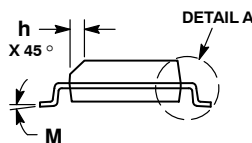
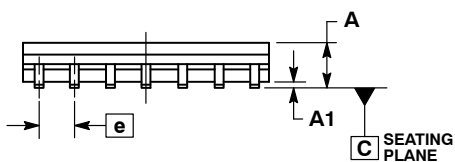
PACKAGE DIMENSIONS

SOIC-14 NB
CASE 751A-03
ISSUE K

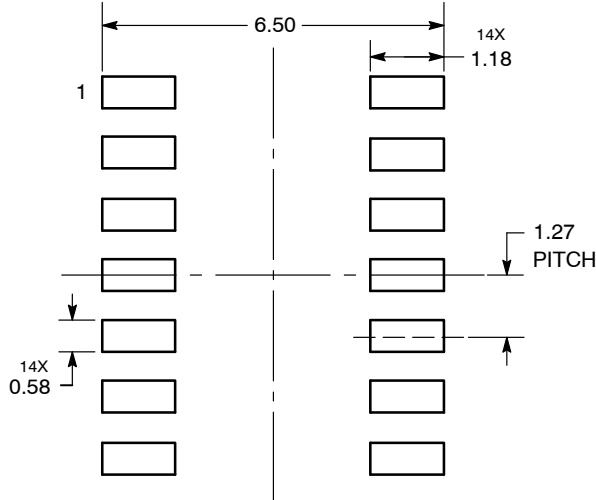


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
 4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
 5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.35 | 1.75 | 0.054 | 0.068 |
| A1 | 0.10 | 0.25 | 0.004 | 0.010 |
| A3 | 0.19 | 0.25 | 0.008 | 0.010 |
| b | 0.35 | 0.49 | 0.014 | 0.019 |
| D | 8.55 | 8.75 | 0.337 | 0.344 |
| E | 3.80 | 4.00 | 0.150 | 0.157 |
| e | 1.27 BSC | | 0.050 BSC | |
| H | 5.80 | 6.20 | 0.228 | 0.244 |
| h | 0.25 | 0.50 | 0.010 | 0.019 |
| L | 0.40 | 1.25 | 0.016 | 0.049 |
| M | 0° | 7° | 0° | 7° |



SOLDERING FOOTPRINT*



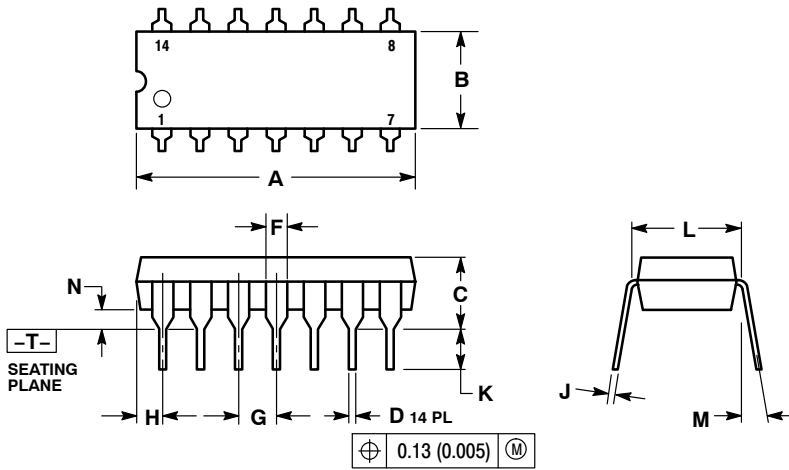
DIMENSIONS: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MC14070B, MC14077B

PACKAGE DIMENSIONS

PDIP-14
CASE 646-06
ISSUE P



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.715 | 0.770 | 18.16 | 19.56 |
| B | 0.240 | 0.260 | 6.10 | 6.60 |
| C | 0.145 | 0.185 | 3.69 | 4.69 |
| D | 0.015 | 0.021 | 0.38 | 0.53 |
| F | 0.040 | 0.070 | 1.02 | 1.78 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.052 | 0.095 | 1.32 | 2.41 |
| J | 0.008 | 0.015 | 0.20 | 0.38 |
| K | 0.115 | 0.135 | 2.92 | 3.43 |
| L | 0.290 | 0.310 | 7.37 | 7.87 |
| M | --- | 10° | --- | 10° |
| N | 0.015 | 0.039 | 0.38 | 1.01 |

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