

MC14001UB, MC14011UB

UB-Suffix Series CMOS Gates

The UB Series logic gates are constructed with P and N channel enhancement mode devices in a single monolithic structure (Complementary MOS). Their primary use is where low power dissipation and/or high noise immunity is desired. The UB set of CMOS gates are inverting non-buffered functions.

Features

- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Linear and Oscillator Applications
- 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
- Pin-for-Pin Replacements for Corresponding CD4000 Series UB Suffix Devices
- Pb-Free Packages are Available*

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 |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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.

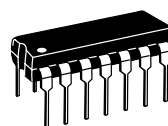
*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



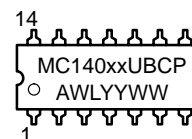
ON Semiconductor®

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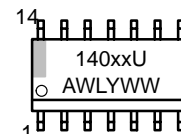
MARKING DIAGRAMS



PDIP-14
P SUFFIX
CASE 646



SOIC-14
D SUFFIX
CASE 751A



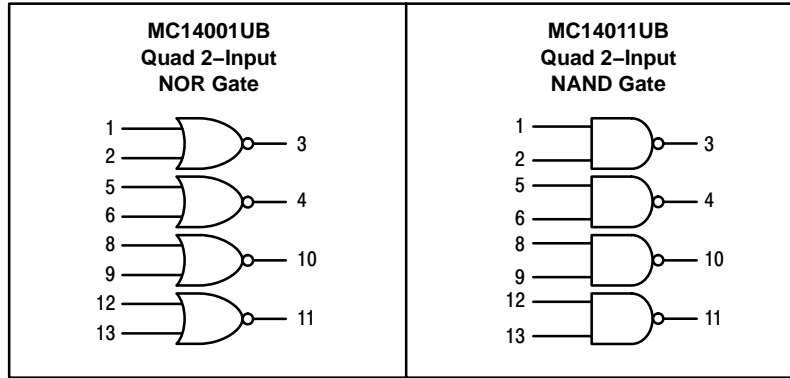
xx = Specific Device Code
A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

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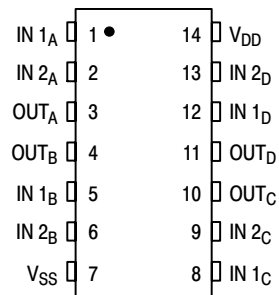
LOGIC DIAGRAMS



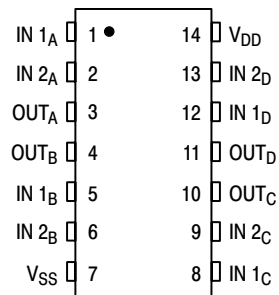
V_{DD} = PIN 14
 V_{SS} = PIN 7
 FOR ALL DEVICES

PIN ASSIGNMENTS

MC14001UB
Quad 2-Input NOR Gate



MC14011UB
Quad 2-Input NAND Gate



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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 Vdc) (V _O = 9.0 Vdc) (V _O = 13.5 Vdc) (V _O = 0.5 Vdc) (V _O = 1.0 Vdc) (V _O = 1.5 Vdc) | "0" Level V _{IL} | 5.0 | - | 1.0 | - | 2.25 | 1.0 | - | 1.0 | Vdc |
| | | 10 | - | 2.0 | - | 4.50 | 2.0 | - | 2.0 | |
| | | 15 | - | 2.5 | - | 6.75 | 2.5 | - | 2.5 | |
| | "1" Level I _{IH} | 5.0 | 4.0 | - | 4.0 | 2.75 | - | 4.0 | - | Vdc |
| | | 10 | 8.0 | - | 8.0 | 5.50 | - | 8.0 | - | |
| | | 15 | 12.5 | - | 12.5 | 8.25 | - | 12.5 | - | |
| 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 | -1.2 | - | -1.0 | -1.7 | - | -0.7 | - | mAdc |
| | | 5.0 | -0.25 | - | -0.2 | -0.36 | - | -0.14 | - | |
| | | 10 | -0.62 | - | -0.5 | -0.9 | - | -0.35 | - | |
| | 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 Gate C _L = 50 pF) | I _T | 5.0 | I _T = (0.3 μA/kHz) f + I _{DD} /N I _T = (0.6 μA/kHz) f + I _{DD} /N I _T = (0.8 μA/kHz) f + I _{DD} /N | | | | | | | μAdc |

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 = 0.001 x the number of exercised gates per package.

SWITCHING CHARACTERISTICS (Note 5) (C_L = 50 pF, T_A = 25°C)

| Characteristic | Symbol | V _{DD} Vdc | Min | Typ (Note 6) | Max | Unit |
|--|-------------------------------------|------------------------|-----|-----------------|-----|------|
| Output Rise Time t _{TLH} = (3.0 ns/pF) C _L + 30 ns t _{TLH} = (1.5 ns/pF) C _L + 15 ns t _{TLH} = (1.1 ns/pF) C _L + 10 ns | t _{TLH} | 5.0 | - | 180 | 360 | ns |
| | | 10 | - | 90 | 180 | |
| | | 15 | - | 65 | 130 | |
| Output Fall Time t _{THL} = (1.5 ns/pF) C _L + 25 ns t _{THL} = (0.75 ns/pF) C _L + 12.5 ns t _{THL} = (0.55 ns/pF) C _L + 9.5 ns | t _{THL} | 5.0 | - | 100 | 200 | ns |
| | | 10 | - | 50 | 100 | |
| | | 15 | - | 40 | 80 | |
| Propagation Delay Time t _{PLH} , t _{PHL} = (1.7 ns/pF) C _L + 30 ns t _{PLH} , t _{PHL} = (0.66 ns/pF) C _L + 22 ns t _{PLH} , t _{PHL} = (0.50 ns/pF) C _L + 15 ns | t _{PLH} , t _{PHL} | 5.0 | - | 90 | 180 | ns |
| | | 10 | - | 50 | 100 | |
| | | 15 | - | 40 | 80 | |

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

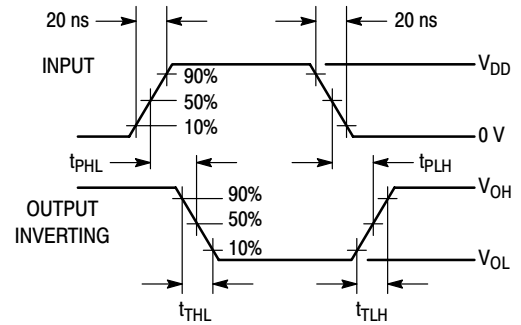
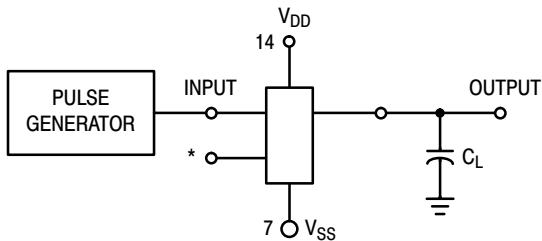
6. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

MC14001UB, MC14011UB

ORDERING INFORMATION

| Device | Package | Shipping† |
|---------------|----------------------|--------------------|
| MC14001UBCP | PDIP-14 | 500 Units / Rail |
| MC14001UBCPG | PDIP-14 (Pb-Free) | 500 Units / Rail |
| MC14001UBD | SOIC-14 | 55 Units / Rail |
| MC14001UBDG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC14001UBDR2 | SOIC-14 | 2500 / Tape & Reel |
| MC14001UBDR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| | | |
| MC14011UBCP | PDIP-14 | 500 Units / Rail |
| MC14011UBCPG | PDIP-14 (Pb-Free) | 500 Units / Rail |
| MC14011UBD | SOIC-14 | 55 Units / Rail |
| MC14011UBDG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC14011UBDR2 | SOIC-14 | 2500 / Tape & Reel |
| MC14011UBDR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |

†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.

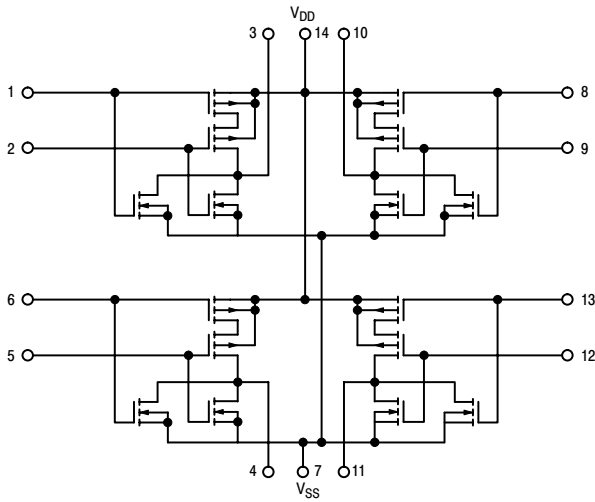


*All unused inputs of AND, NAND gates must be connected to V_{DD} .
All unused inputs of OR, NOR gates must be connected to V_{SS} .

Figure 1. Switching Time Test Circuit and Waveforms

MC14001UB, MC14011UB

MC14001UB CIRCUIT SCHEMATIC



**MC14011UB CIRCUIT SCHEMATIC
(1/4 of Device Shown)**

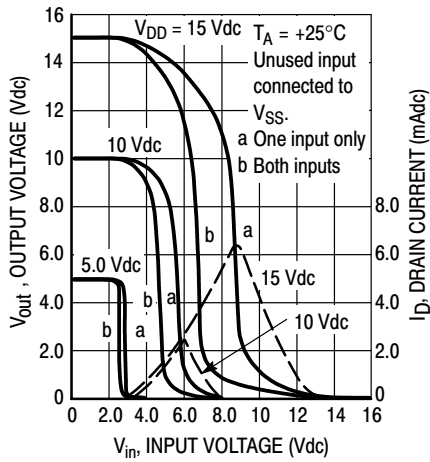
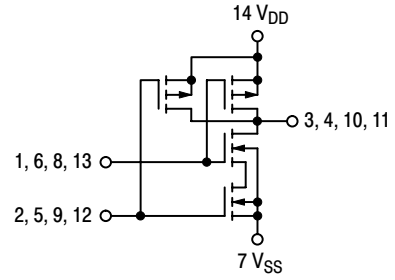


Figure 2. Typical Voltage and Current Transfer Characteristics

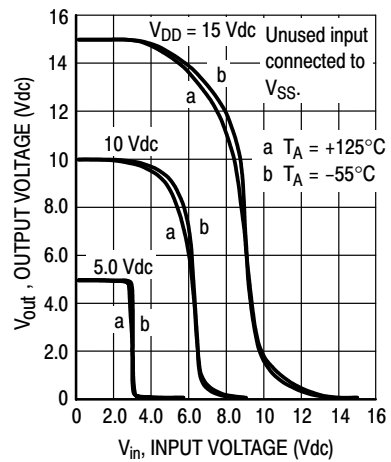


Figure 3. Typical Voltage Transfer Characteristics versus Temperature

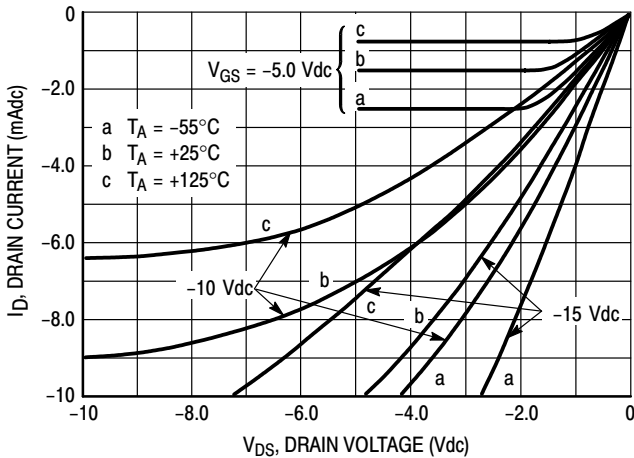


Figure 4. Typical Output Source Characteristics

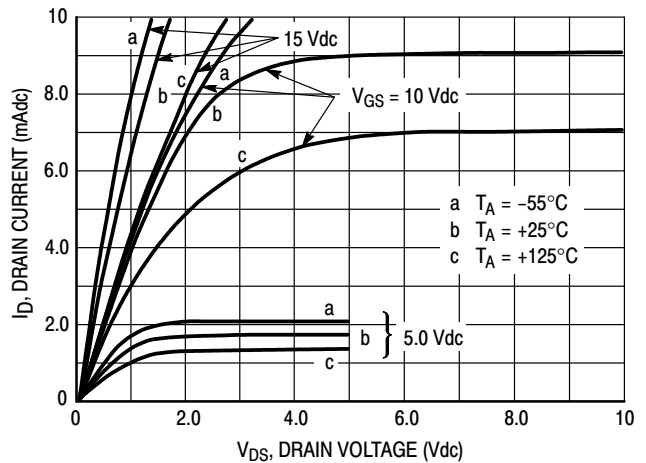
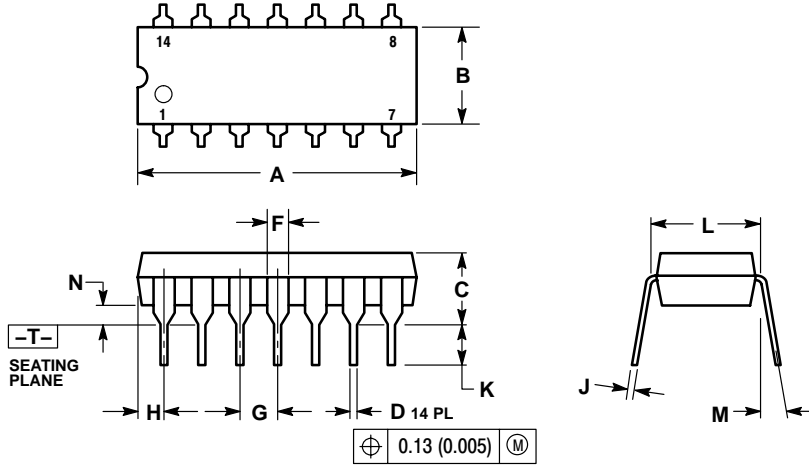


Figure 5. Typical Output Sink Characteristics

MC14001UB, MC14011UB

PACKAGE DIMENSIONS

P SUFFIX
 PLASTIC DIP PACKAGE
 CASE 646-06
 ISSUE N



NOTES:

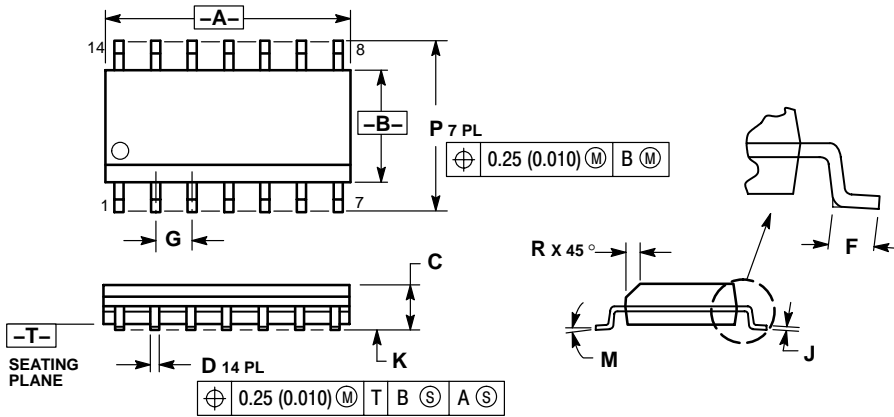
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.715 | 0.770 | 18.16 | 18.80 |
| 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 |

MC14001UB, MC14011UB

PACKAGE DIMENSIONS

D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE G




NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 8.55 | 8.75 | 0.337 | 0.344 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0° | 7° | 0° | 7° |
| P | 5.80 | 6.20 | 0.228 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

MC14001UB, MC14011UB

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