

# 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
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- This Device is Pb-Free and is RoHS Compliant

### 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	$\pm 10$	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 those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Temperature Derating: "D/DW" Package: -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.



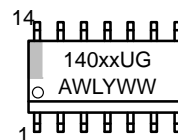
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SOIC-14  
D SUFFIX  
CASE 751A

### MARKING DIAGRAM



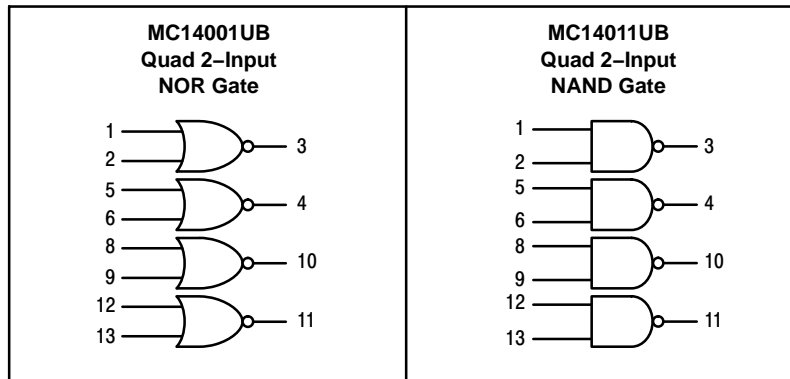
xx = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

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

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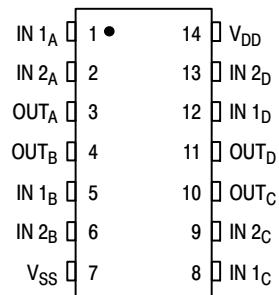
## LOGIC DIAGRAMS



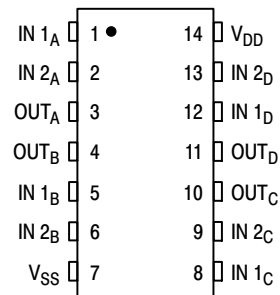
$V_{DD}$  = PIN 14  
 $V_{SS}$  = PIN 7  
 FOR ALL DEVICES

## PIN ASSIGNMENTS

**MC14001UB**  
Quad 2-Input NOR Gate



**MC14011UB**  
Quad 2-Input NAND Gate



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## ELECTRICAL CHARACTERISTICS (Voltages Referenced to V<sub>SS</sub>)

Characteristic	Symbol	V <sub>DD</sub> Vdc	– 55°C		25°C			125°C		Unit
			Min	Max	Min	Typ (Note 2)	Max	Min	Max	
Output Voltage V <sub>in</sub> = V <sub>DD</sub> or 0  V <sub>in</sub> = 0 or V <sub>DD</sub>	“0” Level V <sub>OL</sub>	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 <sub>OH</sub>	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 <sub>O</sub> = 4.5 Vdc) (V <sub>O</sub> = 9.0 Vdc) (V <sub>O</sub> = 13.5 Vdc)  (V <sub>O</sub> = 0.5 Vdc) (V <sub>O</sub> = 1.0 Vdc) (V <sub>O</sub> = 1.5 Vdc)	“0” Level V <sub>IL</sub>	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 V <sub>IH</sub>	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 <sub>OH</sub> = 2.5 Vdc) (V <sub>OH</sub> = 4.6 Vdc) (V <sub>OH</sub> = 9.5 Vdc) (V <sub>OH</sub> = 13.5 Vdc)  (V <sub>OL</sub> = 0.4 Vdc) (V <sub>OL</sub> = 0.5 Vdc) (V <sub>OL</sub> = 1.5 Vdc)	Source I <sub>OH</sub>	5.0	–1.0	–	–0.75	–1.7	–	–0.55	–	mAdc
		5.0	–0.25	–	–0.2	–0.36	–	–0.14	–	
		10	–0.62	–	–0.4	–0.9	–	–0.15	–	
		15	–1.8	–	–1.5	–3.5	–	–1.0	–	
	Sink I <sub>OL</sub>	5.0	0.64	–	0.51	0.88	–	0.36	–	mAdc
		10	1.6	–	1.1	2.25	–	0.7	–	
		15	4.2	–	3.4	8.8	–	2.4	–	
Input Current	I <sub>in</sub>	15	–	±0.1	–	±0.00001	±0.1	–	±1.0	μAdc
Input Capacitance (V <sub>in</sub> = 0)	C <sub>in</sub>	–	–	–	–	5.0	7.5	–	–	pF
Quiescent Current (Per Package)	I <sub>DD</sub>	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 <sub>L</sub> = 50 pF)	I <sub>T</sub>	5.0 10 15	I <sub>T</sub> = (0.3 μA/kHz) f + I <sub>DD</sub> /N I <sub>T</sub> = (0.6 μA/kHz) f + I <sub>DD</sub> /N I <sub>T</sub> = (0.8 μA/kHz) f + I <sub>DD</sub> /N							μAdc

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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<sub>T</sub> is in μH (per package), C<sub>L</sub> in pF, V = (V<sub>DD</sub> – V<sub>SS</sub>) 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<sub>L</sub> = 50 pF, T<sub>A</sub> = 25°C)

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

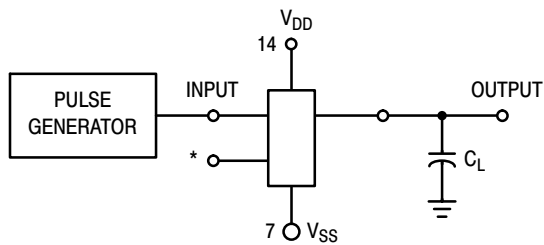
Device	Package	Shipping <sup>†</sup>
MC14001UBDG	SOIC-14 (Pb-Free)	55 Units / Rail
NLV14001UBDG*	SOIC-14 (Pb-Free)	55 Units / Rail
MC14001UBDR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
NLV14001UBDR2G*	SOIC-14 (Pb-Free)	2500 / Tape & Reel

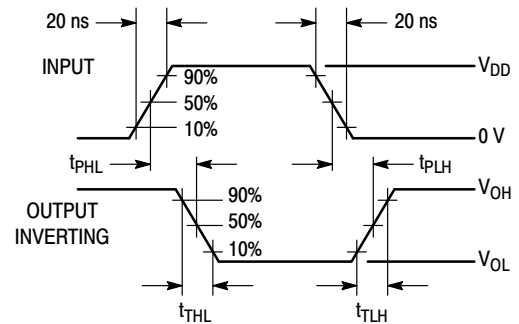
MC14011UBDG	SOIC-14 (Pb-Free)	55 Units / Rail
NLV14011UBDG*	SOIC-14 (Pb-Free)	55 Units / Rail
MC14011UBDR2G	SOIC-14 (Pb-Free)	2500 / Tape & Reel
NLV14011UBDR2G*	SOIC-14 (Pb-Free)	2500 / Tape & Reel

<sup>†</sup>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.



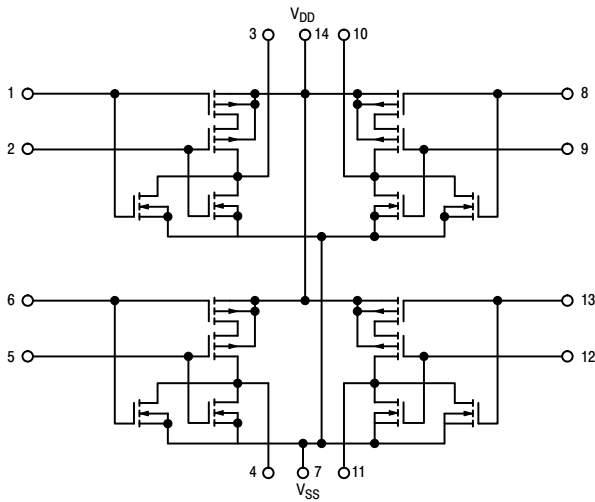
\*All unused inputs of AND, NAND gates must be connected to  $V_{DD}$ .  
All unused inputs of OR, NOR gates must be connected to  $V_{SS}$ .



**Figure 1. Switching Time Test Circuit and Waveforms**

# MC14001UB, MC14011UB

MC14001UB CIRCUIT SCHEMATIC



MC14011UB CIRCUIT SCHEMATIC  
(1/4 of Device Shown)

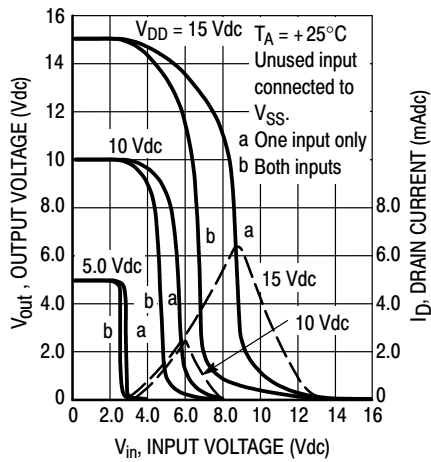
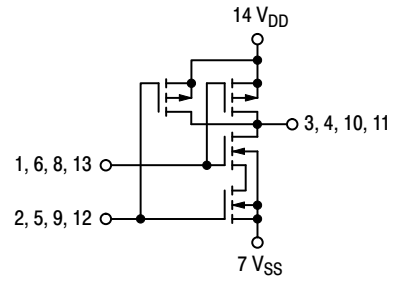


Figure 2. Typical Voltage and Current Transfer Characteristics

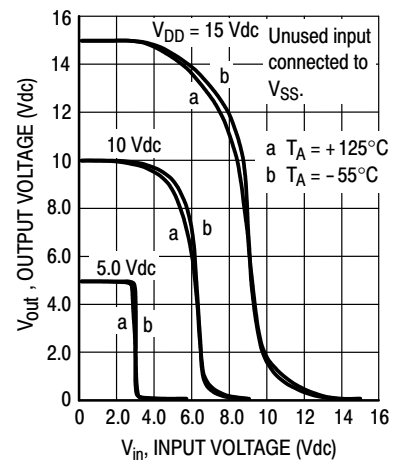


Figure 3. Typical Voltage Transfer Characteristics versus Temperature

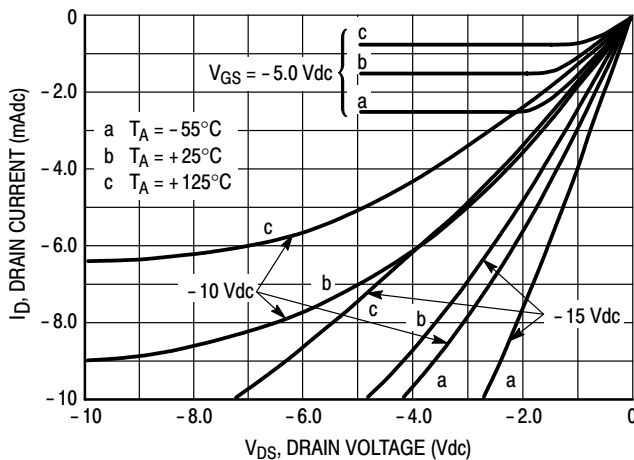


Figure 4. Typical Output Source Characteristics

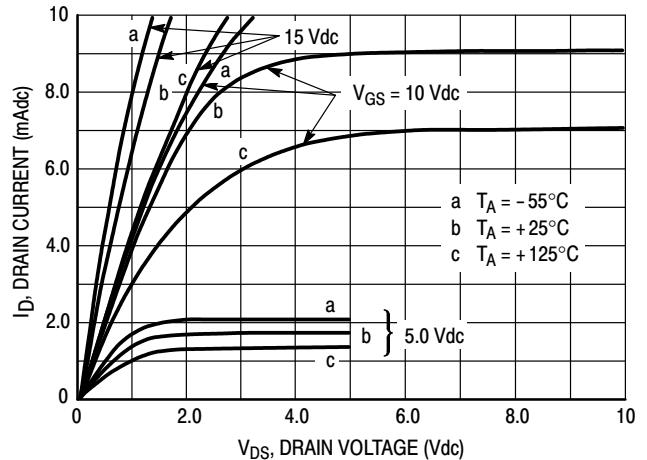
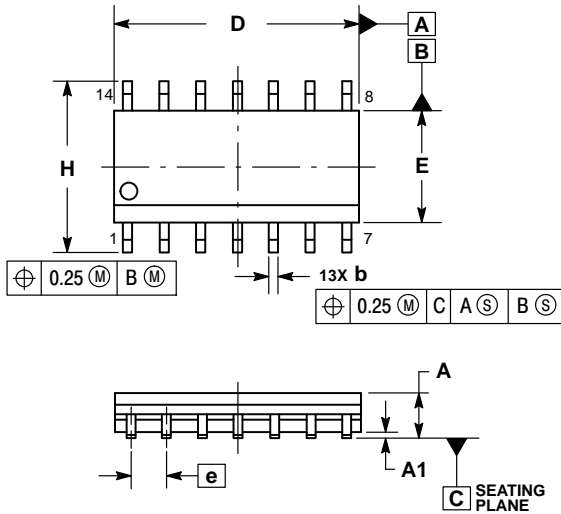


Figure 5. Typical Output Sink Characteristics

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## PACKAGE DIMENSIONS

### SOIC-14 NB CASE 751A-03 ISSUE K

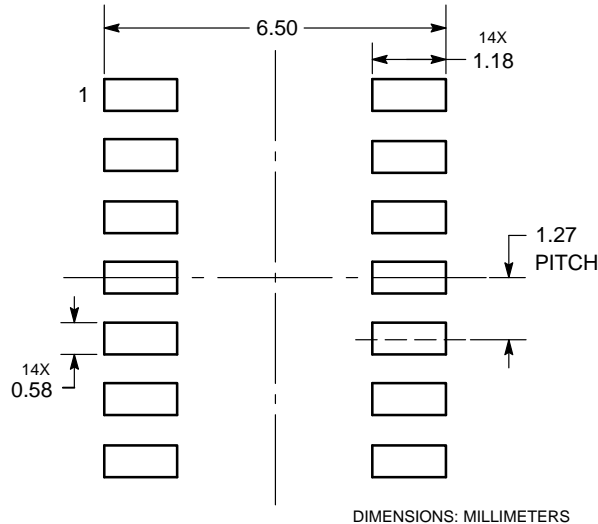


#### NOTES:


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\*



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

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