

# 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.

- 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

### MAXIMUM RATINGS (Voltages Referenced to $V_{SS}$ ) (Note 1.)

| 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 2.)          | 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   |

1. Maximum Ratings are those values beyond which damage to the device may occur.
2. 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.

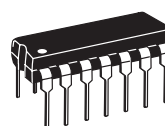


**ON Semiconductor**

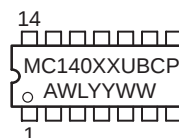
<http://onsemi.com>

### MC14001UB Quad 2-Input NOR Gate MC14011UB Quad 2-Input NAND Gate

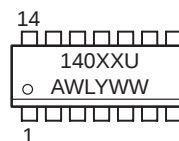
#### MARKING DIAGRAMS



PDIP-14  
P SUFFIX  
CASE 646



SOIC-14  
D SUFFIX  
CASE 751A



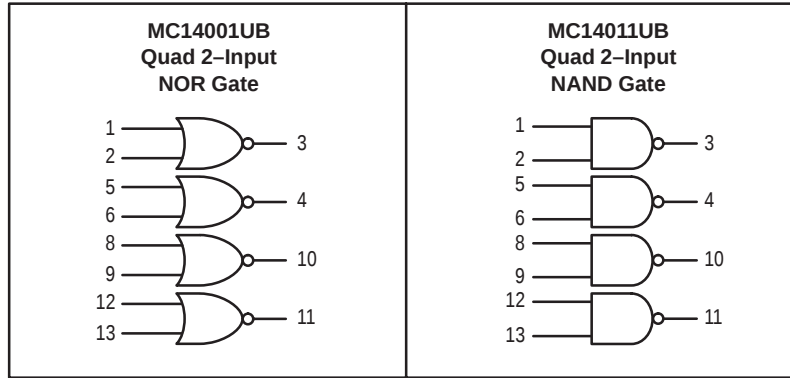
XX = Specific Device Code  
A = Assembly Location  
WL or L = Wafer Lot  
YY or Y = Year  
WW or W = Work Week

#### ORDERING INFORMATION

| Device       | Package | Shipping         |
|--------------|---------|------------------|
| MC14001UBCP  | PDIP-14 | 2000/Box         |
| MC14001UBD   | SOIC-14 | 55/Rail          |
| MC14001UBDR2 | SOIC-14 | 2500/Tape & Reel |
| MC14011UBCP  | PDIP-14 | 2000/Box         |
| MC14011UBD   | SOIC-14 | 55/Rail          |
| MC14011UBDR2 | SOIC-14 | 2500/Tape & Reel |

# MC14001UB, MC14011UB

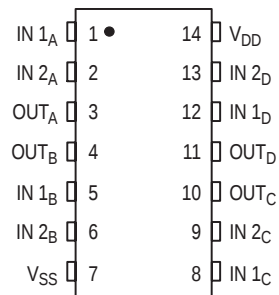
## LOGIC DIAGRAMS



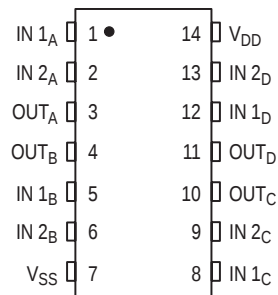
$V_{DD}$  = PIN 14  
 $V_{SS}$  = PIN 7  
 FOR ALL DEVICES

## PIN ASSIGNMENTS

**MC14001UB**  
Quad 2-Input NOR Gate



**MC14011UB**  
Quad 2-Input NAND Gate



# MC14001UB, MC14011UB

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

| Characteristic                                                                                                                                                                                                                                     | Symbol                                | V <sub>DD</sub><br>Vdc | - 55°C                                                                                                                                                               |       | 25°C  |           |       | 125°C  |       | Unit |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-----------|-------|--------|-------|------|
|                                                                                                                                                                                                                                                    |                                       |                        | Min                                                                                                                                                                  | Max   | Min   | Typ (3.)  | Max   | Min    | Max   |      |
| Output Voltage<br>V <sub>in</sub> = V <sub>DD</sub> or 0<br><br>V <sub>in</sub> = 0 or V <sub>DD</sub>                                                                                                                                             | 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  |      |
|                                                                                                                                                                                                                                                    | 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<br>(V <sub>O</sub> = 4.5 Vdc)<br>(V <sub>O</sub> = 9.0 Vdc)<br>(V <sub>O</sub> = 13.5 Vdc)<br><br>(V <sub>O</sub> = 0.5 Vdc)<br>(V <sub>O</sub> = 1.0 Vdc)<br>(V <sub>O</sub> = 1.5 Vdc)                                             | 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   |      |
|                                                                                                                                                                                                                                                    | I <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<br>(V <sub>OH</sub> = 2.5 Vdc)<br>(V <sub>OH</sub> = 4.6 Vdc)<br>(V <sub>OH</sub> = 9.5 Vdc)<br>(V <sub>OH</sub> = 13.5 Vdc)<br><br>(V <sub>OL</sub> = 0.4 Vdc)<br>(V <sub>OL</sub> = 0.5 Vdc)<br>(V <sub>OL</sub> = 1.5 Vdc) | Source<br><br><br><br>I <sub>OH</sub> | 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 | —     |      |
|                                                                                                                                                                                                                                                    |                                       | 15                     | - 1.8                                                                                                                                                                | —     | - 1.5 | - 3.5     | —     | - 1.1  | —     |      |
|                                                                                                                                                                                                                                                    | Sink<br><br><br>I <sub>OL</sub>       | 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 <sub>in</sub>                       | 15                     | —                                                                                                                                                                    | ± 0.1 | —     | ± 0.00001 | ± 0.1 | —      | ± 1.0 | μAdc |
| Input Capacitance<br>(V <sub>in</sub> = 0)                                                                                                                                                                                                         | C <sub>in</sub>                       | —                      | —                                                                                                                                                                    | —     | —     | 5.0       | 7.5   | —      | —     | pF   |
| Quiescent Current<br>(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 (4.) (5.)<br>(Dynamic plus Quiescent,<br>Per Gate C <sub>L</sub> = 50 pF)                                                                                                                                                     | I <sub>T</sub>                        | 5.0                    | I <sub>T</sub> = (0.3 μA/kHz) f + I <sub>DD</sub> /N<br>I <sub>T</sub> = (0.6 μA/kHz) f + I <sub>DD</sub> /N<br>I <sub>T</sub> = (0.8 μA/kHz) f + I <sub>DD</sub> /N |       |       |           |       |        |       | μAdc |

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

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

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

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

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.

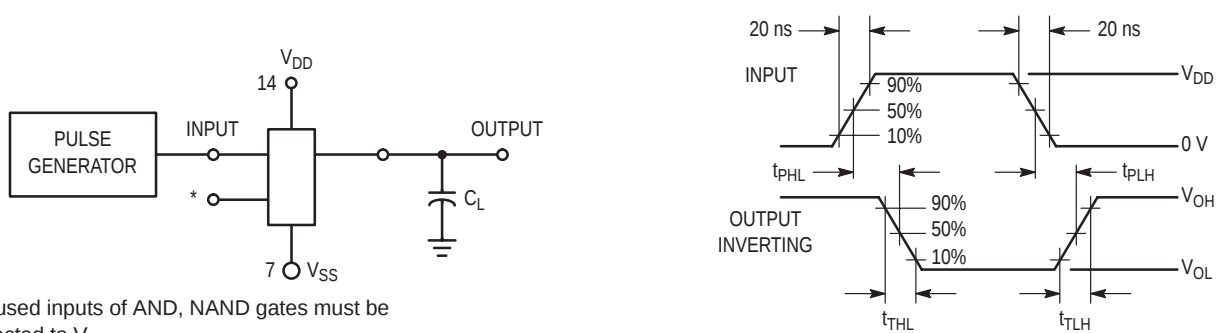
# MC14001UB, MC14011UB

## SWITCHING CHARACTERISTICS <sup>(6.)</sup> ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ )

| Characteristic                                                                                                                                                                                                           | Symbol             | $V_{DD}$<br>Vdc | Min         | Typ <sup>(7.)</sup> | Max               | Unit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------|-------------|---------------------|-------------------|------|
| Output Rise Time<br>$t_{TLH} = (3.0 \text{ ns/pF}) C_L + 30 \text{ ns}$<br>$t_{TLH} = (1.5 \text{ ns/pF}) C_L + 15 \text{ ns}$<br>$t_{TLH} = (1.1 \text{ ns/pF}) C_L + 10 \text{ ns}$                                    | $t_{TLH}$          | 5.0<br>10<br>15 | —<br>—<br>— | 180<br>90<br>65     | 360<br>180<br>130 | ns   |
| Output Fall Time<br>$t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br>$t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$<br>$t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$                               | $t_{THL}$          | 5.0<br>10<br>15 | —<br>—<br>— | 100<br>50<br>40     | 200<br>100<br>80  | ns   |
| Propagation Delay Time<br>$t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 30 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 22 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.50 \text{ ns/pF}) C_L + 15 \text{ ns}$ | $t_{PLH}, t_{PHL}$ | 5.0<br>10<br>15 | —<br>—<br>— | 90<br>50<br>40      | 180<br>100<br>80  | ns   |

6. The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

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



\*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

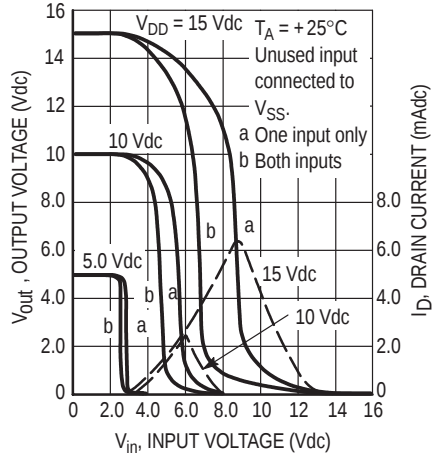
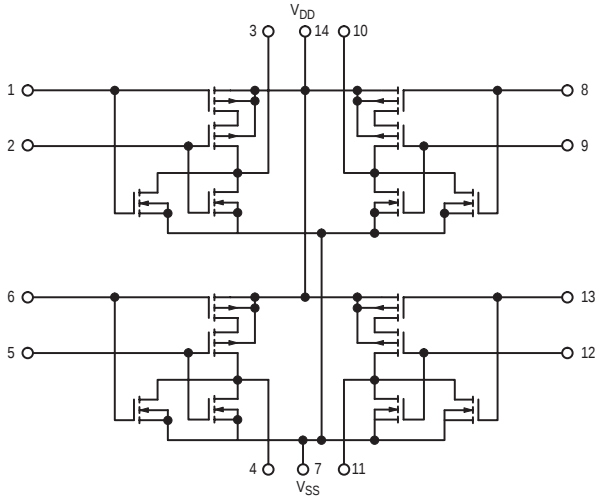


Figure 2. Typical Voltage and Current Transfer Characteristics

MC14011UB CIRCUIT SCHEMATIC  
(1/4 of Device Shown)

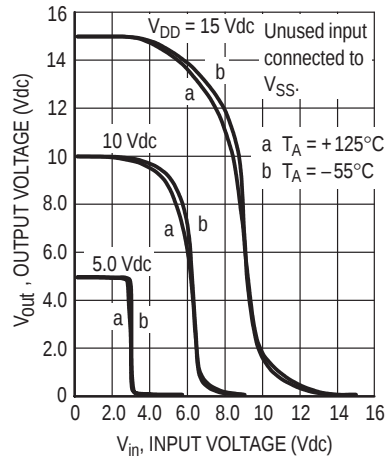
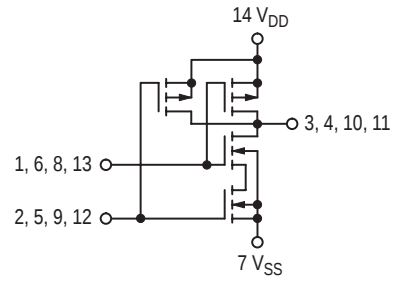


Figure 3. Typical Voltage Transfer Characteristics versus Temperature

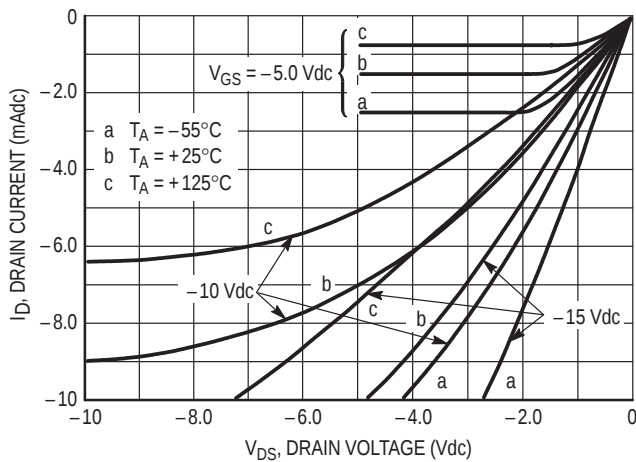


Figure 4. Typical Output Source Characteristics

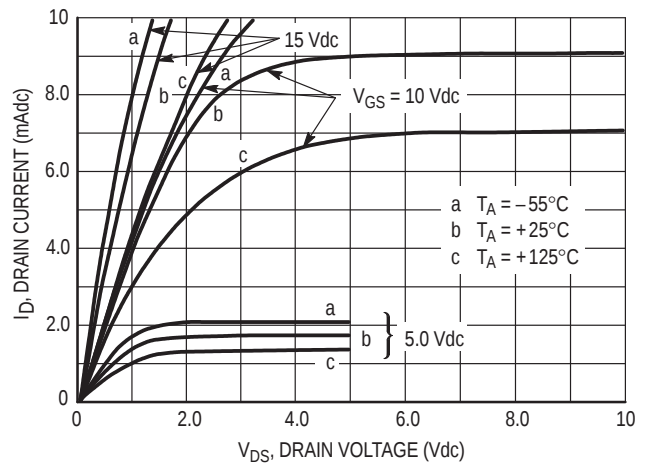
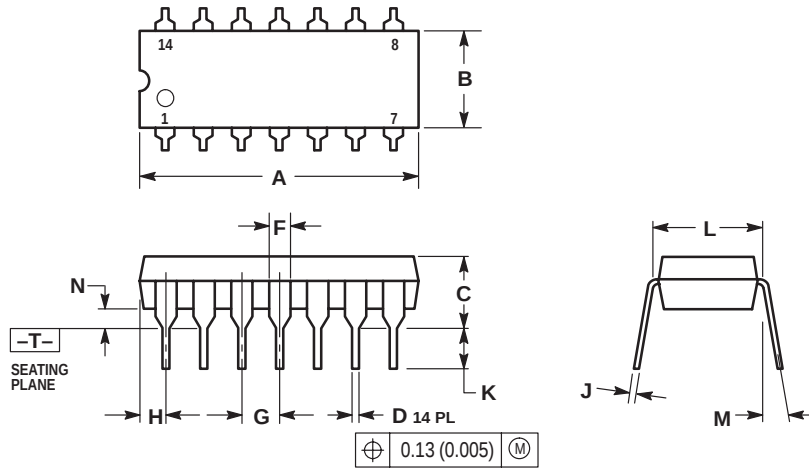


Figure 5. Typical Output Sink Characteristics

# MC14001UB, MC14011UB

## PACKAGE DIMENSIONS

**P SUFFIX**  
**PLASTIC DIP PACKAGE**  
**CASE 646-06**  
**ISSUE M**



### NOTES:

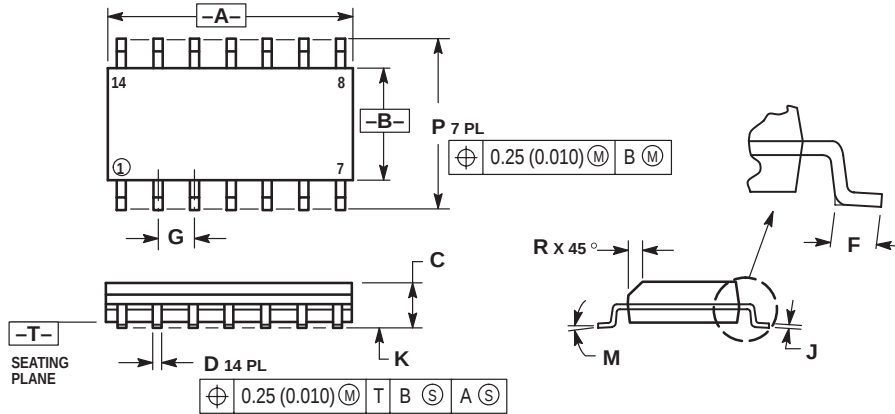
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| 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 F



#### 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 |

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