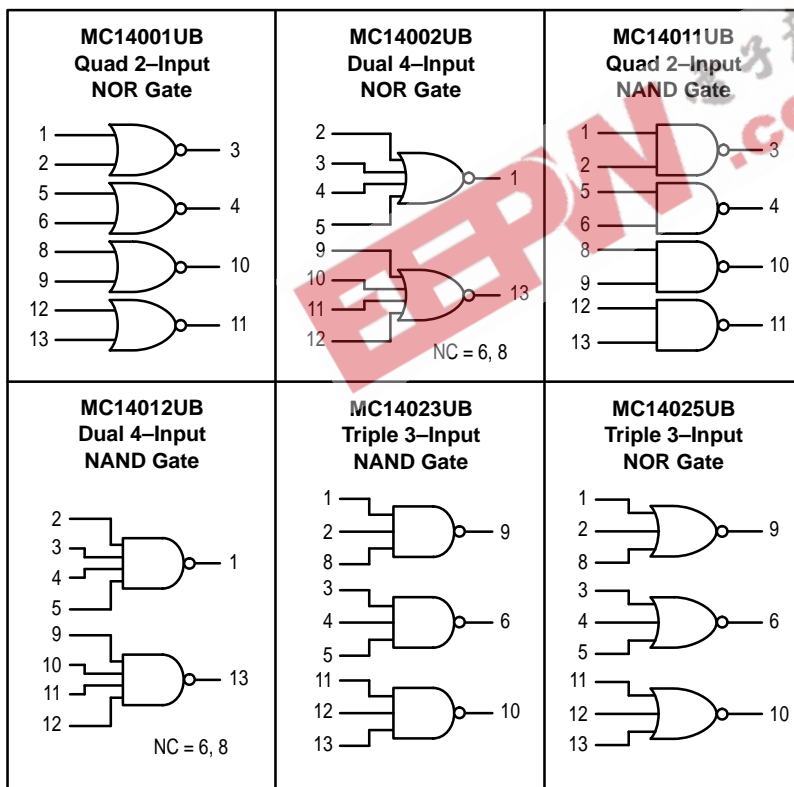


UB-Suffix Series CMOS Gates

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

LOGIC DIAGRAMS



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

MC14001UB
Quad 2-Input NOR Gate

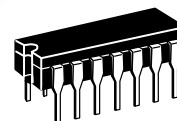
MC14002UB
Dual 4-Input NOR Gate

MC14011UB
Quad 2-Input NAND Gate

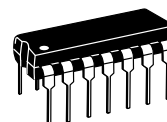
MC14012UB
Dual 4-Input NAND Gate

MC14023UB
Triple 3-Input NAND Gate

MC14025UB
Triple 3-Input NOR Gate



L SUFFIX
CERAMIC
CASE 632



P SUFFIX
PLASTIC
CASE 646



D SUFFIX
SOIC
CASE 751A

ORDERING INFORMATION

MC14XXXUBCP Plastic
MC14XXXUBCL Ceramic
MC14XXXUBD SOIC

T_A = -55° to 125°C for all packages.

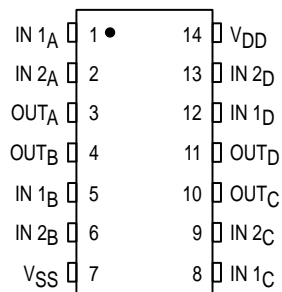
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should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

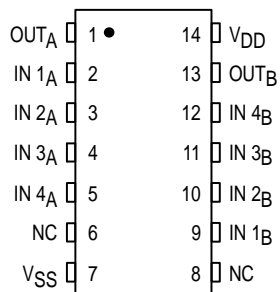


PIN ASSIGNMENTS

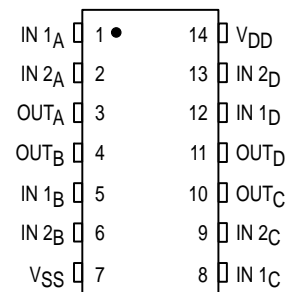
MC14001UB
Quad 2-Input NOR Gate



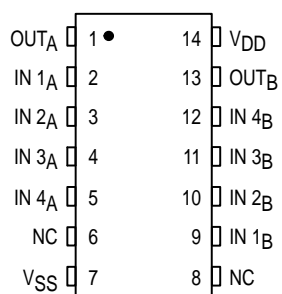
MC14002UB
Dual 4-Input NOR Gate



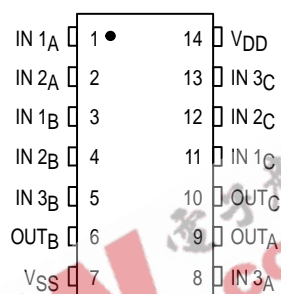
MC14011UB
Quad 2-Input NAND Gate



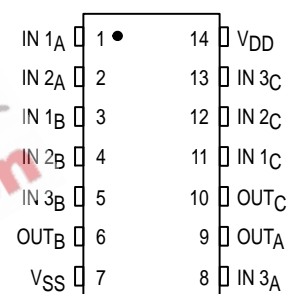
MC14012UB
Dual 4-Input NAND Gate



MC14023UB
Triple 3-Input NAND Gate



MC14025UB
Triple 3-Input NOR Gate



NC = NO CONNECTION

MAXIMUM RATINGS* (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|------------------------------------|--|--------------------------------|------|
| V _{DD} | DC Supply Voltage | - 0.5 to + 18.0 | V |
| V _{in} , V _{out} | Input or Output Voltage (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† | 500 | mW |
| T _{stg} | Storage Temperature | - 65 to + 150 | °C |
| T _L | Lead Temperature (8-Second Soldering) | 260 | °C |

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

† Temperature Derating:

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

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Characteristic | Symbol | V _{DD} Vdc | - 55°C | | 25°C | | | 125°C | | Unit |
|---|--|------------------------|--|------|-------|----------|------|--------|------|------|
| | | | Min | Max | Min | Typ # | Max | Min | Max | |
| Output Voltage V _{in} = V _{DD} or 0 | "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 | |
| | V _{in} = 0 or V _{DD} "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) | "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 | |
| | (V _O = 0.5 Vdc) "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) | 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 | — | |
| | (V _{OL} = 0.4 Vdc) 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**† (Dynamic plus Quiescent, Per Gate C _L = 50 pF) | I _T | 5.0 | I _T = (0.3 μA/kHz) f + I _{DD} /N | | | | | | | μAdc |
| | | 10 | I _T = (0.6 μA/kHz) f + I _{DD} /N | | | | | | | |
| | | 15 | I _T = (0.8 μA/kHz) f + I _{DD} /N | | | | | | | |

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

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

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

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

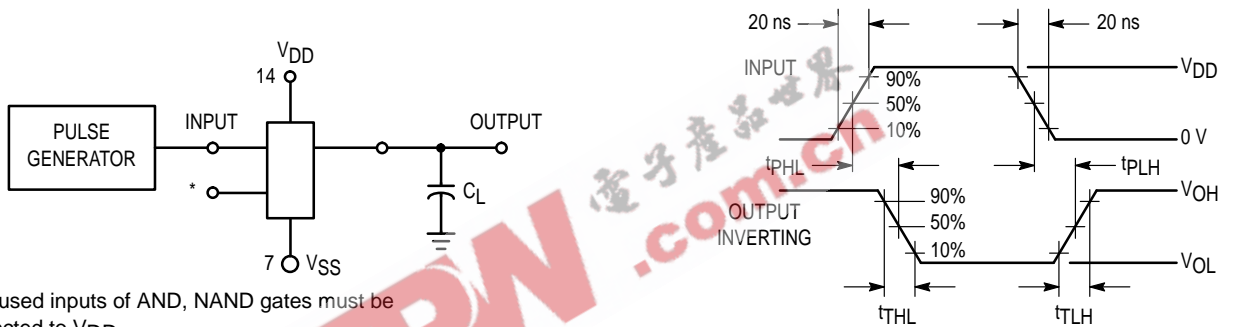
where: I_T is in μH (per package), C_L in pF, V = (V_{DD} - V_{SS}) in volts, f in kHz is input frequency, and k = 0.001 x the number of exercised gates per package.

SWITCHING CHARACTERISTICS* ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

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

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

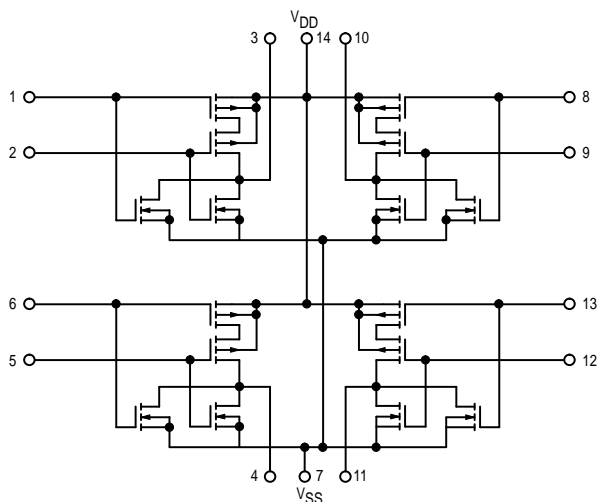
#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



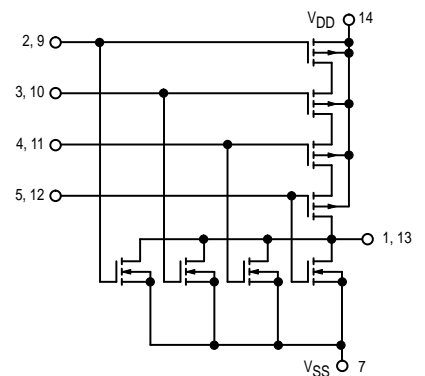
* All unused inputs of AND, NAND gates must be connected to V_{DD}.
 All unused inputs of OR, NOR gates must be connected to V_{SS}.

Figure 1. Switching Time Test Circuit and Waveforms

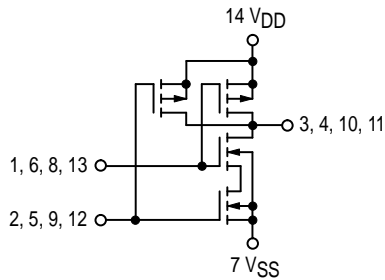
MC14001UB CIRCUIT SCHEMATIC



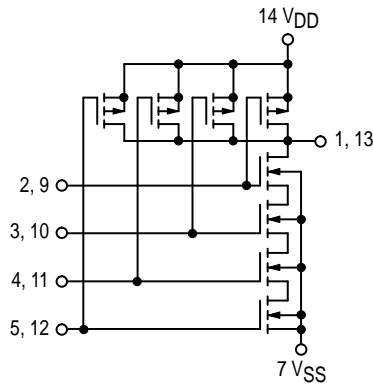
**MC14002UB CIRCUIT SCHEMATIC
(1/2 of Device Shown)**



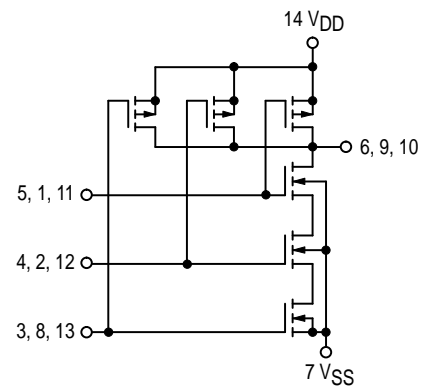
MC14011UB CIRCUIT SCHEMATIC
(1/4 of Device Shown)



MC14012UB CIRCUIT SCHEMATIC
(1/2 of Device Shown)



MC14023UB CIRCUIT SCHEMATIC
(1/3 of Device Shown)



MC14025UB CIRCUIT SCHEMATIC
(1/3 of Device Shown)

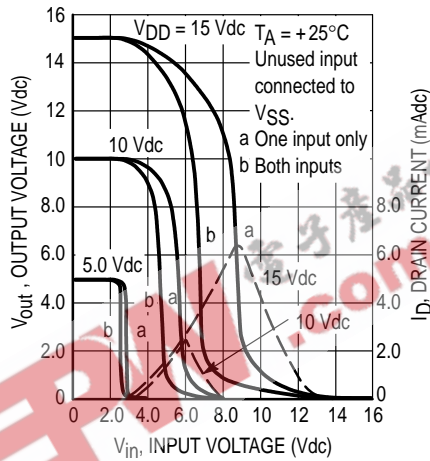
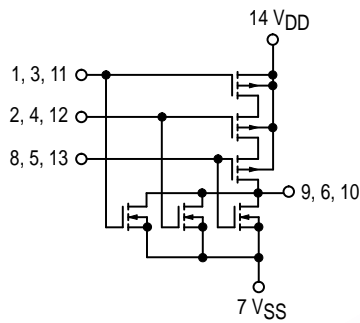


Figure 2. Typical Voltage and Current Transfer Characteristics

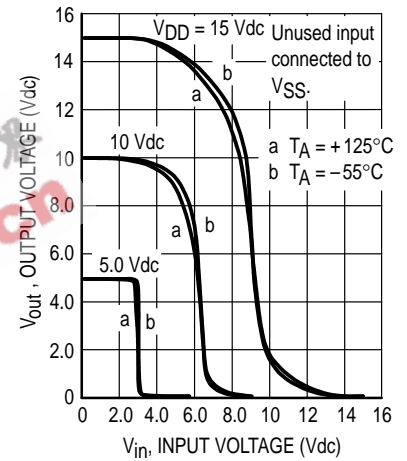


Figure 3. Typical Voltage Transfer Characteristics versus Temperature

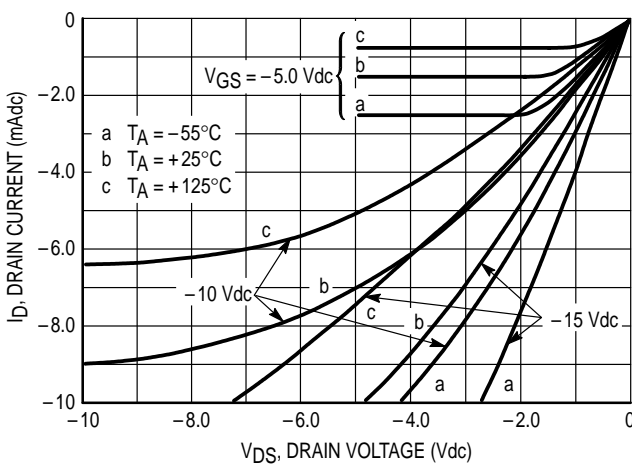


Figure 4. Typical Output Source Characteristics

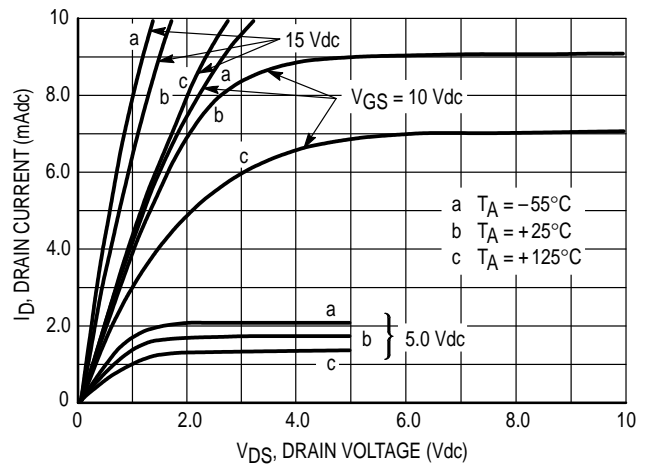
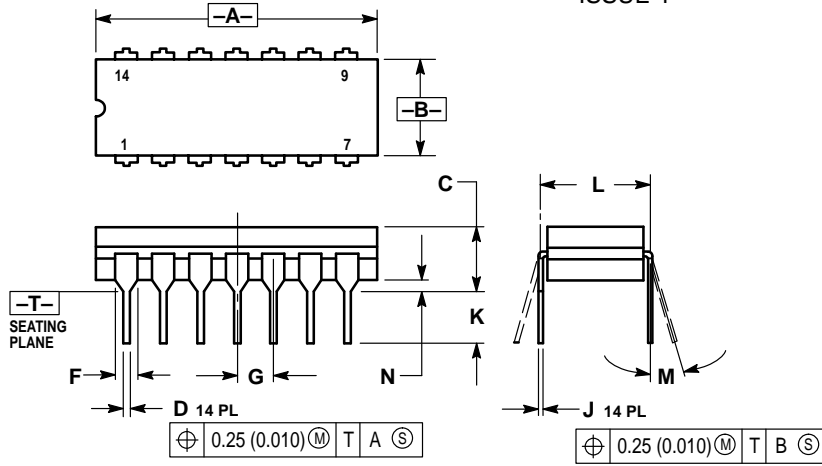


Figure 5. Typical Output Sink Characteristics

OUTLINE DIMENSIONS

L SUFFIX CERAMIC DIP PACKAGE CASE 632-08 ISSUE Y

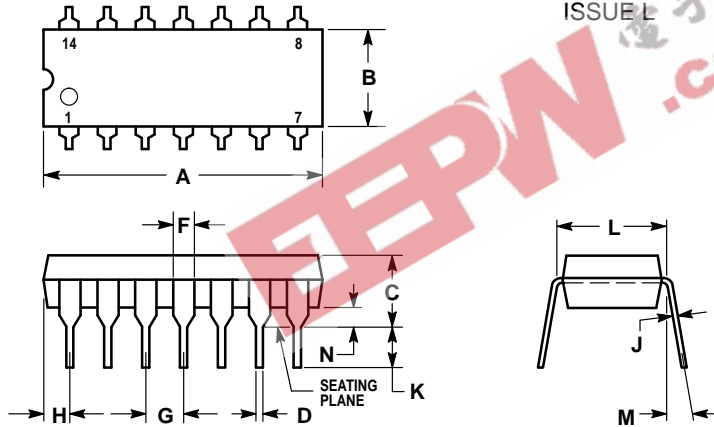


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.750 | 0.785 | 19.05 | 19.94 |
| B | 0.245 | 0.280 | 6.23 | 7.11 |
| C | 0.155 | 0.200 | 3.94 | 5.08 |
| D | 0.015 | 0.020 | 0.39 | 0.50 |
| F | 0.055 | 0.065 | 1.40 | 1.65 |
| G | 0.100 BSC | | 2.54 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.125 | 0.170 | 3.18 | 4.31 |
| L | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 15° | 0° | 15° |
| N | 0.020 | 0.040 | 0.51 | 1.01 |

P SUFFIX PLASTIC DIP PACKAGE CASE 646-06 ISSUE L



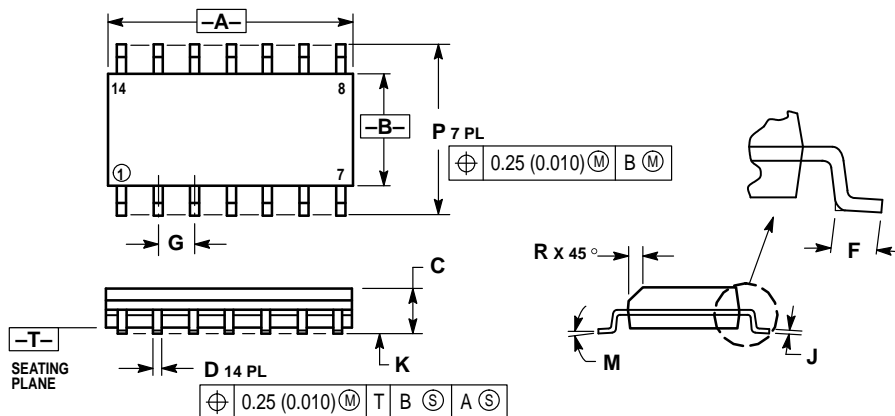
NOTES:

1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
4. 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 | 0.300 BSC | | 7.62 BSC | |
| M | 0° | 10° | 0° | 10° |
| N | 0.015 | 0.039 | 0.39 | 1.01 |

OUTLINE 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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MC14001UB/D

