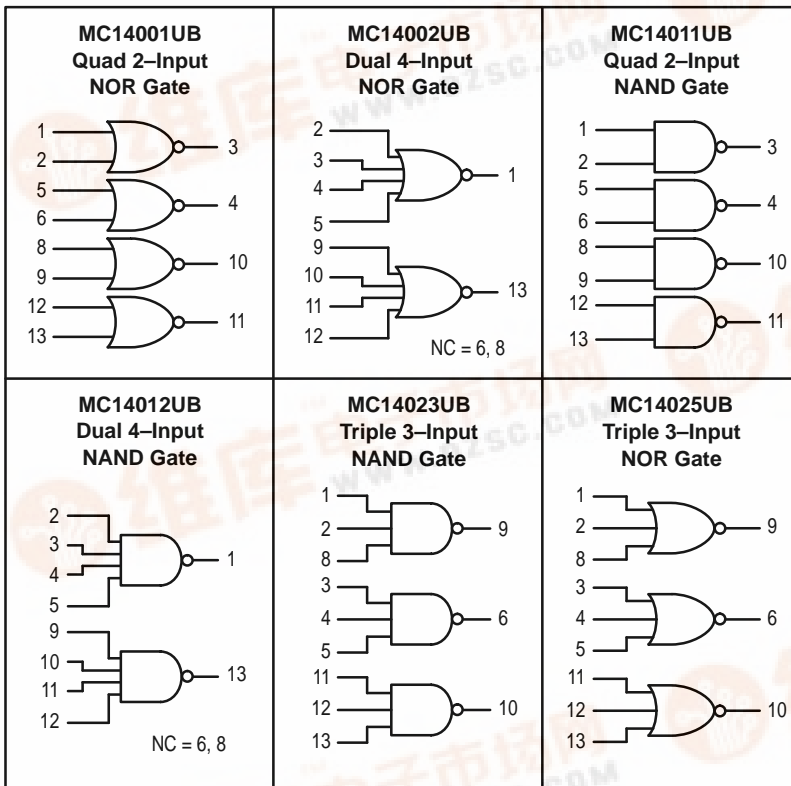


## UB-Suffix Series CMOS Gates

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

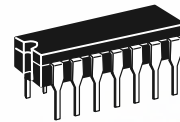
**MC14002UB**  
Dual 4-Input NOR Gate

**MC14011UB**  
Quad 2-Input NAND Gate

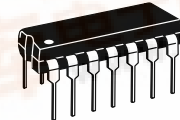
**MC14012UB**  
Dual 4-Input NAND Gate

**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

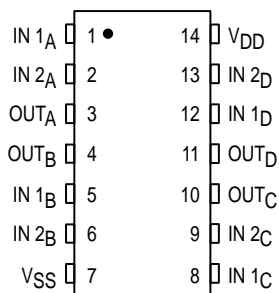
$T_A$  = -55° to 125°C for all packages.

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  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .

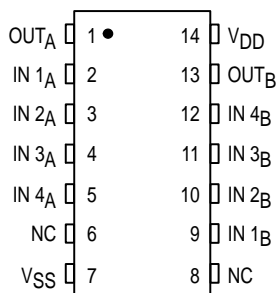
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either  $V_{SS}$  or  $V_{DD}$ ). Unused outputs must be left open.

## PIN ASSIGNMENTS

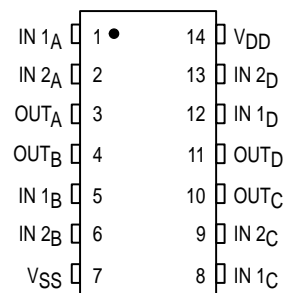
**MC14001UB**  
Quad 2-Input NOR Gate



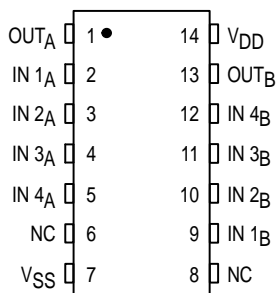
**MC14002UB**  
Dual 4-Input NOR Gate



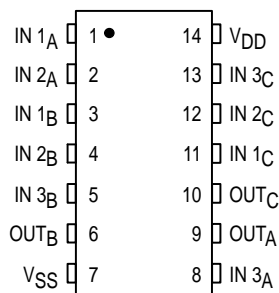
**MC14011UB**  
Quad 2-Input NAND Gate



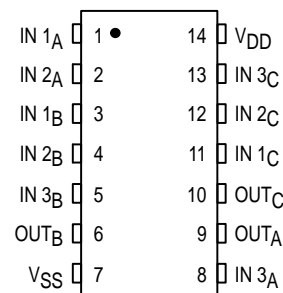
**MC14012UB**  
Dual 4-Input NAND Gate



**MC14023UB**  
Triple 3-Input NAND Gate



**MC14025UB**  
Triple 3-Input NOR Gate



NC = NO CONNECTION

### MAXIMUM RATINGS\* (Voltages Referenced to V<sub>SS</sub>)

Symbol	Parameter	Value	Unit
V <sub>DD</sub>	DC Supply Voltage	- 0.5 to + 18.0	V
V <sub>in</sub> , V <sub>out</sub>	Input or Output Voltage (DC or Transient)	- 0.5 to V <sub>DD</sub> + 0.5	V
I <sub>in</sub> , I <sub>out</sub>	Input or Output Current (DC or Transient), per Pin	± 10	mA
P <sub>D</sub>	Power Dissipation, per Package†	500	mW
T <sub>stg</sub>	Storage Temperature	- 65 to + 150	°C
T <sub>L</sub>	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  $V_{in} = 0$ 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	—		
		15	- 1.8	—	- 1.5	- 3.5	—	- 1.1	—		
	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	—	$\pm 0.1$	—	$\pm 0.00001$	$\pm 0.1$	—	$\pm 1.0$	$\mu$ Adc	
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	$\mu$ Adc	
		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	$I_T = (0.3 \mu\text{A/kHz}) f + I_{DD}/N$							$\mu$ Adc	
		10	$I_T = (0.6 \mu\text{A/kHz}) f + I_{DD}/N$								
		15	$I_T = (0.8 \mu\text{A/kHz}) f + I_{DD}/N$								

#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:

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

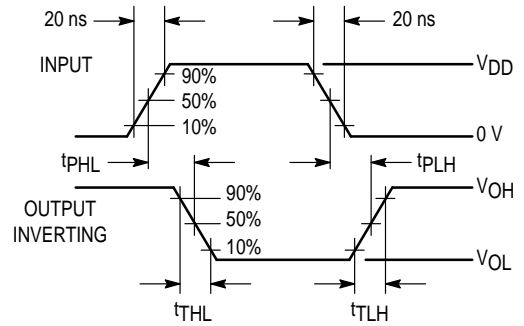
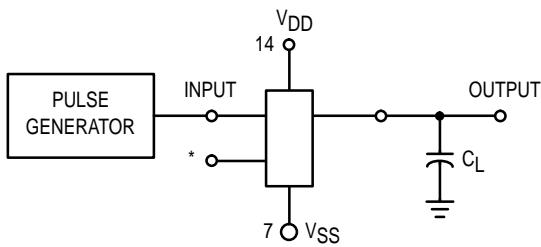
where:  $I_T$  is in  $\mu$ H (per package),  $C_L$  in pF,  $V = (V_{DD} - V_{SS})$  in volts,  $f$  in kHz is input frequency, and  $k = 0.001 \times$  the number of exercised gates per package.

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

Characteristic	Symbol	V <sub>DD</sub> 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.

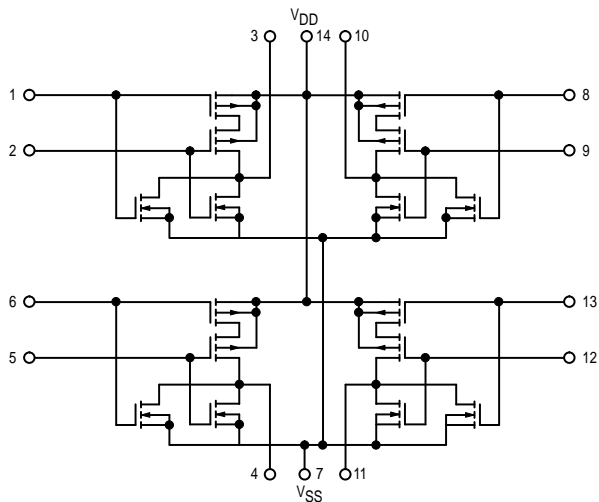
#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



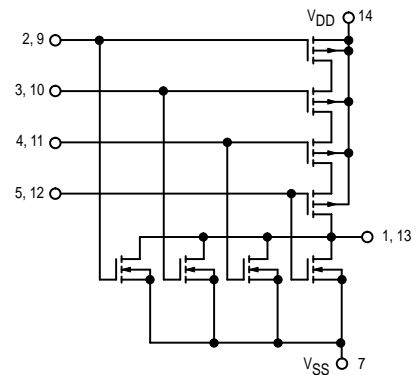
\* All unused inputs of AND, NAND gates must be connected to V<sub>DD</sub>.  
 All unused inputs of OR, NOR gates must be connected to V<sub>SS</sub>.

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

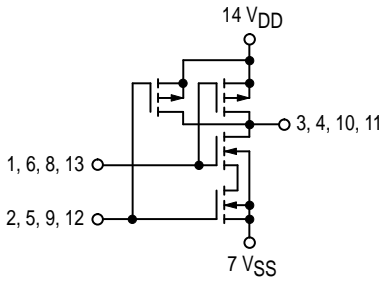
**MC14001UB CIRCUIT SCHEMATIC**



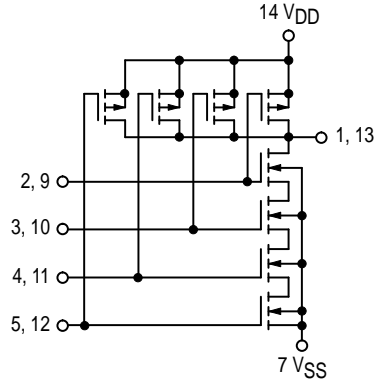
**MC14002UB CIRCUIT SCHEMATIC  
(1/2 of Device Shown)**



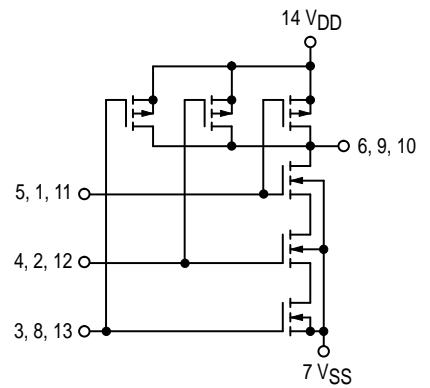
**MC14011UB CIRCUIT SCHEMATIC  
(1/4 of Device Shown)**



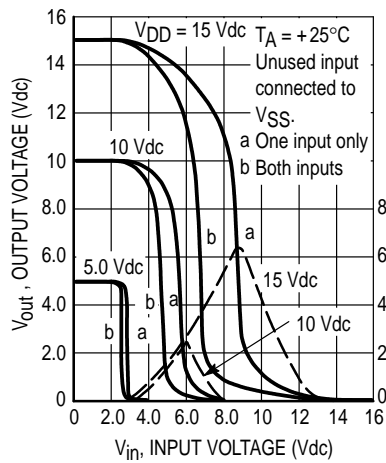
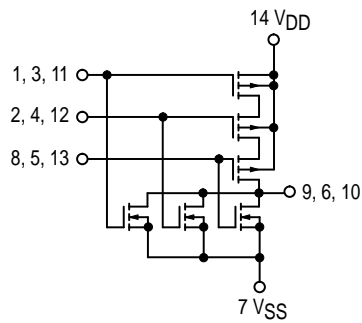
**MC14012UB CIRCUIT SCHEMATIC  
(1/2 of Device Shown)**



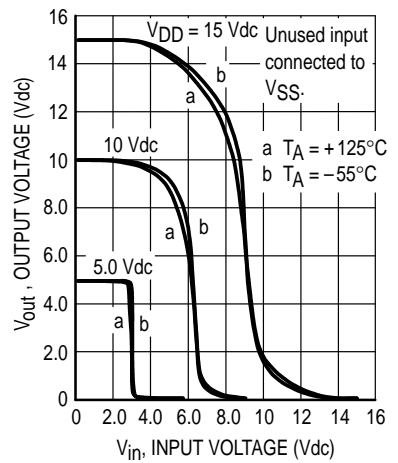
**MC14023UB CIRCUIT SCHEMATIC  
(1/3 of Device Shown)**



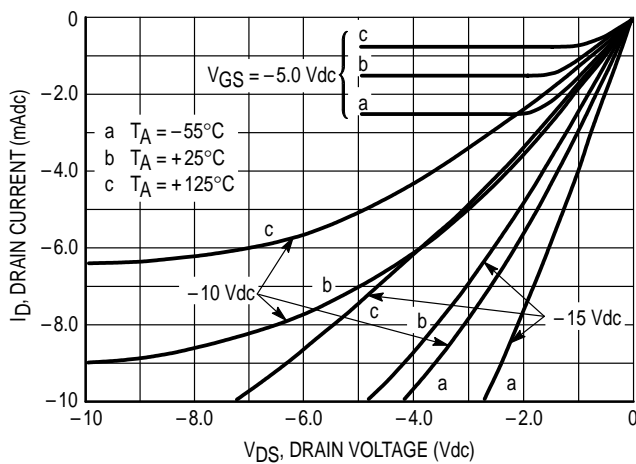
**MC14025UB CIRCUIT SCHEMATIC  
(1/3 of Device Shown)**



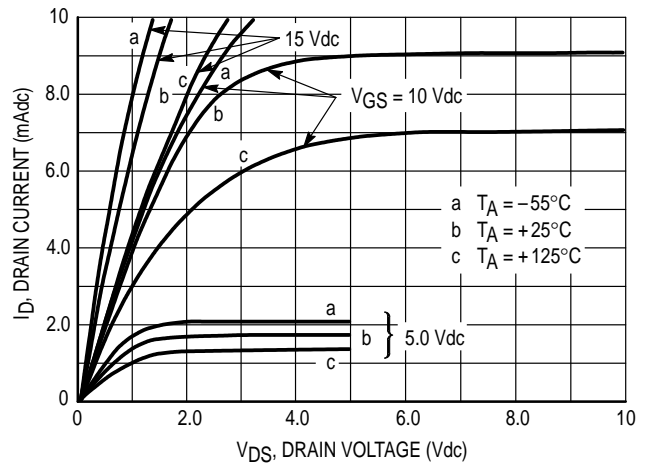
**Figure 2. Typical Voltage and Current Transfer Characteristics**



**Figure 3. Typical Voltage Transfer Characteristics versus Temperature**



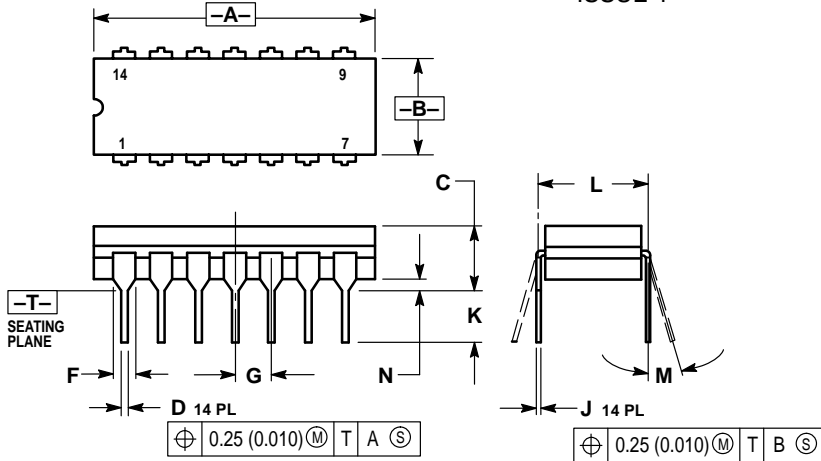
**Figure 4. Typical Output Source Characteristics**



**Figure 5. Typical Output Sink Characteristics**

## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 632-08 ISSUE Y

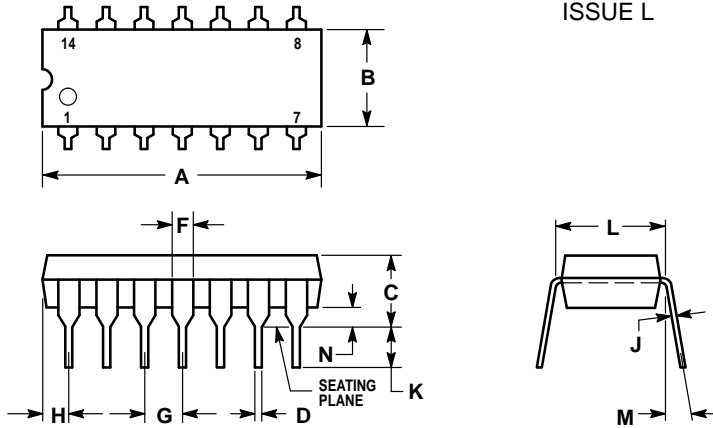


**NOTES:**

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



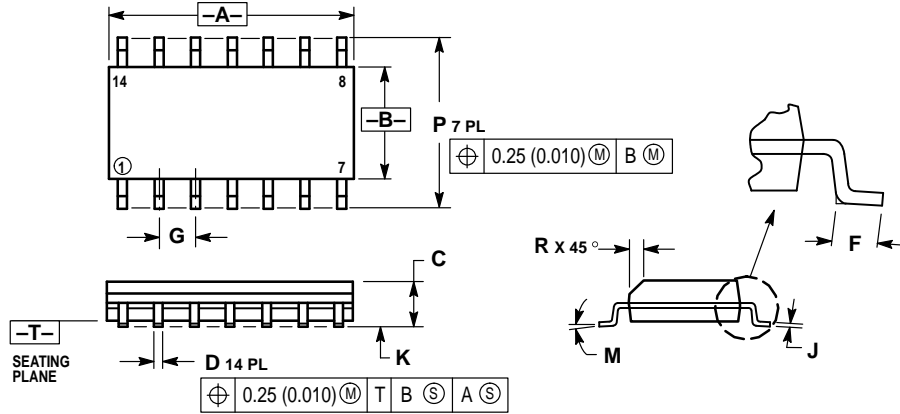
**NOTES:**

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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