

## Triple Serial Adders

The MC14032B and MC14038B triple serial adders have the clock and carry reset inputs common to all three adders. The carry is added on the positive-going clock transition for the MC14032B, and on the negative-going clock transition for the MC14038B. Typical applications include serial arithmetic units, digital correlators, digital servo control systems, datalink computers, and flight control computers.

- Buffered Outputs
- Single-Phase Clocking
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range.
- Pin-for-Pin Replacement for CD4032B and CD4038B.

### 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:

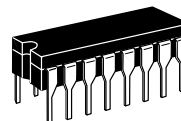
Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

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

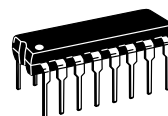
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>in</sub> and V<sub>out</sub> should be constrained to the range V<sub>SS</sub> ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>DD</sub>.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V<sub>SS</sub> or V<sub>DD</sub>). Unused outputs must be left open.

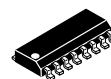
## MC14032B MC14038B



**L SUFFIX**  
CERAMIC  
CASE 620



**P SUFFIX**  
PLASTIC  
CASE 648



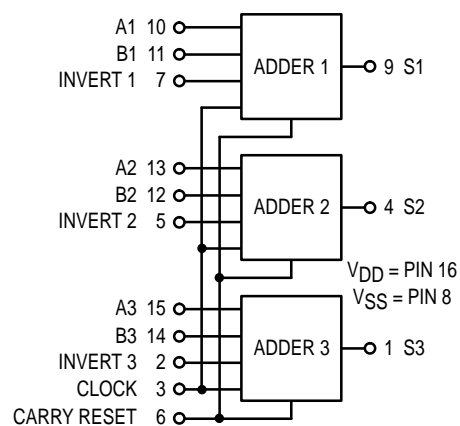
**D SUFFIX**  
SOIC  
CASE 751B

### ORDERING INFORMATION

MC14XXXBCP Plastic  
MC14XXXBCL Ceramic  
MC14XXXBD SOIC

T<sub>A</sub> = - 55° to 125°C for all packages.

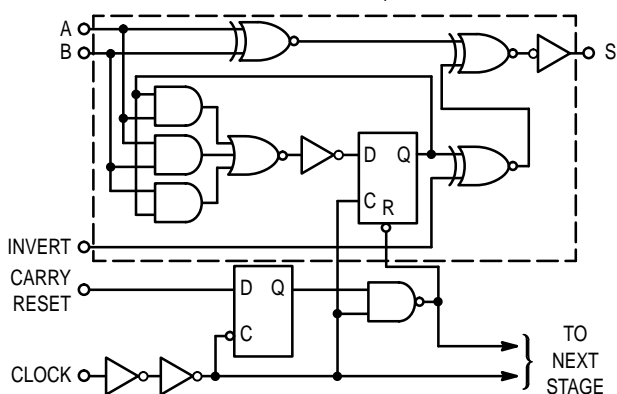
### BLOCK DIAGRAM



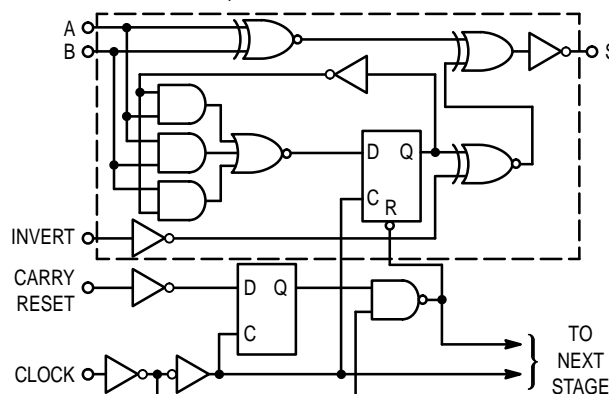
### LOGIC DIAGRAMS

(ONE SECTION AND COMMON INPUTS SHOWN)

#### MC14032B



#### MC14038B



**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 #	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 "0" Level (V <sub>O</sub> = 4.5 or 0.5 Vdc) (V <sub>O</sub> = 9.0 or 1.0 Vdc) (V <sub>O</sub> = 13.5 or 1.5 Vdc)  "1" Level (V <sub>O</sub> = 0.5 or 4.5 Vdc) (V <sub>O</sub> = 1.0 or 9.0 Vdc) (V <sub>O</sub> = 1.5 or 13.5 Vdc)	V <sub>IL</sub>	5.0	—	1.5	—	2.25	1.5	—	1.5	Vdc
		10	—	3.0	—	4.50	3.0	—	3.0	
		15	—	4.0	—	6.75	4.0	—	4.0	
	V <sub>IH</sub>	5.0	3.5	—	3.5	2.75	—	3.5	—	Vdc
		10	7.0	—	7.0	5.50	—	7.0	—	
		15	11	—	11	8.25	—	11	—	
Output Drive Current Source (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)  Sink (V <sub>OL</sub> = 0.4 Vdc) (V <sub>OL</sub> = 0.5 Vdc) (V <sub>OL</sub> = 1.5 Vdc)	I <sub>OH</sub>	5.0	- 3.0	—	- 2.4	- 4.2	—	- 1.7	—	mA <sub>dc</sub>
		5.0	- 0.64	—	- 0.51	- 0.88	—	- 0.36	—	
		10	- 1.6	—	- 1.3	- 2.25	—	- 0.9	—	
		15	- 4.2	—	- 3.4	- 8.8	—	- 2.4	—	
	I <sub>OL</sub>	5.0	0.64	—	0.51	0.88	—	0.36	—	mA <sub>dc</sub>
		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	μA <sub>dc</sub>
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	—	5.0	—	0.005	5.0	—	150	μA <sub>dc</sub>
		10	—	10	—	0.010	10	—	300	
		15	—	20	—	0.015	20	—	600	
Total Supply Current**† (Dynamic plus Quiescent, Per Package) (C <sub>L</sub> = 50 pF on all outputs, all buffers switching)	I <sub>T</sub>	5.0	I <sub>T</sub> = (0.96 μA/kHz) f + I <sub>DD</sub>							μA <sub>dc</sub>
10	I <sub>T</sub> = (1.93 μA/kHz) f + I <sub>DD</sub>									
15	I <sub>T</sub> = (2.80 μA/kHz) f + I <sub>DD</sub>									

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

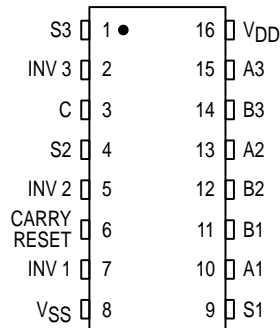
\*\*The formulas given are for the typical characteristics only at 25°C.

†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<sub>T</sub> is in μA (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 = 0.003.

**PIN ASSIGNMENT**



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

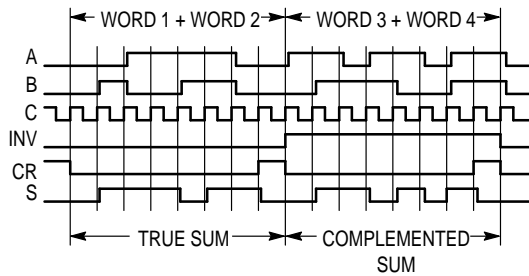
Characteristic	Symbol	V <sub>DD</sub> Vdc	Min	Typ #	Max	Unit
Output Rise and Fall Time $t_{TLH}$ , $t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}$ , $t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}$ , $t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$	$t_{TLH}$ , $t_{THL}$	5.0 10 15	— — —	100 50 40	200 100 80	ns
Propagation Delay Time A, B or Invert to Sum $t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 195 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 87 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$	$t_{PLH}$ , $t_{PHL}$	5.0 10 15	— — —	280 120 90	1400 300 230	ns
Clock to Sum $t_{PLH}$ , $t_{PHL} = (1.7 \text{ ns/pF}) C_L + 415 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.66 \text{ ns/pF}) C_L + 147 \text{ ns}$ $t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 110 \text{ ns}$		5.0 10 15	— — —	500 180 135	2400 600 450	ns
Input Setup Time	$t_{su}$	5.0 10 15	10 10 10	-10 0 0	— — —	ns
Clock Pulse Frequency	$f_{cl}$	5.0 10 15	— — —	4.0 10 12	1.0 2.5 4.0	MHz
Clock Rise and Fall Times	$t_{THL}$ , $t_{TLH}$	5.0 10 15	— — —	— — —	15 5 4	$\mu\text{s}$

\* 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.

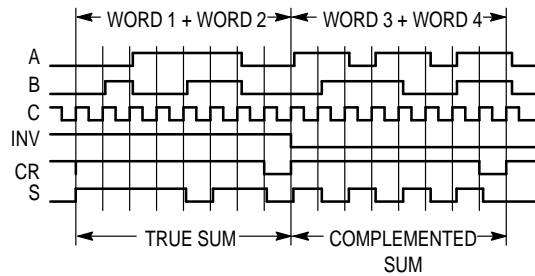
**TIMING DIAGRAMS**

**MC14032B**



WORD 1:  $0.0111100 = +60$       WORD 3:  $1.1011011 = -37$   
 WORD 2:  $0.0110010 = +50$       WORD 4:  $1.1001110 = -50$   
            $0.1101110 = +110$              $1.0101001 = -87$

**MC14038B**



WORD 1:  $1.1000011 = -61$       WORD 3:  $0.0100100 = +36$   
 WORD 2:  $1.1001101 = -51$       WORD 4:  $0.0110001 = +49$   
            $1.0010000 = -112$              $0.1010101 = +85$

NOTE: Unused input pins must be connected to either V<sub>DD</sub> or V<sub>SS</sub>.

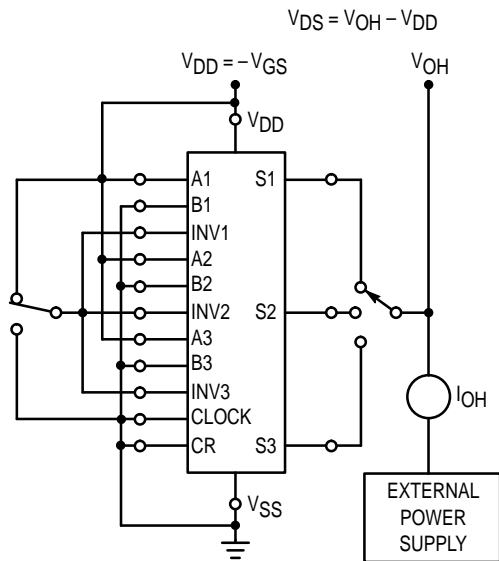


Figure 1. Typical Output Source Test Circuit

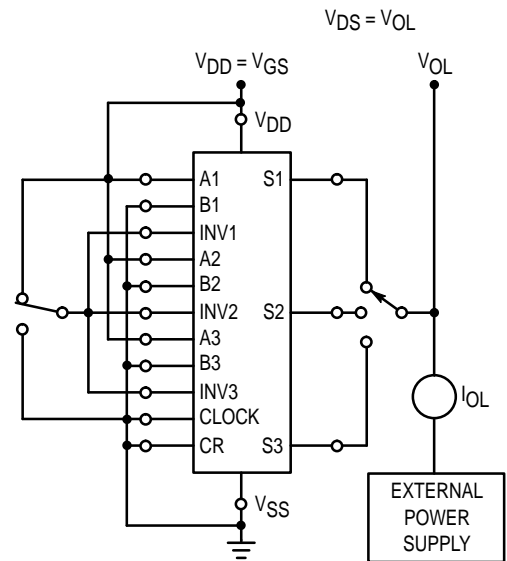


Figure 2. Typical Output Sink Test Circuit

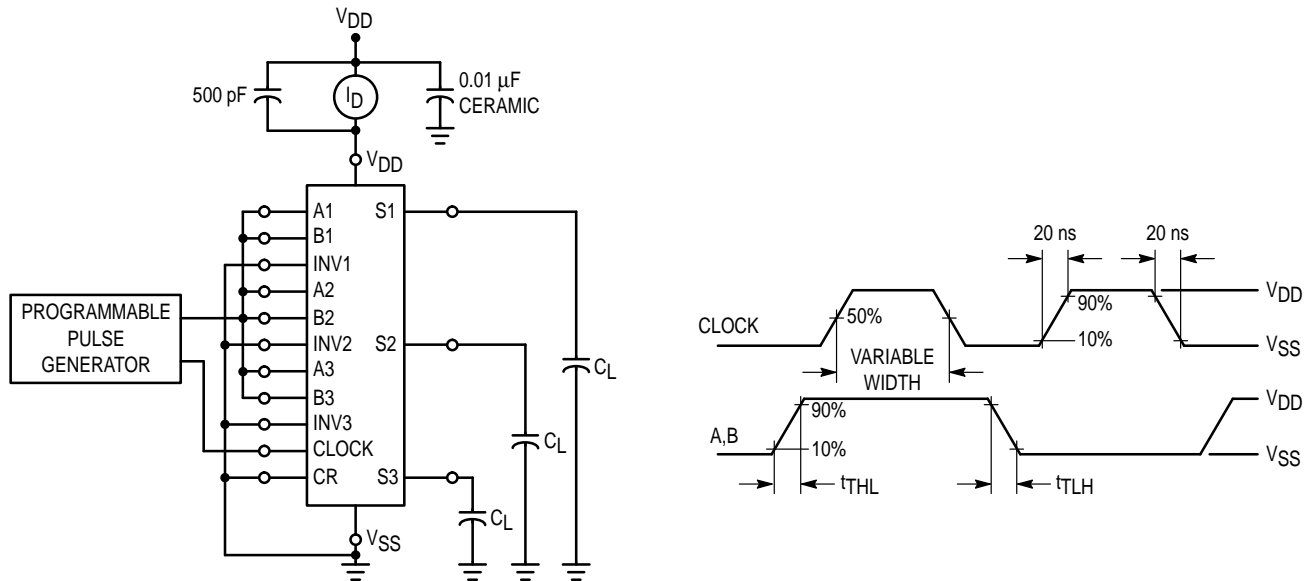
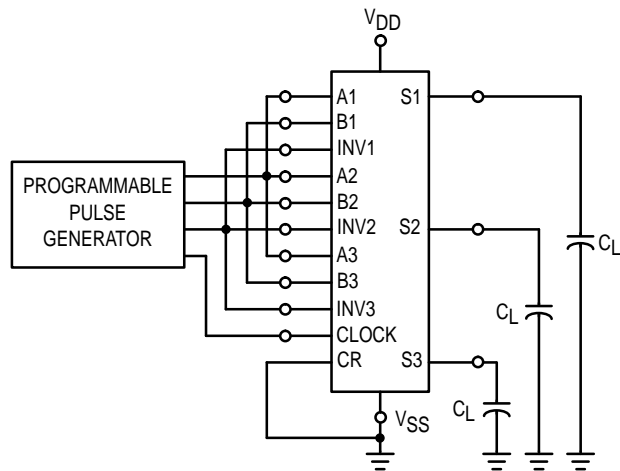
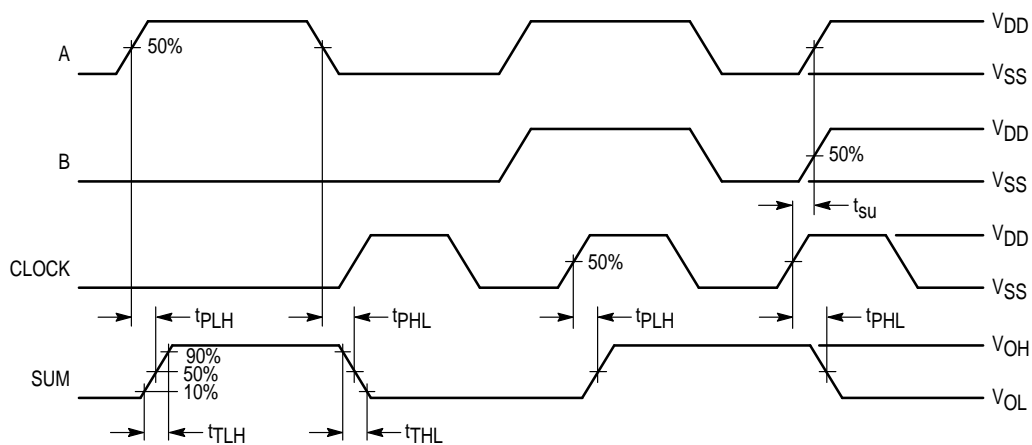


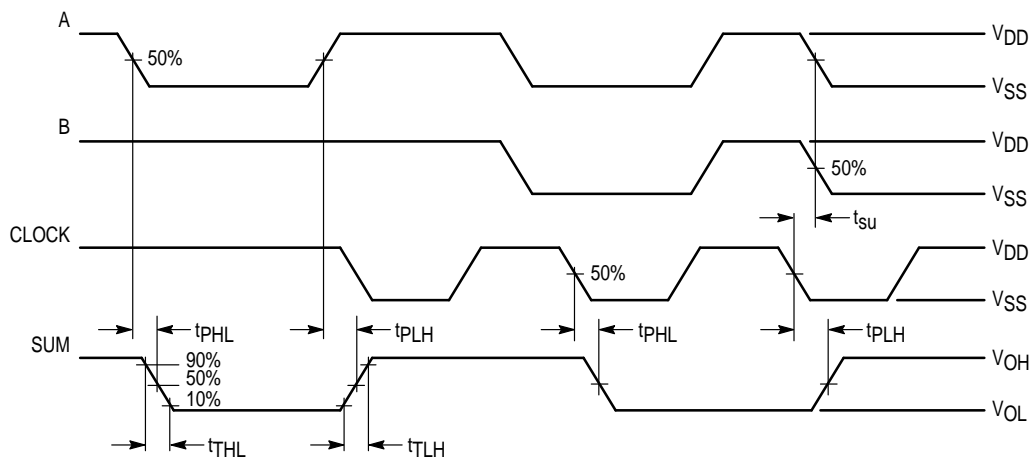
Figure 3. Power Dissipation Test Circuit and Waveforms



**MC14032B**



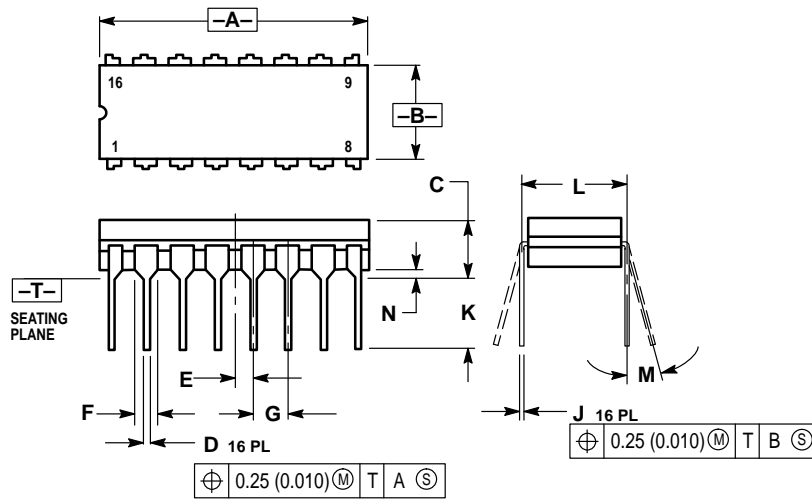
**MC14038B**



**Figure 4. Switching Time Test Circuit and Waveforms**

## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 620-10 ISSUE V

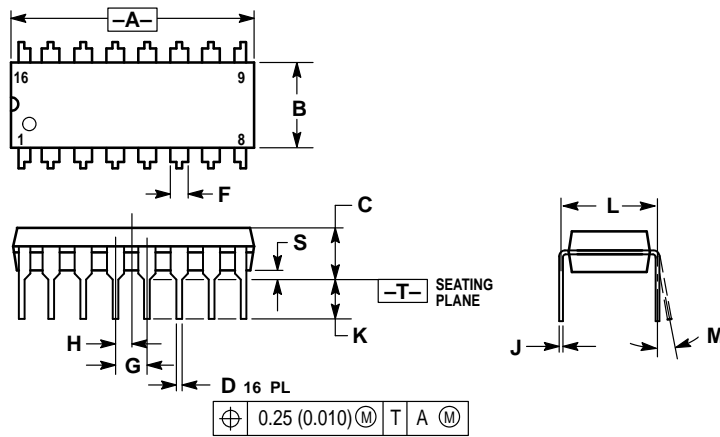


**NOTES:**

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
<b>A</b>	0.750	0.785	19.05	19.93
<b>B</b>	0.240	0.295	6.10	7.49
<b>C</b>	—	0.200	—	5.08
<b>D</b>	0.015	0.020	0.39	0.50
<b>E</b>	0.050 BSC		1.27 BSC	
<b>F</b>	0.055	0.065	1.40	1.65
<b>G</b>	0.100 BSC		2.54 BSC	
<b>H</b>	0.008	0.015	0.21	0.38
<b>K</b>	0.125	0.170	3.18	4.31
<b>L</b>	0.300 BSC		7.62 BSC	
<b>M</b>	0°	15°	0°	15°
<b>N</b>	0.020	0.040	0.51	1.01

### P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R



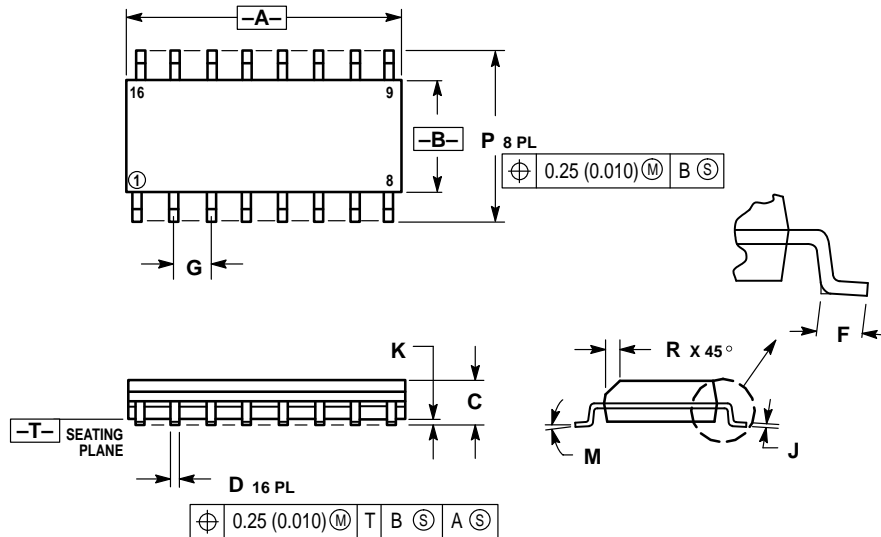
**NOTES:**

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
<b>A</b>	0.740	0.770	18.80	19.55
<b>B</b>	0.250	0.270	6.35	6.85
<b>C</b>	0.145	0.175	3.69	4.44
<b>D</b>	0.015	0.021	0.39	0.53
<b>F</b>	0.040	0.70	1.02	1.77
<b>G</b>	0.100 BSC		2.54 BSC	
<b>H</b>	0.050 BSC		1.27 BSC	
<b>J</b>	0.008	0.015	0.21	0.38
<b>K</b>	0.110	0.130	2.80	3.30
<b>L</b>	0.295	0.305	7.50	7.74
<b>M</b>	0°	10°	0°	10°
<b>S</b>	0.020	0.040	0.51	1.01

## OUTLINE DIMENSIONS


### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



**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	9.80	10.00	0.386	0.393
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	0.229	0.244
R	0.25	0.50	0.010	0.019

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MC14032B/D

