

# Octal 3-State Noninverting Buffer/Line Driver/ Line Receiver

## High-Performance Silicon-Gate CMOS

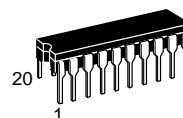
The MC54/74HC241A is identical in pinout to the LS241. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This octal noninverting buffer/line driver/line receiver is designed to be used with 3-state memory address drivers, clock drivers, and other sub-oriented systems. The device has noninverted outputs and two output enables. Enable A is active-low and Enable B is active-high.

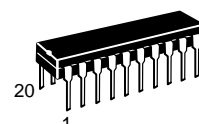
The HC241A is similar in function to the HC244A and HC240A.

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 134 FETs or 33.5 Equivalent Gates

## MC54/74HC241A



**J SUFFIX**  
CERAMIC PACKAGE  
CASE 732-03



**N SUFFIX**  
PLASTIC PACKAGE  
CASE 738-03

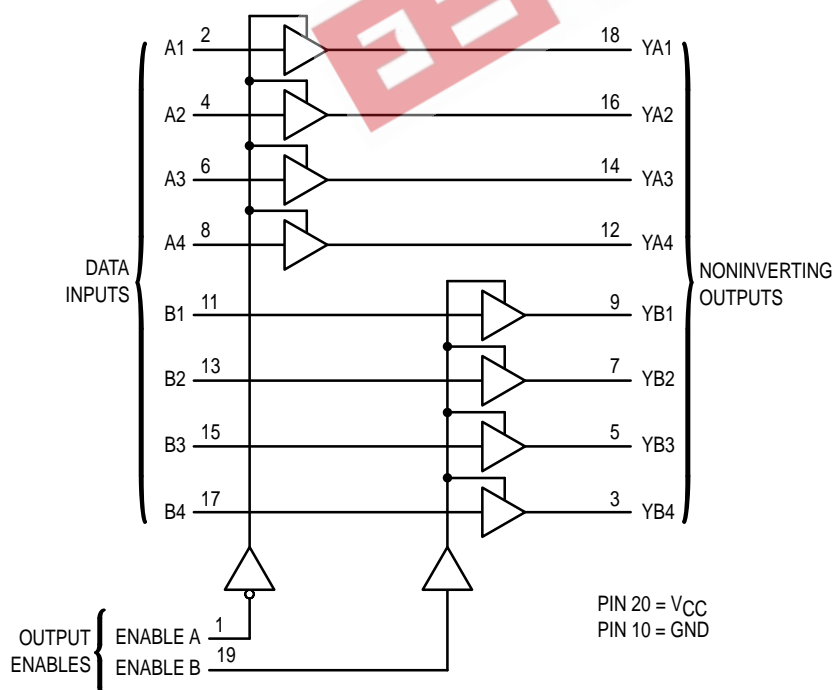


**DW SUFFIX**  
SOIC PACKAGE  
CASE 751D-04

### ORDERING INFORMATION

MC54HCXXXAJ	Ceramic
MC74HCXXXAN	Plastic
MC74HCXXXADW	SOIC

### LOGIC DIAGRAM



### PIN ASSIGNMENT

ENABLE A	1	20	V <sub>CC</sub>
A1	2	19	ENABLE B
YB4	3	18	YA1
A2	4	17	B4
YB3	5	16	YA2
A3	6	15	B3
YB2	7	14	YA3
A4	8	13	B2
YB1	9	12	YA4
GND	10	11	B1

### FUNCTION TABLE

Inputs		Output	Inputs		Output
Enable A	A	YA	Enable B	B	YB
L	L	L	H	L	L
L	H	H	H	H	H
H	X	Z	L	X	Z

Z = high impedance



# MC54/74HC241A

## MAXIMUM RATINGS\*

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	– 0.5 to + 7.0	V
$V_{in}$	DC Input Voltage (Referenced to GND)	– 0.5 to $V_{CC} + 0.5$	V
$V_{out}$	DC Output Voltage (Referenced to GND)	– 0.5 to $V_{CC} + 0.5$	V
$I_{in}$	DC Input Current, per Pin	$\pm 20$	mA
$I_{out}$	DC Output Current, per Pin	$\pm 35$	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	$\pm 75$	mA
$P_D$	Power Dissipation in Still Air, Plastic or Ceramic DIP† SOIC Package†	750 500	mW
$T_{stg}$	Storage Temperature	– 65 to + 150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP or SOIC Package) (Ceramic DIP)	260 300	°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  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ .

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

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

Functional operation should be restricted to the Recommended Operating Conditions.

† Derating — Plastic DIP: – 10 mW/°C from 65° to 125°C

Ceramic DIP: – 10 mW/°C from 100° to 125°C

SOIC Package: – 7 mW/°C from 65° to 125°C

For high frequency or heavy load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage (Referenced to GND)	2.0	6.0	V
V <sub>in</sub> , V <sub>out</sub>	DC Input Voltage, Output Voltage (Referenced to GND)	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature, All Package Types	− 55	+ 125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Time (Figure 1)	V <sub>CC</sub> = 2.0 V 0 V <sub>CC</sub> = 4.5 V 0 V <sub>CC</sub> = 6.0 V 0	1000 500 400	ns

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	$V_{CC}$ V	Guaranteed Limit			Unit
				– 55 to 25°C	≤ 85°C	≤ 125°C	
$V_{IH}$	Minimum High-Level Input Voltage	$V_{out} = V_{CC} - 0.1\text{ V}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 3.0 4.5 6.0	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	1.5 2.1 3.15 4.2	V
$V_{IL}$	Maximum Low-Level Input Voltage	$V_{out} = 0.1\text{ V}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 3.0 4.5 6.0	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	0.5 0.9 1.35 1.8	V
$V_{OH}$	Minimum High-Level Output Voltage	$V_{in} = V_{IH}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	1.9 4.4 5.9	1.9 4.4 5.9	1.9 4.4 5.9	V
		$V_{in} = V_{IH}$ $ I_{out}  \leq 2.4\text{ mA}$	3.0	2.48	2.34	2.2	
		$ I_{out}  \leq 6.0\text{ mA}$	4.5	3.98	3.84	3.7	
		$ I_{out}  \leq 7.8\text{ mA}$	6.0	5.48	5.34	5.2	
$V_{OL}$	Maximum Low-Level Output Voltage	$V_{in} = V_{IL}$ $ I_{out}  \leq 20\text{ }\mu\text{A}$	2.0 4.5 6.0	0.1 0.1 0.1	0.1 0.1 0.1	0.1 0.1 0.1	V
		$V_{in} = V_{IL}$ $ I_{out}  \leq 2.4\text{ mA}$	3.0	0.26	0.33	0.4	
		$ I_{out}  \leq 6.0\text{ mA}$	4.5	0.26	0.33	0.4	
		$ I_{out}  \leq 7.8\text{ mA}$	6.0	0.26	0.33	0.4	

**DC ELECTRICAL CHARACTERISTICS** (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				– 55 to 25°C	≤ 85°C	≤ 125°C	
I <sub>in</sub>	Maximum Input Leakage Current	V <sub>in</sub> = V <sub>CC</sub> or GND	6.0	± 0.1	± 1.0	± 1.0	μA
I <sub>OZ</sub>	Maximum Three-State Leakage Current	Output in High-Impedance State V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>out</sub> = V <sub>CC</sub> or GND	6.0	± 0.5	± 5.0	± 10	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per Package)	V <sub>in</sub> = V <sub>CC</sub> or GND I <sub>out</sub> = 0 μA	6.0	4.0	40	160	μA

NOTE: Information on typical parametric values along with high frequency or heavy load considerations, can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

**AC ELECTRICAL CHARACTERISTICS** (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 3)	2.0	90	115	135	ns
		3.0	45	60	70	
		4.5	18	23	27	
		6.0	15	20	23	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Maximum Propagation Delay, Output Enable to Y (Figures 2 and 4)	2.0	120	150	180	ns
		3.0	60	70	80	
		4.5	24	30	36	
		6.0	20	26	31	
t <sub>PZL</sub> , t <sub>PZH</sub>	Maximum Propagation Delay, Output Enable to Y (Figures 2 and 4)	2.0	90	115	135	ns
		3.0	60	70	80	
		4.5	18	23	27	
		6.0	15	20	23	
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 1 and 3)	2.0	60	75	90	ns
		3.0	23	27	32	
		4.5	12	15	18	
		6.0	10	13	15	
C <sub>in</sub>	Maximum Input Capacitance	—	10	10	10	pF
C <sub>out</sub>	Maximum Three-State Output Capacitance (Output in High-Impedance State)	—	15	15	15	pF

NOTE: For propagation delays with loads other than 50 pF, and information on typical parametric values, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

C <sub>PD</sub>	Power Dissipation Capacitance (Per Transceiver Channel)*	Typical @ 25°C, V <sub>CC</sub> = 5.0 V	pF
		34	

\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ . For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

## SWITCHING WAVEFORMS

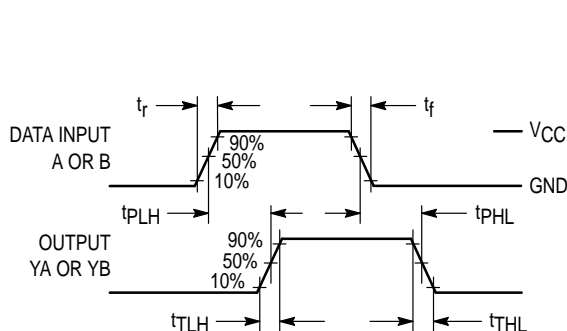


Figure 1.

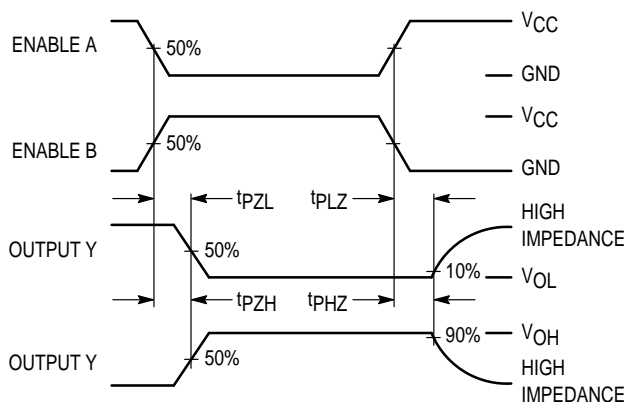
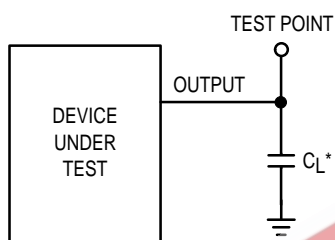
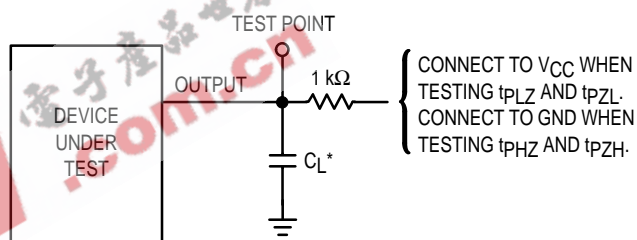


Figure 2.



\* Includes all probe and jig capacitance

Figure 3. Test Circuit



\* Includes all probe and jig capacitance

Figure 4. Test Circuit

## PIN DESCRIPTIONS

## INPUTS

**A1, A2, A3, A4, B1, B2, B3, B4**  
(Pins 2, 4, 6, 8, 11, 13, 15, 17)

Data input pins. Data on these pins appear in noninverted form on the corresponding Y outputs when the outputs are enabled.

## CONTROLS

## Enable A (Pin 1)

Output enable (active-low). When a low level is applied to this pin, the outputs of the "A" devices are enabled and the devices function as noninverting buffers. When a high level is applied, the outputs assume the high-impedance state.

## Enable 8 (Pin 19)

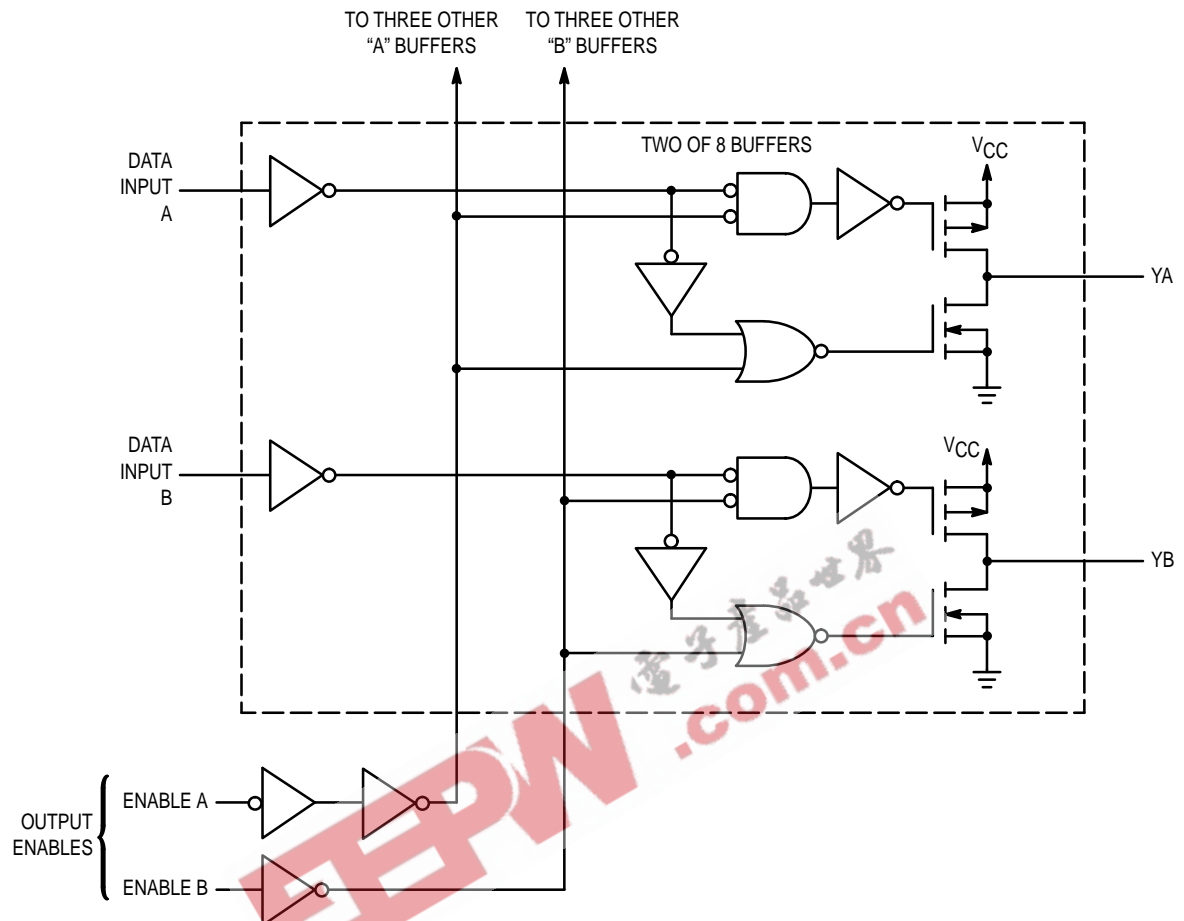
Output enable (active-high). When a high level is applied to this pin, the outputs of the "B" devices are enabled and the devices function as noninverting buffers. When a low level is applied, the outputs assume the high-impedance state.

## OUTPUTS

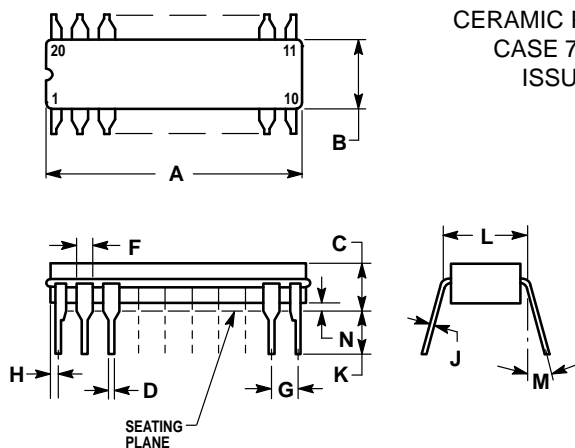
**YA1, YA2, YA3, YA4, YB1, YB2, YB3, YB4**  
(Pins 18, 16, 14, 12, 9, 7, 5, 3)

Device outputs. Depending upon the state of the output-enable pins, these outputs are either noninverting outputs or high-impedance outputs.

## LOGIC DETAIL



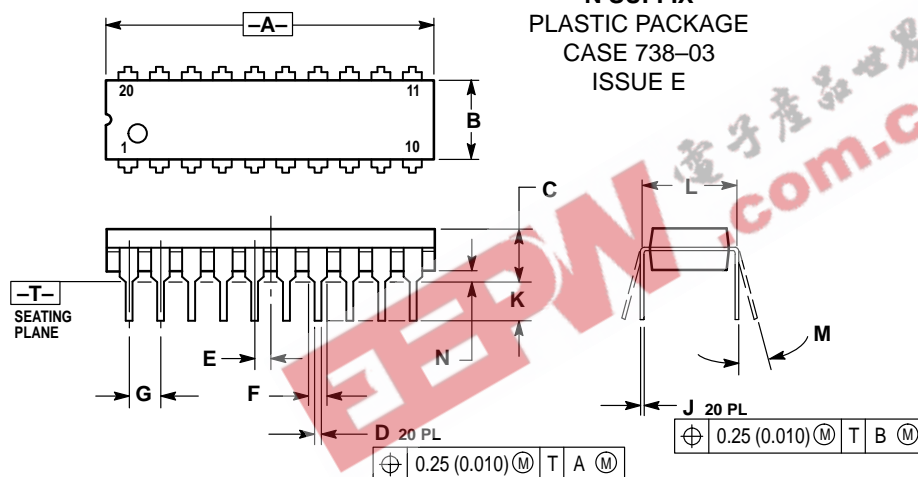
## OUTLINE DIMENSIONS

**J SUFFIX**  
 CERAMIC PACKAGE  
 CASE 732-03  
 ISSUE E


## NOTES:

- LEADS WITHIN 0.25 (0.010) DIAMETER, TRUE POSITION AT SEATING PLANE, AT MAXIMUM MATERIAL CONDITION.
- DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
- DIMENSIONS A AND B INCLUDE MENISCUS.

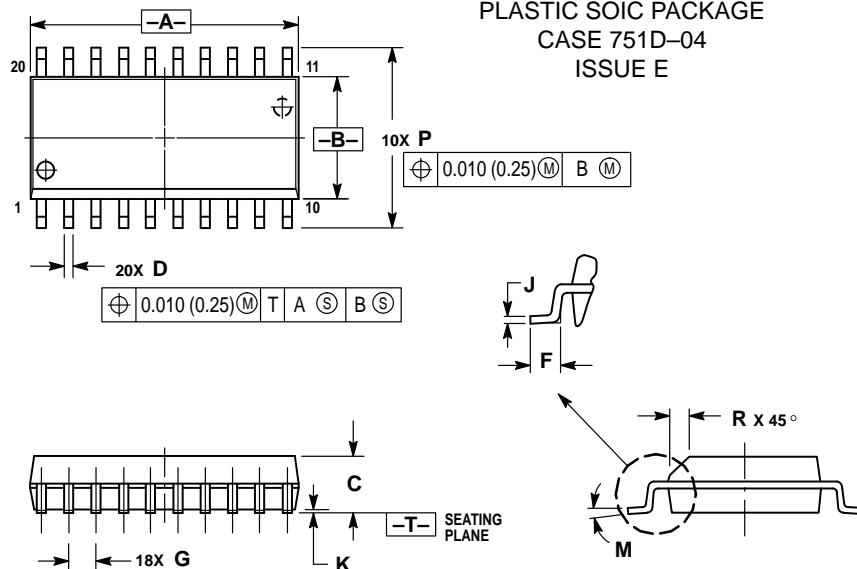
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	23.88	25.15	0.940	0.990
B	6.60	7.49	0.260	0.295
C	3.81	5.08	0.150	0.200
D	0.38	0.56	0.015	0.022
F	1.40	1.65	0.055	0.065
G	2.54 BSC		0.100 BSC	
H	0.51	1.27	0.020	0.050
J	0.20	0.30	0.008	0.012
K	3.18	4.06	0.125	0.160
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.25	1.02	0.010	0.040

**N SUFFIX**  
 PLASTIC PACKAGE  
 CASE 738-03  
 ISSUE E


## NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: INCH.
- DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
- DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.010	1.070	25.66	27.17
B	0.240	0.260	6.10	6.60
C	0.150	0.180	3.81	4.57
D	0.015	0.022	0.39	0.55
E	0.050 BSC		1.27 BSC	
F	0.050	0.070	1.27	1.77
G	0.100 BSC		2.54 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.140	2.80	3.55
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01


**DW SUFFIX**  
 PLASTIC SOIC PACKAGE  
 CASE 751D-04  
 ISSUE E


## NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.150 (0.006) PER SIDE.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	12.65	12.95	0.499	0.510
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

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