

1-of-16 Decoder/Demultiplexer High-Performance Silicon-Gate CMOS

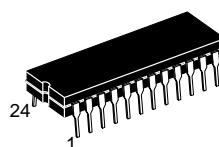
The MC54/74HC154 is identical in pinout to the LS154. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

This device, when enabled, selects one of 16 active-low outputs. Two active-low Chip Selects are provided to facilitate the chip-select, demultiplexing, and cascading functions. When either Chip Select is high, all outputs are high. The demultiplexing function is accomplished by using the Address inputs to select the desired device output. Then, while holding one chip select input low, data can be applied to the other chip select input (see Application Note).

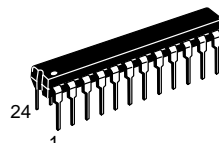
The HC154 is primarily used for memory address decoding and data routing applications.

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2 to 6 V
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7A
- Chip Complexity: 192 FETs or 48 Equivalent Gates

MC54/74HC154



J SUFFIX
CERAMIC PACKAGE
CASE 758-02



N SUFFIX
PLASTIC PACKAGE
CASE 724-03

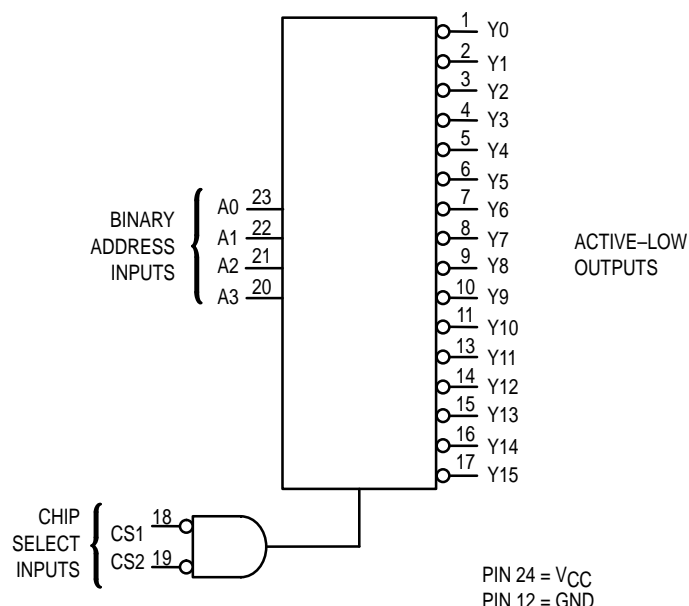


DW SUFFIX
SOIC PACKAGE
CASE 751E-04

ORDERING INFORMATION

MC54HCXXXJ	Ceramic
MC74HCXXXN	Plastic
MC74HCXXXDW	SOIC

LOGIC DIAGRAM



PIN ASSIGNMENT

Y0	1	24	V _{CC}
Y1	2	23	A0
Y2	3	22	A1
Y3	4	21	A2
Y4	5	20	A3
Y5	6	19	CS2
Y6	7	18	CS1
Y7	8	17	Y15
Y8	9	16	Y14
Y9	10	15	Y13
Y10	11	14	Y12
GND	12	13	Y11



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)	– 1.5 to $V_{CC} + 1.5$	V
V_{out}	DC Output Voltage (Referenced to GND)	– 0.5 to $V_{CC} + 0.5$	V
I_{in}	DC Input Current, per Pin	± 20	mA
I_{out}	DC Output Current, per Pin	± 25	mA
I_{CC}	DC Supply Current, V_{CC} and GND Pins	± 50	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) (Ceramic DIP or SOIC Package)	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 _{CC}	DC Supply Voltage (Referenced to GND)	2.0	6.0	V	
V _{in} , V _{out}	DC Input Voltage, Output Voltage (Referenced to GND)	0	V _{CC}	V	
T _A	Operating Temperature, All Package Types	− 55	+ 125	°C	
t _r , t _f	Input Rise and Fall Time	V _{CC} = 2.0 V	0	1000	ns
	(Figure 2)	V _{CC} = 4.5 V	0	500	
		V _{CC} = 6.0 V	0	400	

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	$V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out} \leq 20 \mu\text{A}$	2.0 4.5 6.0	1.5 3.15 4.2	1.5 3.15 4.2	1.5 3.15 4.2	V
V_{IL}	Maximum Low-Level Input Voltage	$V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out} \leq 20 \mu\text{A}$	2.0 4.5 6.0	0.3 0.9 1.2	0.3 0.9 1.2	0.3 0.9 1.2	V
V_{OH}	Minimum High-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 20 \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
		$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 4.0 \text{ mA}$ $ I_{out} \leq 5.2 \text{ mA}$	4.5 6.0	3.98 5.48	3.84 5.34	3.70 5.20	
V_{OL}	Maximum Low-Level Output Voltage	$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 20 \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
		$V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 4.0 \text{ mA}$ $ I_{out} \leq 5.2 \text{ mA}$	4.5 6.0	0.26 0.26	0.33 0.33	0.40 0.40	
I_{in}	Maximum Input Leakage Current	$V_{in} = V_{CC} \text{ or GND}$	6.0	± 0.1	± 1.0	± 1.0	μA
I_{CC}	Maximum Quiescent Supply Current (per Package)	$V_{in} = V_{CC} \text{ or GND}$ $I_{out} = 0 \mu\text{A}$	6.0	8	80	160	μA

NOTE: Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

AC ELECTRICAL CHARACTERISTICS ($C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

Symbol	Parameter	V _{CC} V	Guaranteed Limit			Unit
			– 55 to 25°C	≤ 85°C	≤ 125°C	
t _{PLH} , t _{PHL}	Maximum Propagation Delay, Input A to Output Y (Figures 1 and 3)	2.0 4.5 6.0	190 38 32	240 48 41	285 57 48	ns
t _{PLH} , t _{PHL}	Maximum Propagation Delay, CS to Output Y (Figures 2 and 3)	2.0 4.5 6.0	175 35 30	220 44 37	265 53 45	ns
t _{TLH} , t _{THL}	Maximum Output Transition Time, Any Output (Figures 2 and 3)	2.0 4.5 6.0	75 15 13	95 19 16	110 22 19	ns
C _{in}	Maximum Input Capacitance	—	10	10	10	pF

NOTES:

- For propagation delays with loads other than 50 pF, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).
- Information on typical parametric values can be found in Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

C _{pD}	Power Dissipation Capacitance (Per Package)*	Typical @ 25°C, V _{CC} = 5.0 V	pF
		80	

* 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).

PIN DESCRIPTIONS**INPUTS****A0, A1, A2, A3 (Pins 23, 22, 21, 20)**

Address inputs. These inputs, when the 1-of-16 decoder is enabled, determine which of its sixteen active-low outputs is selected.

OUTPUTS**Y0 – Y15 (Pins 1 – 11, 13 – 17)**

Active-low outputs. These outputs assume a low level

when addressed and both chip-select inputs are active. These outputs remain high when not addressed or a chip-select input is high.

CONTROL INPUTS**CS1, CS2 (Pins 18, 19)**

Active-low chip-select inputs. With low levels on both of these inputs, the outputs of the decoder follow the Address inputs. A high level on either input forces all outputs high.

FUNCTION TABLE

Inputs						Outputs															
CS1	CS2	A3	A2	A1	A0	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12	Y13	Y14	Y15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = High Level, L = Low Level, X = Don't Care

SWITCHING WAVEFORMS

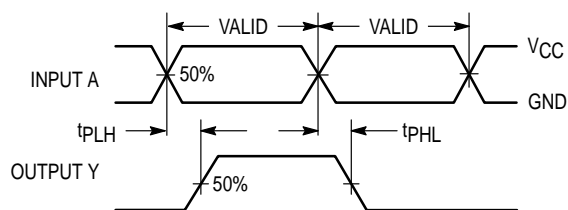


Figure 1.

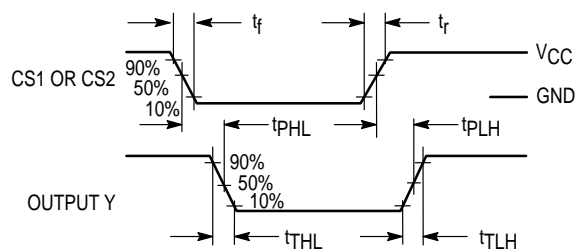
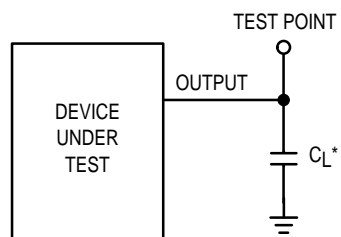


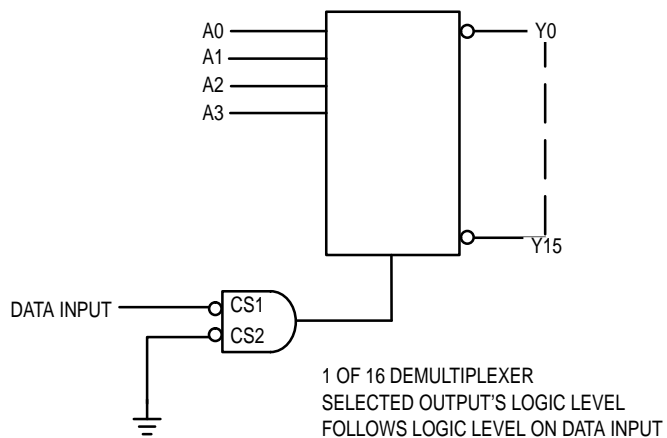
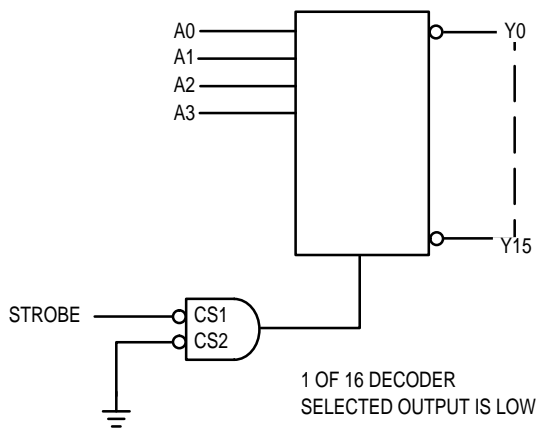
Figure 2.



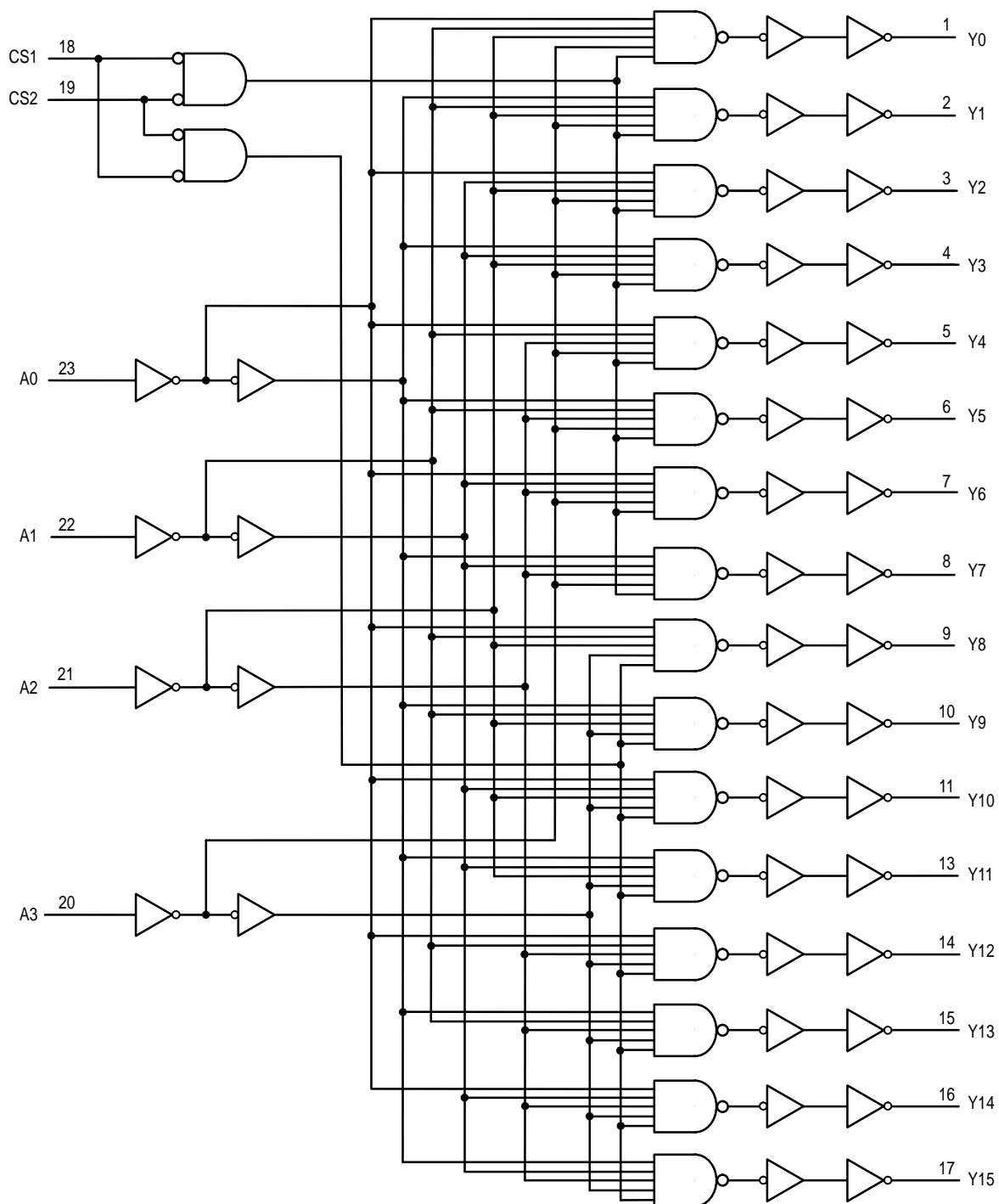
* Includes all probe and jig capacitance

Figure 3. Test Circuit

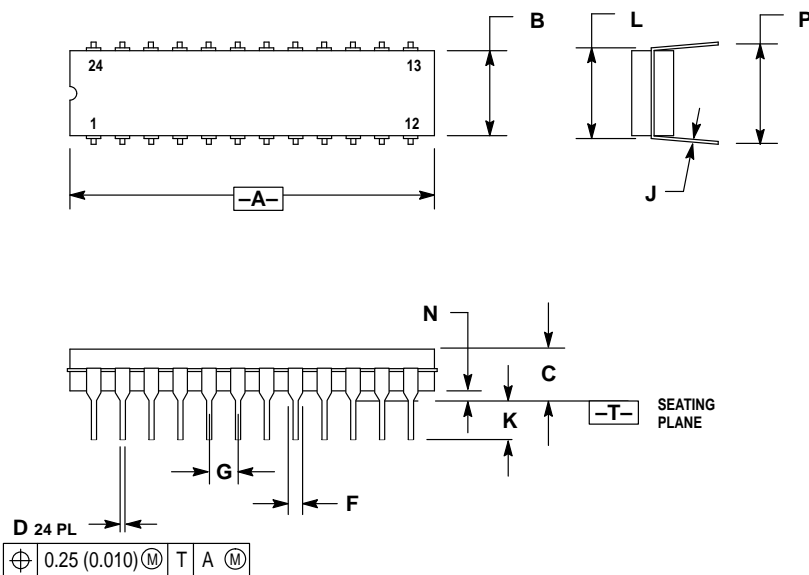
TYPICAL APPLICATIONS



EXPANDED LOGIC DIAGRAM

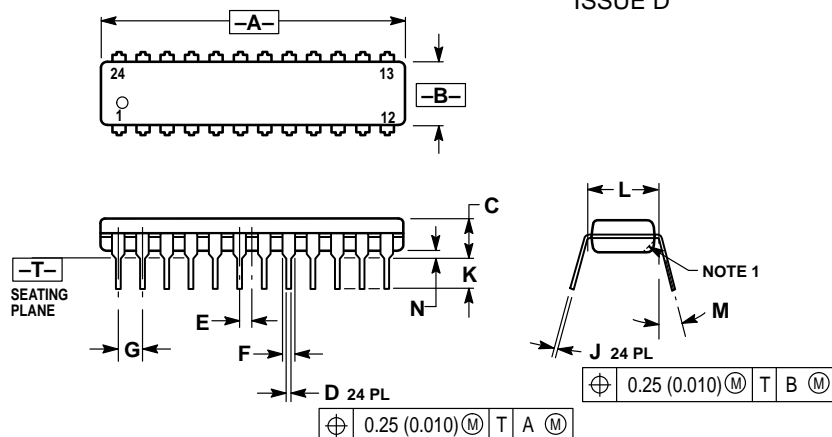


OUTLINE DIMENSIONS

J SUFFIX
 CERAMIC PACKAGE
 CASE 758-02
 ISSUE A


- NOTES:
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 4. CONTROLLING DIMENSION: INCH.
 5. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.240	1.285	31.50	32.64
B	0.285	0.305	7.24	7.75
C	0.160	0.200	4.07	5.08
D	0.015	0.021	0.38	0.53
F	0.045	0.062	1.14	1.57
G	0.100 BSC		2.54 BSC	
J	0.008	0.013	0.20	0.33
K	0.100	0.165	2.54	4.19
L	0.300	0.310	7.62	7.87
N	0.020	0.050	0.51	1.27
P	0.360	0.400	9.14	10.16

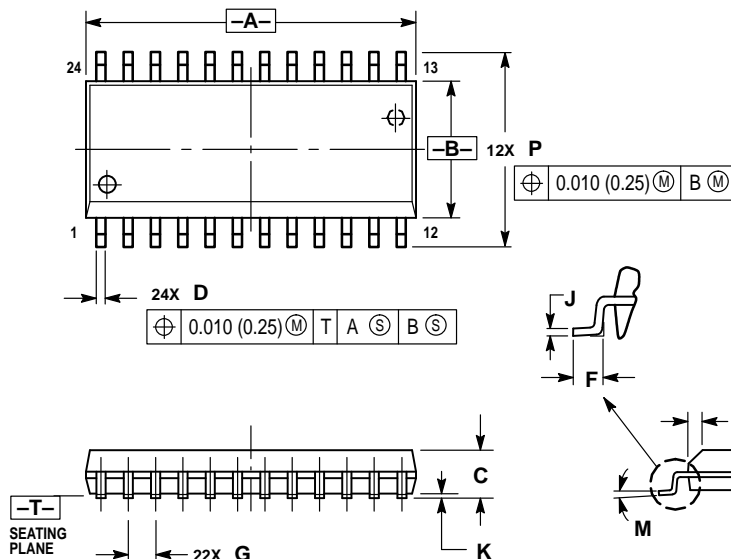
N SUFFIX
 PLASTIC PACKAGE
 CASE 724-03
 ISSUE D


- NOTES:
1. CHAMFERED CONTOUR OPTIONAL.
 2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 4. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.230	1.265	31.25	32.13
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.020	0.38	0.51
E	0.050 BSC		1.27 BSC	
F	0.040	0.060	1.02	1.52
G	0.100 BSC		2.54 BSC	
J	0.007	0.012	0.18	0.30
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

OUTLINE DIMENSIONS


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



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 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	15.25	15.54	0.601	0.612
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	0.41	0.90	0.016	0.035
G	1.27 BSC		0.050 BSC	
J	0.23	0.32	0.009	0.013
K	0.13	0.29	0.005	0.011
M	0°	8°	0°	8°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

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