

# MC74HC132A

## Quad 2-Input NAND Gate with Schmitt-Trigger Inputs

### High-Performance Silicon-Gate CMOS

The MC74HC132A is identical in pinout to the LS132. The device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs.

The HC132A can be used to enhance noise immunity or to square up slowly changing waveforms.

#### Features

- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements as Defined by JEDEC Standard No. 7A
- Chip Complexity: 72 FETs or 18 Equivalent Gates
- Pb-Free Packages are Available\*

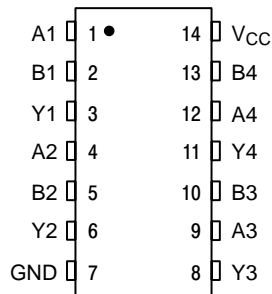


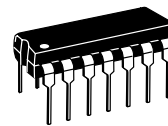
Figure 1. Pin Assignment



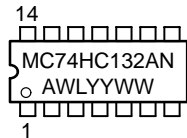
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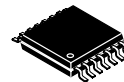
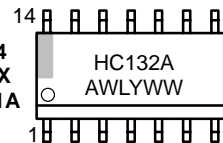
#### MARKING DIAGRAMS



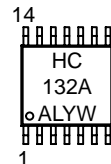
PDIP-14  
N SUFFIX  
CASE 646



SOIC-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week

#### FUNCTION TABLE

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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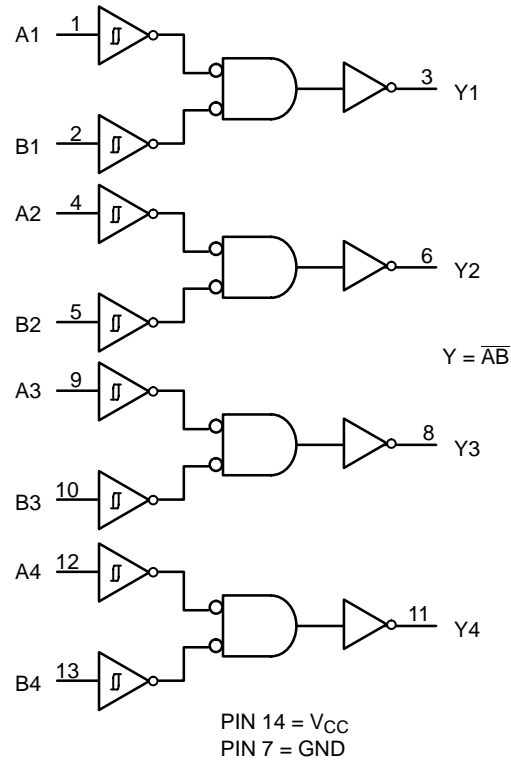


Figure 2. Logic Diagram

## ORDERING INFORMATION

Device Order Number	Package	Shipping†
MC74HC132AN	PDIP-14	2000 Units / Box
MC74HC132ANG	PDIP-14 (Pb-Free)	2000 Units / Box
MC74HC132AD	SOIC-14	55 Units / Rail
MC74HC132ADG	SOIC-14 (Pb-Free)	55 Units / Rail
MC74HC132ADR2	SOIC-14	2500 Tape & Reel
MC74HC132ADR2G	SOIC-14 (Pb-Free)	2500 Tape & Reel
MC74HC132ADT	TSSOP-14*	96 Units / Rail
MC74HC132ADTR2	TSSOP-14*	2500 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

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## MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Positive DC Supply Voltage	- 0.5 to + 7.0	V
$V_{IN}$	Digital Input Voltage	- 0.5 to + 7.0	V
$V_{OUT}$	DC Output Voltage Output in 3-State High or Low State	- 0.5 to + 7.0 - 0.5 to $V_{CC}$ + 0.5	V
$I_{IK}$	Input Diode Current	- 20	mA
$I_{OK}$	Output Diode Current	± 20	mA
$I_{OUT}$	DC Output Current, per Pin	± 25	mA
$I_{CC}$	DC Supply Current, $V_{CC}$ and GND Pins	± 75	mA
$I_{GND}$	DC Ground Current per Ground Pin	± 75	mA
$T_{STG}$	Storage Temperature Range	- 65 to + 150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
$T_J$	Junction Temperature Under Bias	+ 150	°C
$\theta_{JA}$	Thermal Resistance 14-PDIP 14-SOIC 14-TSSOP	78 125 170	°C/W
$P_D$	Power Dissipation in Still Air at 85°C PDIP SOIC TSSOP	750 500 450	mW
MSL	Moisture Sensitivity	Level 1	
$F_R$	Flammability Rating Oxygen Index: 30% – 35%	UL 94 V0 @ 0.125 in	
$V_{ESD}$	ESD Withstand Voltage Human Body Model (Note 1) Machine Model (Note 2) Charged Device Model (Note 3)	> 2000 > 100 > 500	V
$I_{Latch-Up}$	Latch-Up Performance Above $V_{CC}$ and Below GND at 85°C (Note 4)	± 300	mA

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.
5. For high frequency or heavy load considerations, see Chapter 2 the ON Semiconductor 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 (Figure 3)	-	No Limit (Note 6)	ns

6. When  $V_{IN} \sim 0.5 V_{CC}$ ,  $I_{CC} \gg$  quiescent current.
7. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> V	Guaranteed Limit			Unit
				-55°C to 25°C	≤ 85°C	≤ 125°C	
V <sub>T+</sub> max	Maximum Positive-Going Input Threshold Voltage (Figure 5)	V <sub>OUT</sub> = 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	1.5	1.5	1.5	V
			4.5	3.15	3.15	3.15	
			6.0	4.2	4.2	4.2	
V <sub>T+</sub> min	Minimum Positive-Going Input Threshold Voltage (Figure 5)	V <sub>OUT</sub> = 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	1.0	0.95	0.95	V
			4.5	2.3	2.25	2.25	
			6.0	3.0	2.95	2.95	
V <sub>T-</sub> max	Maximum Negative-Going Input Threshold Voltage (Figure 5)	V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	0.9	0.95	0.95	V
			4.5	2.0	2.05	2.05	
			6.0	2.6	2.65	2.65	
V <sub>T-</sub> min	Minimum Negative-Going Input Threshold Voltage (Figure 5)	V <sub>OUT</sub> = V <sub>CC</sub> - 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	0.3	0.3	0.3	V
			4.5	0.9	0.9	0.9	
			6.0	1.2	1.2	1.2	
V <sub>H</sub> max (Note 8)	Maximum Hysteresis Voltage (Figure 5)	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	1.2	1.2	1.2	V
			4.5	2.25	2.25	2.25	
			6.0	3.0	3.0	3.0	
V <sub>H</sub> min (Note 8)	Minimum Hysteresis Voltage (Figure 5)	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V  I <sub>OUT</sub>   ≤ 20 μA	2.0	0.2	0.2	0.2	V
			4.5	0.4	0.4	0.4	
			6.0	0.5	0.5	0.5	
V <sub>OH</sub>	Minimum High-Level Output Voltage	V <sub>IN</sub> ≤ V <sub>T-</sub> min or V <sub>T+</sub> max  I <sub>OUT</sub>   ≤ 20 μA	2.0	1.9	1.9	1.9	V
			4.5	4.4	4.4	4.4	
		V <sub>IN</sub> ≤ -V <sub>T-</sub> min or V <sub>T+</sub> max  I <sub>OUT</sub>   ≤ 4.0 mA  I <sub>OUT</sub>   ≤ 5.2 mA	4.5	3.98	3.84	3.7	V
			6.0	5.48	5.34	5.2	
V <sub>OL</sub>	Maximum Low-Level Output Voltage	V <sub>IN</sub> ≥ V <sub>T+</sub> max  I <sub>OUT</sub>   ≤ 20 μA	2.0	0.1	0.1	0.1	V
			4.5	0.1	0.1	0.1	
		V <sub>IN</sub> ≥ V <sub>T+</sub> max  I <sub>OUT</sub>   ≤ 4.0 mA  I <sub>OUT</sub>   ≤ 5.2 mA	4.5	0.26	0.33	0.4	V
			6.0	0.26	0.33	0.4	
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>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	1.0	10	40	μA

8. V<sub>H</sub>min > (V<sub>T+</sub>min) - (V<sub>T-</sub>max); V<sub>H</sub>max = (V<sub>T+</sub>max) + (V<sub>T-</sub>min).

9. Information on typical parametric values can be found in the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

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## AC ELECTRICAL CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , Input $t_r = t_f = 6.0 \text{ ns}$ )

Symbol	Parameter	V <sub>CC</sub> V	Guaranteed Limit			Unit
			-55°C to 25°C	≤ 85°C	≤ 125°C	
t <sub>PLH</sub> , t <sub>PHL</sub>	Maximum Propagation Delay, Input A or B to Output Y (Figures 3 and 4)	2.0	125	155	190	ns
		4.5	25	31	38	
		6.0	21	26	32	
t <sub>TLH</sub> , t <sub>THL</sub>	Maximum Output Transition Time, Any Output (Figures 3 and 4)	2.0	75	95	110	ns
		4.5	15	19	22	
		6.0	13	16	19	
C <sub>in</sub>	Maximum Input Capacitance	—	10	10	10	pF

10. For propagation delays with loads other than 50 pF, and information on typical parametric values, see the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

C <sub>PD</sub>	Power Dissipation Capacitance (per Gate) (Note 11)	Typical @ 25°C, V <sub>CC</sub> = 5.0 V		pF
		24		

11. 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 the ON Semiconductor High-Speed CMOS Data Book (DL129/D).

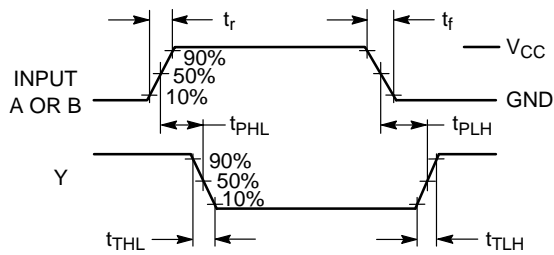
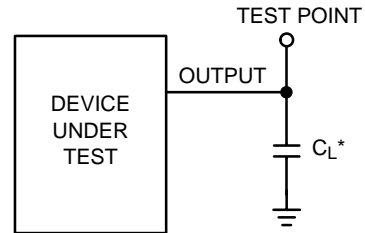


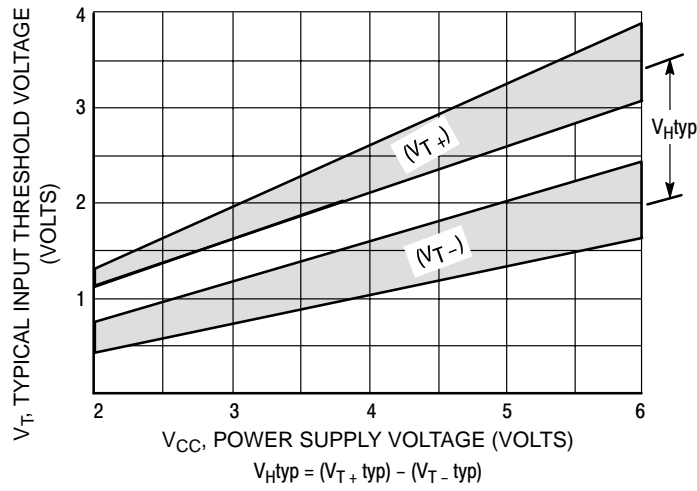
Figure 3. Switching Waveforms



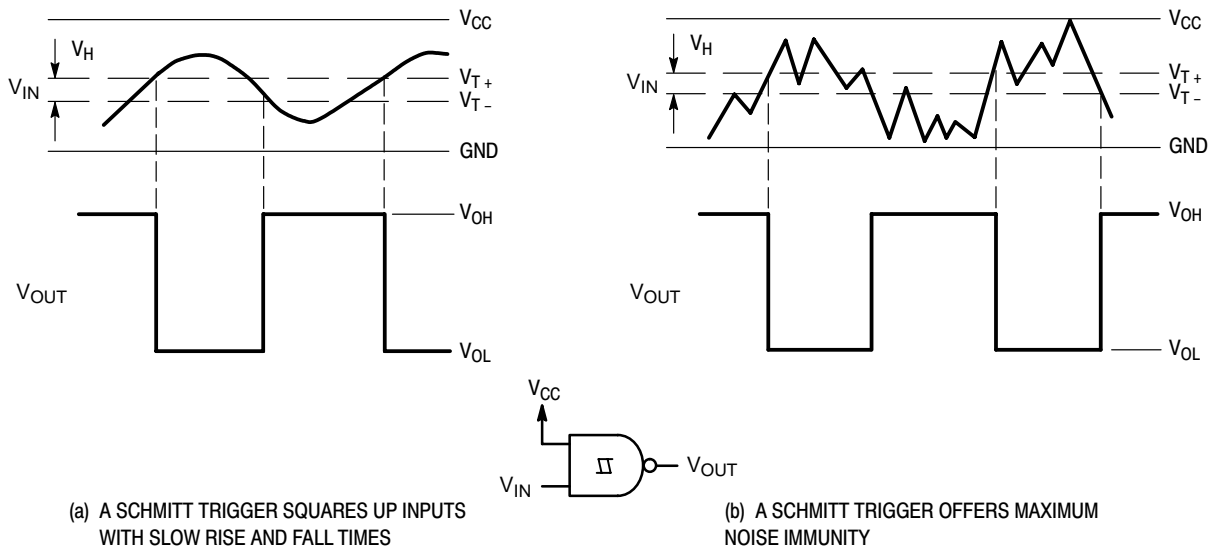
\*Includes all probe and jig capacitance

Figure 4. Test Circuit

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**Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  Versus Power Supply Voltage**

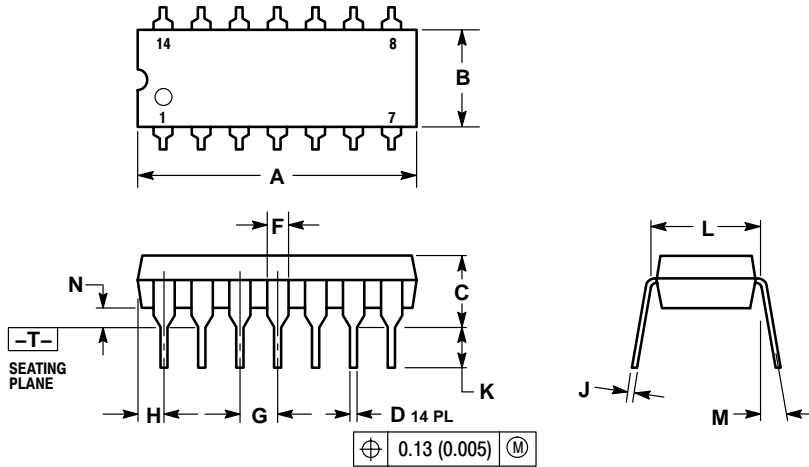


**Figure 6. Typical Schmitt-Trigger Applications**

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## PACKAGE DIMENSIONS

PDIP-14  
N SUFFIX  
CASE 646-06  
ISSUE M

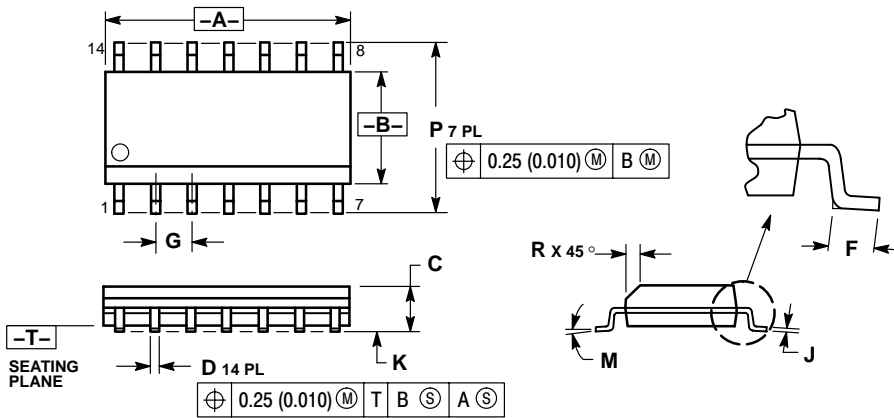


NOTES:

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
A	0.715	0.770	18.16	18.80
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	0.290	0.310	7.37	7.87
M	---	10°	---	10°
N	0.015	0.039	0.38	1.01

SOIC-14  
D SUFFIX  
CASE 751A-03  
ISSUE G



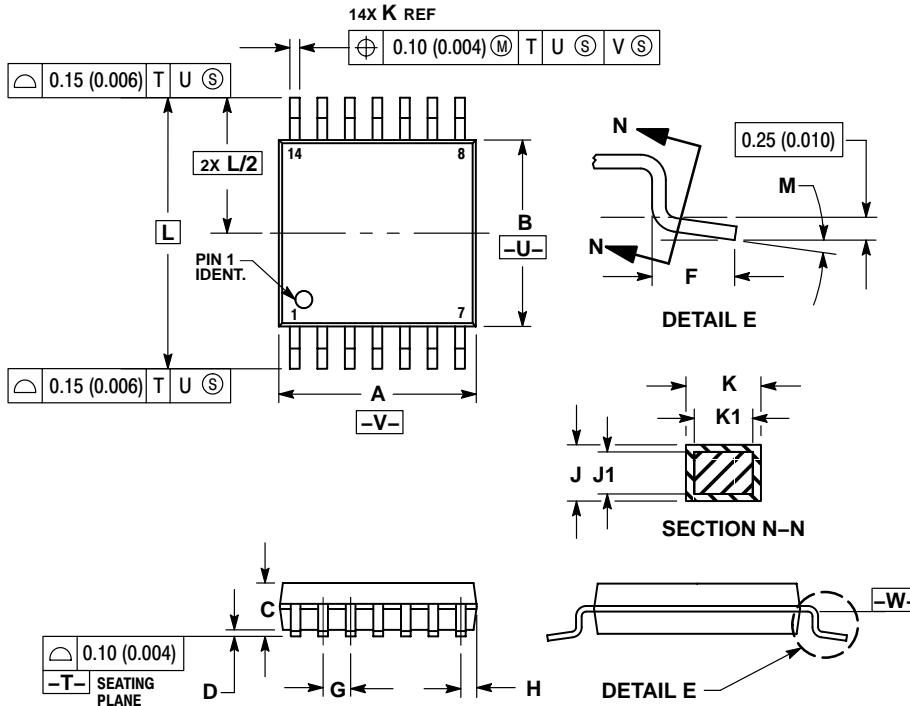
NOTES:

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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TSSOP-14  
DT SUFFIX  
CASE 948G-01  
ISSUE O



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.90	5.10	0.193	0.200
B	4.30	4.50	0.169	0.177
C	---	1.20	---	0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
H	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
M	0°	8°	0°	8°

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