

*Product Preview*

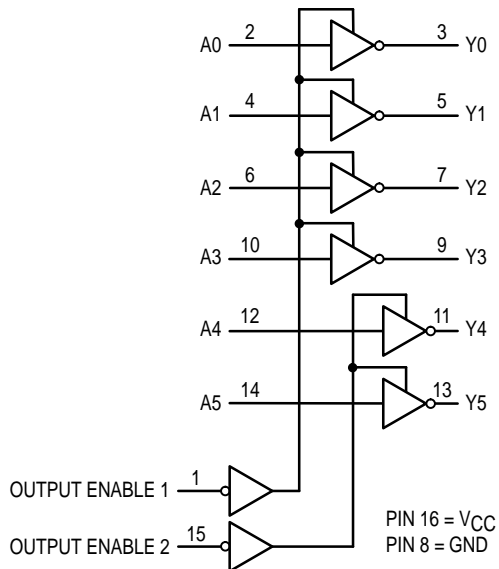
**Hex 3-State Inverting Buffer  
with Separate 2-Bit and  
4-Bit Sections**  
**High-Performance Silicon-Gate CMOS**

The MC74HC368A is identical in pinout to the LS368. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

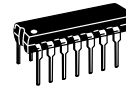
This device is arranged into 2-bit and 4-bit sections, each having its own active-low Output Enable. When either of the enables is high, the affected buffer outputs are placed into high-impedance states. The HC368A has inverting outputs.

- 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: 80 FETs or 20 Equivalent Gates

**LOGIC DIAGRAM**



**MC74HC368A**



**N SUFFIX**  
PLASTIC PACKAGE  
16-LEAD  
CASE 648-08



**D SUFFIX**  
SOIC PACKAGE  
16-LEAD  
CASE 751B-05

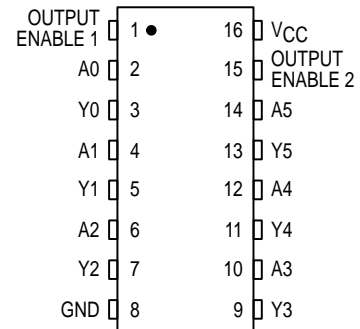


**DT SUFFIX**  
TSSOP PACKAGE  
16-LEAD  
CASE 948F-01

**ORDERING INFORMATION**

|              |         |
|--------------|---------|
| MC74HCXXXAN  | Plastic |
| MC74HCXXXAD  | SOIC    |
| MC74HCXXXADT | TSSOP   |

**PIN ASSIGNMENT**



**FUNCTION TABLE**

| Inputs                |   | Output |  |
|-----------------------|---|--------|--|
| Enable 1,<br>Enable 2 | A | Y      |  |
| L                     | L | H      |  |
| L                     | H | L      |  |
| H                     | X | Z      |  |

X = don't care  
Z = high-impedance



**MAXIMUM RATINGS\***

| Symbol           | Parameter   | Value                          | Unit |
|------------------|---|--------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage (Referenced to GND)   | - 0.5 to + 7.0                 | V    |
| V <sub>in</sub>  | DC Input Voltage (Referenced to GND)  | - 0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>out</sub> | DC Output Voltage (Referenced to GND)   | - 0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>in</sub>  | DC Input Current, per Pin   | ± 20                           | mA   |
| I <sub>out</sub> | DC Output Current, per Pin  | ± 25                           | mA   |
| I <sub>CC</sub>  | DC Supply Current, V <sub>CC</sub> and GND Pins                                       | ± 50                           | mA   |
| P <sub>D</sub>   | Power Dissipation in Still Air,<br>Plastic DIP†<br>SOIC Package†<br>TSSOP Package†    | 750<br>500<br>450              | mW   |
| T <sub>stg</sub> | Storage Temperature   | - 65 to + 150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds<br>Plastic DIP, SOIC or TSSOP Package | 260                            | °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 GND ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>CC</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). 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  
SOIC Package: - 7 mW/°C from 65° to 125°C  
TSSOP Package: - 6.1 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<br>(Figure 1)               | V <sub>CC</sub> = 2.0 V<br>V <sub>CC</sub> = 4.5 V<br>V <sub>CC</sub> = 6.0 V | 0<br>0<br>0     | 1000<br>500<br>400 | ns |

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

| Symbol          | Parameter                         | Test Conditions   | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------|-----------------------------------|---|----------------------|------------------|--------|---------|------|
|                 |                                   |   |                      | - 55 to<br>25°C  | ≤ 85°C | ≤ 125°C |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage  | V <sub>out</sub> = 0.1 V<br> 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>IL</sub> | Maximum Low-Level Input Voltage   | V <sub>out</sub> = V <sub>CC</sub> - 0.1 V<br> 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>OH</sub> | Minimum High-Level Output Voltage | V <sub>in</sub> = V <sub>IL</sub><br> 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>IL</sub><br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA | 4.5                  | 3.98             | 3.84   | 3.70    |      |
|                 |                                   |   | 6.0                  | 5.48             | 5.34   | 5.20    |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage  | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 20 μA                                  | 2.0                  | 0.1              | 0.1    | 0.1     | V    |
|                 |                                   |   | 4.5                  | 0.1              | 0.1    | 0.1     |      |
|                 |                                   |   | 6.0                  | 0.1              | 0.1    | 0.1     |      |
|                 |                                   | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA | 4.5                  | 0.26             | 0.33   | 0.40    |      |
| 6.0             | 0.26                              |   | 0.33                 | 0.40             |        |         |      |
| 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   |

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

| Symbol          | Parameter                                      | Test Conditions   | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------|--|---|----------------------|------------------|--------|---------|------|
|                 |  |   |                      | - 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| I <sub>OZ</sub> | Maximum Three-State Leakage Current            | Output in High-Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>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<br>I <sub>out</sub> = 0 μA   | 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<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Symbol                                 | Parameter   | V <sub>CC</sub><br>V | Guaranteed Limit |                 |                 | Unit |
|--|---|----------------------|------------------|-----------------|-----------------|------|
|  |   |                      | - 55 to 25°C     | ≤ 85°C          | ≤ 125°C         |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A to Output Y<br>(Figures 1 and 3)       | 2.0<br>4.5<br>6.0    | 95<br>19<br>16   | 120<br>24<br>20 | 145<br>29<br>25 | ns   |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 2 and 4) | 2.0<br>4.5<br>6.0    | 175<br>35<br>30  | 220<br>44<br>37 | 265<br>53<br>45 | ns   |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Output Y<br>(Figures 2 and 4) | 2.0<br>4.5<br>6.0    | 190<br>38<br>32  | 240<br>48<br>41 | 285<br>57<br>48 | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 3)           | 2.0<br>4.5<br>6.0    | 60<br>12<br>10   | 75<br>15<br>13  | 90<br>18<br>15  | ns   |
| 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   |

NOTES:

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

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Buffer)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |    |
|-----------------|---|---|----|
|                 |   | 40                                      | pF |

\* Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup>f + I<sub>CC</sub> V<sub>CC</sub>. For load considerations, see Chapter 2 of the Motorola High-Speed CMOS Data Book (DL129/D).

**SWITCHING WAVEFORMS**

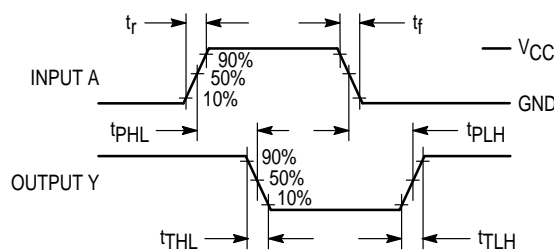


Figure 1.

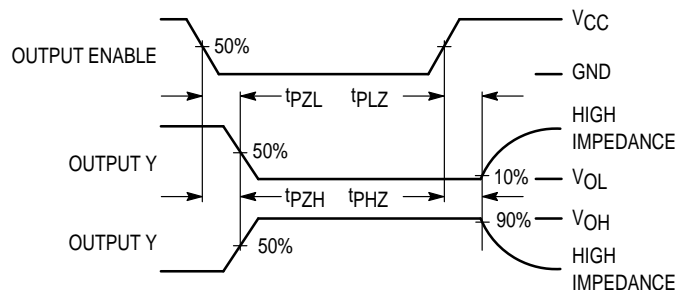
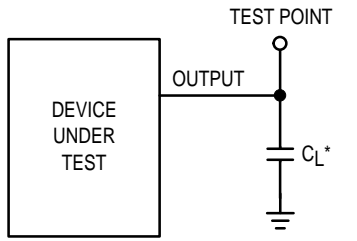


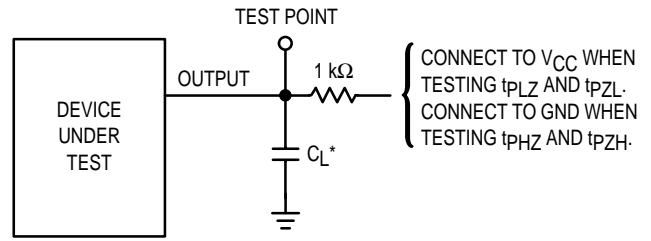
Figure 2.

TEST CIRCUITS



\* Includes all probe and jig capacitance

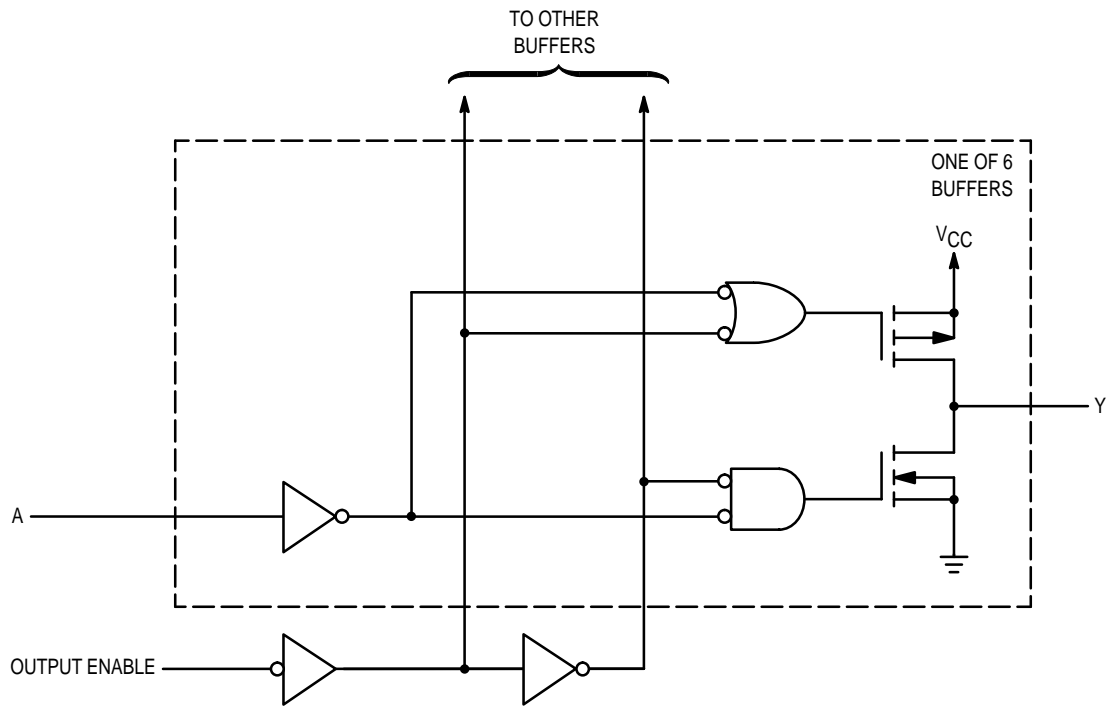
Figure 3.



\* Includes all probe and jig capacitance

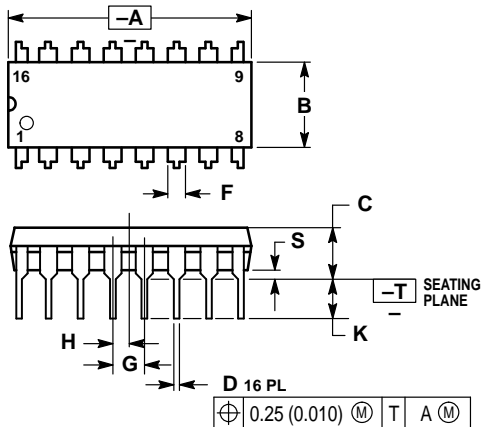
Figure 4.

LOGIC DETAIL



OUTLINE DIMENSIONS

**N SUFFIX**  
**PLASTIC PACKAGE**  
**CASE 648-08**  
**ISSUE R**

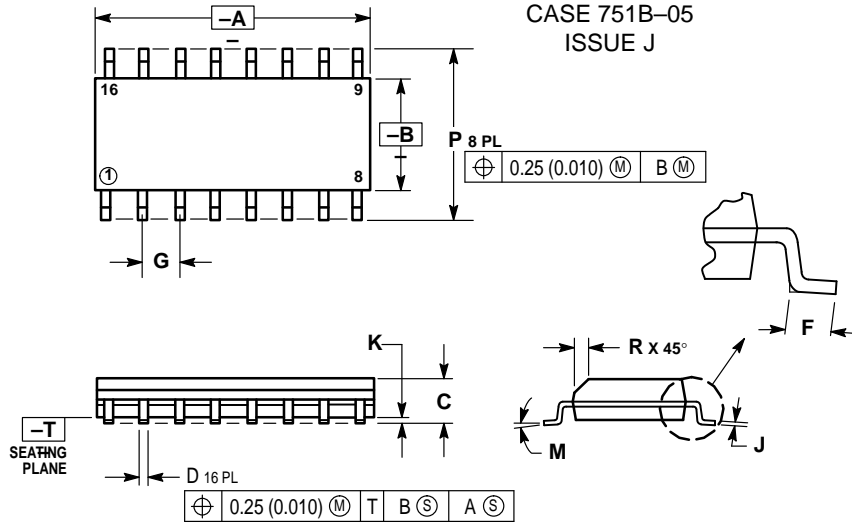


NOTES:

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   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.070 | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

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



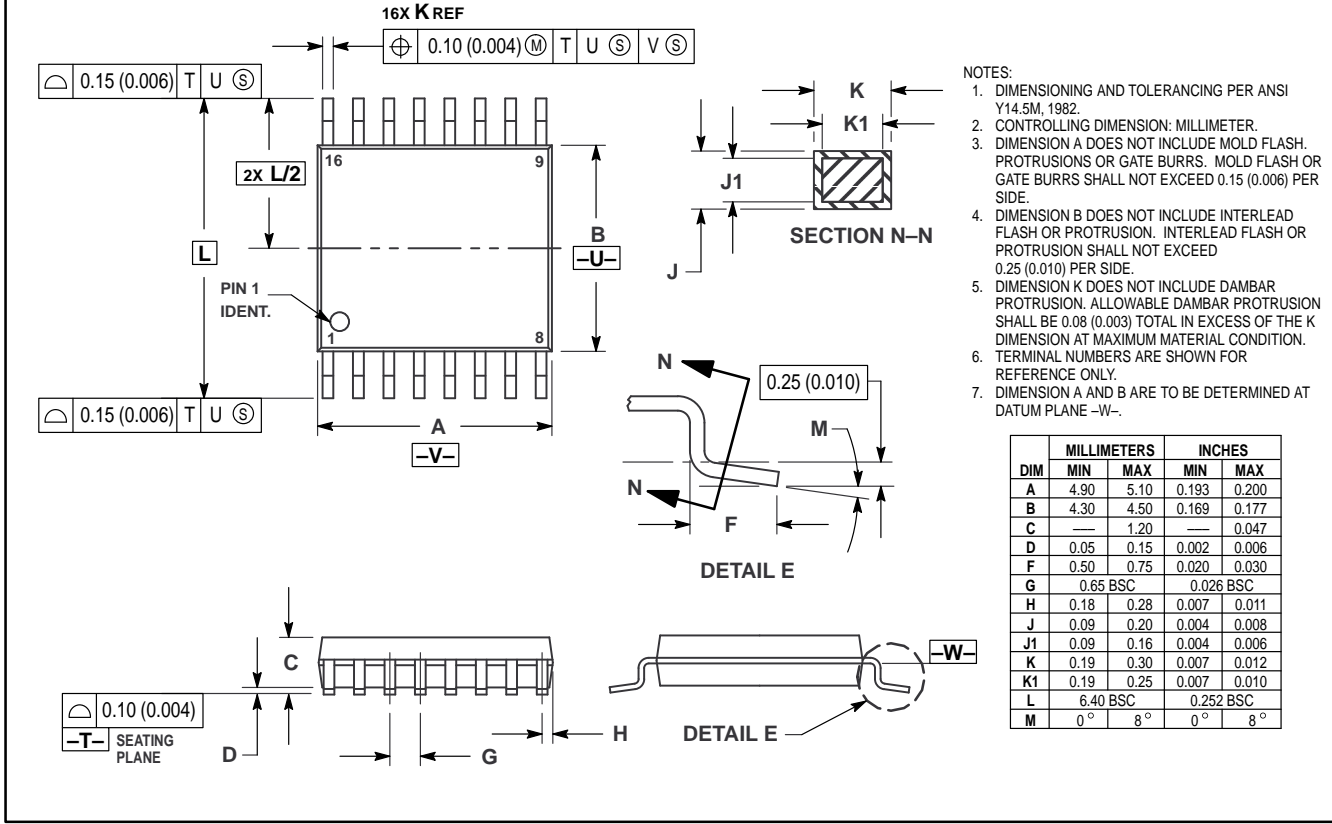
NOTES:

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 |

OUTLINE DIMENSIONS

DT SUFFIX  
 PLASTIC TSSOP PACKAGE  
 CASE 948F-01  
 ISSUE O



Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

**How to reach us:**  
**USA/EUROPE/Locations Not Listed:** Motorola Literature Distribution;  
 P.O. Box 5405; Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, 6F Seibu-Butsuryu-Center,  
 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 81-3-3521-8315

**Mfax™:** RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609  
**INTERNET:** http://Design-NET.com

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
 51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

