

# Hex Inverter

## MM74HCT04

### General Description

The MM74HCT04 is a logic function fabricated by using advanced silicon-gate CMOS technology which provides the inherent benefits of CMOS—low quiescent power and wide power supply range. This device is input and output characteristic as well as pin-out compatible with standard 74LS logic families. The MM74HCT04, triple buffered, hex inverters, features low power dissipation and fast switching times. All inputs are protected from static discharge by internal diodes to V<sub>CC</sub> and ground.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

### Features

- TTL, LS Pin-out and Threshold Compatible
- Fast Switching: t<sub>PLH</sub>, t<sub>PHL</sub> = 10 ns (typ.)
- Low Power: 10 μW at DC, 3.7 mW at 5 MHz
- High Fan Out: ≥10 LS Loads
- Inverting, Triple Buffered
- These Devices are Pb-Free, Halide Free and are RoHS Compliant

### Connection Diagram

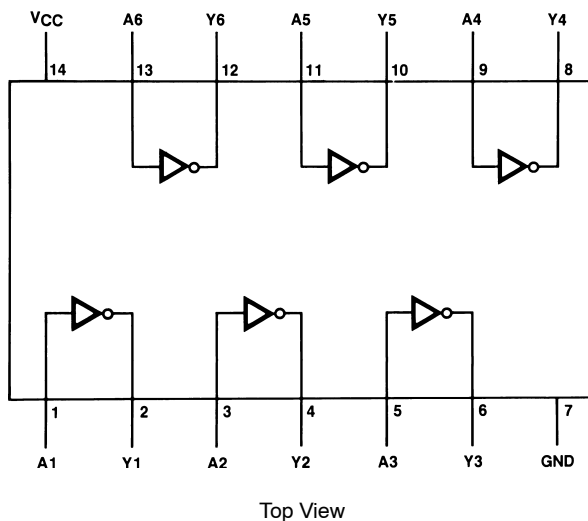
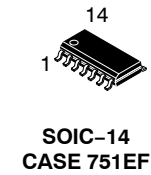
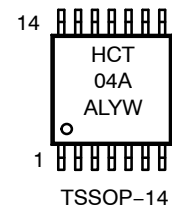
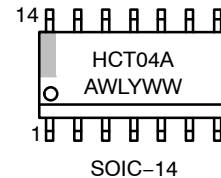


Figure 1. Pin Assignments for SOIC and TSSOP



### MARKING DIAGRAM



HCT04A = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
Y = Year  
WW, W = Work Week

### ORDERING INFORMATION

See detailed ordering and shipping information on page 727 of this data sheet.

# MM74HCT04

## ABSOLUTE MAXIMUM RATINGS (Note 1)

| Symbol           | Parameter                               | Rating                      |
|------------------|---|-----------------------------|
| $V_{CC}$         | Supply Voltage                          | -0.5 to +7.0 V              |
| $V_{IN}$         | DC Input Voltage                        | -0.5 to $V_{CC} + 0.5$ V    |
| $V_{OUT}$        | DC Output Voltage                       | -0.5 to $V_{CC} + 0.5$ V    |
| $I_{IK}, I_{OK}$ | Clamp Diode Current                     | $\pm 20$ mA                 |
| $I_{OUT}$        | DC Output Current, per Pin              | $\pm 25$ mA                 |
| $I_{CC}$         | DC $V_{CC}$ or GND Current, per Pin     | $\pm 50$ mA                 |
| $T_{STG}$        | Storage Temperature Range               | -65°C to +150°C             |
| $P_D$            | Power Dissipation                       | S.O. Package Only<br>500 mW |
| $T_L$            | Lead Temperature (Soldering 10 Seconds) | 260°C                       |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Unless otherwise specified all voltages are referenced to ground.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                   | Min | Max      | Unit |
|-------------------|-----------------------------|-----|----------|------|
| $V_{CC}$          | Supply Voltage              | 4.5 | 5.5      | V    |
| $V_{IN}, V_{OUT}$ | DC Input or Output Voltage  | 0   | $V_{CC}$ | V    |
| $T_A$             | Operating Temperature Range | -55 | +125     | °C   |
| $t_r, t_f$        | Input Rise or Fall Times    | -   | 500      | ns   |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

# MM74HCT04

## DC ELECTRICAL CHARACTERISTICS ( $V_{CC} = 5\text{ V} \pm 10\%$ (unless otherwise specified))

| Symbol   | Parameter                         | Conditions  | $T_A = 25^\circ\text{C}$ |                   | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ | $T_A = -55^\circ\text{C}$<br>to $125^\circ\text{C}$ | Unit          |
|----------|-----------------------------------|---|--------------------------|-------------------|--|---|---------------|
|          |                                   |   | Typ.                     | Guaranteed Limits |  |   |               |
| $V_{IH}$ | Minimum HIGH Level Input Voltage  |   | –                        | 2.0               | 2.0  | 2.0   | V             |
| $V_{IL}$ | Maximum LOW Level Input Voltage   |   | –                        | 0.8               | 0.8  | 0.8   | V             |
| $V_{OH}$ | Minimum HIGH Level Output Voltage | $V_{IN} = V_{IH}$ or $V_{IL}$ ,<br>$ I_{OUT}  = 20\ \mu\text{A}$                              | $V_{CC}$                 | $V_{CC} - 0.1$    | $V_{CC} - 0.1$                                     | $V_{CC} - 0.1$                                      | V             |
|          |                                   | $V_{IN} = V_{IH}$ or $V_{IL}$ ,<br>$ I_{OUT}  = 4.0\ \text{mA}$ ,<br>$V_{CC} = 4.5\ \text{V}$ | 4.2                      | 3.98              | 3.84   | 3.7   |               |
|          |                                   | $V_{IN} = V_{IH}$ or $V_{IL}$ ,<br>$ I_{OUT}  = 4.8\ \text{mA}$ ,<br>$V_{CC} = 5.5\ \text{V}$ | 5.2                      | 4.98              | 4.84   | 4.7   |               |
| $V_{OL}$ | Maximum LOW Level Voltage         | $V_{IN} = V_{IH}$<br>$ I_{OUT}  = 20\ \mu\text{A}$  | 0                        | 0.1               | 0.1  | 0.1   | V             |
|          |                                   | $V_{IN} = V_{IH}$<br>$ I_{OUT}  = 4.0\ \text{mA}$<br>$V_{CC} = 4.5\ \text{V}$                 | 0.2                      | 0.26              | 0.33   | 0.4   |               |
|          |                                   | $V_{IN} = V_{IH}$<br>$ I_{OUT}  = 4.8\ \text{mA}$<br>$V_{CC} = 5.5\ \text{V}$                 | 0.2                      | 0.26              | 0.33   | 0.4   |               |
| $I_{IN}$ | Maximum Input Current             | $V_{IN} = V_{CC}$ or GND,<br>$V_{IH}$ or $V_{IL}$   | –                        | $\pm 0.1$         | $\pm 1.0$  | $\pm 1.0$   | $\mu\text{A}$ |
| $I_{CC}$ | Maximum Quiescent Supply Current  | $V_{IN} = V_{CC}$ or GND,<br>$I_{OUT} = 0\ \mu\text{A}$                                       | –                        | 2.0               | 20   | 40  | $\mu\text{A}$ |
|          |                                   | $V_{IN} = 2.4\ \text{V}$ or $0.5\ \text{V}$<br>(Note 2)                                       | –                        | 0.3               | 0.4  | 0.5   | mA            |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. This is measured per input with all other inputs held at  $V_{CC}$  or ground.

# MM74HCT04

## AC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 5.0\text{ V}$ ,  $t_r = t_f = 6\text{ ns}$ ,  $C_L = 15\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (unless otherwise specified))

| Symbol                | Parameter                 | Conditions | Typ. | Guaranteed Limit | Unit |
|-----------------------|---------------------------|------------|------|------------------|------|
| $t_{PLH}$ , $t_{PHL}$ | Maximum Propagation Delay |            | 10   | 18               | ns   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS

( $V_{CC} = 5.0\text{ V} \pm 10\%$ ,  $t_r = t_f = 6\text{ ns}$ ,  $C_L = 50\text{ pF}$  (unless otherwise specified))

| Symbol                | Parameter                         | Conditions | $T_A = 25^\circ\text{C}$ |                   | $T_A = -40^\circ\text{C}$<br>to $85^\circ\text{C}$ | $T_A = -55^\circ\text{C}$<br>to $125^\circ\text{C}$ | Unit |
|-----------------------|-----------------------------------|------------|--------------------------|-------------------|--|---|------|
|                       |                                   |            | Typ.                     | Guaranteed Limits |  |   |      |
| $t_{PLH}$ , $t_{PHL}$ | Maximum Propagation Delay         |            | 14                       | 20                | 25   | 30  | ns   |
| $t_{THL}$ , $t_{TLH}$ | Maximum Output Rise and Fall Time |            | 8                        | 15                | 19   | 22  | ns   |
| $C_{PD}$              | Power Dissipation Capacitance     | (Note 3)   | 20                       | –                 | –  | –   | pF   |
| $C_{IN}$              | Input Capacitance                 |            | 5                        | 10                | 10   | 10  | pF   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3.  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

## ORDERING INFORMATION

| Device        | Package   | Shipping <sup>†</sup>    |
|---------------|---|--------------------------|
| MM74HCT04M    | SOIC–14, Case 751A–03<br>(Pb–Free and Halide Free)  | 55 Units / Tube          |
| MM74HCT04MX   | SOIC–14, Case 751EF<br>(Pb–Free and Halide Free)    | 2500 Units / Tape & Reel |
| MM74HCT04MTCX | TSSOP–14, Case 948G–01<br>(Pb–Free and Halide Free) | 2500 Units / Tape & Reel |

<sup>†</sup>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](#).

NOTE: All packages are lead free per JEDEC: J–STD–020B standard.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-14 NB  
CASE 751A-03  
ISSUE L

DATE 03 FEB 2016



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT MAXIMUM MATERIAL CONDITION.
  4. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
  5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 0.19        | 0.25 | 0.008     | 0.010 |
| b   | 0.35        | 0.49 | 0.014     | 0.019 |
| D   | 8.55        | 8.75 | 0.337     | 0.344 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 5.80        | 6.20 | 0.228     | 0.244 |
| h   | 0.25        | 0.50 | 0.010     | 0.019 |
| L   | 0.40        | 1.25 | 0.016     | 0.049 |
| M   | 0°          | 7°   | 0°        | 7°    |

### SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

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

### GENERIC MARKING DIAGRAM\*



- XXXXXX = Specific Device Code
- A = Assembly Location
- WL = Wafer Lot
- Y = Year
- WW = Work Week
- G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

STYLES ON PAGE 2

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**SOIC-14**  
**CASE 751A-03**  
**ISSUE L**

DATE 03 FEB 2016

STYLE 1:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. NO CONNECTION  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 2:  
 CANCELLED

STYLE 3:  
 PIN 1. NO CONNECTION  
 2. ANODE  
 3. ANODE  
 4. NO CONNECTION  
 5. ANODE  
 6. NO CONNECTION  
 7. ANODE  
 8. ANODE  
 9. ANODE  
 10. NO CONNECTION  
 11. ANODE  
 12. ANODE  
 13. NO CONNECTION  
 14. COMMON CATHODE

STYLE 4:  
 PIN 1. NO CONNECTION  
 2. CATHODE  
 3. CATHODE  
 4. NO CONNECTION  
 5. CATHODE  
 6. NO CONNECTION  
 7. CATHODE  
 8. CATHODE  
 9. CATHODE  
 10. NO CONNECTION  
 11. CATHODE  
 12. CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 5:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. NO CONNECTION  
 7. COMMON ANODE  
 8. COMMON CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. ANODE/CATHODE  
 12. ANODE/CATHODE  
 13. NO CONNECTION  
 14. COMMON ANODE

STYLE 6:  
 PIN 1. CATHODE  
 2. CATHODE  
 3. CATHODE  
 4. CATHODE  
 5. CATHODE  
 6. CATHODE  
 7. CATHODE  
 8. ANODE  
 9. ANODE  
 10. ANODE  
 11. ANODE  
 12. ANODE  
 13. ANODE  
 14. ANODE

STYLE 7:  
 PIN 1. ANODE/CATHODE  
 2. COMMON ANODE  
 3. COMMON CATHODE  
 4. ANODE/CATHODE  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. ANODE/CATHODE  
 8. ANODE/CATHODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. COMMON CATHODE  
 12. COMMON ANODE  
 13. ANODE/CATHODE  
 14. ANODE/CATHODE

STYLE 8:  
 PIN 1. COMMON CATHODE  
 2. ANODE/CATHODE  
 3. ANODE/CATHODE  
 4. NO CONNECTION  
 5. ANODE/CATHODE  
 6. ANODE/CATHODE  
 7. COMMON ANODE  
 8. COMMON ANODE  
 9. ANODE/CATHODE  
 10. ANODE/CATHODE  
 11. NO CONNECTION  
 12. ANODE/CATHODE  
 13. ANODE/CATHODE  
 14. COMMON CATHODE

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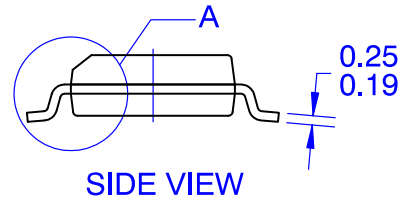
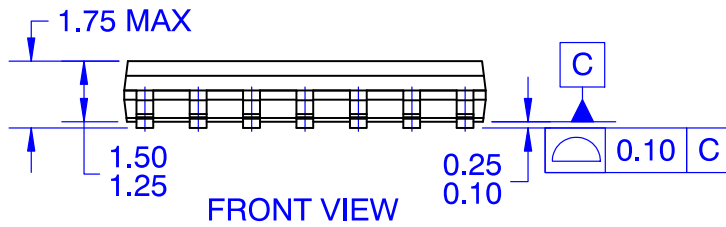
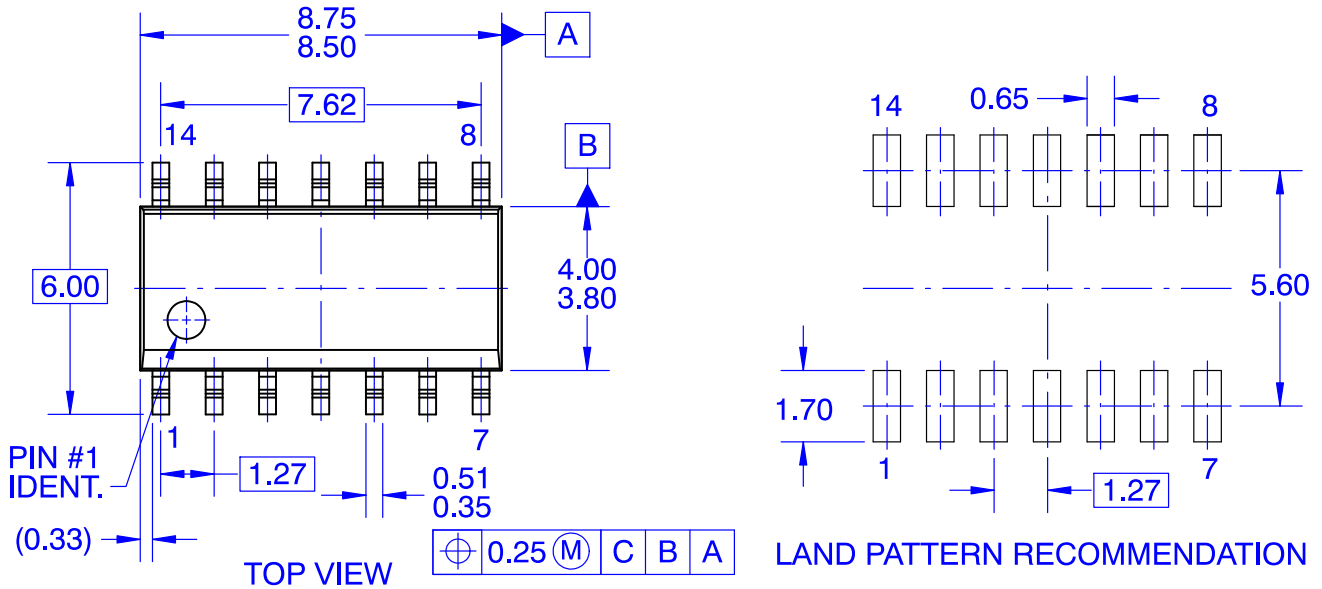
**MECHANICAL CASE OUTLINE**  
**PACKAGE DIMENSIONS**

ON Semiconductor®



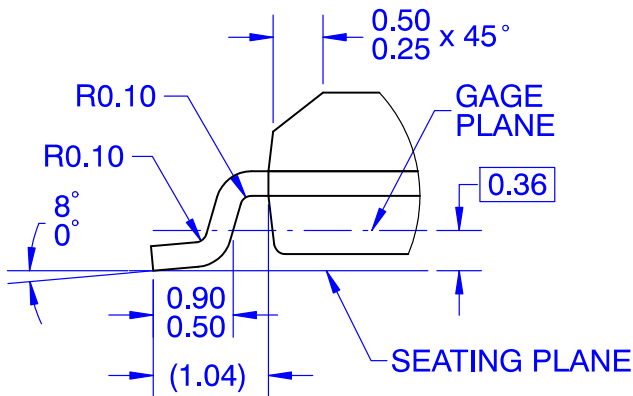
**SOIC14**  
**CASE 751EF**  
**ISSUE O**

DATE 30 SEP 2016



**NOTES:**

- A. CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS
- D. LAND PATTERN STANDARD: SOIC127P600X145-14M
- E. CONFORMS TO ASME Y14.5M, 2009



**DETAIL A**  
**SCALE 16 : 1**

|                         |                    |  |
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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



**TSSOP-14 WB**  
CASE 948G  
ISSUE C

DATE 17 FEB 2016

SCALE 2:1



**NOTES:**

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
- 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.
- DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
- 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.
- TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
- 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°    |

**GENERIC MARKING DIAGRAM\***

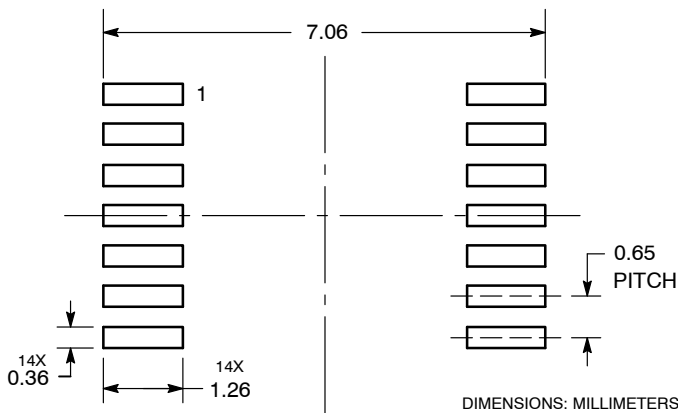


- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- = Pb-Free Package

(Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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