

# MC74VHC244

## FUNCTION TABLE

| INPUTS                            |      | OUTPUTS |
|-----------------------------------|------|---------|
| OE <sub>A</sub> , OE <sub>B</sub> | A, B | YA, YB  |
| L                                 | L    | L       |
| L                                 | H    | H       |
| H                                 | X    | Z       |

## ORDERING INFORMATION

| Device                   | Package                | Shipping <sup>†</sup> |
|--------------------------|------------------------|-----------------------|
| MC74VHC244DW - OBSOLETE* | SOIC-20 WB             | 38 Units/Rail         |
| MC74VHC244DWR2           | SOIC-20 WB             | 1000/Tape & Reel      |
| MC74VHC244DT             | TSSOP-20 (Pb-Free)     | 75 Units/Rail         |
| MC74VHC244DTR2           | TSSOP-20 (Pb-Free)     | 2500/Tape & Reel      |
| MC74VHC244M - OBSOLETE*  | SOIC EIAJ-20 (Pb-Free) | 1600 Units/Box        |
| MC74VHC244MEL            | SOIC EIAJ-20 (Pb-Free) | 2000/Tape & Reel      |

\*This device is obsolete, information available for reference.

†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.

## MAXIMUM RATINGS (Note 1)

| Symbol               | Parameter                                       | Value                                                                                                          | Unit        |
|----------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------|
| V <sub>CC</sub>      | Positive DC Supply Voltage                      | -0.5 to +7.0                                                                                                   | V           |
| V <sub>IN</sub>      | Digital Input Voltage                           | -0.5 to +7.0                                                                                                   | V           |
| V <sub>OUT</sub>     | DC Output Voltage                               | -0.5 to V <sub>CC</sub> +0.5                                                                                   | V           |
| I <sub>IK</sub>      | Input Diode Current                             | -20                                                                                                            | mA          |
| I <sub>OK</sub>      | Output Diode Current                            | ± 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 | ± 75                                                                                                           | mA          |
| P <sub>D</sub>       | Power Dissipation in Still Air                  | SOIC<br>TSSOP<br>500<br>450                                                                                    | mW          |
| T <sub>STG</sub>     | Storage Temperature Range                       | -65 to +150                                                                                                    | °C          |
| V <sub>ESD</sub>     | ESD Withstand Voltage                           | Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4)<br>>2000<br>>200<br>>2000 | V           |
| I <sub>LATCHUP</sub> | Latchup Performance                             | Above V <sub>CC</sub> and Below GND at 125°C (Note 5)                                                          | ± 300<br>mA |
| θ <sub>JA</sub>      | Thermal Resistance, Junction-to-Ambient         | SOIC<br>TSSOP<br>96<br>128                                                                                     | °C/W        |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. 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.

2. Tested to EIA/JESD22-A114-A

3. Tested to EIA/JESD22-A115-A

4. Tested to JESD22-C101-A

5. Tested to EIA/JESD78

# MC74VHC244

## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Characteristics                                                                               | Min | Max             | Unit |
|---------------------------------|-----------------------------------------------------------------------------------------------|-----|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage                                                                             | 2.0 | 5.5             | V    |
| V <sub>IN</sub>                 | DC Input Voltage                                                                              | 0   | 5.5             | V    |
| V <sub>OUT</sub>                | DC Output Voltage                                                                             | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature Range, all Package Types                                                | -55 | 125             | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Time<br>V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0   | 100<br>20       | ns/V |

## DEVICE JUNCTION TEMPERATURE VERSUS TIME TO 0.1% BOND FAILURES

| Junction Temperature °C | Time, Hours | Time, Years |
|-------------------------|-------------|-------------|
| 80                      | 1,032,200   | 117.8       |
| 90                      | 419,300     | 47.9        |
| 100                     | 178,700     | 20.4        |
| 110                     | 79,600      | 9.4         |
| 120                     | 37,000      | 4.2         |
| 130                     | 17,800      | 2.0         |
| 140                     | 8,900       | 1.0         |

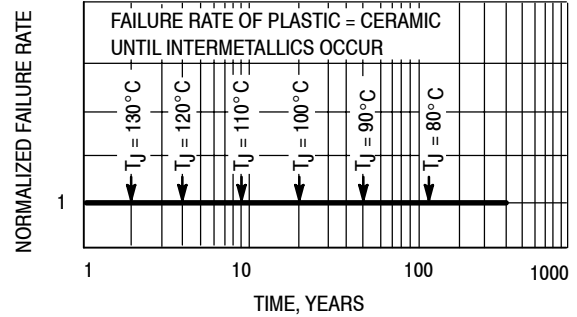


Figure 2. Failure Rate vs. Time Junction Temperature

## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition                                                                                                  | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25°C          |                   |                                | T <sub>A</sub> ≤ 85°C          |                                | -55°C ≤ T <sub>A</sub> ≤ 125°C |                                | Unit |
|-----------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------|------------------------|--------------------------------|-------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------|
|                 |                                                |                                                                                                            |                        | Min                            | Typ               | Max                            | Min                            | Max                            | Min                            | Max                            |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               |                                                                                                            | 2.0<br>3.0 to 5.5      | 1.5<br>V <sub>CCX</sub><br>0.7 |                   |                                | 1.5<br>V <sub>CCX</sub><br>0.7 | 1.5<br>V <sub>CCX</sub><br>0.7 | 1.5<br>V <sub>CCX</sub><br>0.7 |                                | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                |                                                                                                            | 2.0<br>3.0 to 5.5      |                                |                   | 0.5<br>V <sub>CCX</sub><br>0.3 |                                | 0.5<br>V <sub>CCX</sub><br>0.3 |                                | 0.5<br>V <sub>CCX</sub><br>0.3 | V    |
| V <sub>OH</sub> | Maximum High-Level Output Voltage              | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -50 μA                           | 2.0<br>3.0<br>4.5      | 1.9<br>2.9<br>4.4              | 2.0<br>3.0<br>4.5 |                                | 1.9<br>2.9<br>4.4              |                                | 1.9<br>2.9<br>4.4              |                                | V    |
|                 |                                                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -4 mA<br>I <sub>OH</sub> = -8 mA | 3.0<br>4.5             | 2.58<br>3.94                   |                   |                                | 2.48<br>3.8                    |                                | 2.34<br>3.66                   |                                |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 50 μA                            | 2.0<br>3.0<br>4.5      |                                | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1              |                                | 0.1<br>0.1<br>0.1              |                                | 0.1<br>0.1<br>0.1              | V    |
|                 |                                                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = 4 mA<br>I <sub>OH</sub> = 8 mA   | 3.0<br>4.5             |                                |                   | 0.36<br>0.36                   |                                | 0.44<br>0.44                   |                                | 0.52<br>0.52                   |      |
| I <sub>IN</sub> | Input Leakage Current                          | V <sub>IN</sub> = 5.5 V or GND                                                                             | 0 to 5.5               |                                |                   | ±0.1                           |                                | ±1.0                           |                                | ±1.0                           | μA   |
| I <sub>OZ</sub> | Maximum 3-State Leakage Current                | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>OUT</sub> = V <sub>CC</sub> or GND          | 5.5                    |                                |                   | ±0.25                          |                                | ±2.5                           |                                | ±2.5                           | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per package) | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                   | 5.5                    |                                |                   | 4.0                            |                                | 40.0                           |                                | 40.0                           | μA   |

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

| Symbol                     | Parameter                                                                  | Test Conditions                                    | $T_A = 25^\circ\text{C}$ |      |      | $T_A \leq 85^\circ\text{C}$ |      | $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ |      | Unit |
|----------------------------|----------------------------------------------------------------------------|----------------------------------------------------|--------------------------|------|------|-----------------------------|------|-----------------------------------------------------|------|------|
|                            |                                                                            |                                                    | Min                      | Typ  | Max  | Min                         | Max  | Min                                                 | Max  |      |
| $t_{PLH}$ ,<br>$t_{PHL}$   | Maximum Propagation Delay, A to YA or B to YB                              | $V_{CC} = 3.3 \pm 0.3$ V $C_L = 15$ pF             |                          | 5.8  | 8.4  | 1.0                         | 10.0 | 1.0                                                 | 11.0 | ns   |
|                            |                                                                            | $C_L = 50$ pF                                      |                          | 8.3  | 11.9 | 1.0                         | 13.5 | 1.0                                                 | 14.5 |      |
|                            |                                                                            | $V_{CC} = 5.0 \pm 0.5$ V $C_L = 15$ pF             |                          | 3.9  | 5.5  | 1.0                         | 6.5  | 1.0                                                 | 7.5  |      |
|                            |                                                                            | $C_L = 50$ pF                                      |                          | 5.4  | 7.5  | 1.0                         | 8.5  | 1.0                                                 | 9.5  |      |
| $t_{PZL}$ ,<br>$t_{PZH}$   | Output Enable Time<br>$\overline{OE}A$ to YA or<br>$\overline{OE}B$ to YB  | $V_{CC} = 3.3 \pm 0.3$ V $C_L = 15$ pF             |                          | 6.6  | 10.6 | 1.0                         | 12.5 | 1.0                                                 | 13.5 | ns   |
|                            |                                                                            | $R_L = 1$ k $\Omega$ $C_L = 50$ pF                 |                          | 9.1  | 14.1 | 1.0                         | 16.0 | 1.0                                                 | 17.0 |      |
|                            |                                                                            | $V_{CC} = 5.0 \pm 0.5$ V $C_L = 15$ pF             |                          | 4.7  | 7.3  | 1.0                         | 8.5  | 1.0                                                 | 9.5  |      |
|                            |                                                                            | $R_L = 1$ k $\Omega$ $C_L = 50$ pF                 |                          | 6.2  | 9.3  | 1.0                         | 10.5 | 1.0                                                 | 11.5 |      |
| $t_{PLZ}$ ,<br>$t_{PHZ}$   | Output Disable Time<br>$\overline{OE}A$ to YA or<br>$\overline{OE}B$ to YB | $V_{CC} = 3.3 \pm 0.3$ V $C_L = 50$ pF             |                          | 10.3 | 14.0 | 1.0                         | 16.0 | 1.0                                                 | 17.0 | ns   |
|                            |                                                                            | $R_L = 1$ k $\Omega$                               |                          | 6.7  | 9.2  | 1.0                         | 10.5 | 1.0                                                 | 11.5 |      |
| $t_{OSLH}$ ,<br>$t_{OSHL}$ | Output to Output Skew                                                      | $V_{CC} = 3.3 \pm 0.3$ V $C_L = 50$ pF<br>(Note 6) |                          |      | 1.5  |                             | 1.5  |                                                     | 1.5  | ns   |
|                            |                                                                            | $V_{CC} = 5.0 \pm 0.5$ V $C_L = 50$ pF<br>(Note 6) |                          |      | 1.0  |                             | 1.0  |                                                     | 1.5  |      |
| $C_{in}$                   | Maximum Input Capacitance                                                  |                                                    |                          | 4    | 10   |                             | 10   |                                                     | 10   | pF   |
| $C_{out}$                  | Maximum Three-State Output Capacitance (Output in High-Impedance State)    |                                                    |                          | 6    |      |                             |      |                                                     |      | pF   |

|          |                                        |                                                       |    |
|----------|----------------------------------------|-------------------------------------------------------|----|
| $C_{PD}$ | Power Dissipation Capacitance (Note 7) | Typical @ $25^\circ\text{C}$ , $V_{CC} = 5.0\text{V}$ | pF |
|          |                                        | 19                                                    |    |

6. Parameter guaranteed by design.  $t_{OSLH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{OSHL} = |t_{PHLm} - t_{PHLn}|$ .

7.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/8$  (per bit).  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

## NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns, $C_L = 50$ pF, $V_{CC} = 5.0$ V)

| Symbol    | Parameter                                | $T_A = 25^\circ\text{C}$ |      | Unit |
|-----------|------------------------------------------|--------------------------|------|------|
|           |                                          | Typ                      | Max  |      |
| $V_{OLP}$ | Quiet Output Maximum Dynamic $V_{OL}$    | 0.6                      | 0.9  | V    |
| $V_{OLV}$ | Quiet Output Minimum Dynamic $V_{OL}$    | -0.6                     | -0.9 | V    |
| $V_{IHD}$ | Minimum High Level Dynamic Input Voltage |                          | 3.5  | V    |
| $V_{ILD}$ | Maximum Low Level Dynamic Input Voltage  |                          | 1.5  | V    |

# MC74VHC244

## SWITCHING WAVEFORMS

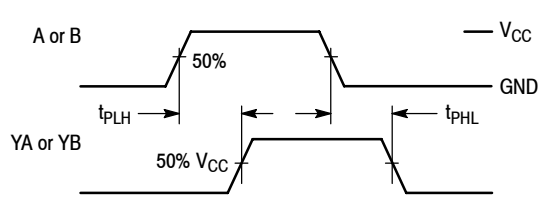


Figure 3. Switching Waveform

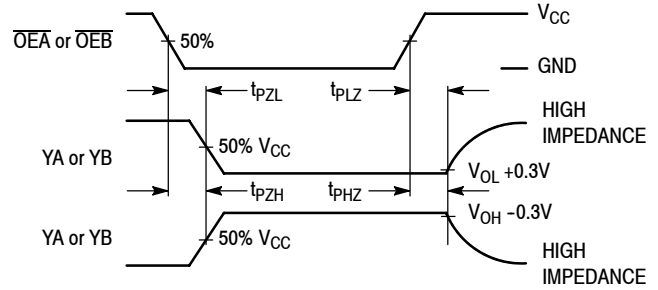
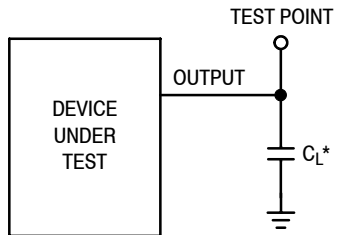


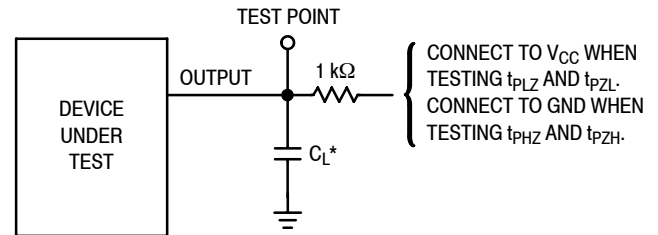
Figure 4. Switching Waveform

## TEST CIRCUITS



\*Includes all probe and jig capacitance

Figure 5. Test Circuit



\*Includes all probe and jig capacitance

Figure 6. Test Circuit

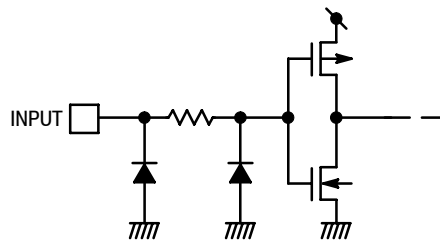
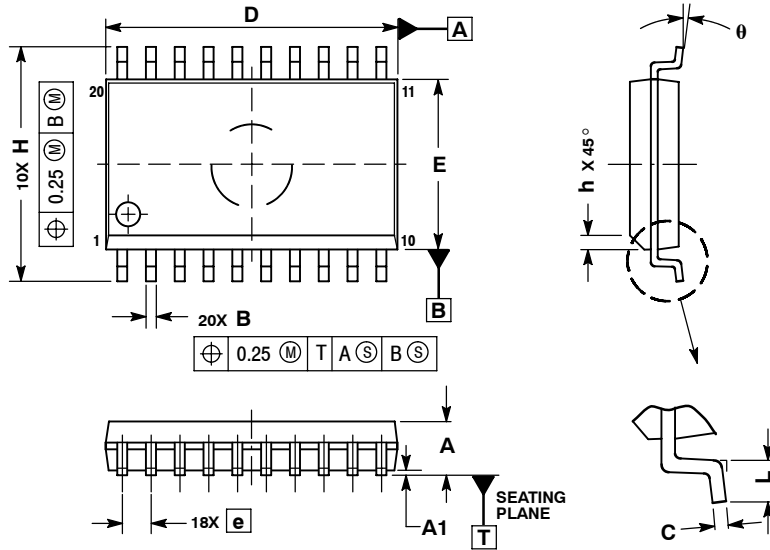


Figure 7. Input Equivalent Circuit

# MC74VHC244

## OUTLINE DIMENSIONS

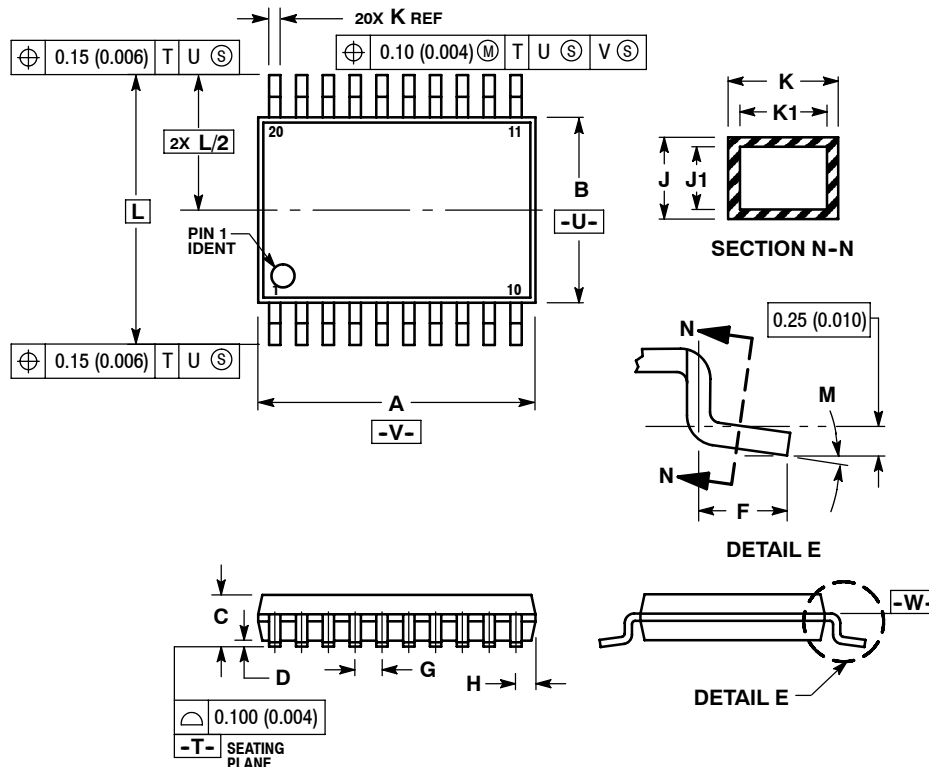
SOIC-20 WB  
DW SUFFIX  
CASE 751D-05  
ISSUE G



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

|     | MILLIMETERS |       |
|-----|-------------|-------|
| DIM | MIN         | MAX   |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| B   | 0.35        | 0.49  |
| C   | 0.23        | 0.32  |
| D   | 12.65       | 12.95 |
| E   | 7.40        | 7.60  |
| e   | 1.27 BSC    |       |
| H   | 10.05       | 10.55 |
| h   | 0.25        | 0.75  |
| L   | 0.50        | 0.90  |
| θ   | 0°          | 7°    |

TSSOP-20  
DT SUFFIX  
CASE 948E-02  
ISSUE B



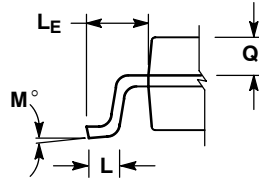
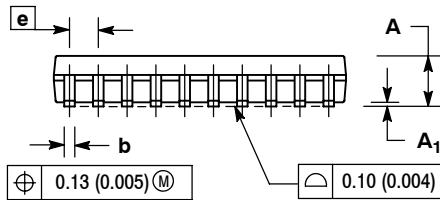
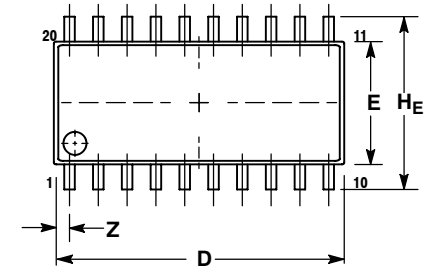
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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-.

|     | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
| DIM | MIN         | MAX  | MIN       | MAX   |
| A   | 6.40        | 6.60 | 0.252     | 0.260 |
| 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   | 0.27        | 0.37 | 0.011     | 0.015 |
| 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°    |

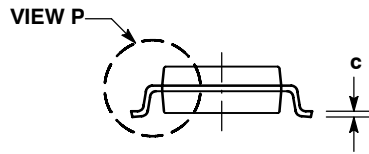
# MC74VHC244

## OUTLINE DIMENSIONS

SOIC EIAJ-20  
M SUFFIX  
CASE 967-01  
ISSUE O



DETAIL P



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 12.35       | 12.80 | 0.486     | 0.504 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.81  | ---       | 0.032 |

# MC74VHC244

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