

# MC74HC1G02

## Single 2-Input NOR Gate

The MC74HC1G02 is a high speed CMOS 2-input NOR gate fabricated with silicon gate CMOS technology.

The internal circuit is composed of multiple stages, including a buffer output which provides high noise immunity and stable output.

The MC74HC1G02 output drive current is 1/2 compared to MC74HC series.

### Features

- High Speed:  $t_{PD} = 7 \text{ ns}$  (Typ) at  $V_{CC} = 5 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 1 \mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- High Noise Immunity
- Balanced Propagation Delays ( $t_{PLH} = t_{PHL}$ )
- Symmetrical Output Impedance ( $I_{OH} = I_{OL} = 2 \text{ mA}$ )
- Chip Complexity: < 100 FETs
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

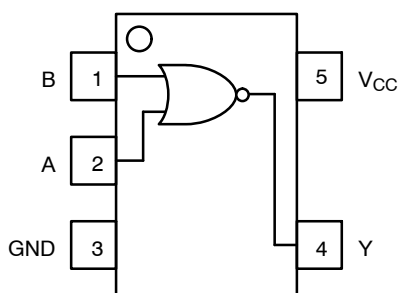


Figure 1. Pinout

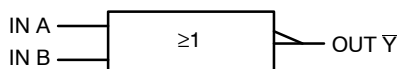


Figure 2. Logic Symbol

| PIN ASSIGNMENT |                 |
|----------------|-----------------|
| 1              | B               |
| 2              | A               |
| 3              | GND             |
| 4              | Y               |
| 5              | V <sub>CC</sub> |



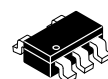
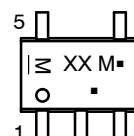
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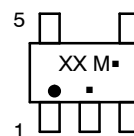


SC-88A  
DF SUFFIX  
CASE 419A

### MARKING DIAGRAMS



TSOP-5  
DT SUFFIX  
CASE 483



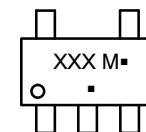
XX = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.



SC-74A  
DBV SUFFIX  
CASE 318BQ



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### FUNCTION TABLE

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | L      |
| H      | L | L      |
| H      | H | L      |

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data

# MC74HC1G02

## MAXIMUM RATINGS

| Symbol                | Parameter                                                                                          | Value                        | Unit |
|-----------------------|----------------------------------------------------------------------------------------------------|------------------------------|------|
| $V_{CC}$              | DC Supply Voltage<br>SC-88A (NLV), TSOP-5<br>SC-88A, SC-74A                                        | -0.5 to +7.0<br>-0.5 to +6.5 | 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    |
| $I_{IK}$              | DC Input Diode Current                                                                             | $\pm 20$                     | mA   |
| $I_{OK}$              | DC Output Diode Current                                                                            | $\pm 20$                     | mA   |
| $I_{OUT}$             | DC Output Source/Sink Current                                                                      | $\pm 12.5$                   | mA   |
| $I_{CC}$ or $I_{GND}$ | DC Supply Current per Supply Pin or Ground Pin                                                     | $\pm 25$                     | 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 (Note 1)<br>SC70-5/SC-88A/SOT-353<br>SOT23-5/TSOP-5/SC59-5<br>SC-74A            | 659<br>555<br>555            | °C/W |
| $P_D$                 | Power Dissipation in Still Air at 85°C<br>SC70-5/SC-88A/SOT-353<br>SOT23-5/TSOP-5/SC59-5<br>SC-74A | 190<br>225<br>225            | mW   |
| MSL                   | Moisture Sensitivity                                                                               | Level 1                      |      |
| $F_R$                 | Flammability Rating<br>Oxygen Index: 28 to 34                                                      | UL 94 V-0 @ 0.125 in         |      |
| $V_{ESD}$             | ESD Withstand Voltage (Note 2)<br>Human Body Model<br>Charged Device Model                         | 2000<br>1000                 | V    |
| $I_{LATCHUP}$         | Latchup Performance (Note 3)<br>SC-88A (NLV), SOT-23<br>SC-88A, SC-74A                             | $\pm 500$<br>$\pm 100$       | mA   |

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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 20 ounce copper trace with no air flow.
2. HBM tested to ANSI/ESDA/JEDEC JS-001-2017. CDM tested to JESD22-C101-F. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued per JEDEC/JEP172A.
3. Tested to EIA/JESD78 Class II.

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## RECOMMENDED OPERATING CONDITIONS

| Symbol                          | Parameter                   | Min                                | Max             | Unit |      |
|---------------------------------|-----------------------------|------------------------------------|-----------------|------|------|
| V <sub>CC</sub>                 | DC Supply Voltage           | 2.0                                | 6.0             | V    |      |
| V <sub>IN</sub>                 | DC Input Voltage            | 0.0                                | V <sub>CC</sub> | V    |      |
| V <sub>OUT</sub>                | DC Output Voltage           | 0.0                                | V <sub>CC</sub> | V    |      |
| T <sub>A</sub>                  | Operating Temperature Range | −55                                | +125            | °C   |      |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise and Fall Time    | SC-88A (NLV), TSOP-5               |                 |      | ns/V |
|                                 |                             | V <sub>CC</sub> = 2.0 V            | 0               | 1000 |      |
|                                 |                             | V <sub>CC</sub> = 3.0 V            | 0               | 600  |      |
|                                 |                             | V <sub>CC</sub> = 4.5 V            | 0               | 500  |      |
|                                 |                             | V <sub>CC</sub> = 6.0 V            | 0               | 400  |      |
|                                 | Input Rise and Fall Time    | SC-88A, SC-74A                     |                 |      |      |
|                                 |                             | V <sub>CC</sub> = 1.65 V to 1.95 V | 0               | 20   |      |
|                                 |                             | V <sub>CC</sub> = 2.3 V to 2.7 V   | 0               | 20   |      |
|                                 |                             | V <sub>CC</sub> = 3.0 V to 3.6 V   | 0               | 10   |      |
|                                 |                             | V <sub>CC</sub> = 4.5 V to 6.0 V   | 0               | 5    |      |

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.

## DC ELECTRICAL CHARACTERISTICS

| Symbol   | Parameter                 | Test Conditions                                                                       | $V_{CC}$<br>(V) | $T_A = 25^\circ\text{C}$ |      |                | $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$ |           | $-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ |           | Unit          |
|----------|---------------------------|---------------------------------------------------------------------------------------|-----------------|--------------------------|------|----------------|----------------------------------------------------|-----------|-----------------------------------------------------|-----------|---------------|
|          |                           |                                                                                       |                 | Min                      | Typ  | Max            | Min                                                | Max       | Min                                                 | Max       |               |
| $V_{IH}$ | High-Level Input Voltage  |                                                                                       | 2.0             | 1.5                      | –    | –              | 1.5                                                | –         | 1.5                                                 | –         | V             |
|          |                           |                                                                                       | 3.0             | 2.1                      | –    | –              | 2.1                                                | –         | 2.1                                                 | –         |               |
|          |                           |                                                                                       | 4.5             | 3.15                     | –    | –              | 3.15                                               | –         | 3.15                                                | –         |               |
|          |                           |                                                                                       | 6.0             | 4.20                     | –    | –              | 4.20                                               | –         | 4.20                                                | –         |               |
| $V_{IL}$ | Low-Level Input Voltage   |                                                                                       | 2.0             | –                        | –    | 0.5            | –                                                  | 0.5       | –                                                   | 0.5       | V             |
|          |                           |                                                                                       | 3.0             | –                        | –    | 0.9            | –                                                  | 0.9       | –                                                   | 0.9       |               |
|          |                           |                                                                                       | 4.5             | –                        | –    | 1.35           | –                                                  | 1.35      | –                                                   | 1.35      |               |
|          |                           |                                                                                       | 6.0             | –                        | –    | 1.80           | –                                                  | 1.80      | –                                                   | 1.80      |               |
| $V_{OH}$ | High-Level Output Voltage | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OH} = -20\text{ }\mu\text{A}$                    | 2.0             | 1.9                      | 2.0  | –              | 1.9                                                | –         | 1.9                                                 | –         | V             |
|          |                           |                                                                                       | 3.0             | 2.9                      | 3.0  | –              | 2.9                                                | –         | 2.9                                                 | –         |               |
|          |                           |                                                                                       | 4.5             | 4.4                      | 4.5  | –              | 4.4                                                | –         | 4.4                                                 | –         |               |
|          |                           |                                                                                       | 6.0             | 5.9                      | 6.0  | –              | 5.9                                                | –         | 5.9                                                 | –         |               |
|          |                           | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OH} = -2\text{ mA}$<br>$I_{OH} = -2.6\text{ mA}$ | 4.5             | 4.18                     | 4.31 | –              | 4.13                                               | –         | 4.08                                                | –         |               |
|          |                           |                                                                                       | 6.0             | 5.68                     | 5.80 | –              | 5.63                                               | –         | 5.58                                                | –         |               |
| $V_{OL}$ | Low-Level Output Voltage  | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OL} = 20\text{ }\mu\text{A}$                     | 2.0             | –                        | 0.0  | 0.1            | –                                                  | 0.1       | –                                                   | 0.1       | V             |
|          |                           |                                                                                       | 3.0             | –                        | 0.0  | 0.1            | –                                                  | 0.1       | –                                                   | 0.1       |               |
|          |                           |                                                                                       | 4.5             | –                        | 0.0  | 0.1            | –                                                  | 0.1       | –                                                   | 0.1       |               |
|          |                           |                                                                                       | 6.0             | –                        | 0.0  | 0.1            | –                                                  | 0.1       | –                                                   | 0.1       |               |
|          |                           | $V_{IN} = V_{IH}$ or $V_{IL}$<br>$I_{OL} = 2\text{ mA}$<br>$I_{OL} = 2.6\text{ mA}$   | 4.5             | –                        | 0.17 | 0.26           | –                                                  | 0.33      | –                                                   | 0.40      |               |
|          |                           |                                                                                       | 6.0             | –                        | 0.18 | 0.26           | –                                                  | 0.33      | –                                                   | 0.40      |               |
| $I_{IN}$ | Input Leakage Current     | $V_{IN} = 6.0\text{ V}$ or GND                                                        | 6.0             | –                        | –    | $\pm 0.1$<br>* | –                                                  | $\pm 1.0$ | –                                                   | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{CC}$ | Quiescent Supply Current  | $V_{IN} = V_{CC}$ or GND                                                              | 6.0             | –                        | –    | 1.0            | –                                                  | 10        | –                                                   | 40        | $\mu\text{A}$ |

\*Guaranteed by design.

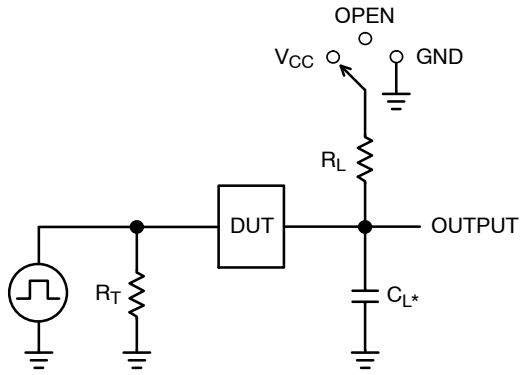
# MC74HC1G02

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 6.0$ ns)

| Symbol                                 | Parameter                                       | Test Conditions                                  | T <sub>A</sub> = 25°C |     |     | –40°C ≤ T <sub>A</sub> ≤ 85°C |     | –55°C ≤ T <sub>A</sub> ≤ 125°C |     | Unit |
|----------------------------------------|-------------------------------------------------|--------------------------------------------------|-----------------------|-----|-----|-------------------------------|-----|--------------------------------|-----|------|
|                                        |                                                 |                                                  | Min                   | Typ | Max | Min                           | Max | Min                            | Max |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay,<br>Input A or B to $\bar{Y}$ | V <sub>CC</sub> = 5.0 V   C <sub>L</sub> = 15 pF | –                     | 3.5 | 15  | –                             | 20  | –                              | 25  | ns   |
|                                        |                                                 | V <sub>CC</sub> = 2.0 V   C <sub>L</sub> = 50 pF | –                     | 20  | 100 | –                             | 125 | –                              | 155 |      |
|                                        |                                                 | V <sub>CC</sub> = 3.0 V                          | –                     | 11  | 27  | –                             | 35  | –                              | 90  |      |
|                                        |                                                 | V <sub>CC</sub> = 4.5 V                          | –                     | 8   | 20  | –                             | 25  | –                              | 35  |      |
|                                        |                                                 | V <sub>CC</sub> = 6.0 V                          | –                     | 7   | 17  | –                             | 21  | –                              | 26  |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Output Transition<br>Time                       | V <sub>CC</sub> = 5.0 V   C <sub>L</sub> = 15 pF | –                     | 3   | 10  | –                             | 15  | –                              | 20  | ns   |
|                                        |                                                 | V <sub>CC</sub> = 2.0 V   C <sub>L</sub> = 50 pF | –                     | 25  | 125 | –                             | 155 | –                              | 200 |      |
|                                        |                                                 | V <sub>CC</sub> = 3.0 V                          | –                     | 16  | 35  | –                             | 45  | –                              | 60  |      |
|                                        |                                                 | V <sub>CC</sub> = 4.5 V                          | –                     | 11  | 25  | –                             | 31  | –                              | 38  |      |
|                                        |                                                 | V <sub>CC</sub> = 6.0 V                          | –                     | 9   | 21  | –                             | 26  | –                              | 32  |      |
| C <sub>IN</sub>                        | Input Capacitance                               |                                                  | –                     | 5   | 10  | –                             | 10  | –                              | 10  | pF   |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Note 4)          | Typical @ 25°C, V <sub>CC</sub> = 5.0 V          |                       |     |     |                               |     |                                |     | pF   |
|                                        |                                                 | 10                                               |                       |     |     |                               |     |                                |     |      |

4.  $C_{PD}$  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:  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption;  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

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\* $C_L$  includes probe and jig capacitance  
 $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )  
 $f = 1$  MHz

Figure 3. Test Circuit

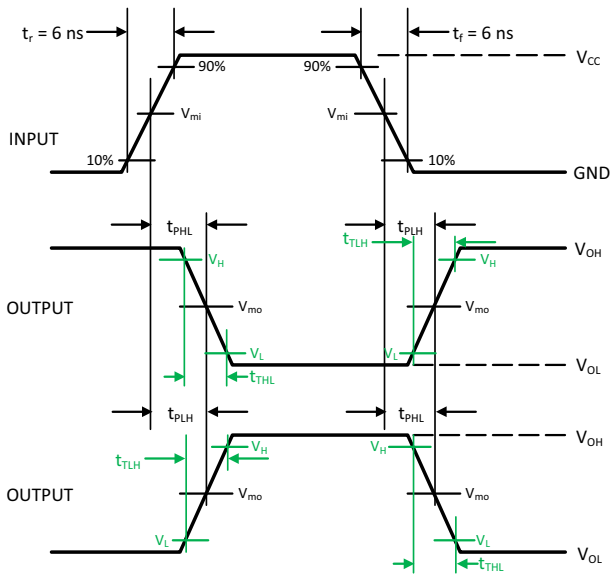


Figure 4. Switching Waveforms

| Test                         | Switch Position | $C_L$ , pF                   | $R_L$ , $\Omega$ |
|------------------------------|-----------------|------------------------------|------------------|
| $t_{PLH} / t_{PHL}$          | Open            | See AC Characteristics Table | X                |
| $t_{TLH} / t_{THL}$ (Note 5) | Open            |                              | X                |
| $t_{PLZ} / t_{PZL}$          | $V_{CC}$        |                              | 1 k              |
| $t_{PHZ} / t_{PZH}$          | GND             |                              | 1 k              |

X - Don't Care

| $V_{CC}$ , V | $V_{mi}$ , V | $V_{mo}$ , V          |                                      | $V_L$ , V                        | $V_H$ , V                        | $V_Y$ , V |
|--------------|--------------|-----------------------|--------------------------------------|----------------------------------|----------------------------------|-----------|
|              |              | $t_{PLH}, t_{PHL}$    | $t_{PZL}, t_{PLZ}, t_{PZH}, t_{PHZ}$ |                                  |                                  |           |
| 3.0 to 3.6   | $V_{CC}/2$   | $(V_{OH} - V_{OL})/2$ | $V_{CC}/2$                           | $V_{OL} + 0.1 (V_{OH} - V_{OL})$ | $V_{OL} + 0.9 (V_{OH} - V_{OL})$ | 0.3       |
| 4.5 to 5.5   | $V_{CC}/2$   | $(V_{OH} - V_{OL})/2$ | $V_{CC}/2$                           | $V_{OL} + 0.1 (V_{OH} - V_{OL})$ | $V_{OL} + 0.9 (V_{OH} - V_{OL})$ | 0.3       |

5.  $t_{TLH}$  and  $t_{THL}$  are measured from 10% to 90% of  $(V_{OH} - V_{OL})$ , and 90% to 10% of  $(V_{OH} - V_{OL})$ , respectively.

## MC74HC1G02

### ORDERING INFORMATION

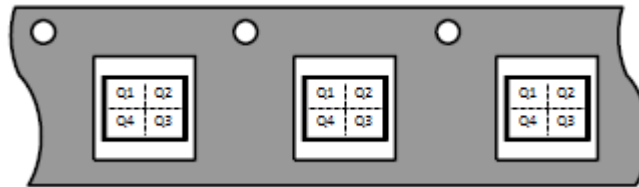
| Device                               | Packages | Specific Device Code | Pin 1 Orientation<br>(See below) | Shipping <sup>†</sup> |
|--------------------------------------|----------|----------------------|----------------------------------|-----------------------|
| MC74HC1G02DFT2G                      | SC-88A   | H3                   | Q4                               | 3000 / Tape & Reel    |
| NLVHC1G02DFT2G*                      | SC-88A   | H3                   | Q4                               | 3000 / Tape & Reel    |
| MC74HC1G02DTT1G                      | TSOP-5   | H3                   | Q4                               | 3000 / Tape & Reel    |
| MC74HC1G02DBVT1G<br>(In Development) | SC-74A   | TBD                  | Q4                               | 3000 / Tape & Reel    |

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

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

### Pin 1 Orientation in Tape and Reel

Direction of Feed



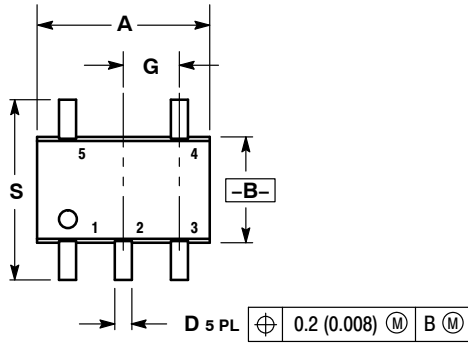
# MC74HC1G02

## PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)

CASE 419A-02

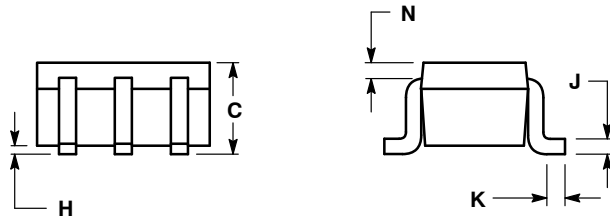
ISSUE L



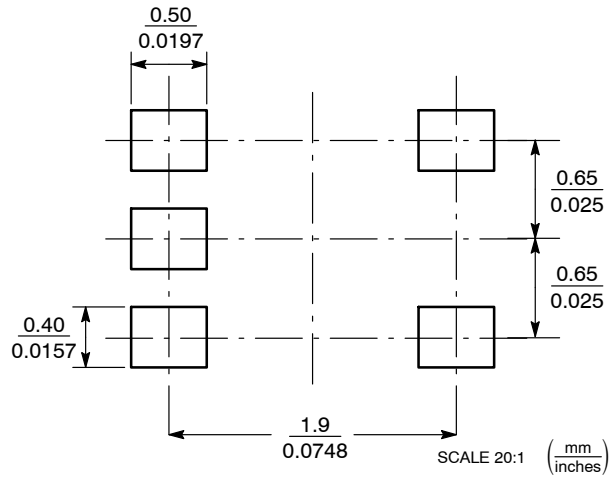
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.071     | 0.087 | 1.80        | 2.20 |
| B   | 0.045     | 0.053 | 1.15        | 1.35 |
| C   | 0.031     | 0.043 | 0.80        | 1.10 |
| D   | 0.004     | 0.012 | 0.10        | 0.30 |
| G   | 0.026 BSC |       | 0.65 BSC    |      |
| H   | ---       | 0.004 | ---         | 0.10 |
| J   | 0.004     | 0.010 | 0.10        | 0.25 |
| K   | 0.004     | 0.012 | 0.10        | 0.30 |
| N   | 0.008 REF |       | 0.20 REF    |      |
| S   | 0.079     | 0.087 | 2.00        | 2.20 |



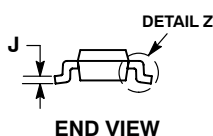
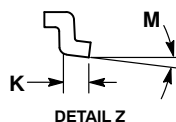
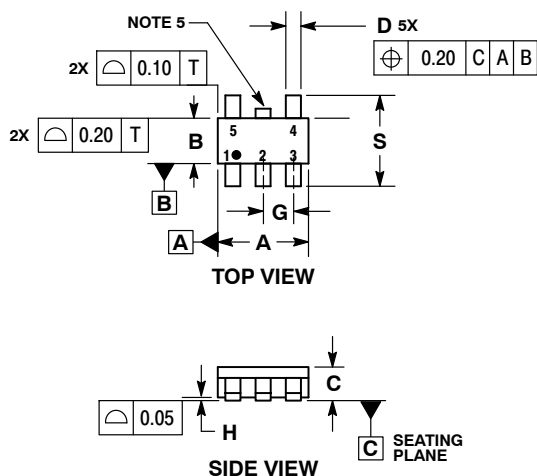
## SOLDER FOOTPRINT



# MC74HC1G02

## PACKAGE DIMENSIONS

### TSOP-5 CASE 483 ISSUE M

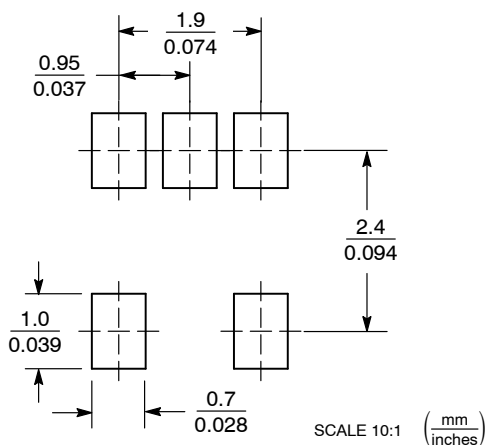


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE, DIMENSION A.
5. OPTIONAL CONSTRUCTION: AN ADDITIONAL TRIMMED LEAD IS ALLOWED IN THIS LOCATION. TRIMMED LEAD NOT TO EXTEND MORE THAN 0.2 FROM BODY.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 2.85        | 3.15 |
| B   | 1.35        | 1.65 |
| C   | 0.90        | 1.10 |
| D   | 0.25        | 0.50 |
| G   | 0.95 BSC    |      |
| H   | 0.01        | 0.10 |
| J   | 0.10        | 0.26 |
| K   | 0.20        | 0.60 |
| M   | 0°          | 10°  |
| S   | 2.50        | 3.00 |

#### SOLDERING FOOTPRINT\*



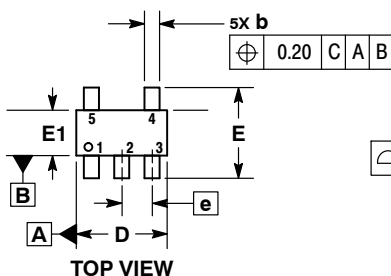
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



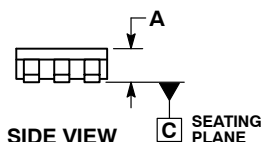
# MC74HC1G02

## PACKAGE DIMENSIONS

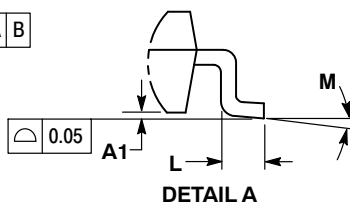
### SC-74A CASE 318BQ ISSUE B



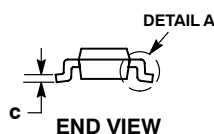
TOP VIEW



SIDE VIEW



DETAIL A



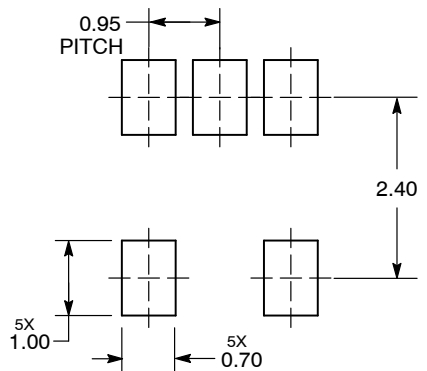
END VIEW

#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.90        | 1.10 |
| A1  | 0.01        | 0.10 |
| b   | 0.25        | 0.50 |
| c   | 0.10        | 0.26 |
| D   | 2.85        | 3.15 |
| E   | 2.50        | 3.00 |
| E1  | 1.35        | 1.65 |
| e   | 0.95 BSC    |      |
| L   | 0.20        | 0.60 |
| M   | 0°          | 10°  |

### RECOMMENDED 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.

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