

# MC74HC1GU04

## Single Unbuffered Inverter

The MC74HC1GU04 is a high speed CMOS unbuffered inverter fabricated with silicon gate CMOS technology.

The MC74HC1GU04 output drive current is 1/2 compared to MC74HC series.

- 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: FET = 105
- These Devices are Pb-Free and are RoHS Compliant

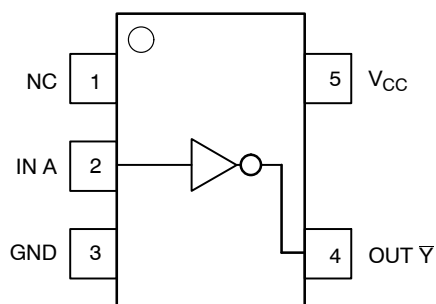


Figure 1. Pinout

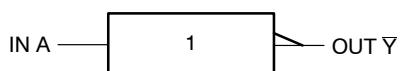


Figure 2. Logic Symbol



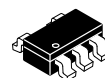
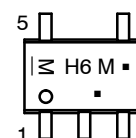
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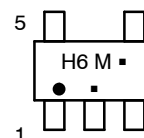
### MARKING DIAGRAMS



SC-88A / SOT-353 / SC-70  
DF SUFFIX  
CASE 419A



TSOP-5 / SOT-23 / SC-59  
DT SUFFIX  
CASE 483



H6 = 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.

### PIN ASSIGNMENT

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

### FUNCTION TABLE

| Input A | Output Y |
|---------|----------|
| L       | H        |
| H       | L        |

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# MC74HC1GU04

## MAXIMUM RATINGS

| Symbol        | Parameter                                                                                                     | Value                   | Unit |
|---------------|---------------------------------------------------------------------------------------------------------------|-------------------------|------|
| $V_{CC}$      | DC 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    |
| $I_{IK}$      | DC Input Diode Current                                                                                        | $\pm 20$                | mA   |
| $I_{OK}$      | DC Output Diode Current                                                                                       | $\pm 20$                | mA   |
| $I_{OUT}$     | DC Output Sink Current                                                                                        | $\pm 12.5$              | mA   |
| $I_{CC}$      | DC Supply Current per Supply 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<br>SC70-5/SC-88A/SOT-353 (Note 1)<br>SOT23-5/TSOP-5/SC59-5                                 | 350<br>230              | °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                      | 150<br>200              | 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<br>Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 200<br>N/A  | V    |
| $I_{LATCHUP}$ | Latchup Performance<br>Above $V_{CC}$ and Below GND at 125°C (Note 5)                                         | $\pm 500$               | mA   |

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

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace with no air flow.
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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                                                                                                                            | Min              | Max                       | Unit |
|------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------------|------|
| $V_{CC}$   | DC Supply Voltage                                                                                                                    | 2.0              | 6.0                       | V    |
| $V_{IN}$   | DC Input Voltage                                                                                                                     | 0.0              | $V_{CC}$                  | V    |
| $V_{OUT}$  | DC Output Voltage                                                                                                                    | 0.0              | $V_{CC}$                  | V    |
| $T_A$      | Operating Temperature Range                                                                                                          | - 55             | + 125                     | °C   |
| $t_r, t_f$ | Input Rise and Fall Time<br>$V_{CC} = 2.0\text{ V}$<br>$V_{CC} = 3.0\text{ V}$<br>$V_{CC} = 4.5\text{ V}$<br>$V_{CC} = 6.0\text{ V}$ | 0<br>0<br>0<br>0 | 1000<br>600<br>500<br>400 | ns   |

## 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         |

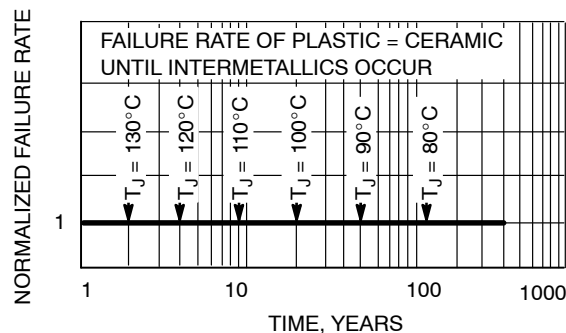


Figure 3. Failure Rate vs. Time Junction Temperature

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## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                                                                                 | Test Conditions                                                                                              | 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<br>4.5<br>6.0 | 1.7<br>2.45<br>3.60<br>4.80 |                          |                           | 1.7<br>2.45<br>3.60<br>4.80 |                           | 1.7<br>2.45<br>3.60<br>4.80    |                           | V    |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                                                           |                                                                                                              | 2.0<br>3.0<br>4.5<br>6.0 |                             |                          | 0.3<br>0.5<br>0.9<br>1.20 |                             | 0.3<br>0.5<br>0.9<br>1.20 |                                | 0.3<br>0.5<br>0.9<br>1.20 | V    |
| V <sub>OH</sub> | Minimum High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -20 μA                             | 2.0<br>3.0<br>4.5<br>6.0 | 1.8<br>2.7<br>4.0<br>5.5    | 2.0<br>3.0<br>4.5<br>5.9 |                           | 1.8<br>2.7<br>4.0<br>5.5    |                           | 1.8<br>2.7<br>4.0<br>5.5       |                           | V    |
|                 |                                                                                           | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = -2 mA<br>I <sub>OH</sub> = -2.6 mA | 4.5<br>6.0               | 4.18<br>5.68                | 4.33<br>5.76             |                           | 4.13<br>5.63                |                           | 4.08<br>5.58                   |                           |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 20 μA                              | 2.0<br>3.0<br>4.5<br>6.0 |                             | 0.0<br>0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1<br>0.1  |                             | 0.1<br>0.1<br>0.1<br>0.1  |                                | 0.1<br>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>OL</sub> = 2 mA<br>I <sub>OL</sub> = 2.6 mA   | 4.5<br>6.0               |                             |                          | 0.26<br>0.26              |                             | 0.33<br>0.33              |                                | 0.40<br>0.40              |      |
| I <sub>IN</sub> | Maximum Input Leakage Current                                                             | V <sub>IN</sub> = 6.0 V or GND                                                                               | 6.0                      |                             |                          | ±0.1                      |                             | ±1.0                      |                                | ±1.0                      | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current                                                          | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                     | 6.0                      |                             |                          | 1.0                       |                             | 10                        |                                | 40                        | μA   |

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 6.0 ns)

| Symbol                                 | Parameter                                    | Test Conditions                                   | 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 |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Input A or B to Y | V <sub>CC</sub> = 5.0 V    C <sub>L</sub> = 15 pF |                       | 3   | 15  |                       | 20  |                                | 25  | ns   |
|                                        |                                              | V <sub>CC</sub> = 2.0 V    C <sub>L</sub> = 50 pF |                       | 17  | 100 |                       | 125 |                                | 155 |      |
|                                        |                                              | V <sub>CC</sub> = 3.0 V                           |                       | 9   | 27  |                       | 35  |                                | 90  |      |
|                                        |                                              | V <sub>CC</sub> = 4.5 V                           |                       | 7   | 20  |                       | 25  |                                | 35  |      |
|                                        |                                              | V <sub>CC</sub> = 6.0 V                           |                       | 6.5 | 17  |                       | 21  |                                | 26  |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Output Transition Time                       | V <sub>CC</sub> = 5.0 V    C <sub>L</sub> = 15 pF |                       | 4   | 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                           |                       | 12  | 25  |                       | 31  |                                | 38  |      |
|                                        |                                              | V <sub>CC</sub> = 6.0 V                           |                       | 10  | 21  |                       | 26  |                                | 32  |      |
| C <sub>IN</sub>                        | Maximum Input Capacitance                    |                                                   |                       | 5   | 10  |                       | 10  |                                | 10  | pF   |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Note 6)       | Typical @ 25°C, V <sub>CC</sub> = 5.0 V           |                       |     |     |                       |     |                                |     | pF   |
|                                        |                                              | 10                                                |                       |     |     |                       |     |                                |     |      |

6. C<sub>PD</sub> 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is 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<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# MC74HC1GU04

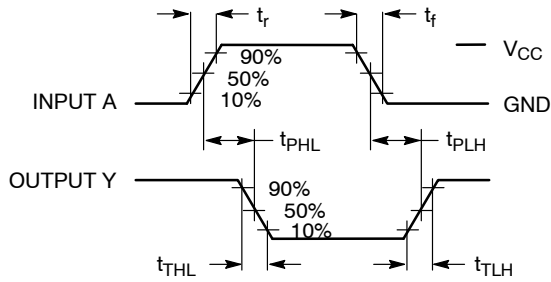
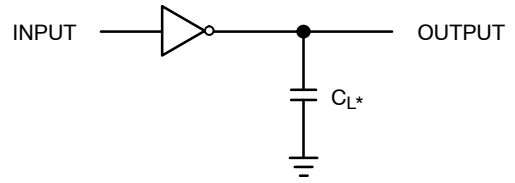


Figure 4. Switching Waveforms



\*Includes all probe and jig capacitance.  
A 1-MHz square input wave is recommended for propagation delay tests.

Figure 5. Test Circuit

## DEVICE ORDERING INFORMATION

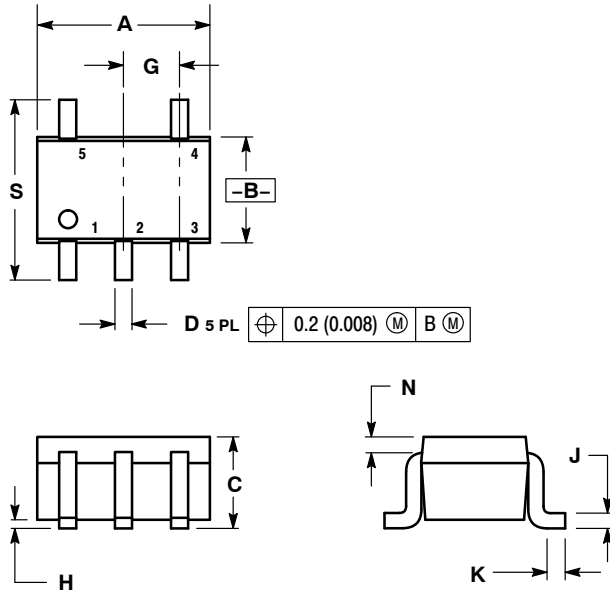
| Device Order Number | Device Nomenclature     |                       |            |                 |                |                      | Package Type                           | Tape and Reel Size†        |
|---------------------|-------------------------|-----------------------|------------|-----------------|----------------|----------------------|----------------------------------------|----------------------------|
|                     | Logic Circuit Indicator | Temp Range Identifier | Technology | Device Function | Package Suffix | Tape and Reel Suffix |                                        |                            |
| MC74HC1GU04DFT1G    | MC                      | 74                    | HC1G       | U04             | DF             | T1                   | SC70-5/SC-88A/<br>SOT-353<br>(Pb-Free) | 178 mm (7 in)<br>3000 Unit |
| MC74HC1GU04DFT2G    | MC                      | 74                    | HC1G       | U04             | DF             | T2                   | SC70-5/SC-88A/<br>SOT-353<br>(Pb-Free) | 178 mm (7 in)<br>3000 Unit |
| MC74HC1GU04DTT1G    | MC                      | 74                    | HC1G       | U04             | DT             | T1                   | SOT23-5/TSOP-5/<br>SC59-5<br>(Pb-Free) | 178 mm (7 in)<br>3000 Unit |

†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.

# MC74HC1GU04

## PACKAGE DIMENSIONS

SC-88A (SC-70-5/SOT-353)  
CASE 419A-02  
ISSUE K



### NOTES:

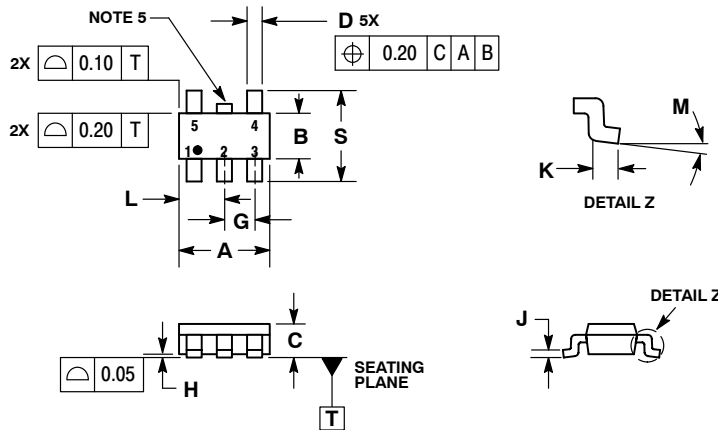
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. 419A-01 OBSOLETE. NEW STANDARD 419A-02.
4. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

| 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 |

# MC74HC1GU04

## PACKAGE DIMENSIONS

### TSOP-5 CASE 483-02 ISSUE H

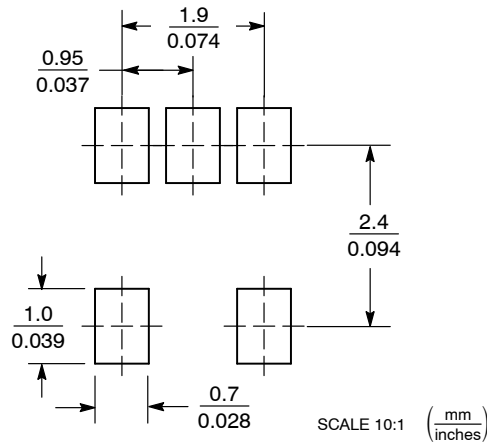


#### NOTES:

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.
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   | 3.00        | BSC  |
| B   | 1.50        | BSC  |
| 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 |
| L   | 1.25        | 1.55 |
| 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.

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В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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