

# MC74HC03A

## Quad 2-Input NAND Gate with Open-Drain Outputs High-Performance Silicon-Gate CMOS

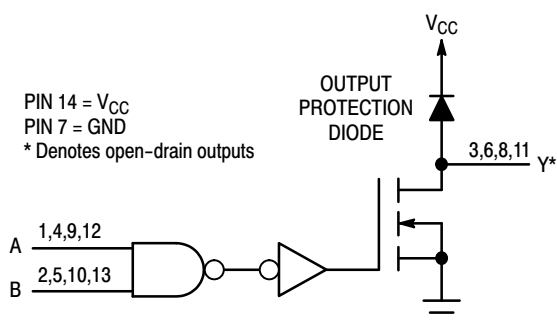
The MC74HC03A is identical in pinout to the LS03. The device inputs are compatible with Standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The HC03A NAND gate has, as its outputs, a high-performance MOS N-Channel transistor. This NAND gate can, therefore, with a suitable pullup resistor, be used in wired-AND applications. Having the output characteristic curves given in this data sheet, this device can be used as an LED driver or in any other application that only requires a sinking current.

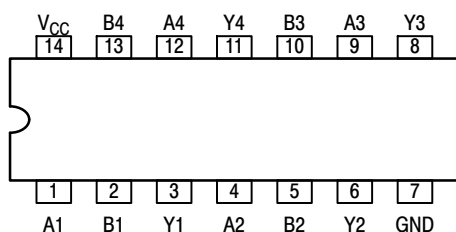
### Features

- Output Drive Capability: 10 LSTTL Loads With Suitable Pullup Resistor
- Outputs Directly Interface to CMOS, NMOS and TTL
- High Noise Immunity Characteristic of CMOS Devices
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1  $\mu$ A
- In Compliance With the JEDEC Standard No. 7 A Requirements
- Chip Complexity: 28 FETs or 7 Equivalent Gates
- 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

### LOGIC DIAGRAM



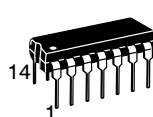
### Pinout: 14-Lead Packages (Top View)



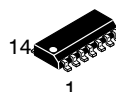
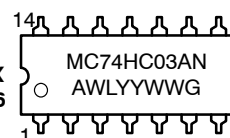
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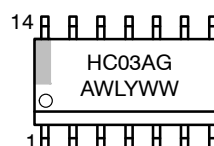
### MARKING DIAGRAMS



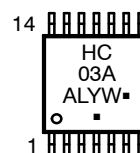
PDIP-14  
N SUFFIX  
CASE 646



SOIC-14  
D SUFFIX  
CASE 751A



TSSOP-14  
DT SUFFIX  
CASE 948G



A = Assembly Location  
L, WL = Wafer Lot  
Y, YY = Year  
W, WW = Work Week  
G or ■ = Pb-Free Package

(Note: Microdot may be in either location)

### FUNCTION TABLE

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

Z = High Impedance

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# MC74HC03A

## MAXIMUM RATINGS

| Symbol    | Parameter                                                                             | Value                   | Unit |
|-----------|---------------------------------------------------------------------------------------|-------------------------|------|
| $V_{CC}$  | DC Supply Voltage (Referenced to GND)                                                 | - 0.5 to + 7.0          | V    |
| $V_{in}$  | DC Input Voltage (Referenced to GND)                                                  | - 0.5 to $V_{CC} + 0.5$ | V    |
| $V_{out}$ | DC Output Voltage (Referenced to GND)                                                 | - 0.5 to $V_{CC} + 0.5$ | V    |
| $I_{in}$  | DC Input Current, per Pin                                                             | $\pm 20$                | mA   |
| $I_{out}$ | DC Output Current, per Pin                                                            | $\pm 25$                | mA   |
| $I_{CC}$  | DC Supply Current, $V_{CC}$ and GND Pins                                              | $\pm 50$                | mA   |
| $P_D$     | Power Dissipation in Still Air<br>Plastic DIP†<br>SOIC Package†<br>TSSOP Package†     | 750<br>500<br>450       | mW   |
| $T_{stg}$ | Storage Temperature                                                                   | -65 to + 150            | °C   |
| $T_L$     | Lead Temperature, 1 mm from Case for 10 Seconds<br>Plastic DIP, SOIC or TSSOP Package | 260                     | °C   |

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.

†Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C  
SOIC Package: - 7 mW/°C from 65° to 125°C  
TSSOP Package: - 6.1 mW/°C from 65° to 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $GND \leq (V_{in} \text{ or } V_{out}) \leq V_{CC}$ . Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or  $V_{CC}$ ). Unused outputs must be left open.

## RECOMMENDED OPERATING CONDITIONS

| Symbol                             | Parameter                                            | Min                     | Max             | Unit |    |
|------------------------------------|------------------------------------------------------|-------------------------|-----------------|------|----|
| V <sub>CC</sub>                    | DC Supply Voltage (Referenced to GND)                | 2.0                     | 6.0             | V    |    |
| V <sub>in</sub> , V <sub>out</sub> | DC Input Voltage, Output Voltage (Referenced to GND) | 0                       | V <sub>CC</sub> | V    |    |
| T <sub>A</sub>                     | Operating Temperature, All Package Types             | −55                     | +125            | °C   |    |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time                             | V <sub>CC</sub> = 2.0 V | 0               | 1000 | ns |
|                                    | (Figure 1)                                           | V <sub>CC</sub> = 4.5 V | 0               | 500  |    |
|                                    |                                                      | V <sub>CC</sub> = 6.0 V | 0               | 400  |    |

## DESIGN GUIDE

| Criteria                        | Value  | Unit |
|---------------------------------|--------|------|
| Internal Gate Count*            | 7.0    | ea   |
| Internal Gate Propagation Delay | 1.5    | ns   |
| Internal Gate Power Dissipation | 5.0    | μW   |
| Speed Power Product             | 0.0075 | pJ   |

\*Equivalent to a two-input NAND gate

# MC74HC03A

## DC CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Condition                                                                                                                                      | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|-----------------|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|-------|--------|------|
|                 |                                                |                                                                                                                                                |                      | -55 to 25°C      | ≤85°C | ≤125°C |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>out</sub> = 0.1V or V <sub>CC</sub> - 0.1V<br> I <sub>out</sub>   ≤ 20μA                                                                | 2.0                  | 1.50             | 1.50  | 1.50   | V    |
|                 |                                                |                                                                                                                                                | 3.0                  | 2.10             | 2.10  | 2.10   |      |
|                 |                                                |                                                                                                                                                | 4.5                  | 3.15             | 3.15  | 3.15   |      |
|                 |                                                |                                                                                                                                                | 6.0                  | 4.20             | 4.20  | 4.20   |      |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1V or V <sub>CC</sub> - 0.1V<br> I <sub>out</sub>   ≤ 20μA                                                                | 2.0                  | 0.50             | 0.50  | 0.50   | V    |
|                 |                                                |                                                                                                                                                | 3.0                  | 0.90             | 0.90  | 0.90   |      |
|                 |                                                |                                                                                                                                                | 4.5                  | 1.35             | 1.35  | 1.35   |      |
|                 |                                                |                                                                                                                                                | 6.0                  | 1.80             | 1.80  | 1.80   |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>out</sub> = 0.1V or V <sub>CC</sub> - 0.1V<br> I <sub>out</sub>   ≤ 20μA                                                                | 2.0                  | 0.1              | 0.1   | 0.1    | V    |
|                 |                                                |                                                                                                                                                | 4.5                  | 0.1              | 0.1   | 0.1    |      |
|                 |                                                |                                                                                                                                                | 6.0                  | 0.1              | 0.1   | 0.1    |      |
|                 |                                                | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 2.4mA<br> I <sub>out</sub>   ≤ 4.0mA<br> I <sub>out</sub>   ≤ 5.2mA | 3.0                  | 0.26             | 0.33  | 0.40   |      |
|                 |                                                |                                                                                                                                                | 4.5                  | 0.26             | 0.33  | 0.40   |      |
|                 |                                                |                                                                                                                                                | 6.0                  | 0.26             | 0.33  | 0.40   |      |
| I <sub>in</sub> | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                                                       | 6.0                  | ±0.1             | ±1.0  | ±1.0   | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0μA                                                                             | 6.0                  | 1.0              | 10    | 40     | μA   |
| I <sub>OZ</sub> | Maximum Three-State Leakage Current            | Output in High-Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND            | 6.0                  | ±0.5             | ±5.0  | ±10    | μA   |

## AC CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

| Symbol                                 | Parameter                                                                  | V <sub>CC</sub><br>V | Guaranteed Limit |       |        | Unit |
|----------------------------------------|----------------------------------------------------------------------------|----------------------|------------------|-------|--------|------|
|                                        |                                                                            |                      | -55 to 25°C      | ≤85°C | ≤125°C |      |
| t <sub>PLZ</sub> ,<br>t <sub>PZL</sub> | Maximum Propagation Delay, Input A or B to Output Y<br>(Figures 1 and 2)   | 2.0                  | 120              | 150   | 180    | ns   |
|                                        |                                                                            | 3.0                  | 45               | 60    | 75     |      |
|                                        |                                                                            | 4.5                  | 24               | 30    | 36     |      |
|                                        |                                                                            | 6.0                  | 20               | 26    | 31     |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 1 and 2)            | 2.0                  | 75               | 95    | 110    | ns   |
|                                        |                                                                            | 3.0                  | 27               | 32    | 36     |      |
|                                        |                                                                            | 4.5                  | 15               | 19    | 22     |      |
|                                        |                                                                            | 6.0                  | 13               | 16    | 19     |      |
| C <sub>in</sub>                        | Maximum Input Capacitance                                                  |                      | 10               | 10    | 10     | pF   |
| C <sub>out</sub>                       | Maximum Three-State Output Capacitance<br>(Output in High-Impedance State) |                      | 10               | 10    | 10     | pF   |

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Buffer)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V, V <sub>EE</sub> = 0 V | pF |
|-----------------|---------------------------------------------|----------------------------------------------------------------|----|
|                 |                                             | 8.0                                                            |    |

\* Used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> V<sub>CC</sub><sup>2</sup>f + I<sub>CC</sub> V<sub>CC</sub>.

# MC74HC03A

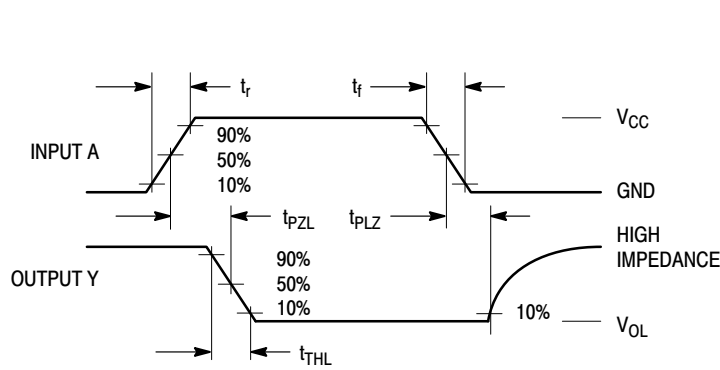
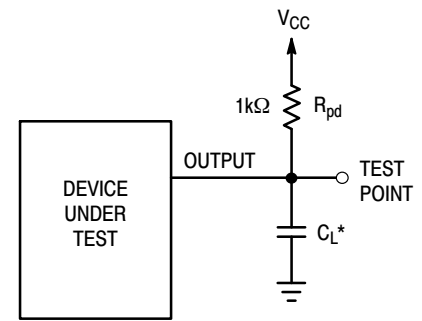
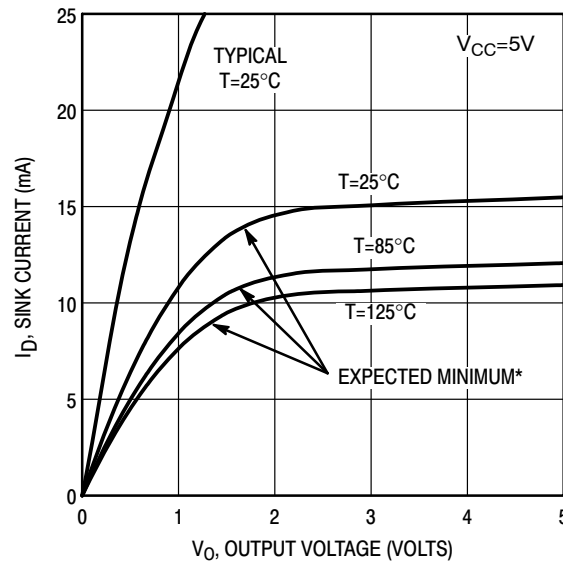


Figure 1. Switching Waveforms



\*Includes all probe and jig capacitance

Figure 2. Test Circuit



\*The expected minimum curves are not guarantees, but are design aids.

Figure 3. Open-Drain Output Characteristics

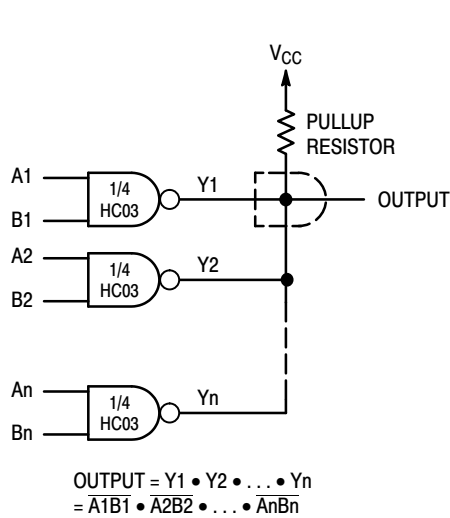


Figure 4. Wired AND

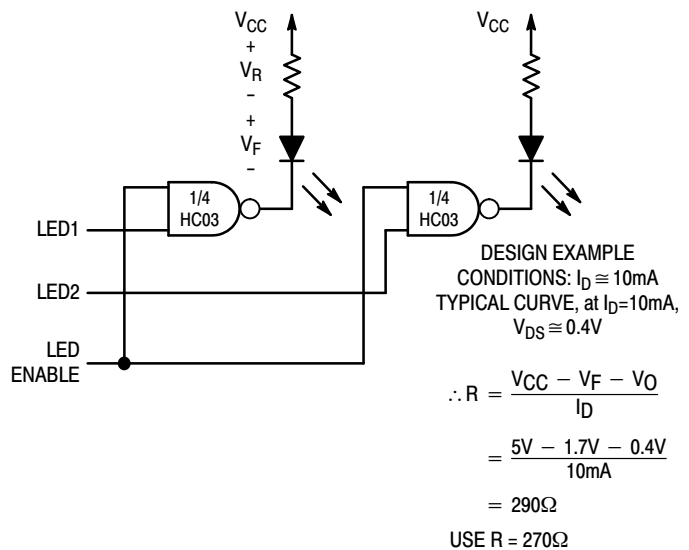


Figure 5. LED Driver With Blanking

## MC74HC03A

### ORDERING INFORMATION

| Device           | Package               | Shipping†          |
|------------------|-----------------------|--------------------|
| MC74HC03ANG      | PDIP-14<br>(Pb-Free)  | 25 Units / Rail    |
| MC74HC03ADG      | SOIC-14<br>(Pb-Free)  | 55 Units / Rail    |
| MC74HC03ADR2G    | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel |
| MC74HC03ADTR2G   | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel |
| NLV74HC03ADG*    | SOIC-14<br>(Pb-Free)  | 55 Units / Rail    |
| NLV74HC03ADR2G*  | SOIC-14<br>(Pb-Free)  | 2500 / Tape & Reel |
| NLV74HC03ADTR2G* | TSSOP-14<br>(Pb-Free) | 2500 / Tape & Reel |
| NLV74HC03ANG*    | PDIP-14<br>(Pb-Free)  | 25 Units / Rail    |

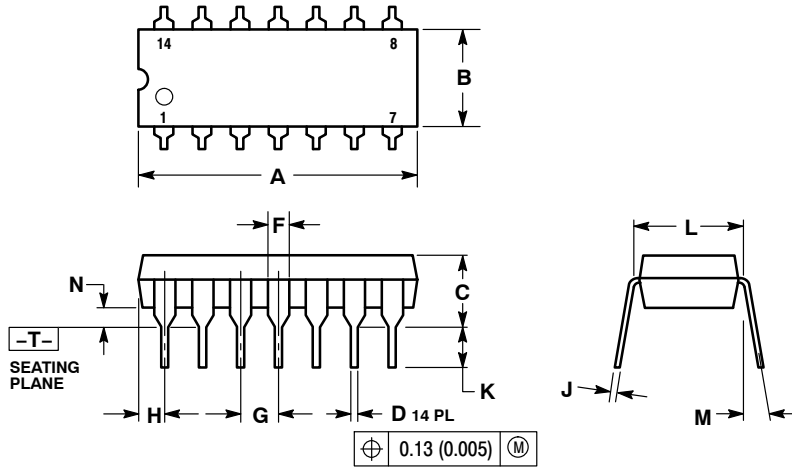
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

# MC74HC03A

## PACKAGE DIMENSIONS

PDIP-14  
N SUFFIX  
CASE 646-06  
ISSUE P



### NOTES:

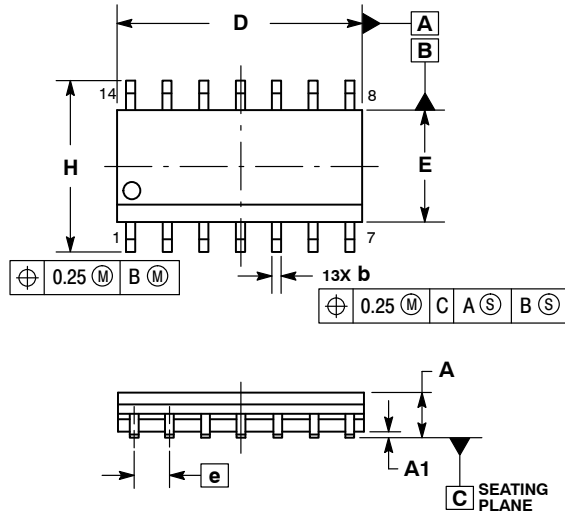
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.715     | 0.770 | 18.16       | 19.56 |
| B   | 0.240     | 0.260 | 6.10        | 6.60  |
| C   | 0.145     | 0.185 | 3.69        | 4.69  |
| D   | 0.015     | 0.021 | 0.38        | 0.53  |
| F   | 0.040     | 0.070 | 1.02        | 1.78  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.052     | 0.095 | 1.32        | 2.41  |
| J   | 0.008     | 0.015 | 0.20        | 0.38  |
| K   | 0.115     | 0.135 | 2.92        | 3.43  |
| L   | 0.290     | 0.310 | 7.37        | 7.87  |
| M   | 10°       |       | 10°         |       |
| N   | 0.015     | 0.039 | 0.38        | 1.01  |

# MC74HC03A

## PACKAGE DIMENSIONS

SOIC-14 NB  
CASE 751A-03  
ISSUE K

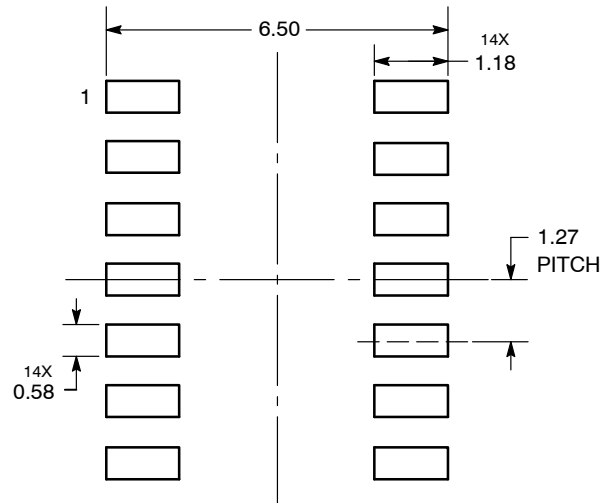


### NOTES:

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\*



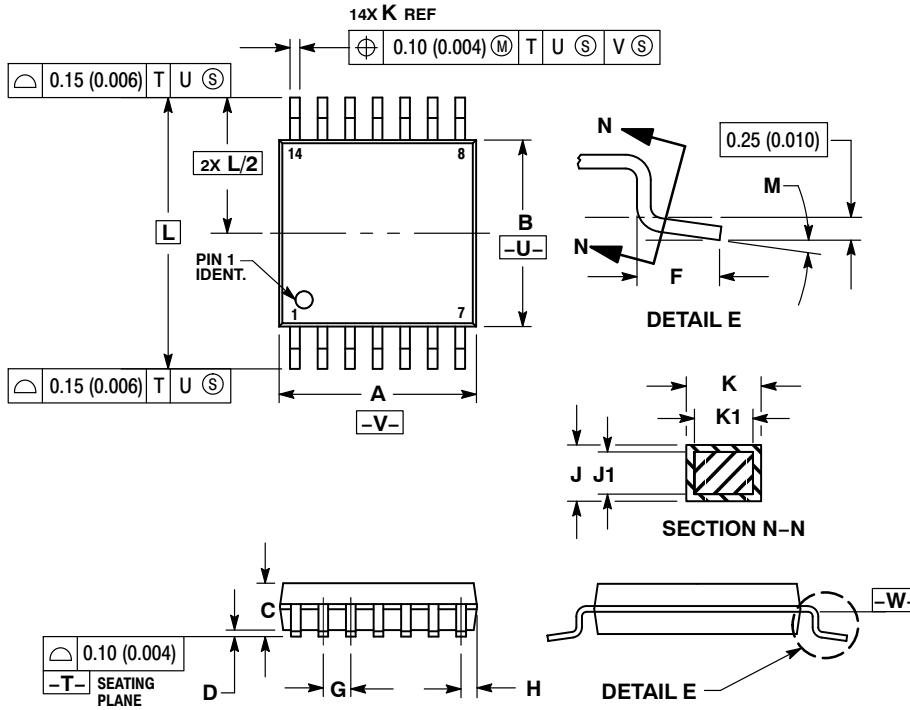
DIMENSIONS: MILLIMETERS

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

# MC74HC03A

## PACKAGE DIMENSIONS

TSSOP-14  
DT SUFFIX  
CASE 948G-01  
ISSUE B

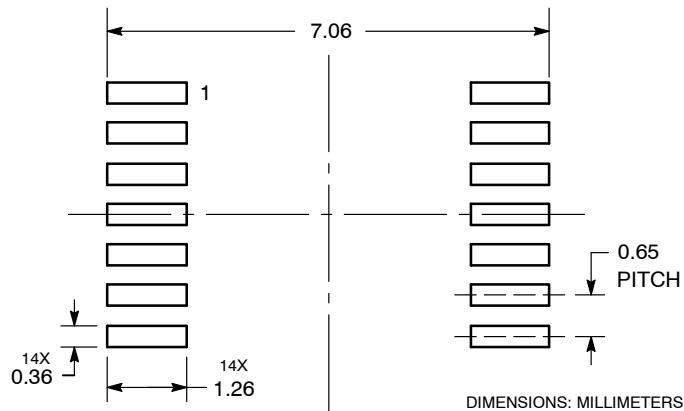


### NOTES:

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-.

| 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°    |

### 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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- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.