

# MC74HC05A

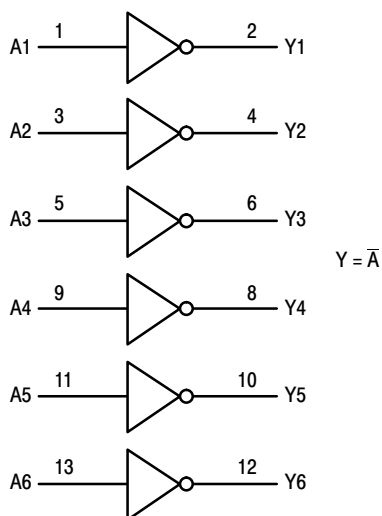
## Hex Inverter with Open Drain Outputs

The MC74HC05A contains six inverters with open drain outputs. The MC74HC05A is identical to the MC74HC04A, except for the open drain outputs. The outputs can be connected to other open drain outputs to implement active LOW wired-OR or active High wired-AND logic functions. The open drain outputs require pull-up resistors to perform correctly.

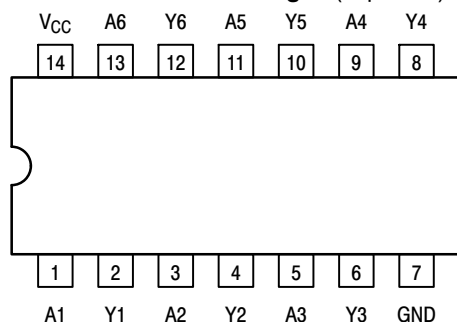
### Features

- Output Drive Capability: 10 LSTTL Loads with Suitable Pull-up 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. 7A Requirements
- Chip Complexity: 36 FETs or 9 Equivalent Gates
- These are Pb-Free Devices

### LOGIC DIAGRAM



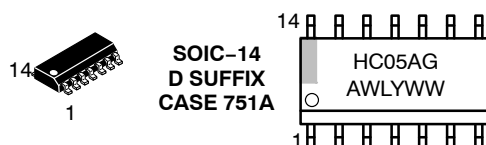
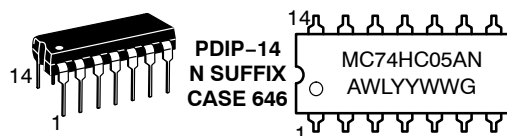
### Pinout: 14-Lead Packages (Top View)



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### MARKING DIAGRAMS



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

(Note: Microdot may be in either location)

### FUNCTION TABLE

| Inputs | Outputs |
|--------|---------|
| A      | 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.

# MC74HC05A

## 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.

\*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.

†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

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                                                                                                                  | Min         | Max                | Unit |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|-------------|--------------------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                                                                                      | 2.0         | 6.0                | V    |
| $V_{in}, V_{out}$ | DC Input Voltage, Output Voltage (Referenced to GND)                                                                       | 0           | $V_{CC}$           | V    |
| $T_A$             | Operating Temperature, All Package Types                                                                                   | – 55        | + 125              | °C   |
| $t_r, t_f$        | Input Rise and Fall Time<br>(Figure 1)<br>$V_{CC} = 2.0 \text{ V}$<br>$V_{CC} = 4.5 \text{ V}$<br>$V_{CC} = 6.0 \text{ V}$ | 0<br>0<br>0 | 1000<br>500<br>400 | ns   |

# MC74HC05A

## 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    |
|                 |                                                |                                                                                                                                     | 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    |
|                 |                                                |                                                                                                                                     | 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>   ≤ 4.0mA<br> I <sub>out</sub>   ≤ 5.2mA                     | 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> = 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> = 50pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

| 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                  | 90               | 115   | 135    | ns   |
|                                        |                                                                            | 4.5                  | 18               | 23    | 27     |      |
|                                        |                                                                            | 6.0                  | 15               | 20    | 23     |      |
| t <sub>THL</sub>                       | Maximum Output Transition Time, Any Output<br>(Figures 1 and 2)            | 2.0                  | 75               | 95    | 110    | ns   |
|                                        |                                                                            | 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 |
|                 |                                             | 4.0                                                            |    |

\* 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>.

# MC74HC05A

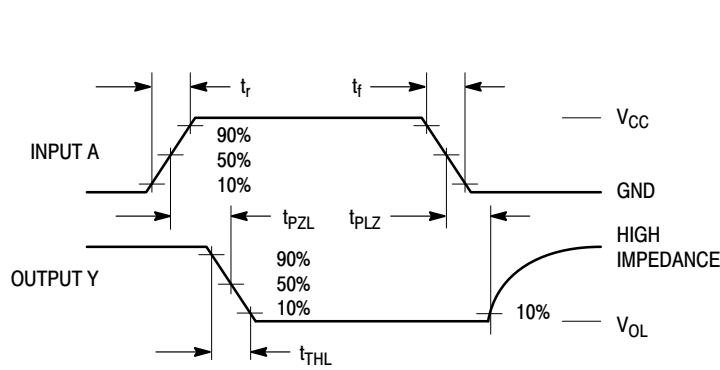
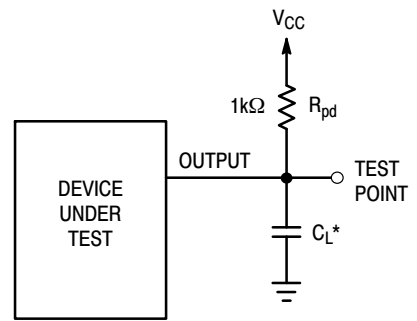
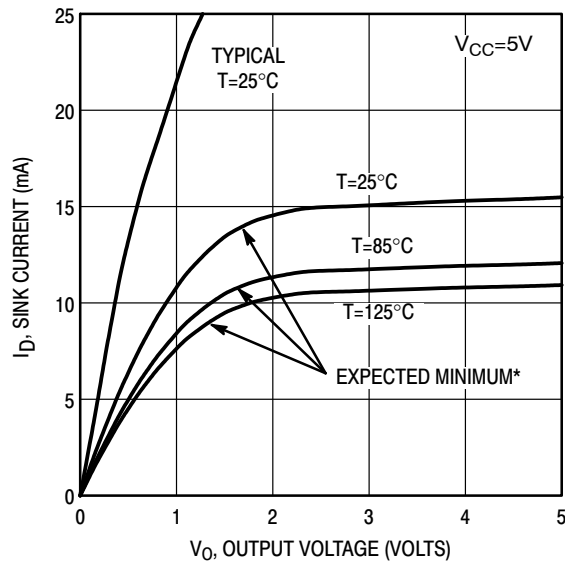


Figure 1. Switching Waveforms



\*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

## ORDERING INFORMATION

| Device         | Package                | Shipping <sup>†</sup> |
|----------------|------------------------|-----------------------|
| MC74HC05ANG    | PDIP-14<br>(Pb-Free)   | 25 / Rail             |
| MC74HC05ADG    | SOIC-14<br>(Pb-Free)   | 55 / Rail             |
| MC74HC05ADR2G  | SOIC-14<br>(Pb-Free)   | 2500 / Tape & Reel    |
| MC74HC05ADTR2G | TSSOP-14*              |                       |
| MC74HC05AFG    | SOEIAJ-14<br>(Pb-Free) | 50 / Rail             |
| MC74HC05AFELG  | SOEIAJ-14<br>(Pb-Free) | 2000 / Tape & Reel    |

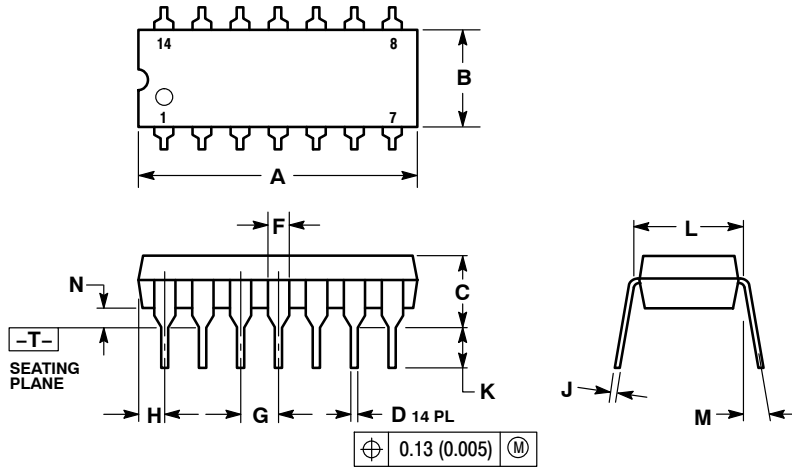
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

# MC74HC05A

## PACKAGE DIMENSIONS

**PDIP-14**  
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  |

## PACKAGE DIMENSIONS

Technical drawing of a 14-pin micro connector. The drawing includes a top view, a side view, and two detail views (DETAIL E).

**Top View:**

- Overall width:  $0.15 (0.006)$  T U S
- Overall height:  $0.15 (0.006)$  T U S
- Pin pitch:  $0.10 (0.004)$  M T U S V S
- Pin 1 IDENT. (Pin 1 is circled)
- Pin numbers: 1, 7, 8, 14
- Dimensions:  $2X L/2$ ,  $L$ ,  $B$ ,  $A$ ,  $-U-$ ,  $-V-$

**Side View:**

- Seating Plane:  $0.10 (0.004)$  T U S
- Dimensions:  $D$ ,  $C$ ,  $G$ ,  $H$

**DETAIL E (Top):**

- Dimension:  $0.25 (0.010)$
- Labels: N, M, F

**SECTION N-N:**

- Labels: J, J1, K, K1

**DETAIL E (Bottom):**

- Label:  $-W-$

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°    |

7.06

1

0.65 PITCH

14X 0.36

14X 1.26

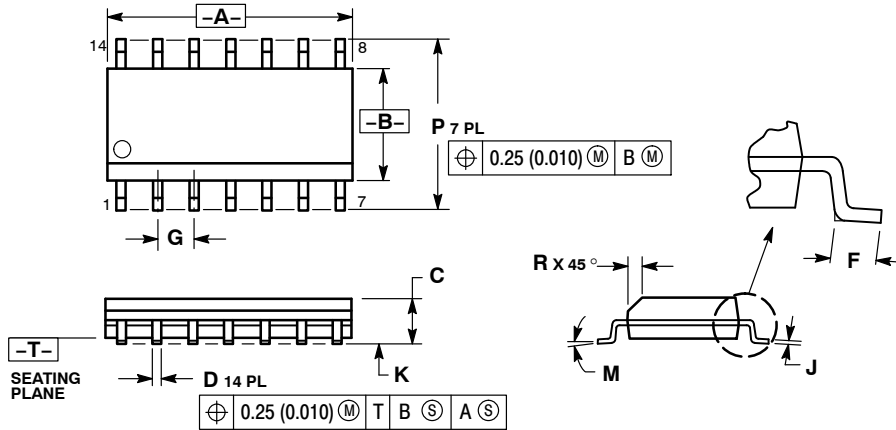
DIMENSIONS: MILLIMETERS

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

# MC74HC05A

## PACKAGE DIMENSIONS

SOIC-14  
CASE 751A-03  
ISSUE H

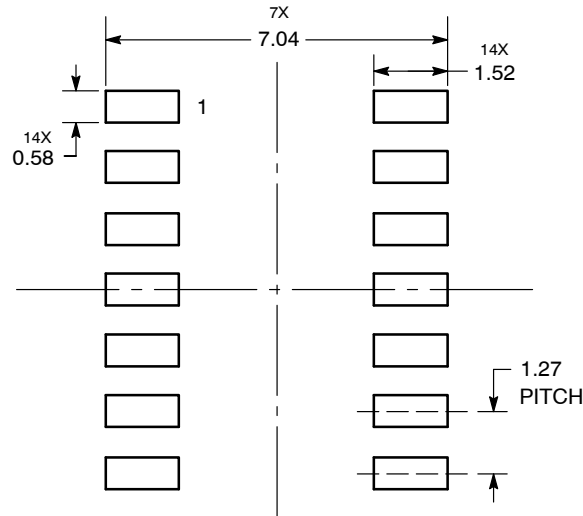


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 8.55        | 8.75 | 0.337     | 0.344 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.19        | 0.25 | 0.008     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0°          | 7°   | 0°        | 7°    |
| P   | 5.80        | 6.20 | 0.228     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

### 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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MC74HC05A/D



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