

# MC74VHC00

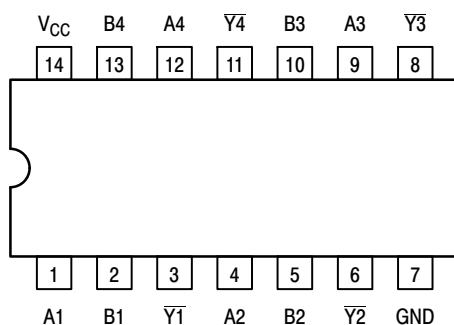
## Quad 2-Input NAND Gate

The MC74VHC00 is an advanced high speed CMOS 2-input NAND gate fabricated with silicon gate CMOS technology. It achieves high speed operation similar to equivalent Bipolar Schottky TTL while maintaining CMOS low power dissipation.

The internal circuit is composed of three stages, including a buffer output which provides high noise immunity and stable output. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

### Features

- High Speed:  $t_{PD} = 3.7 \text{ ns (Typ)}$  at  $V_{CC} = 5 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 2 \mu\text{A (Max)}$  at  $T_A = 25^\circ\text{C}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Designed for 2 V to 5.5 V Operating Range
- Low Noise:  $V_{OLP} = 0.8 \text{ V (Max)}$
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: HBM > 2000 V; Machine Model > 200 V
- Chip Complexity: 32 FETs or 8 Equivalent Gates
- These Devices are Pb-Free and are RoHS Compliant



**Figure 1. Pinout: 14-Lead Packages**  
(Top View)

### FUNCTION TABLE

| Inputs |   | Output    |
|--------|---|-----------|
| A      | B | $\bar{Y}$ |
| L      | L | H         |
| L      | H | H         |
| H      | L | H         |
| H      | H | L         |



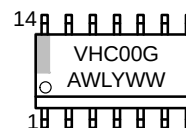
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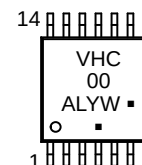
### MARKING DIAGRAMS



**SO-14**  
**D SUFFIX**  
**CASE 751A**



**TSSOP-14**  
**DT SUFFIX**  
**CASE 948G**



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

### ORDERING INFORMATION

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

## MC74VHC00

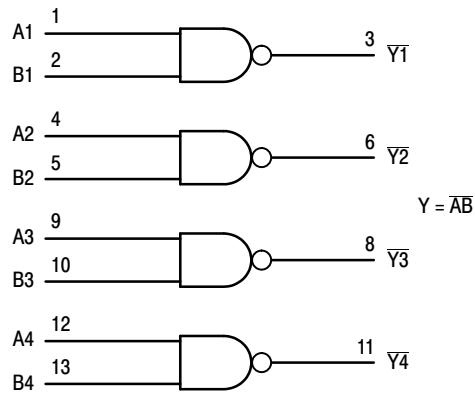


Figure 2. Logic Diagram

### MAXIMUM RATINGS

| Symbol         | Parameter                                | Value                                                                                                        | Unit |
|----------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------|------|
| $V_{CC}$       | Positive DC Supply Voltage               | -0.5 to +7.0                                                                                                 | V    |
| $V_{IN}$       | Digital Input Voltage                    | -0.5 to +7.0                                                                                                 | V    |
| $V_{OUT}$      | DC Output Voltage                        | -0.5 to $V_{CC} + 0.5$                                                                                       | V    |
| $I_{IK}$       | Input Diode Current                      | -20                                                                                                          | mA   |
| $I_{OK}$       | Output Diode Current                     | $\pm 20$                                                                                                     | mA   |
| $I_{OUT}$      | DC Output Current, per Pin               | $\pm 25$                                                                                                     | mA   |
| $I_{CC}$       | DC Supply Current, $V_{CC}$ and GND Pins | $\pm 75$                                                                                                     | mA   |
| $P_D$          | Power Dissipation in Still Air           | SOIC Package<br>TSSOP<br>200<br>180                                                                          | mW   |
| $T_{STG}$      | Storage Temperature Range                | -65 to +150                                                                                                  | °C   |
| $V_{ESD}$      | ESD Withstand Voltage                    | Human Body Model (Note 1)<br>Machine Model (Note 2)<br>Charged Device Model (Note 3)<br>>2000<br>>200<br>N/A | V    |
| $I_{LATCH-UP}$ | Latch-Up Performance                     | Above $V_{CC}$ and Below GND at 125°C (Note 4)<br>$\pm 300$                                                  | mA   |
| $\theta_{JA}$  | Thermal Resistance, Junction to Ambient  | SOIC Package<br>TSSOP<br>143<br>164                                                                          | °C/W |

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. Tested to EIA/JESD22-A114-A
2. Tested to EIA/JESD22-A115-A
3. Tested to JESD22-C101-A
4. Tested to EIA/JESD78

### RECOMMENDED OPERATING CONDITIONS

| Symbol     | Characteristics                                | Min                                                                                                | Max       | Unit |
|------------|------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------|------|
| $V_{CC}$   | DC Supply Voltage                              | 2.0                                                                                                | 5.5       | V    |
| $V_{IN}$   | DC Input Voltage                               | 0                                                                                                  | 5.5       | V    |
| $V_{OUT}$  | DC Output Voltage                              | 0                                                                                                  | $V_{CC}$  | V    |
| $T_A$      | Operating Temperature Range, All Package Types | -55                                                                                                | 125       | °C   |
| $t_r, t_f$ | Input Rise or Fall Time                        | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$<br>$V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$<br>0<br>0 | 100<br>20 | ns/V |

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.

# MC74VHC00

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                 | Test Conditions                                                                                              | V <sub>CC</sub><br>V | T <sub>A</sub> = 25°C         |                   |                               | T <sub>A</sub> = -40 to 85°C  |                               | T <sub>A</sub> = -55 to +125°C |                               | Unit |
|-----------------|---------------------------|--------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|-------------------------------|------|
|                 |                           |                                                                                                              |                      | Min                           | Typ               | Max                           | Min                           | Max                           | Min                            | Max                           |      |
| V <sub>IH</sub> | High-Level Input Voltage  |                                                                                                              | 2.0<br>3.0 to 5.5    | 1.50<br>V <sub>CC</sub> × 0.7 |                   |                               | 1.50<br>V <sub>CC</sub> × 0.7 |                               | 1.50<br>V <sub>CC</sub> × 0.7  |                               | V    |
| V <sub>IL</sub> | Low-Level Input Voltage   |                                                                                                              | 2.0<br>3.0 to 5.5    |                               |                   | 0.50<br>V <sub>CC</sub> × 0.3 |                               | 0.50<br>V <sub>CC</sub> × 0.3 |                                | 0.50<br>V <sub>CC</sub> × 0.3 | V    |
| V <sub>OH</sub> | High-Level Output Voltage | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = - 50 µA                            | 2.0<br>3.0<br>4.5    | 1.9<br>2.9<br>4.4             | 2.0<br>3.0<br>4.5 |                               | 1.9<br>2.9<br>4.4             |                               | 1.9<br>2.9<br>4.4              |                               | V    |
|                 |                           | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = - 4 mA<br>I <sub>OH</sub> = - 8 mA | 3.0<br>4.5           | 2.58<br>3.94                  |                   |                               | 2.48<br>3.80                  |                               | 2.40<br>3.70                   |                               |      |
| V <sub>OL</sub> | Low-Level Output Voltage  | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 50 µA                              | 2.0<br>3.0<br>4.5    |                               | 0.0<br>0.0<br>0.0 | 0.1<br>0.1<br>0.1             |                               | 0.1<br>0.1<br>0.1             |                                | 0.1<br>0.1<br>0.1             | V    |
|                 |                           | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 4 mA<br>I <sub>OL</sub> = 8 mA     | 3.0<br>4.5           |                               |                   | 0.36<br>0.36                  |                               | 0.44<br>0.44                  |                                | 0.55<br>0.55                  |      |
| I <sub>in</sub> | Input Leakage Current     | V <sub>in</sub> = 5.5 V or GND                                                                               | 0 to 5.5             |                               |                   | ± 0.1                         |                               | ± 1.0                         |                                | ± 2.0                         | µA   |
| I <sub>CC</sub> | Quiescent Supply Current  | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                     | 5.5                  |                               |                   | 2.0                           |                               | 20                            |                                | 40                            | µA   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns)

| Symbol                                 | Parameter                              | Test Conditions                                                                   | T <sub>A</sub> = 25°C |            |             | T <sub>A</sub> = -40 to 85°C |             | T <sub>A</sub> = -55 to +125°C |            | Unit |
|----------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------|-----------------------|------------|-------------|------------------------------|-------------|--------------------------------|------------|------|
|                                        |                                        |                                                                                   | Min                   | Typ        | Max         | Min                          | Max         | Min                            | Max        |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay, A or B to $\bar{Y}$ | V <sub>CC</sub> = 3.3 ± 0.3 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 5.5<br>8.0 | 7.9<br>11.4 | 1.0<br>1.0                   | 9.5<br>13.0 | 1.0<br>1.0                     | 10<br>14.5 | ns   |
|                                        |                                        | V <sub>CC</sub> = 5.0 ± 0.5 V    C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |                       | 3.7<br>5.2 | 5.5<br>7.5  | 1.0<br>1.0                   | 6.5<br>8.5  | 1.0<br>1.0                     | 7.0<br>9.5 |      |
| C <sub>in</sub>                        | Input Capacitance                      |                                                                                   |                       | 4.0        | 10          |                              | 10          |                                | 10         | pF   |

|                 |                                        |                                         |    |
|-----------------|----------------------------------------|-----------------------------------------|----|
| C <sub>PD</sub> | Power Dissipation Capacitance (Note 5) | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|                 |                                        | 19                                      |    |

5. 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>/4 (per gate). 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>.

## NOISE CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns, C<sub>L</sub> = 50 pF, V<sub>CC</sub> = 5.0 V, Measured in SOIC Package)

| Symbol           | Characteristic                               | T <sub>A</sub> = 25°C |       | Unit |
|------------------|----------------------------------------------|-----------------------|-------|------|
|                  |                                              | Typ                   | Max   |      |
| V <sub>OLP</sub> | Quiet Output Maximum Dynamic V <sub>OL</sub> | 0.3                   | 0.8   | V    |
| V <sub>OLV</sub> | Quiet Output Minimum Dynamic V <sub>OL</sub> | - 0.3                 | - 0.8 | V    |
| V <sub>IHD</sub> | Minimum High Level Dynamic Input Voltage     |                       | 3.5   | V    |
| V <sub>ILD</sub> | Maximum Low Level Dynamic Input Voltage      |                       | 1.5   | V    |

# MC74VHC00

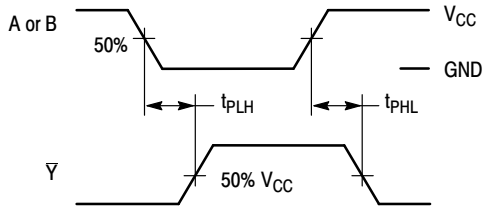
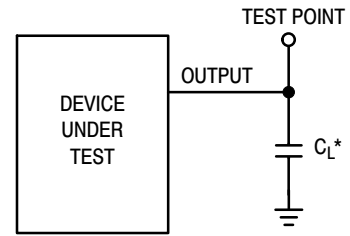


Figure 3. Switching Waveforms



\*Includes all probe and jig capacitance

Figure 4. Test Circuit

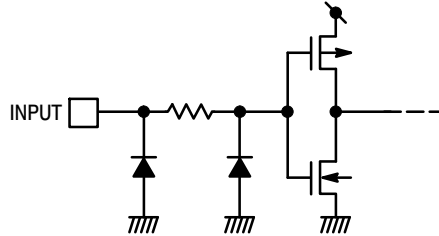


Figure 5. Input Equivalent Circuit

## ORDERING INFORMATION

| Device         | Package                | Shipping <sup>†</sup> |
|----------------|------------------------|-----------------------|
| MC74VHC00DR2G  | SOIC-14<br>(Pb-Free)   | 2500 / Tape & Reel    |
| MC74VHC00DTG   | TSSOP-14*<br>(Pb-Free) | 96 Units / Rail       |
| MC74VHC00DTR2G | TSSOP-14*<br>(Pb-Free) | 2500 / Tape & Reel    |

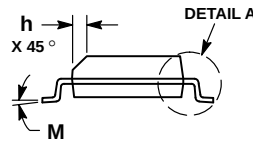
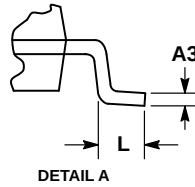
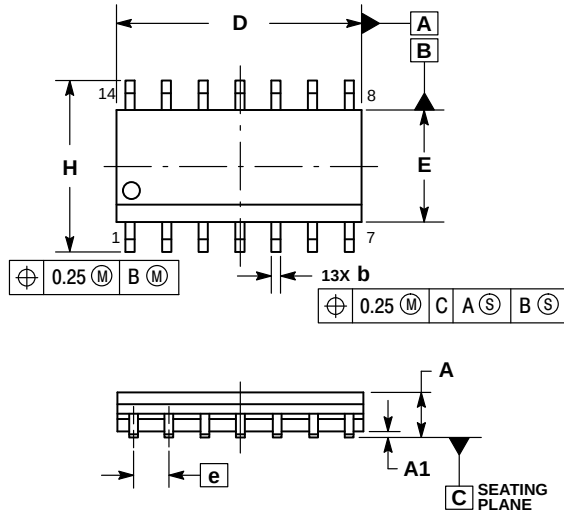
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*This package is inherently Pb-Free.

# MC74VHC00

## PACKAGE DIMENSIONS

SOIC-14  
CASE 751A-03  
ISSUE K

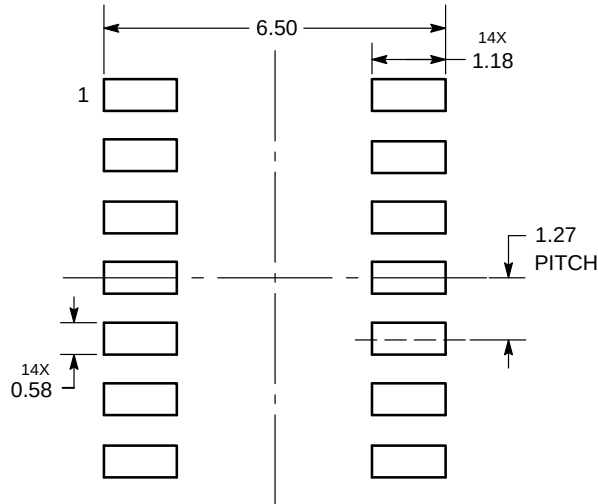


### NOTES:

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\*



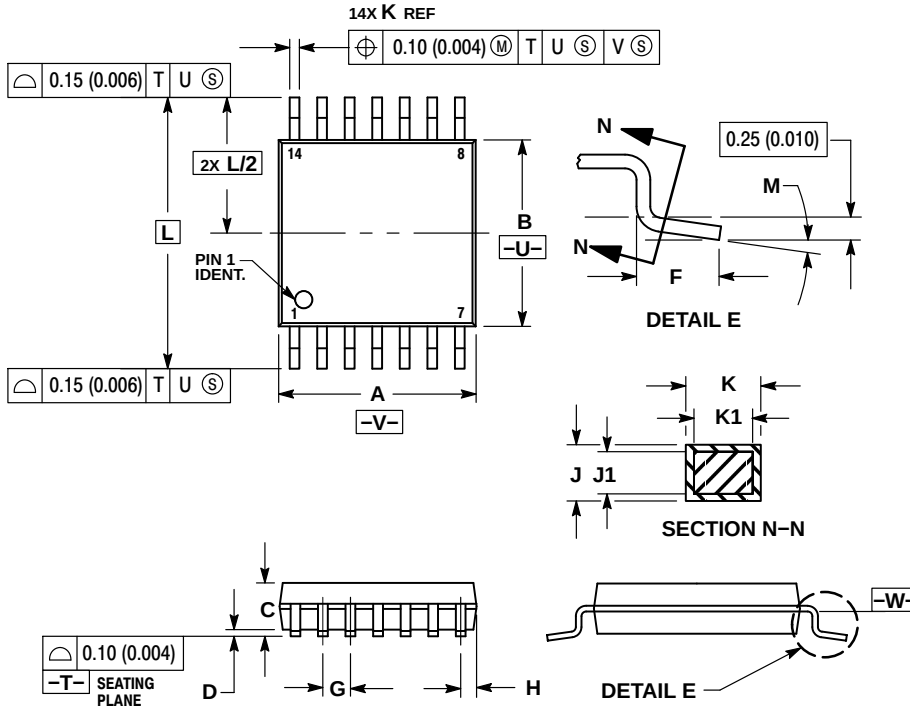
DIMENSIONS: MILLIMETERS

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

# MC74VHC00

## PACKAGE DIMENSIONS

TSSOP-14  
CASE 948G  
ISSUE B

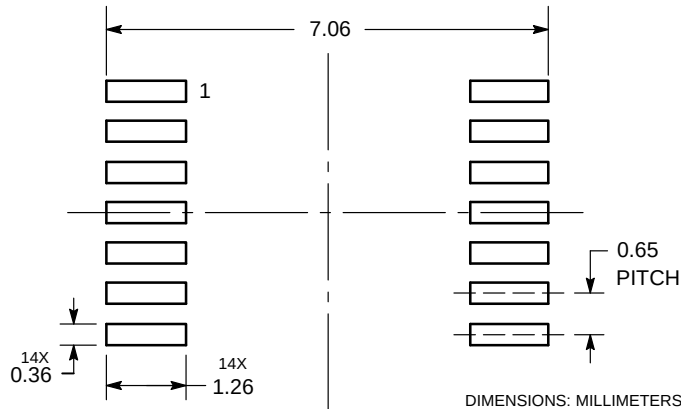


### NOTES:

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



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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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