

MC74HC164A

8-Bit Serial-Input/Parallel-Output Shift Register

High-Performance Silicon-Gate CMOS

The MC74HC164A is identical in pinout to the LS164. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LSTTL outputs.

The MC74HC164A is an 8-bit, serial-input to parallel-output shift register. Two serial data inputs, A1 and A2, are provided so that one input may be used as a data enable. Data is entered on each rising edge of the clock. The active-low asynchronous Reset overrides the Clock and Serial Data inputs.

Features

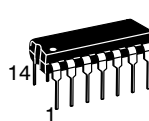
- Output Drive Capability: 10 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 V to 6.0 V
- Low Input Current: 1 μ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the JEDEC Standard No. 7 A Requirements
- Chip Complexity: 244 FETs or 61 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



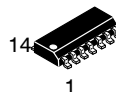
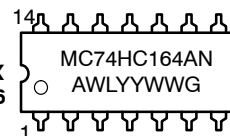
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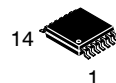
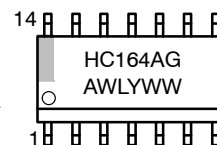
MARKING DIAGRAMS



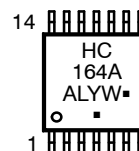
PDIP-14
N SUFFIX
CASE 646



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

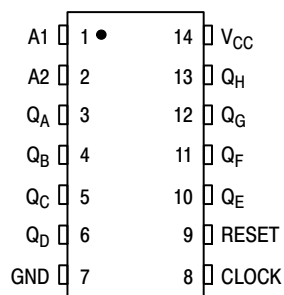
(Note: Microdot may be in either location)

ORDERING INFORMATION

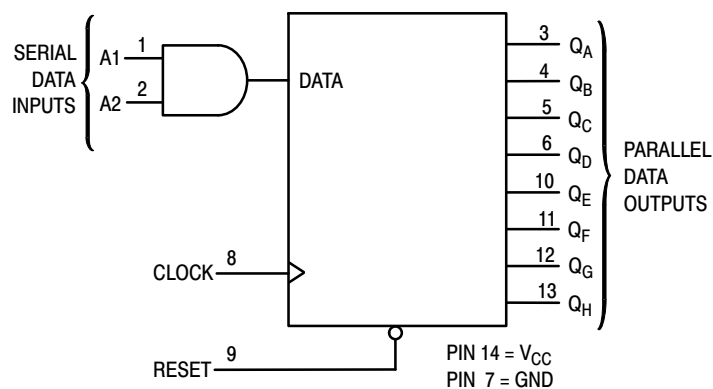
See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

MC74HC164A

PIN ASSIGNMENT



LOGIC DIAGRAM



FUNCTION TABLE

| Inputs | | | | Outputs | | | |
|--------|-------|----|----|-----------|-----------------|-----|-----------------|
| Reset | Clock | A1 | A2 | QA | QB | ... | QH |
| L | X | X | X | L | L | ... | L |
| H | | X | X | No Change | | | |
| H | | H | D | D | QA _n | ... | QG _n |
| H | | D | H | D | QA _n | ... | QG _n |

D = data input

QA_n - QG_n = data shifted from the preceding stage on a rising edge at the clock input.

ORDERING INFORMATION

| Device | Package | Shipping [†] |
|-------------------|-----------------------|-----------------------|
| MC74HC164ANG | PDIP-14 (Pb-Free) | 25 Units / Rail |
| MC74HC164ADG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC74HC164ADR2G | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| MC74HC164ADTR2G | TSSOP-14 (Pb-Free) | 2500 / Tape & Reel |
| NLV74HC164ADR2G* | SOIC-14 (Pb-Free) | 2500 / Tape & Reel |
| NLV74HC164ADTR2G* | TSSOP-14 (Pb-Free) | 2500 / Tape & Reel |

[†]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

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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 | ± 20 | mA |
| I_{out} | DC Output Current, per Pin | ± 25 | mA |
| I_{CC} | DC Supply Current, V_{CC} and GND Pins | ± 50 | mA |
| P_D | Power Dissipation in Still Air, Plastic DIP† SOIC Package† TSSOP Package† | 750 500 450 | mW |
| T_{stg} | Storage Temperature | - 65 to + 150 | °C |
| T_L | Lead Temperature, 1 mm from Case for 10 Seconds (Plastic DIP, SOIC or TSSOP Package) | 260 | °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.

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

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 (Figure 1) | $V_{CC} = 2.0 \text{ V}$ $V_{CC} = 4.5 \text{ V}$ $V_{CC} = 6.0 \text{ V}$ | 0 1000 500 400 | ns |

DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol | Parameter | Test Conditions | V_{CC} V | Guaranteed Limit | | | Unit |
|----------|-----------------------------------|---|---------------|------------------|-------------------------|--------------------------|------|
| | | | | -55°C to 25°C | $\leq 85^\circ\text{C}$ | $\leq 125^\circ\text{C}$ | |
| V_{IH} | Minimum High-Level Input Voltage | $V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out} \leq 20 \mu\text{A}$ | 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 | 4.2 | 4.2 | 4.2 | |
| V_{IL} | Maximum Low-Level Input Voltage | $V_{out} = 0.1 \text{ V or } V_{CC} - 0.1 \text{ V}$ $ I_{out} \leq 20 \mu\text{A}$ | 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 | 1.8 | 1.8 | 1.8 | |
| V_{OH} | Minimum High-Level Output Voltage | $V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 20 \mu\text{A}$ | 2.0 | 1.9 | 1.9 | 1.9 | V |
| | | | 4.5 | 4.4 | 4.4 | 4.4 | |
| | | | 6.0 | 5.9 | 5.9 | 5.9 | |
| | | $V_{in} = V_{IH} \text{ or } V_{IL}$ $ I_{out} \leq 2.4 \text{ mA}$ $ I_{out} \leq 4.0 \text{ mA}$ $ I_{out} \leq 5.2 \text{ mA}$ | 3.0 | 2.48 | 2.34 | 2.20 | |
| | | | 4.5 | 3.98 | 3.84 | 3.70 | |
| | | | 6.0 | 5.48 | 5.34 | 5.20 | |

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DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol | Parameter | Test Conditions | V _{CC} V | Guaranteed Limit | | | Unit |
|-----------------|--|--|----------------------|------------------|--------|---------|------|
| | | | | -55°C to 25°C | ≤ 85°C | ≤ 125°C | |
| V _{OL} | Maximum Low-Level Output Voltage | V _{in} = V _{IH} or V _{IL} I _{out} ≤ 20 μA | 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 _{in} = V _{IH} or V _{IL} I _{out} ≤ 2.4 mA I _{out} ≤ 4.0 mA I _{out} ≤ 5.2 mA | 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 _{in} | Maximum Input Leakage Current | V _{in} = V _{CC} or GND | 6.0 | ± 0.1 | ± 1.0 | ± 1.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current (per Package) | V _{in} = V _{CC} or GND I _{out} = 0 μA | 6.0 | 4 | 40 | 160 | μA |

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

| Symbol | Parameter | V _{CC} V | Guaranteed Limit | | | Unit |
|--|---|---|------------------|--------|---------|------|
| | | | -55°C to 25°C | ≤ 85°C | ≤ 125°C | |
| f _{max} | Maximum Clock Frequency (50% Duty Cycle) (Figures 1 and 4) | 2.0 | 10 | 10 | 10 | MHz |
| | | 3.0 | 20 | 20 | 20 | |
| | | 4.5 | 40 | 35 | 30 | |
| | | 6.0 | 50 | 45 | 40 | |
| t _{PLH} , t _{PHL} | Maximum Propagation Delay, Clock to Q (Figures 1 and 4) | 2.0 | 160 | 200 | 250 | ns |
| | | 3.0 | 100 | 150 | 200 | |
| | | 4.5 | 32 | 40 | 48 | |
| | | 6.0 | 27 | 34 | 42 | |
| t _{PHL} | Maximum Propagation Delay, Reset to Q (Figures 2 and 4) | 2.0 | 175 | 220 | 260 | ns |
| | | 3.0 | 100 | 150 | 200 | |
| | | 4.5 | 35 | 44 | 53 | |
| | | 6.0 | 30 | 37 | 45 | |
| t _{TLH} , t _{THL} | Maximum Output Transition Time, Any Output (Figures 1 and 4) | 2.0 | 75 | 95 | 110 | ns |
| | | 3.0 | 27 | 32 | 36 | |
| | | 4.5 | 15 | 19 | 22 | |
| | | 6.0 | 13 | 16 | 19 | |
| C _{in} | Maximum Input Capacitance | — | 10 | 10 | 10 | pF |
| C _{PD} | Power Dissipation Capacitance (Per Package)* | Typical @ 25°C, V _{CC} = 5.0 V | | | pF | |
| | | 180 | | | | |

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TIMING REQUIREMENTS (Input $t_r = t_f = 6$ ns)

| Symbol | Parameter | V _{CC} V | Guaranteed Limit | | | Unit |
|------------|--|----------------------|------------------|--------|---------|------|
| | | | -55°C to 25°C | ≤ 85°C | ≤ 125°C | |
| t_{su} | Minimum Setup Time, A1 or A2 to Clock (Figure 3) | 2.0 | 25 | 35 | 40 | ns |
| | | 3.0 | 15 | 20 | 25 | |
| | | 4.5 | 7 | 8 | 9 | |
| | | 6.0 | 5 | 6 | 6 | |
| t_h | Minimum Hold Time, Clock to A1 or A2 (Figure 3) | 2.0 | 3 | 3 | 3 | ns |
| | | 3.0 | 3 | 3 | 3 | |
| | | 4.5 | 3 | 3 | 3 | |
| | | 6.0 | 3 | 3 | 3 | |
| t_{rec} | Minimum Recovery Time, Reset Inactive to Clock (Figure 2) | 2.0 | 3 | 3 | 3 | ns |
| | | 3.0 | 3 | 3 | 3 | |
| | | 4.5 | 3 | 3 | 3 | |
| | | 6.0 | 3 | 3 | 3 | |
| t_w | Minimum Pulse Width, Clock (Figure 1) | 2.0 | 50 | 60 | 75 | ns |
| | | 3.0 | 26 | 35 | 45 | |
| | | 4.5 | 12 | 15 | 20 | |
| | | 6.0 | 10 | 12 | 15 | |
| t_w | Minimum Pulse Width, Reset (Figure 2) | 2.0 | 50 | 60 | 75 | ns |
| | | 3.0 | 26 | 35 | 45 | |
| | | 4.5 | 12 | 15 | 20 | |
| | | 6.0 | 10 | 12 | 15 | |
| t_r, t_f | Maximum Input Rise and Fall Times (Figure 1) | 2.0 | 1000 | 1000 | 1000 | ns |
| | | 3.0 | 800 | 800 | 800 | |
| | | 4.5 | 500 | 500 | 500 | |
| | | 6.0 | 400 | 400 | 400 | |

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PIN DESCRIPTIONS

INPUTS

A1, A2 (Pins 1, 2)

Serial Data Inputs. Data at these inputs determine the data to be entered into the first stage of the shift register. For a high level to be entered into the shift register, both A1 and A2 inputs must be high, thereby allowing one input to be used as a data-enable input. When only one serial input is used, the other must be connected to V_{CC} .

Clock (Pin 8)

Shift Register Clock. A positive-going transition on this pin shifts the data at each stage to the next stage. The shift

register is completely static, allowing clock rates down to DC in a continuous or intermittent mode.

OUTPUTS

$Q_A - Q_H$ (Pins 3, 4, 5, 6, 10, 11, 12, 13)

Parallel Shift Register Outputs. The shifted data is presented at these outputs in true, or noninverted, form.

CONTROL INPUT

Reset (Pin 9)

Active-Low, Asynchronous Reset Input. A low voltage applied to this input resets all internal flip-flops and sets Outputs $Q_A - Q_H$ to the low level state.

SWITCHING WAVEFORMS

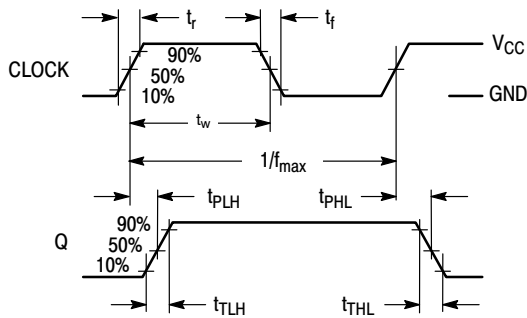


Figure 1.

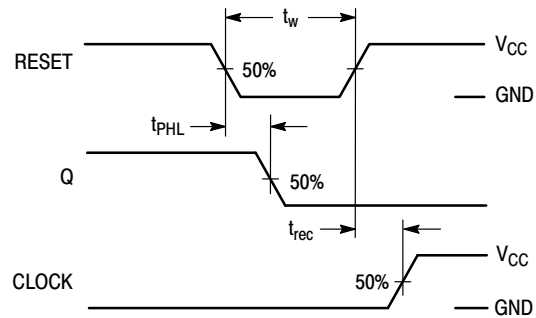


Figure 2.

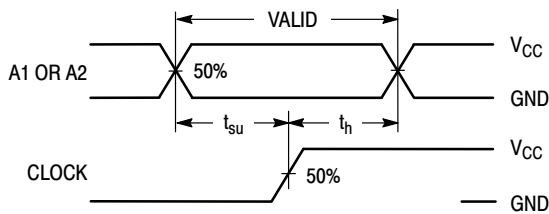
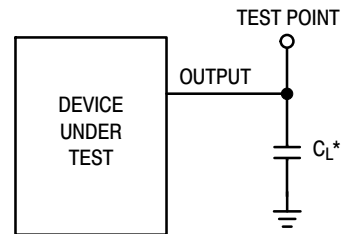


Figure 3.

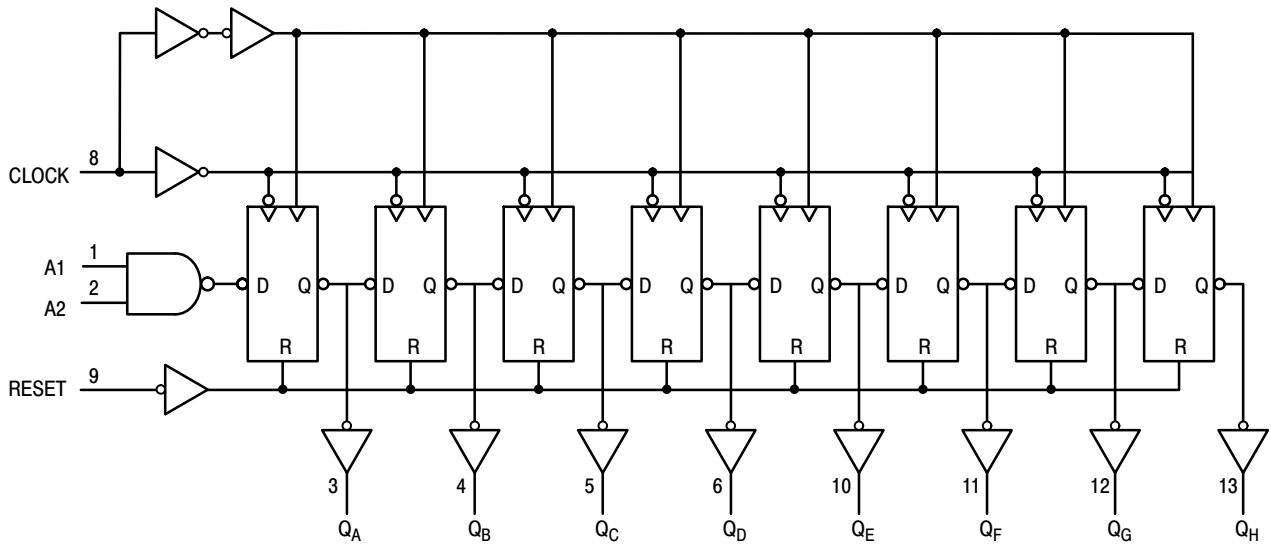


*Includes all probe and jig capacitance

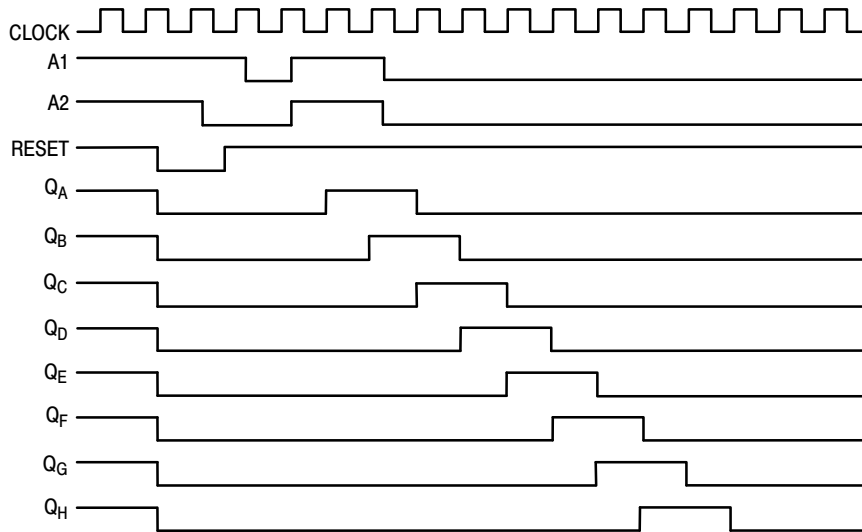
Figure 4. Test Circuit

MC74HC164A

EXPANDED LOGIC DIAGRAM



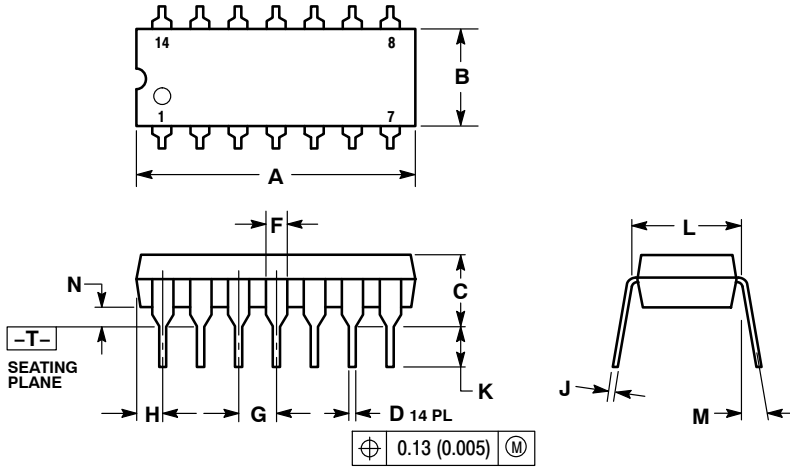
TIMING DIAGRAM



MC74HC164A

PACKAGE DIMENSIONS

PDIP-14
N SUFFIX
CASE 646-06
ISSUE P



NOTES:

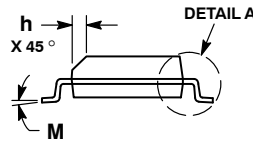
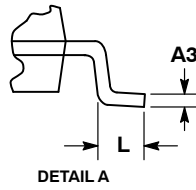
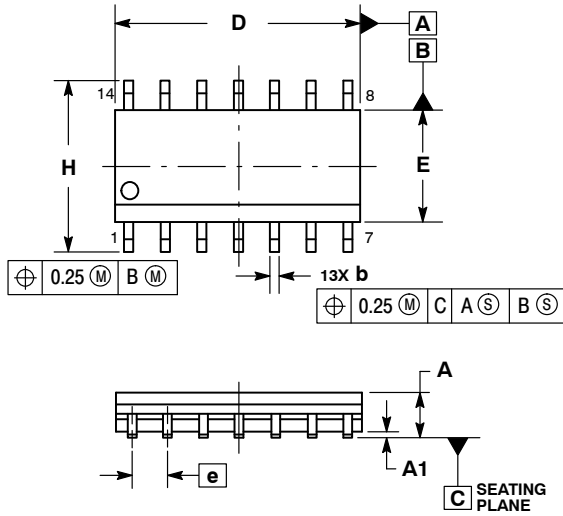
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| 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 |

MC74HC164A

PACKAGE DIMENSIONS

SOIC-14 NB
CASE 751A-03
ISSUE K

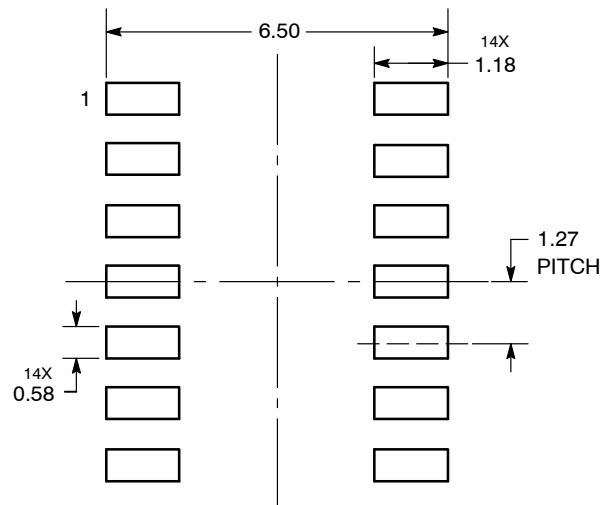


NOTES:

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*



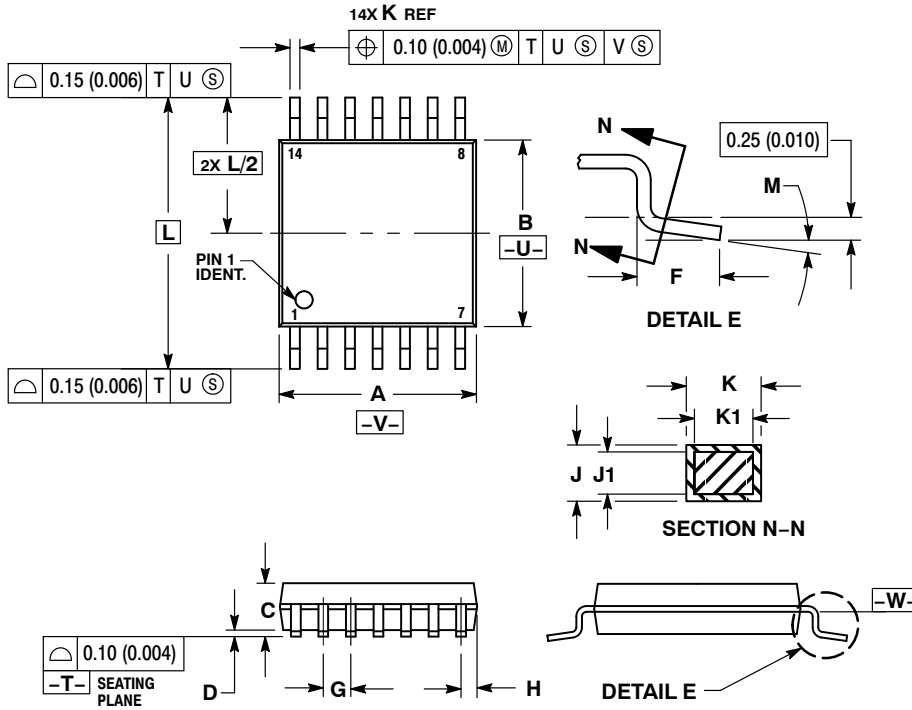
DIMENSIONS: MILLIMETERS

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

MC74HC164A

PACKAGE DIMENSIONS

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

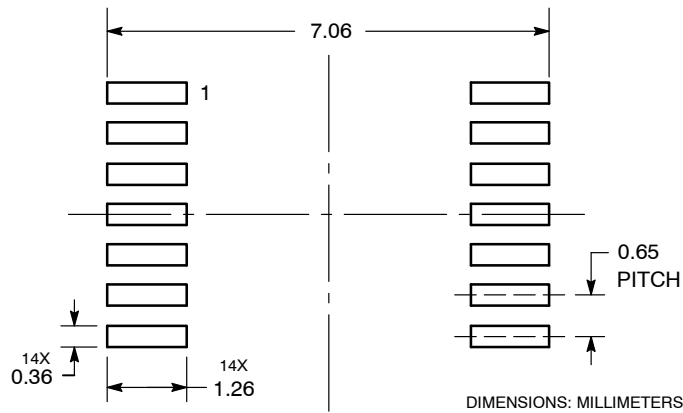


NOTES:

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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Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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