# 74LVC08A

# Low-Voltage CMOS Quad 2-Input AND Gate

## With 5 V−Tolerant Inputs

The 74LVC08A is a high performance, quad 2−input AND gate operating from a 1.2 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance. A $V_I$ specification of 5.5 V allows 74LVC08A inputs to be safely driven from 5.0 V devices.

Current drive capability is 24 mA at the outputs.

### Features

- Designed for 1.2 V to 3.6 V $V_{CC}$ Operation
- 5.0 V Tolerant Inputs − Interface Capability With 5.0 V TTL Logic
- 24 mA Output Sink and Source Capability
- Near Zero Static Supply Current (10 μA) Substantially Reduces System Power Requirements
- ESD Performance: Human Body Model >2000 V
  Machine Model >200 V
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

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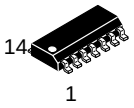
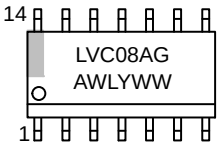
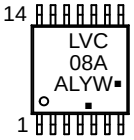
**MARKING DIAGRAMS**




**SOIC−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 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 6 of this data sheet.

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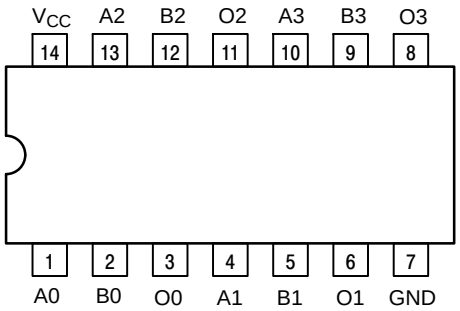



**Figure 1. Pinout: 14−Lead** (Top View)

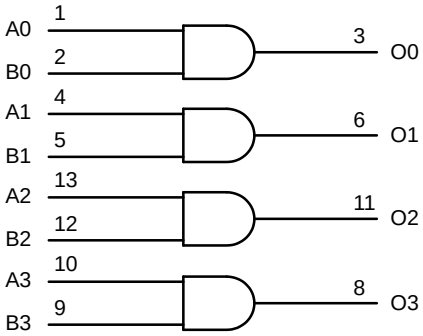



**Figure 2. Logic Diagram**

**PIN NAMES**

| Pins | Function |
|---|---|
| An, Bn | Data Inputs |
| On | Outputs |

**TRUTH TABLE**

| Inputs | | Outputs |
|---|---|---|
| **An** | **Bn** | **On** |
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

H = High Voltage Level
L = Low Voltage Level

For $I_{CC}$ reasons, DO NOT FLOAT Inputs

## MAXIMUM RATINGS

| Symbol | Parameter | Value | Condition | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | −0.5 to +6.5 | | V |
| $V_I$ | DC Input Voltage | $-0.5 \le V_I \le +6.5$ | | V |
| $V_O$ | DC Output Voltage | $-0.5 \le V_O \le V_{CC} + 0.5$ | Output in HIGH or LOW State (Note 1) | V |
| $I_{IK}$ | DC Input Diode Current | −50 | $V_I$ < GND | mA |
| $I_{OK}$ | DC Output Diode Current | −50 | $V_O$ < GND | mA |
| | | +50 | $V_O > V_{CC}$ | mA |
| $I_O$ | DC Output Source/Sink Current | ±50 | | mA |
| $I_{CC}$ | DC Supply Current Per Supply Pin | ±100 | | mA |
| $I_{GND}$ | DC Ground Current Per Ground Pin | ±100 | | mA |
| $T_{STG}$ | Storage Temperature Range | −65 to +150 | | °C |
| $T_L$ | Lead Temperature, 1 mm from Case for 10 Seconds | $T_L$ = 260 | | °C |
| $T_J$ | Junction Temperature Under Bias | $T_J$ = 135 | | °C |
| $\theta_{JA}$ | Thermal Resistance (Note 2) | SOIC = 85<br>TSSOP = 100 | | °C/W |
| MSL | Moisture Sensitivity | | Level 1 | |

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. $I_O$ absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm−by−1 inch, 2 ounce copper trace no air flow.

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage<br>Operating<br>Functional | <br>1.65<br>1.2 | | <br>3.6<br>3.6 | V |
| $V_I$ | Input Voltage | 0 | | 5.5 | V |
| $V_O$ | Output Voltage<br>HIGH or LOW State<br>3−State | <br>0<br>0 | | <br>$V_{CC}$<br>5.5 | V |
| $I_{OH}$ | HIGH Level Output Current<br>$V_{CC}$ = 3.0 V − 3.6 V<br>$V_{CC}$ = 2.7 V − 3.0 V | | | <br>−24<br>−12 | mA |
| $I_{OL}$ | LOW Level Output Current<br>$V_{CC}$ = 3.0 V − 3.6 V<br>$V_{CC}$ = 2.7 V − 3.0 V | | | <br>24<br>12 | mA |
| $T_A$ | Operating Free−Air Temperature | −40 | | +125 | °C |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate<br>$V_{CC}$ = 1.65 V to 2.7 V<br>$V_{CC}$ = 2.7 V to 3.6 V | <br>0<br>0 | | <br>20<br>10 | 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.

## DC ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Conditions | −40°C to +85°C | | | −40°C to +125°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ (Note 3) | Max | Min | Typ (Note 3) | Max | |
| $V_{IH}$ | HIGH−level input voltage | $V_{CC}$ = 1.2 V | 1.08 | − | − | 1.08 | − | − | V |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 0.65 x $V_{CC}$ | − | − | 0.65 x $V_{CC}$ | − | − | |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.7 | − | − | 1.7 | − | − | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | 2.0 | − | − | 2.0 | − | − | |
| $V_{IL}$ | LOW−level input voltage | $V_{CC}$ = 1.2 V | − | − | 0.12 | − | − | 0.12 | V |
| | | $V_{CC}$ = 1.65 V to 1.95 V | − | − | 0.35 x $V_{CC}$ | − | − | 0.35 x $V_{CC}$ | |
| | | $V_{CC}$ = 2.3 V to 2.7 V | − | − | 0.7 | − | − | 0.7 | |
| | | $V_{CC}$ = 2.7 V to 3.6 V | − | − | 0.8 | − | − | 0.8 | |
| $V_{OH}$ | HIGH−level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | | V |
| | | $I_O$ = −100 μA; $V_{CC}$ = 1.65 V to 3.6 V | $V_{CC}$ − 0.2 | − | − | $V_{CC}$ − 0.3 | − | − | |
| | | $I_O$ = −4 mA; $V_{CC}$ = 1.65 V | 1.2 | − | − | 1.05 | − | − | |
| | | $I_O$ = −8 mA; $V_{CC}$ = 2.3 V | 1.8 | − | − | 1.65 | − | − | |
| | | $I_O$ = −12 mA; $V_{CC}$ = 2.7 V | 2.2 | − | − | 2.05 | − | − | |
| | | $I_O$ = −18 mA; $V_{CC}$ = 3.0 V | 2.4 | − | − | 2.25 | − | − | |
| | | $I_O$ = −24 mA; $V_{CC}$ = 3.0 V | 2.2 | − | − | 2.0 | − | − | |
| $V_{OL}$ | LOW−level output voltage | $V_I$ = $V_{IH}$ or $V_{IL}$ | | | | | | | V |
| | | $I_O$ = 100 μA; $V_{CC}$ = 1.65 V to 3.6 V | − | − | 0.2 | − | − | 0.3 | |
| | | $I_O$ = 4 mA; $V_{CC}$ = 1.65 V | − | − | 0.45 | − | − | 0.65 | |
| | | $I_O$ = 8 mA; $V_{CC}$ = 2.3 V | − | − | 0.6 | − | − | 0.8 | |
| | | $I_O$ = 12 mA; $V_{CC}$ = 2.7 V | − | − | 0.4 | − | − | 0.6 | |
| | | $I_O$ = −24 mA; $V_{CC}$ = 3.0 V | − | − | 0.55 | − | − | 0.8 | |
| $I_I$ | Input leakage current | $V_I$ = 5.5V or GND $V_{CC}$ = 3.6 V | − | ±0.1 | ±5 | − | ±0.1 | ±20 | μA |
| $I_{OFF}$ | Power−off leakage current | $V_I$ or $V_O$ = 5.5 V; $V_{CC}$ = 0.0 V | − | ±0.1 | ±10 | − | ±0.1 | ±20 | μA |
| $I_{CC}$ | Supply current | $V_I$ = $V_{CC}$ or GND; $I_O$ = 0 A; $V_{CC}$ = 3.6 V | − | 0.1 | 10 | − | 0.1 | 40 | μA |
| $\Delta I_{CC}$ | Additional supply current | per input pin; $V_I$ = $V_{CC}$ − 0.6 V; $I_O$ = 0 A; $V_{CC}$ = 2.7 V to 3.6 V | − | 5 | 500 | − | 5 | 5000 | 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.

3. All typical values are measured at $T_A$ = 25°C and $V_{CC}$ = 3.3 V, unless stated otherwise.

**AC ELECTRICAL CHARACTERISTICS** ($t_R = t_F$ = 2.5 ns)

| Symbol | Parameter | Conditions | −40°C to +85°C | | | −40°C to +125°C | | | Unit |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ[1] | Max | Min | Typ[1] | Max | |
| $t_{pd}$ | Propagation Delay (Note 5) | $V_{CC}$ = 1.2 V | − | 11.0 | − | − | − | − | ns |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 0.5 | 4.2 | 9.0 | 0.5 | − | 10.4 | ns |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 1.0 | 2.5 | 6.9 | 1.0 | − | 8.0 | |
| | | $V_{CC}$ = 2.7 V | 1.5 | 2.5 | 4.8 | 1.5 | − | 5.6 | |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 1.0 | 2.3 | 4.1 | 1.0 | − | 4.8 | |
| $t_{sk(0)}$ | Output Skew Time (Note 6) | $V_{CC}$ = 3.0 V to 3.6 V | − | − | 1.0 | − | − | 1.5 | ns |

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.

4. Typical values are measured at $T_A$ = 25°C and $V_{CC}$ = 3.3 V, unless stated otherwise.
5. $t_{pd}$ is the same as $t_{PLH}$ and $t_{PHL}$.
6. Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device. The specification applies to any outputs switching in the same direction, either HIGH−to−LOW ($t_{OSHL}$) or LOW−to−HIGH ($t_{OSLH}$); parameter guaranteed by design.

**DYNAMIC SWITCHING CHARACTERISTICS**

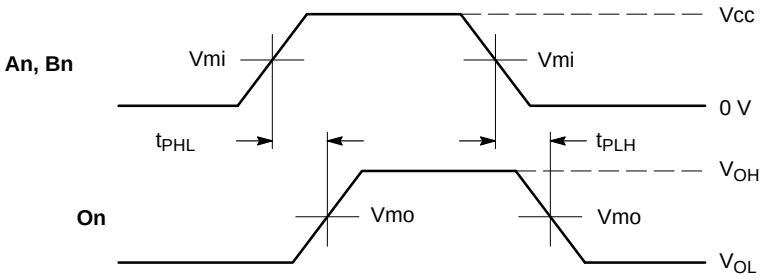
| Symbol | Characteristic | Condition | $T_A$ = +25°C | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{OLP}$ | Dynamic LOW Peak Voltage (Note 7) | $V_{CC}$ = 3.3 V, $C_L$ = 50 pF, $V_{IH}$ = 3.3 V, $V_{IL}$ = 0 V<br>$V_{CC}$ = 2.5 V, $C_L$ = 30 pF, $V_{IH}$ = 2.5 V, $V_{IL}$ = 0 V | | 0.8<br>0.6 | | V |
| $V_{OLV}$ | Dynamic LOW Valley Voltage (Note 7) | $V_{CC}$ = 3.3 V, $C_L$ = 50 pF, $V_{IH}$ = 3.3 V, $V_{IL}$ = 0 V<br>$V_{CC}$ = 2.5 V, $C_L$ = 30 pF, $V_{IH}$ = 2.5 V, $V_{IL}$ = 0 V | | −0.8<br>−0.6 | | V |

7. Number of outputs defined as “n”. Measured with “n−1” outputs switching from HIGH−to−LOW or LOW−to−HIGH. The remaining output is measured in the LOW state.

**CAPACITIVE CHARACTERISTICS**

| Symbol | Parameter | Condition | Typical | Unit |
|---|---|---|---|---|
| $C_{IN}$ | Input Capacitance | $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ | 4.0 | pF |
| $C_{OUT}$ | Output Capacitance | $V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$ | 5.0 | pF |
| $C_{PD}$ | Power Dissipation Capacitance (Note 8) | Per input; $V_I$ = GND or $V_{CC}$ | | pF |
| | | $V_{CC}$ = 1.65 V to 1.95 V | 4.4 | |
| | | $V_{CC}$ = 2.3 V to 2.7 V | 7.7 | |
| | | $V_{CC}$ = 3.0 V to 3.6 V | 10.5 | |

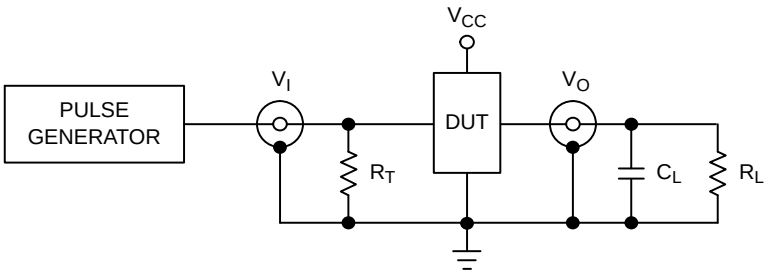
8. $C_{PD}$ is used to determine the dynamic power dissipation ($P_D$ in μW).
   $P_D = C_{PD} \times V_{CC}^2 \times fi \times N + \Sigma (C_L \times V_{CC}^2 \times fo)$ where:
   fi = input frequency in MHz; fo = output frequency in MHz
   $C_L$ = output load capacitance in pF $V_{CC}$ = supply voltage in Volts
   N = number of outputs switching
   $\Sigma(C_L \times V_{CC}^2 \times fo)$ = sum of the outputs.




**WAVEFORM 1 − PROPAGATION DELAYS**
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1 MHz; $t_W$ = 500 ns

| Symbol | Vcc | | |
|---|---|---|---|
| | **3.3 V ± 0.3 V** | **2.7 V** | **$V_{CC}$ < 2.7 V** |
| Vmi | 1.5 V | 1.5 V | Vcc/2 |
| Vmo | 1.5 V | 1.5 V | Vcc/2 |

**Figure 3. AC Waveforms**




$C_L$ includes jig and probe capacitance
$R_T = Z_{OUT}$ of pulse generator (typically 50 Ω)

| Supply Voltage | Input | | Load | |
|---|---|---|---|---|
| **$V_{CC}$ (V)** | **$V_I$** | **$t_r$, $t_f$** | **$C_L$** | **$R_L$** |
| 1.2 | $V_{CC}$ | ≤ 2 ns | 30 pF | 1 kΩ |
| 1.65 − 1.95 | $V_{CC}$ | ≤ 2 ns | 30 pF | 1 kΩ |
| 2.3 − 2.7 | $V_{CC}$ | ≤ 2 ns | 30 pF | 500 Ω |
| 2.7 | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω |
| 3 − 3.6 | 2.7 V | ≤ 2.5 ns | 50 pF | 500 Ω |

**Figure 4. Test Circuit**

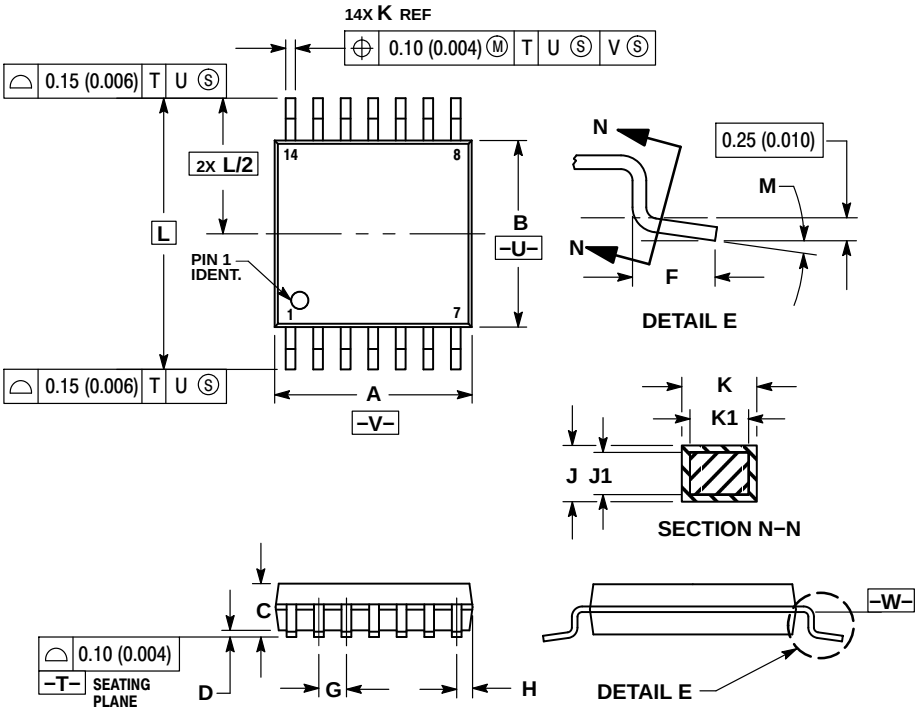
## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| 74LVC08ADR2G | SOIC−14 (Pb−Free) | 2500 / Tape & Reel |
| 74LVC08ADTR2G | 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.

## PACKAGE DIMENSIONS

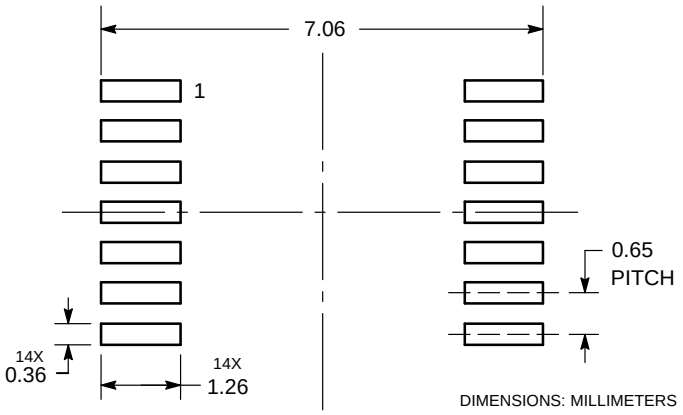
**TSSOP−14**
CASE 948G
ISSUE B




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−.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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 ° |

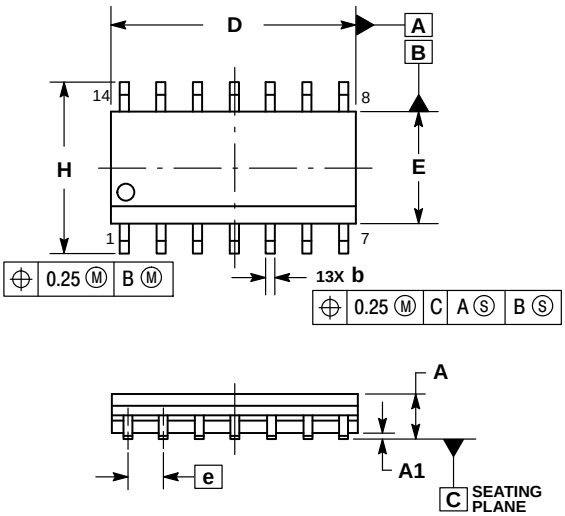
### SOLDERING FOOTPRINT*




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

## PACKAGE DIMENSIONS

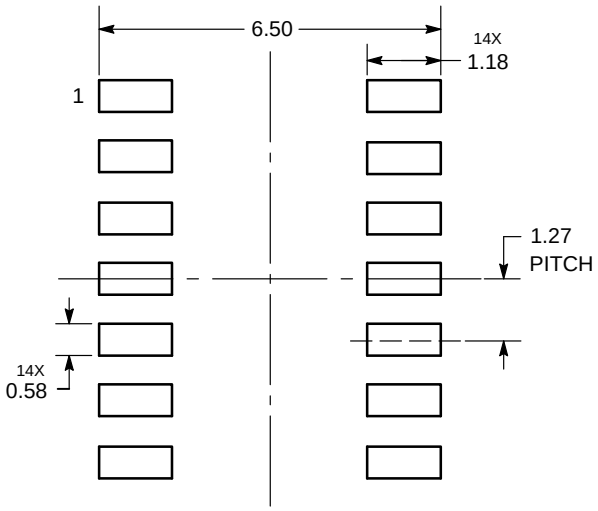
**SOIC−14 NB**
CASE 751A−03
ISSUE K




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.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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.

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Живое партнерство

**ООО «ЛайфЭлектроникс»** **“LifeElectronics” LLC**

*ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703*

*Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.*

*С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров*

*Мы предлагаем:*

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

*В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.*

*Конструкторский отдел помогает осуществить:*

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

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***www.lifeelectronics.ru***