

SNx4LVC08A Quadruple 2-Input Positive-AND Gates

1 Features

- Latch-up performance exceeds 250mA per JESD 17
- ESD protection exceeds JESD 22
 - 2000V Human-Body Model (A114-A)
 - 1000V Charged-Device Model (C101)
 - On products compliant to MIL-PRF-38535, All parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.
- SN74LVC08A operates from 1.65V to 3.6V
- SN54LVC08A operates from 2.0V to 3.6V
- SNx4LVC08A specified from -40°C to $+85^{\circ}\text{C}$ and -40°C to $+125^{\circ}\text{C}$
- SN54LVC08A specified from -55°C to $+125^{\circ}\text{C}$
- Inputs accept voltages to 5.5V
- Max t_{pd} of 4.1ns at 3.3V
- Typical V_{OLP} (output ground bounce) $<0.8\text{V}$ at $V_{CC} = 3.3\text{V}$, $T_A = 25^{\circ}\text{C}$
- Typical V_{OHV} (output V_{OH} undershoot) $>2\text{V}$ at $V_{CC} = 3.3\text{V}$, $T_A = 25^{\circ}\text{C}$

2 Applications

- Servers
- LED Displays
- Network Switches
- I/O Expanders
- Base Station Processor Board

3 Description

The SN54LVC08A quadruple 2-input positive-AND gate is designed for 2.7V to 3.6V V_{CC} operation, and the SN74LVC08A quadruple 2-input positive-AND gate is designed for 1.65V to 3.6V V_{CC} operation.

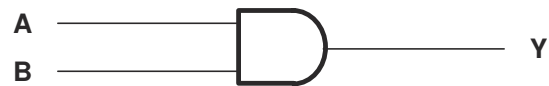
The SNx4LVC08A devices perform the Boolean function $Y = A \cdot B$ or $Y = \overline{A} + \overline{B}$ in positive logic.

Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of these devices as translators in a mixed 3.3V/5V system environment.

Device Information

| PART NUMBER | PACKAGE ⁽¹⁾ | PACKAGE SIZE ⁽²⁾ | BODY SIZE ⁽³⁾ |
|-------------|------------------------|-----------------------------|--------------------------|
| SNx4LVC08A | BQA (WQFN, 14) | 3mm × 2.5mm | 3mm × 2.5mm |
| | D (SOIC, 14) | 8.65mm × 6mm | 8.65mm × 3.91mm |
| | DB (SSOP, 14) | 6.2mm × 7.8mm | 6.20mm × 5.30mm |
| | NS (SOP, 14) | 10.2mm × 7.8mm | 10.30mm × 5.30mm |
| | PW (TSSOP, 14) | 5mm × 4.4mm | 5.00mm × 4.40mm |
| | RGY (VQFN, 14) | 3.5mm × 3.5mm | 3.50mm × 3.50mm |
| | FK (LCCC, 20) | 8.9mm × 8.9mm | 8.89mm × 8.89mm |
| | J (CDIP, 14) | 19.55mm × 7.9mm | 19.55mm × 6.7mm |
| | W (CFP, 14) | 9.21mm × 9mm | 9.21mm × 6.28mm |

- (1) For more information, see [Section 11](#).
- (2) The package size (length × width) is a nominal value and includes pins, where applicable.
- (3) The body size (length × width) is a nominal value and does not include pins.



Logic Diagram, Each Gate
(Positive Logic)



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4 Pin Configuration and Functions

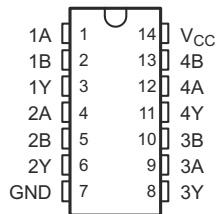


Figure 4-1. D, DB, NS, J, W, or PW Package 14-Pin SOIC, SSOP, SOP, CDIP, or TSSOP (Top View)

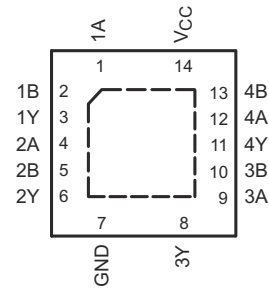


Figure 4-2. BQA or RGY Package 14-Pin WQFN or VQFN (Top View)

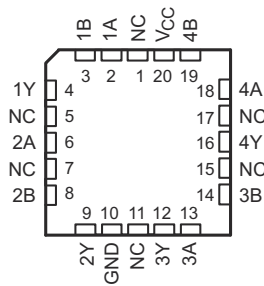


Figure 4-3. FK Package 20-Pin LCCC (Top View)

Table 4-1. Pin Functions

| NAME | PIN | | TYPE | DESCRIPTION |
|------------------------------------|---|------|--------|---|
| | SOIC, SSOP, SOP, CDIP, TSSOP, VQFN,WQFN | LCCC | | |
| 1A | 1 | 2 | I | Channel 1 input A |
| 1B | 2 | 3 | I | Channel 1 input B |
| 1Y | 3 | 4 | O | Channel 1 output |
| 2A | 4 | 6 | I | Channel 2 input A |
| 2B | 5 | 8 | I | Channel 2 input B |
| 2Y | 6 | 9 | O | Channel 2 output |
| GND | 7 | 10 | Ground | Ground |
| 3Y | 8 | 12 | O | Channel 3 output |
| 3A | 9 | 13 | I | Channel 3 input A |
| 3B | 10 | 14 | I | Channel 3 input B |
| 4Y | 11 | 16 | O | Channel 4 output |
| 4A | 12 | 18 | I | Channel 4 input A |
| 4B | 13 | 19 | I | Channel 4 input B |
| V _{CC} | 14 | 20 | Power | Positive supply |
| Thermal Information ⁽¹⁾ | | | — | The thermal pad can be connected to GND or left floating. Do not connect to any other signal or supply. |
| NC ⁽²⁾ | — | 1 | — | No connect |
| | | 5 | | |
| | | 7 | | |
| | | 11 | | |
| | | 15 | | |
| | | 17 | | |

(1) For BQA package only.

(2) NC – No internal connection

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | | MIN | MAX | UNIT |
|------------------|---|----------------------------------|------|-----------------------|------|
| V _{CC} | Supply voltage | | -0.5 | 6.5 | V |
| V _I | Input voltage ⁽²⁾ | | -0.5 | 6.5 | V |
| V _O | Output voltage ^{(2) (3)} | | -0.5 | V _{CC} + 0.5 | V |
| I _{IK} | Input clamp current | V _I < 0 | | -50 | mA |
| I _{OK} | Output clamp current | V _O < 0 | | -50 | mA |
| I _O | Continuous output current | | | ±50 | mA |
| | Continuous current through V _{CC} or GND | | | ±100 | mA |
| P _{tot} | Power dissipation ^{(4) (5)} | T _A = -40°C to +125°C | | 500 | mW |
| T _J | Junction temperature | | -65 | 150 | °C |
| T _{stg} | Storage temperature | | -65 | 150 | °C |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V_{CC} is provided in the *Recommended Operating Conditions* table.
- (4) For the D package: above 70°C, the value of P_{tot} derates linearly with 8 mW/K.
- (5) For the DB, NS, and PW packages: above 60°C, the value of P_{tot} derates linearly with 5.5 mW/K.

5.2 ESD Ratings

| | | VALUE | UNIT |
|--------------------|-------------------------|--|-------|
| V _(ESD) | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾ | ±2000 |
| | | Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾ | ±1000 |
| | | Machine Model (MM) A115-A | 200 |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions, SN54LVC08A

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | SN54LVC08A | | UNIT |
|-----------------|------------------------------------|--------------------------------|-----------------|------|
| | | -55°C to +125°C | | |
| | | MIN | MAX | |
| V _{CC} | Supply voltage | Operating | 2 | 3.6 |
| | | Data retention only | 1.5 | |
| V _{IH} | High-level input voltage | V _{CC} = 2.7V to 3.6V | | V |
| V _{IL} | Low-level input voltage | V _{CC} = 2.7V to 3.6V | | V |
| V _I | Input voltage | 0 | 5.5 | V |
| V _O | Output voltage | 0 | V _{CC} | V |
| I _{OH} | High-level output current | V _{CC} = 2.7V | | -12 |
| | | V _{CC} = 3V | | -24 |
| I _{OL} | Low-level output current | V _{CC} = 2.7V | | 12 |
| | | V _{CC} = 3V | | 24 |
| Δt/Δv | Input transition rise or fall rate | | 8 | ns/V |

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

5.4 Recommended Operating Conditions, SN74LVC08A

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | SN74LVC08A | | | | | | UNIT | | |
|-----------------|------------------------------------|----------------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|------------------------|-----------------|------|
| | | T _A = 25°C | | –40°C to +85°C | | –40°C to +125°C | | | | |
| | | MIN | MAX | MIN | MAX | MIN | MAX | | | |
| V _{CC} | Supply voltage | Operating | | 1.65 | 3.6 | 1.65 | 3.6 | 1.65 | 3.6 | V |
| | | Data retention only | | 1.5 | | 1.5 | | 1.5 | | |
| V _{IH} | High-level input voltage | V _{CC} = 1.65V to 1.95V | | 0.65 × V _{CC} | | 0.65 × V _{CC} | | 0.65 × V _{CC} | | V |
| | | V _{CC} = 2.3V to 2.7V | | 1.7 | | 1.7 | | 1.7 | | |
| | | V _{CC} = 2.7V to 3.6V | | 2 | | 2 | | 2 | | |
| V _{IL} | Low-level input voltage | V _{CC} = 1.65V to 1.95V | | 0.35 × V _{CC} | | 0.35 × V _{CC} | | 0.35 × V _{CC} | | V |
| | | V _{CC} = 2.3V to 2.7V | | 0.7 | | 0.7 | | 0.7 | | |
| | | V _{CC} = 2.7V to 3.6V | | 0.8 | | 0.8 | | 0.8 | | |
| V _I | Input voltage | 0 | 5.5 | 0 | 5.5 | 0 | 5.5 | 0 | 5.5 | V |
| V _O | Output voltage | 0 | V _{CC} | 0 | V _{CC} | 0 | V _{CC} | 0 | V _{CC} | V |
| I _{OH} | High-level output current | V _{CC} = 1.65V | | –4 | | –4 | | –4 | | mA |
| | | V _{CC} = 2.3V | | –8 | | –8 | | –8 | | |
| | | V _{CC} = 2.7 V | | –12 | | –12 | | –12 | | |
| | | V _{CC} = 3V | | –24 | | –24 | | –24 | | |
| I _{OL} | Low-level output current | V _{CC} = 1.65V | | 4 | | 4 | | 4 | | mA |
| | | V _{CC} = 2.3V | | 8 | | 8 | | 8 | | |
| | | V _{CC} = 2.7V | | 12 | | 12 | | 12 | | |
| | | V _{CC} = 3V | | 24 | | 24 | | 24 | | |
| Δt/Δv | Input transition rise or fall rate | | 8 | | 8 | | 8 | | 8 | ns/V |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

5.5 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | SN74LVC08A | | | | | | UNIT |
|-------------------------------|--|------------|----------|-----------|---------|------------|------------|------|
| | | BQA (WQFN) | D (SOIC) | DB (SSOP) | NS (SO) | PW (TSSOP) | RGY (LCCC) | |
| | | 14 PINS | 14 PINS | 14 PINS | 14 PINS | 14 PINS | 14 PINS | |
| R _{θJA} | Junction-to-ambient thermal resistance | 102.3 | 127.8 | 140.4 | 123.8 | 150.8 | 92.1 | °C/W |
| R _{θJC(top)} | Junction-to-case (top) thermal resistance | 96.8 | 81.9 | 65.3 | 52.7 | 56.0 | 56.6 | °C/W |
| R _{θJB} | Junction-to-board thermal resistance | 70.9 | 84.4 | 60.2 | 53.9 | 69.5 | 27.5 | °C/W |
| ψ _{JT} | Junction-to-top characterization parameter | 16.6 | 39.6 | 25.3 | 17.9 | 8.9 | 4.5 | °C/W |
| ψ _{JB} | Junction-to-board characterization parameter | 70.9 | 83.9 | 59.6 | 53.6 | 68.9 | 27.7 | °C/W |
| R _{θJC(bot)} | Junction-to-case (bottom) thermal resistance | 50.1 | N/A | N/A | N/A | N/A | 19.1 | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

5.6 Electrical Characteristics, SN54LVC08A

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | SN54LVC08A | | | UNIT |
|------------------|--|-----------------|-----------------------|--------------------|-----|------|
| | | | –55°C to +125°C | | | |
| | | | MIN | TYP ⁽¹⁾ | MAX | |
| V _{OH} | I _{OH} = –100 μA | 2.7V to 3.6V | V _{CC} – 0.2 | | | V |
| | I _{OH} = –12 mA | 2.7V | 2.2 | | | |
| | | 3V | 2.4 | | | |
| V _{OL} | I _{OL} = 100 μA | 2.7V to 3.6V | 0.2 | | | V |
| | I _{OL} = 12 mA | 2.7V | 0.4 | | | |
| | I _{OL} = 24 mA | 3V | 0.55 | | | |
| I _I | V _I = 5.5 V or GND | 3.6V | ±5 | | | μA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6V | 10 | | | μA |
| ΔI _{CC} | One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND | 2.7V to 3.6V | 500 | | | μA |
| C _i | V _I = V _{CC} or GND | 3.3V | 5 | | | pF |

(1) T_A = 25°C

5.7 Electrical Characteristics, SN74LVC08A

over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | V _{CC} | SN74LVC08A | | | | | | UNIT | |
|--------------------------|--|-----------------|-----------------------|-----|------|-----------------------|-----|-----------------------|------|-----|
| | | | T _A = 25°C | | | –40°C to +85°C | | –40°C to +125°C | | |
| | | | MIN | TYP | MAX | MIN | MAX | MIN | | MAX |
| V _{OH} | I _{OH} = –100 μA | 1.65V to 3.6V | V _{CC} – 0.2 | | | V _{CC} – 0.2 | | V _{CC} – 0.3 | | V |
| | I _{OH} = –4 mA | 1.65V | 1.29 | | | 1.2 | | 1.05 | | |
| | | 2.3V | 1.9 | | | 1.7 | | 1.55 | | |
| | I _{OH} = –12 mA | 2.7V | 2.2 | | | 2.2 | | 2.05 | | |
| | | 3V | 2.4 | | | 2.4 | | 2.25 | | |
| I _{OH} = –24 mA | 3V | 2.3 | | | 2.2 | | 2 | | | |
| V _{OL} | I _{OL} = 100 μA | 1.65V to 3.6V | 0.1 | | | 0.2 | | 0.3 | | V |
| | I _{OL} = 4 mA | 1.65V | 0.24 | | | 0.45 | | 0.6 | | |
| | | 2.3V | 0.3 | | | 0.7 | | 0.75 | | |
| | I _{OL} = 12 mA | 2.7V | 0.4 | | | 0.4 | | 0.6 | | |
| | | 3V | 0.55 | | | 0.55 | | 0.8 | | |
| I _{OL} = 24 mA | 3V | 0.55 | | | 0.55 | | 0.8 | | | |
| I _I | V _I = 5.5 V or GND | 3.6V | ±1 | | | ±5 | | ±20 | | μA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 3.6V | 1 | | | 10 | | 40 | | μA |
| ΔI _{CC} | One input at V _{CC} – 0.6 V, Other inputs at V _{CC} or GND | 2.7V to 3.6V | 500 | | | 500 | | 5000 | | μA |
| C _i | V _I = V _{CC} or GND | 3.3V | 5 | | | | | | | pF |

5.8 Switching Characteristics, SN54LVC08A

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | SN54LVC08A | | UNIT |
|-----------------|--------------|-------------|-----------------|-----------------|-----|------|
| | | | | –55°C to +125°C | | |
| | | | | MIN | MAX | |
| t _{pd} | A or B | Y | 2.7V | 4.8 | | ns |
| | | | 3.3V ± 0.3V | 1 | 4.1 | |

5.9 Switching Characteristics, SN74LVC08A

over recommended operating free-air temperature range (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

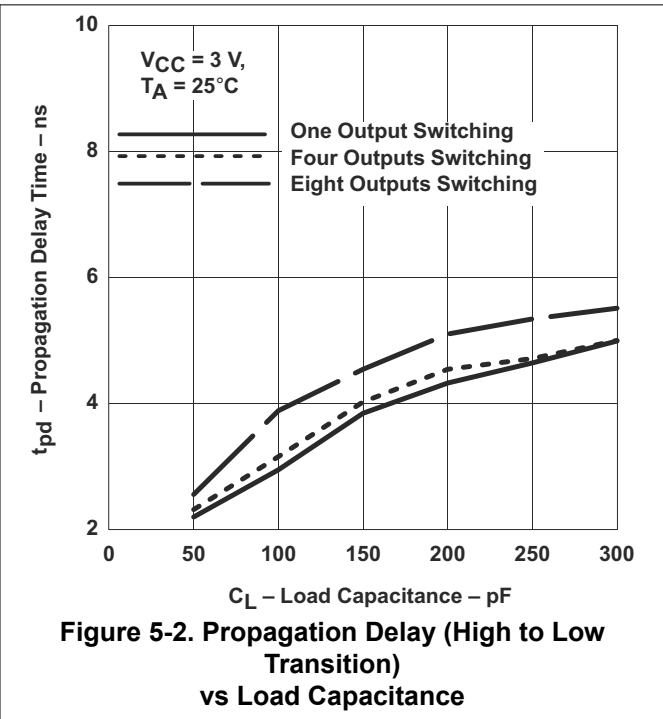
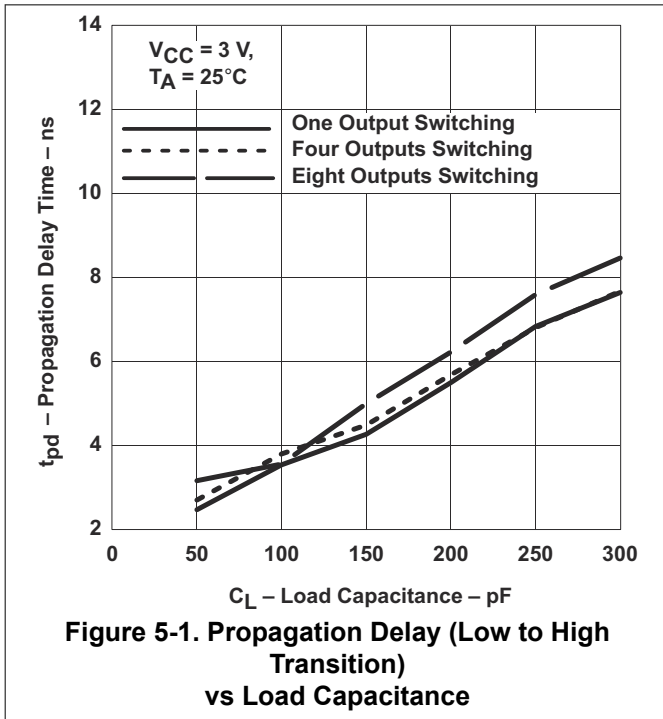
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | SN74LVC08A | | | | | | UNIT | |
|--------------------|--------------|-------------|-----------------|-----------------------|-----|-----|----------------|-----|-----------------|------|-----|
| | | | | T _A = 25°C | | | –40°C to +85°C | | –40°C to +125°C | | |
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | | MAX |
| t _{pd} | A or B | Y | 1.8V ± 0.15V | 1 | 5 | 9.3 | 1 | 9.8 | 1 | 11.3 | ns |
| | | | 2.5V ± 0.2V | 1 | 2.9 | 6.4 | 1 | 6.9 | 1 | 9 | |
| | | | 2.7V | 1 | 3 | 4.6 | 1 | 4.8 | 1 | 6 | |
| | | | 3.3V ± 0.3V | 1 | 2.6 | 3.9 | 1 | 4.1 | 1 | 5.5 | |
| t _{sk(o)} | | | 3.3V ± 0.3V | | | | | 1 | 1.5 | ns | |

5.10 Operating Characteristics

T_A = 25°C

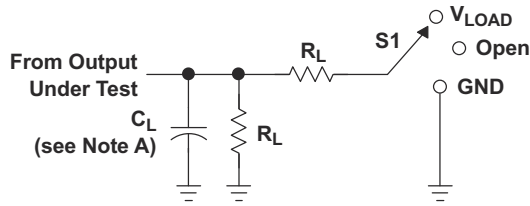
| PARAMETER | | TEST CONDITIONS | V _{CC} | TYP | UNIT |
|-----------------|--|-----------------|-----------------|-----|------|
| C _{pd} | Power dissipation capacitance per gate | f = 10 MHz | 1.8 V | 7 | pF |
| | | | 2.5 V | 9.8 | |
| | | | 3.3 V | 10 | |

5.11 Typical Characteristics



6 Parameter Measurement Information

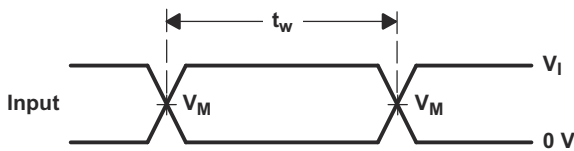
Load Circuit and Voltage Waveforms



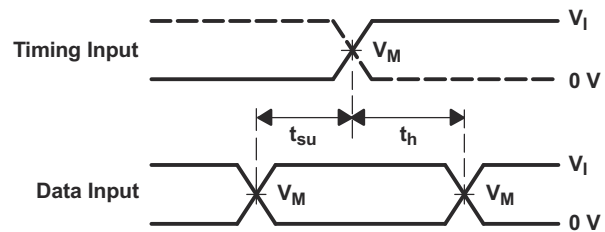
LOAD CIRCUIT

| TEST | S1 |
|-------------------|------------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | V_{LOAD} |
| t_{PHZ}/t_{PZH} | GND |

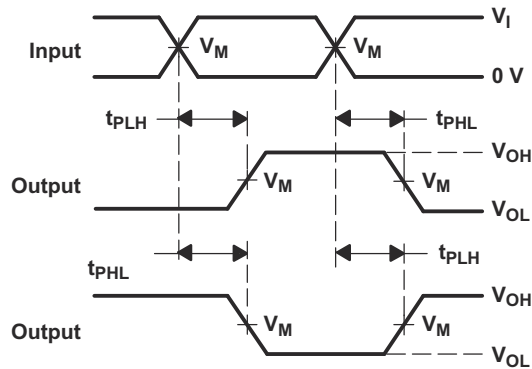
| V_{CC} | INPUTS | | V_M | V_{LOAD} | C_L | R_L | V_D |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------|
| | V_I | t_r/t_f | | | | | |
| $1.8\text{ V} \pm 0.15\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| 2.7 V | 2.7 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 2.7 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |



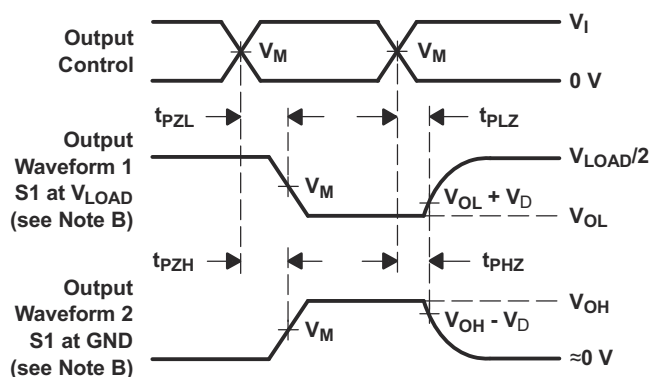
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10\text{ MHz}$, $Z_O = 50\text{ W}$.
 D. The outputs are measured one at a time, with one transition per measurement.
 E. t_{pLZ} and t_{pHZ} are the same as t_{dis} .
 F. t_{pZL} and t_{pZH} are the same as t_{en} .
 G. t_{pLH} and t_{pHL} are the same as t_{pd} .
 H. All parameters and waveforms are not applicable to all devices.

7 Detailed Description

7.1 Overview

The SN74LVC08 device contains four 2-input positive AND gate device and performs the Boolean function $Y = A \times B$. This device is useful when multiple AND function is used in the system.

7.2 Functional Block Diagram

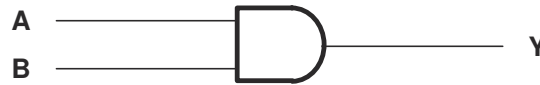


Figure 7-1. Logic Diagram, Each Gate (Positive Logic)

7.3 Feature Description

7.3.1 Balanced High-Drive CMOS Push-Pull Outputs

A balanced output allows the device to sink and source similar currents. The high drive capability of this device creates fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the power output of the device to be limited to avoid thermal runaway and damage due to over-current. The electrical and thermal limits defined in the [Section 5.1](#) must be followed at all times.

7.3.2 Standard CMOS Inputs

Standard CMOS inputs are high impedance and are typically modelled as a resistor in parallel with the input capacitance given in the [Section 5.6](#) and [Section 5.7](#). The worst case resistance is calculated with the maximum input voltage, given in the [Section 5.1](#), and the maximum input leakage current, given in the [Section 5.6](#) and [Section 5.7](#), using ohm's law ($R = V \div I$).

Signals applied to the inputs need to have fast edge rates, as defined by $\Delta t/\Delta v$ in [Section 5.3](#) and [Section 5.4](#) to avoid excessive currents and oscillations. If a slow or noisy input signal is required, a device with a Schmitt-trigger input should be utilized to condition the input signal prior to the standard CMOS input.

7.3.3 Clamp Diodes

The inputs to this device have negative clamping diodes. The outputs to this device have both positive and negative clamping diodes as shown in [Figure 7-2](#).

CAUTION

Voltages beyond the values specified in the [Section 5.1](#) table can cause damage to the device. The input negative-voltage and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

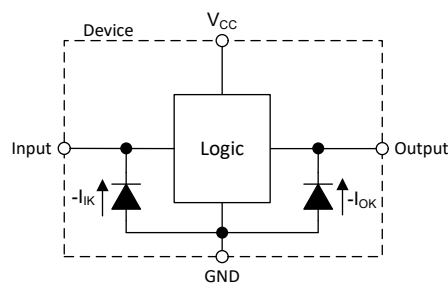


Figure 7-2. Electrical Placement of Clamping Diodes for Each Input and Output

7.3.4 Over-voltage Tolerant Inputs

Input signals to this device can be driven above the supply voltage so long as they remain below the maximum input voltage value specified in the [Section 5.1](#).

7.4 Device Functional Modes

[Table 7-1](#) lists the functional modes for the SN54LVC08A and SN74LVC08A devices.

Table 7-1. Truth Table

| INPUTS | | OUTPUT |
|--------|---|--------|
| A | B | Y |
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The SN74LVC08A is used to drive CMOS device and used for implementing AND logic. The LVC family can support current drive of about 24 mA at 3-V V_{CC} . The inputs for SN74LVC08A are 5.5-V tolerant allowing it to translate down to V_{CC} .

8.2 Typical Application

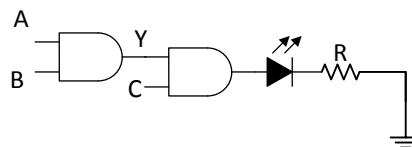


Figure 8-1. Three Input AND Gate Implementation and Driving LED

8.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so routing and load conditions should be considered to prevent ringing.

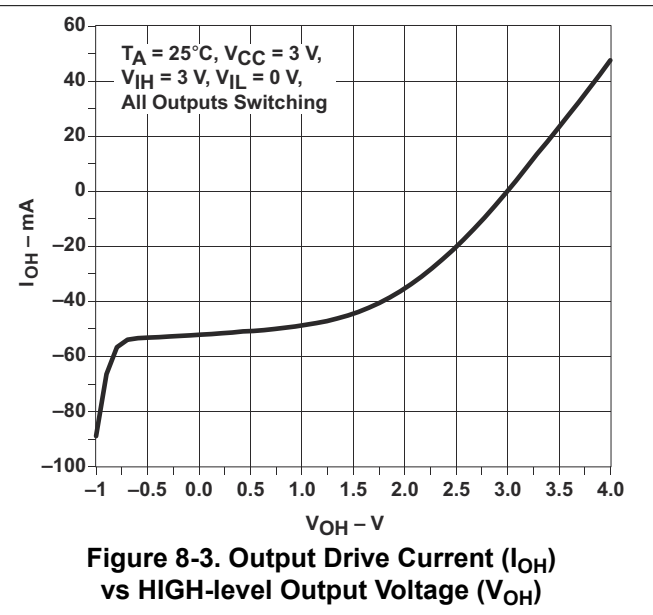
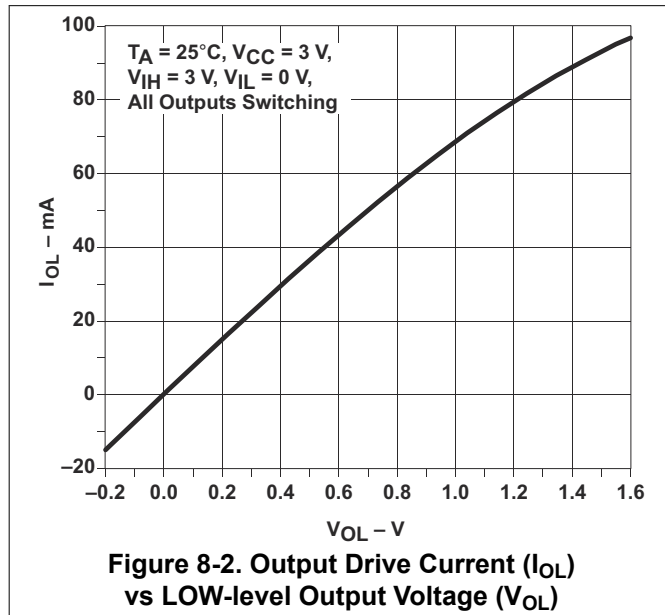
8.2.2 Detailed Design Procedure

SN74LVC08A contains four AND gates in one package which can be used for individual AND function or to implement complex Boolean logic. Figure 8-1 shows an example of implementing 3input AND function. AB are inputs for AND gate which are connected to another AND gate. $Z = A \times B \times C$. SN74LVC08A support high drive current of 24 mA which can be used to drive LEDs of even Drive low current signal FETs, an example is shown in Figure 8-1 TI recommends to use a series resistance to limit the current. If V_{CC} is 3 V, and LED current should be 10 mA, and the forward-voltage of LED is 2.5 V, then R as shown in Figure 8-1 is calculated using Equation 1:

$$R = (V_{CC} - V_{LED}) / I \quad (1)$$

$$R = (3 - 2.5) / 0.01 = 50 \Omega$$

8.2.3 Application Curves



Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [Recommended Operating Conditions](#) table.

The V_{CC} pin must have a good bypass capacitor to prevent power disturbance. TI recommends to use a 0.1- μF capacitor. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1- μF and 1- μF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

8.3 Layout

8.3.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in [Figure 8-4](#) are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or VCC, whichever makes more sense or is more convenient.

Even low data rate digital signals can have high frequency signal components due to fast edge rates. When a PCB trace turns a corner at a 90° angle, a reflection can occur. A reflection occurs primarily because of the change of width of the trace. At the apex of the turn, the trace width increases to 1.414 times the width. This increase upsets the transmission-line characteristics, especially the distributed capacitance and self-inductance of the trace which results in the reflection. Not all PCB traces can be straight and therefore some traces must turn corners. [Figure 8-5](#) shows progressively better techniques of rounding corners. Only the last example (BEST) maintains constant trace width and minimizes reflections.

8.3.2 Layout Examples

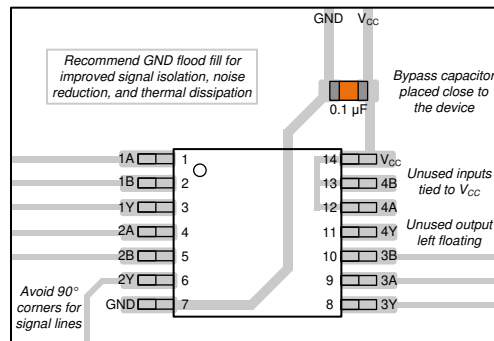


Figure 8-4. Example Layout

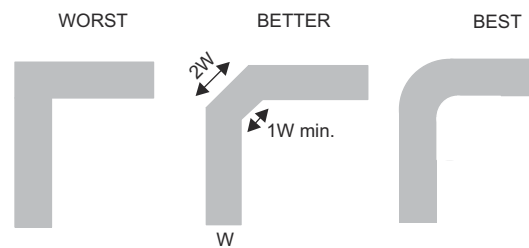


Figure 8-5. Trace Example

9 Device and Documentation Support

9.1 Documentation Support (Analog)

9.1.1 Related Documentation

For related documentation see the following:

[Implications of Slow or Floating CMOS Inputs](#), SCBA004

9.1.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to order now.

Table 9-1. Related Links

| PARTS | PRODUCT FOLDER | ORDER NOW | TECHNICAL DOCUMENTS | TOOLS & SOFTWARE | SUPPORT & COMMUNITY |
|------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| SN54LVC08A | Click here | Click here | Click here | Click here | Click here |
| SN74LVC08A | Click here | Click here | Click here | Click here | Click here |

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. In the upper right corner, click on *Alert me* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.3 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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9.3.1 Community Resources

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

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9.5 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.6 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

10

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Revision V (May 2024) to Revision W (July 2024) | Page |
|--|------|
| • Updated thermal values for D package from RθJA = 98.6 to 127.8, RθJC(top) = 56.0 to 81.9, RθJB = 53.3 to 84.4, ΨJT = 16.4 to 39.6, ΨJB = 53.0 to 83.9, RθJC(bot) = N/A, all values in °C/W | 6 |

| Changes from Revision U (March 2024) to Revision V (May 2024) | Page |
|---|-------------|
| • Updated R θ JA values: DB = 112.8 to 140.4, PW = 127.7 to 150.8, RGY = 51.1 to 92.1, NS = 95.1 to 123.8; updated DB, PW, RGY, and NS packages for R θ JC(top), R θ JB, Ψ JT, Ψ JB, and R θ JC(bot), all values in $^{\circ}$ C/W..... | 6 |

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|--|-------------------------|
| 5962-9753401Q2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962- 9753401Q2A SNJ54LVC 08AFK | Samples |
| 5962-9753401QCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9753401QC A SNJ54LVC08AJ | Samples |
| 5962-9753401QDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9753401QD A SNJ54LVC08AW | Samples |
| SN74LVC08ABQAR | ACTIVE | WQFN | BQA | 14 | 3000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08AD | ACTIVE | SOIC | D | 14 | 50 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADBR | ACTIVE | SSOP | DB | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08ADBRE4 | ACTIVE | SSOP | DB | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08ADE4 | ACTIVE | SOIC | D | 14 | 50 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADG4 | ACTIVE | SOIC | D | 14 | 50 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU SN | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADRE4 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADRG3 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADRG4 | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ADT | ACTIVE | SOIC | D | 14 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ANSR | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08ANSRE4 | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LVC08A | Samples |
| SN74LVC08APW | ACTIVE | TSSOP | PW | 14 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|--------------------------------------|-------------------------|
| SN74LVC08APWG4 | ACTIVE | TSSOP | PW | 14 | 90 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWR | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU SN | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWRE4 | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWRG3 | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | SN | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWRG4 | ACTIVE | TSSOP | PW | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWT | ACTIVE | TSSOP | PW | 14 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08APWTG4 | ACTIVE | TSSOP | PW | 14 | 250 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | LC08A | Samples |
| SN74LVC08ARGYR | ACTIVE | VQFN | RGY | 14 | 3000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | LC08A | Samples |
| SN74LVC08ARGYRG4 | ACTIVE | VQFN | RGY | 14 | 3000 | RoHS & Green | NIPDAU | Level-2-260C-1 YEAR | -40 to 125 | LC08A | Samples |
| SNJ54LVC08AFK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9753401Q2A SNJ54LVC 08AFK | Samples |
| SNJ54LVC08AJ | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9753401QC A SNJ54LVC08AJ | Samples |
| SNJ54LVC08AW | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9753401QD A SNJ54LVC08AW | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSELETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of ≤ 1000 ppm threshold. Antimony trioxide based flame retardants must also meet the ≤ 1000 ppm threshold requirement.

- (3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.
- (5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.
- (6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN54LVC08A, SN74LVC08A :

- Catalog : [SN74LVC08A](#)
- Automotive : [SN74LVC08A-Q1](#), [SN74LVC08A-Q1](#)
- Enhanced Product : [SN74LVC08A-EP](#), [SN74LVC08A-EP](#)
- Military : [SN54LVC08A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

- Military - QML certified for Military and Defense Applications

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