TEXAS INSTRUMENTS

SN54LV86A, SN74LV86A

SCLS392G – APRIL 1998 – REVISED FEBRUARY 2015

SNx4LV86A Quadruple 2-Input Exclusive-OR Gates

1 Features

- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 8 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C
- Support Mixed-Mode Voltage Operation on All Ports
- Latch-Up Performance Exceeds 250 mA per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

2 Applications

- EPOS
- Programmable Logic Controller (PLC)
- DCS and PAC: Analog Input Module
- Medical Meters: Portable
- Server Motherboard
- Printer

3 Description

The 'LV86A devices are quadruple 2-input exclusive-OR gates designed for 2-V to 5.5-V V_{CC} operation.

These devices contain four independent 2-input exclusive-OR gates. They perform the Boolean function $Y = A \oplus B$ or $Y = \overline{A}B + A\overline{B}$ in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

Device Information[1]

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LV86A	VQFN (14)	3.50 mm × 3.50 mm
	SOIC (14)	8.65 mm × 3.91 mm
	SOP (14)	10.30 mm × 5.30 mm
	SSOP (14)	6.20 mm × 5.30 mm
	TSSOP (14)	5.00 mm × 4.40 mm

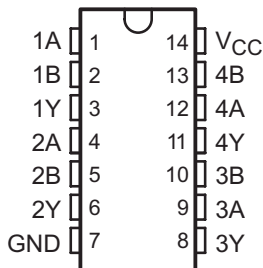(1) For all available packages, see the orderable addendum at the end of the data sheet.

4 Simplified Schematic

A.   These are five equivalent exclusive-OR symbols valid for an 'LV86A gate in positive logic; negation can be shown at any two ports. See *Functional Block Diagram* for more information.

Table of Contents

5 Revision History

Changes from Revision F (April 2005) to Revision G   **Page**

- Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section 1
- Updated operating free-air temperature maximum from 85°C to 125°C for SN74LV86A 5

Product Folder Links: *SN54LV86A SN74LV86A*

6 Pin Configuration and Functions

SN54LV86A: J or W Package
SN74LV86A: D, DB, DGV, NS, or PW Package
(Top View)

```
1A  [ 1      14 ]  V_CC
1B  [ 2      13 ]  4B
1Y  [ 3      12 ]  4A
2A  [ 4      11 ]  4Y
2B  [ 5      10 ]  3B
2Y  [ 6       9 ]  3A
GND [ 7       8 ]  3Y
```

SN54LV86A: FK Package
(Top View)

```
       1B  1A  NC  V_CC  4B
        3   2   1  20  19
1Y  [ 4              18 ]  4A
NC  [ 5              17 ]  NC
2A  [ 6              16 ]  4Y
NC  [ 7              15 ]  NC
2B  [ 8              14 ]  3B
        9  10  11  12  13
       2Y  GND  NC  3Y  3A
```
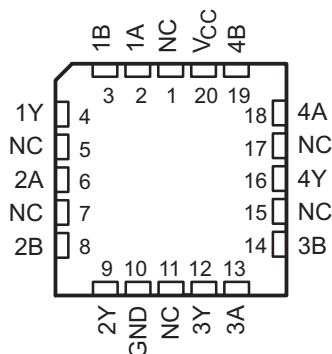
B. NC − No internal connection

Pin Functions

PIN	I/O	DESCRIPTION
1	1A	A input 1
2	1B	B input 1
3	1Y	Output 1
4	2A	A input 2
5	2B	B input 2
6	2Y	Output 2
7	GND	ground
8	3Y	Output 3
9	3A	A input 3
10	3B	B input 3
11	4Y	Output 4
12	4A	A input 4
13	4B	B input 4
14	V_{CC}	Power pin

Submit Documentation Feedback   3

Product Folder Links: *SN54LV86A SN74LV86A*

7 Specifications

7.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
V_{CC}	Supply voltage	−0.5	7	V
V_I	Input voltage [2]	−0.5	7	V
V_O	Voltage applied to any output in the high-impedance or power-off state [2]	−0.5	7	V
V_O	Output voltage [2][3]	−0.5	V_{CC} + 0.5 V	V
I_{IK}	Input clamp current, V_I < 0		−20	mA
I_{OK}	Output clamp current, V_O < 0		−50	mA
I_O	Continuous output current, V_O = 0 to V_{CC}	−25	25	mA
	Continuous current through V_{CC} or GND	−50	50	mA
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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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) This value is limited to 5.5-V maximum.

7.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 [1]	2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 [2]	1000	

(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.

7.3 Recommended Operating Conditions

see [1]

			MIN	MAX	UNIT
V_{CC}	Supply voltage		2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		V
		V_{CC} = 2.3 V to 2.7 V	V_{CC} × 0.7		
		V_{CC} = 3 V to 3.6 V	V_{CC} × 0.7		
		V_{CC} = 4.5 V to 5.5 V	V_{CC} × 0.7		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5	V
		V_{CC} = 2.3 V to 2.7 V		V_{CC} × 0.3	
		V_{CC} = 3 V to 3.6 V		V_{CC} × 0.3	
		V_{CC} = 4.5 V to 5.5 V		V_{CC} × 0.3	
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 V		−50	µA
		V_{CC} = 2.3 V to 2.7 V		−2	mA
		V_{CC} = 3 V to 3.6 V		−6	
		V_{CC} = 4.5 V to 5.5 V		−12	
I_{OL}	Low-level output current	V_{CC} = 2 V		50	µA
		V_{CC} = 2.3 V to 2.7 V		2	mA
		V_{CC} = 3 V to 3.6 V		6	
		V_{CC} = 4.5 V to 5.5 V		12	
Δt/Δv	Input transition rise or fall rate	V_{CC} = 2.3 V to 2.7 V		200	ns/V
		V_{CC} = 3 V to 3.6 V		100	
		V_{CC} = 4.5 V to 5.5 V		20	
T_A	Operating free-air temperature		−55	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, SCBA004.

7.4 Thermal Information

	THERMAL METRIC[1]	D	DB	DGV	NS	PW	UNIT
		14 PINS					
$R_{\theta JA}$	Junction-to-ambient thermal resistance[2]	90.6	107.1	129.0	90.7	122.6	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	50.9	59.6	52.1	48.3	51.4	
$R_{\theta JB}$	Junction-to-board thermal resistance	44.8	54.4	62.0	49.4	64.4	
ψ_{JT}	Junction-to-top characterization parameter	14.7	20.5	6.5	14.6	6.7	
ψ_{JB}	Junction-to-board characterization parameter	44.5	53.8	61.3	49.1	63.8	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) The package thermal impedance is calculated in accordance with JESD 51-7.

7.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V_{CC}	SN54LV86A			SN74LV86A −40°C to 125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}	$I_{OH} = -50$ μA	2 to 5.5 V	$V_{CC} - 0.1$			$V_{CC} - 0.1$			V
	$I_{OH} = -2$ mA	2.3 V	2			2			
	$I_{OH} = -6$ mA	3 V	2.48			2.48			
	$I_{OH} = -12$ mA	4.5 V	3.8			3.8			
V_{OL}	$I_{OL} = 50$ μA	2 to 5.5 V			0.1			0.1	V
	$I_{OL} = 2$ mA	2.3 V			0.4			0.4	
	$I_{OL} = 6$ mA	3 V			0.44			0.44	
	$I_{OL} = 12$ mA	4.5 V			0.55			0.55	
I_I	$V_I = 5.5$ V or GND	0 to 5.5 V			±1			±1	μA
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			20			20	μA
I_{off}	V_I or $V_O = 0$ to 5.5 V	0			5			5	μA
C_i	$V_I = V_{CC}$ or GND	3.3 V		1.4			1.4		pF

7.6 Switching Characteristics, V_{CC} = 2.5 V ±0.2 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	C_L = 15 pF		7.9[1]	17.6[1]	1[2]	21[2]	ns
			C_L = 50 pF		10.5	22.6	1	26.5	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV86A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.

7.7 Switching Characteristics, V_{CC} = 3.3 V ±0.3 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	C_L = 15 pF		5.5[1]	11[1]	1[2]	13[2]	ns
			C_L = 50 pF		7.4	14.5	1	16.5	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV86A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.

7.8 Switching Characteristics, V_{CC} = 5 V ±0.5 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{pd}	A or B	Y	C_L = 15 pF		3.7[1]	6.8[1]	1[2]	8[2]	ns
			C_L = 50 pF		5.3	8.8	1	10	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.
(2) This note applies to SN54LV86A only: On products compliant to MIL-PRF-38535, this parameter is not production tested.

Product Folder Links: *SN54LV86A SN74LV86A*

7.9 Noise Characteristics for SN74LV86A

V_{CC} = 3.3 V, C_L = 50 pF, T_A = 25°C (see [1])

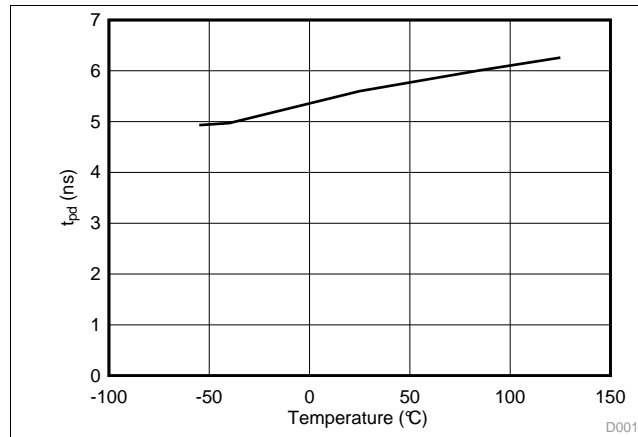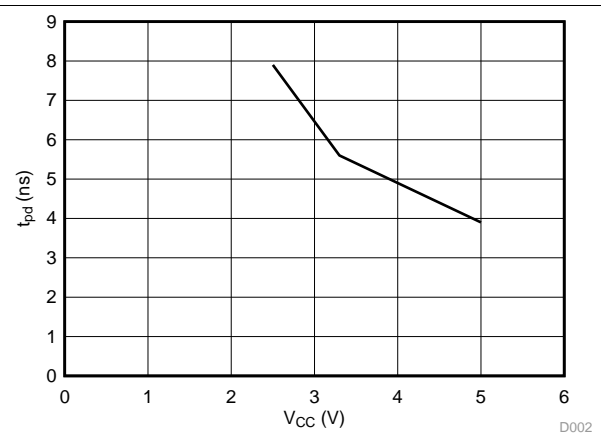|	PARAMETER	MIN	TYP	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.2	0.8	
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		−0.1	−0.8	
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		3.1		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	

(1)   Characteristics are for surface-mount packages only.

7.10 Operating Characteristics

T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 10 MHz	3.3 V	8.4	pF
			5 V	8.8	

7.11 Typical Characteristics

Figure 1. t_{pd} vs Temperature at 3.3 V

Figure 2. t_{pd} vs V_{CC} at 25°C

Product Folder Links: *SN54LV86A SN74LV86A*

8 Parameter Measurement Information

LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}

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

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 ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.

D. The outputs are measured one at a time, with one input 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_{PHL} and t_{PLH} are the same as t_{pd}.

H. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

Product Folder Links: *SN54LV86A SN74LV86A*

9 Detailed Description

9.1 Overview

The 'LV86A devices are quadruple 2-input exclusive-OR gates designed for 2-V to 5.5-V V_{CC} operation.

These devices contain four independent 2-input exclusive-OR gates. They perform the Boolean function $Y = A \oplus B$ or $Y = \overline{A}B + A\overline{B}$ in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.
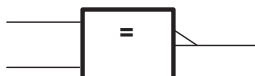
9.2 Functional Block Diagram

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

A.   These are five equivalent exclusive-OR symbols valid for an 'LV86A gate in positive logic; negation can be shown at any two ports.
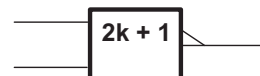
Figure 4. Exclusive OR

The output is active (low) if all inputs stand at the same logic level (that is, A = B).

Figure 5. Logic-Identity Element

The output is active (low) if an even number of inputs (that is, 0 or 2) are active.

Figure 6. Even-Parity Element

The output is active (high) if an odd number of inputs (that is, only 1 of the 2) are active.

Figure 7. Odd-Parity Element

9.3 Feature Description

- Wide operating voltage range, operates from 2 to 5.5 V
- Allows down voltage translation, inputs accept voltages to 5.5 V

9.4 Device Functional Modes

Table 1. Function Table
(Each Gate)

INPUTS		OUTPUT
A	**B**	**Y**
L	L	L
L	H	H
H	L	H
H	H	L

Product Folder Links: *SN54LV86A SN74LV86A*

10 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. Customers should validate and test their design implementation to confirm system functionality.

10.1 Application Information

The SN74LV86A is a low drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The inputs can accept voltages to 5.5 V at any valid V_{CC} making it Ideal for down translation.

10.2 Typical Application
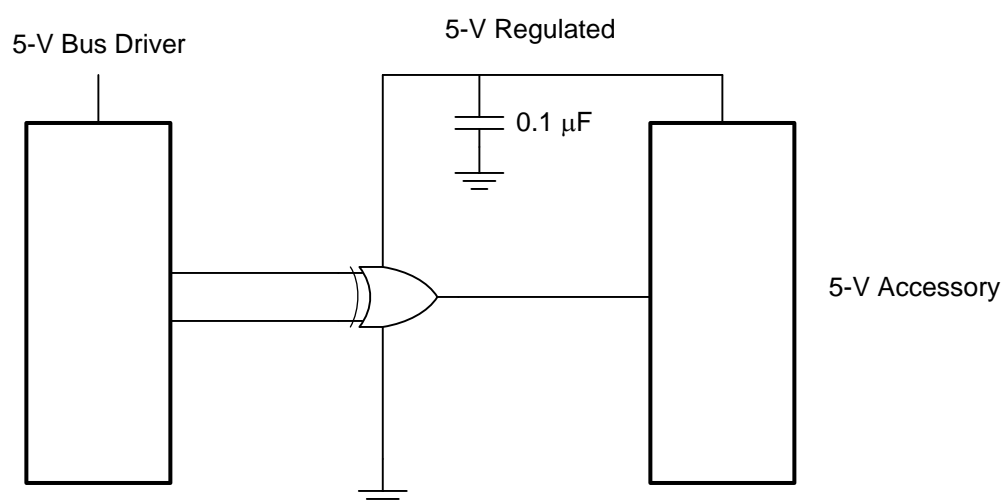
Figure 8. Typical Application Schematic

10.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken 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.

10.2.2 Detailed Design Procedure

1. Recommended Input conditions
   – Rise time and fall time specs see (Δt/ΔV) in *Recommended Operating Conditions.*
   – Specified High and low levels. See (V_{IH} and V_{IL}) in *Recommended Operating Conditions.*
2. Recommend output conditions
   – Load currents should not exceed 25 mA per output and 50 mA total for the part
   – Outputs should not be pulled above V_{CC}

Typical Application (continued)

10.2.3 Application Curve
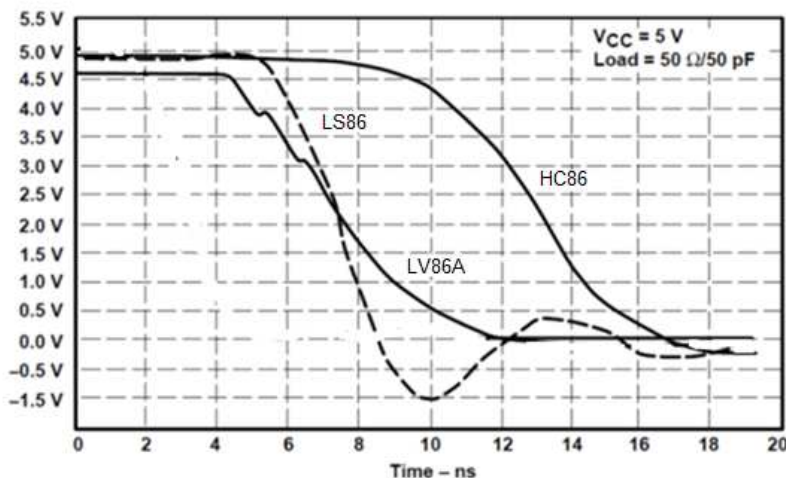
Figure 9. Switching Characteristics Comparison

11 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in *Recommended Operating Conditions*.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends 0.1 µF and if there are multiple V_{CC} terminals then .01 or .022 µF is recommended for each power terminal. It is okay to parallel multiple bypass capacitors to reject different frequencies of noise. A 0.1 µF and 1 µF are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.
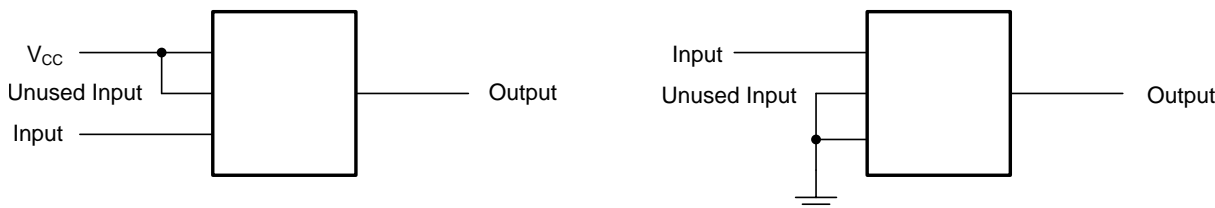
12 Layout

12.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or 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 below are the 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 V_{CC} whichever make more sense or is more convenient. It is generally okay to float outputs unless the part is a transceiver. If the transceiver has an output enable pin it will disable the outputs section of the part when asserted. This will not disable the input section of the IOs so they also cannot float when disabled.

12.2 Layout Example

Figure 10. Layout Recommendation

13 Device and Documentation Support

13.1 Related Links

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

Table 2. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LV86A	Click here	Click here	Click here	Click here	Click here
SN74LV86A	Click here	Click here	Click here	Click here	Click here

13.2 Trademarks

All trademarks are the property of their respective owners.

13.3 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

13.4 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

14 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.

Product Folder Links: *SN54LV86A SN74LV86A*

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74LV86AD	Obsolete	Production	SOIC (D) | 14	-	-	Call TI	Call TI	-40 to 125	LV86A
SN74LV86ADBR	Active	Production	SSOP (DB) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ADBR.A	Active	Production	SSOP (DB) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ADGVR	Active	Production	TVSOP (DGV) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ADGVR.A	Active	Production	TVSOP (DGV) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ADR	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ADR.A	Active	Production	SOIC (D) | 14	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86ANSR	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	74LV86A
SN74LV86ANSR.A	Active	Production	SOP (NS) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	74LV86A
SN74LV86APW	Obsolete	Production	TSSOP (PW) | 14	-	-	Call TI	Call TI	-40 to 125	LV86A
SN74LV86APWR	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWR.A	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWRG4	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWRG4	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	No	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWRG4.A	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	No	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWRG4.A	Active	Production	TSSOP (PW) | 14	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV86A
SN74LV86APWT	Obsolete	Production	TSSOP (PW) | 14	-	-	Call TI	Call TI	-40 to 125	LV86A

(1) Status: For more details on status, see our product life cycle.

(2) Material type: When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) Lead finish/Ball material: Parts 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.

(5) MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF SN74LV86A :

- Automotive : SN74LV86A-Q1

- Enhanced Product : SN74LV86A-EP

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

Reel Diameter

Reel Width (W1)

TAPE DIMENSIONS

Cavity

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

Sprocket Holes

User Direction of Feed

Pocket Quadrants

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV86ADBR	SSOP	DB	14	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74LV86ADGVR	TVSOP	DGV	14	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74LV86ADR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74LV86ANSR	SOP	NS	14	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
SN74LV86APWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV86APWRG4	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

PACKAGE MATERIALS INFORMATION

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV86ADBR	SSOP	DB	14	2000	353.0	353.0	32.0
SN74LV86ADGVR	TVSOP	DGV	14	2000	353.0	353.0	32.0
SN74LV86ADR	SOIC	D	14	2500	353.0	353.0	32.0
SN74LV86ANSR	SOP	NS	14	2000	353.0	353.0	32.0
SN74LV86APWR	TSSOP	PW	14	2000	353.0	353.0	32.0
SN74LV86APWRG4	TSSOP	PW	14	2000	353.0	353.0	32.0

6.2
5.8 TYP

A

PIN 1 ID
AREA

1

14

12X 1.27

8.75
8.55
NOTE 3

2X
7.62

7

8

B

4.0
3.8
NOTE 4

14X 0.51
0.31

⊕ 0.25Ⓜ C A B

C

SEATING PLANE

◯ 0.1 C

1.75 MAX

SEE DETAIL A

0.25
0.13 TYP

0.25
GAGE PLANE

0° - 8°

1.27
0.40

0.25
0.10

DETAIL A
TYPICAL

4220718/A 09/2016

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing
   per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not
   exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.

TEXAS
INSTRUMENTS
www.ti.com

14X (1.55)

1

14

14X (0.6)

SYMM

12X (1.27)

SYMM

7

8

(R0.05)
TYP

(5.4)

LAND PATTERN EXAMPLE
SCALE:8X

SOLDER MASK
OPENING

METAL

0.07 MAX
ALL AROUND

NON SOLDER MASK
DEFINED

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

0.07 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220718/A   09/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

14X (1.55)

SYMM

1

14X (0.6)

14

12X (1.27)

SYMM

7

8

(5.4)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A   09/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

PINS ** DIM	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

NOTES: A.   All linear dimensions are in millimeters.
          B.   This drawing is subject to change without notice.
          C.   Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DGV (R-PDSO-G**) PLASTIC SMALL-OUTLINE

24 PINS SHOWN

	PINS **	14	16	20	24	38	48	56
DIM								
A MAX		3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN		3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

8.2
7.4 TYP

PIN 1 INDEX AREA

12X 0.65

14

2X

3.9

6.5
5.9
NOTE 3

1

7

8

14X 0.38
0.22

⊕ 0.15Ⓜ C A B

5.6
5.0
NOTE 4

C

⌒ 0.1 C

SEATING PLANE

0.25
0.09

SEE DETAIL A

0.25
GAGE PLANE

2 MAX

0.05 MIN

0° -8°

0.95
0.55

DETAIL A
TYPICAL
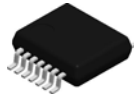
4220762/A   05/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

14X (1.85)

14X (0.45)

1

SYMM

(R0.05) TYP

14

SYMM

12X (0.65)

7

8

(7)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED
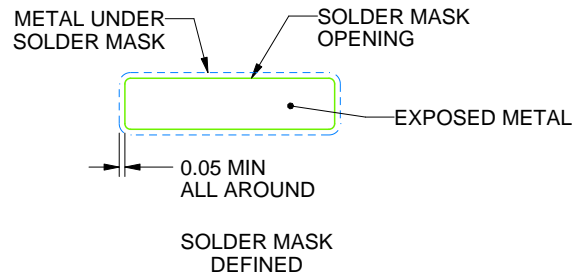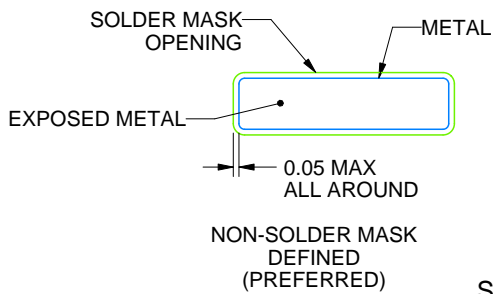
SOLDER MASK DETAILS

4220762/A   05/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

14X (1.85)

1

14X (0.45)

12X (0.65)

7

SYMM
℄

(R0.05) TYP

14

SYMM
℄

8

(7)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220762/A   05/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

6.6
6.2 TYP

A

PIN 1 INDEX AREA

1

14

12X 0.65

2X
3.9

5.1
4.9
NOTE 3

7

8

14X 0.30
0.17

⊕ 0.1 Ⓜ C A B

B

4.5
4.3
NOTE 4

SEATING
PLANE

C

◁ 0.1 C

4X (0° -12°)

1.2 MAX

SEE DETAIL A

(0.15) TYP

0.25
GAGE PLANE

0.15
0.05

0.75
0.50

0° -8°

DETAIL A
TYPICAL

4220202/B   12/2023

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK DETAILS

NON-SOLDER MASK
DEFINED
(PREFERRED)

SOLDER MASK
DEFINED

4220202/B   12/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

14X (1.5)

SYMM

1

14X (0.45)

(R0.05) TYP

14

SYMM

12X (0.65)

7

8

(5.8)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220202/B   12/2023

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.