



# SNx4LS06 Hex Inverter Buffers and Drivers With Open-Collector High-Voltage Outputs

## 1 Features

- Convert TTL Voltage Levels to MOS Levels
- High Sink-Current Capability
- Input Clamping Diodes Simplify System Design
- Open-Collector Driver for Indicator Lamps and Relays
- Inputs Fully Compatible With Most TTL Circuits
- 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.

## 2 Applications

- Factory Automation
- Building Automation
- Line Drivers
- Electronic Point of Sale
- Desktop or Notebook PCs

## 3 Description

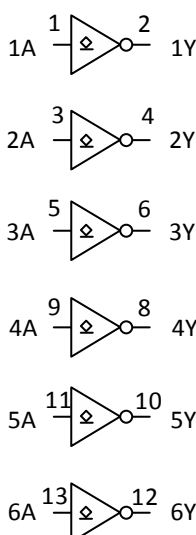
The SNx4LS06 devices feature high-voltage, open-collector outputs to interface with high-level circuits (such as MOS), or for driving high-current loads, and also are characterized for use as inverter buffers for driving TTL inputs. The SNx4LS06 devices have a rated output voltage of 30 V.

### Device Information<sup>(1)</sup>

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SN54LS06	CDIP (14)	19.50 mm × 6.92 mm
	LCCC (20)	8.89 mm × 8.89 mm
SN74LS06D	SOIC (14)	8.65 mm × 3.91 mm
SN74LS06DB	SSOP (14)	5.30 mm × 6.20 mm
SN74LS06N	PDIP (14)	19.30 mm × 6.35 mm
SN74LS06NS	SOP (14)	5.30 mm × 10.20 mm

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

### Logic Diagram (Positive Logic)



Pin numbers shown are for the D, DB, J, N, and NS packages.



## Table of Contents

<b>1 Features</b> .....	<b>1</b>	8.4 Device Functional Modes .....	<b>8</b>
<b>2 Applications</b> .....	<b>1</b>	<b>9 Application and Implementation</b> .....	<b>9</b>
<b>3 Description</b> .....	<b>1</b>	9.1 Application Information .....	<b>9</b>
<b>4 Revision History</b> .....	<b>2</b>	9.2 Typical Application .....	<b>9</b>
<b>5 Pin Configuration and Functions</b> .....	<b>3</b>	<b>10 Power Supply Recommendations</b> .....	<b>11</b>
<b>6 Specifications</b> .....	<b>4</b>	<b>11 Layout</b> .....	<b>11</b>
6.1 Absolute Maximum Ratings .....	4	11.1 Layout Guidelines .....	11
6.2 ESD Ratings .....	4	11.2 Layout Examples .....	11
6.3 Recommended Operating Conditions .....	4	<b>12 Device and Documentation Support</b> .....	<b>12</b>
6.4 Thermal Information .....	5	12.1 Documentation Support .....	12
6.5 Electrical Characteristics .....	5	12.2 Related Links .....	12
6.6 Switching Characteristics .....	5	12.3 Receiving Notification of Documentation Updates .....	12
6.7 Typical Characteristics .....	6	12.4 Community Resources .....	12
<b>7 Parameter Measurement Information</b> .....	<b>7</b>	12.5 Trademarks .....	12
<b>8 Detailed Description</b> .....	<b>8</b>	12.6 Electrostatic Discharge Caution .....	12
8.1 Overview .....	8	12.7 Glossary .....	12
8.2 Functional Block Diagram .....	8	<b>13 Mechanical, Packaging, and Orderable Information</b> .....	<b>12</b>
8.3 Feature Description .....	8		

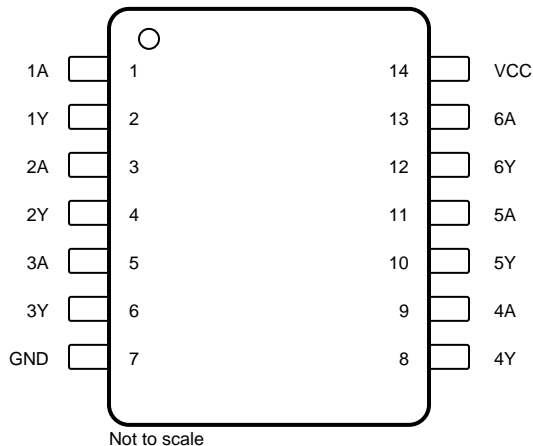
## 4 Revision History

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

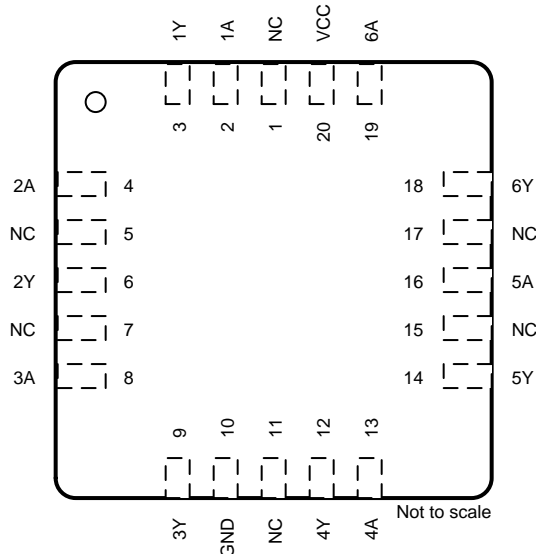
Changes from Revision E (February 2004) to Revision F	Page
• Added <i>Applications</i> section, <i>Device Information</i> table, <i>ESD Ratings</i> table, <i>Feature Description</i> section, <i>Device Functional Modes</i> , <i>Application and Implementation</i> section, <i>Power Supply Recommendations</i> section, <i>Layout</i> section, <i>Device and Documentation Support</i> section, and <i>Mechanical, Packaging, and Orderable Information</i> section .....	<b>1</b>
• Added Military Disclaimer to Features list .....	<b>1</b>
• Added Applications .....	<b>1</b>
• Changed values in the <i>Thermal Information</i> table to align with JEDEC standards .....	<b>5</b>

## 5 Pin Configuration and Functions

**D, DB, J, N, and NS Package**  
14-Pin SOIC, SSOP, CDIP, PDIP, and SOP  
Top View



**FK Package**  
20-Pin LCCC  
Top View



### Pin Functions

PIN			I/O	DESCRIPTION
NAME	SOIC, SSOP, CDIP, PDIP, SOP	LCCC		
1A	1	2	I	1A Input
1Y	2	3	O	1Y Output
2A	3	4	I	2A Input
2Y	4	6	O	2Y Output
3A	5	8	I	3A Input
3Y	6	9	O	3Y Output
4A	9	13	I	4A Input
4Y	8	12	O	4Y Output
5A	11	16	I	5A Input
5Y	10	14	O	5Y Output
6A	13	19	I	6A Input
6Y	12	18	O	6Y Output
GND	7	10	—	Ground
NC	—	1, 5, 7, 11, 15, 17	—	No internal connection
V <sub>CC</sub>	14	20	—	Power pin

## 6 Specifications

### 6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

	MIN	MAX	UNIT
Supply voltage, $V_{CC}$		7	V
Input voltage, $V_I$ <sup>(2)</sup>		7	V
Output voltage, $V_O$ (SNx4LS06) <sup>(2)(3)</sup>		30	V
Absolute maximum junction temperature, $T_J$		150	°C
Storage temperature, $T_{stg}$	–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) All voltage values are with respect to GND.
- (3) This is the maximum voltage that must be applied to any output when it is in the off state.

### 6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$ Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>	±500	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup>	±2000	

- (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. Tested on N package

### 6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	NOM	MAX	UNIT
$V_{CC}$	Supply voltage	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			V
$V_{IL}$	Low-level input voltage			0.8	V
$V_{OH}$	High-level output voltage (SNx4LS06)			30	V
$I_{OL}$	Low-level output current	SN54LS06		30	mA
		SN74LS06		40	
$T_A$	Operating free-air temperature	SN54LS06		–55	°C
		SN74LS06		0	

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

## 6.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74LS06				UNIT
		D (SOIC)	DB (SSOP)	N (PDIP)	NS (SOP)	
		14 PINS	14 PINS	14 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	85.8	97.4	50.2	82.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	44	49.8	37.5	40.9	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	40.3	44.5	30	41.4	°C/W
$\psi_{JT}$	Junction-to-top characterization parameter	11.1	16.5	22.3	12.4	°C/W
$\psi_{JB}$	Junction-to-board characterization parameter	40.1	44	29.9	41.1	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	—	—	—	°C/W

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

## 6.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS <sup>(1)</sup>		MIN	TYP <sup>(2)</sup>	MAX	UNIT
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$				–1.5	V
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$ , $V_{OH} = 30 \text{ V}$ , SNx4LS06				0.25	mA
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$	$I_{OL} = 16 \text{ mA}$		0.25	0.4	V
		$I_{OL} = 30 \text{ mA}$			0.7	
		$I_{OL} = 40 \text{ mA}$ , SN74LS06			0.7	
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$				1	mA
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$				20	μA
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$				–0.2	mA
$I_{CCH}$	$V_{CC} = \text{MAX}$				18	mA
$I_{CCL}$	$V_{CC} = \text{MAX}$				60	mA

(1) For conditions shown as MIN or MAX, use the appropriate value specified under *Recommended Operating Conditions*.

(2) All typical values are at  $V_{CC} = 5 \text{ V}$ , and  $T_A = 25^\circ\text{C}$ .

## 6.6 Switching Characteristics

$V_{CC} = 5 \text{ V}$  and  $T_A = 25^\circ\text{C}$  (see [Figure 2](#))

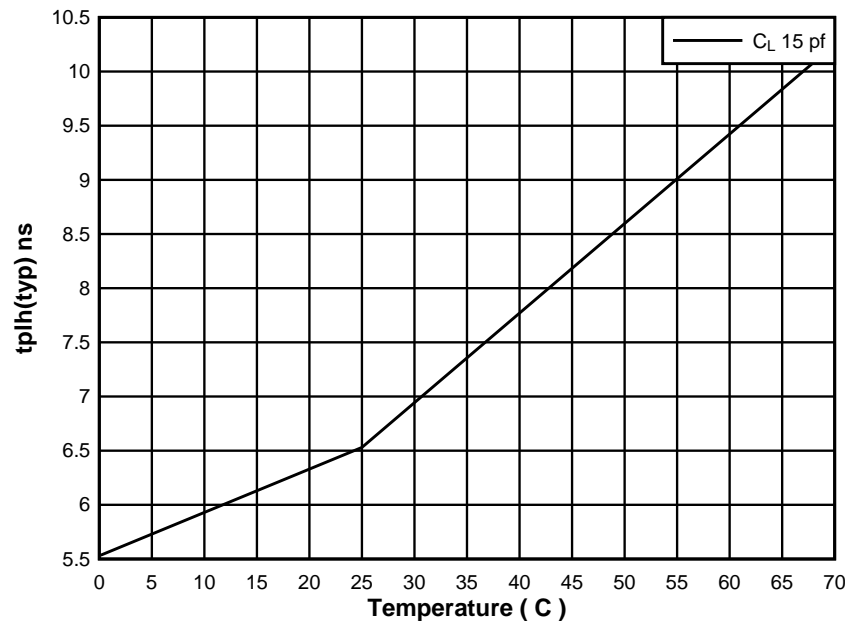
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	From A (input) to Y (output), $R_L = 110 \Omega$ , $C_L = 15 \text{ pF}$	7		15	ns
$t_{PHL}$	From A (input) to Y (output), $R_L = 110 \Omega$ , $C_L = 15 \text{ pF}$	10		20	

## SN54LS06, SN74LS06

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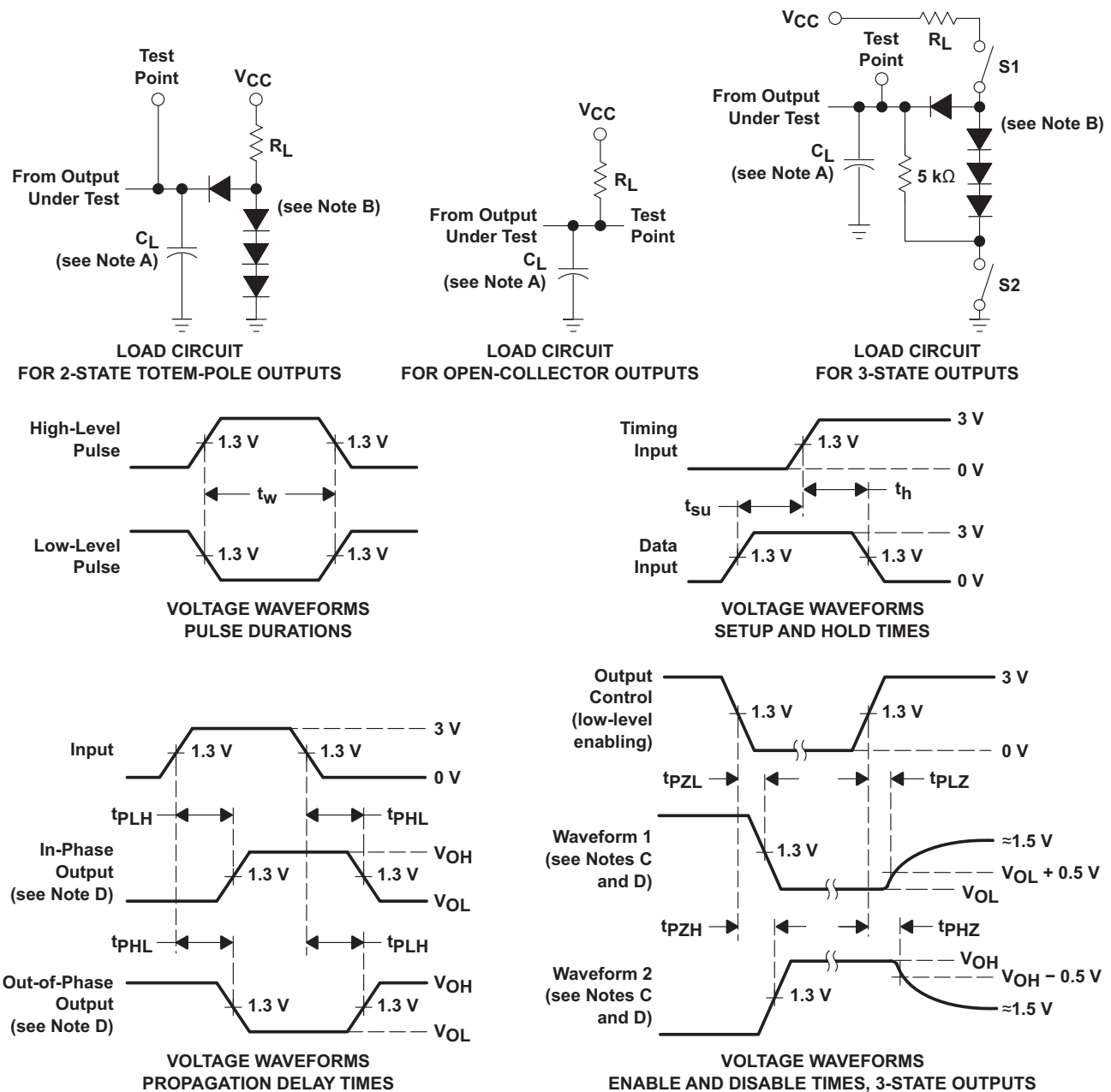
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### 6.7 Typical Characteristics



**Figure 1. Propagation Delay vs Temperature**

## 7 Parameter Measurement Information



- $C_L$  includes probe and jig capacitance.
- All diodes are 1N3064 or equivalent.
- 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.
- S1 and S2 are closed for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PHZ}$ , and  $t_{PLZ}$ ; S1 is open and S2 is closed for  $t_{PZH}$ ; S1 is closed and S2 is open for  $t_{PZL}$ .
- Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O \approx 50 \Omega$ ,  $t_r \leq 1.5$  ns,  $t_f \leq 2.6$  ns.
- The outputs are measured one at a time, with one input transition per measurement.

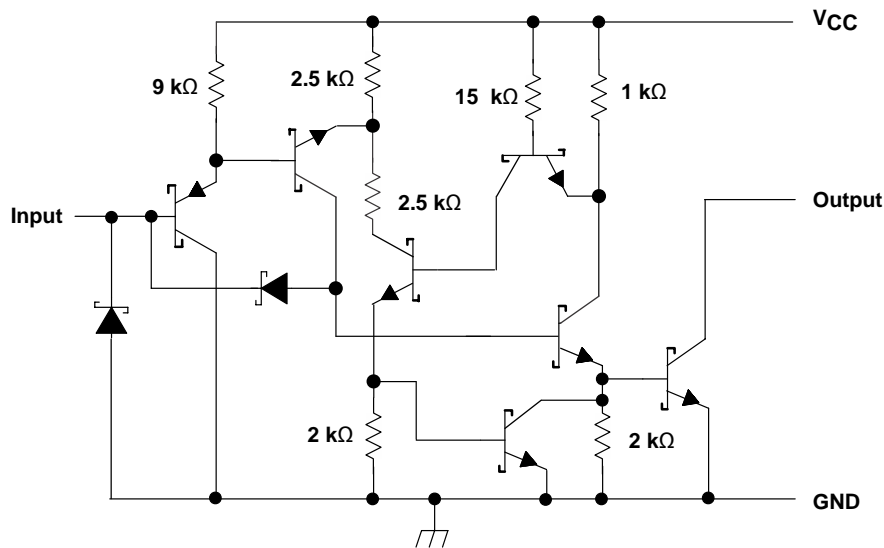
**Figure 2. Load Circuits and Voltage Waveforms**

## 8 Detailed Description

### 8.1 Overview

The SNx4LS06 devices are open-collector output inverters. The maximum sink current for the SN54LS06 device is 30 mA, and for the SN74LS06 device it is 40 mA. These devices are compatible with most TTL families. Inputs are diode-clamped to minimize transmission effects, which simplifies design. Typical power dissipation is 175 mW, and average propagation delay time is 8 ns.

### 8.2 Functional Block Diagram



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### 8.3 Feature Description

The SNx4LS06 devices can convert most TTL voltage circuit voltage level to MOS levels. The devices have high sink-current capability of up to 40 mA. The open-collector driver can be used for typical applications including Indicator lamps and relays.

### 8.4 Device Functional Modes

Table 1 lists the functional modes of the SNx4LS06 devices.

**Table 1. Function Table**

INPUT A	OUTPUT Y
H	L
L	Hi-Z



## 9 Application and Implementation

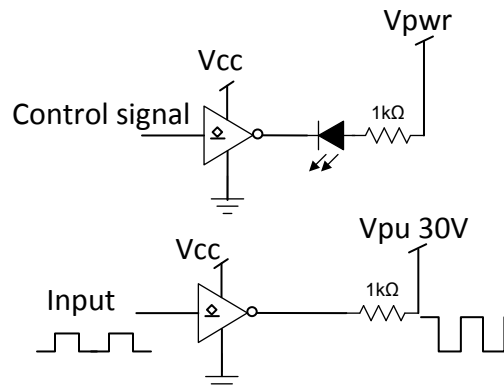
### NOTE

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.

### 9.1 Application Information

The open-collector device is suitable for high-drive and high-voltage translation applications.

### 9.2 Typical Application



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**Figure 3. Application Schematic**

#### 9.2.1 Design Requirements

The SNx4LS06 are open-collector devices which can sink current (up to 40 mA on SN74LS06). The devices can be used in applications such as LED drivers and voltage translation using pullup resistors.

#### 9.2.2 Detailed Design Procedure

1. Recommended input conditions:
  - Specified high and low levels. See ( $V_{IH}$  and  $V_{IL}$ ) in the [Recommended Operating Conditions](#).
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid  $V_{CC}$ .
2. Recommended output conditions:
  - Load currents must not exceed ( $I_O$  max) per output.
  - Outputs can be pulled up to 30 V.

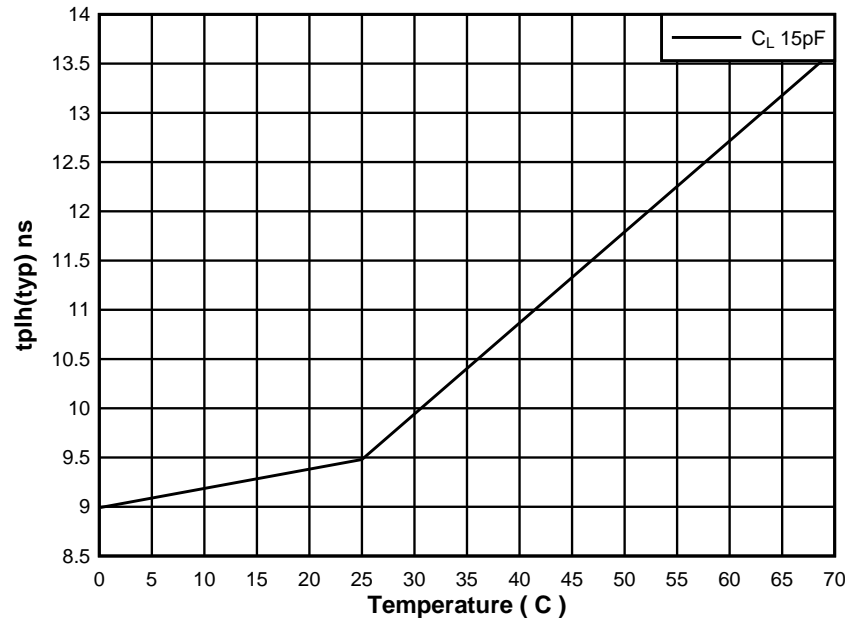
## SN54LS06, SN74LS06

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### Typical Application (continued)

#### 9.2.3 Application Curve



**Figure 4. Propagation Delay vs Temperature**

## 10 Power Supply Recommendations

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

Each  $V_{CC}$  pin must have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1- $\mu$ F capacitor, and if there are multiple  $V_{CC}$  pins, then TI recommends a 0.01- $\mu$ F or 0.022- $\mu$ F capacitor for each power pin. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor must be installed as close to the power pin as possible for best results.

## 11 Layout

### 11.1 Layout Guidelines

When using multiple bit logic devices, inputs must 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 must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. The following rules 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 must be applied to any particular unused input depends on the function of the device. Generally they are tied to GND or  $V_{CC}$  whichever make more sense or is more convenient. TI recommends keeping the signal lines as short and as straight as possible (see [Figure 6](#)). Incorporation of microstrip or stripline techniques are also recommended when signal lines are more than 1" long. These traces must be designed with a characteristic impedance of either 50  $\Omega$  or 75  $\Omega$  as required by the application.

### 11.2 Layout Examples

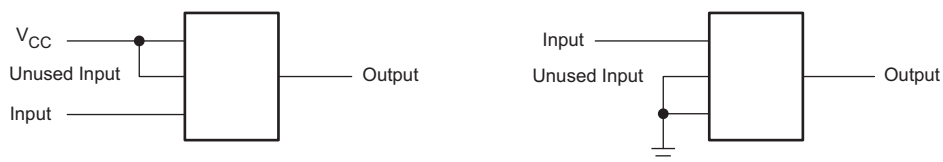


Figure 5. Layout Schematic

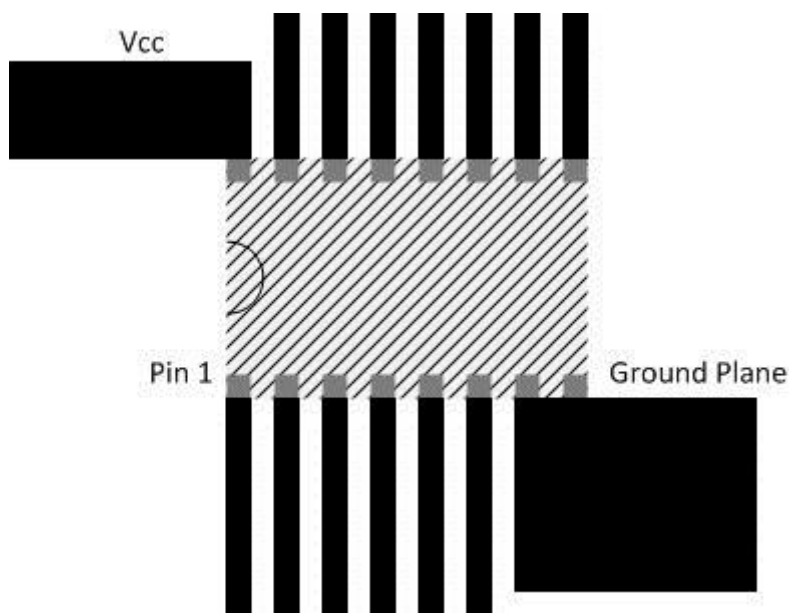


Figure 6. Signal Line Layout

## 12 Device and Documentation Support

### 12.1 Documentation Support

#### 12.1.1 Related Documentation

For related documentation see the following:

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

### 12.2 Related Links

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

**Related Links**

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LS06	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
SN74LS06	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>
SN74LS16	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>	<a href="#">Click here</a>

### 12.3 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.

### 12.4 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

**TI E2E™ Online Community** *TI's Engineer-to-Engineer (E2E) Community*. Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

**Design Support** *TI's Design Support* Quickly find helpful E2E forums along with design support tools and contact information for technical support.

### 12.5 Trademarks

E2E is a trademark of Texas Instruments.  
All other trademarks are the property of their respective owners.

### 12.6 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.

### 12.7 Glossary

[SLYZ022](#) — *TI Glossary*.

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

## 13 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/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9861701Q2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9861701Q2A SNJ54LS 06FK	<a href="#">Samples</a>
5962-9861701QCA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9861701QC A SNJ54LS06J	<a href="#">Samples</a>
SN54LS06J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54LS06J	<a href="#">Samples</a>
SN74LS06D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS06	<a href="#">Samples</a>
SN74LS06DBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS06	<a href="#">Samples</a>
SN74LS06DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS06	<a href="#">Samples</a>
SN74LS06DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS06	<a href="#">Samples</a>
SN74LS06DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	LS06	<a href="#">Samples</a>
SN74LS06N	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS06N	<a href="#">Samples</a>
SN74LS06NE4	ACTIVE	PDIP	N	14	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74LS06N	<a href="#">Samples</a>
SN74LS06NSR	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS06	<a href="#">Samples</a>
SN74LS06NSRG4	ACTIVE	SO	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS06	<a href="#">Samples</a>
SNJ54LS06FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 9861701Q2A SNJ54LS 06FK	<a href="#">Samples</a>
SNJ54LS06J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-9861701QC A SNJ54LS06J	<a href="#">Samples</a>

<sup>(1)</sup> 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.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> **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  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm threshold requirement.

<sup>(3)</sup> MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> 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.

<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54LS06, SN74LS06 :**

● Catalog: [SN74LS06](#)

● Military: [SN54LS06](#)

NOTE: Qualified Version Definitions:

● Catalog - TI's standard catalog product

- 
- Military - QML certified for Military and Defense Applications

**TAPE AND REEL INFORMATION**


\*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
SN74LS06DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1



## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LS06DR	SOIC	D	14	2500	367.0	367.0	38.0

**J 14**

## GENERIC PACKAGE VIEW

**CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.

4040083-5/G

**J0014A****PACKAGE OUTLINE****CDIP - 5.08 mm max height**

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

**NOTES:**

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.



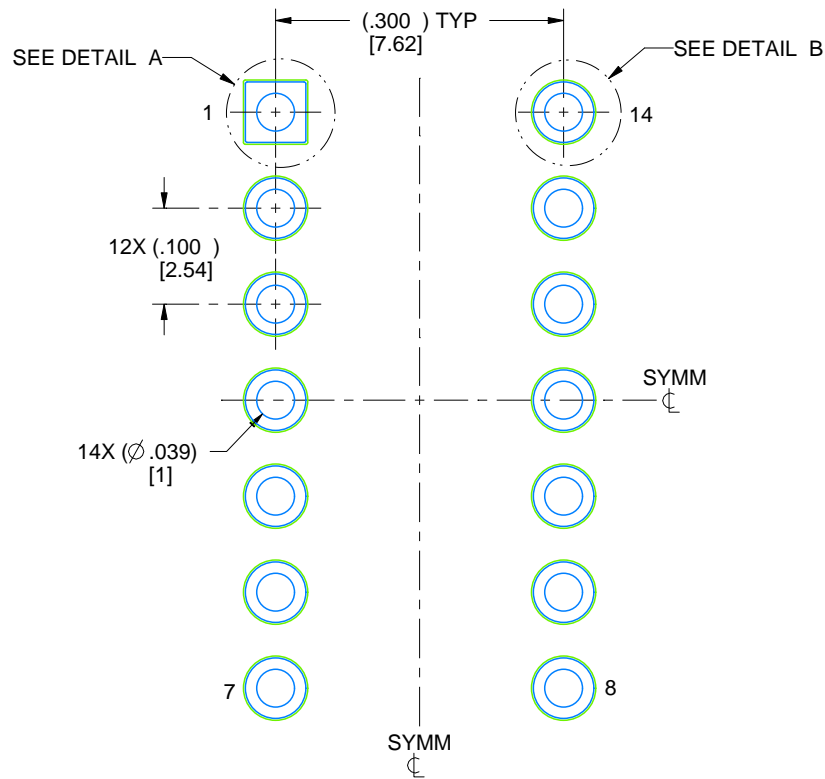
**TEXAS  
INSTRUMENTS**  
www.ti.com

# EXAMPLE BOARD LAYOUT

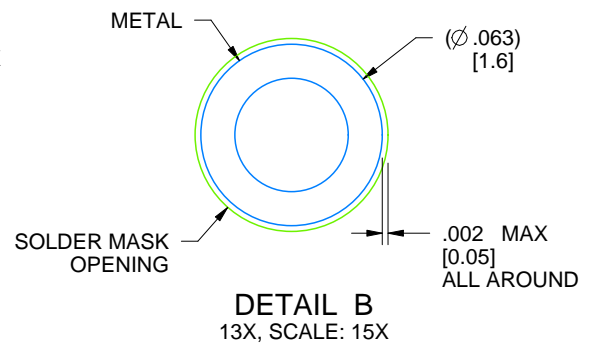
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE  
NON-SOLDER MASK DEFINED  
SCALE: 5X



4214771/A 05/2017

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040047-5/M 06/11

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

N (R-PDIP-T\*\*)

16 PINS SHOWN



## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- 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.  
 D. Falls within JEDEC MO-150



FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	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.

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