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# SN54LS06, SN74LS06, SN74LS16 HEX INVERTER BUFFERS/DRIVERS WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

SDLS020B – MAY 1990 – REVISED JANUARY 2002

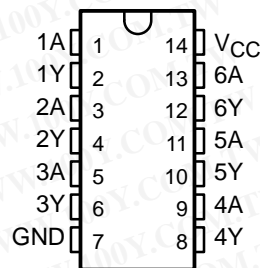
- Convert TTL Voltage Levels to MOS Levels
- High Sink-Current Capability
- Input Clamping Diodes Simplify System Design
- Open-Collector Driver for Indicator Lamps and Relays
- Inputs Fully Compatible With Most TTL Circuits

## description

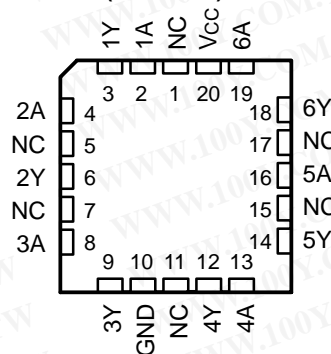
These hex inverter buffers/drivers feature high-voltage open-collector outputs to interface with high-level circuits (such as MOS), or for driving high-current loads, and also are characterized for use as inverter buffers for driving TTL inputs. The 'LS06 devices have a rated output voltage of 30 V, and the SN74LS16 has a rated output voltage of 15 V. The maximum sink current for the SN54LS06 is 30 mA, and for the SN74LS06 and SN74LS16 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.

SN54LS06 . . . J PACKAGE  
SN74LS06, SN74LS16 . . . D, N, OR NS PACKAGE  
(TOP VIEW)



SN54LS06 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SOIC – D	Tube	SN74LS06D	LS06
		Tape and reel	SN74LS06DR	
	SOP – NS	Tape and reel	SN74LS06NSR	74LS06
	SSOP – DB	Tape and reel	SN74LS06DBR	LS06
–55°C to 125°C	PDIP – N	Tube	SN74LS06N	SN74LS06N
		Tube	SN54LS06J	SN54LS06J
	CDIP – J	Tube	SNJ54LS06J	SNJ54LS06J
		LCCC – FK	Tube	SNJ54LS06FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

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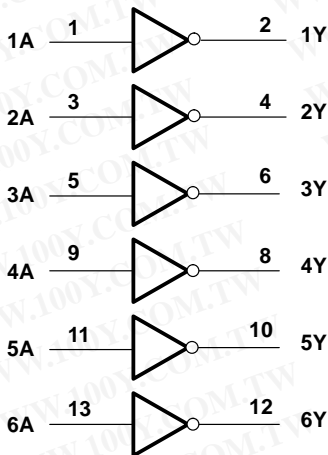
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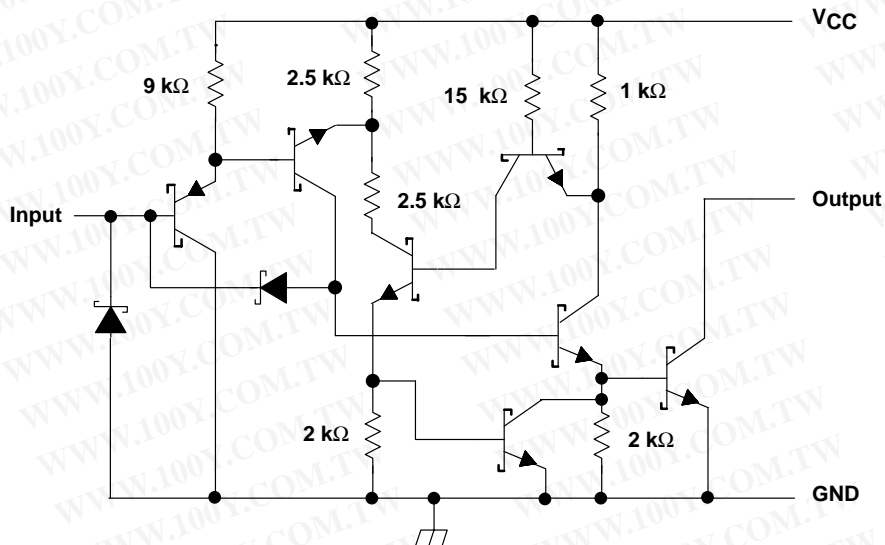
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## logic diagram (positive logic)



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

## schematic (each gate)



Resistor values shown are nominal.

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## WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUTS

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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$ (see Note 1)	5.5 V
Output voltage, $V_O$ (see Notes 1 and 2): SN54LS06, SN74LS06	30 V
SN74LS16	15 V
Package thermal impedance, $\theta_{JA}$ (see Note 3): D package	86°C/W
N package	80°C/W
NS package	76°C/W
Storage temperature range, $T_{stg}$	-65°C to 150°C

† 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.

- NOTES: 1. All voltage values are with respect to GND.  
2. This is the maximum voltage that should be applied to any output when it is in the off state.  
3. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

		SN54LS06			SN74LS06 SN74LS16			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$V_{OH}$	High-level output voltage			30			30	V
							15	V
$I_{OL}$	Low-level output current			30			40	mA
$T_A$	Operating free-air temperature	-55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS‡	SN54LS06			SN74LS06 SN74LS16			UNIT	
		MIN	TYP§	MAX	MIN	TYP§	MAX		
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -12 \text{ mA}$			-1.5			-1.5	V	
$I_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IL} = 0.8 \text{ V}$	'LS06, $V_{OH} = 30 \text{ V}$					0.25	V	
		SN74LS16, $V_{OH} = 15 \text{ V}$					0.25		
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$	$I_{OL} = 16 \text{ mA}$			0.25		0.25	0.4	V
		$I_{OL} = 30 \text{ mA}$					0.7		
		$I_{OL} = 40 \text{ mA}$						0.7	
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$			1			1	mA	
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.4 \text{ V}$			20			20	µA	
$I_{IL}$	$V_{CC} = \text{MAX}$ , $V_I = 0.4 \text{ V}$			-0.2			-0.2	mA	
$I_{CCH}$	$V_{CC} = \text{MAX}$			18			18	mA	
$I_{CCL}$	$V_{CC} = \text{MAX}$			60			60	mA	

‡ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	MAX	UNIT
$t_{PLH}$	A	Y	$R_L = 110\ \Omega$ , $C_L = 15\ \text{pF}$	7	15	ns
$t_{PHL}$				10	20	

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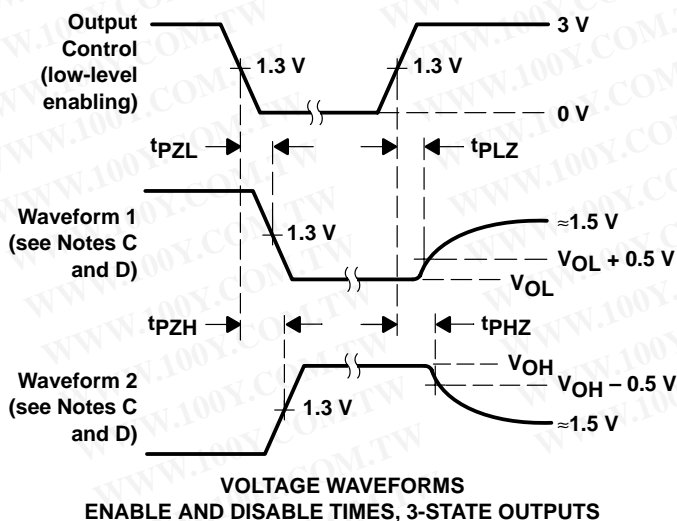
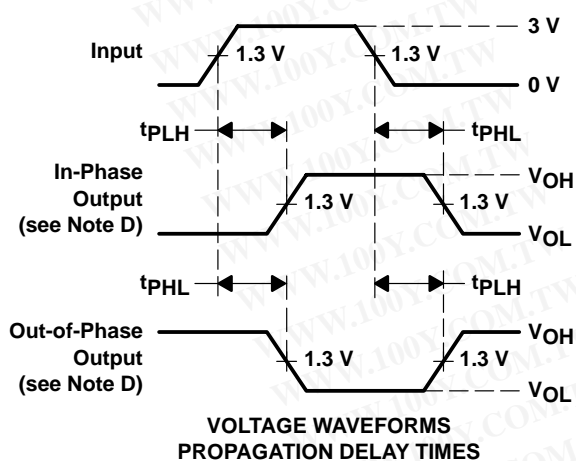
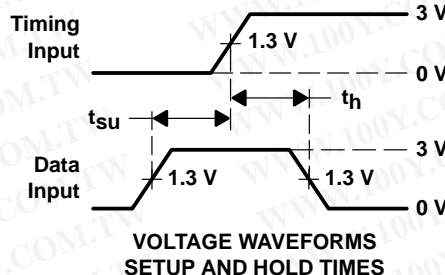
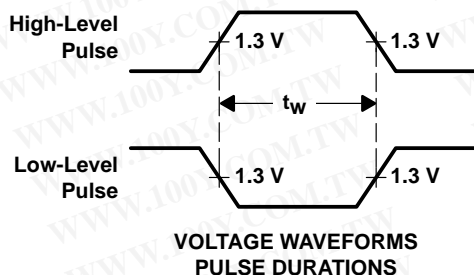
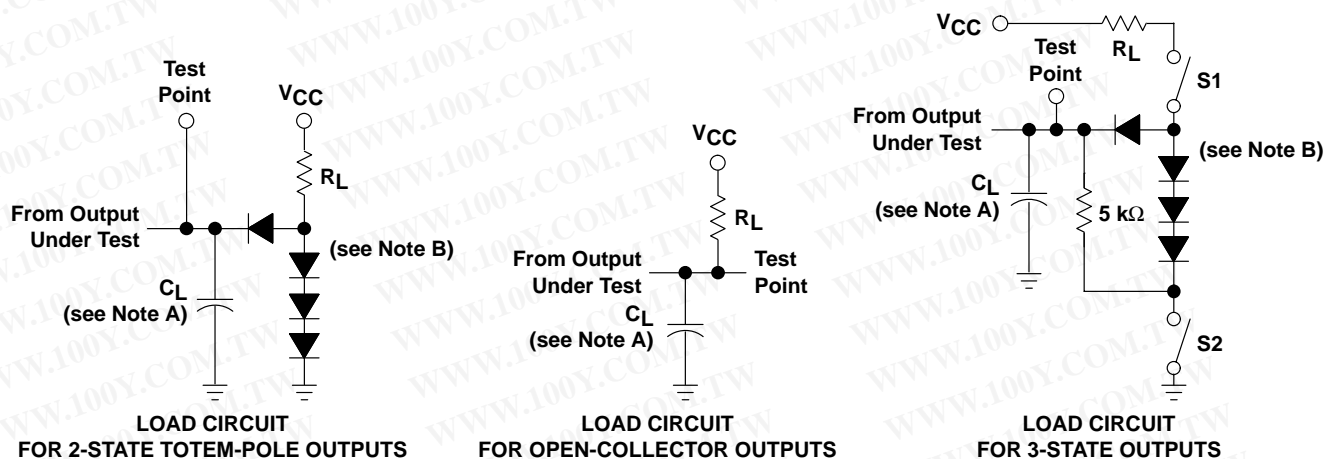


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## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- $C_L$  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 1. Load Circuits and Voltage Waveforms

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