

XD74LS00 DIP14 / XL74LS00 SOP14

1 Features

- Package Options Include:
 - Plastic Small-Outline (D, NS, PS)
 - Shrink Small-Outline (DB)
 - Ceramic Flat (W)
 - Ceramic Chip Carriers (FK)
 - Standard Plastic (N)
 - Ceramic (J)
- Also Available as Dual 2-Input Positive-NAND Gate in Small-Outline (PS) Package
- Inputs Are TTL Compliant; $V_{IH} = 2\text{ V}$ and $V_{IL} = 0.8\text{ V}$
- Inputs Can Accept 3.3-V or 2.5-V Logic Inputs
- 5400, 54LS00, and 54S00 are Characterized For Operation Over the Full Military Temperature Range of -55°C to 125°C

2 Applications

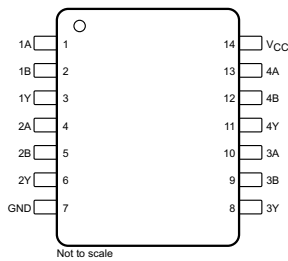
- AV Receivers
- Portable Audio Docks
- Blu-Ray Players
- Home Theater
- MP3 Players or Recorders
- Personal Digital Assistants (PDAs)

Logic Diagram, Each Gate (Positive Logic)

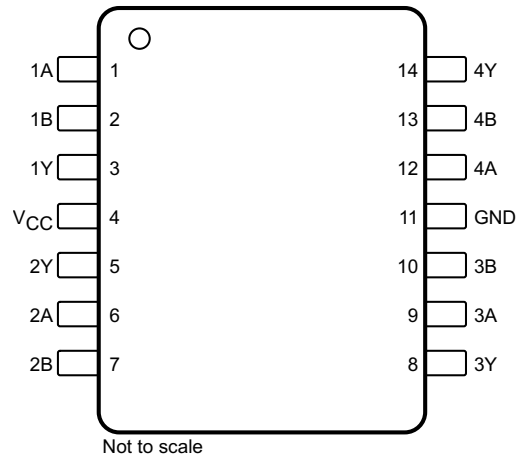


5 Pin Configuration and Functions

74LS00 D, DB, N, and NS Packages
 14-Pin CDIP, CFP, SOIC, PDIP, SO, or SSOP
 Top View



74LS00 PS Package
 18-Pin SO
 Top View



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Pin Functions

NAME	PIN				I/O	DESCRIPTION
	CDIP, CFP, SOIC, PDIP, SO, SSOP	SO 74LS00	CFP (5400)	LCCC		
1A	1	1	1	2	I	Gate 1 input
1B	2	2	2	3	I	Gate 1 input
1Y	3	3	3	4	O	Gate 1 output
2A	4	6	6	6	I	Gate 2 input
2B	5	7	7	8	I	Gate 2 input
2Y	6	5	5	9	O	Gate 2 output
3A	10	—	9	13	I	Gate 3 input
3B	9	—	10	14	I	Gate 3 input

Pin Functions (continued)

NAME	PIN				I/O	DESCRIPTION
	CDIP, CFP, SOIC, PDIP, SO, SSOP	SO (74LS00)	CFP (5400)	LCCC		
3Y	8	—	8	12	O	Gate 3 output
4A	13	—	12	18	I	Gate 4 input
4B	12	—	13	19	I	Gate 4 input
4Y	11	—	14	16	O	Gate 4 output
GND	7	4	11	10	—	Ground
NC	—	—	—	1, 5, 7, 11, 15, 17	—	No connect
V _{CC}	14	8	4	20	—	Power supply

6 Specifications

6.1 Absolute Maximum Ratings

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

	MIN	MAX	UNIT
Supply voltage, V _{CC} ⁽²⁾		7	V
Input voltage	x400 and xS400	5.5	V
	74LS00	7	
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) Voltage values are with respect to network ground terminal.

6.2 ESD Ratings: 74LS00

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

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500-V HBM is possible with the necessary precautions.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250-V CDM is possible with the necessary precautions. Pins listed as ±2000 V may actually have higher performance. ESD Tested on 74LS00 package.

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6.3 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	54xx00	4.5	5	5.5	V
		74xx00	4.75	5	5.25	
V _{IH}	High-level input voltage		2			V
V _{IL}	Low-level input voltage	x400, 7LS400, and x4S00			0.8	V
		54LS00			0.7	
I _{OH}	High-level output current	5400, 54LS00, and 74LS00			-0.4	mA
		x4S00			-1	
I _{OL}	Low-level output current	x400			16	mA
		5LS400			4	
		7LS400			8	
		x4S00			20	

Recommended Operating Conditions (continued)

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

			MIN	NOM	MAX	UNIT
T _A	Operating free-air temperature	54xx00	-55		125	°C
		74xx00	0		70	

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6.4 Thermal Information

THERMAL METRIC ⁽¹⁾⁽²⁾		74LS00				UNIT
		D (SOIC)	DB (SSOP)	N (PDIP)	NS (SO)	
		14 PINS	14 PINS	14 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	90.9	102.8	54.8	89.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	51.9	53.3	42.1	48.1	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	48	53.4	34.8	50.1	°C/W
ψ_{JT}	Junction-to-top characterization parameter	18.6	16.5	26.9	16.7	°C/W
ψ_{JB}	Junction-to-board characterization parameter	47.8	52.9	34.7	49.8	°C/W

6.5 Electrical Characteristics: x400

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IK}	$V_{CC} = \text{MIN}$ and $I_I = -12 \text{ mA}$			-1.5	V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, and $I_{OH} = -0.4 \text{ mA}$	2.4	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, and $I_{OL} = 16 \text{ mA}$		0.2	0.4	V
I_I	$V_{CC} = \text{MAX}$ and $V_I = 5.5 \text{ V}$			1	mA
I_{IH}	$V_{CC} = \text{MAX}$ and $V_I = 2.4 \text{ V}$			40	μA
I_{IL}	$V_{CC} = \text{MAX}$ and $V_I = 0.4 \text{ V}$			-1.6	mA
I_{OS}	$V_{CC} = \text{MAX}$	5400		-55	mA
		7400		-18	
I_{CCH}	$V_{CC} = \text{MAX}$ and $V_I = 0 \text{ V}$		4	8	mA
I_{CCL}	$V_{CC} = \text{MAX}$ and $V_I = 4.5 \text{ V}$		12	22	mA

6.6 Electrical Characteristics: 74LS00

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IK}	$V_{CC} = \text{MIN}$ and $I_I = -18 \text{ mA}$			-1.5	V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IL} = \text{MAX}$, and $I_{OH} = -0.4 \text{ mA}$	2.5	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$ and $V_{IH} = 2 \text{ V}$	$I_{OL} = 4 \text{ mA}$	0.25	0.4	V
		$I_{OL} = 8 \text{ mA}$ (74LS00)	0.35	0.5	
I_I	$V_{CC} = \text{MAX}$ and $V_I = 7 \text{ V}$			0.1	mA
I_{IH}	$V_{CC} = \text{MAX}$ and $V_I = 2.7 \text{ V}$			20	μA
I_{IL}	$V_{CC} = \text{MAX}$ and $V_I = 0.4 \text{ V}$			-0.4	mA
I_{OS}	$V_{CC} = \text{MAX}$	-20		-100	mA
I_{CCH}	$V_{CC} = \text{MAX}$ and $V_I = 0 \text{ V}$		0.8	1.6	mA
I_{CCL}	$V_{CC} = \text{MAX}$ and $V_I = 4.5 \text{ V}$		2.4	4.4	mA

6.7 Electrical Characteristics: x4S00

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{IK}	$V_{CC} = \text{MIN}$ and $I_I = -18 \text{ mA}$			-1.2	V
V_{OH}	$V_{CC} = \text{MIN}$, $V_{IL} = 0.8 \text{ V}$, and $I_{OH} = -1 \text{ mA}$	2.5	3.4		V
V_{OL}	$V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, and $I_{OL} = 20 \text{ mA}$			0.5	V
I_I	$V_{CC} = \text{MAX}$ and $V_I = 5.5 \text{ V}$			1	mA
I_{IH}	$V_{CC} = \text{MAX}$ and $V_I = 2.7 \text{ V}$			50	μA
I_{IL}	$V_{CC} = \text{MAX}$ and $V_I = 0.5 \text{ V}$			-2	mA

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Electrical Characteristics: x4S00 (continued)

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

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{OS}	$V_{CC} = \text{MAX}$	-40		-100	mA
I_{CCH}	$V_{CC} = \text{MAX}$ and $V_I = 0 \text{ V}$		10	16	mA
I_{CCL}	$V_{CC} = \text{MAX}$ and $V_I = 4.5 \text{ V}$		20	36	mA

6.8 Switching Characteristics: x400

$V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$, and over operating free-air temperature range (unless otherwise noted). See Figure 2.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A or B	Y	$R_L = 400 \Omega$ and $C_L = 15 \text{ pF}$		11	22	ns
t_{PHL}					7	15	

6.9 Switching Characteristics: x4LS00

$V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$, and over operating free-air temperature range (unless otherwise noted). See Figure 2.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A or B	Y	$R_L = 2 \text{ k}\Omega$ and $C_L = 15 \text{ pF}$		9	15	ns
t_{PHL}					10	15	

6.10 Switching Characteristics: x4S00

$V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$, and over operating free-air temperature range (unless otherwise noted). See Figure 2.

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	A or B	Y	$R_L = 280 \Omega$ and $C_L = 15 \text{ pF}$		3	4.5	ns
			$R_L = 280 \Omega$ and $C_L = 50 \text{ pF}$		4.5		
t_{PHL}	A or B	Y	$R_L = 280 \Omega$ and $C_L = 15 \text{ pF}$		3	5	
			$R_L = 280 \Omega$ and $C_L = 50 \text{ pF}$		5		

6.11 Typical Characteristics

$C_L = 15 \text{ pF}$

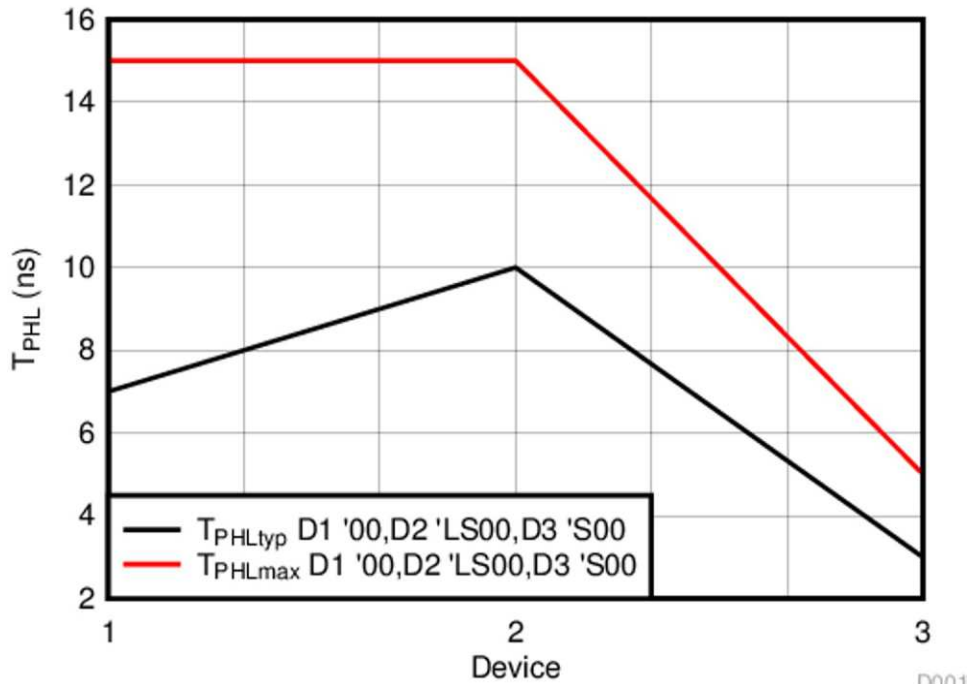
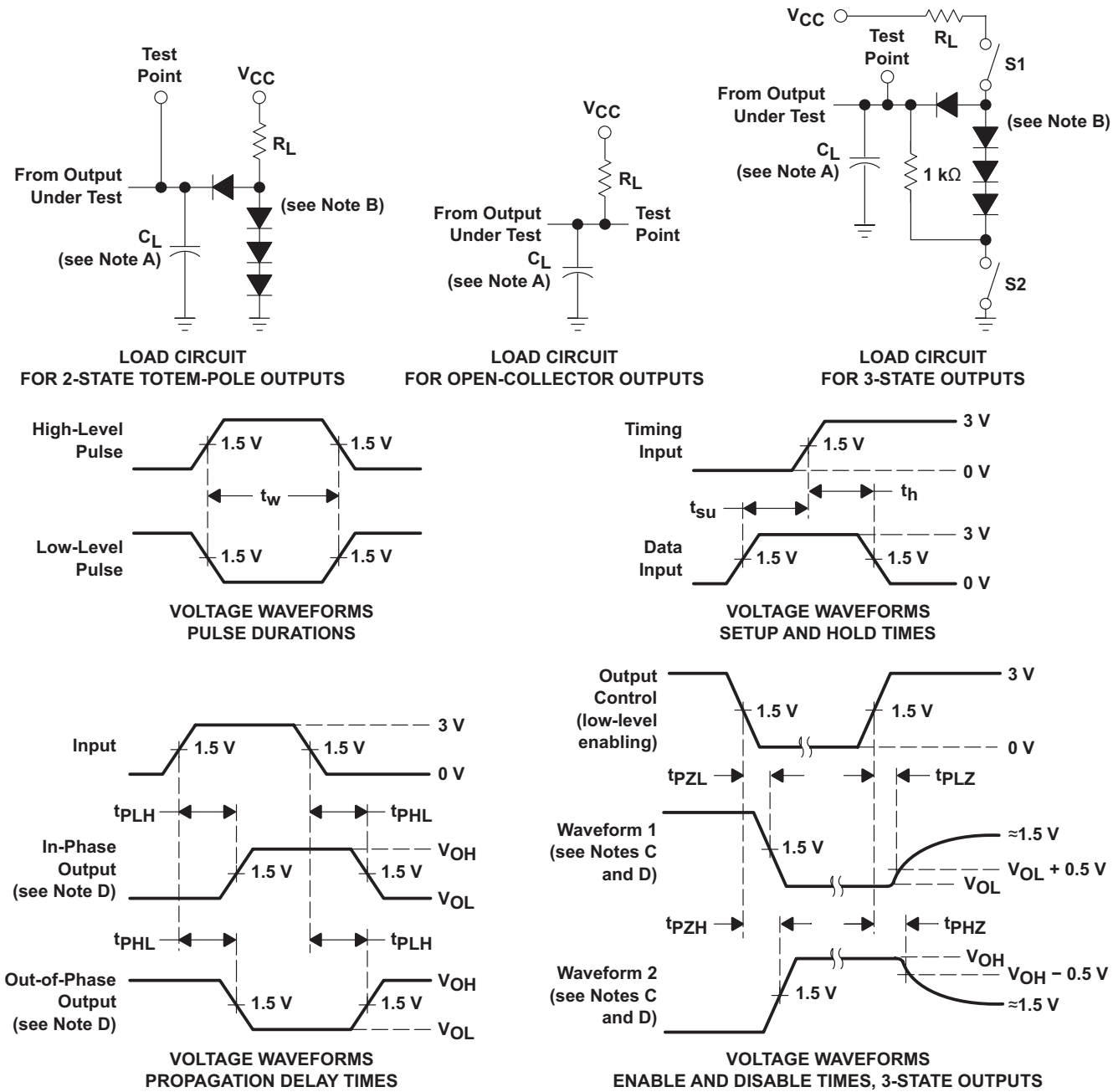


Figure 1. T_{PHL} (Across Devices)

D001

7 Parameter Measurement Information

7.1 Propagation Delays, Setup and Hold Times, and Pulse Width



- NOTES:
- A. C_L includes probe and jig capacitance.
 - B. All diodes are 1N3064 or equivalent.
 - C. 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.
 - D. 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} .
 - E. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O \approx 50 \Omega$; t_r and $t_f \leq 7$ ns for Series 54/74 devices and t_r and $t_f \leq 2.5$ ns for Series 54S/74S devices.
 - F. 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 74LS00 devices are quadruple, 2-input NAND gates which perform the Boolean function $Y = \overline{A \cdot B}$ or $Y = \overline{A} + \overline{B}$ in positive logic.

8.2 Functional Block Diagram



8.3 Feature Description

The operating voltage of 74LS00 is from 4.75-V to 5.25-V V_{CC} . The operating voltage of 54xx00 is from 4.5-V to 5.5-V V_{CC} . The 54xx00 devices are rated from -55°C to 125°C whereas 74LS00 device are rated from 0°C to 70°C .

8.4 Device Functional Modes

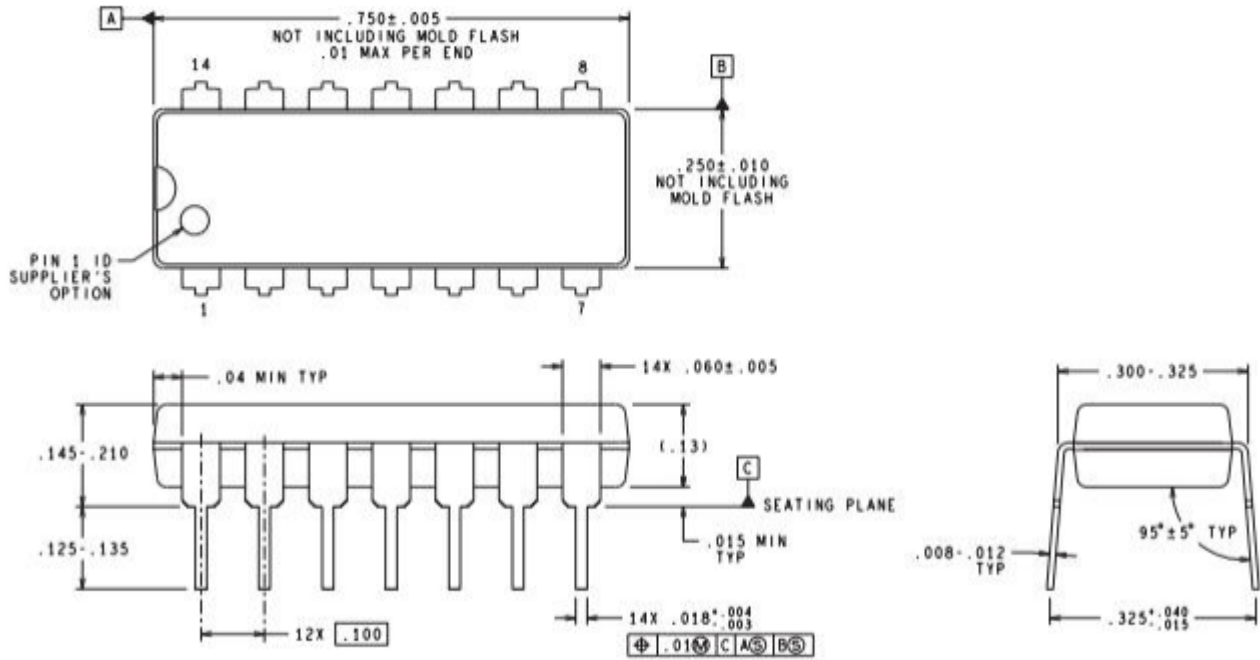
Table 1 lists the functions of the devices.

Table 1. Functional Table (Each Gate)

INPUTS		OUTPUT
A	B	Y
H	H	L
L	X	H
X	L	H

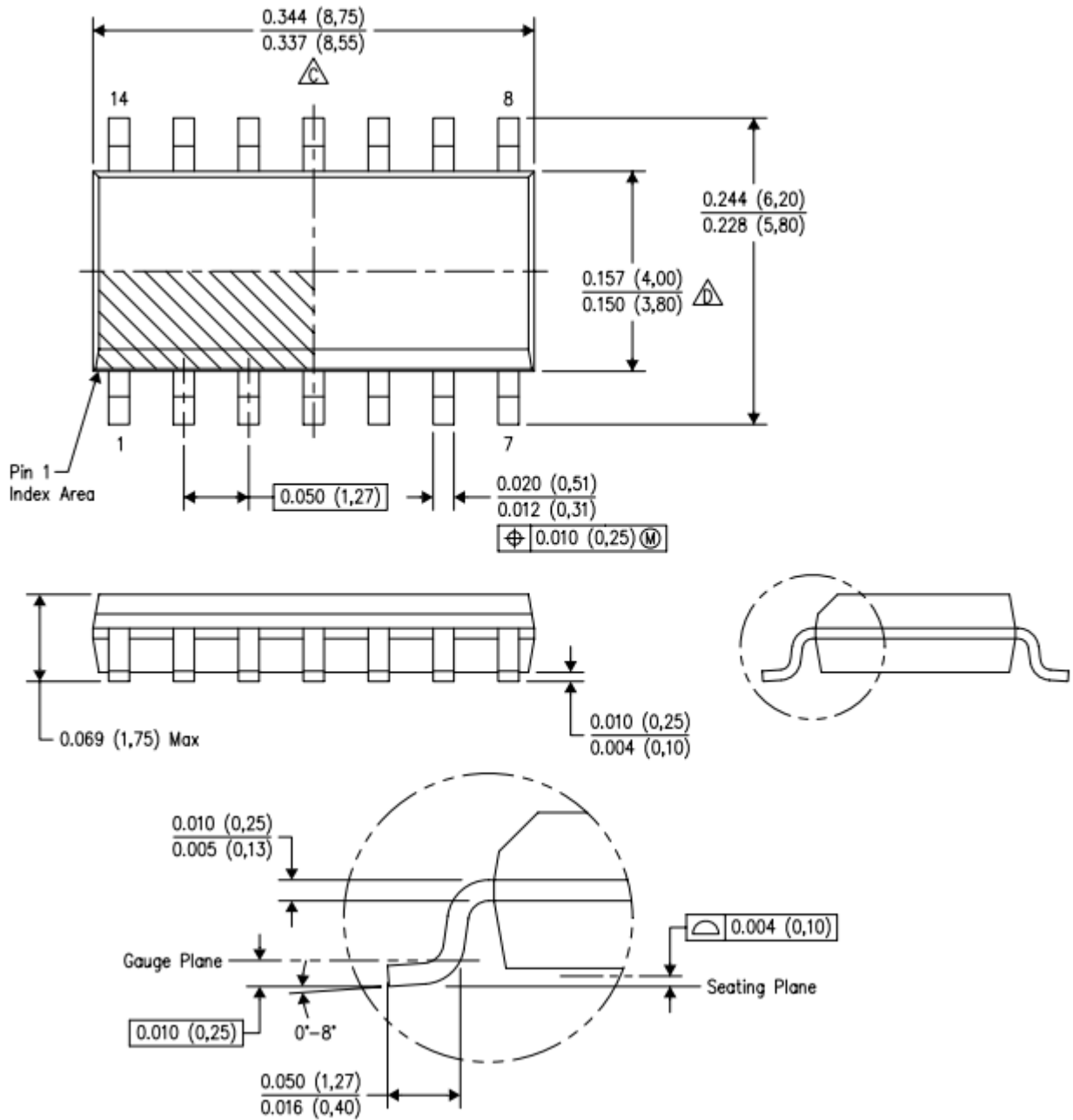
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