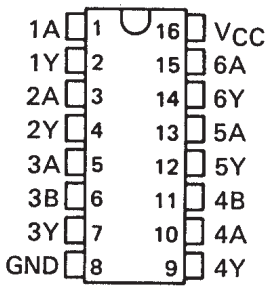
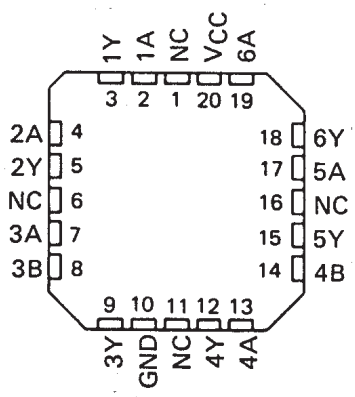
SDLS157 – DECEMBER 1983 – REVISED MARCH 1988

- **Delay Elements for Generating Delay Lines**
- **Inverting and Non-inverting Elements**
- **Buffer NAND Elements Rated at I_{OL} of 12/24 mA**
- **PNP Inputs Reduce Fan-In (I_{IL} = −0.2 mA MAX)**
- **Worst Case MIN/MAX Delays Guaranteed Across Temperature and V_{CC} Ranges**

SN54LS31 . . . J OR W PACKAGE
SN74LS31 . . . D OR N PACKAGE
(TOP VIEW)



SN54LS31 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

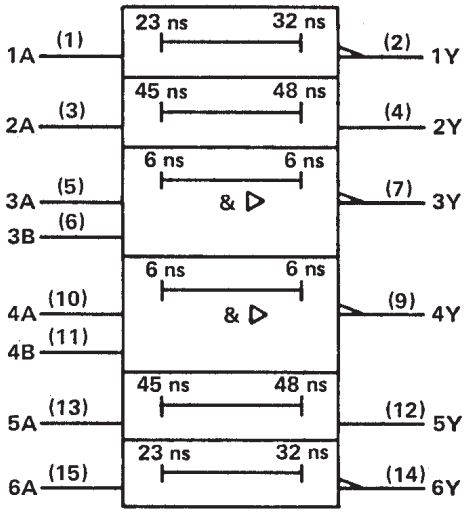
description

These 'LS31 delay elements are intended to provide well-defined delays across both temperature and V_{CC} ranges. Used in cascade, a limitless range of delay gating is possible.

All inputs are PNP with I_{IL} MAX of −0.2 mA. Gates 1, 2, 5, and 6 have standard Low-Power Schottky output sink current capability of 4 and 8 mA I_{OL}. Buffers 3 and 4 are rated at 12 and 24 mA.

The SN54LS31 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74LS31 is characterized for operation from 0°C to 70°C.

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, N, and W packages.

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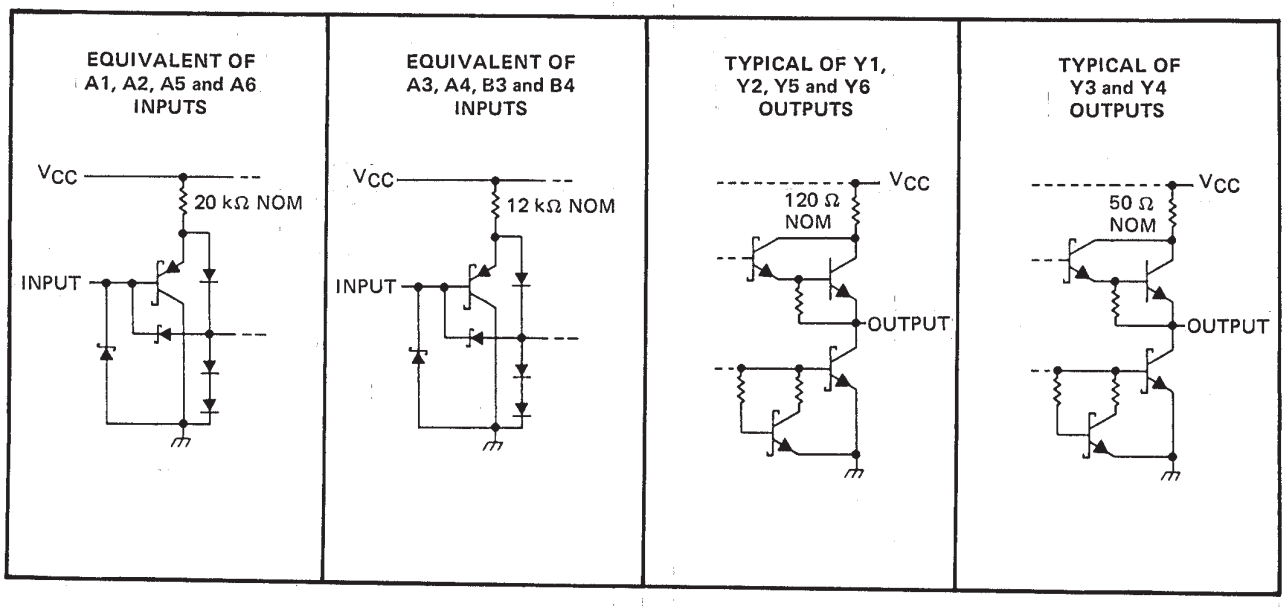
Delay Element	Logic	Typical Delays			Rated I_{OL}
		t_{PLH}	t_{PHL}	AVG.	
Gates 1 and 6	Inverting	32 ns	23 ns	27.5 ns	4 and 8 mA
Gates 2 and 5	Non-Inverting	45 ns	48 ns	46.5 ns	4 and 8 mA
Buffers 3 and 4	2-Input NAND	6 ns	6 ns	6 ns	12 and 24 mA



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

Supply voltage, V_{CC} (See Note 1) . . . . . 7 V
Input voltage, V_I: All inputs . . . . . 7 V
Operating free-air temperature range: SN54LS31 . . . . . – 55°C to 125°C
SN74LS31 . . . . . 0°C to 70°C
Storage temperature range . . . . . – 65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

			SN54LS31			SN74LS31			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	55	4.75	5	5.25	V
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage				0.7			0.8	V
I_{OH}	High-level output current	Y3, Y4 outputs			– 1.2			– 1.2	mA
		All other outpus			– 0.4			– 0.4	
I_{OL}	Low-level output current	Y3, Y4 outputs			12			24	mA
		All other outputs			4			8	
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†			SN54LS31			SN74LS31			UNIT
					MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IK}		V_{CC} = MIN, I_I = – 18 mA					– 1.5			– 1.5	V
V_{OH}		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	Y3, Y4	I_{OH} = – 1.2 mA	2.4	3.1		2.4	3.1		V
			Others	I_{OH} = – 0.4 mA	2.5	3.1		2.7	3.1		
V_{OL}		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	Y3, Y4	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
				I_{OL} = 24 mA					0.35	0.5	
			Others	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	
				I_{OL} = 8 mA					0.35	0.5	
I_I		V_{CC} = MAX, V_I = 7 V					0.1			0.1	mA
I_{IH}		V_{CC} = MAX, V_I = 2.7 V					20			20	μA
I_{IL}		V_{CC} = MAX, V_I = 0.4 V					– 0.2			– 0.2	mA
I_{OS}§		V_{CC} = MAX, A3, A4, B3, B4 = 0 V		Y3, Y4	– 30		– 130	– 30		– 130	mA
		V_{CC} = MAX, A1, A6 = 0 V, A2, A5 = 4.5 V		Y1, Y2, Y5, Y6	– 20		– 100	– 20		– 100	
I_{CC}	I_{CCH}	V_{CC} = MAX, A2, A5 = 4.5 V, all other inputs 0 V				2.3	4		2.3	4	mA
	I_{CCL}	V_{CC} = MAX, A2, A5 = 0 V, all other inputs 4.5 V				13	20		13	20	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and the duration of the short-circuit should not exceed one second.

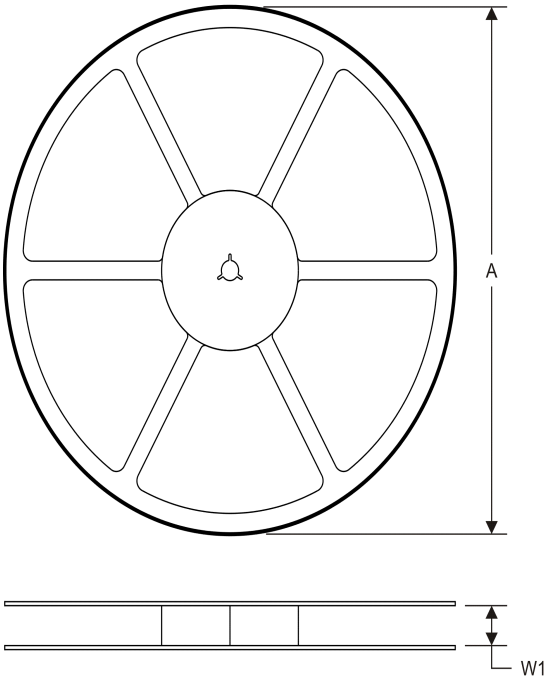
switching characteristics, (see note 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54LS31			SN74LS31			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH}	A1, A6	Y1, Y6	15		70	22		65	ns
t_{PHL}			9		50	13		45	ns
t_{PLH}	A2, A5	Y2, Y5	22		90	31		80	ns
t_{PHL}			20		105	30		95	ns
t_{PLH}	A3, B3, A4, Y4	Y3, Y4	2		20	2		15	ns
t_{PHL}			2		20	2		15	ns

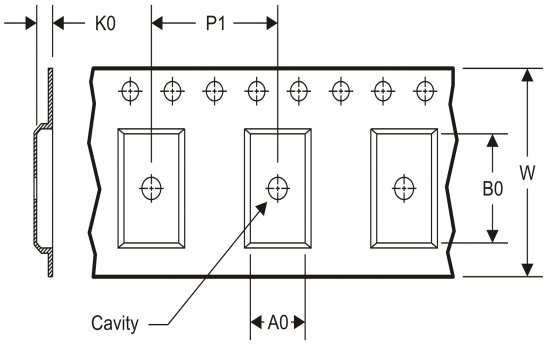
NOTE 2: V_{CC} = MIN to MAX
R_L = 667 Ω, C_L = 45 pF for Y3 and Y4.
R_L = 2 kΩ, C_L = 15 pF for Y1, Y2, Y5 and Y6.
T_A = MIN to MAX
Load circuits and voltage waveforms are shown in Section 1.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



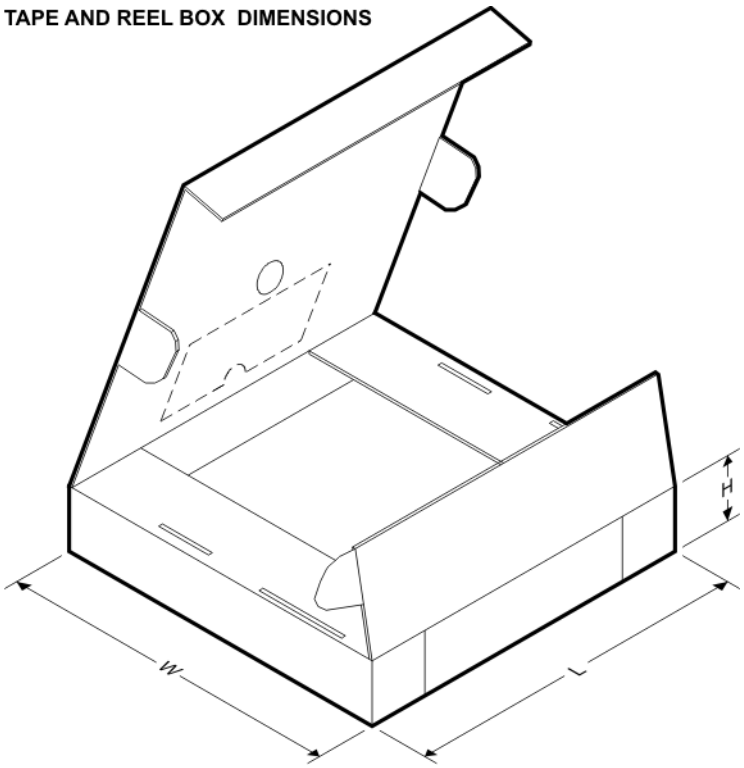
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN74LS31NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	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)
SN74LS31NSR	SO	NS	16	2000	367.0	367.0	38.0

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