

SN54LS31, SN74LS31 DELAY ELEMENTS

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

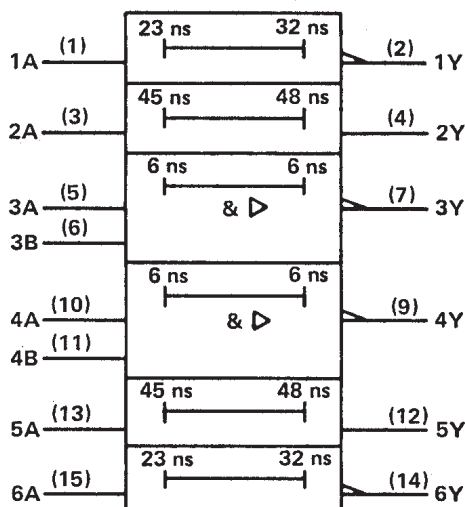
description

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 .

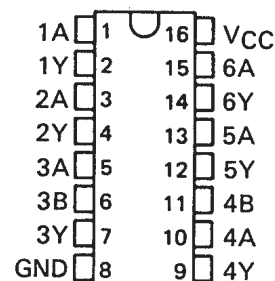
logic symbol†



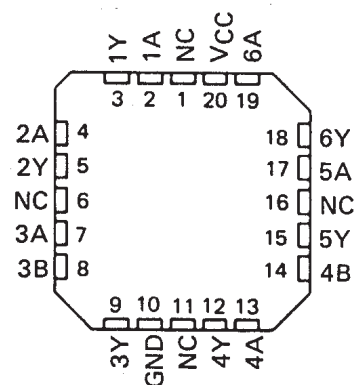
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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

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



SN54LS31 . . . FK PACKAGE
(TOP VIEW)

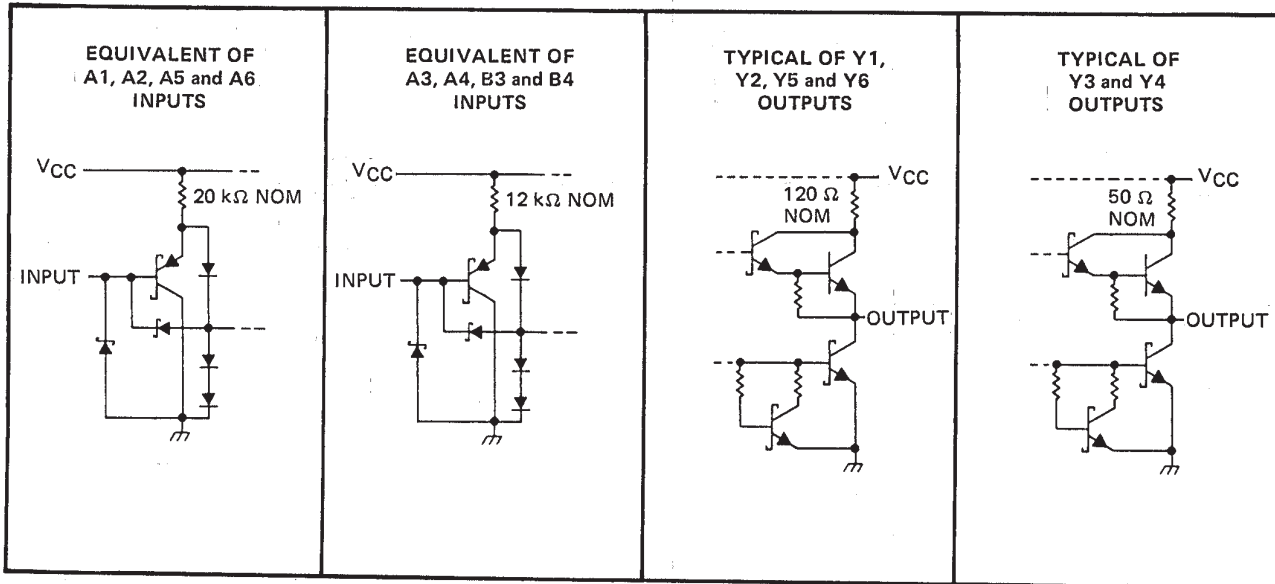


NC - No internal connection

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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	5.5	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	Y3, Y4 outputs		– 1.2	mA
	All other outputs		– 0.4	All other outputs		– 0.4	
I _{OL} Low-level output current	Y3, Y4 outputs		12	Y3, Y4 outputs		24	mA
	All other outputs		4	All other outputs		8	
T _A Operating free-air temperature	– 55	125		0	70		°C



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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}	$V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$		-1.5			-1.5			V	
V_{OH}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = \text{MAX}$	Y3, Y4	$I_{OH} = -1.2 \text{ mA}$			2.4 3.1			V	
		Others	$I_{OH} = -0.4 \text{ mA}$			2.5 3.1				
V_{OL}	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = \text{MAX}$	Y3, Y4	$I_{OL} = 12 \text{ mA}$			0.25 0.4			V	
			$I_{OL} = 24 \text{ mA}$			0.35 0.5				
		Others	$I_{OL} = 4 \text{ mA}$			0.25 0.4				
			$I_{OL} = 8 \text{ mA}$			0.35 0.5				
I_I	$V_{CC} = \text{MAX}, V_I = 7 \text{ V}$		0.1			0.1			mA	
I_{IH}	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$		20			20			μA	
I_{IL}	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$		-0.2			-0.2			mA	
$I_{OS}\S$	$V_{CC} = \text{MAX}, A3, A4, B3, B4 = 0 \text{ V}$		Y3, Y4			-30 -130			mA	
	$V_{CC} = \text{MAX}, A1, A6 = 0 \text{ V}, A2, A5 = 4.5 \text{ V}$		Y1, Y2, Y5, Y6			-20 -100				
I_{CC}	I_{CCH}	$V_{CC} = \text{MAX}, A2, A5 = 4.5 \text{ V}, \text{ all other inputs } 0 \text{ V}$		2.3 4			2.3 4			mA
	I_{CCL}	$V_{CC} = \text{MAX}, A2, A5 = 0 \text{ V}, \text{ all other inputs } 4.5 \text{ V}$		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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

§ 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			22			ns
t_{PHL}			9			13			
t_{PLH}	A2, A5	Y2, Y5	22			31			ns
t_{PHL}			20			30			
t_{PLH}	A3, B3, A4, Y4	Y3, Y4	2			2			ns
t_{PHL}			2			2			

NOTE 2: $V_{CC} = \text{MIN to MAX}$

$R_L = 667 \Omega, C_L = 45 \text{ pF}$ for Y3 and Y4.

$R_L = 2 \text{ k}\Omega, C_L = 15 \text{ pF}$ for Y1, Y2, Y5 and Y6.

$T_A = \text{MIN to MAX}$

Load circuits and voltage waveforms are shown in Section 1.

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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	346.0	346.0	33.0

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