

# 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

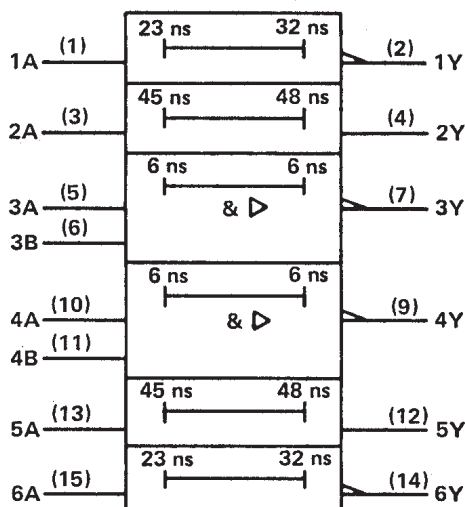
## description

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  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74LS31 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

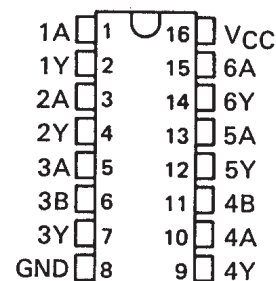
## logic symbol†



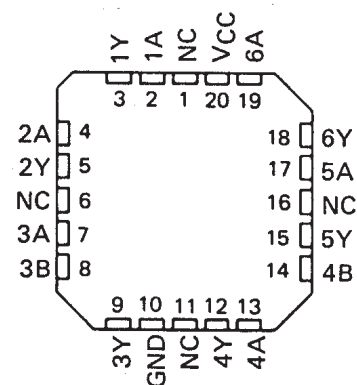
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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)

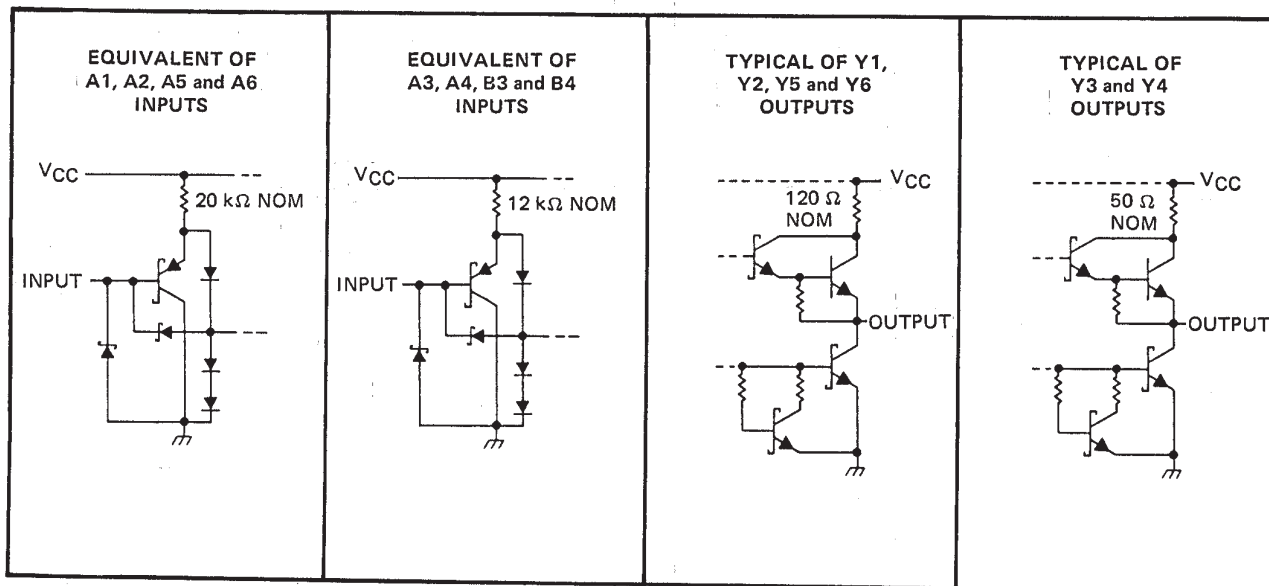


NC - No internal connection

# SN54LS31, SN74LS31 DELAY ELEMENTS

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Delay Element	Logic	Typical Delays			Rated I <sub>OL</sub>
		t <sub>PLH</sub>	t <sub>PHL</sub>	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 <sub>CC</sub> (See Note 1)	7 V
Input voltage, V <sub>I</sub> : 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 <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.7			0.8	V
I <sub>OH</sub> 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 <sub>OL</sub> Low-level output current	Y3, Y4 outputs		12	Y3, Y4 outputs		24	mA
	All other outputs		4	All other outputs		8	
T <sub>A</sub> 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 <sub>IK</sub>	V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA		-1.5			-1.5			V	
V <sub>OH</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	Y3, Y4	I <sub>OH</sub> = -1.2 mA			2.4 3.1			V	
		Others	I <sub>OH</sub> = -0.4 mA			2.5 3.1				
V <sub>OL</sub>	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	Y3, Y4	I <sub>OL</sub> = 12 mA			0.25 0.4			V	
			I <sub>OL</sub> = 24 mA			0.35 0.5				
		Others	I <sub>OL</sub> = 4 mA			0.25 0.4				
			I <sub>OL</sub> = 8 mA			0.35 0.5				
I <sub>I</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V		0.1			0.1			mA	
I <sub>IH</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V		20			20			μA	
I <sub>IL</sub>	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V		-0.2			-0.2			mA	
I <sub>OS</sub> §	V <sub>CC</sub> = MAX, A3, A4, B3, B4 = 0 V		Y3, Y4			-30 -130			mA	
	V <sub>CC</sub> = MAX, A1, A6 = 0 V, A2, A5 = 4.5 V		Y1, Y2, Y5, Y6			-20 -100				
I <sub>CC</sub>	I <sub>CC</sub> H	V <sub>CC</sub> = MAX, A2, A5 = 4.5 V, all other inputs 0 V		2.3 4			2.3 4			mA
	I <sub>CC</sub> L	V <sub>CC</sub> = 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<sub>CC</sub> = 5 V, T<sub>A</sub> = 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 <sub>PLH</sub>	A1, A6	Y1, Y6	15			22			ns
t <sub>PHL</sub>			70			65			
t <sub>PLH</sub>	A2, A5	Y2, Y5	9			13			ns
t <sub>PHL</sub>			50			45			
t <sub>PLH</sub>	A3, B3, A4, Y4	Y3, Y4	22			31			ns
t <sub>PHL</sub>			90			80			
t <sub>PLH</sub>	Y4	Y3, Y4	20			30			ns
t <sub>PHL</sub>			105			95			
t <sub>PLH</sub>	Y4	Y3, Y4	2			2			ns
t <sub>PHL</sub>			20			15			
t <sub>PHL</sub>	Y4	Y3, Y4	2			2			ns
t <sub>PHL</sub>			20			15			

NOTE 2: V<sub>CC</sub> = MIN to MAX

R<sub>L</sub> = 667 Ω, C<sub>L</sub> = 45 pF for Y3 and Y4.

R<sub>L</sub> = 2 kΩ, C<sub>L</sub> = 15 pF for Y1, Y2, Y5 and Y6.

T<sub>A</sub> = MIN to MAX

Load circuits and voltage waveforms are shown in Section 1.

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