

- Delay Elements for Generating Delay Lines
- Inverting and Non-inverting Elements
- Buffer NAND Elements Rated at IOL of 12/24 mA
- PNP Inputs Reduce Fan-In (IIL = -0.2 mA MAX)
- Worst Case MIN/MAX Delays Guaranteed Across Temperature and VCC Ranges

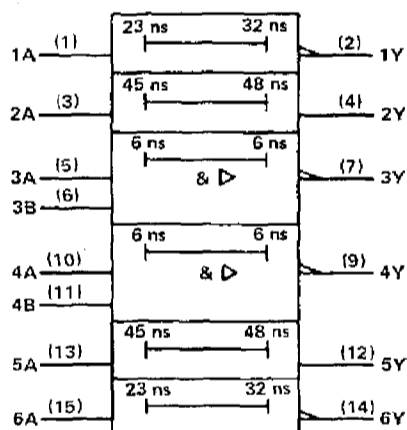
description

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

All inputs are PNP with IIL 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 IOL. Buffers 3 and 4 are rated at 12 and 24 mA.

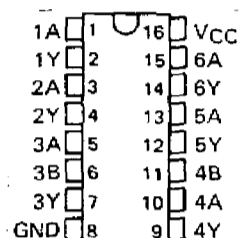
The SN54LS31 is characterized for operation over the full military temperature range of -55°C to 125°C. The SN74LS31 is characterized for operation from 0°C to 70°C.

logic symbol†

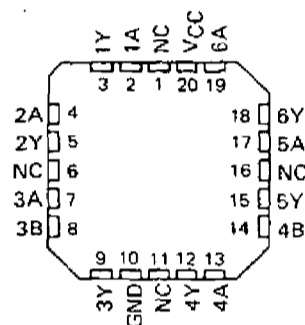


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

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



SN54LS31 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

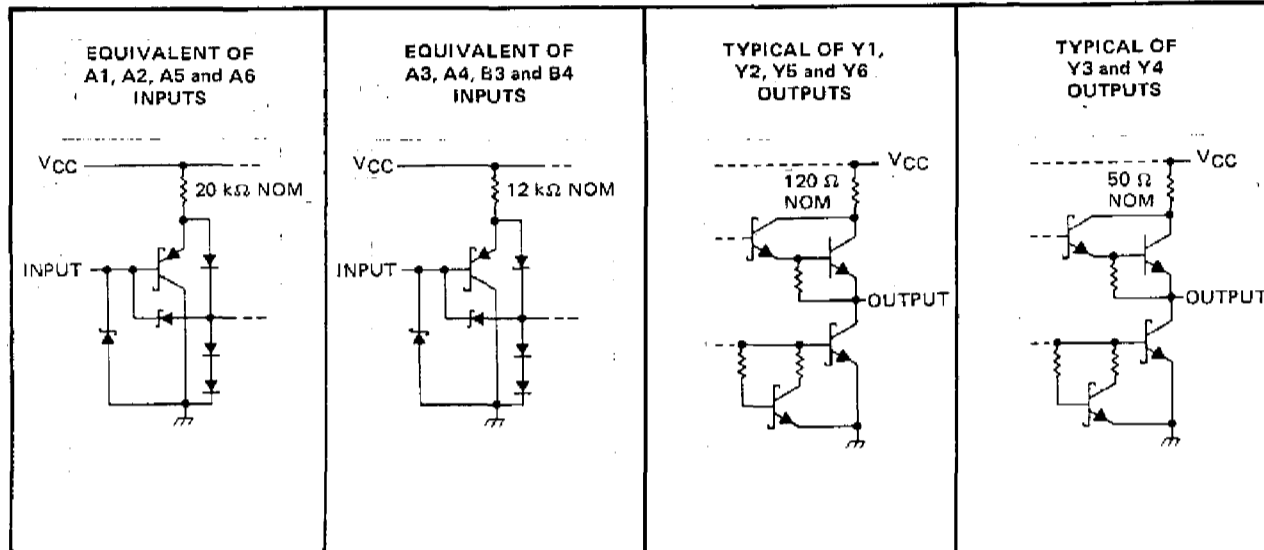
PRODUCTION DATA documents contain information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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**SN54LS31, SN74LS31
DELAY ELEMENTS**

Delay Element	Logic	Typical Delays			Rated I _{OL}
		t _{PLH}	t _{PHL}	AVG. ¹	
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

**TEXAS
INSTRUMENTS**

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**SN54LS31, SN74LS31
DELAY ELEMENTS**

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 Others	I _{OH} = -1.2 mA I _{OH} = -0.4 mA	2.4 2.5	3.1 3.1	2.4 2.7	3.1 3.1	V	
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 _{CC} H	V _{CC} = MAX, A2, A5 = 4.5 V, all other inputs 0 V		2.3	4	2.3	4	mA	
	I _{CC} L	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.

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