

- 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

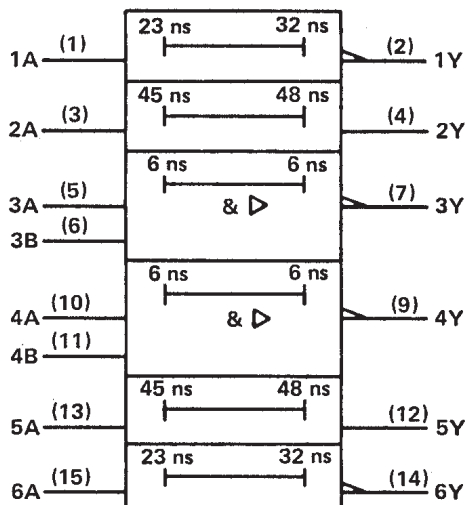
description

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 .

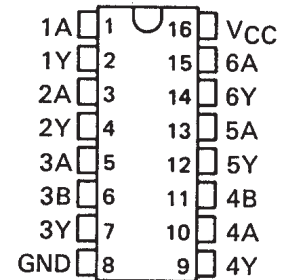
logic symbol†



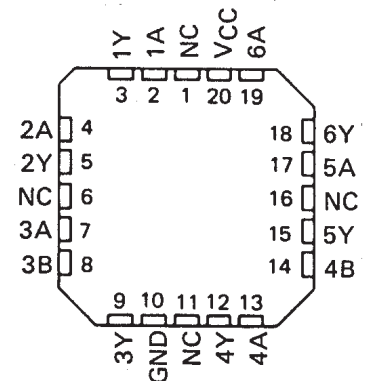
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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)

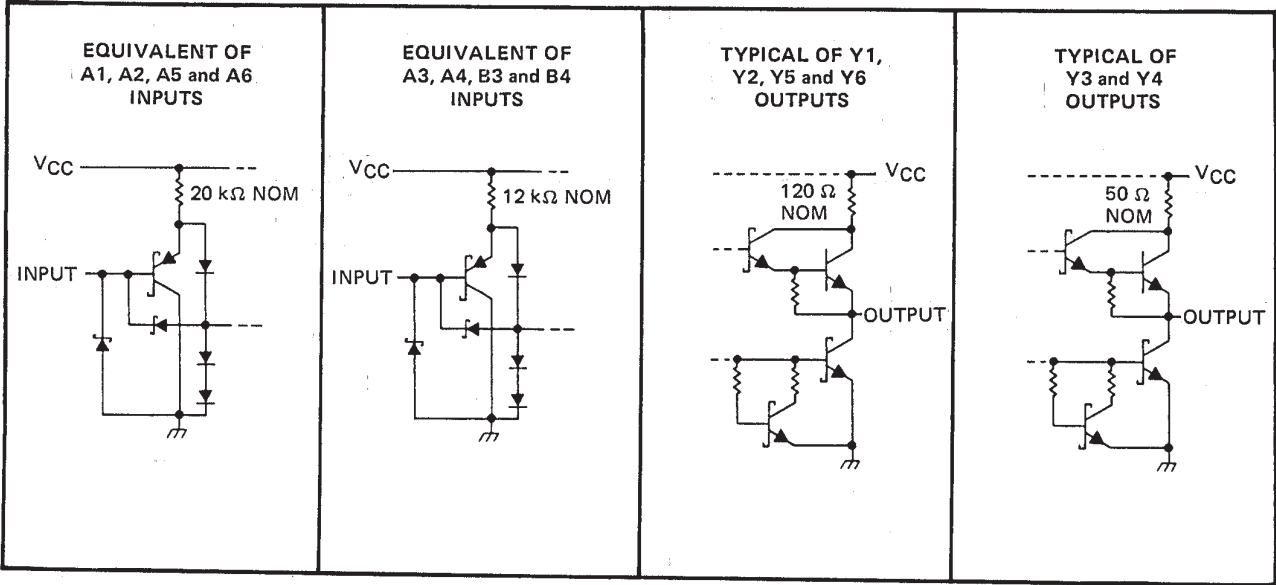


NC - No internal connection

SN54LS31, SN74LS31
DELAY ELEMENTS

SDLS157 – DECEMBER 1983 – REVISED MARCH 1988

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			− 1.2			mA	
		All other outputs	− 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			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	
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 $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$.

§ 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		70	22		65	ns
t_{PHL}			9		50	13		45	
t_{PLH}	A2, A5	Y2, Y5	22		90	31		80	ns
t_{PHL}			20		105	30		95	
t_{PLH}	A3, B3, A4, Y4	Y3, Y4	2		20	2		15	ns
t_{PHL}			2		20	2		15	

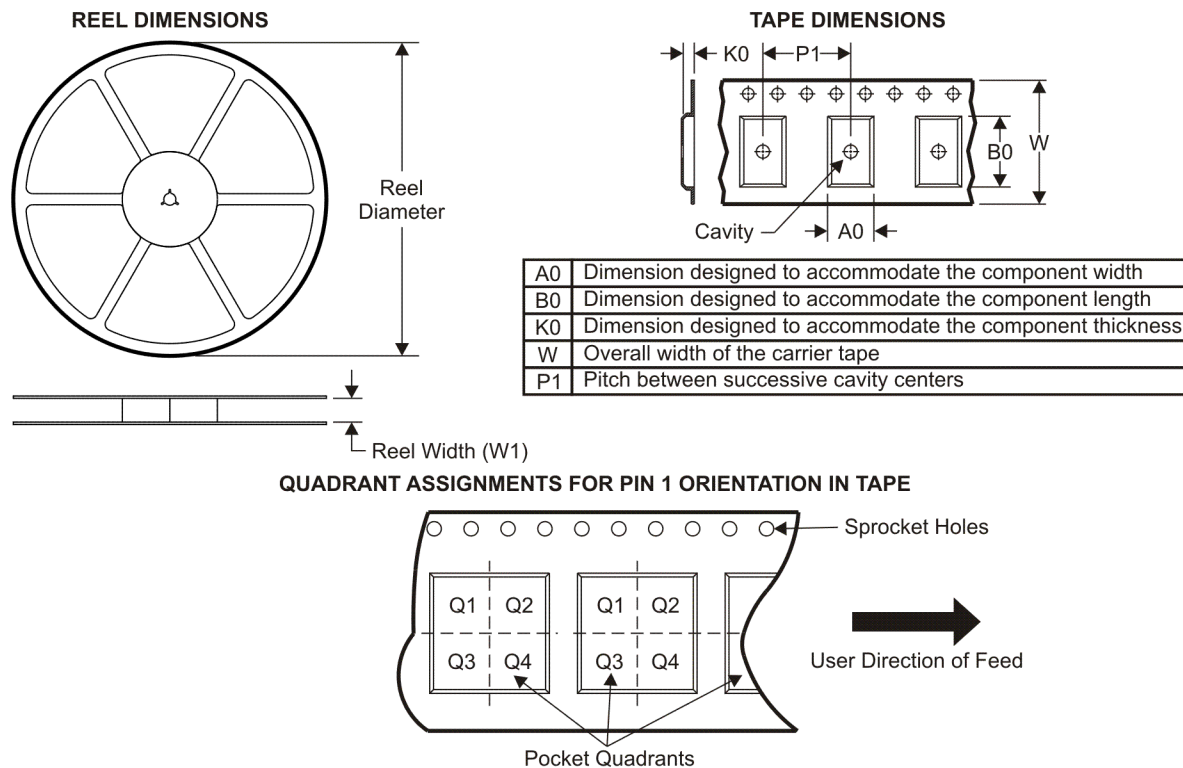
NOTE 2: $V_{CC} = \text{MIN to MAX}$

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

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

$T_A = \text{MIN to MAX}$

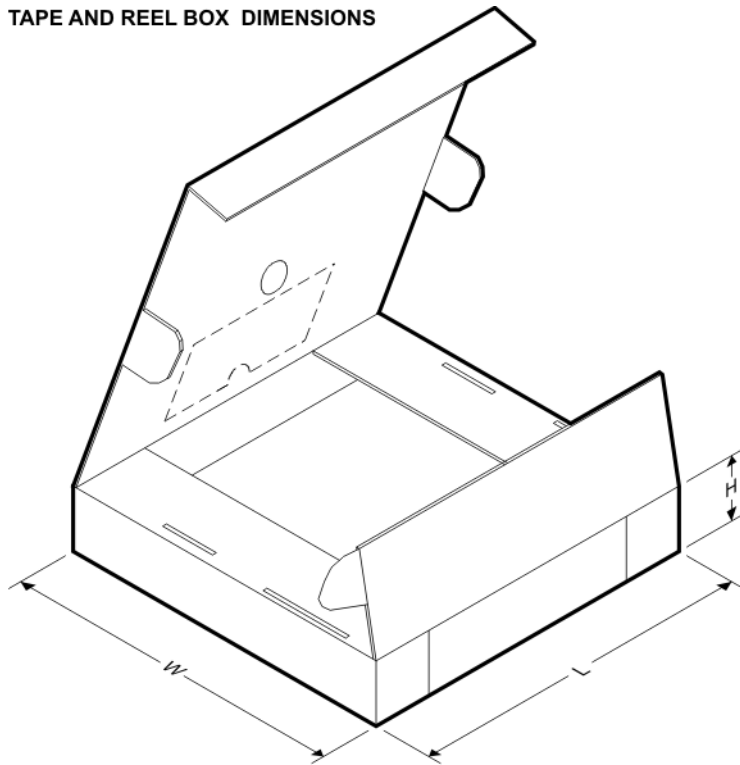
Load circuits and voltage waveforms are shown in Section 1.

TAPE AND REEL INFORMATION


*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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps