

# SN54LS595, SN54LS596, SN74LS595, SN74LS596 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

SDLS006

D2634, JANUARY 1981 (REVISED MARCH 1988)

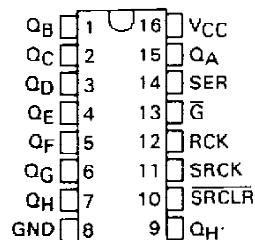
- 8-Bit Serial-In, Parallel-Out Shift Registers with Storage
- Choice of 3-State ('LS595) or Open-Collector ('LS596) Parallel Outputs
- Shift Register Has Direct Clear
- Accurate Shift Frequency: DC to 20 MHz

## description

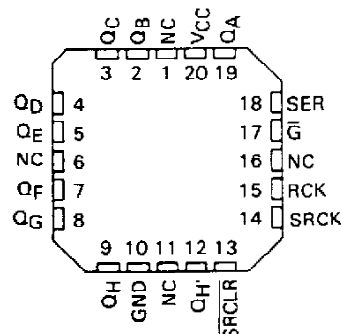
These devices each contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has parallel 3-state ('LS595) or open-collector ('LS596) outputs. Separate clocks are provided for both the shift register and the storage register. The shift register has a direct-overriding clear, serial input, and serial output pins for cascading.

Both the shift register and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register state will always be one clock pulse ahead of the storage register.

SN54LS595, SN54LS596 . . . J OR W PACKAGE  
SN74LS595, SN74LS596 . . . N PACKAGE  
(TOP VIEW)

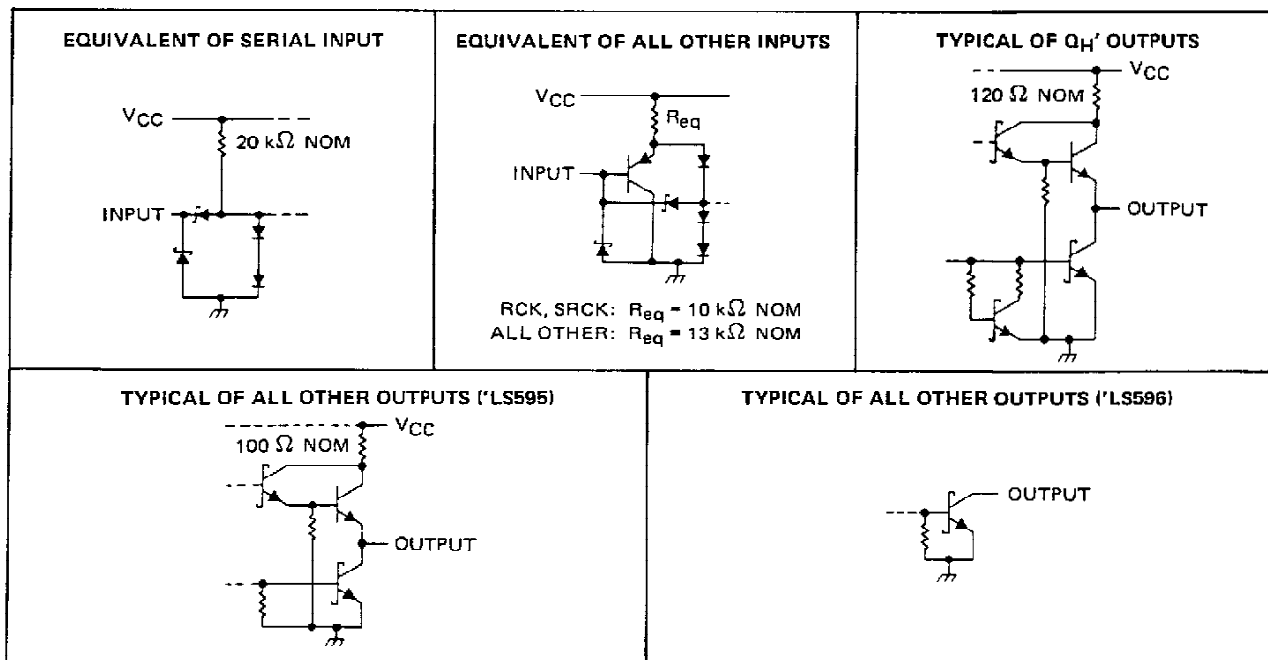


SN54LS595, SN54LS596 . . . FK PACKAGE  
(TOP VIEW)



NC - No internal connection

## schematics of inputs and outputs



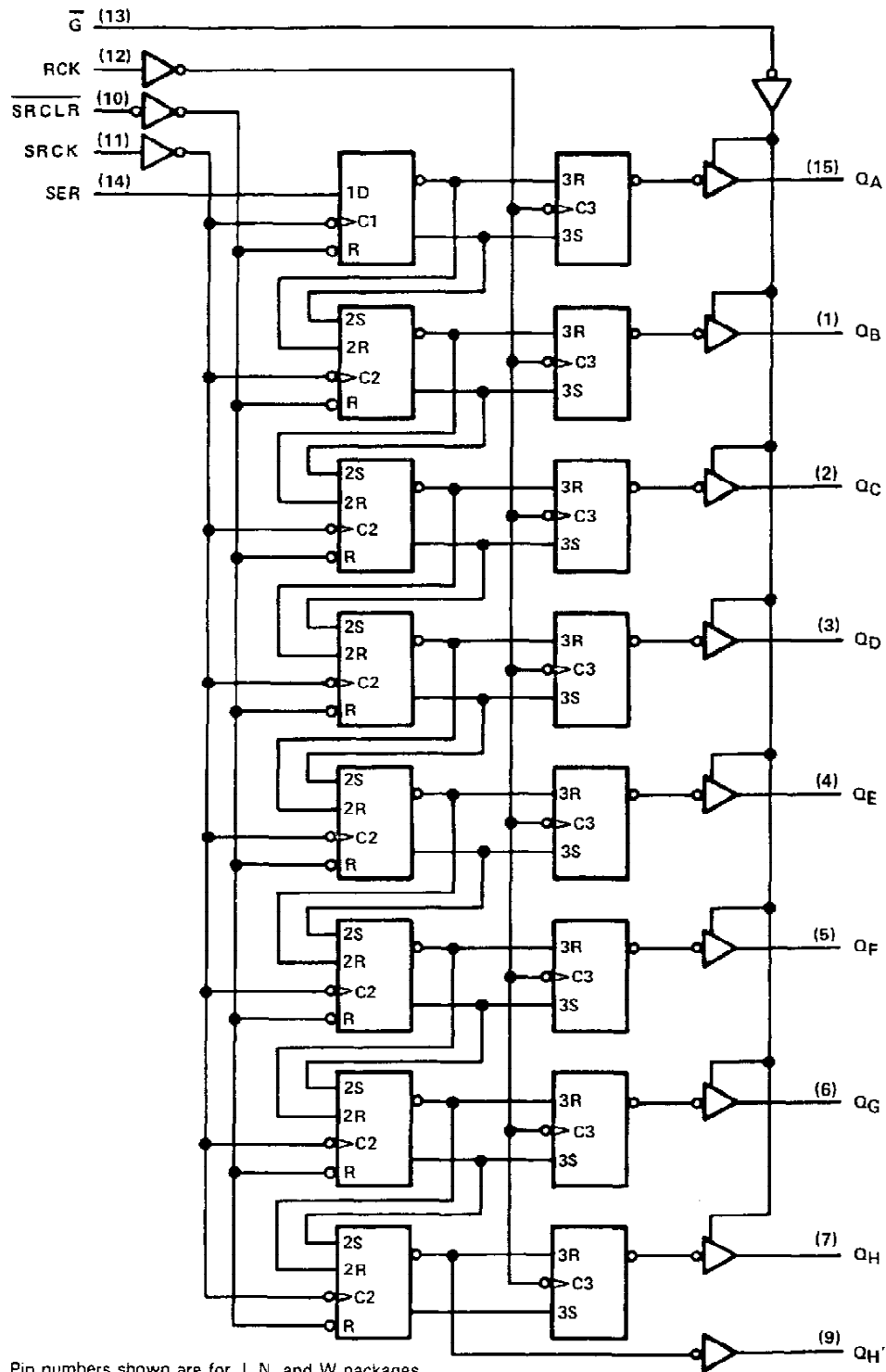
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# **SN54LS595, SN54LS596, SN74LS595, SN74LS596** **8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

logic diagram (positive logic)



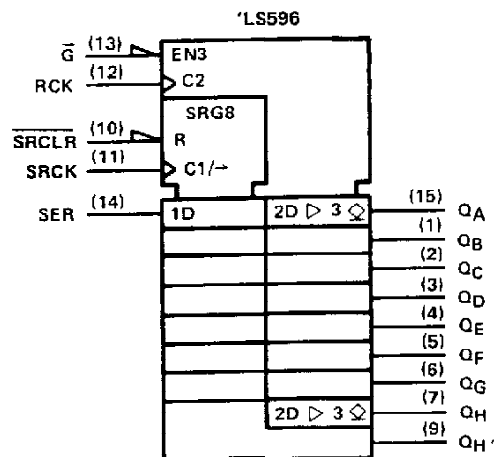
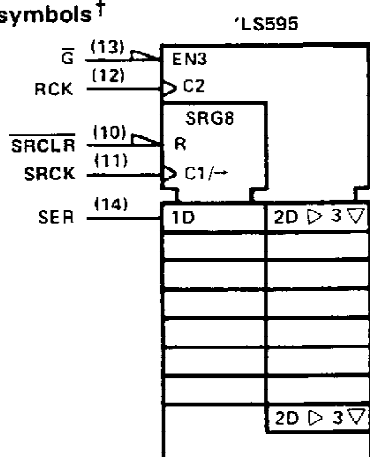
Pin numbers shown are for J, N, and W packages.

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# SN54LS595, SN54LS596, SN74LS595, SN74LS596 8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

logic symbols†



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

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

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54LS595, SN54LS596	-55°C to 125°C
SN74LS595, SN74LS596	0°C to 70°C
Storage temperature range	-65°C to 150°C

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

## recommended operating conditions

		SN54LS'			SN74LS'			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
$V_{OH}$	High-level output voltage	QA thru QH, 'LS596 only		5.5	5.5			V
$I_{OH}$	High-level output current	QH'		-1	-1			mA
		QA thru QH, 'LS595 only		-1	-2.6			
$I_{OL}$	Low-level output current	QH'		8	16			mA
		Q		12	24			
$f_{SRCK}$	Shift clock frequency	0		20	0		20	MHz
$t_w(SRCK)$	Duration of shift clock pulse	25			25			ns
$t_w(RCK)$	Duration of register clock pulse	20			20			ns
$t_w(SRCLR)$	Duration of shift clear pulse, low level	20			20			ns
$t_{su}$	Setup time	SRCLR inactive before SRCK ↑		20	20			ns
		SER before SRCK ↑		20	20			
		SRCK ↑ before RCK ↑ (see Note 2)		40	40			
		SRCLR low before RCK ↑		40	40			
$t_h$	Hold time	SER after SRCK ↑		0	0			ns
$T_A$	Operating free-air temperature	-55		125	0		70	°C

NOTE 2: This setup time ensures the register will see stable data from the shift-register outputs. The clocks may be connected together, in which case the storage register state will be one clock pulse behind the shift register.

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**SN54LS595, SN54LS596, SN74LS595, SN74LS596**  
**8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS †	SN54LS*		SN74LS*		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>	'LS595 Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	I <sub>OH</sub> = - 1 mA		2.4	3.2		V	
	I <sub>OH</sub> = - 2.6 mA				2.4	3.1			
	Q <sub>H</sub> '		I <sub>OH</sub> = - 1 mA		2.4	3.2	2.4		3.2
I <sub>OH</sub>	'LS596 Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V			0.1		0.1	mA	
V <sub>OL</sub>	Q	V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX	I <sub>OL</sub> = 12 mA		0.25	0.4	0.25	0.4	V
			I <sub>OL</sub> = 24 mA				0.35	0.5	
			I <sub>OL</sub> = 8 mA		0.25	0.4	0.25	0.4	
	Q <sub>H</sub> '		I <sub>OL</sub> = 16 mA				0.35	0.5	
I <sub>OZH</sub>	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 2.7 V			20		20	μA	
I <sub>OZL</sub>	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 0.4 V			- 20		- 20	μA	
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>	SER	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			- 0.4		- 0.4	mA	
	All others				- 0.2		- 0.2		
I <sub>OS</sub> §	'LS595 Q	V <sub>CC</sub> = MAX, V <sub>O</sub> = 0 V	- 30		- 130	- 30		- 130	mA
	Q <sub>H</sub> '		- 20		- 100	- 20		- 100	
I <sub>CCH</sub>	'LS595	V <sub>CC</sub> = MAX, All possible inputs grounded, All outputs open	33		50	33		50	mA
	'LS596		30		45	30		45	
I <sub>CCL</sub>	'LS595		42		65	42		65	mA
	'LS596		36		55	36		55	
I <sub>CCZ</sub>	'LS595		44		65	44		65	mA

† 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 duration of the short-circuit should not exceed one second.

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**SN54LS595, SN54LS596, SN74LS595, SN74LS596**  
**8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES**

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$  (see note 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	'LS595			'LS596			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$t_{PLH}$	SRCK $\uparrow$	$Q_H'$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$		12	18		14	21	ns
$t_{PHL}$					17	25		20	30	ns
$t_{PLH}$	RCK $\uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 45\text{ pF}$		12	18		28	42	ns
$t_{PHL}$					24	35		24	35	ns
$t_{PZH}$	$\overline{G} \downarrow$	$Q_A$ thru $Q_H$			20	30				ns
$t_{PZL}$					25	38				ns
$t_{PHZ}$	$\overline{G} \uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 5\text{ pF}$		20	30				ns
$t_{PLZ}$					25	38				ns
$t_{PLH}$	$\overline{G} \uparrow$	$Q_A$ thru $Q_H$	$R_L = 667\ \Omega$ , $C_L = 45\text{ pF}$					40	60	ns
$t_{PHL}$	$\overline{G} \downarrow$	$Q_A$ thru $Q_H$						25	38	ns
$t_{PHL}$	SRCLR $\downarrow$	$Q_H'$	$R_L = 1\text{ k}\Omega$ , $C_L = 30\text{ pF}$		24	35		24	35	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

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