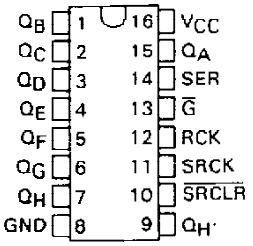
SN54LS595, SN54LS596, SN74LS595, SN74LS596
8-BIT SHIFT REGISTERS WITH OUTPUT LATCHES

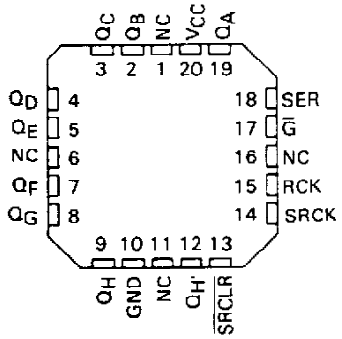
SDLS006 D2634, JANUARY 1981 - REVISED MARCH 1988

- 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

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



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



NC - No internal connection

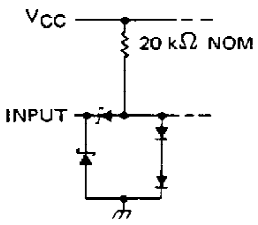
description

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.

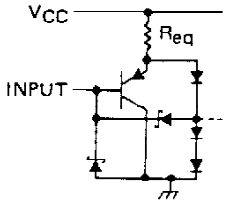
Both the shift register and storage register clocks are positive-edge triggered. If the user wishes to connect both clocks together, the shift register state will always be one clock pulse ahead of the storage register.

schematics of inputs and outputs

EQUIVALENT OF SERIAL INPUT

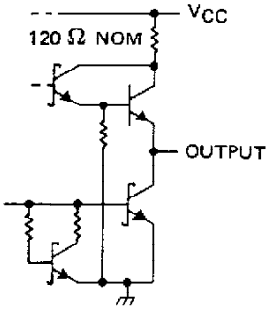


EQUIVALENT OF ALL OTHER INPUTS

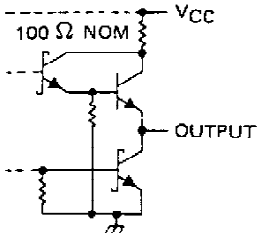


RCK, SRCK: R_{eq} = 10 kΩ NOM
ALL OTHER: R_{eq} = 13 kΩ NOM

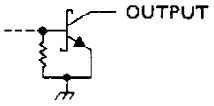
TYPICAL OF Q_H' OUTPUTS



TYPICAL OF ALL OTHER OUTPUTS ('LS595)



TYPICAL OF ALL OTHER OUTPUTS ('LS596)



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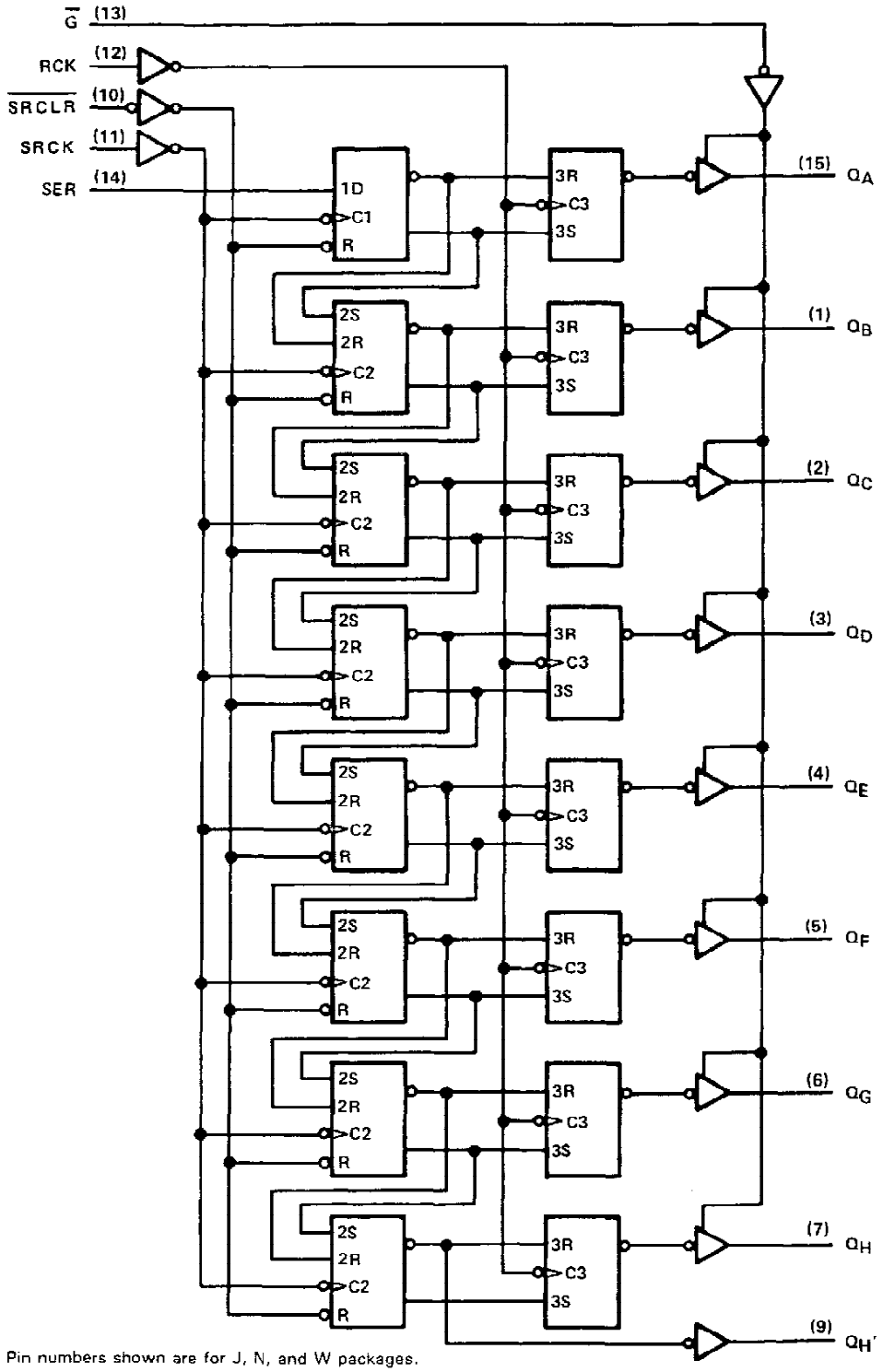
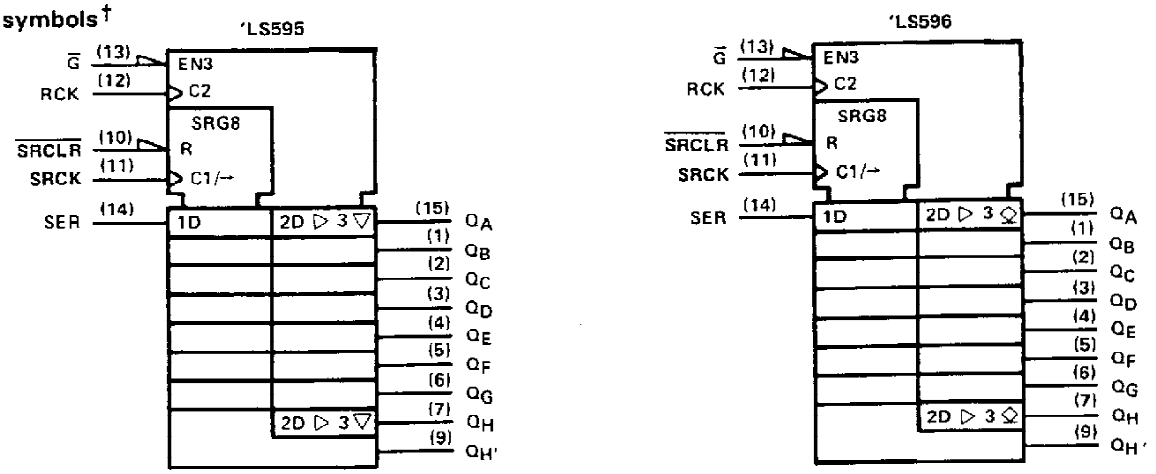
logic diagram (positive logic)



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

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	Q_A thru Q_H, 'LS596 only			5.5			5.5	V
I_{OH}	High-level output current	Q_H'			−1			−1	mA
		Q_A thru Q_H, 'LS595 only			−1			−2.6	
I_{OL}	Low-level output current	Q_H'			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
$t_{w(\overline{SRCLR})}$	Duration of shift clear pulse, low level		20			20			ns
t_{su}	Setup time	$\overline{SRCLR}$ inactive before SRCK ↑	20			20			ns
		SER before SRCK ↑	20			20			
		SRCK ↑ before RCK ↑ (see Note 2)	40			40			
		$\overline{SRCLR}$ 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.

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_{IK}		V_{CC} = MIN, I_I = −18 mA				−1.5			−1.5	V
V_{OH}	'LS595 Q	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OH} = −1 mA	2.4	3.2					V
			I_{OH} = −2.6 mA				2.4	3.1		
	Q_H'		I_{OH} = −1 mA	2.4	3.2		2.4	3.2		
I_{OH}	'LS596 Q	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 5.5 V				0.1			0.1	mA
V_{OL}	Q	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = MAX	I_{OL} = 12 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 24 mA					0.35	0.5	
	Q_H'		I_{OL} = 8 mA		0.25	0.4		0.25	0.4	
			I_{OL} = 16 mA					0.35	0.5	
I_{OZH}	'LS595 Q	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 2.7 V				20			20	μA
I_{OZL}	'LS595 Q	V_{CC} = MAX, V_{IH} = 2 V, V_{IL} = MAX, V_{OH} = 0.4 V				−20			−20	μA
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}	SER	V_{CC} = MAX, V_I = 0.4 V				−0.4			−0.4	mA
	All others					−0.2			−0.2	
I_{OS}§	'LS595 Q	V_{CC} = MAX, V_O = 0 V		−30		−130	−30		−130	mA
	Q_H'			−20		−100	−20		−100	
I_{CCH}	'LS595	V_{CC} = MAX, All possible inputs grounded, All outputs open			33	50		33	50	mA
	'LS596				30	45		30	45	
I_{CCL}	'LS595				42	65		42	65	mA
	'LS596				36	55		36	55	
I_{CCZ}	'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_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C (see note 3)

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

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

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