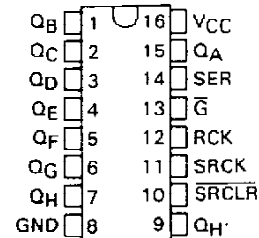- **8-Bit Serial-In, Parallel-Out Shift Registers with Storage**

- **Choice of 3-State ('LS595) or Open-Collector ('LS596) Parallel Outputs**

- **Shift Register Has Direct Clear**

- **Accurate Shift Frequency: DC to 20 MHz**
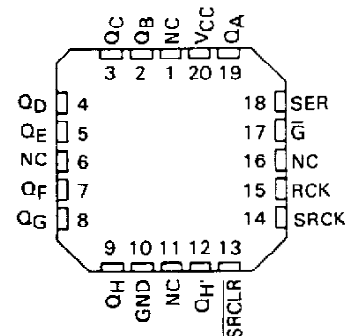
description

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
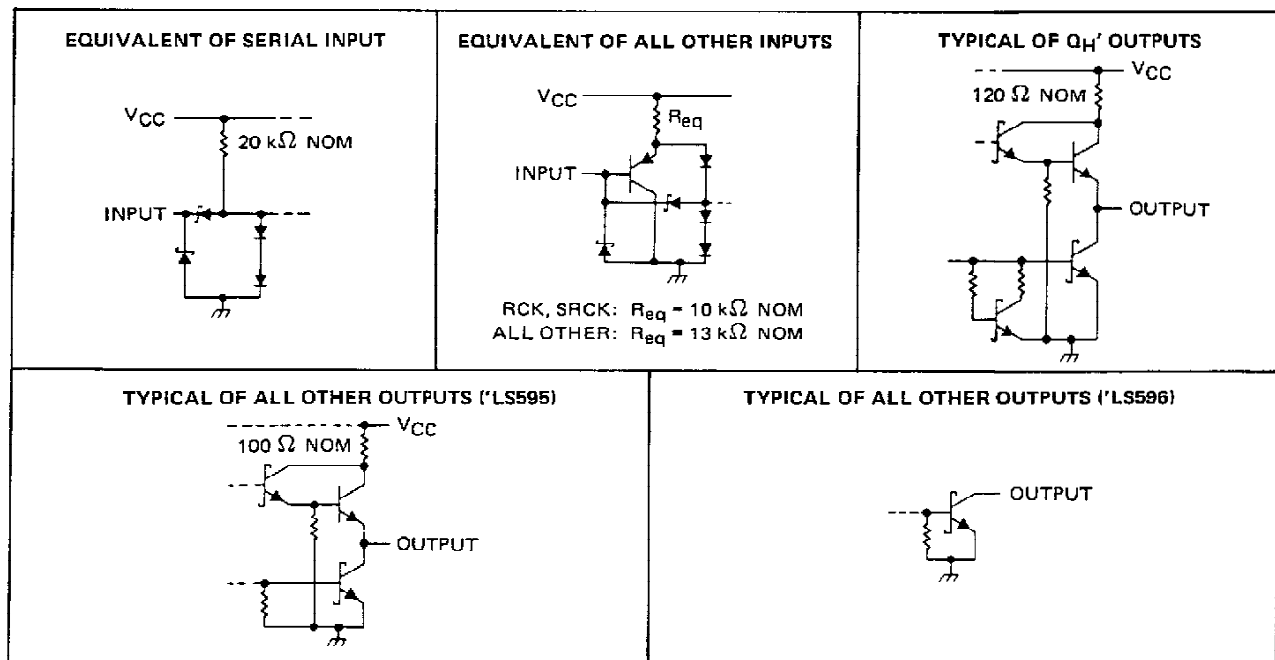**SN74LS595, SN74LS596 . . . N PACKAGE**
(TOP VIEW)

Q_B	1	16	V_{CC}
Q_C	2	15	Q_A
Q_D	3	14	SER
Q_E	4	13	$\overline{G}$
Q_F	5	12	RCK
Q_G	6	11	SRCK
Q_H	7	10	$\overline{SRCLR}$
GND	8	9	Q_H'

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

Top pins: Q_C (3), Q_B (2), NC (1), V_{CC} (20), Q_A (19)

Q_D	4	18	SER
Q_E	5	17	$\overline{G}$
NC	6	16	NC
Q_F	7	15	RCK
Q_G	8	14	SRCK

Bottom pins: Q_H (9), GND (10), NC (11), Q_H' (12), $\overline{SRCLR}$ (13)

NC - No internal connection

schematics of inputs and outputs

EQUIVALENT OF SERIAL INPUT

V_{CC} — 20 kΩ NOM — INPUT

EQUIVALENT OF ALL OTHER INPUTS

V_{CC} — R_{eq} — INPUT

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

TYPICAL OF Q_H' OUTPUTS

V_{CC} — 120 Ω NOM — OUTPUT

TYPICAL OF ALL OTHER OUTPUTS ('LS595)

V_{CC} — 100 Ω NOM — OUTPUT

TYPICAL OF ALL OTHER OUTPUTS ('LS596)

OUTPUT

TEXAS INSTRUMENTS

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logic diagram (positive logic)

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

logic symbols†

'LS595

'LS596
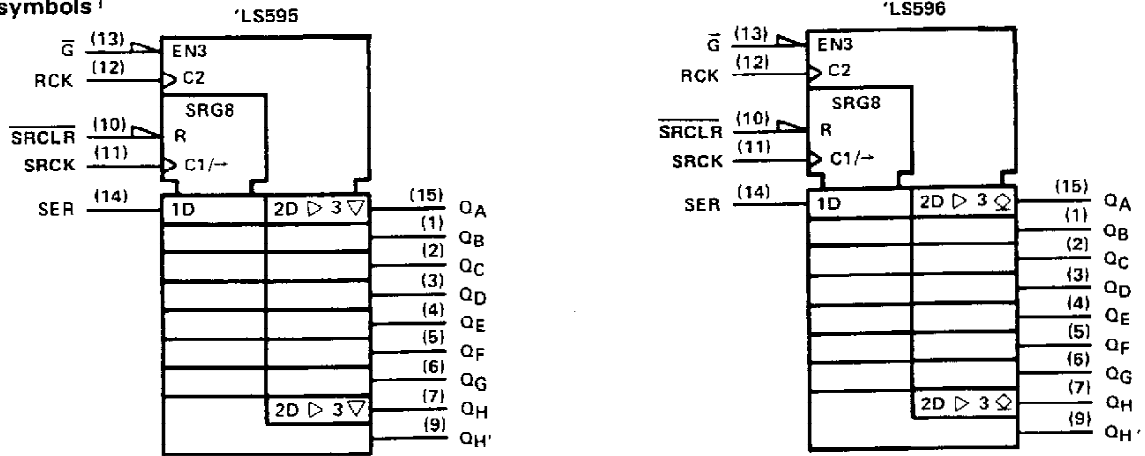
†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.
Pin numbers shown are for J, N, and W packages.

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			
		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* MIN	SN54LS* TYP‡	SN54LS* MAX	SN74LS* MIN	SN74LS* TYP‡	SN74LS* MAX	UNIT
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				33	50		33	50	mA
	'LS596	V_{CC} = MAX,			30	45		30	45	
I_{CCL}	'LS595	All possible inputs grounded,			42	65		42	65	mA
	'LS596	All outputs open			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 MIN	'LS595 TYP	'LS595 MAX	'LS596 MIN	'LS596 TYP	'LS596 MAX	UNIT
t_{PLH}	SRCK↑	Q_H'	R_L = 1kΩ,	C_L = 30 pF		12	18		14	21	ns
t_{PHL}	SRCK↑	Q_H'				17	25		20	30	ns
t_{PLH}	RCK↑	Q_A thru Q_H				12	18		28	42	ns
t_{PHL}	RCK↑	Q_A thru Q_H	R_L = 667 Ω,	C_L = 45 pF		24	35		24	35	ns
t_{PZH}	$\overline{G}$↓	Q_A thru Q_H				20	30				ns
t_{PZL}	$\overline{G}$↓	Q_A thru Q_H				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}	$\overline{G}$↑	Q_A thru Q_H				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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