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SN54LS395A, SN74LS395A 4-BIT CASCADABLE SHIFT REGISTERS WITH 3-STATE OUTPUTS

SDLS172

OCTOBER 1976 — REVISED MARCH 1988

- Three-State, 4 Bit, Cascadable, Parallel-In, Parallel-Out Registers
- 'LS395A Offers Three Times the Sink-Current Capability of 'LS395
- Low Power Dissipation . . . 75 mW Typical (Enabled)
- Applications:
 - N-Bit Serial-To-Parallel Converter
 - N-Bit Parallel-To-Serial Converter
 - N-Bit Storage Register

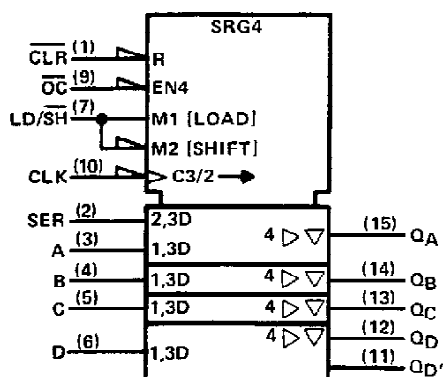
description

These 4-bit registers feature parallel inputs, parallel outputs, and clock (CLK), serial (SER), load shift (LD/SH), output control (OC) and direct overriding clear (CLR) inputs.

Shifting is accomplished when the load/shift control is low. Parallel loading is accomplished by applying the four bits of data and taking the load/shift control input high. The data is loaded into the associated flip-flops and appears at the outputs after the high-to-low transition of the clock input. During parallel loading, the entry of serial data is inhibited.

When the output control is low, the normal logic levels of the four outputs are available for driving the loads or bus lines. The outputs are disabled independently from the level of the clock by a high logic level at the output control input. The outputs then present a high impedance and neither load nor drive the bus line; however, sequential operation of the registers is not affected. During the high-impedance mode, the output at Q_D is still available for cascading.

logic symbol†

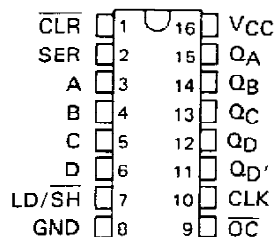


†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

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

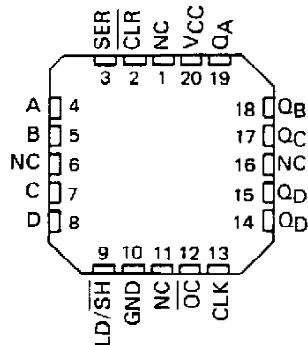
SN54LS395A . . . J OR W PACKAGE
SN74LS395A . . . D OR N PACKAGE

(TOP VIEW)



SN54LS395A . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

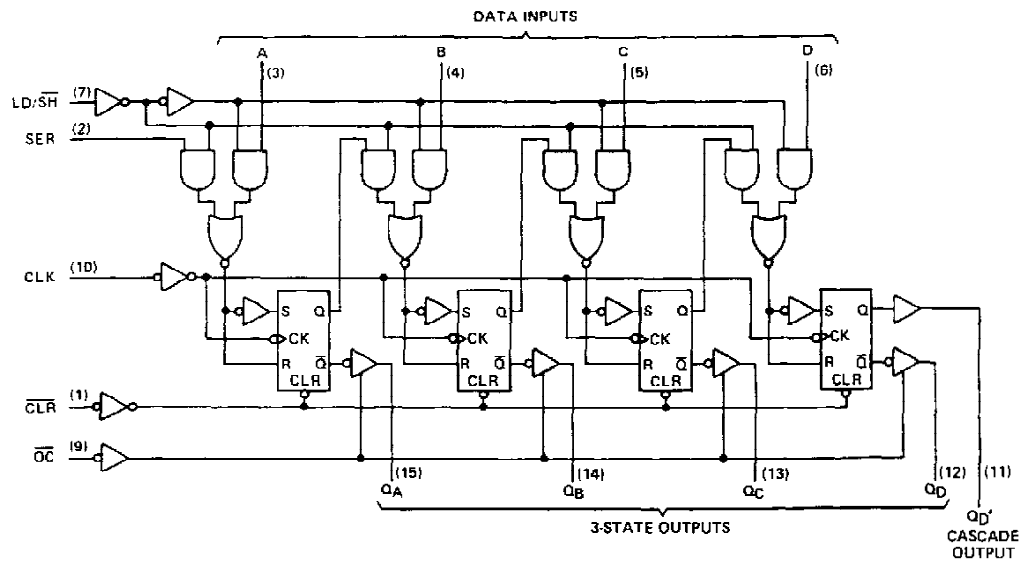
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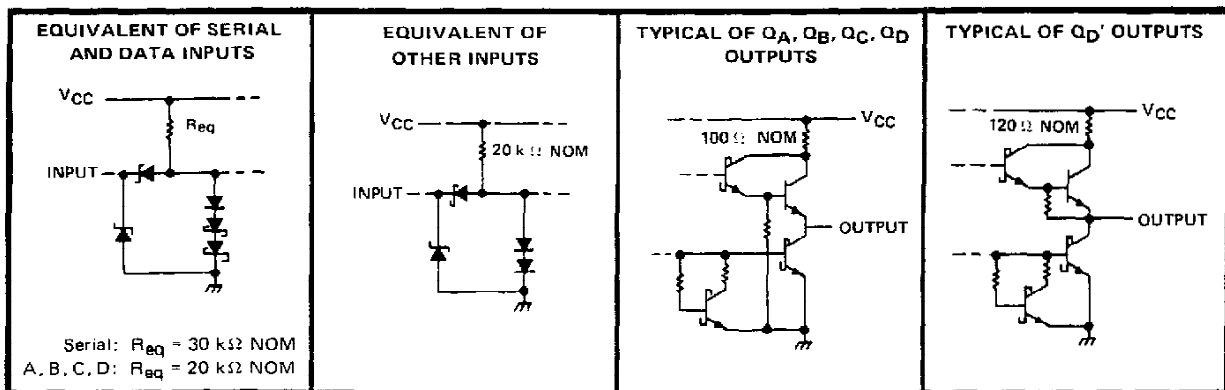
SN54LS395A, SN74LS395A **4-BIT CASCADABLE SHIFT REGISTERS WITH 3-STATE OUTPUTS**

logic diagram (positive logic)



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

schematics of inputs and outputs



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SN54LS395A, SN74LS395A **4-BIT CASCADABLE SHIFT REGISTERS WITH 3-STATE OUTPUTS**

FUNCTION TABLE

INPUTS					3-STATE OUTPUTS				CASCADE
$\overline{\text{CLR}}$	$\text{LD}/\overline{\text{SH}}$	CLK	SER	PARALLEL	Q_A	Q_B	Q_C	Q_D	OUTPUT
				A B C D					Q_D'
L	X	X	X	X X X X	L	L	L	L	L
H	H	H	X	X X X X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}	Q_{D0}
H	H	L	X	a b c d	a	b	c	d	d
H	L	H	X	X X X X	Q_{A0}	Q_{B0}	Q_{C0}	Q_{D0}	Q_{D0}
H	L	L	H	X X X X	H	Q_{An}	Q_{Bn}	Q_{Cn}	Q_{Cn}
H	L	L	L	X X X X	L	Q_{An}	Q_{Bn}	Q_{Cn}	Q_{Cn}

When the output control is high, the 3-state outputs are disabled to the high-impedance state; however, sequential operation of the registers and the output at Q_D' are not affected.

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
Operating free-air temperature range: SN54LS395A	-55°C to 125°C
SN74LS395A	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

		SN54LS395A			SN74LS395A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}	Q_A, Q_B, Q_C, Q_D	-1			-2.6			mA
	Q_D'	-400			-400			μA
Low-level output current, I_{OL}	Q_A, Q_B, Q_C, Q_D	12			24			mA
	Q_D'	4			8			mA
Clock frequency, f_{clock}		0		30	0		30	MHz
Width of clock pulse, $t_w(\text{clock})$		16			16			ns
Setup time, high-level or low-level data, t_{su}	$LD/\overline{SH}$	40			40			ns
	All other inputs	20			20			
Hold time, high-level or low-level data, t_h		10			10			ns
Operating free-air temperature, T_A		-55		125	0		70	$^{\circ}C$


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4-BIT CASCADABLE SHIFT REGISTERS WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS [†]	SN54LS395A			SN74LS395A			UNIT
		MIN	TYP [‡]	MAX	MIN	TYP [‡]	MAX	
V _{IH} High-level input voltage		2			2			V
V _{IL} Low-level input voltage				0.7			0.8	V
V _{IK} Input clamp voltage	V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V
V _{OH} High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max, I _{OH} = MAX	Q _A , Q _B , Q _C , Q _D			Q _A , Q _B , Q _C , Q _D			V
		Q _{D'}			Q _{D'}			V
V _{OL} Low-level output voltage	V _{CC} = MIN, V _{IL} = V _{IL} max, V _{IH} = 2 V	Q _A , Q _B , Q _C , Q _D			Q _A , Q _B , Q _C , Q _D			V
		I _{OL} = 12 mA			I _{OL} = 12 mA			V
		I _{OL} = 24 mA			I _{OL} = 24 mA			V
		I _{OL} = 4 mA			I _{OL} = 4 mA			V
I _{OZH} Off-state output current, high-level voltage applied	V _{CC} = MAX, V _O = 2.7 V, V _{IH} = 2 V	Q _A , Q _B , Q _C , Q _D			Q _A , Q _B , Q _C , Q _D			μA
		Q _{D'}			Q _{D'}			μA
I _{OZL} Off-state output current, low-level voltage applied	V _{CC} = MAX, V _O = 0.4 V, V _{IH} = 2 V	Q _A , Q _B , Q _C , Q _D			Q _A , Q _B , Q _C , Q _D			μA
		Q _{D'}			Q _{D'}			μA
I _I Input current at maximum input voltage	V _{CC} = MAX, V _I = 7 V			0.1			0.1	mA
I _{IH} High-level input current	V _{CC} = MAX, V _I = 2.7 V			20			20	μA
I _{IL} Low-level input current	V _{CC} = MAX, V _I = 0.4 V			-0.4			-0.4	mA
I _{OS} Short-circuit output current [§]	V _{CC} = MAX	Q _A , Q _B , Q _C , Q _D			Q _A , Q _B , Q _C , Q _D			mA
		Q _{D'}			Q _{D'}			mA
I _{CC} Supply current	V _{CC} = MAX. See Note 2	Condition A			Condition A			mA
		Condition B			Condition B			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.

NOTE 2: I_{CC} is measured with the outputs open, the serial input and mode control at 4.5 V, and the data inputs grounded under the following conditions:

- Output control at 4.5 V and a momentary 3 V, then ground, applied to clock input.
- Output control and clock input grounded.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
f _{max} Maximum clock frequency	See Note 3,	30	45		MHz
t _{PHL} Propagation delay time, high-to-low-level output from clear	Q _A , Q _B , Q _C , Q _D outputs: R _L = 667 Ω, C _L = 45 pF Q _{D'} output: R _L = 2 kΩ, C _L = 15 pF		22	35	ns
t _{PLH} Propagation delay time, low-to-high-level output			15	30	ns
t _{PHL} Propagation delay time, high-to-low-level output			20	30	ns
t _{PZH} Output enable time to high level			15	25	ns
t _{PZL} Output enable time to low level	C _L = 5 pF, See Note 3		17	25	ns
t _{PHZ} Output disable time from high level			11	17	ns
t _{PLZ} Output disable time from low level			12	20	ns

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

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