

# 8-Bit Latch/Register with Readback

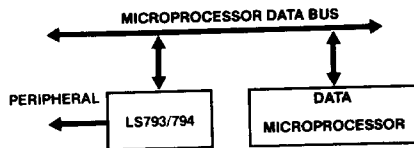
## SN54/74LS793 SN54/74LS794

### Features/Benefits

- I/O port configuration enables output data back onto input bus
- 8-bit data path matches byte boundaries
- Ideal for microprocessor interface

### Description

These 8-bit latches/registers are useful for I/O operations on a microprocessor bus. An image of the output data can be read back by the CPU. This operation is important in control algorithms which make decisions based on the previous status of output controls. Rather than storing a redundant copy of the output data in memory, simply reading the register as an I/O port allows the data to be retrieved from where it has been stored in an 'LS793/4, for verification and/or updating.



The data is loaded in the registers on the low-to-high transition of the clock (CK), for the 'LS794. The data is passed through the 'LS793 when the gate, (G), is High, and it is "latched" when G changes to Low. The output enable,  $\overline{OE}$  is used to enable data on D7-D0. When  $\overline{OE}$  is low the output of the latches/registers is enabled on D0-D7, enabling D as an output bus so that the host can perform a read operation. When  $\overline{OE}$  is High, D7-D0 are inputs to the latches/registers configuring D as an input bus.

The output drive of these commercial parts for any output pin is  $I_{OL} = 24$  mA.

### 'LS793 Function Table

G	$\overline{OE}$	Q	D
L	L	$Q_0^{**}$	Output, Q
L	H	$Q_0^{**}$	Input
H <sup>†</sup>	L	D*	Output, Q*
H	H	D	Input

\* In this case the output of the latch feeds the input, and a "race" condition results.

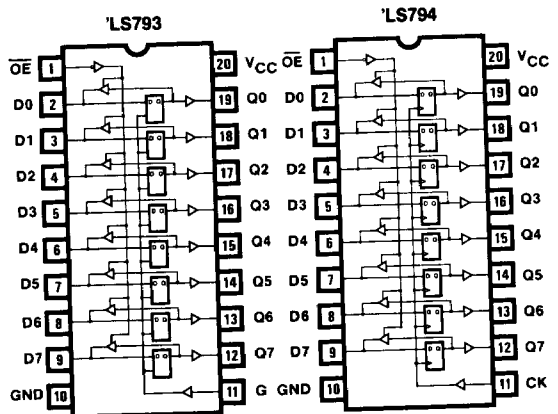
\*\*  $Q_0$  represents the previous "latched" state.

† This transition is not a normal mode of operation and may produce hazards.

### Ordering Information

PART NUMBER	PKG	TEMP	POLARITY	TYPE	POWER
SN54LS793	J,W,L	Mil	Non-invert	Latch	LS
SN74LS793	N,J,NL	Com			
SN54LS794	J,W,L	Mil	Non-invert	Register	LS
SN74LS794	N,J,NL	Com			

### Logic Symbols

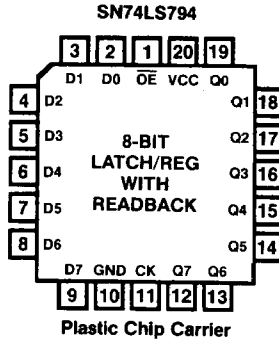
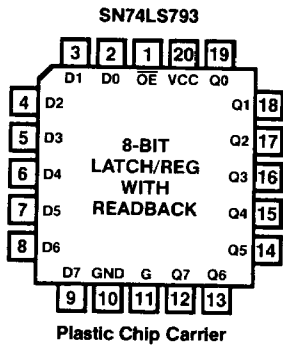


### 'LS794 Function Table

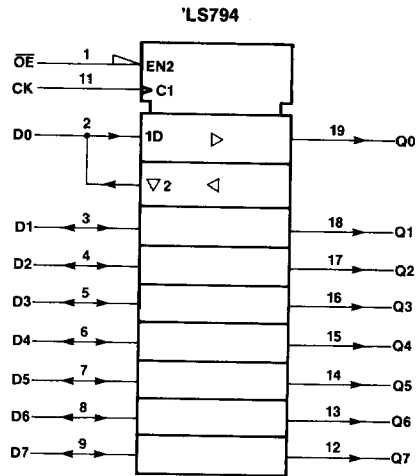
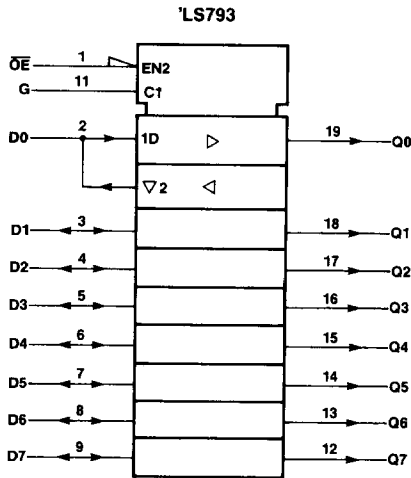
CK	$\overline{OE}$	Q	D
L or H or ↓	L	$Q_0$	Output, Q
L or H or ↓	H	$Q_0$	Input
↑	L	$Q_0$	Output, Q*
↑	H	D	Input

\* In this case the output of the register is clocked to the inputs and the overall Q output is unchanged at  $Q_0$ .

Pin Configurations



IEEE Symbols



**Absolute Maximum Ratings**

Supply voltage $V_{CC}$ .....	-0.5 V to 7 V
Input voltage .....	-1.5 V to 7 V
Off-state output voltage .....	-0.5 V to 5.5 V
Storage temperature .....	-65°C to +150°C

**Operating Conditions**

SYMBOL	PARAMETER	MILITARY			COMMERCIAL			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$T_A$	Operating free air temperature	-55		125	0		75	°C
$t_w$	Width of Clock/Gate	High		15		15		ns
		Low ('LS794 only)		15		15		
$t_{su}$	Setup time	'LS793		15↓		10↓		ns
		'LS794		15↑		15↑		
$t_h$	Hold time	'LS793		10↓		10↓		
		'LS794		0↑		0↑		

↑ ↓ The arrow indicates the transition of the clock/gate input used for reference. ↑ for the low-to-high transitions, ↓ for the high-to-low transitions.

**Electrical Characteristics Over Operating Conditions**

SYMBOL	PARAMETER		TEST CONDITIONS	MILITARY		COMMERCIAL		UNIT		
				MIN	TYP	MAX	MIN		TYP	MAX
$V_{IL}$	Low-level input voltage					0.7		0.8	V	
$V_{IH}$	High-level input voltage			2			2		V	
$V_{IC}$	Input clamp voltage		$V_{CC} = \text{MIN}$	$I_I = -18 \text{ mA}$				-1.5	V	
$I_{IL}$	Low-level input current		$V_{CC} = \text{MAX}$	$V_I = 0.4 \text{ V}$				-250	μA	
$I_{IH}$	High-level input current		$V_{CC} = \text{MAX}$	$V_I = 2.7 \text{ V}$				40	μA	
$I_I$	Maximum input current	D or Q	$V_{CC} = \text{MAX}$	$V_I = 5.5 \text{ V}$		0.1	0.1	0.1	mA	
		All others		$V_I = 7 \text{ V}$						
$V_{OL}$	Low-level output voltage		$V_{CC} = \text{MIN}$ $V_{IL} = \text{MAX}$ $V_{IH} = 2 \text{ V}$	$I_{OL} = 12 \text{ mA}$		0.25	0.4	0.25	0.4	V
				$I_{OL} = 24 \text{ mA}$				0.35	0.5	
$V_{OH}$	High-level output voltage		$V_{CC} = \text{MIN}$ $V_{IL} = \text{MAX}$ $V_{IH} = 2 \text{ V}$	$I_{OH} = -1 \text{ mA}$		2.4	3.4			V
				$I_{OH} = -2.6 \text{ mA}$				2.4	3.1	
$I_{OZL}$	Off-state output current		$V_{CC} = \text{MAX}$ $V_{IL} = \text{MAX}$ $V_{IH} = 2 \text{ V}$	$V_O = 0.4 \text{ V}$				-250	-250	μA
$I_{OZH}$				$V_O = 2.7 \text{ V}$				40	40	
$I_{OS}$	Output short-circuit current*		$V_{CC} = \text{MAX}$			-30	-130	-30	-130	mA
$I_{CC}$	Supply current		$V_{CC} = \text{MAX}$ Outputs open	'LS793				120	120	mA
				'LS794				120	120	

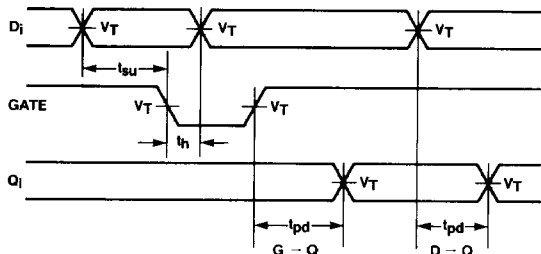
\* Not more than one output should be shorted at a time and duration of the short-circuit should not exceed one second.

**Switching Characteristics**  $V_{CC} = 5V, T_A = 25^\circ C$

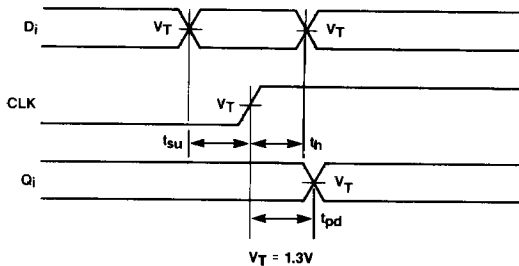
SYMBOL	PARAMETER	TEST CONDITIONS (See Interface Test Load/Waveforms)	'LS793			'LS794			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$t_{MAX}$	Maximum clock frequency	$C_L = 45pF R_L = 280 \Omega$				35	50		MHz
$t_{PLH}$	Data to output delay		12	18					ns
$t_{PHL}$			12	18					ns
$t_{PLH}$	Clock/gate to output delay		17	25		9	20		ns
$t_{PHL}$			12	25		14	20		ns
$t_{PZL}$	Output enable delay †		15	20		15	20		ns
$t_{PZH}$		11	20		11	20		ns	
$t_{PLZ}$	Output disable delay †	$C_L = 5pF R_L = 280 \Omega$	8	20		8	20		ns
$t_{PHZ}$			9	20		9	20		ns

† For the 'LS793, G should remain LOW during these tests.

**'LS793 Timing Diagrams**



**'LS794 Timing Diagrams**

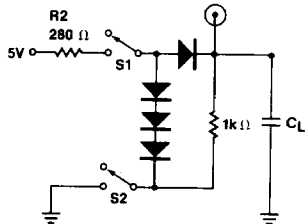


The case when gate is HIGH and data flows through the part is specified as Data to Output delay in the Switching Characteristics table. ( $V_T = 1.3V$ ).

**Test Loads**

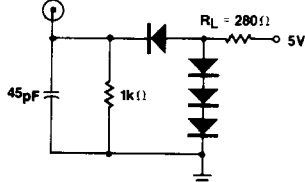
**FOR D OUTPUTS-ENABLE AND DISABLE**

TEST POINT FOR  $D_i^*$

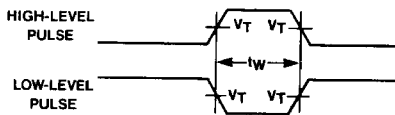


**FOR Q OUTPUTS**

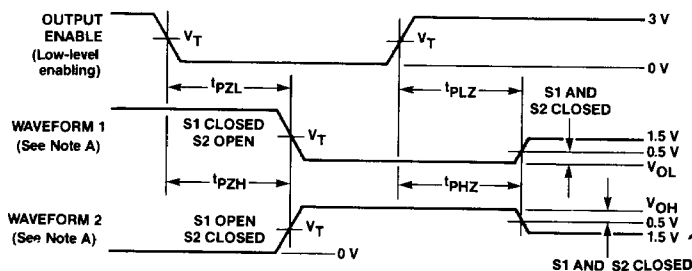
TEST POINT FOR  $Q_i^*$



**PULSE WIDTH**



**ENABLE AND DISABLE WAVEFORMS**



For the 'LS793, the latch control "G" should be low while testing the enable and disable times, so that the output (Q) does not change. ( $V_T = 1.3V$ ).

NOTES: A. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.

\* The "TEST POINT" is driven by the output under test, and observed by instrumentation.

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