Digital Logic Design :

Lecture 14

LATCHES : The latch is a type of bistable storage device.

The S-R Latch :

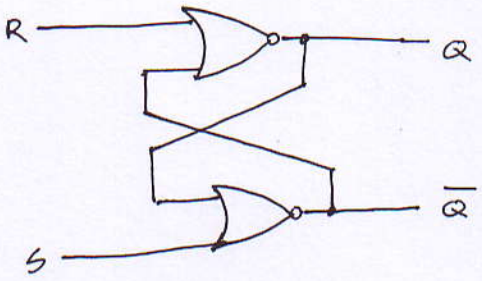


Fig : Active High input S-R latch

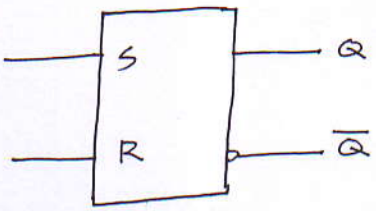


Fig : Logic symbol for Active -High input SR latch

Truth table for active HIGH input S-R Latch :

Inputs		Outputs		Comments
S	R	Q	$\overline{Q}$	
0	0	NC	NC	No change, Latch remains in previous state.
0	1	0	1	Latch Reset
1	0	1	0	Latch Set
1	1	0	0	Invalid condition

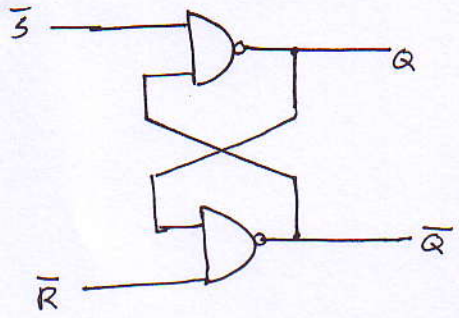


Fig : Active-Low input $\overline{S}$-$\overline{R}$ latch

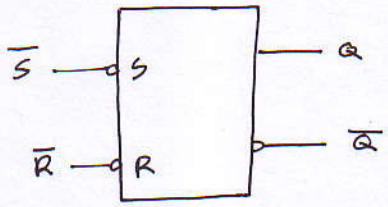
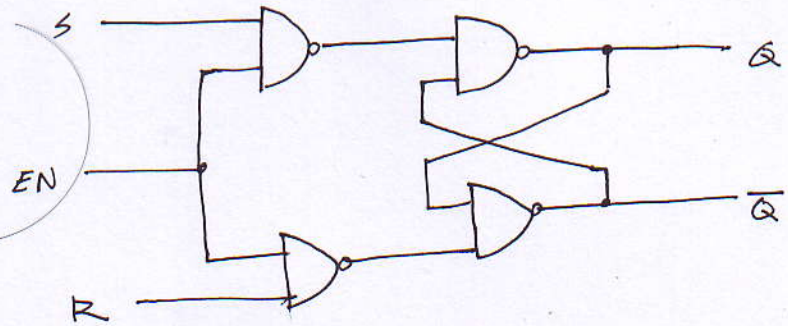


Fig : Logic symbol of $\overline{S}$-$\overline{R}$ latch

Inputs		Outputs		Comments
$\overline{S}$	$\overline{R}$	Q	$\overline{Q}$	
0	0	1	1	Invalid condition
0	1	1	0	Latch Set
1	0	0	1	Latch Reset
1	1	NC	NC	No change, Latch remains in previous state.

A gated SR latch :



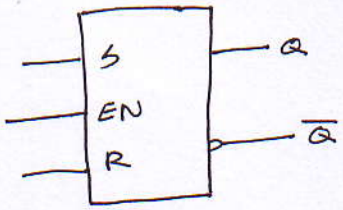
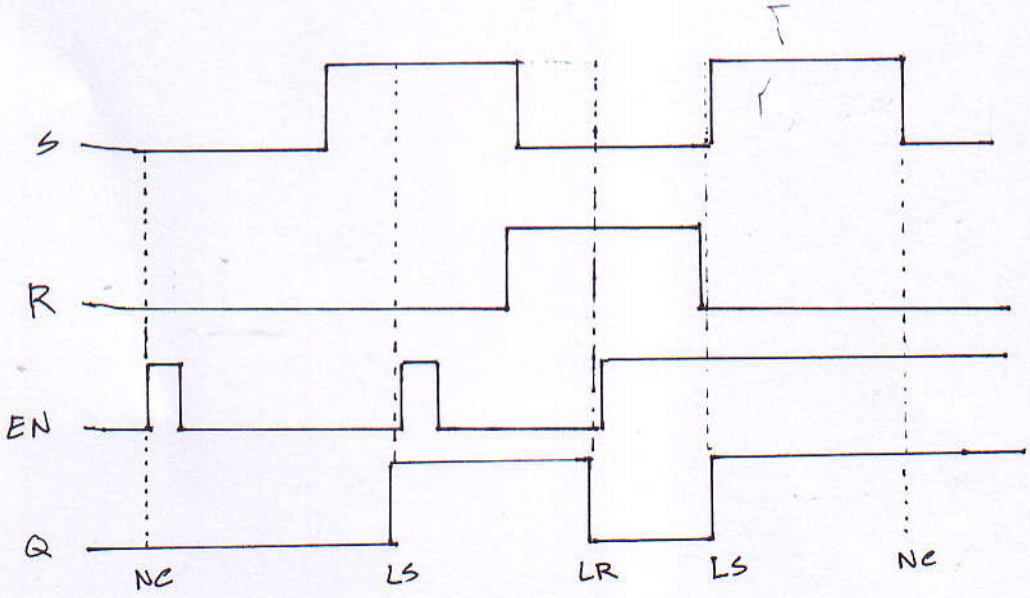


Fig : Logic diagram

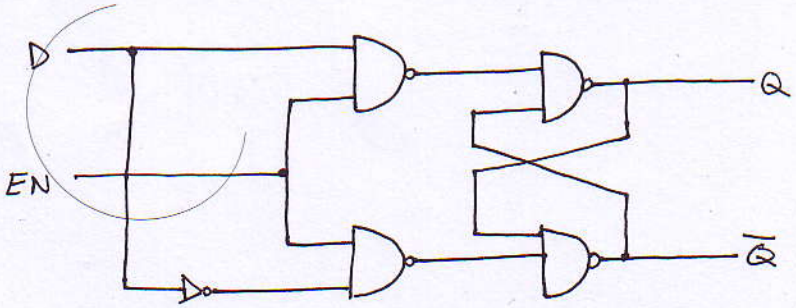
Truth table for gated SR Latch :

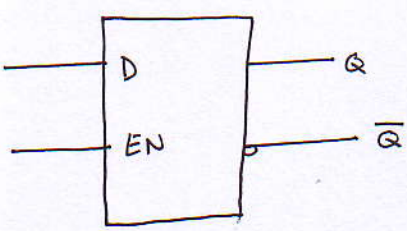
Inputs			Outputs		Comments
EN	S	R	Q	$\overline{Q}$	
0	X	X	NC	NC	No change, the latch remains in previous state
1	0	0	NC	NC	"
1	0	1	0	1	Latch Reset
1	1	0	1	0	Latch Set
1	1	1	1	1	Invalid condition

Determine Q if the gated S-R Latch is initially RESET.



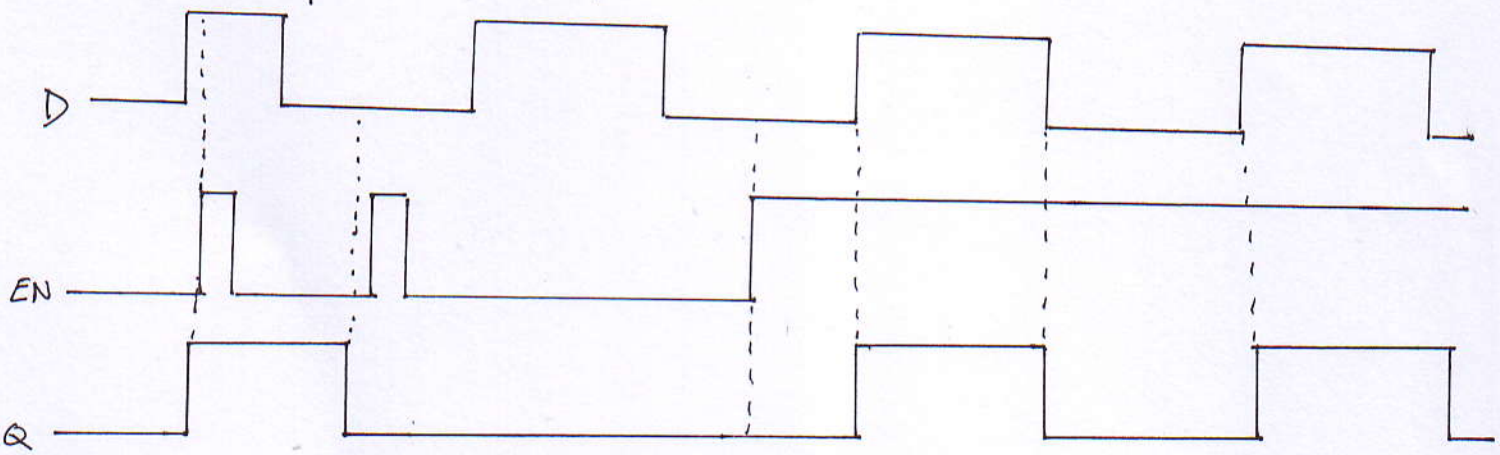
The Gated D Latch :





Truth table for D Latch :

Inputs		Outputs		Comments
EN	D	Q	$\bar{Q}$	
0	X	NC	NC	No change
1	1	1	0	SET
1	0	0	1	RESET



Determine Q if the D-latch is initially RESET

EDGE - TRIGGERED FLIP - FLOPS

A flip-flop is a synchronous bistable device. An edge-triggered flip-flop changes state either at the positive edge (rising edge) or at the negative edge (falling edge) of the clock pulse and is sensitive to its inputs only at this transition of the clock.

The Edge-Triggered S-R flip-flops :

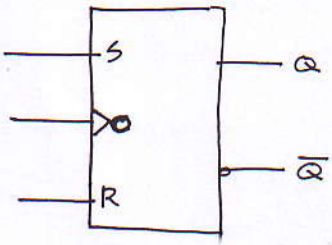


Fig : Logic symbol of positive edge triggered SR flipflop.

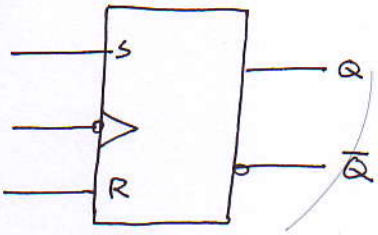
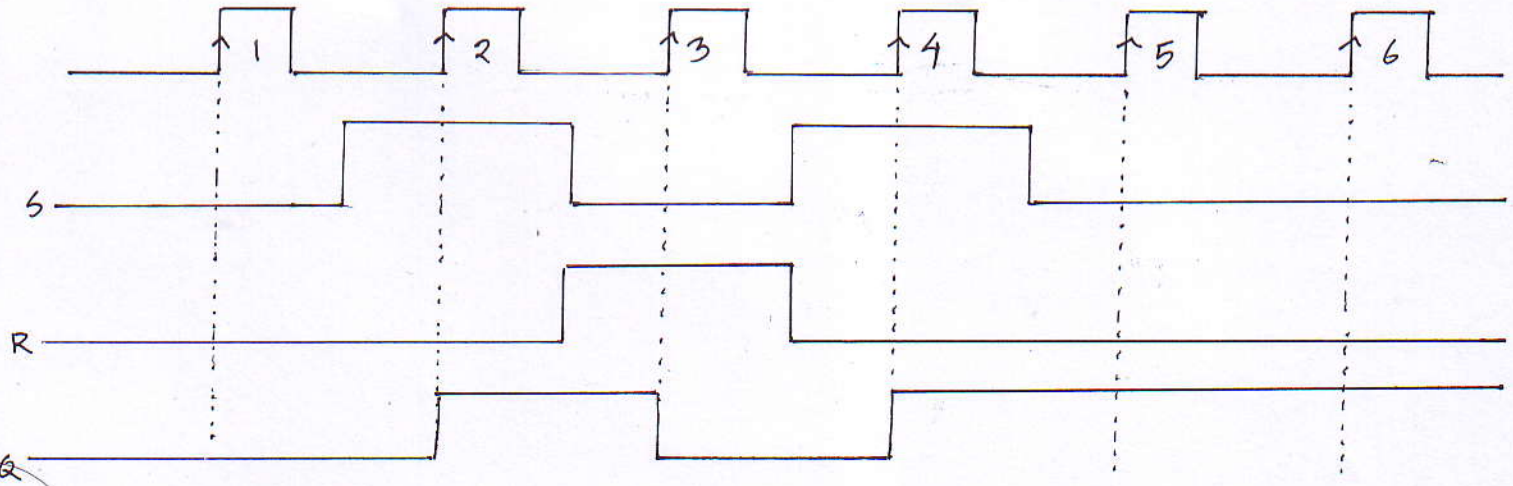


Fig : Logic symbol of negative edge triggered SR flip flop.

Inputs			Outputs		comments
S	R	Clk	Q	$\overline{Q}$	
0	0	X	NC	NC	No change
0	1	↑	0	1	RESET
1	0	↑	1	0	SET
1	1	↑	?	?	Invalid



Determine Q if the positive edge triggered flip flop is

A method of Edge-Triggering :

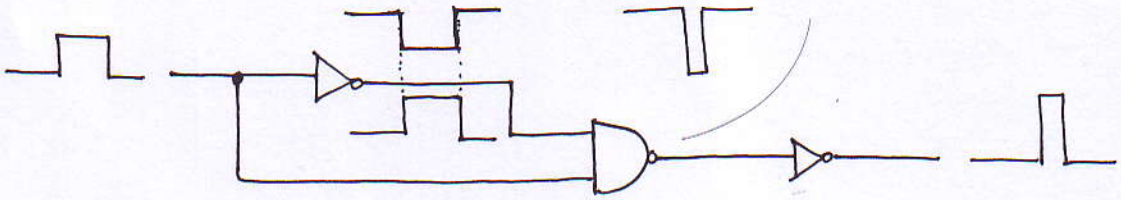


Fig : Pulse transition detector