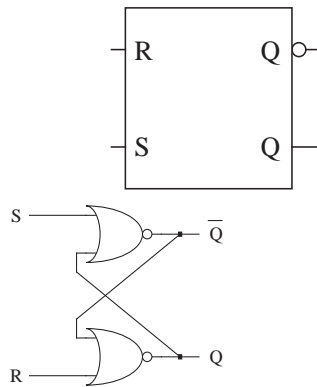


Latches

S-R (Set/Reset) Latch:

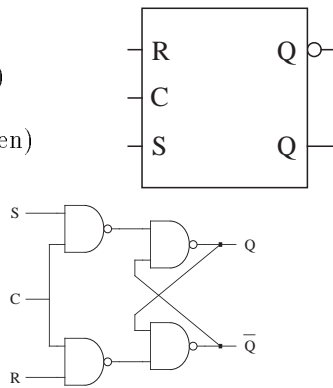
<i>S</i>	<i>R</i>	<i>Q</i> ⁺	<i>Q'</i> ⁺	
0	0	hold		
0	1	0	1	(reset)
1	0	1	0	(set)
1	1	0	0	(forbidden)



$$Q^+ = S + \bar{R}Q$$

Clocked (level sensitive) S-R (Set/Reset) Latch:

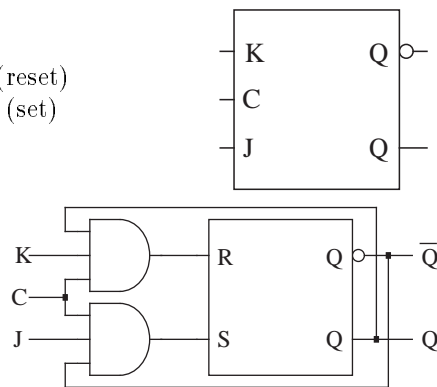
<i>S</i>	<i>R</i>	<i>C</i>	<i>Q</i> ⁺	<i>Q'</i> ⁺	
0	0	1	hold		
0	1	1	0	1	(reset)
1	0	1	1	0	(set)
1	1	1	0	0	(forbidden)
<i>x</i>	<i>x</i>	0	hold		



$$Q^+ = S + \bar{R}Q$$

Clocked (level sensitive) J-K Latch:

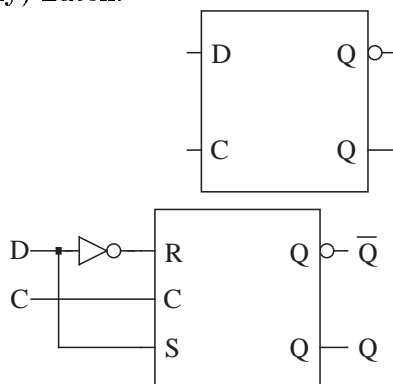
<i>S</i>	<i>R</i>	<i>C</i>	<i>Q</i> ⁺	<i>Q'</i> ⁺	
0	0	1	hold		
0	1	1	0	1	(reset)
1	0	1	1	0	(set)
1	1	1	toggle		
<i>x</i>	<i>x</i>	0	hold		



$$Q^+ = J\bar{Q} + \bar{K}Q$$

Clocked (level sensitive) D (Delay) Latch:

<i>D</i>	<i>C</i>	<i>Q</i> ⁺	<i>Q'</i> ⁺	
0	1	0	1	(reset)
1	1	1	0	(set)
<i>x</i>	0	hold		

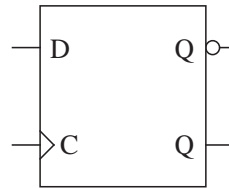


$$Q^+ = J\bar{Q} + \bar{K}Q$$

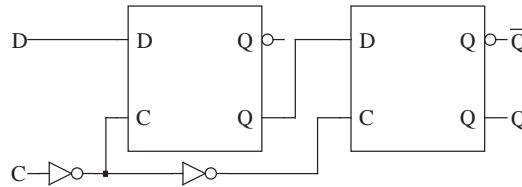
Flip-Flops

D Flip-Flop (Positive Edge-Triggered):

D	C	Q ⁺	Q' ⁺	
0	↑	0	1	(reset)
1	↑	1	0	(set)
x	not ↑	hold		

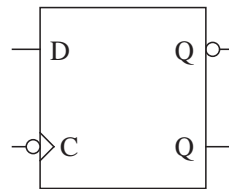


$$Q^+ = J\bar{Q} + \bar{K}Q$$

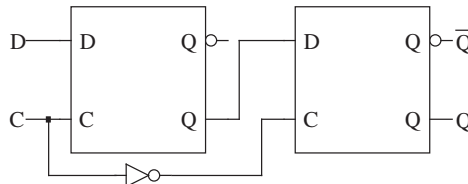


D Flip-Flop (Negative Edge-Triggered):

D	C	Q ⁺	Q' ⁺	
0	↓	0	1	(reset)
1	↓	1	0	(set)
x	not ↓	hold		

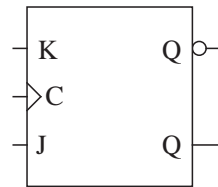


$$Q^+ = J\bar{Q} + \bar{K}Q$$

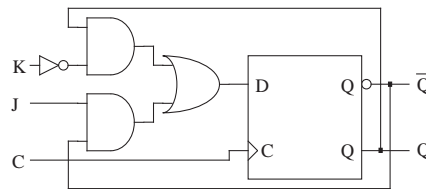


J-K Flip-Flop (Positive Edge-Triggered):

S	R	C	Q ⁺	Q' ⁺	
0	0	↑	hold		
0	1	↑	0	1	(reset)
1	0	↑	1	0	(set)
1	1	↑	toggle		
x	x	not ↑	hold		

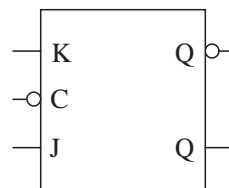


$$Q^+ = J\bar{Q} + \bar{K}Q$$

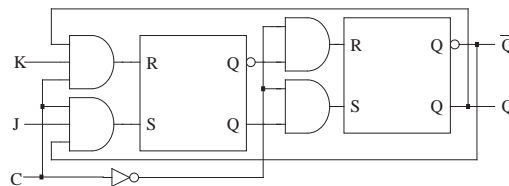


J-K Flip-Flop (Master/Slave):

S	R	C	Q ⁺	Q' ⁺	
0	0	⌊	hold		
0	1	⌊	0	1	(reset)
1	0	⌊	1	0	(set)
1	1	⌊	toggle		
x	x	else	hold		

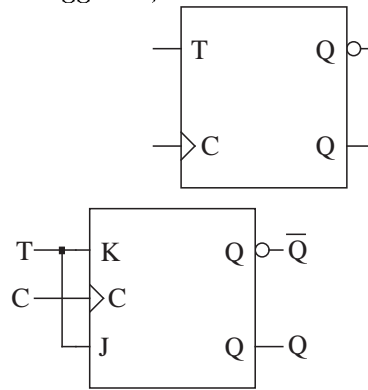


$$Q^+ = J\bar{Q} + \bar{K}Q$$



T (Toggle) Flip-Flop (Positive Edge-Triggered):

T	C	Q^+	Q'^+
0	↑	hold	
1	↑	toggle	
x	not ↑	hold	



$$Q^+ = T \oplus Q$$