
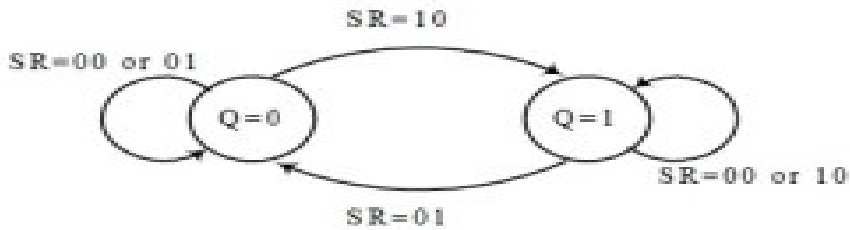

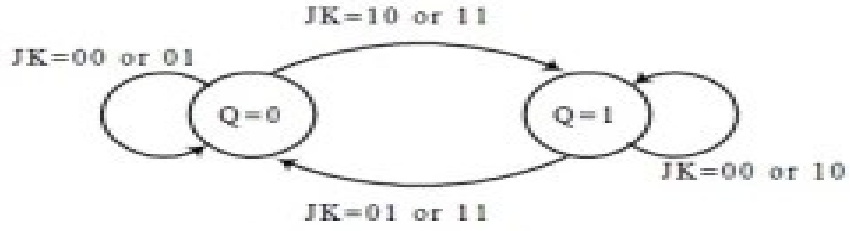

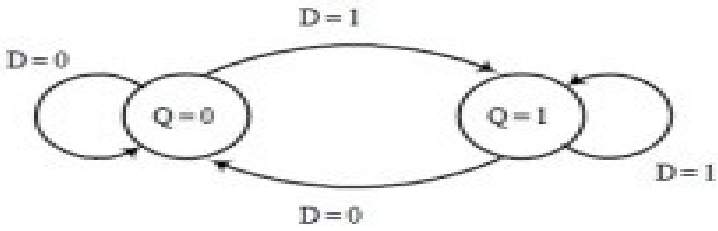
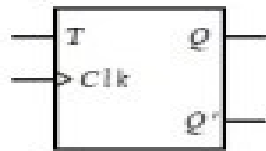
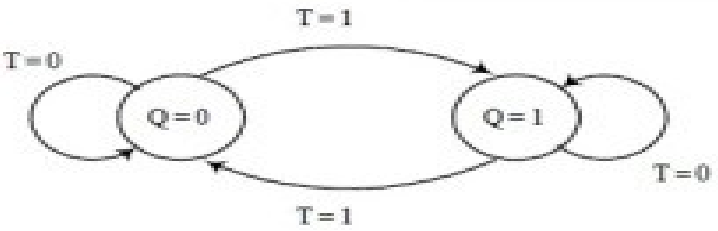


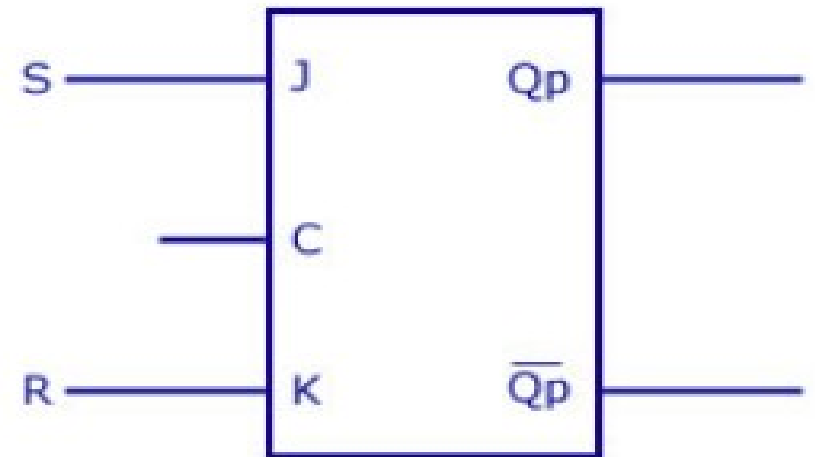
Name / Symbol	Characteristic (Truth) Table	State Diagram / Characteristic Equations	Excitation Table																																																								
<div>SR</div> <div></div>	<table><tr><th>S</th><th>R</th><th>Q</th><th>Q<sub>next</sub></th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>×</td></tr><tr><td>1</td><td>1</td><td>1</td><td>×</td></tr></table>	S	R	Q	Q <sub>next</sub>	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1	0	×	1	1	1	×	<div></div> <div><math display="block">Q_{next} = S + R'Q</math><math display="block">SR = 0</math></div>	<table><tr><th>Q</th><th>Q<sub>next</sub></th><th>S</th><th>R</th></tr><tr><td>0</td><td>0</td><td>0</td><td>×</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>×</td><td>0</td></tr></table>	Q	Q <sub>next</sub>	S	R	0	0	0	×	0	1	1	0	1	0	0	1	1	1	×	0
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<div>JK</div> <div></div>	<table><tr><th>J</th><th>K</th><th>Q</th><th>Q<sub>next</sub></th></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></table>	J	K	Q	Q <sub>next</sub>	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	0	<div></div> <div><math display="block">Q_{next} = J'K'Q + JK' + JKQ'</math><math display="block">= J'K'Q + JK'Q + JK'Q' + JKQ'</math><math display="block">= K'Q(J' + J) + JQ'(K' + K)</math><math display="block">= K'Q + JQ'</math></div>	<table><tr><th>Q</th><th>Q<sub>next</sub></th><th>J</th><th>K</th></tr><tr><td>0</td><td>0</td><td>0</td><td>×</td></tr><tr><td>0</td><td>1</td><td>1</td><td>×</td></tr><tr><td>1</td><td>0</td><td>×</td><td>1</td></tr><tr><td>1</td><td>1</td><td>×</td><td>0</td></tr></table>	Q	Q <sub>next</sub>	J	K	0	0	0	×	0	1	1	×	1	0	×	1	1	1	×	0
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<div>D</div> <div></div>	<table><tr><th>D</th><th>Q</th><th>Q<sub>next</sub></th></tr><tr><td>0</td><td>×</td><td>0</td></tr><tr><td>1</td><td>×</td><td>1</td></tr></table>	D	Q	Q <sub>next</sub>	0	×	0	1	×	1	<div></div> <div><math display="block">Q_{next} = D</math></div>	<table><tr><th>Q</th><th>Q<sub>next</sub></th><th>D</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>	Q	Q <sub>next</sub>	D	0	0	0	0	1	1	1	0	0	1	1	1																																
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<div>T</div> <div></div>	<table><tr><th>T</th><th>Q</th><th>Q<sub>next</sub></th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	T	Q	Q <sub>next</sub>	0	0	0	0	1	1	1	0	1	1	1	0	<div></div> <div><math display="block">Q_{next} = TQ' + T'Q = T \oplus Q</math></div>	<table><tr><th>Q</th><th>Q<sub>next</sub></th><th>T</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>	Q	Q <sub>next</sub>	T	0	0	0	0	1	1	1	0	1	1	1	0																										
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# J-K Flip Flop to S-R Flip Flop

Conversion Table

S-R Inputs		Outputs		J-K Inputs	
S	R	Q <sub>p</sub>	Q <sub>p+1</sub>	J	K
0	0	0	0	0	X
0	0	1	1	X	0
0	1	0	0	0	X
0	1	1	0	X	1
1	0	0	1	1	X
1	0	1	1	X	0
1	1	Invalid		Dont care	
1	1	Invalid		Dont care	

Logic Diagram



S	RQ <sub>p</sub>			
	00	01	11	10
0	0 <sup>0</sup>	X <sup>1</sup>	X <sup>3</sup>	0 <sup>2</sup>
1	1 <sup>4</sup>	X <sup>5</sup>	X <sup>7</sup>	X <sup>6</sup>

J=S

S	RQ <sub>p</sub>			
	00	01	11	10
0	X <sup>0</sup>	0 <sup>1</sup>	1 <sup>3</sup>	X <sup>2</sup>
1	X <sup>4</sup>	0 <sup>5</sup>	X <sup>7</sup>	X <sup>6</sup>

K=R

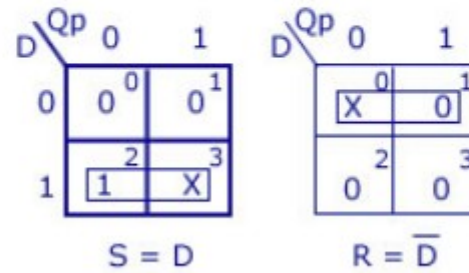
K=R

## S-R Flip Flop to D Flip Flop

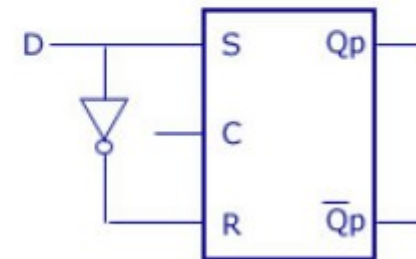
Conversion Table

D Input	Outputs		S-R Inputs	
	$Q_p$	$Q_{p+1}$	S	R
0	0	0	0	X
0	1	0	0	1
1	0	1	1	0
1	1	1	X	0

K-maps



Logic Diagram



## D Flip Flop to S-R Flip Flop

Conversion Table

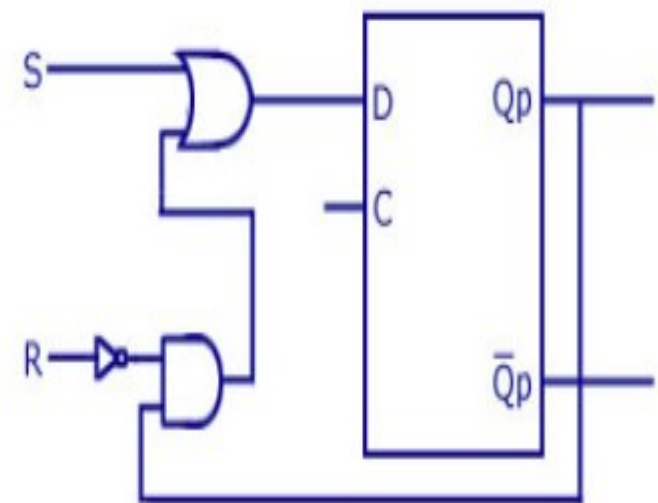
S-R Inputs		Outputs		D Input
S	R	Q <sub>p</sub>	Q <sub>p+1</sub>	
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	Invalid		Dont care
1	1	Invalid		Dont care

K-map

S \ RQ <sub>p</sub>				
	00	01	11	10
0	0	1	0	0
1	1	1	X	X

$$D = S + \bar{R}Q_n$$

Logic Diagram



## J-K Flip Flop to T Flip Flop

Conversion Table

T Input	Outputs		J-K Inputs	
	$Q_p$	$Q_{p+1}$	J	K
0	0	0	0	X
0	1	1	X	0
1	0	1	1	X
1	1	0	X	1

K-maps

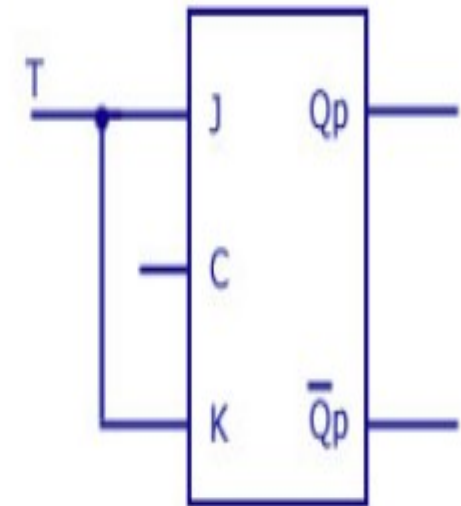
T	$Q_p$		
	0	1	
0	0	X	
1	1	X	

$J=T$

T	$Q_p$		
	0	1	
0	X	0	
1	X	1	

$K=T$

Logic Diagram

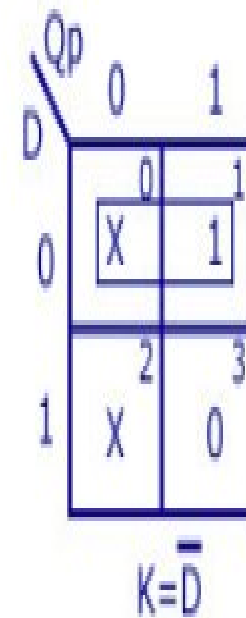
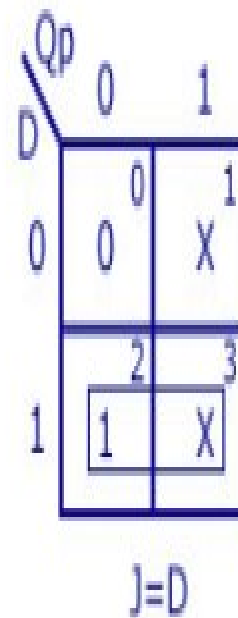


## J-K Flip Flop to D Flip Flop

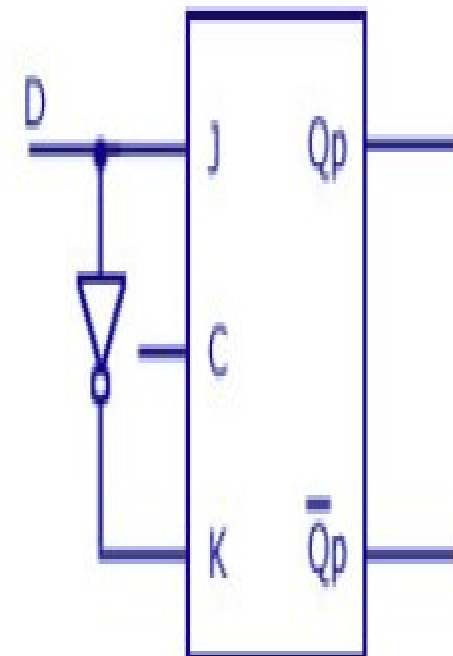
Conversion Table

D Input	Outputs		J-K Inputs	
	$Q_p$	$Q_{p+1}$	J	K
0	0	0	0	X
0	1	0	X	1
1	0	1	1	X
1	1	0	X	0

K-maps



Logic Diagram



## D Flip Flop to J-K Flip Flop

Conversion Table

J-K Input		Outputs		D Input
J	K	Q <sub>p</sub>	Q <sub>p+1</sub>	
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

K-map

		KQ <sub>p</sub>			
		00	01	11	10
J	0	0	1	0	0
	1	1	1	0	1

$$D = J\bar{Q}_p + \bar{K}Q_p$$

Logic Diagram

