

Digital System Design

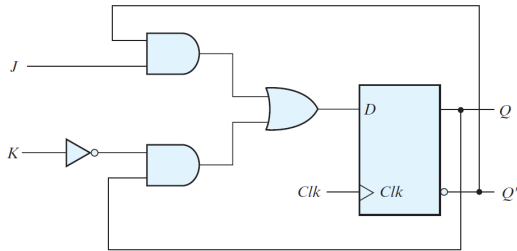
Module 4 - SEQUENTIAL LOGIC CIRCUITS

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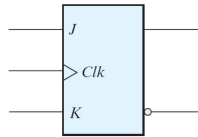
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JK Flip-Flops



(a) Circuit diagram



(b) Graphic symbol

JK flip-flop

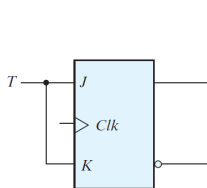
J	K	D	Q
1	0	$Q' + Q$	1
0	1	0	0
1	1	Q'	Q'
0	0	Q	Q

$$D = JQ' + K'Q$$

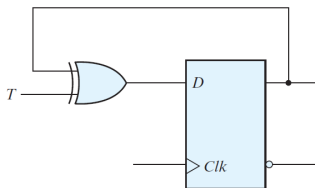
OR

$$Q = JQ' + K'Q$$

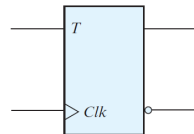
T (toggle) flip-flop



(a) From JK flip-flop



(b) From D flip-flop



(c) Graphic symbol

T (toggle) flip-flop

T	D	Q
1	Q'	Q'
0	Q	Q

$$D = T \oplus Q = TQ' + T'Q$$

Characteristic Tables

Flip-Flop Characteristic Tables

<i>J</i>	<i>K</i>	$Q(t + 1)$	
0	0	$Q(t)$	No change
0	1	0	Reset
1	0	1	Set
1	1	$Q'(t)$	Complement

Characteristic Tables

D Flip-Flop

D	$Q(t + 1)$	
0	0	Reset
1	1	Set

T Flip-Flop

T	$Q(t + 1)$	
0	$Q(t)$	No change
1	$Q'(t)$	Complement