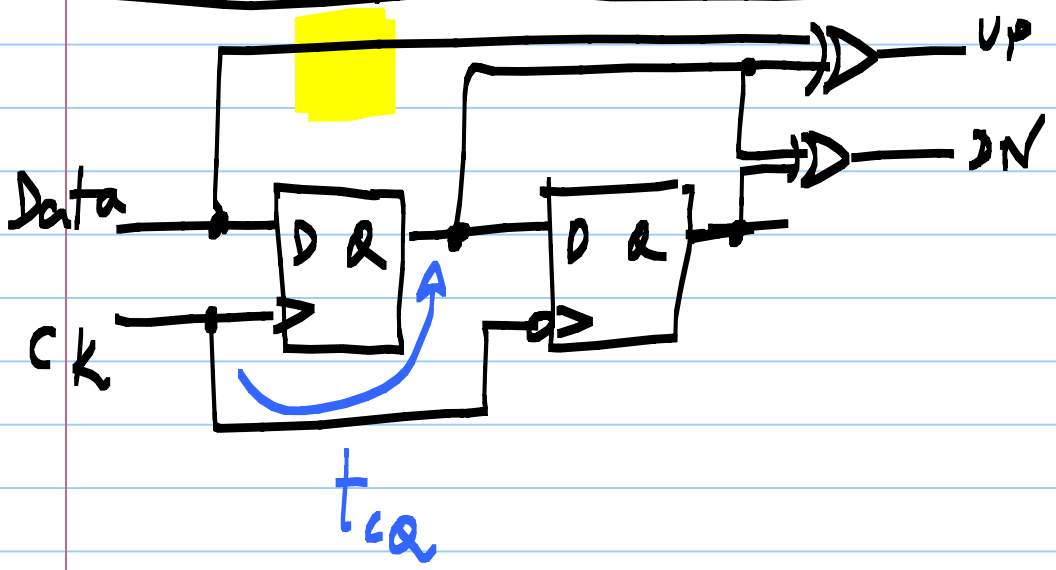
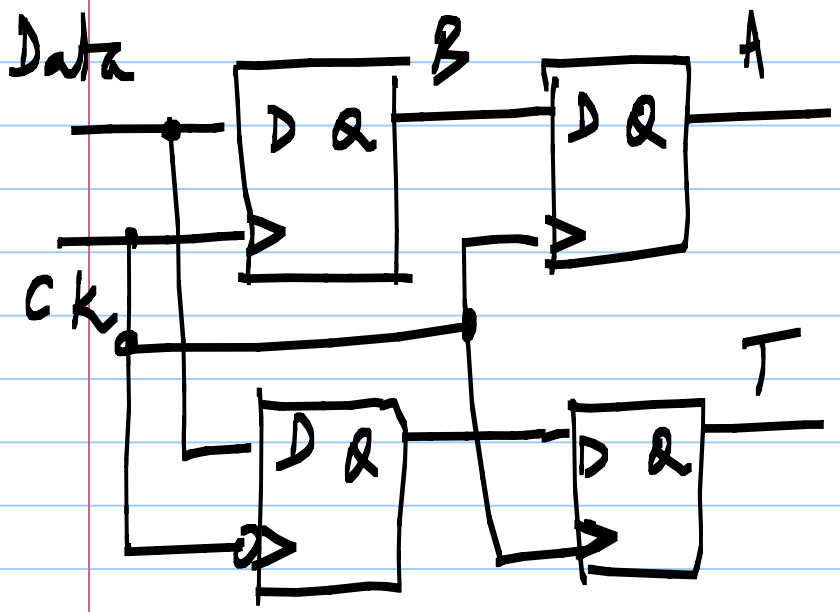
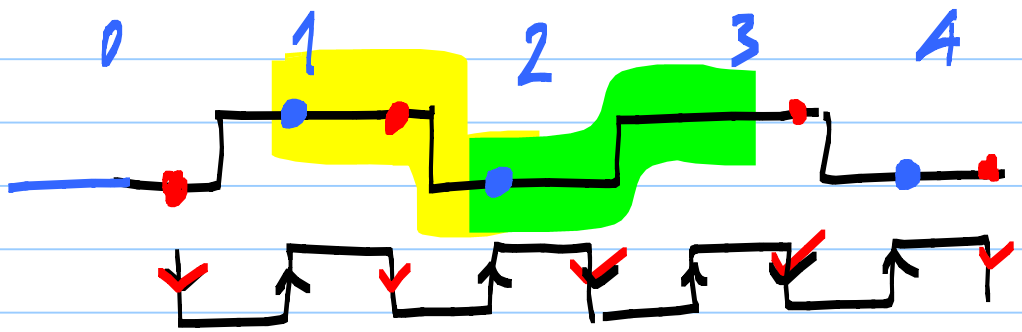
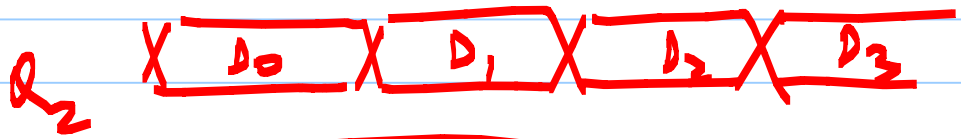
Linear phase detector

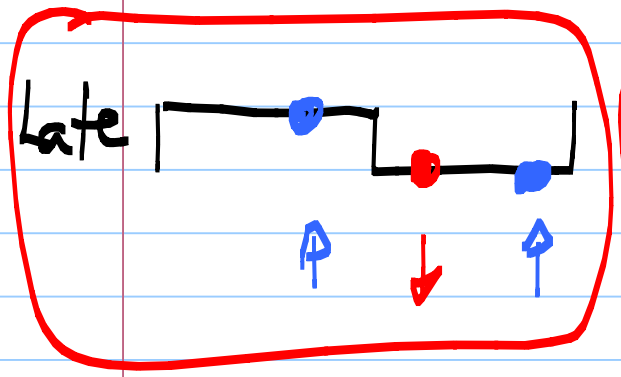


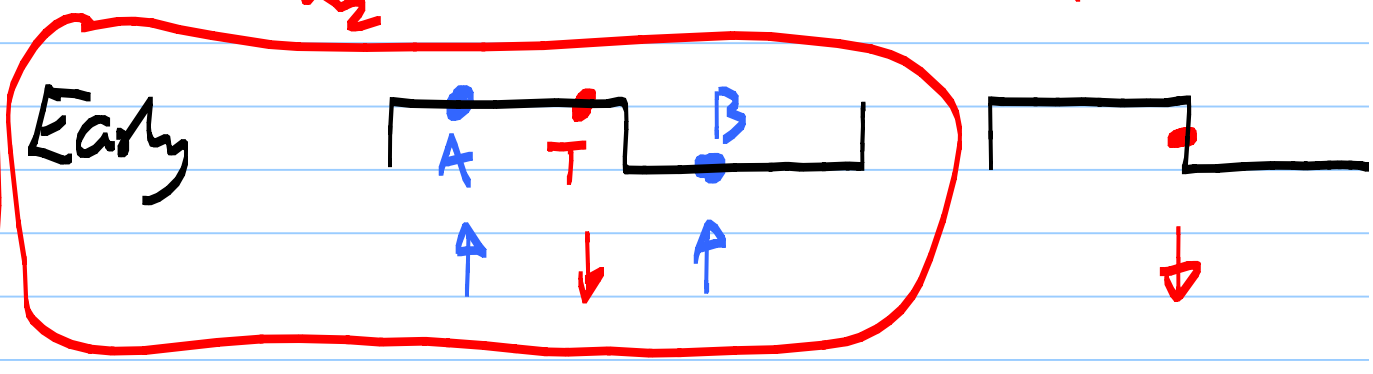

Data
B
A
D Q
D Q
ck
D Q
D Q
T

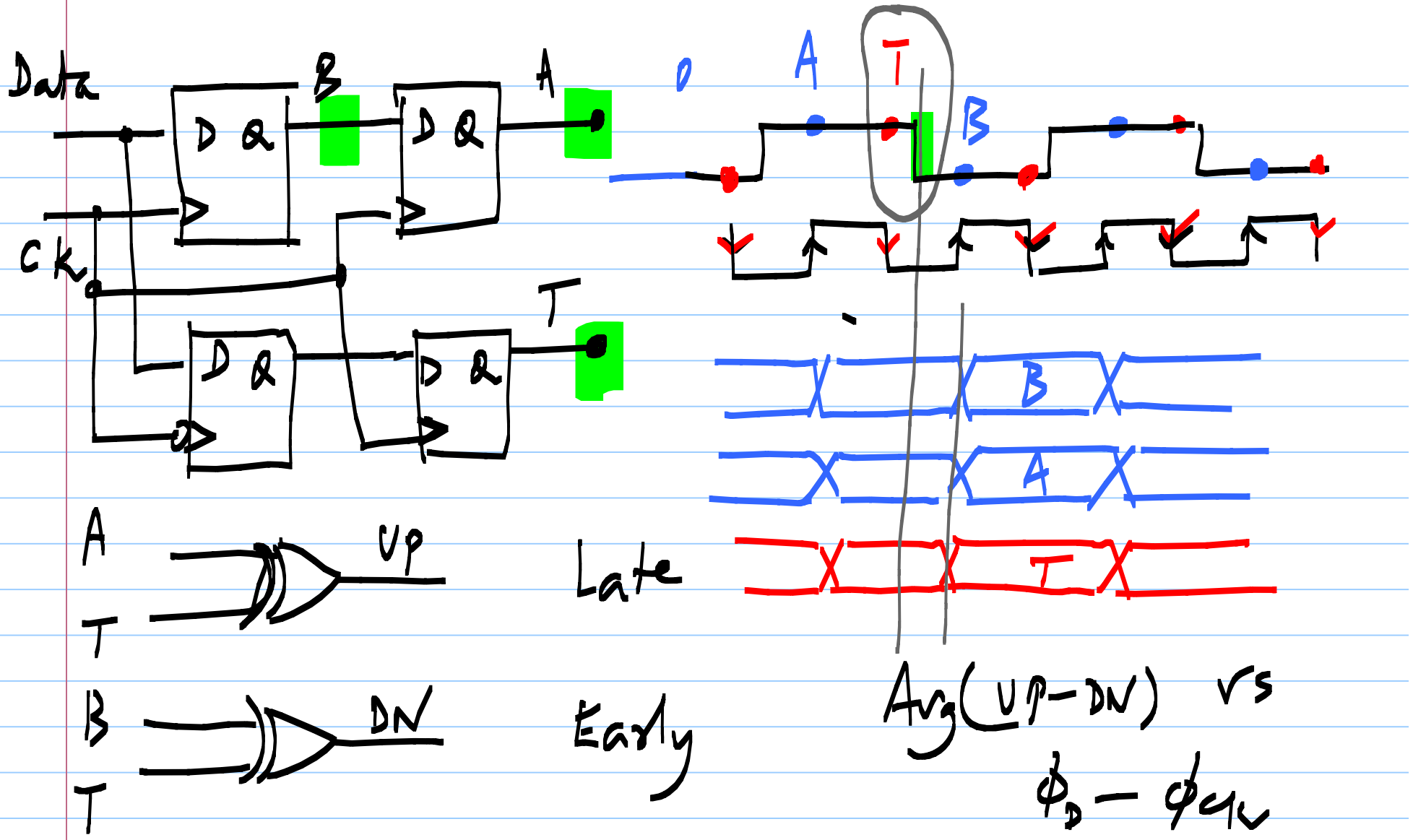

0
1
2
3
4

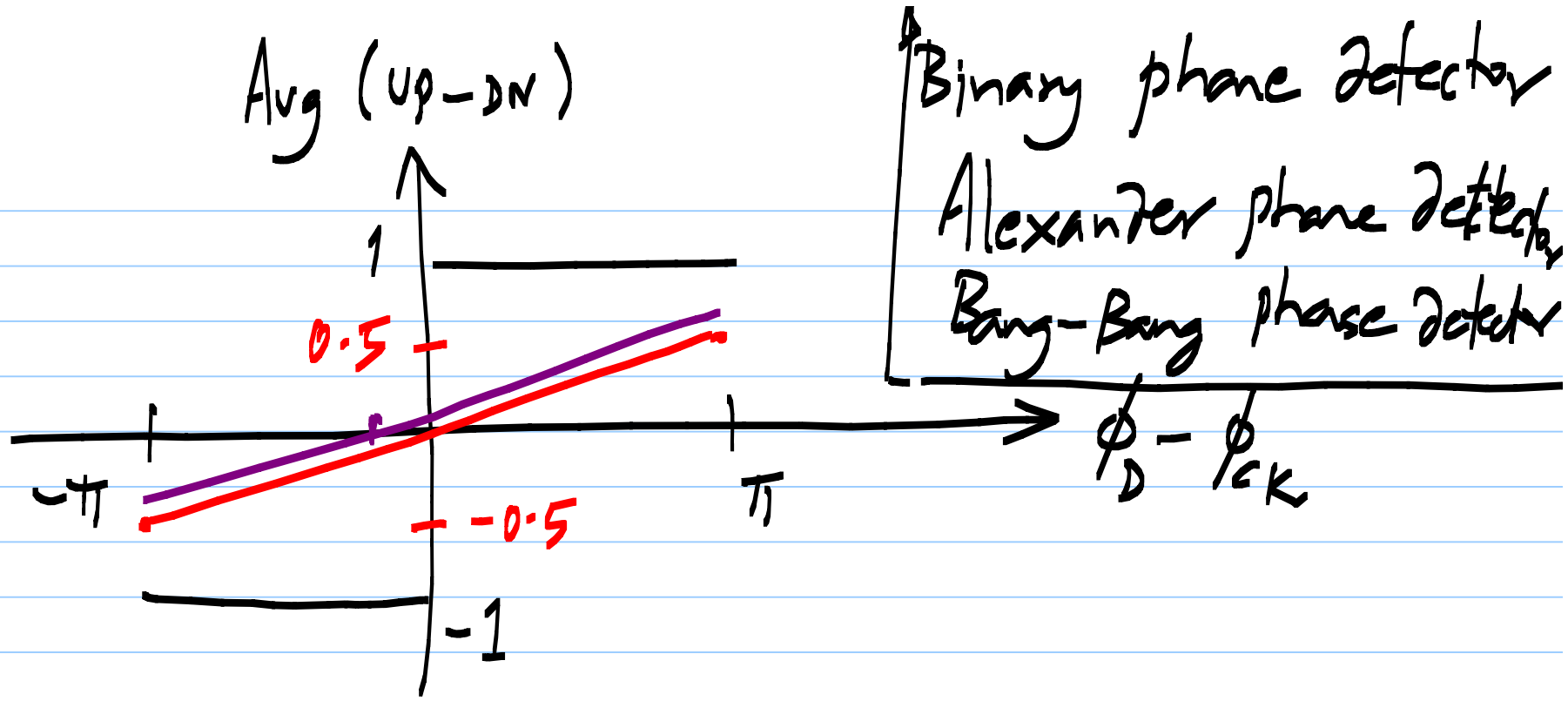

Q_1
D_0
D_1
D_2
D_3


Q_2
D_0
D_1
D_2
D_3


Late


Early
A
T
B


Data
B
A
D Q
D Q
Ck
T
D Q
D Q
A
T
Up
Late
B
DN
Early
Avg(UP-DN) vs
$\phi_D - \phi_{Ck}$


Avg (up-dn)
1
0.5
-0.5
-1
-π
π
Binary phase detector
Alexander phase detector
Bang-Bang phase detector
$\phi_D - \phi_{CK}$

Binary phase detector

\+ No phase offset due to t_{cq}

\+ Can be implemented at lower speed after digitization

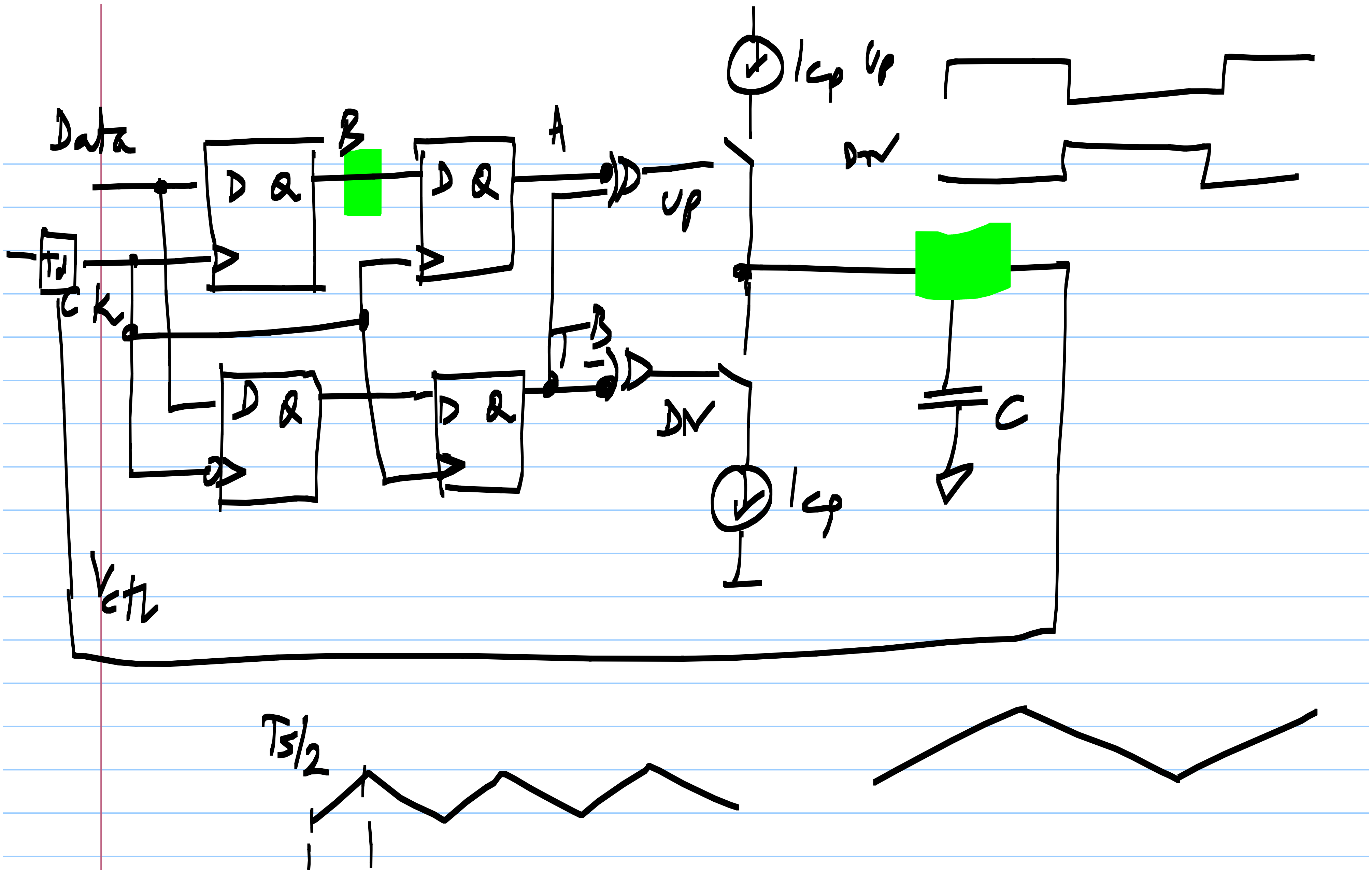
\+ Pulse width (UP, DN) $\geq T_s$

\- Bang-bang jitter

Linear phase detector

\- Phase offset due to t_{cq}

\- Pulse width (UP, DN) $= T_s/2$


Data
B
A
D Q
D Q
D Q
D Q
Td
Ck
B
up
DN
Icp
Up
Dn
Icp
C
Vctl
Ts/2