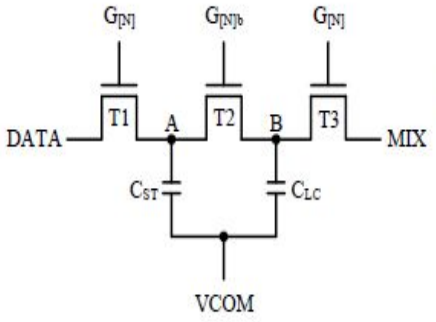
HW3 BPLC Simulation

1.

BPLC pixel circuit *(IEEE/OSA JDT 2015)*



$$V_A = V_{LC} = \frac{1}{2}\left(V_{DATA} + V_{MIX}\right)$$

※ Simulate three conditions and save your waveforms of node A and node B. Please explain the voltage change of node A and B.

=> Enlarge V_{LC} from ±15 V to ±20 V

Simulated parameter:

C_{LC} = 6 pF

C_{ST} = 6 pF

$M_{T1,T2}$ = 100

M_{T3} = 300

VCOM = 0 V

Initial $V_A = V_B$ = 0 V

Simulated condition:

(1) For MIX = 0 V

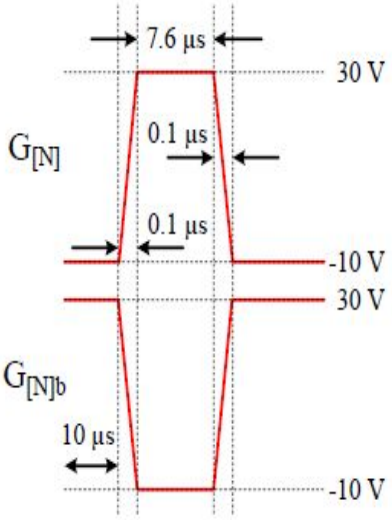
V_{DATA} = 0 V

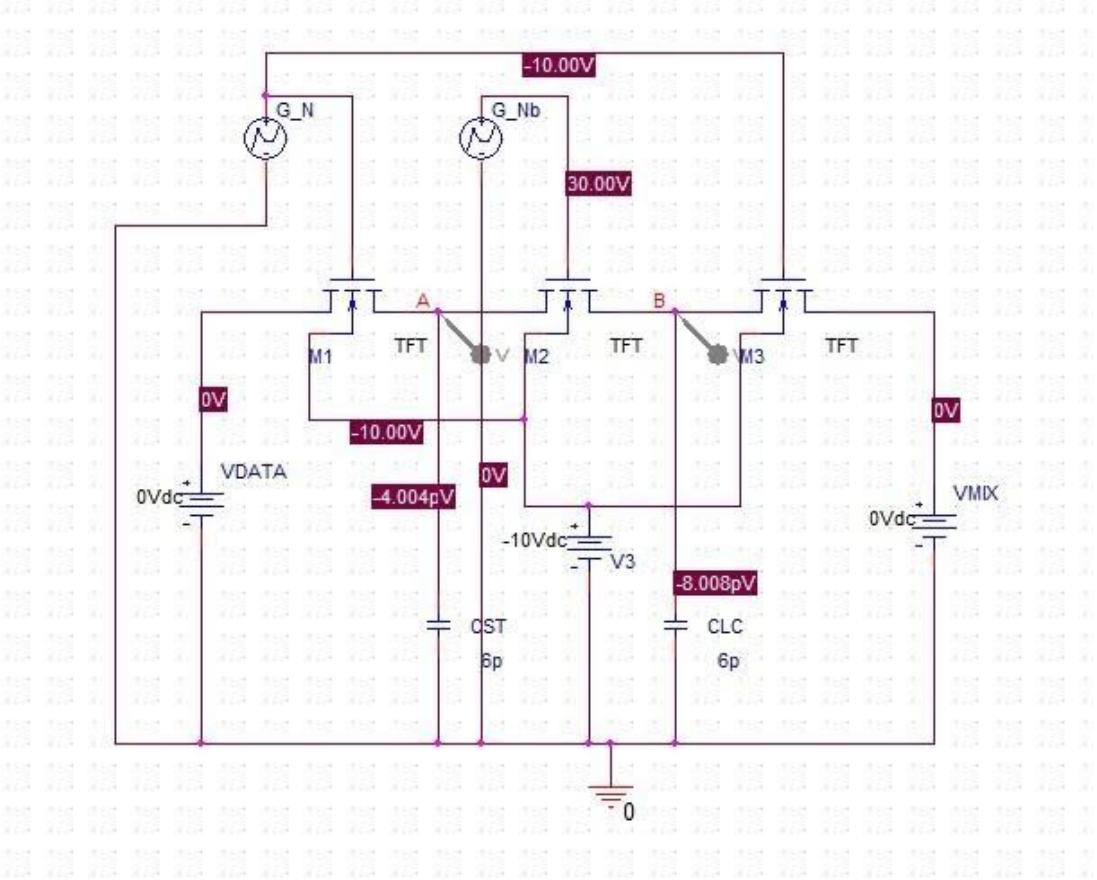
(2) For MIX = 10 V

V_{DATA} = 7.5 V

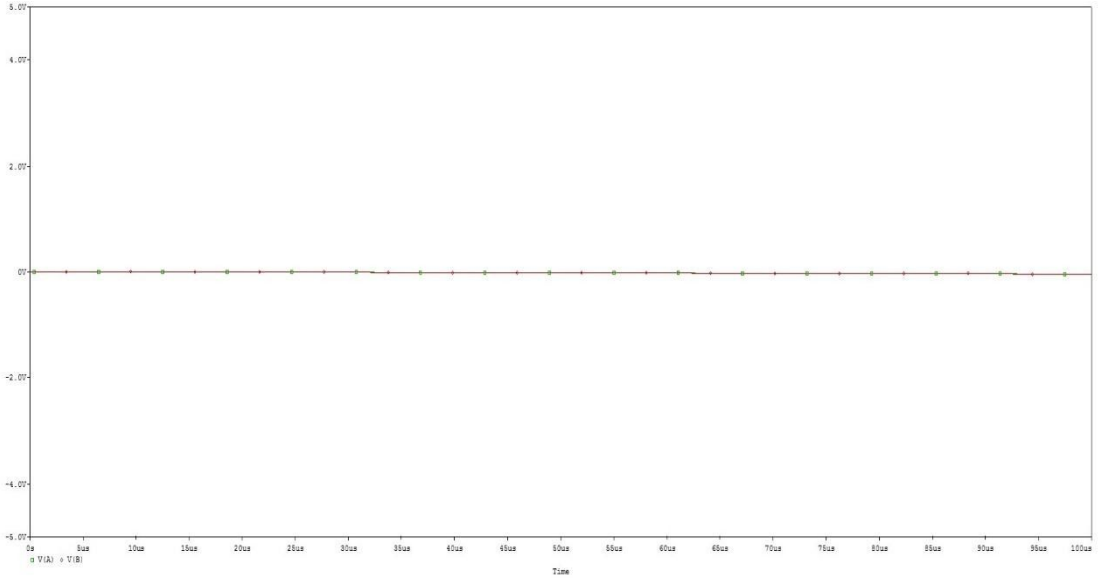
(3) For MIX = 25 V

V_{DATA} = 15 V

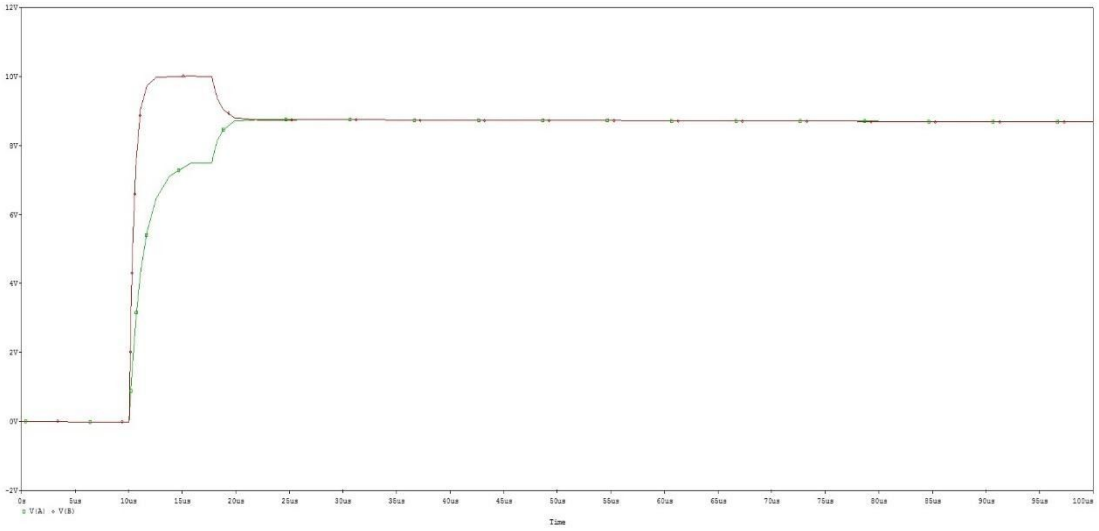




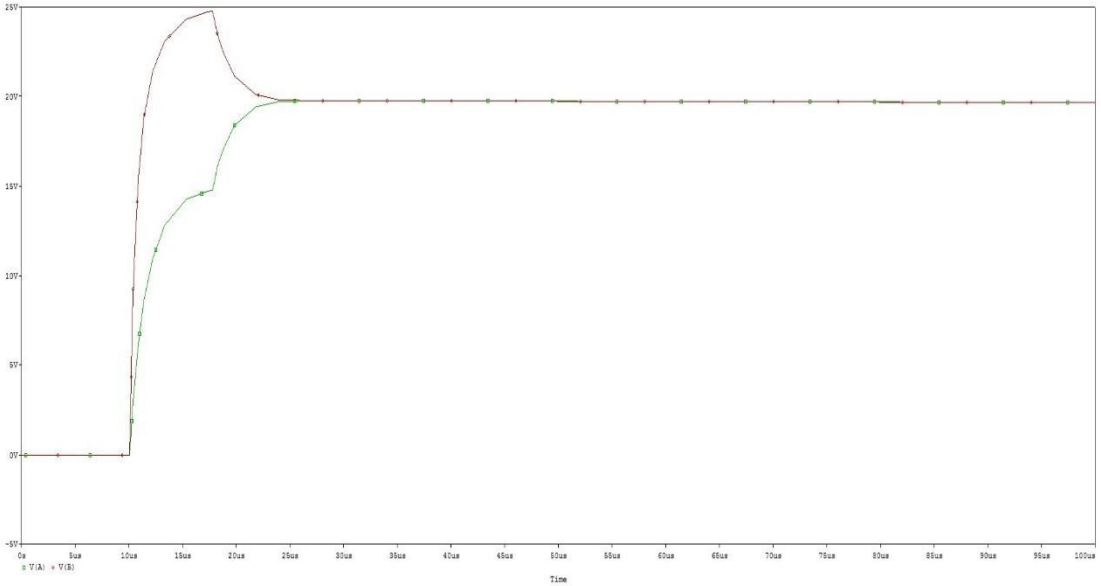
Condition 1:



Condition 2:



Condition 3:



Please explain the voltage change of node A and B.

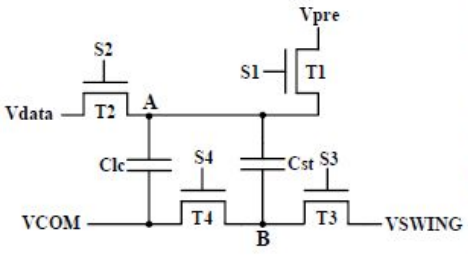
Ans:

$V_A = V_B = 1/2 * (V_{DATA} + V_{MIX})$

可看出$V_{MIX} + V_{DATA}$ 值增加，實際值與理論值差距也增加，發生此結果可能是電容漏電或者其他因素的影響。

2.

BPLC pixel circuit *(IDW 2013)* => **Enlarge V_{LC} from ±15 V to ± 20 V**



※ Simulate normal mode and coupling mode under positive polarity, and save your waveforms of node A and node B. Please explain the voltage change of node A and B.

Simulated parameter:

C_{LC} = 6 pF

C_{ST} = 6 pF

$M_{T1,T2,T3,T4}$ = 100

Vpre = 7.5 V

Initial $V_A = V_B$ = 0 V

Simulated condition:

(1) For VCOM = 0 V

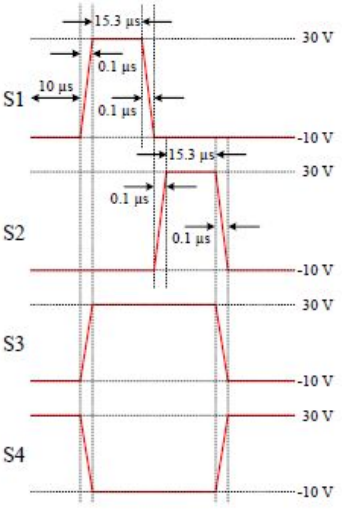
VSWING = 0 V

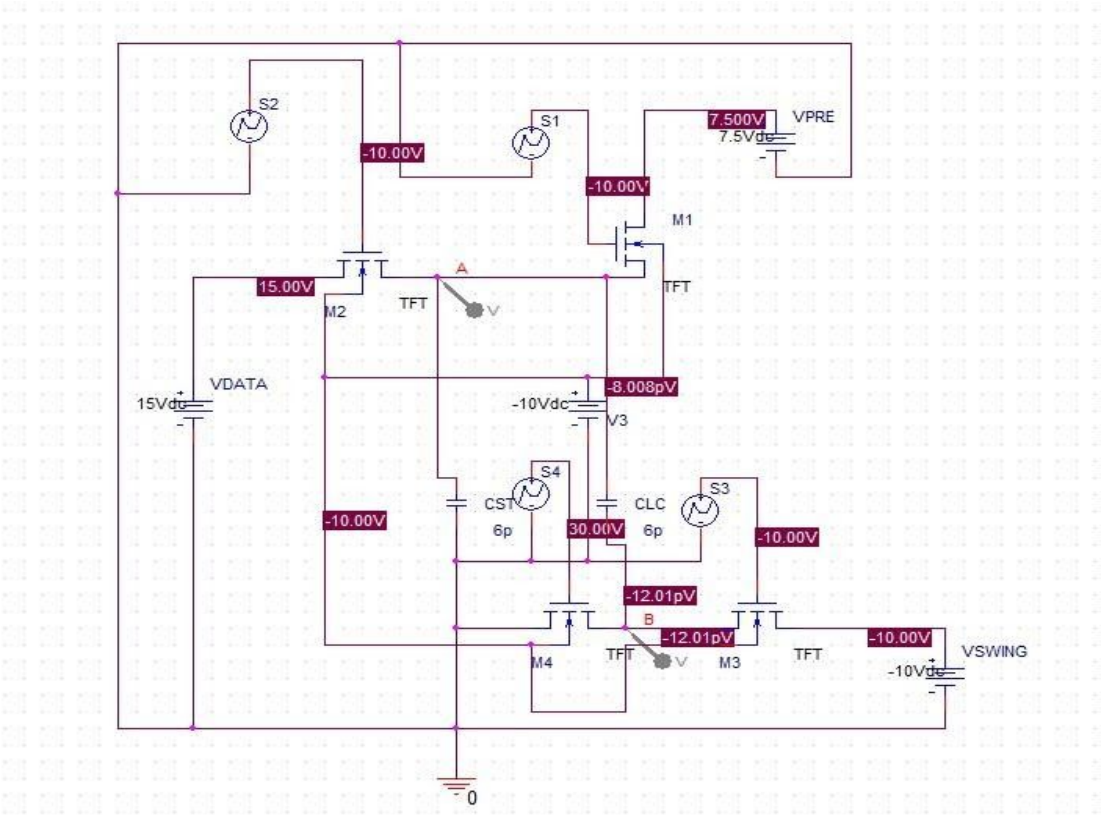
V_{DATA} = 15 V

(2) For VCOM = 0 V

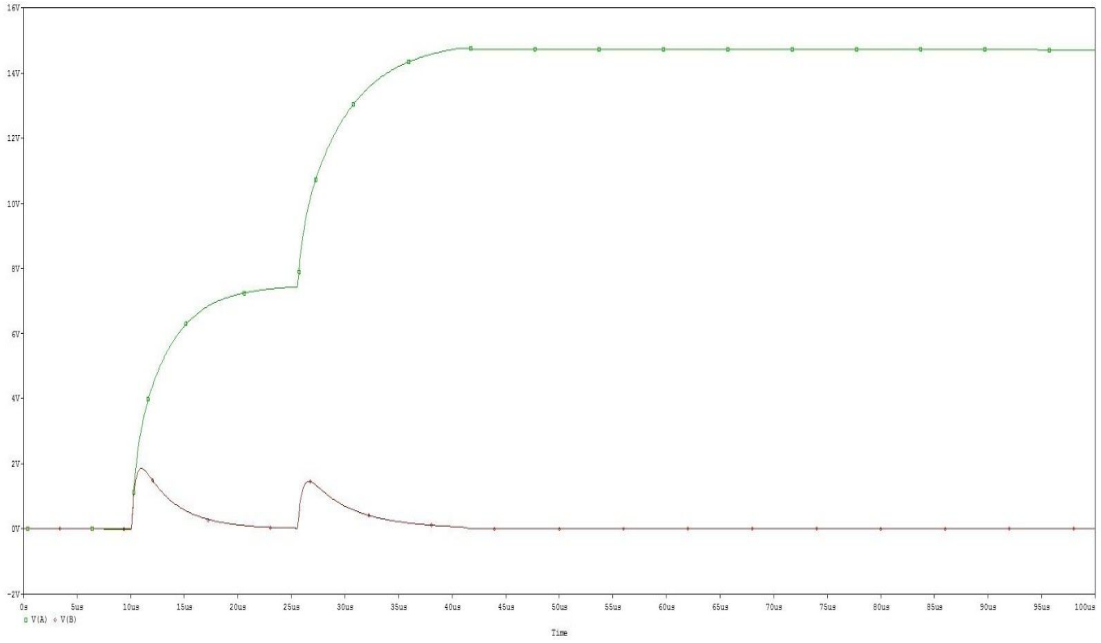
VSWING = -10 V

V_{DATA} = 15 V

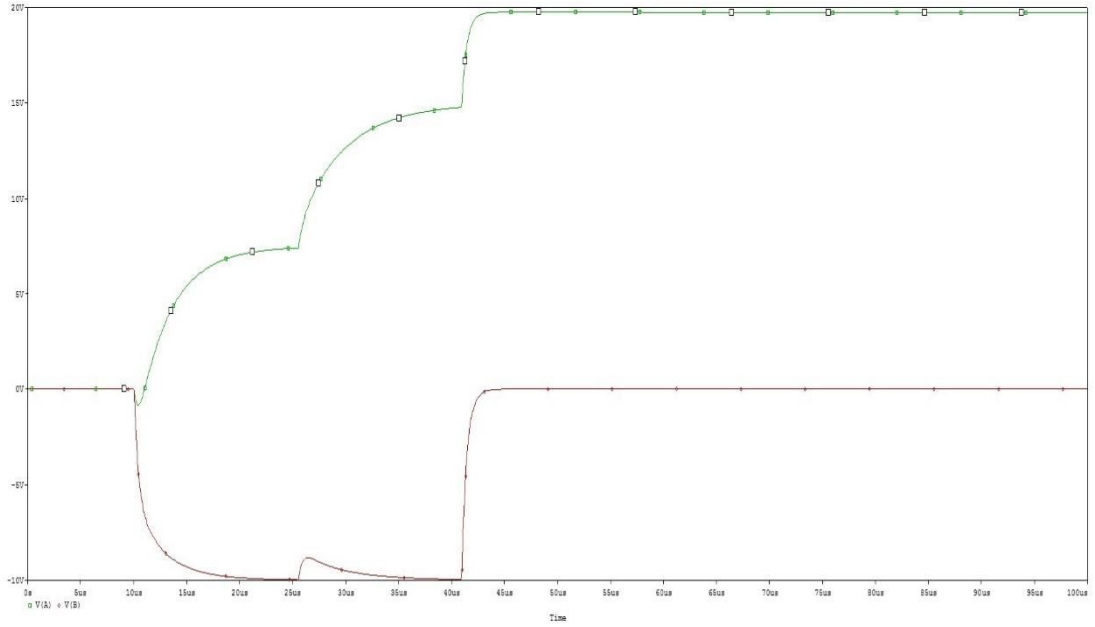




Condition 1:



Condition 2:



Please explain the voltage change of node A and B.

Ans:

Condition 1:

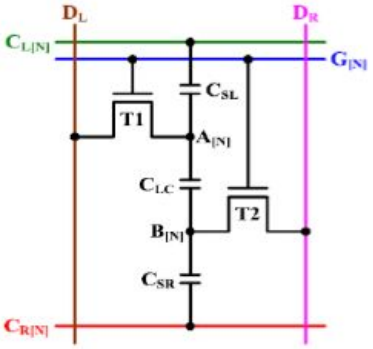
T1打開對A點灌入7.5V，T2打開對A點灌入15V的電壓，灌入電壓的同時，B點受A點影響，電壓略為上升，但因VSWING影響而拉回0V。

Condition 2:

在A點灌入7.5V的同時，B點拉至-10V，A點受B點影響被拉低一點後才開始上升，41us時，T4打開，B點灌入VCOM拉回0V。

3. Pixel operation

BPLC pixel circuit *(IEEE EDL 2015 & SID 2015* distinguished paper)



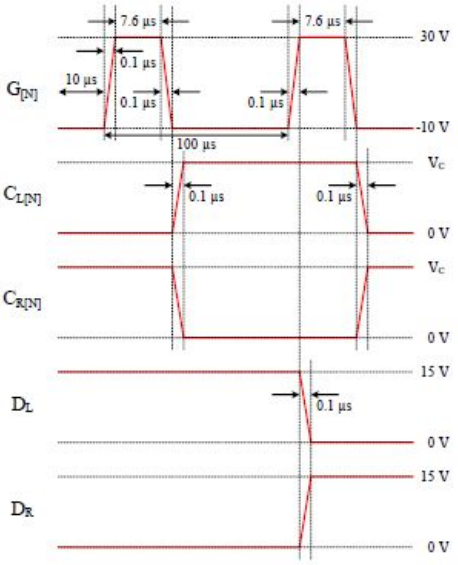
Simulated parameter:

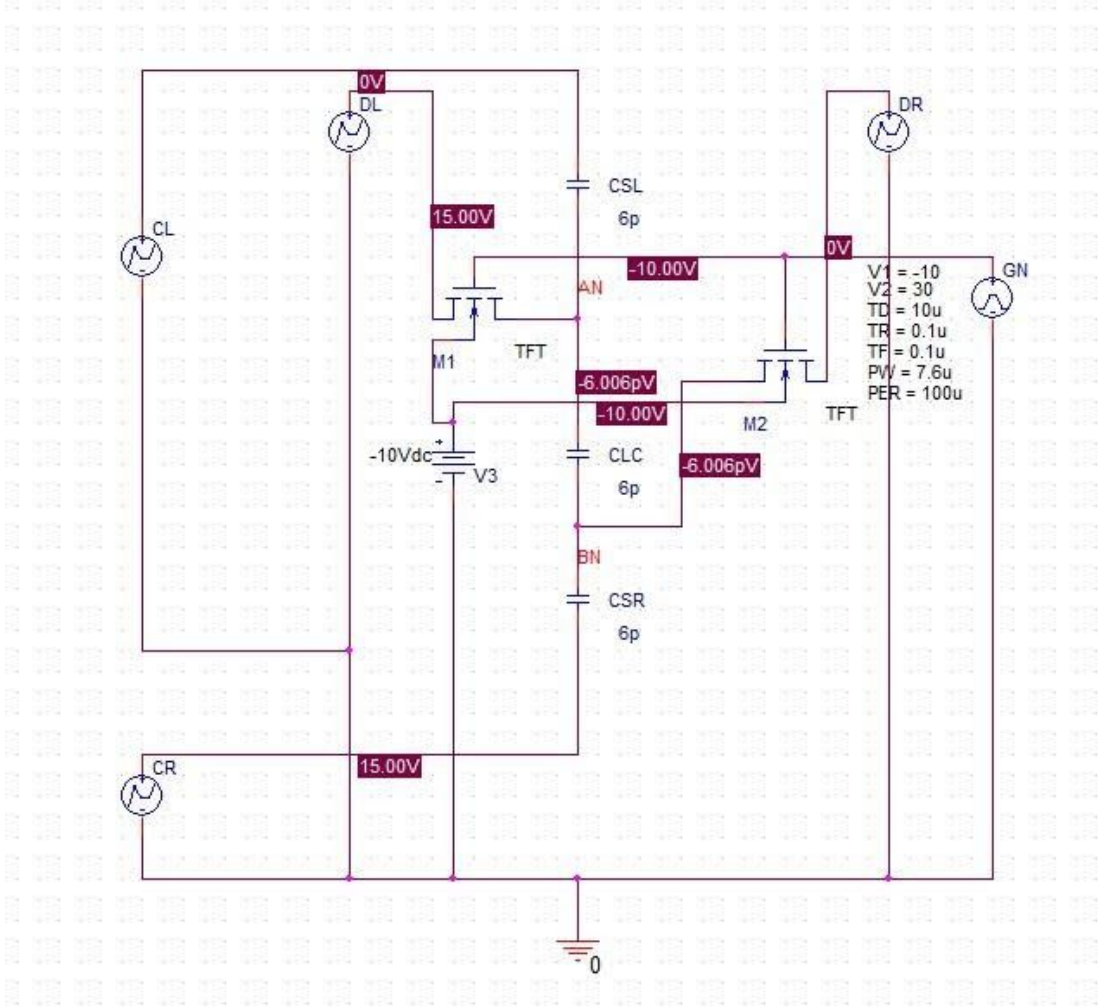
C_{LC} = 6 pF

C_{SL}, C_{SR} = 6 pF

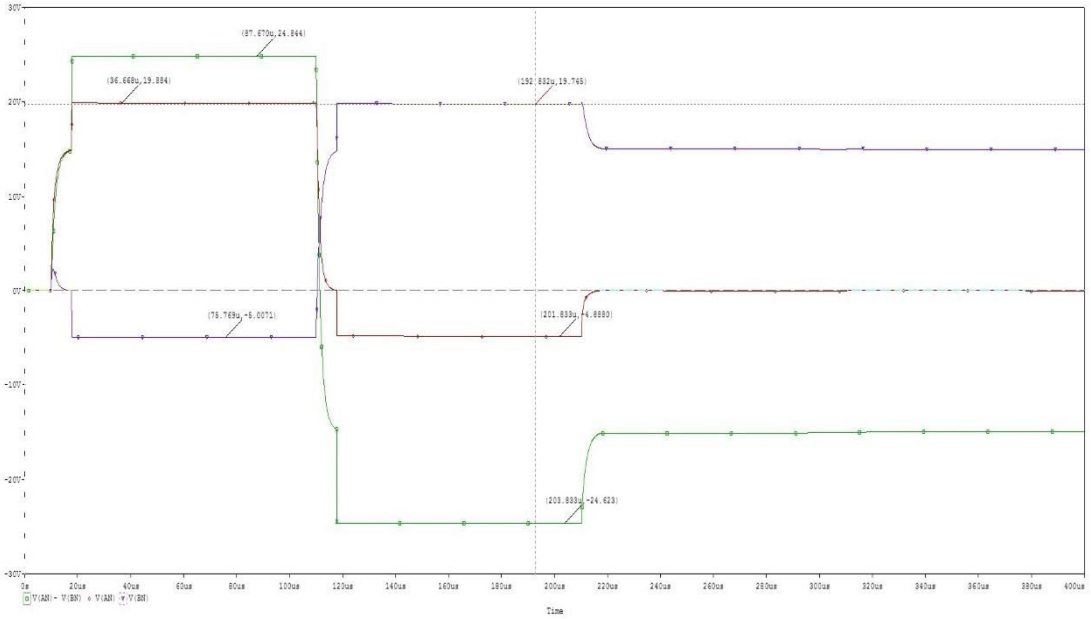
M_{T1}, M_{T2} = 300

Initial $V_A = V_B$ = 0 V





I. Please design the value of V_C to achieve the maximum V_{LC} (A[N]-B[N]) of 25 V and -25 V.

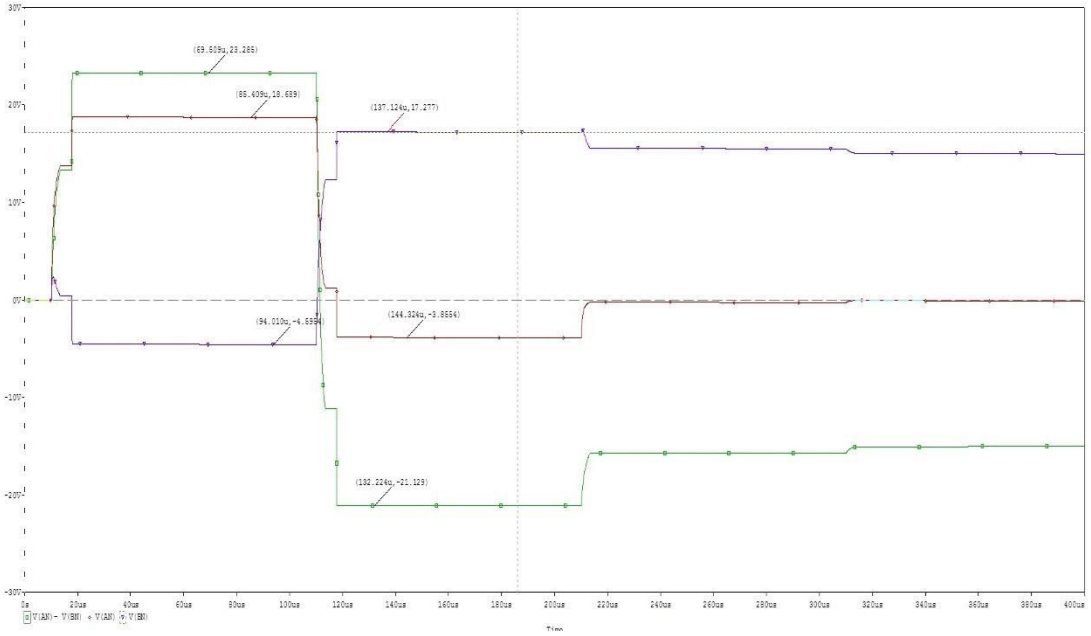


Ans:

$V_{LC} = V_{DL} - V_{DR} \pm (2/3) * V_C$

因此推得V_C =15V

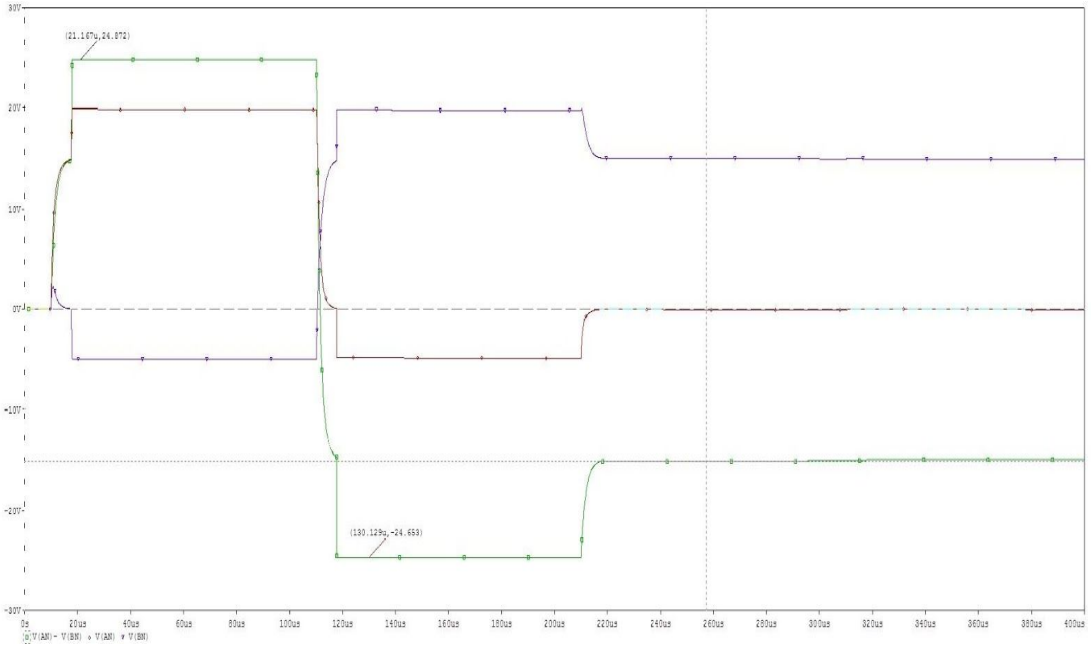
II. If the pulse-width of G[N]is shortened from 7.6 μs to 3.3 μs, please explain what you observe from the waveforms of V_A and V_B.



Ans:

觀察可知充放電曲線有一段為平直線，由於充放電時間不足，因此V_{LC}低於前一模擬。

III. How to adjust problem 2 to achieve the result in problem 1?



Ans:

調整TFT的M值到800左右可得到與第一題相近的結果。