VE311 Hw5 周维崧 518021911039

(a). $A_v = -R_D \mu_n C_{ox} \frac{W}{L} (V_{in} - V_{TH})$

$= -10\times10^3 \times 350\times10^{-4} \times 3.835\times10^{-3} \times \frac{W}{2-2\times0.08} \times (0.9-0.7) = -10.$

$\Rightarrow W_{drawn} = 68.54\ um$

$V_{OUT} = V_{DD} - I_D \cdot R_D$

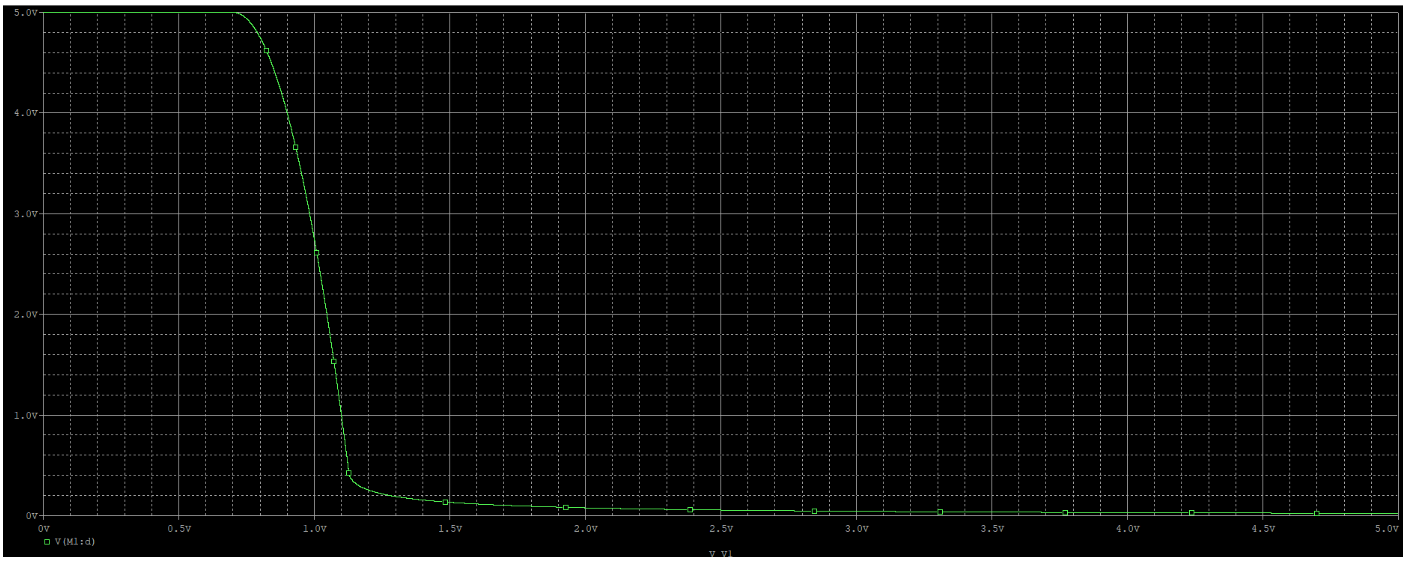
$= 5 - \frac{1}{2}\times350\times10^{-4}\times3.835\times10^{-3}\times\frac{68.54}{2-2\times0.08}\times(0.9-0.7)^2\times10\times10^3$

$= 4.00V$

We can check that $V_{DS} = 4.00 > V_{GS} - V_{TH} = 0.9 - 0.7 = 0.2$

Therefore, it is in saturation region.

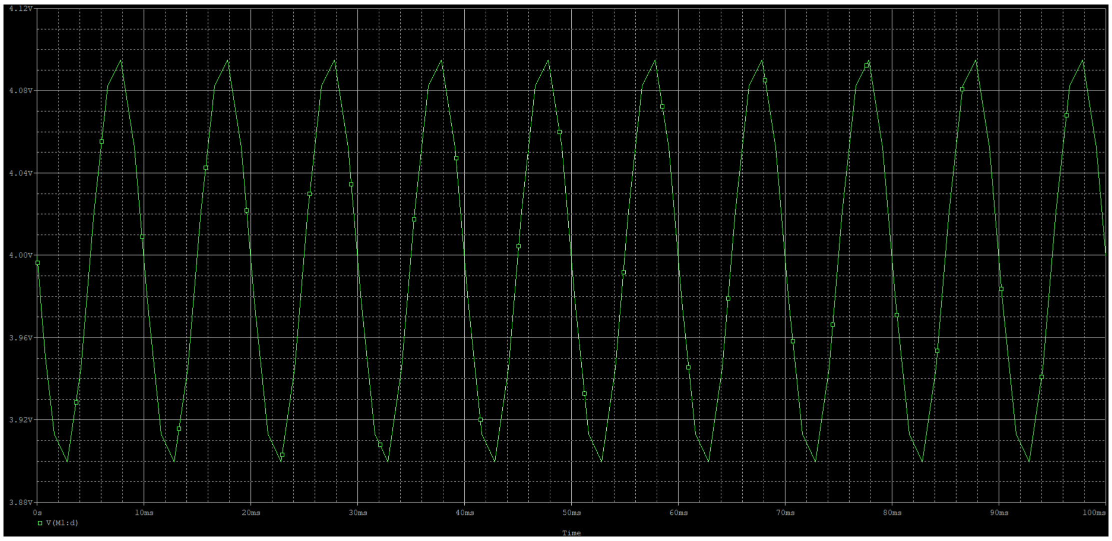
(b).



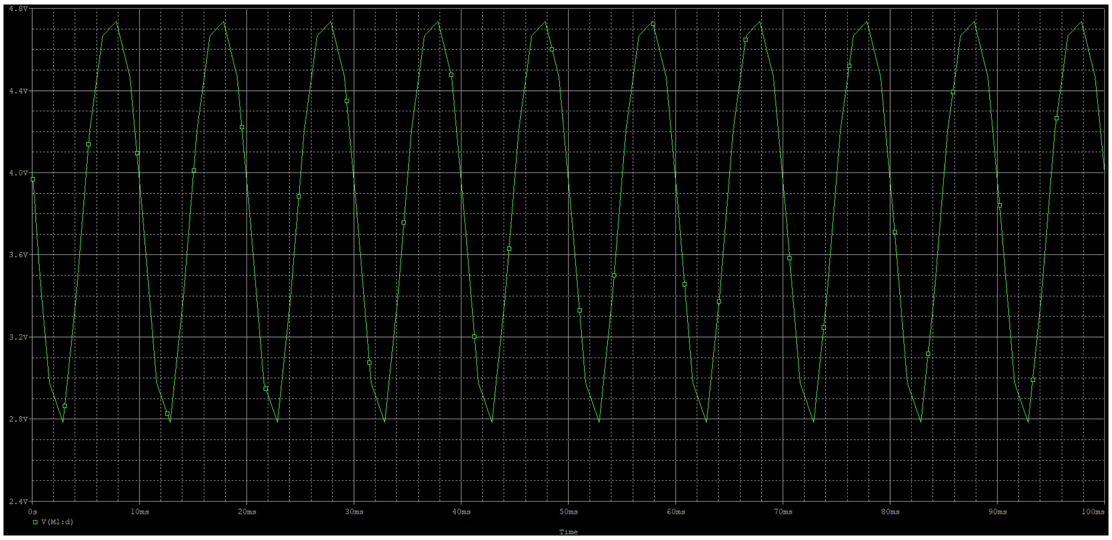
We can know that (0.899, 4.0095) (0.901, 3.9895)

slope $= \frac{3.9895 - 4.0095}{0.901 - 0.899} = -10 = A_v$

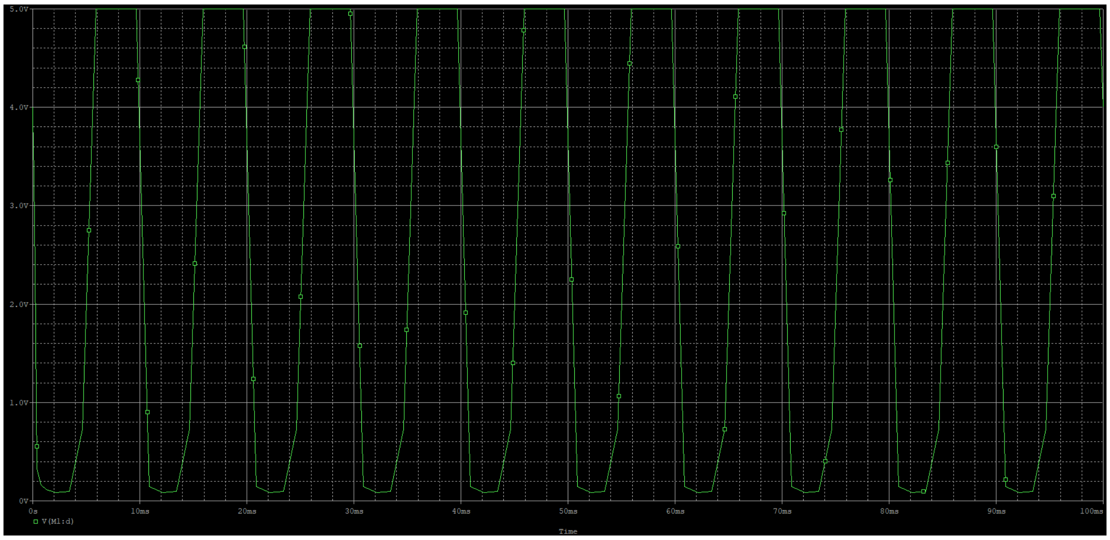
(C).



B = 0.01 V



B = 0.1 V



B = 1V

When $B = 0.01V$, $|A_v| = \frac{0.195}{0.01 \times 2} = 9.75$

When $B = 0.1V$, $|A_v| = \frac{1.95}{0.1 \times 2} = 9.75$

When $B = 1V$, $|A_v| = \frac{4.91}{1 \times 2} = 2.46$

As amplitude increase, $|A_v|$ decreases. For the AC part of V_{out}, the positive amplitude grows slower compared with the negative amplitude. And when V_{out} achieves $5V$, it will not increase because $V_{DD} = 5V$.