V_{DS}

V_{DD} — A

Sat.   triode

V_{DS}, amplified!

Cutoff

Q_{pt}

V_{DS} —   B

C

V_t V_{GS} V_{GS} V_{DD} V_{GS}

Edge of
Saturation

i_D ↓

DC bias pt.
(Q-pt)

small
Signal

$$\uparrow \text{small signal Voltage gain}$$

Example:

① Qpoint $\Rightarrow V_{GS}Q = 0.6 \text{ v}^-$

Assume Saturation, then confirm.

$I_{DQ} = \frac{1}{2} k'_n \frac{\omega}{L} (V_{GS}Q - Vt)^2$

$I_{DQ} = \frac{1}{2} (.4)(10)(.6 - .4)^2$

$I_{DQ} = 0.08 \text{ mA} \qquad V_{DS}Q = V_{DD} - I_{DQ}(R_D)$

$V_{DS}Q = 1.8 - (.08)(17.5)$

$V_{DS}Q = 0.4 \text{ v}$

② Find A_v

$A_v = -R_D \left[k'_n \frac{\omega}{L} (v_{GSQ} - v_t) \right]$

$A_v = -(17.5) \left[0.4 \; (10)(0.6 - 0.4) \right]$

$A_v = -14 \; V/v$

V_{DS}

A

$0.4v \; —$ Q

$\bullet B$

$|$ $\uparrow$
$.4v$ $.6v$ V_{GS}

$\Rightarrow$ 2nd order

How do you choose Q point?

V_{DS}

A

Q

B

V_t V_{GS} edge V_{GS}