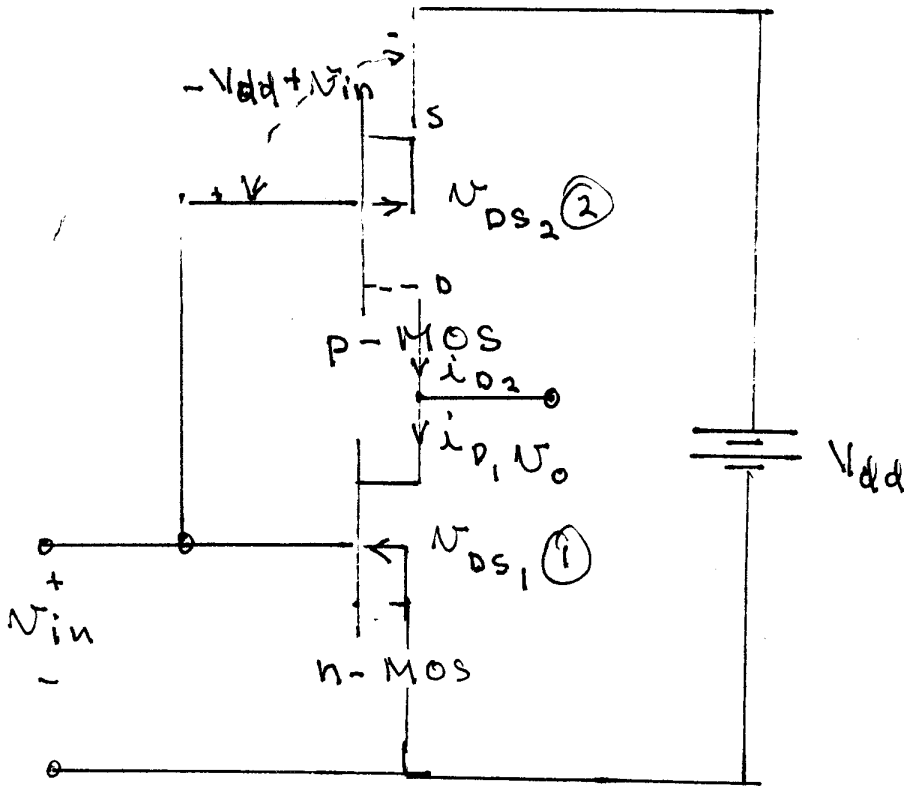
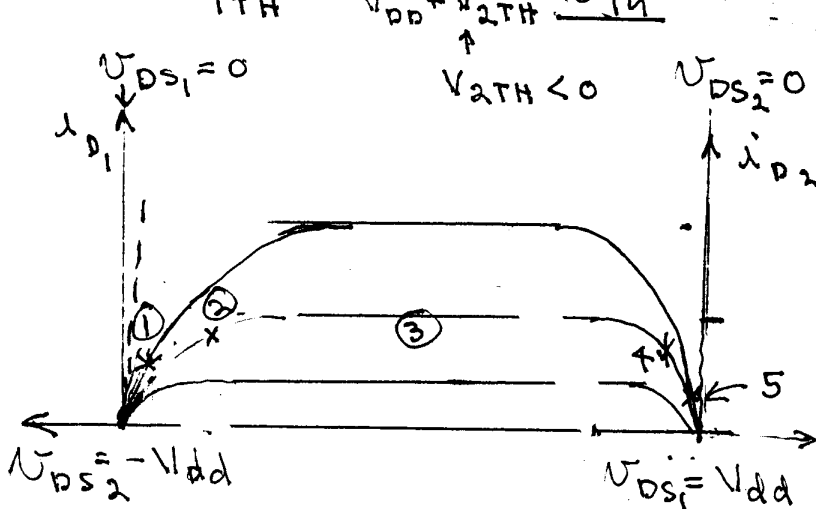
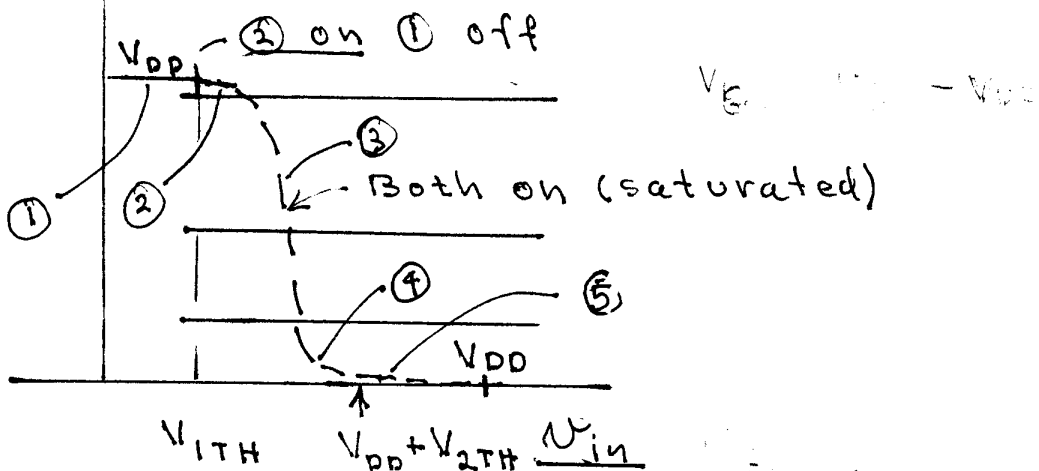


CMOS Inverter



$$V_{DS1} + V_{DS2} = V_{DD}$$

Output Voltage V_o



saturation

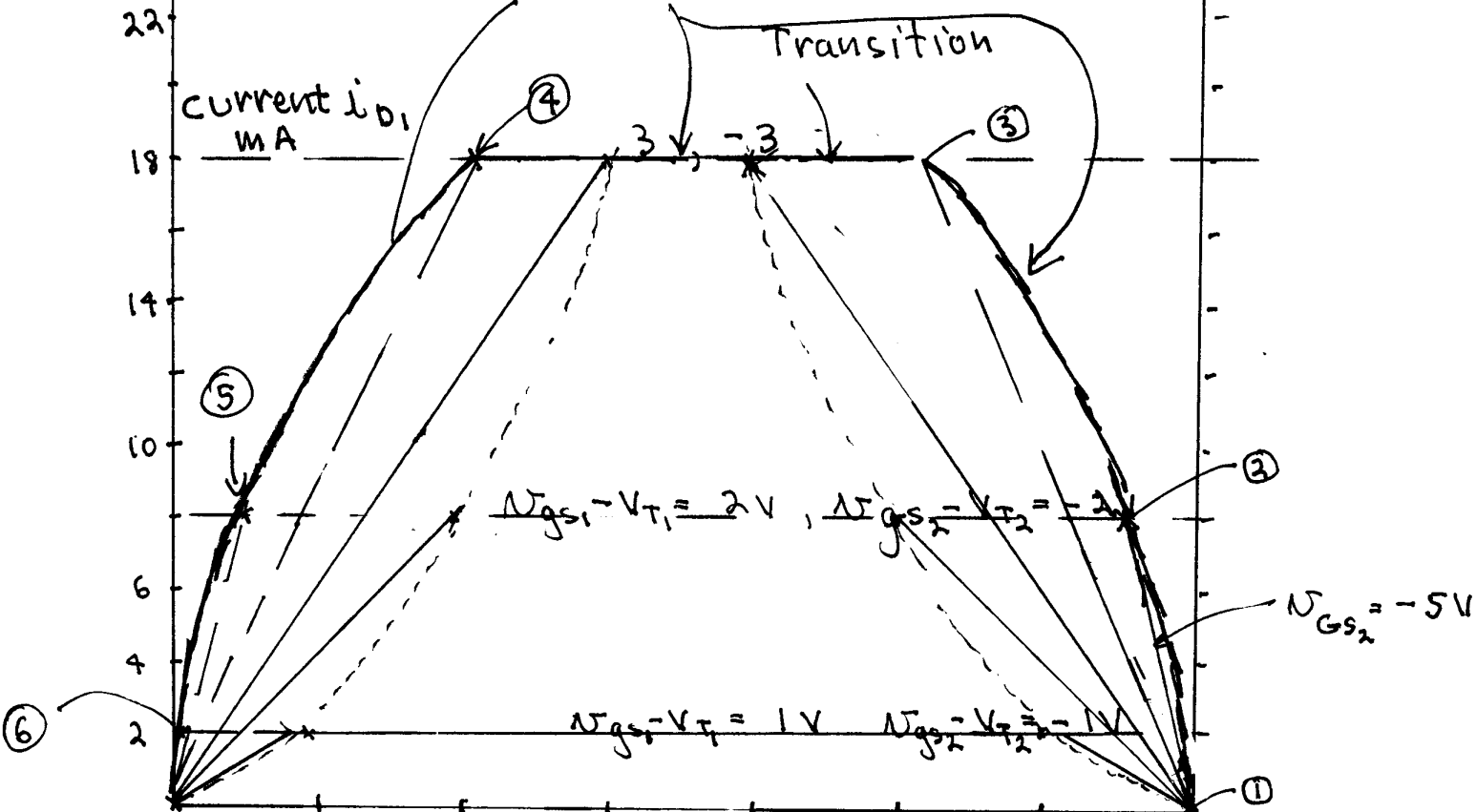
$$i_D = k (V_{in} - V_T)^2$$

$$i_D = k (V_{DD} - V_{in} - V_T)^2$$

Triode

KVL - $V_{DS2} + V_{DS1} = V_{DD}$

Solution Curve for drain current



$V_{DS1} = 0$
 $V_{DS2} = -7V = -V_{DD}$
 $V_{DD} = 7V$
 $V_{T1} = 0V$
 $V_{T2} = 0V$
 $V_{GS2} = -5V$
 $V_{GS1} = V_{DD}$
 $V_{DS2} = 0$
 1 on
 2 off
 1 off
 2 on

saturation $i_D = k (V_{GS} - V_T)^2$; $k = 2 \text{ mA/V}^2$

$V_{GS} - V_T = V_{DS} \rightarrow$ saturation - triode boundary

No	V_{GS1}	i_D	$V_{GS2} = V_{GS1} - V_{DD}$	Condition NMOS1 PMOS2
①	1V	0	-7V	Saturation region Triode
②	2V	8 mA	-5V	" Triode
③	3V	18 mA	-4V	" Triode
④	4V	18 mA	-3V	Triode Saturation
⑤	5V	8 mA	-2V	
⑥	6V	2 mA	-1V	