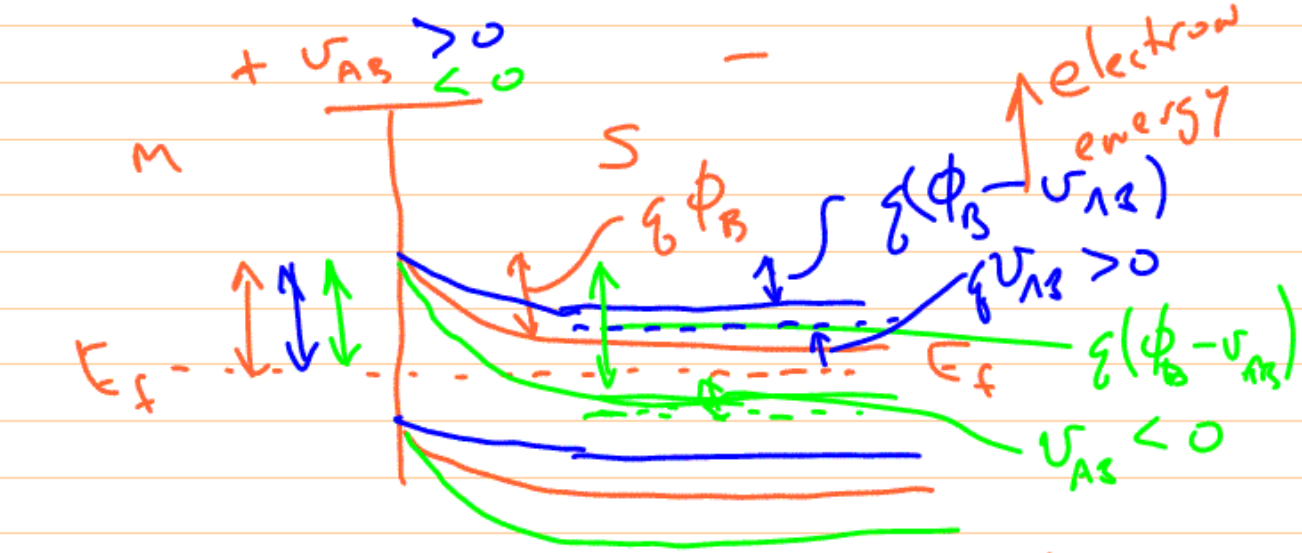
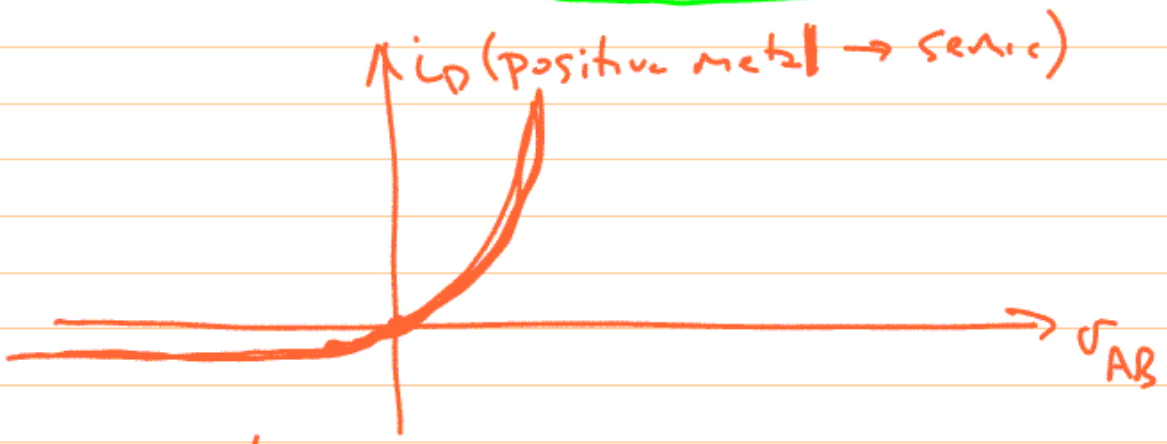
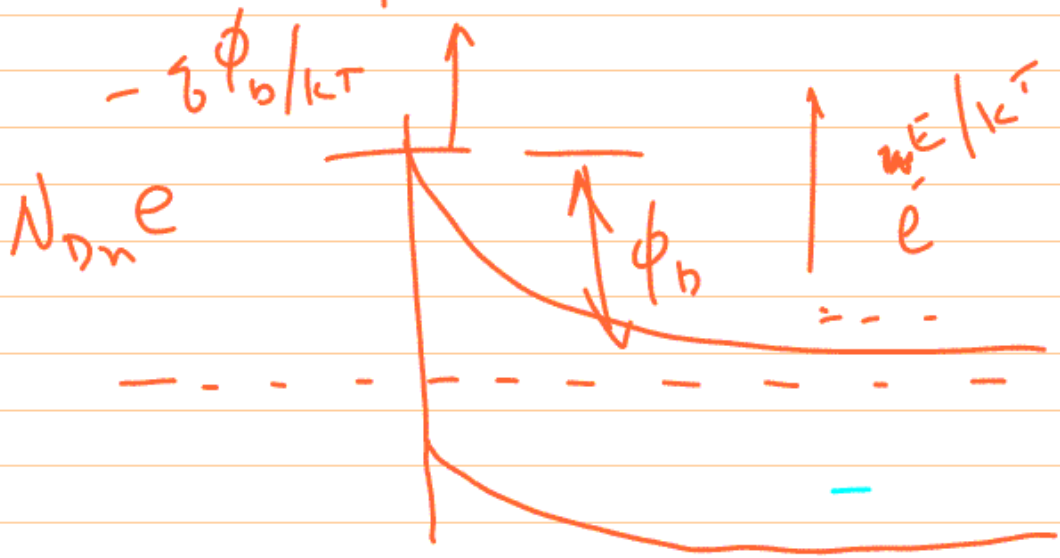
6.772/SMA5111 – LECTURE #2

Note Title 2/4/2003

METAL – SEMICONDUCTOR JUNCTIONS (SCHOTTKY BARRIERS)







$$i_D = I_S\left(e^{qU_{AB}/kT} - 1\right)$$

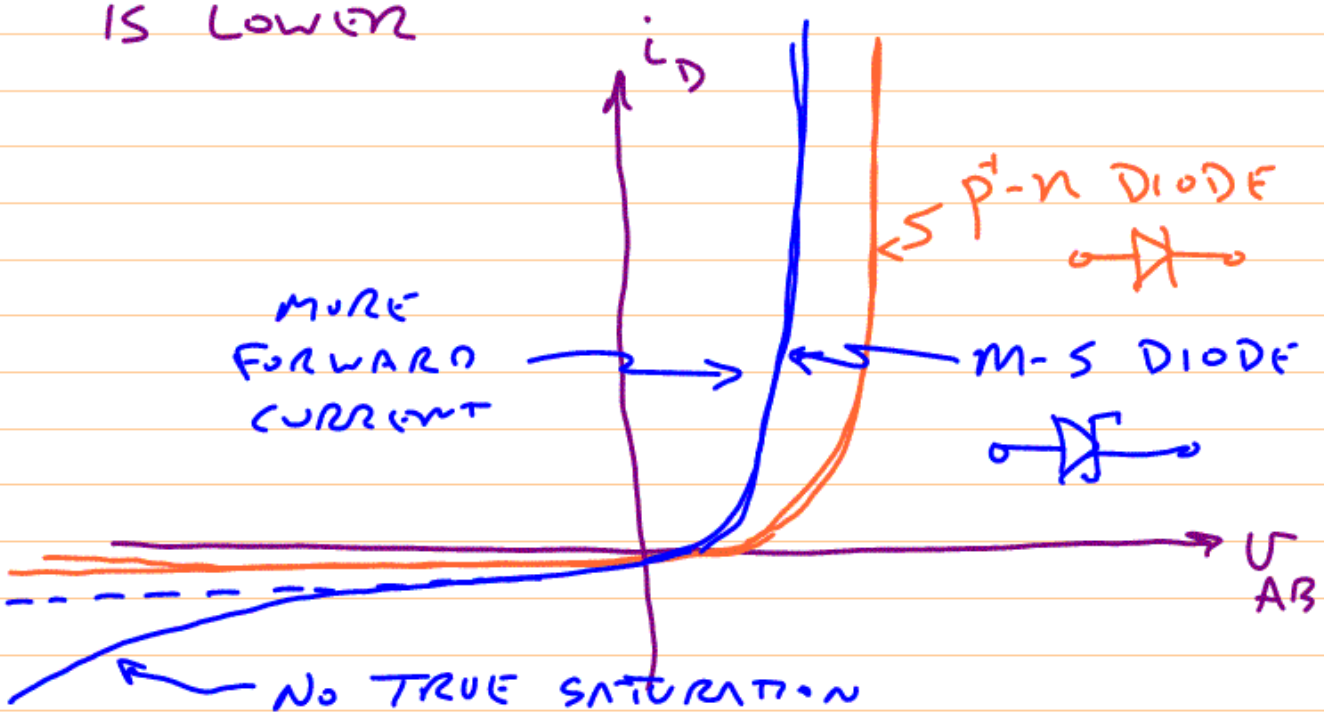
COMPARE I_S's:

M-S DIODE ON n-TYPE: $I_{S\,M\text{-}S}$

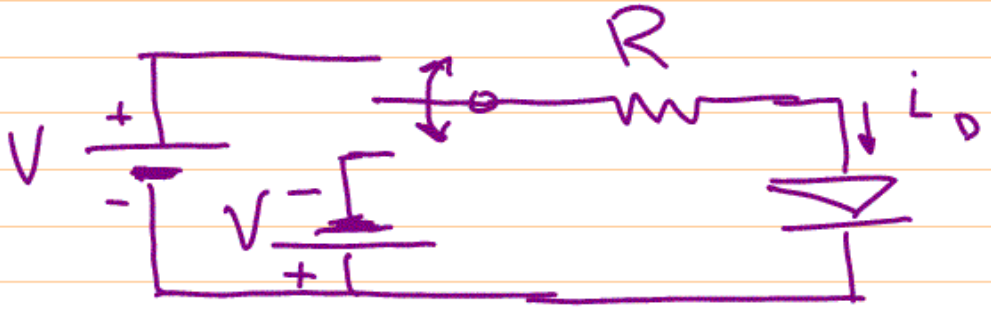
p^+-n DIODE ON SAME n: $I_{S\,p\text{-}n}$

WE FIND $I_{S\,M\text{-}S} > I_{S\,p\text{-}n}$

BECAUSE THE M-S BARRIER HEIGHT IS LOWER



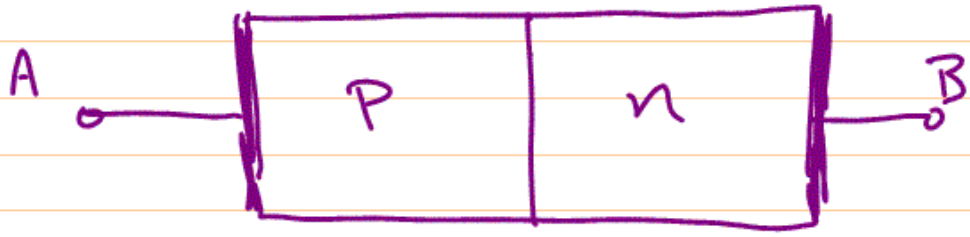
SWITCHING — CONSIDER CIRCUIT

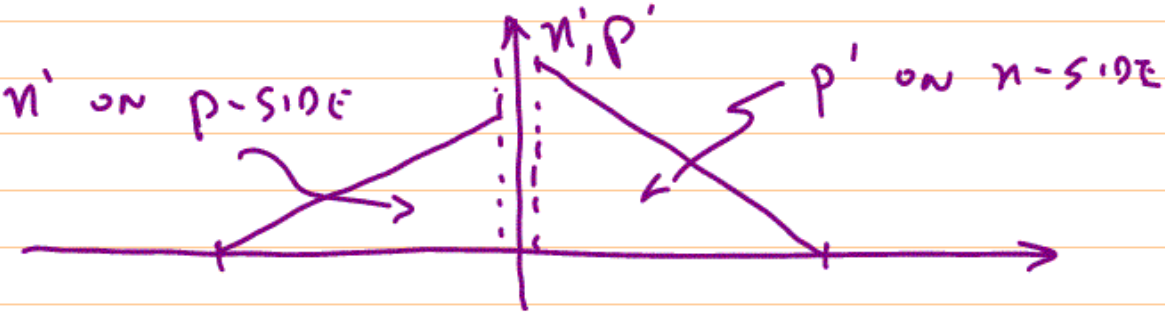


SWITCH: UP for $t < 0$

DOWN for $t \geq 0$

FOR $t < 0$, $i_D \simeq (V - 0.6)/R$

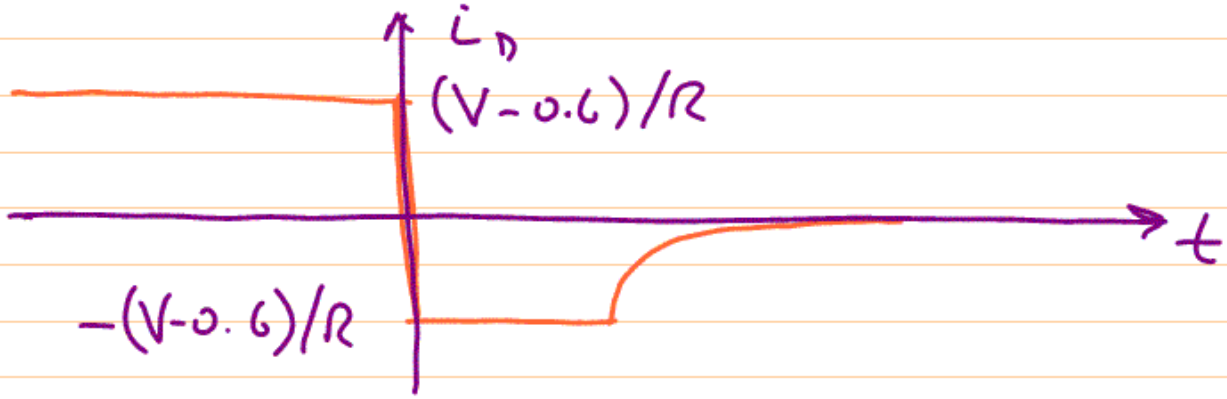




WHAT HAPPENS FOR $t \geq 0$?

FOR $t \gg 0$, $i_D = 0$, BUT WHAT ABOUT $t \geq 0$?

CURRENT CAN FLOW FOR A SHORT WHILE, UNTIL EXCESS CARRIER SUPPLIES ARE USED UP.



WITH A SCHOTTKY (i.e M-S) DIODE THERE IS ALMOST NO CHARGE STORED AND A MUCH FASTER TRANSIENT

THIS IS A VERY IMPORTANT FEATURE OF M-S DIODES !