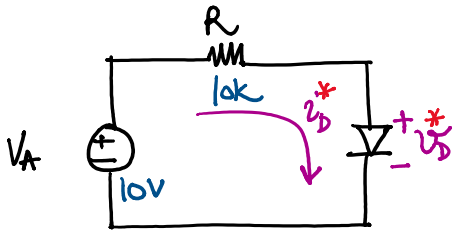
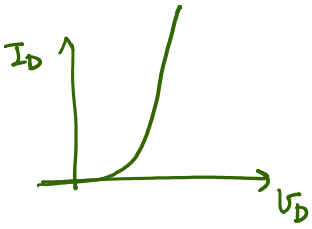
ECE 310 – Lecture 9

Wednesday, January 31, 2018 10:33 AM



find i_D & v_D



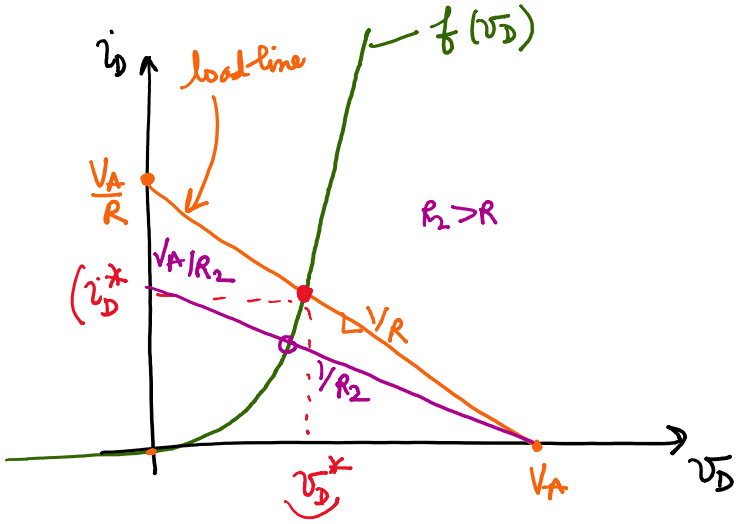
$$i_D = I_S\left(e^{\frac{v_D}{nV_T}} - 1\right) \longrightarrow (1)$$

Emission Coefficient $n = 1$

KVL: $V_A = i_D \cdot R + v_D \longrightarrow (2)$

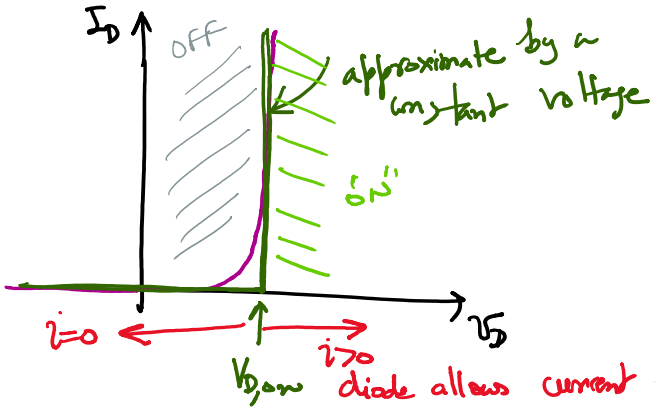
Load-line analysis:

$$i_D = \underbrace{\frac{V_A - v_D}{R}}_{} = \underbrace{f(v_D)}$$



Constant Voltage Model

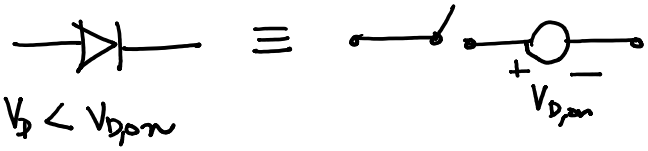
Nonlinear I-V curve analysis is not straightforward.



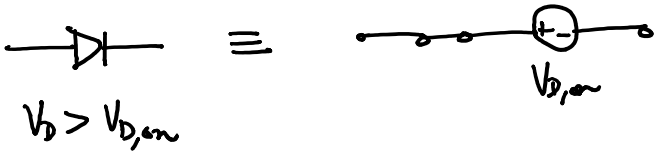
Can approximate the fwd bias region by a constant $V_{D,on}$

↳ Book uses 800mV or 0.8V

Reverse Bias



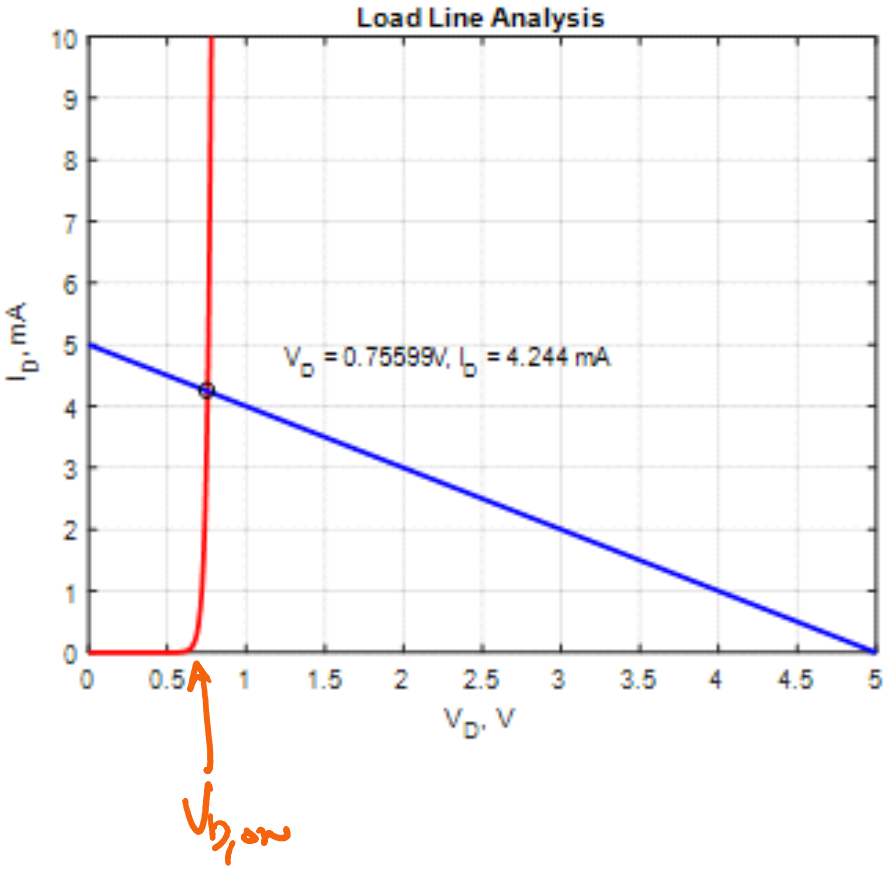
forward Bias



The diode is turned on when the fwd bias voltage is

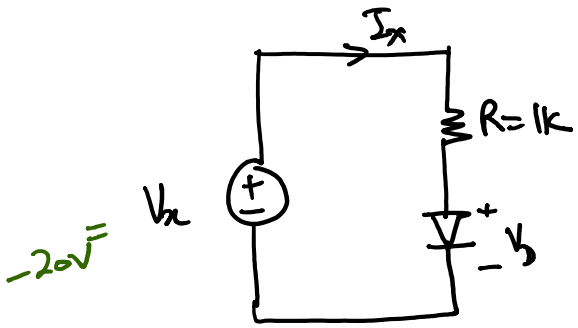
$V_D > V_{D,on}$

↳ 0.8V


Load Line Analysis
V_D = 0.75599V, I_D = 4.244 mA
I_D, mA
V_D, V
0
1
2
3
4
5
6
7
8
9
10
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

$V_{D,on}$

$V_x = 3V$ & $V_x = 0.5V$



$-20V$

"ON"

a) $V_x = 3V$

$V_D = V_{D,on} = 0.8V$

$\Rightarrow I_x = \frac{V_x - V_{D,on}}{R} = 2.2mA$

"off"

b) $V_x = 0.5V$

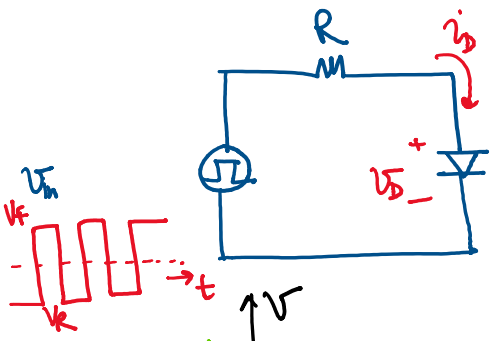
$I_x \simeq 0$ ✓

$V_D = 0.5V$

$\because i_x = 0$

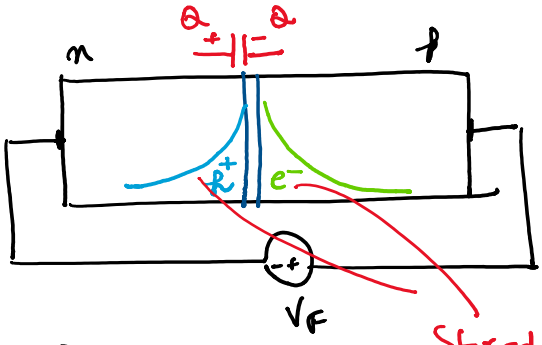
$V_x = V_D + I_x R$ ($I_x R \to 0$)

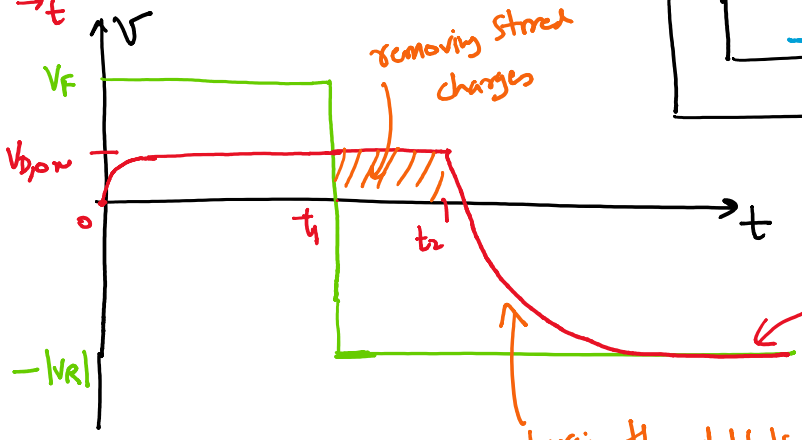
Reverse Recovery of a Diode:



$V_F > V_{D,ON}$

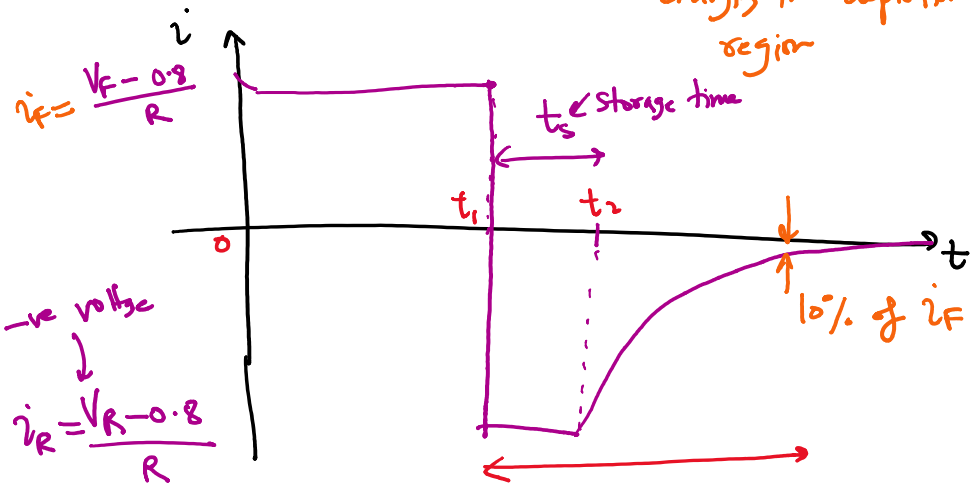
$\frac{V_F - V_{D,ON}}{R}$ ← $V_{in} = V_F$





all of Rev Bias Voltage Drops across the diode

charging the depletion region



t_{rr} → reverse recovery time