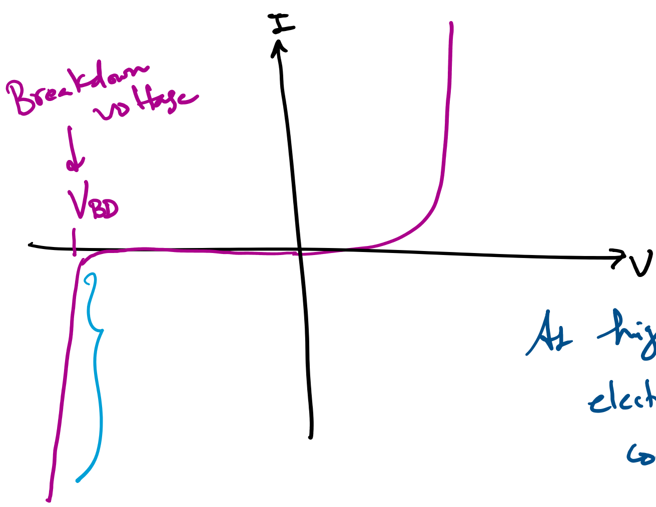
ECE 310- Lecture 10

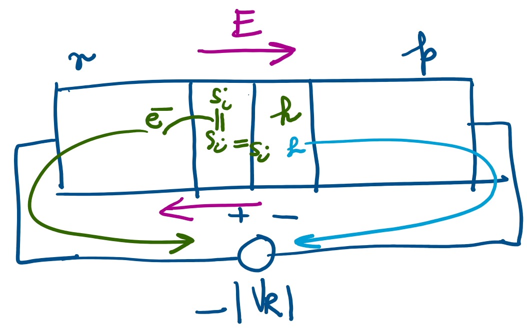
Thursday, February 1, 2018 10:21 PM

ma 111629

↑ ECE Ambassador Program

Reverse Breakdown





At high electric fields, the field can tear off electrons from the Si lattice by breaking covalent bonds

↳ Electrons flow in the opposite direction of the field

↳ large current flow.

Zener Breakdown → high doping levels on both n & p sides

Zener effect → 3-8V ← V_Z Zener voltage

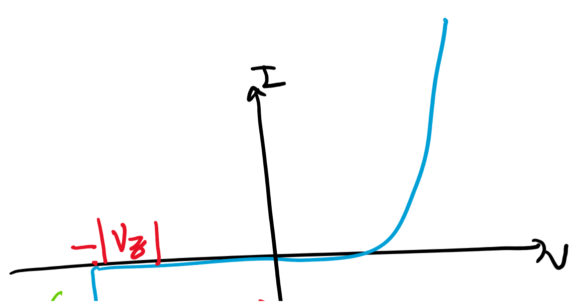
Avalanche Breakdown → low doping levels.

↳ $< 10^{15}$ cm^{-3}

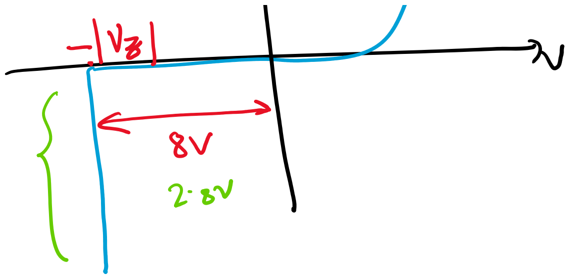
↳ chain reaction or multiplier effect

↳ impact ionization

* Effects are reversible unless large current melts the device.



Read Chapter 2



Read Chapter 2.

Chapter 3

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Why diodes?

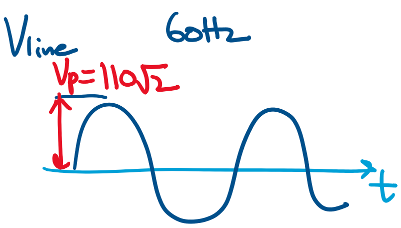
Ex. Cellphone charger:

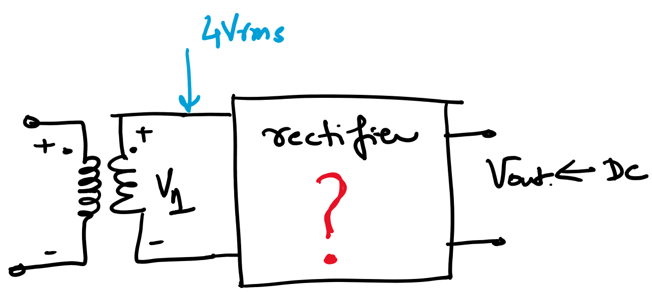
AC line voltage 110V @ 60 Hz (110V → rms)

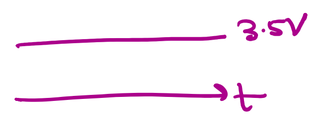
We require 3.5V DC

(Asia/EU 220V @ 50 Hz)

$V_{rms} = \frac{V_p}{\sqrt{2}}$

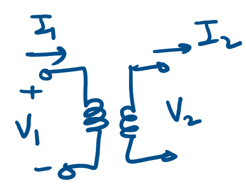






Step down Transformer

turn ratio $\frac{110}{4} = 27.5 : 1$



$V_1 I_1 = V_2 I_2$

$\frac{r}{1} : \frac{V_1}{V_2}$ ⟸ turn ratio

Transformer

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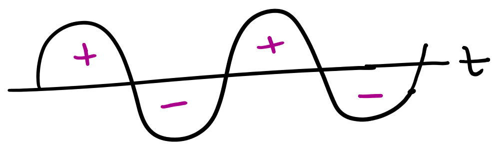
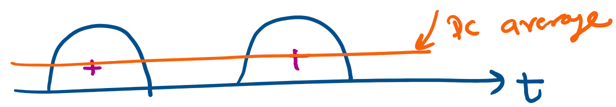
retain +ve half cycles



⇒

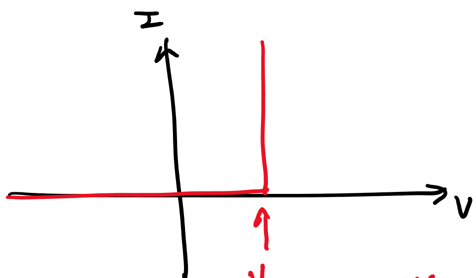


average ⇐ DC = 0

We use Diode ⇒

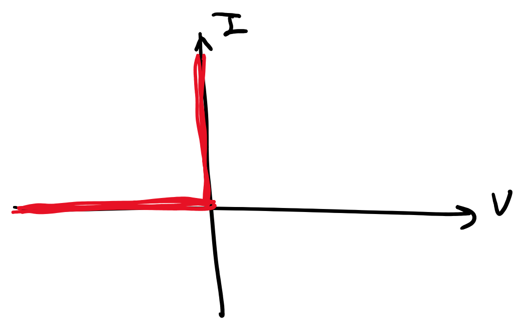
Short for +ve voltages
open for −ve voltages

Constant voltage Diode (CVD)

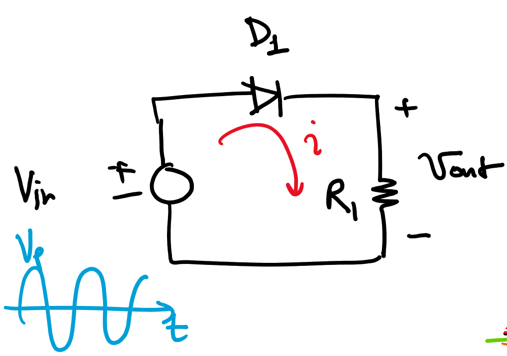


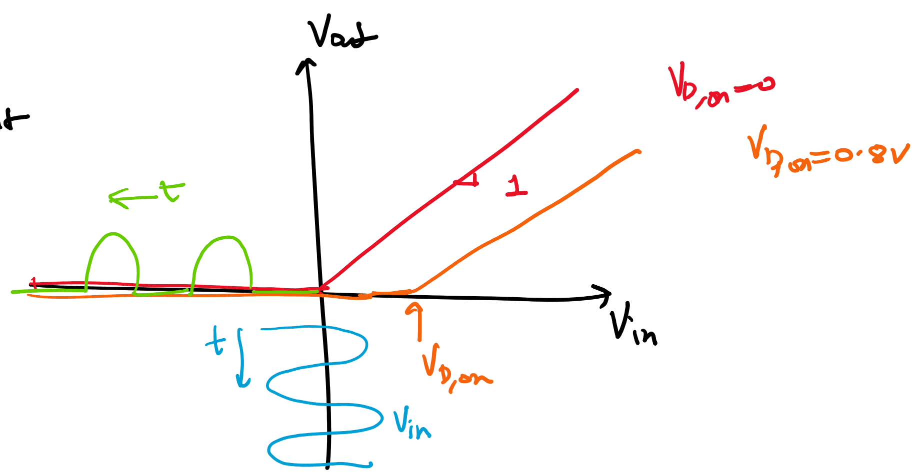
Ideal Diode

$V_{D,on} = 0$

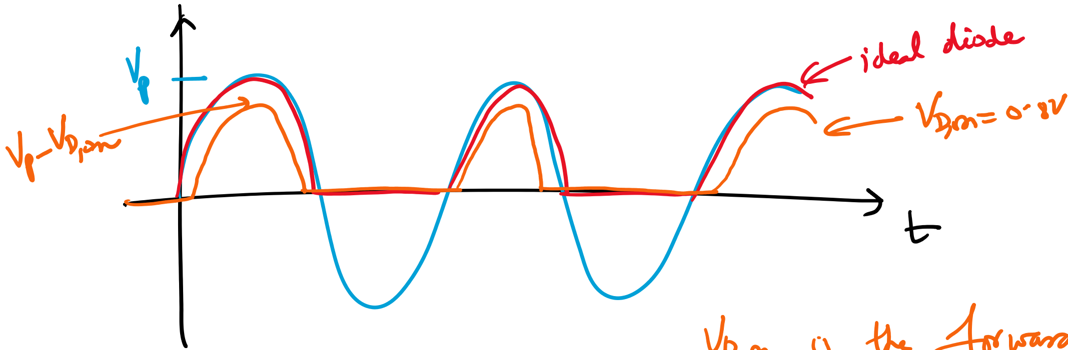


Ideal Diode



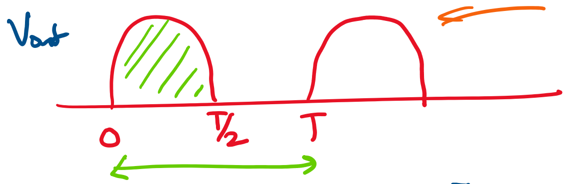


input / output characteristics



$V_{D,on}$ is the forward voltage drop in the diode.

output waveform

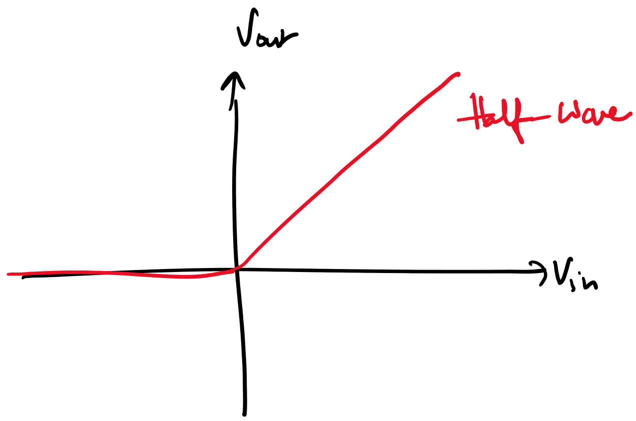


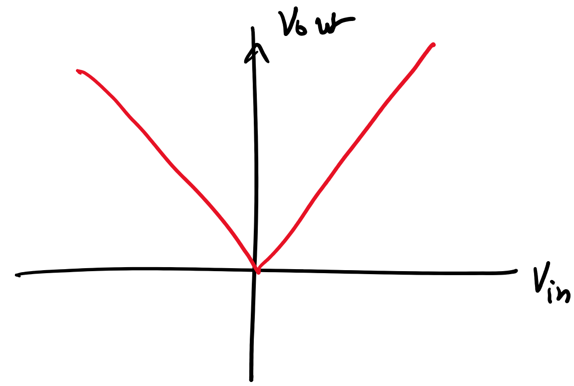
Half wave rectifier

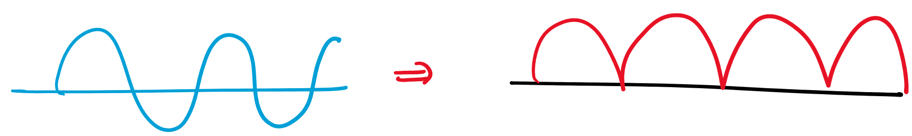
$$V_{out,avg} = \frac{1}{T}\int_0^T V_{out}(t)\,dt = \frac{1}{T}\int_0^{T/2} V_p \sin(\omega t)\,dt$$

$$= \frac{1}{T}\frac{V_p}{\omega}\left[-\cos\omega t\right]_0^{T/2}$$

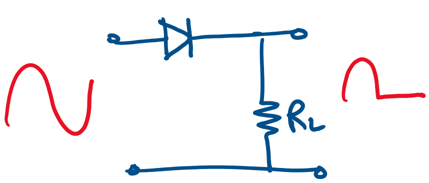
$$= \frac{V_p}{\pi}$$ ← average or DC content in the half wave rectified output



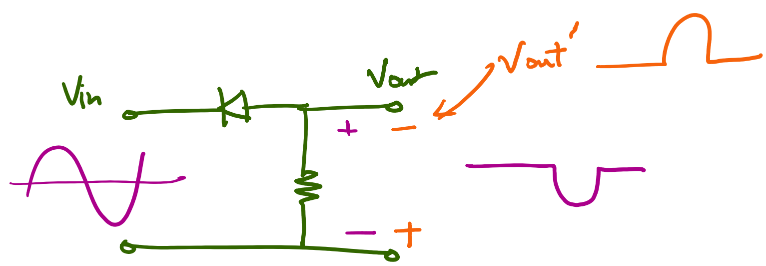




$\frac{2V_p}{\pi}$



+ve cycle



negative cycle