EP215
Electronics Lab 1

Lecture 3
Review of Lab 2
Simplest Active device: DIODE

Review of Lab 2

1. One Diode (voltage) clamp

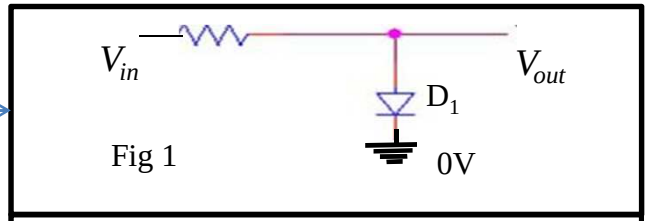


Fig 1

2. Two Diode (voltage) limiter

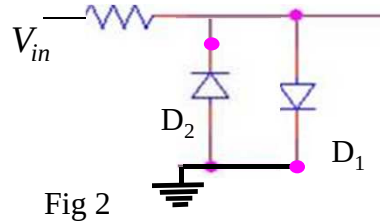


Fig 2

3. One Diode half-wave rectifier

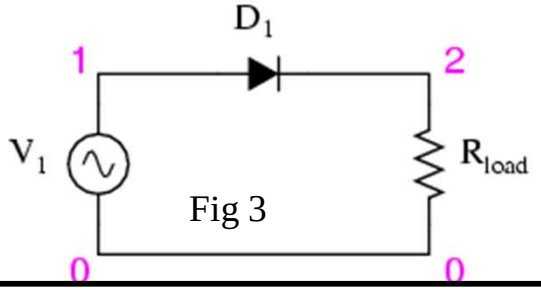


Fig 3

4. Four diode full-wave rectifier

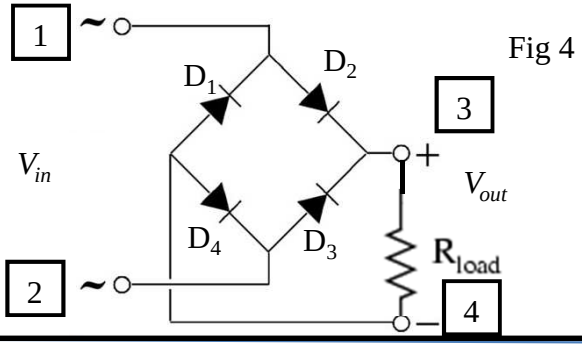
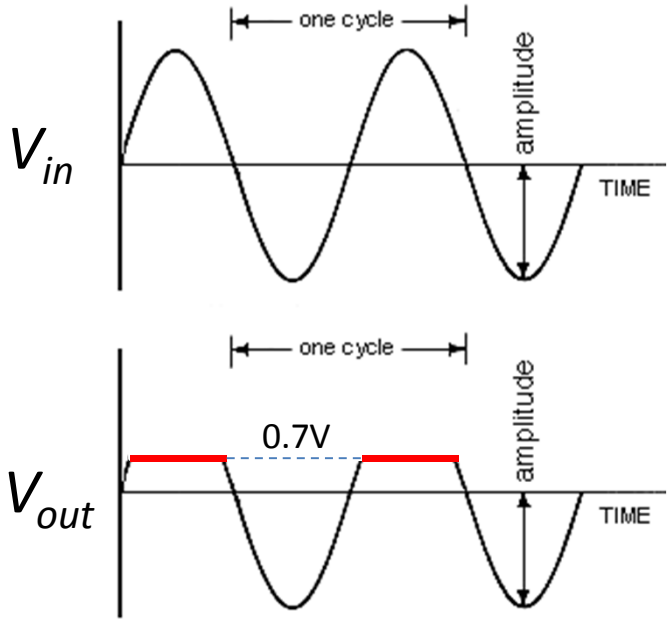


Fig 4

What happens in a diode clamp?



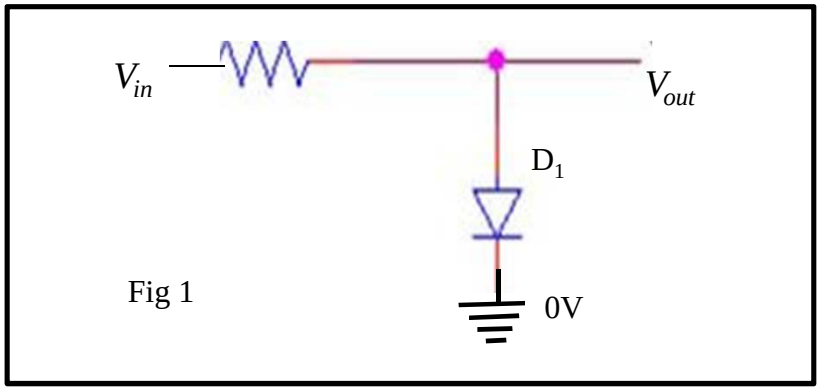


Fig 1

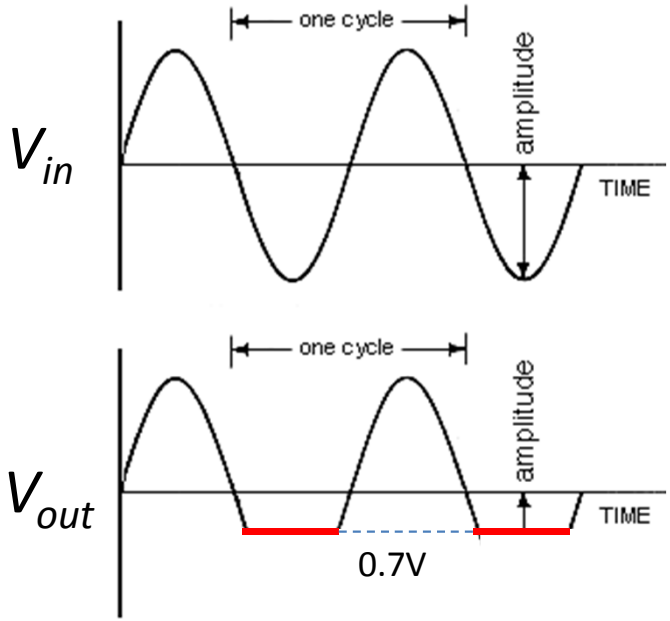
If $V_{in} < 0.7V$, $V_{out} = V_{in}$

If $V_{in} > 0.7V$, $V_{out} = 0.7V$

Follow up questions:

1. This circuit only clamps the positive part of V_{in}
   What modification would cause it to clamp the <u>negative</u> part of V_{in}?
2. What modification would make it clamp <u>both</u> positive and negative ?

What happens in a diode clamp?



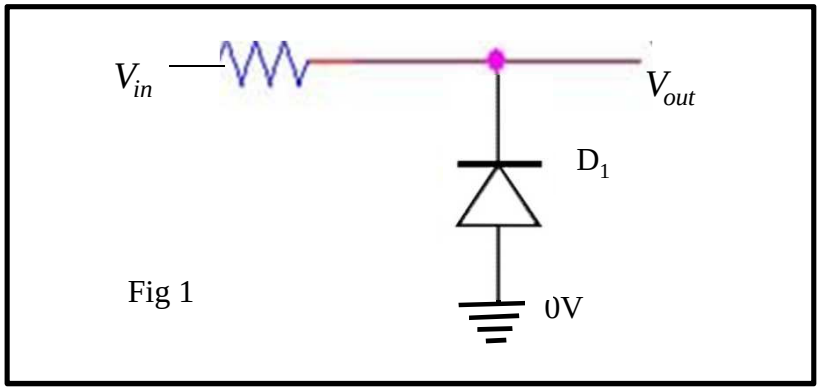


Fig 1

If $V_{in} > 0.7V$, $V_{out} = V_{in}$

If $V_{in} < 0.7V$, $V_{out} = 0.7V$

What modification would cause it to clamp the <u>negative</u> part of V_{in}?

Diode Limiter

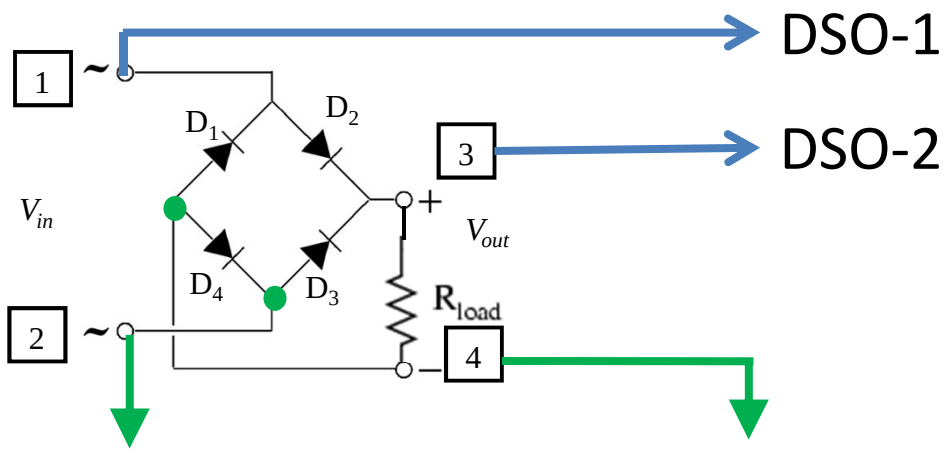
http://www.falstad.com/circuit/e-diodelimit.html

Half wave Rectifier

http://www.falstad.com/circuit/e-rectify.html

Full wave rectifier

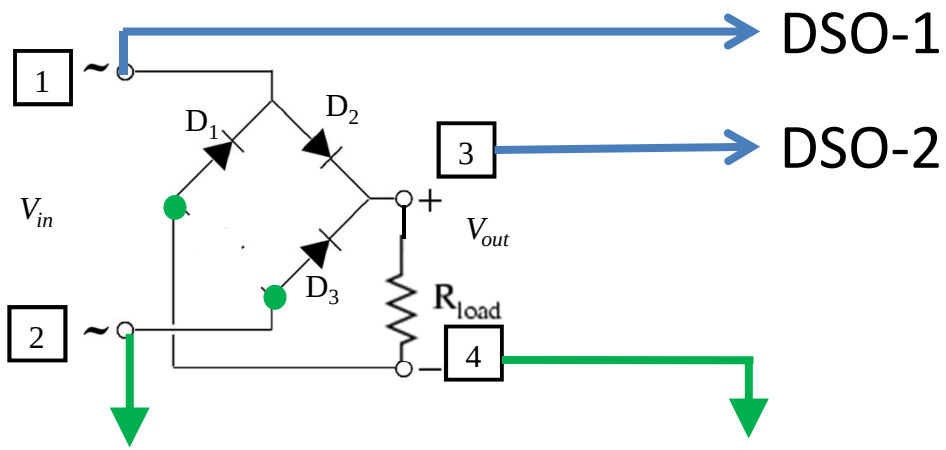
http://www.falstad.com/circuit/e-fullrect.html



Full wave rectifier

with measurements of V_{in} V_{out}

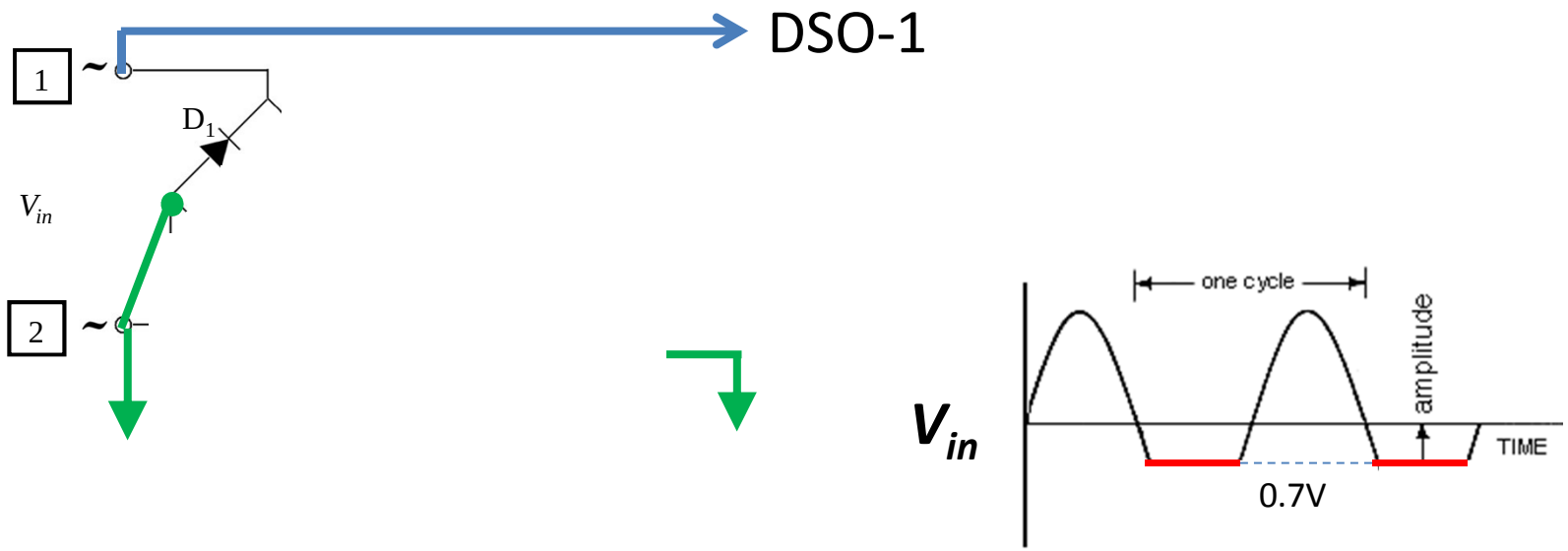
http://www.falstad.com/circuit/e-fullrect.html



Full wave rectifier

Looks like a negative clamp from V_{in}

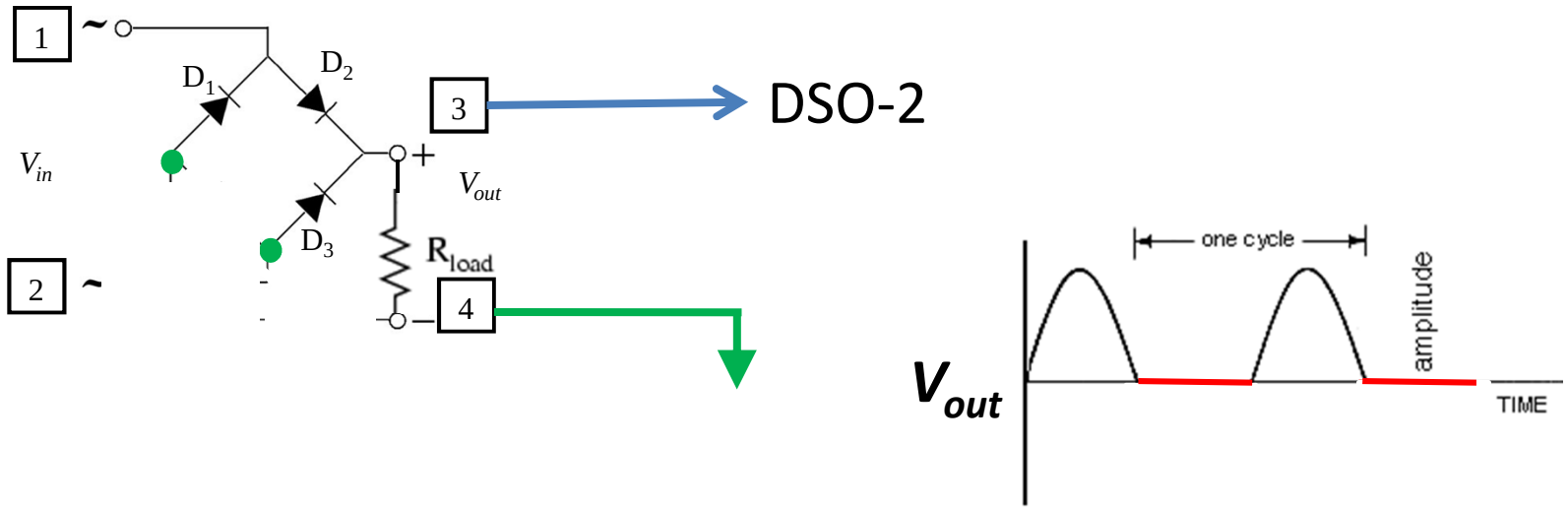
http://www.falstad.com/circuit/e-fullrect.html



Full wave rectifier

Looks like a half-wave rectifier from V_{out}

http://www.falstad.com/circuit/e-fullrect.html

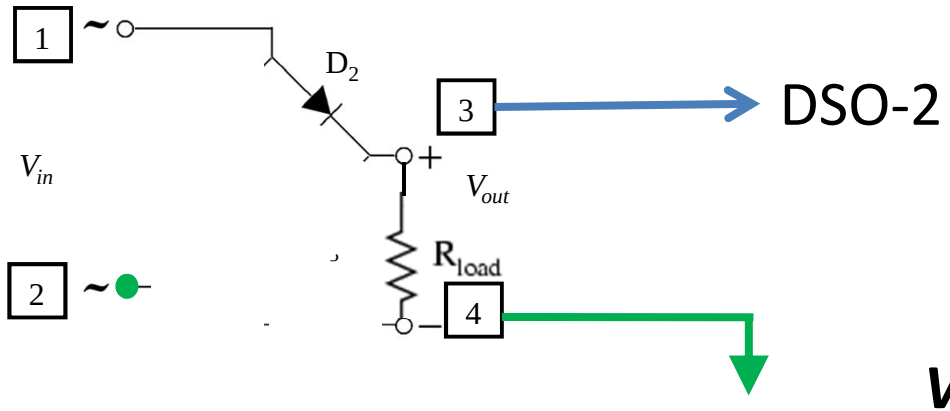


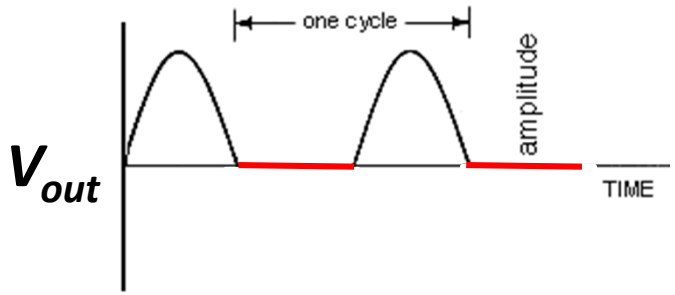
Note: D_1 and D_3 function as positive clamps (like Slide 4)
– but are irrelevant, because the half-wave rectification makes sure that V_{out} is always positive.

Full wave rectifier

Looks like a half-wave rectifier from V_{out}

http://www.falstad.com/circuit/e-fullrect.html





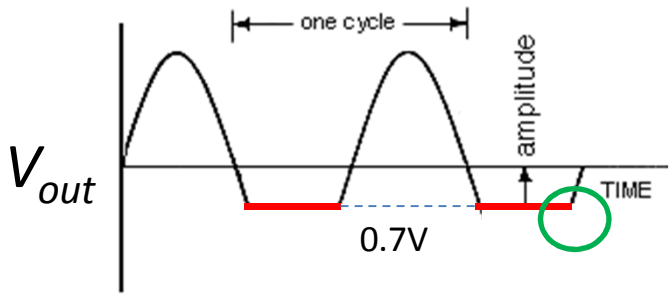
Notice the green dots which represent 0V

Prep for Lab 3

We have used ‘working’ definitions of Diode operation:

Cathode to Anode voltage > 0.7V → ‘ON’
Cathode to Anode voltage < 0.7V → ‘OFF’

This is not good enough for detailed circuit building & analysis



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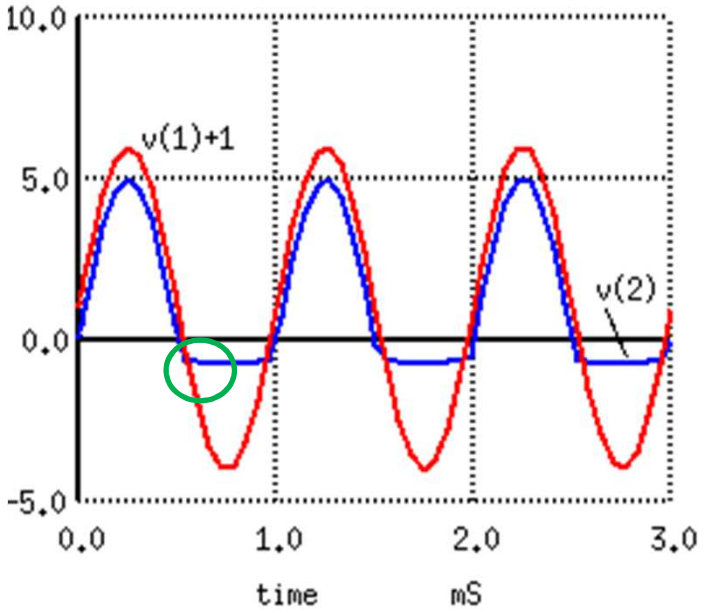

I-V characteristics of two terminal devices

As the voltage across a diode increases from 0.65V to 0.75V it changes smoothly from:

- A state of not conducting current
- To a state of conducting current

(V)

(I)

We will learn how to determine the **I-V** characteristics of any two terminal device without using graph paper!

Useful reference for this course

"Foundations of Analog and Digital Electronics"
by Anant Agarwal and Jeffrey Lang

http://www.allaboutcircuits.com