

Electronics I

Diodes

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Semiconductors

- ☐ Material that can either be a conductor or an insulator
- ☐ Silicone is the main material in semiconductors
- ☐ Silicone is doped to create an insulator or conductor

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P type materials

- ☐ P type:
 - Materials are positively charged
 - Have fewer electrons than protons
 - The lack of electrons create "holes"
 - Holes are there to accept traveling electrons
- ☐ P type material is created by doping pure silicone with boron or gallium

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N type materials

- ☐ N type:
 - Materials are negatively charged
 - Have more electrons than protons
 - The excess of electrons creates free electrons for traveling
 - The free electrons travel to fill the open holes in the P type material
- ☐ N type material is created by doping pure silicone with phosphorus or arsenic.

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P and N type together

□ Transistor:

- An electrical device that controls the flow of electricity.
- Created by sandwiching P type and N type materials
- Two layers create a "diode"
- Three layers create a "transistor"

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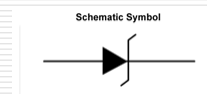
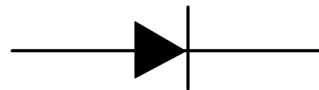
Diode

□ Diode:

- A device that only allows current flow in on direction.

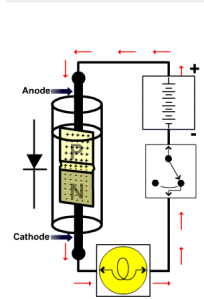
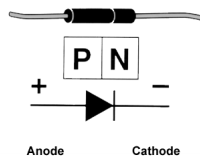
□ Zener diode:

- Used to control a level of voltage.
- Installed "reversed biased"
- It will stop current until reverse voltage reaches a set point, it will then allow current to flow



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Diode components

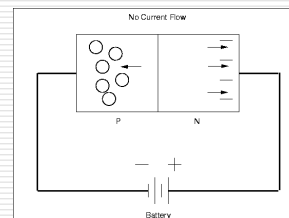
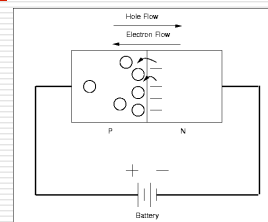


- Anode:
 - Consists of the P type material
 - Positive side
- Cathode:
 - Consists of the N type material
 - Negative side
- Depletion zone:
 - Mating of P and N
- Holes
 - Lack of electrons
- Electrons
 - Negative charge of an atom

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Diode Biasing

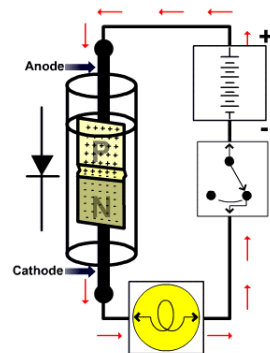
- Biasing:
 - Is the direction in which the diode is installed in the circuit.



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Diode Forward Biased

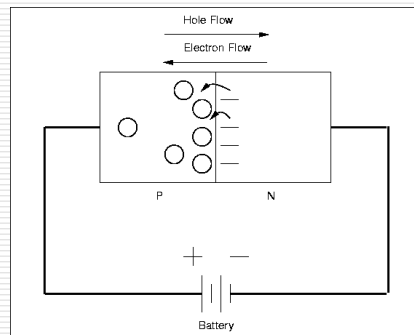
Forward Biased Diode in Circuit



- Forward biasing, is when the positive is attached to the anode and the negative is attached to the cathode

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Diode Forward Biased

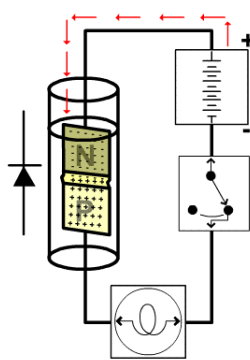


- The charges of the circuit interact with the like charges of the diode.
- This interaction cause the holes and electrons to move into the depletion zone creating a path for current.

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Diode Reverse Biased

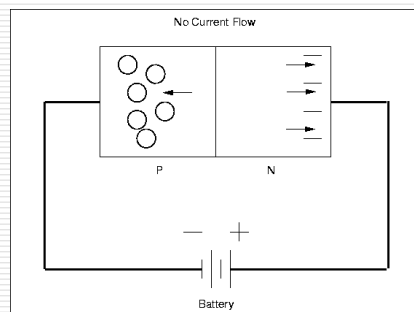
Reverse Biased Diode in Circuit



- Reverse biasing, is when the positive is attached to the cathode and the negative is attached to the anode

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Diode Reverse Biased

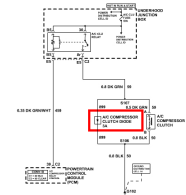


- The charges of the circuit interact with the unlike charges of the diode.
- This interaction cause the holes and electrons to move away from the depletion zone opening/stopping the path for current

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Uses of diodes

A/C COMPRESSOR CIRCUIT

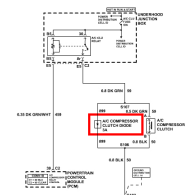


- Clamping diode:
 - Used to control the voltage spike of a collapsing magnetic field.
- Rectifier Bridge (alternators)
 - Convert A/C current into D/C current.
- LED's
 - Light emitting diodes, low amperage alternative to incandescent bulbs.

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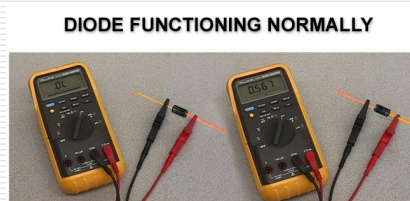
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LED's

- ☐ Light Emitting Diode
- ☐ Act as traditional diodes, but when installed forward biased the LED emits light.
- ☐ Used in some digital displays
- ☐ Regular diodes use .3 to .7 volts to allow current.
- ☐ LED's require 1.5 - 2.2 volts to operate. This voltage results in enough amperage to damage the LED. LED's can only handle 20-30 mA of current.
- ☐ [Continue](#)

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Diode Testing



- ☐ Resistance testing in forward biased and reverse biased directions.
- ☐ Forward should have continuity and reverse should be OL.

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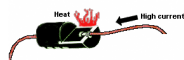
Barrier Voltage

- ☐ The voltage potential across the “PN” junction.
- ☐ Most diodes have a range of .3 to .7 volts dropped for operation.
- ☐ This drop is used to move the electrons and holes.

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Failures of diodes

DIODE FAILURES



- ☐ Failure test results:
 - Open in reverse and forward.
 - Shorted in reverse and forward.
- ☐ Causes:
 - Excessive current in forward biased direction.
 - Excessive potential difference (voltage) in reverse or forward directions.

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