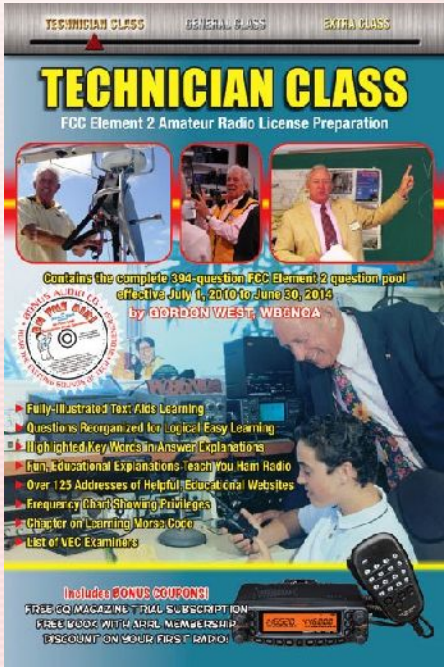
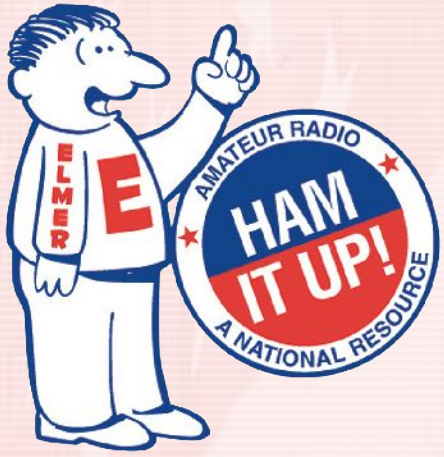
Technician Licensing Class

Electrons Go With the Flow!

Presented by





Amateur Radio Technician Class
Element 2 Course Presentation

ELEMENT 2 SUB-ELEMENTS
(Groupings)

- **About Ham Radio**
- **Call Signs**
- **Control**
- **Mind the Rules**
- **Tech Frequencies**
- **Your First Radio**
- **Going On The Air!**
- **Repeaters**
- **Emergency!**
- **Weak Signal Propagation**

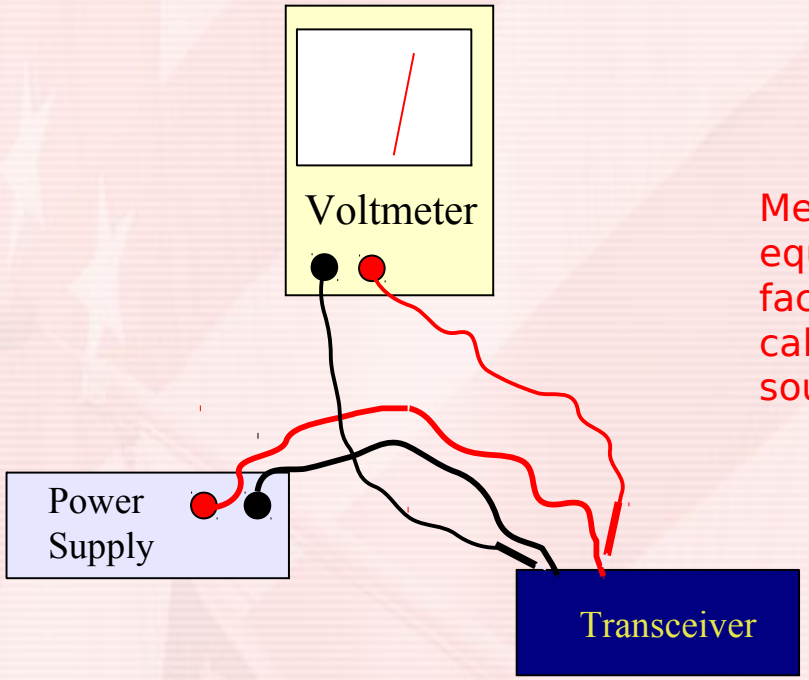
Amateur Radio Technician Class
Element 2 Course Presentation

- **ELEMENT 2 SUB-ELEMENTS** **(Groupings)**
  - **Talk to Outer Space!**
  - **Your Computer Goes Ham Digital!**
  - **Multi-Mode Radio Excitement**
  - **Run Some Interference Protection**
  - **Electrons – Go With the Flow!**
  - **It's the Law, per Mr. Ohm!**
  - **Go Picture These!**
  - **Antennas**
  - **Feed Me with Some Good Coax!**
  - **Safety First!**

Electrons – Go With the Flow!

- T5A5 Voltage is the electrical term for the **e**lectro**m**otive **f**orce (EMF) that causes electron flow.
  - Think of voltage as water pressure in the pipes (not the flow)
- T5A11 The volt is the basic unit of electromotive force.
- T7D1 A voltmeter is an instrument you would use to measure electric potential or electromotive force.
- T7D2 The correct way to connect a voltmeter to a circuit is in parallel with the circuit.
  - Car battery is measured in parallel
  - House wall sockets are measured in parallel

Electrons – Go With the Flow!



Measure at the equipment to factor in any loss in cables from power source.

Electrons – Go With the Flow!

- T6A10 1.2 volts is the nominal voltage of a fully charged nickel-cadmium cell.

Small and compact just like Ham Radio handhelds.

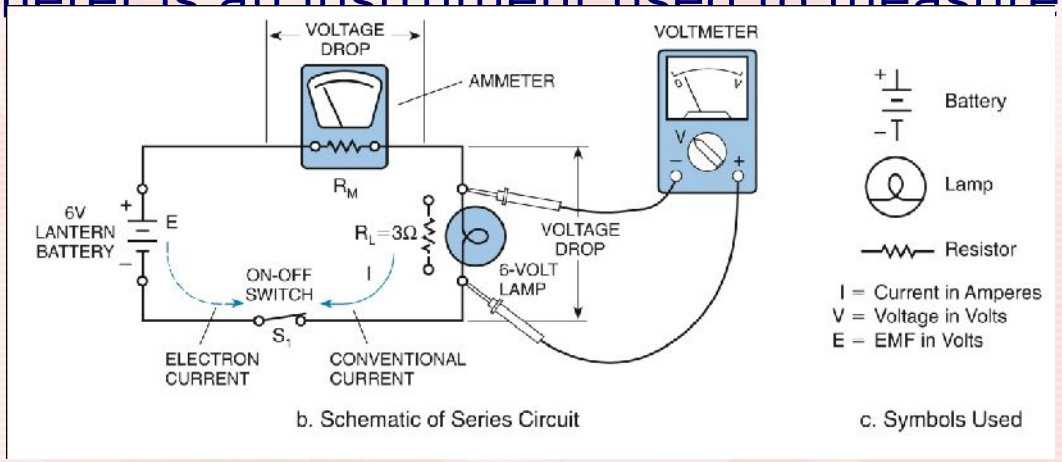
Rubber duck antenna

Ni-Cad rechargeable 1.25 volt batteries in a marine hand held.

- T6A11 A carbon-zinc battery type is not rechargeable.

Electrons – Go With the Flow!

- T5A6 A mobile transceiver usually requires about 12 volts.
- T4A11 A mobile transceiver's power negative connection should be made at the battery or engine block ground strap.
  - Ham radio power leads need to be connected directly at the battery source.
- T5A3 Current is the name for the flow of electrons in an electric circuit.
  - Think of the flow of water in a pipe (not the force)
- T7D4 An ammeter is an instrument used to measure electric current.

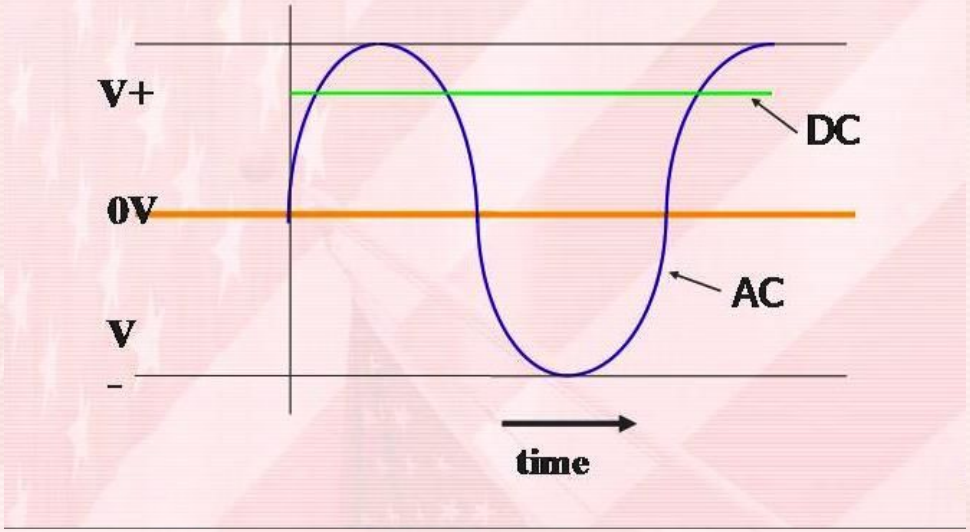


Ammeter in series to measure current.

Electrons – Go With the Flow!

- T7D3 An ammeter is connected to a circuit in series with the circuit.
- T5A1 Electrical current is measured in amperes
- T5A7 Copper is a good electrical conductor.
- T5A9 Alternating current is the name for a current that rev

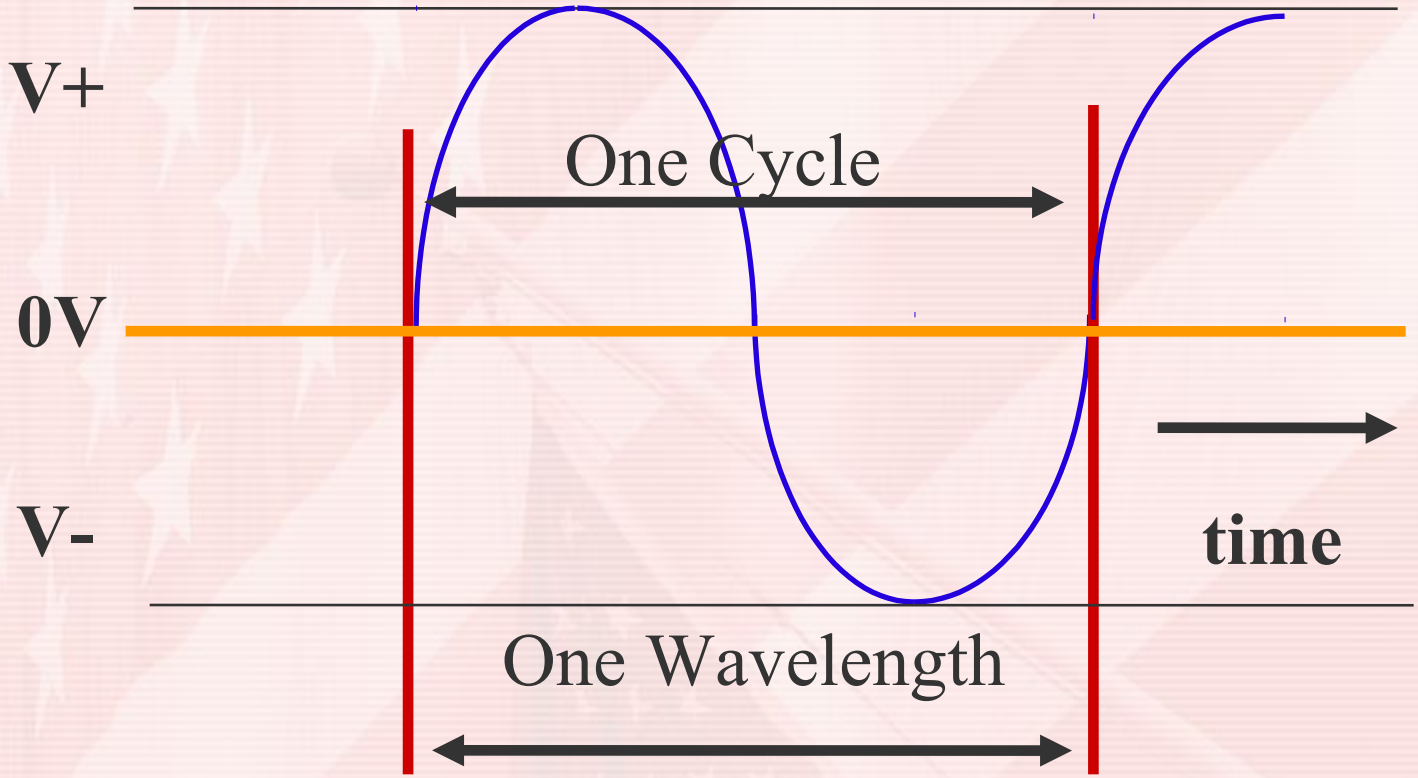
Copper is a good conducto r



AC & DC voltages

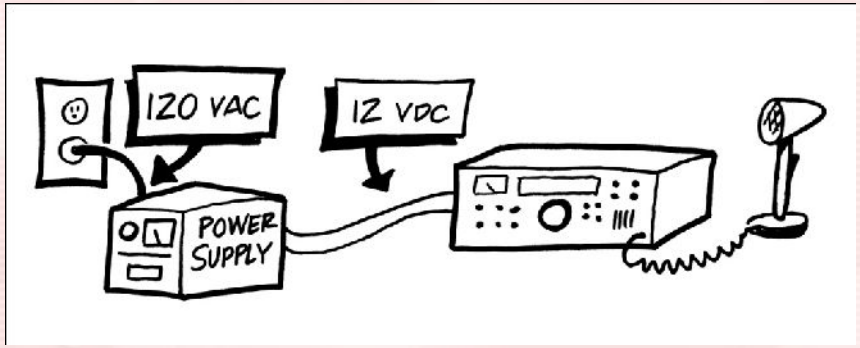
Electrons – Go With the Flow!

- T3B2 The term that describes the number of times per second that an alternating current reverses direction is frequency.



Electrons – Go With the Flow!

- T6D1 Rectifier devices or circuits change an alternating current into a varying direct current signal.



Power supply contains: Transformer, rectifier (diodes), filter choke, capacitors, and regulators.

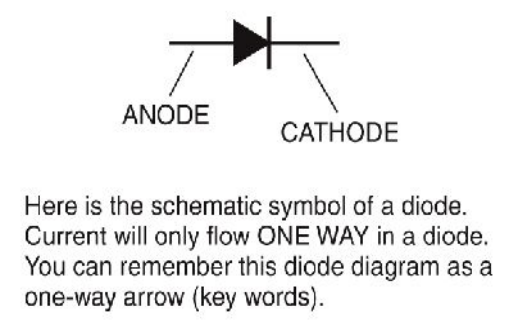
This circuitry converts the house 120 VAC to varying DC and that is filtered and smoothed out to produce DC current that we need for our ham radio equipment.

Electrons – Go With the Flow!

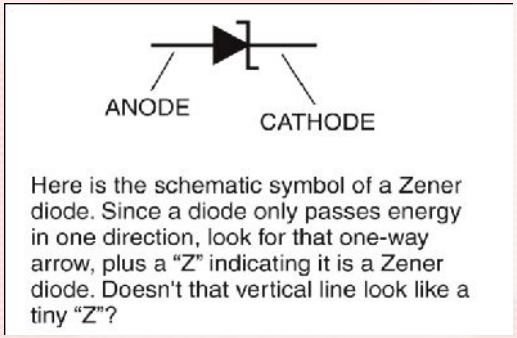
- T5A4 Direct current is the name for a current that flows only in one direction.

Electrons – Go With the Flow!

- T6B2 A diode is an electronic component that allows current to flow in only one direction.
  - Rectification is process of changing AC to pulsating DC
  - Diode stops current flow when it tries to go in the reverse direction
- T6B9 Anode and cathode are the names of the two electrodes of a diode



Semiconductor Diode

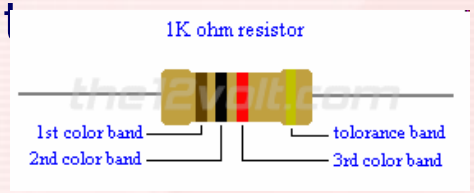


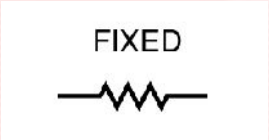
Zener Diode

- T6B6 A semiconductor diode's cathode lead usually identified with a stripe

Electrons – Go With the Flow!

- T6A1 A resistor is the electrical component used to oppose the flow of current in a DC circuit





Schematic Symbol

- T7D5 An ohmmeter is an instrument used to measure resistance

A D'Arsonval-type meter uses a mechanical needle to indicate the test results.

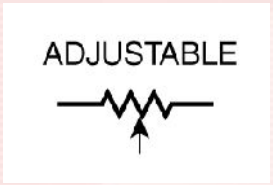
Digital meter

Both use internal batteries.

Caution: NEVER measure voltage or current in the Ohm position

Electrons – Go With the Flow!

- T6A2 The potentiometer is the type of component often used as an adjustable volume control.

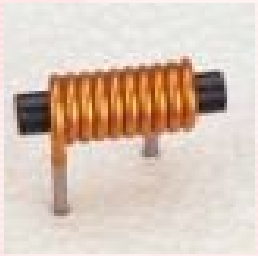


Schematic Symbol

- T6A3 Resistance is the electrical parameter controlled by a potentiometer.
- T5A8 Glass is a good electrical insulator.

Electrons – Go With the Flow!

- T6A6 An inductor is the type of electrical component that stores energy in a magnetic field.
- T6A7 The inductor is an electrical component usually composed of a coil of wire.

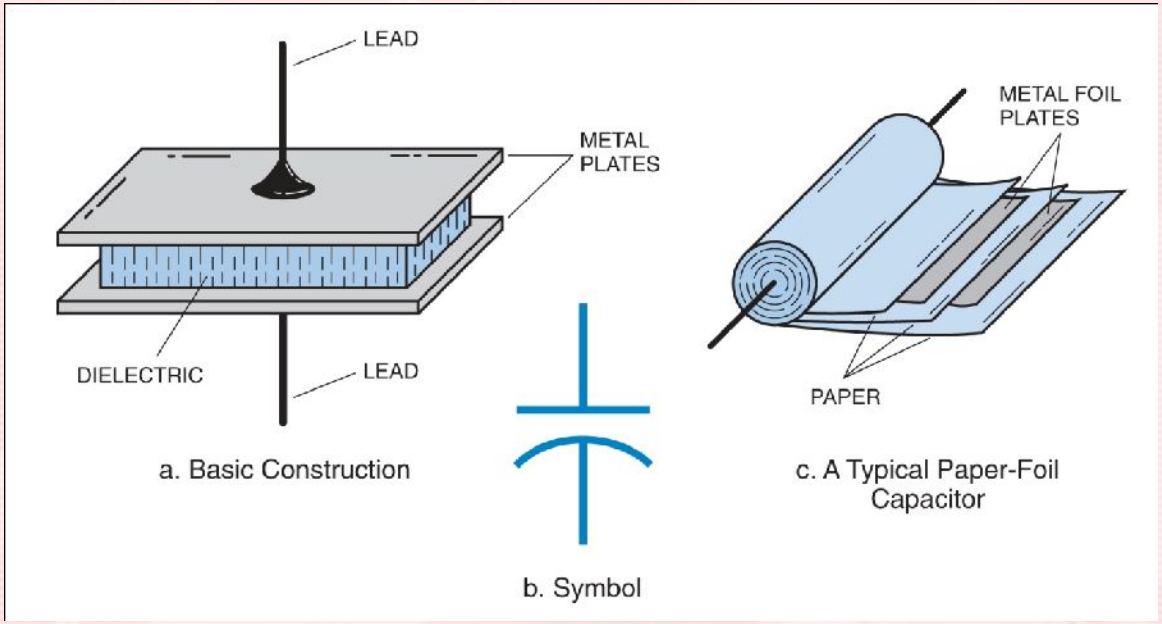


Schematic Symbol

- T5C3 The ability to store energy in a magnetic field is called inductance.
- T5C4 The basic unit of inductance is the henry.

Electrons – Go With the Flow!

- T5C1 The ability to store energy in an electric field is called capacitance.
- T5C2 The basic unit of capacitance is the farad.
- T6A4 A capacitor is the electrical component that stores energy in an electric field.



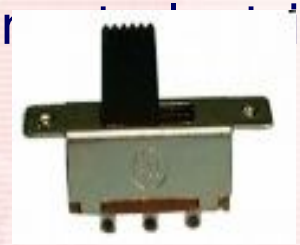
Typical construction and schematic symbol for capacitors.

Various types of capacitors

Electrons – Go With the Flow!

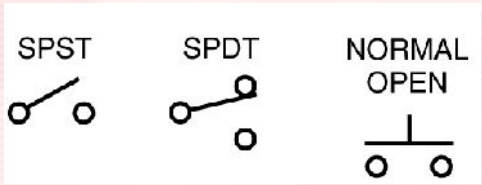
- T6A5 The capacitor is the type of electrical component consisting of two or more conductive surfaces separated by an insulator.
  - Paper, glass, air, etc...
- T6A8 A switch is an electrical component that is used to co disconn cal circuits

Toggle Switch



Slide Switch

Rocker Switch

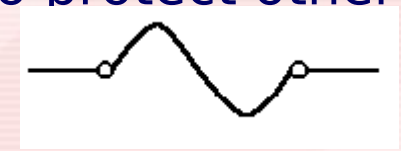


Schematic Symbol

- T6A9 A fuse is an electrical component used to protect other circuit compo m current o ds.

Slow Blow Fuse

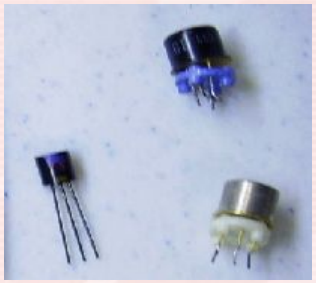
Automobile Fuse



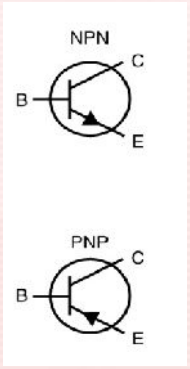
Schematic Symbol

Electrons – Go With the Flow!

- T6B3 A transistor is a component that can be used as an electronic switch or amplifier.

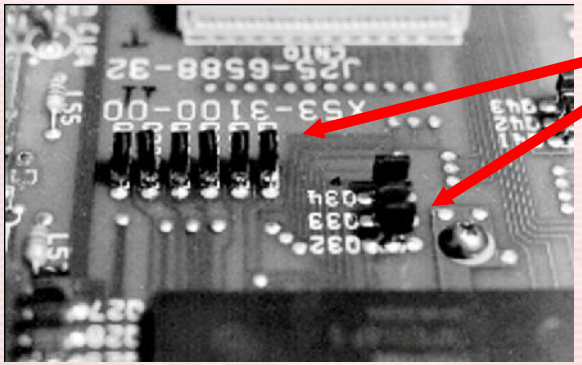


Small Signal Transistors



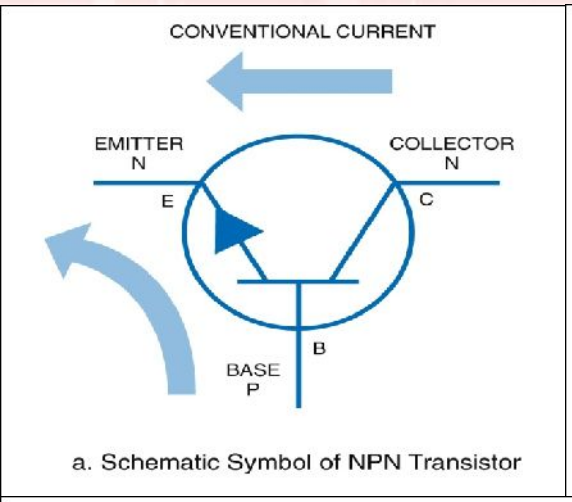
Schematic Symbol

- T6B1 Transistors are a class of electronic components capable of using a voltage or current signal to control current flow.

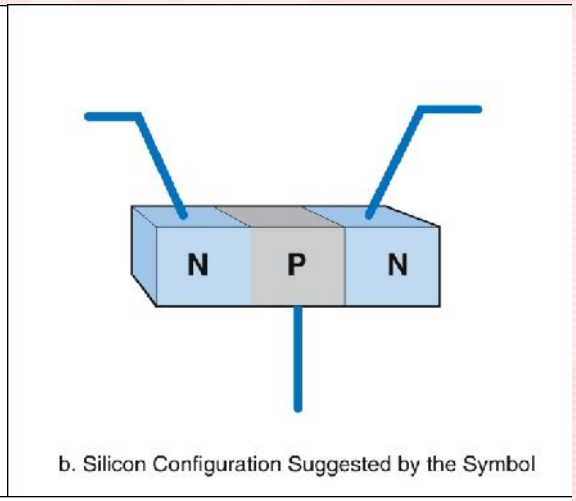


Rows of Transistors

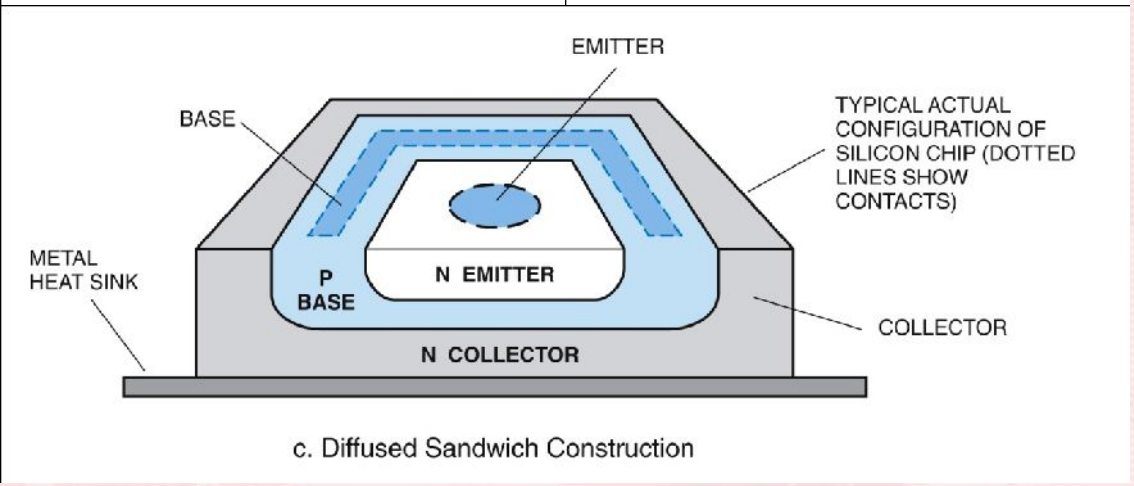
Electrons – Go With the Flow!



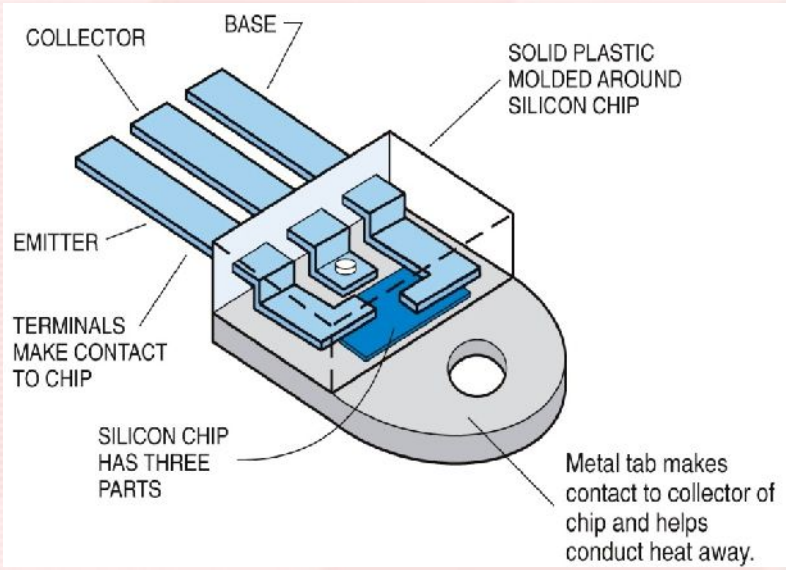
a. Schematic Symbol of NPN Transistor



b. Silicon Configuration Suggested by the Symbol



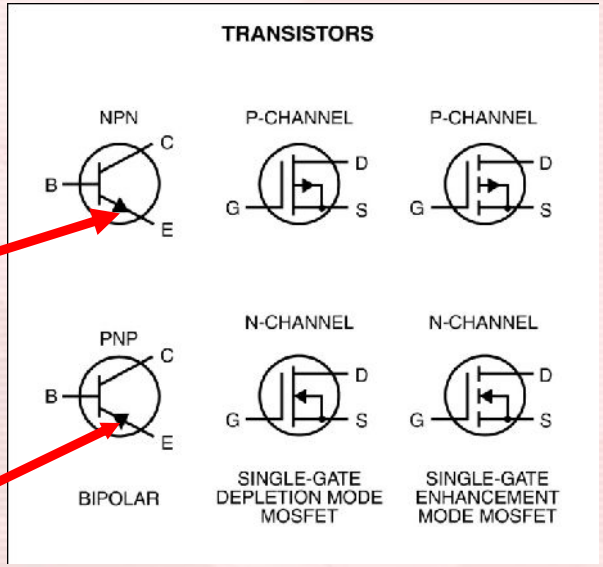
c. Diffused Sandwich Construction



Transistor Basics

Electrons – Go With the Flow!

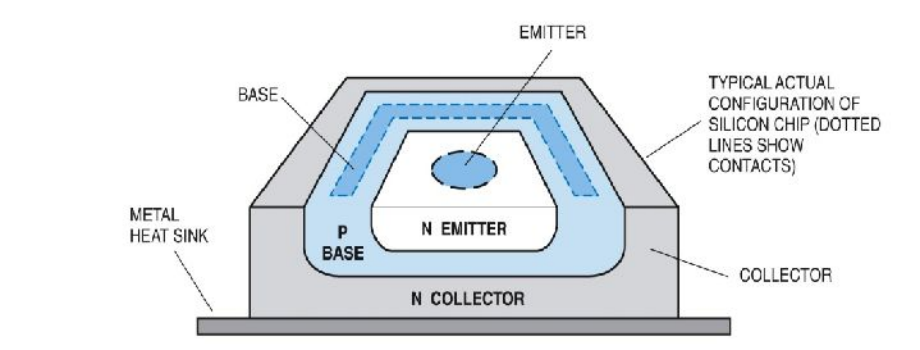
- T6B5 The transistor is an electronic components that can amplify signals.
- T6B12 Gain is the term that describes a transistor's ability to amplify a signal.
- T6B10 The bipolar transistor semiconductor component has an emitter electrode.



Emitter Electrode

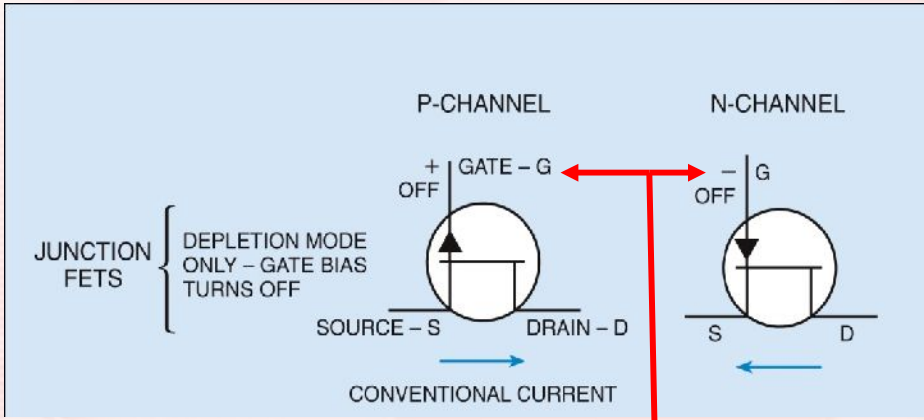
Electrons – Go With the Flow!

- T6B4 The bipolar junction transistor is a component that is made of three layers of semiconductor material.



Bipolar Junction Transistor

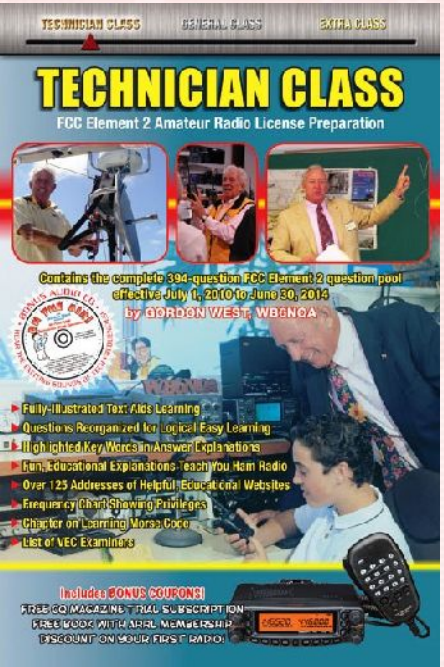
- T6B8 The abbreviation "FET" stands for **F**ield **E**ffect **T**ransistor.



Field **E**ffect **T**ransistor

- T6B11 The field effect transistor semiconductor component has

Element 2 Technician Class Question Pool



Electrons Go With the Flow!

Valid July 1, 2010

Through

June 30, 2014

T5A05 What is the electrical term for the electromotive force (EMF) that causes electron flow?

A. Voltage
B. Ampere-hours
C. Capacitance
D. Inductance

T5A11 What is the basic unit of electromotive force?

A. The volt
B. The watt
C. The ampere
D. The ohm

T7D01 Which instrument would you use to measure electric potential or electromotive force?

A. An ammeter
B. A voltmeter
C. A wavemeter
D. An ohmmeter

T7D02 What is the correct way to connect a voltmeter to a circuit?

A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit

T6A10 What is the nominal voltage of a fully charged nickel-cadmium cell?

A. 1.0 volts
B. 1.2 volts
C. 1.5 volts
D. 2.2 volts

T6A11 Which battery type is not rechargeable?

A. Nickel-cadmium
B. Carbon-zinc
C. Lead-acid
D. Lithium-ion

T5A06 How much voltage does a mobile transceiver usually require?

A. About 12 volts
B. About 30 volts
C. About 120 volts
D. About 240 volts

T4A11 Where should a mobile transceiver's power negative connection be made?

A. At the battery or engine block ground strap
B. At the antenna mount
C. To any metal part of the vehicle
D. Through the transceiver's mounting bracket

T5A03 What is the name for the flow of electrons in an electric circuit?

A. Voltage
B. Resistance
C. Capacitance
D. Current

T7D04 Which instrument is used to measure electric current?

A. An ohmmeter
B. A wavemeter
C. A voltmeter
D. An ammeter

T7D03 How is an ammeter usually connected to a circuit?

A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit

T5A01 Electrical current is measured in which of the following units?

A. Volts
B. Watts
C. Ohms
D. Amperes

T5A07 Which of the following is a good electrical conductor?

A. Glass
B. Wood
C. Copper
D. Rubber

T5A09 What is the name for a current that reverses direction on a regular basis?

A. Alternating current
B. Direct current
C. Circular current
D. Vertical current

T3B02

What term describes the number of times per second that an alternating current reverses direction?

A. Pulse rate
B. Speed
C. Wavelength
D. Frequency

T6D01 Which of the following devices or circuits changes an alternating current into a varying direct current signal?

A. Transformer
B. Rectifier
C. Amplifier
D. Reflector

T5A04 What is the name for a current that flows only in one direction?

A. Alternating current
B. Direct current
C. Normal current
D. Smooth current

T6B02 What electronic component allows current to flow in only one direction?

A. Resistor
B. Fuse
C. Diode
D. Driven element

T6B09 What are the names of the two electrodes of a diode?

A. Plus and minus
B. Source and drain
C. Anode and cathode
D. Gate and base

T6B06 How is a semiconductor diode's cathode lead usually identified?

A. With the word "cathode"
B. With a stripe
C. With the letter "C"
D. All of these choices are correct

T6A01 What electrical component is used to oppose the flow of current in a DC circuit?

A. Inductor
B. Resistor
C. Voltmeter
D. Transformer

T7D05 What instrument is used to measure resistance?

A. An oscilloscope
B. A spectrum analyzer
C. A noise bridge
D. An ohmmeter

T6A02 What type of component is often used as an adjustable volume control?

A. Fixed resistor
B. Power resistor
C. Potentiometer
D. transformer

T6A03 What electrical parameter is controlled by a potentiometer?

A. Inductance
B. Resistance
C. Capacitance
D. Field strength

T5A08 Which of the following is a good electrical insulator?

A. Copper
B. Glass
C. Aluminum
D. Mercury

T6A06 What type of electrical component stores energy in a magnetic field?

A. Resistor
B. Capacitor
C. Inductor
D. Diode

T6A07 What electrical component is usually composed of a coil of wire?

A. Switch
B. Capacitor
C. Diode
D. Inductor

T5C03 What is the ability to store energy in a magnetic field called?

A. Admittance
B. Capacitance
C. Resistance
D. Inductance

T5C04 What is the basic unit of inductance?

A. The coulomb
B. The farad
C. The henry
D. The ohm

T5C01 What is the ability to store energy in an electric field called?

A. Inductance
B. Resistance
C. Tolerance
D. Capacitance

T5C02 What is the basic unit of capacitance?

A. The farad
B. The ohm
C. The volt
D. The henry

T6A04 What electrical component stores energy in an electric field?

A. Resistor
B. Capacitor
C. Inductor
D. Diode

T6A05 What type of electrical component consists of two or more conductive surfaces separated by an insulator?

A. Resistor
B. Potentiometer
C. Oscillator
D. Capacitor

T6A08 What electrical component is used to connect or disconnect electrical circuits?

A. Zener diode
B. Switch
C. Inductor
D. Variable resistor

T6A09 What electrical component is used to protect other circuit components from current overloads?

A. Fuse
B. Capacitor
C. Shield
D. Inductor

T6B03 Which of these components can be used as an electronic switch or amplifier?

A. Oscillator
B. Potentiometer
C. Transistor
D. Voltmeter

T6B01 What class of electronic components is capable of using a voltage or current signal to control current flow?

A. Capacitors
B. Inductors
C. Resistors
D. Transistors

T6B05 Which of the following electronic components can amplify signals?

A. Transistor
B. Variable resistor
C. Electrolytic capacitor
D. Multi-cell battery

T6B12 What is the term that describes a transistor's ability to amplify a signal?

A. Gain
B. Forward resistance
C. Forward voltage drop
D. On resistance

T6B10 Which semiconductor component has an emitter electrode?

A. Bipolar transistor
B. Field effect transistor
C. Silicon diode
D. Bridge rectifier

T6B04 Which of these components is made of three layers of semiconductor material?

A. Alternator
B. Bipolar junction transistor
C. Triode
D. Pentagrid converter

T6B08 What does the abbreviation "FET" stand for?

A. Field Effect Transistor
B. Fast Electron Transistor
C. Free Electron Transition
D. Field Emission Thickness

T6B11 Which semiconductor component has a gate electrode?

A. Bipolar transistor
B. Field effect transistor
C. Silicon diode
D. Bridge rectifier