1

General Class Unit 2B
Question Pool §6

Electrical Components

2 Questions

2

Batteries

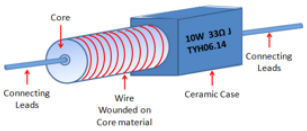
- *High discharge current* is an advantage of the low internal resistance of a nickel-cadmium battery.
- A standard 12 volt lead-acid battery has a minimum allowable discharge voltage of *10.5 volts*. Discharging below this level can cause irreversible changes in the chemical nature of the cell, which can damage or destroy the cell.

G6A02 G6A01

3

Resistors

- A wire-wound resister should not be used in an RF circuit because *its inductance could make circuit performance unpredictable*.



G6A06

4

Capacitors

- An advantage of ceramic capacitors compared to other types is their *comparatively low cost*.
- An advantage of an electrolytic capacitor is its *high capacitance for a given volume*.
- The polarity of applied voltages is important for polarized capacitors because:
  - *Incorrect polarity can cause the capacitor to short-circuit.*
  - *Reverse voltages can destroy the dielectric layer of an electrolytic capacitor.*
  - *The capacitor could overheat and explode.*

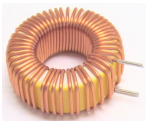
G6A14 G6A04 G6A13

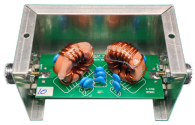
Capacitors

5 G6A14 G6A04 G6A13

Inductors

- A ferrite core toroidal inductor has the advantages of:
  - *Large values of inductance may be obtained.*
  - *The magnetic properties of the core may be optimized for a specific range of frequencies.*
  - *Most of the magnetic field is contained in the core.*
- When an inductor is operated above its self-resonant frequency, *it becomes capacitive.*

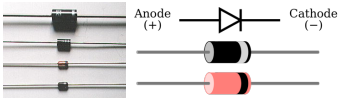




6 G6A08 G6A11

Diodes

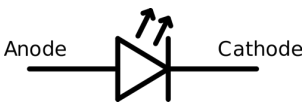
- A diode allows current in the forward direction (forward-biased), but not the reverse direction.
- All semiconductors have a junction threshold voltage, which is the needed forward voltage to create a conducting path through the device.
- Junction Threshold Voltages:
  - Germanium diode – *0.3 volts*
  - Silicon diode – *0.7 volts*



7 G6A03 G6A05

LEDs

- When an LED is emitting light it is *forward biased.*



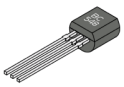
8 G6B08

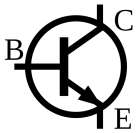
Transistors

9

G6A07

- The saturation voltage is where the transistor allows maximum current through the transistor.
- The cut-off voltage is where the transistor stops all current through the transistor.
- In a logic circuit the stable operating points are set by a transistor's *saturation and cutoff regions*.



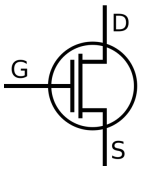


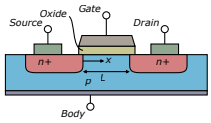
Transistors

10

G6A09

- *The gate is separated from the channel with a thin insulating layer* in a MOSFET transistor.



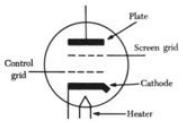


Vacuum Tubes

11

G6A10 G6A12

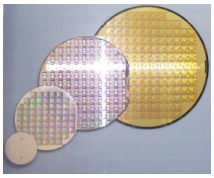
- The *control grid* of a triode vacuum tube is used to regulate the flow of electrons between the cathode and plate.
- The primary purpose of a screen grid in a vacuum tube is *to reduce grid-to-plate capacitance*.
- A vacuum tube acts most like *a field effect transistor*.

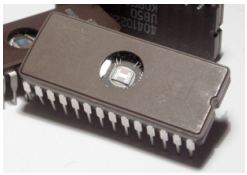


Integrated Circuits (IC)

12

- An integrated circuit is a set of circuits that are built into a plate or chip.
- ICs are usually built on silicon and can pack billions of components into an area the size of your finger nail.

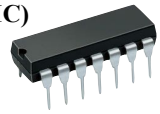




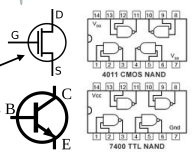
Integrated Circuits (IC)

13

G6B06 G6B03 G6B02



- ICs can be digital, analog, or mixed circuits.
- An integrated circuit operational amplifier is an example of an *analog* device.
- ICs use various logic families including CMOS (Complementary Metal Oxide Semiconductor) TTL (Transistor Transistor Logic).
  - CMOS has an advantage over TTL in that they have *low power consumption*.
  - A MMIC is a *monolithic microwave integrated circuit.*



Memory

14

G6B04 G6B05

- Memory comes in two main forms:
  - ROM – *Read Only Memory*
  - RAM – Random Access Memory
- Memory is non-volatile if *the stored information is maintained even if power is removed*.

Ferrite Cores

15

G6B10 G6B01

- A ferrite bead or core or choke may reduce common-mode RF current on the shield of a coaxial cable *by creating an impedance in the current's path*.
- *The composition, or "mix," of materials used* determines the performance of a ferrite core at different frequencies.

Connectors

16

G6B13 G6B07 G6B11 G6B12

- RF connectors
  - *PL-259* – commonly used at frequencies up to 150 MHz
  - Type N – *a moisture-resistant RF connector up to 10 GHz*
  - SMA – *small threaded connector suitable for signals up to several GHz*
- Non RF Connectors
  - *RCA Phono* – commonly used for audio signals

LCDs

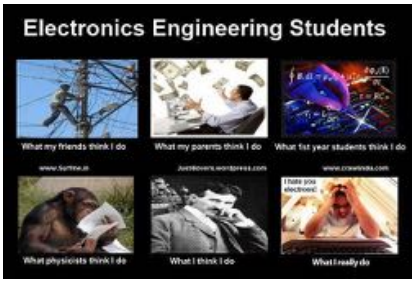
17 G6B09

•A liquid crystal display *utilizes ambient or back lighting*.

 New England Amateur Radio Inc. Amateur Radio General License Course

---

18



 New England Amateur Radio Inc. Amateur Radio General License Course

---