Reading the Tea Leaves
a.k.a .
Electronic Schematic Diagrams

KARS Presentation

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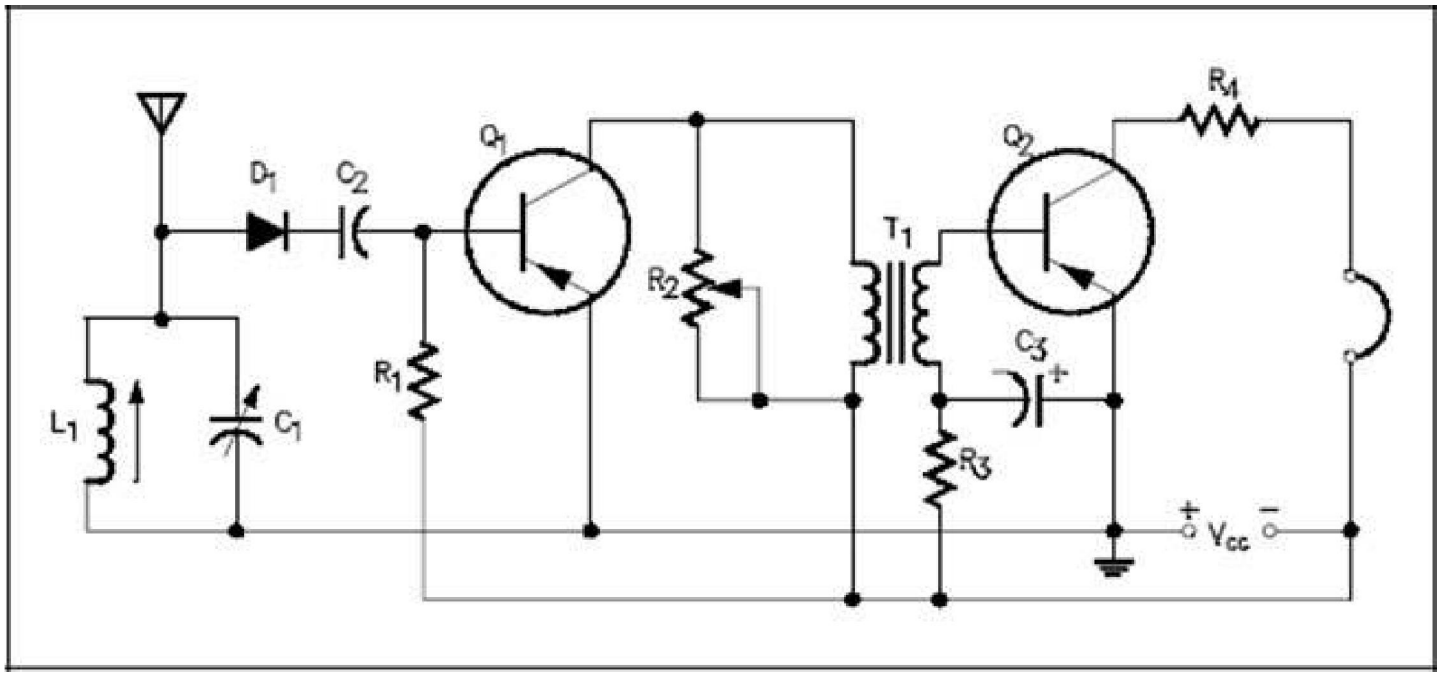
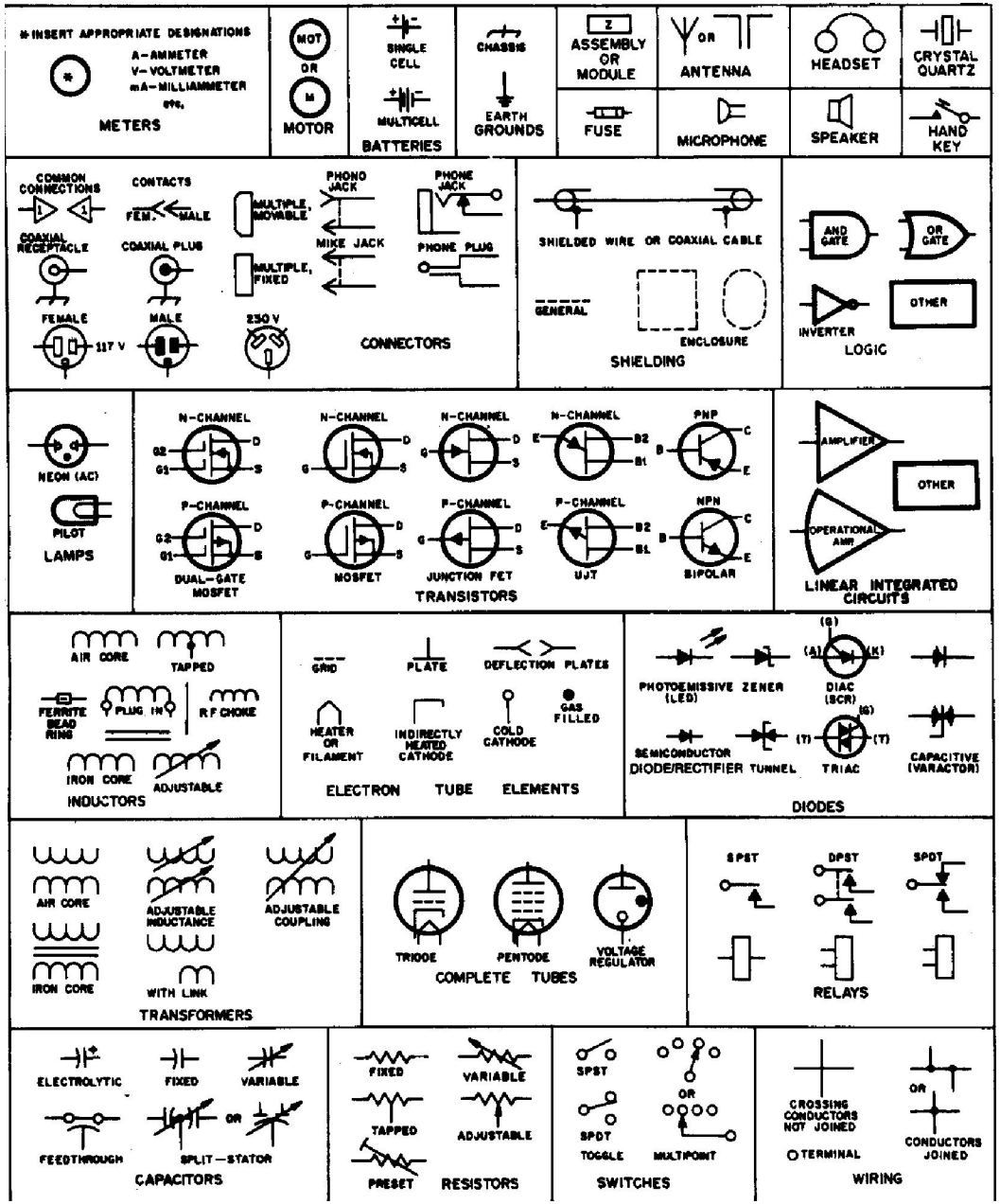
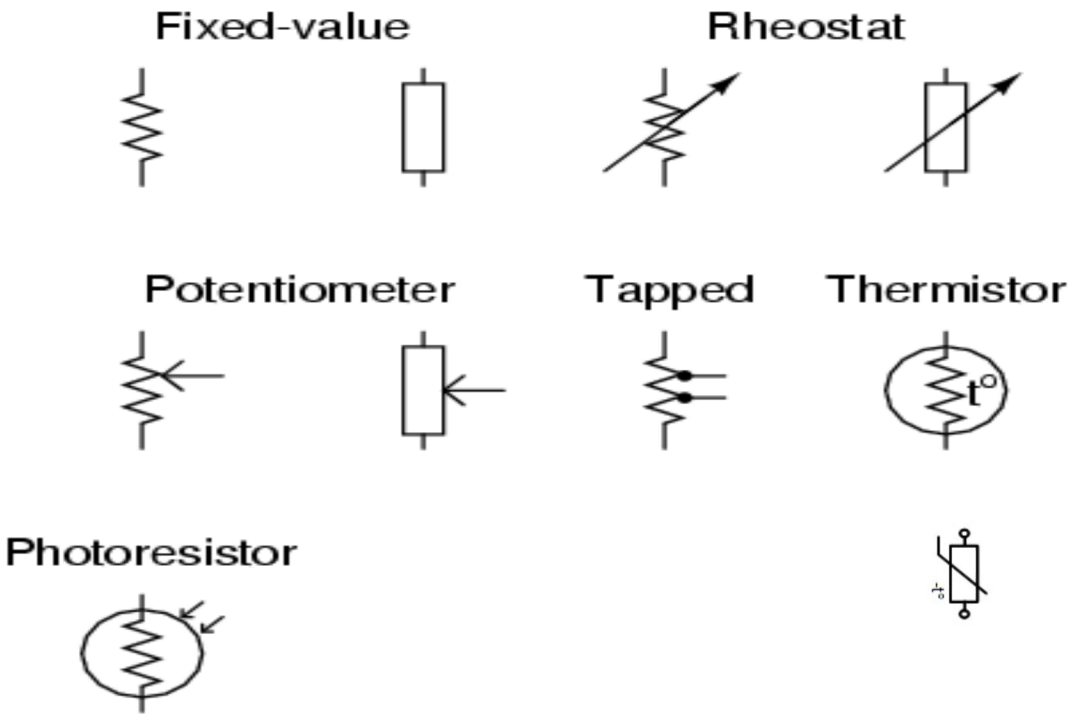
WB5KVV

What is a schematic ?

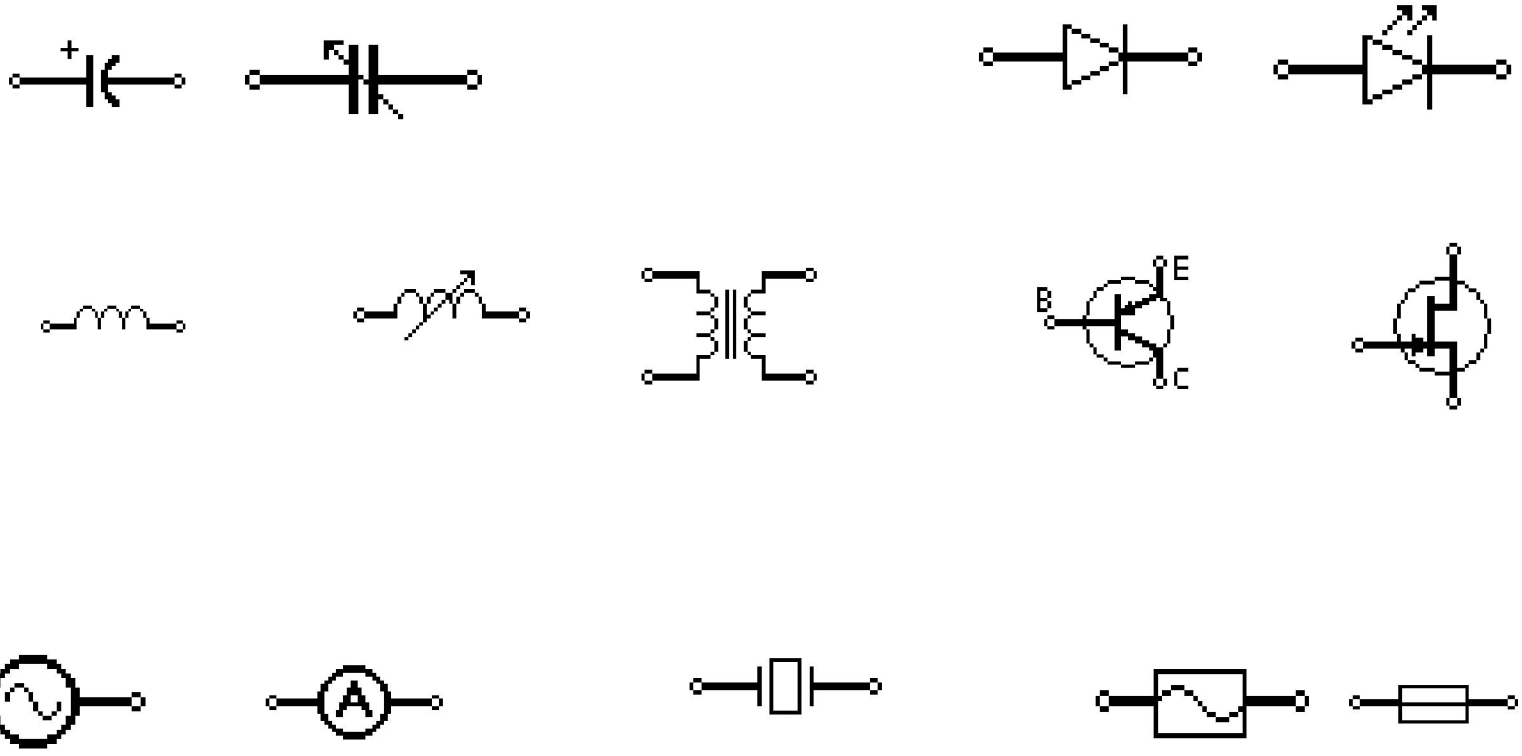



* INSERT APPROPRIATE DESIGNATIONS
A – AMMETER
V – VOLTMETER
mA – MILLIAMMETER
ETC.
METERS
MOT
OR
M
MOTOR
SINGLE CELL
MULTICELL
BATTERIES
CHASSIS
EARTH GROUNDS
Z
ASSEMBLY OR MODULE
FUSE
OR
ANTENNA
MICROPHONE
HEADSET
SPEAKER
CRYSTAL QUARTZ
HAND KEY
COMMON CONNECTIONS
CONTACTS
FEM.
MALE
COAXIAL RECEPTACLE
COAXIAL PLUG
FEMALE
MALE
117 V
MULTIPLE, MOVABLE
MULTIPLE, FIXED
PHONO JACK
MIKE JACK
PHONE JACK
PHONE PLUG
230 V
CONNECTORS
SHIELDED WIRE OR COAXIAL CABLE
GENERAL
ENCLOSURE
SHIELDING
AND GATE
OR GATE
INVERTER
OTHER
LOGIC
NEON (AC)
PILOT
LAMPS
N-CHANNEL
P-CHANNEL
DUAL-GATE MOSFET
MOSFET
JUNCTION FET
UJT
PNP
NPN
BIPOLAR
TRANSISTORS
AMPLIFIER
OPERATIONAL AMP
OTHER
LINEAR INTEGRATED CIRCUITS
AIR CORE
TAPPED
FERRITE BEAD
PLUG IN
RF CHOKE
IRON CORE
ADJUSTABLE
INDUCTORS
GRID
PLATE
DEFLECTION PLATES
HEATER OR FILAMENT
INDIRECTLY HEATED CATHODE
COLD CATHODE
GAS FILLED
ELECTRON TUBE ELEMENTS
PHOTOEMISSIVE (LED)
ZENER
DIAC (SCR)
SEMICONDUCTOR DIODE/RECTIFIER
TUNNEL
TRIAC
CAPACITIVE (VARACTOR)
DIODES
AIR CORE
ADJUSTABLE INDUCTANCE
ADJUSTABLE COUPLING
IRON CORE
WITH LINK
TRANSFORMERS
TRIODE
PENTODE
VOLTAGE REGULATOR
COMPLETE TUBES
SPST
DPST
SPDT
RELAYS
ELECTROLYTIC
FIXED
VARIABLE
FEEDTHROUGH
SPLIT-STATOR
CAPACITORS
FIXED
VARIABLE
TAPPED
ADJUSTABLE
PRESET
RESISTORS
SPST
SPDT
TOGGLE
OR
MULTIPOINT
SWITCHES
CROSSING CONDUCTORS NOT JOINED
TERMINAL
OR
CONDUCTORS JOINED
WIRING

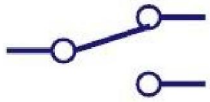
Resistors

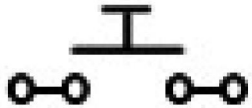

Fixed-value
Rheostat
Potentiometer
Tapped
Thermistor
t°
Photoresistor
t°

Other Common Symbols

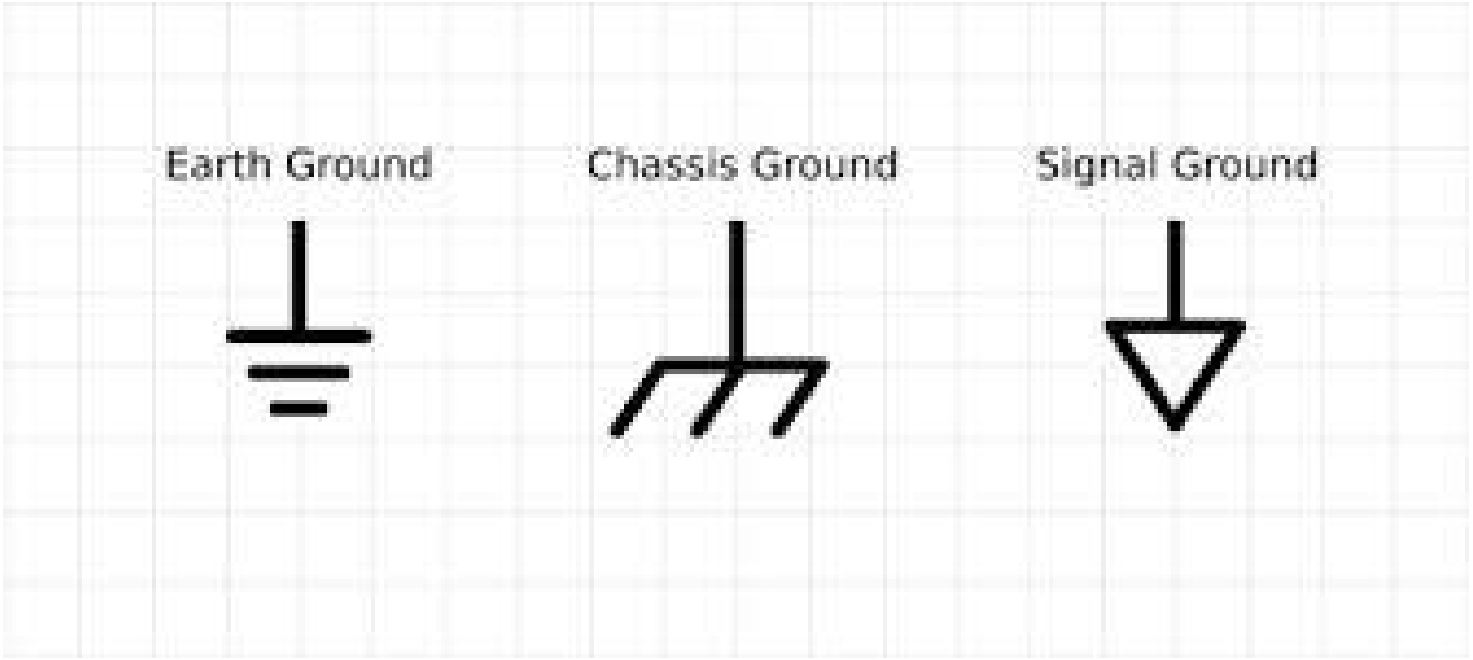


Switches and Jacks

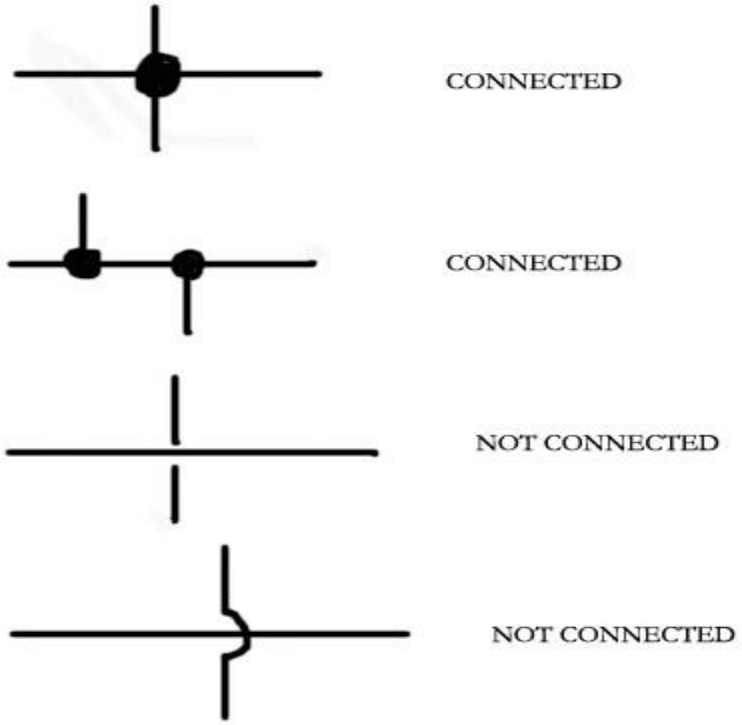




Grounds



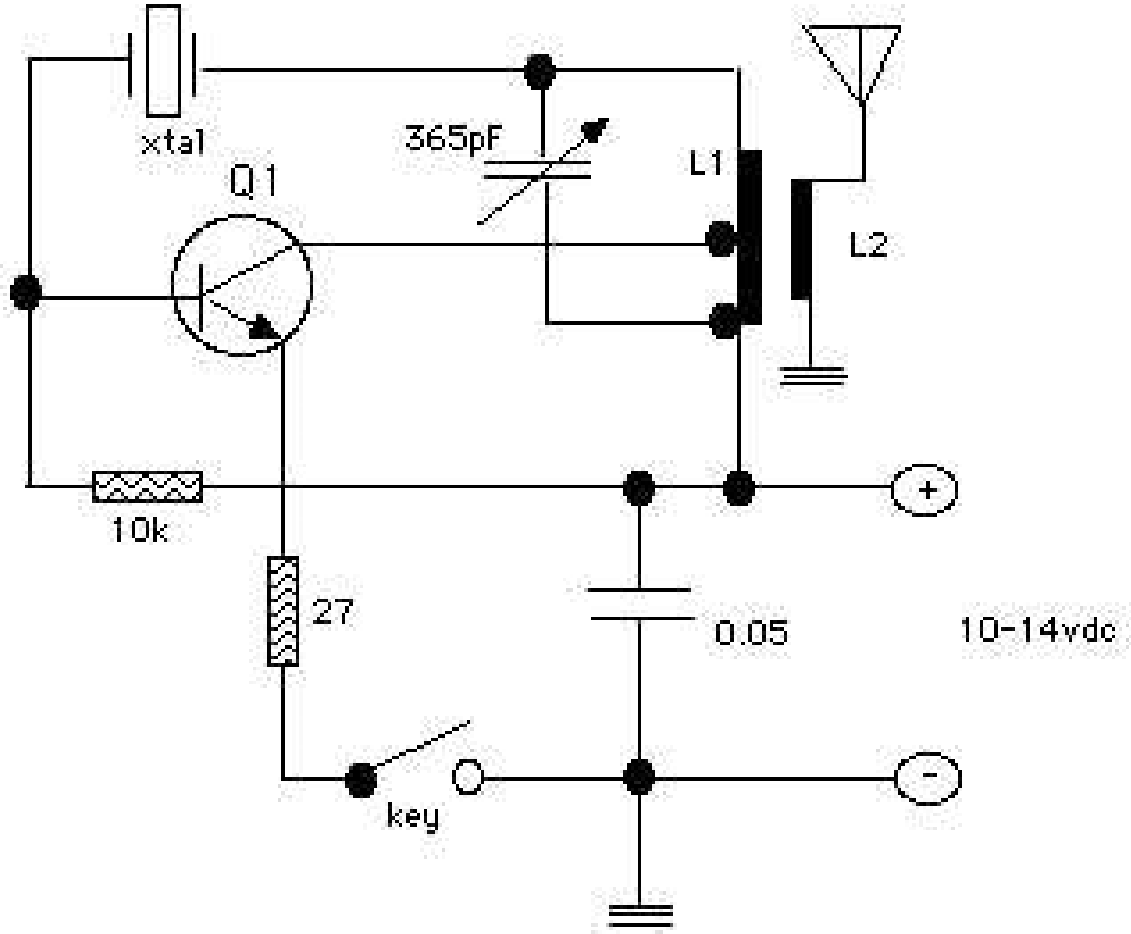
Wiring



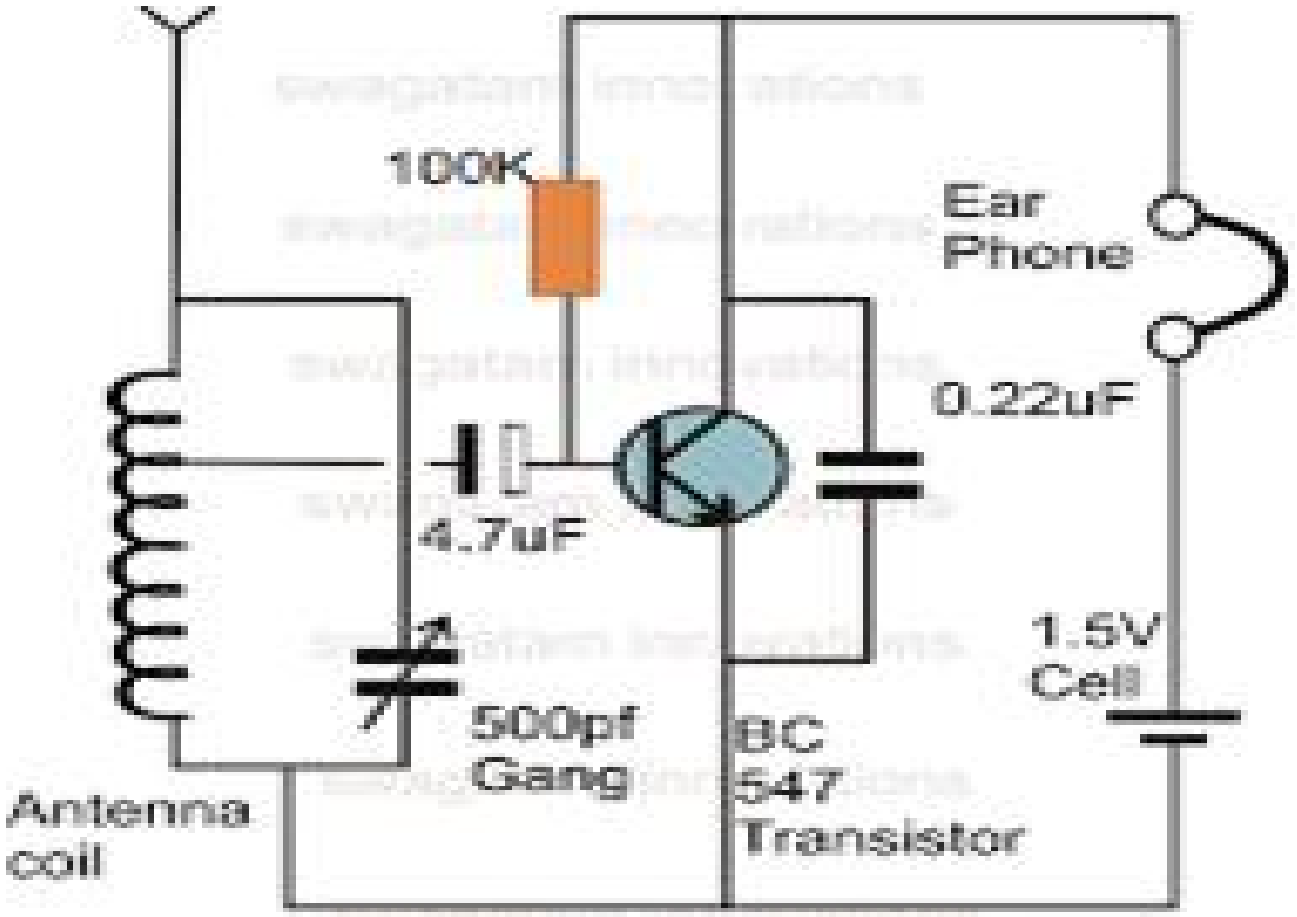
Common Conventions / Practices

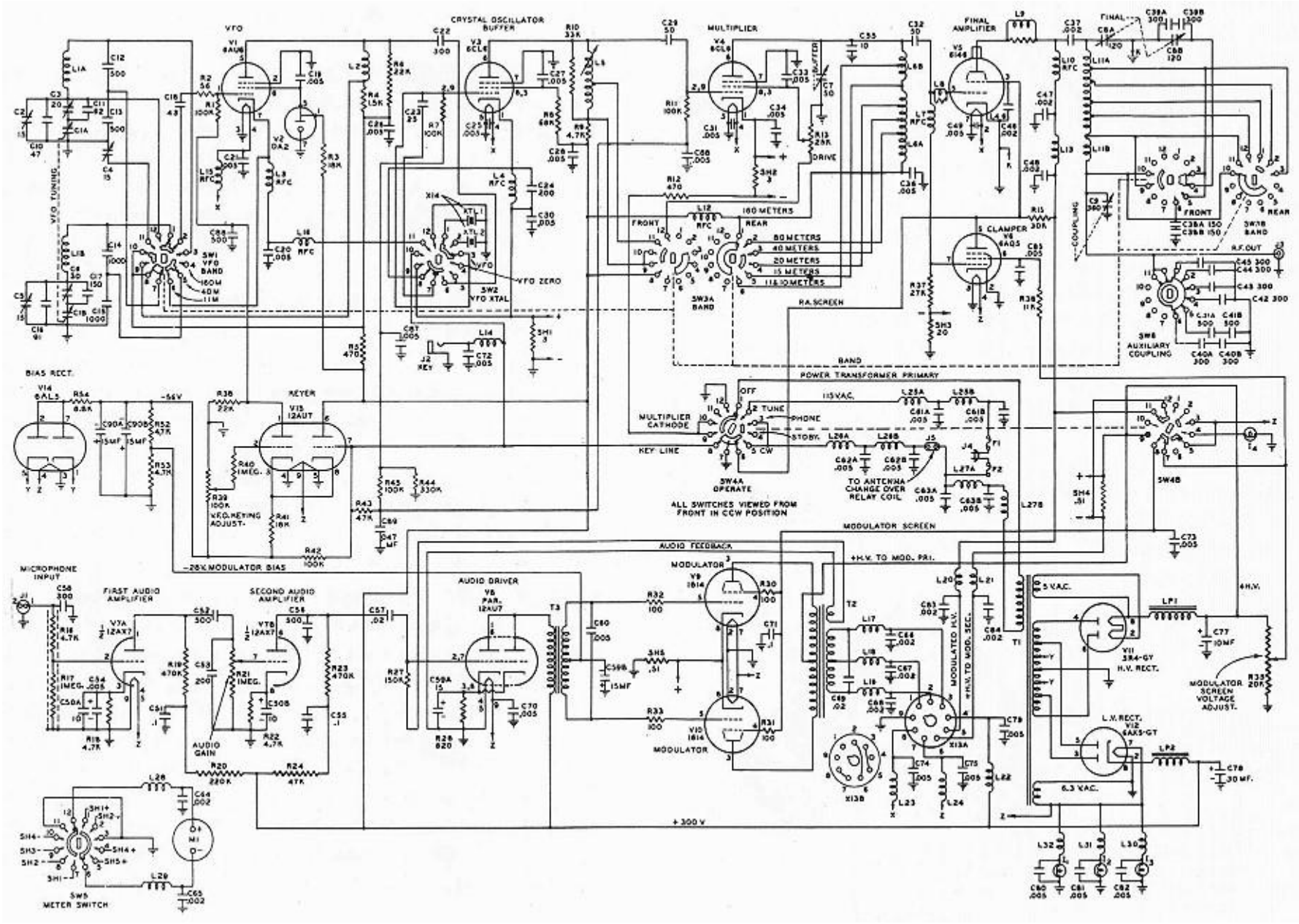
- Not all ground wires shown
- Signal most often starts at left side
- DC voltage source most often starts at top
- IC pins – depicted by function, not by actual physical location
- Sub-diagrams for
  - sections such as built-in power supply
  - different / multiple operating modes when gang switches are used
  - Expanded view of complex or very crowed areas

Simple CW transmitter



Receiver


100K
Ear
Phone
0.22uF
4.7uF
1.5V
Cell
500pf
Gang
BC
547
Transistor
Antenna
coil


VFO
CRYSTAL OSCILLATOR BUFFER
MULTIPLIER
FINAL AMPLIFIER
FINAL
VFO TUNING
SW1 VFO BAND
160M
40M
11M
SW2 VFO XTAL
VFO ZERO
160 METERS
80 METERS
40 METERS
20 METERS
15 METERS
11&10 METERS
SW3A BAND
R.F. SCREEN
S CLAMPER
SW3B BAND
R.F. OUT
SW3B AUXILIARY COUPLING
BAND
POWER TRANSFORMER PRIMARY
115 VAC.
BIAS RECT.
KEYER
KEY LINE
MULTIPLIER CATHODE
OFF
TUNE
PHONE
STDBY.
CW
SW4A OPERATE
TO ANTENNA CHANGE OVER RELAY COIL
ALL SWITCHES VIEWED FROM FRONT IN CCW POSITION
SW4B
MODULATOR SCREEN
AUDIO FEEDBACK
+H.V. TO MOD. PRI.
MICROPHONE INPUT
FIRST AUDIO AMPLIFIER
SECOND AUDIO AMPLIFIER
AUDIO DRIVER
MODULATOR
AUDIO GAIN
-26V MODULATOR BIAS
MODULATED H.V. +H.V. TO MOD. SEC.
5 VAC.
H.V. RECT.
L.V. RECT.
6.3 VAC.
MODULATOR SCREEN VOLTAGE ADJUST.
+300 V
SW5 METER SWITCH

Some Challenges

- Inconsistencies – examples: USA vs rest of world for resistors, wiring crossings, oddball symbols (example: buzzer device)
- Grounds – actual ground connections not always shown on schematic
- Discontinuities – sub-diagrams, *goto* X, *from* Y
- Physical connections - plugs and sockets, (phone jacks, coax, mike connections)

Additional Info

- ARRL Tech reference articles from QST – *Basics for Beginners, First Steps in Radio*, searchword *schematics*
- SparkFun -https://learn.sparkfun.com/tutorials/how-to-read-a-schematic
- Build Electronic Circuits -https://www.build-electronic-circuits.com/electronic-schematics/