EE-100 Engineering Laboratory

Module1: PCB

Dr. –Ing. Ahmad Kamal Nasir

[Office Hours]

Tuesday (1000-1100)

Thursday (1000-1100)

Room 9-245A (EE Dept. Right Wing)

Module 1

WEEK 2

Today's Topics

- Create computer schematic of your circuit
  - Introduction to Proteus
  - Introduction to Proteus ISIS GUI
  - Basic circuit schematic in Proteus ISIS
  - Circuit Simulation in Proteus ISIS
- Create computer generated layout drawing of a circuit
  - Introduction to Proteus ARES GUI
  - Basic circuit layout drawing in Proteus ARES
  - Circuit Visualization in Proteus ARES

Task 2(a)

- Hand draw a diagram/sketch for an electronic circuit to Turn On/Off a LED. Use the proper electronic symbol to represent circuit elements of your circuit. [Hint: Use a switch and resistor for control]

  Circuit Specification:

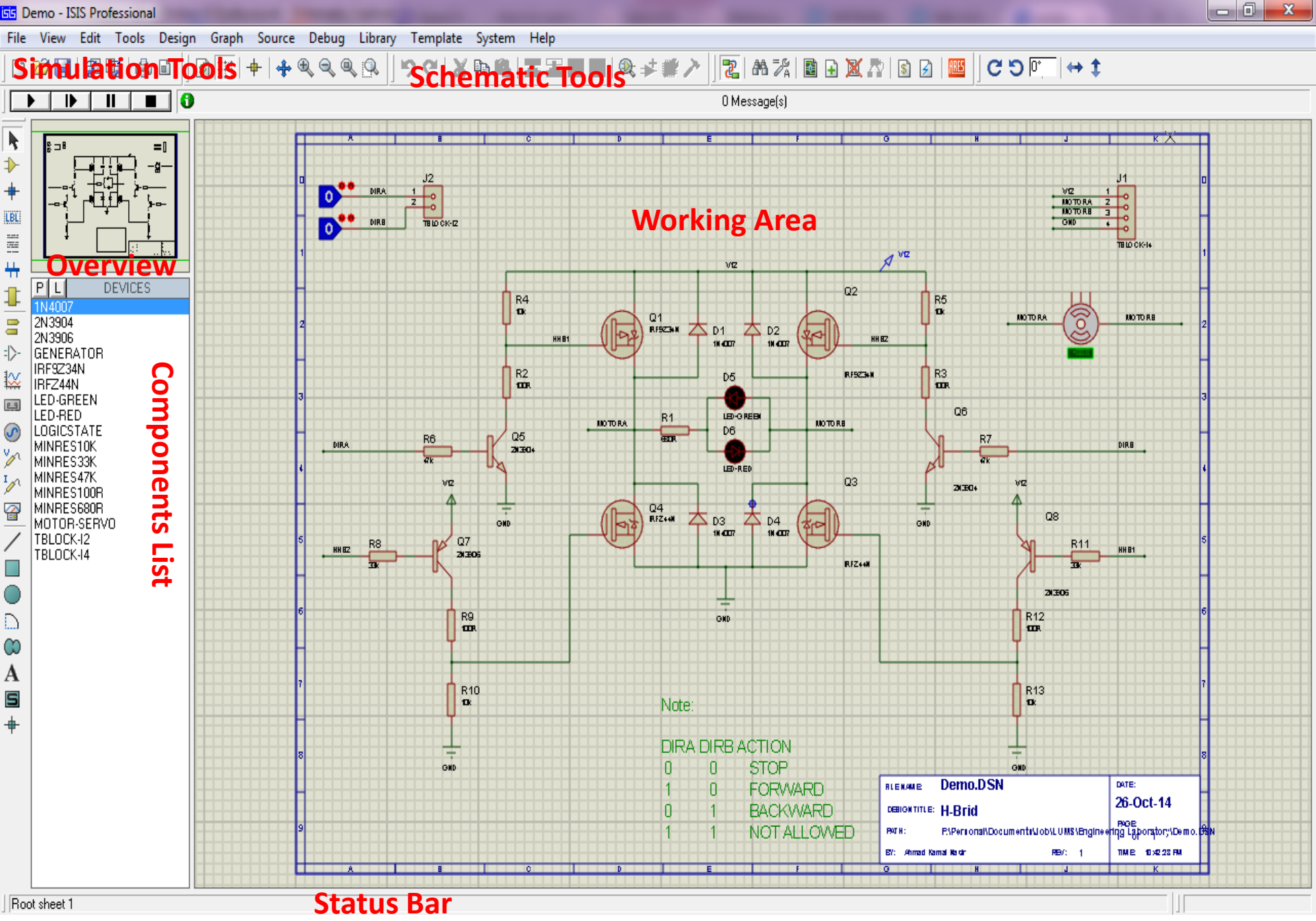
  Power Supply/Battery Voltage: DC 5V

  LED Current: 20mA, LED Voltage Drop: 2V

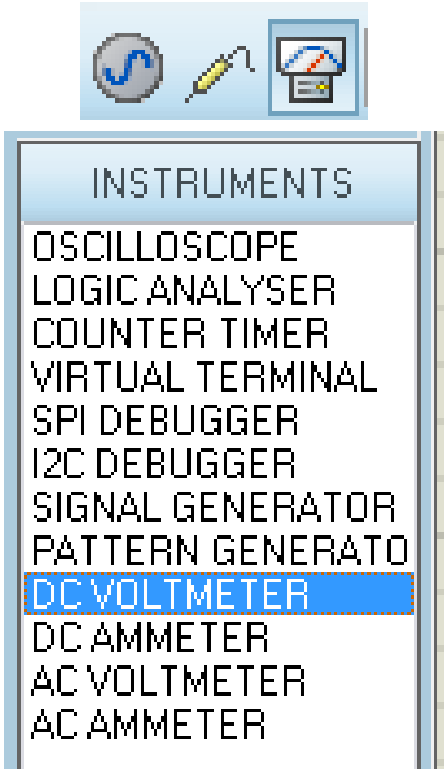
  Switch: SPST

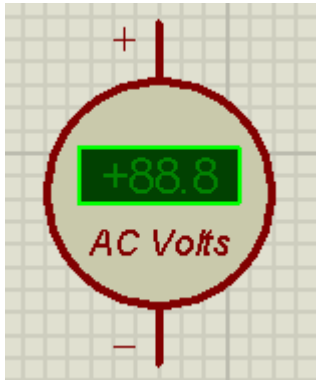
PCB Fabrication Workflow

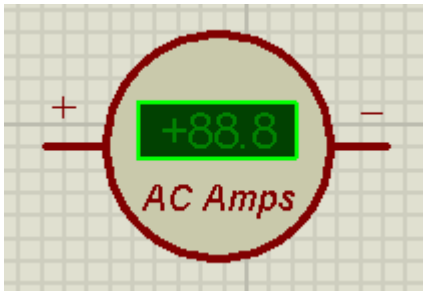
- Translate your manual sketch in to a computerized drawing
- Simulate and analyze your circuit, modify the circuit components if required.
- Create a layout drawing of your circuit: place and arrange the components and connect then using wire-lines
- Print the drawings and etch the PCB

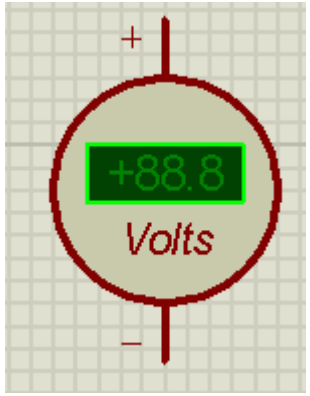

Demo - ISIS Professional
File View Edit Tools Design Graph Source Debug Library Template System Help
Simulation Tools
Schematic Tools
0 Message(s)
Overview
P L DEVICES
1N4007
2N3904
2N3906
GENERATOR
IRF9Z34N
IRFZ44N
LED-GREEN
LED-RED
LOGICSTATE
MINRES10K
MINRES33K
MINRES47K
MINRES100R
MINRES680R
MOTOR-SERVO
TBLOCK-I2
TBLOCK-I4
Components List
Working Area
J2
J1
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
D1
D2
D3
D4
D5
D6
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
Note:
DIRA DIRB ACTION
0 0 STOP
1 0 FORWARD
0 1 BACKWARD
1 1 NOT ALLOWED
Demo.DSN
H-Brid
26-Oct-14
Root sheet 1
Status Bar

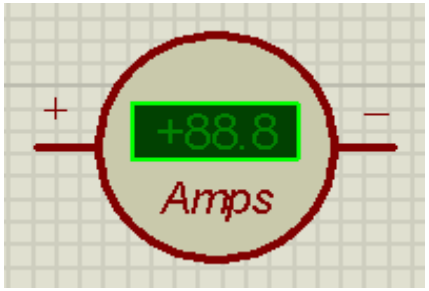
Voltmeter and Ammeter



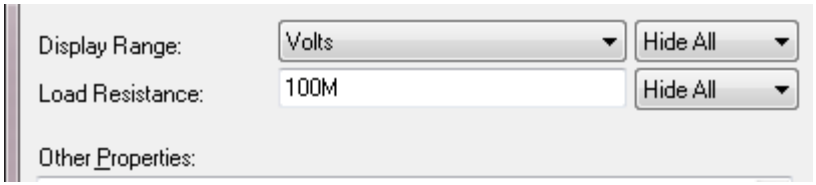




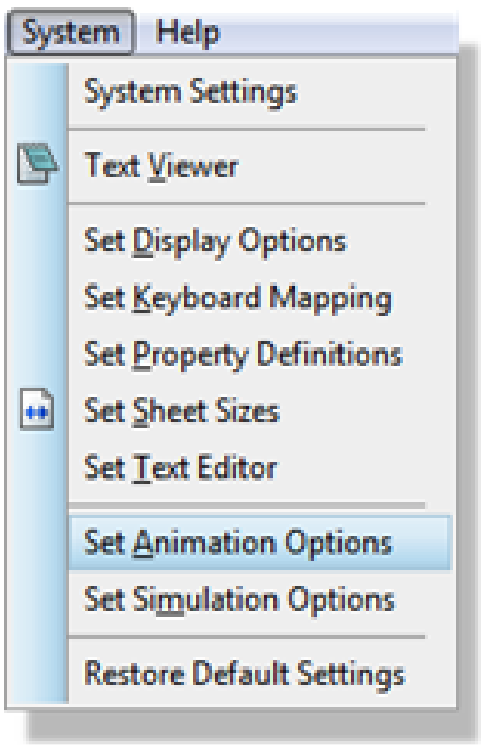


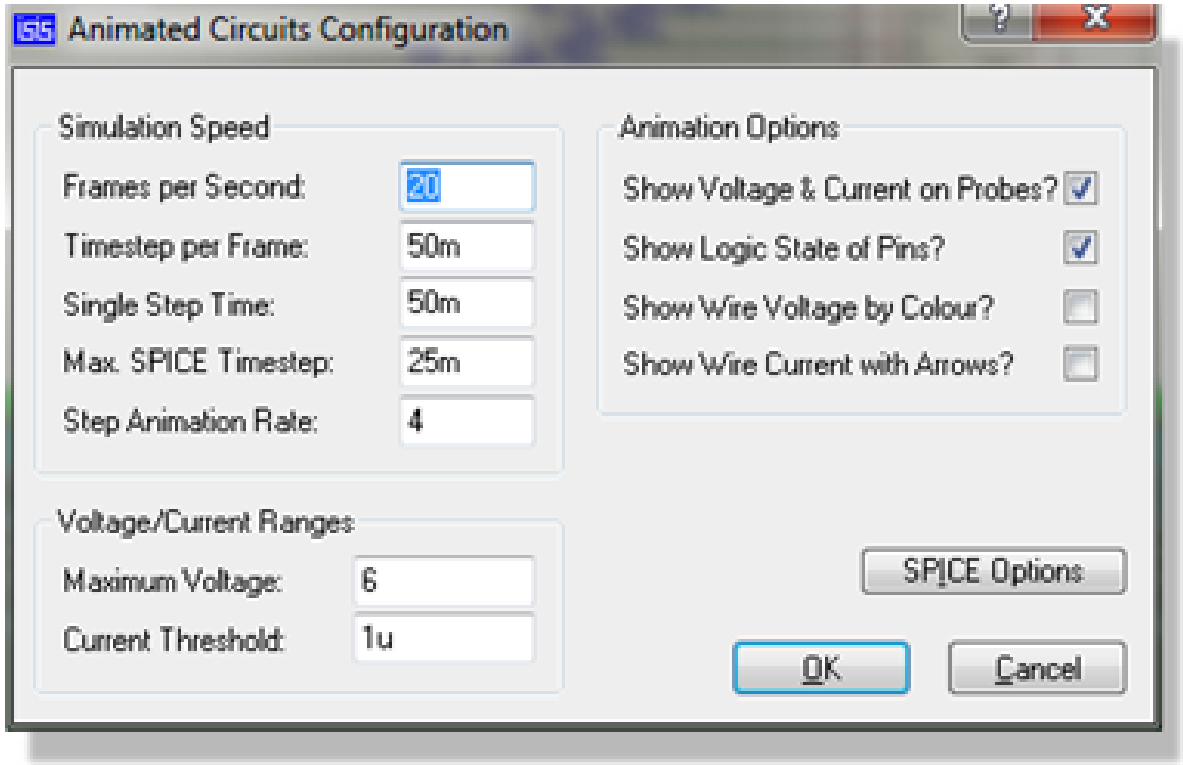


AC voltmeter and ammeter
Shows True RMS value

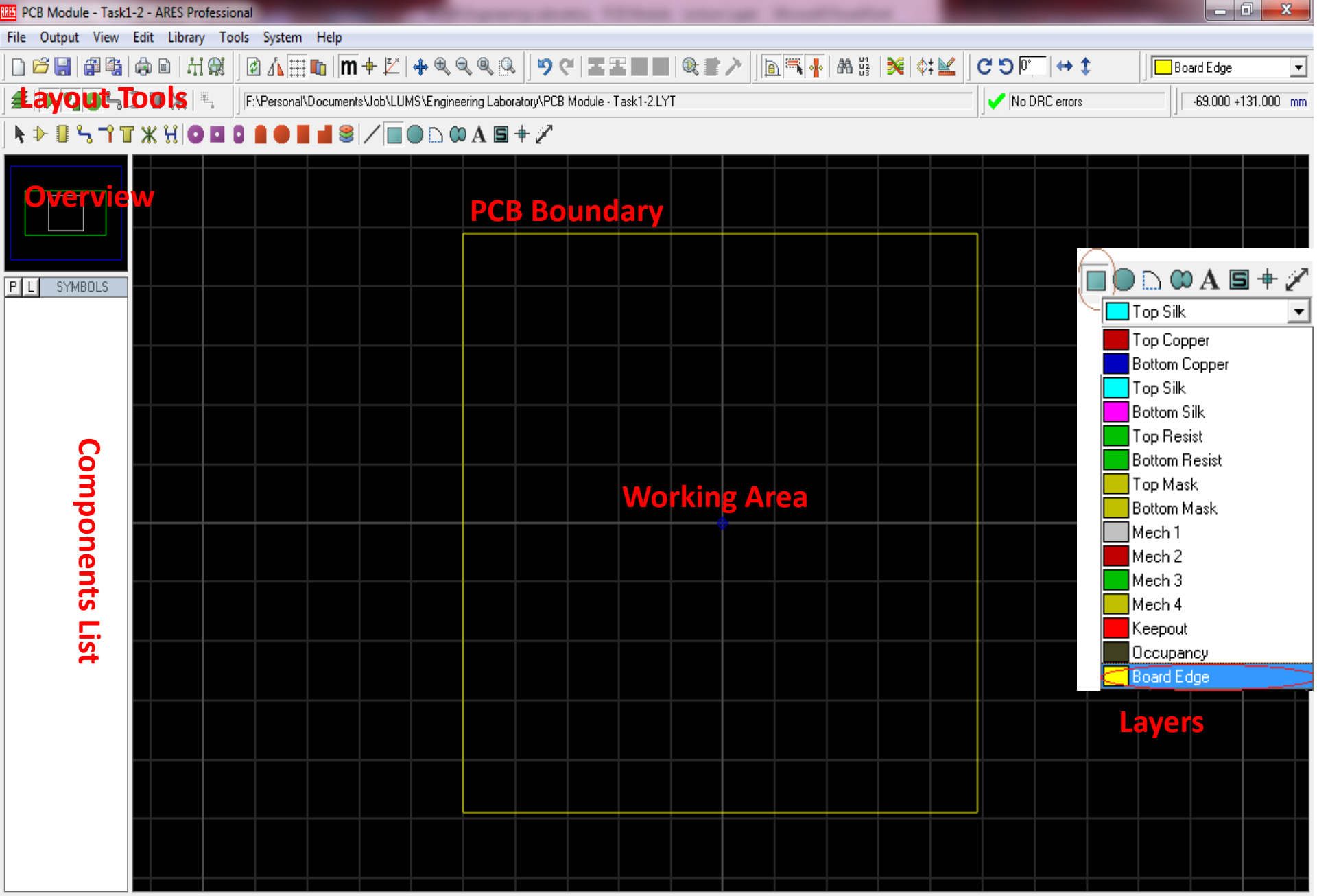


Setting Up Environment: Animation/Timestamp Control

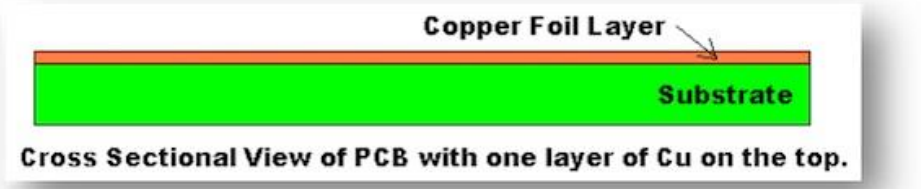




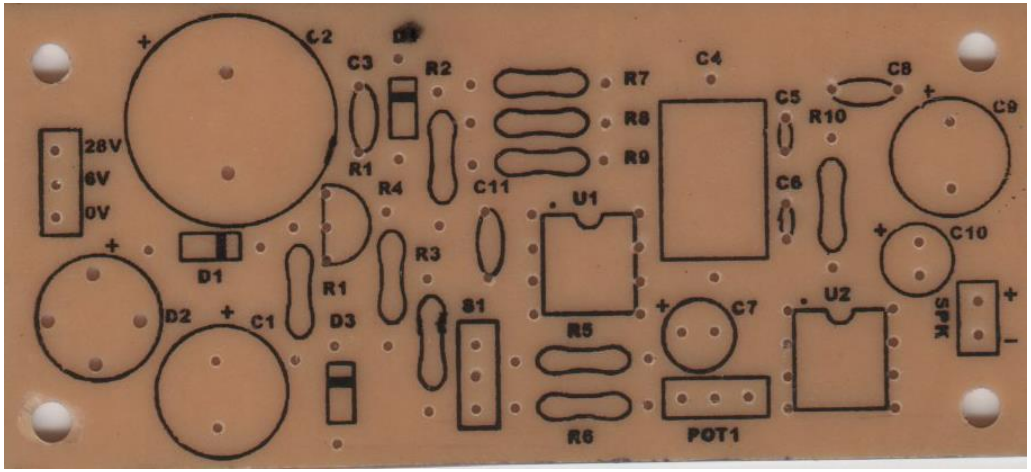
Configuring the Step time for Animation

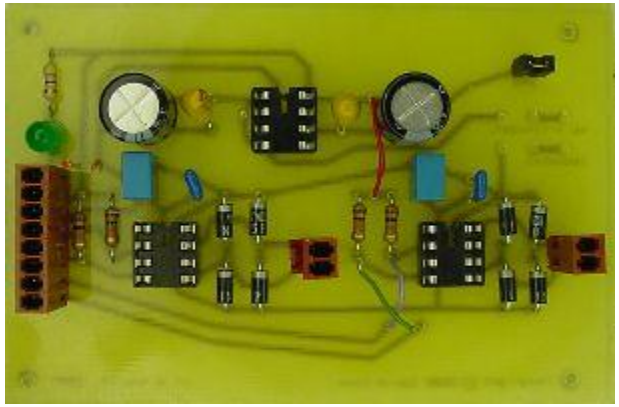

PCB Module - Task1-2 - ARES Professional
File Output View Edit Library Tools System Help
Layout Tools
F:\Personal\Documents\Job\LUMS\Engineering Laboratory\PCB Module - Task1-2.LYT
No DRC errors
-69.000 +131.000 mm
Board Edge
Overview
PCB Boundary
P L SYMBOLS
Components List
Working Area
Top Silk
Top Copper
Bottom Copper
Top Silk
Bottom Silk
Top Resist
Bottom Resist
Top Mask
Bottom Mask
Mech 1
Mech 2
Mech 3
Mech 4
Keepout
Occupancy
Board Edge
Layers

Single Layer PCB

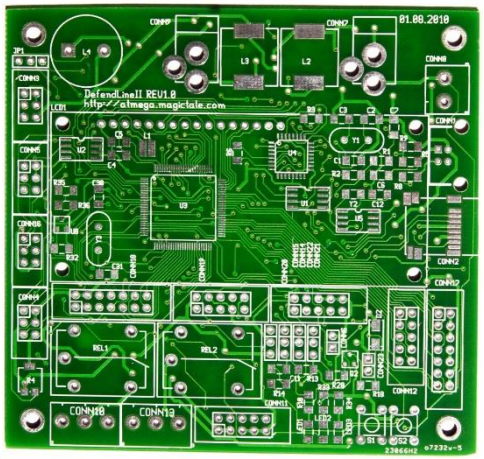


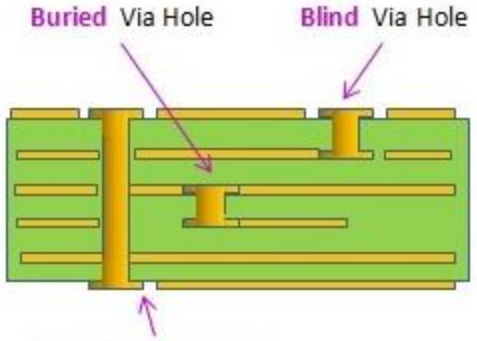
Cross Sectional View of PCB with one layer of Cu on the top.

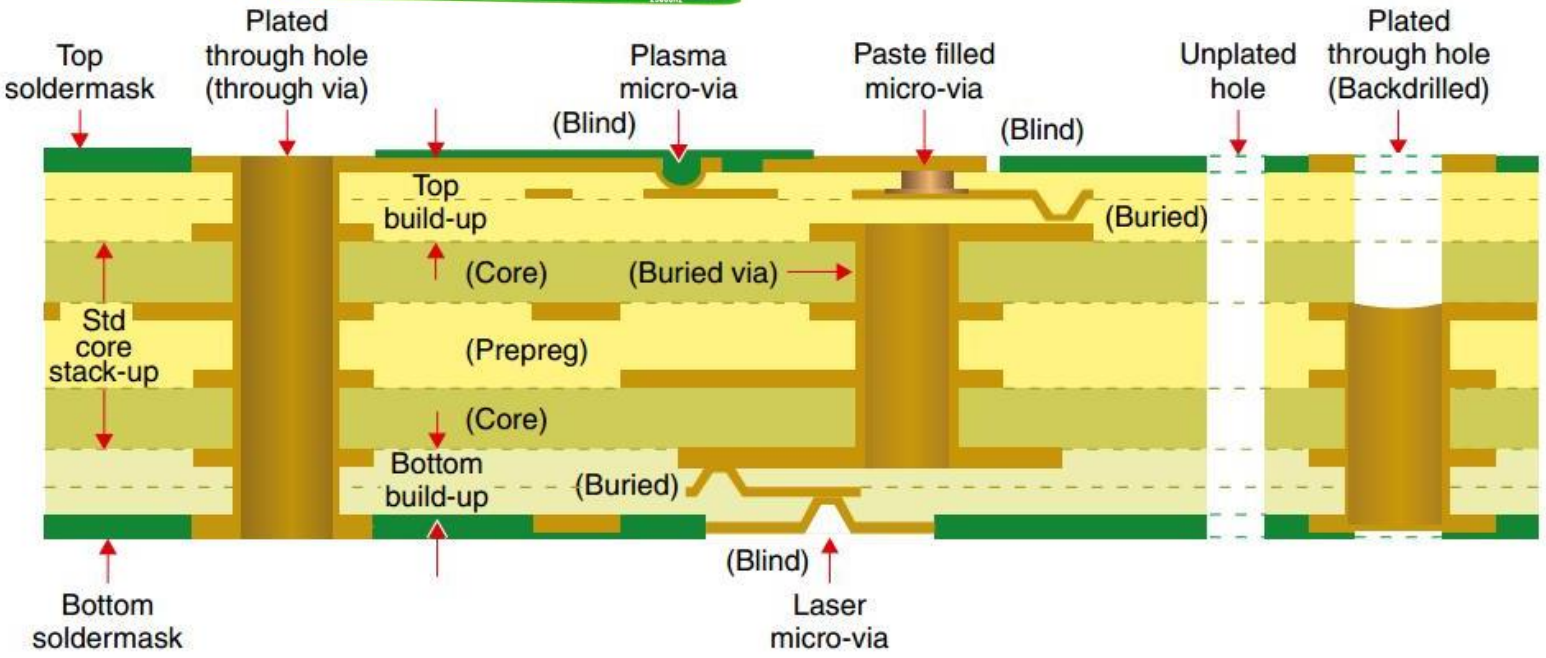




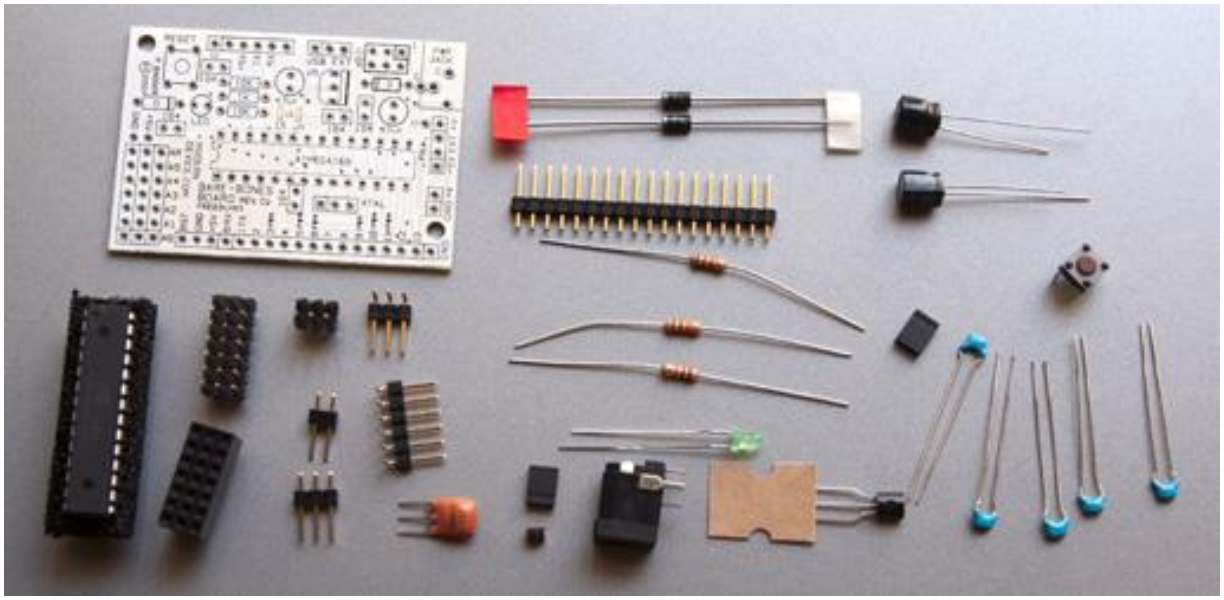
Multilayer PCB Nomenclature

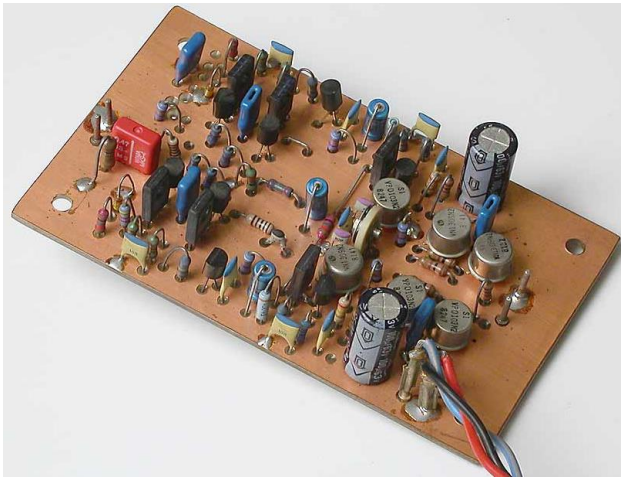


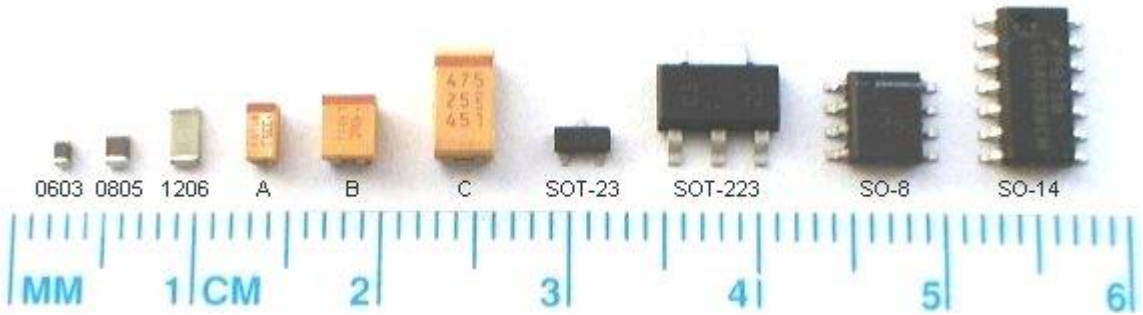


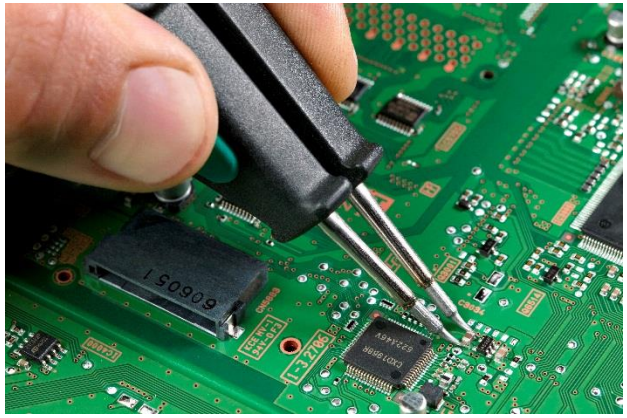


Through-Hole/SMD Components

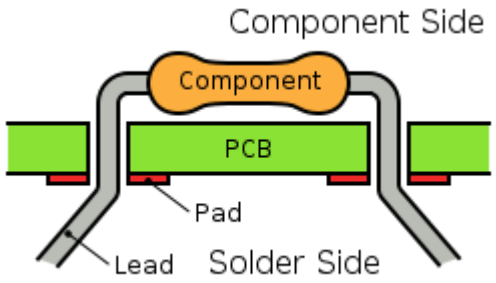


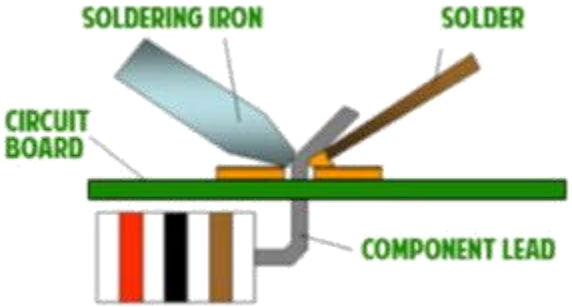


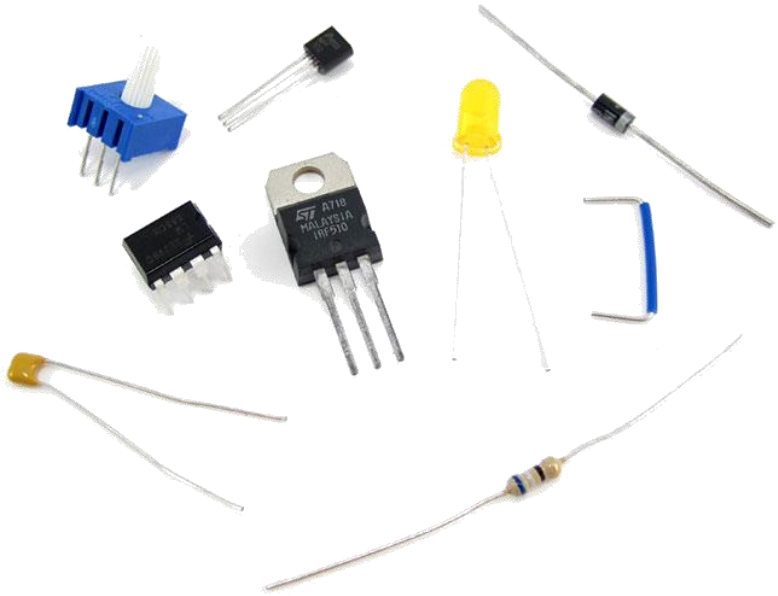


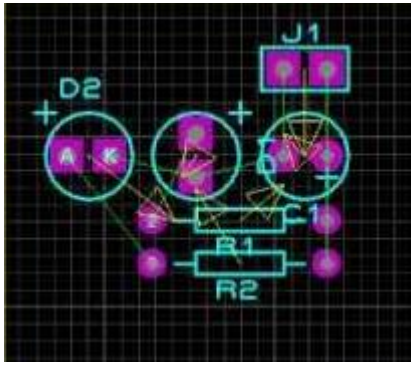


Through hole components









SMD Components

Condensador cerámico SMD

Condensador de Tantalio SMD

Condensador electrolítico SMD

R47	4R7	47R	K47	4K7	47K	M47	4M7
0.47 Ω	4.7 Ω	47 Ω	470 Ω	4.7 kΩ	47 kΩ	470 kΩ	4.7 MΩ

R464	464R	4K64	471	472	473	474	475
0.464 Ω	464 Ω	4.64 kΩ	470 Ω	4.7 kΩ	47 kΩ	470 kΩ	4.7 MΩ

4640	470
464 Ω	47 Ω

THESE STYLES ARE AMBIGUOUS AND ARE RARELY USED

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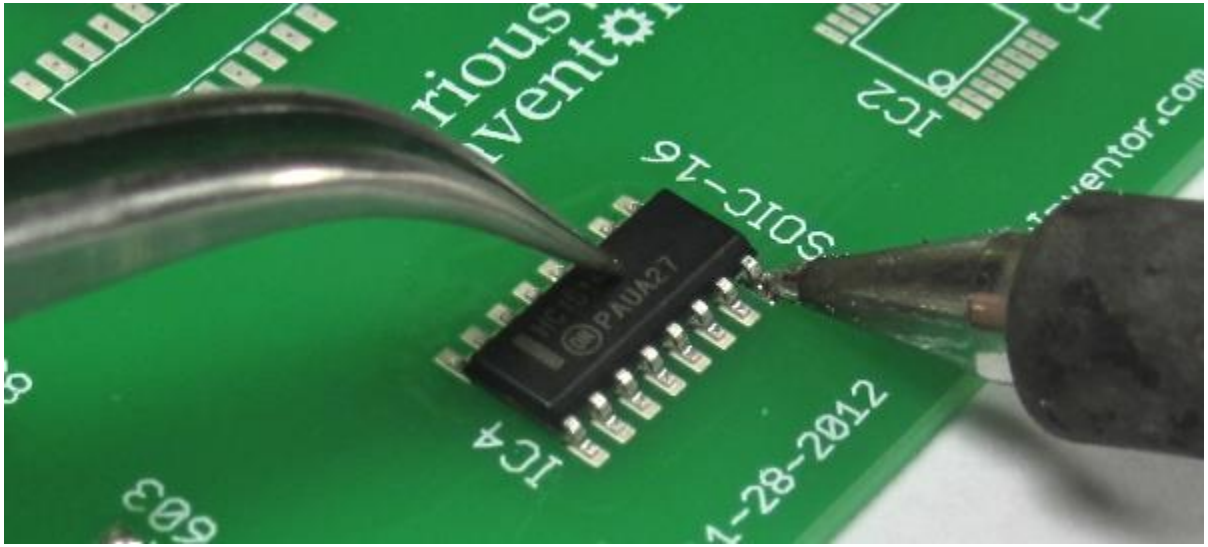
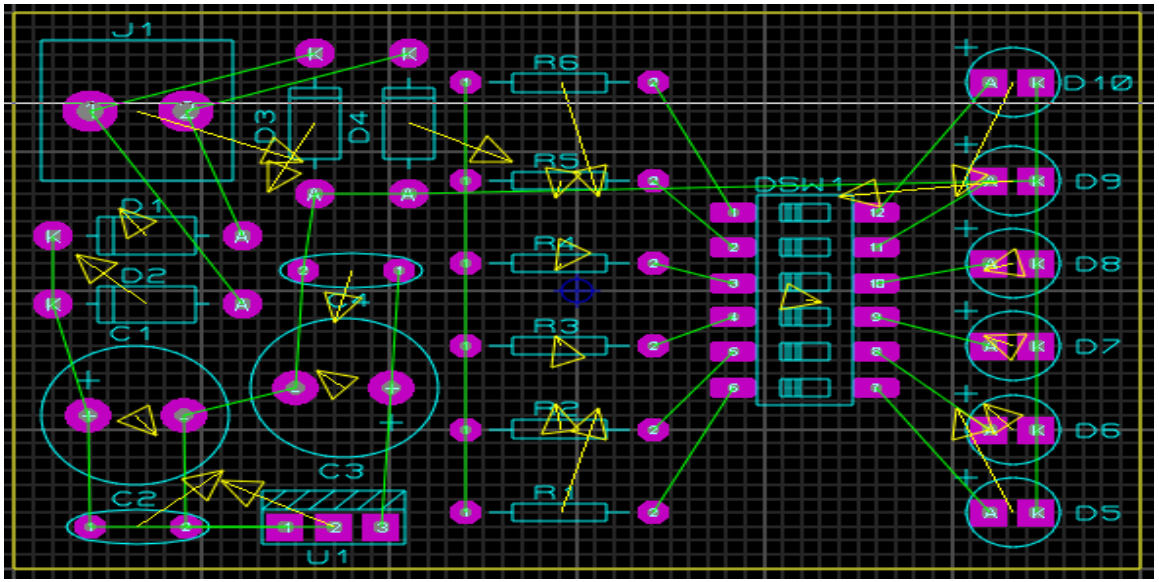
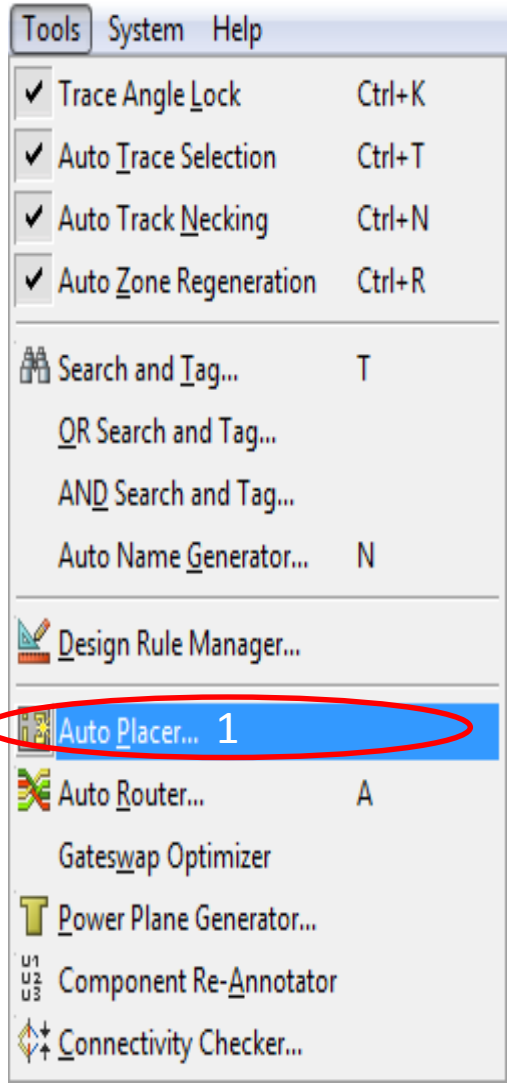
SHORT-CIRCUITING "ZERO-OHM LINKS" OR "JUMPERS"

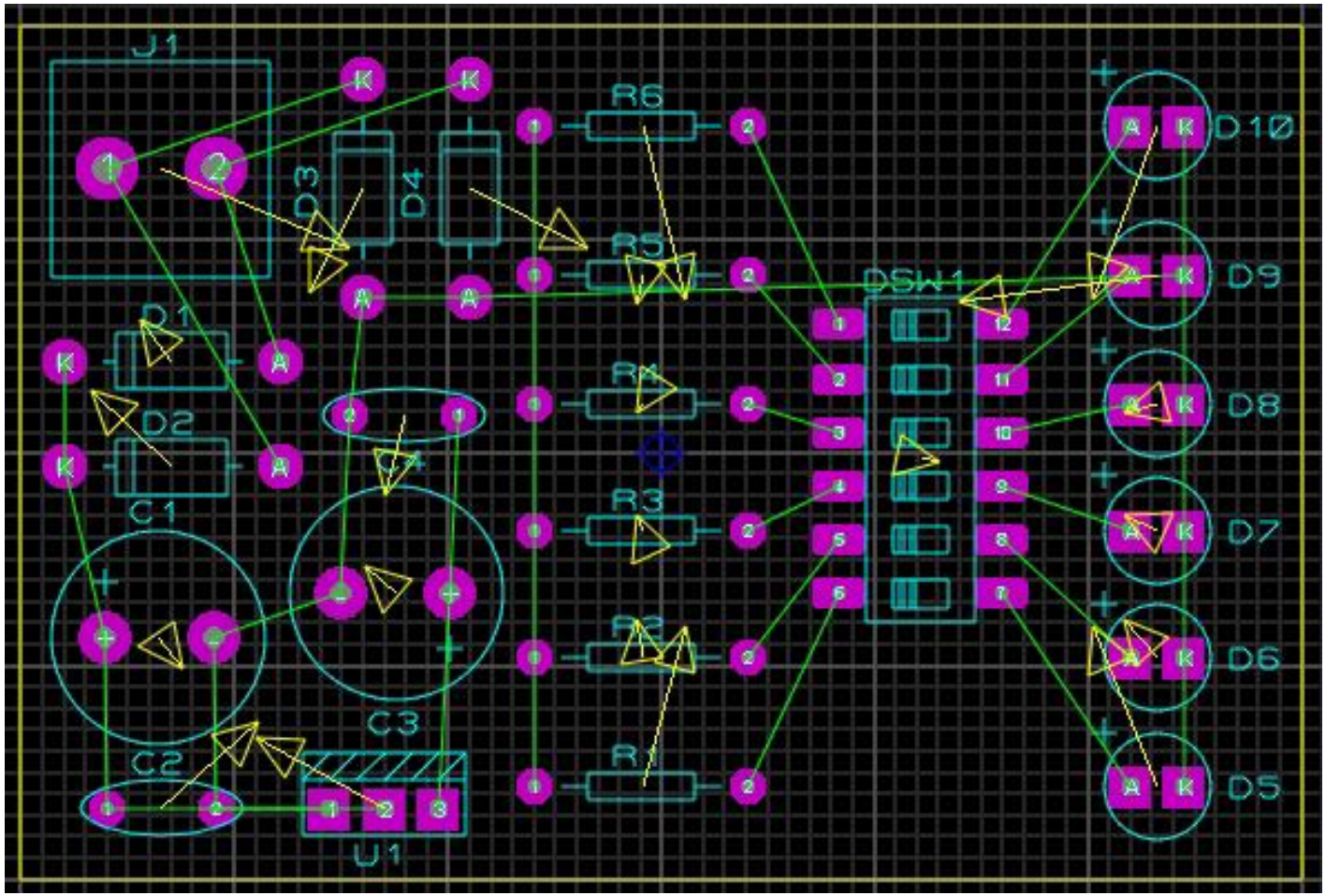


Auto/Manual Component Placement

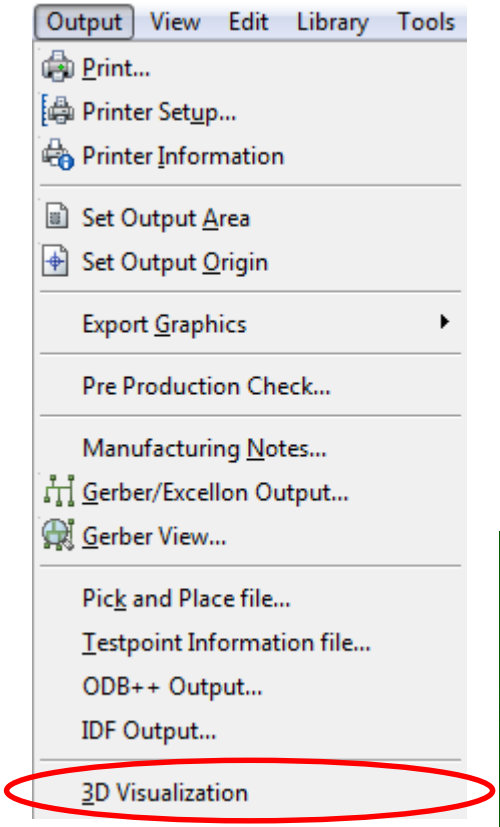


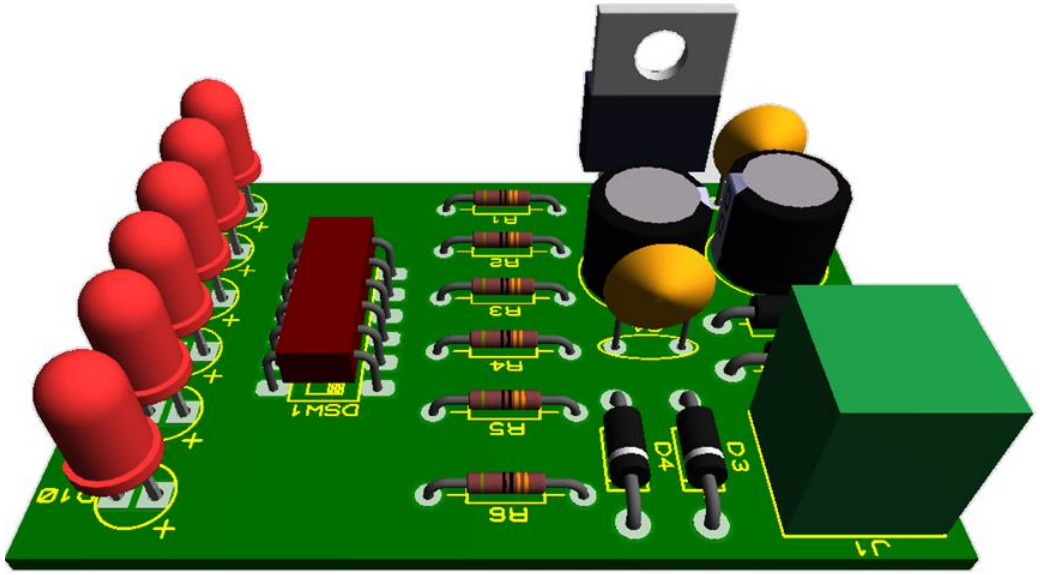


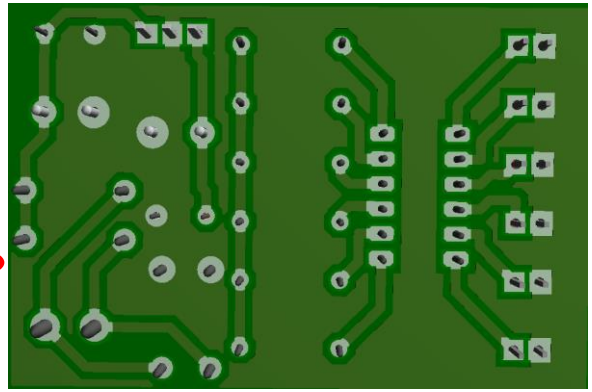
Auto Routing

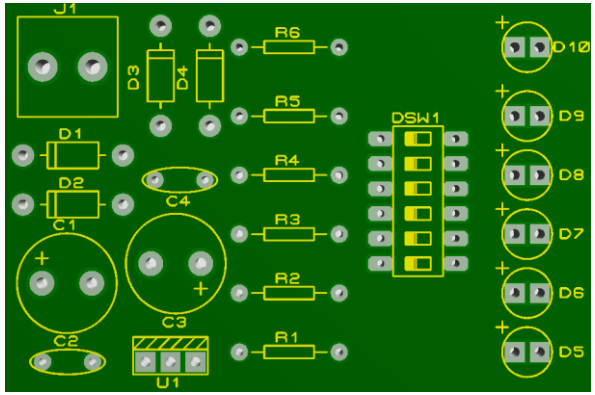


3D PCB View


Output
View
Edit
Library
Tools
Print...
Printer Setup...
Printer Information
Set Output Area
Set Output Origin
Export Graphics
Pre Production Check...
Manufacturing Notes...
Gerber/Excellon Output...
Gerber View...
Pick and Place file...
Testpoint Information file...
ODB++ Output...
IDF Output...
3D Visualization


DSW1
R1
R2
R3
R4
R5
R6
D3
D4
J1



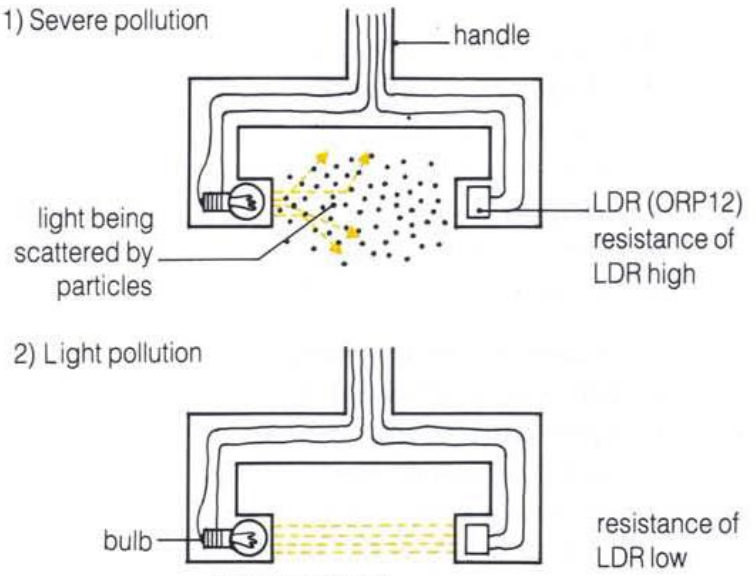

J1
D3
D4
R6
R5
R4
R3
R2
R1
D1
D2
C1
C2
C3
C4
DSW1
U1
D10
D9
D8
D7
D6
D5

Exercise

How the indicator works

Polluted water often contains suspended particles, which affect the passage of light. When light is shone through the water towards the LDR therefore, the amount of light reaching the LDR will depend upon the level of pollution. (See diagrams.)

The resistance of an LDR depends upon the amount of light falling on it. (See page 112.) As the light level increases, so the resistance decreases. The ORP12 LDR has a resistance of 10 million ohms (10 MΩ) in the dark, and as little as 130 Ω in bright light.

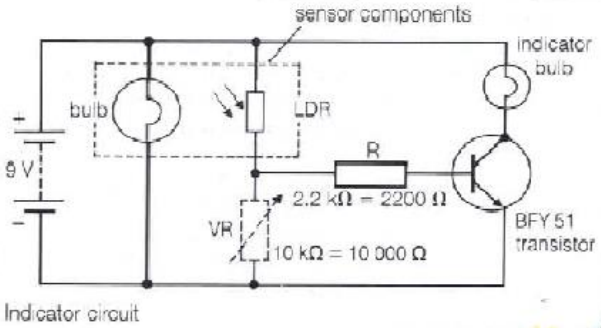


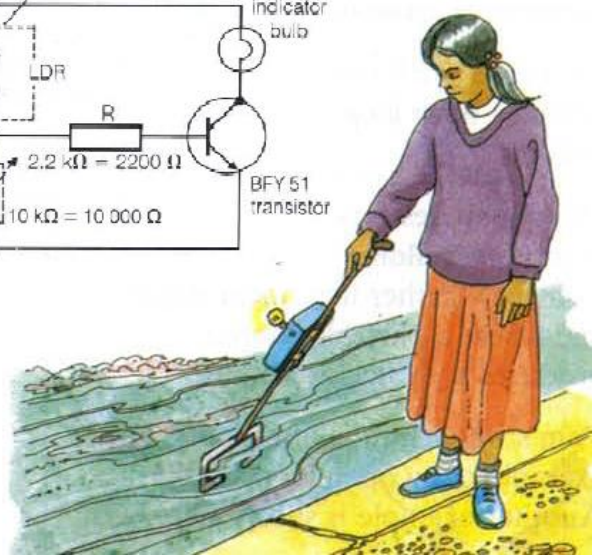
How the circuit works

If you ignore the variable resistor (VR) for a moment, the operation of the circuit can be explained as follows.

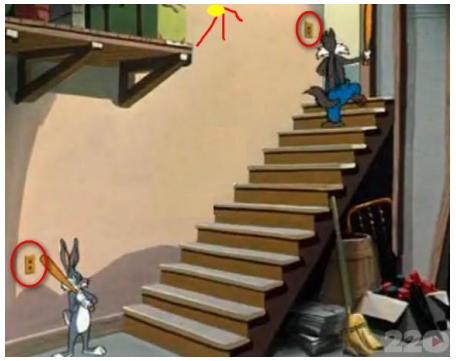
When the LDR is in darkness (in polluted water) its resistance is high. Insufficient base current flows to turn on the transistor, and the indicator bulb is off.

In less polluted water however, the resistance of the LDR falls. This allows sufficient base current to flow to turn the transistor on. The transistor's collector current passes through the indicator bulb, making it glow.





Task 2(b)



- Design a circuit to turn on/off an LED either from top or bottom of stairs?
- Create computer drawings to simulate and fabricate the PCB of the above circuit
  Circuit Specification:
  Power Supply/Battery Voltage: DC 5V
  LED Current: 20mA, LED Voltage Drop: 2V
  Switch: SPDT