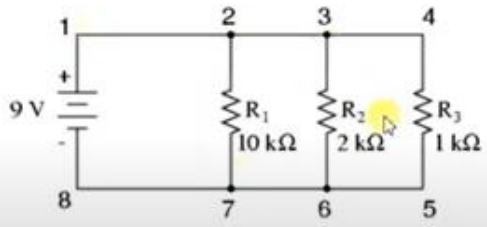
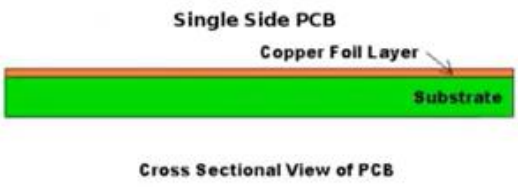
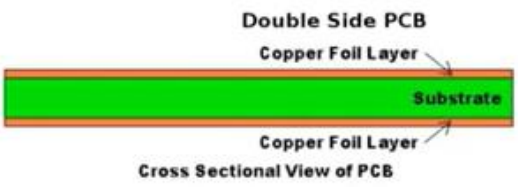
What is PCB

Printed Circuit Board



Best Way to materialize and manufacture a circuit





Copper layers can be of different thickness
Most common and popular thickness of copper layer is 35 micron

Bare PCB

Substrate

- The base material, or substrate, is usually fiberglass.
- Its called "FR4".
- This solid core gives the PCB its rigidity and thickness.
- There are also flexible PCBs built on flexible high-temperature plastic (Kapton or the equivalent).
- Board Thickness
- 0.8mm -2.6 mm thickness, most common is 1.6mm thick board

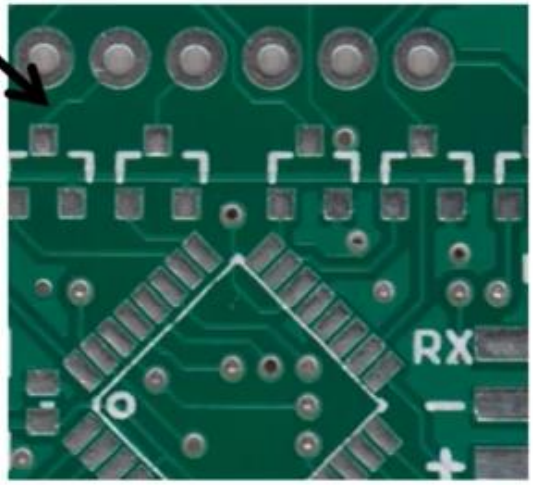
PCB

- Draw a circuit on PCB
- PCB Etching
- Drill it
- Solder Components
- Finish the System
- DIY PCB Looks like this →

DIY vs Manufactured

Solder mask

- It's the layer on copper
- It gives PCB its color
- RED/GREEN/Blue/Blac k
- Protects Copper part of pcb
- Everywhere except pads and holes for soldering



SilkScreen

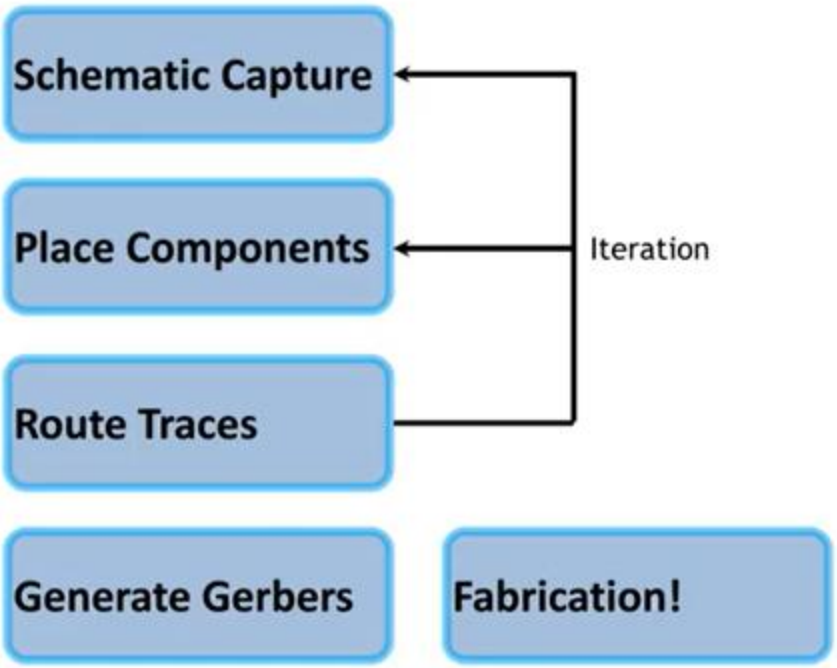
- White Ink over solder mask
- Identification of component names
- Symbols
- Manufacturer data
- Pin no / names

Common Terms

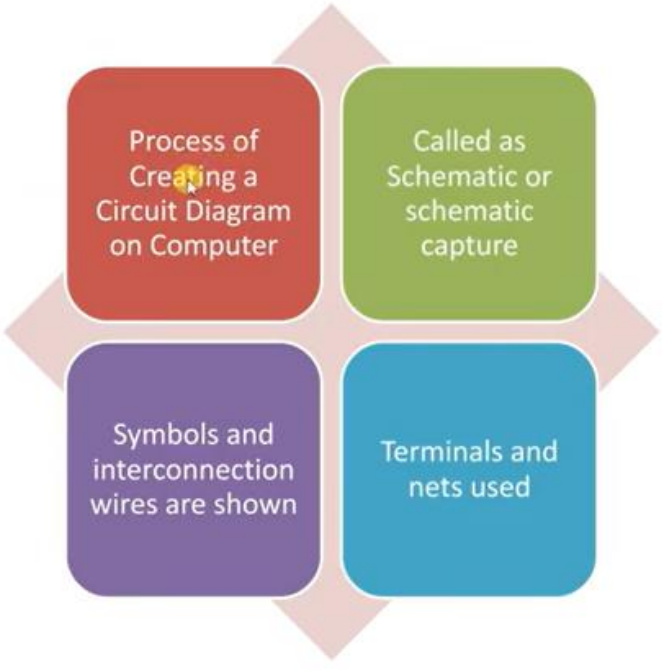
- **DRC** → Design rule check
- **Hole** → hole to insert and solder component
- **Pad** → pad to solder surface mount component
- **Via** → hole to connect 2 layers of PCb
- **Track** → copper line connecting 2 parts / wire of circuit
- **Jumper** → wire to place where track can't be drawn
- **Plane** → Excess copper area
- **Foot print** → Component print on PCB

DRC to check by software for any error
Plane to sink current and good look

The PCB Design Process



Schematic Capture



Component Placement

Components are placed on work area → Actual size dimensions needed

Called PCB foot prints → Many are available many needs creation

Perhaps most important step in good PCB Design and fabrication → Depends on target size and dimensions

Route Traces

ONCE COMPONENTS ARE PLACED, WE ROUTE TRACES

THESE ARE COPPER TRACES WHICH WILL BE FORMED ON PCB

COPPER TRACE WIDTH IS SPECIFIED IN MILLS / THOU

WIDTH OF TRACE DEPENDS ON CURRENT FLOWING THROUGH IT

COPPER WIDTH OF BOARD ALSO COMES IN PICTURE

Generate Gerbers

Manufacturing data understandable by machines for drilling the PCB

Every PCB CAD tool supports gerber generation

These files are to be sent to manufacturers for PCB fabrication

PCB Design

- Art and Science
- Hand drawn method
- Computer Aided Design Tools (CAD)
- Craftsmanship
- Practice and understanding

CAD Tools

Computer Software to design PCBs

Most Popular are

- Protel → Altium Designer
- Eagle
- Mentor Graphics PADS
- **Proteus ISIS and ARES Suite**
- Kicad .. (Free)
- Many more

Proteus ISIS

Measurement units on PCB

1 mil == 1 thou == 0.001 inch = 0.0254 mm = 0.00254 CM

thou is the most common unit in PCB design tools

However mm can also be used

Single Sided PCB Design Begin with Schematic

Creating Schematic

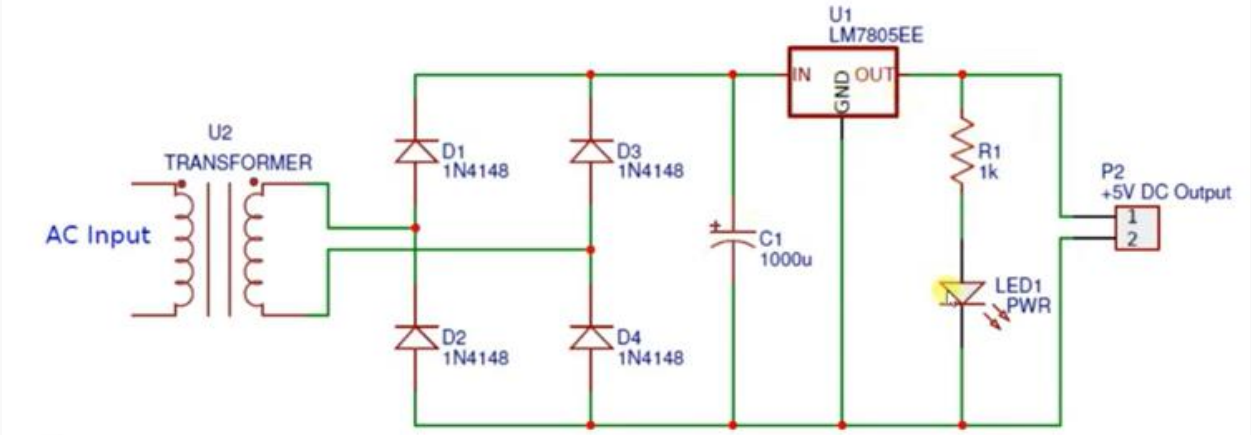
Finding parts

Checking PCB footprints on the parts

Join parts

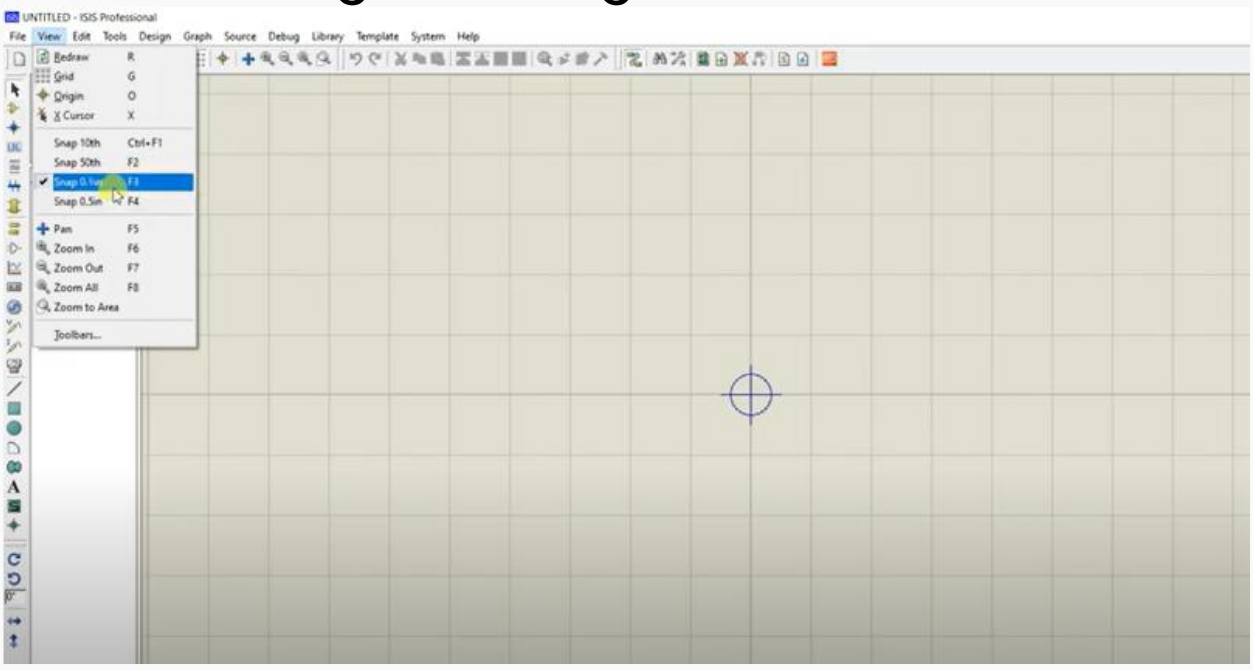
Finish schematic

+5v Power Supply

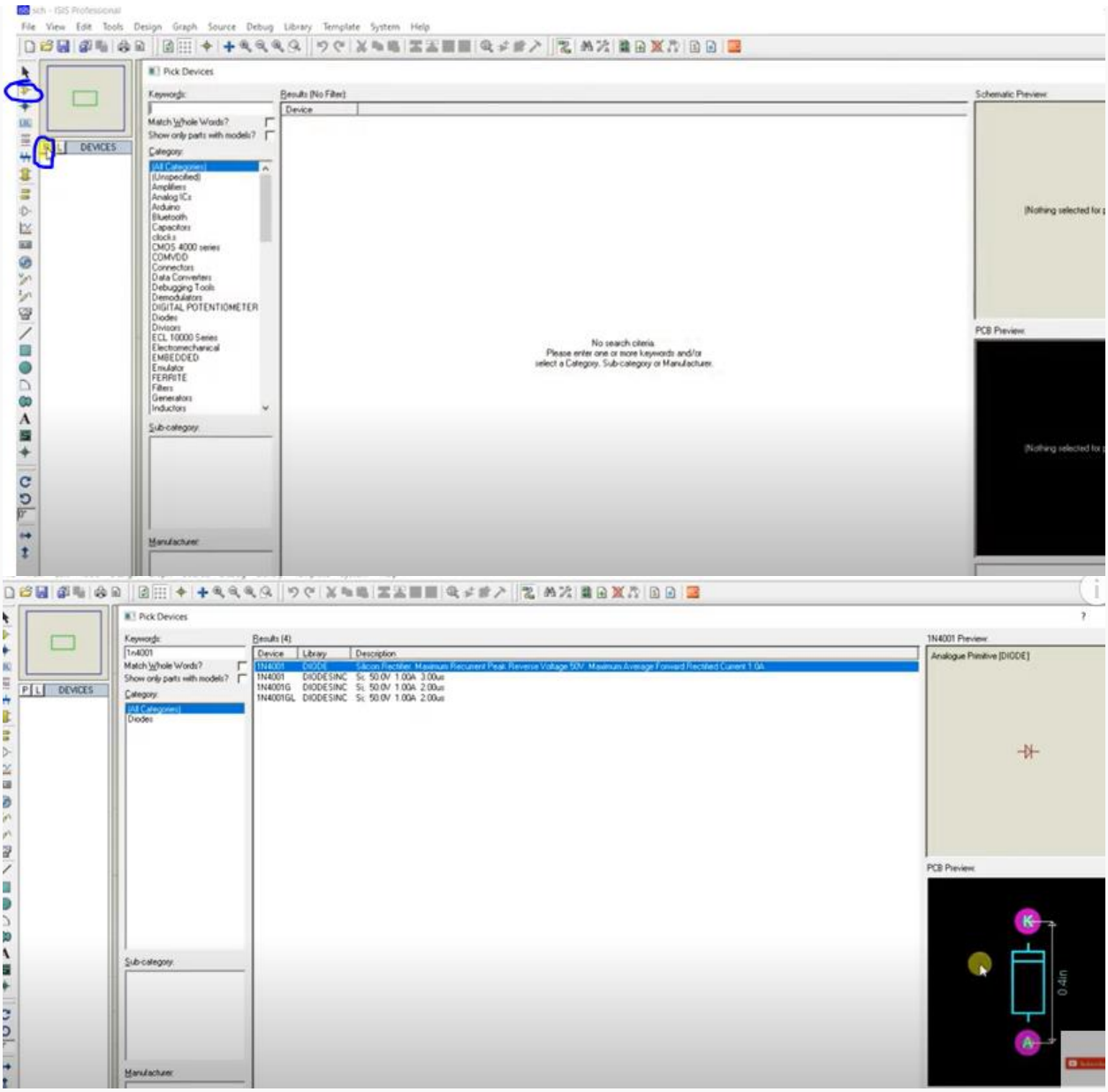


Proteus software

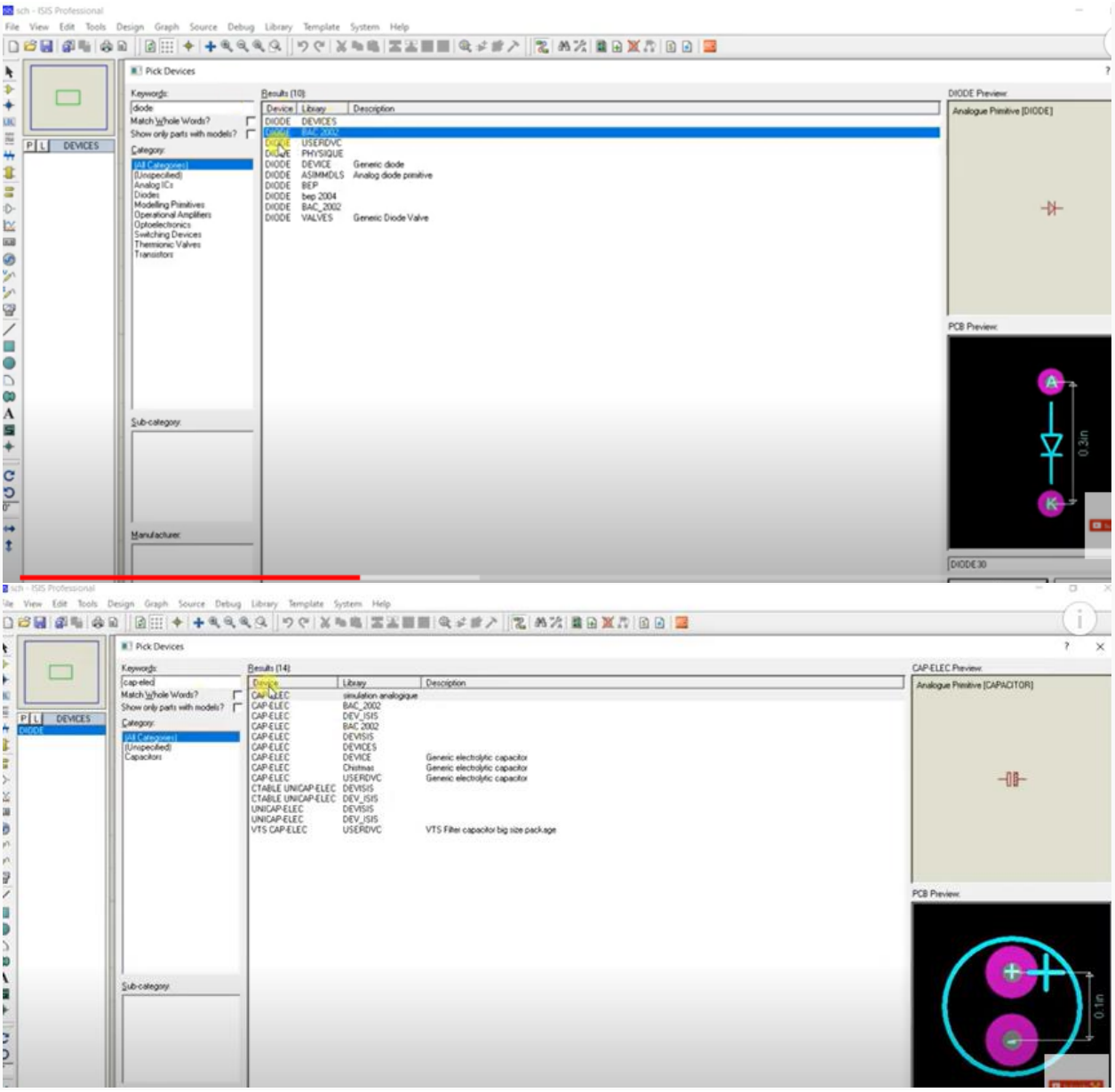
Press G for grid change



Distance between two grids is 0.1 inch



Only chose that component which has PCB


sch - ISIS Professional
File View Edit Tools Design Graph Source Debug Library Template System Help
Pick Devices
Keywords:
diode
Match Whole Words?
Show only parts with models?
Category:
(All Categories)
(Unspecified)
Analog ICs
Diodes
Modelling Primitives
Operational Amplifiers
Optoelectronics
Switching Devices
Thermionic Valves
Transistors
Sub-category:
Manufacturer:
Results (10):
Device Library Description
DIODE DEVICES
DIODE BAC_2002
DIODE USERDVC
DIODE PHYSIQUE
DIODE DEVICE Generic diode
DIODE ASIMMDLS Analog diode primitive
DIODE BEP
DIODE bep 2004
DIODE BAC_2002
DIODE VALVES Generic Diode Valve
DIODE Preview:
Analogue Primitive [DIODE]
PCB Preview:
A
K
0.3in
DIODE30
P L DEVICES
sch - ISIS Professional
File View Edit Tools Design Graph Source Debug Library Template System Help
Pick Devices
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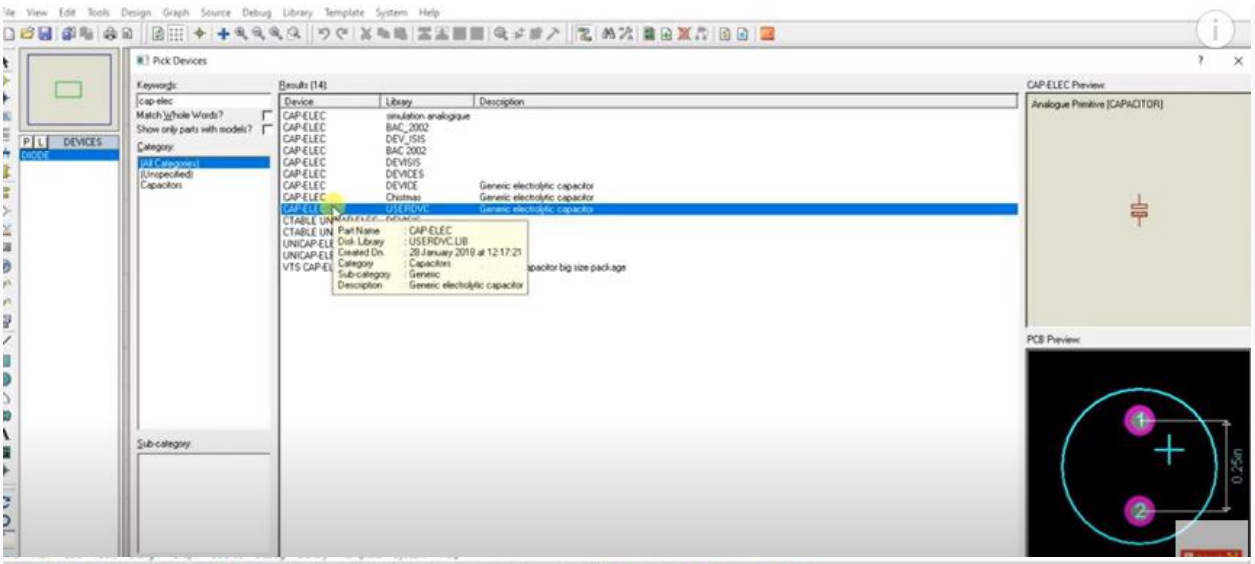
cap-elec
Match Whole Words?
Show only parts with models?
Category:
(All Categories)
(Unspecified)
Capacitors
Sub-category:
Results (14):
Device Library Description
CAP-ELEC simulation analogique
CAP-ELEC BAC_2002
CAP-ELEC DEV_ISIS
CAP-ELEC BAC 2002
CAP-ELEC DEVISIS
CAP-ELEC DEVICES
CAP-ELEC DEVICE Generic electrolytic capacitor
CAP-ELEC Chistmas Generic electrolytic capacitor
CAP-ELEC USERDVC Generic electrolytic capacitor
CTABLE UNICAP-ELEC DEVISIS
CTABLE UNICAP-ELEC DEV_ISIS
UNICAP-ELEC DEVISIS
UNICAP-ELEC DEV_ISIS
VTS CAP-ELEC USERDVC VTS Filter capacitor big size package
CAP-ELEC Preview:
Analogue Primitive [CAPACITOR]
PCB Preview:
0.1in
P L DEVICES
DIODE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Capacitors
Sub-category:
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Device
Library
Description
CAP-ELEC simulation analogique
CAP-ELEC BAC_2002
CAP-ELEC DEV_ISIS
CAP-ELEC BAC 2002
CAP-ELEC DEVISIS
CAP-ELEC DEVICES
CAP-ELEC DEVICE Generic electrolytic capacitor
CAP-ELEC Chistmas Generic electrolytic capacitor
CAP-ELEC USERDVC Generic electrolytic capacitor
Part Name : CAP-ELEC
Disk Library : USERDVC.LIB
Created On : 28 January 2019 at 12:17:21
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Sub-category : Generic
Description : Generic electrolytic capacitor
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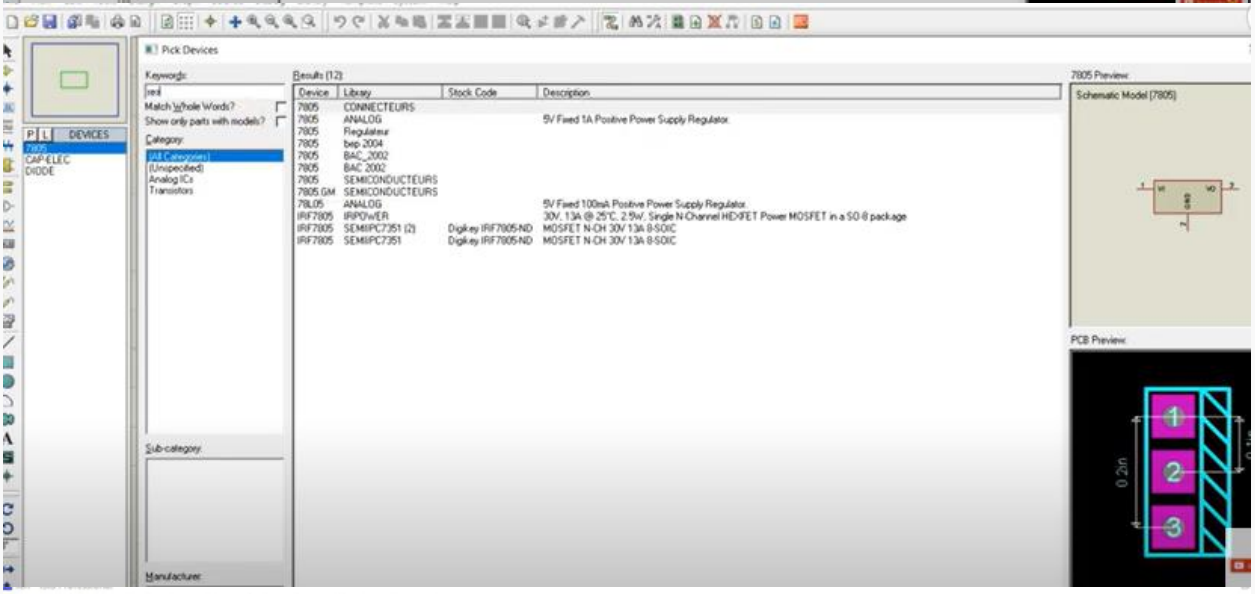
Analogue Primitive [CAPACITOR]
PCB Preview:
0.25in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Keywords:
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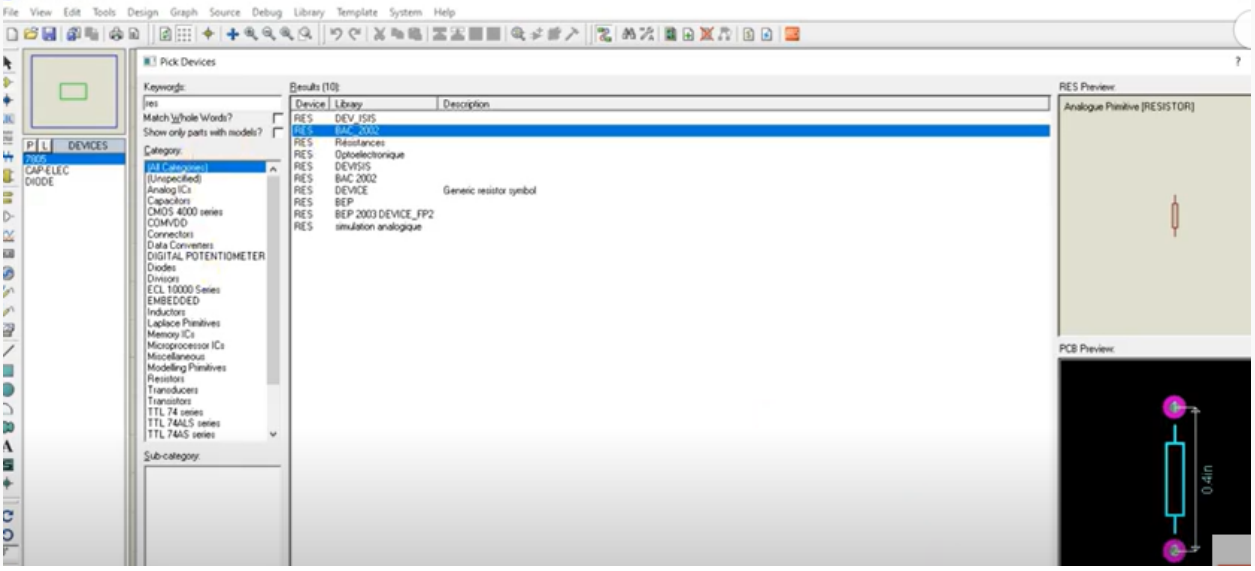
Match Whole Words?
Show only parts with models?
Category:
(All Categories)
(Unspecified)
Analog ICs
Transistors
Sub-category:
Manufacturer:
Results (12)
Device
Library
Stock Code
Description
7805 CONNECTEURS
7805 ANALOG 5V Fixed 1A Positive Power Supply Regulator.
7805 Regulateur
7805 bep 2004
7805 BAC_2002
7805 BAC 2002
7805 SEMICONDUCTEURS
7805.GM SEMICONDUCTEURS
78L05 ANALOG 5V Fixed 100mA Positive Power Supply Regulator.
IRF7805 IRPOWER 30V, 13A @ 25°C, 2.5W, Single N-Channel HEXFET Power MOSFET in a SO-8 package
IRF7805 SEMIIPC7351 (2) Digi-key IRF7805-ND MOSFET N-CH 30V 13A 8-SOIC
IRF7805 SEMIIPC7351 Digi-key IRF7805-ND MOSFET N-CH 30V 13A 8-SOIC
7805 Preview:
Schematic Model [7805]
PCB Preview:
0.2in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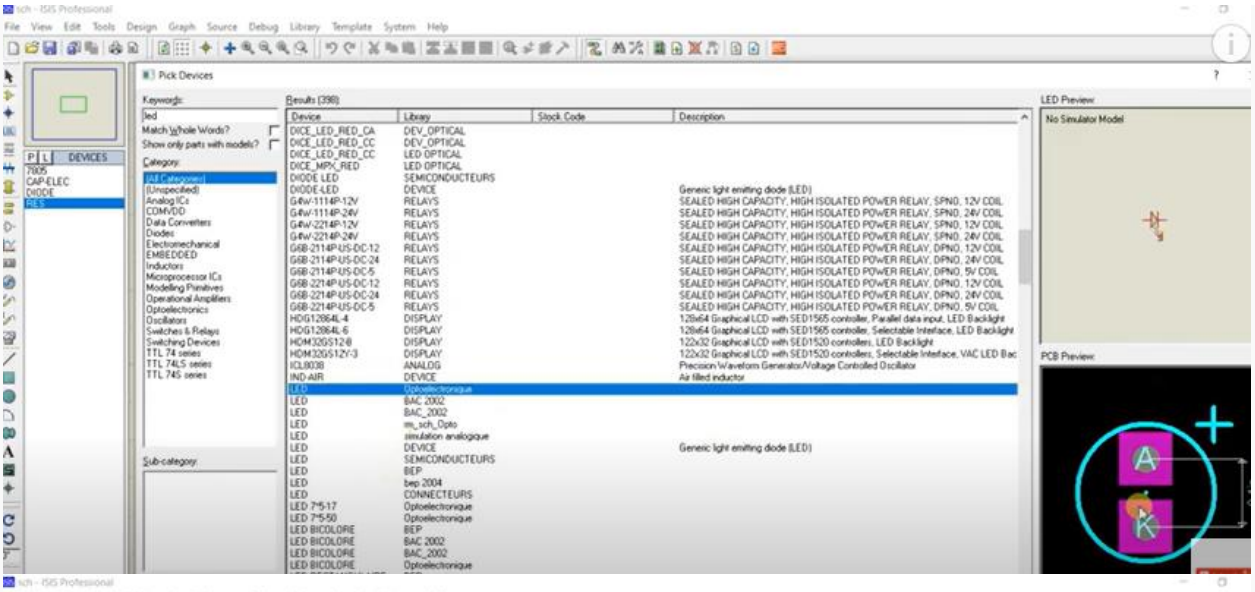
Show only parts with models?
Category:
(All Categories)
(Unspecified)
Analog ICs
Capacitors
CMOS 4000 series
COMVDD
Connectors
Data Converters
DIGITAL POTENTIOMETER
Diodes
Divisors
ECL 10000 Series
EMBEDDED
Inductors
Laplace Primitives
Memory ICs
Microprocessor ICs
Miscellaneous
Modelling Primitives
Resistors
Transducers
Transistors
TTL 74 series
TTL 74ALS series
TTL 74AS series
Sub-category:
Results (10):
Device
Library
Description
RES DEV_ISIS
RES BAC_2002
RES Résistances
RES Optoelectronique
RES DEVISIS
RES BAC 2002
RES DEVICE Generic resistor symbol
RES BEP
RES BEP 2003 DEVICE_FP2
RES simulation analogique
RES Preview:
Analogue Primitive [RESISTOR]
PCB Preview:
0.4in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COMVDD
Data Converters
Diodes
Electromechanical
EMBEDDED
Inductors
Microprocessor ICs
Modelling Primitives
Operational Amplifiers
Optoelectronics
Oscillators
Switches & Relays
Switching Devices
TTL 74 series
TTL 74LS series
TTL 74S series
Sub-category:
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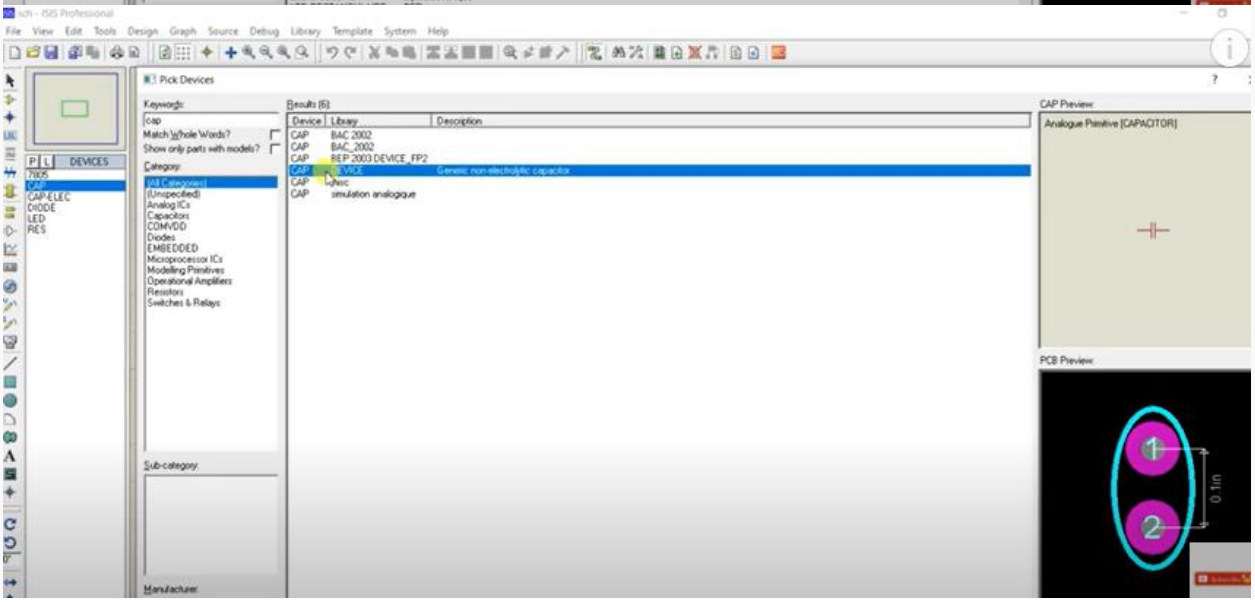
Library
Stock Code
Description
LED Preview:
No Simulator Model
PCB Preview:
A
K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Match Whole Words?
Show only parts with models?
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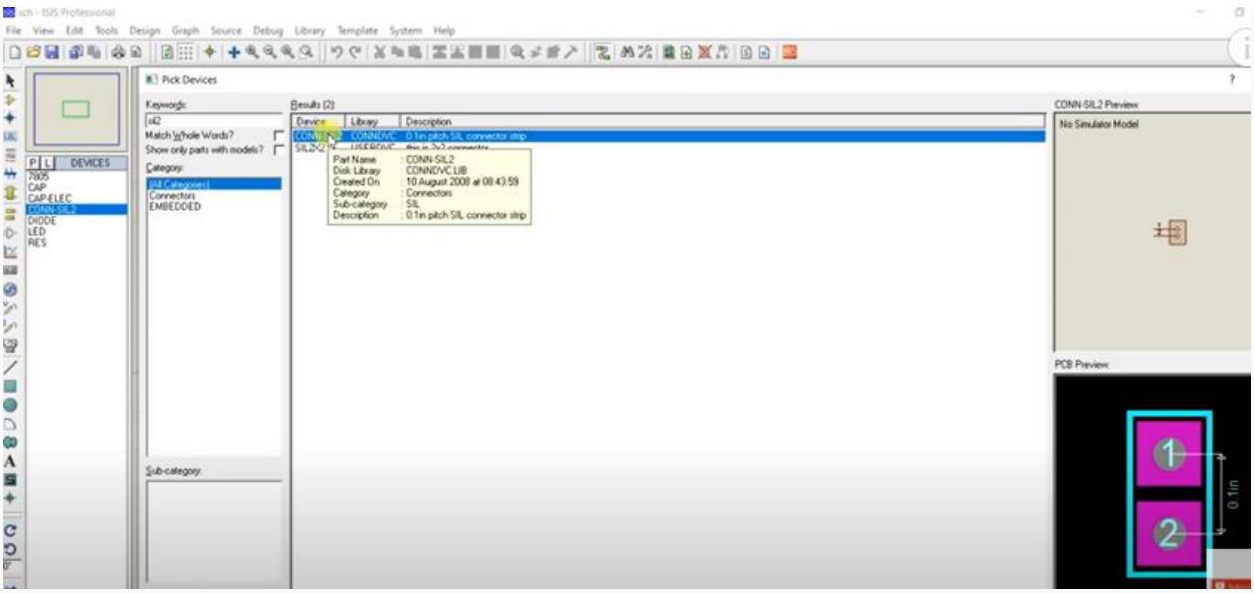
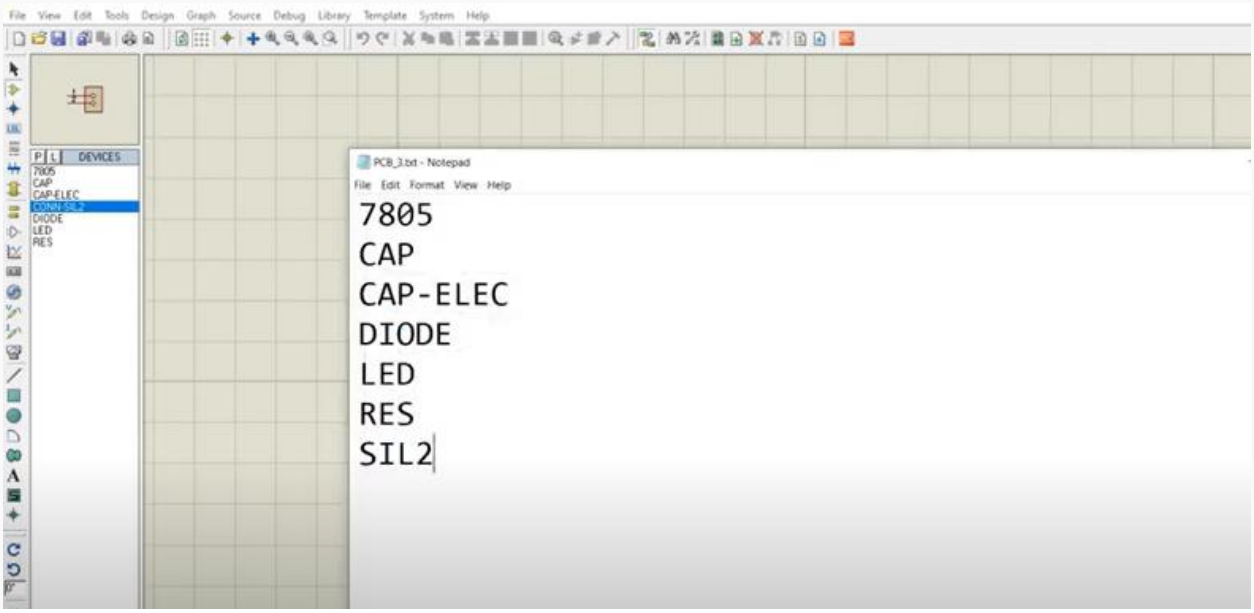
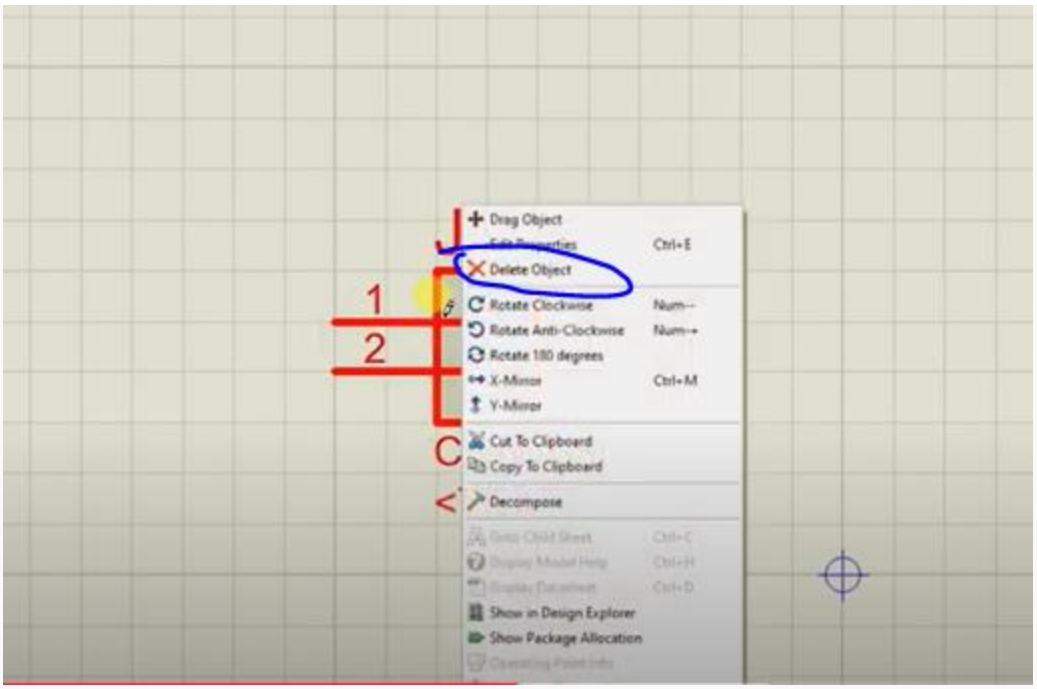
(All Categories)
(Unspecified)
Analog ICs
Capacitors
COMVDD
Diodes
EMBEDDED
Microprocessor ICs
Modelling Primitives
Operational Amplifiers
Resistors
Switches & Relays
Sub-category:
Manufacturer:
Results (6):
Device
Library
Description
CAP BAC 2002
CAP BAC_2002
CAP BEP 2003 DEVICE_FP2
CAP DEVICE Generic non-electrolytic capacitor
CAP dwc
CAP simulation analogique
CAP Preview:
Analogue Primitive [CAPACITOR]
PCB Preview:
1
2
0.1in



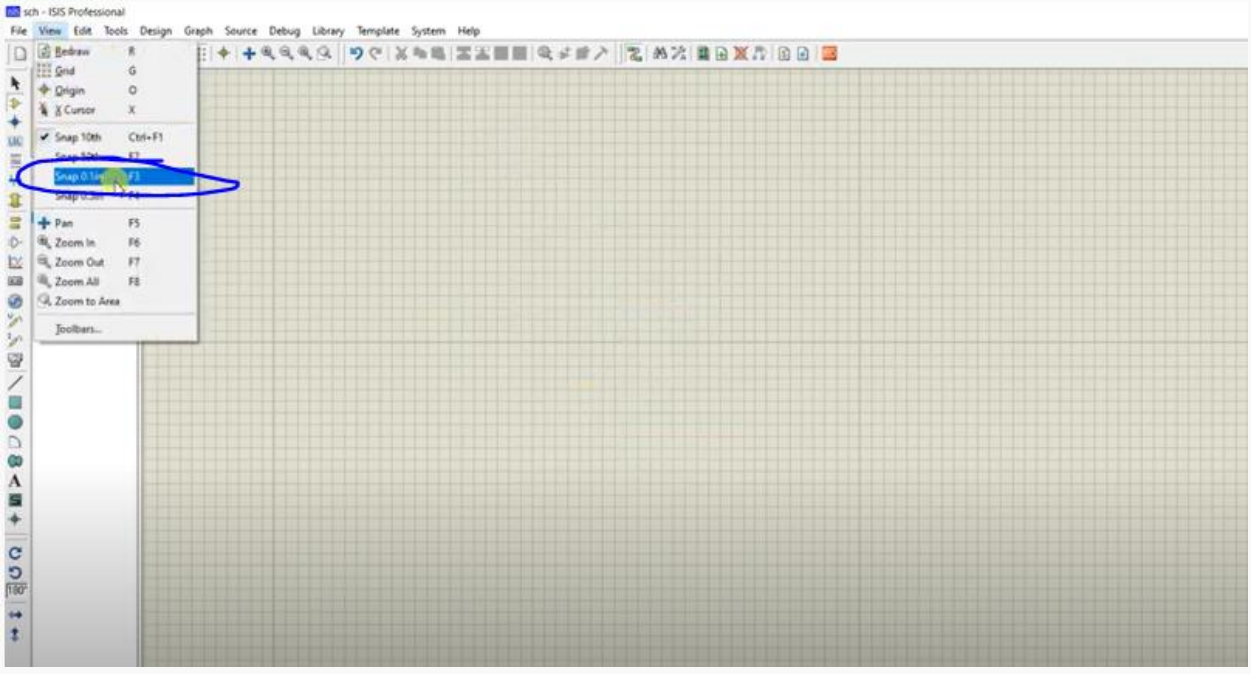
SIL serial inline connector



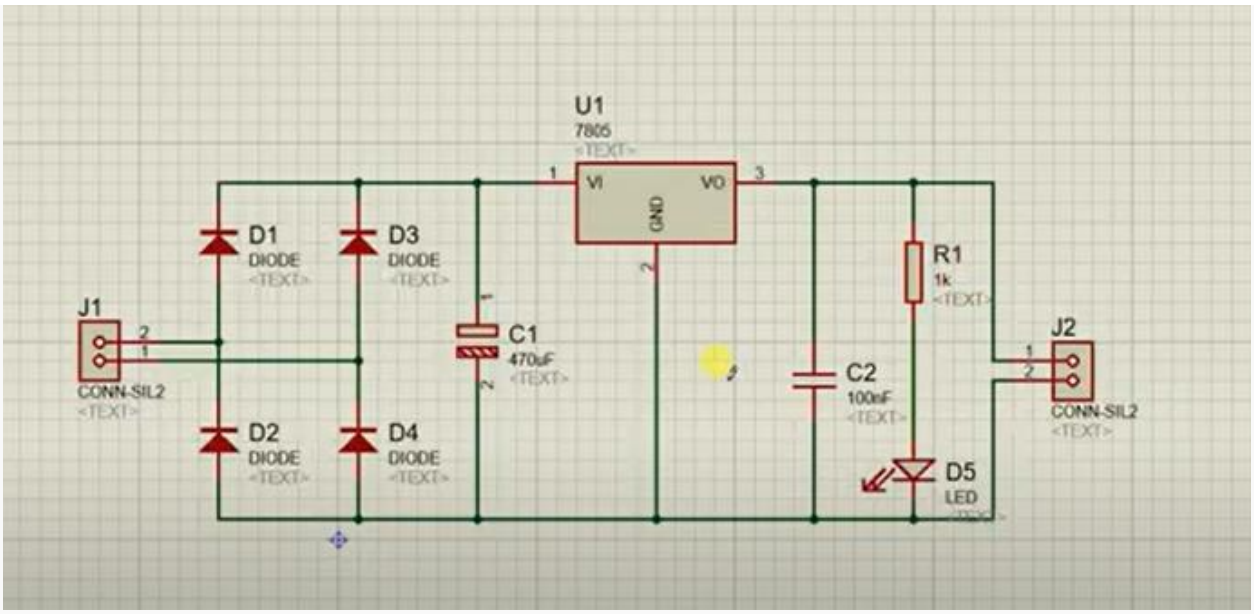


Or double right click to delete

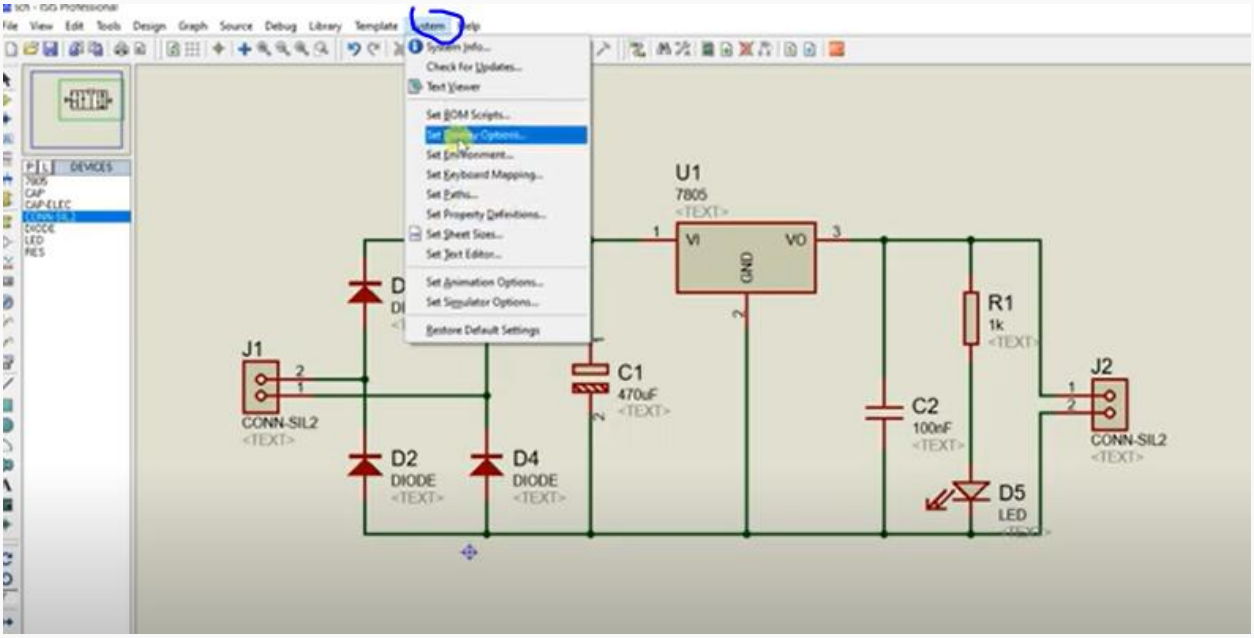
Click mouse on component and + sign to rotate



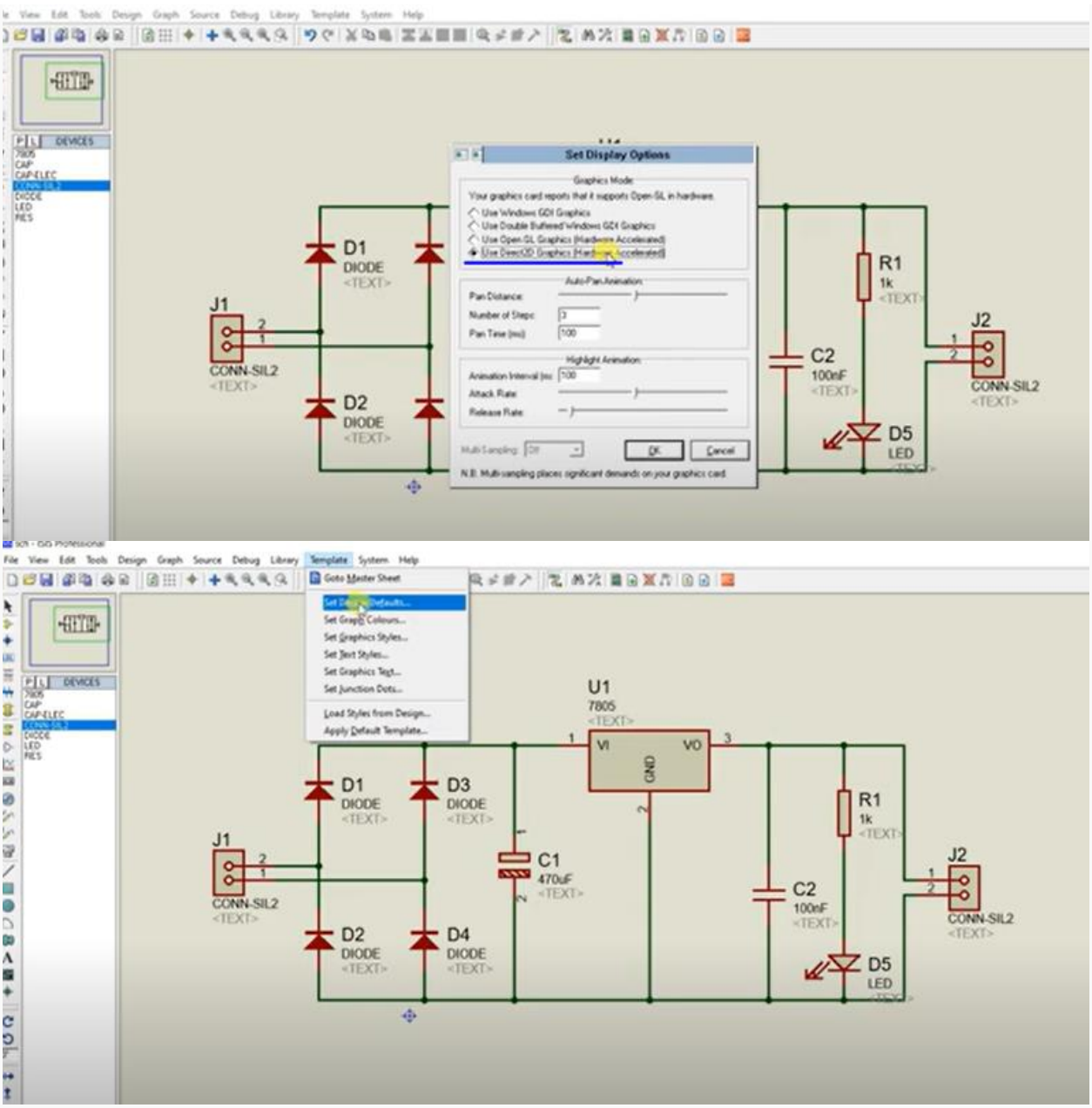
0.1 inch



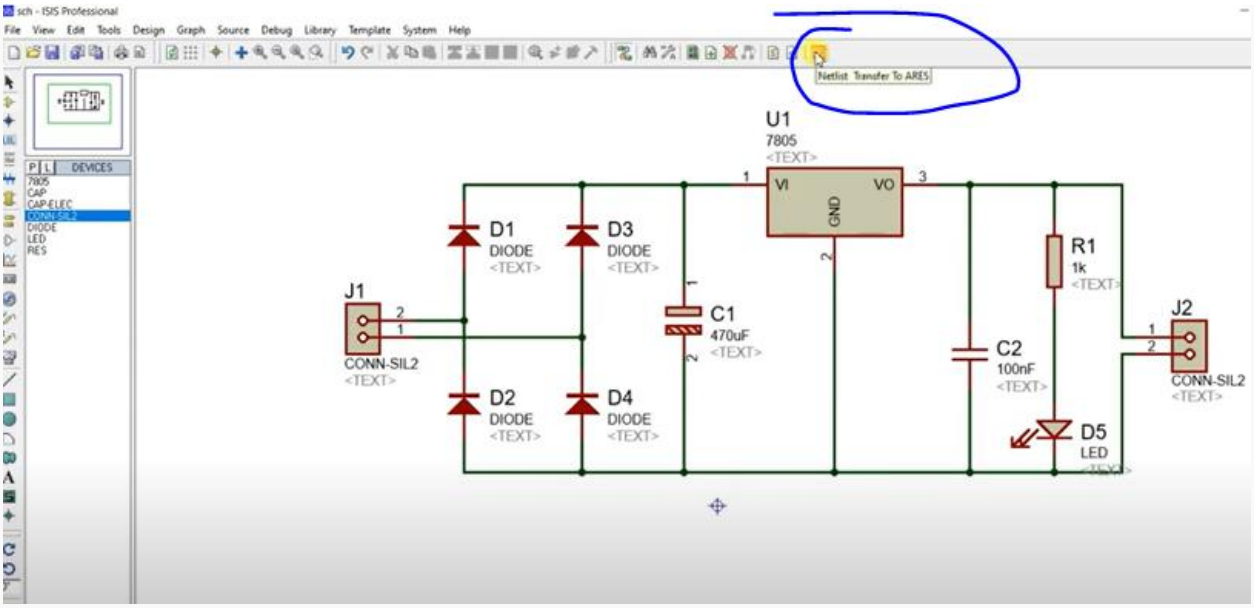
Remove grid by G click



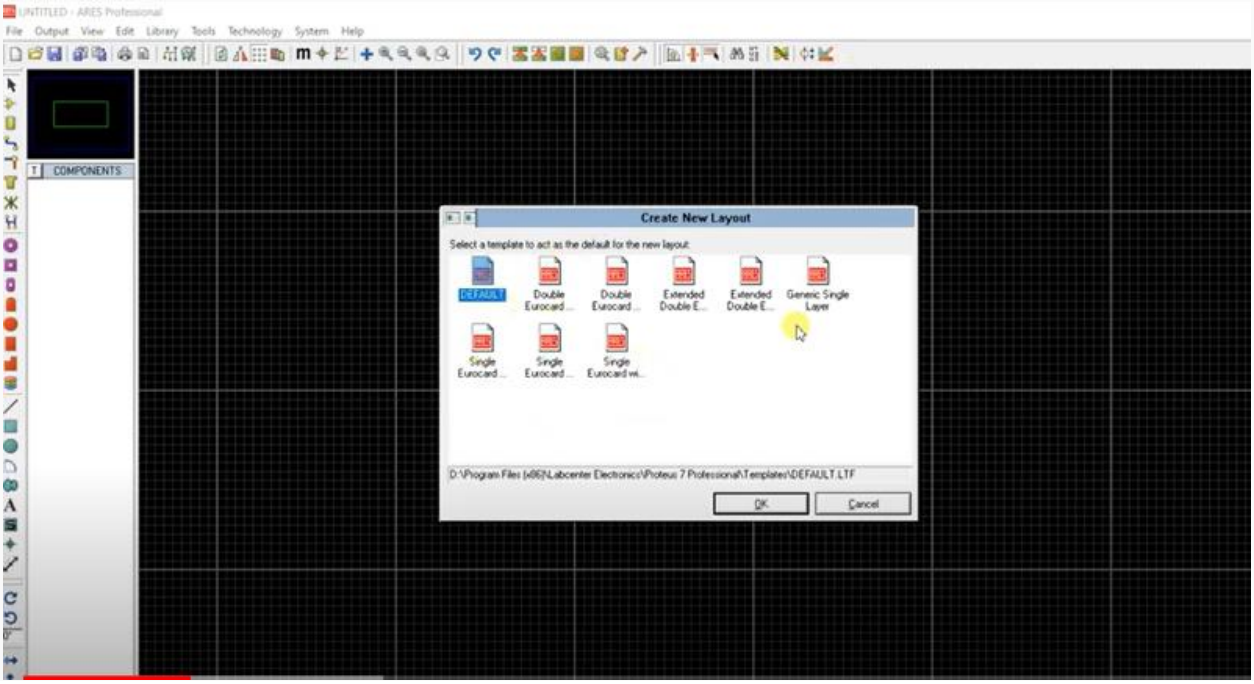
systems set display option
chose graphics card

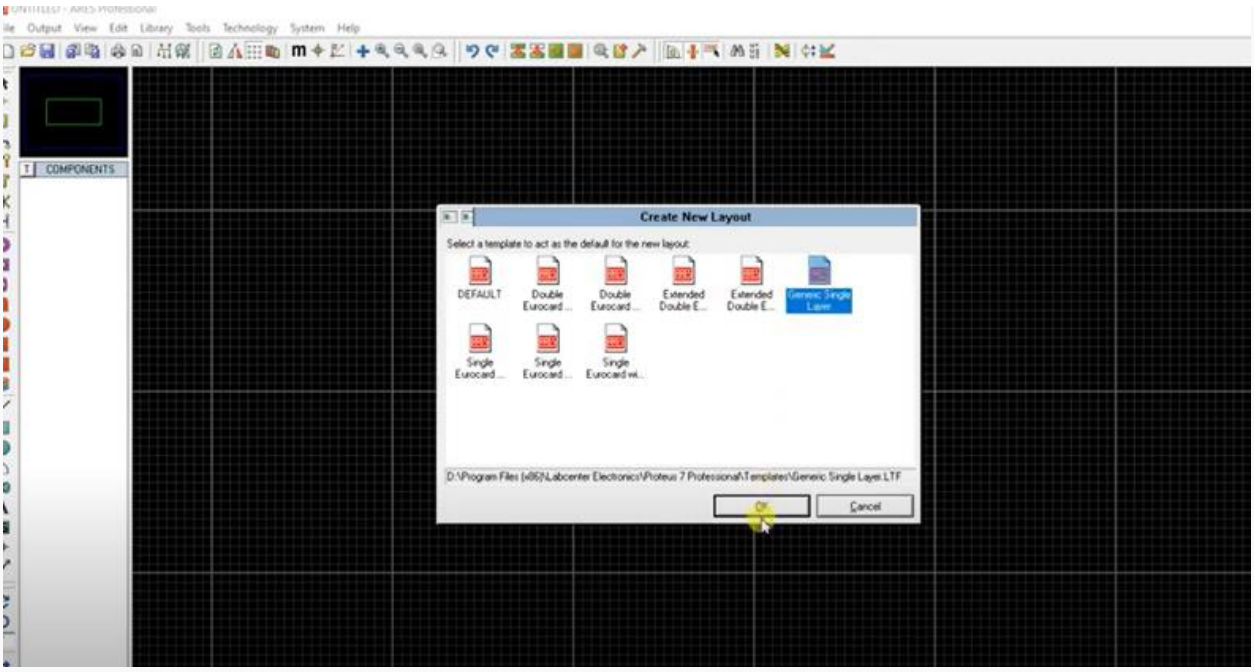


Template set design defaults for background color

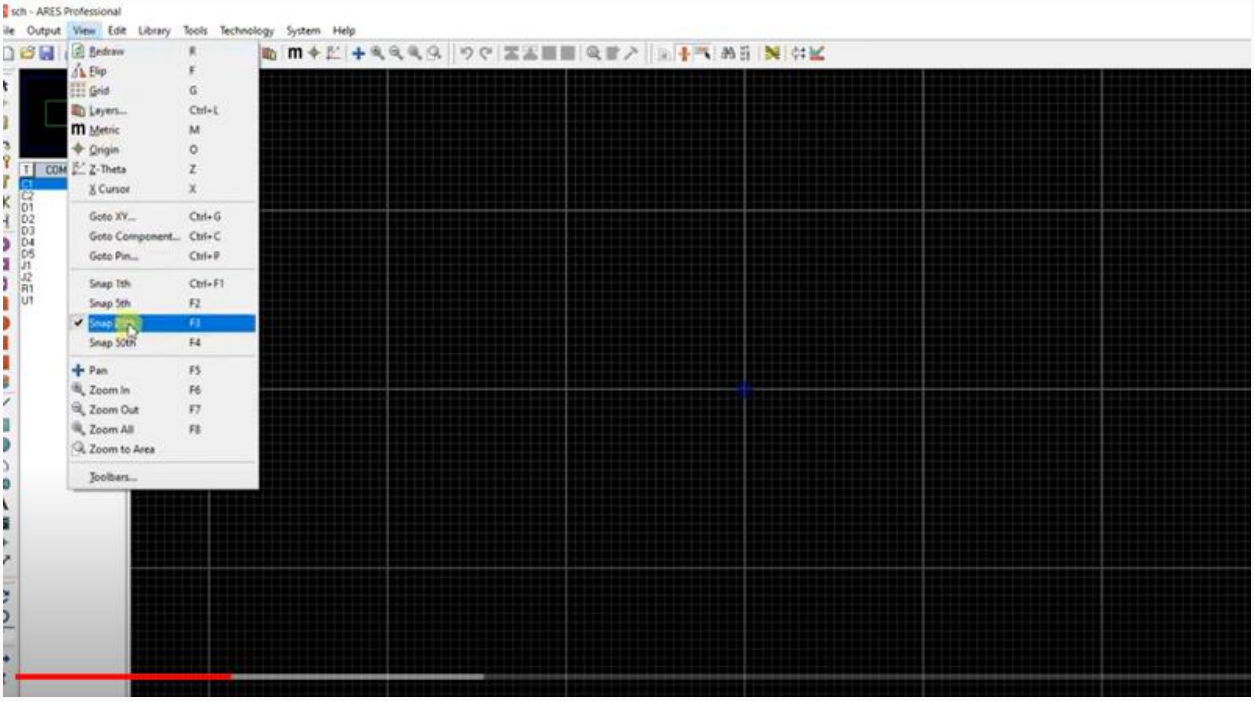


Netlist transfer to ARES



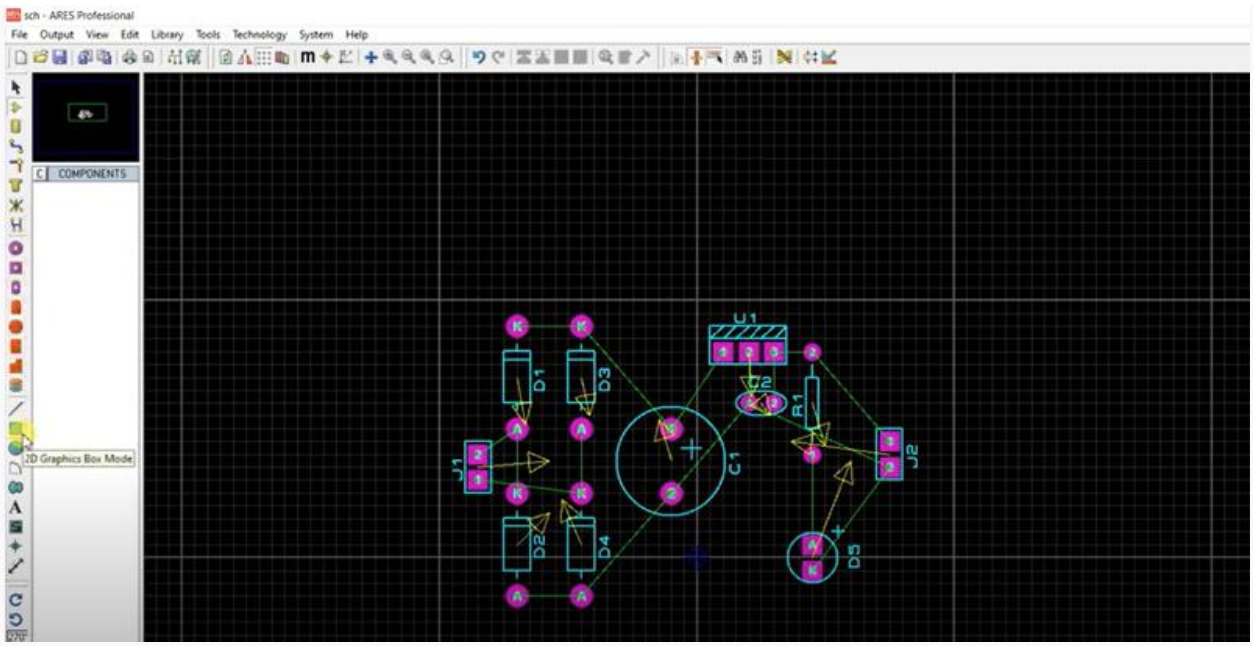


Generic single layer

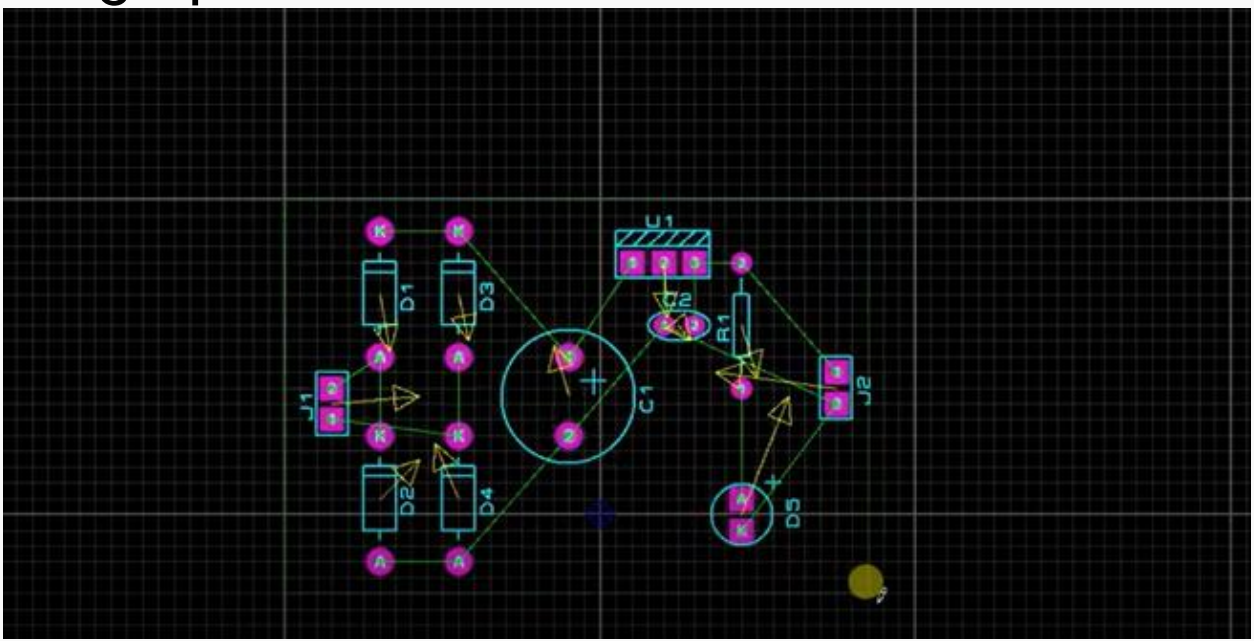


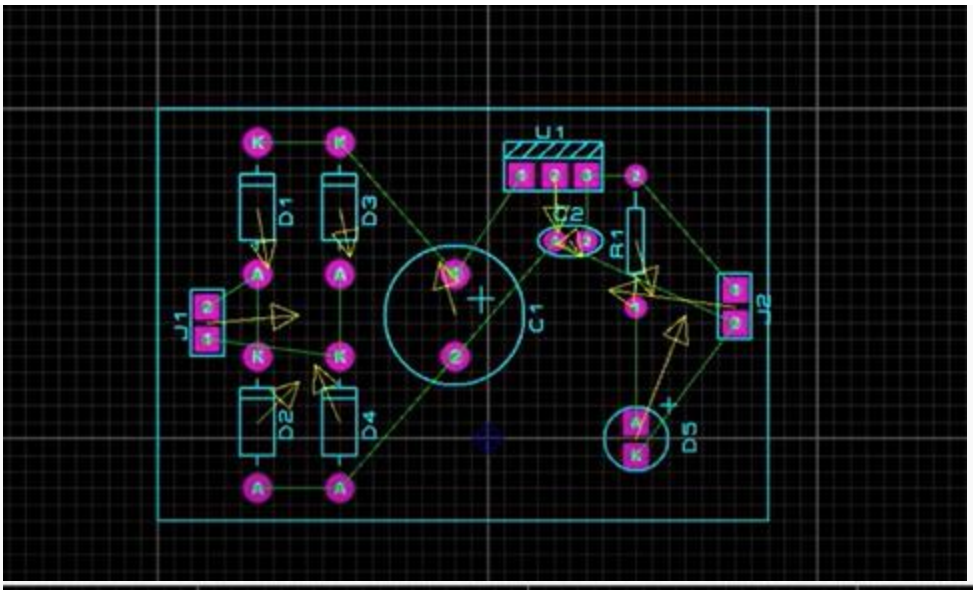
View 25th snap

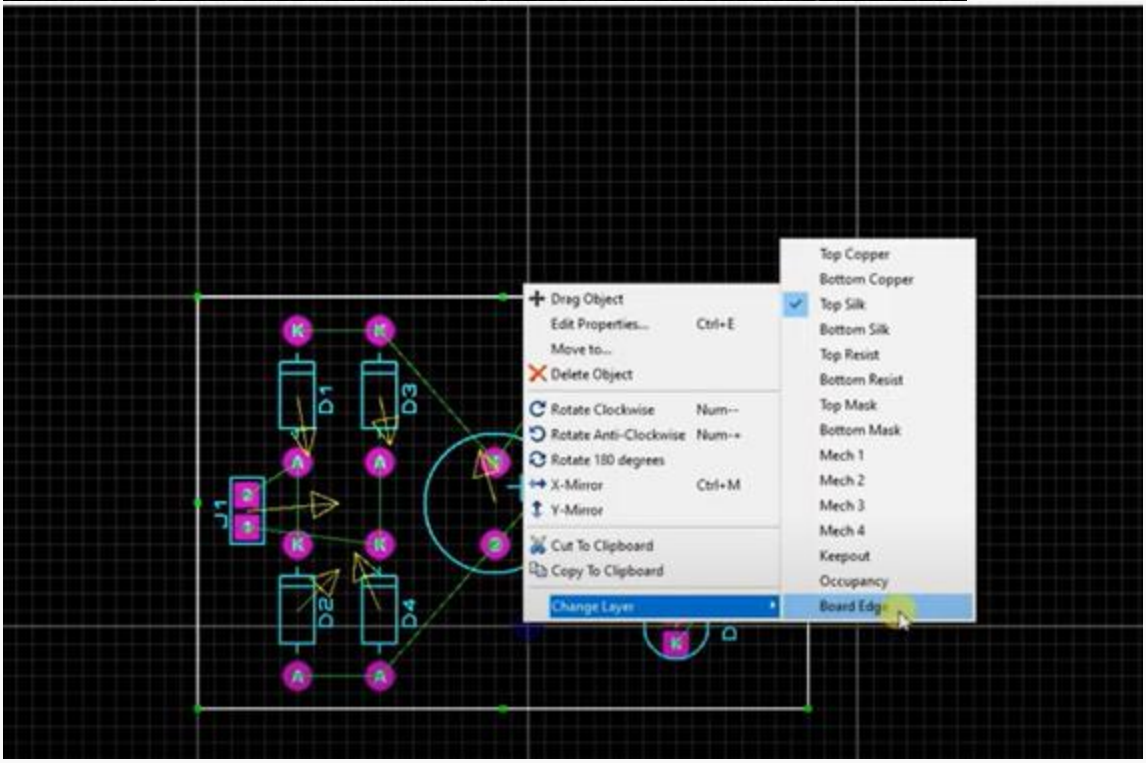
Set boundary for PCB cmponents



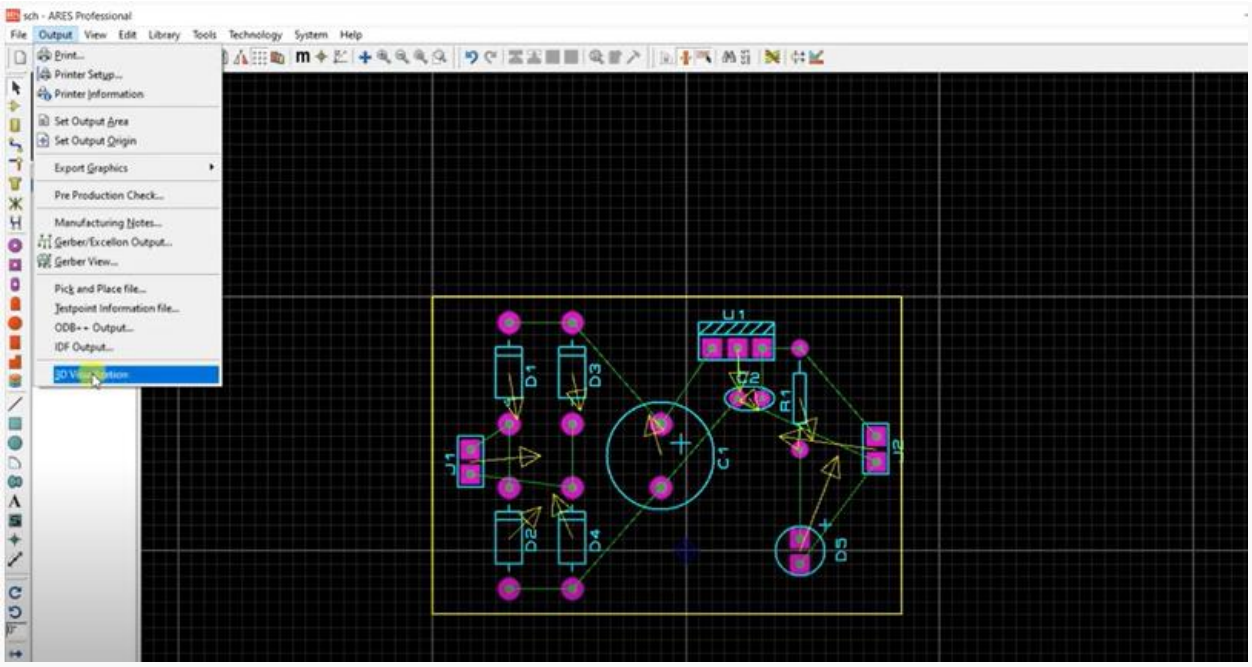
2D graphics box mode



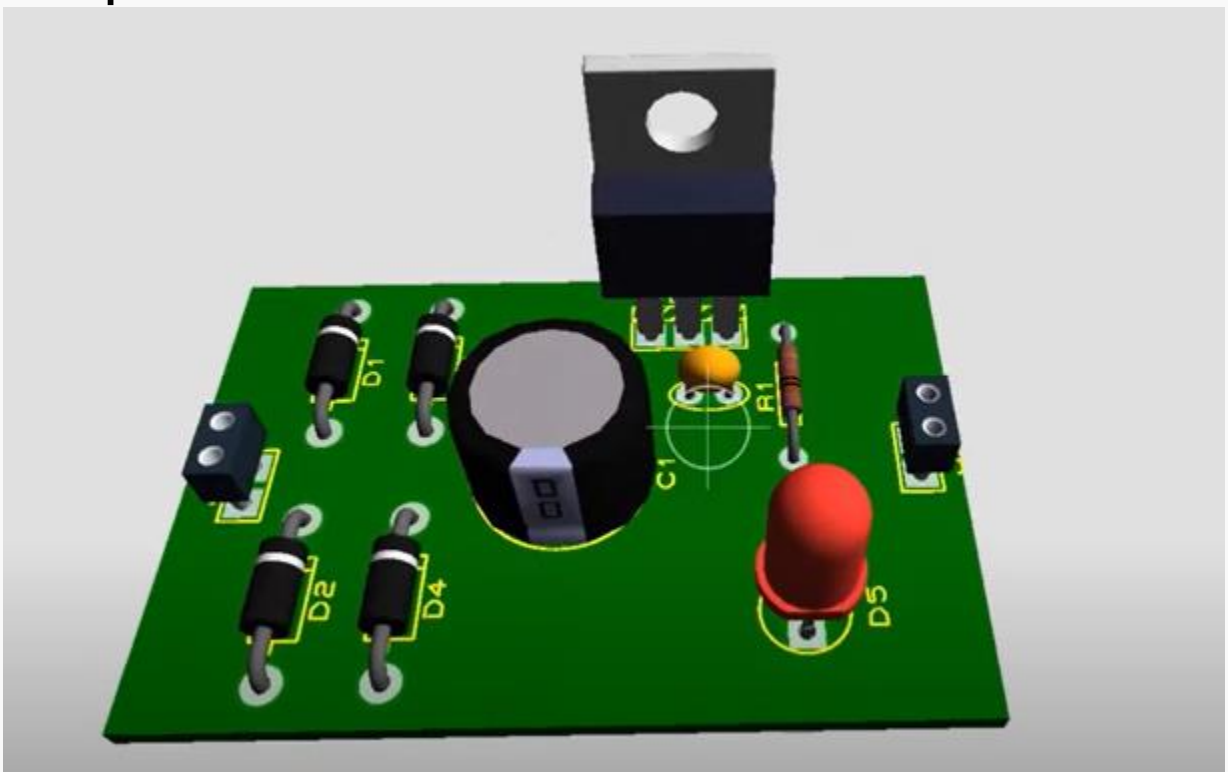


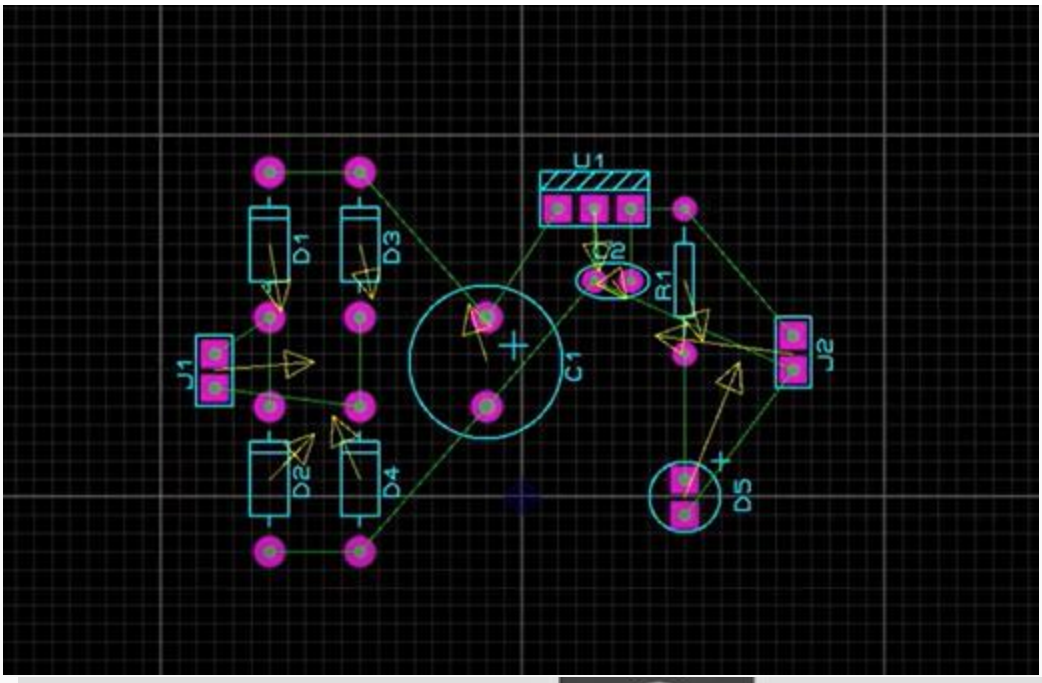


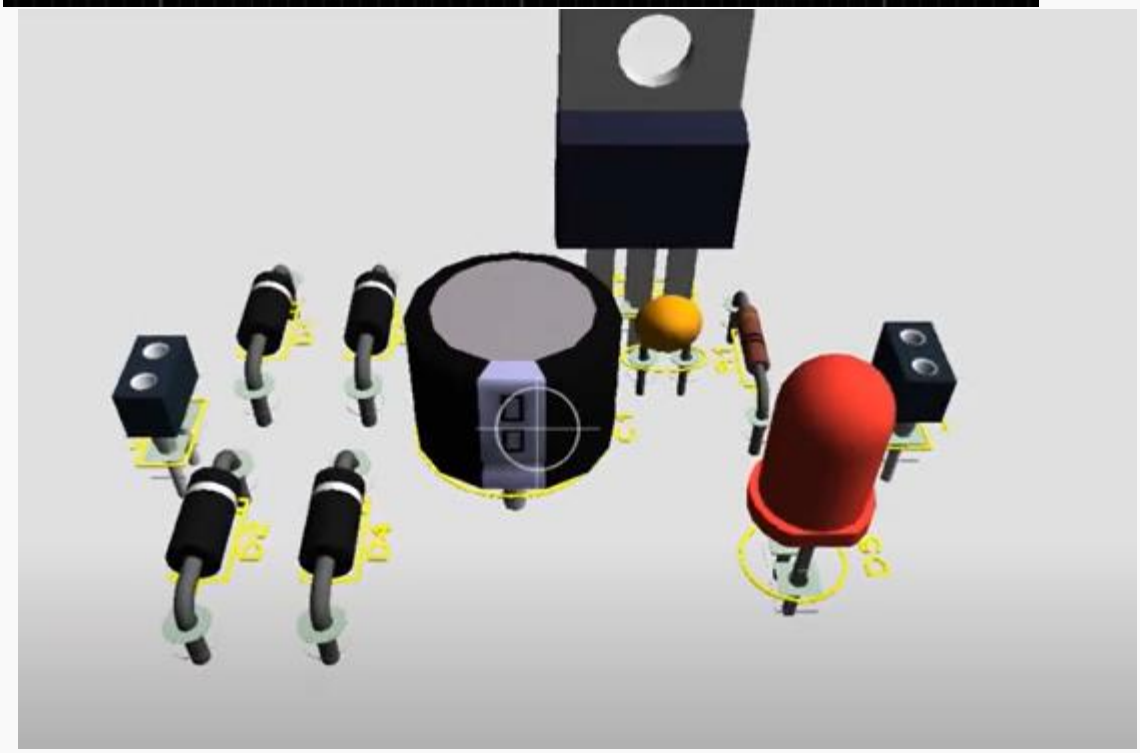
Right click, change layer to board edge



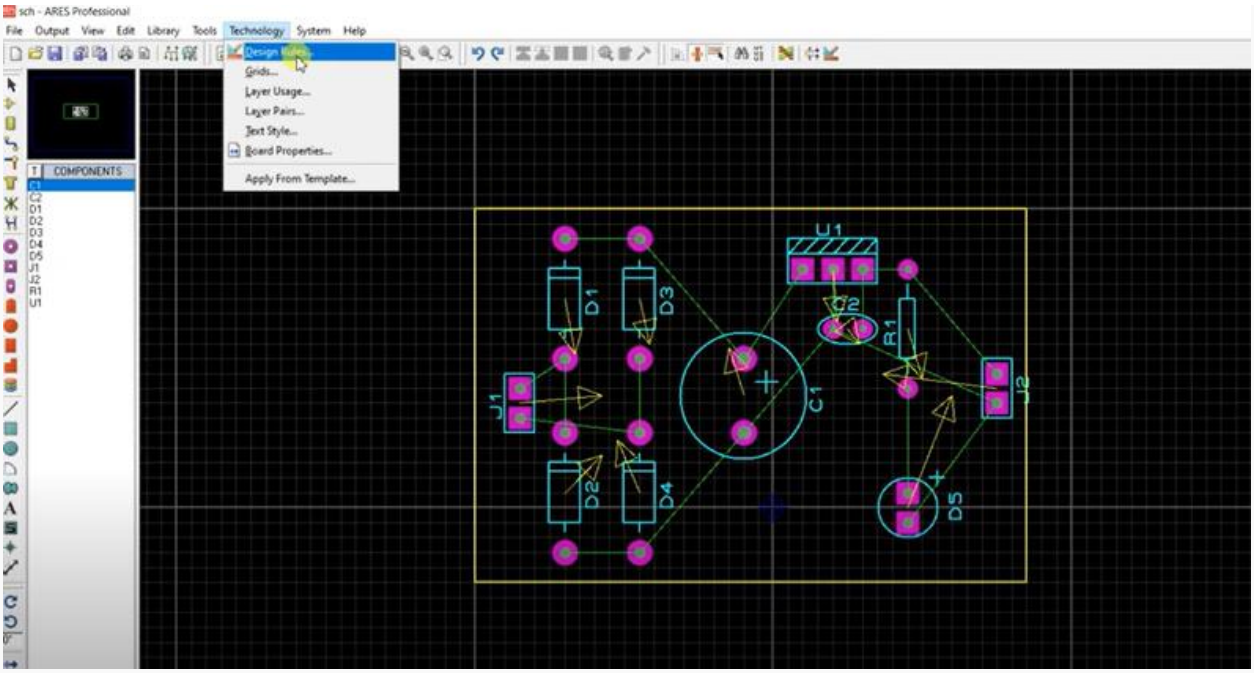
Output 3d visualization



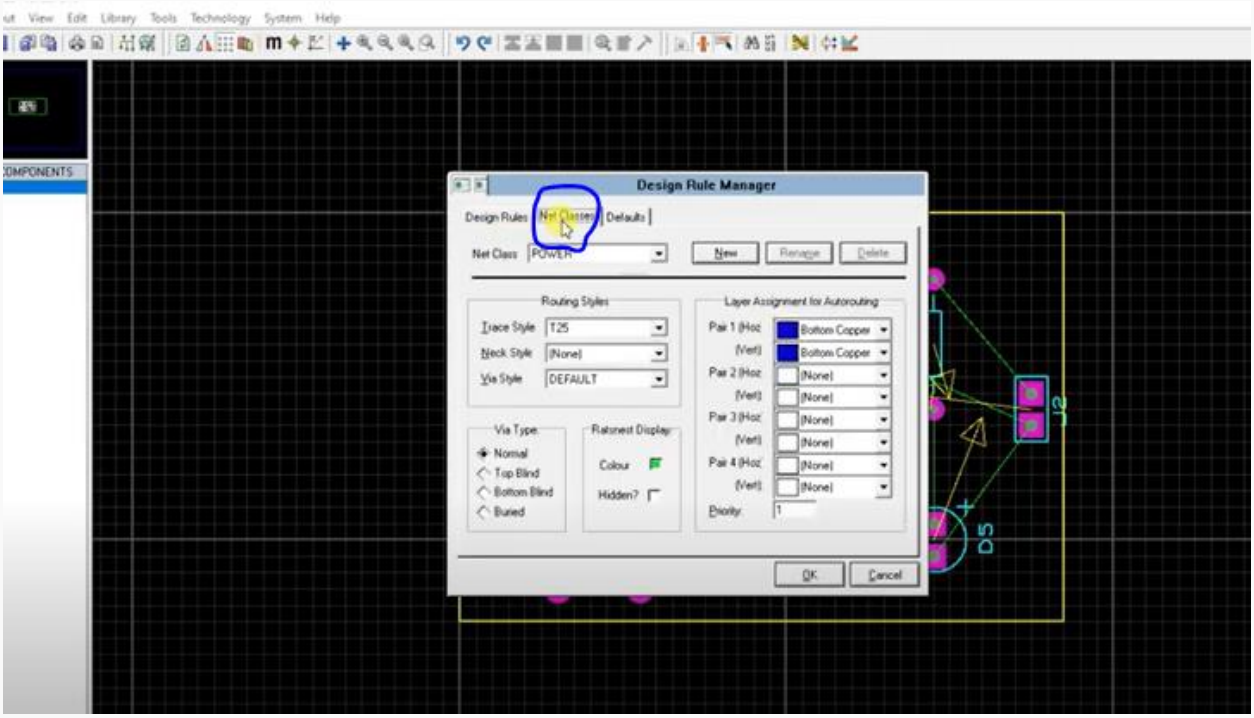




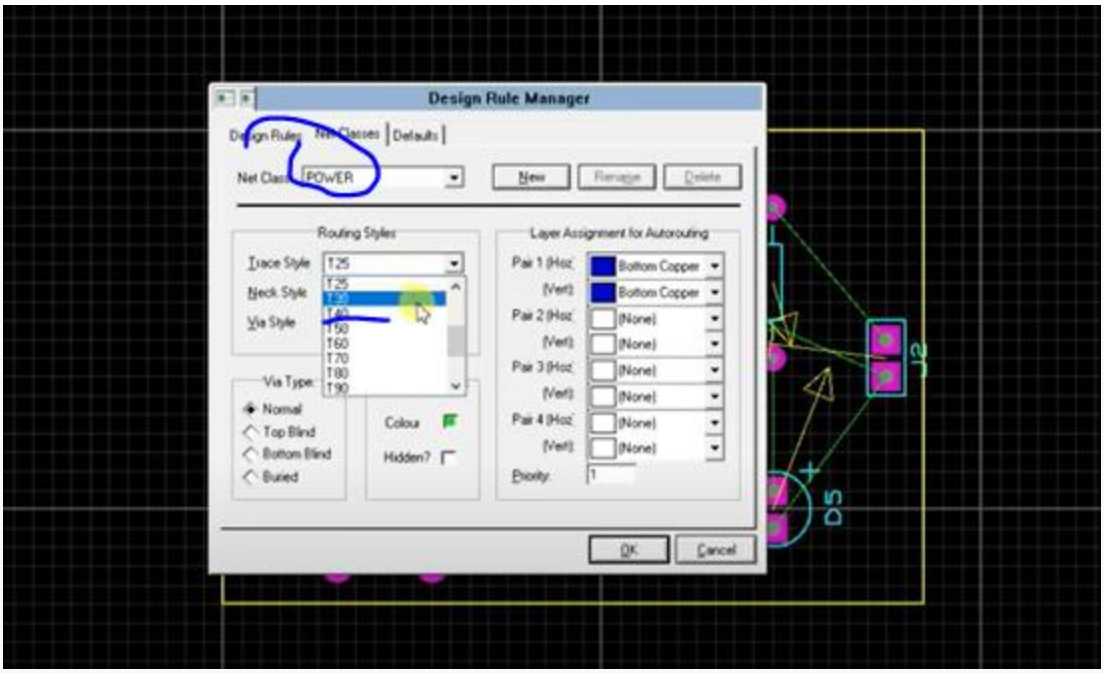
No board edge



Technology, design rule



Net classes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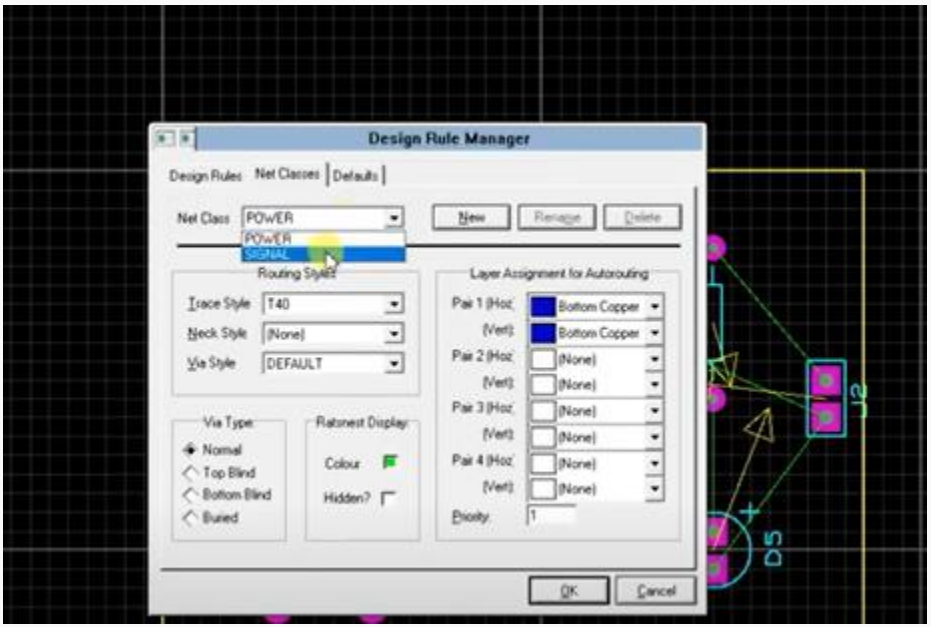
Design Rules
Net Classes
Defaults
Net Class
POWER
New
Rename
Delete
Routing Styles
Trace Style
T25
Neck Style
Via Style
T25
T30
T40
T50
T60
T70
T80
T90
Via Type
Normal
Top Blind
Bottom Blind
Buried
Colour
Hidden?
Layer Assignment for Autorouting
Pair 1 (Hoz
(Vert)
Bottom Copper
Pair 2 (Hoz
(None)
Pair 3 (Hoz
Pair 4 (Hoz
Priority
1
OK
Cancel
J2
D5

T30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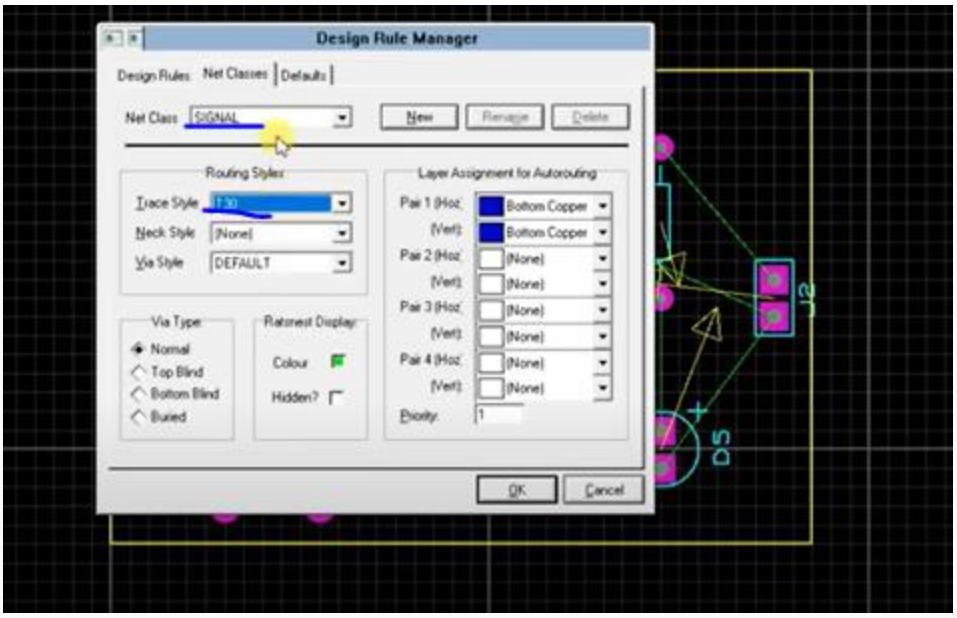
POWER
SIGNAL
New
Rename
Delete
Routing Styles
Trace Style
T40
Neck Style
(None)
Via Style
DEFAULT
Via Type
Normal
Top Blind
Bottom Blind
Buried
Ratsnest Display
Colour
Hidden?
Layer Assignment for Autorouting
Pair 1 (Hoz
(Vert)
Bottom Copper
Pair 2 (Hoz
(None)
Pair 3 (Hoz
Pair 4 (Hoz
Priority
1
OK
Cancel
J2
D5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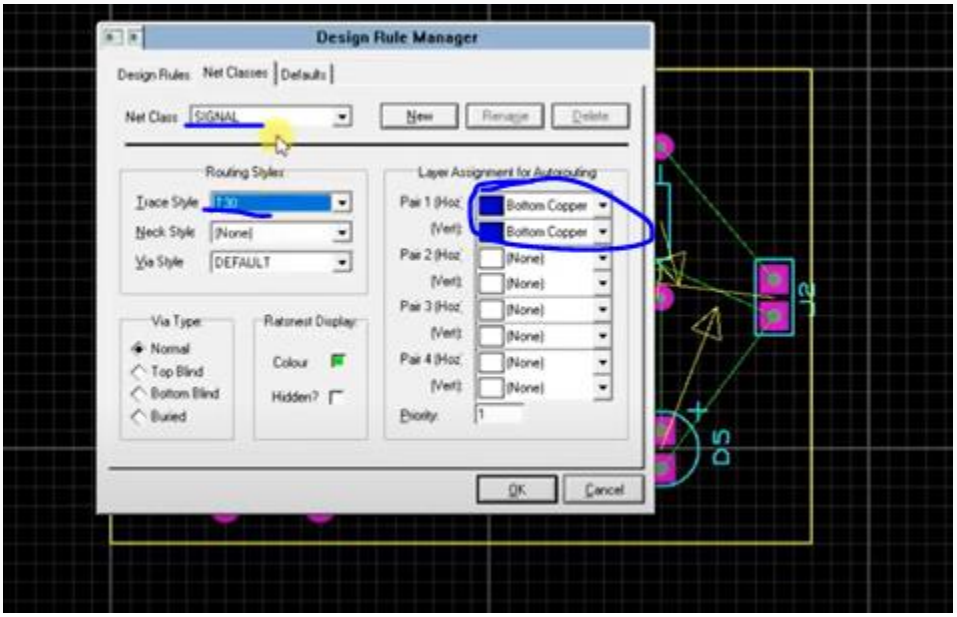
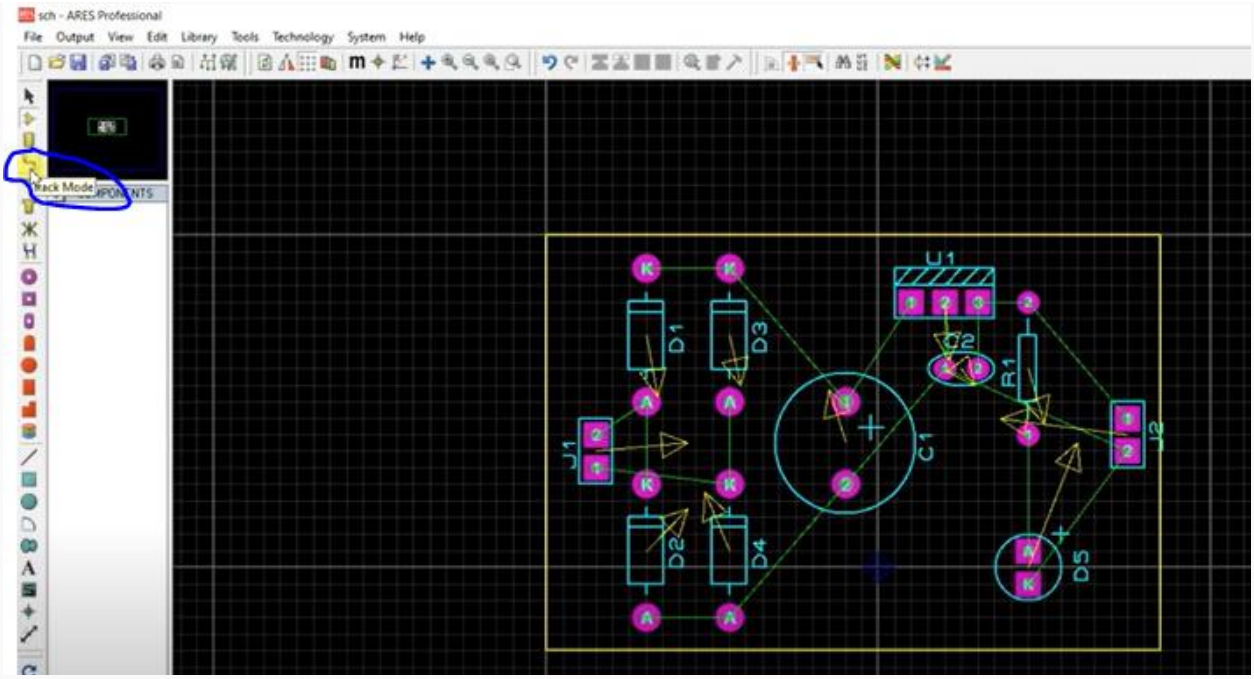
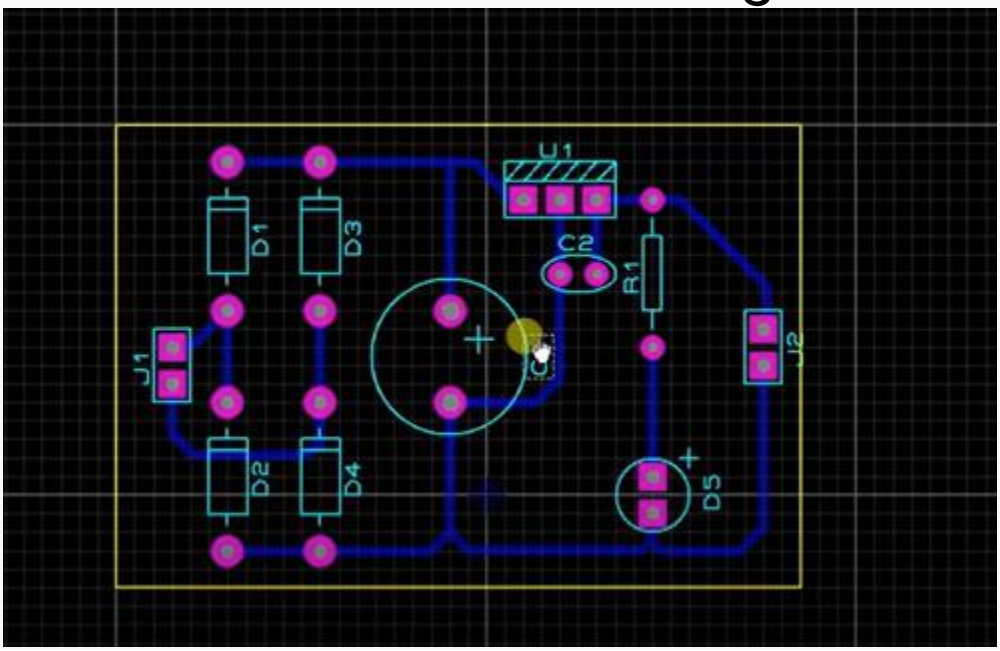
Design Rules
Net Classes
Defaults
Net Class
SIGNAL
New
Rename
Delete
Routing Styles
Trace Style
T30
Neck Style
(None)
Via Style
DEFAULT
Layer Assignment for Autorouting
Pair 1 (Hoz
(Vert)
Bottom Copper
Pair 2 (Hoz
Pair 3 (Hoz
Pair 4 (Hoz
(None)
Via Type
Normal
Top Blind
Bottom Blind
Buried
Ratsnest Display
Colour
Hidden?
Priority
1
OK
Cancel
J2
D5

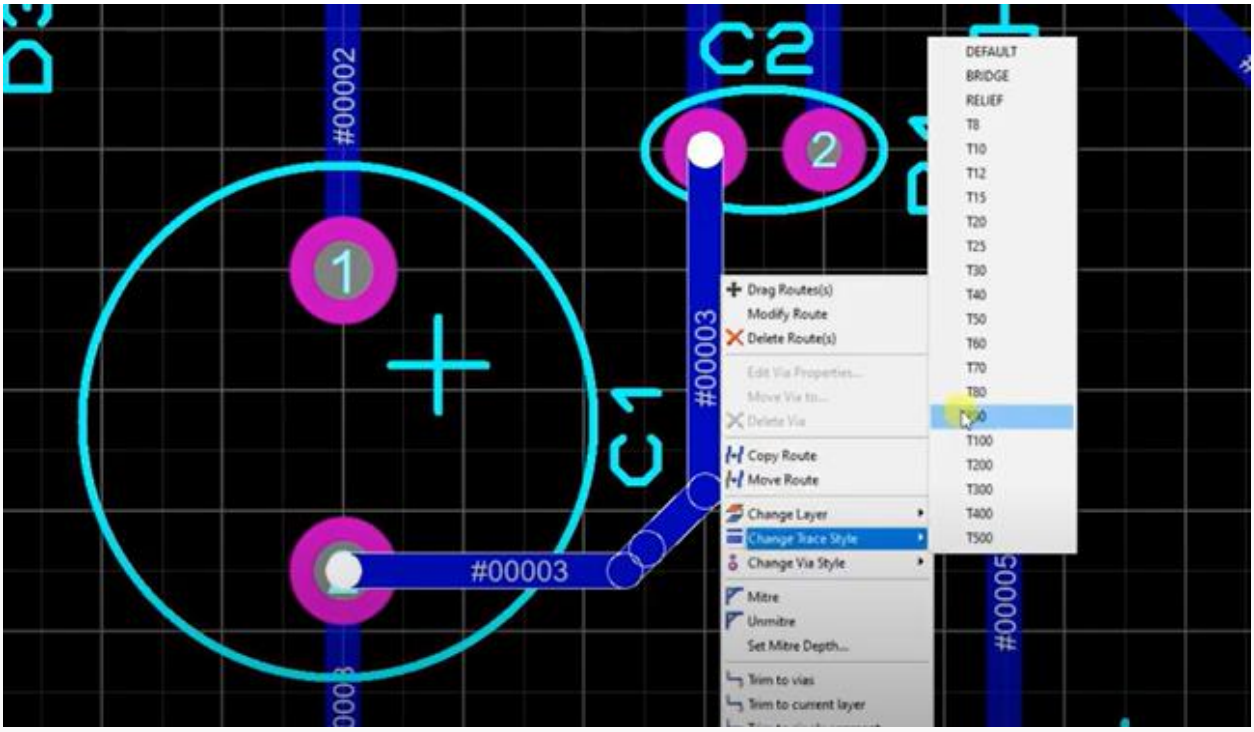
T30

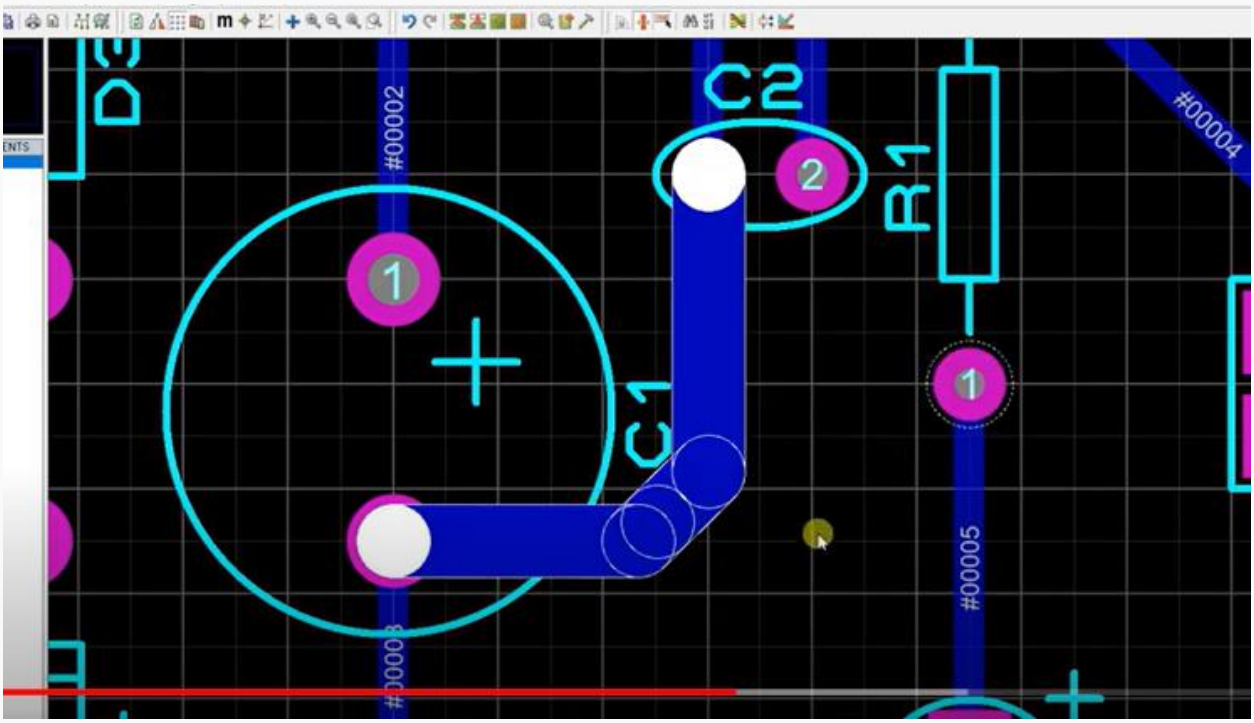

Design Rule Manager
Design Rules
Net Classes
Defaults
Net Class
SIGNAL
New
Rename
Delete
Routing Styles
Trace Style
T30
Neck Style
(None)
Via Style
DEFAULT
Layer Assignment for Autorouting
Pair 1 (Hoz
(Vert)
Bottom Copper
Pair 2 (Hoz
Pair 3 (Hoz
Pair 4 (Hoz
(None)
Via Type
Normal
Top Blind
Bottom Blind
Buried
Ratsnest Display
Colour
Hidden?
Priority
1
OK
Cancel
J2
D5



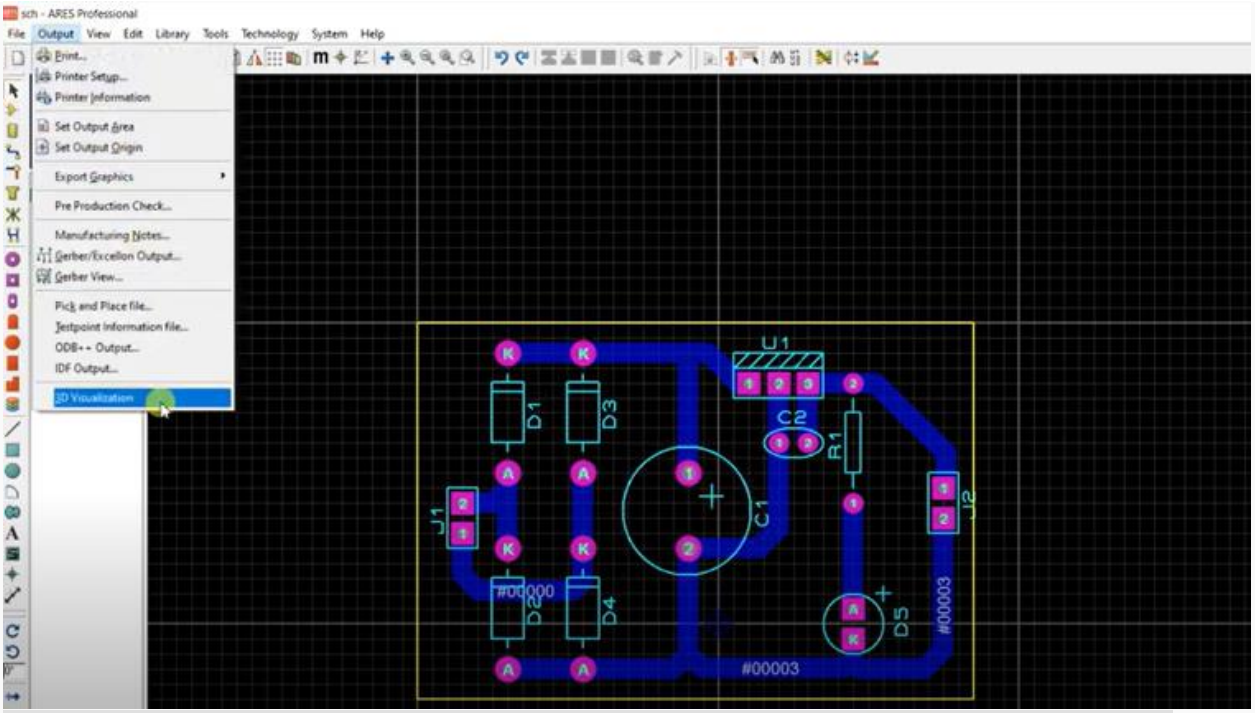
Track mode to start routing







T70 70 thou width


sch - ARES Professional
File Output View Edit Library Tools Technology System Help
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
U1
D1
D3
C2
R1
J1
C1
J2
D2
D4
D5
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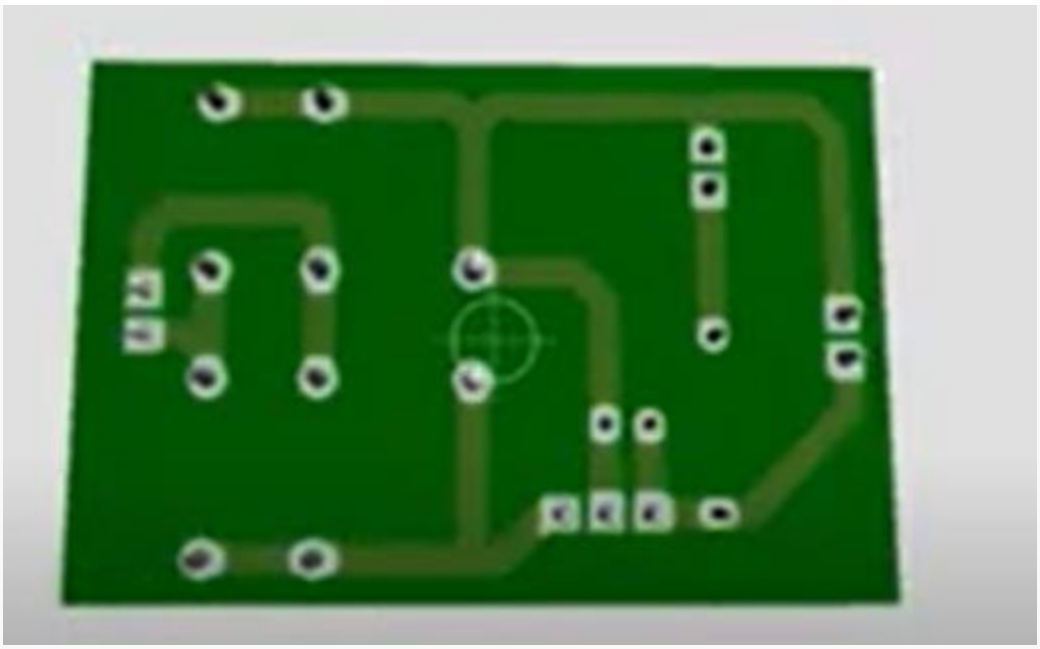
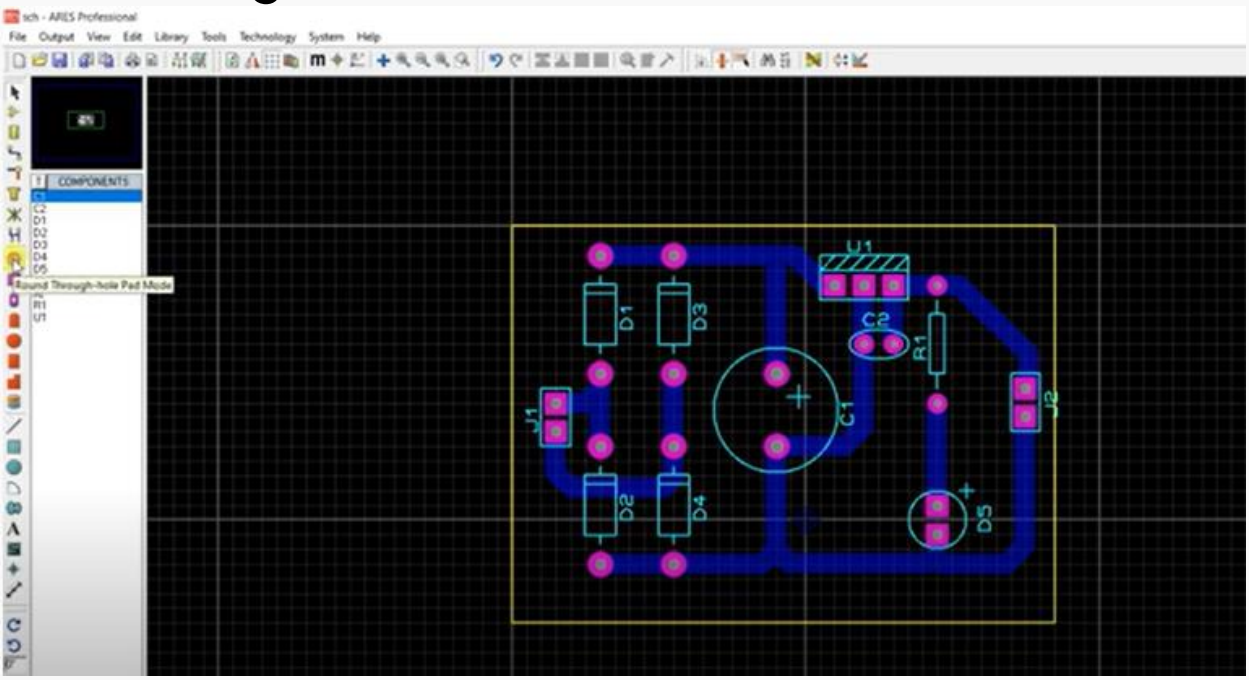
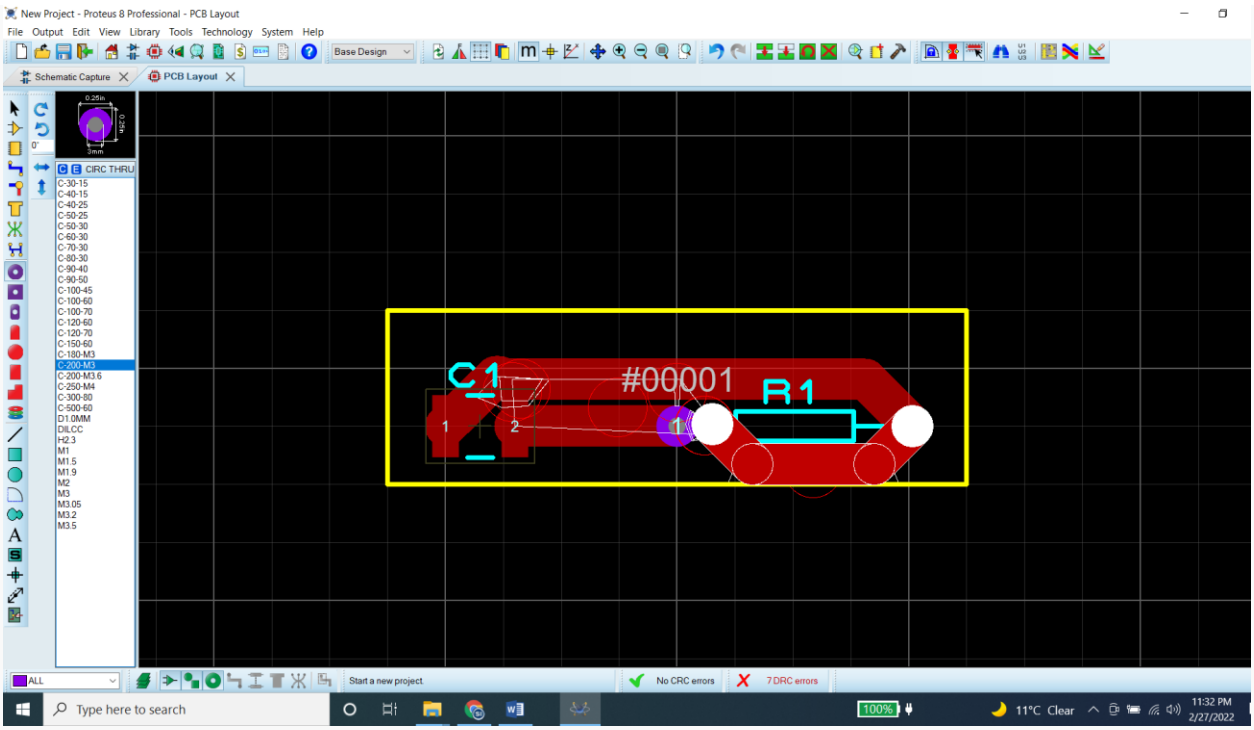
#00003



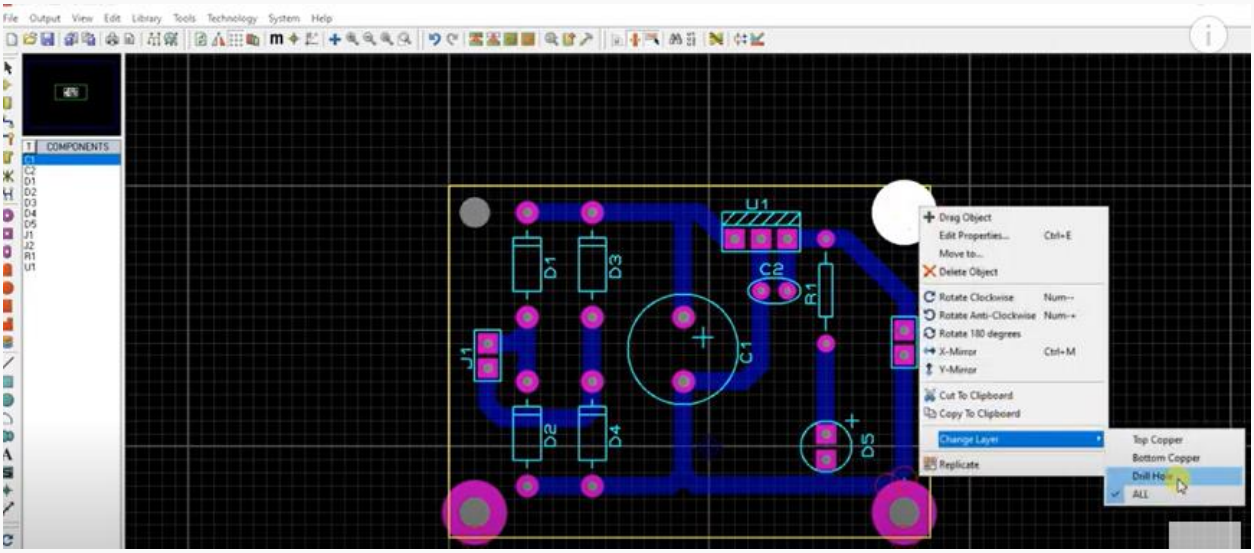
Mounting holes



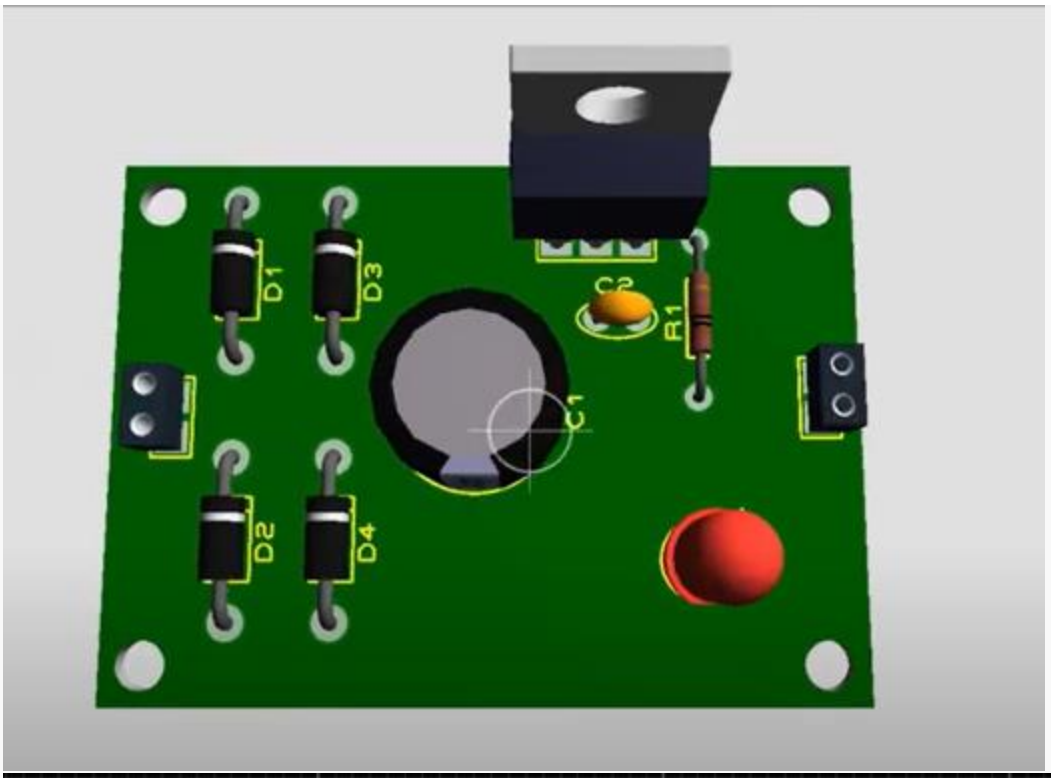
Round through hole pad mode

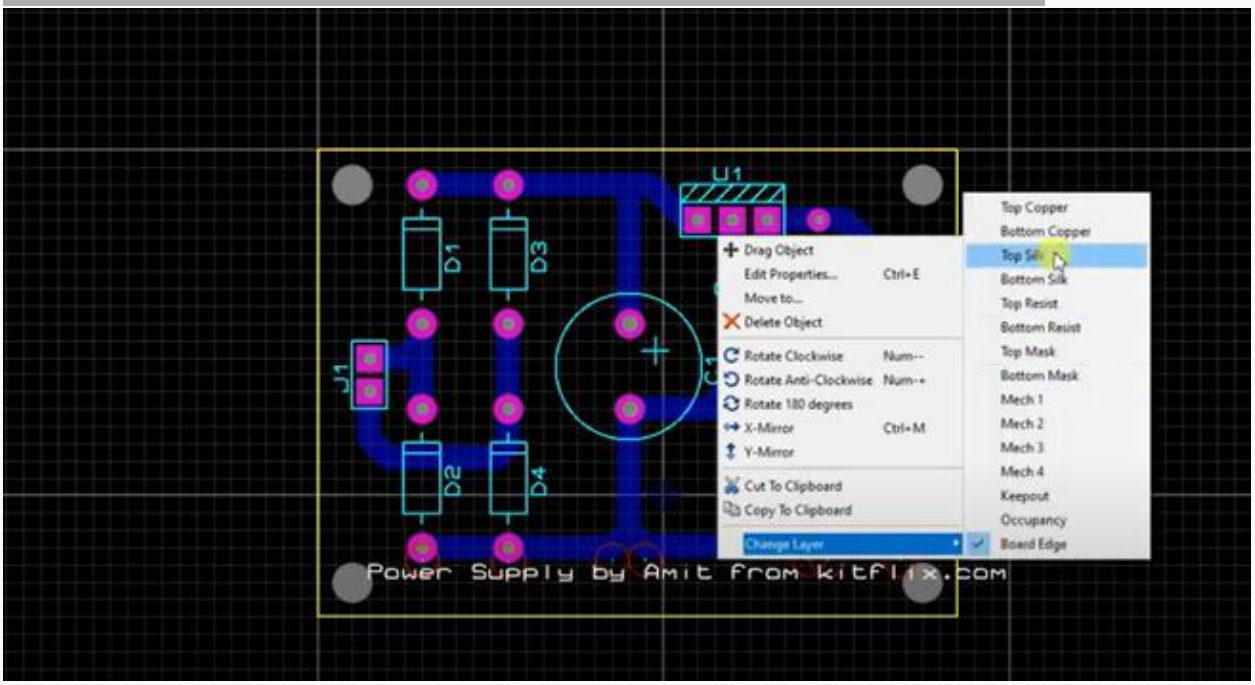


C200 m3

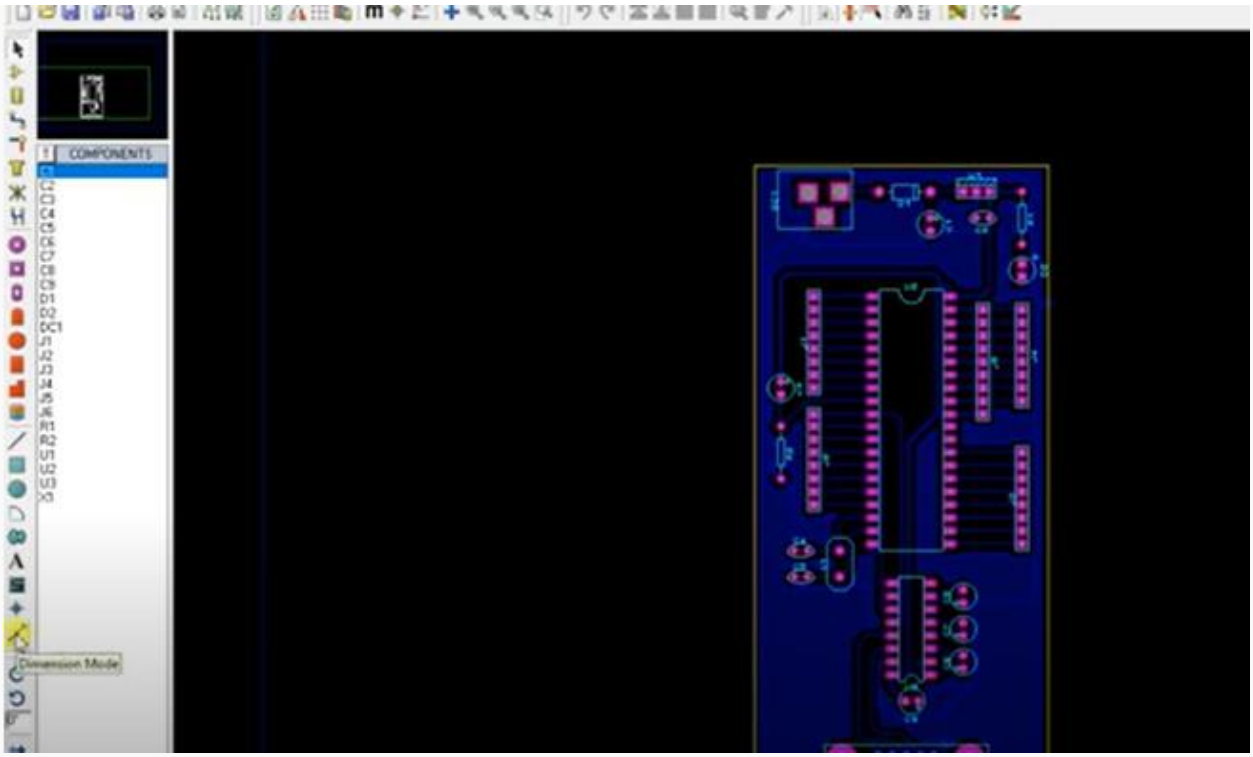


Drill hole



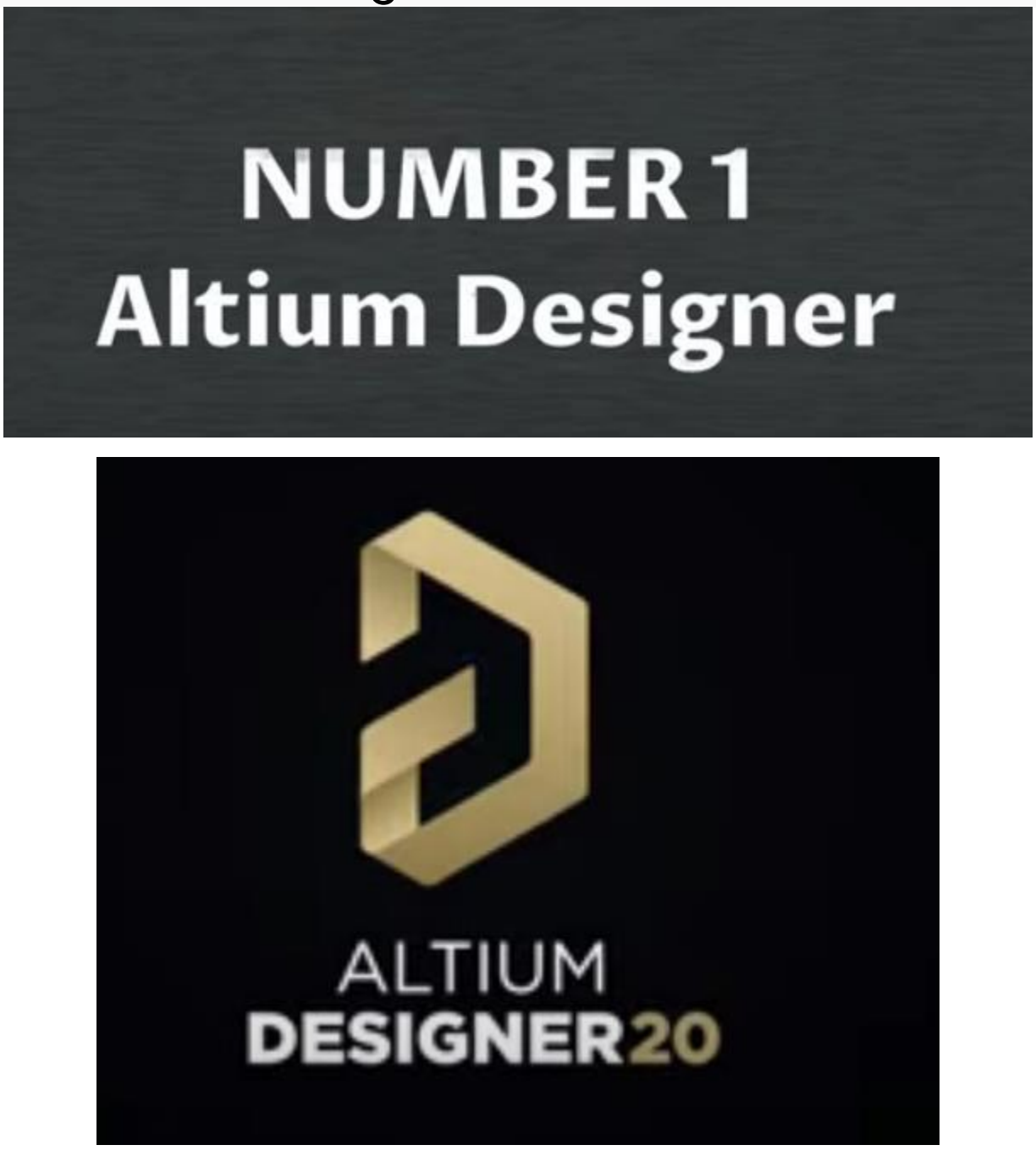


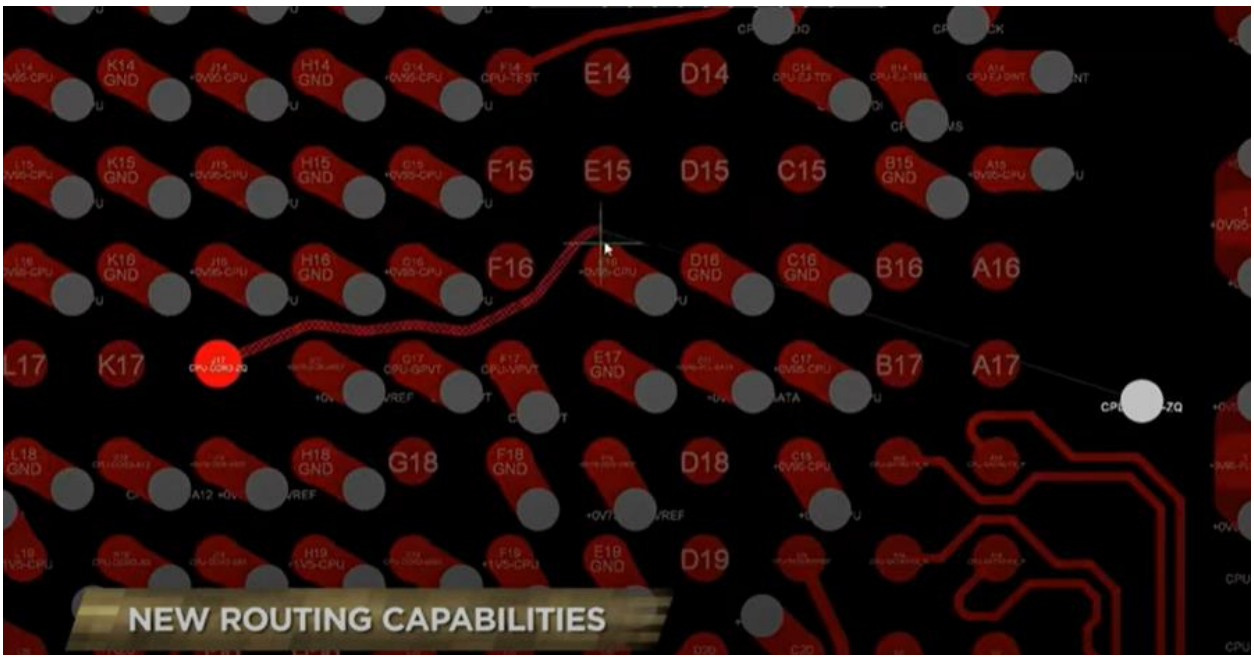
Text change layer to top silk

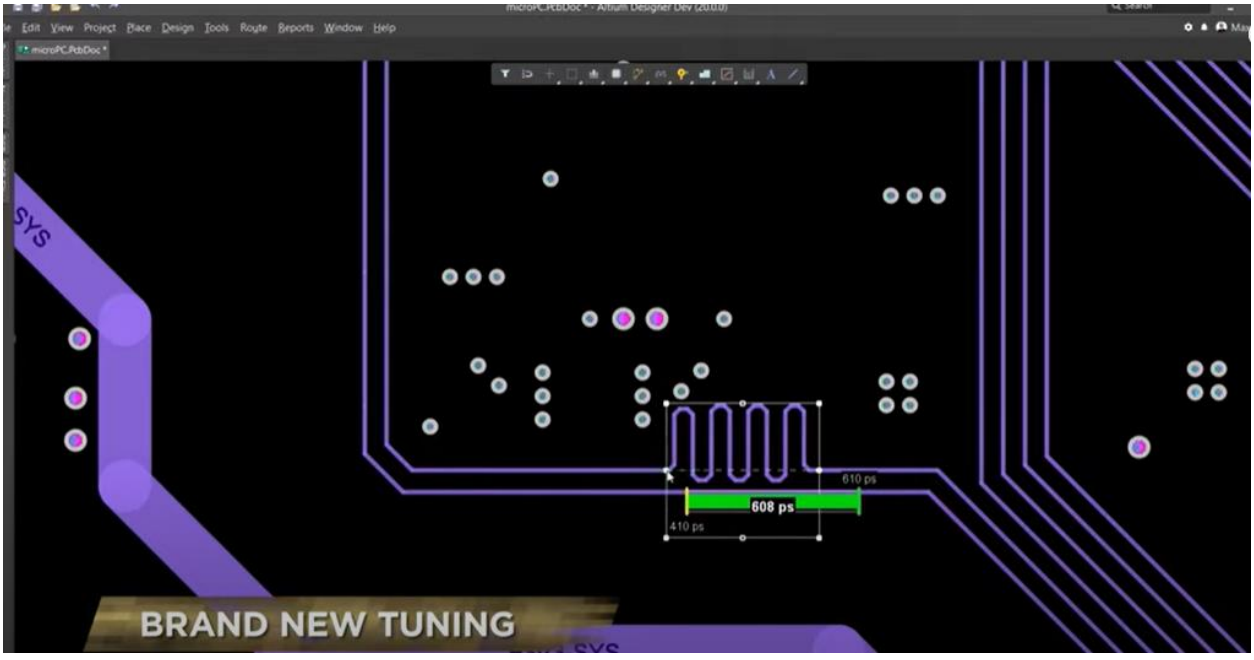


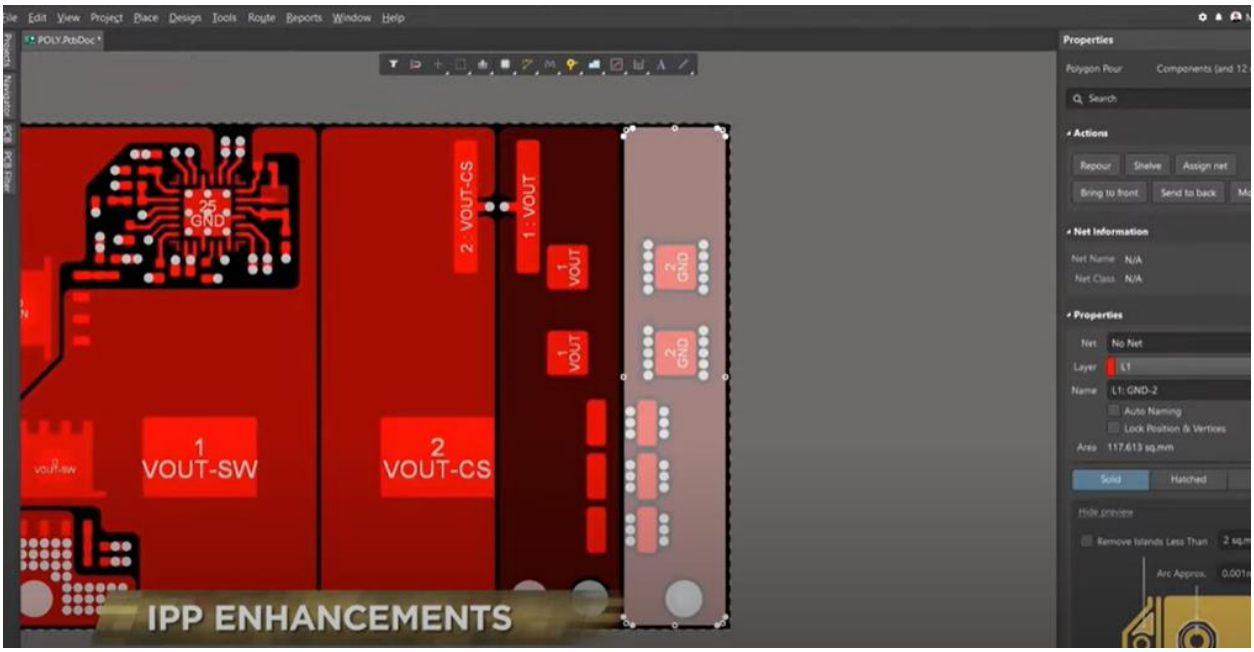
Dimension mode for dimesntions
C for cm, m for mm

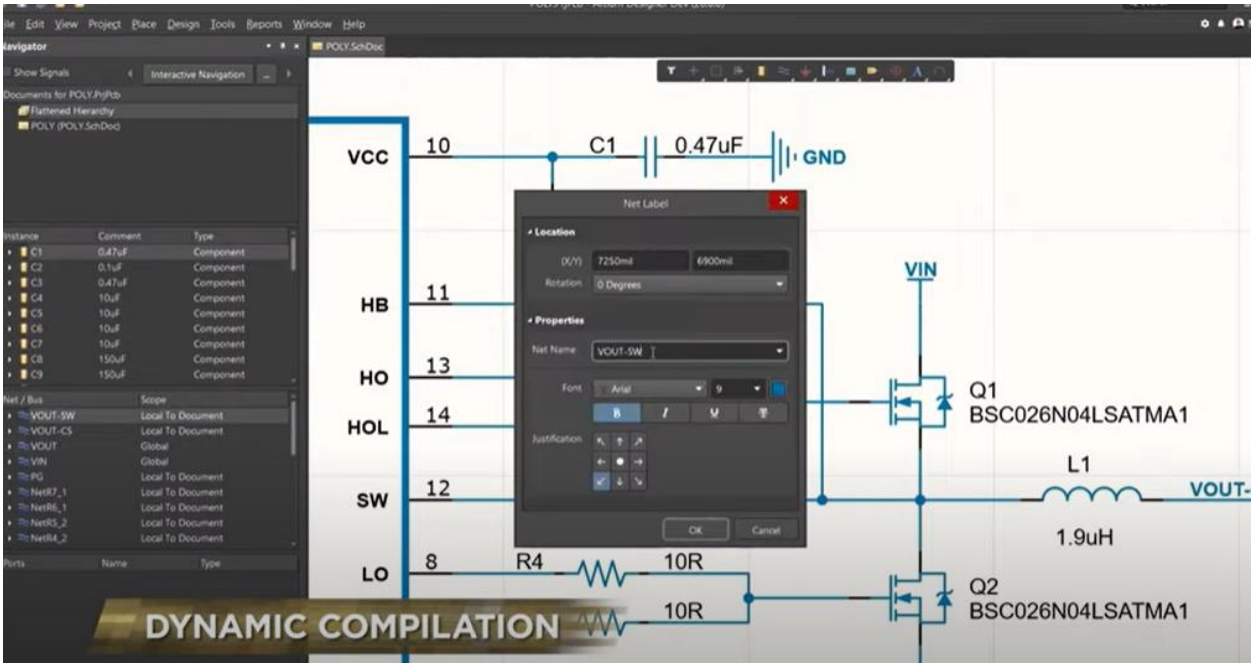
5 best PCB design software




NEW ROUTING CAPABILITIES


Edit View Project Place Design Tools Route Reports Window Help
610 ps
608 ps
410 ps
BRAND NEW TUNING


IPP ENHANCEMENTS
1
VOUT-SW
2
VOUT-CS
2 : VOUT-CS
1 : VOUT
GND
Properties
Actions
Net Information
Properties


DYNAMIC COMPILATION
VCC
10
C1
0.47uF
GND
HB
11
HO
13
HOL
14
SW
12
LO
8
R4
10R
10R
VIN
Q1
BSC026N04LSATMA1
L1
1.9uH
Q2
BSC026N04LSATMA1
Net Label
Location
Properties
Net Name
VOUT-SW
OK
Cancel

NUMBER 2
OrCAD

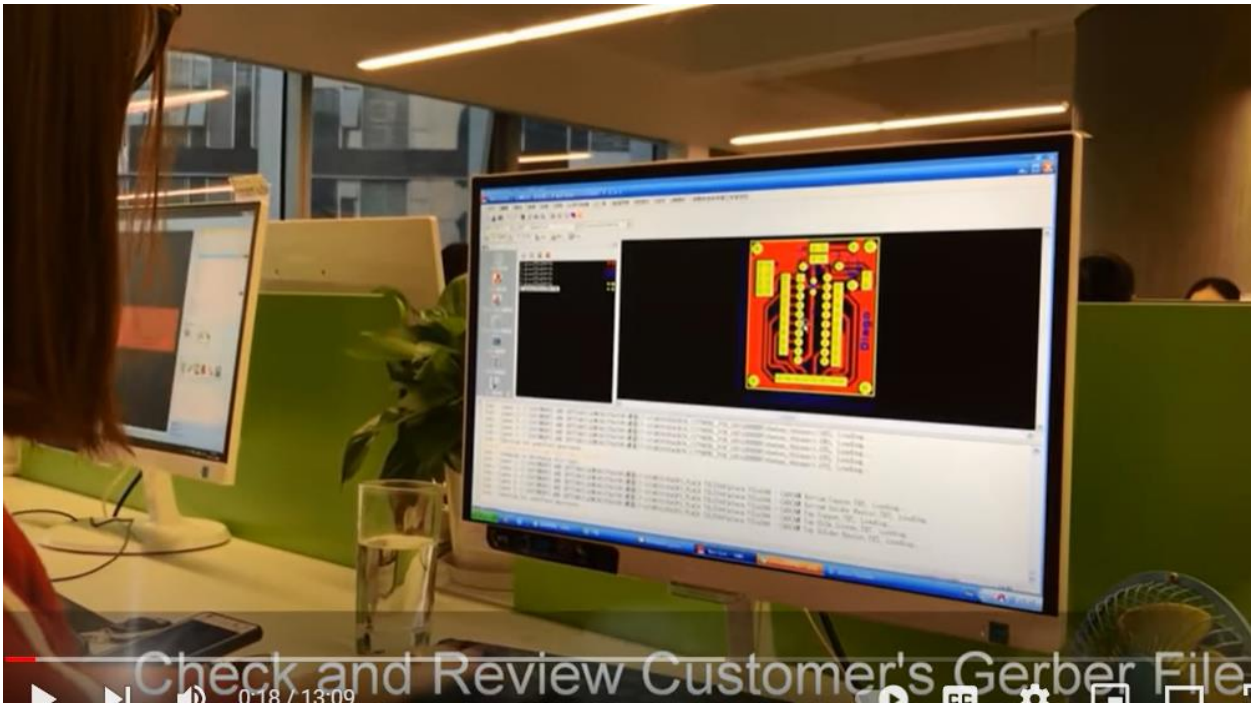
NUMBER 3
Kicad

NUMBER 4
Autodesk Eagle

NUMBER 5
Proteus

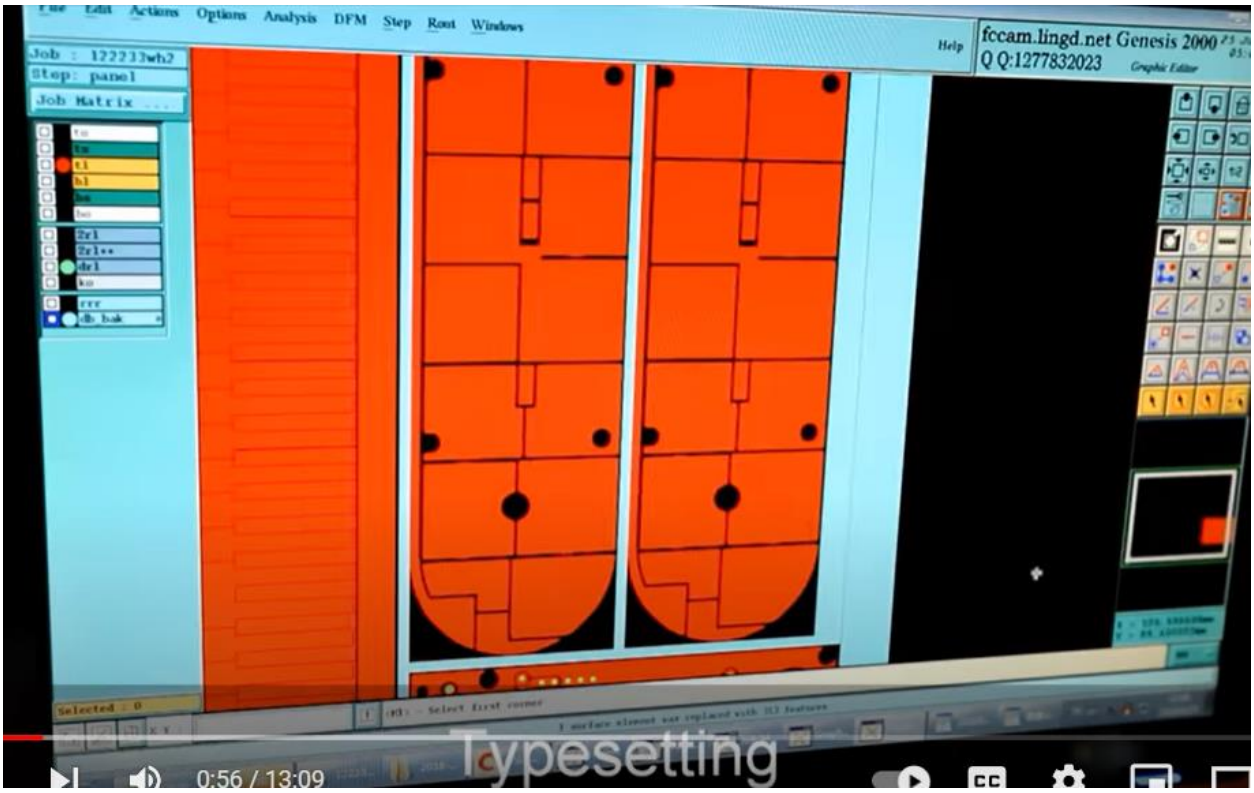
PCB Steps

1. DFM or Design for Manufacturing



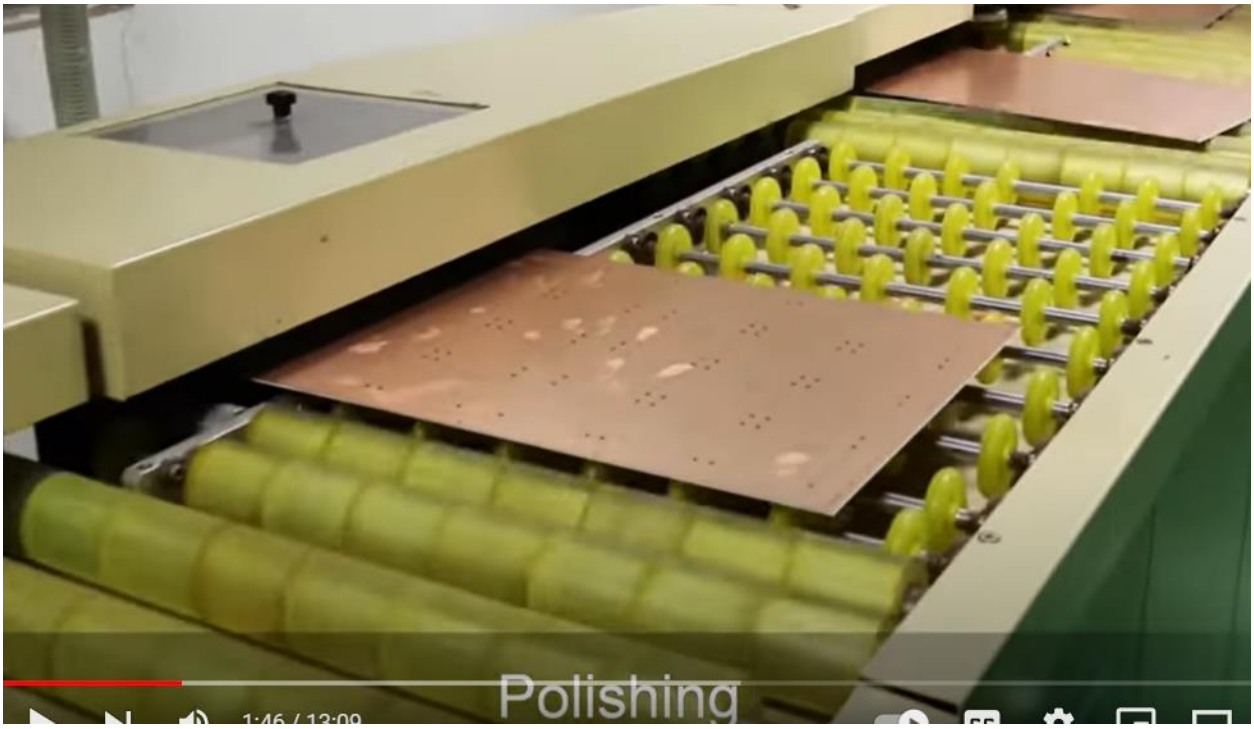

Engineering Department
0:25 / 13:09


fccam.lingd.net Genesis 2000
Q Q:1277832023
Produce the Manufacturing Data
0:37 / 13:09


File Edit Actions Options Analysis DFM Step Rout Windows
Help
fccam.lingd.net Genesis 2000
Q Q:1277832023
Graphic Editor
Job : 122233wh2
Step: panel
Job Matrix ...
Typesetting
0:56 / 13:09


Board Cutting

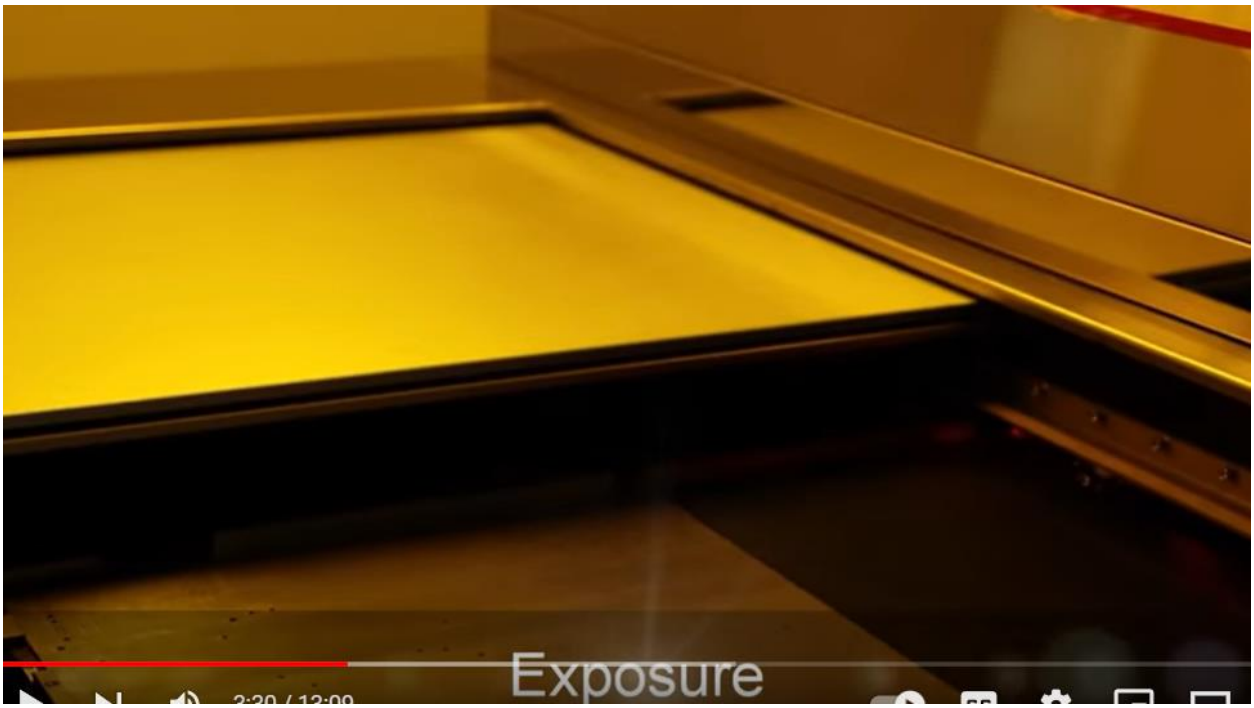

当心机械伤
Drilling

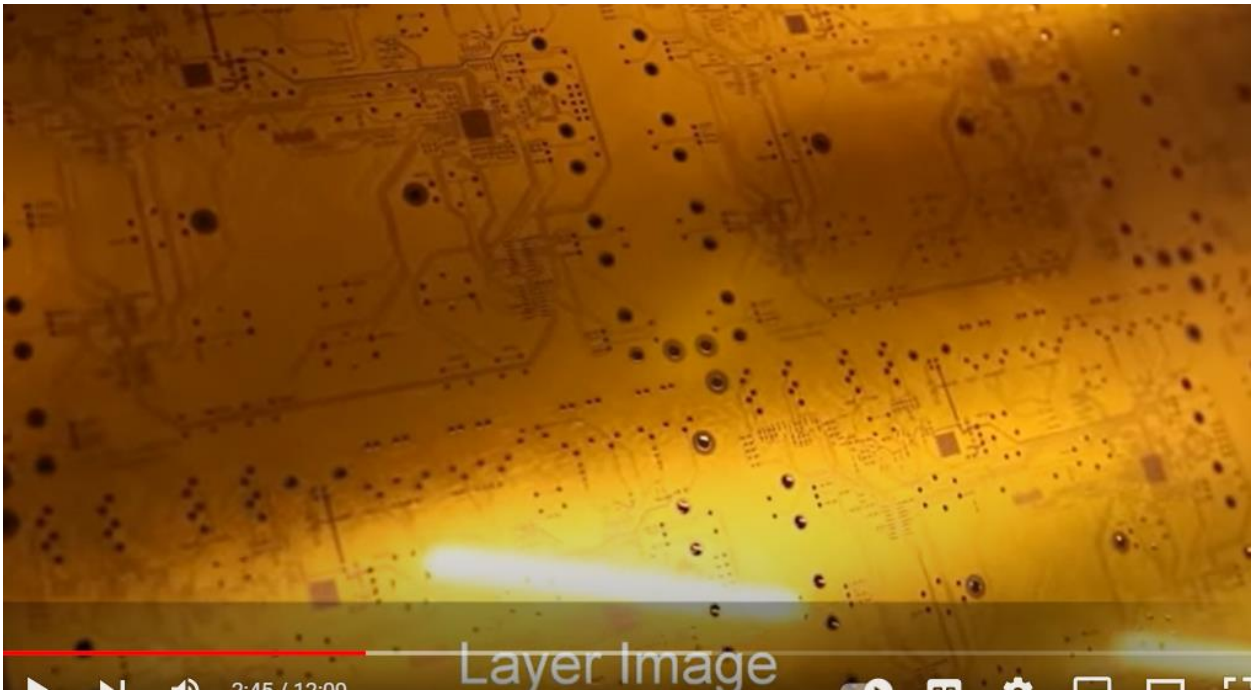

Polishing

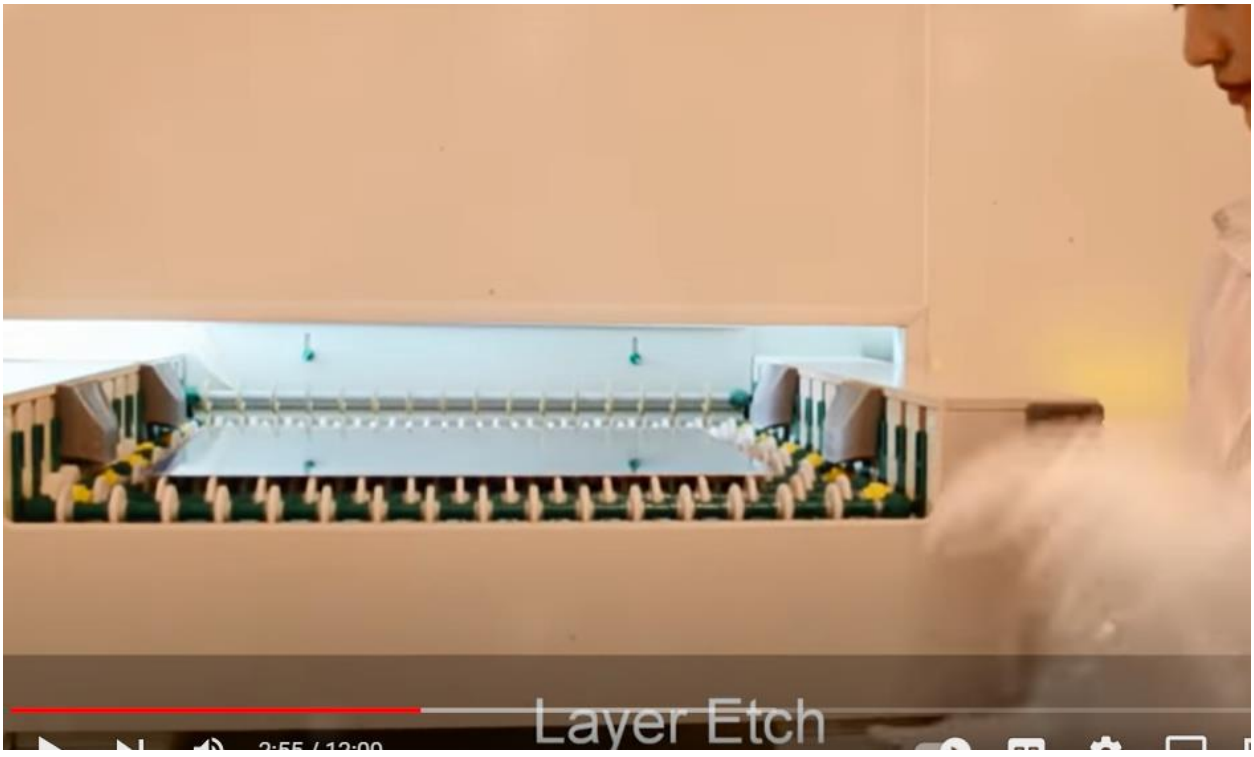

Plated Throught Hole(PTH)

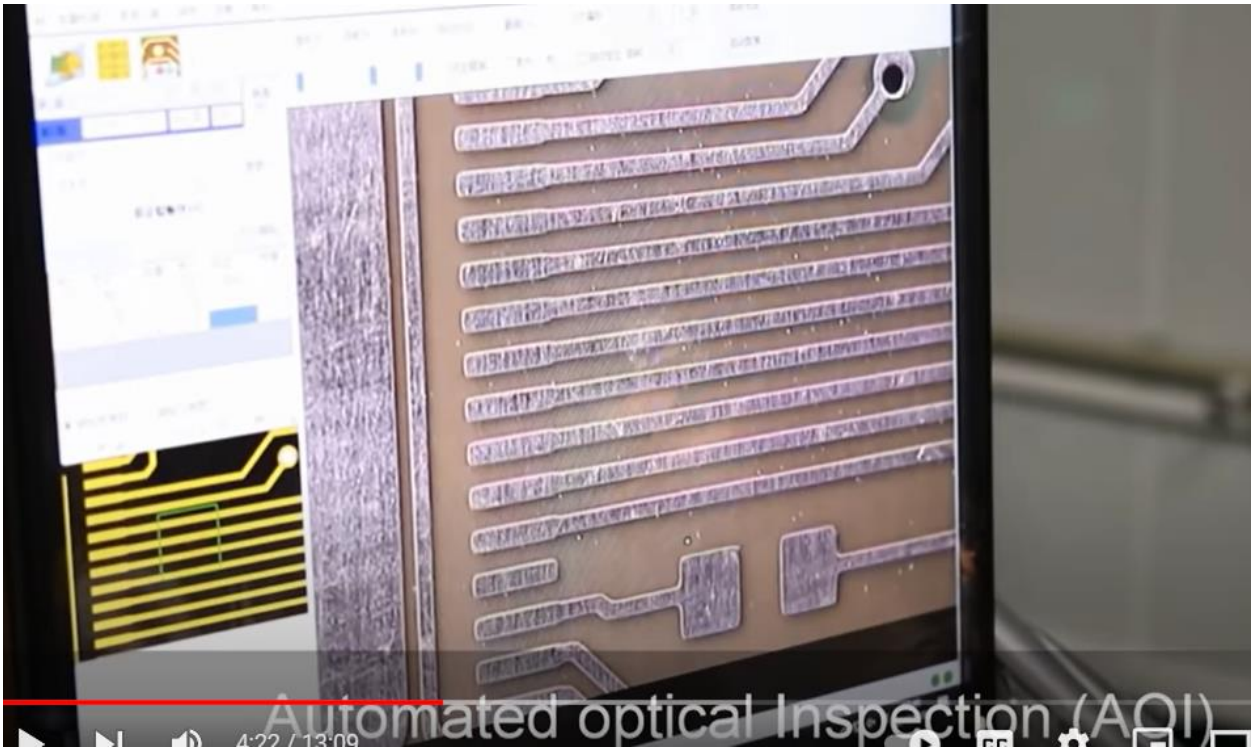

Panel Plating


Membrane Pasting
3:05 / 13:09


Exposure


Layer Image

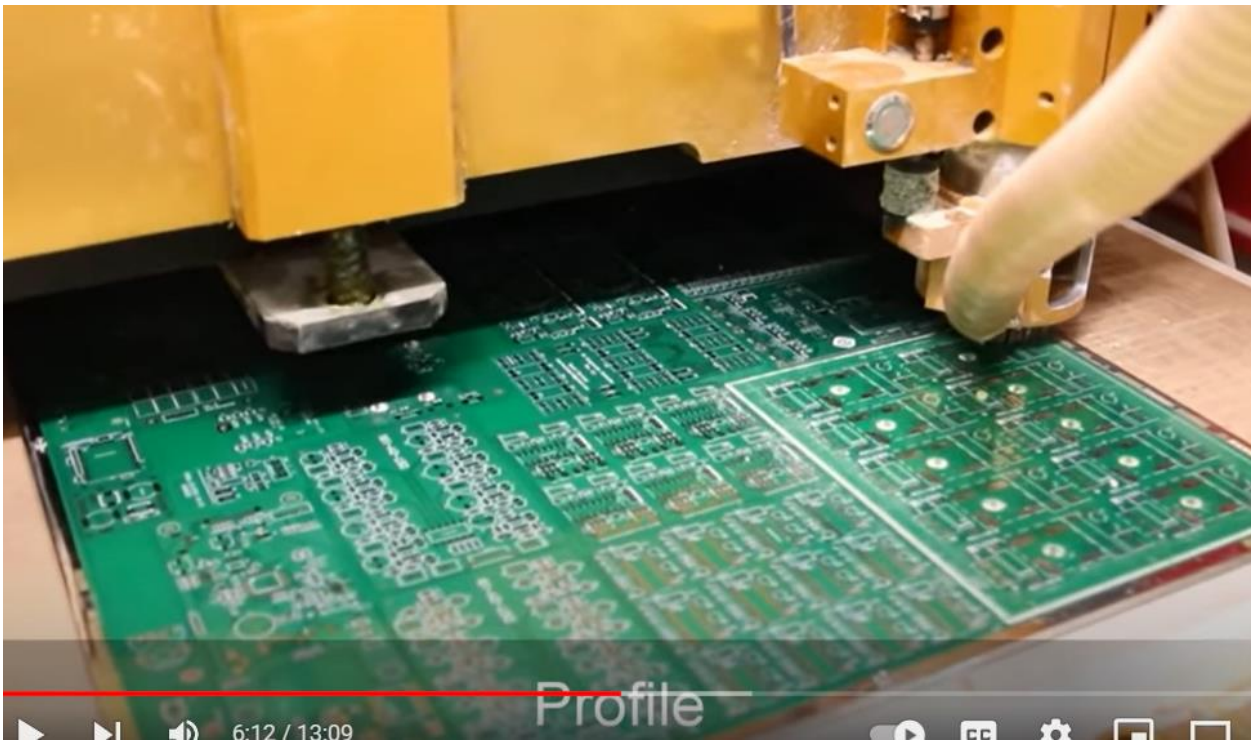

Layer Etch


Automated optical Inspection (AOI)
4:22 / 13:09

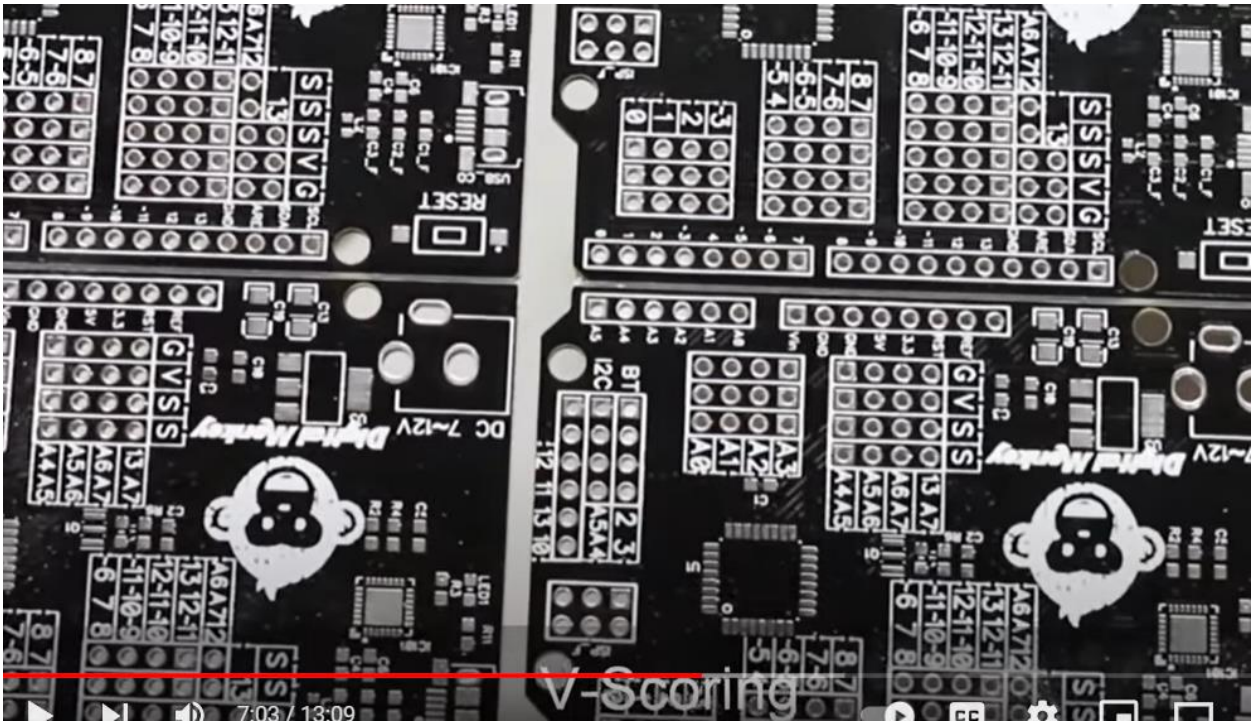

Soldermask
4:52 / 13:09

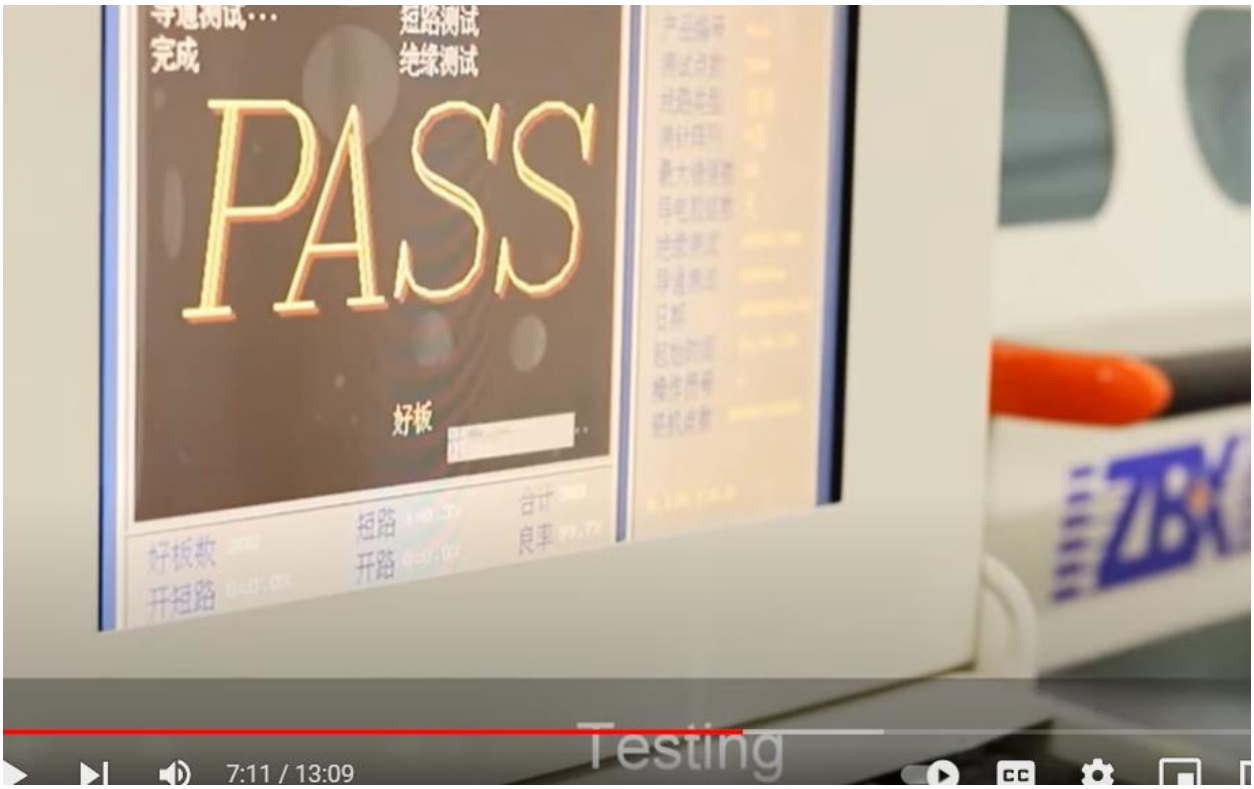

Drying
5:26 / 13:09


Silkscreen
5:54 / 13:09

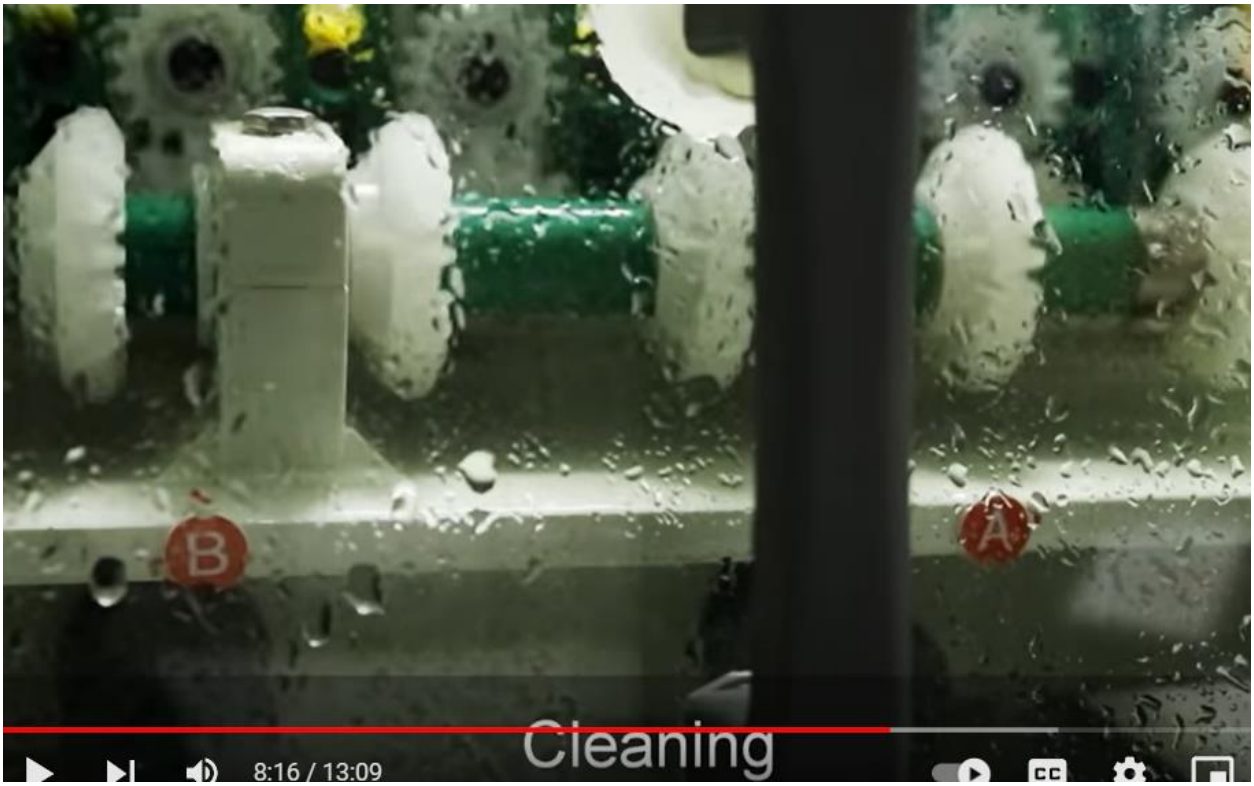

Profile
6:12 / 13:09

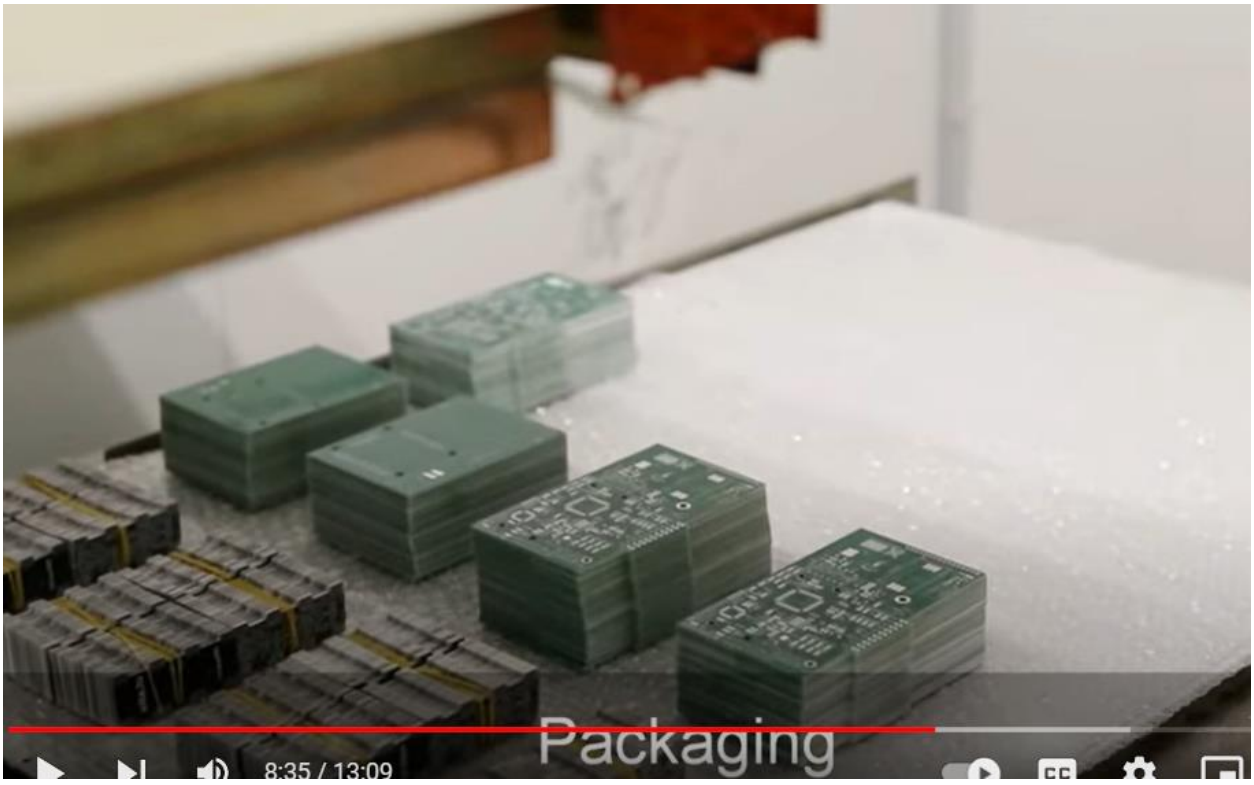

V-Scoring
6:51 / 13:09

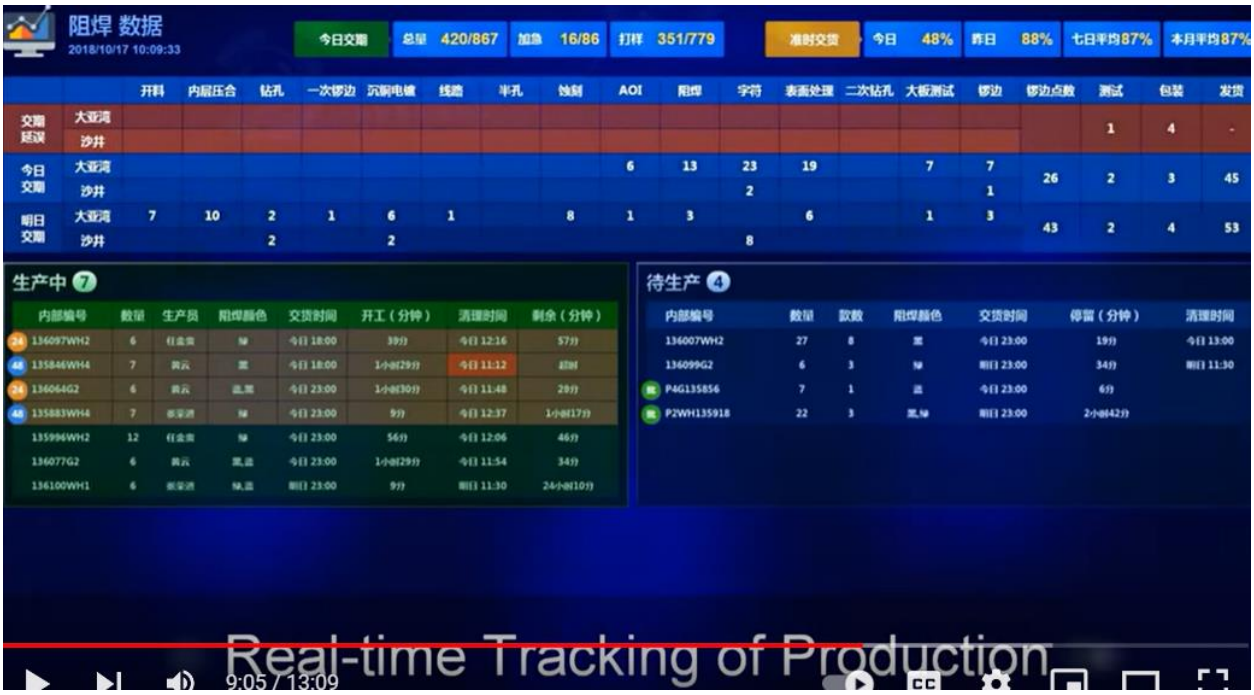

V-Scoring
7:03 / 13:09


完成
短路测试
绝缘测试
PASS
好板
Testing
7:11 / 13:09

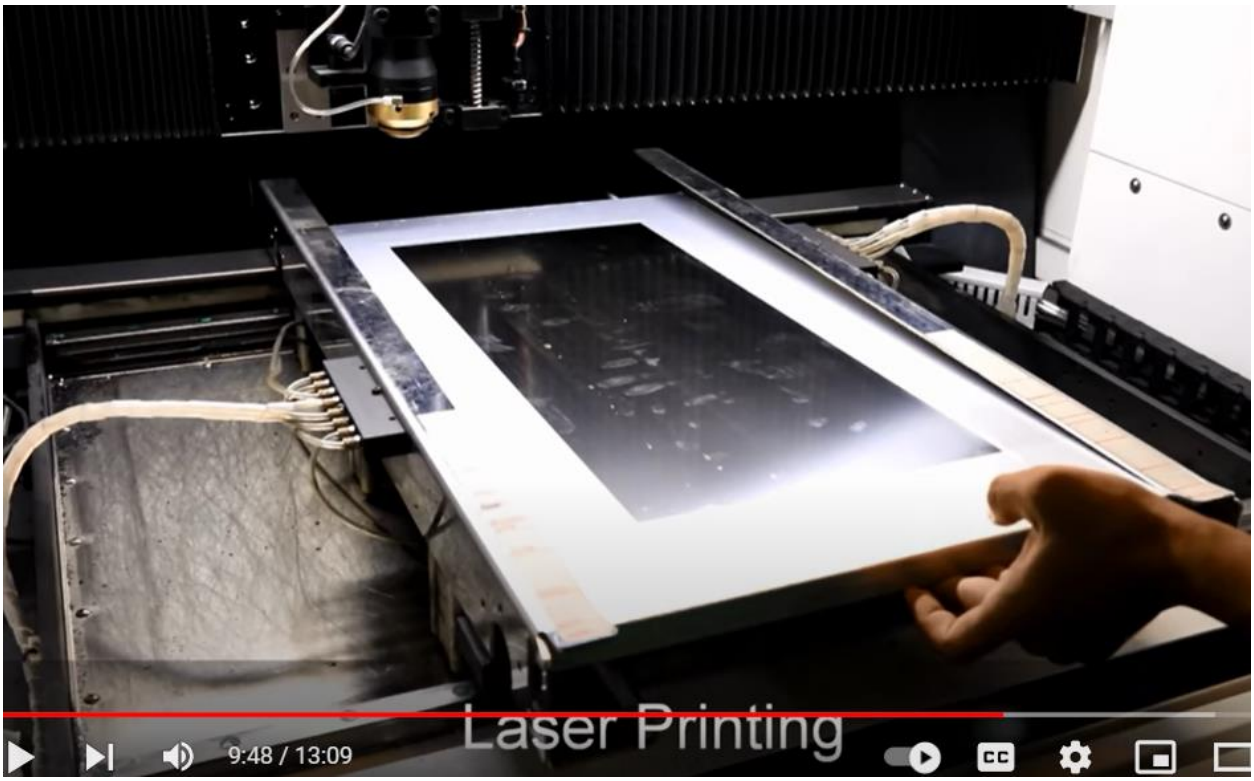

Flying Probe
7:47 / 13:09


B
A
Cleaning
8:16 / 13:09


Packaging
8:35 / 13:09


阻焊 数据
2018/10/17 10:09:33
今日交期
总量 420/867
加急 16/86
打样 351/779
准时交货
今日 48%
昨日 88%
七日平均87%
本月平均87%
开料 内层压合 钻孔 一次锣边 沉铜电镀 线路 半孔 蚀刻 AOI 阻焊 字符 表面处理 二次钻孔 大板测试 锣边 锣边点数 测试 包装 发货
交期延误 大亚湾 1 4 -
沙井
今日交期 大亚湾 6 13 23 19 7 7 26 2 3 45
沙井 2 1
明日交期 大亚湾 7 10 2 1 6 1 8 1 3 6 1 3 43 2 4 53
沙井 2 2 8
生产中 7
内部编号 数量 生产员 阻焊颜色 交货时间 开工（分钟） 清理时间 剩余（分钟）
136097WH2 6 今日 18:00 39分 今日 12:16 57分
135846WH4 7 今日 18:00 1小时29分 今日 11:12 超时
136064G2 6 今日 23:00 1小时30分 今日 11:48 28分
135883WH4 7 今日 23:00 9分 今日 12:37 1小时17分
135996WH2 12 今日 23:00 56分 今日 12:06 46分
136077G2 6 今日 23:00 1小时29分 今日 11:54 34分
136100WH1 6 明日 23:00 9分 明日 11:30 24小时10分
待生产 4
内部编号 数量 款数 阻焊颜色 交货时间 停留（分钟） 清理时间
136007WH2 27 8 今日 23:00 19分 今日 13:00
136099G2 6 3 明日 23:00 34分 明日 11:30
P4G135856 7 1 今日 23:00 6分
P2WH135918 22 3 明日 23:00 2小时42分
Real-time Tracking of Production
9:05 / 13:09

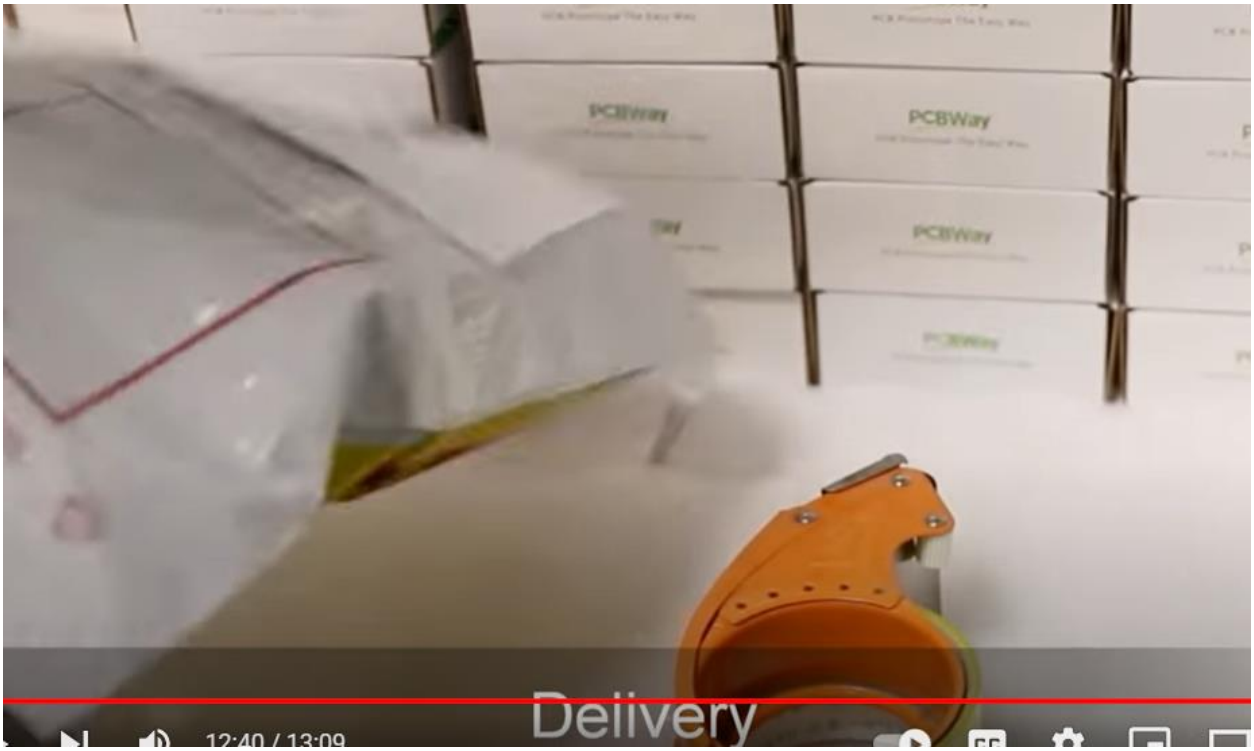

One-stop PCB Assembly
Stencil File Import
9:33 / 13:09



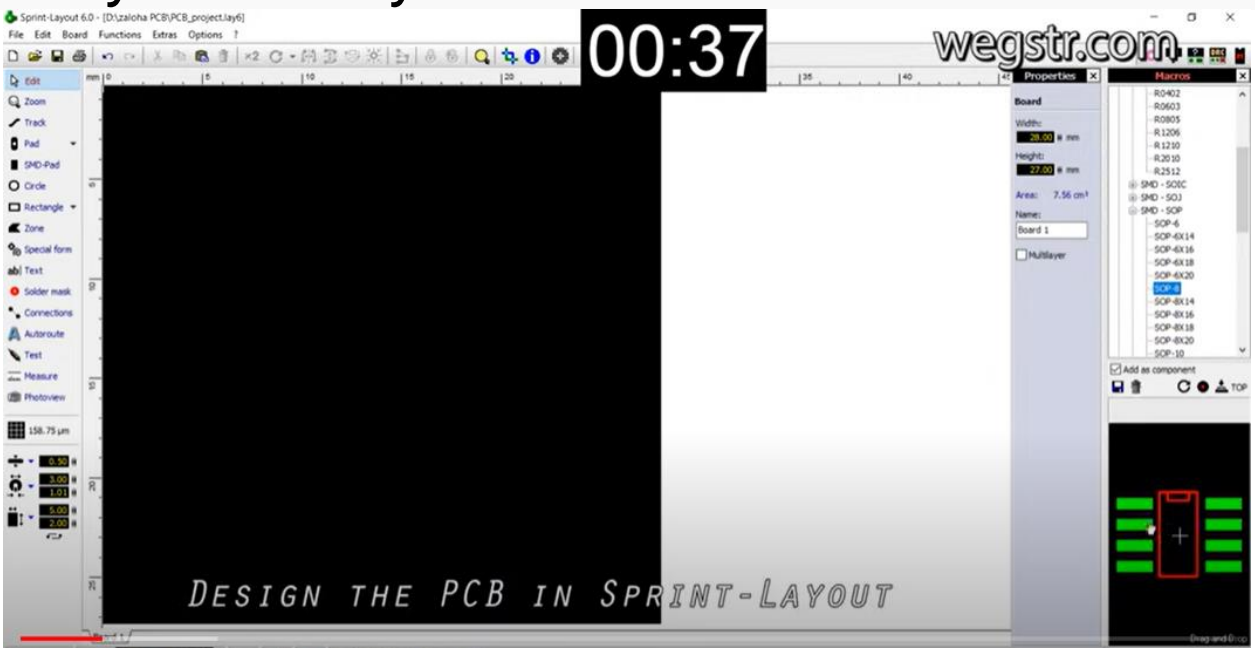
surface-mount technology (SMT)

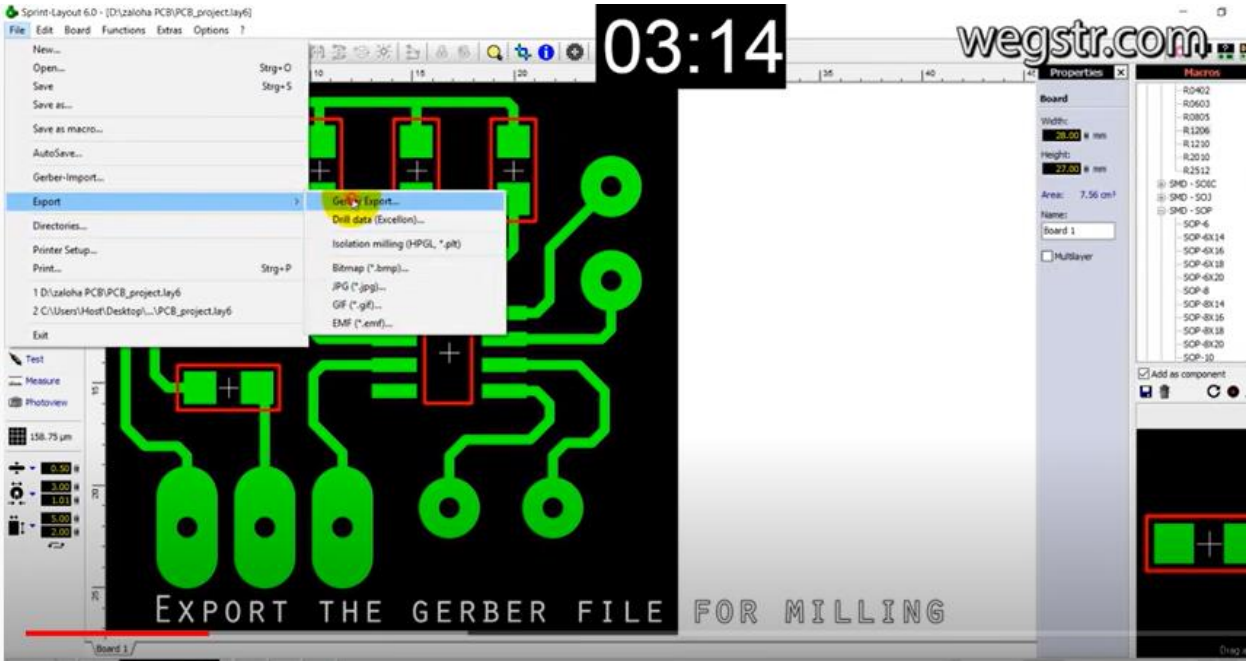
Surface Mount Devices (SMD)

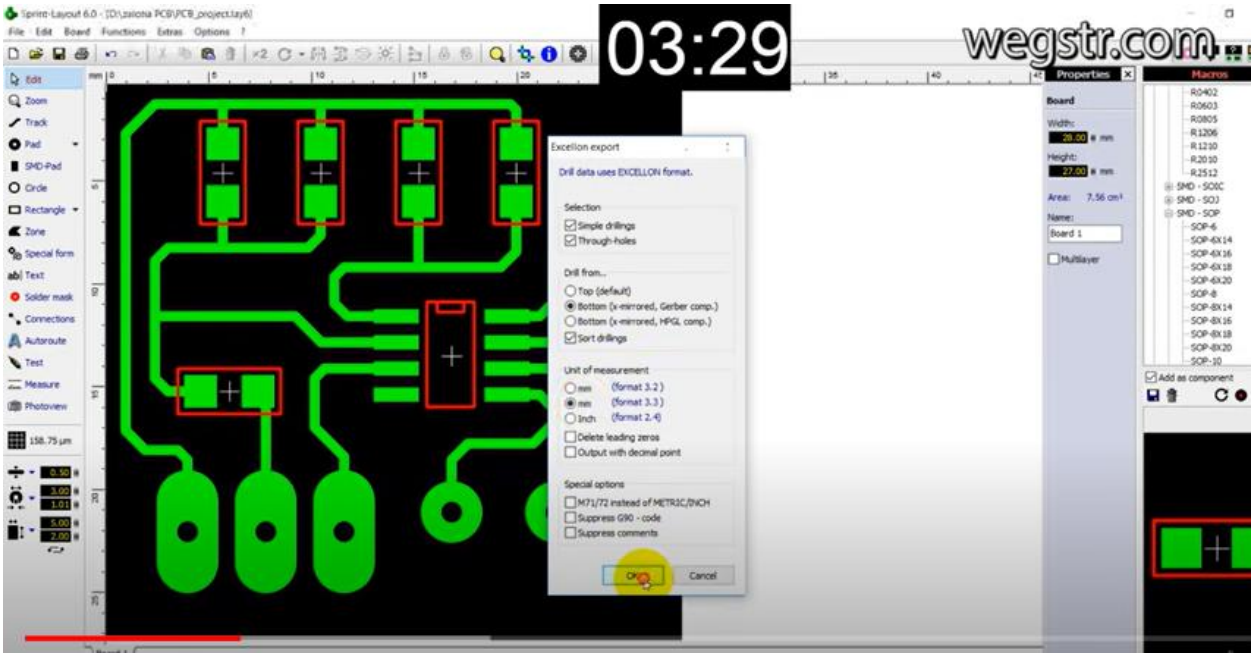
Automated optical inspection (AOI)



PCB making, PCB prototyping quickly and easy - STEP by STEP







How to make a PCB

2. PCB
3. Front/back Print on paper (photo paper), laser printer not inkjet
4. Single side copper
5. Cut print/PCB based on size
6. Cleaning copper side with soap, wash in water
7. Paste print on cu side, ironing 5-10 min
8. Remove paper while plate is hot, do it before plate cold
9. Acid

10. PCB inside
11. Hydrogen peroxide (H_2O_2) soln white
12. 20 – 25 min, move continuously hand with gloves
13. Put more Hydrogen peroxide soln white (applications: ear, nails, makeup brush cleaning, wounds for animals etc,)
14. Water wash, remove black print, use petrol etc scoth brite
15. Copper print visible, pcb ready
16. 1 mm (LED, small transistor, resistor) 1.5 mm (transistor, relay) bit for drill
17. Component placement and soldering

PCB Designing in Proteus ARES

1. Laser printer for dark print
2. Print on **Sticker** paper or 8 gram A4 page (fiber cleaning)
3. Dip in ferric chloride
4. Drilling

Notes:

5. PCB board cleaning with scotch brite green side
6. Golden colur shining
7. No hand touch afterwards

V.imp: Without toner transfer, simple PCB dip in ferric chloride fast dip and out,

8. Wash with tissue or cloth, (microscopic level roughness achieved, good bcz toner ink stick very good, best solution) surface golden to brown
9. Now ironing to transfer toner, (iron thermostat can heat and convert paper yellow not black), no preheat PCB required before printing page
10. Printed page on PCB, put iron on it, only vertically press (otherwise toner spread if movement horizontal) use newspaper first, then direct iron on PCB. Do not press hard

v.imp: do not put PCB directly in cold water, use pan and rubber tube piece and put tube on hot PCB then cold pan/iron. Rubber put uniform pressure. Cold to absorb heat to convert laser ink (plastic powder) molten state to solid state with uniform pressure to stick on PCB

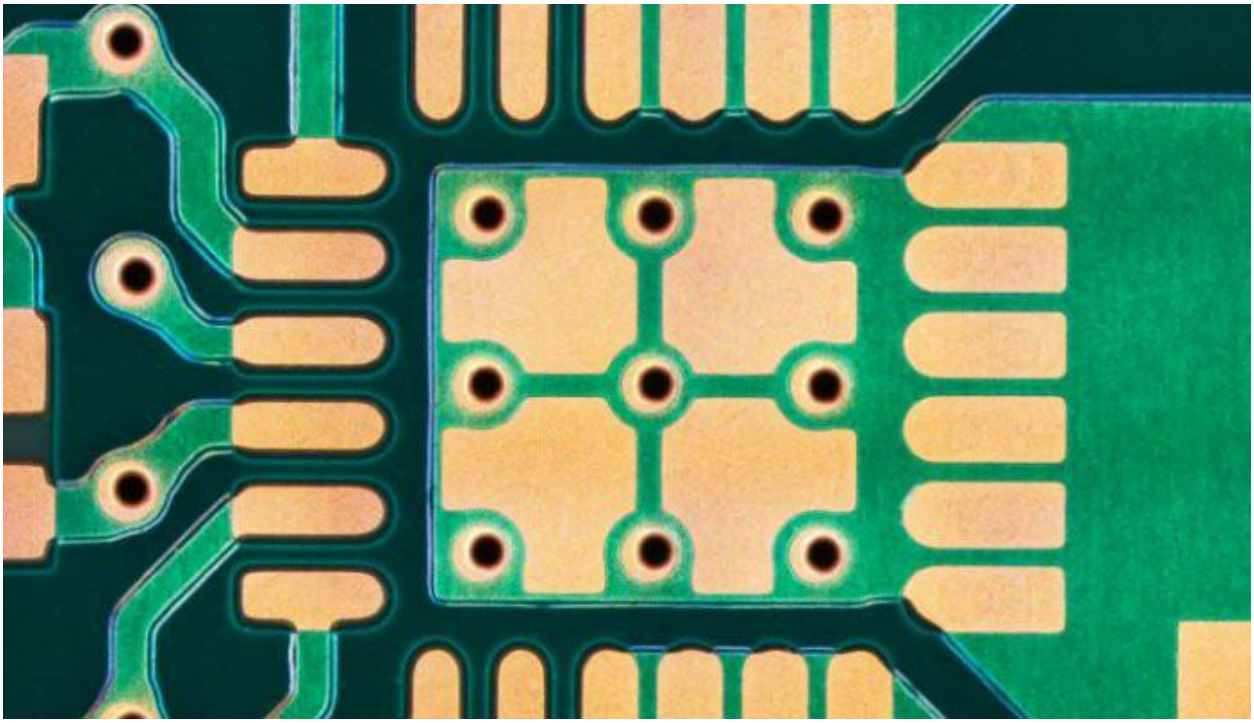
11. put it in water to wet/loose paper
12. if still broken trace then use marker
13. etching in acid
14. drill

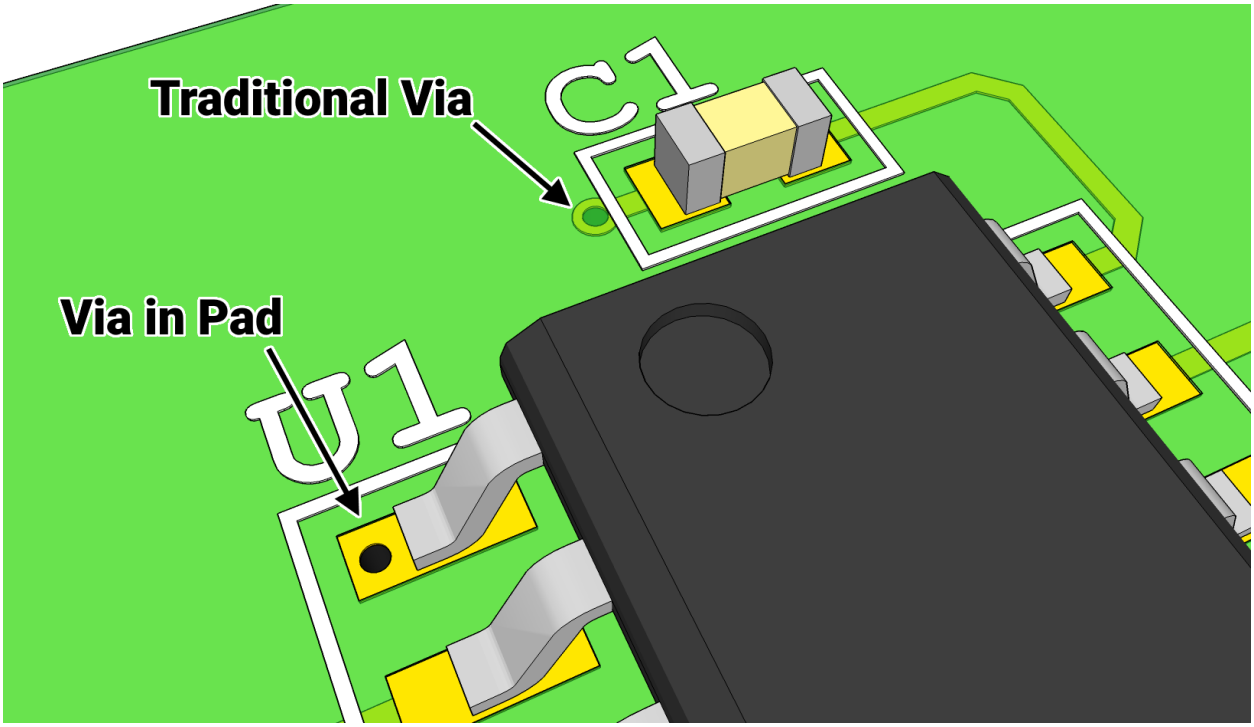
v.imp: trace width **1mm or 0.5 mm** traces usually in proteus, use thick traces if circuit is not complex. **Min 2mm or 3-4mm,** good transfer, good current handling capability, **10mm, 7mm** for **20-25A** current. AREA manually change trace properties. Unless space constraint then max trace width plan.

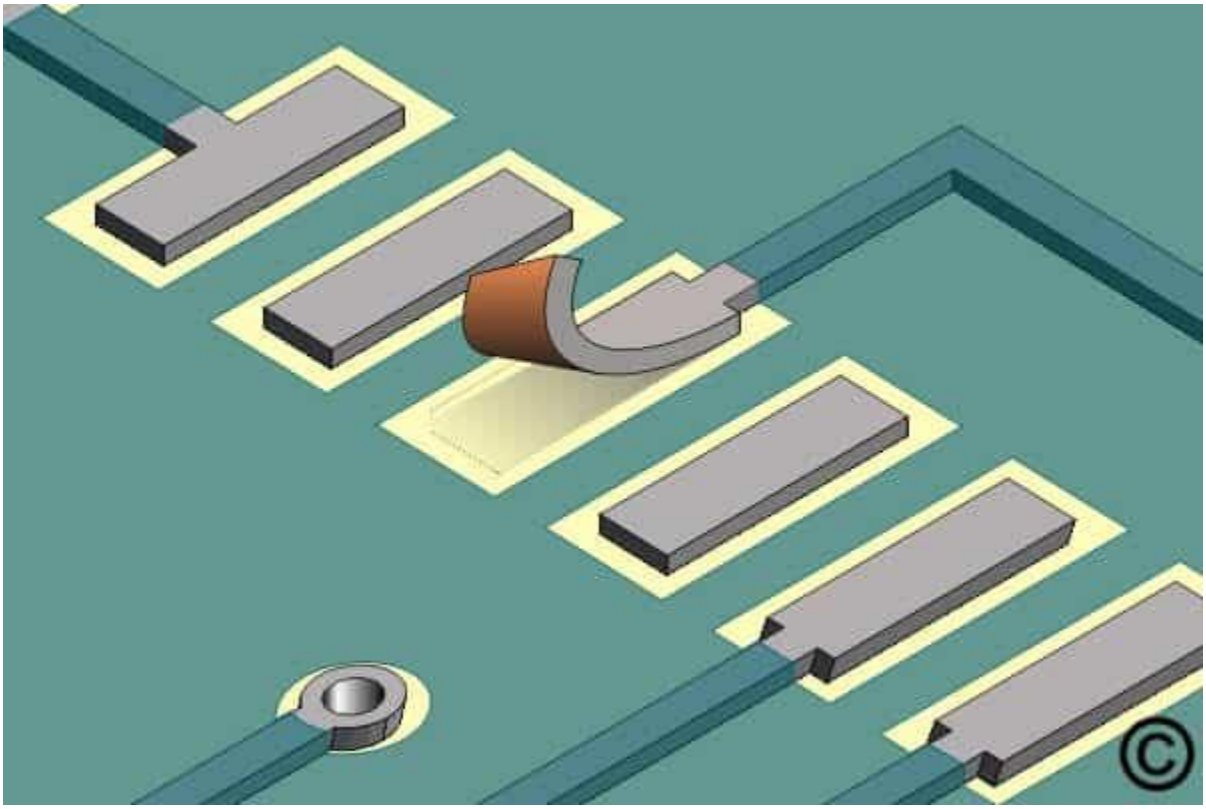
15. PCB pads (rings where ICs mount with center hole), when shift to ares weak pads, cu area thin, PCB pad damages and wires during drilling, rectangular shape pad in horizontal area to avoid damage due to heat accumulation. **Bakellite** Pad cheap (fiber costly) glue not good during drilling, BJT NPN manually legs wider, use bigger model of transistor which has wider gap in pins

1. PCB cleaning scotch brite Acid dip
2. Rubber cool and stick
3. Before PCB making: PCB designing trace width more than 1mm
4. Pads as thick as possible (transistor burn replace new, desolder pads broker ukhar jaty)

PCB Pads




Traditional Via
C1
Via in Pad
U1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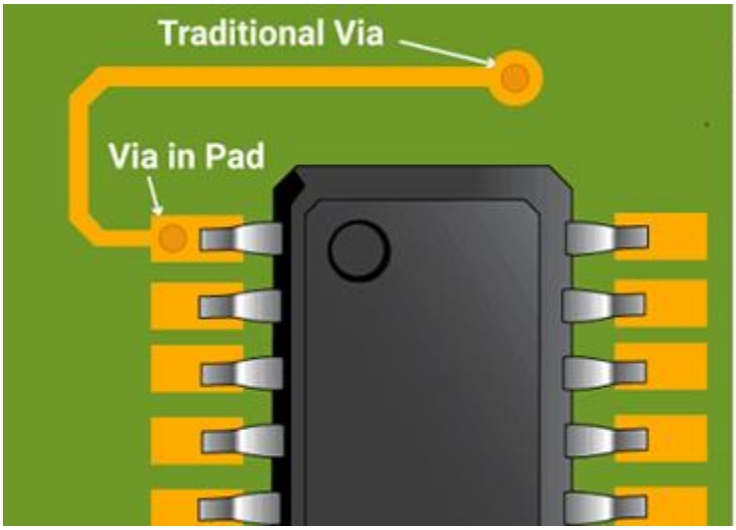
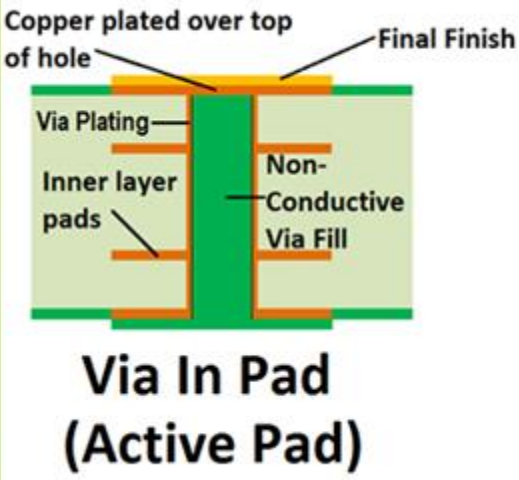
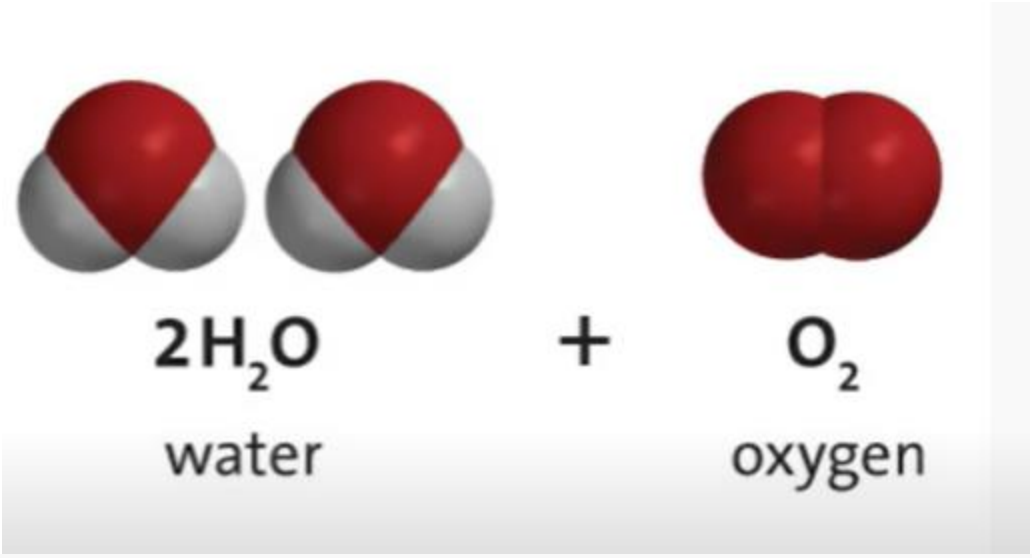




Via In Pad
(Active Pad)

9 UNEXPECTED BENEFITS OF HYDROGEN PEROXIDE

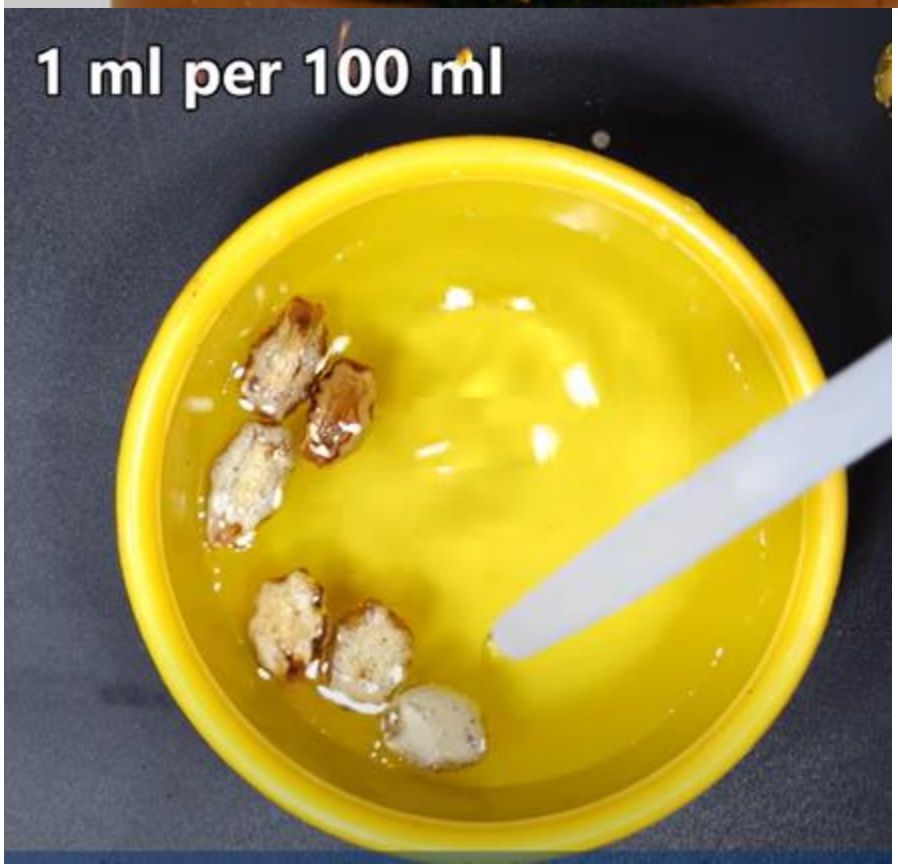
1. HELPS CLEAN YOUR EARS
2. KILLS FUNGUS ON NAILS
3. STOPS ATHLETE'S FOOT
4. HELPS WITH SORE THROATS
5. HELPS STOP ACNE
6. HELPS CLEAN MOLD AND MILDEW
7. REMOVES STAINS
8. KILLS PLANT FUNGUS
9. CLEANS VEGETABLES



HOW TO CORRECTLY USE HYDROGEN PEROXIDE IN YOUR GARDEN?

3% or 6% not 25%
Dry plants cut and put few hours with 3% solution in 1 liter water
Seed 1% per liter
Tree cutting tools cleaning

#9. SEED GERMINATION




#8. DISINFECT TOOLS

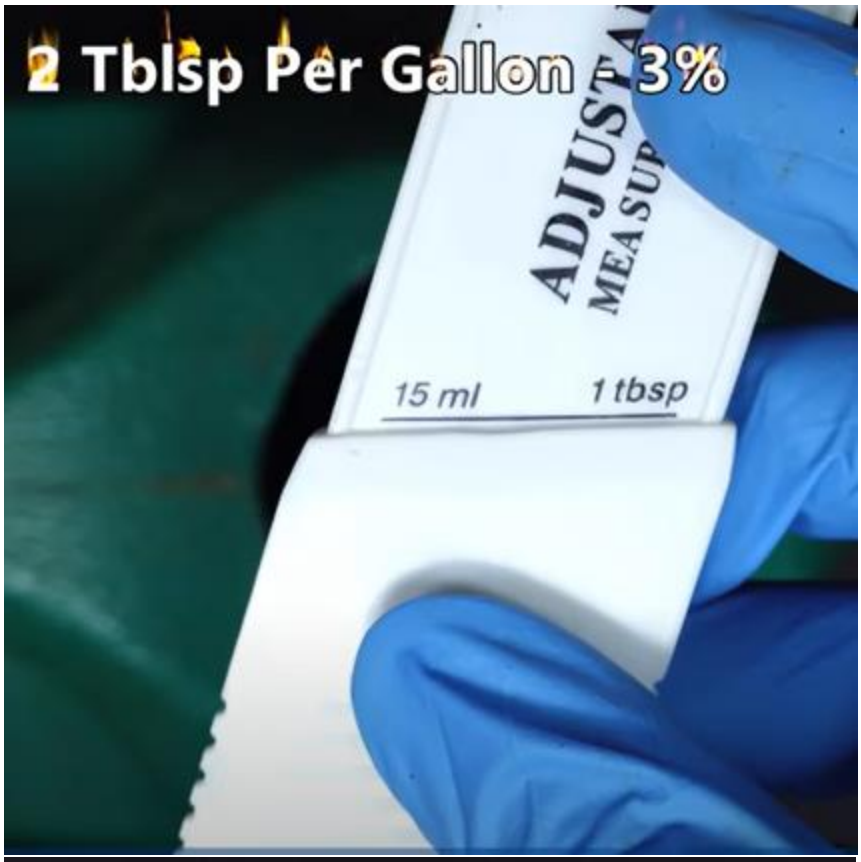

#7. DISINFECT SEED TRAYS


6%
SOLUTION
20 VOL

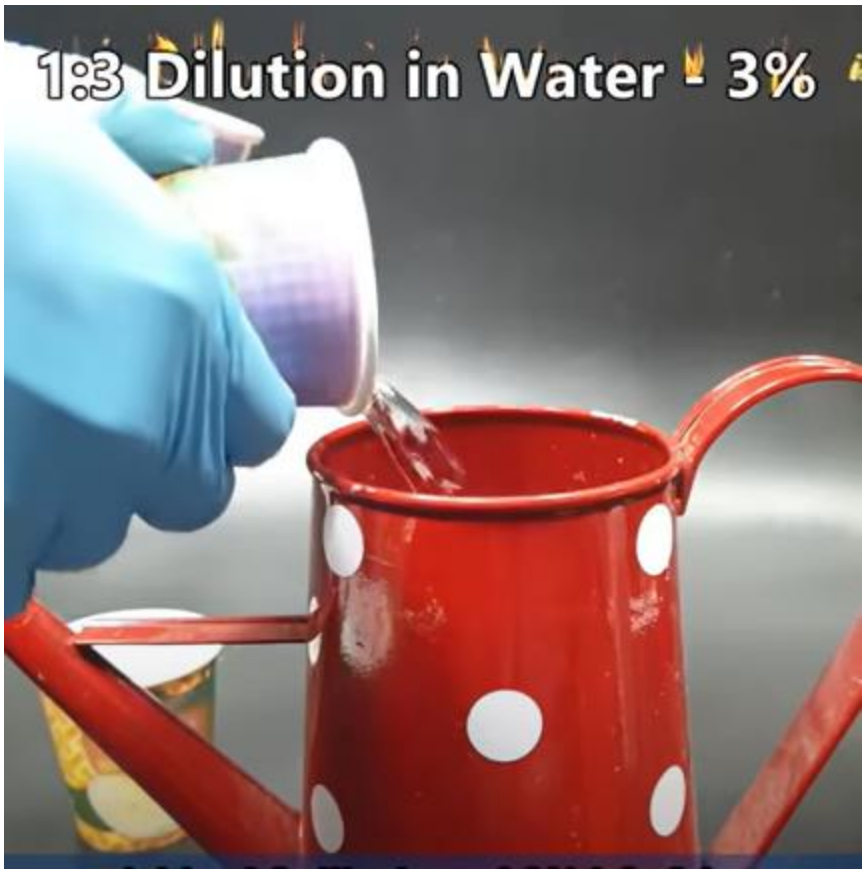

#6. TREAT ROOT ROT


OVER WATERING


2-3 Tsp Per Litre - 3%


2 Tblsp Per Gallon - 3%
15 ml
1 tbsp


#5. SEED STARTING MIX

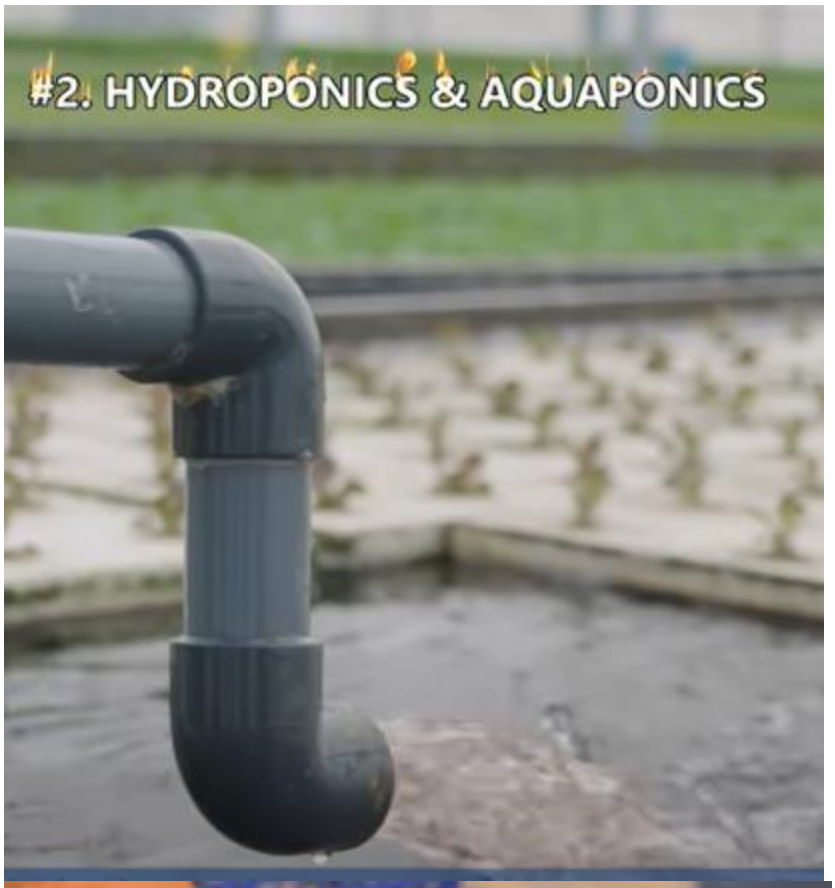

1:3 Dilution in Water - 3%

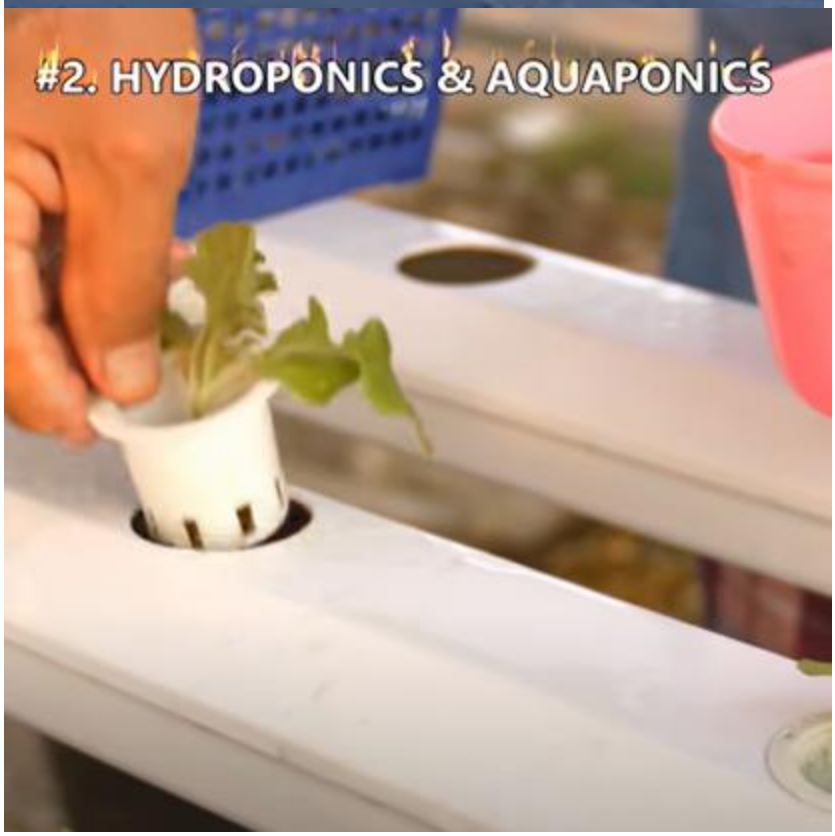

#4. WEED KILLER


#3. FERTILIZER


1 Tsp Per Litre - 3%
3%
Hydrogen


1 Tblsp Per gallon - 3%


#2. HYDROPONICS & AQUAPONICS


#2. HYDROPONICS & AQUAPONICS


#1. PESTICIDE
Antiseptic Mouthwash
Clear Up Acne
Remove Ear Wax
Treat Foot Fungus
Disinfect Childrens Toys
Get Rid of Musty Odors
Whiten Laundry
All-Purpose Cleaner
Clean Fruits & Veggies and Preserve Freshness