



# เอกสารประกอบการบรรยาย

ดาวน์โหลดได้ที่

<https://github.com/lamloei/present2/20180706/>

ติดตามได้ที่

<https://www.facebook.com/lamloeicom>



## PCB Eagle (បរទួលយក)

- 2.30 ខែមិថុនា



# Lamloei ทำเกี่ยวกับอะไร?

PCB/AC Form Factory

เอกสารกำกับโรงงาน PCB PCBA PCBC

- หมวดหมู่ PCB/AC
- สินค้า
  - NodeWIFI
  - Node32s, Node32s Plus
  - Node32Pico
  - FT2PICO



# PCB/AC គីអូអាបៈទេ?

PCB (Printed Circuit Board) - ផែនលាយទងແដែង

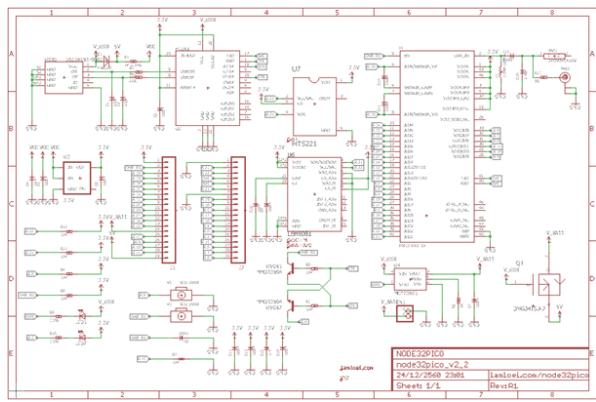
PCBA (Printed Circuit Board Assembly) – ផែនលាយទងແដែងទីប៉ែកវី  
អុបករណីឡៅ

\*PCBC (Printed Circuit Board Casing) – កល់ងីស៊បកូរិត ឧបករណី

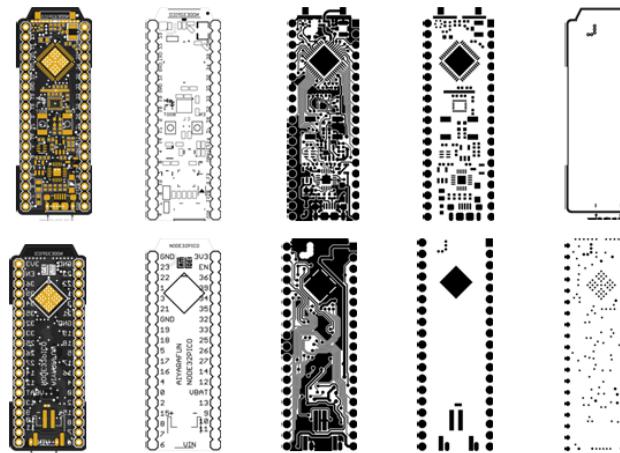


# เอกสารกำกับโรงงาน มีอะไรบ้าง?

## Schematic Gerber BOM XY OTHER



(Schematic)



Gerber

1uf	288	1288	180 C1
100nf	350	1275	180 C2
100nf	400	1275	180 C3
100nf	450	1275	180 C4
100nf	125	1438	180 C5
100nf	175	1438	180 C6
1uf	250	1438	180 C7
100nf	125	1606	0 C8
100nf	550	1638	180 C9
100nf	516	1731	180 C10
100nf	584	1731	180 C11
100nf	125	1800	180 C12
47PF	275	2025	180 C13
47PF	425	2025	180 C14
500mA	588	2125	90 F1
	50	1500	270 J1
	650	1500	270 J2
	350	1000	90 J3
	350	1000	90 J4
B3U-1000P	125	2025	0 K1
B3U-1000P	575	2025	180 K2
	556	1862	270 LED1
12K	175	1275	0 R1
12K	225	1275	0 R2
12K	125	1519	0 R3
12K	500	1525	180 R4

XY

Node32Pico		v2.2	24/12/2017				
Item	Quantity	Reference	Part	Footprint	Mfg	Mfg P/N	Vendor
1	1	ANT1	ANTENNA CHIP UWB 2.3 - 2.7 GHZ		Johanson	2500AT44M0400E	
2	1	ANT2	U.FL				
3	2	C1, C2	CAP CER 47PF 50V COG 2%	0402	Murata	GRM155SC1H470GA01D	
4	9	C3, C5, C6, C7, C8, C9, C11, C12, C16	CAP CER 0.1UF 16V X7R	0402	Murata	GRM155R71C104KA88D	

BOM

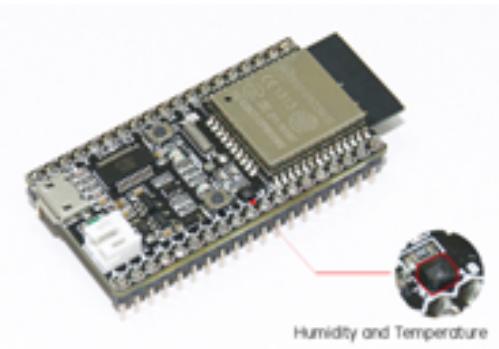
(OTHER)



# ทำเป็นสินค้า



Node32Pico



Node32s Plus



Node32s



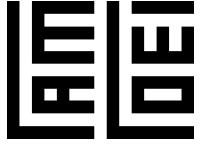
NodeWiFi



# ตามสไตล์ Maker คืออะไร?

ผู้ประดิษฐ์ผลิตภัณฑ์ ตอบโจทย์ตัวเอง

1. SME – ร้านข้าวแกง
2. START UP – อาหารตามสั่ง
3. MAKER – ชื้อของมาทำกินเอง

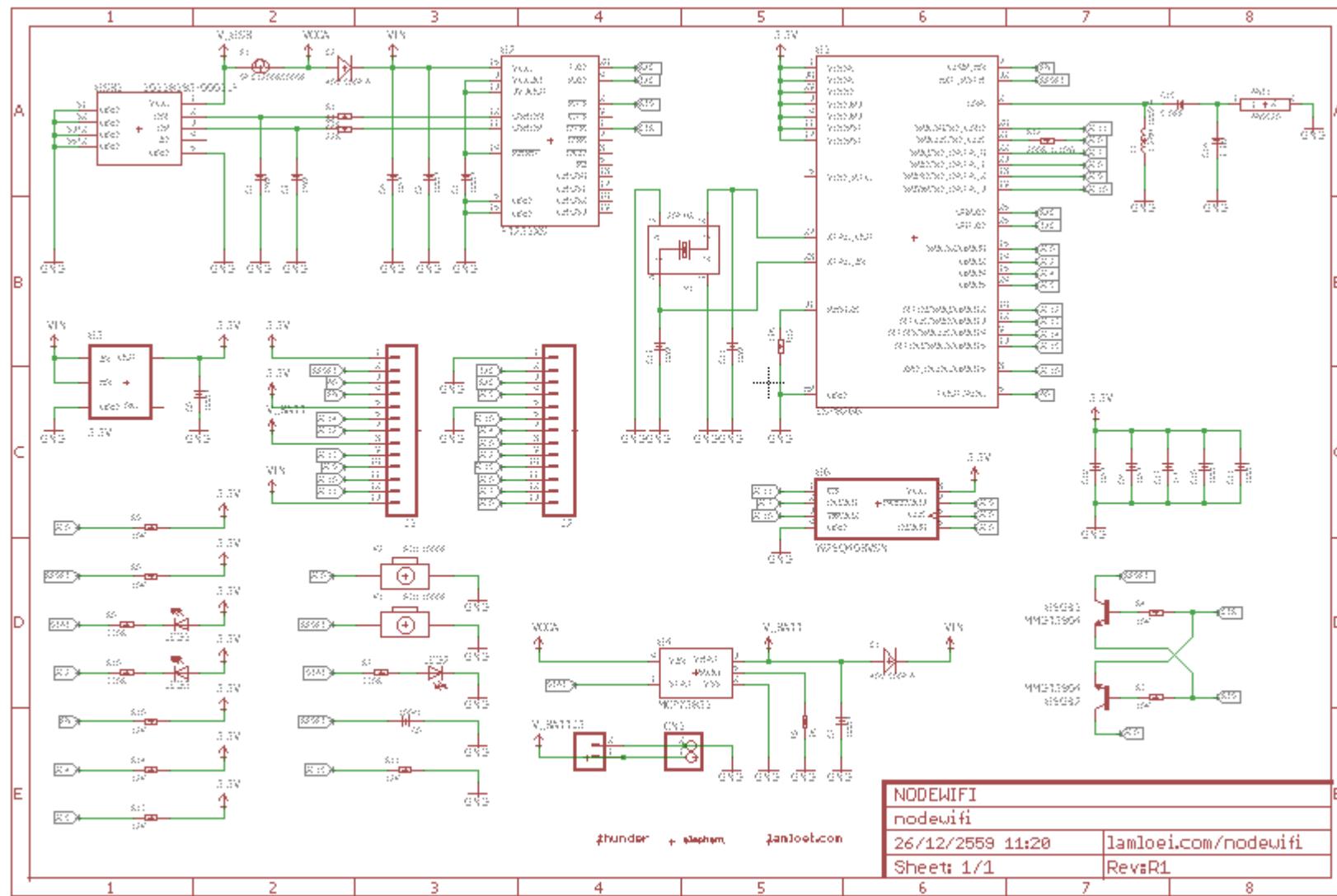


# เอกสารกำกับโรงงาน PCBA ?

เอกสารสั่งโรงงานให้กระทำ หรือไม่กระทำ  
ตามแบบที่คุณกำหนด

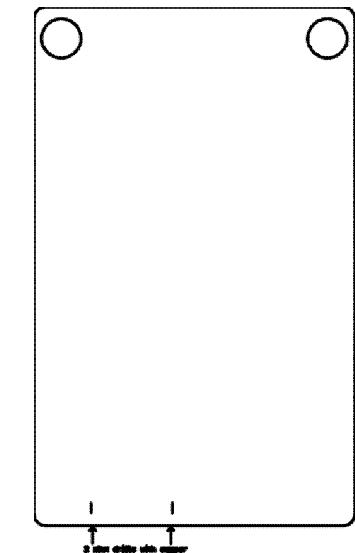
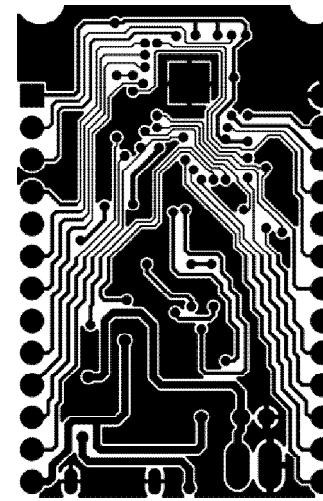
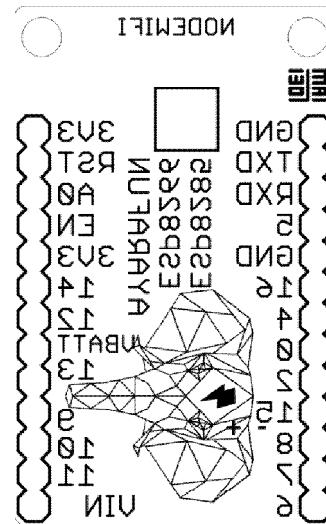
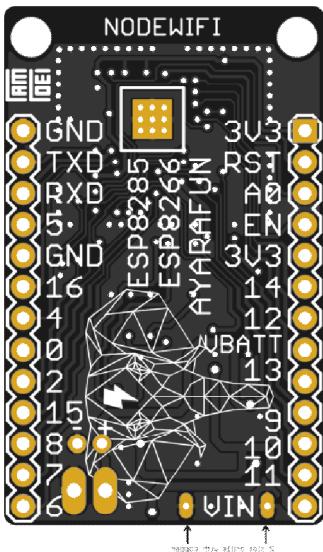
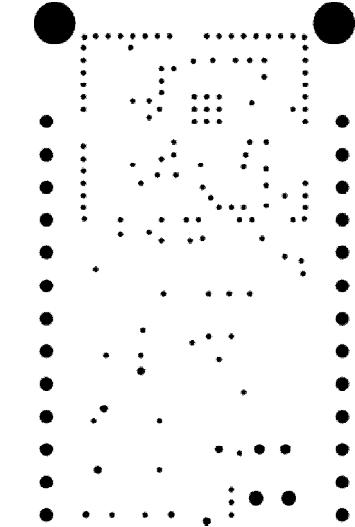
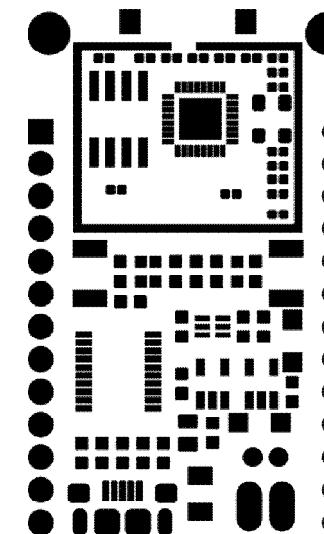
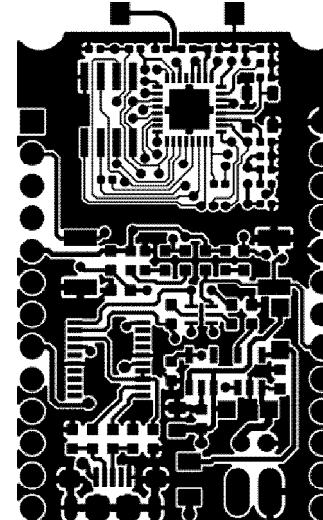
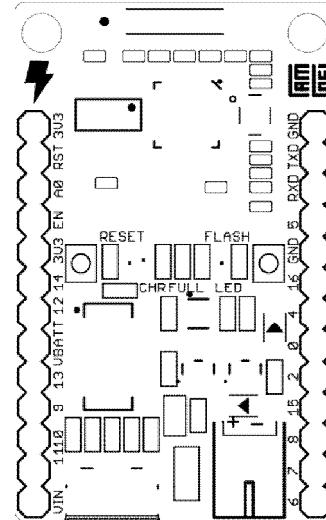
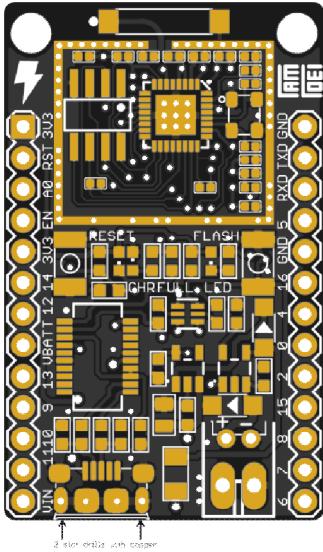


# (NodeWiFi Schematic)

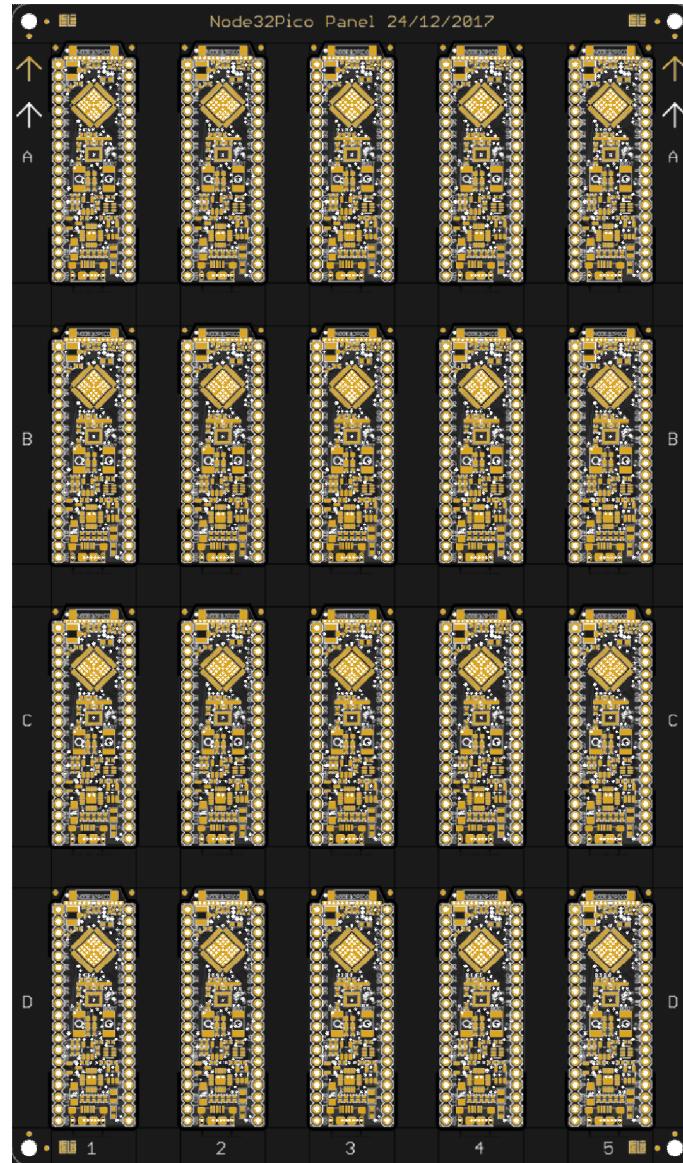




# NodeWiFi Gerber



# Node32Pico Gerber Panel



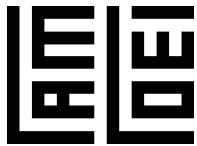
ขนาดประมาณ A4, A3



# Node32Pico Gerber Panel



1. ชีอปอร์ด
2. Fiducial 2 จุด ควรจะไม่สมมาตรกัน
3. ลูกศร
4. ตำแหน่ง



# NodeWiFi BOM

		Node WiFi		v1.0	23/1/2017					
Item	Quantity	Reference	Part	Footprint	Mfg	Mfg P/N	Vendor	Vendor P/N	Gtech P/N	Notes
1	1	ANT1	ANTENNA CHIP UWB 2.3 - 2.7 GHZ		Johanson	2500AT44M0400E	Mouser	609-2500AT44M0400E	PL01	
2	2	C1, C2	CAP CER 47PF 50V NPO 5%	0603	Samsung	CL10C470JB8NNNC	Digikey	1276-1037-1-ND	PT022A	
3	5	C3, C5, C6, C7, C8	CAP CER 0.1UF +/-10% 50V X7R	0603	Samsung	CL10B104KB8NNNC	Digikey	1276-1000-1-ND	C542B	
4	1	C4	CAP CER 10UF 10V X5R	0805	Murata	GRM21BR61A106KE19L	Mouser	81-GRM21BR61A106KE19	ND02	
5	2	C9, C10	CAP CER 10UF 6.3V X6S	0402	Murata	GRM155C80J106ME1D	Mouser	81-GRM155C80J106ME1D		
6	2	C11, C12	CAP CER 9PF 50V NPO	0402	Murata	GRM155C1H9R0DA01D	Mouser	81-GRM1885C1H9R0CA1D	PL05	
7	2	C13, C16	CAP CER 0.1UF 16V X7R	0402	Murata	GRM155R71C104KA88D	Mouser	81-GRM155R71C104KA88	PL04	
8	1	C14	CAP CER 2.4PF 50V NPO	0402	Murata	GRM155C1H2R4BA01D	Mouser	81-GRM155C1H2R4BA1D	PT088	
9	1	C15	CAP CER 6.8PF 50V NPO	0402	Murata	GRM155C1H6R8CA01D	Mouser	81-GRM155C1H6R8CA1D	PT087	
10	1	C17	CAP CER 1UF 25V X5R	0402	Murata	GRM155R61E105KA12D	Mouser	81-GRM155R61E105KA2D	PL03	
11	1	CN1	2mm PTH connector							Not installed
12	2	D1, D2	DIODE SCHOTTKY 40V 500mA	SOD-123	Taiwan Semi	B0540W	Mouser	821-B0540W	ND05	
13	1	F1	PTC RESTTBLLE 0.25A 24V CHIP	1206	Bel Fuse	OZCJ0025AF2E	Mouser	530-0ZCJ0025AF2E	ND06	
14	2	J1, J2	13-PIN Male Header	0.1"						
15	1	J3	JST 2.0mm Battery Connector							
16	2	K1, K2	Switch, Momentary Tact SPST 160gf 3.9x2.9x2.0mm	SMD	ALPS	SKRKAEE010	Mouser	688-SKRKAE	PT012	
17	1	L1	FIXED IND 1.6NH 1A 120 MOHM	0402	TDK	MLG1005S1N6BTD25	Mouser	810-MLG1005S1N6BTD25	PT095	
18	1	LED1	LED RED 2.0V 622nm 110mcd	0603		WB-0603QRC	China		C200A	
19	1	LED2	LED GREEN 2.0V 572nm 40mcd	0603		WB-0603QGC	China		C202C	
20	1	LED3	LED YELLOW 2.0V 589nm 145mcd	0603		WB-0603QYC	China		C201A	
21	2	R1, R2	RES 22 OHM 1% 1/10W	0603	Yageo	AC0603FR-0722RL	Mouser	603-AC0603FR-0722RL	PT020	
22	4	R3, R4, R6, R9	RES 10K OHM 1% 1/10W	0603	Yageo	RC0603FR-0710KL	Mouser	603-RC0603FR-0710KL	PT014	
23	1	R5	RES 3K OHM 1% 1/10W	0603	Yageo	RC0603FR-073KL	Mouser	603-RC0603FR-073KL		
24	3	R7, R8, R10	RES 330 OHM 1% 1/10W	0603	Panasonic	ERJ-3EKF3300V	Mouser	667-ERJ-3EKF3300V	PT015	
25	5	R11, R13, R14, R15, R16	RES 12K OHM 1% 1/16W	0402	Yageo	RC0402FR-0712KL	Mouser	603-RC0402FR-0712KL	PL10	
26	1	R12	RES SMD 0.00OHM JUMPER 1/16W	0402	Yageo	RC0402JR-070RL	Mouser	603-RC0402JR-070RL	PL13	
27	1	U1	ESP8285		Espressif		Espressif			
28	1	U2	IC USB SERIAL FULL UART	20SSOP	FTDI	FT231XS-R	Mouser	895-FT231XS-R	ND08	



# FT2PICO XY

1uf	288	1288	180 C1
100nf	350	1275	180 C2
100nf	400	1275	180 C3
100nf	450	1275	180 C4
100nf	125	1438	180 C5
100nf	175	1438	180 C6
1uf	250	1438	180 C7
100nf	125	1606	0 C8
100nf	550	1638	180 C9
100nf	516	1731	180 C10
100nf	584	1731	180 C11
100nf	125	1800	180 C12
47PF	275	2025	180 C13
47PF	425	2025	180 C14
500mA	588	2125	90 F1
	50	1500	270 J1
	650	1500	270 J2
	350	1000	90 J3
	350	1000	90 J4
B3U-1000P	125	2025	0 K1
B3U-1000P	575	2025	180 K2
	556	1862	270 LED1
12K	175	1275	0 R1
12K	225	1275	0 R2



# Other .HEX Testrun

The screenshot shows a terminal window titled "COM29". The window displays the output of a microcontroller's sensor test program. The text output is as follows:

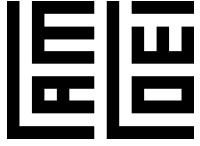
```
|  
11: iuvirncl (-72)*  
12: NSTDA-WIFI (-72)  
13: eduroam (-73)*  
14: NSTDA-GUEST (-74)  
15: NSTDA-WIFI (-88)  
  
***CHIP ID***  
ESP32 Chip ID = 940E001DA0D8  
Chip Revision (official version): 0  
  
***I2C SCANNING***  
I2C device found at address 0x1C !  
I2C device found at address 0x5F !  
I2C device found at address 0x6A !  
done  
  
***HALL SENSOR***  
sensor = 9  
  
***TIME TEMPERATURE SENSOR***  
scan start 00:00:00 Temp onBoard 167°F 75.00°C  
  
***HTS221 SENSOR***  
Humidity : 20.00 %  
Temperature: 38.60 celsius  
  
***LSM9DS1 SENSOR***  
G: -0.10, -2.93, -0.39 deg/s  
A: -0.03, 0.03, 0.98 g  
M: 0.61, -0.74, -0.82 gauss  
Pitch, Roll: 1.54, 1.55  
Heading: 137.85  
  
***WIFI SCAN***  
scan done
```

At the bottom of the window, there are three buttons: "Autoscroll" (unchecked), "No line ending" (dropdown menu), "115200 baud" (dropdown menu), and "Clear output".



# ค่าใช้จ่าย? โดยประมาณ

1. PCB
2. BOM
3. Assembly
4. Stencil
5. Setup
6. Other



# ค่าใช้จ่าย? โดยประมาณ

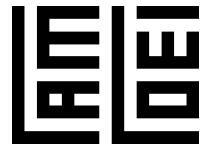
1. PCB - A \* จำนวน panel (สมมุติ 5\*20=100)
2. BOM - B \* จำนวนบอร์ด (100)
3. Assembly - ~50 \* จำนวนบอร์ด
4. Stencil(Frame) - C ครั้งแรก 4500 ครั้งต่อไป 0
5. Setup - ครั้งแรก 4000 ครั้งต่อไป 2000
6. Other - ครั้งแรก 15-30 วัน ครั้งต่อไป 1 วัน  
@3000 บอร์ดต่อวัน (ของ คิวงาน ซับซ้อน)

# สามารถนำอุปกรณ์มาเองได้

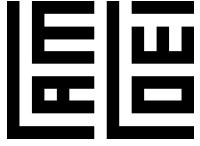
- สามารถซื้อเอง หรือทางโรงงานซื้อ ผสานกันได้
- เพิ่ม 10%
- ของความพร้อมกัน
- ความมีต้นแบบที่ทำงานได้ 1 ชิ้นงาน



Break; 10 นาที

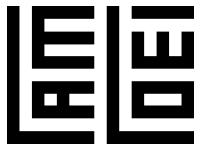


เราจะเขียนเอกสารกำกับน้ำอย่างไร?



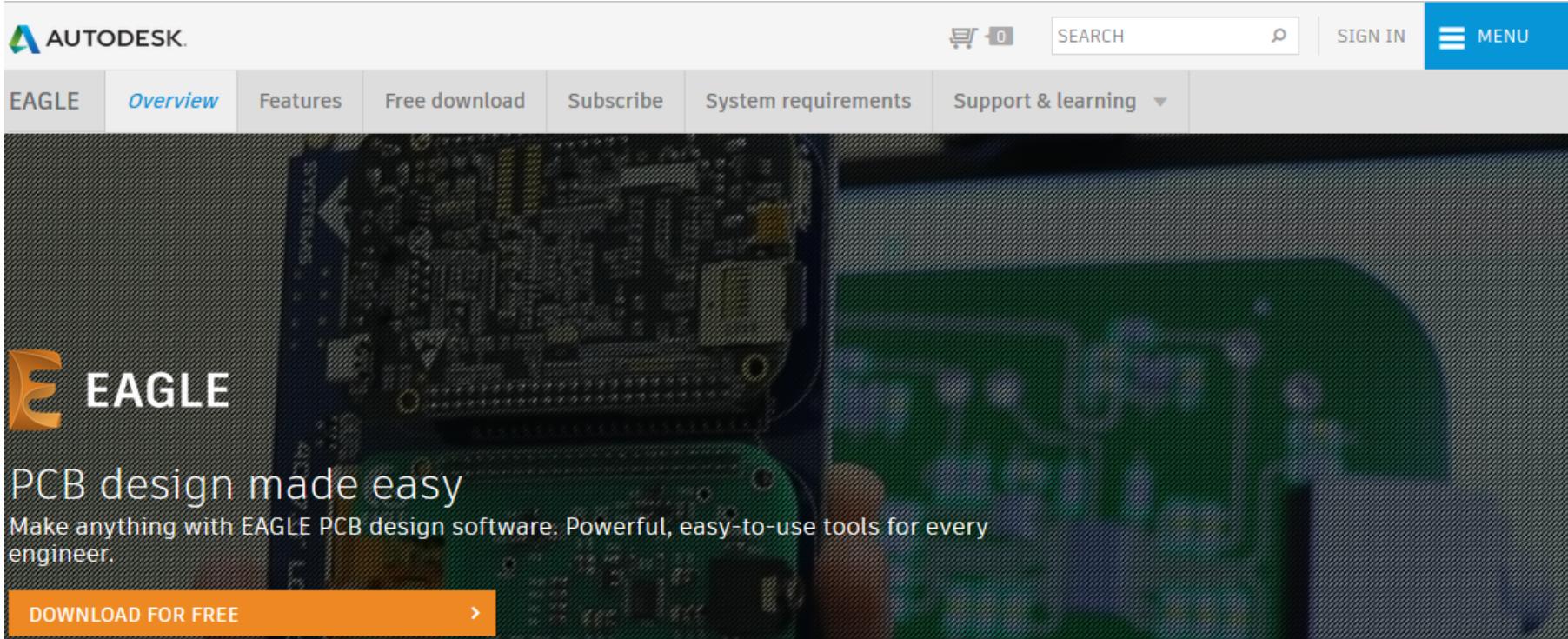
## คอร์สเรียน PCB Eagle (Hand on)

- 1 วัน
- ลงมือทำ
- ลงรายละเอียดมากกว่า
- ราคา 3,800 บาท
- สอบตามเพิ่มเติมภายหลังได้
- ทrick การทำเอกสารกำกับโรงงาน

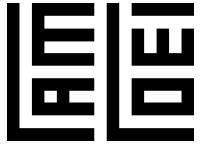


<https://www.autodesk.com/products/eagle/>

## overview



The screenshot shows the Autodesk EAGLE product page. At the top, there's a navigation bar with the Autodesk logo, a shopping cart icon (0 items), a search bar, a 'SIGN IN' button, and a 'MENU' button. Below the navigation bar, there's a horizontal menu with tabs: 'EAGLE' (selected), 'Overview' (highlighted in blue), 'Features', 'Free download', 'Subscribe', 'System requirements', and 'Support & learning'. The main content area features a large image of a printed circuit board (PCB) with various electronic components. On the left side of this image, the word 'EAGLE' is written in white, with a stylized orange 'E' icon to its left. Below the image, the text 'PCB design made easy' is displayed in white, followed by the subtext 'Make anything with EAGLE PCB design software. Powerful, easy-to-use tools for every engineer.' At the bottom left, there's a prominent orange button with the text 'DOWNLOAD FOR FREE' in white, accompanied by a right-pointing arrow.



# Download

## Present Eagle

- <https://github.com/lamloei/present2>

## Gerber bv

- <https://sourceforge.net/projects/gerbv/files/>

## Eagle 7

- <ftp://ftp.cadsoft.de/eagle/program/7.7/>

## หรือ Eagle 9

<https://www.autodesk.com/products/eagle/free-download>



## ໄດອະແກຣມ

sch



bom

brd



gerber

XY



# ทำไมถึงเลือกใช้ Eagle?

1. คนใช้เยอะ
2. บอร์ดตัวอย่าง Arduino, Adafruit, Sparkfun
3. Library เยอะ
4. Sch Brd เป็น XML text เข้าไปแก้ได้



## PCB FAB

<https://oshpark.com/>

<https://pcbs.io/>

[https://www.seeedstudio.com/fusion\\_pcb.html](https://www.seeedstudio.com/fusion_pcb.html)

<https://www.elecrow.com/pcb-prototyping.html>

<https://www.pcbway.com/>

<http://www.seagate15.com>

<https://www.facebook.com/LayerCircuit>

[http://www.allpcb.com/setinvite.aspx?inviteid=27397&url=https://www.allpcb.com/online\\_quote.html](http://www.allpcb.com/setinvite.aspx?inviteid=27397&url=https://www.allpcb.com/online_quote.html)



## PCB Software

<https://www.autodesk.com/products/eagle>

<http://www.altium.com/>

<http://kicad-pcb.org/>

<https://circuits.io/pcb>

<https://easyeda.com/>

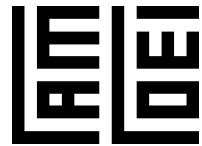
<https://www.rs-online.com/designspark/pcb-software>

และโปรแกรมอื่นๆ

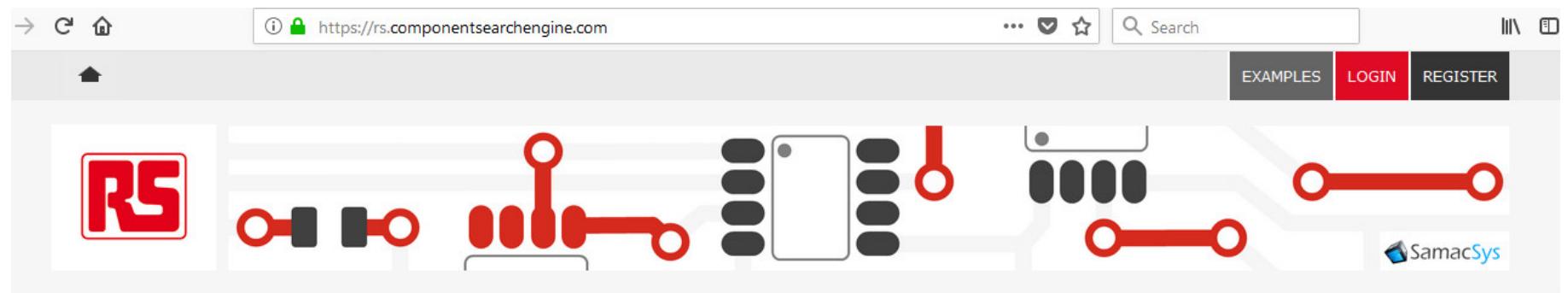


# Vendor BOM แหล่งซื้ออุปกรณ์

- Mouser
- Digikey
- RS
- ES



<https://rs.componentsearchengine.com/>

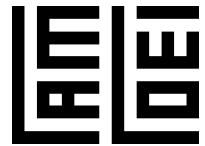


## Electronic Component SEARCH ENGINE

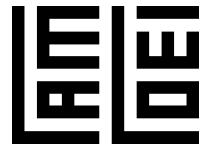
United Kingdom ▾

English ▾



<https://www.snapeda.com/>

The screenshot shows the homepage of SnapEDA. At the top, there is a navigation bar with icons for back, forward, refresh, and home, followed by a URL bar showing <https://www.snapeda.com>. To the right of the URL bar are search and filter icons. Below the navigation bar is a header with the SnapEDA logo, a search bar labeled "Search Parts", and buttons for "Search", "Build Parts", "Request Parts", "About", "Sign Up", and "Log In". The main background features a repeating pattern of electronic component symbols (like resistors, capacitors, and transistors) in white on an orange background. Centered on this background is the text "Build circuit boards faster with instant parts", "Download free symbols & footprints for millions of electronic components.", and "The largest source of verified parts.". Below this is a blue button labeled "Explore Now". On the right side of the orange section, there are two blue buttons: "Sign In With LinkedIn" and "Join By Email". At the bottom of the page is a dark blue footer bar containing a search input field with placeholder text "Search by Part Number or Keywords" and a magnifying glass icon, along with a link "Or see examples: [USB Type A](#), [SMA Connector](#)".



<https://th.rs-online.com/web/>

RS Components Ltd (GB) | https://th.rs-online.com/web/

TechZor

Home

Search by keyword or part No.

Search

เข้าสู่ระบบ / Log In ▶  
Welcome NARONG  
ໃຊ້ຄູນເກີດໄວ່ ▶

2

All Products ▾ Our Brands ▾ Newest Products My Account ▾ Services

ขั้นต่อไปของระบบอัตโนมัติ

ເລືອມຕ່ອງຄຸນເຂົາກັບໂທລູ້ຂໍ້ມູນຮະບນອຸດສານກຽມອັຈລຽບ  
ສ້າງຮັນປ່າຈຸນ້າ ອານາຄາຕ ແລະຍິ່ງກວ່ານ້ຳ  
ເຮົາໄດ້ສັດຍອືນສິນຄ້າຍອດນີ້ຍືນໄວ້ສ້າງຮັນຄຸນ

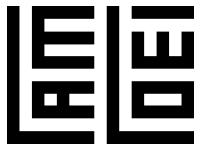
ເລີ່ມຕົ້ນໄດ້





## โปรแกรมที่ต้องใช้

1. Eagle
2. Gerbv
3. Notepad
4. Excel



# Subscribe

## Subscribe

### EAGLE Standard

### EAGLE Premium

#### EAGLE Standard

Includes 99 schematic sheets, 4 signal layers, and 160 cm<sup>2</sup> board area.

- Access to the latest software releases
- Get 1-on-1 online support ([see all subscriber benefits](#))
- Available for Windows, Mac, and Linux ([see system requirements](#))

[SEE SUBSCRIBER BENEFITS](#)

<input checked="" type="radio"/>	Monthly	\$15
----------------------------------	---------	------

<input type="radio"/>	1 year	\$100
-----------------------	--------	-------

<input type="radio"/>	2 year	\$200
-----------------------	--------	-------

<input type="radio"/>	3 year	\$300
-----------------------	--------	-------

## Subscribe

### EAGLE Standard

### EAGLE Premium

#### EAGLE Premium

Includes 999 schematic sheets, 16 signal layers, and unlimited board areas.

- Access to the latest software releases
- Get 1-on-1 online support ([see all subscriber benefits](#))
- Available for Windows, Mac, and Linux ([see system requirements](#))

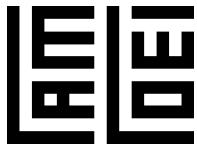
[SEE SUBSCRIBER BENEFITS](#)

<input checked="" type="radio"/>	Monthly	\$65
----------------------------------	---------	------

<input type="radio"/>	1 year	\$500
-----------------------	--------	-------

<input type="radio"/>	2 year	\$1,000
-----------------------	--------	---------

<input type="radio"/>	3 year	\$1,500
-----------------------	--------	---------



ftp://ftp.cadsoft.de/eagle/program/7.7/

Index of ftp://ftp.cadsoft.de/eagle/program/7.7/

[Up to higher level directory](#)

<u>Name</u>	<u>Size</u>	<u>Last Modified</u>
<a href="#">eagle-lin32-7.7.0.run</a>	50282 KB	10/4/16 12:00:00 AM
<a href="#">eagle-lin32-7.7.0.run.INF</a>	1 KB	10/4/16 12:00:00 AM
<a href="#">eagle-lin32.run</a>		10/5/16 12:00:00 AM
<a href="#">eagle-lin64-7.7.0.run</a>	49911 KB	10/4/16 12:00:00 AM
<a href="#">eagle-lin64-7.7.0.run.INF</a>	1 KB	10/4/16 12:00:00 AM
<a href="#">eagle-lin64.run</a>		10/5/16 12:00:00 AM
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<a href="#">eagle-win64.exe</a>		10/5/16 12:00:00 AM
<a href="#">elektro-tutorial.pdf</a>	4817 KB	5/8/09 12:00:00 AM



# Eagle Document

The screenshot shows the EAGLE 7.7.0 Setup window with a blue header bar containing the title "EAGLE 7.7.0 Setup". Below the header, there is a section titled "EAGLE License" with the following text:

If you have received a license file, please select "Use license file" below.  
Otherwise you can select "EAGLE Express" to run EAGLE as a free version.

To do the licensing when you start EAGLE for the first time, select "Don't license now".

Three radio buttons are available for selection:

- Use license file
- EAGLE Express
- Don't license now

A "Next" button is located at the bottom right of the main window. To the right of the main window, a smaller "Warning" dialog box is displayed, also with a blue header bar and a red close button. The dialog contains the following text:

The directory  
C:\Users\admin\Documents\eagle  
doesn't exist!

EAGLE needs this directory to store your projects. If you don't want to create this directory now, or if you want to use a different directory, you can answer "No" here and make the proper adjustments later in the Control Panel under "Options/Directories".

Create it?

At the bottom right of the warning dialog, there are two buttons: "Yes" and "No".

# <https://sourceforge.net/projects/gerbv/files/>

[Home](#) / [Browse](#) / [Science & Engineering](#) / [Electronic Design Automation \(EDA\)](#) / [gerbv — a Gerber \(RS-274X\) viewer](#) / [Files](#)

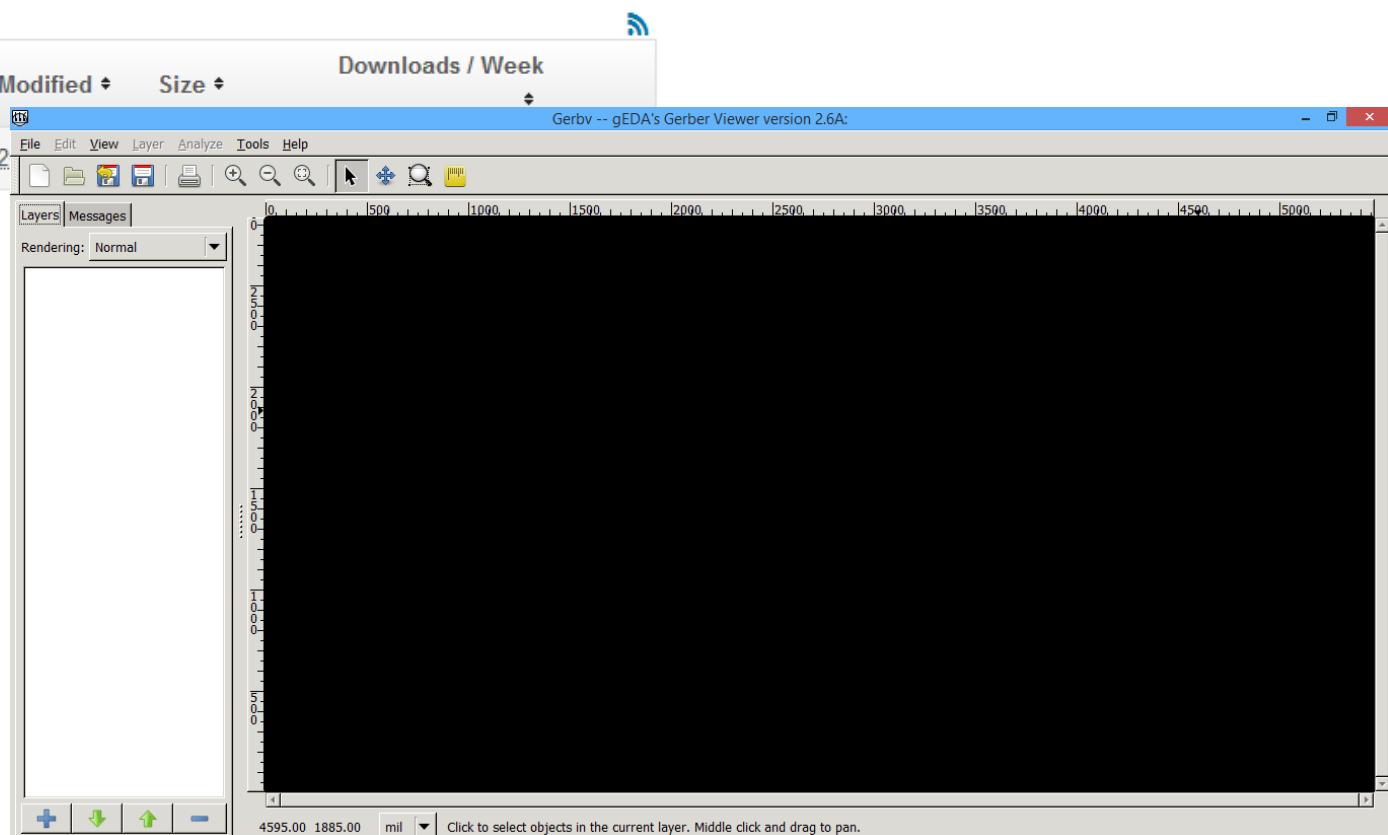
## **gerbv — a Gerber (RS-274X) viewer**

Brought to you by: [ahvezda](#), [asvl](#), [danmc](#), [spetm](#), [thepurlieu](#)

[Summary](#) | **Files** | [Reviews](#) | [Support](#) | [Wiki](#) | [Mailing Lists](#) | [Tickets](#) | [News](#) | [Git](#)

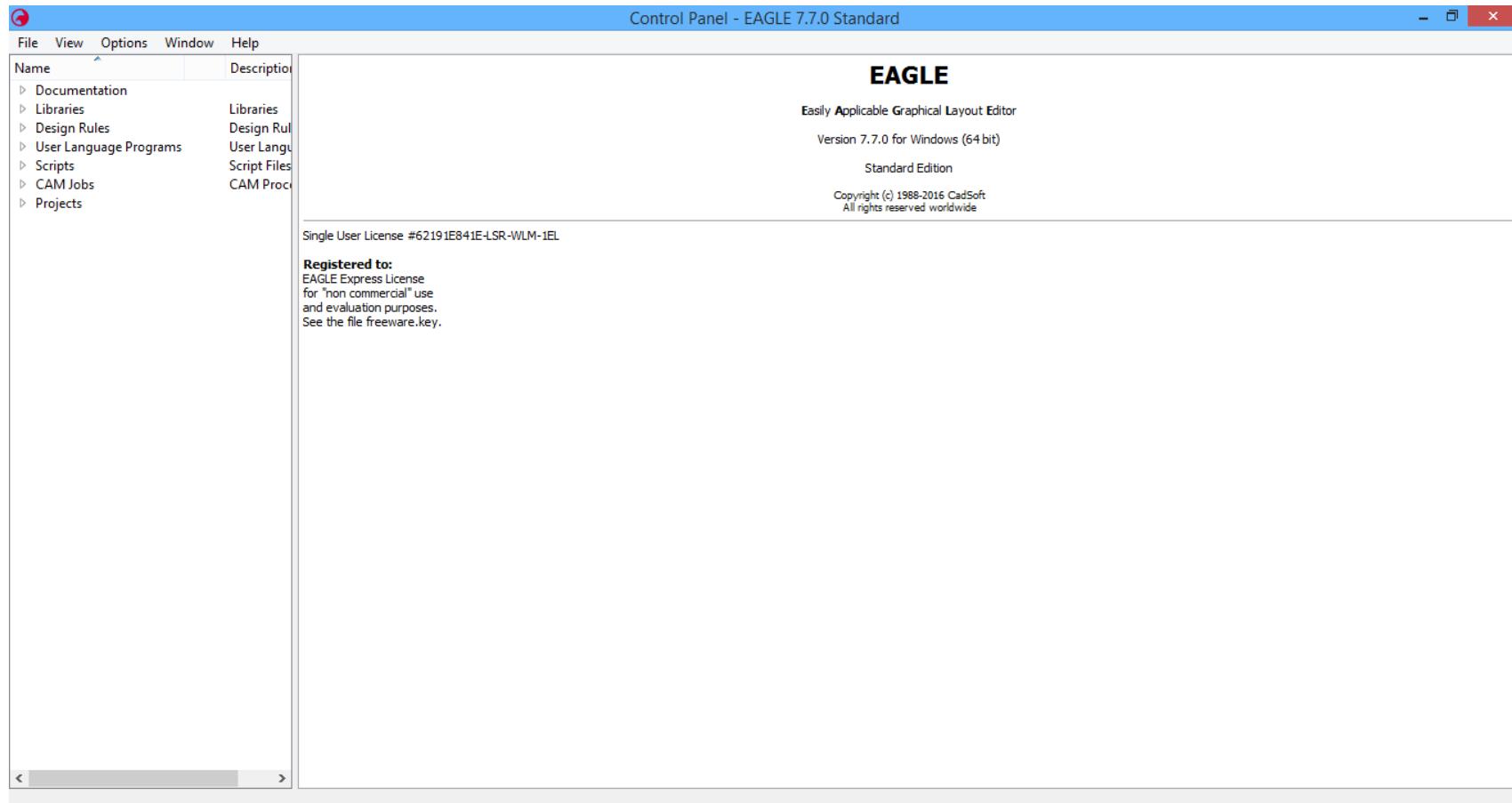
Looking for the latest version? [Download gerbv-win-static\\_20160713.zip \(4.8 MB\)](#)

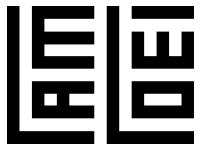
Home  
Name  
gerbv  
Modified  
Size  
Downloads / Week  
Totals: 1 Item





# Eagle Control Panel

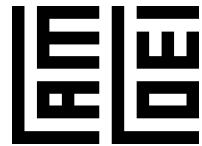




# Control Panel Menu

The screenshot shows the EAGLE software interface with the Control Panel menu open. The menu bar includes File, View, Options, Window, Help, and a blue-highlighted View option. The View menu contains Extended mode (checked), Refresh (F5), Search in tree (Ctrl+F), and Sort. The Options menu includes Directories..., Backup / Locking..., User interface..., and Window positions... The Help menu includes Control Panel (Alt+0), General, Context (F1), Control Panel, EAGLE License..., Check for Update..., and About EAGLE. Below the menu bar is a tree view of project files under the eagle folder, with examples selected. The examples folder contains arduino, elektro, hexapod, ltspice, seeed, singlesided, ti-launchpad, and tutorial subfolders, each with their respective descriptions.

Name	Description
Documentation	
Libraries	Libraries
Design Rules	Design Rules
User Language Programs	User Language Programs
Scripts	Script Files
CAM Jobs	CAM Processor Jobs
Projects	
eagle	
examples	Examples Folder
arduino	Arduino Mega 2560 Reference Board
elektro	Examples Folder for Electrical Schematics
hexapod	Hexapod Example Project
ltspice	Examples of imported schematics from LTspice.
seeed	Various projects from Seeed
singlesided	Example Project for Singlesided Autorouting
ti-launchpad	MSP430F5529 LaunchPad Development Kit
tutorial	Example Files for the Tutorial Projects



# Eagle Folder

A screenshot of a Windows File Explorer window. The address bar shows the path: This PC > Local Disk (C:) > EAGLE-7.7.0. The main area displays a list of nine subfolders under the heading "EAGLE-7.7.0".

Name	Date modified	Type
bin	29/6/2560 10:06	File folder
cam	29/6/2560 10:05	File folder
doc	29/6/2560 10:05	File folder
dru	29/6/2560 10:05	File folder
lbr	29/6/2560 10:05	File folder
misc	29/6/2560 10:05	File folder
projects	29/6/2560 10:05	File folder
scr	29/6/2560 10:05	File folder
ulp	29/6/2560 10:05	File folder

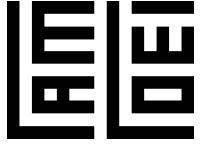
C:\EAGLE-7.7.0

C:\Users\admin\Documents\eagle



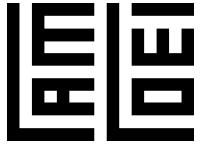
## คำศัพท์

- Folder โฟลเดอร์ ซึ่งอนกันได้
- Project โฟลเดอร์สุดท้าย ที่ใช้เก็บ sch, brd
- sch - Schematic ผังวงจรรวม แสดงการต่อขาอุปกรณ์
- brd - Board แผ่นวงจรรวม
- bom – Bill of material รายการอุปกรณ์
- gerber – แบบพิมพ์เขียว pcb สำหรับส่งโรงงานผลิต
- XY - แบบบอกตำแหน่งอุปกรณ์
- dru – กฎโรงงานผลิต
- cam – แปลง brd เป็น gerber
- Via – (layer 44) รูเจาะที่มีขอบ มีทางเดงเชื่อมระหว่างลายด้านบนกับด้านล่าง
- Tent Via – (layer 44 กำหนดด้วย dru) รูเจาะที่ไม่มีขอบ มีทางเดงเชื่อมระหว่างลายด้านบน กับด้านล่าง

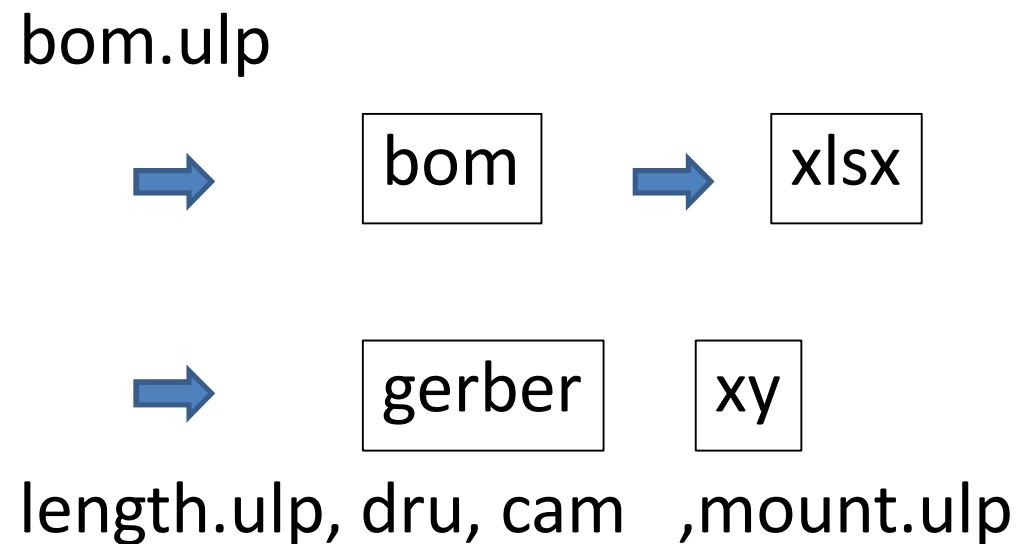
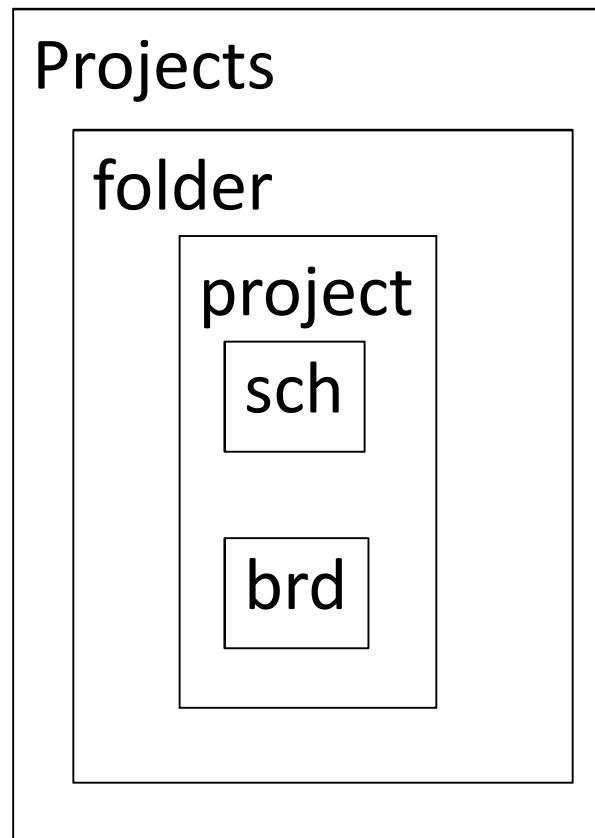


## คำศัพท์

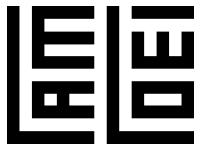
- Pad - (layer 44) ชุดเจาะที่มีขอบ มีทางเดงเชื่อมระหว่างลายด้านบนกับด้านล่าง ที่มีขาอุปกรณ์ (หรือ via ที่มีขาอุปกรณ์)
- Hole - (layer 45) ชุดเจาะที่ไม่มีขอบ ไม่มีทางเดงเชื่อมบนล่าง
- Not Installed – มีรายการอุปกรณ์ แต่ไม่ต้องใส่
- inch - นิ้ว
- mil – 1/1000 นิ้ว
- mm – มิลลิเมตร
- mic – 1/1000 มิลลิเมตร
- จุดไข่ปลา – 1 จุด = 2.54mm = 0.1 นิ้ว



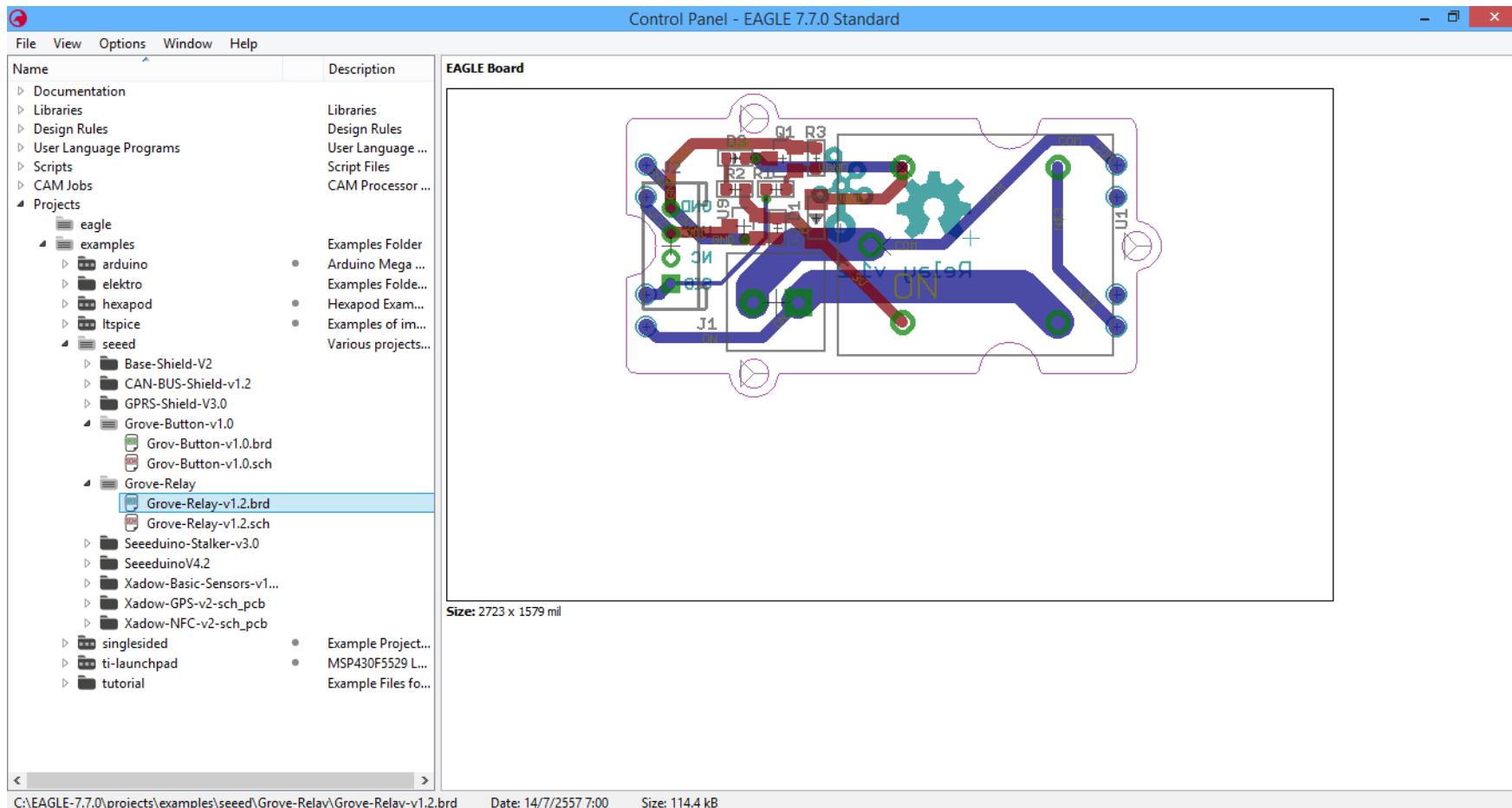
# Projects



ชื่อไฟล์ **sch** กับชื่อไฟล์ **brd** ต้องเป็นชื่อเดียวกัน



# Examples



# Home > Get Started Now > Select a file on your computer



Iamloei

Home Shared Projects Pricing and Design Rules Support Blog Projects Order History Profile Cart Log out

## OSH Park

### Upload your design



You can upload your design as

- an Eagle **.brd** board file
- a KiCAD **.kicad\_pcb** board file
- a **.zip** file containing Gerber CAM files



We support the default CAM filenames for most CAD packages. See our [design submission guidelines](#) or [design tool help](#) for more information.

**Select a file on your computer**

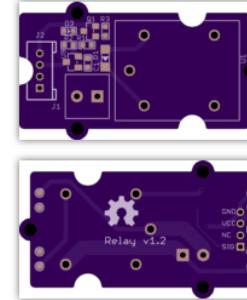
Designed and developed by [Rabid](#).

**Detected 2 layer board of 1.65x0.94 inches (41.94x23.88mm). \$7.75 for three.**

Your upload has finished processing. Enter the project details below and we'll move on to checking all the individual layers to make sure that they're correct.

**Design notes:**

- Processing Grove-Relay-v1.2.brd as Eagle CAM job.
- Detected 2 layer stackup: (1\*16)
- 2 layer board of 1.65x0.94 inches.



Name

Description

Start Over

Continue

**OSH Park**  
Verify your design

**Board Top**  
This shows the final manufactured board as if you have it in your hand. You can see the raw gold copper, solder mask white, via holes, and the board outline. Internal cutouts are indicated by black outlines but if the image here is entirely white, you'll want to make sure there are no gaps in the board outline. Please make no dimension or measurement cuts.

**Board Bottom**  
This shows the final manufactured board as if you have it in your hand. You can see the raw gold copper, solder mask white, via holes, and the board outline. Internal cutouts are indicated by black outlines but if the image here is entirely white, you'll want to make sure there are no gaps in the board outline. Please make no dimension or measurement cuts.

**Drills**  
Drills should show up as white circles on a purple background. Drills are represented by their diameter in mils or Drill with (x,y) coordinates, and are not supported. Internal cutouts are indicated by black outlines but if the image here is entirely white, you'll want to make sure there are no gaps in the board outline. Please make no dimension or measurement cuts.

**Top Solder Mask**  
This shows the portion of the silkscreen where to remove the purple solder mask. The gold-colored areas will be etched away to reveal the board, and purple areas will be covered in purple soldermask. If you submit an empty file we will remove the entire board. If you submit a file with holes, we will cover them in purple soldermask. To expose the entire board, submit this file a few times with different offsets. If you want to expose a service area everywhere and expose all the board, submit this file a few times with the same offset of four square inches. We don't officially support custom or printed stencils, but you can do them yourself if you follow the stencil and print instructions.

**Board Outline**  
This shows the portion of the silkscreen where to remove the purple solder mask. The gold-colored areas will be etched away to reveal the board, and purple areas will be covered in purple soldermask. We can cut non-rectangular board shapes, but the corners must be rounded. To make a circular board, a circular board with a two inch radius is recommended. Please make sure the corners of your square inches.

**Bottom Silk Screen**  
This shows the portion of the silkscreen we will place copper everywhere we see gold color. If you are using Altium Designer or Altium Circutmaker, carefully examine the board to make sure there are no vias or other features being included on this layer. See [this](#) for more.

If you are using Eagle, be aware that areas are placed on the wrong side of the board. Place paper links between pads showing on this layer, and the same in mirrored traces. If there are no paper links between pads showing on this layer, please move your .brd to the far extremes.

**Top Layer**  
This shows the portion of the silkscreen we will place copper everywhere we see gold color. If you are using Altium Designer or Altium Circutmaker, carefully examine the board to make sure there are no vias or other features being included on this layer. See [this](#) for more.

If you are using Eagle, be aware that areas are placed on the wrong side of the board. Place paper links between pads showing on this layer, and the same in mirrored traces. If there are no paper links between pads showing on this layer, please move your .brd to the far extremes.

**Bottom Solder Mask**  
This shows the portion of the silkscreen that we will ignore. The gold-colored areas will be etched away to reveal the board, and purple areas will be covered in purple soldermask. If you submit an empty file we will remove the entire board. If you submit a file with holes, we will cover them in purple soldermask. To expose the entire board, submit this file a few times with different offsets. If you want to expose a service area everywhere and expose all the board, submit this file a few times with the same offset of four square inches.

**Bottom Layer**  
This shows the portion of the silkscreen we will place copper everywhere we see gold color. If you are using Altium Designer or Altium Circutmaker, carefully examine the board to make sure there are no vias or other features being included on this layer. See [this](#) for more.

If you are using Eagle, be aware that areas are placed on the wrong side of the board. Place paper links between pads showing on this layer, and the same in mirrored traces. If there are no paper links between pads showing on this layer, please move your .brd to the far extremes.

**Top Silk Screen**  
We will ignore the portion of the silkscreen that we will place copper everywhere we see gold color. If you are using Altium Designer or Altium Circutmaker, carefully examine the board to make sure there are no vias or other features being included on this layer. See [this](#) for more.

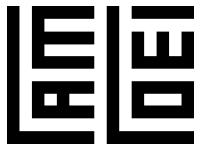
If you are using Eagle, be aware that areas are placed on the wrong side of the board. Place paper links between pads showing on this layer, and the same in mirrored traces. If there are no paper links between pads showing on this layer, please move your .brd to the far extremes.

**Bottom**  
Rendered from "Grove-Relay-v1.2.brd"

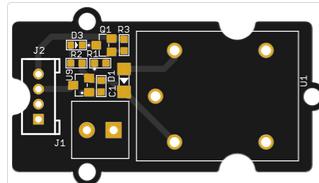
**Approved**



# oshpark

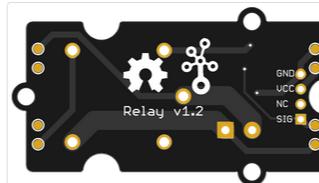


#### Board Images:



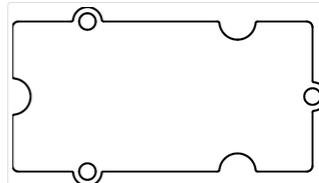
Top View - Complete Board

This is what your finished board will look like from the top.



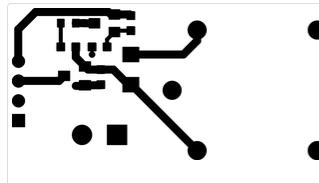
Bottom View - Complete Board

This is what your finished board will look like from the bottom.



Board Outline

This shows the outline of your board, it will be cut to this shape.



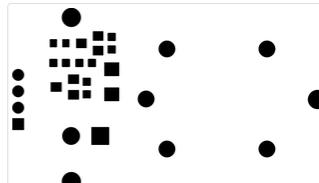
Top Copper Layer

This shows where the copper will remain after etching the top of the board.



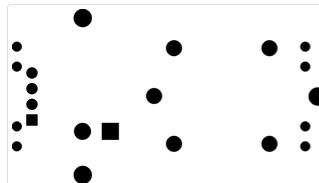
Bottom Copper Layer

This shows where the copper will remain after etching the bottom of the board. (mirrored)



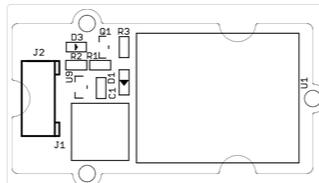
Top Soldermask

This shows where soldermask will be applied on the top over the bare copper board.



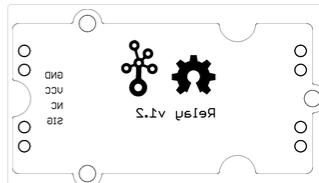
Bottom Soldermask

This shows where soldermask will be applied on the bottom over the bare copper board. (mirrored)



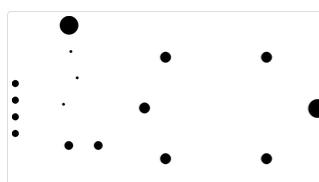
Top Silkscreen

This is the white print that will be printed on the top of the board.



Bottom Silkscreen

This is the white print that will be printed on the bottom of the board. (mirrored)



Drill Holes

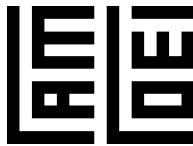
This shows all the holes that will be drilled in your board.

pcbs



## Copy Link

[https://www.allpcb.com/invite.aspx?inviteid=27397&url=https://www.allpcb.com/online\\_quote.html](https://www.allpcb.com/invite.aspx?inviteid=27397&url=https://www.allpcb.com/online_quote.html)



**Order Type:** Single PCB  Panel PCB as design  Panel by ALLPCB (1)

**Dimensions:**  X  mm \*size of pc (2)

\*The dimension can be accurate to one decimal places, for any deviation ,we will refer to the file

**Quantity:**  \*pcs (3)

**PCB Type:** FR-4 ( ShengYi Tg140 )  CEM-1  Aluminum Board

\*Only single-sided available for CEM-1 and aluminum boards.

**Layers:**  1  2  4  6

**PCB Kinds:**  1 (Numbers of boards types in documents) For Example

**Thickness:**  0.4  0.6  0.8  1.0  1.2  1.6  2.0 

\*V-cut is not acceptable for 0.4mm board thickness.

**Finished Copper (outer):**  1oz  2oz 

\*Inner copper thickness 1oz as default for multi-layer board.

**Min Spacing:**  5/5mil  6/6mil 

**Min Hole Size:**  0.25mm  0.3mm  0.35mm  0.4mm 

\*With min. via size 0.25mm ,the board thickness should be less than 1.6mm.

**Solder Mask:**  None  Green  Black  White  Yellow  Red  
**(TAIYO)**  Blue  Matte black  Matte green

**Silkscreen Color:**  None  Green  Black  White  Yellow  
**(TAIYO)** \*Silk screen and solder resist can not be the same color.

**Surface Finish:**  HASL with Lead  HASL Lead Free  Immersion gold  OSP

**Golden Finger:**  No  Yes

**Charge Details**

Project	Panel	Board	Film	HASL	Testing	Color	Others
11.05	0.00	6.30	6.63	0.00	0.00	0.00	0.02

**PCB price and delivery** Current Time (GMT+8): 2018-07-05 23:49:35

lead time	Quantity	Price
<b>TopSpeed</b> 24 hours	5	24.00

**Shipping by**

THAILAND (5)

DHL  3-5 days wt : 0.66 kg

**Estimated Shipping Time** 2018-07-07 / **Estimated Arriving Time** 2018-7-12

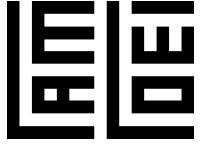
PCB Cost (Product Cost): \$24.00  
Shipping Cost: \$29.44  
**Subtotal:** \$28.00

\* Your email:

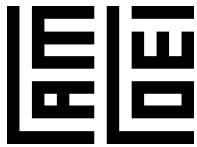
Fill in any PCB details to make it as clear as possible for us to understand your requirements.



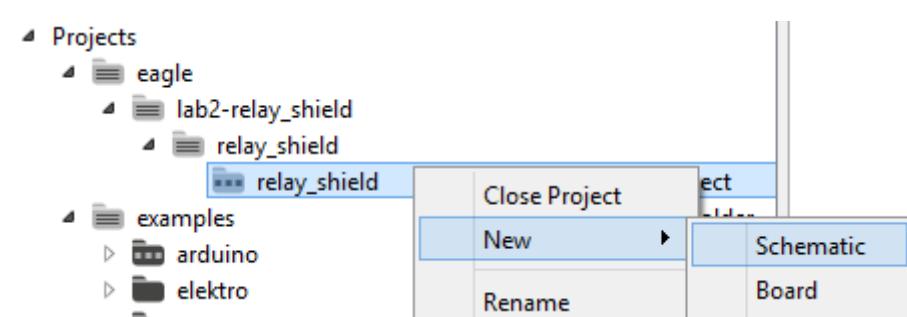
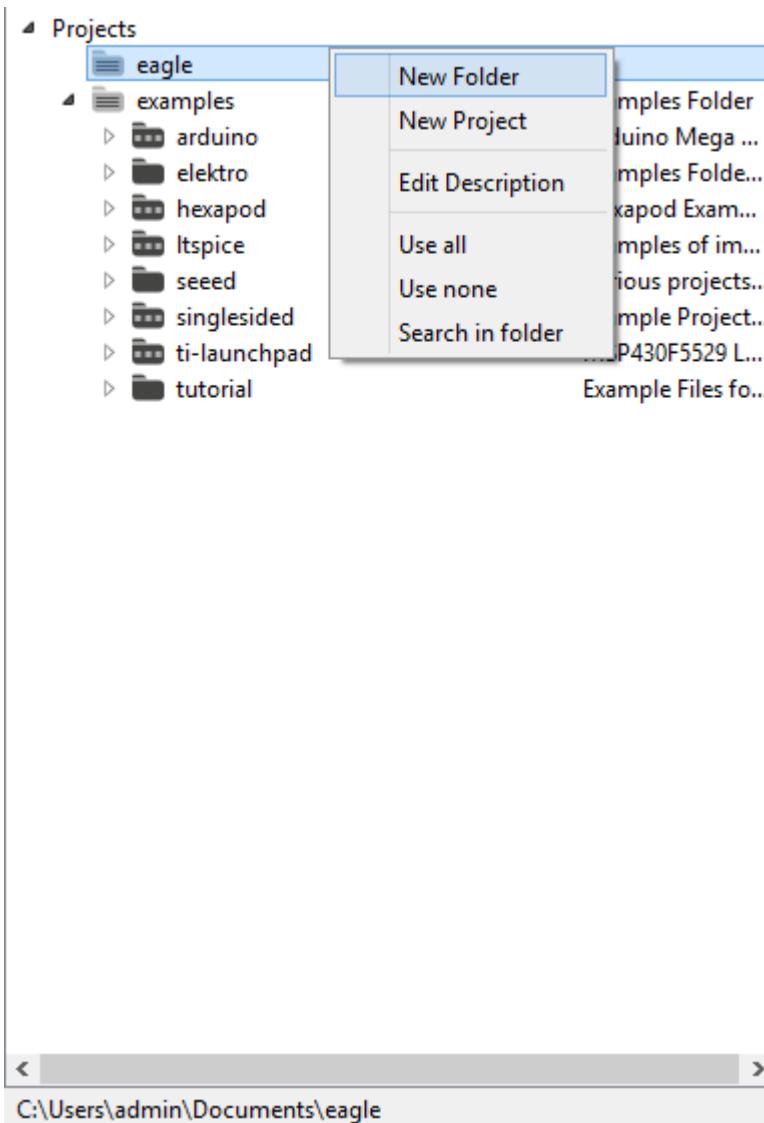
จ่ายด้วย Paypal



สร้างโปรดเจด?



# New Project

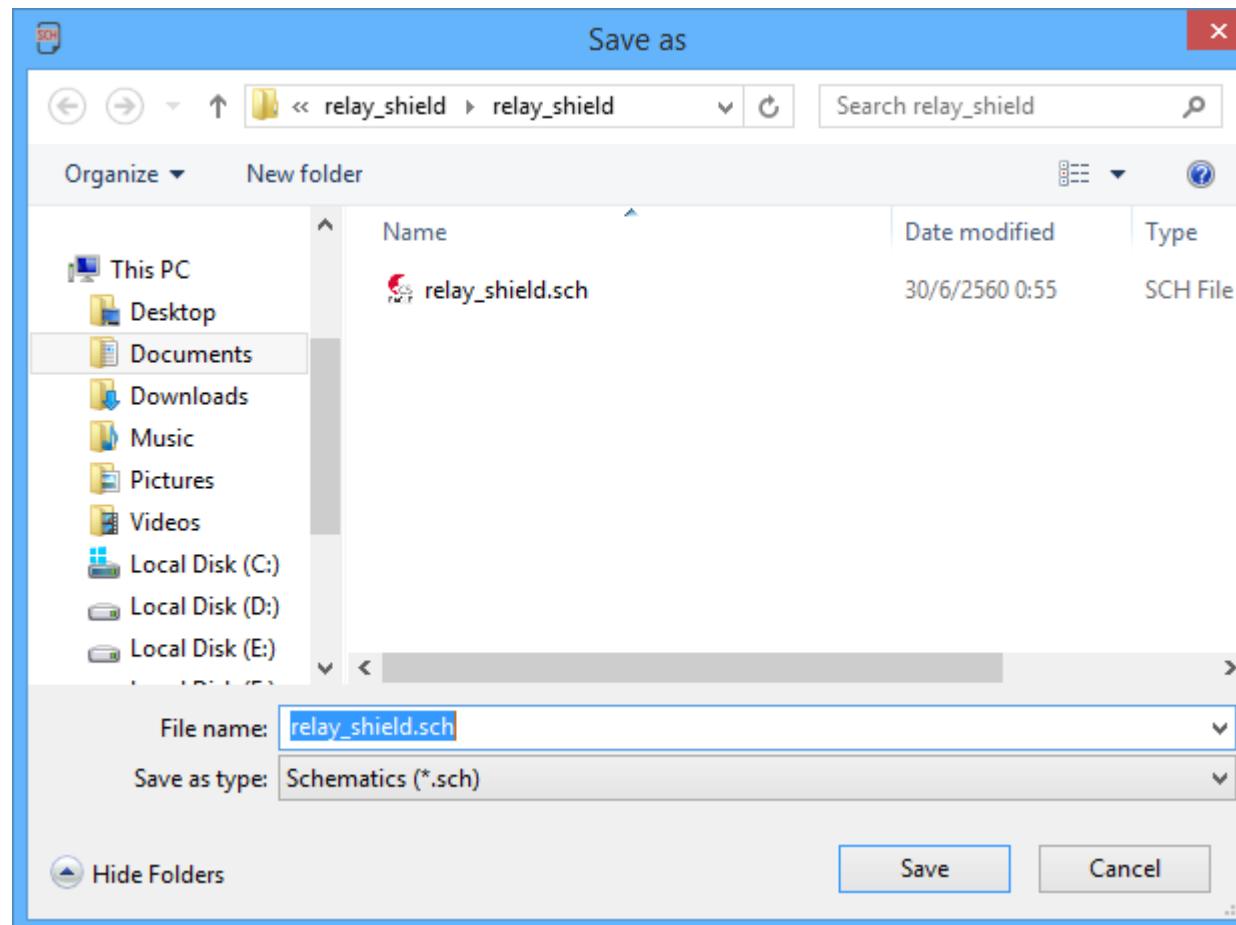


New > Schematic



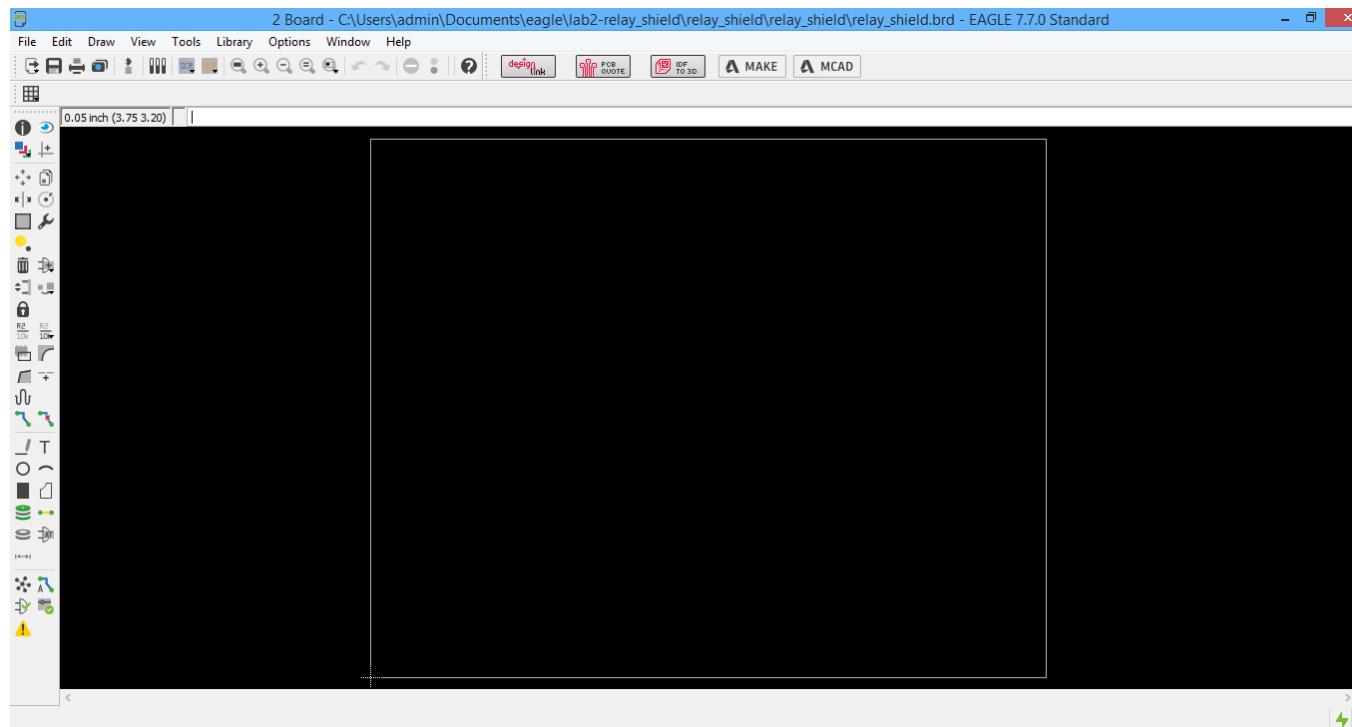
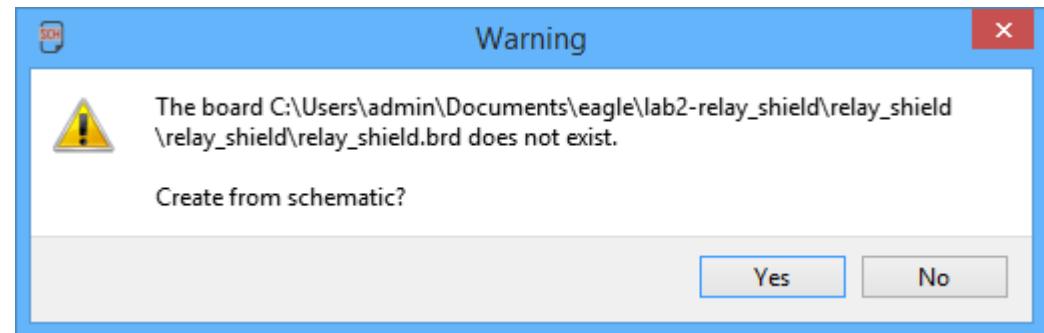
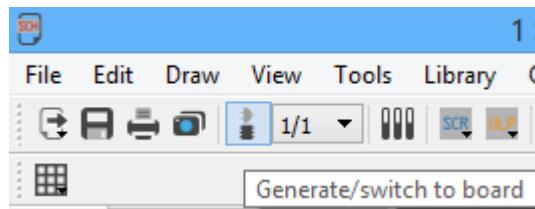
# Save Schematic

Save ตั้งชื่อไฟล์ Schematic





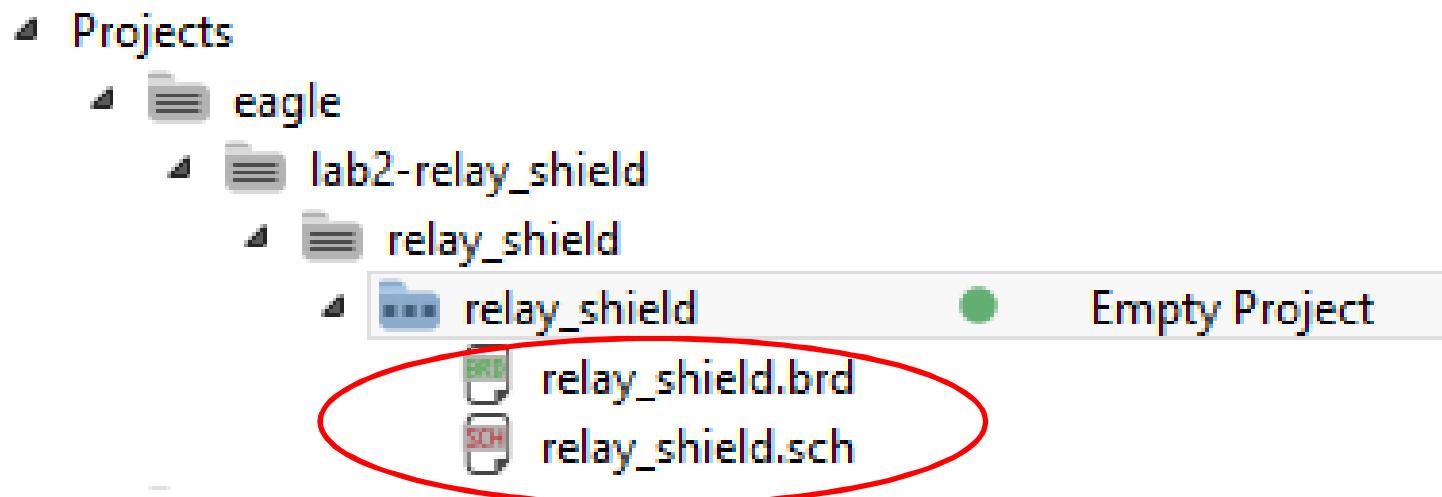
# New Board



แล้วกดบันทึก



# Lab 2 สร้าง sch กับ brd ที่ซื้อเหมือนกัน อยู่ภายใต้ projectเดียวกัน

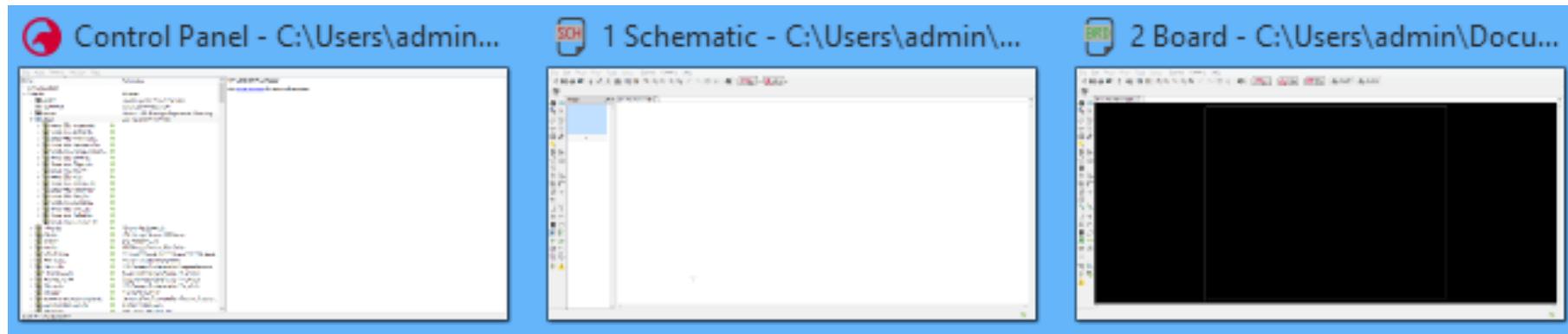


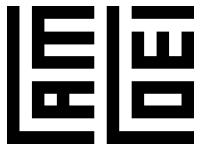


# Control Panel

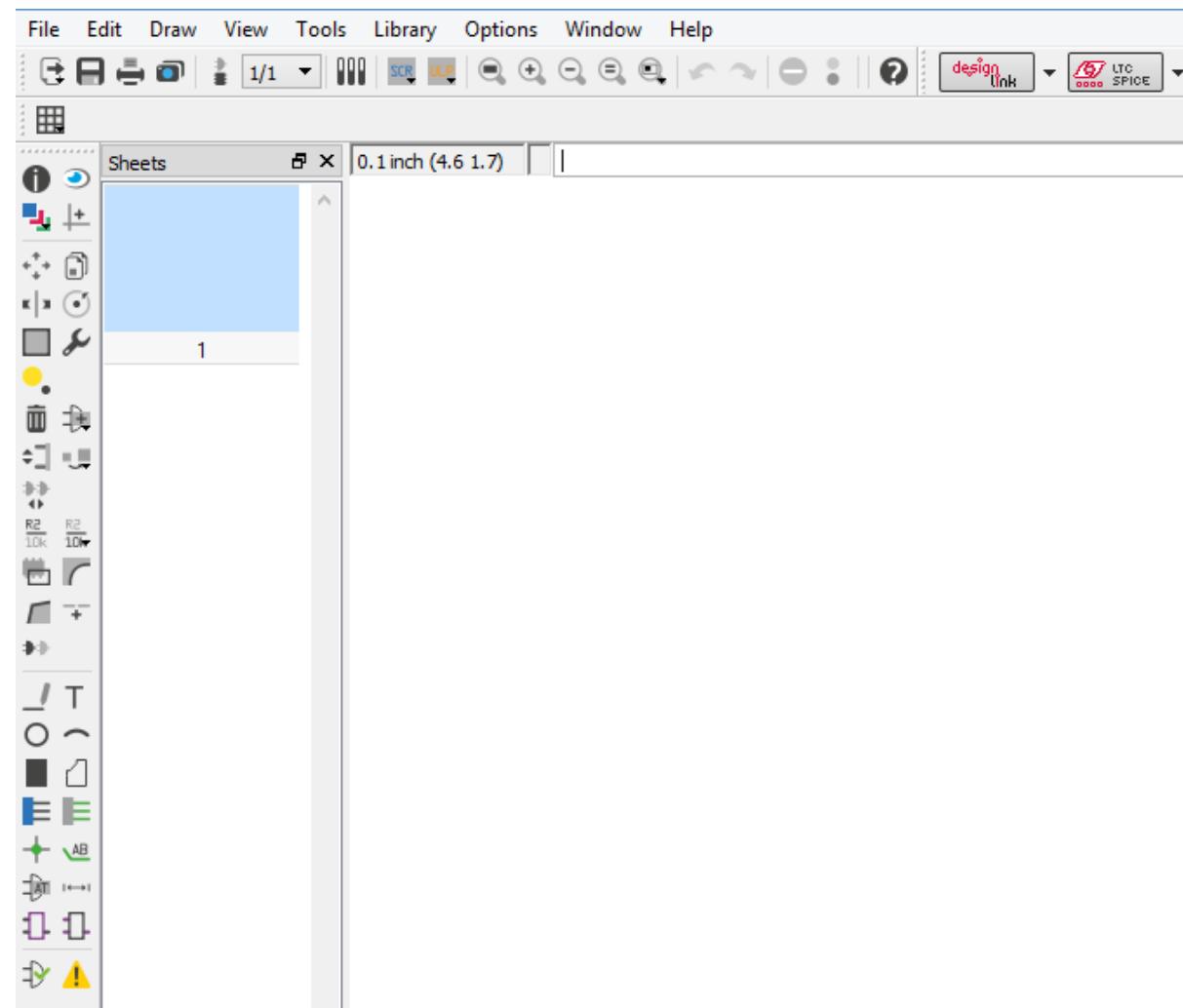
## Schematic

## Board



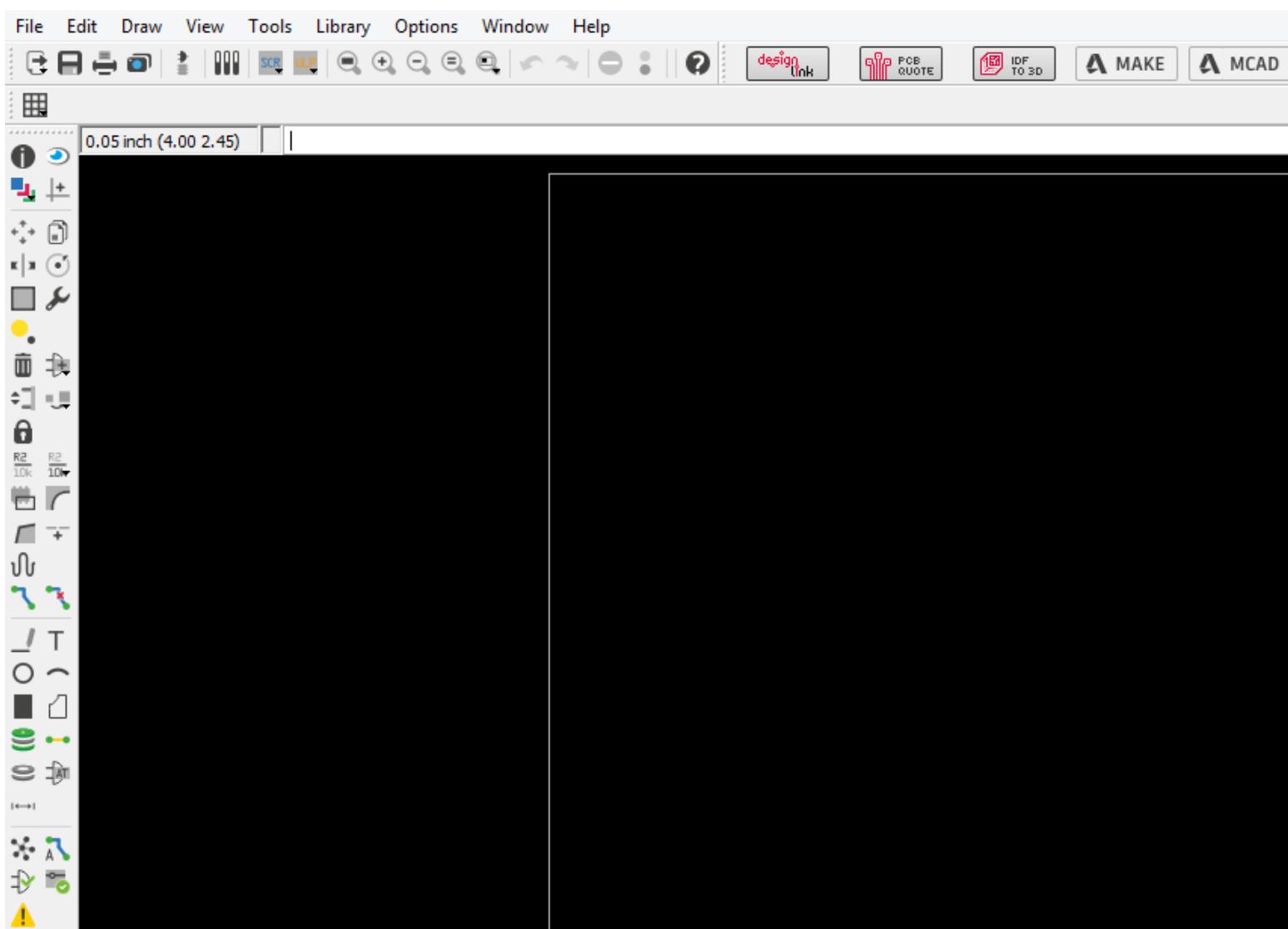


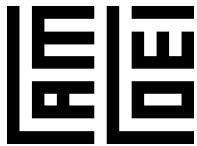
# Schematic



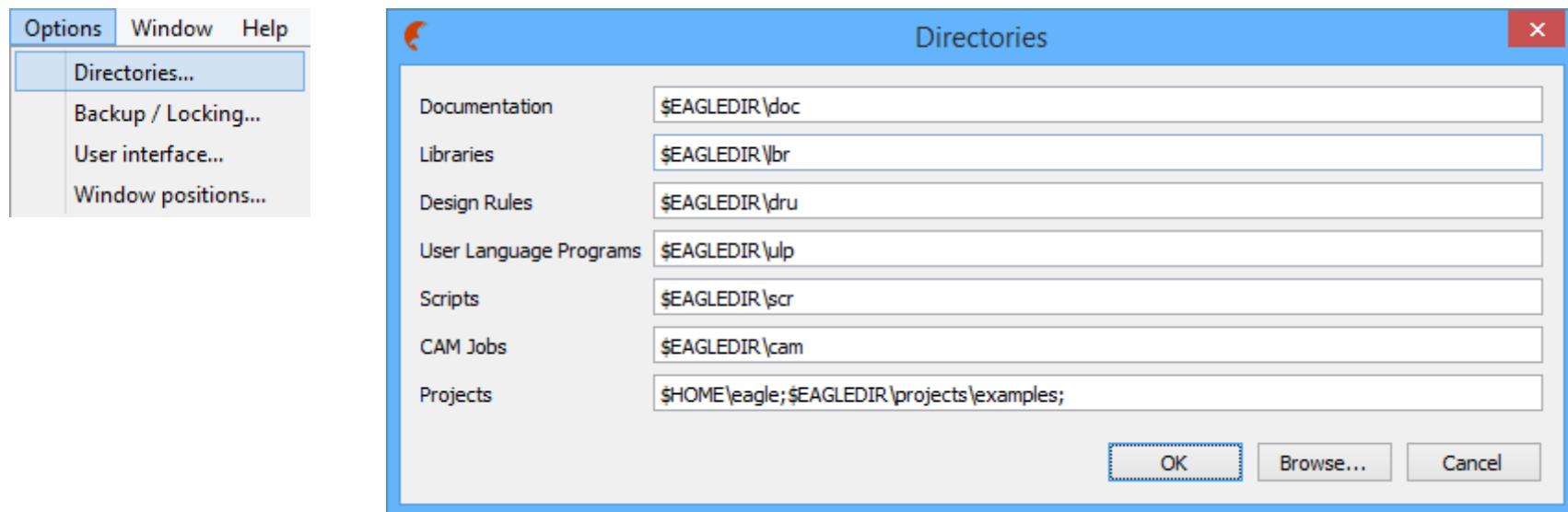


# Board





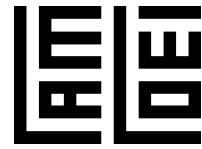
# Control Panel > Options > Directories...





# Sch Button & Brd Button





# Lab 3 គំណត់ការ lbr, dru, cam

PC ▶ Local Disk (C:) ▶ EAGLE-7.7.0 ▶ lbr

Name	Date modified	Type	Size
📁 elektro	29/6/2560 10:05	File folder	
📁 element14	29/6/2560 10:05	File folder	
📁 Itspice	29/6/2560 10:05	File folder	
📁 seeed	29/6/2560 10:05	File folder	
📁 Adafruit-Eagle-Library-master	30/6/2560 14:53	File folder	
📁 opl_package	30/6/2560 14:53	File folder	
📁 SparkFun-Eagle-Libraries-master	30/6/2560 14:53	File folder	
📄 DESCRIPTION	13/12/2549 4:16	File	2 KB
📄 40xx.lbr	13/12/2554 5:12	LBR File	370 KB
📄 41xx.lbr	13/12/2554 5:12	LBR File	29 KB
📄 45xx.lbr	13/12/2554 5:12	LBR File	230 KB
📄 74ac-logic.lbr	13/12/2554 5:12	LBR File	380 KB
📄 751xx.lbr	13/12/2554 5:12	LBR File	79 KB

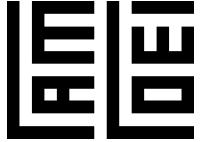
PC ▶ Local Disk (C:) ▶ EAGLE-7.7.0 ▶ dru

Name	Date modified	Type	Size
📁 Eurocircuits	29/6/2560 10:05	File folder	
📁 Multi-CB	29/6/2560 10:05	File folder	
📁 WEdirekt	29/6/2560 10:05	File folder	
📄 default.dru	13/12/2549 4:16	DRU File	3 KB
📄 DESCRIPTION	13/12/2549 4:16	File	1 KB
📄 Elecrow_2-layer_PCB_eagle_rule.dru	29/6/2560 20:07	DRU File	3 KB
📄 Elecrow_4-layer_PCB_eagle_rule.dru	29/6/2560 20:07	DRU File	3 KB
📄 oshpark-2layer.dru	29/6/2560 19:53	DRU File	3 KB
📄 OSHPark-4layer.dru	29/6/2560 19:56	DRU File	3 KB
📄 PCBs_io.dru	29/6/2560 19:58	DRU File	3 KB
📄 SeeedStudio_2layer_DRU_no_angle_20140...	17/6/2557 16:36	DRU File	3 KB
📄 SeeedStudio_4layer_DRU_no_angle_20140...	26/8/2558 9:41	DRU File	2 KB

PC ▶ Local Disk (C:) ▶ EAGLE-7.7.0 ▶ cam

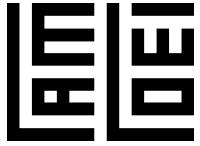
Name	Date modified	Type	Size
📄 Elecrow_Gerber_Generator_DrillAlign.cam	29/6/2560 20:08	Altium CAMtastic ...	11 KB
📄 Elecrow_Gerber_Generator_4-layer_1-2-15... cam	29/6/2560 20:07	Altium CAMtastic ...	13 KB
📄 Seeed_Gerber_Generator_2-layer.cam	29/6/2560 20:03	Altium CAMtastic ...	11 KB
📄 PCBs_ioEagle7.2.cam	29/6/2560 19:58	Altium CAMtastic ...	7 KB
📄 OSHPark-4layer-Eagle7.2.cam	29/6/2560 19:56	Altium CAMtastic ...	10 KB
📄 OSHPark-2layer-Eagle7.2.cam	29/6/2560 19:56	Altium CAMtastic ...	9 KB
📄 gerb274x-mill-drill.cam	31/8/2558 7:04	Altium CAMtastic ...	9 KB
📄 Seeed_Gerber_Generator_4-layer_1-2-15... cam	3/12/2556 14:42	Altium CAMtastic ...	13 KB

// ផ្តល់បន្ថែម ឬ ចេញលក្ខណៈ lbr ទិន្នន័យ  
បិទបើក Eagle ឱ្យ ហើរកាត់ F5

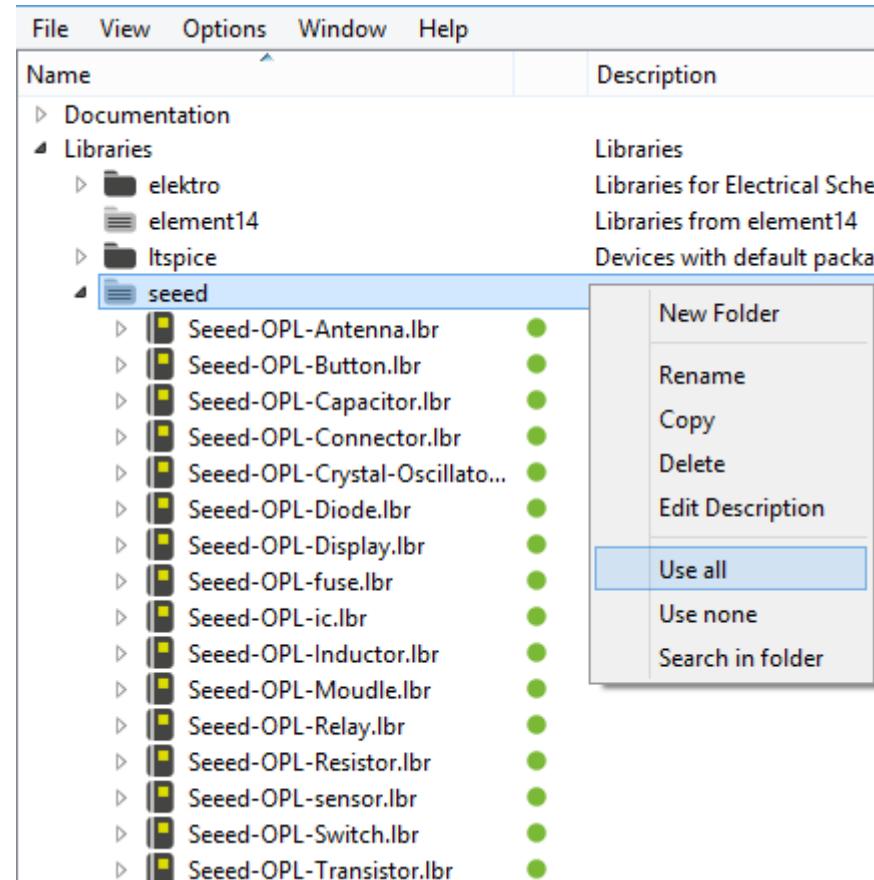


# Control panel จะมีรายชื่อเพิ่มขึ้นมา

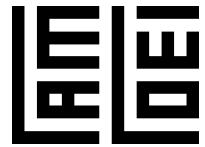
Libraries	Libraries
▷ Adafruit-Eagle-Library-master	Libraries for Electrical Schema
▷ elektro	Libraries from element14
▷ element14	Devices with default packages
▷ Itspice	
▷ opl_package	
▷ seeed	OPL Libraries from Seeed
▷ SparkFun-Eagle-Libraries-master	
Design Rules	Design Rules
▷ Eurocircuits	EAGLE Design Rules
▷ Multi-CB	EAGLE Design Rules
▷ WEdirekt	EAGLE Design Rules
▷ default.dru	EAGLE Design Rules
▷ Elecrow_2-layer_PCB_eagle_rule....	EAGLE Design Rules
▷ Elecrow_4-layer_PCB_eagle_rule....	EAGLE Design Rules
▷ oshpark-2layer.dru	EAGLE Design Rules
▷ OSHPark-4layer.dru	EAGLE Design Rules
▷ PCBs_io.dru	MakerWorks Design Rules
▷ SeeedStudio_2layer_DRU_no_an...	EAGLE Design Rules
▷ SeeedStudio_4layer_DRU_no_an...	EAGLE Design Rules
CAM Jobs	CAM Processor Jobs
▷ Elecrow_Gerber_Generator_4-lay...	Seeed Studio 2-layer PCB Gerber Generator
▷ Elecrow_Gerber_Generator_Drill...	Seeed Studio 2-layer PCB Gerber Generator
▷ excellon.cam	Generates Excellon Drill Data
▷ gerb274x-4layer.cam	Generates Extended Gerber Format for a 4 la
▷ gerb274x-mill-drill.cam	Generates Extended Gerber Format
▷ gerb274x.cam	Generates Extended Gerber Format
▷ gerber.cam	Generates Gerber Format
▷ layout2.cam	Generates EPS Format
▷ OSHPark-2layer-Eagle7.2.cam	For 2 layer PCB designs using Eagle version
▷ OSHPark-4layer-Eagle7.2.cam	For 4 layer PCB designs using Eagle version
▷ PCBs_ioEagle7.2.cam	2 layer PCB designs for Marker.Works using
▷ schematic.cam	Example for cam2printer.ulp
▷ Seeed_Gerber_Generator_2-layer...	Seeed Studio 2-layer PCB Gerber Generator
▷ Seeed_Gerber_Generator_4-layer...	Seeed Studio 2-layer PCB Gerber Generator



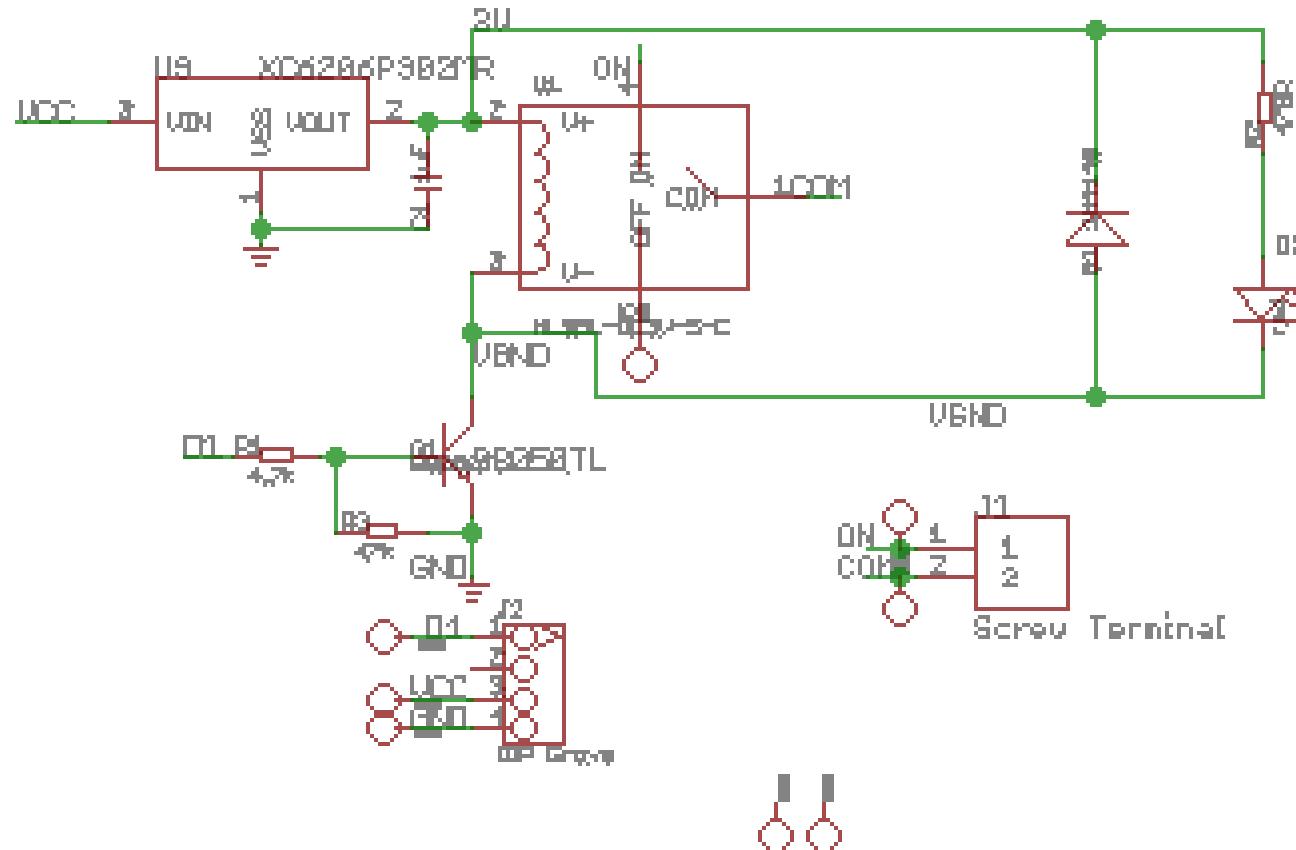
# Use all Libraries

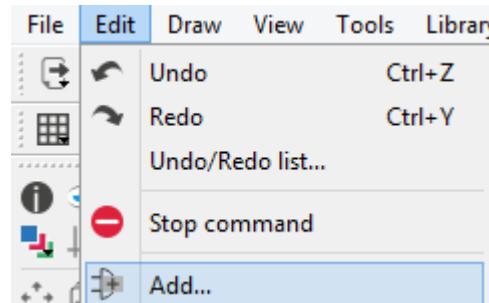


เปิดใช้เฉพาะเท่าที่จำเป็น จะทำงานเร็วกว่า



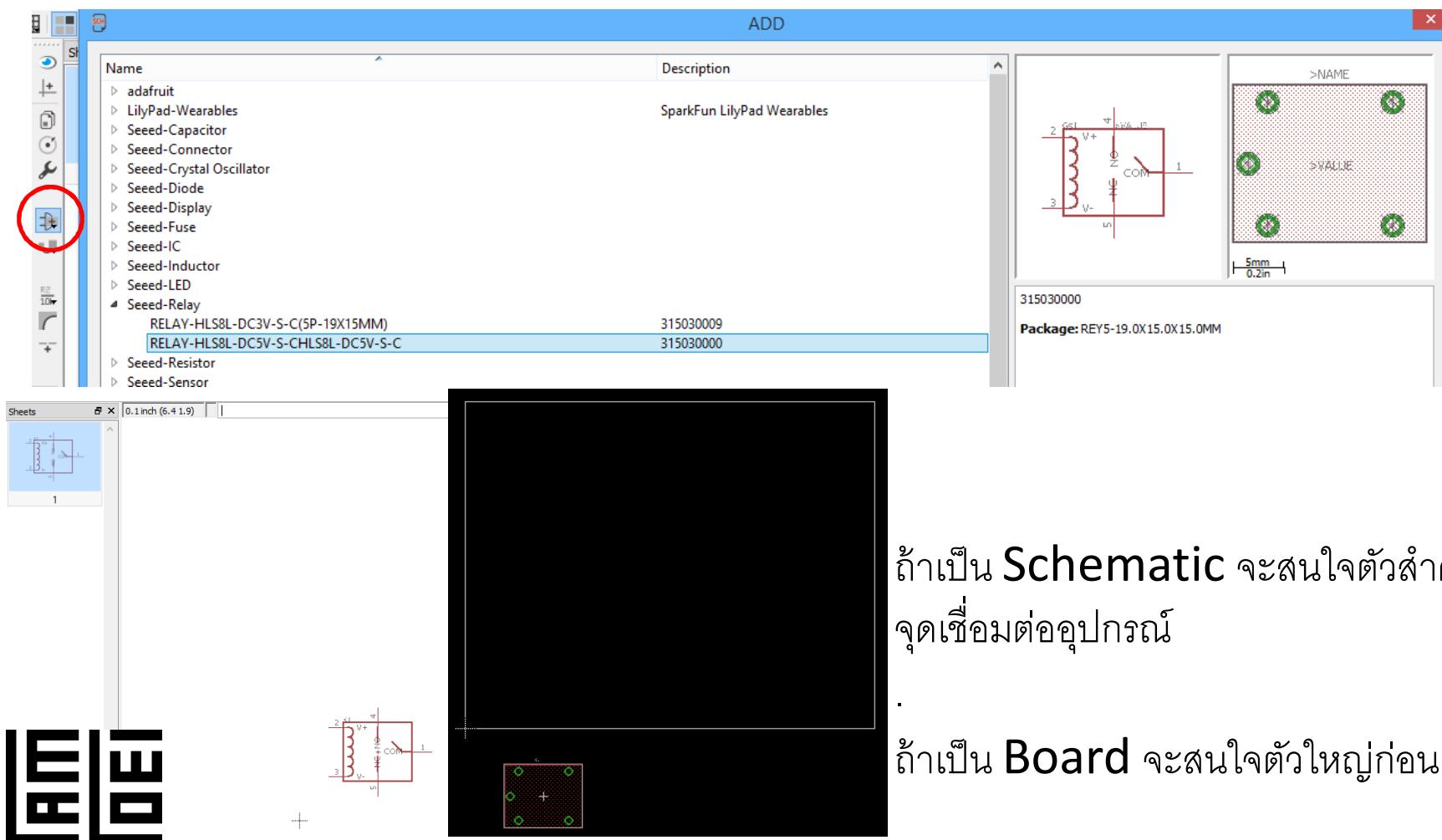
# Lab 4 สร้าง relay module





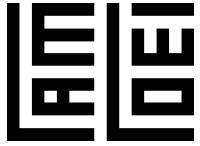
# Lab4 Schematic > Edit > Add...

Sch > ADD > Seeed-Relay > RELAY-DC5V



ถ้าเป็น Schematic จะสนใจตัวสำคัญก่อน  
จุดเชื่อมต่ออุปกรณ์

ถ้าเป็น Board จะสนใจตัวใหญ่ก่อน

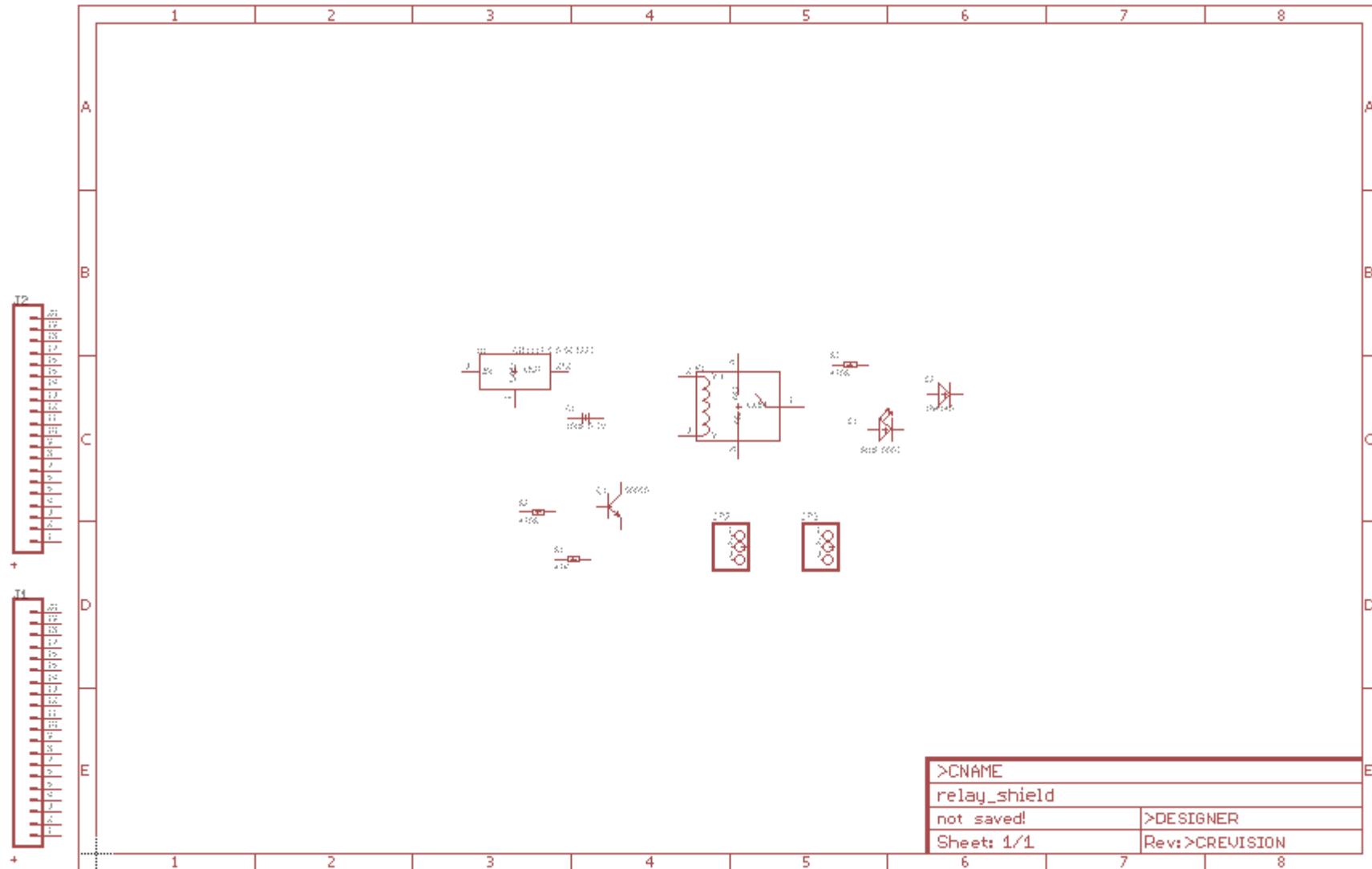


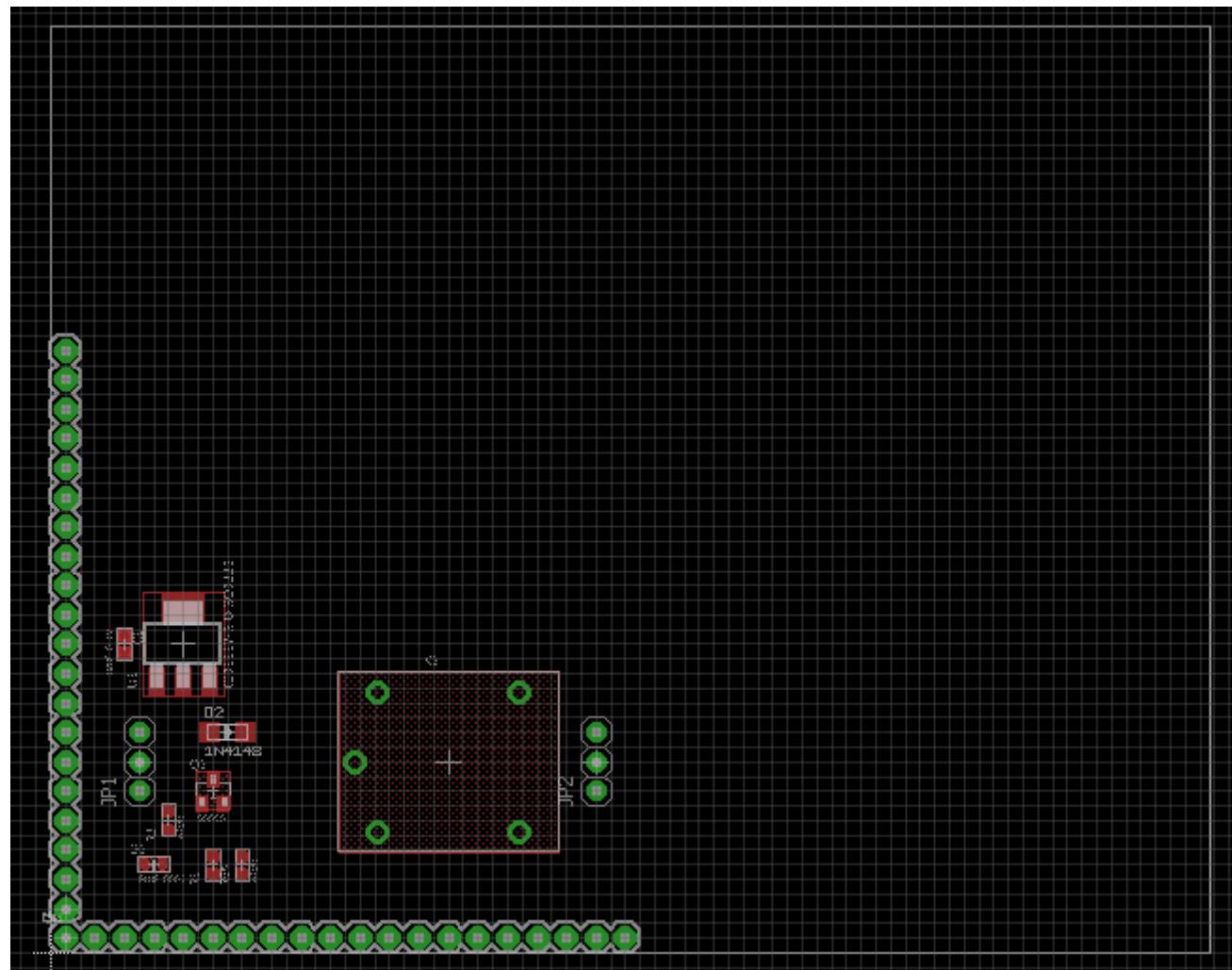
## ເພີ່ມອຸປະກອນ

- Sch > ADD > Seeed-Transistor > s8050
- Sch > ADD > Seeed-Resistors > SMD-res-47k-0603
- Sch > ADD > Seeed-Resistors > SMD-res-470-0603 \*2
- Sch > ADD > Seeed-LED > SMD-LED-0603
- Sch > ADD > Seeed-Diode > SMD 1N4148 (LL-34)
- Sch > ADD > Seeed-IC > PMIC-CJT1117-5.0(SOT223)
- Sch > ADD > Seeed-Capacitor > 10uf 6.3v 0603
- Sch > ADD > Adafruit > PINHD-1x3 > PINHD-1x3\*2
- Sch > ADD > SparkFun-Aesthetics > FRAME-A4L



# Lab 5 เรียนอุปกรณ์

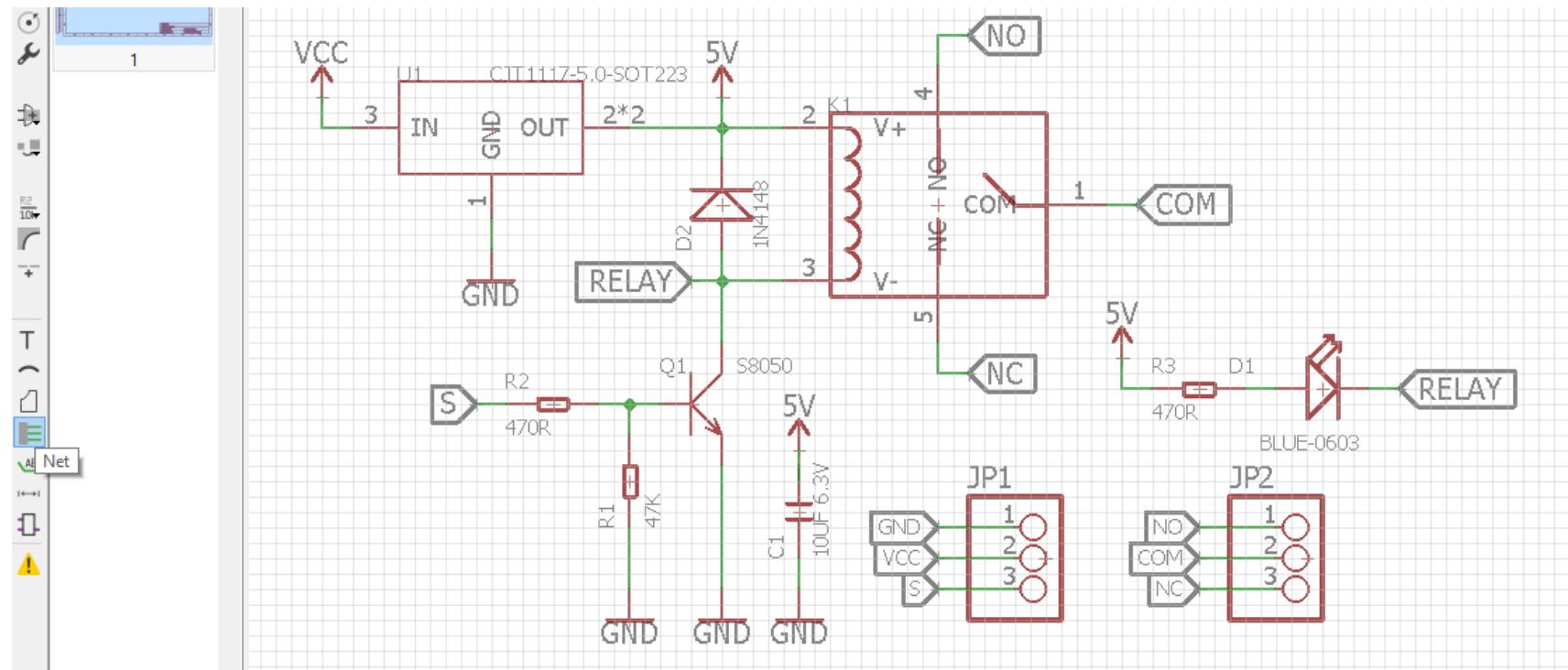




สามารถได้ทีละอุปกรณ์ได้



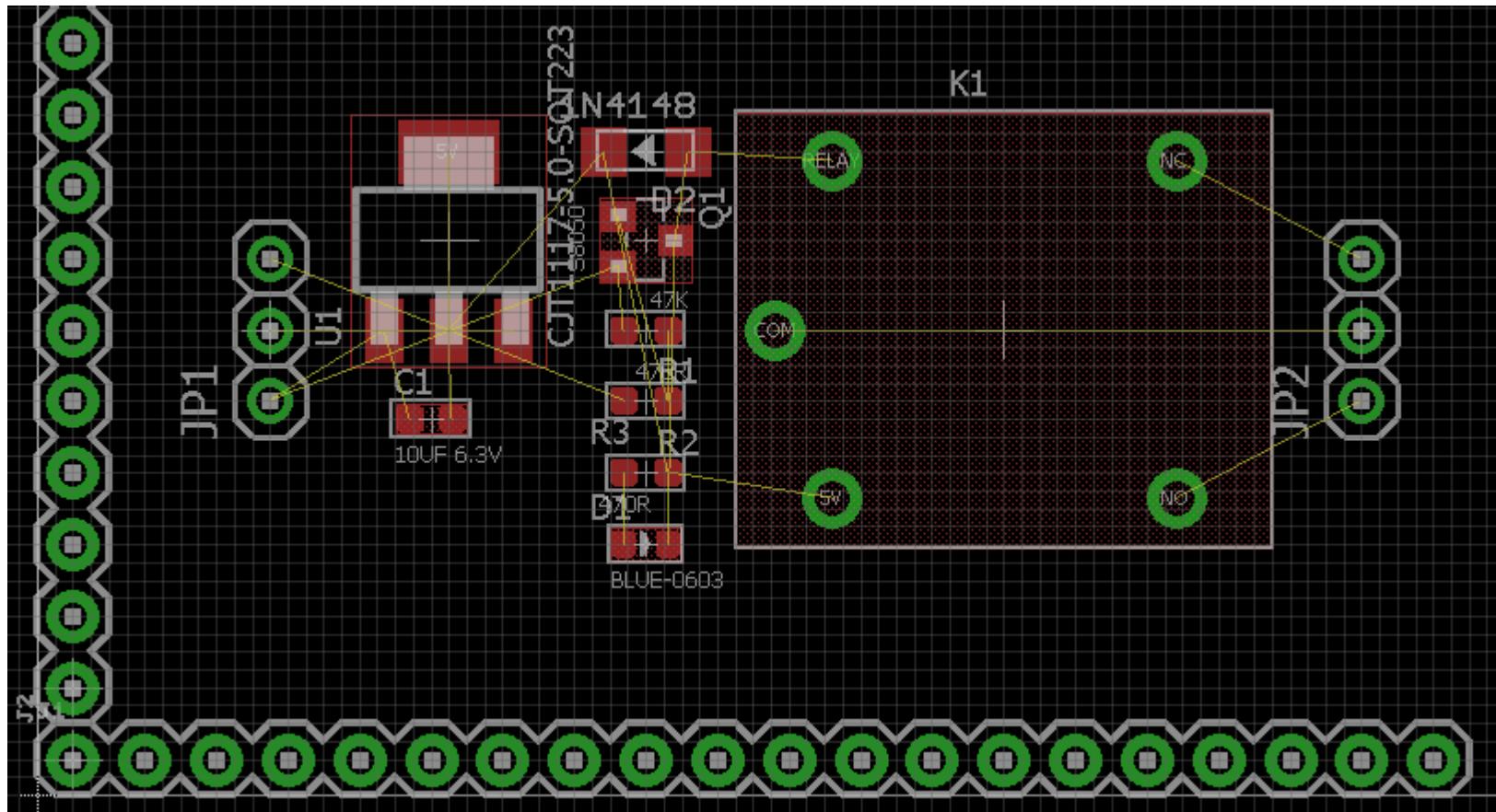
# Lab 6 ลากเส้นโดยใช้ Net



Sch > ADD > SparkFun-PowerSymbols > VCC, 5V, GND



# เรียนรู้การณ์บనບອຮດ





# layer

Display	
Layers:	
Nr	Name
1	Top
16	Bottom
17	Pads
18	Vias
19	Unrouted
20	Dimension
21	tPlace
22	bPlace
23	tOrigins
24	bOrigins
25	tNames
26	bNames
27	tValues
28	bValues
29	tStop
30	bStop
31	tCream
32	bCream
33	tFinish
34	bFinish
35	tGlue
36	bGlue
37	tTest
38	bTest
39	tKeepout
40	bKeepout
41	tRestrict
42	bRestrict
43	vRestrict
44	Drills
45	Holes
46	Milling
47	Measures
48	Document
49	Reference
51	tDocu
52	bDocu

1 ลายทองแดงด้านบน

16 ลายทองแดงด้านล่าง

19 จุดเชื่อมที่ยังไม่ได้เดินลายทองแดง

20 ขอบบอร์ด

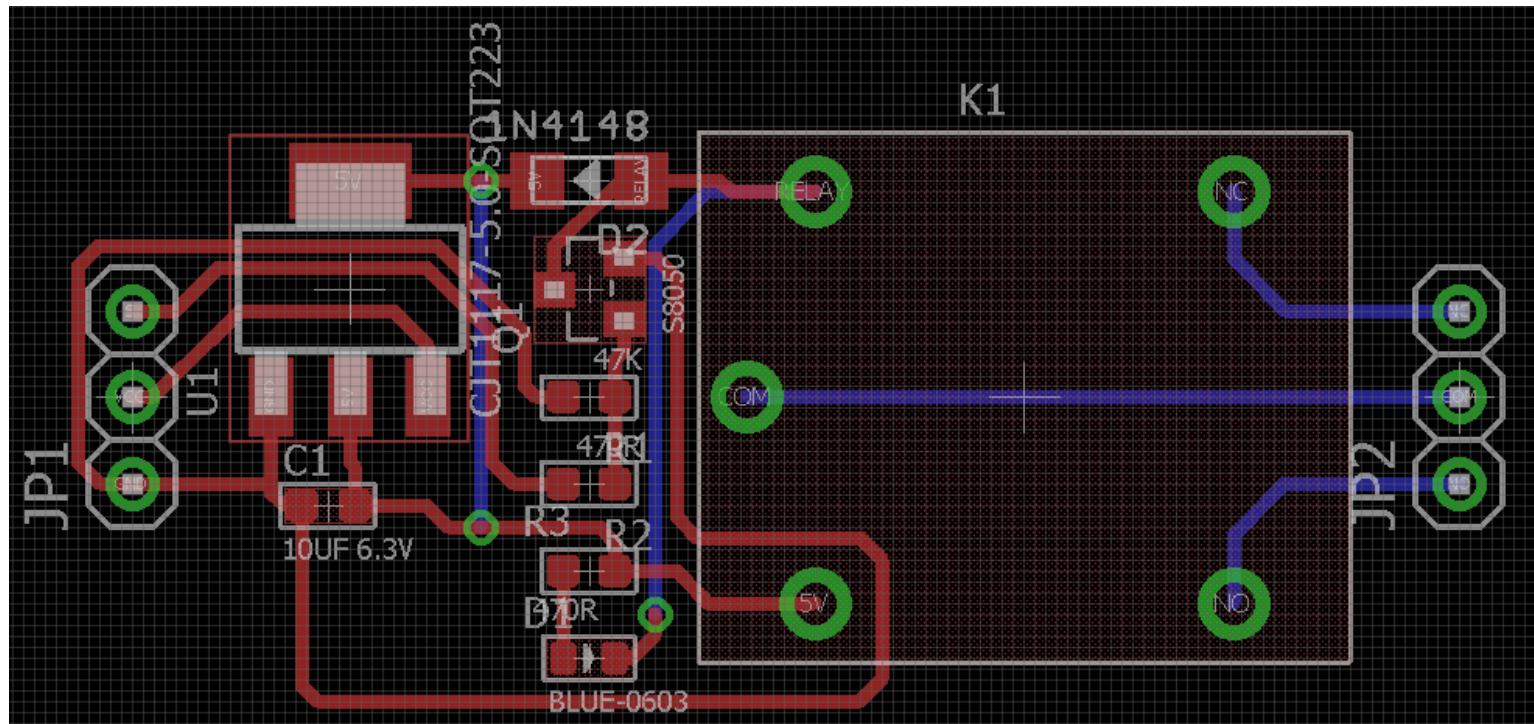
21 สกรีนขวาด้านบน

22 สกรีนขวาด้านล่าง

48, 51, 52 คอมเม้น

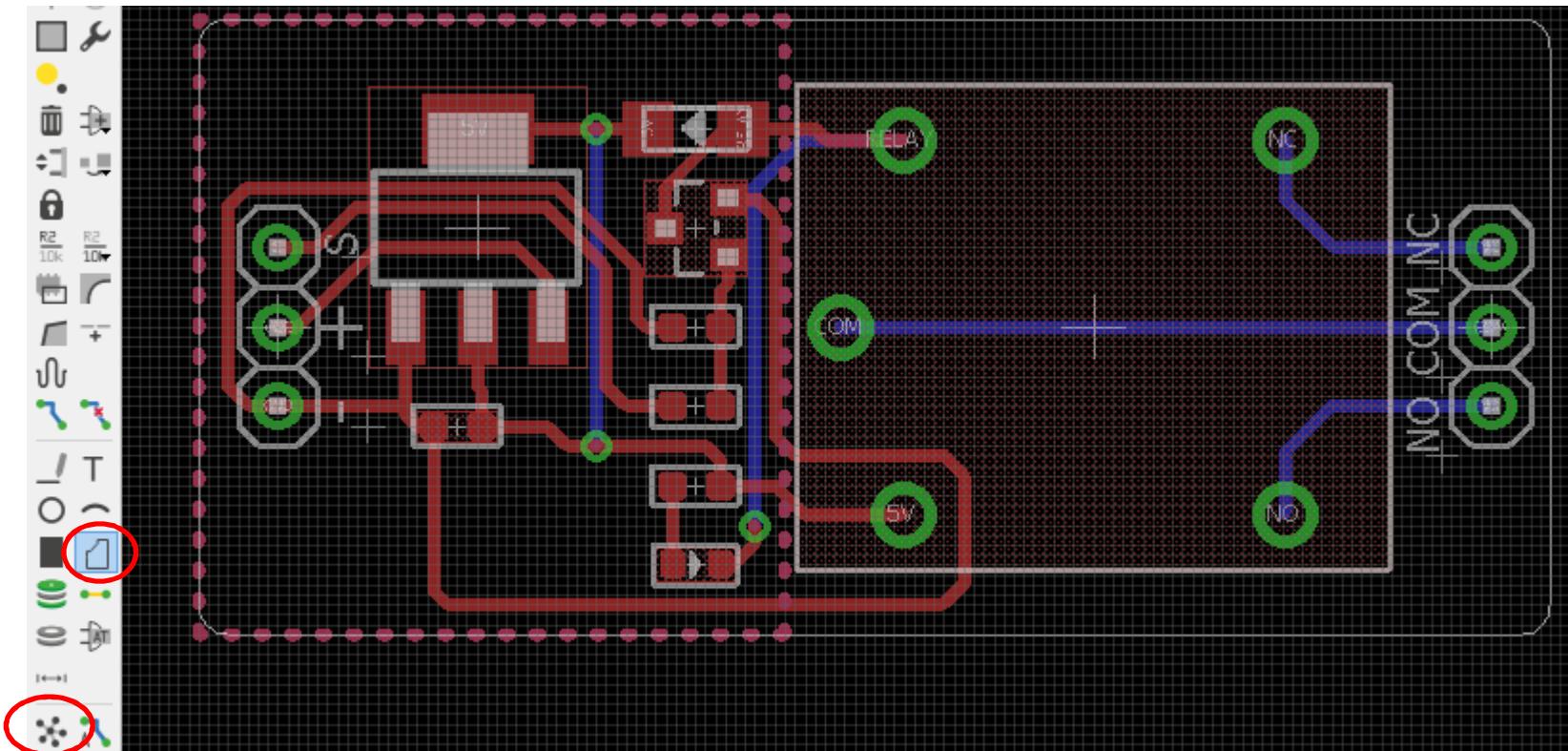
RAM  
DEI

# ลากเส้น Route



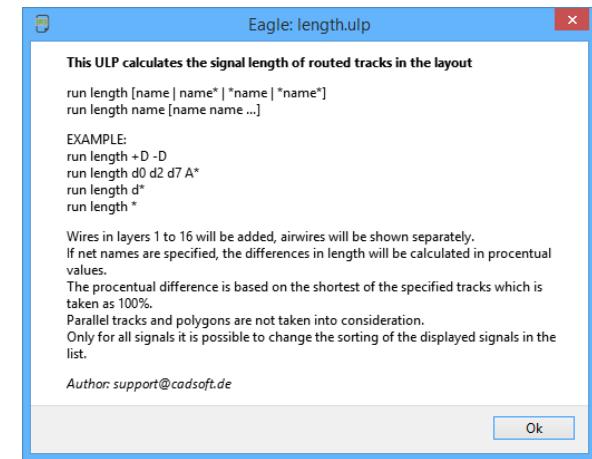
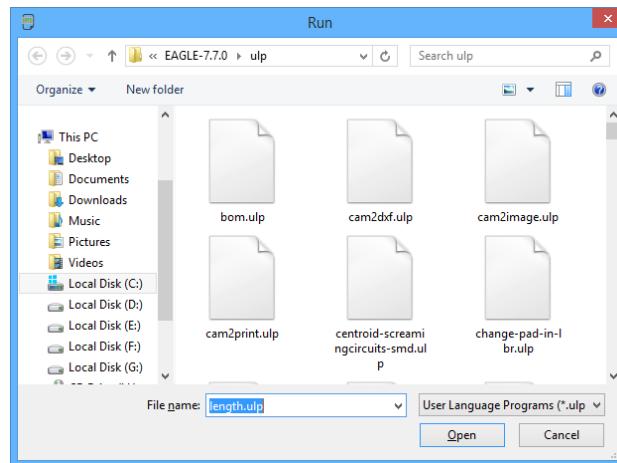
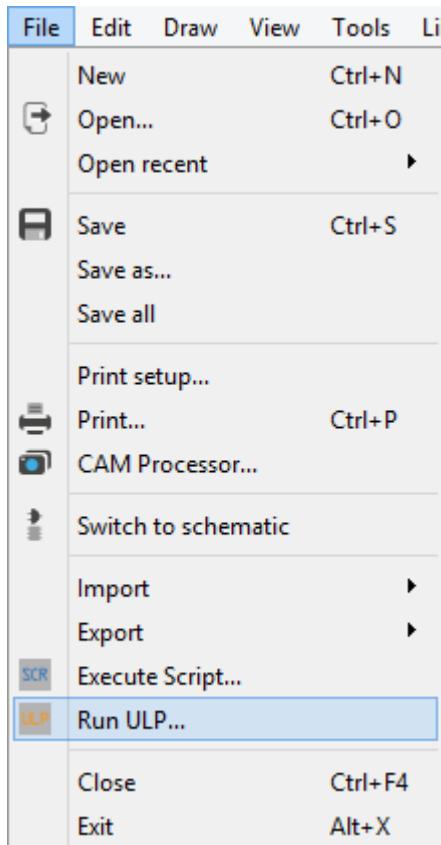


# ໃສ່ Ground Plane





# ตรวจสอบการครบถ้วน length.ulp



Eagle: Wire length of Layout

Signal	l [mm]	diff. [mm]	diff. [%]	unrouted [mm]
5V	33.960325140	31.420325140	1237.021	--
COM	20.800000000	18.260000000	718.898	--
GND	74.133899662	71.593899662	2818.657	--
NS2	2.540000000	0.000000000	0.000	--
NS3	4.931210245	2.391210245	94.142	--
NC	9.169604615	6.629604615	261.008	--
NO	9.169604615	6.629604615	261.008	--
RELAY	27.957981846	25.417981846	1000.708	--
S	17.961153673	15.421153673	607.132	--
VCC	11.632943428	9.092943428	357.990	--

Ok Save Help



# ตรวจ DRU oshpark-2layer.dru

The screenshot shows the Eagle DRC (Design Rule Check) interface. A red circle highlights the 'Limit' input field in the 'Stop' mask settings, which contains the value '50mil'. Below the dialog, a message in Thai reads: 'ต้องไม่มี Error จึงถูก' (There must be no errors to be correct).

DRC (oshpark-2layer)

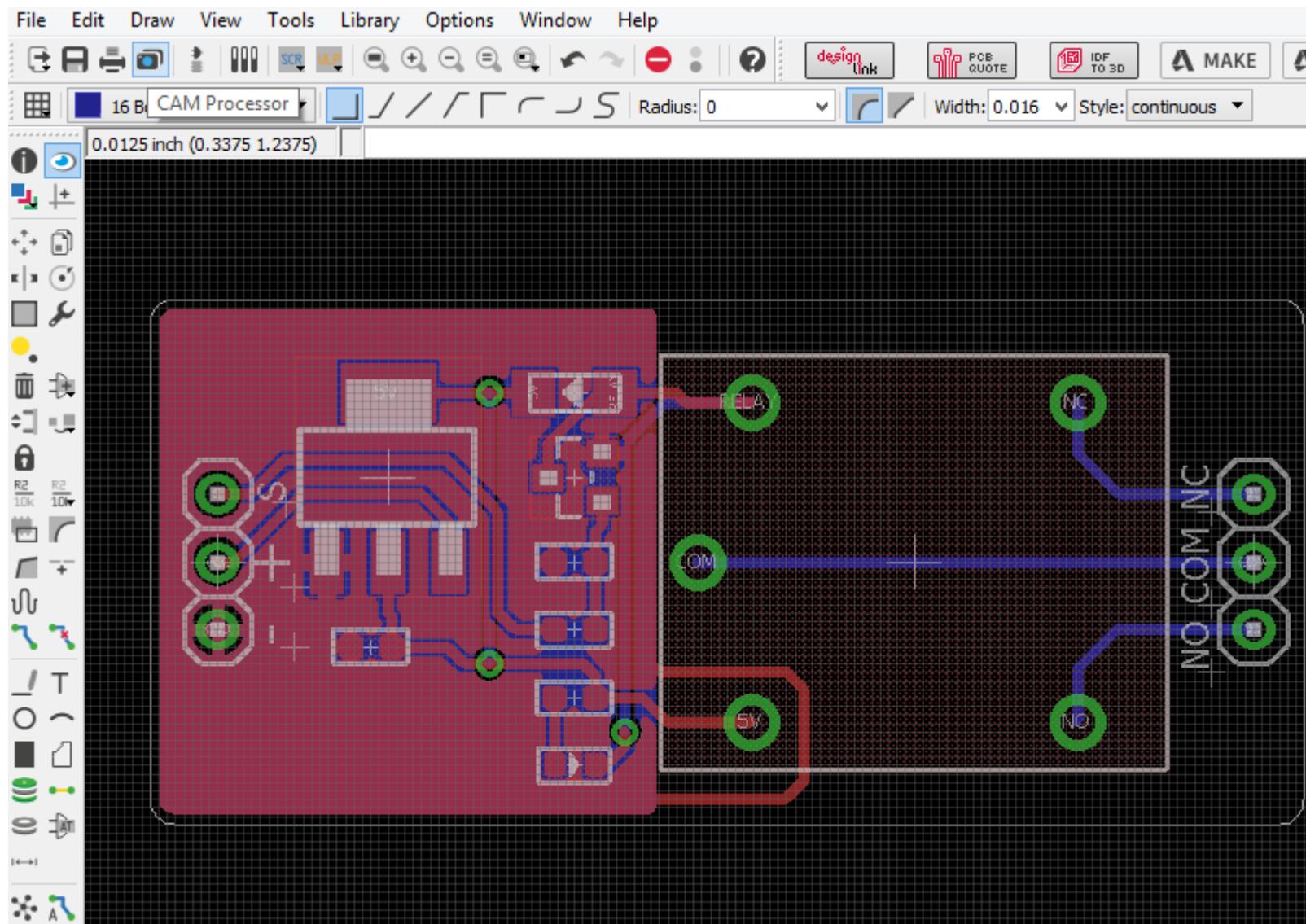
File Layers Clearance Distance Sizes Restring Shapes Supply Masks Misc

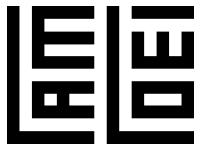
Mask values are defined in percent of the smaller dimension of smds, pads and vias (limited by Min and Max).  
Stop masks are generated for smds, pads and those vias that have a drill diameter that exceeds Limit.  
Cream masks are generated for smds only.

Check Select Cancel Apply

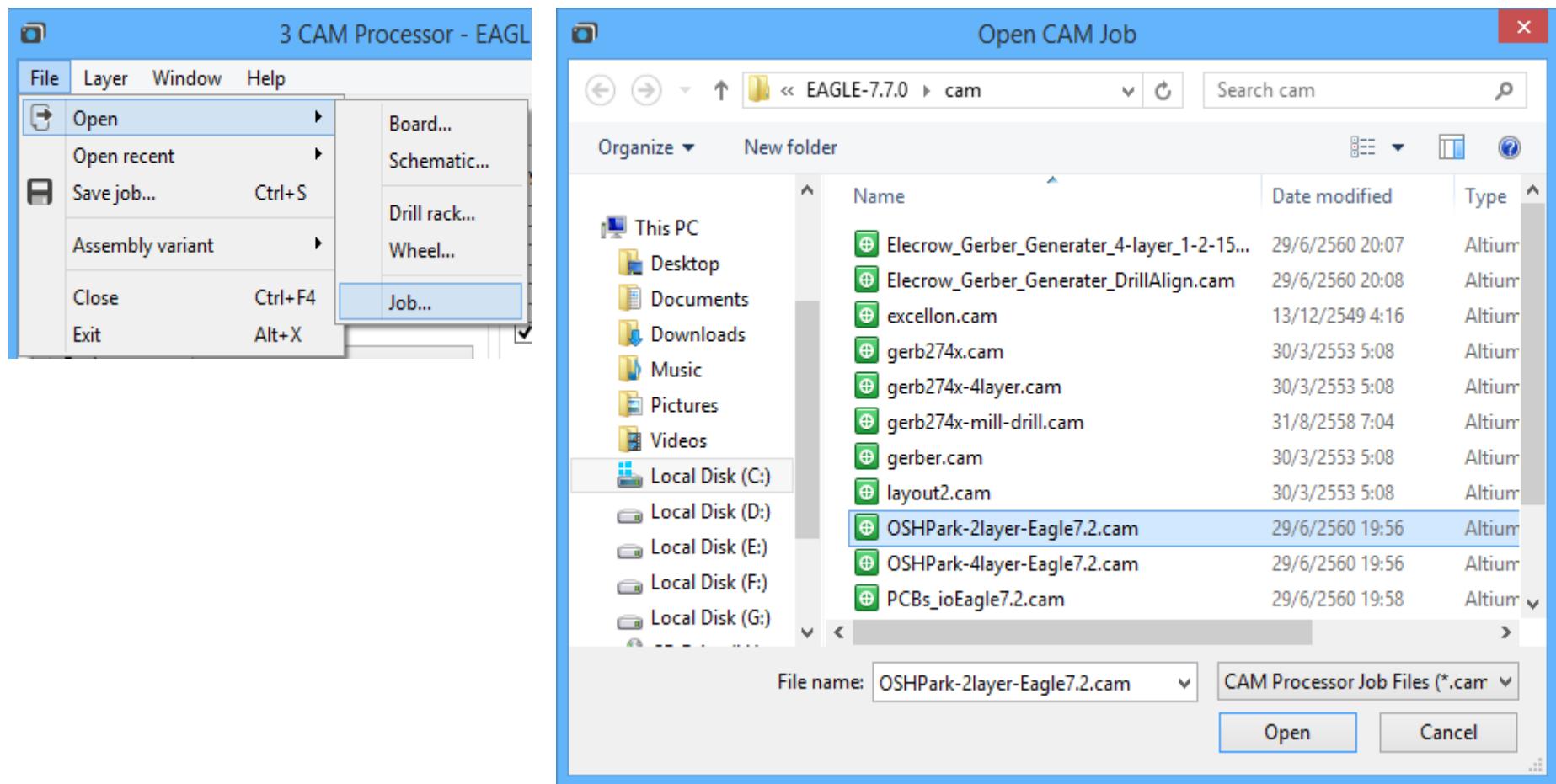


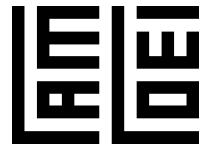
# คลิกปุ่ม CAM Processor





# File > Open > Job...





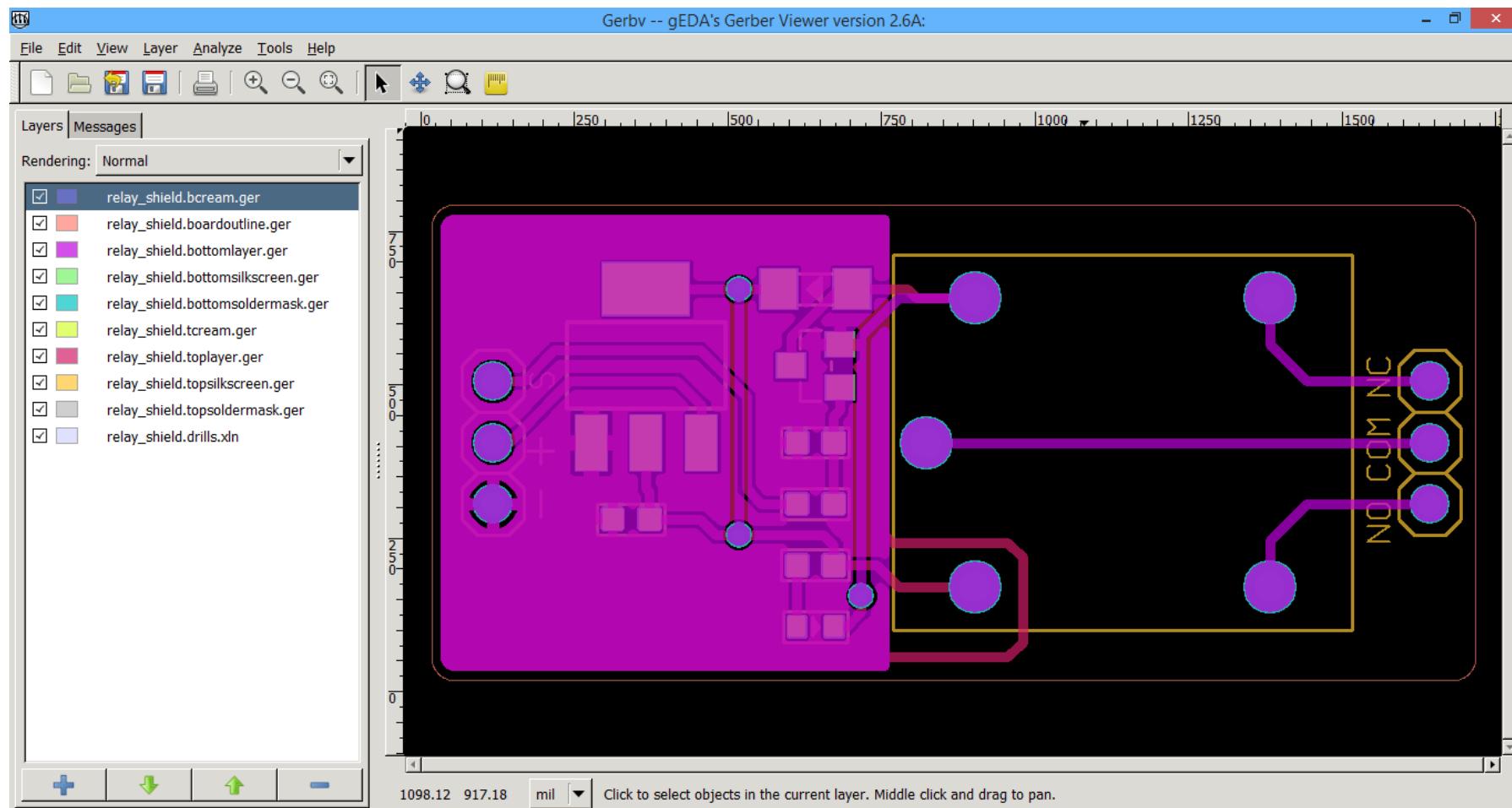
# CAM File

PC ▶ Documents ▶ eagle ▶ lab2-relay\_shield ▶ relay\_shield ▶ relay\_shield

Name	Date modified	Type	Size
relay_shield.bcream.ger	30/6/2560 19:58	GER File	1 KB
relay_shield.bcream.gpi	30/6/2560 19:58	GPI File	1 KB
relay_shield.boardoutline.ger	30/6/2560 19:58	GER File	5 KB
relay_shield.boardoutline.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.bottomlayer.ger	30/6/2560 19:58	GER File	1 KB
relay_shield.bottomlayer.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.bottomsilkscreen.ger	30/6/2560 19:58	GER File	1 KB
relay_shield.bottomsilkscreen.gpi	30/6/2560 19:58	GPI File	1 KB
relay_shield.bottomsoldermask.ger	30/6/2560 19:58	GER File	1 KB
relay_shield.bottomsoldermask.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.drills.dri	30/6/2560 19:58	DRI File	1 KB
relay_shield.drills.xln	30/6/2560 19:58	XLN File	1 KB
relay_shield.tcream.ger	30/6/2560 19:58	GER File	3 KB
relay_shield.tcream.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.toplayer.ger	30/6/2560 19:58	GER File	6 KB
relay_shield.toplayer.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.topsilkscreen.ger	30/6/2560 19:58	GER File	5 KB
relay_shield.topsilkscreen.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.topsoldermask.ger	30/6/2560 19:58	GER File	4 KB
relay_shield.topsoldermask.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.sch	30/6/2560 19:50	SCH File	52 KB
relay_shield.brd	30/6/2560 19:49	BRD File	41 KB
relay_shield.b#1	30/6/2560 19:43	B#1 File	40 KB
relay_shield.s#1	30/6/2560 19:29	S#1 File	123 KB
33.5 KB			

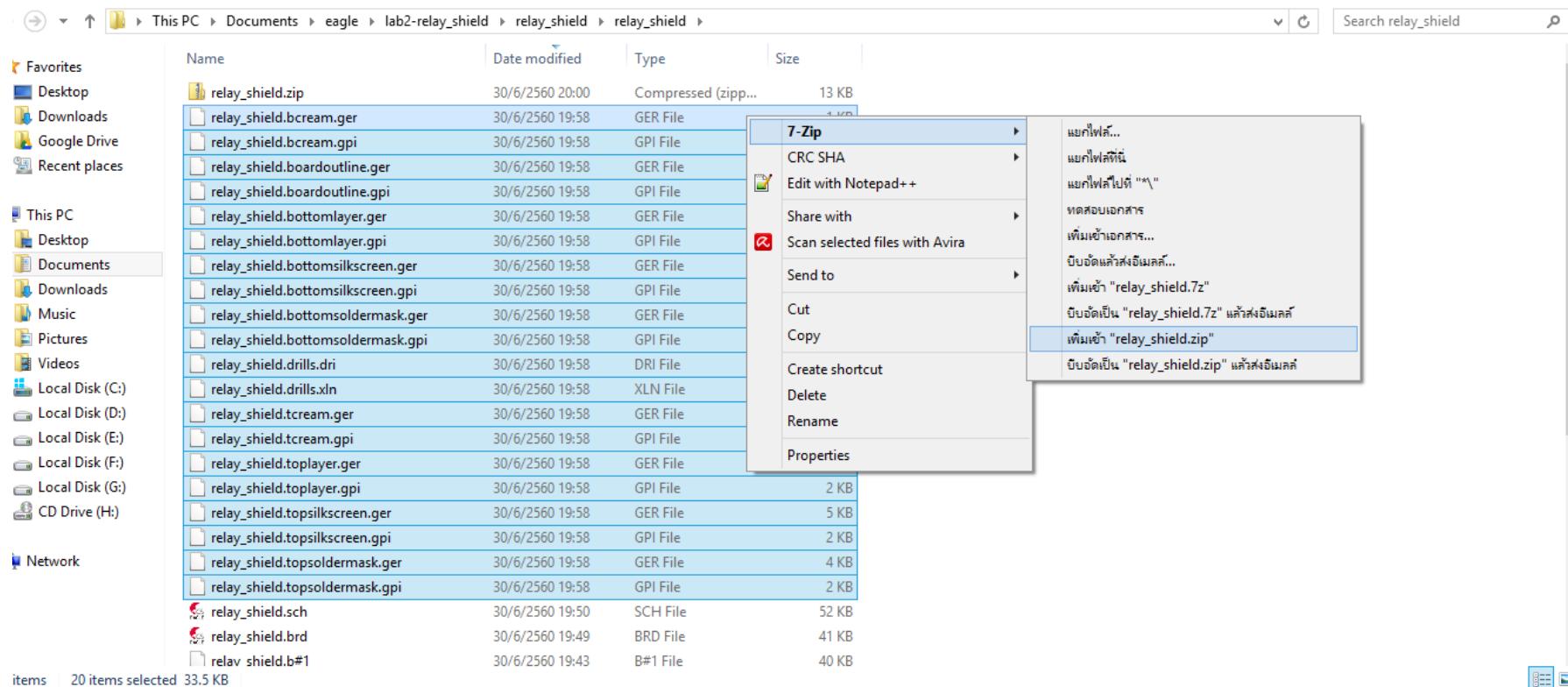


# ตรวจด้วย Gerbv



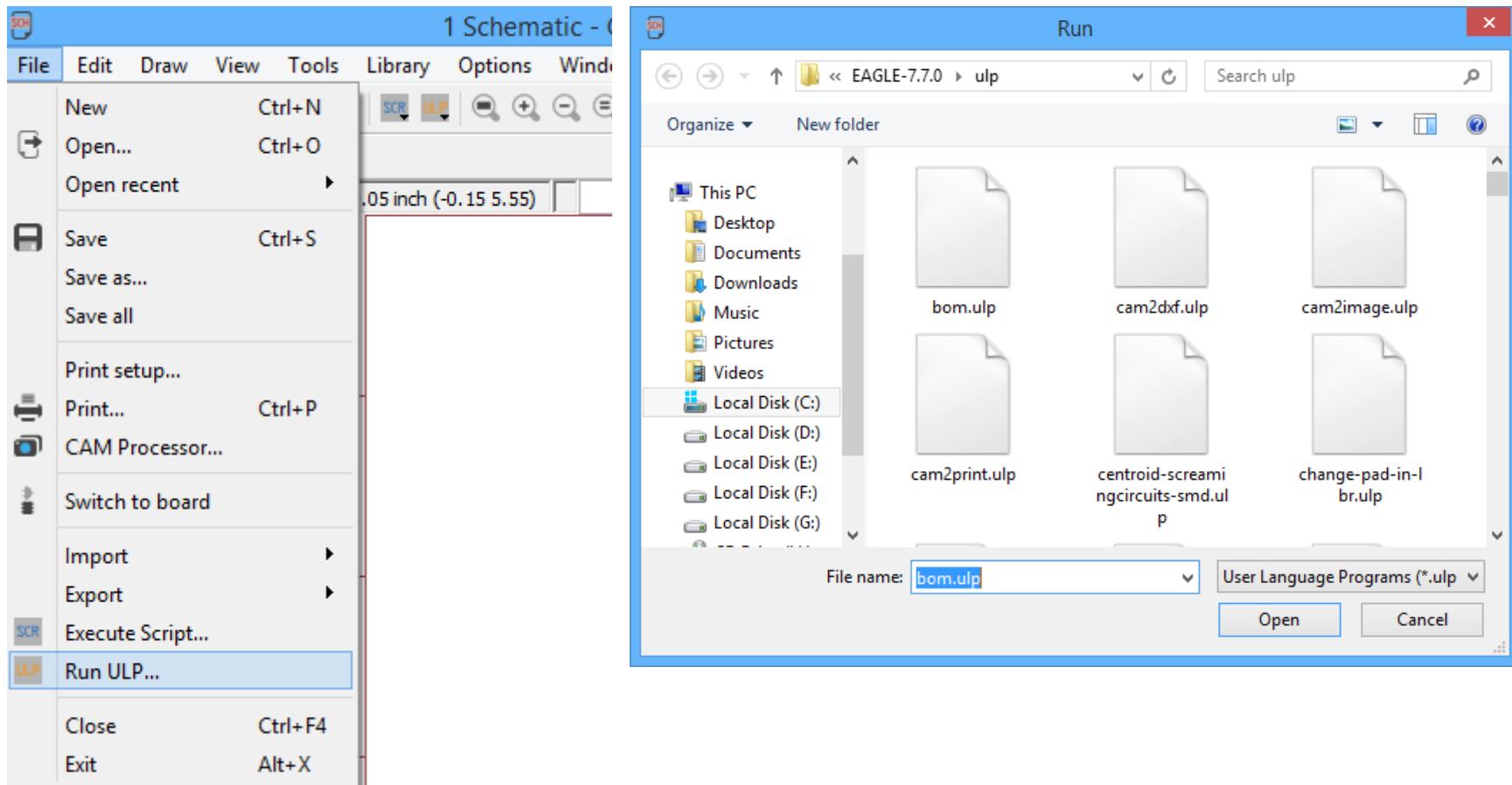


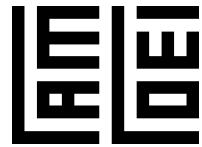
# Zip cam file





# Lab 11 BOM File





# เลือก CSV แล้ว Save

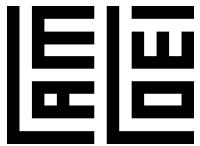
Eagle: Bill Of Material

Part	Value	Device	Package	Description	MPN	VALUE
C1	10UF 6.3V	CERAMIC-10UF-6.3V-20%-X5R(0603)	C0603	302010286	CC0603MRX5R5BB106	10UF 6.3V
D1	BLUE-0603	SMD-LED-CLEAR-BLUE(0603)	LED-0603	304090045	19-217-BHC-ZL1M2RY-3T	BLUE-0603
D2	1N4148	SMD-DIODE-SWITCH-1N4148(LL-34)	LL-34	304040016	1N4148	1N4148
JP1		PINHD-1X3	1X03		PIN HEADER	
JP2		PINHD-1X3	1X03		PIN HEADER	
K1		RELAY-HLS8L-DC5V-S-CHLS8L-DC5V-S-C	REY5-19.0X15.0X15.0MM	315030000		
Q1	S8050	SMD-TRANSISTORS-NPN-25V-500MW-S8050(SOT-23)	SOT-23	305010017	S8050	S8050
R1	470R	SMD-RES-470R-5%-1/10W(0603)	R0603	301010088	RC0603JR-07470RL	470R
R2	470R	SMD-RES-470R-5%-1/10W(0603)	R0603	301010088	RC0603JR-07470RL	470R

List type      Output format

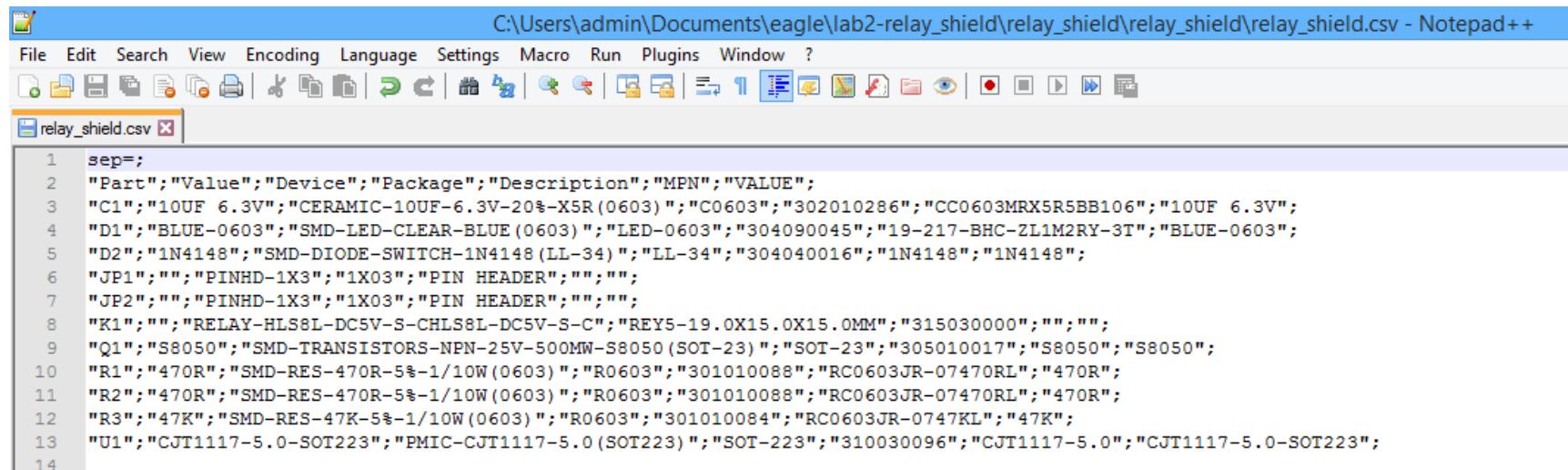
Parts       Text  
 Values       CSV  
 List attributes       HTML

View   Save...   Help   Close      Version 1.11

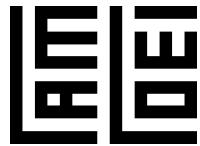


sep=;

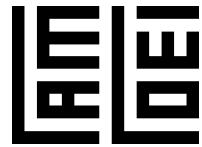
- เปิดไฟล์ csv ด้วย Notepad
- พิมพ์ sep=; ในบรรทัดแรก



```
C:\Users\admin\Documents\eagle\lab2-relay_shield\relay_shield\relay_shield.csv - Notepad++
File Edit Search View Encoding Language Settings Macro Run Plugins Window ?
relay_shield.csv x
1 sep=;
2 "Part";"Value";"Device";"Package";"Description";"MPN";"VALUE";
3 "C1";"10UF 6.3V";"CERAMIC-10UF-6.3V-20%-X5R (0603)";"C0603";"302010286";"CC0603MRX5R5BB106";"10UF 6.3V";
4 "D1";"BLUE-0603";"SMD-LED-CLEAR-BLUE (0603)";"LED-0603";"304090045";"19-217-BHC-ZL1M2RY-3T";"BLUE-0603";
5 "D2";"1N4148";"SMD-DIODE-SWITCH-1N4148 (LL-34)";"LL-34";"304040016";"1N4148";"1N4148";
6 "JP1";"";"PINHD-1X3";"1X03";"PIN HEADER";"";;
7 "JP2";"";"PINHD-1X3";"1X03";"PIN HEADER";"";;
8 "K1";"";"RELAY-HLS8L-DC5V-S-CHLS8L-DC5V-S-C";"REY5-19.0X15.0X15.0MM";"315030000";"";;
9 "Q1";"S8050";"SMD-TRANSISTORS-NPN-25V-500MW-S8050 (SOT-23)";"SOT-23";"305010017";"S8050";"S8050";
10 "R1";"470R";"SMD-RES-470R-5%-1/10W (0603)";"R0603";"301010088";"RC0603JR-07470RL";"470R";
11 "R2";"470R";"SMD-RES-470R-5%-1/10W (0603)";"R0603";"301010088";"RC0603JR-07470RL";"470R";
12 "R3";"47K";"SMD-RES-47K-5%-1/10W (0603)";"R0603";"301010084";"RC0603JR-0747KL";"47K";
13 "U1";"CJT1117-5.0-SOT223";"PMIC-CJT1117-5.0 (SOT223)";"SOT-223";"310030096";"CJT1117-5.0";"CJT1117-5.0-SOT223";
14
```



# เปิด CSV ด้วย Excel



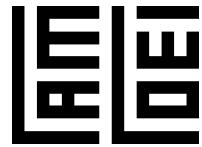
# Lab12 เปิด bom template

The screenshot shows two Excel spreadsheets side-by-side. The left spreadsheet, titled 'bom.xlsx', has a header row with 'Name' in bold. Below it, there are 12 rows of data with columns for 'Item', 'Quantity', 'Reference', and 'Part'. The right spreadsheet, titled 'relay\_shield.csv', has a header row with 'Part', 'Value', 'Device', 'Package', 'Description', 'MPN', and 'VALUE'. It contains 12 rows of component details. A red circle highlights the status bar at the bottom of the screen, which displays 'ค่าเฉลี่ย: 1.222222222 จำนวน: 9 ผลรวม: 11'.

Name			
Item	Quantity	Reference	Part
1	1	C1	
2	1	D1	
3	1	D2	
4	2	JP1, JP2	
5	1	K1	
6	1	Q1	
7	2	R1, R2	
8	1	R3	
9	1	U1	
13			+/-
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

A	B	C	D	E	F	G
1	Part	Value	Device	Package	Description	MPN
2	C1	10UF	6.3V CERAMIC	-C0603	3.02E+08	CC0603MR10UF 6.3V
3	D1	BLUE-0603	SMD-LED-C	LED-0603	3.04E+08	19-217-BH BLUE-0603
4	D2	1N4148	SMD-DIODE	LL-34	3.04E+08	1N4148 1N4148
5	JP1		PINHD-1X	1X03	PIN HEADER	
6	JP2		PINHD-1X	1X03	PIN HEADER	
7	K1		RELAY-HL	REY5-19.0	3.15E+08	
8	Q1	S8050	SMD-TRANSISTOR	-23	3.05E+08	S8050 S8050
9	R1	470R	SMD-RESISTOR	-R0603	3.01E+08	RC0603JR-470R
10	R2	470R	SMD-RESISTOR	-R0603	3.01E+08	RC0603JR-470R
11	R3	47K	SMD-RESISTOR	-R0603	3.01E+08	RC0603JR-47K
12	U1	CJT1117-5PMIC-CJT1	SOT-223		3.1E+08	CJT1117-5 CJT1117-5-S
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						

ค่าเฉลี่ย: 1.222222222 จำนวน: 9 ผลรวม: 11



# Lab13 ค้นหา bom

Contact Mouser (Bangkok) +66 2694-2310 | [Feedback](#)

 MOUSER  
ELECTRONICS.

All ▾ Part No. / Keyword

Stocked  RoHS Compliant

Products Manufacturers Applications Services & Tools Catalogue Help

All Products > Passive Components > Capacitors > MLCCs > Multilayer Ceramic Capacitors MLCC - SMD/SMT > Murata Electronics GRM188R60J106ME47J

[See an Error?](#)

  
[Enlarge](#)

Mouser Part No: 81-GRM188R60J106ME7J  
Manufacturer Part No: GRM188R60J106ME47J  
Manufacturer: [Murata Electronics](#)  
Description: Multilayer Ceramic Capacitors MLCC - SMD/SMT 10uF 6.3Volts 20%

Learn more about Murata Electronics  
GRM188R60J106ME47J

[GRM188R60J106ME47J Datasheet](#)

Images are for reference only  
See Product Specifications

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**Real Time Availability**

Stock:	65,396 Can Dispatch Immediately
On Order:	20000 <a href="#">View Delivery Dates</a>
Factory Lead Time: 37 Weeks	

**Enter Quantity:**  
 [Buy](#) Minimum: 1 Multiples: 1  
[This Product Ships FREE](#)

Select Packaging Option Below

**Specifications** **Features** **Documents (1)** **My Notes**

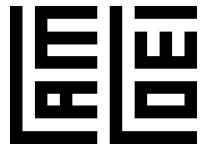
Product Category:	Multilayer Ceramic Capacitors MLCC - SMD/SMT	<input checked="" type="checkbox"/>
Manufacturer:	Murata	<input type="checkbox"/>
RoHS:	 <a href="#">Details</a>	<input type="checkbox"/>
Series:	GRM	<input type="checkbox"/>
Capacitance:	10 uF	<input type="checkbox"/>
Voltage Rating DC:	6.3 VDC	<input type="checkbox"/>
Dielectric:	X5R	<input type="checkbox"/>
Tolerance:	20 %	<input type="checkbox"/>
Case Code - in:	0603	<input type="checkbox"/>
Case Code - mm:	1608	<input type="checkbox"/>
Height:	0.8 mm	<input type="checkbox"/>

**Pricing (USD)**

Cut Tape  
1: \$0.15  
10: \$0.105  
100: \$0.049  
500: \$0.035  
1,000: \$0.028  
2,500: \$0.024

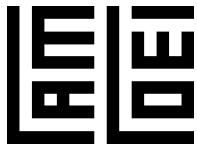
MouseReel™ Reel Service Fee  
\$7.00 Price will be calculated in basket.

Full Reels of 10000  
To purchase full reel, order in multiples of 10000:



# Bom.xlsx

A	B	C	D	E	F	G	H	I
1		Relay Module		v1.0	2/9/2560			
Item	Quantity	Reference	Part	Footprint	Mfg	Mfg P/N	Vendor	Vendor P/N
1	1	C1	Ceramic Capacitors MLCC - SMD/SMT 10uF 6.3Volts 20%	0603	Murata Electronics	GRM188R60J106ME47J	Mouser	81-GRM188R60J106
2	1	D1	SMD Blue Clear 470nm	0603	Lite-On	LTST-C190TBKT	Mouser	859-LTST-C190
3	1	D2	General Purpose, Power, Switching 100V Io/200mA T/R	LL-34	Fairchild Semiconductor	FDLL4148	Mouser	512-FDL
4	2	JP1, JP2						
5	1	K1	Relays Power PCB Relay SPDT Sealed 5VDC	SPDT (1 Form C)	Omron	G5LE-14-DC5	Mouser	653-G5LE-14
6	1	Q1	Bipolar Transistors - BJT 625mW, 25V, 1500mA	SOT-23-3	Micro Commercial Components (MCC)	MMSS8050-L-TP	Mouser	833-MMSS8050
7	2	R1, R2	SMD 470 OHM 1%	0603	Yageo	RC0603FR-07470RL	Mouser	603-RC0603FR-074
8	1	R3	SMD 47K OHM 1%	0603	Yageo	RC0201FR-0747KL	Mouser	603-RC0201FR-074
9	1	U1	LDO Voltage Regulators 5.0V 1A Positive	SOT-223-3	ON Semiconductor	NCP1117ST50T3G	Mouser	863-NCP1117ST5

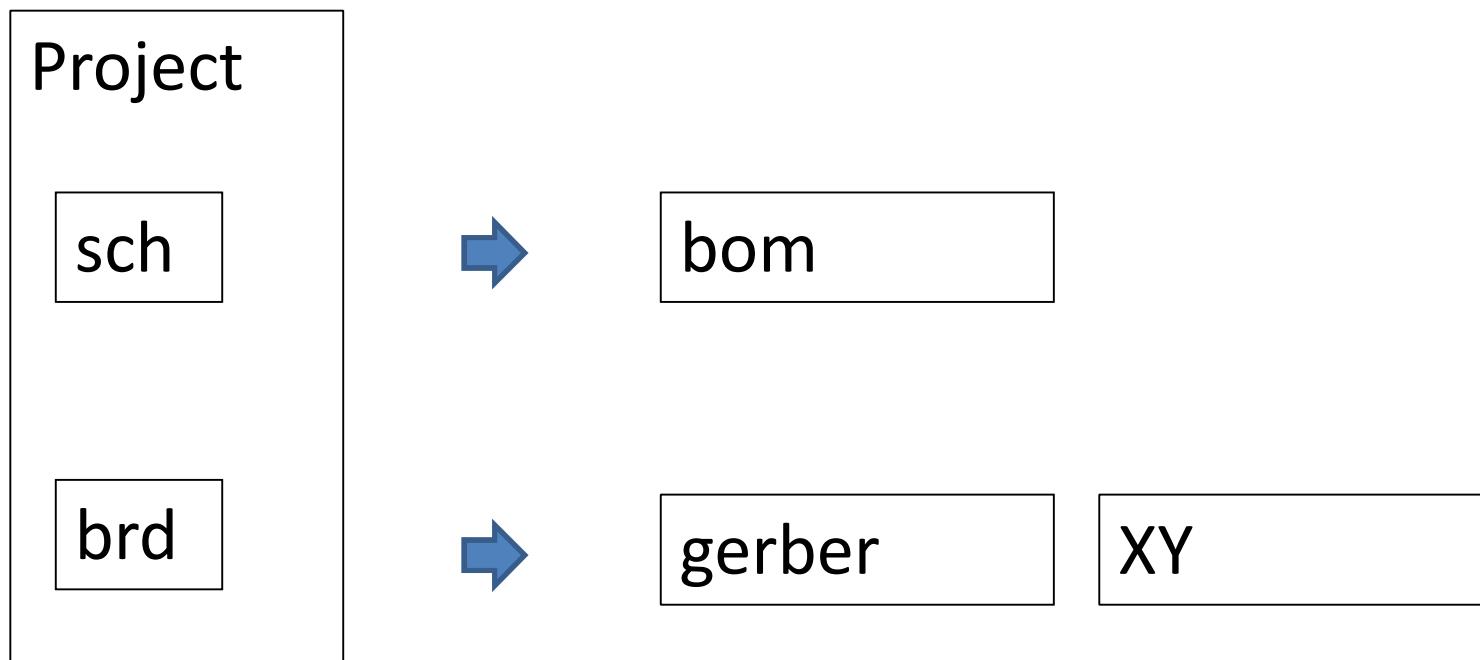


# Board > File > run ulp... > mount.ulp

1uf	288	1288	180 C1
100nf	350	1275	180 C2
100nf	400	1275	180 C3
100nf	450	1275	180 C4
100nf	125	1438	180 C5
100nf	175	1438	180 C6
1uf	250	1438	180 C7
100nf	125	1606	0 C8
100nf	550	1638	180 C9
100nf	516	1731	180 C10
100nf	584	1731	180 C11
100nf	125	1800	180 C12
47PF	275	2025	180 C13
47PF	425	2025	180 C14
500mA	588	2125	90 F1
	50	1500	270 J1
	650	1500	270 J2
	350	1000	90 J3
	350	1000	90 J4
B3U-1000P	125	2025	0 K1
B3U-1000P	575	2025	180 K2
	556	1862	270 LED1
12K	175	1275	0 R1
12K	225	1275	0 R2



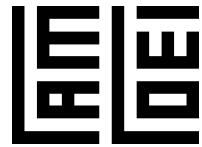
# สรุป



sch กับ brd ต้องเป็นชื่อเดียวกัน



ปอร์ดมีขนาดเล็ก?

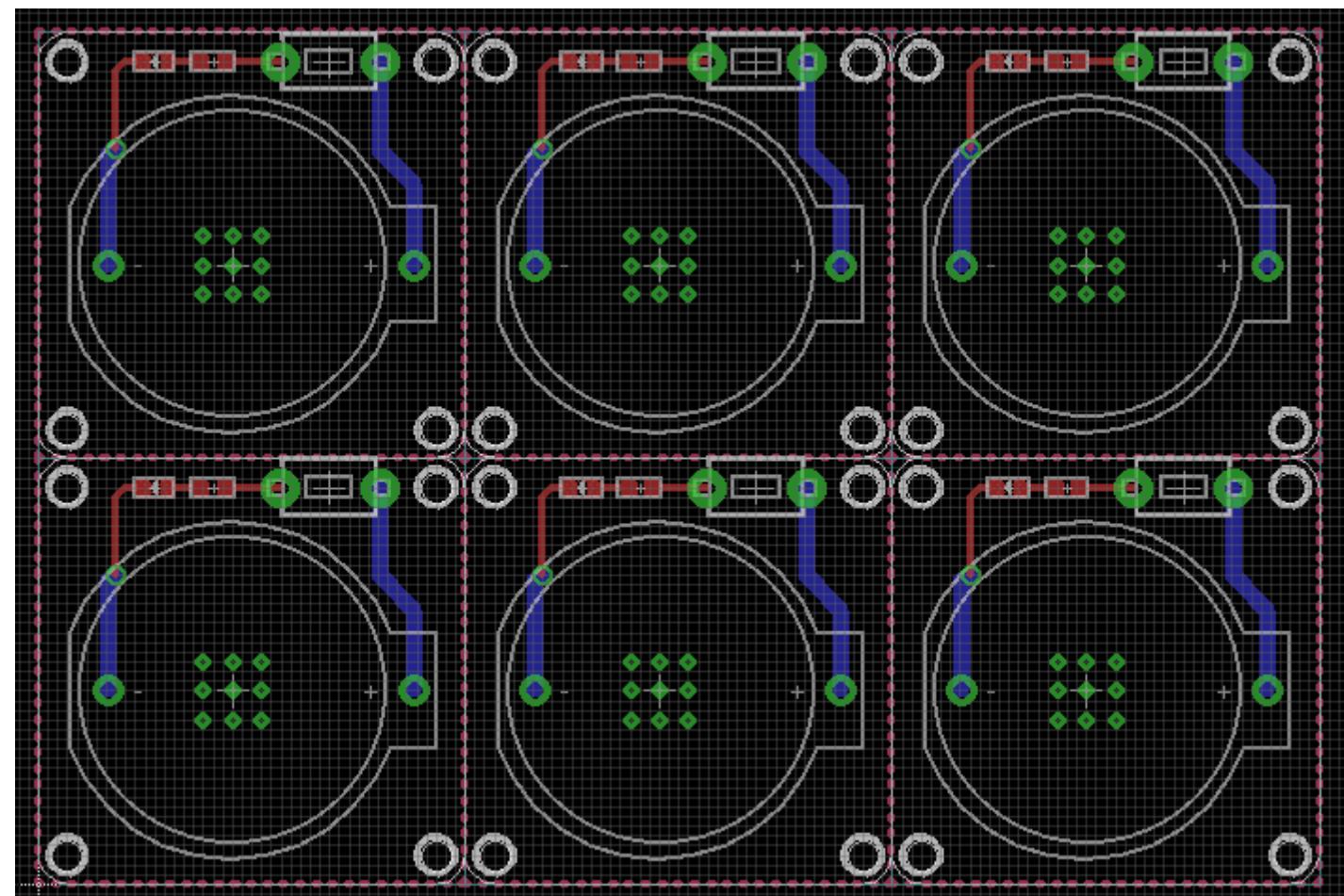


File > New

Edit > Paste

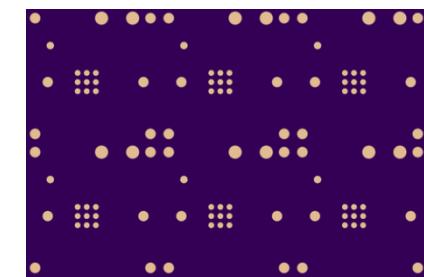
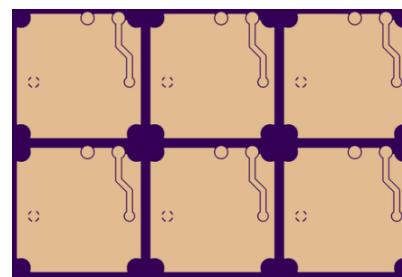
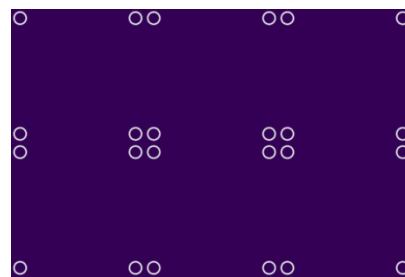
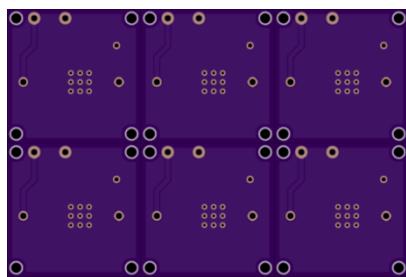
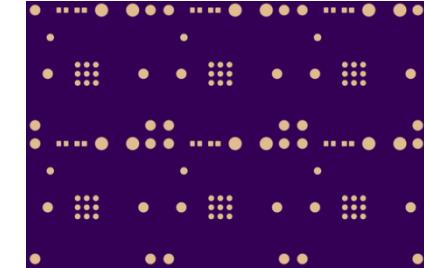
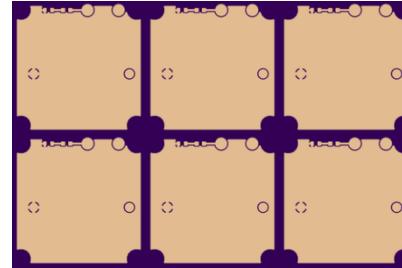
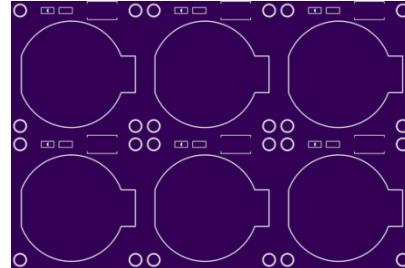
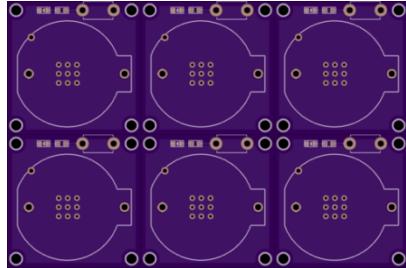
Wire > layer 46 width: 0 เพื่อแบ่งช่อง

แล้วบันทึก switch2032-panel.brd

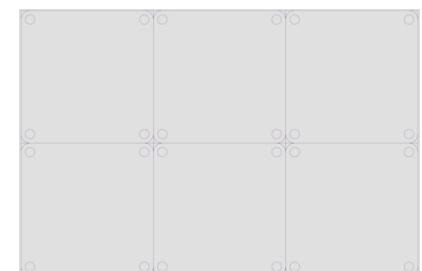
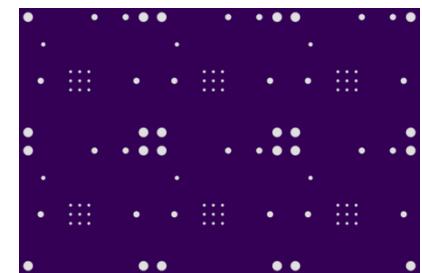




สร้าง gerber ใหม่



ให้คำนวณ cost ของ panel



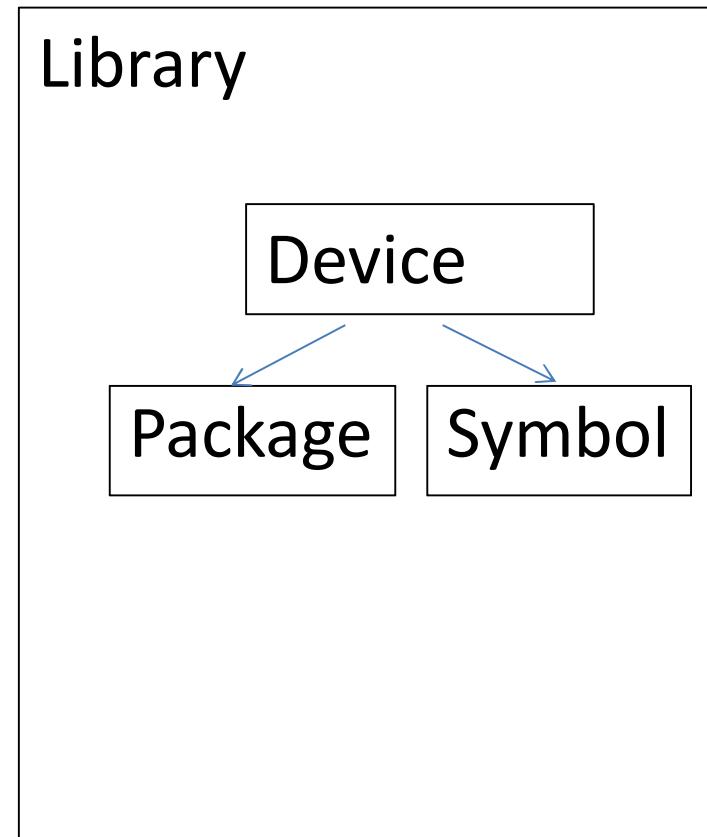


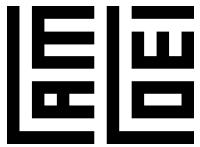
อุปกรณ์ใหม่ ไม่มีสายทองแดง?



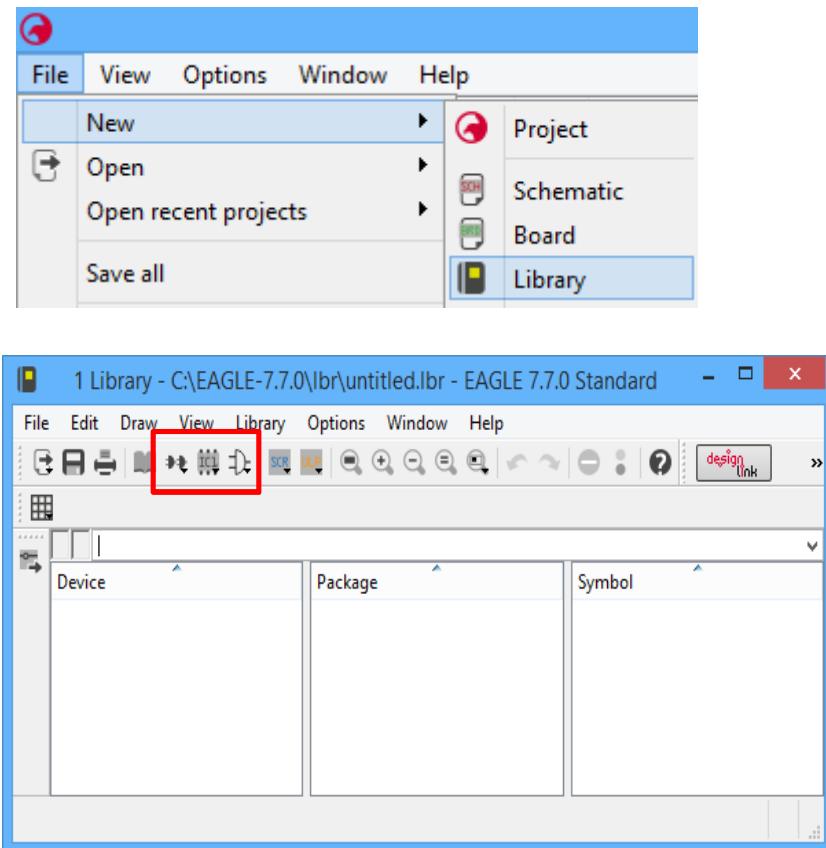
# Library

- Device > Lib
- Package > Brd
- Symbol > Sch





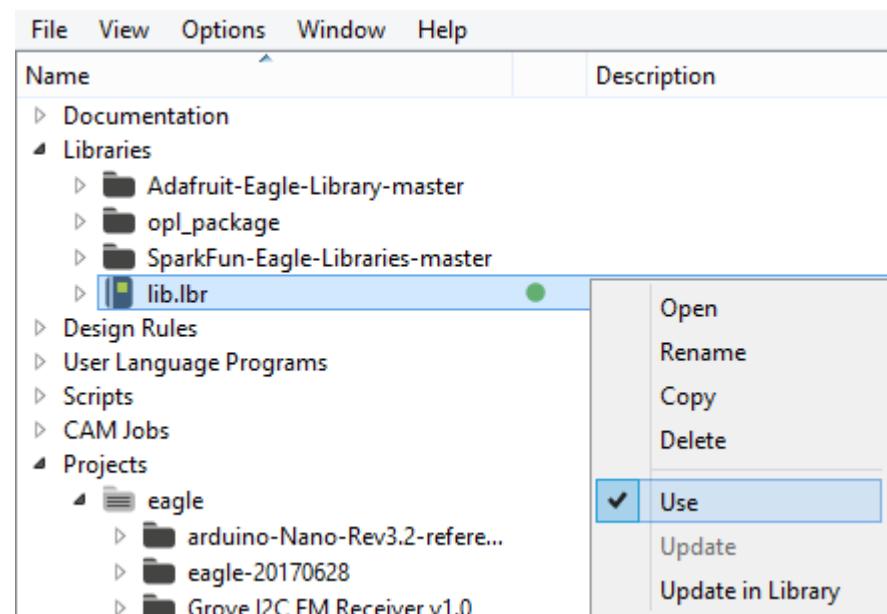
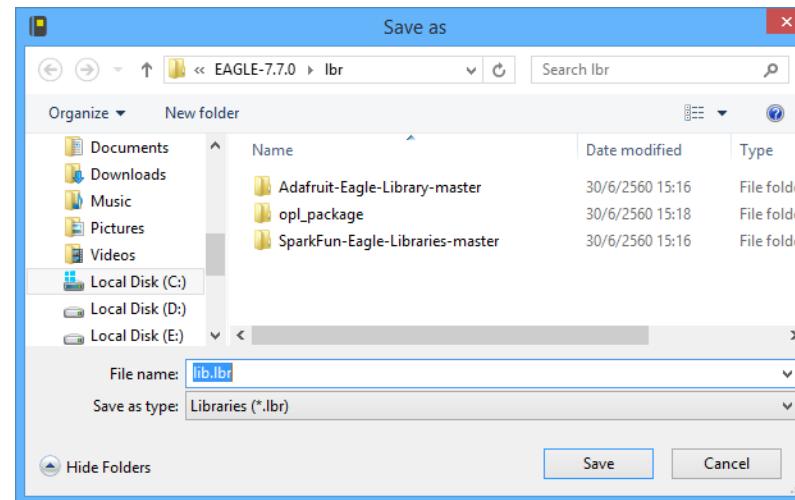
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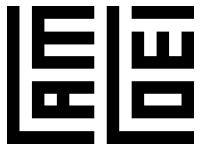


สร้าง library ใหม่

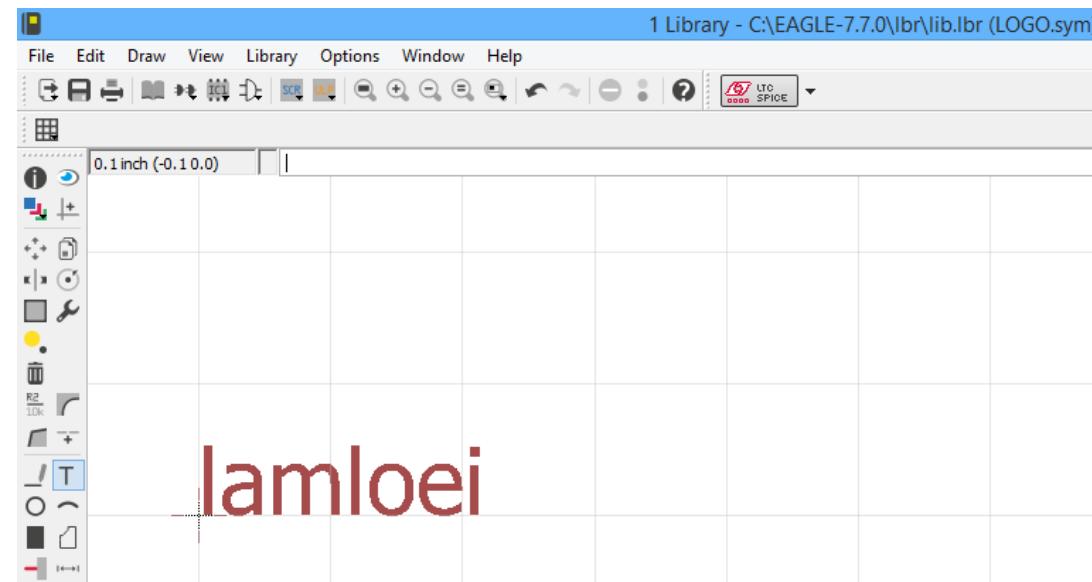
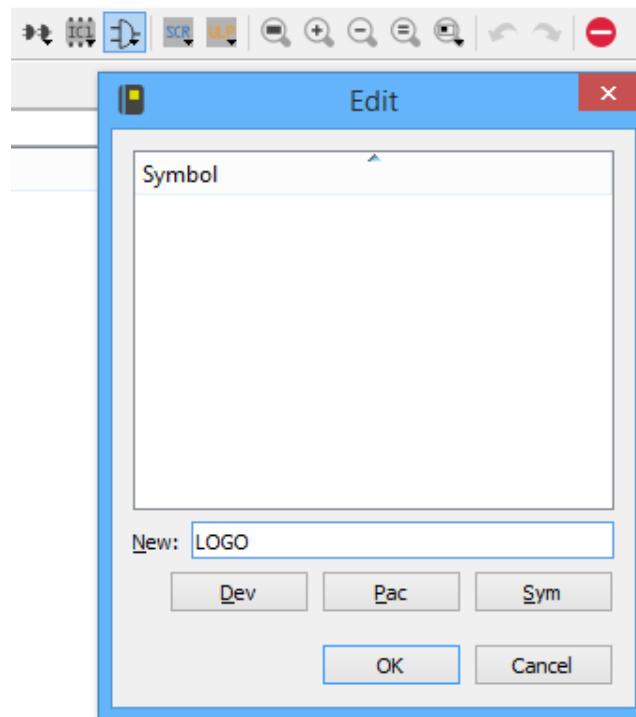
แล้วบันทึก

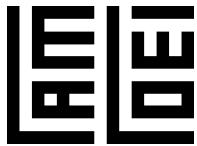
คลิกขวา Use



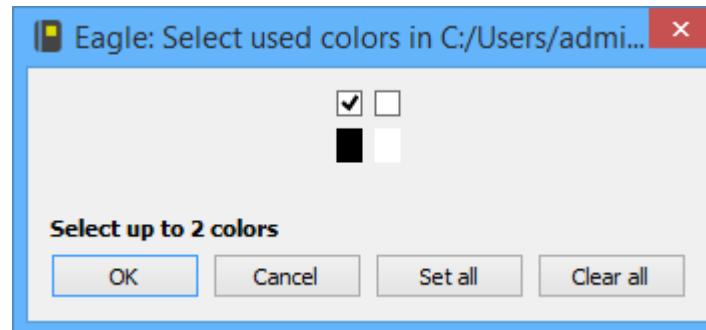
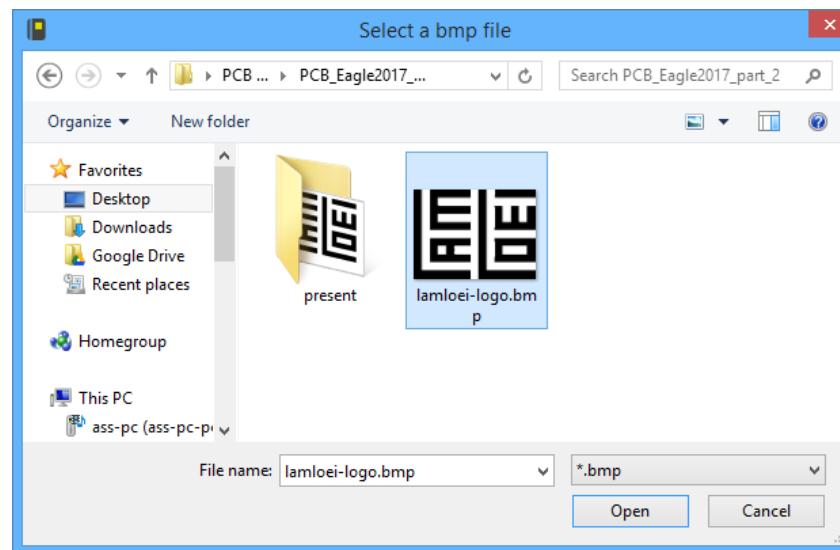
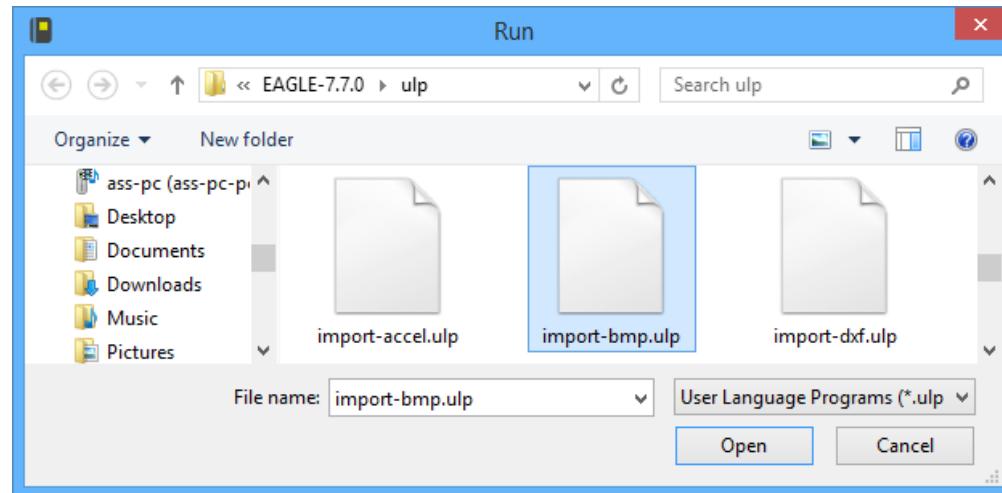
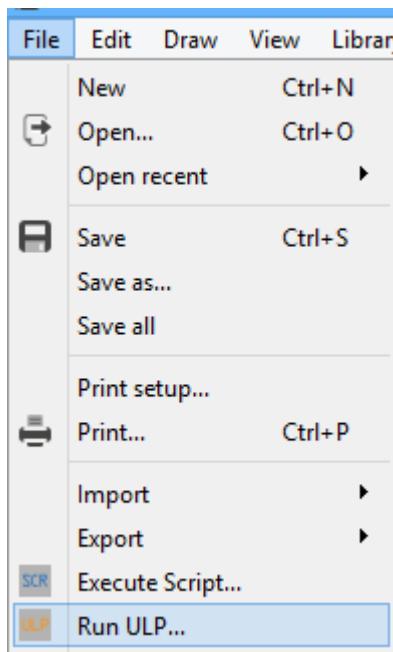
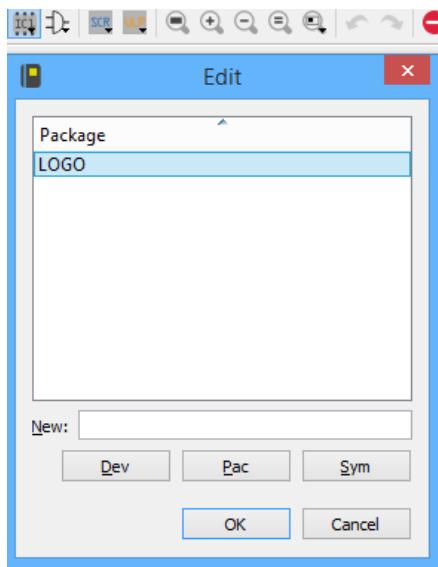


# New Symbol



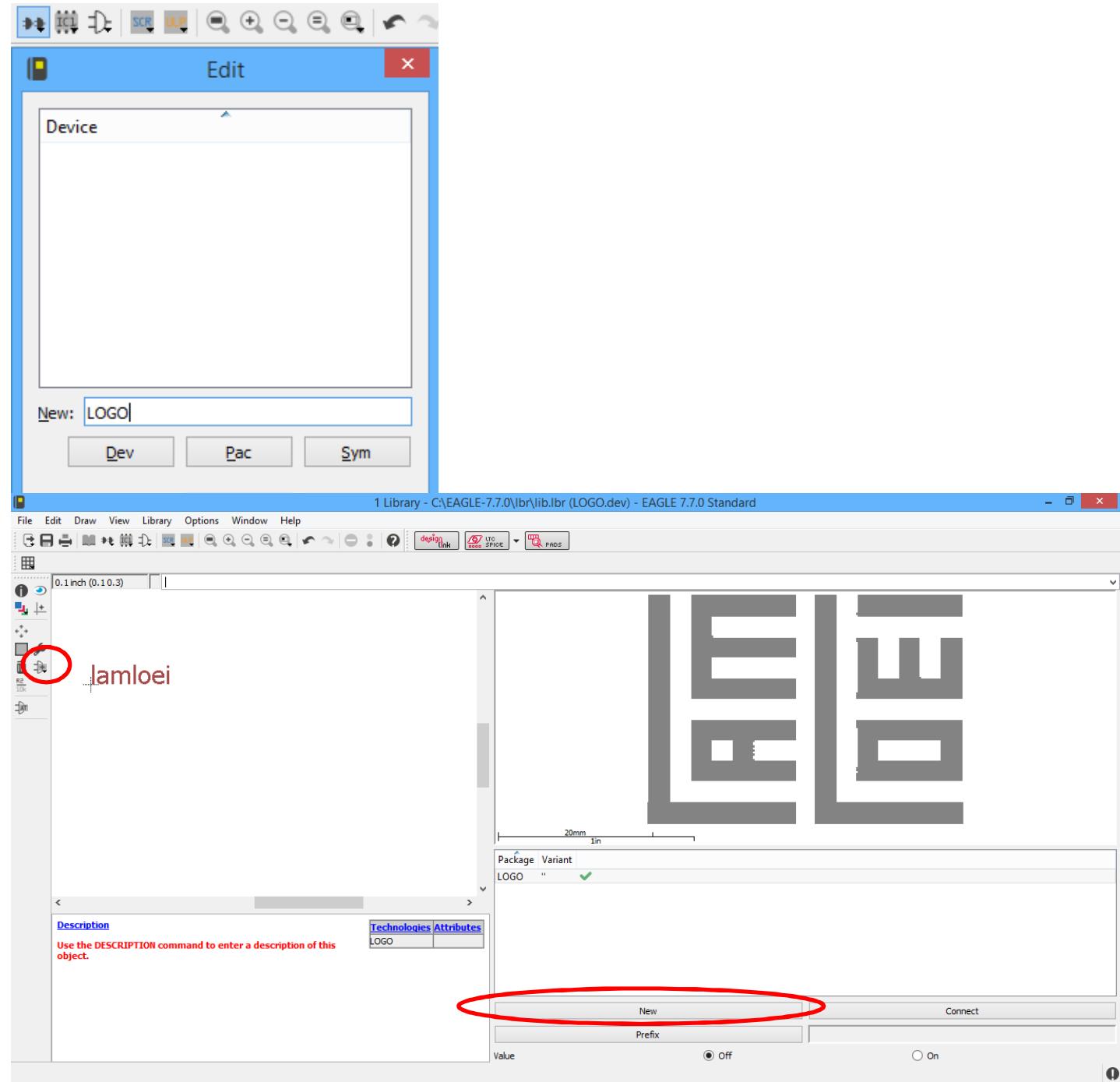


# New Package





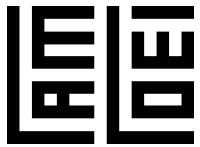
## New Device



แล้วบันทึก

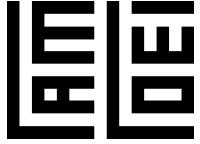


ปรับแต่งขั้นสูง?

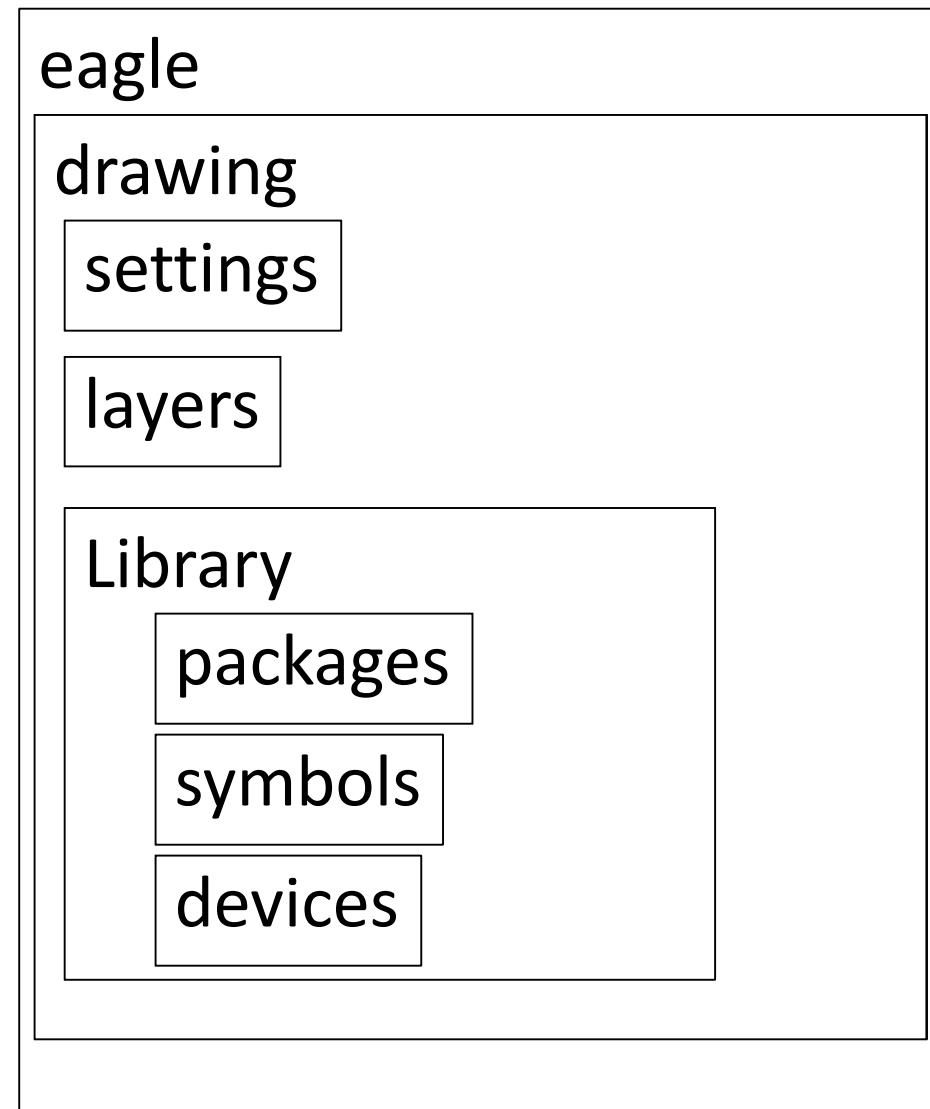


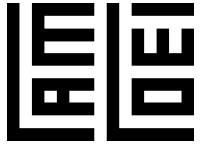
# Lab6 xml

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2   <!DOCTYPE eagle SYSTEM "eagle.dtd">
3   <eagle version="6.4">
4     <drawing>
5       <settings>
6         <setting alwaysvectorfont="no"/>
7         <setting verticaltext="up"/>
8       </settings>
9       <grid distance="50" unitdist="mil" unit="mil" style="lines" multiple="1" display="yes"
10      <layers>
168     <library>
169       <packages>
170         <package name="REY5-19.0X15.0X15.0MM">
184       </packages>
185       <symbols>
186         <symbol name="RELAY-HLS8L-DC5V-S-C">
209       </symbols>
210       <devicesets>
211         <deviceset name="RELAY-HLS8L-DC3V-S-C(5P-19X15MM)" prefix="K" uservalue="yes">
234         <deviceset name="RELAY-HLS8L-DC5V-S-C" prefix="K" uservalue="yes">
254       </devicesets>
255     </library>
256   </drawing>
257 </eagle>
```



# โครงสร้าง xml ของ library





Q & A

