ΓAM
ΓOEI

เอกสารประกอบการบรรยาย

ดาวน์โหลดได้ที่

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

ติดตามได้ที่

https://www.facebook.com/lamloeicom

PCB Eagle (บรรยาย)

- 2.30 ชั่วโมง

Lamloei ทำเกี่ยวกับอะไร?

PCB/AC Form Factory

เอกสารกำกับโรงงาน PCB PCBA PCBC

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

PCB/AC คืออะไร?

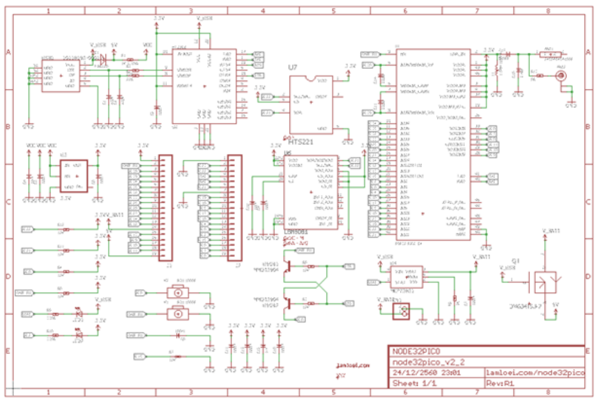
PCB (Printed Circuit Board) - แผ่นลายทองแดง

PCBA (Printed Circuit Board Assembly) – แผ่นลายทองแดงที่บัดกรีอุปกรณ์แล้ว

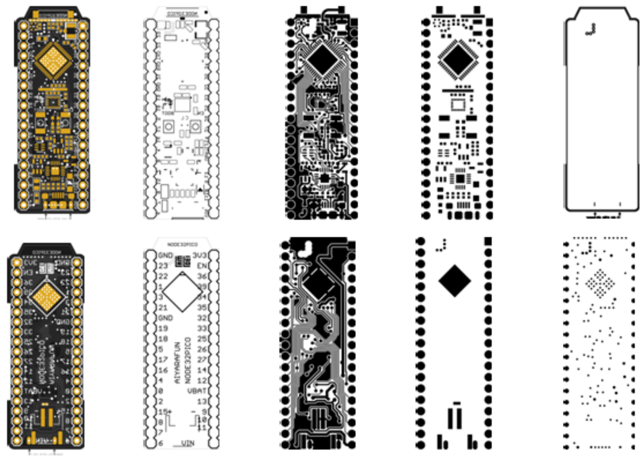
***PCBC** (Printed Circuit Board Casing) – กล่องใส่บอร์ด อะคริลิค

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

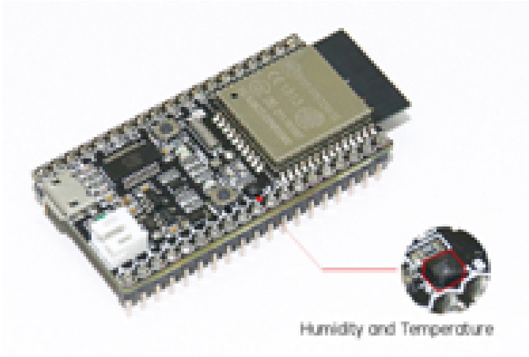
	Node32Pico		v2.2	24/12/2017		
Item	**Quantity**	**Reference**	**Part**	**Footprint**	**Mfg**	**Mfg P/N**	**Vendor**
1	1	ANT1	ANTENNA CHIP UWB 2.3 - 2.7 GHZ		Johanson	2500AT44M0400E	Mouser
2	1	ANT2	U.FL				
3	2	C1, C2	CAP CER 47PF 50V COG 2%	0402	Murata	GRM1555C1H470GA01D	Mouser
4	9	C3, C5, C6, C7, C8, C9, C11, C12, C16	CAP CER 0.1UF 16V X7R	0402	Murata	GRM155R71C104KA88D	Mouser

BOM

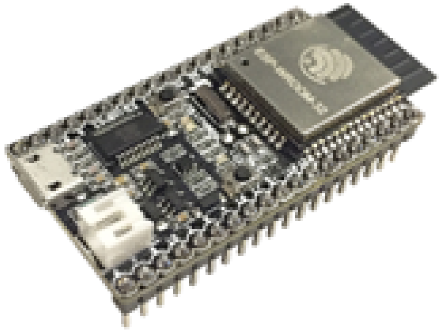
(OTHER)

ทำเป็นสินค้า

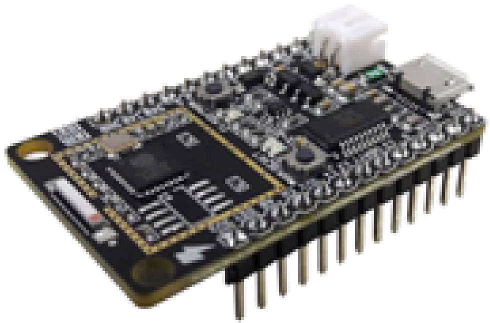
Node32Pico



Node32s Plus



Node32s



NodeWiFi

ตามสไตล์ Maker คืออะไร?

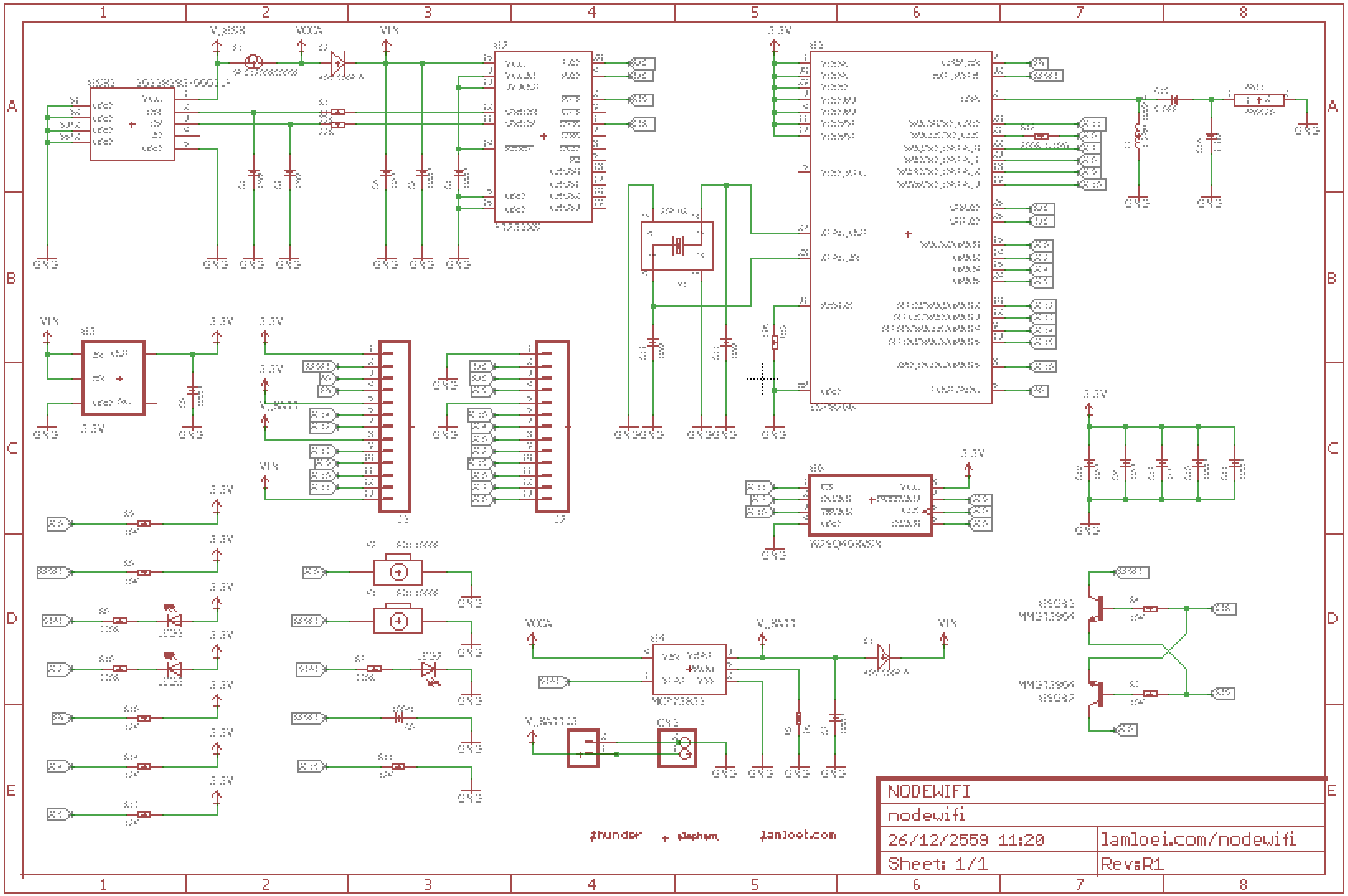
ผู้ประดิษฐ์ผลิตภัณฑ์ ตอบโจทย์ตัวเอง

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

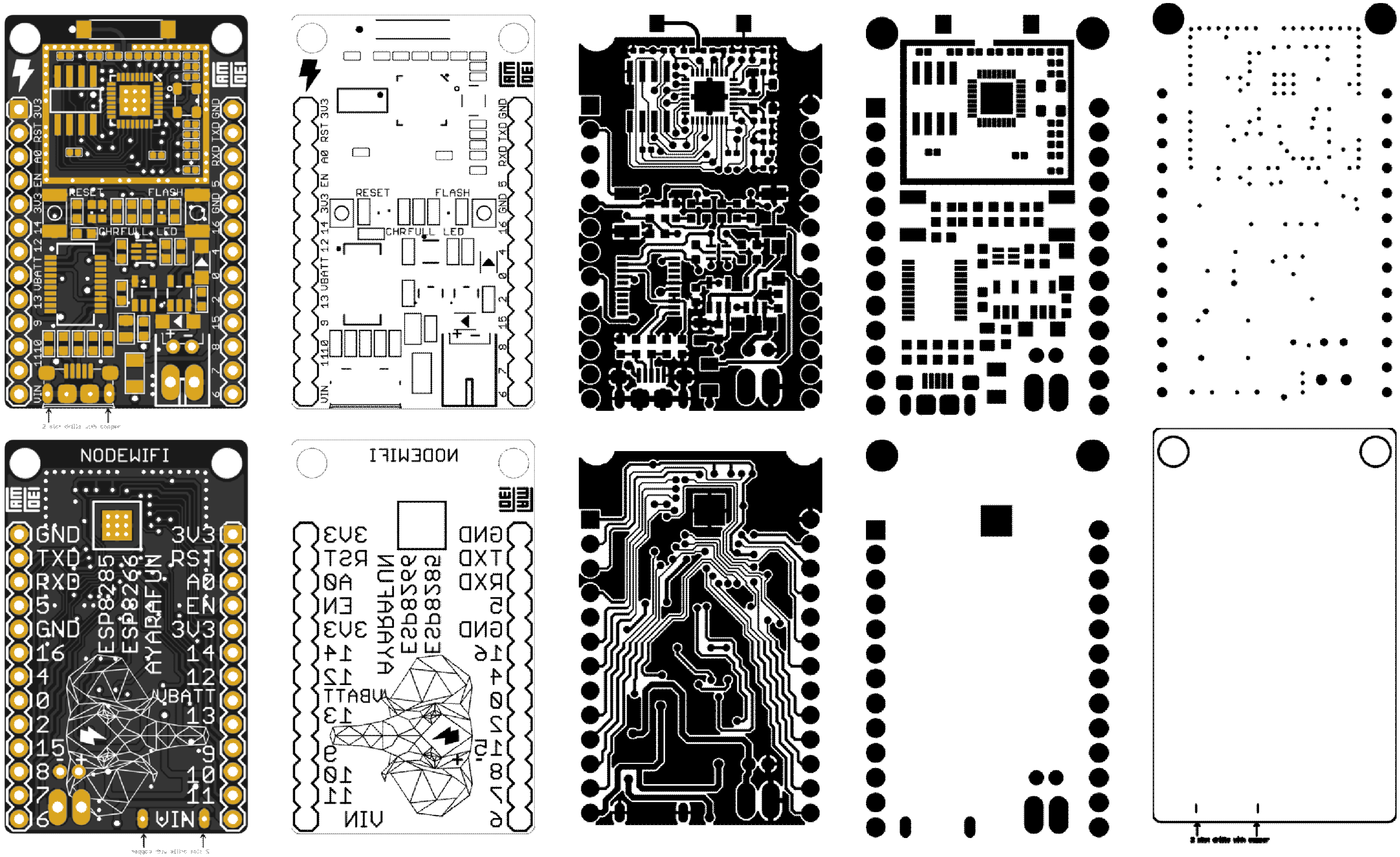
เอกสารกำกับโรงงาน PCBA ?

เอกสารสั่งโรงงานให้กระทำ หรือไม่กระทำ
ตามแบบที่คุณกำหนด

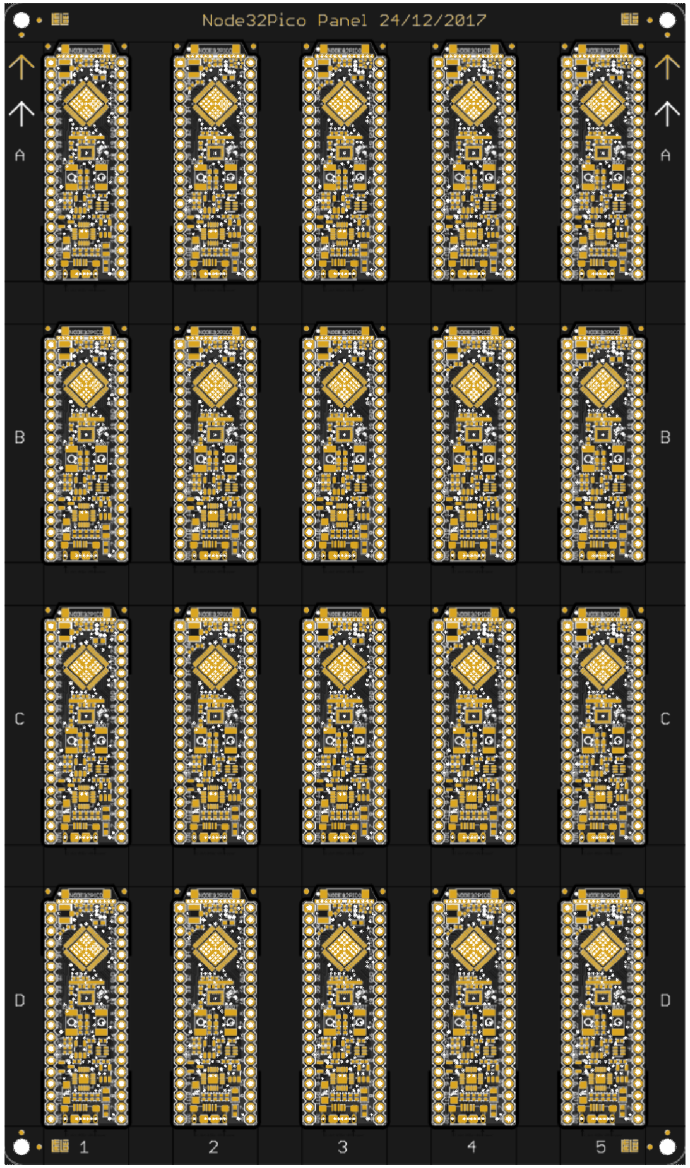
(NodeWiFi Schematic)



NodeWiFi Gerber

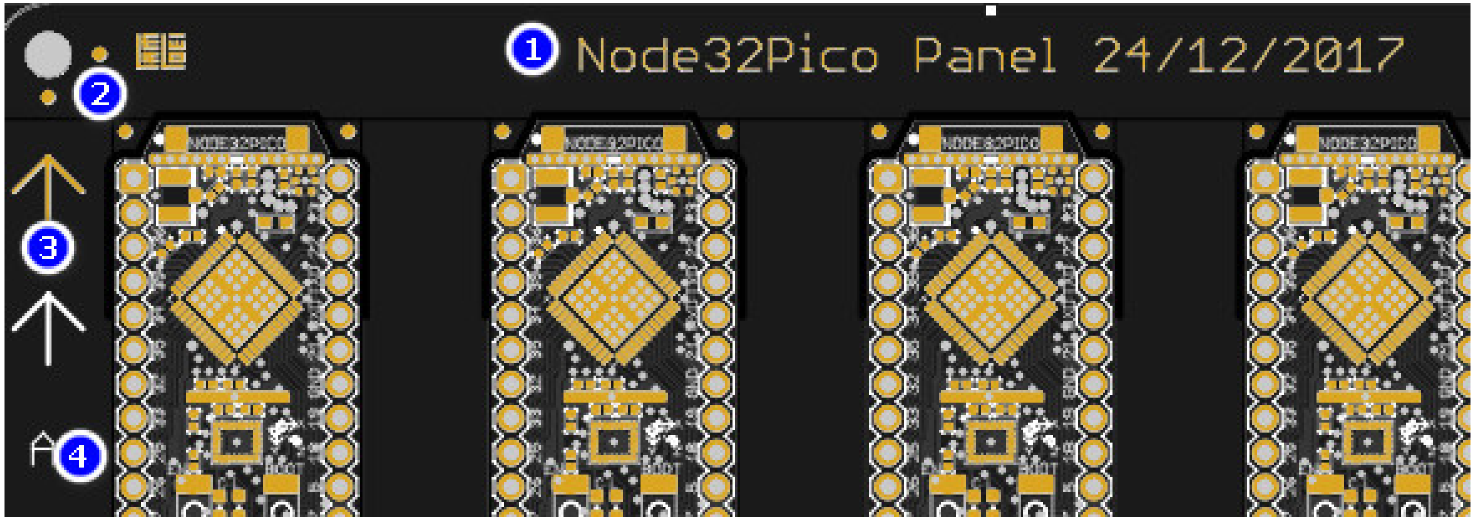


Node32Pico Gerber Panel



ขนาดประมาณ A4, A3

Node32Pico Gerber Panel



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

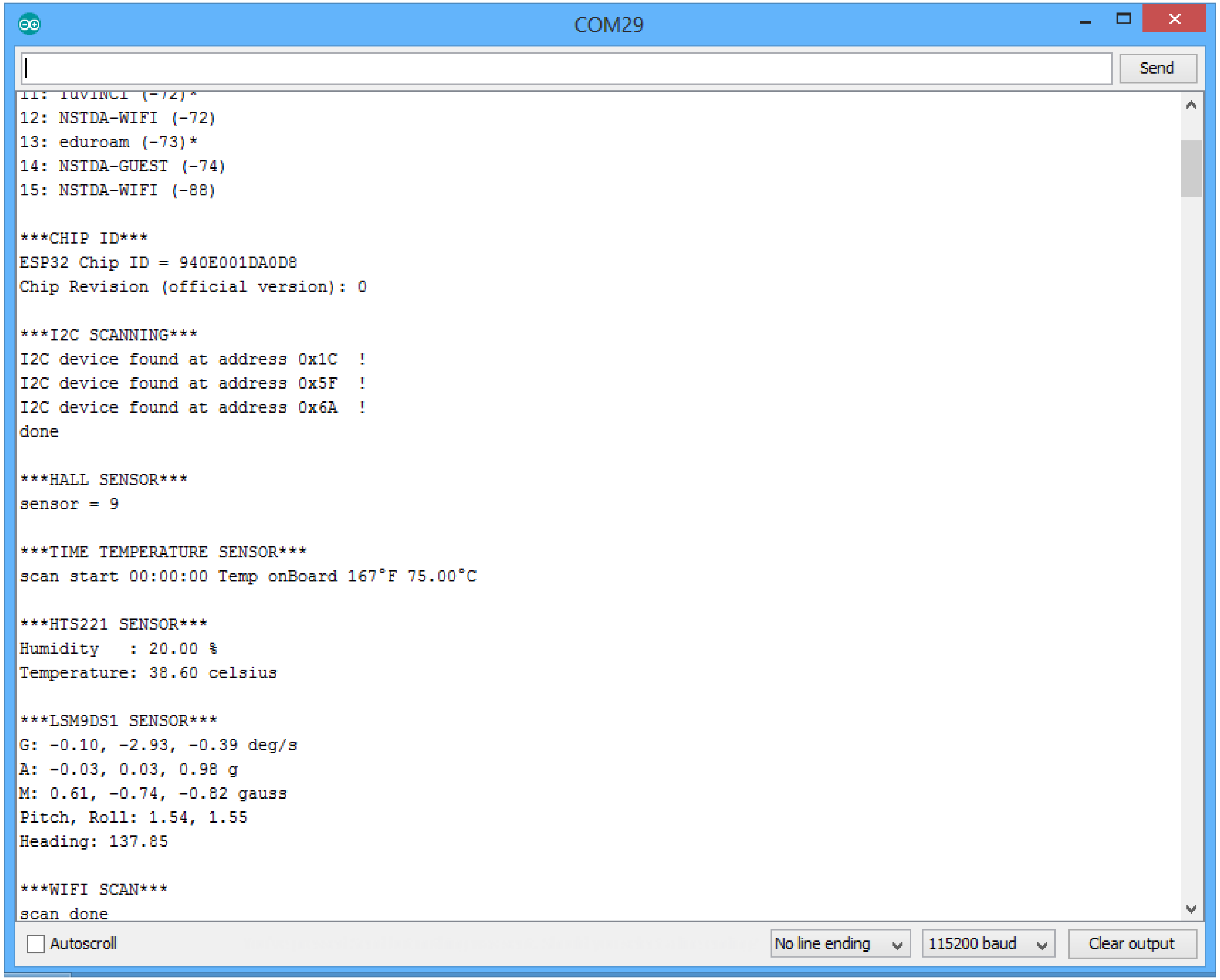
NodeWiFi BOM

		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	GRM155C80J106ME11D	Mouser	81-GRM155C80J106ME1D		
6	2	C11, C12	CAP CER 9PF 50V NP0	0402	Murata	GRM1555C1H9R0DA01D	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 NP0	0402	Murata	GRM1555C1H2R4BA01D	Mouser	81-GRM1555C1H2R4BA1D	PT088	
9	1	C15	CAP CER 6.8PF 50V NP0	0402	Murata	GRM1555C1H6R8CA01D	Mouser	81-GRM1555C1H6R8CA1D	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 RESTTBLE 0.25A 24V CHIP	1206	Bel Fuse	0ZCJ0025AF2E	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 0.0OHM 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



ค่าใช้จ่าย? โดยประมาณ

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

ค่าใช้จ่าย? โดยประมาณ

1. PCB - A * จำนวนpanel (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 ผสมกันได้
- เผื่อ 10%
- ของควรมาพร้อมกัน
- ควรมีต้นแบบที่ทำงานได้ 1 ชิ้นงาน

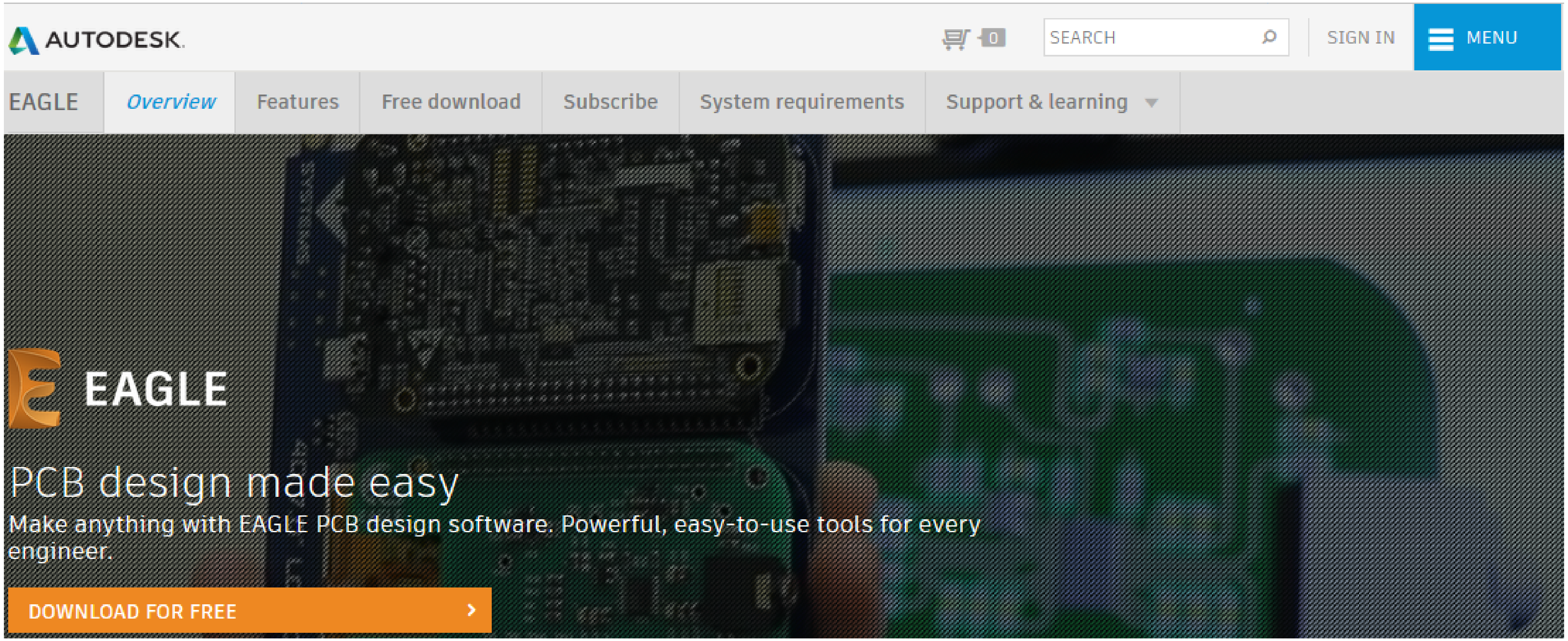
Break; 10 นาที

เราจะเขียนเอกสารกำกับนั้นอย่างไร?

คอร์สเรียน PCB Eagle (Hand on)

- 1 วัน
- ลงมือทำ
- ลงรายละเอียดมากกว่า
- ราคา 3,800 บาท
- สอบถามเพิ่มเติมภายหลังได้
- ทริคการทำเอกสารกำกับโรงงาน

https://www.autodesk.com/products/eagle/overview



Download

Present Eagle

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

Gerber bv

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

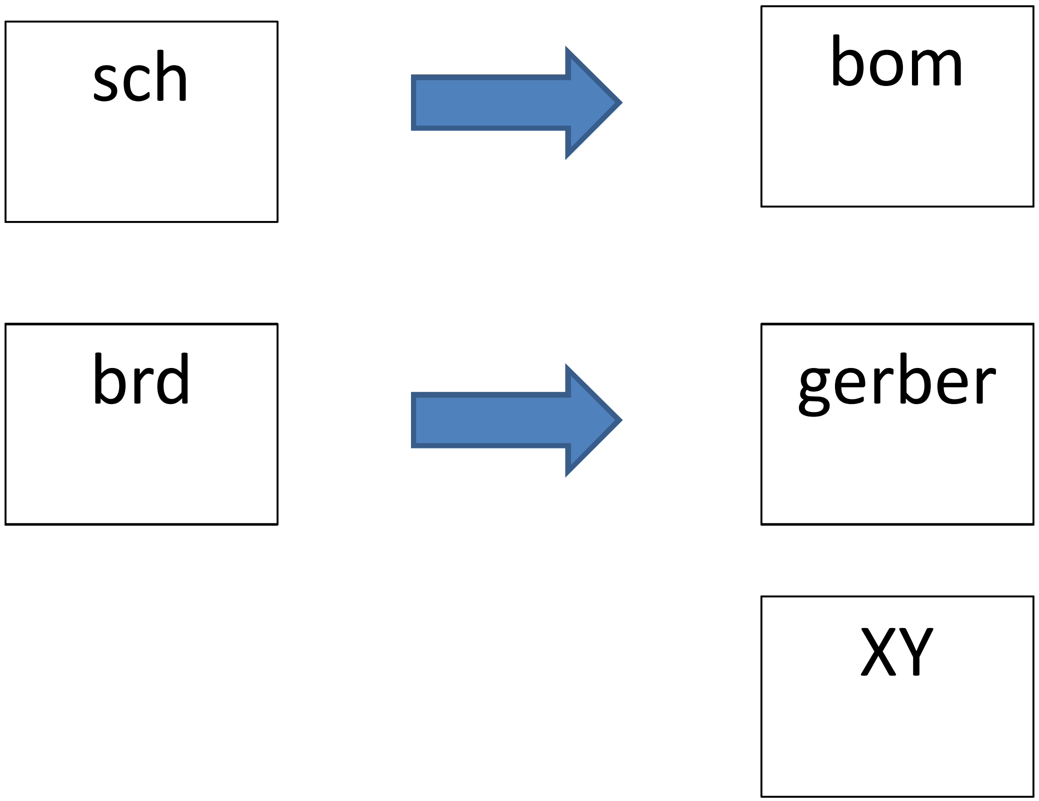
Eagle 7

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

หรือ Eagle 9

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

ไดอะแกรม



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.elecrow.com/pcb-prototyping.html

https://www.pcbway.com/

http://www.seegate15.com

https://www.facebook.com/LayerCircuit

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/

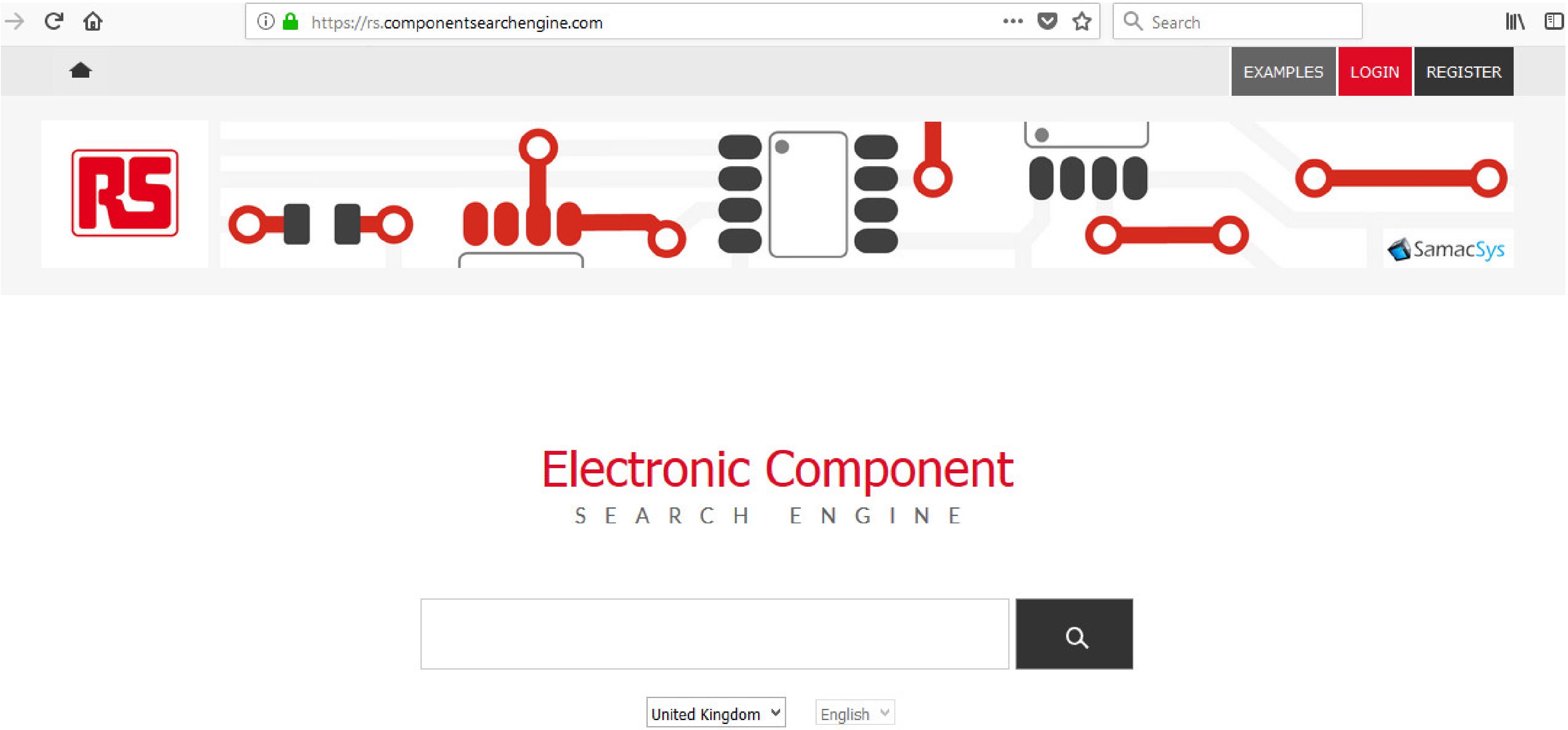
https://www.rs-online.com/designspark/pcb-software

และโปรแกรมอื่นๆ

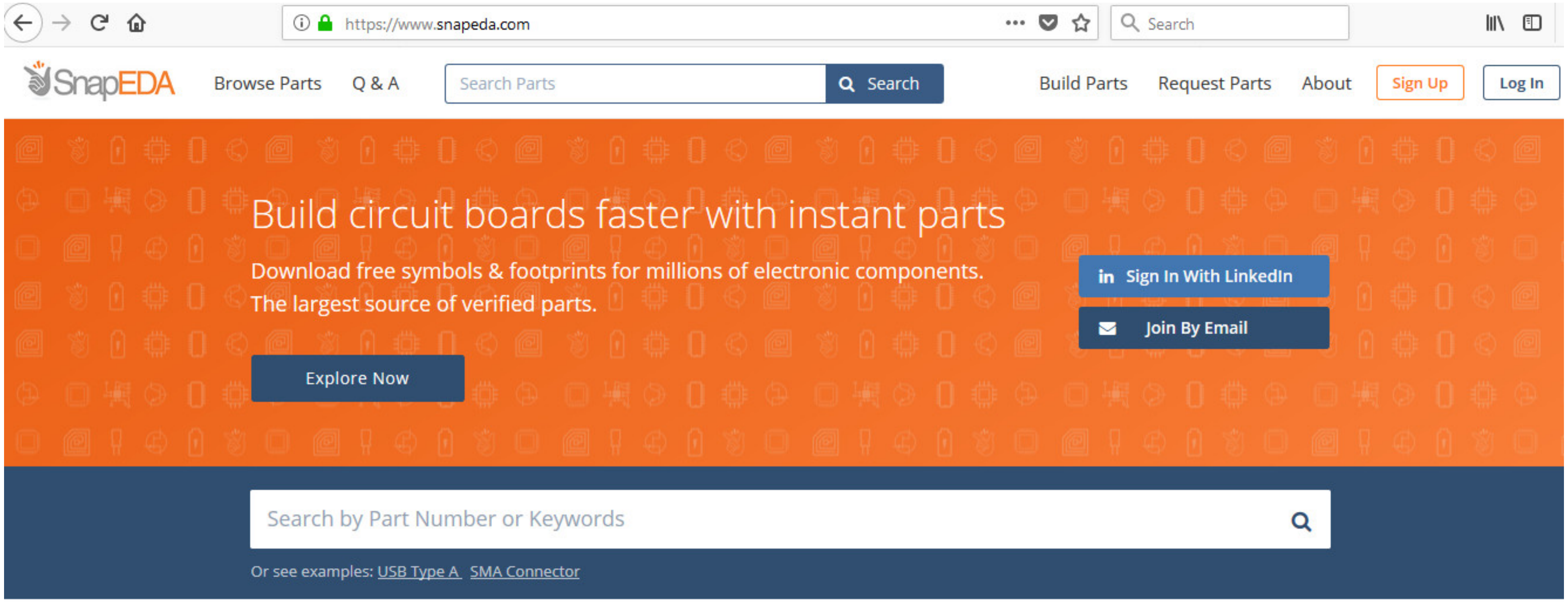
Vendor BOM แหล่งซื้ออุปกรณ์

- Mouser
- Digikey
- RS
- ES

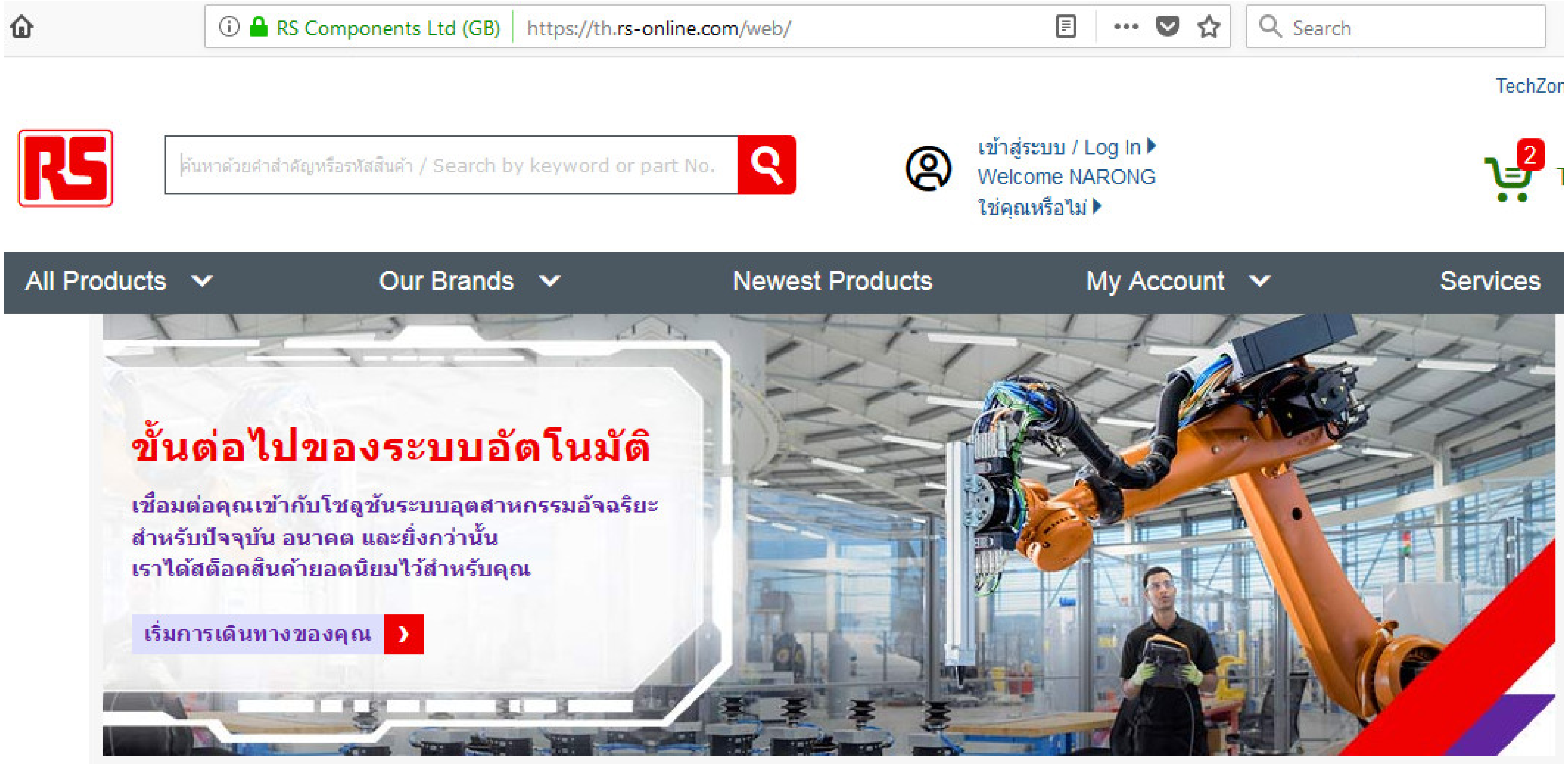
https://rs.componentsearchengine.com/



https://www.snapeda.com/



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



โปรแกรมที่ต้องใช้

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

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

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

Up to higher level directory

Name	Size	Last Modified	
eagle-lin32-7.7.0.run	50282 KB	10/4/16	12:00:00 AM
eagle-lin32-7.7.0.run.INF	1 KB	10/4/16	12:00:00 AM
eagle-lin32.run		10/5/16	12:00:00 AM
eagle-lin64-7.7.0.run	49911 KB	10/4/16	12:00:00 AM
eagle-lin64-7.7.0.run.INF	1 KB	10/4/16	12:00:00 AM
eagle-lin64.run		10/5/16	12:00:00 AM
eagle-mac64-7.7.0.zip	54173 KB	10/4/16	12:00:00 AM
eagle-mac64-7.7.0.zip.INF	1 KB	10/4/16	12:00:00 AM
eagle-mac64.zip		10/5/16	12:00:00 AM
eagle-win32-7.7.0.exe	55208 KB	10/4/16	12:00:00 AM
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eagle-win32.exe		10/5/16	12:00:00 AM
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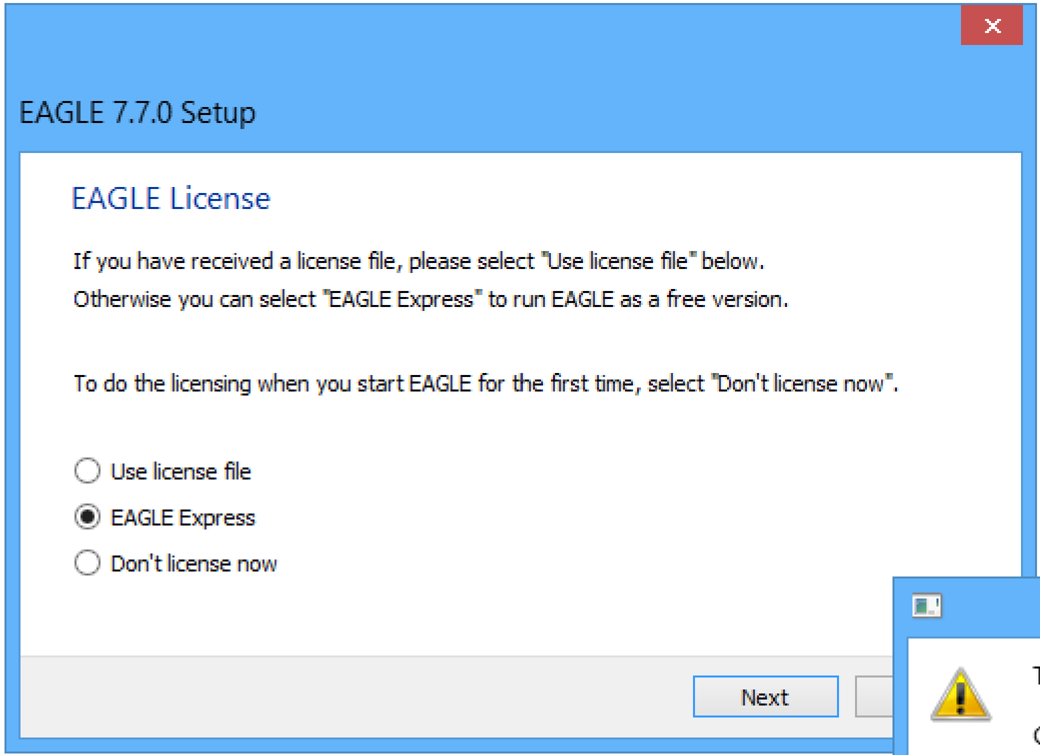
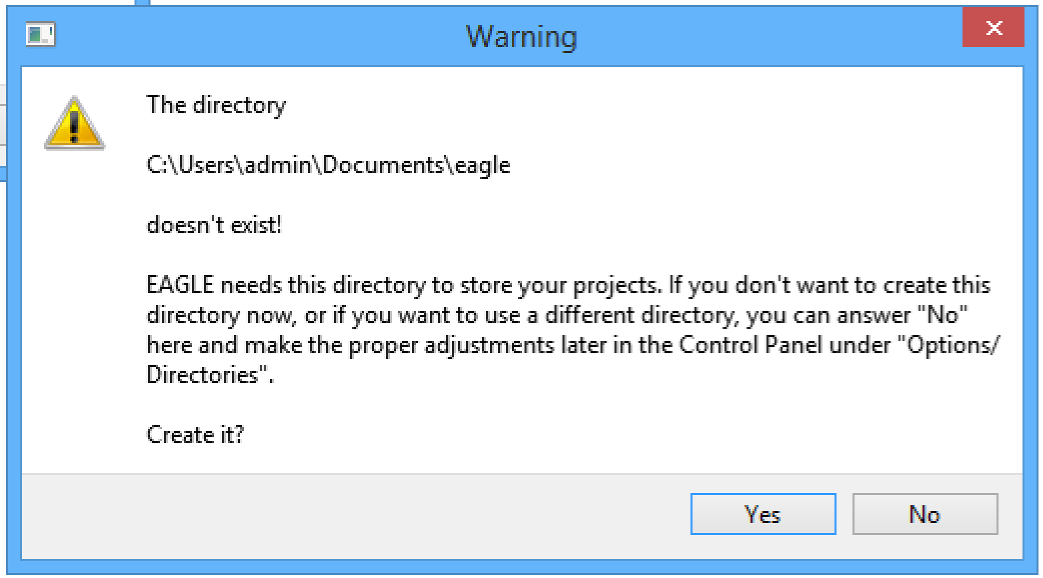
elektro-tutorial.pdf	4817 KB	5/8/09	12:00:00 AM

Eagle Document





https://sourceforge.net/projects/gerbv/files/

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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

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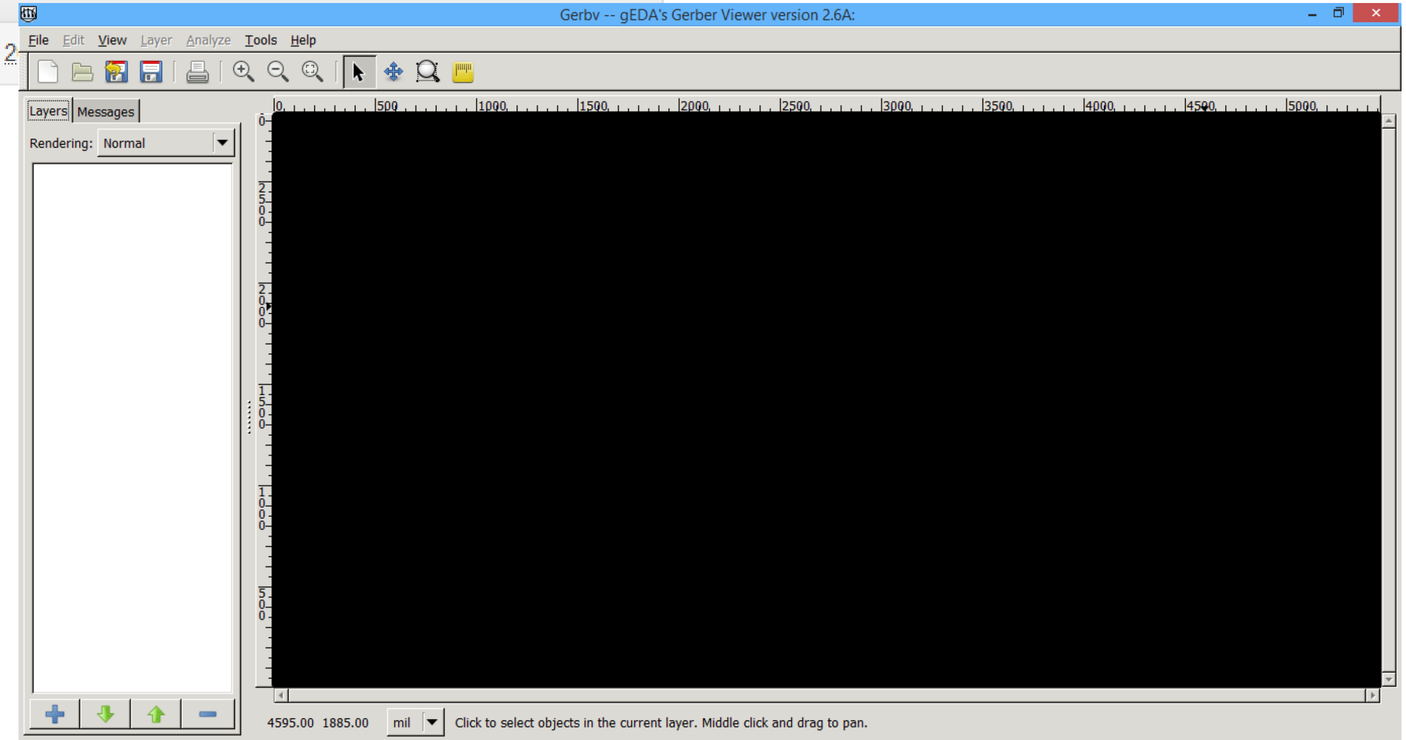
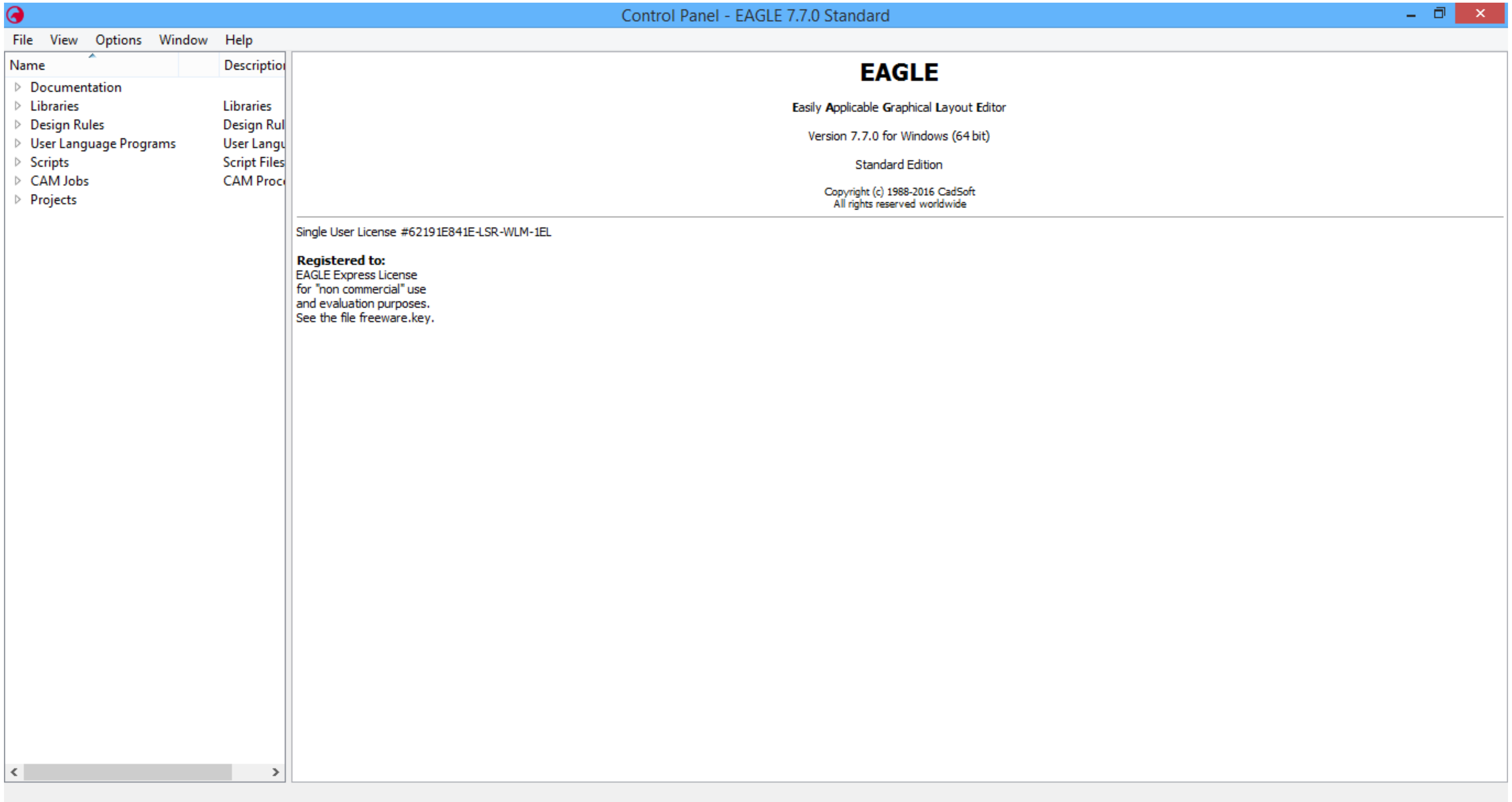
Home

Name ⬍	Modified ⬍	Size ⬍	Downloads / Week ⬍
gerbv	2		

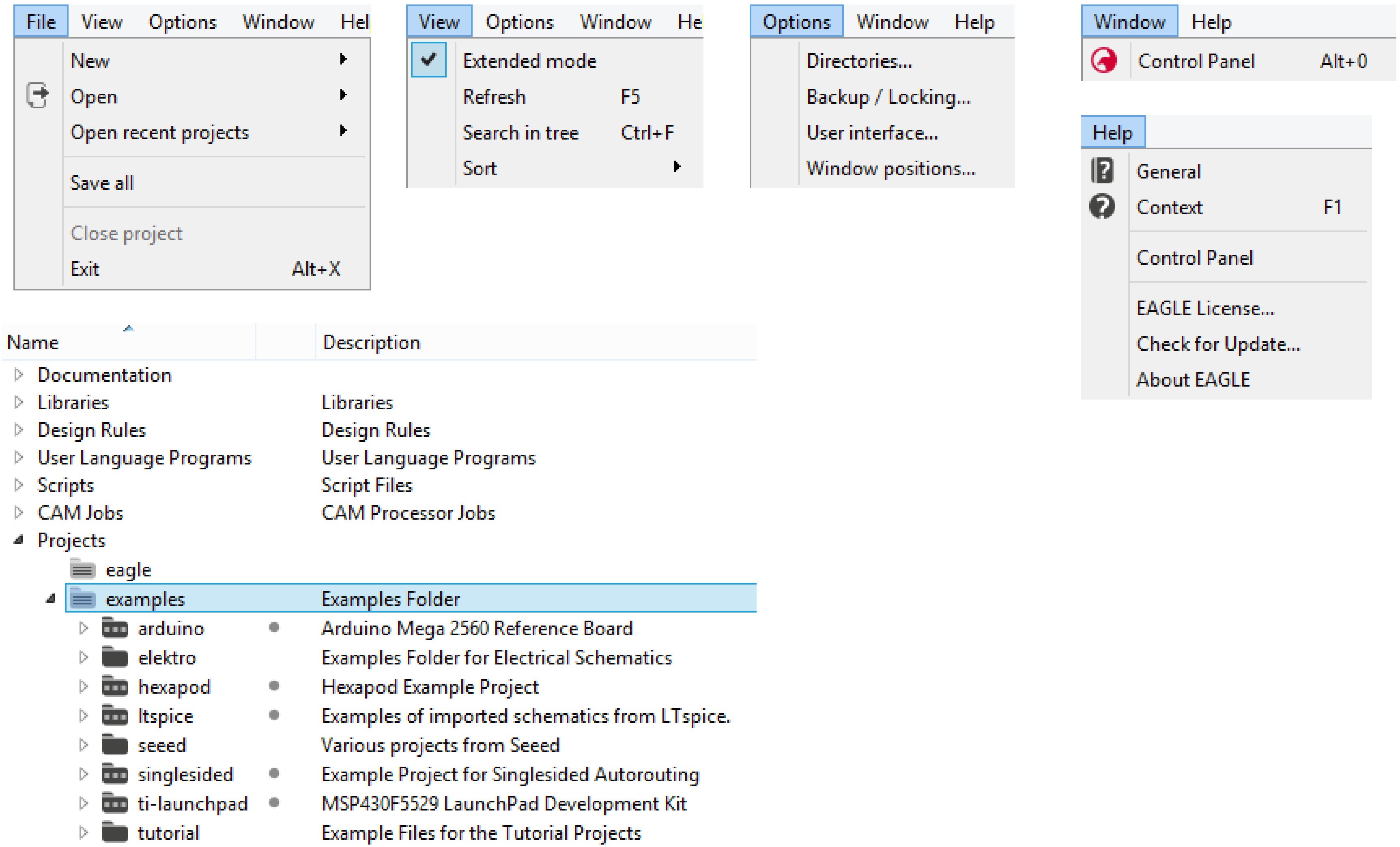
Totals: 1 Item



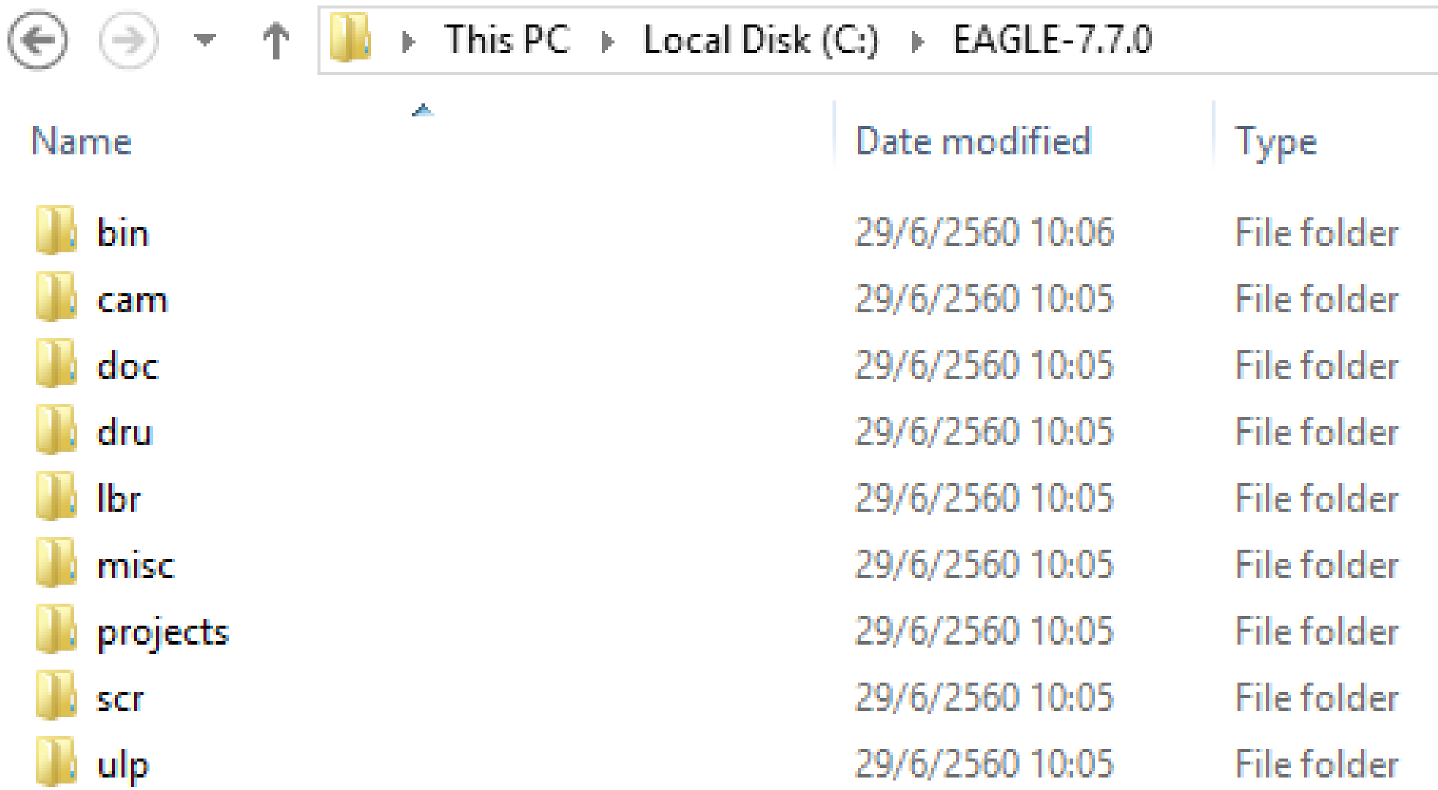
Eagle Control Panel



Control Panel Menu



Eagle Folder



C:\EAGLE-7.7.0
C:\Users\admin\Documents\eagle

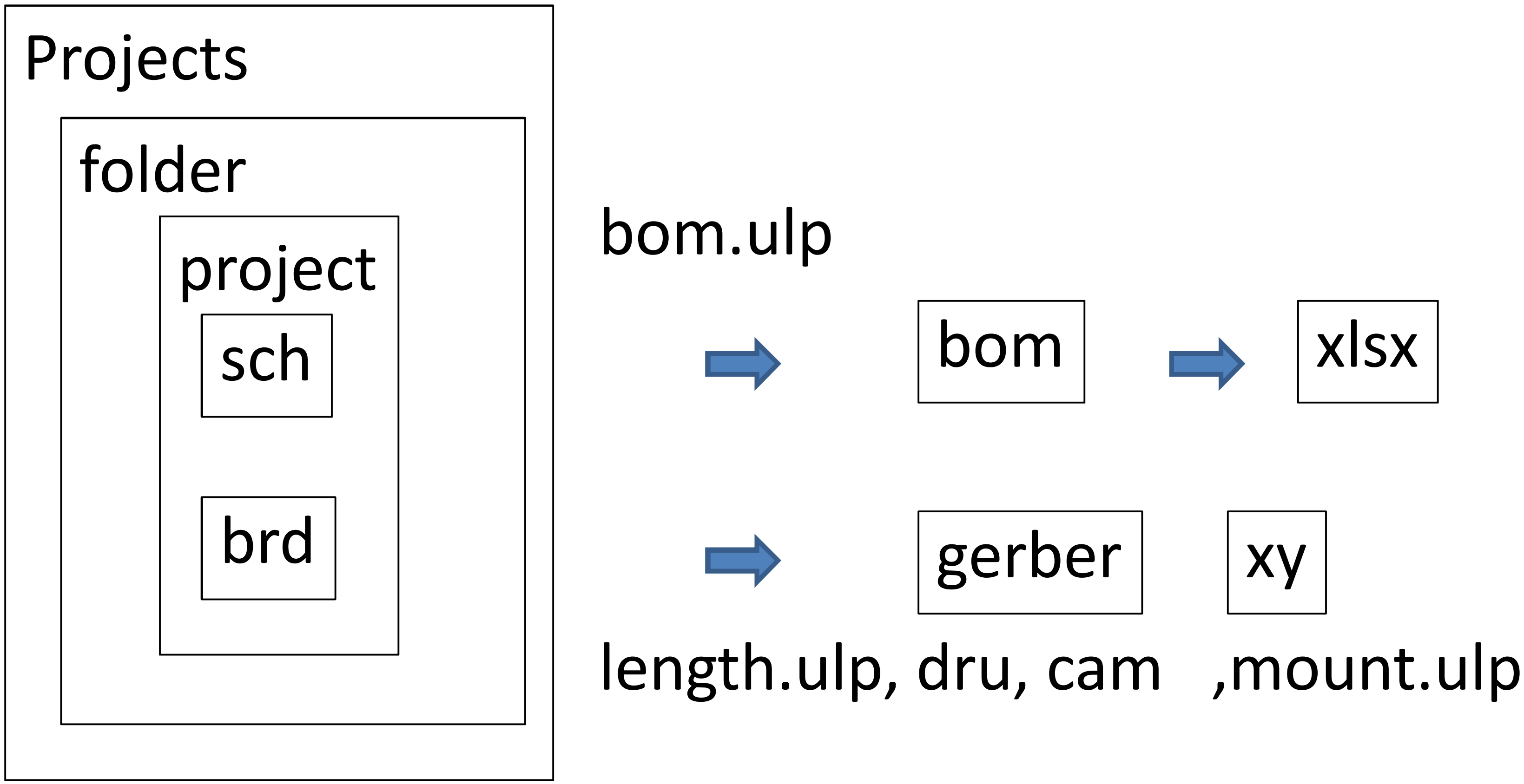
คำศัพท์

- Folder โฟลเดอร์ ซ้อนกันได้
- 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 มีทองแดงเชื่อมระหว่างลายด้านบนกับด้านล่าง
- Tent Via – (layer 44 กำหนดด้วย dru) รูเจาะที่ไม่มีขอบ มีทองแดงเชื่อมระหว่างลายด้านบนกับด้านล่าง

คำศัพท์

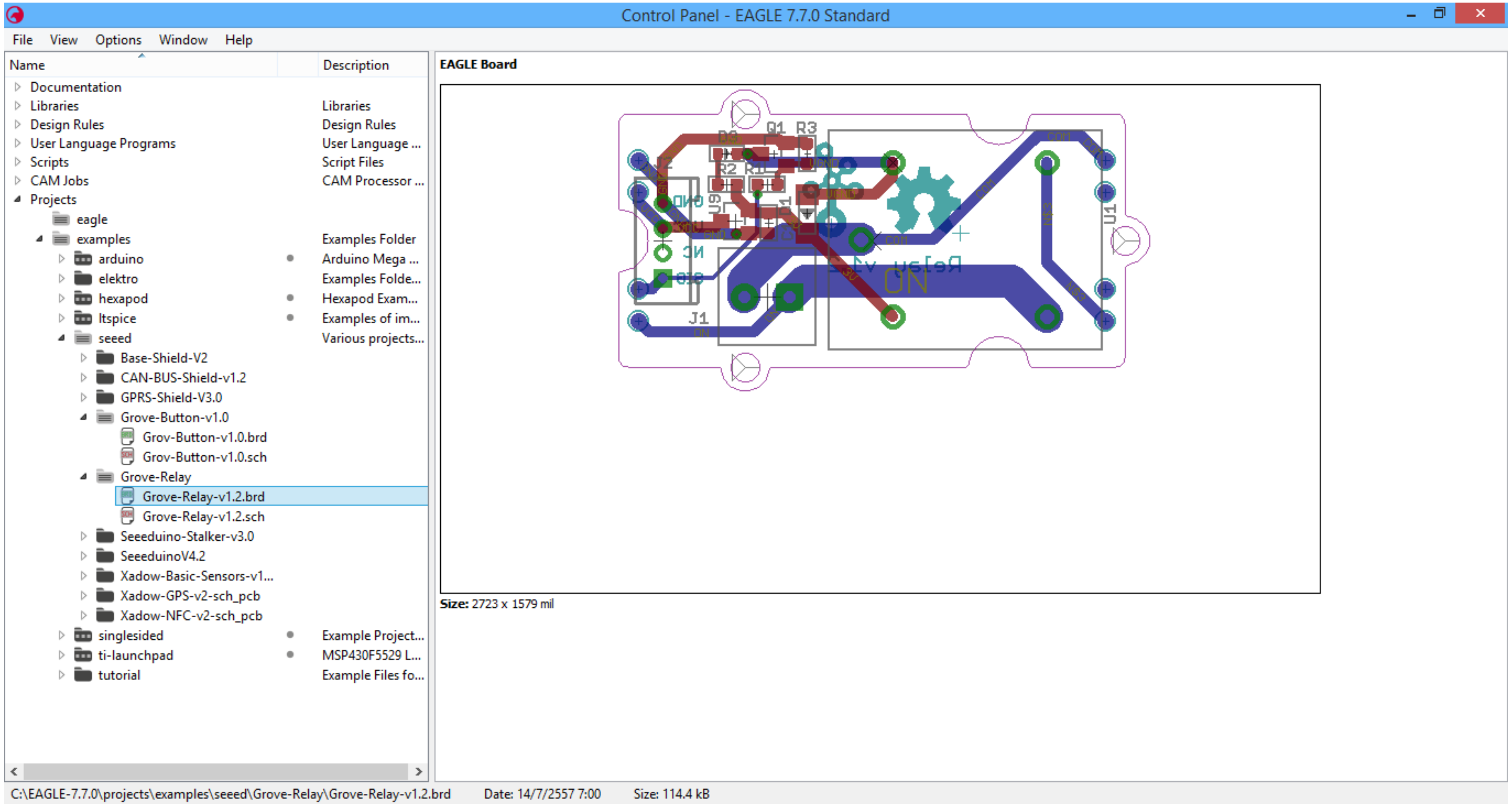
- Pad - (layer 44) รูเจาะที่มีขอบ มีทองแดงเชื่อมระหว่างลายด้านบนกับด้านล่าง ที่มีขาอุปกรณ์ (หรือ via ที่มีขาอุปกรณ์)
- Hole - (layer 45) รูเจาะที่ไม่มีขอบ ไม่มีทองแดงเชื่อมบนล่าง
- Not Installed – มีรายการอุปกรณ์ แต่ไม่ต้องใส่
- inch - นิ้ว
- mil – 1/1000 นิ้ว
- mm – มิลลิเมตร
- mic – 1/1000 มิลลิเมตร
- จุดไข่ปลา – 1 จุด = 2.54mm = 0.1นิ้ว

Projects



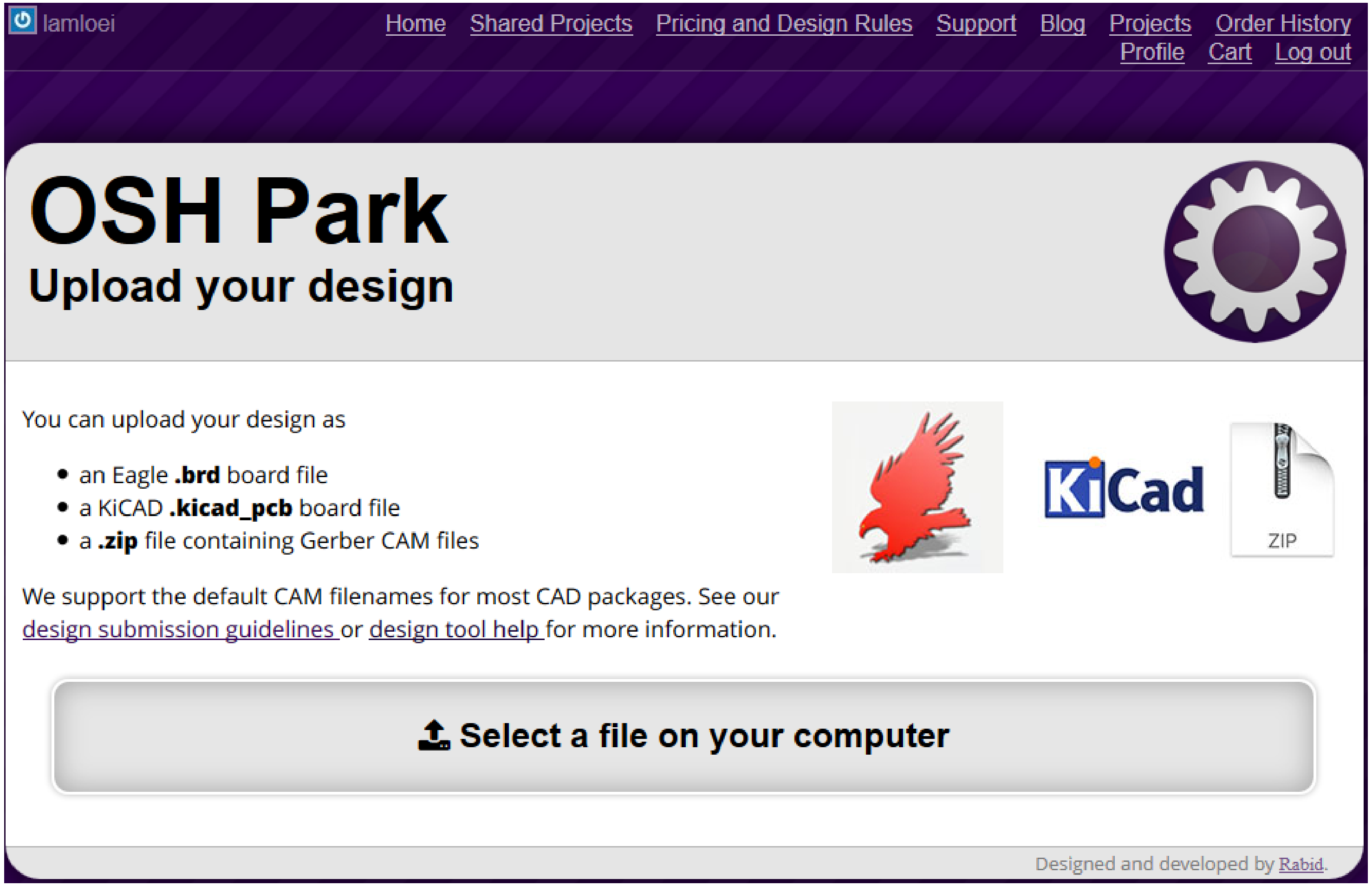
ชื่อไฟล์ sch กับชื่อไฟล์ brd ต้องเป็นชื่อเดียวกัน

Examples



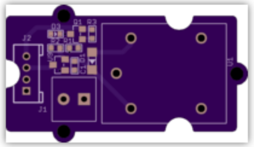
Control Panel - EAGLE 7.7.0 Standard
File View Options Window Help
Name
Description
Documentation
Libraries Libraries
Design Rules Design Rules
User Language Programs User Language ...
Scripts Script Files
CAM Jobs CAM Processor ...
Projects
eagle
examples Examples Folder
arduino Arduino Mega ...
elektro Examples Folde...
hexapod Hexapod Exam...
ltspice Examples of im...
seeed Various projects...
Base-Shield-V2
CAN-BUS-Shield-v1.2
GPRS-Shield-V3.0
Grove-Button-v1.0
Grov-Button-v1.0.brd
Grov-Button-v1.0.sch
Grove-Relay
Grove-Relay-v1.2.brd
Grove-Relay-v1.2.sch
Seeeduino-Stalker-v3.0
SeeeduinoV4.2
Xadow-Basic-Sensors-v1...
Xadow-GPS-v2-sch_pcb
Xadow-NFC-v2-sch_pcb
singlesided Example Project...
ti-launchpad MSP430F5529 L...
tutorial Example Files fo...
EAGLE Board
Size: 2723 x 1579 mil
C:\EAGLE-7.7.0\projects\examples\seeed\Grove-Relay\Grove-Relay-v1.2.brd
Date: 14/7/2557 7:00
Size: 114.4 kB

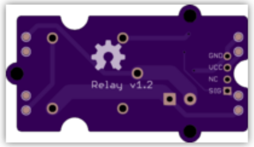
Home > Get Started Now > Select a file on your computer



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.





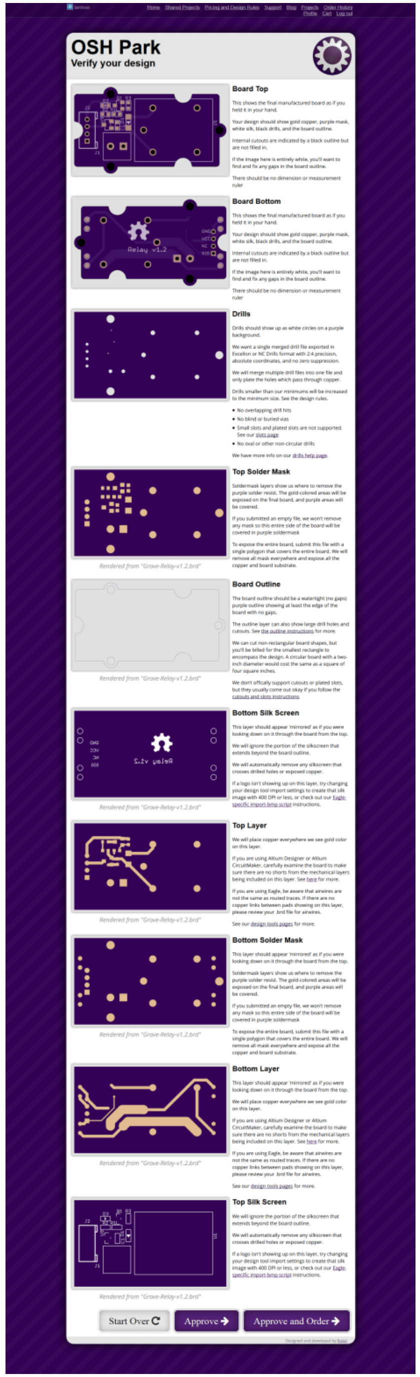
Design notes:

- 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: Grove-Relay-v1.2.brd

Description: Enter a short description of your project

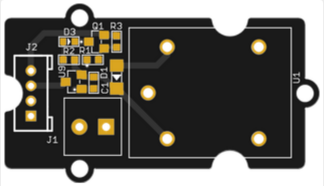
Start Over | Continue



oshpark

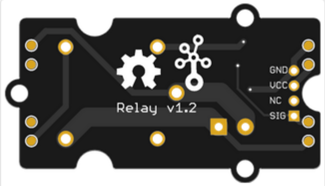
Board Images:

pcbs



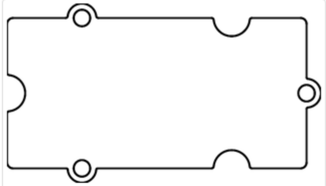
Top View - Complete Board

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



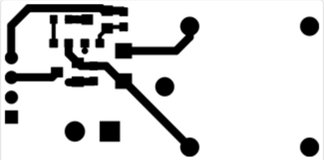
Bottom View - Complete Board

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.

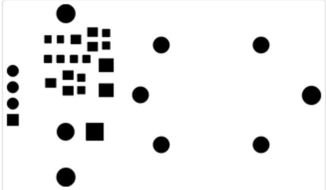


Top Copper Layer

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

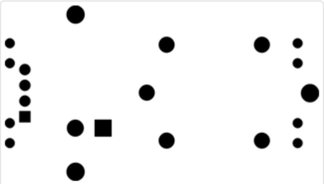
Bottom Copper Layer

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



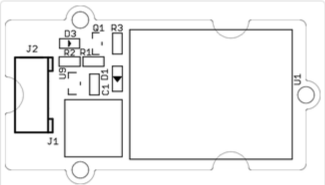
Top Soldermask

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



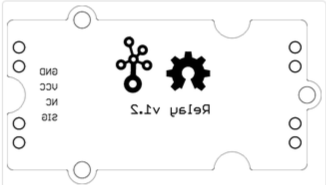
Bottom Soldermask

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



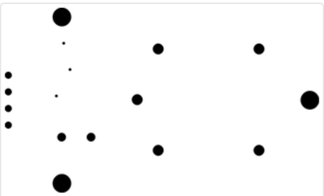
Top Silkscreen

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)

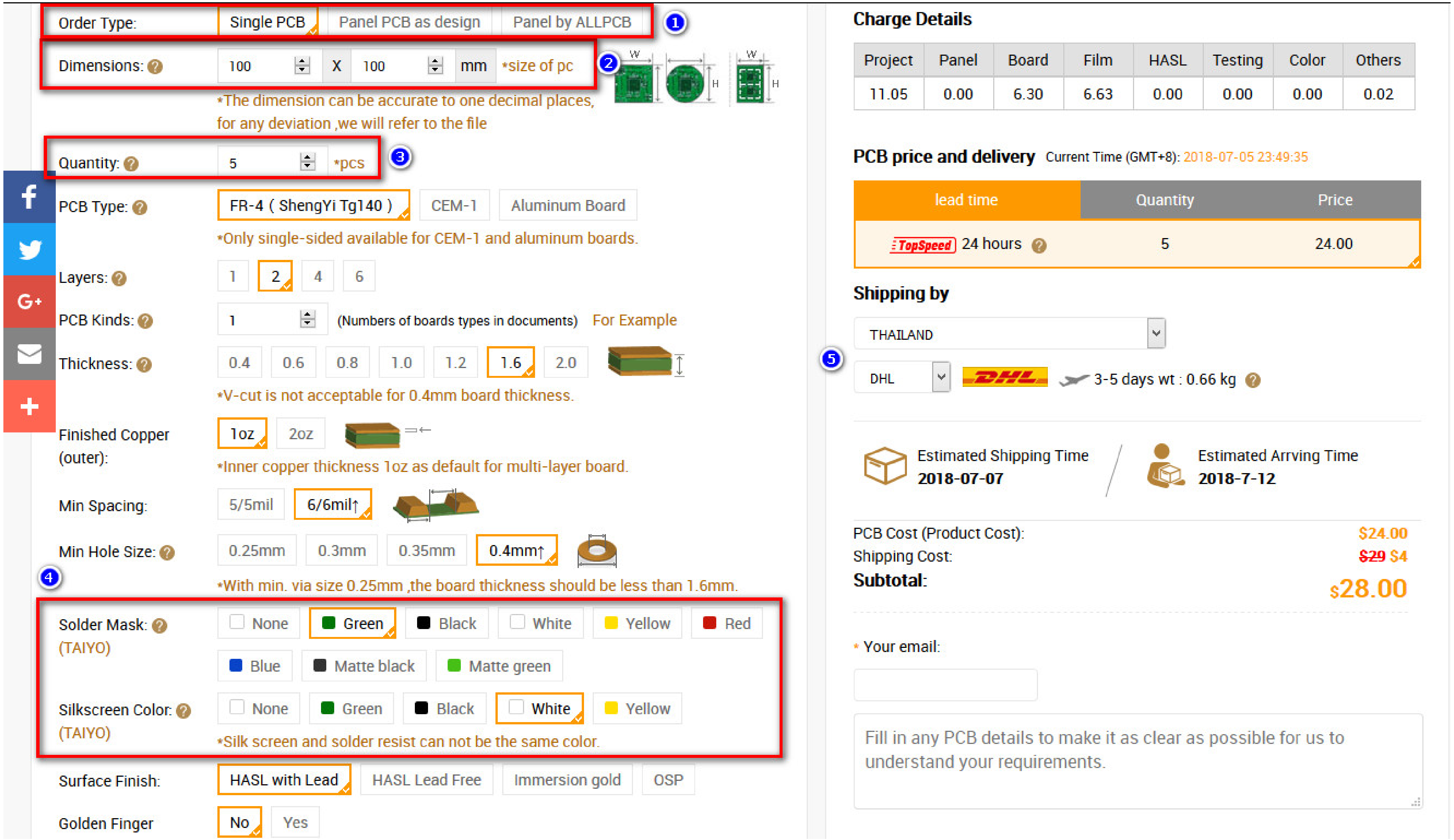


Drill Holes

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

Copy Link

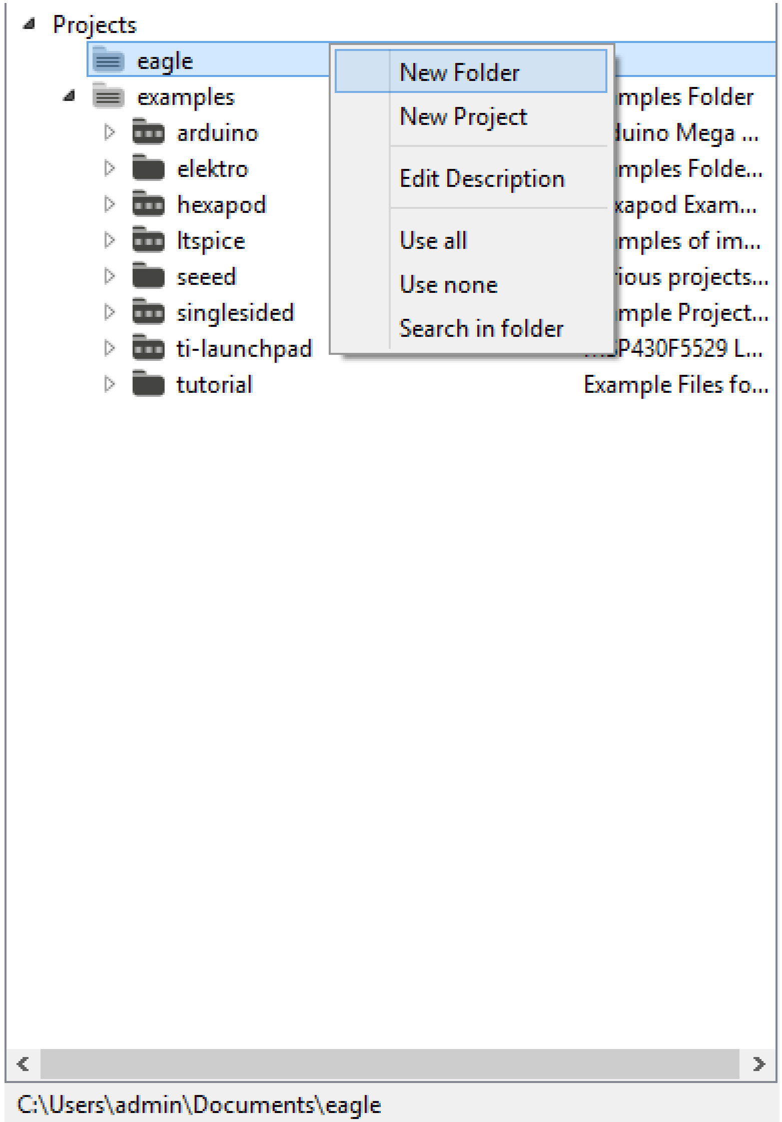
https://www.allpcb.com/setinvite.aspx?inviteid=27397&url=https://www.allpcb.com/online_quote.html

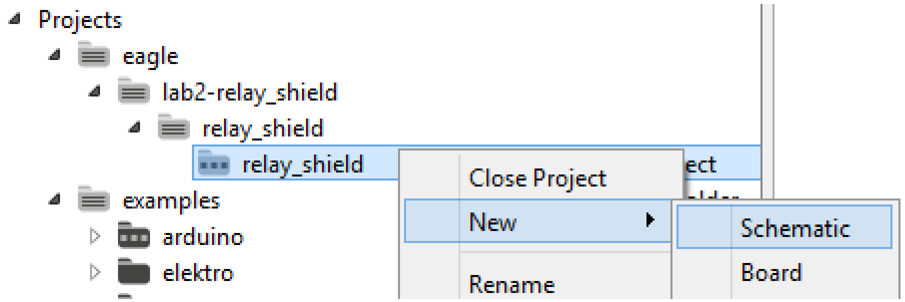

Order Type:
Single PCB
Panel PCB as design
Panel by ALLPCB
1
Dimensions:
100
X
100
mm
*size of pc
2
*The dimension can be accurate to one decimal places,
for any deviation ,we will refer to the file
Quantity:
5
*pcs
3
PCB Type:
FR-4 (ShengYi Tg140)
CEM-1
Aluminum Board
*Only single-sided available for 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↑
4
*With min. via size 0.25mm ,the board thickness should be less than 1.6mm.
Solder Mask: (TAIYO)
None
Green
Black
White
Yellow
Red
Blue
Matte black
Matte green
Silkscreen Color: (TAIYO)
None
Green
Black
White
Yellow
*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
TopSpeed 24 hours
5
24.00
Shipping by
THAILAND
5
DHL
3-5 days wt : 0.66 kg
Estimated Shipping Time
2018-07-07
Estimated Arrving Time
2018-7-12
PCB Cost (Product Cost):
$24.00
Shipping Cost:
$29 $4
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

สร้างโปรเจค?

New Project

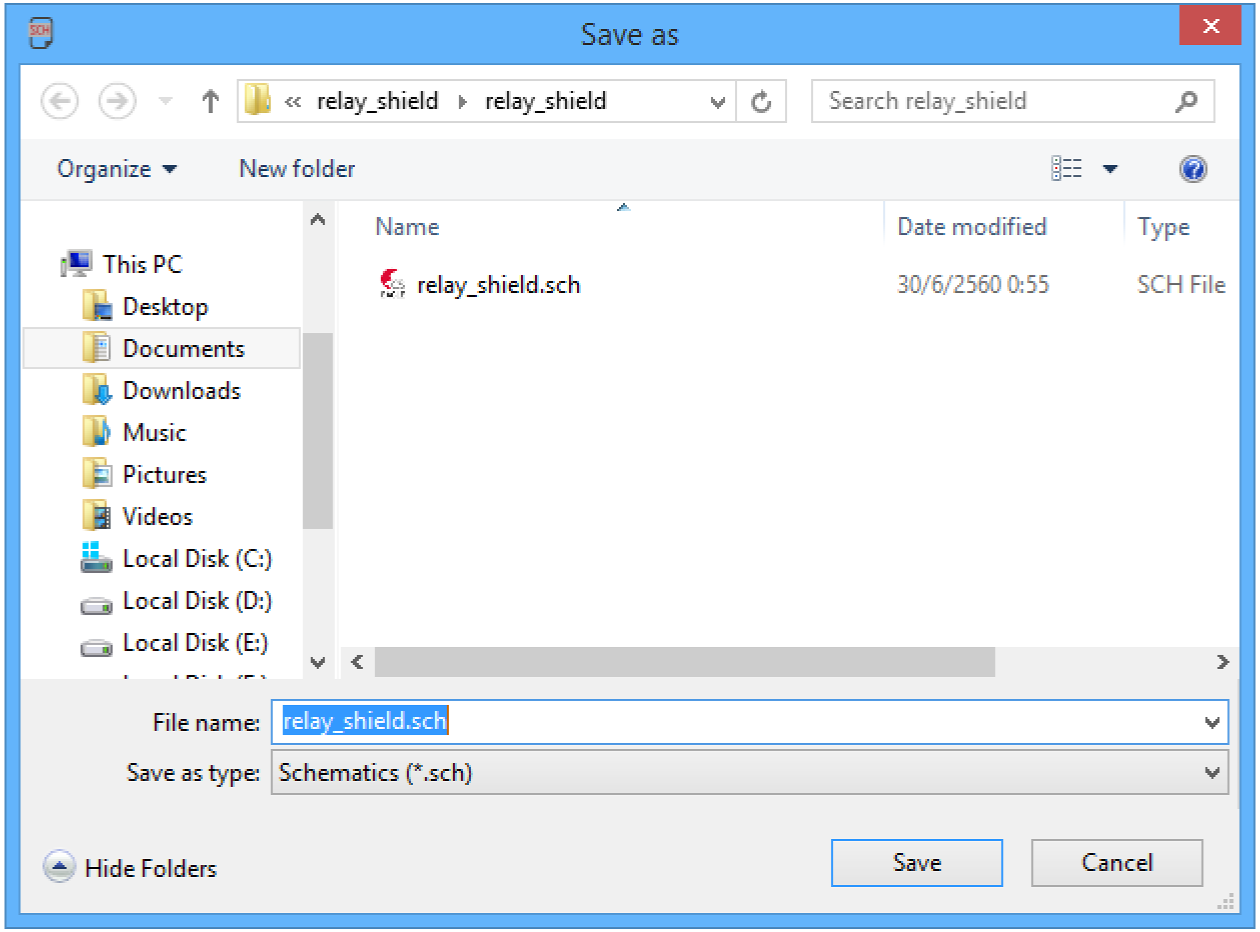




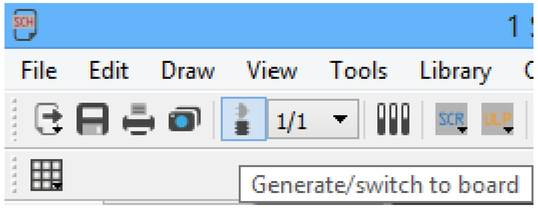
New > Schematic

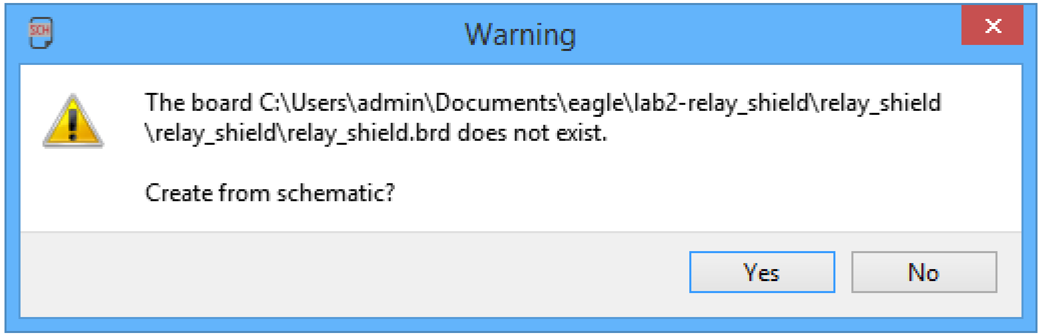
Save Schematic

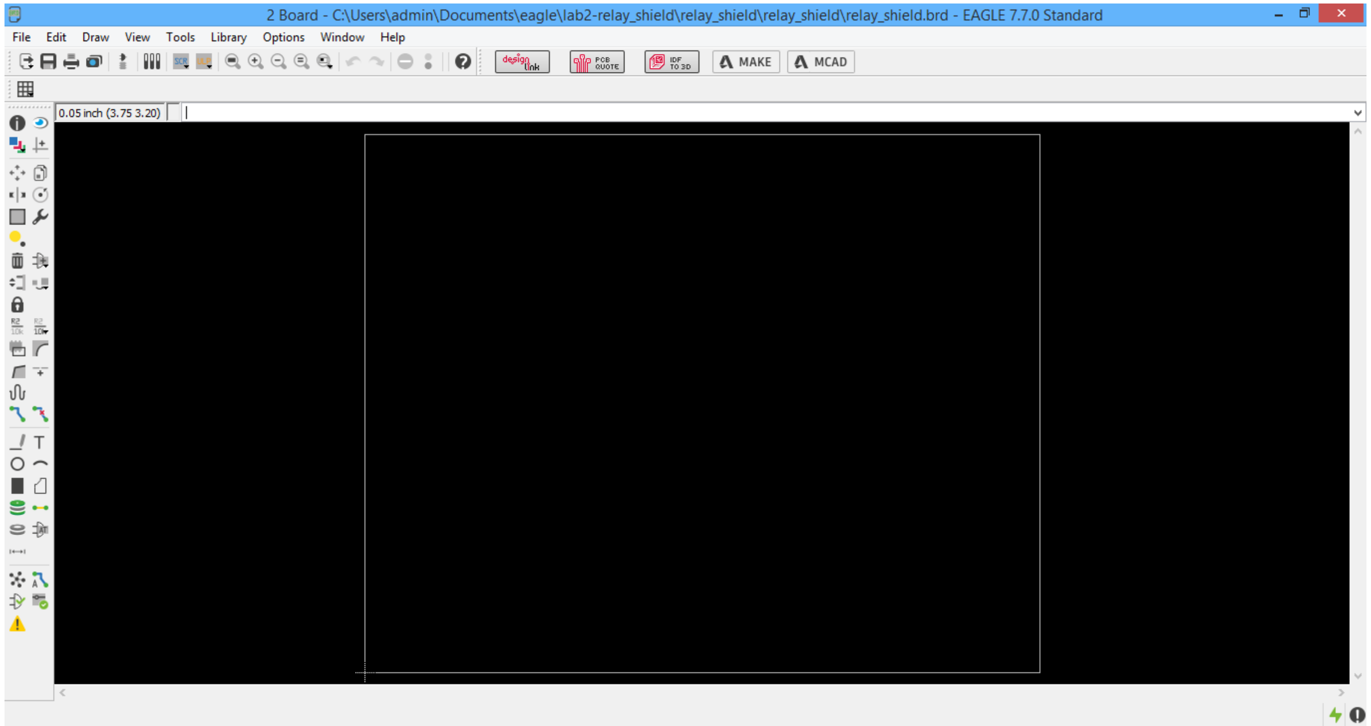
Save ตั้งชื่อไฟล์ Schematic



New Board

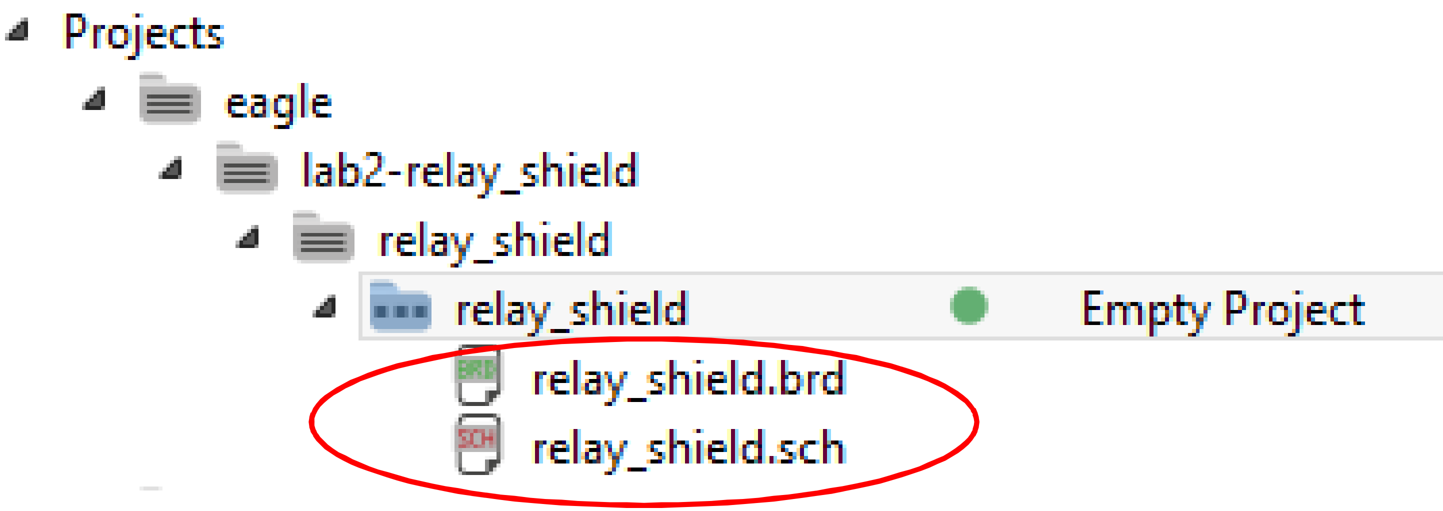






แล้วกดบันทึก

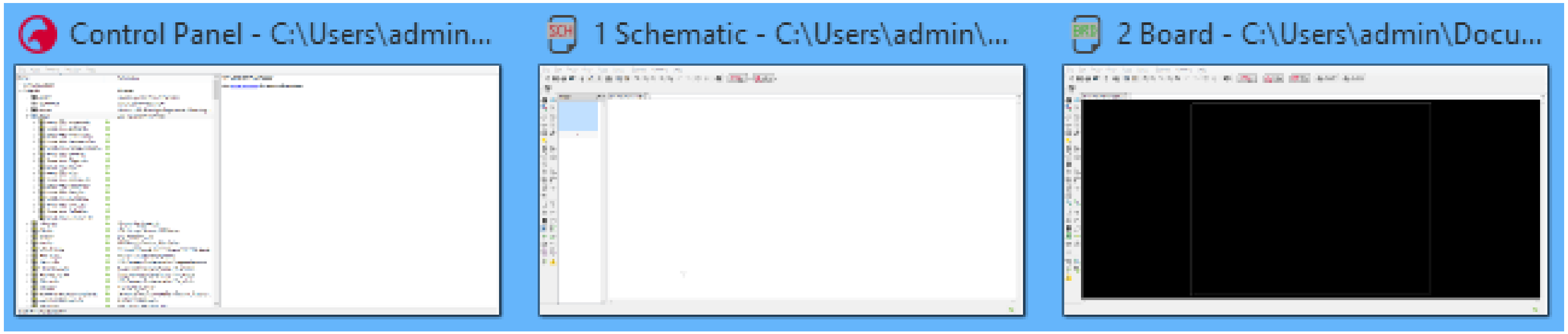
Lab 2 สร้าง sch กับ brd ที่ชื่อเหมือนกัน อยู่ภายใต้ project เดียวกัน



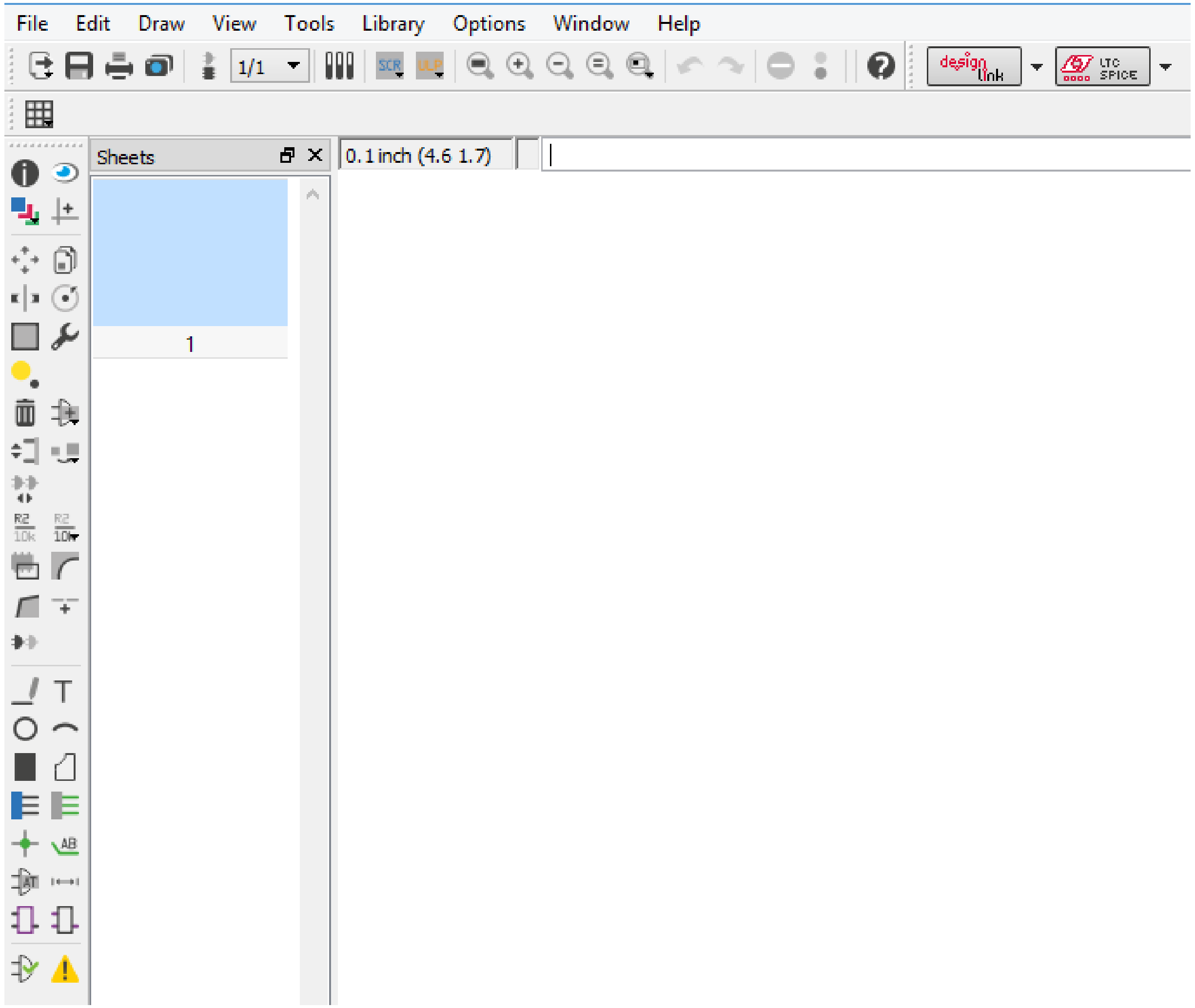
Control Panel

Schematic

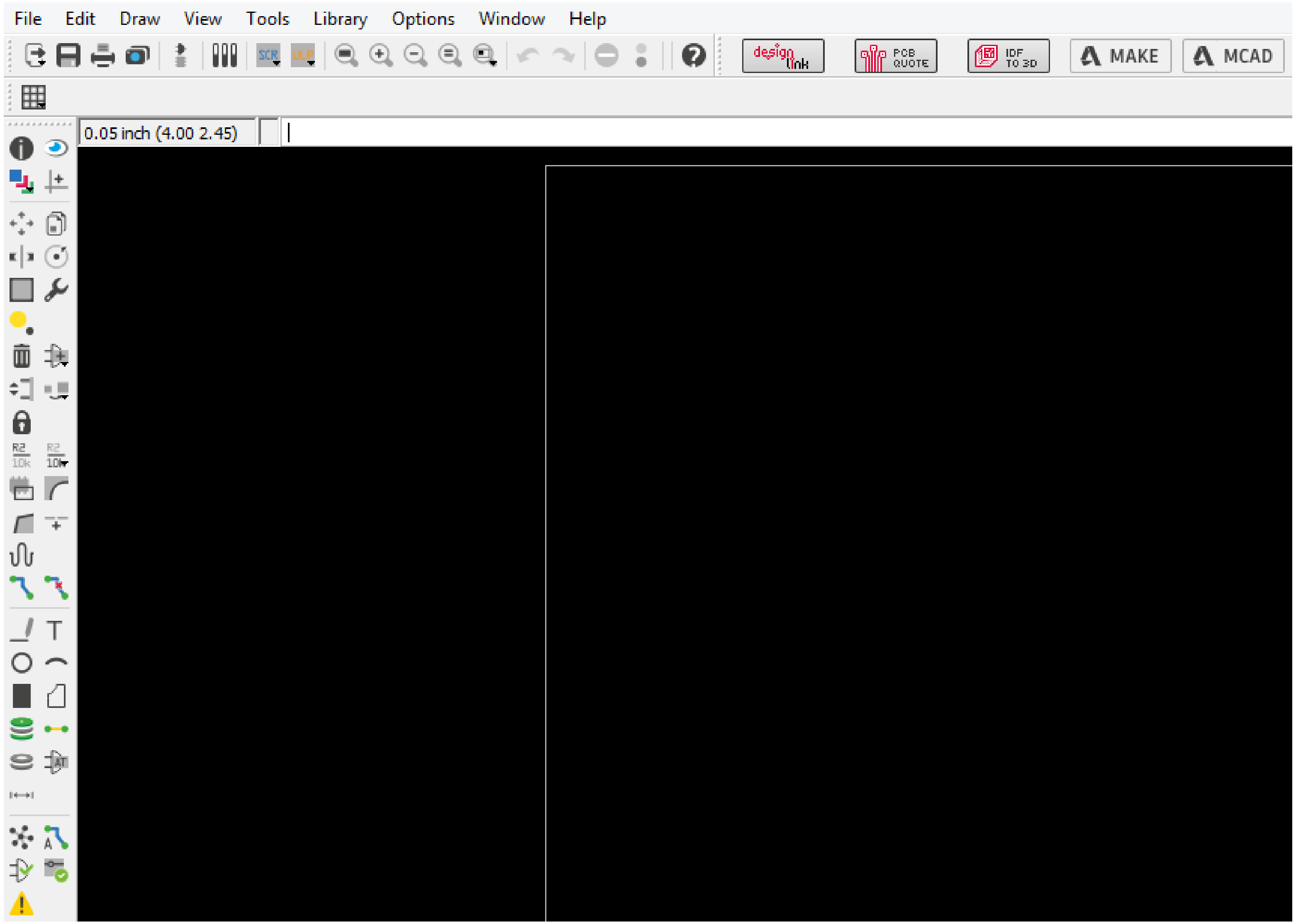
Board



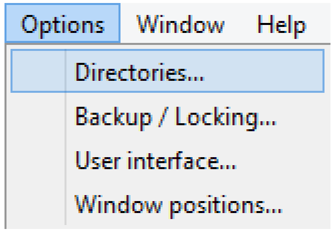
Schematic

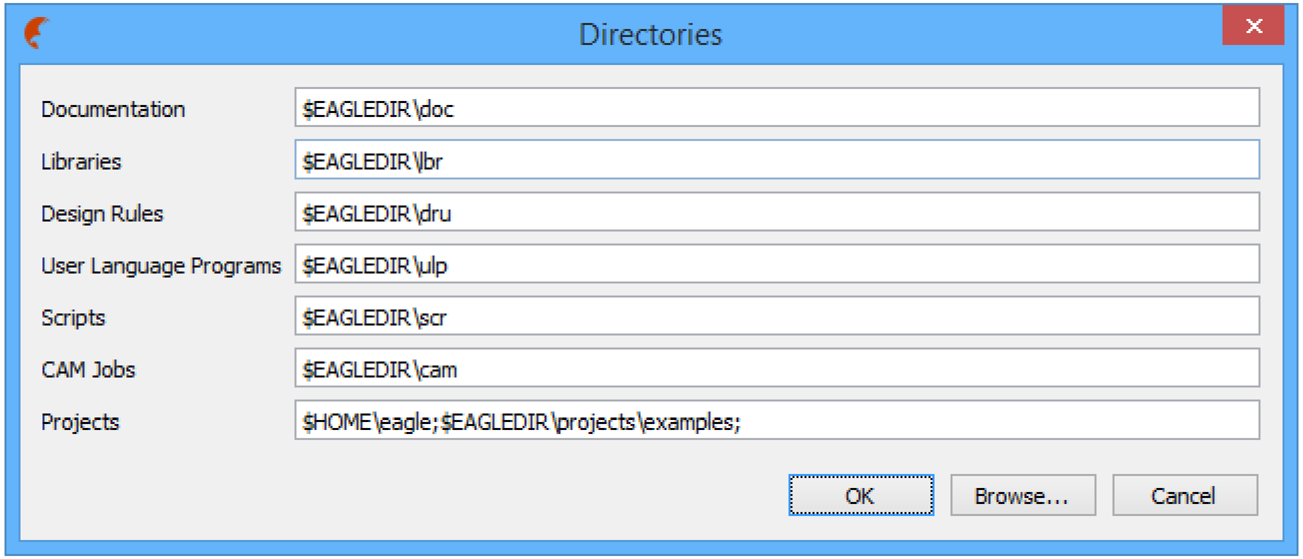

File
Edit
Draw
View
Tools
Library
Options
Window
Help
1/1
Sheets
1
0.1 inch (4.6 1.7)

Board

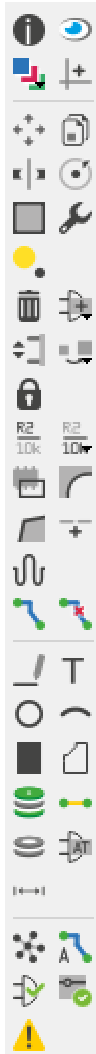

File
Edit
Draw
View
Tools
Library
Options
Window
Help
MAKE
MCAD
0.05 inch (4.00 2.45)

Control Panel > Options > Directories…





Sch Button & Brd Button



Lab 3 คัดลอก 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	
ltspice	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 ▸ cam

Name	Date modified	Type	Size
Elecrow_Gerber_Generater_DrillAlign.cam	29/6/2560 20:08	Altium CAMtastic ...	11 KB
Elecrow_Gerber_Generater_4-layer_1-2-15...	29/6/2560 20:07	Altium CAMtastic ...	13 KB
Seeed_Gerber_Generater_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_Generater_4-layer_1-2-15-...	3/12/2556 14:42	Altium CAMtastic ...	13 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

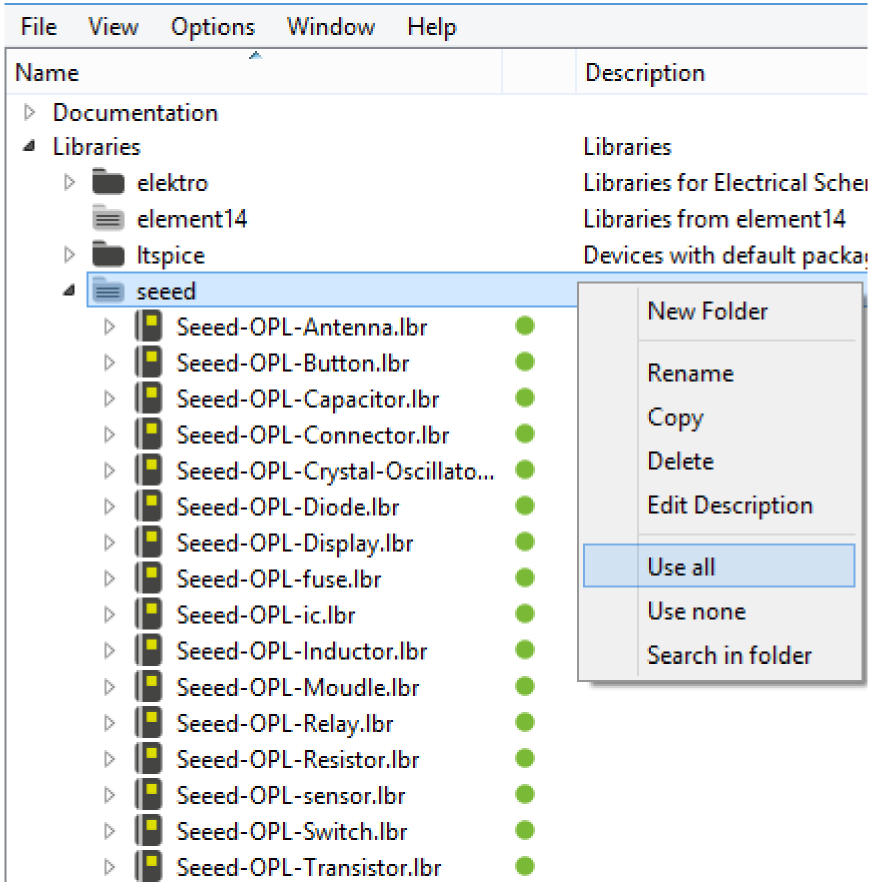
//ให้ลบเปลี่ยน หรือเปลี่ยน lbr เดิมก่อน

ปิดเปิด Eagle ใหม่ หรือกด F5

Control panel จะมีรายชื่อเพิ่มขึ้นมา

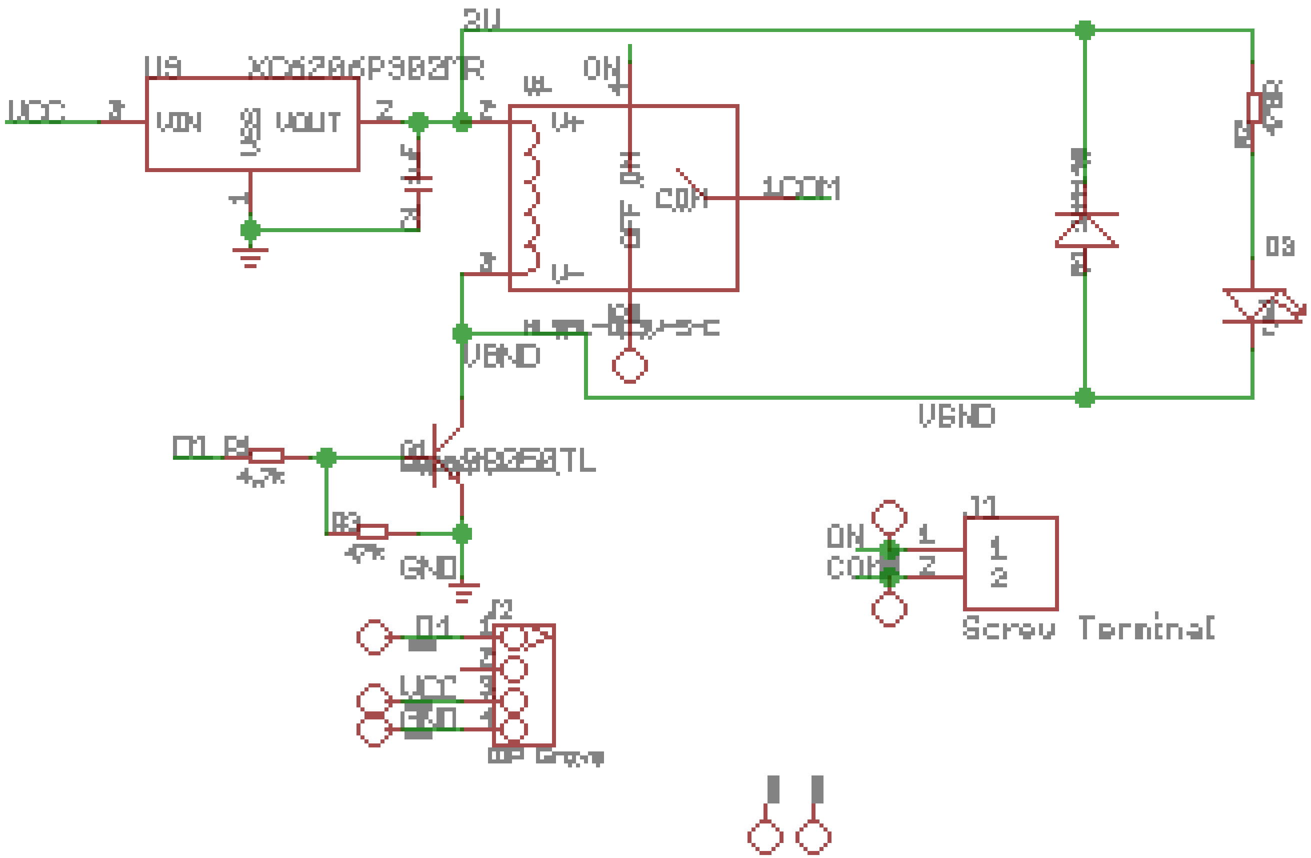
Libraries	Libraries
Adafruit-Eagle-Library-master	
elektro	Libraries for Electrical Schema
element14	Libraries from element14
ltspice	Devices with default packages
opl_package	
seeed	OPL Libraries from Seeed
SparkFun-Eagle-Libraries-master	
Design Rules	Design Rules
Eurocircuits	
Multi-CB	
WEdirekt	
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_Generater_4-lay...	Seeed Studio 2-layer PCB Gerber Generator
Elecrow_Gerber_Generater_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_Generater_2-layer...	Seeed Studio 2-layer PCB Gerber Generator
Seeed_Gerber_Generater_4-layer...	Seeed Studio 2-layer PCB Gerber Generator

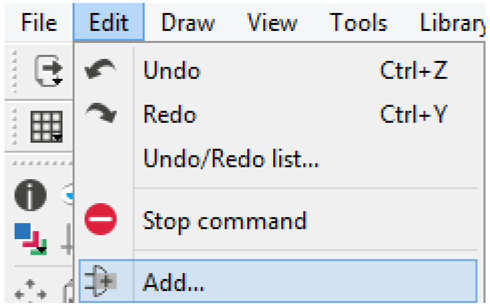
Use all Libraries



เปิดใช้เฉพาะเท่าที่จำเป็น จะทำงานเร็วกว่า

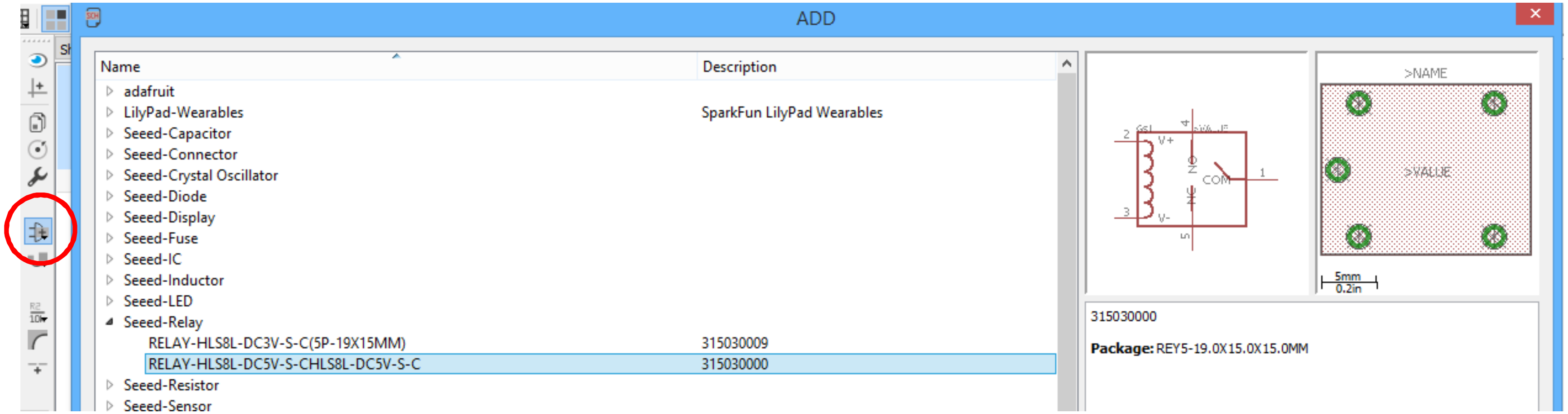
Lab 4 สร้าง relay module

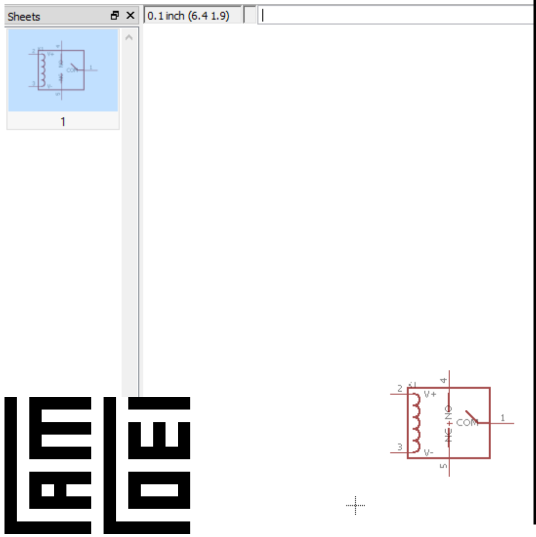


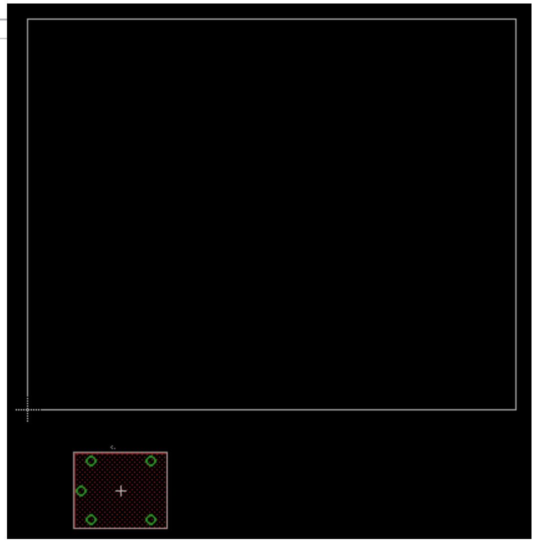


Lab4 Schematic > Edit > Add...

Sch > ADD > Seeed-Relay > RELAY-DC5V







ถ้าเป็น Schematic จะสนใจตัวสำคัญก่อน จุดเชื่อมต่ออุปกรณ์

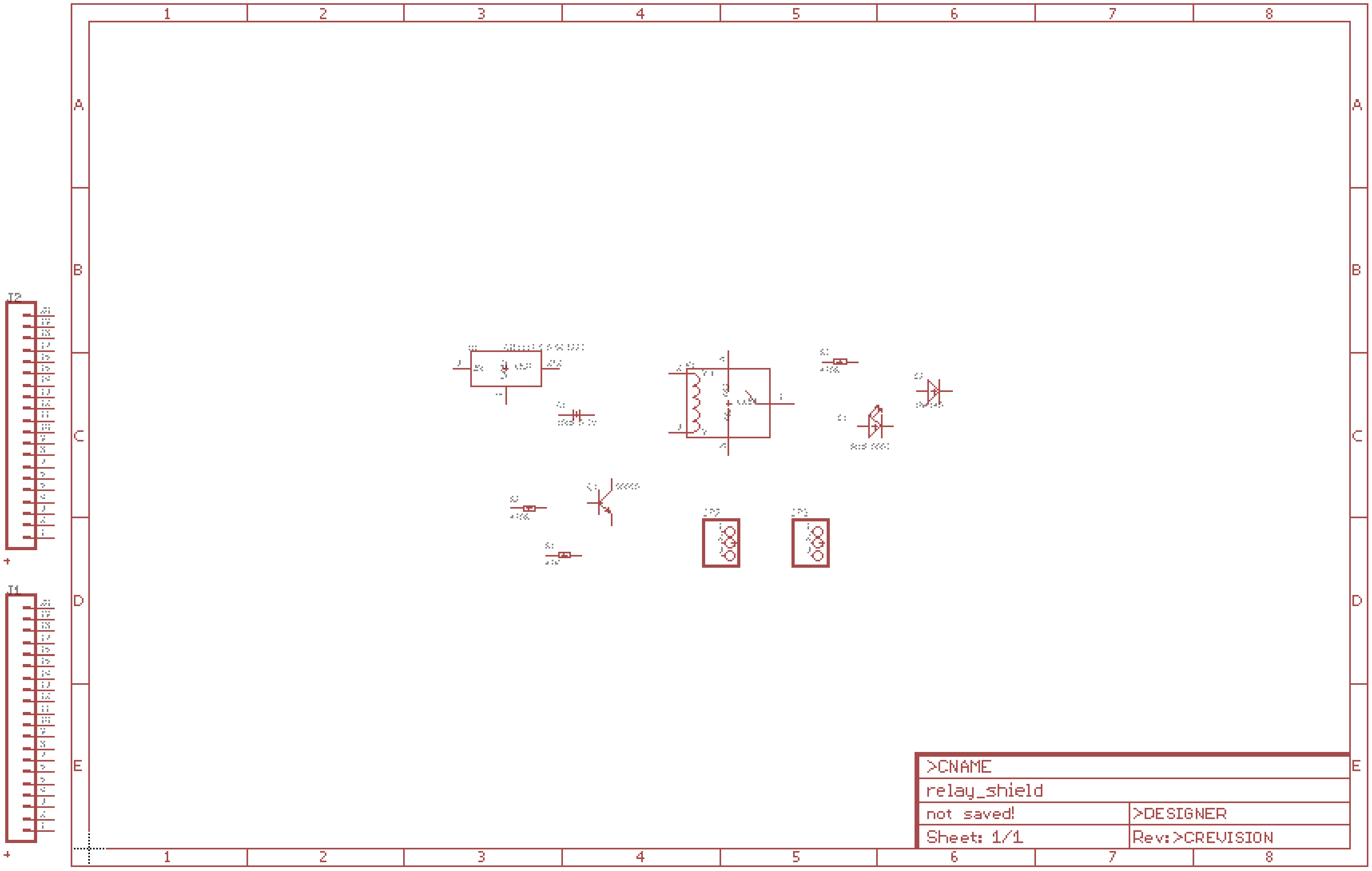
.

ถ้าเป็น Board จะสนใจตัวใหญ่ก่อน

เพิ่มอุปกรณ์

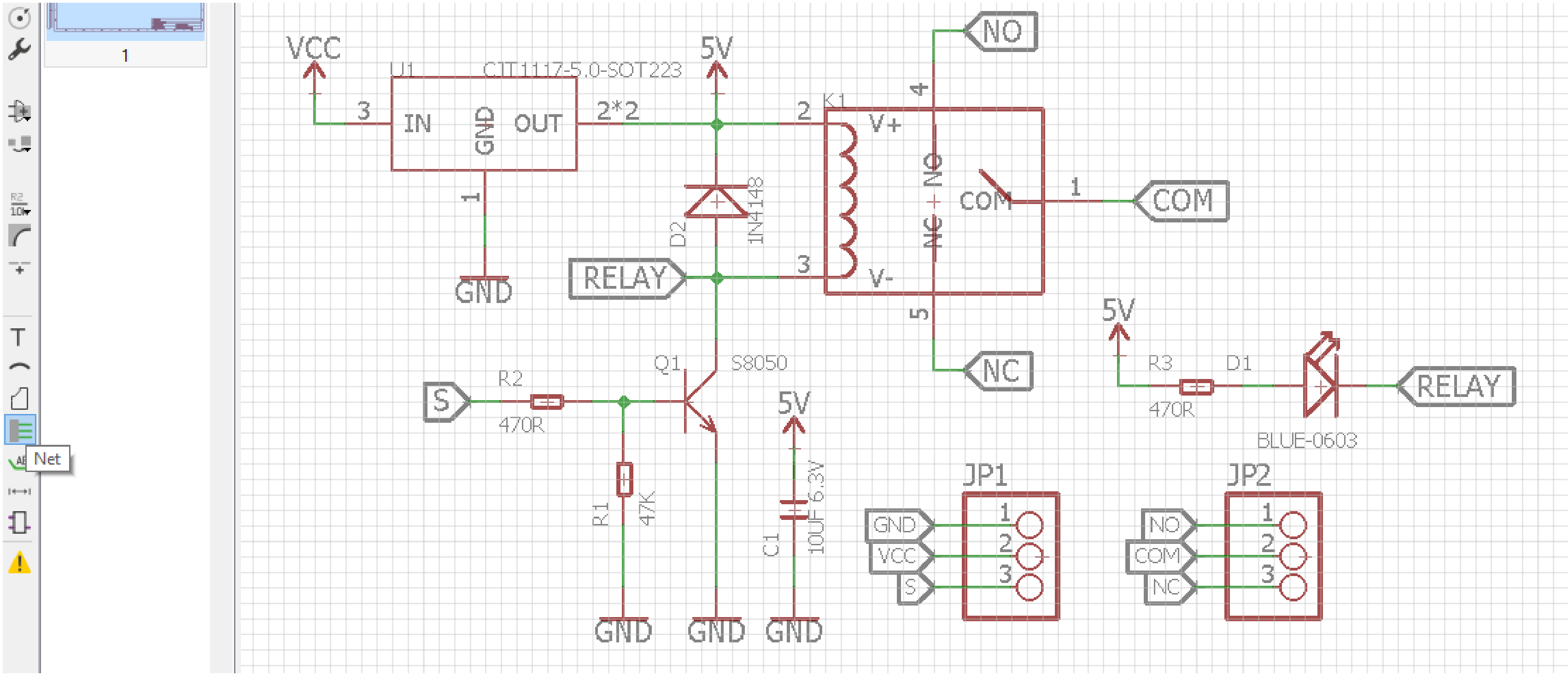
- Sch > ADD > Seeed-Transistor > s8050
- Sch > ADD > Seeed-Resistors > SMD-res-47k-0603
- Sch > ADD > Seeed-Resistors > SMD-res-470-0603 *2
- Sch > ADD > Seeed-LED > SMD-LED-0603
- Sch > ADD > Seeed-Diode > SMD 1N4148 (LL-34)
- Sch > ADD > Seeed-IC > PMIC-CJT1117-5.0(SOT223)
- Sch > ADD > Seeed-Capacitor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

Lab 5 เรียงอุปกรณ์



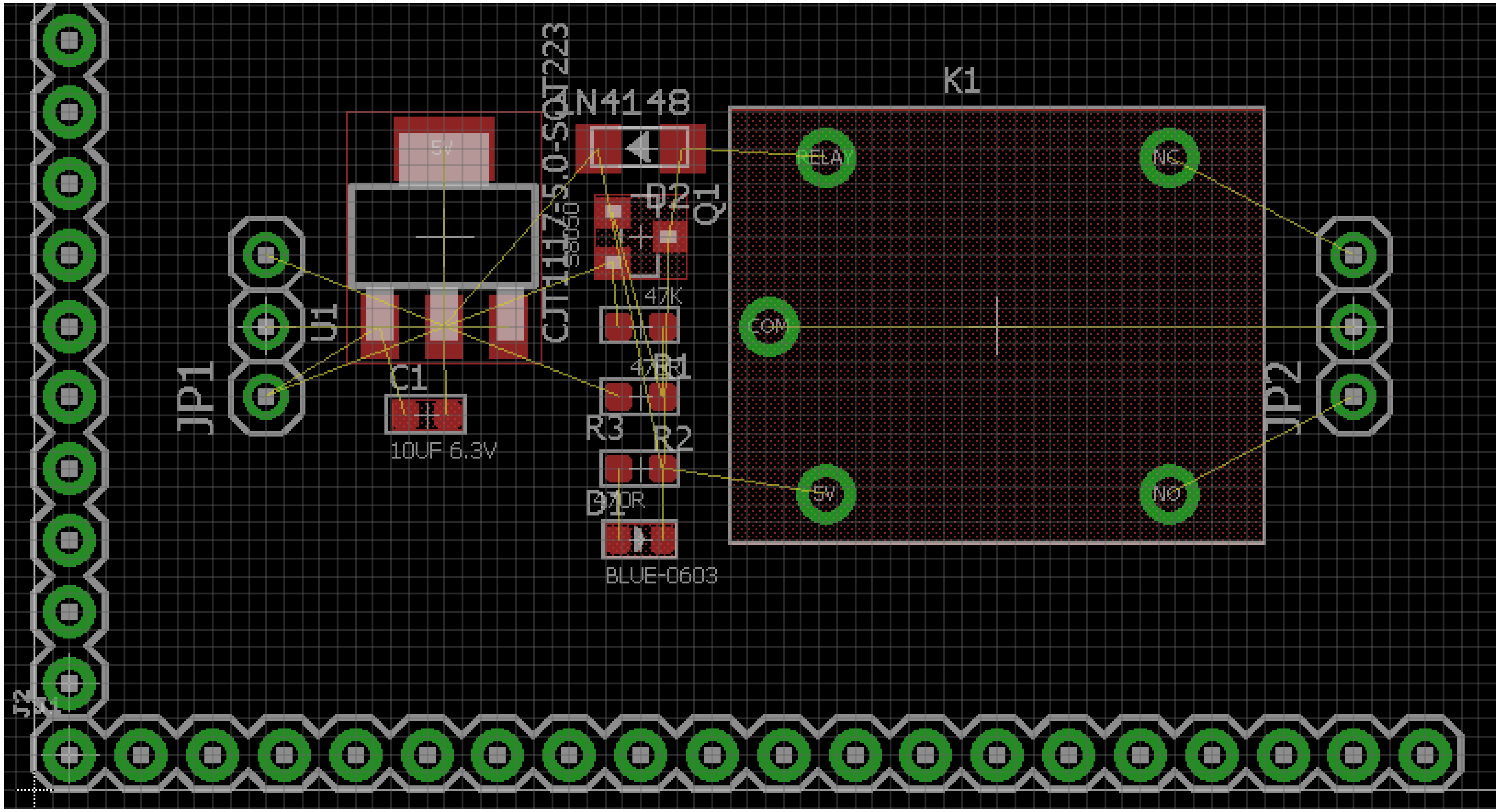
สามารถลงได้ทีละอุปกรณ์ได้

Lab 6 ลากเส้นโดยใช้ Net



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

เรียงอุปกรณ์บนบอร์ด



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

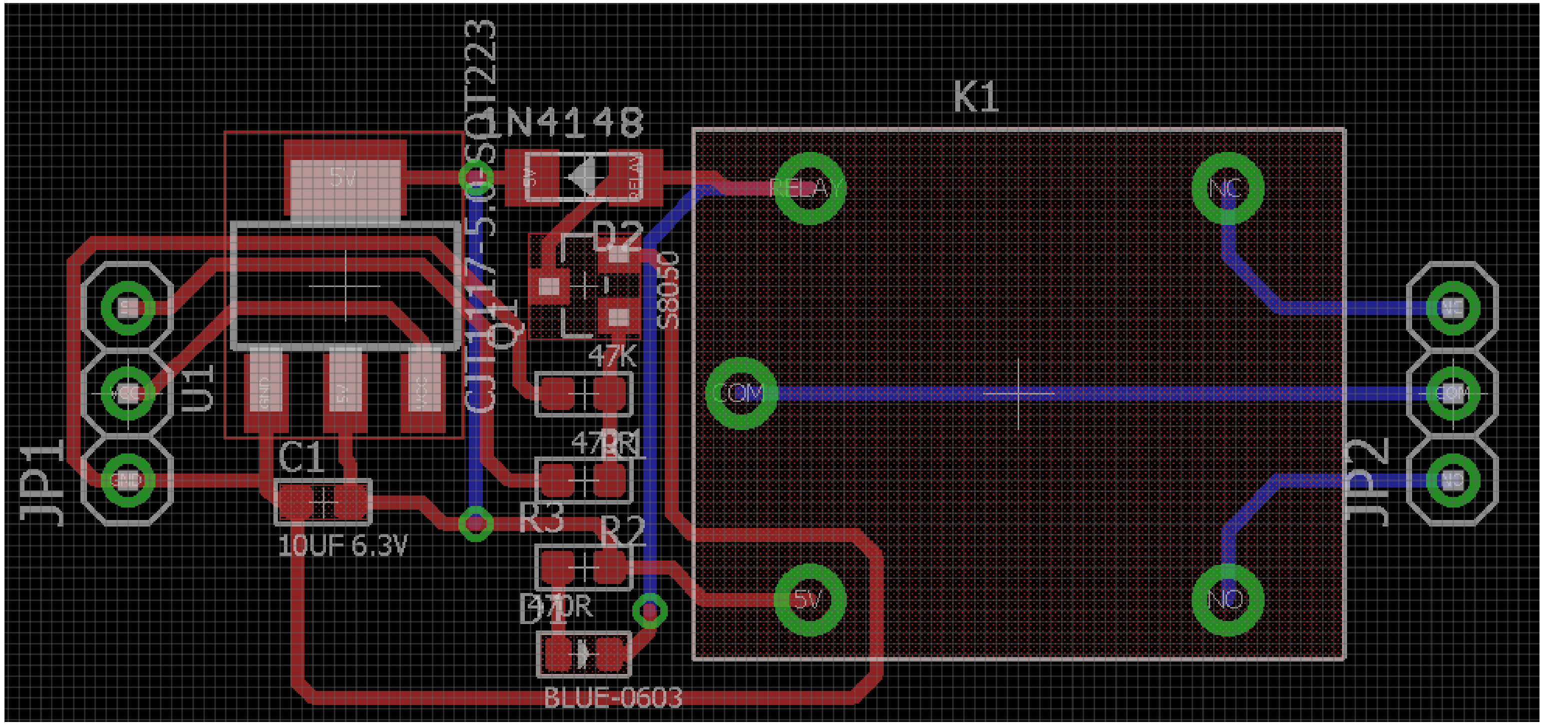
20 ขอบบอร์ด

21 สกรีนขาวด้านบน

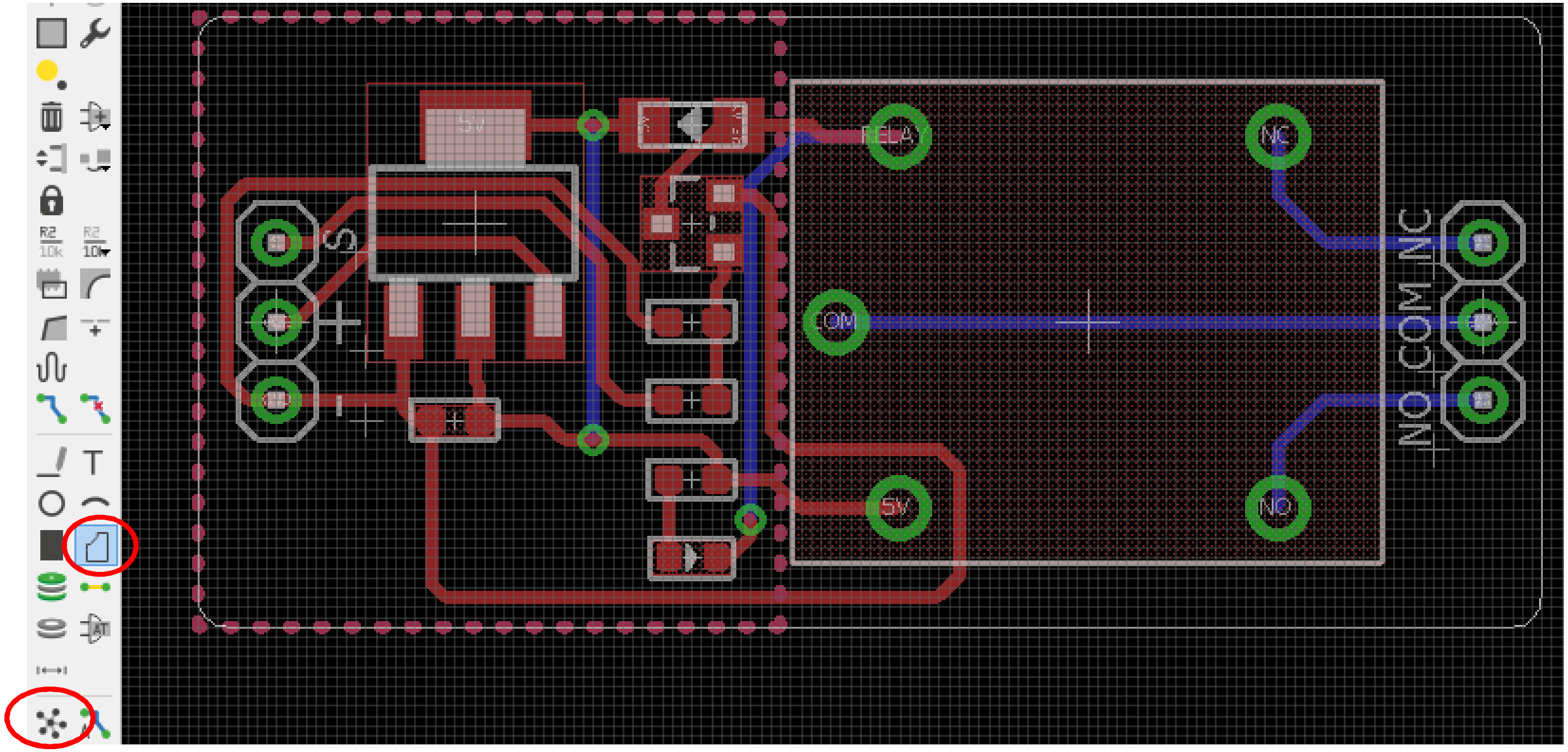
22 สกรีนขาวด้านล่าง

48, 51, 52 คอมเม้น

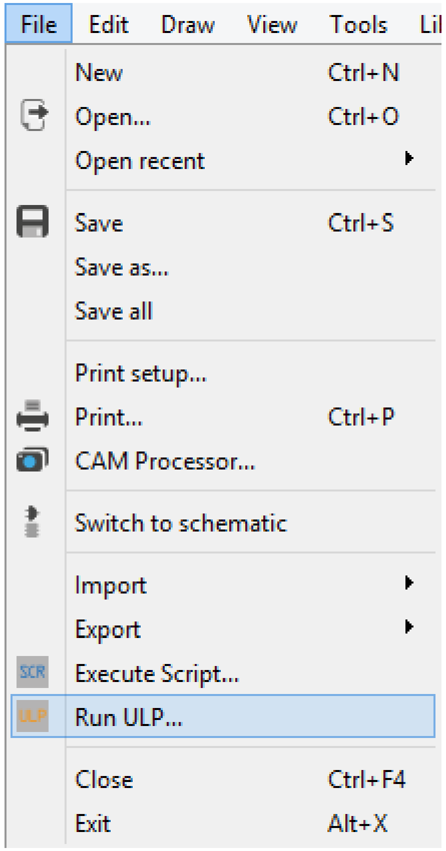
ลากเส้น Route

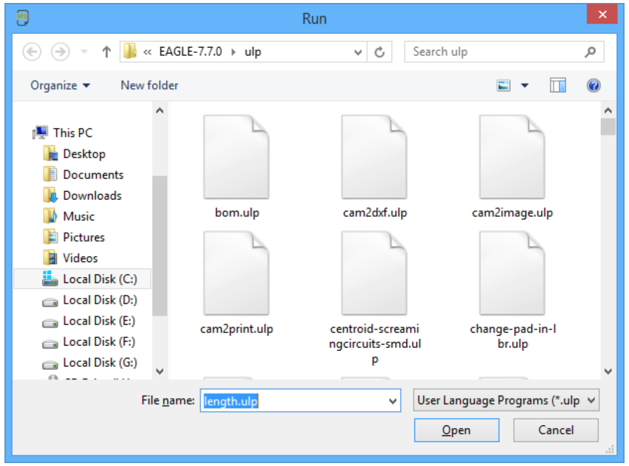


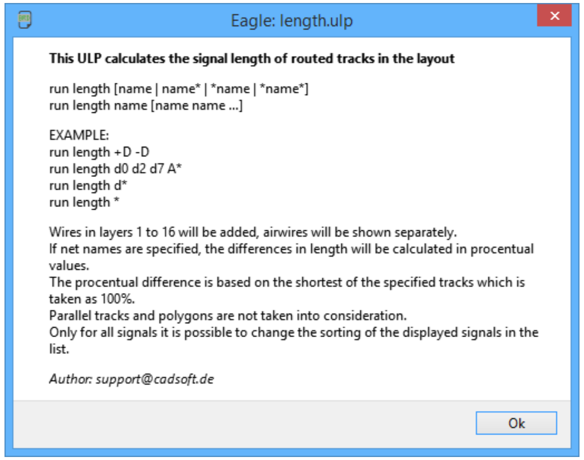
ใส่ Ground Plane

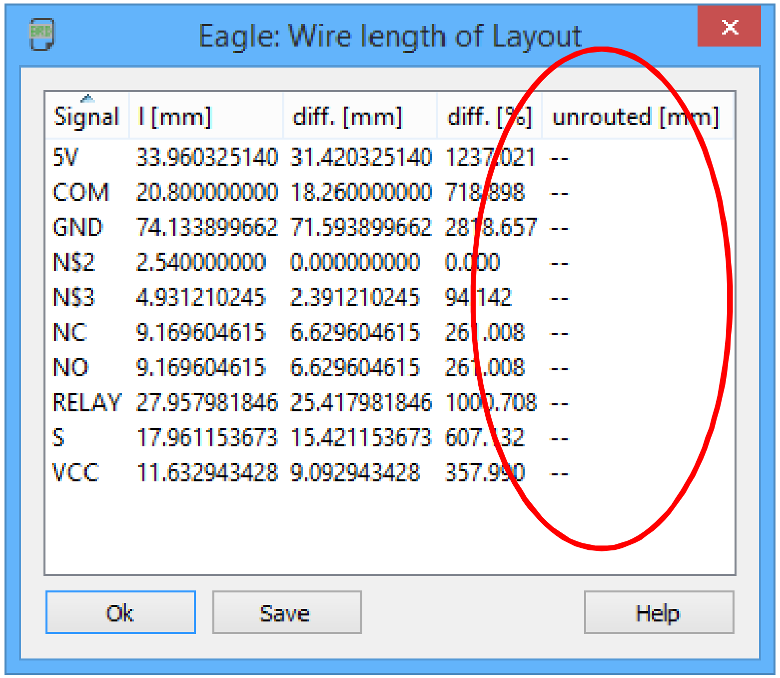


ตรวจลากครบทุกเส้น length.ulp

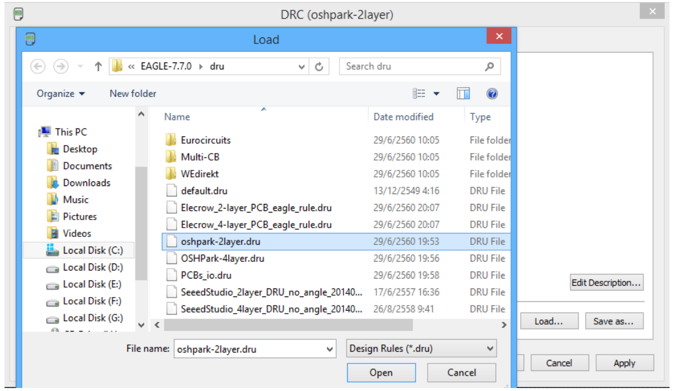


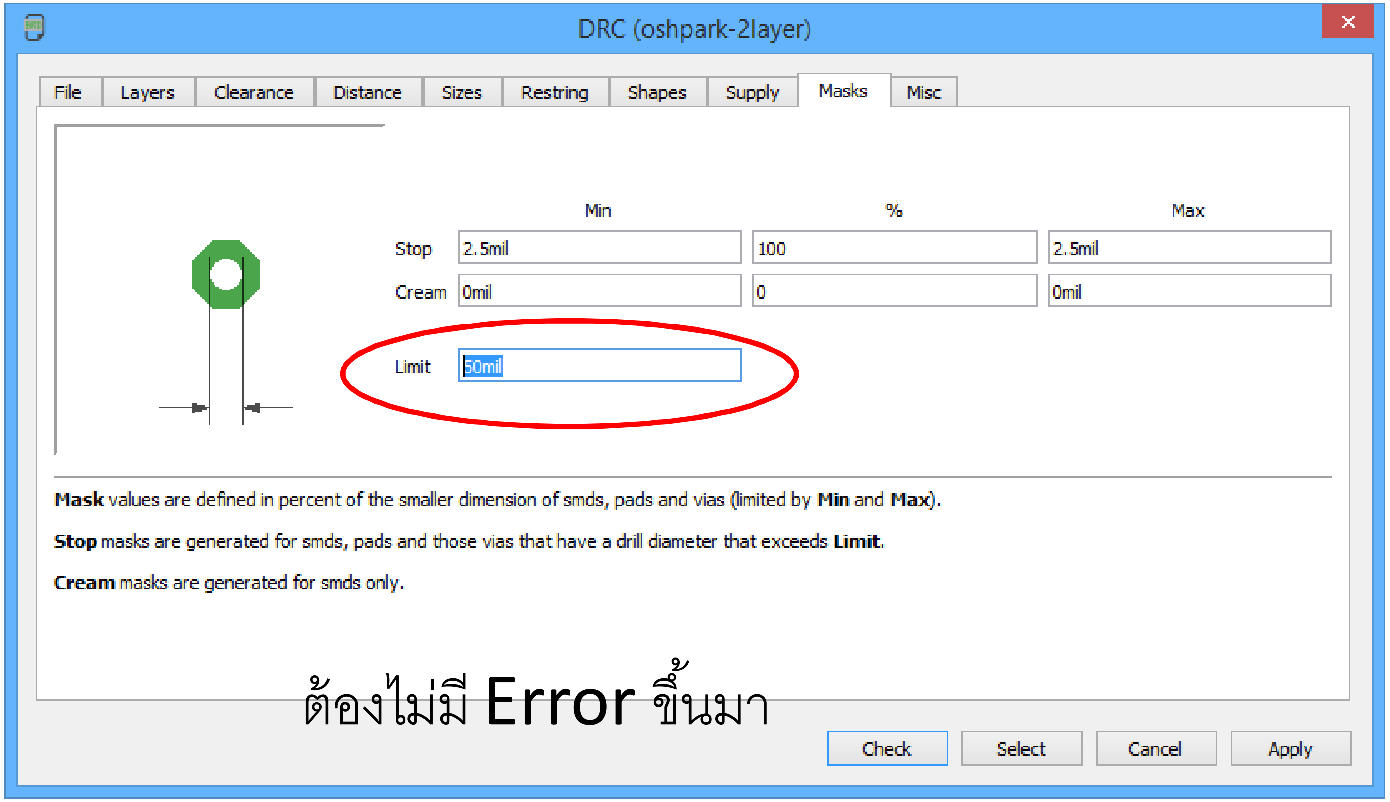






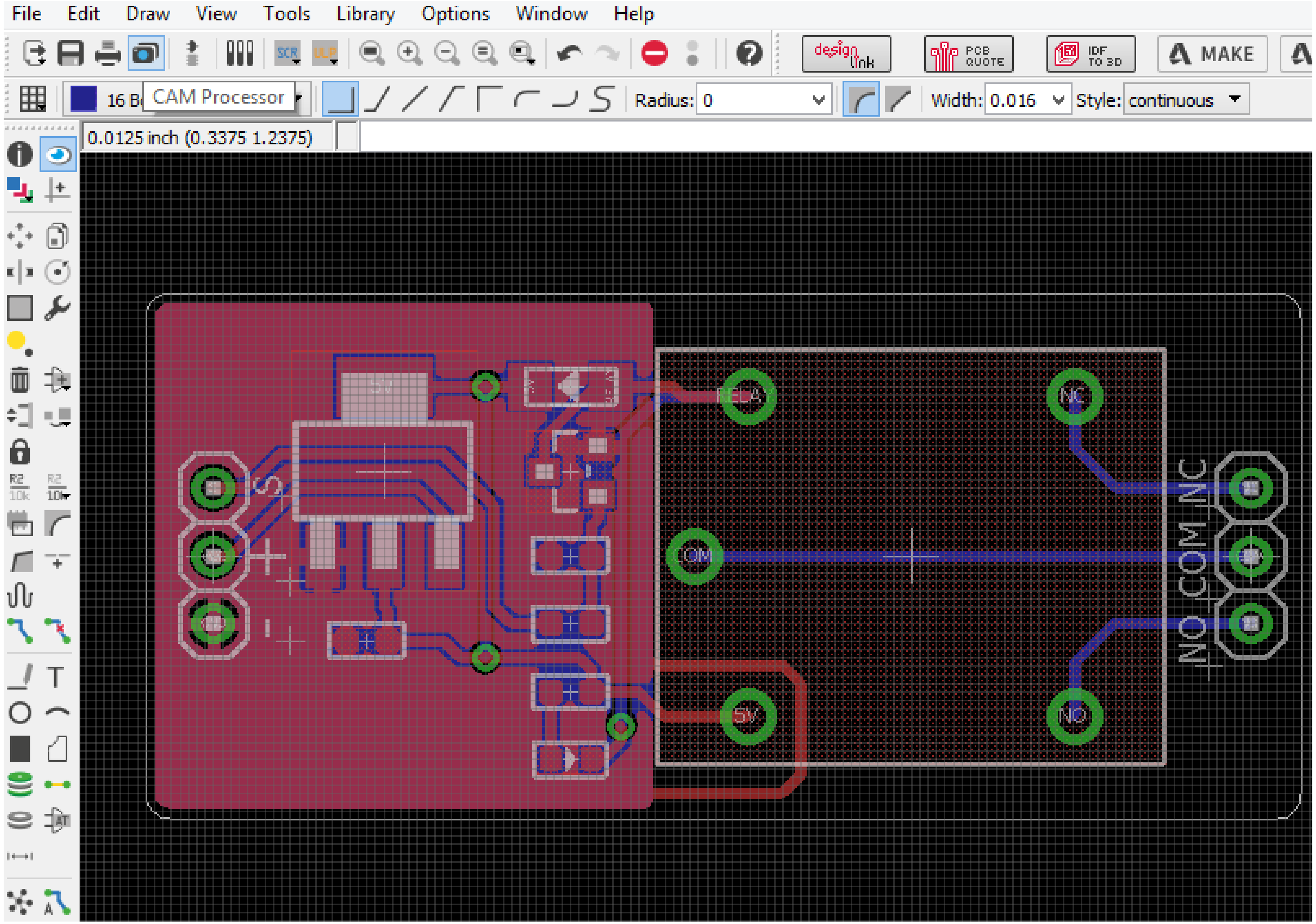
ตรวจ DRU oshpark-2layer.dru



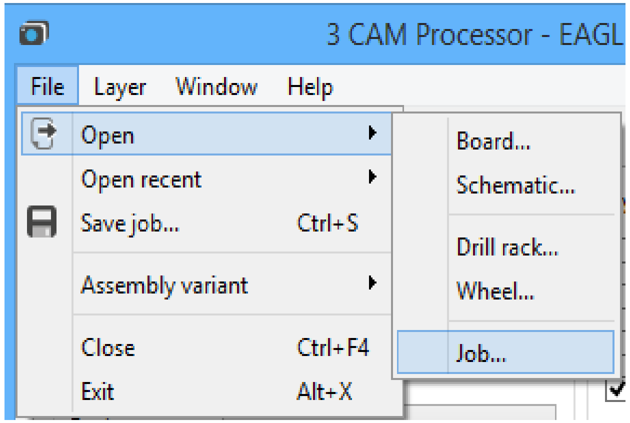


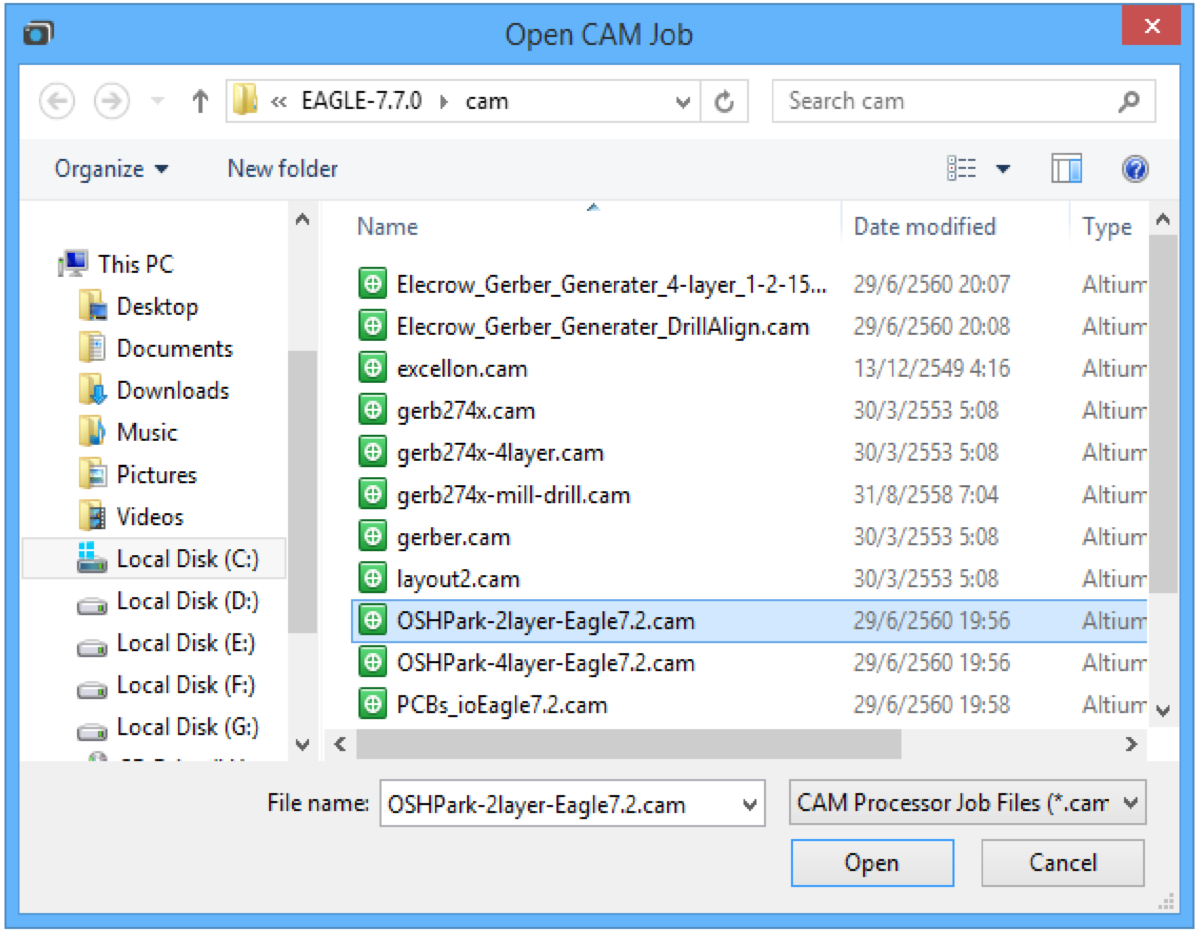
ต้องไม่มี Error ขึ้นมา

คลิกปุ่ม CAM Processor



File > Open > Job...





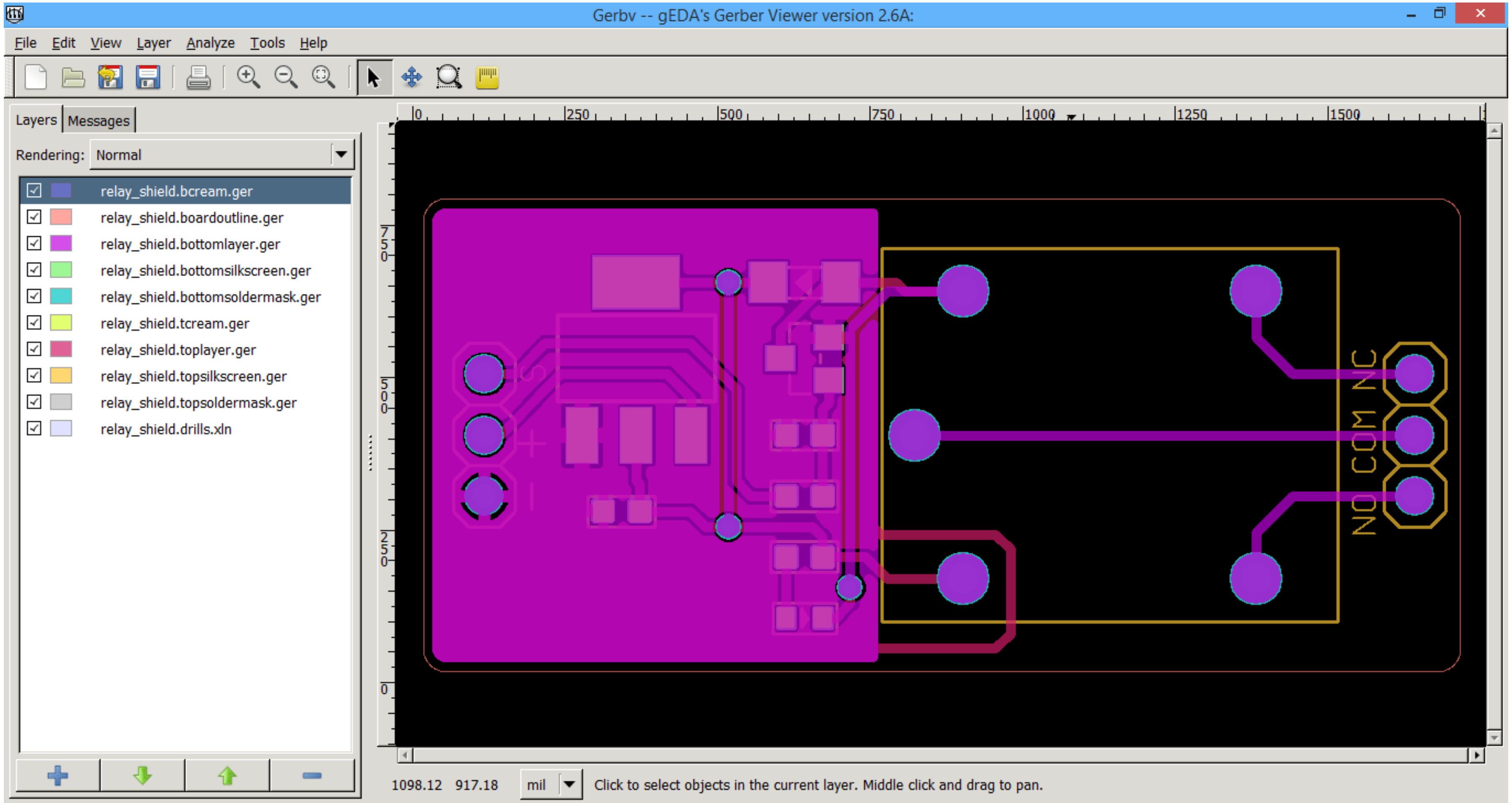
CAM File

PC ▸ Documents ▸ eagle ▸ lab2-relay_shield ▸ relay_shield ▸ relay_shield

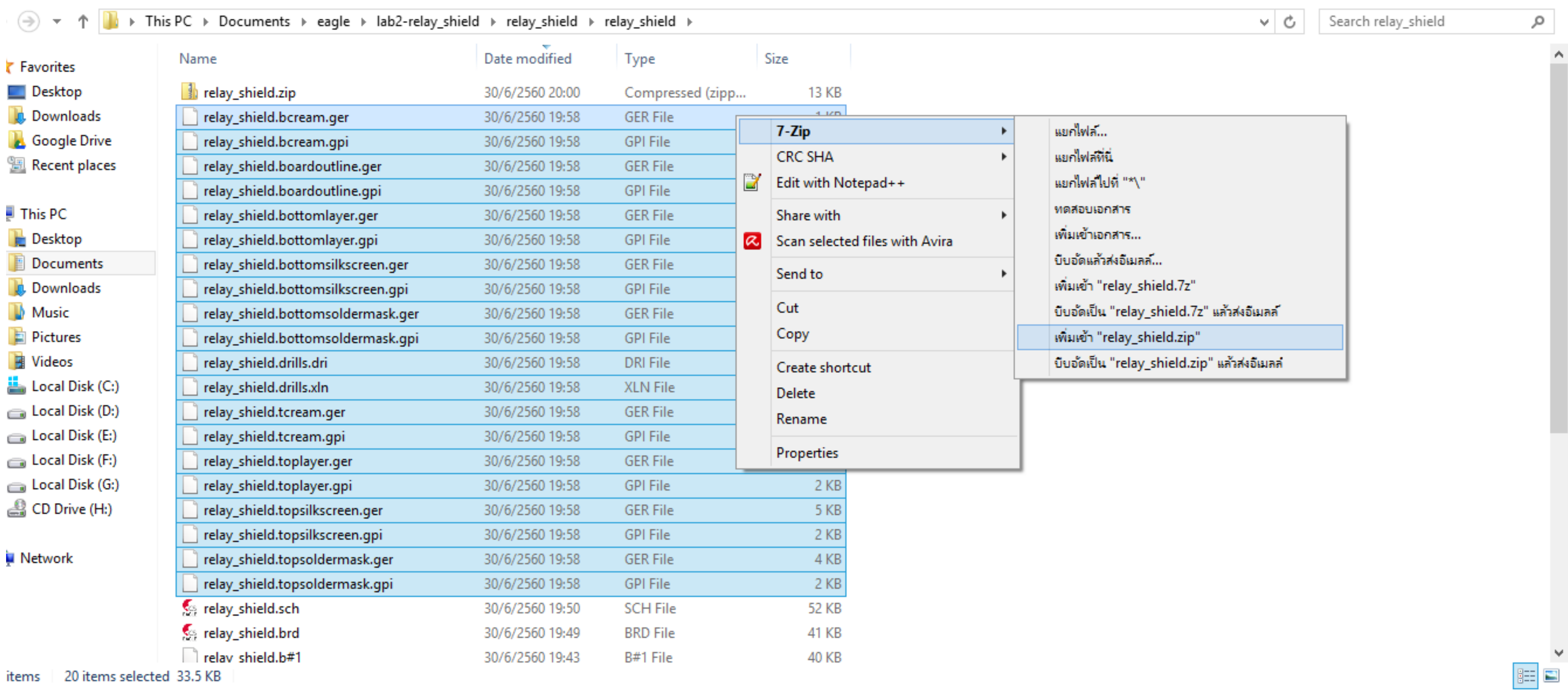
Name	Date modified	Type	Size
relay_shield.bcream.ger	30/6/2560 19:58	GER File	1 KB
relay_shield.bcream.gpi	30/6/2560 19:58	GPI File	1 KB
relay_shield.boardoutline.ger	30/6/2560 19:58	GER File	5 KB
relay_shield.boardoutline.gpi	30/6/2560 19:58	GPI File	2 KB
relay_shield.bottomlayer.ger	30/6/2560 19:58	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


This PC › Documents › eagle › lab2-relay_shield › relay_shield › relay_shield
Search relay_shield
Favorites
Desktop
Downloads
Google Drive
Recent places
This PC
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Local Disk (D:)
Local Disk (E:)
Local Disk (F:)
Local Disk (G:)
CD Drive (H:)
Network
Name
Date modified
Type
Size
relay_shield.zip 30/6/2560 20:00 Compressed (zipp... 13 KB
relay_shield.bcream.ger 30/6/2560 19:58 GER File
relay_shield.bcream.gpi 30/6/2560 19:58 GPI File
relay_shield.boardoutline.ger 30/6/2560 19:58 GER File
relay_shield.boardoutline.gpi 30/6/2560 19:58 GPI File
relay_shield.bottomlayer.ger 30/6/2560 19:58 GER File
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relay_shield.bottomsilkscreen.ger 30/6/2560 19:58 GER File
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relay_shield.bottomsoldermask.ger 30/6/2560 19:58 GER File
relay_shield.bottomsoldermask.gpi 30/6/2560 19:58 GPI File
relay_shield.drills.dri 30/6/2560 19:58 DRI File
relay_shield.drills.xln 30/6/2560 19:58 XLN File
relay_shield.tcream.ger 30/6/2560 19:58 GER File
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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
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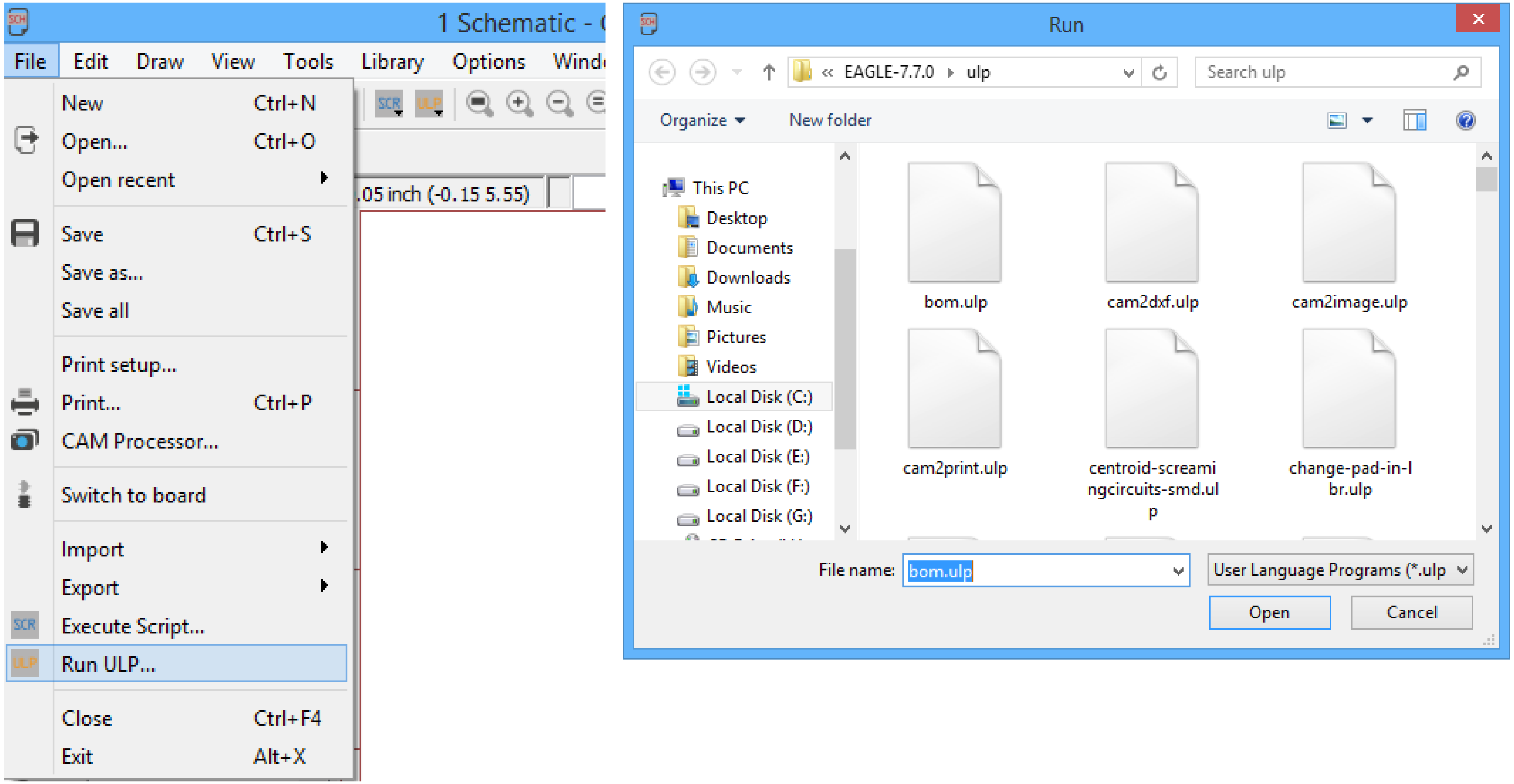
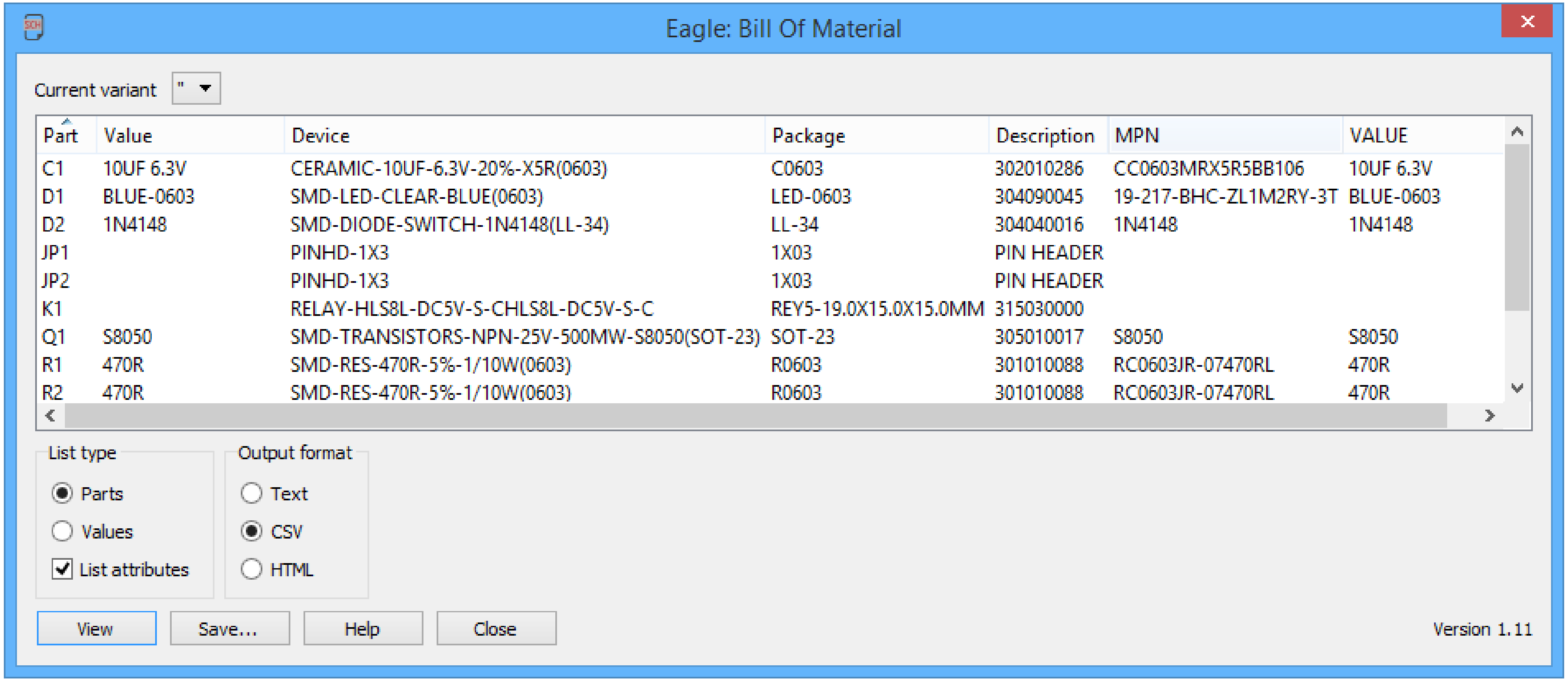
relay_shield.sch 30/6/2560 19:50 SCH File 52 KB
relay_shield.brd 30/6/2560 19:49 BRD File 41 KB
relay_shield.b#1 30/6/2560 19:43 B#1 File 40 KB
items 20 items selected 33.5 KB
7-Zip
CRC SHA
Edit with Notepad++
Share with
Scan selected files with Avira
Send to
Cut
Copy
Create shortcut
Delete
Rename
Properties
แยกไฟล์...
แยกไฟล์ที่นี่
แยกไฟล์ไปที่ "*\"
ทดสอบเอกสาร
เพิ่มเข้าเอกสาร...
บีบอัดแล้วส่งอีเมลล์...
เพิ่มเข้า "relay_shield.7z"
บีบอัดเป็น "relay_shield.7z" แล้วส่งอีเมลล์
เพิ่มเข้า "relay_shield.zip"
บีบอัดเป็น "relay_shield.zip" แล้วส่งอีเมลล์

Lab 11 BOM File

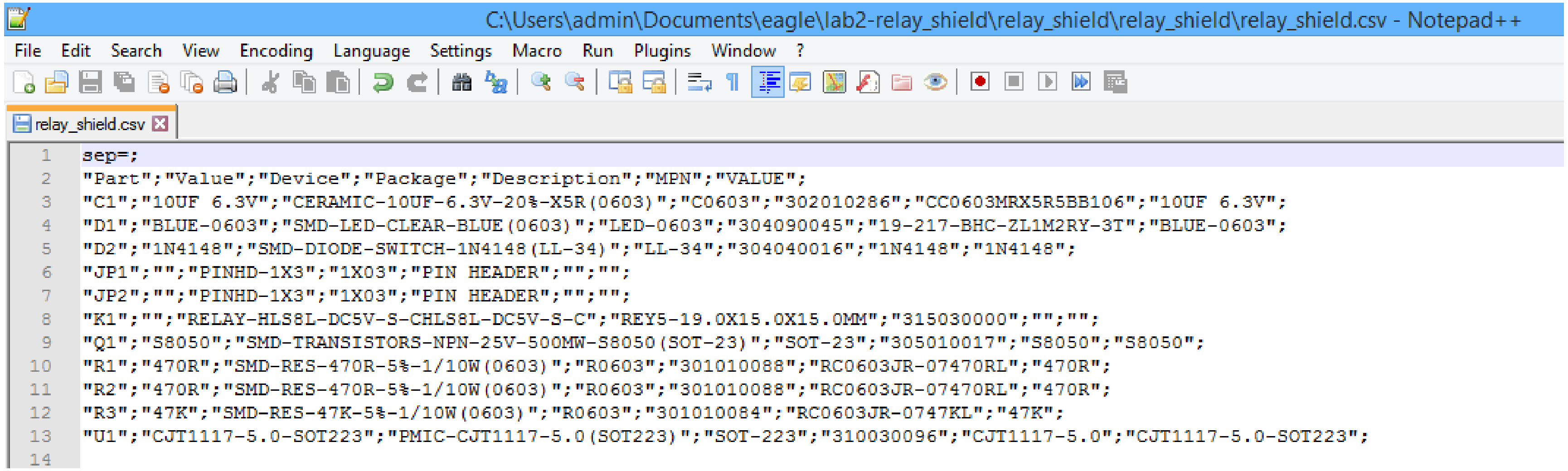


เลือก CSV แล้ว Save

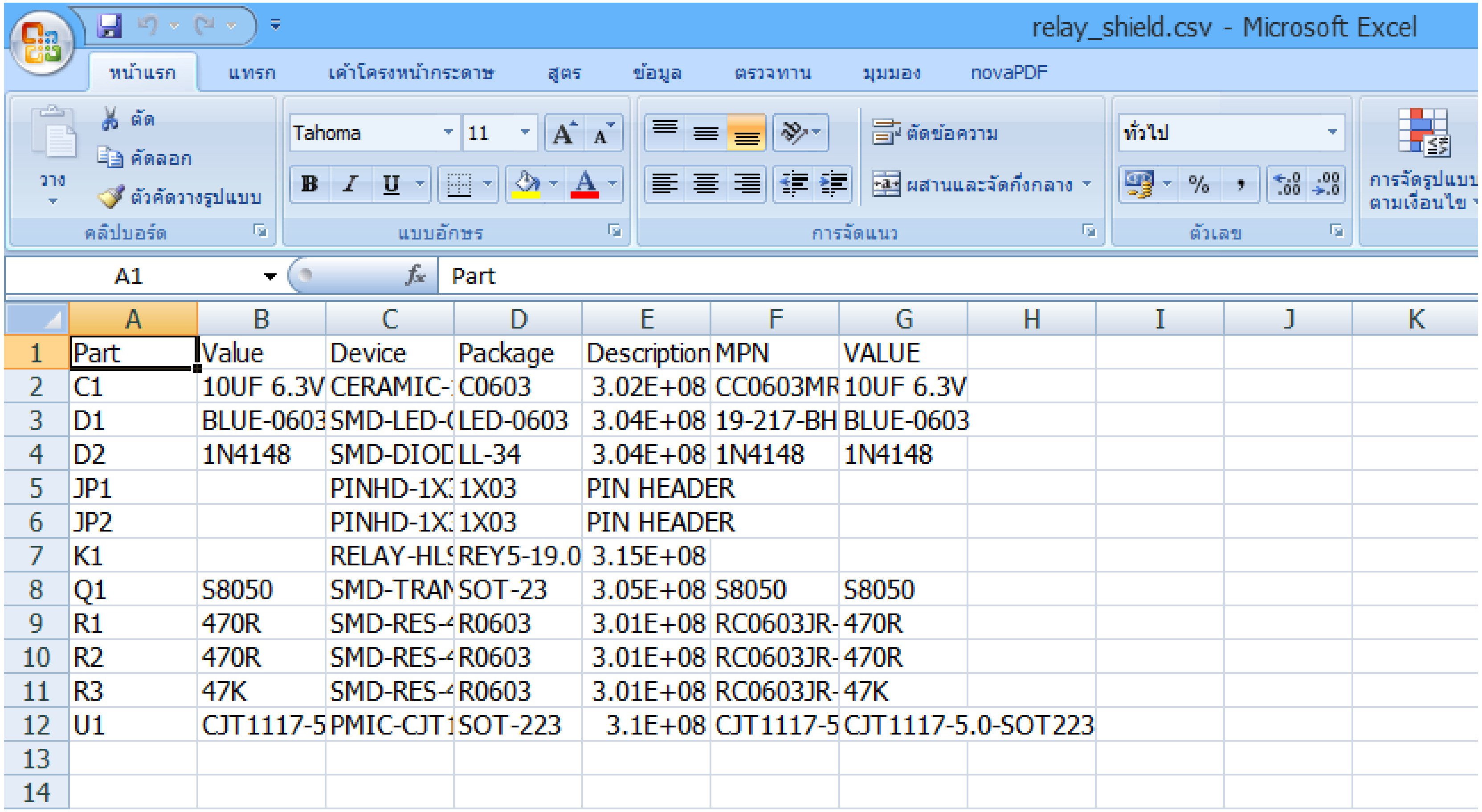


sep=;

- เปิดไฟล์ csv ด้วย Notepad
- พิมพ์ sep=; ในบรรทัดแรก



เปิด csv ด้วย Excel



	A	B	C	D	E	F	G
1	Part	Value	Device	Package	Description	MPN	VALUE
2	C1	10UF 6.3V	CERAMIC-	C0603	3.02E+08	CC0603MR	10UF 6.3V
3	D1	BLUE-0603	SMD-LED-(	LED-0603	3.04E+08	19-217-BH	BLUE-0603
4	D2	1N4148	SMD-DIOD	LL-34	3.04E+08	1N4148	1N4148
5	JP1		PINHD-1X	1X03	PIN HEADER		
6	JP2		PINHD-1X	1X03	PIN HEADER		
7	K1		RELAY-HLS	REY5-19.0	3.15E+08		
8	Q1	S8050	SMD-TRAN	SOT-23	3.05E+08	S8050	S8050
9	R1	470R	SMD-RES-4	R0603	3.01E+08	RC0603JR-	470R
10	R2	470R	SMD-RES-4	R0603	3.01E+08	RC0603JR-	470R
11	R3	47K	SMD-RES-4	R0603	3.01E+08	RC0603JR-	47K
12	U1	CJT1117-5	PMIC-CJT1	SOT-223	3.1E+08	CJT1117-5	CJT1117-5.0-SOT223
13							
14							

Lab12 เปิด bom template

bom.xlsx

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	

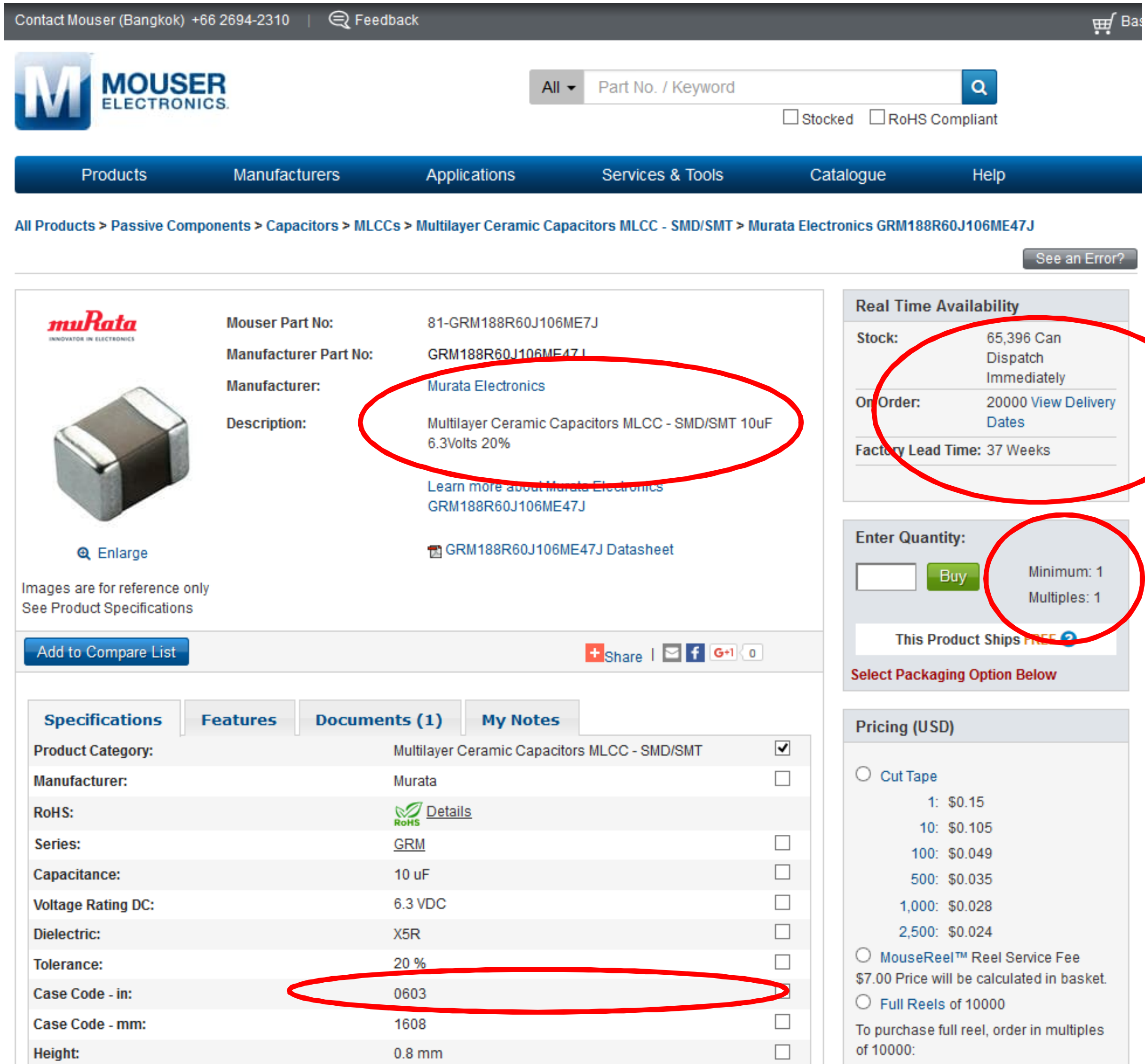
relay_shield.csv

Part	Value	Device	Package	Description	MPN	VALUE
C1	10UF 6.3V	CERAMIC-:	C0603	3.02E+08	CC0603MR	10UF 6.3V
D1	BLUE-0603	SMD-LED-(	LED-0603	3.04E+08	19-217-BH	BLUE-0603
D2	1N4148	SMD-DIOD	LL-34	3.04E+08	1N4148	1N4148
JP1		PINHD-1X:	1X03	PIN HEADER		
JP2		PINHD-1X:	1X03	PIN HEADER		
K1		RELAY-HLS	REY5-19.0	3.15E+08		
Q1	S8050	SMD-TRAN	SOT-23	3.05E+08	S8050	S8050
R1	470R	SMD-RES-4	R0603	3.01E+08	RC0603JR-	470R
R2	470R	SMD-RES-4	R0603	3.01E+08	RC0603JR-	470R
R3	47K	SMD-RES-4	R0603	3.01E+08	RC0603JR-	47K
U1	CJT1117-5	PMIC-CJT1	SOT-223	3.1E+08	CJT1117-5	CJT1117-5.0-S

relay_shield

พร้อม ค่าเฉลี่ย: 1.222222222 นับจำนวน: 9 ผลรวม: 11

Lab13 ค้นหา bom



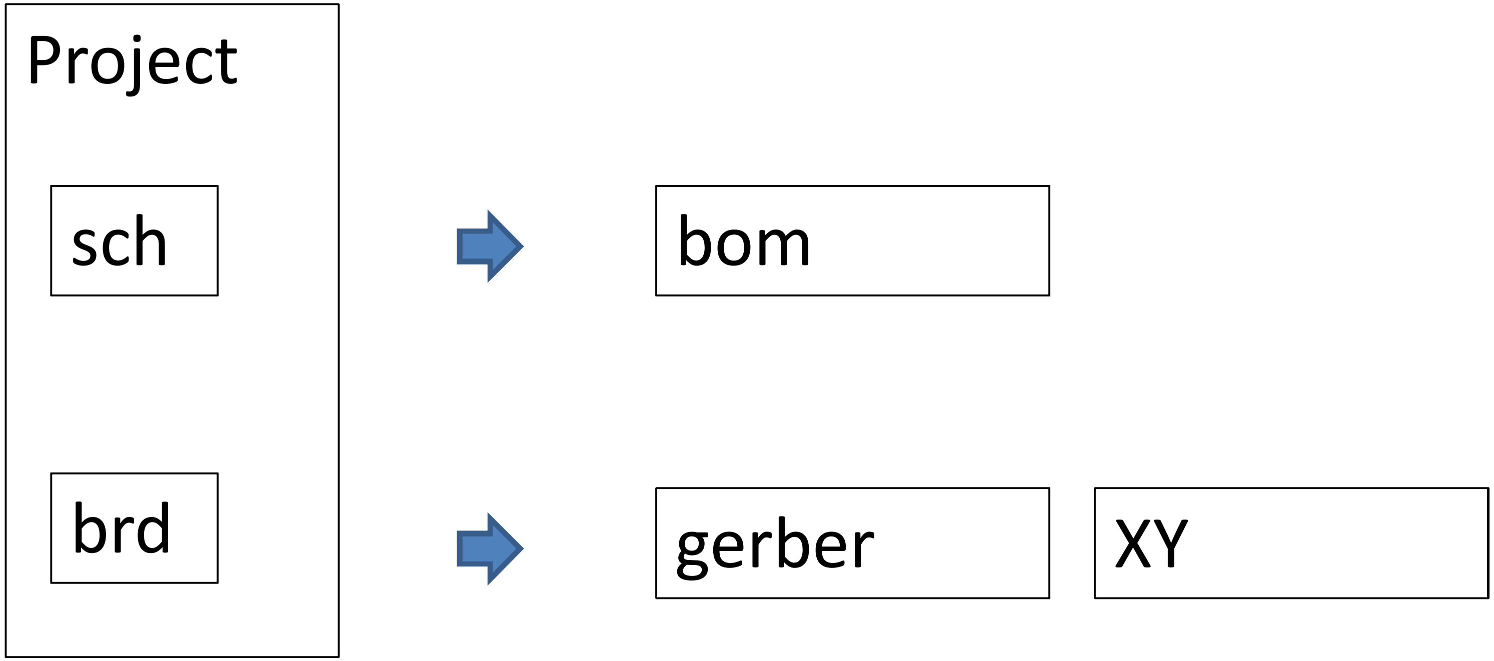
Bom.xlsx

	A	B	C	D	E	F	G	H	I
1			**Relay Module**		**v1.0**	2/9/2560			
2									
3	**Item**	**Quantity**	**Reference**	**Part**	**Footprint**	**Mfg**	**Mfg P/N**	**Vendor**	**Vendor P/N**
4	**1**	1	C1	Ceramic Capacitors MLCC - SMD/SMT 10uF 6.3Volts 20%	0603	Murata Electronics	GRM188R60J106ME47J	Mouser	81-GRM188R60J106
5	**2**	1	D1	SMD Blue Clear 470nm	0603	Lite-On	LTST-C190TBKT	Mouser	859-LTST-C190
6	**3**	1	D2	General Purpose, Power, Switching 100V Io/200mA T/R	LL-34	Fairchild Semiconductor	FDLL4148	Mouser	512-FDL
7	**4**	2	JP1, JP2						
8	**5**	1	K1	Relays Power PCB Relay SPDT Sealed 5VDC	SPDT (1 Form C)	Omron	G5LE-14-DC5	Mouser	653-G5LE-1
9	**6**	1	Q1	Bipolar Transistors - BJT 625mW, 25V, 1500mA	SOT-23-3	Micro Commercial Components (MCC)	MMSS8050-L-TP	Mouser	833-MMSS8050
10	**7**	2	R1, R2	SMD 470 OHM 1%	0603	Yageo	RC0603FR-07470RL	Mouser	603-RC0603FR-07
11	**8**	1	R3	SMD 47K OHM 1%	0603	Yageo	RC0201FR-0747KL	Mouser	603-RC0201FR-0
12	**9**	1	U1	LDO Voltage Regulators 5.0V 1A Positive	SOT-223-3	ON Semiconductor	NCP1117ST50T3G	Mouser	863-NCP1117ST5
13									

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

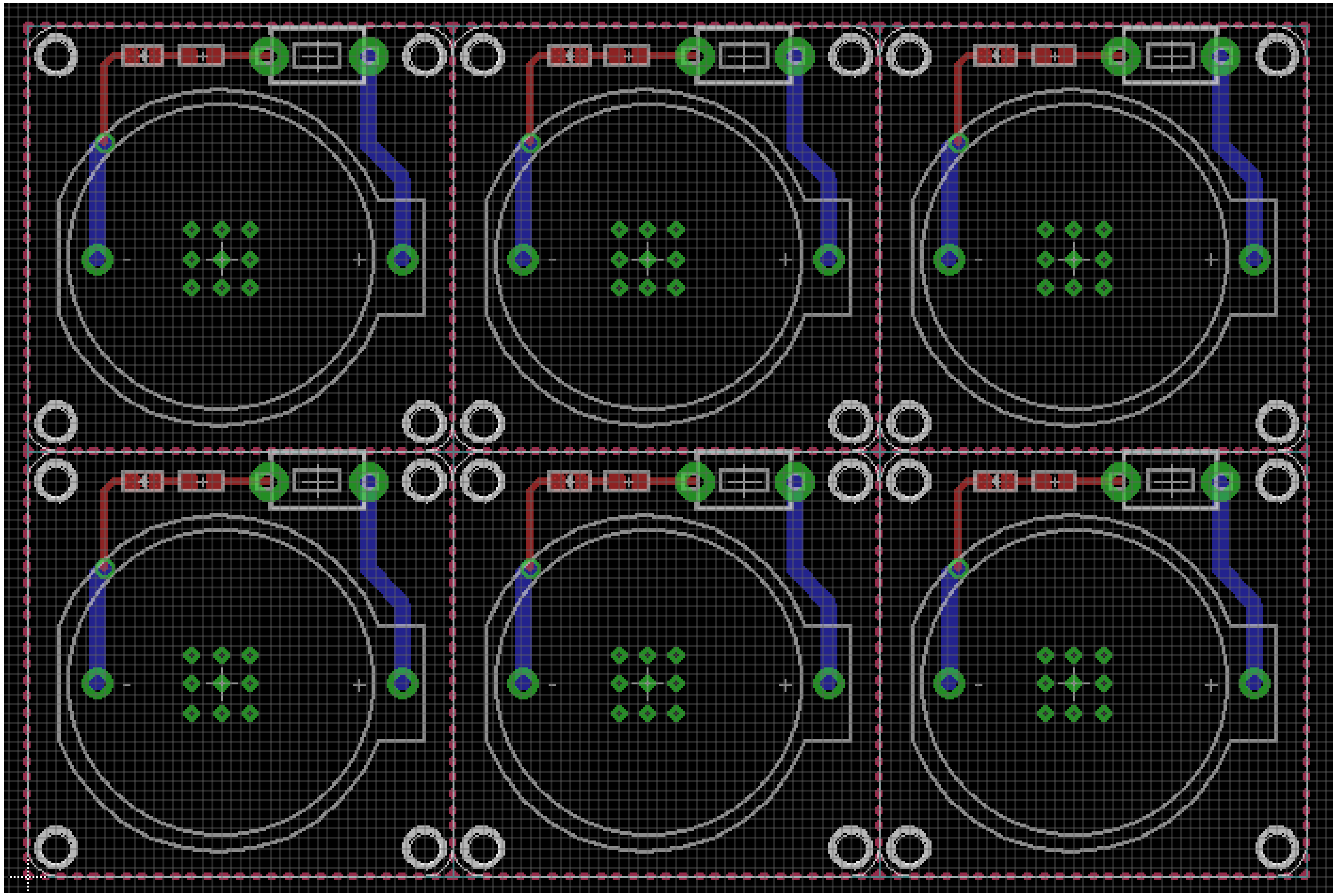
บอร์ดมีขนาดเล็ก?

File > New

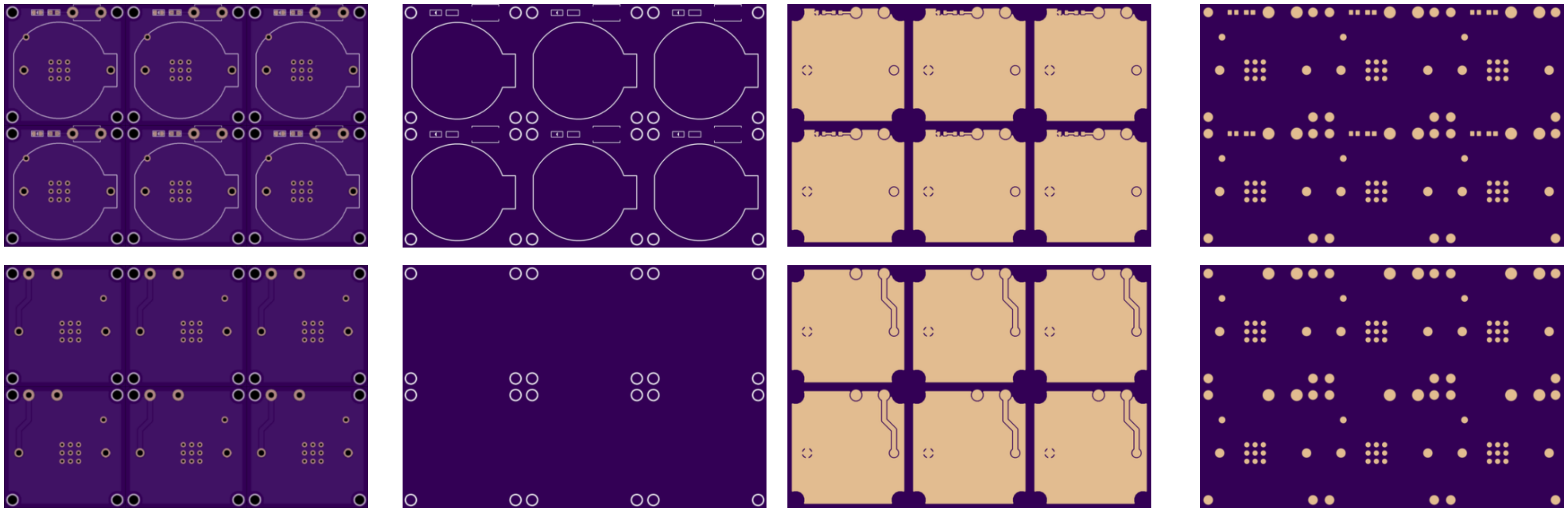
Edit > Paste

Wire > layer 46 width: 0 เพื่อแบ่งช่อง

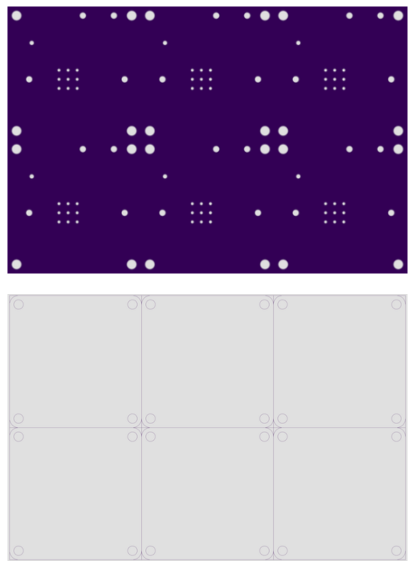
แล้วบันทึก switch2032-panel.brd



สร้าง gerber ใหม่



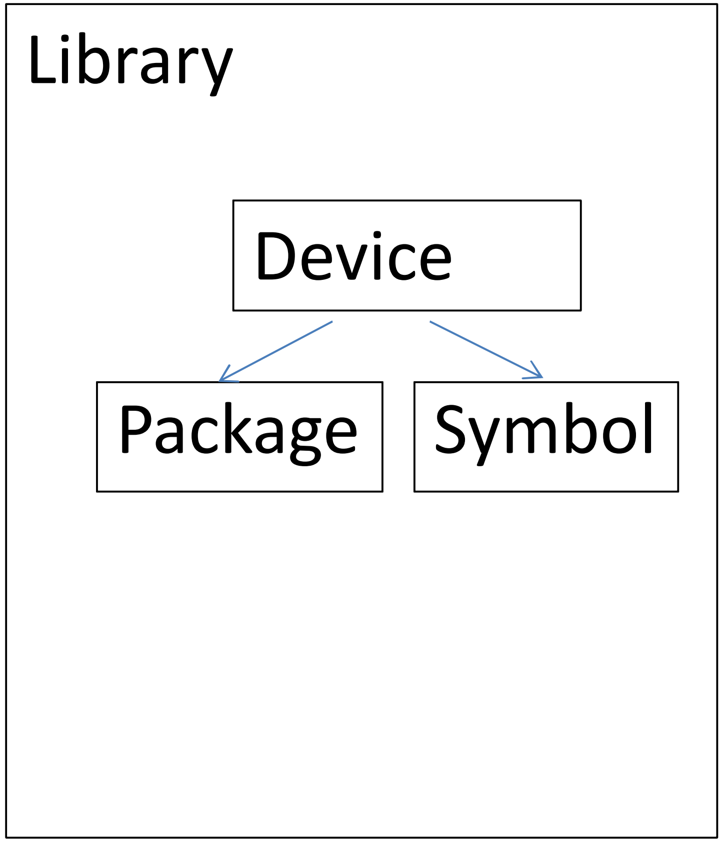
ให้คำนวณ cost ของ panel



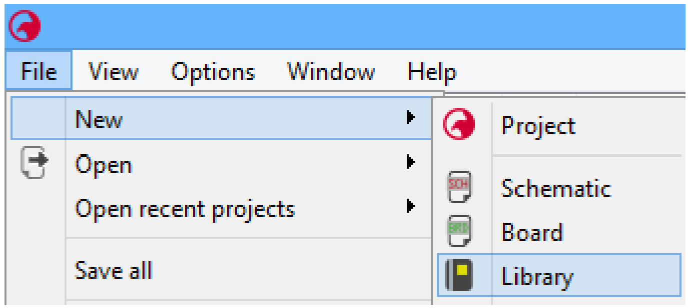
อุปกรณ์ใหม่ ไม่มีลายทองแดง?

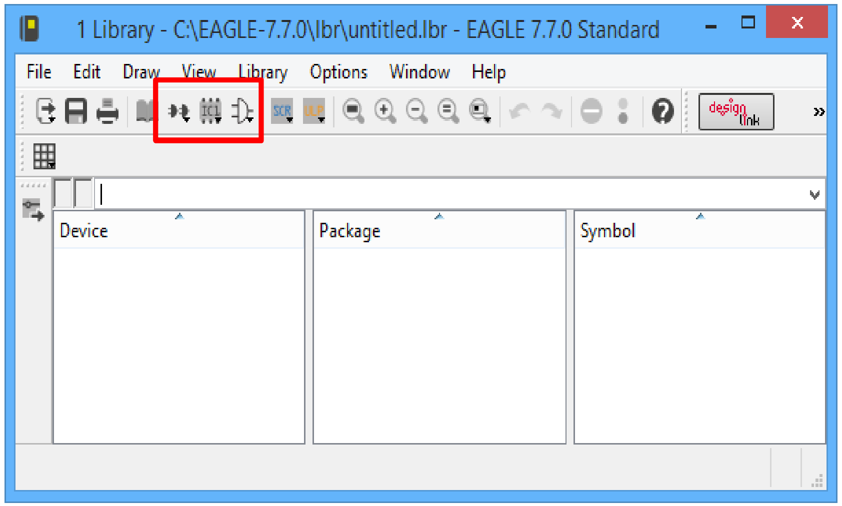
Library

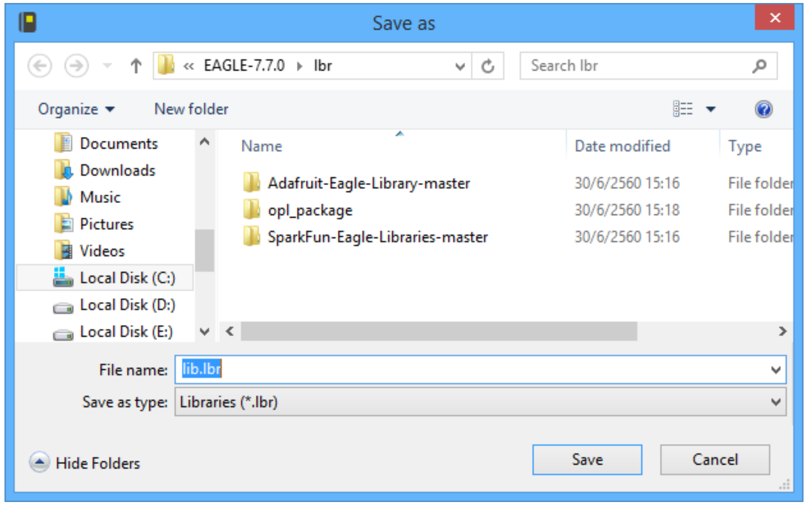
- Device > Lib
- Package > Brd
- Symbol > Sch

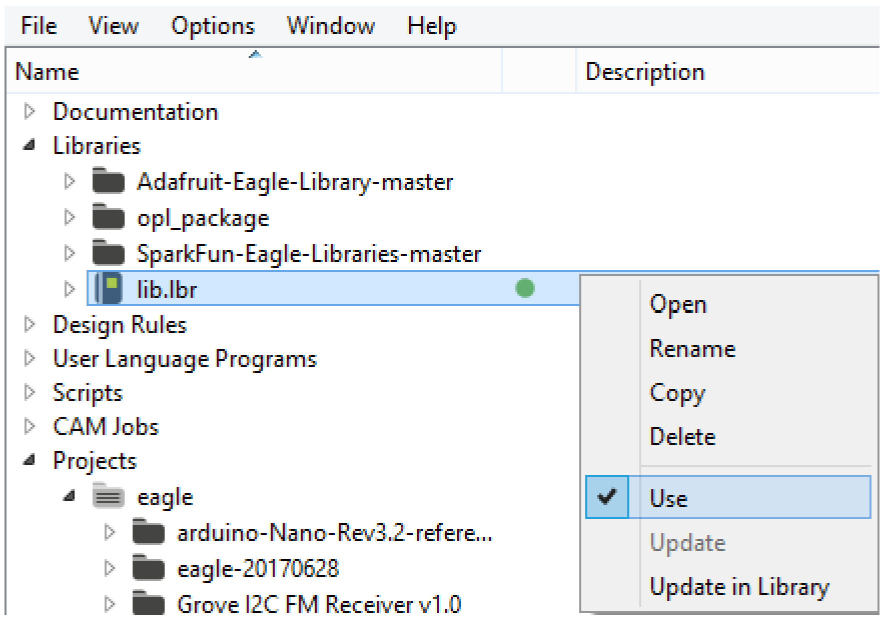


File > New > Library







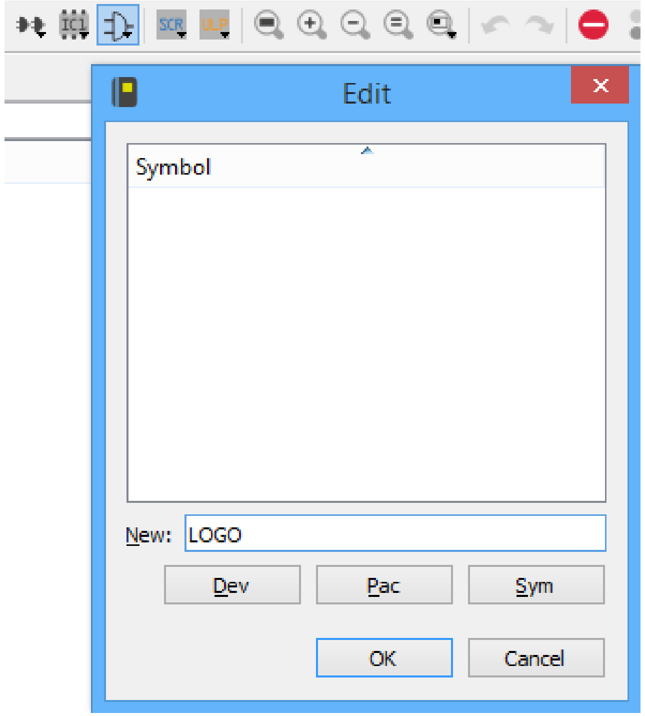


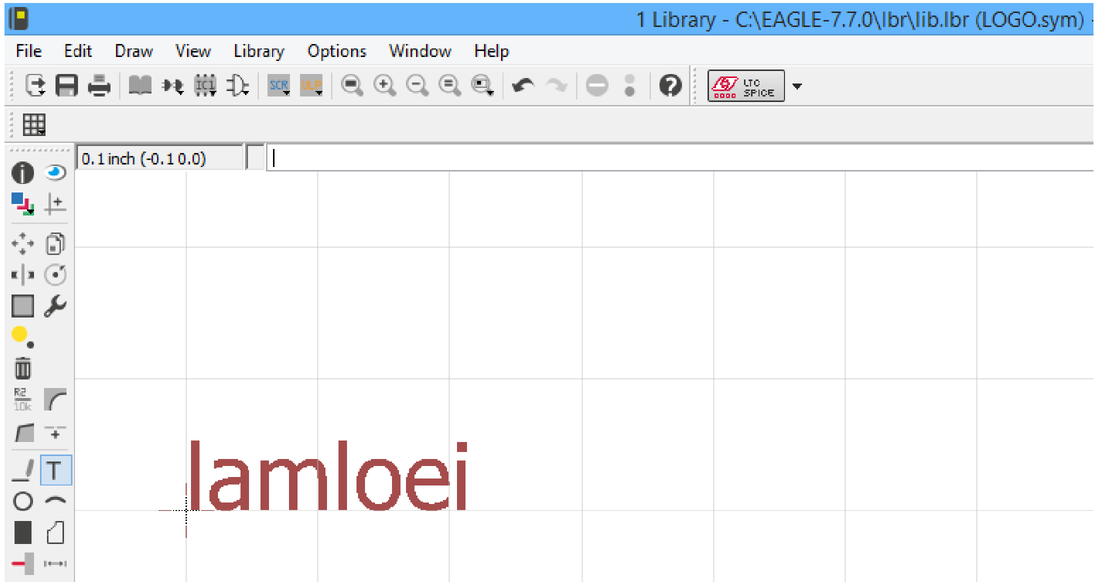
สร้าง library ใหม่

แล้วบันทึก

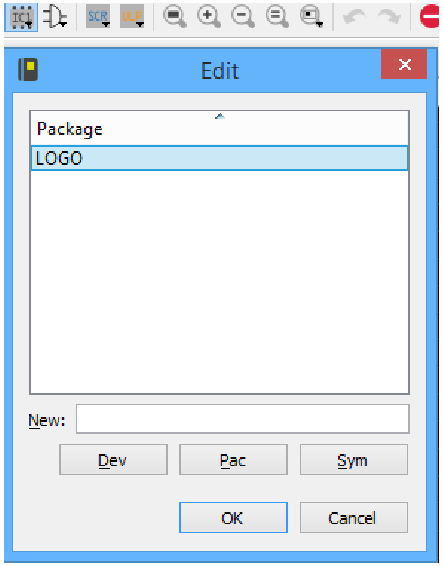
คลิกขวา Use

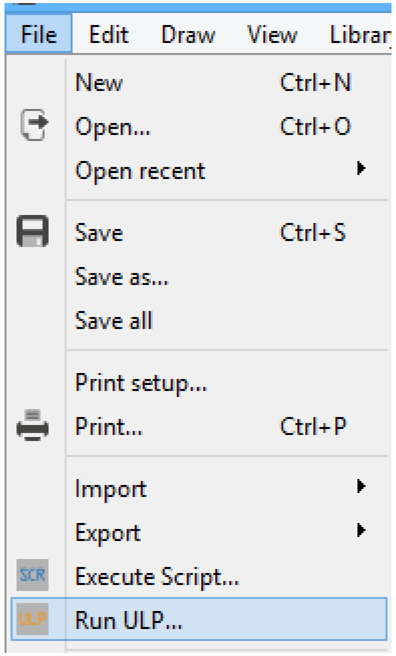
New Symbol

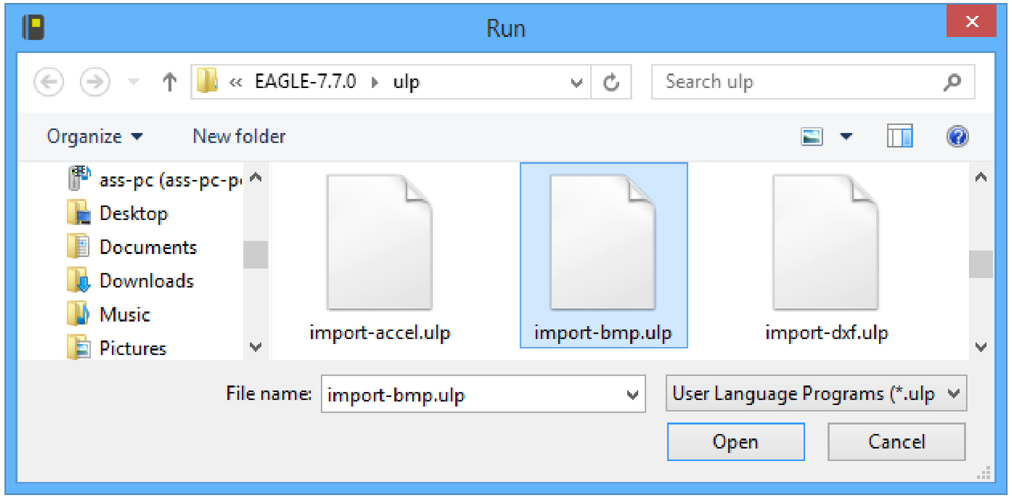

Edit
Symbol
New: LOGO
Dev
Pac
Sym
OK
Cancel

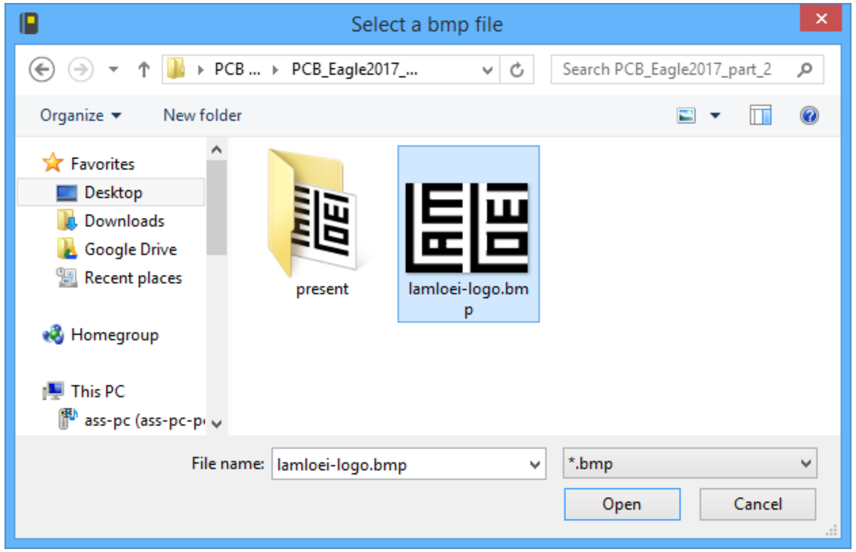

1 Library - C:\EAGLE-7.7.0\lbr\lib.lbr (LOGO.sym)
File Edit Draw View Library Options Window Help
0.1 inch (-0.1 0.0)
lamloei

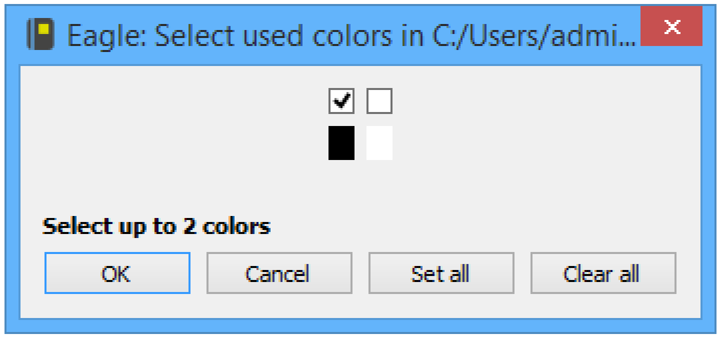
New Package


Edit
Package
LOGO
New:
Dev
Pac
Sym
OK
Cancel

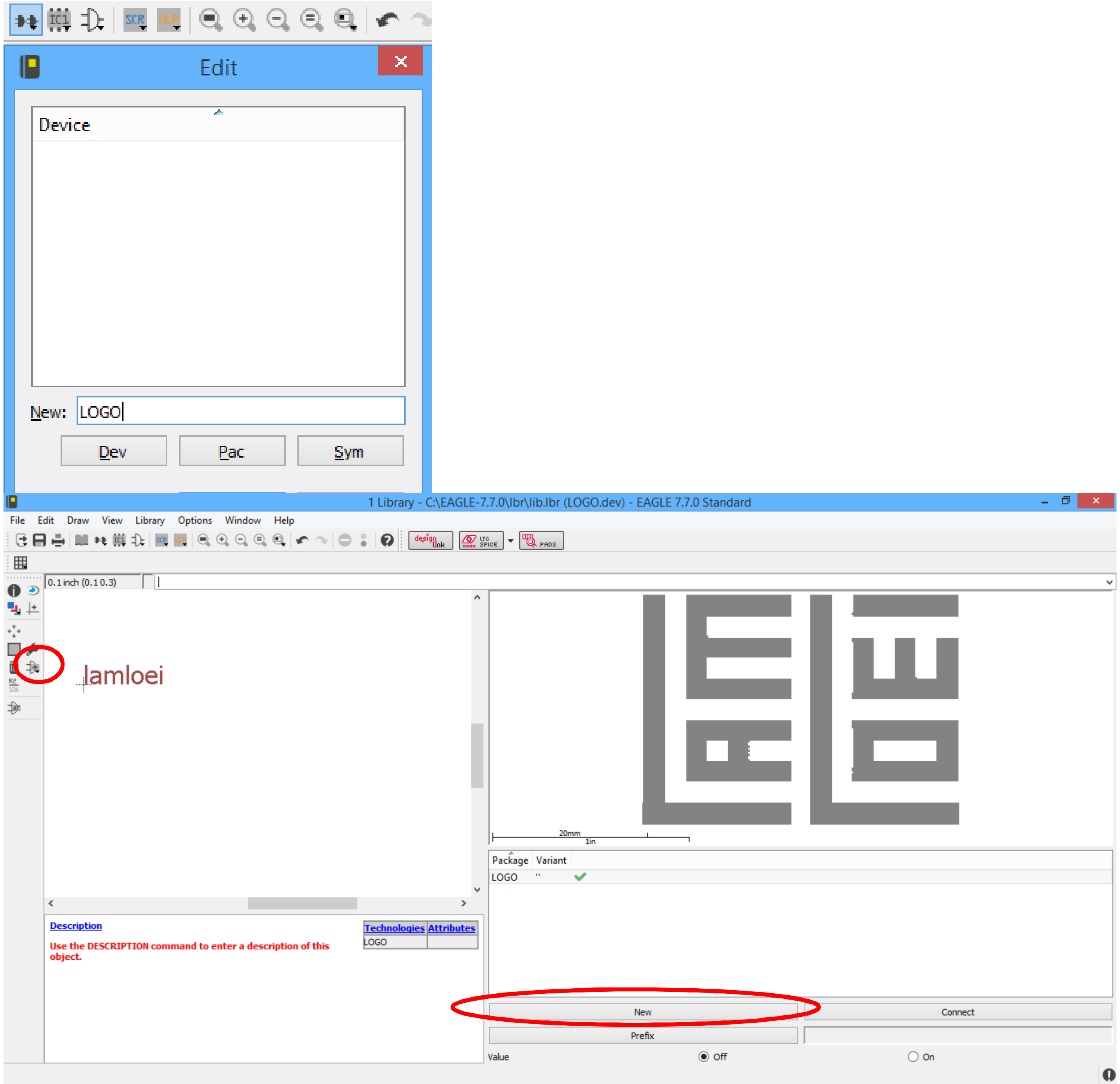

File
Edit
Draw
View
Librar
New Ctrl+N
Open... Ctrl+O
Open recent
Save Ctrl+S
Save as...
Save all
Print setup...
Print... Ctrl+P
Import
Export
Execute Script...
Run ULP...


Run
« EAGLE-7.7.0 ▸ ulp
Search ulp
Organize
New folder
ass-pc (ass-pc-p
Desktop
Documents
Downloads
Music
Pictures
import-accel.ulp
import-bmp.ulp
import-dxf.ulp
File name: import-bmp.ulp
User Language Programs (*.ulp
Open
Cancel


Select a bmp file
PCB ... ▸ PCB_Eagle2017_...
Search PCB_Eagle2017_part_2
Organize
New folder
Favorites
Desktop
Downloads
Google Drive
Recent places
Homegroup
This PC
ass-pc (ass-pc-p
present
lamloei-logo.bmp
File name: lamloei-logo.bmp
*.bmp
Open
Cancel


Eagle: Select used colors in C:/Users/admi...
Select up to 2 colors
OK
Cancel
Set all
Clear all

New Device



แล้วบันทึก

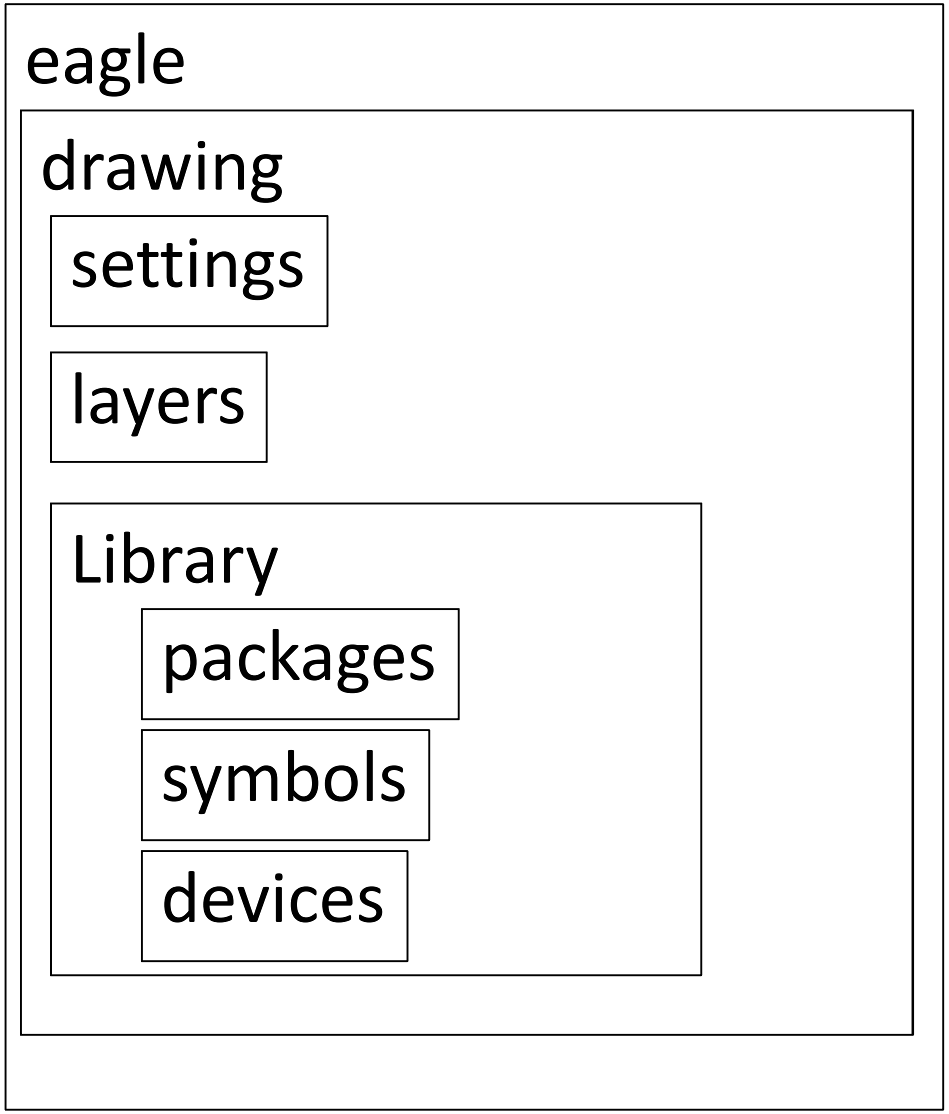
ปรับแต่งขั้นสูง?

Lab6 xml

Seeed-Relay.lbr

```xml
<?xml version="1.0" encoding="utf-8"?>
<!DOCTYPE eagle SYSTEM "eagle.dtd">
<eagle version="6.4">
<drawing>
<settings>
<setting alwaysvectorfont="no"/>
<setting verticaltext="up"/>
</settings>
<grid distance="50" unitdist="mil" unit="mil" style="lines" multiple="1" display="yes"
<layers>
<library>
<packages>
<package name="REY5-19.0X15.0X15.0MM">
</packages>
<symbols>
<symbol name="RELAY-HLS8L-DC5V-S-C">
</symbols>
<devicesets>
<deviceset name="RELAY-HLS8L-DC3V-S-C(5P-19X15MM)" prefix="K" uservalue="yes">
<deviceset name="RELAY-HLS8L-DC5V-S-C" prefix="K" uservalue="yes">
</devicesets>
</library>
</drawing>
</eagle>
```

โครงสร้าง xml ของ library



Q & A

AM
OEI