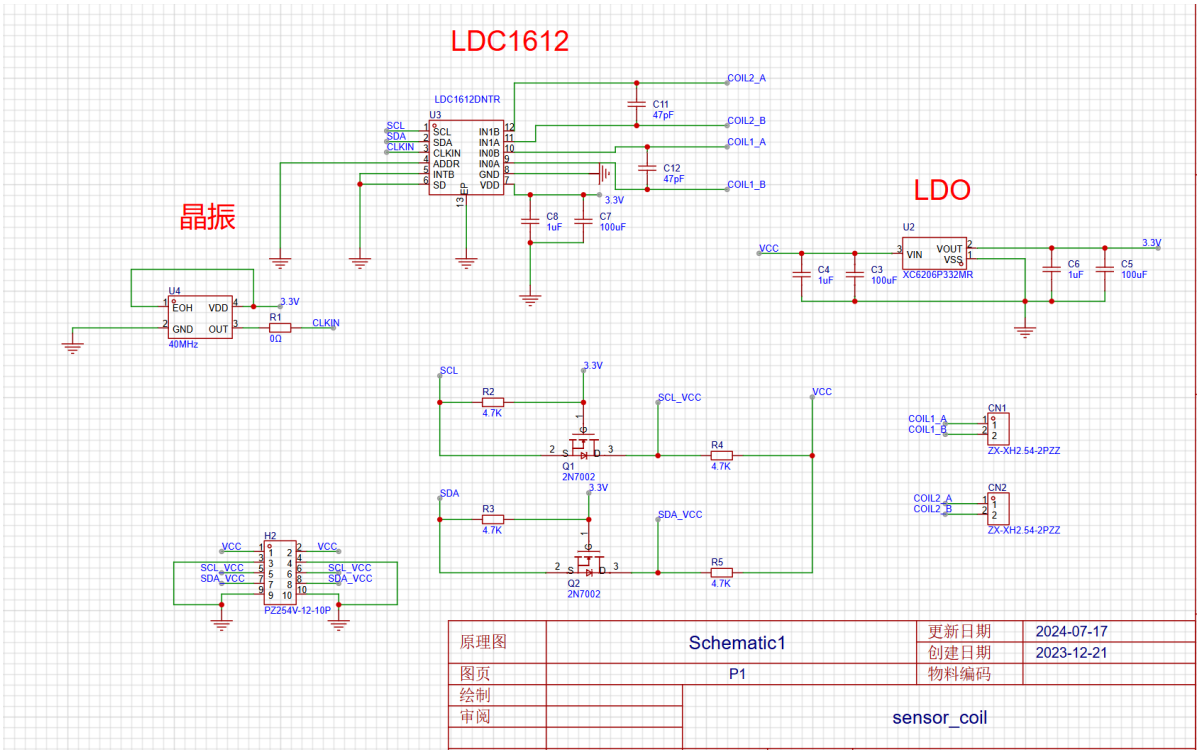
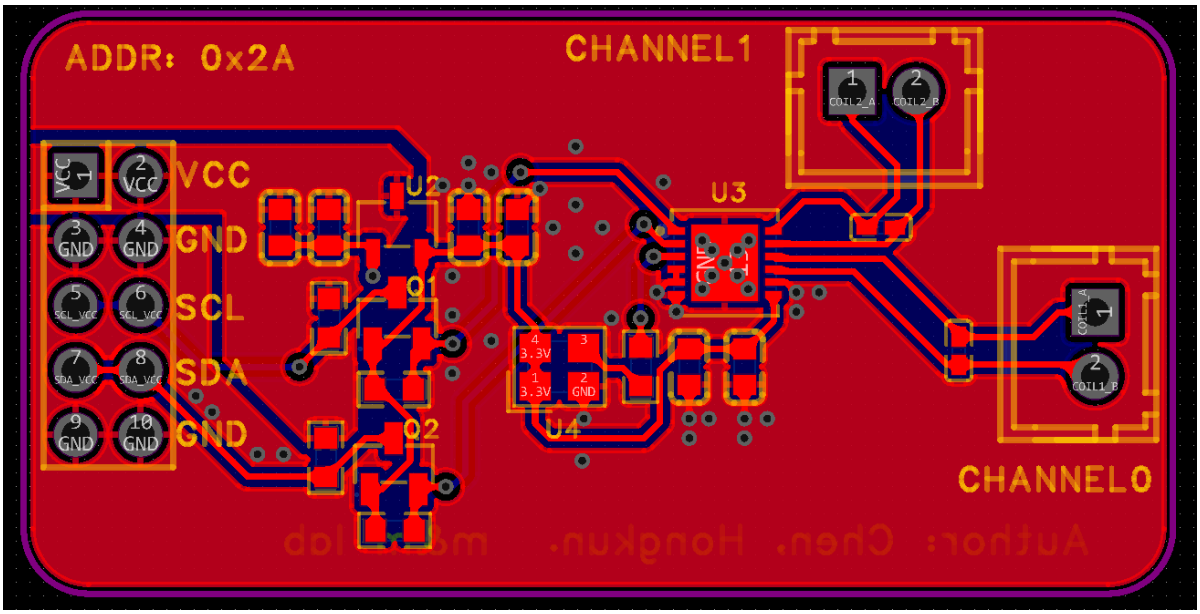
mmlab-Sensor-Coil README

Introduction

0x2A.epro and 0x2B.epro are PCB based on Texas Instruments' LDC1612. .epro means it is Jia-Li-Chuang EDA file, you have to use Jia-Li-Chuang to open it. If you don't have this EDA, I put the schematic underneath, this schematic is refer to Seeed's studio.



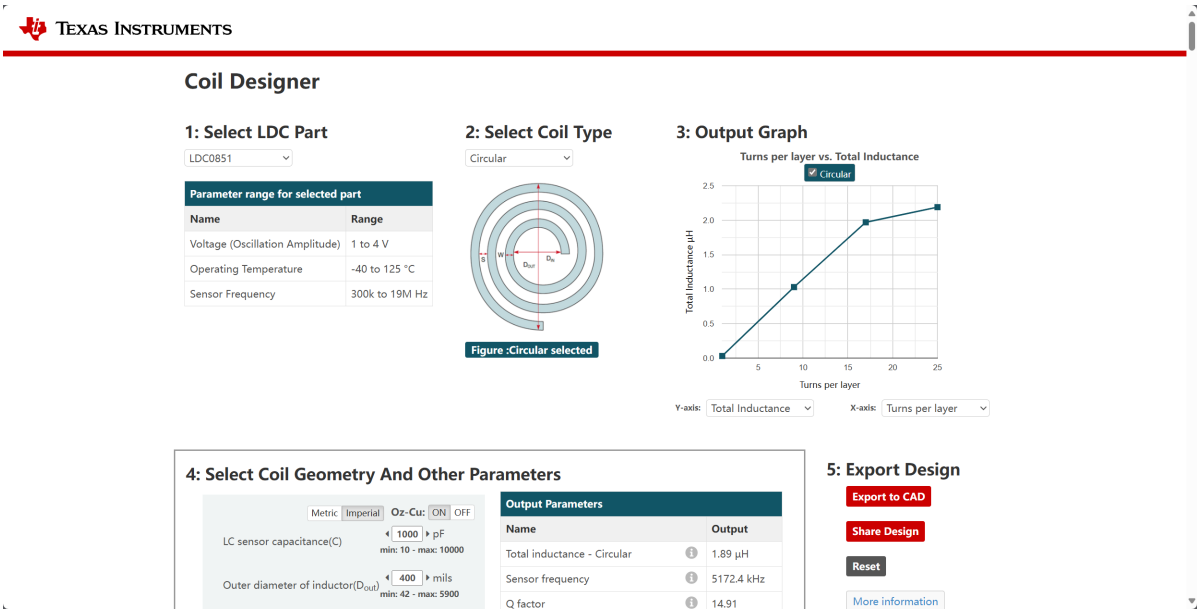
The upper schematic corresponds to the slave address (or serial bus address byte from master) 0x2A, as we let ADDR connect to GND. If you want to make slave address turn to 0x2B, you should connect to 3.3V. ***Pay attention: you are not allowed to make the ADDR pin to hang.***



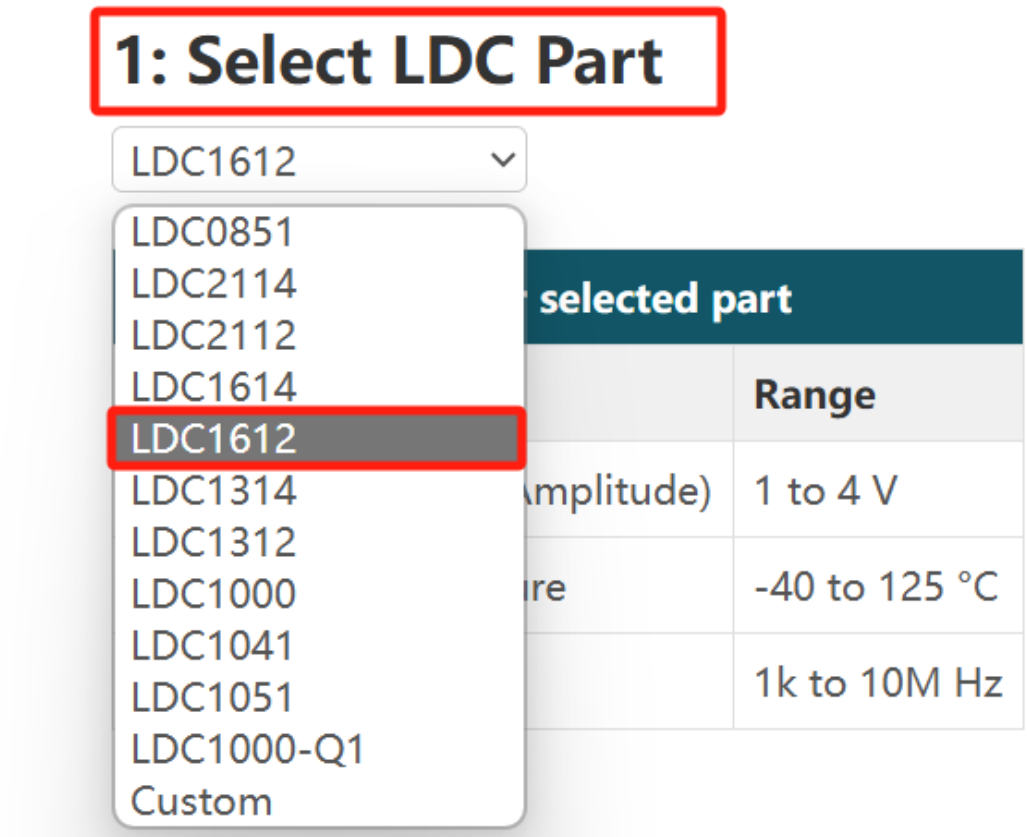
sensor-coils-example.epro series is sensor coils examples, these files obtain classic coil design, you can choose a proper coil according to your motor. If you want more, please utilize TI's calculator: Coil Designer. This calculator can help you derive the proper coils in Altium Designer or Cadence Allegro and so on.

Coil Designer Basic Tutorial

1. First, you need to register and login your TI's account number. Then you click into this address, it should be look like this :



2. Select LDC part : LDC1612 or LDC1614 (the difference between LDC1614 and LDC1612 is just the number of coils they can approve, LDC1614 can approve 4 coils in the same time, rather than 2 coils LDC1612 approve). We recommend select circular coil type, as this type can offer consistent accuracy and breadth.



3. Slide down, here you can select the parameters you want to design, of course, within a reasonable range, when beyond a reasonable range, the calculator will display red or orange in a column, warning you should not do this, at this time you just need to adjust some parameters to get a reasonable coil or you will not be allowed to export the design files. You can also click on view more to see more parameters, here we recommend you click on view more.

Metric | Imperial | **Oz-Cu:** ON | OFF

LC sensor capacitance(C)	1000 pF **min: 50 - max: 10000**
Outer diameter of inductor(D_{out})	400.0(mils **min: 42 - max: 5900**
Layers(M)	2 Layer **min: 1 - max: 8**
Turns per layer(N)	10 Turns **min: 1 - max: 120**
Trace width(W)	4 mils **min: 2 - max: 40**
Spacing between traces(S)	4 mils **min: 2 - max: 12**
Copper thickness(t)	1 oz-Cu **min: 0.5 - max: 5**
Temperature(T)	25 °C **min: -40 - max: 125**
Voltage (Oscillation Amplitude) (V)	1.8 V **min: 1 - max: 1.8**
Space between 1st layer and 2nd layer(x12)	4.00 mils **min: 1 - max: 60**

4: Select Coil Geometry And Other Parameters

Metric | Imperial Oz-Cu: ON | OFF

LC sensor capacitance(C)	1000 pF	min: 50 - max: 10000
Outer diameter of inductor(D_{out})	400.0 mils	min: 42 - max: 5900
Layers(M)	2 Layer	min: 1 - max: 8
Turns per layer(N)	16 Turns	min: 1 - max: 120
Trace width(W)	4 mils	min: 2 - max: 40
Spacing between traces(S)	4 mils	min: 2 - max: 12
Copper thickness(t)	1 oz-Cu	min: 0.5 - max: 5
Temperature(T)	25 °C	min: -40 - max: 125

Output Parameters

Name	Output
Total inductance - Circular	7.2 µH
Sensor frequency	1871.94 kHz
Q factor	17.84
AC resistance (skin effect only)	4.75 Ω
Coil fill ratio	0.36
Coil inner diameter (D_{in})	144 mils

View more

4: Select Coil Geometry And Other Parameters

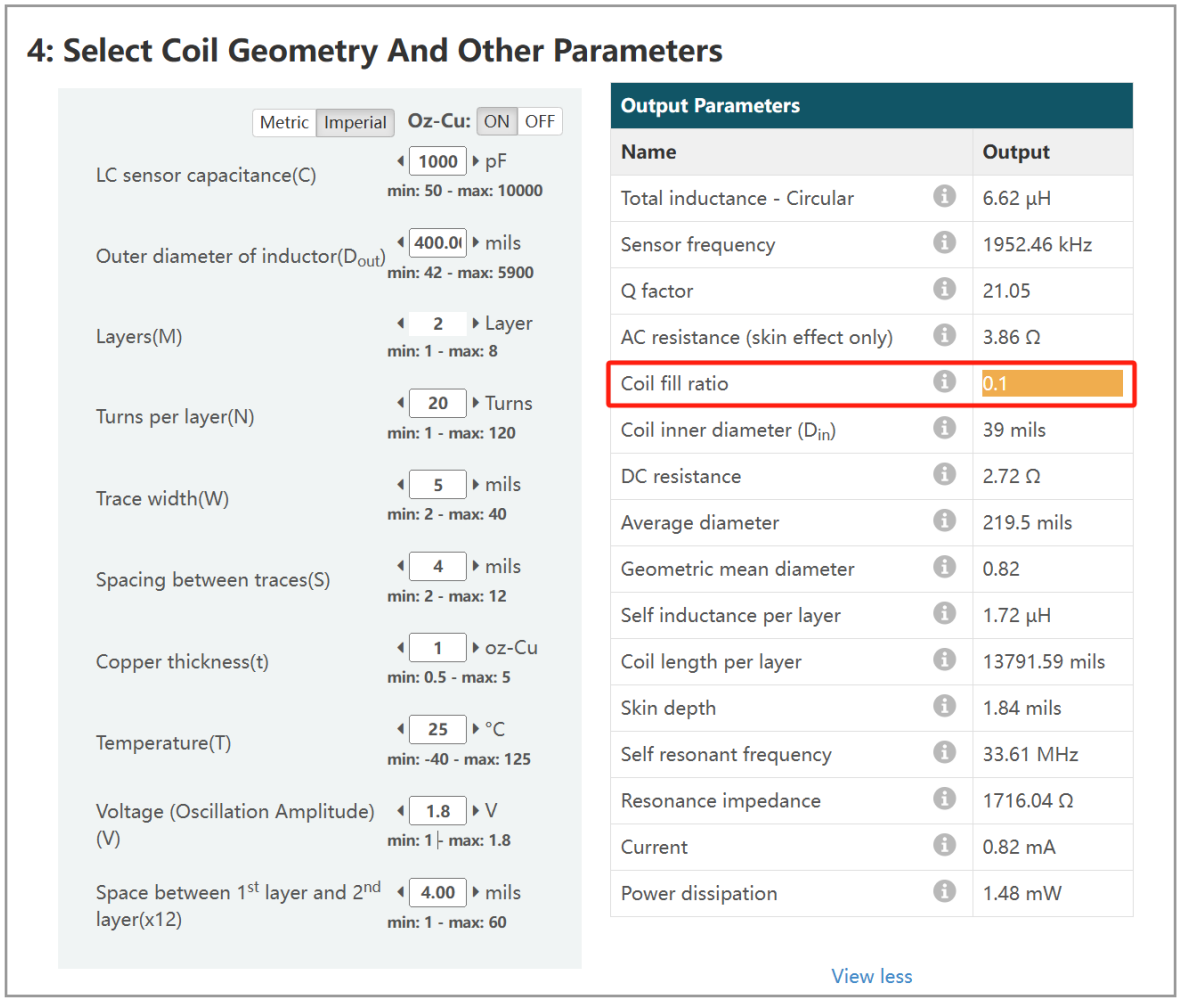
Metric | Imperial Oz-Cu: ON | OFF

LC sensor capacitance(C)	1000 pF	min: 50 - max: 10000
Outer diameter of inductor(D_{out})	400.0 mils	min: 42 - max: 5900
Layers(M)	2 Layer	min: 1 - max: 8
Turns per layer(N)	30 Turns	min: 1 - max: 120
Trace width(W)	4 mils	min: 2 - max: 40
Spacing between traces(S)	4 mils	min: 2 - max: 12
Copper thickness(t)	1 oz-Cu	min: 0.5 - max: 5
Temperature(T)	25 °C	min: -40 - max: 125
Voltage (Oscillation Amplitude) (V)	1.8 V	min: 1 - max: 1.8
Space between 1st layer and 2nd layer(x12)	4.00 mils	min: 1 - max: 60

Output Parameters

Name	Output
Total inductance - Circular	8.32 µH
Sensor frequency	1742.25 kHz
Q factor	17.58
AC resistance (skin effect only)	5.18 Ω
Coil fill ratio	-0.2
Coil inner diameter (D_{in})	-80 mils
DC resistance	3.72 Ω
Average diameter	160 mils
Geometric mean diameter	1.5
Self inductance per layer	2.17 µH
Coil length per layer	15079.64 mils
Skin depth	1.95 mils
Self resonant frequency	29.99 MHz
Resonance impedance	1605.64 Ω
Current	0.88 mA
Power dissipation	1.58 mW

View less



4. After correctly designing, you need to click on the right column.(If not properly designed, the left table still has red or orange columns, will not be able to perform the next operation), export your design, here we choose is Altium Designer. Then, Click export, wait patiently for a while (please note that your network connection must be normal at this time), the following window will pop up, click download, your design will be downloaded in the form of a compressed package.

5: Export Design

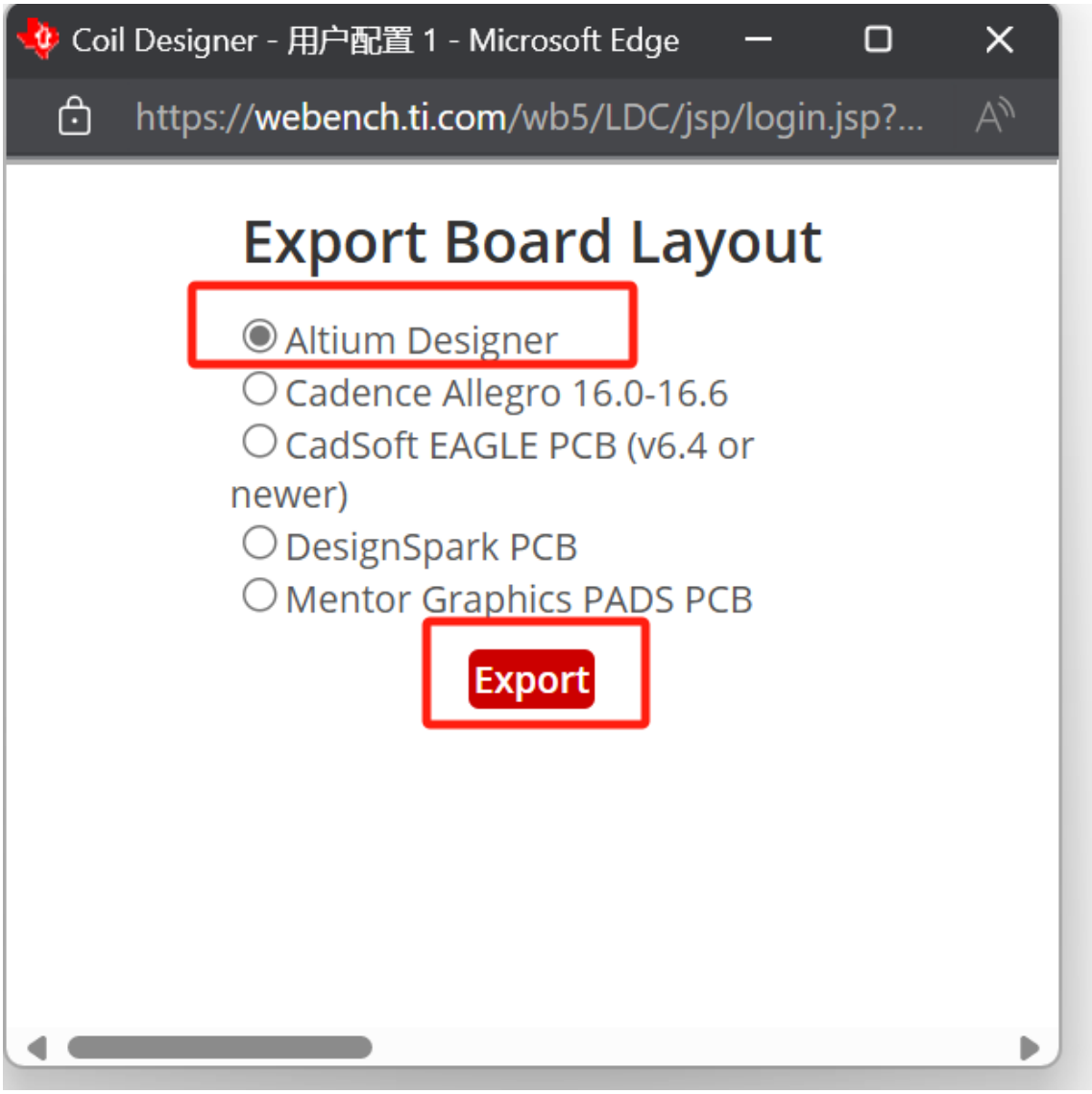
Export to CAD

Share Design

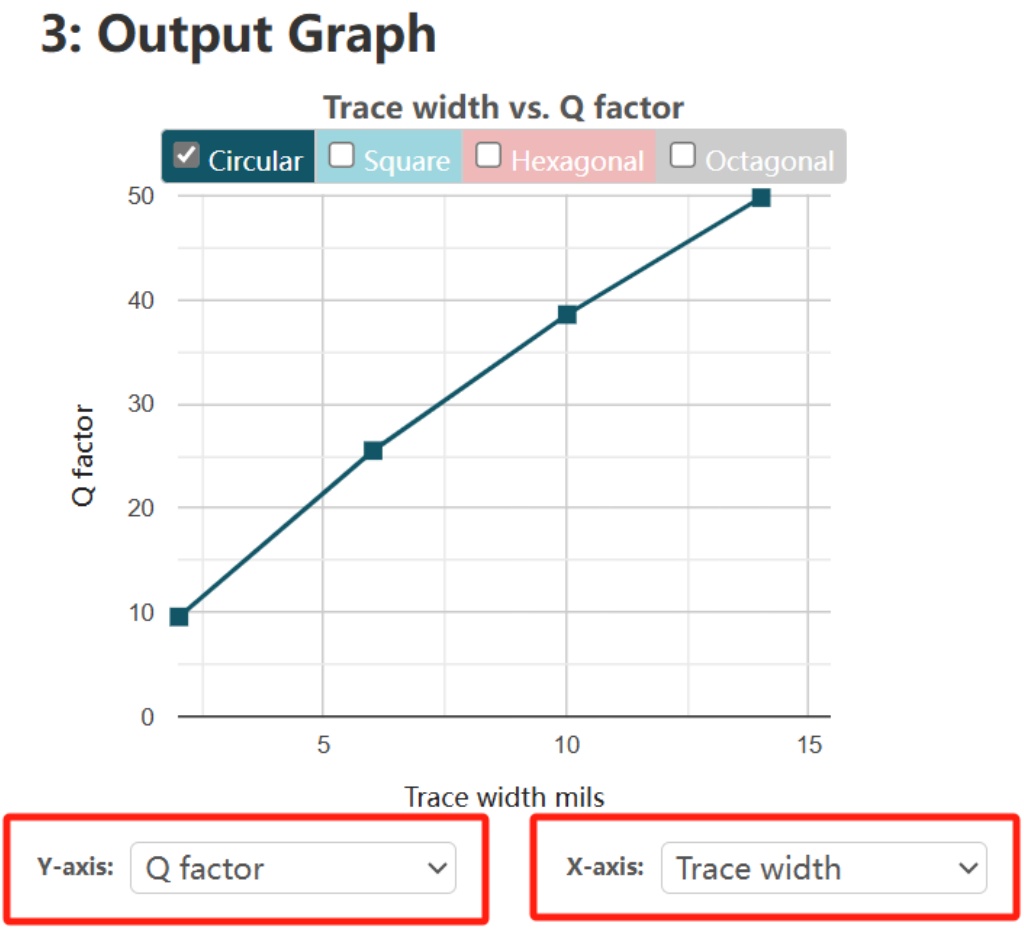
Reset

More information

Support & Community

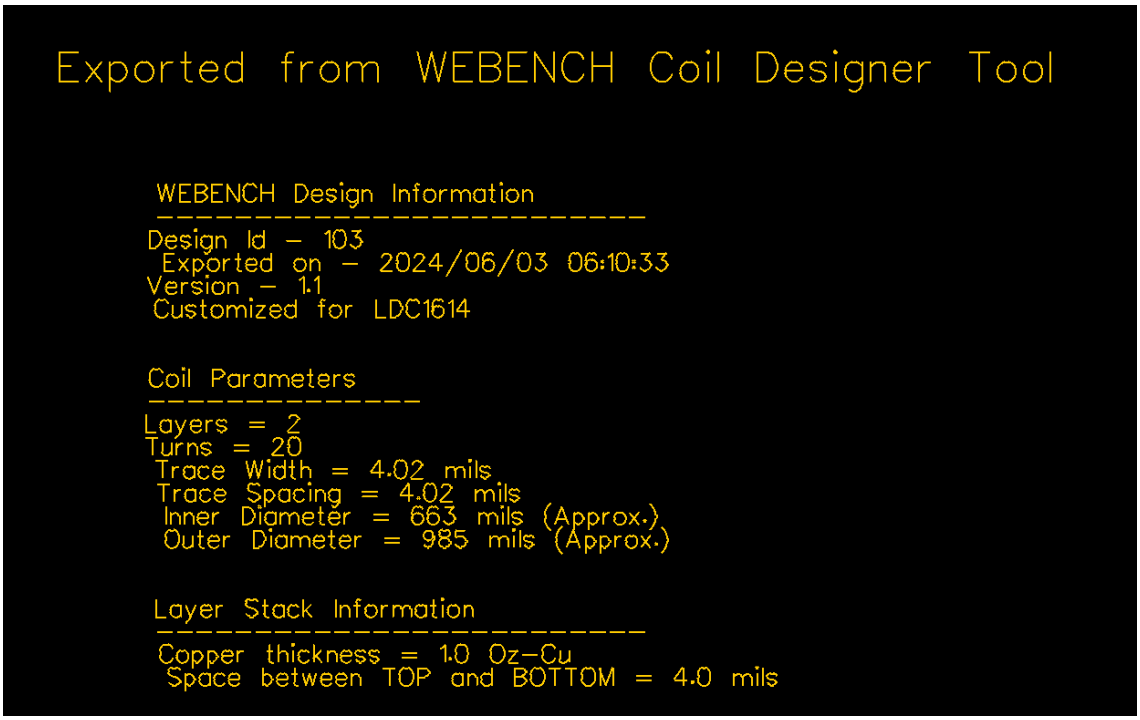


5. You can also view the physical properties of the coil you designed, and you can select the physical meaning of the x-axis and y-axis.

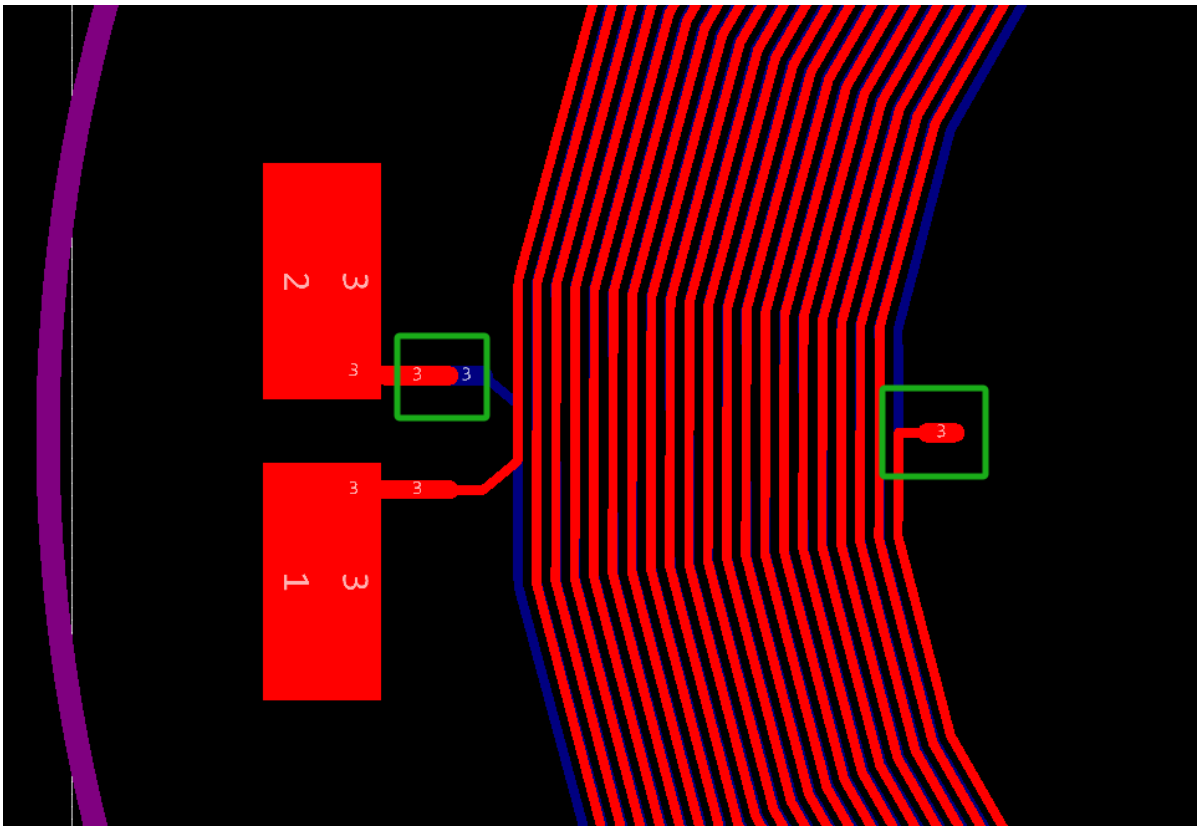


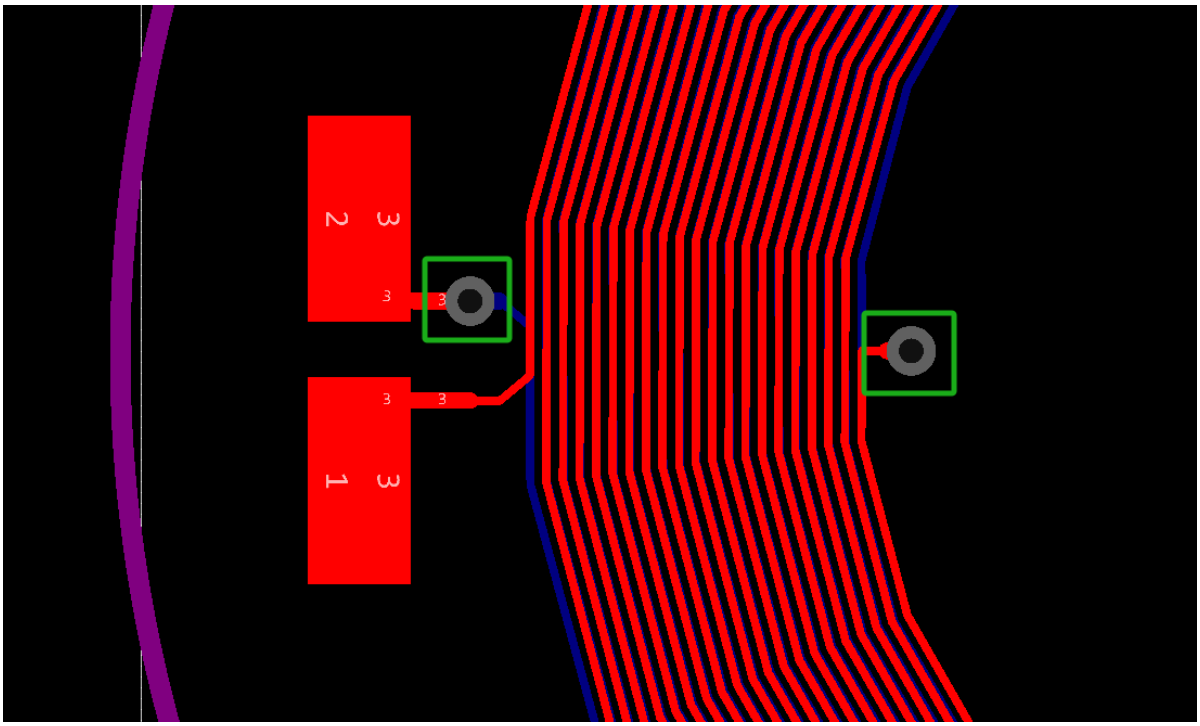
The problem you may face during learning and using

- **The coils that exported from Coil Designer can't be utilized**
- Solution: The coils that exported from Coil Designer look like this, the right side is the information of coil you have designed:



At this time, we can see that the upper and lower layers of the coil have formed a open circuit because there is no hole, and the coil cannot work normally. At this point we only need to add holes where we want to change layers. After adding holes, the coils can work perfectly. Pay attention: if you use FPC materials, Jia-Li-Chuang's work customer service will notifies you it is an error to add a hole on this board, regardless of this warning, the design is workable after actual proofing tests.




2
3
3
3
3
1
3