



# LPKF電路板製作

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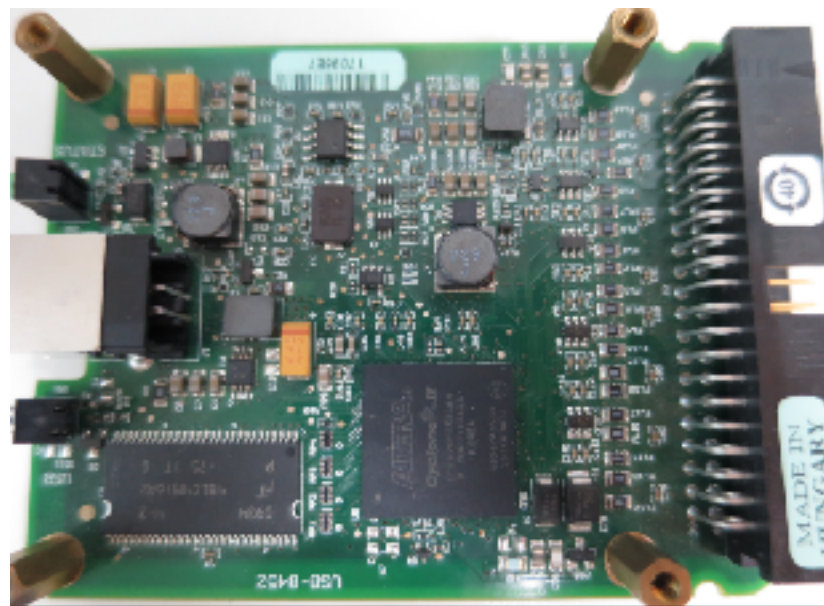
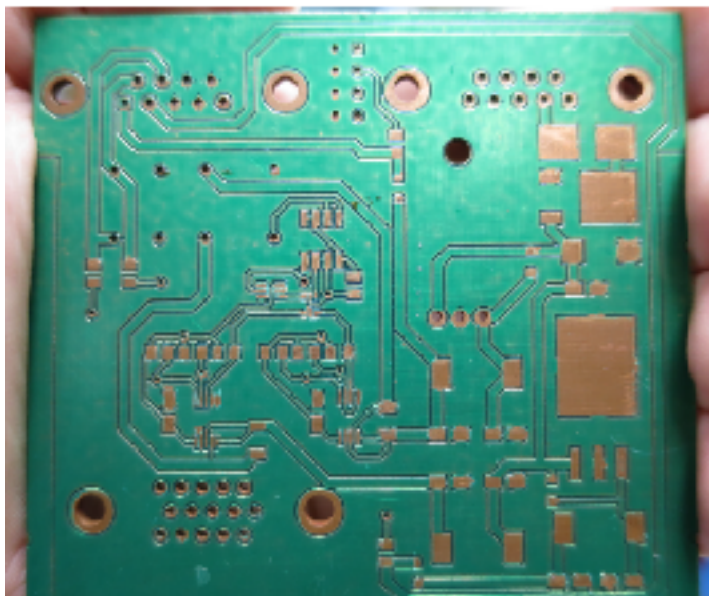
# 大綱

- 印刷電路板介紹
- LPKF簡介&PCB實作流程



# 印刷電路板

- Print Circuit Board, 簡稱PCB
- 依電路設計，將連接電路零件的電器佈線繪製成圖形，在依設計所指定的機械加工、表面處理等方式，在絕緣體上使電氣導體重現所構成的電路板。
- 蝕刻&雕刻

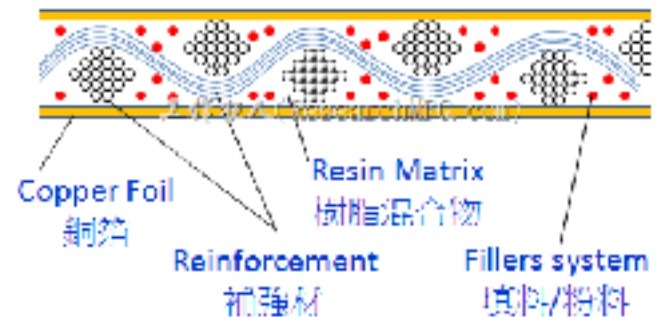




# 電路板材質

- 基材：以基材的絕緣及強化部分做分類，常見的原料為電木板、玻璃纖維板，以及各式的塑膠板。
  - FR-1~FR-6、G-10、CEM-1~CEM-5、AIN、SIC
- 金屬塗層：基板上的配線，也就是基板線路跟電子元件焊接的地方。
  - 銅、錫、鉛錫合金、金、銀

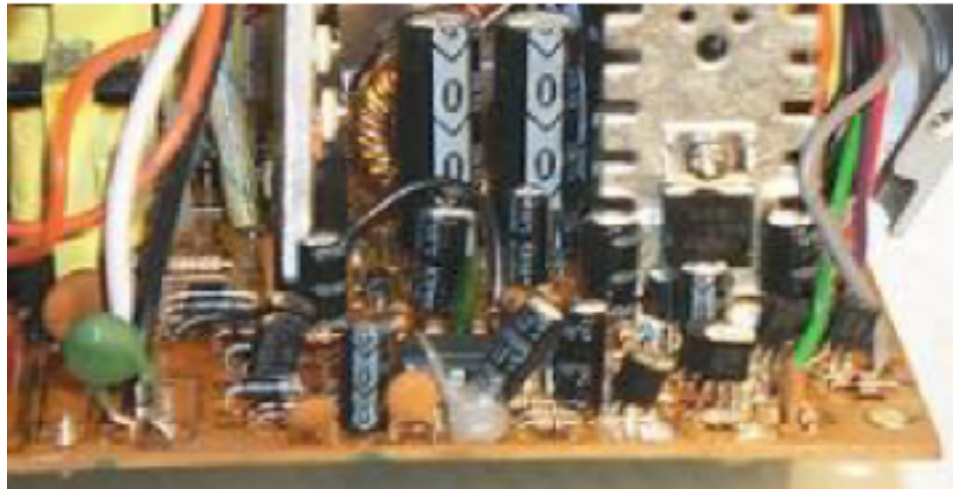
## PCB板材結構





# 電路板種類-電路配置

- 單面板：最基本的PCB，零件集中一面，導線則集中在另一面上。

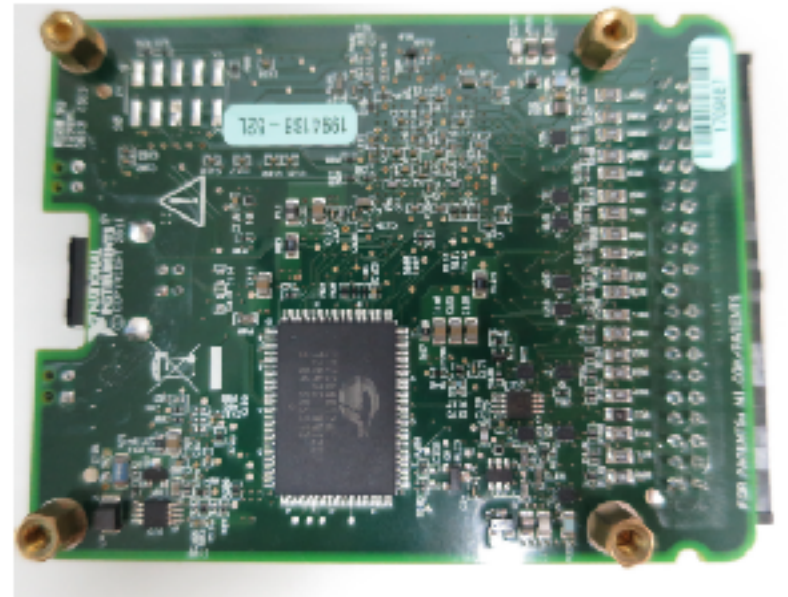
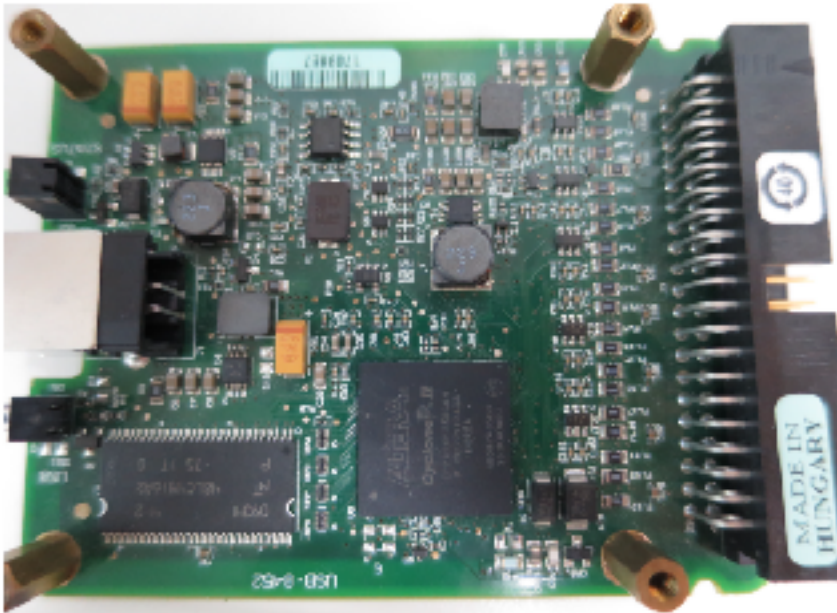


<http://www2.nsysu.edu.tw/IEE/lou/elec/web/process/pcb.htm>



# 電路板種類-電路配置

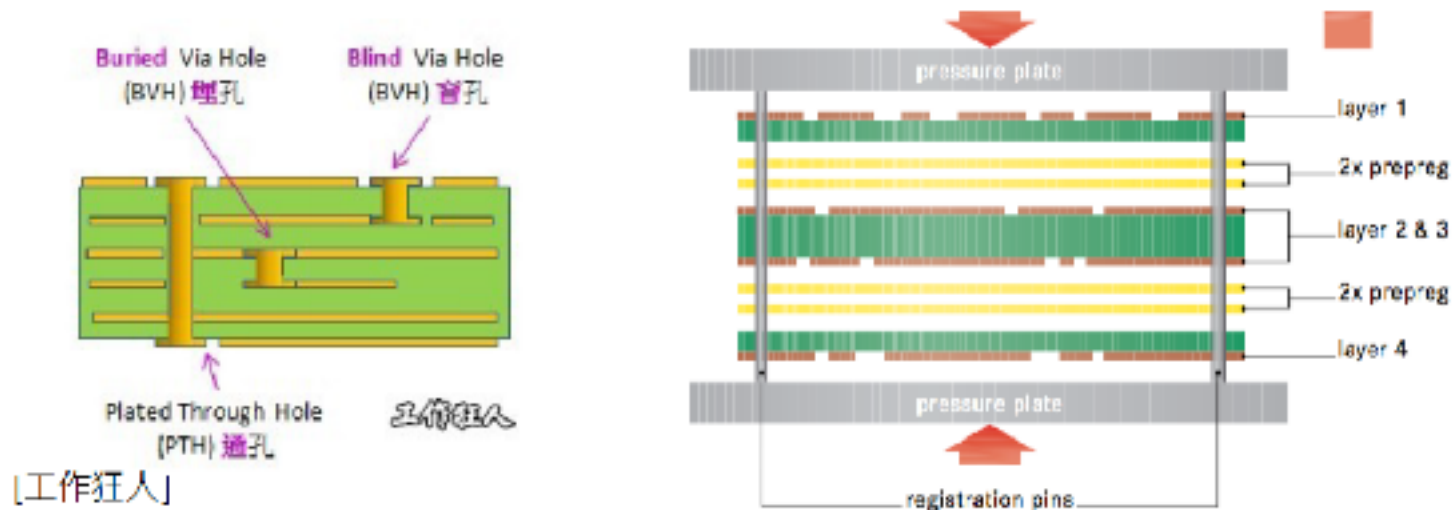
- 雙面板：此種電路板兩面都有佈線。但為了連通上下兩面的導線，必須在兩面有適當的電路連接，稱為「導孔(via)」經電鍍後方可導通。





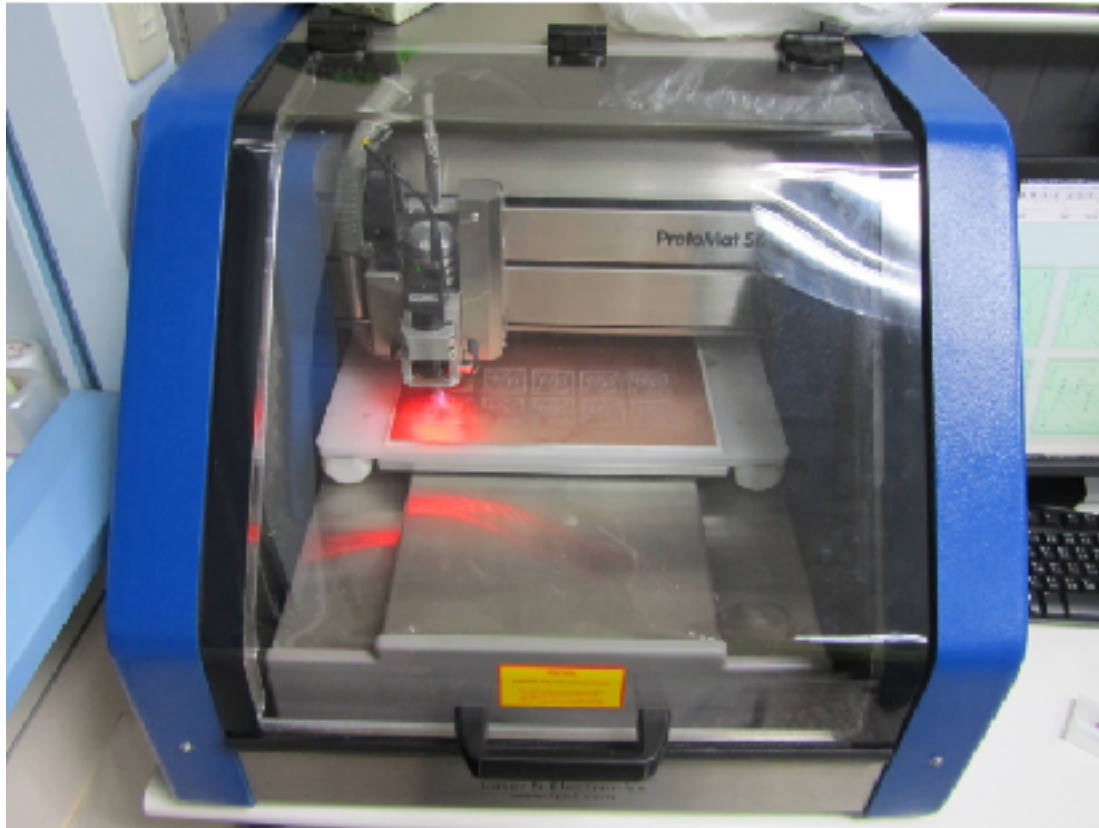
# 電路板種類-電路配置

- 多層板：為了增加佈線面積，多層板用上了更多單或雙面的佈線板，層數多為偶數。
- Vias的分類：通孔(PTH)、盲孔(BVH)、埋孔(BVH)
- 各層分類：訊號層、電源層、地線層





# 雕刻機實作流程



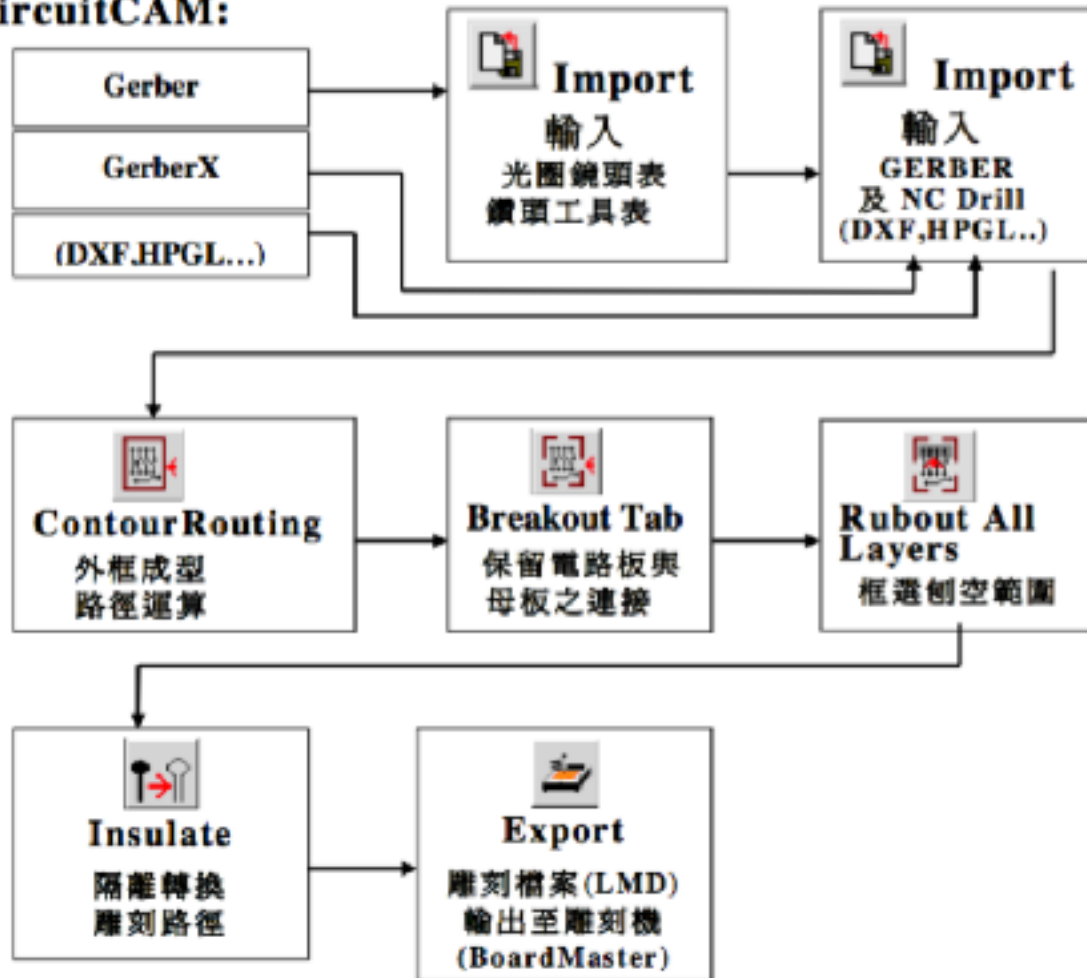
- 經**Ultiboard**完成後的電路佈局輸出成Gerber檔
- Gerber檔匯入**CircuitCAM**處理後輸出LMD檔
- 打開**BoardMaster**並匯入LMD檔
- 鑽孔&線路雕刻





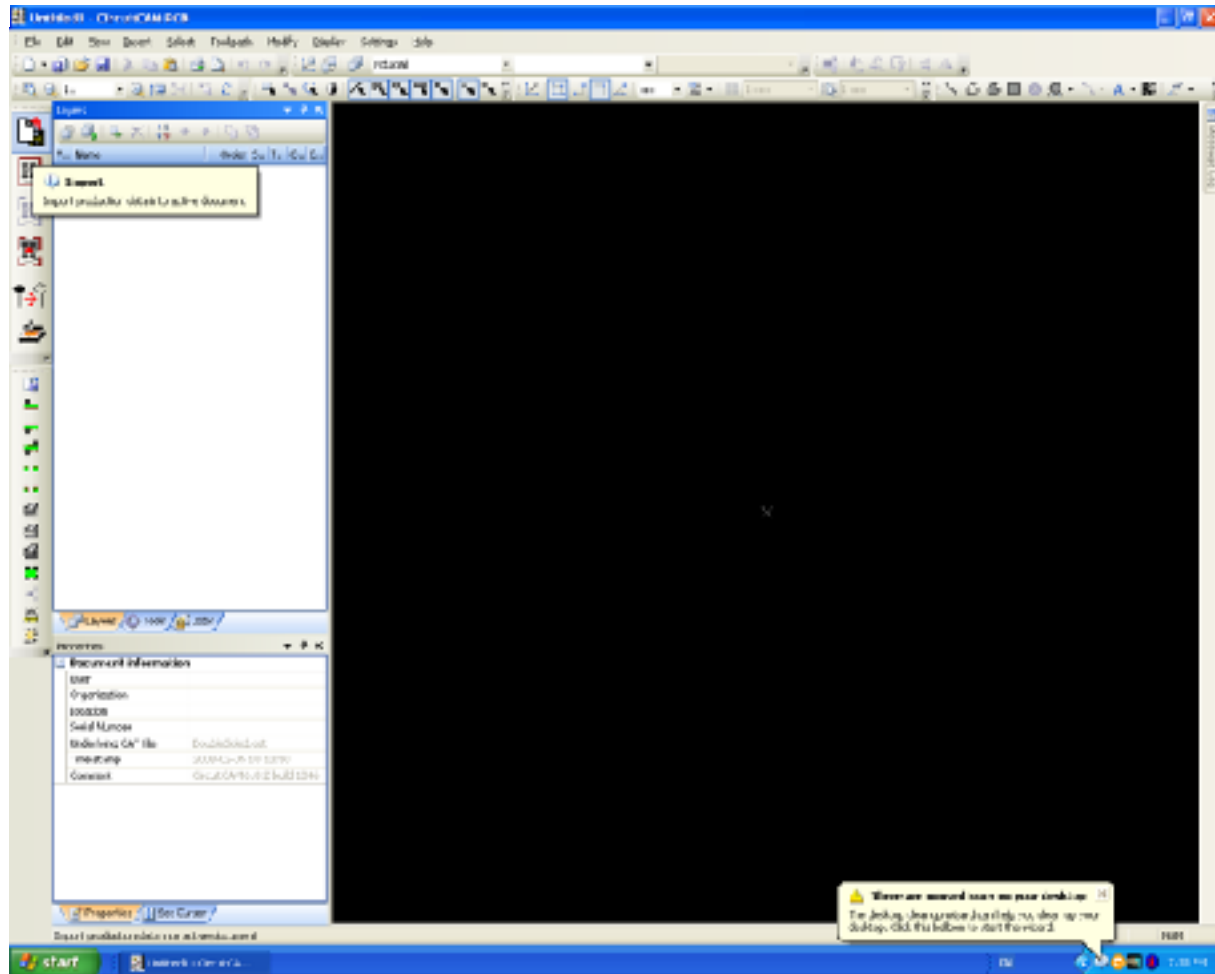
# CircuitCAM流程圖

CircuitCAM:



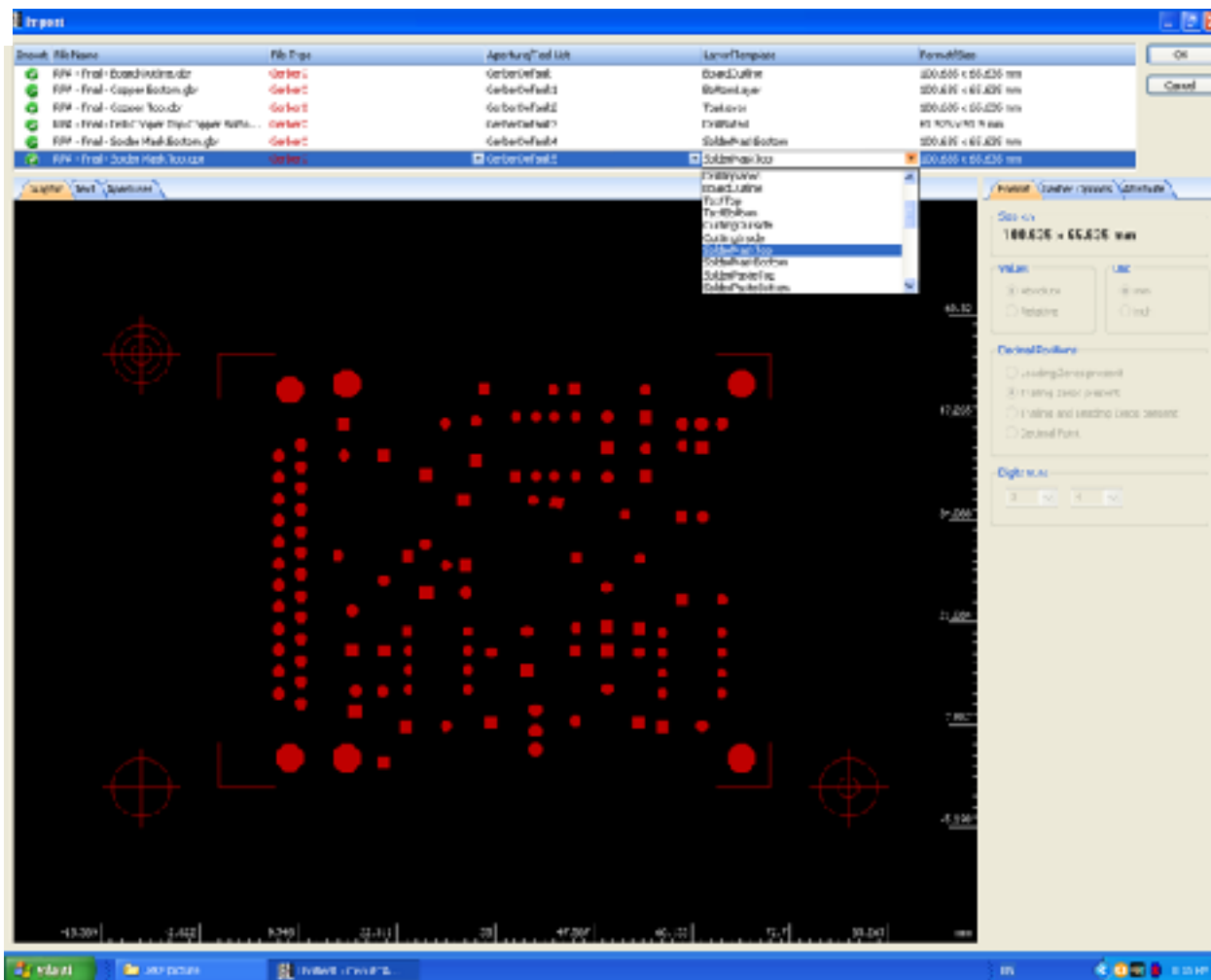


# CircuitCAM介面



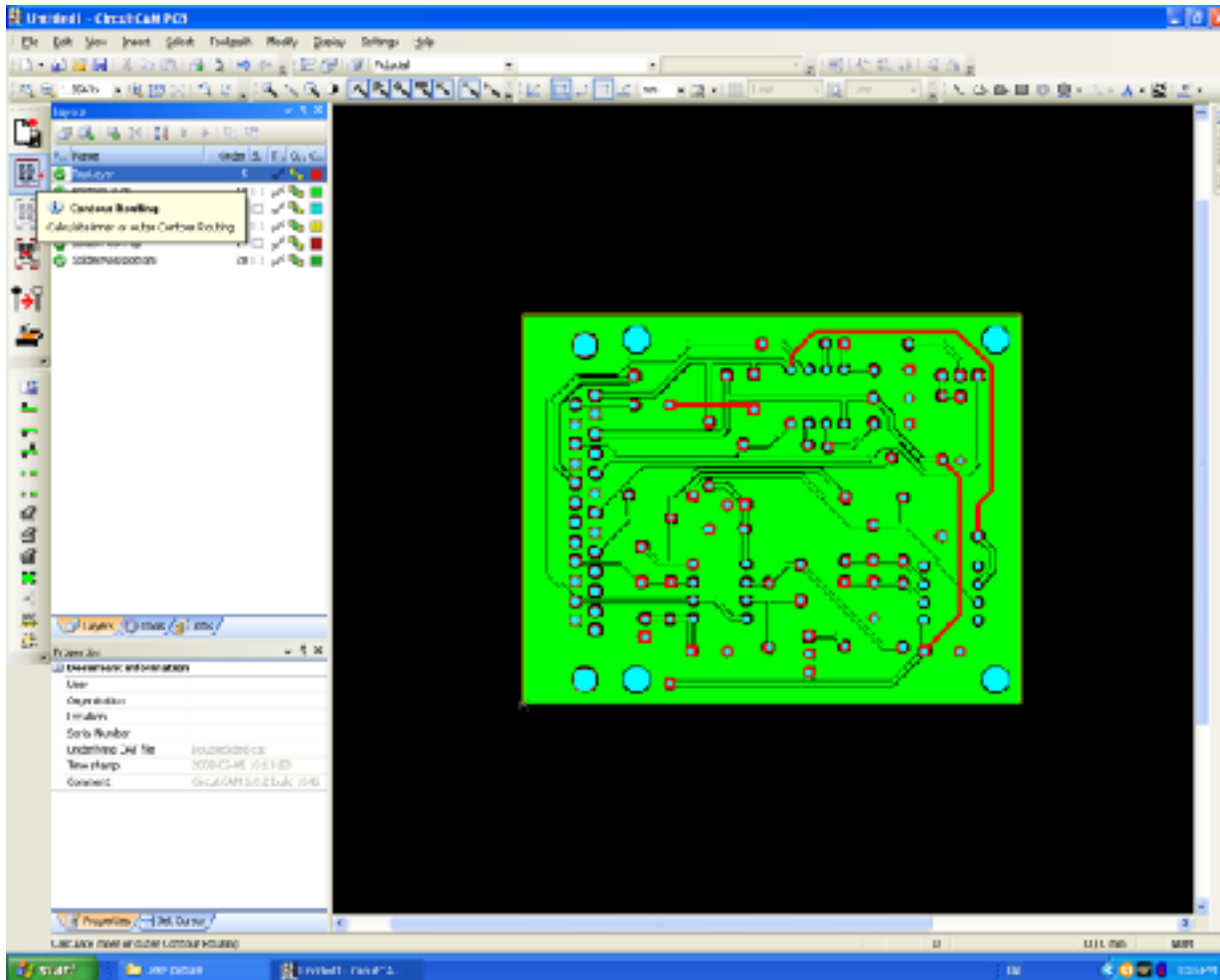


# 定義PCB各層



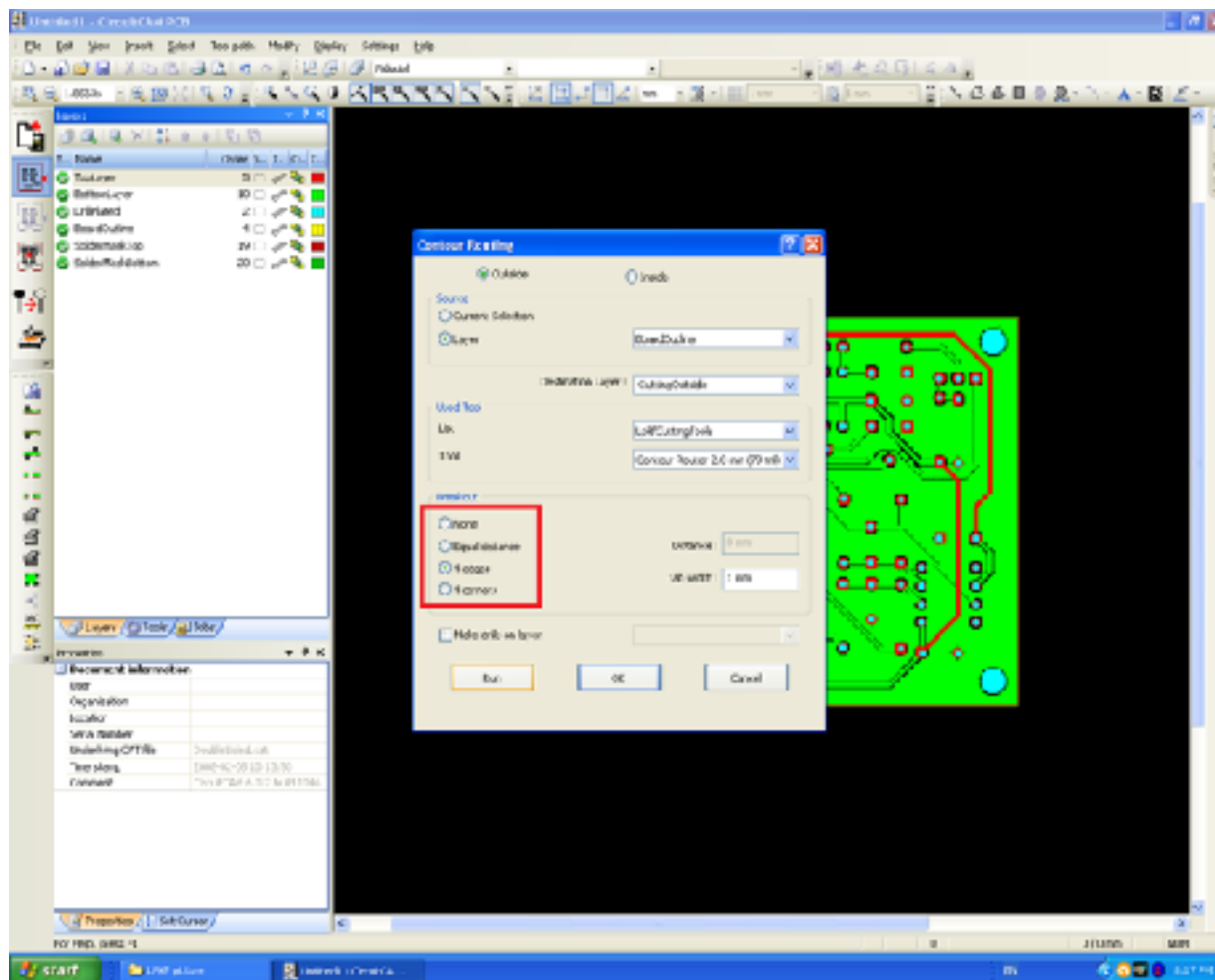


# 定義BoardOutline



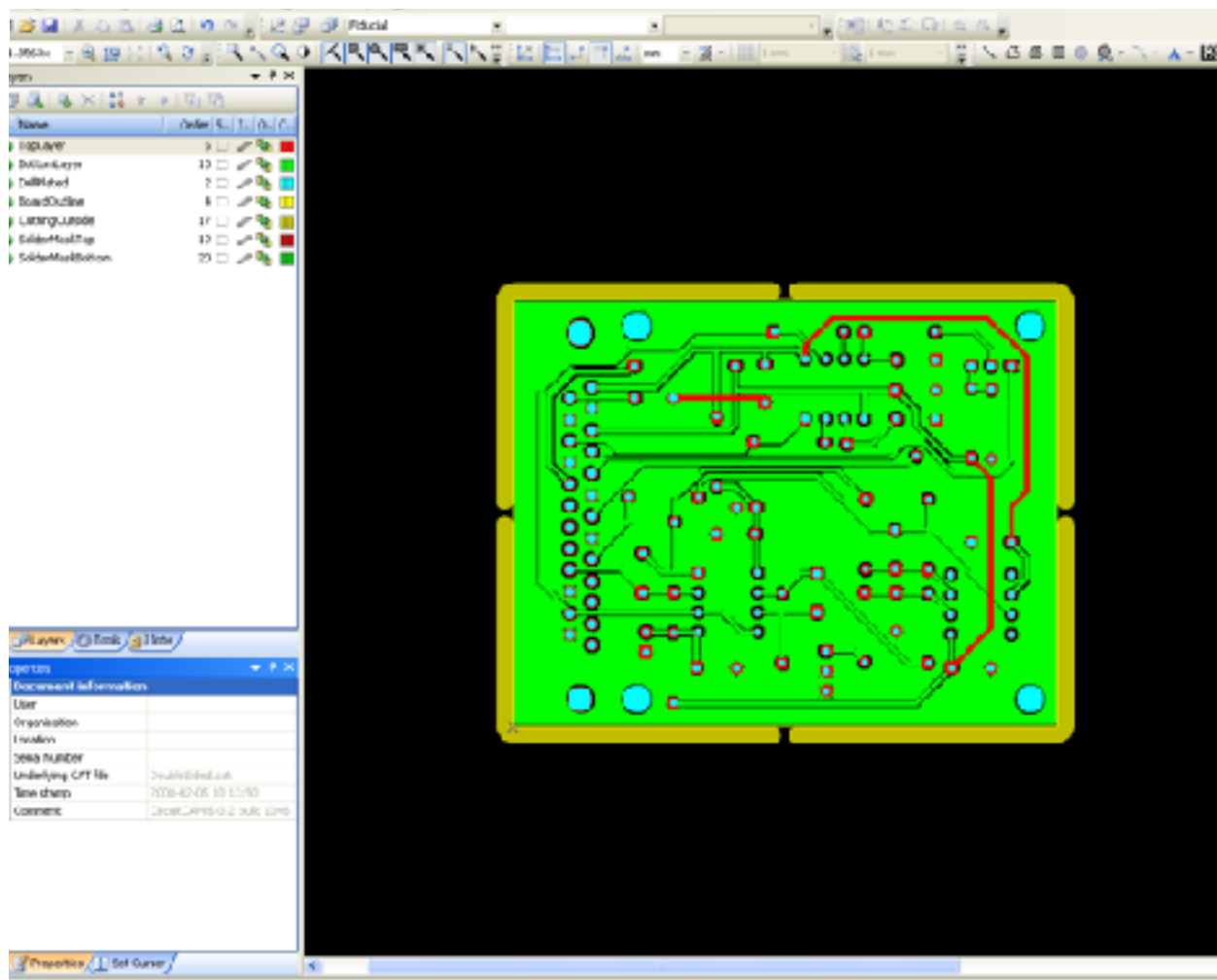


# 定義BoardOutline-2



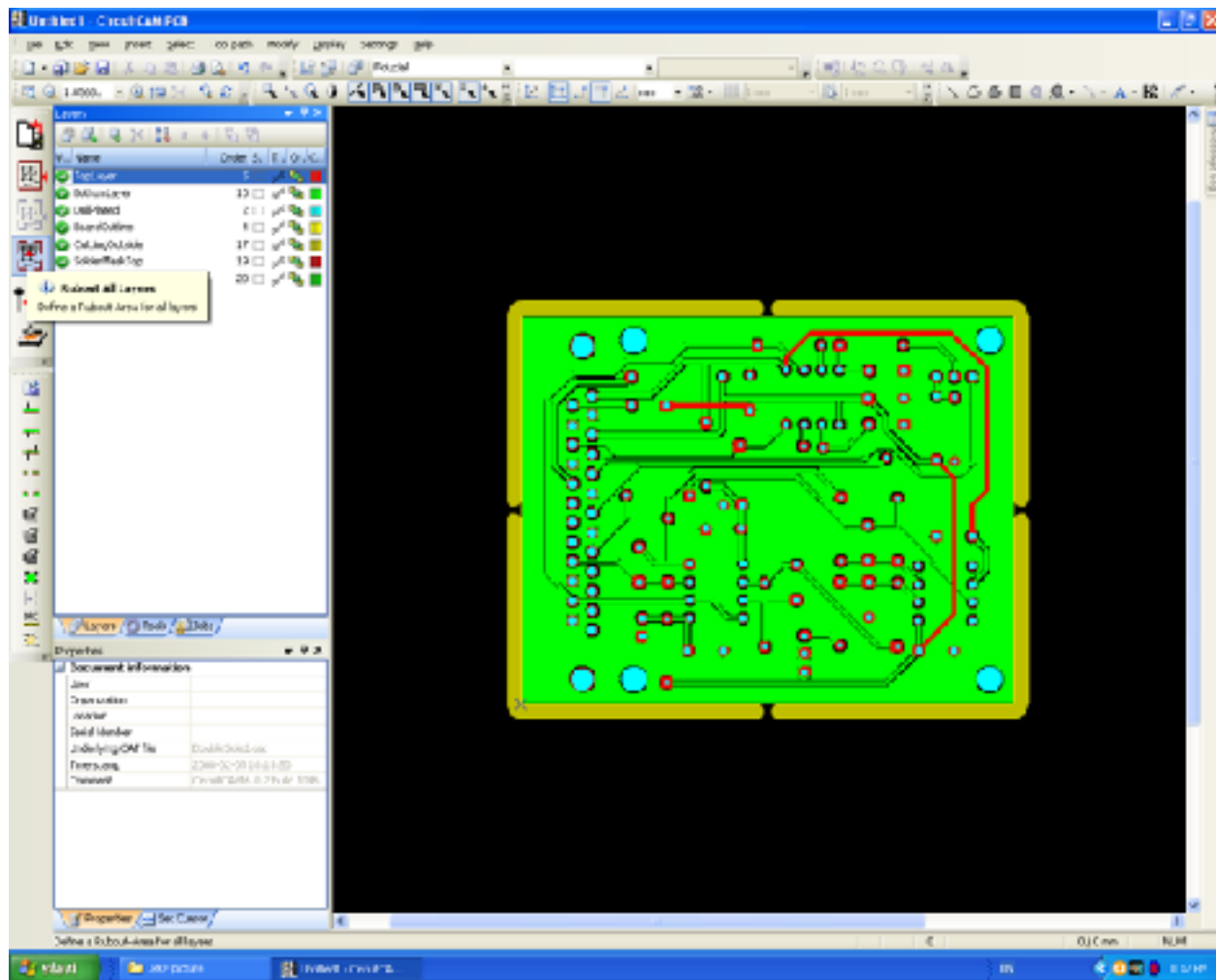


# 定義BoardOutline-3



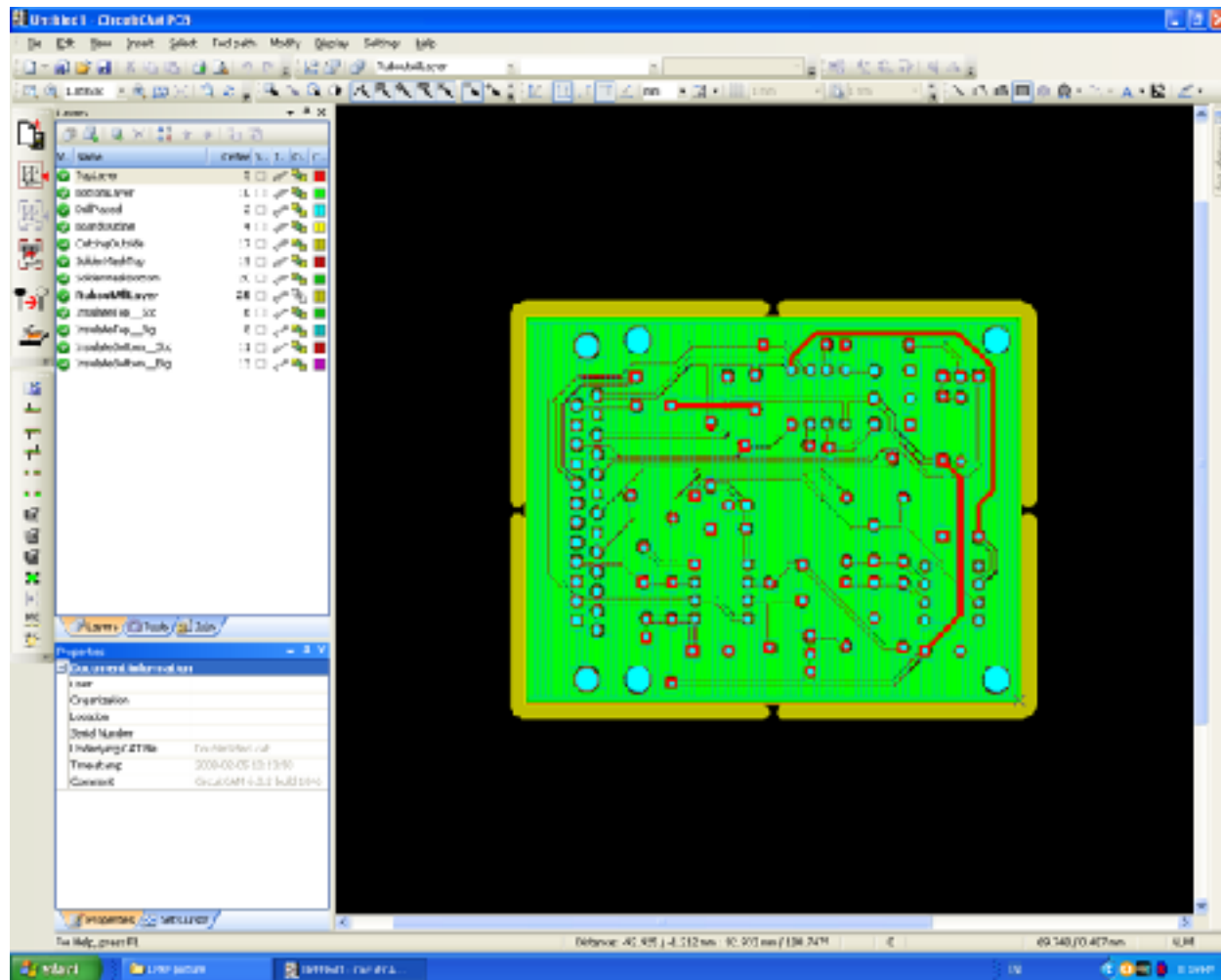


# 計算雕刻刀所走路線





# 完成，輸出LMD檔

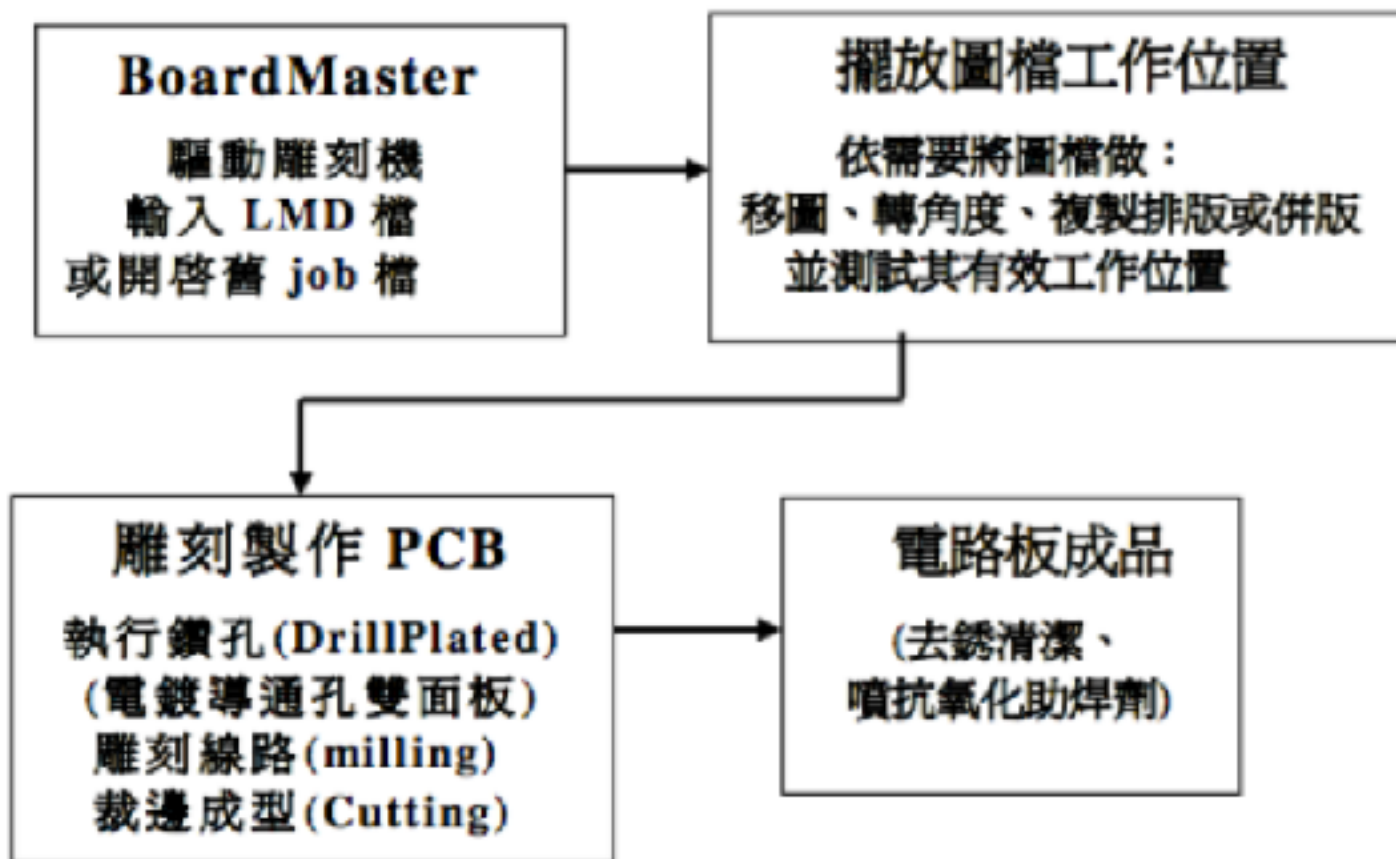






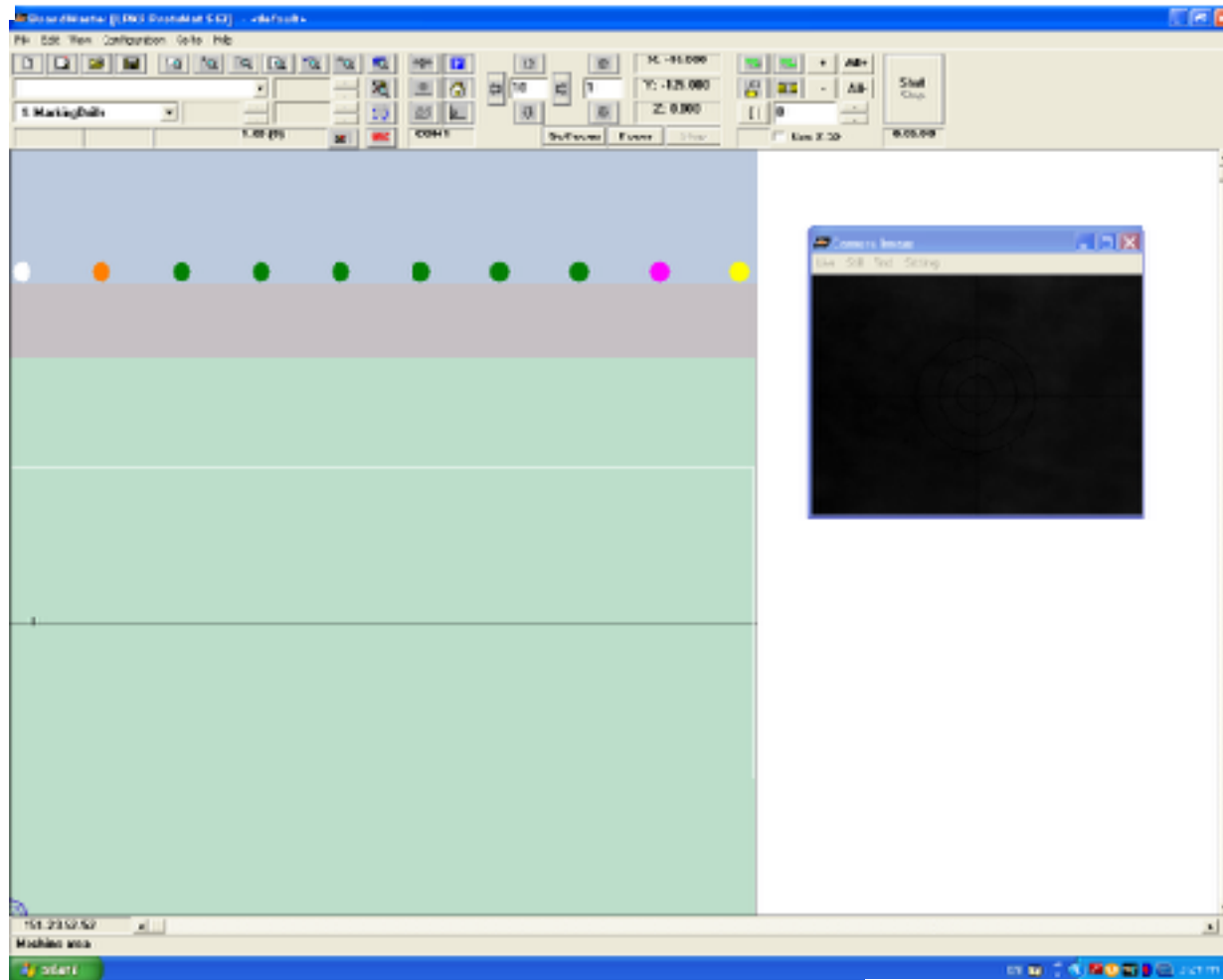
# BoardMaster流程圖

## BoardMaster:



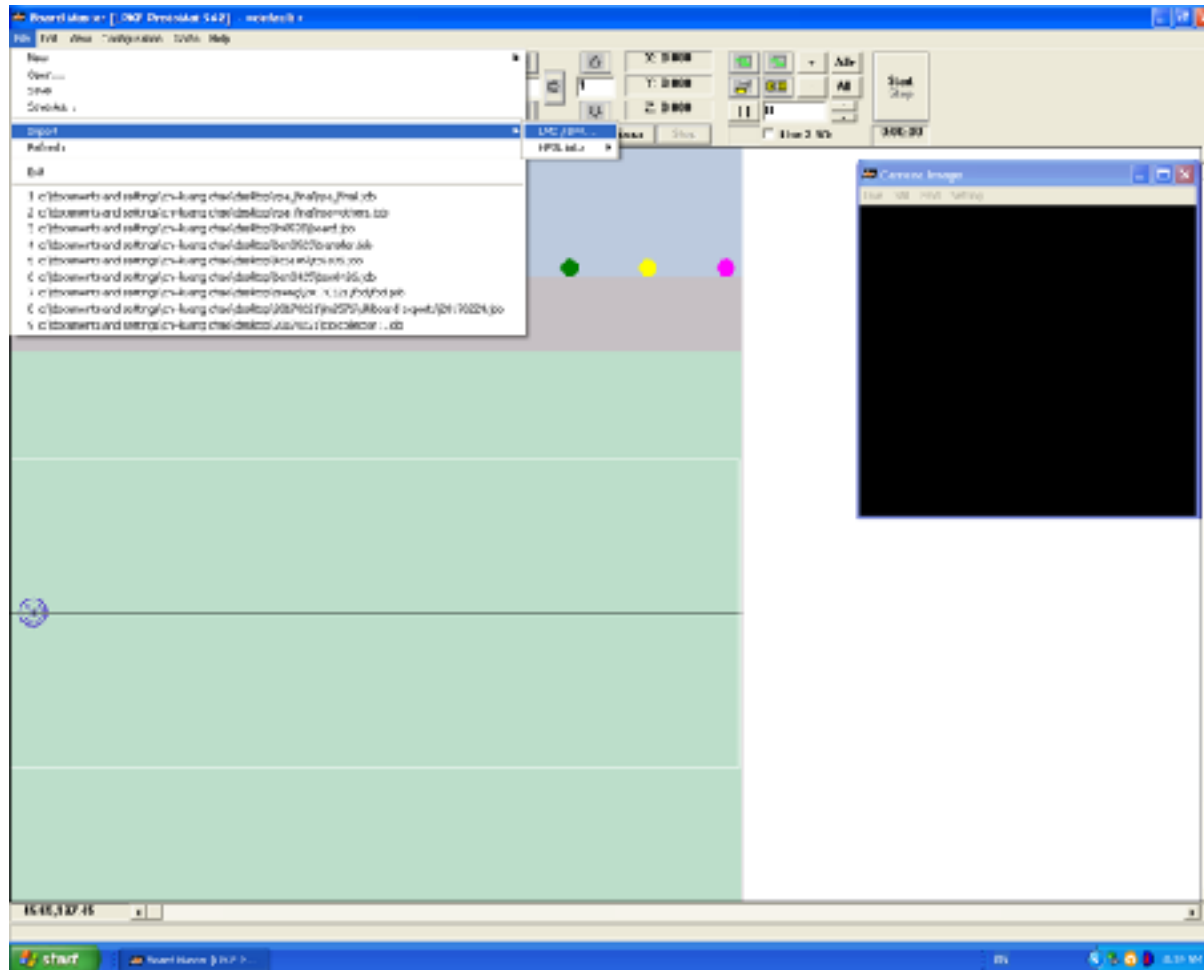


# BoardMaster介面



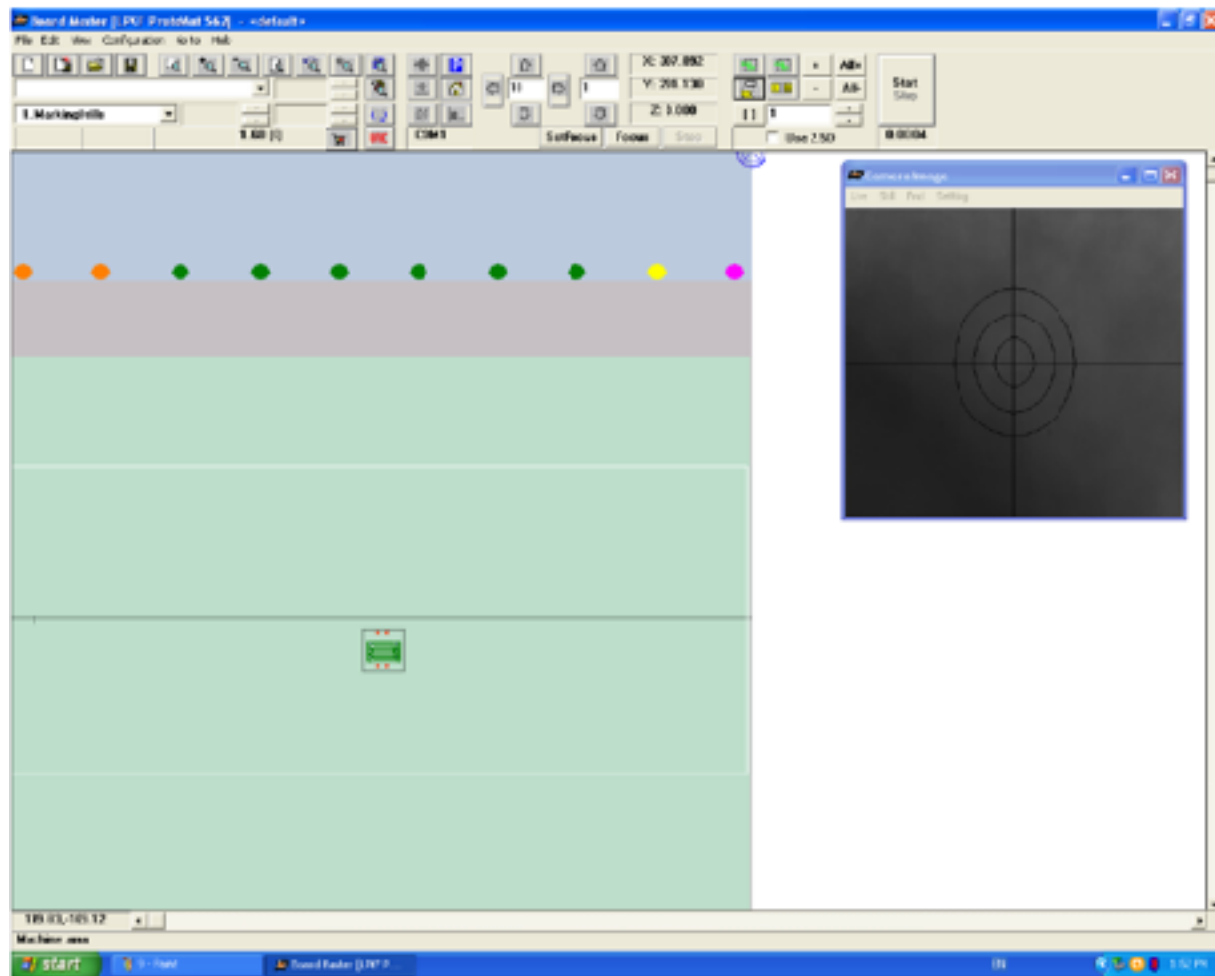


# Import LMD檔





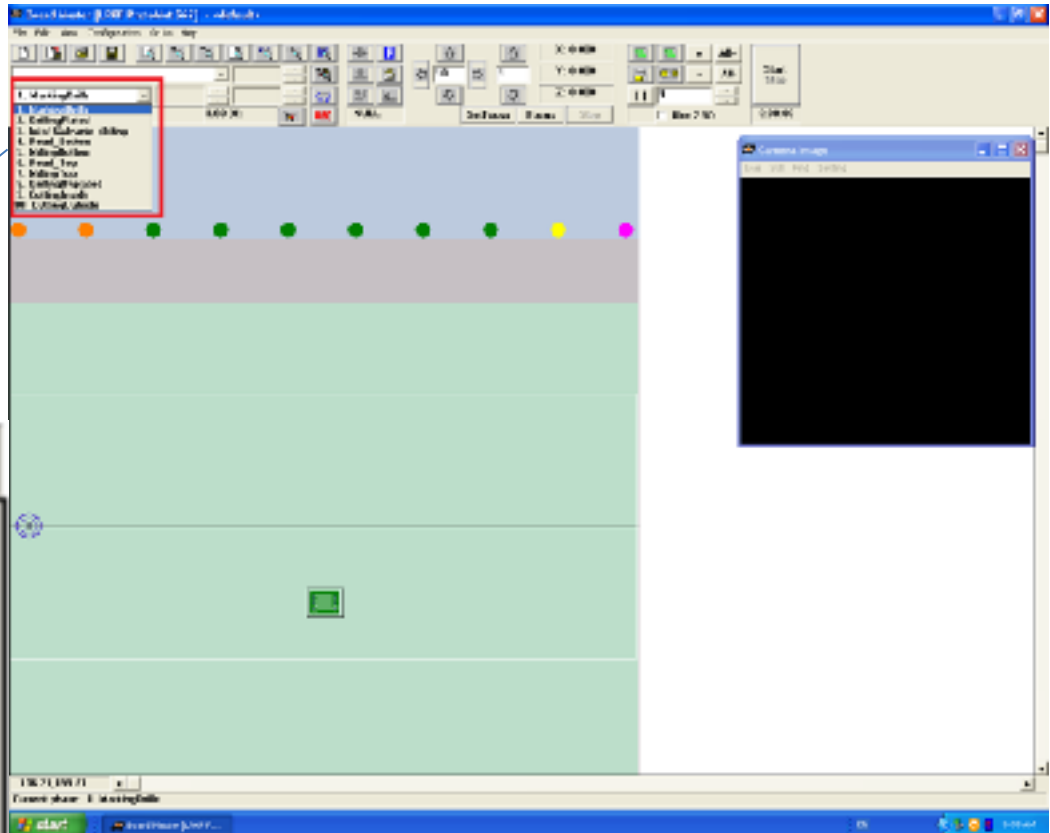
# Import LMD檔-2





# 步驟流程

- 確認流程後，  
雕刻刀需要測  
深度

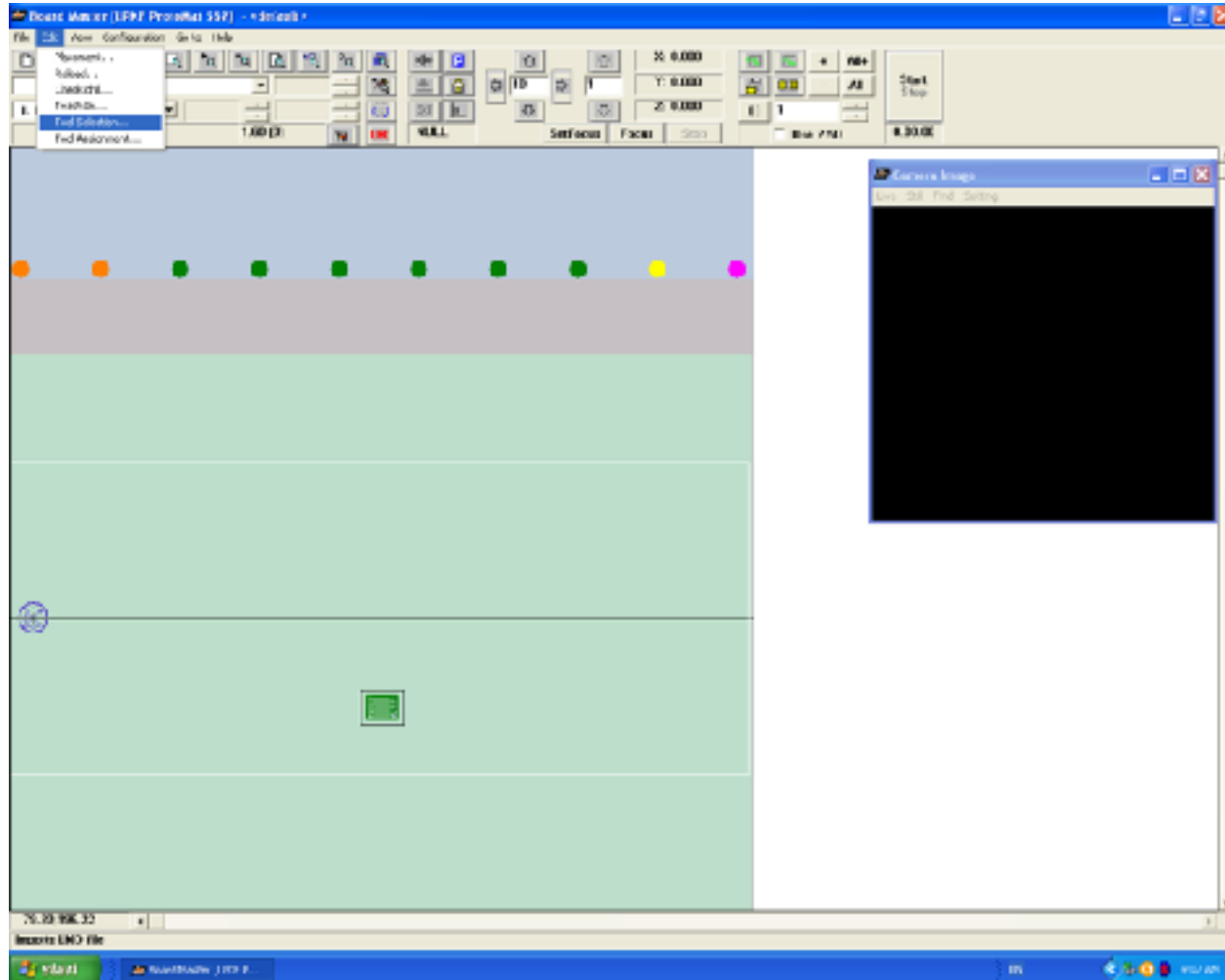


1. MarkingDrills
2. DrillingPlated
3. Info! Galvanic plating
4. Read\_Bottom
5. MillingBottom
6. Read\_Top
7. MillingTop
8. DrillingUnplated
9. CuttingInside
10. CuttingOutside



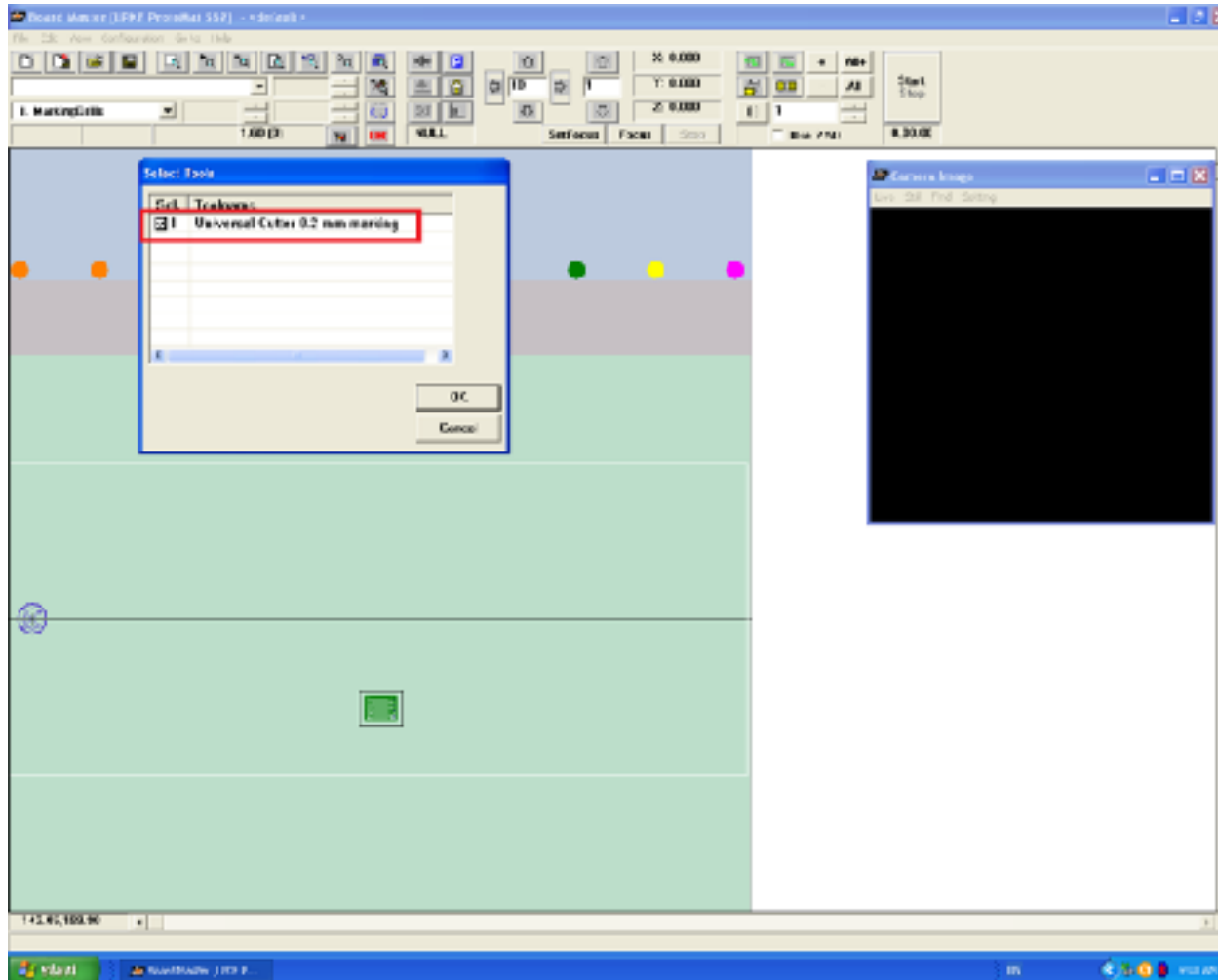


# Tool Selection



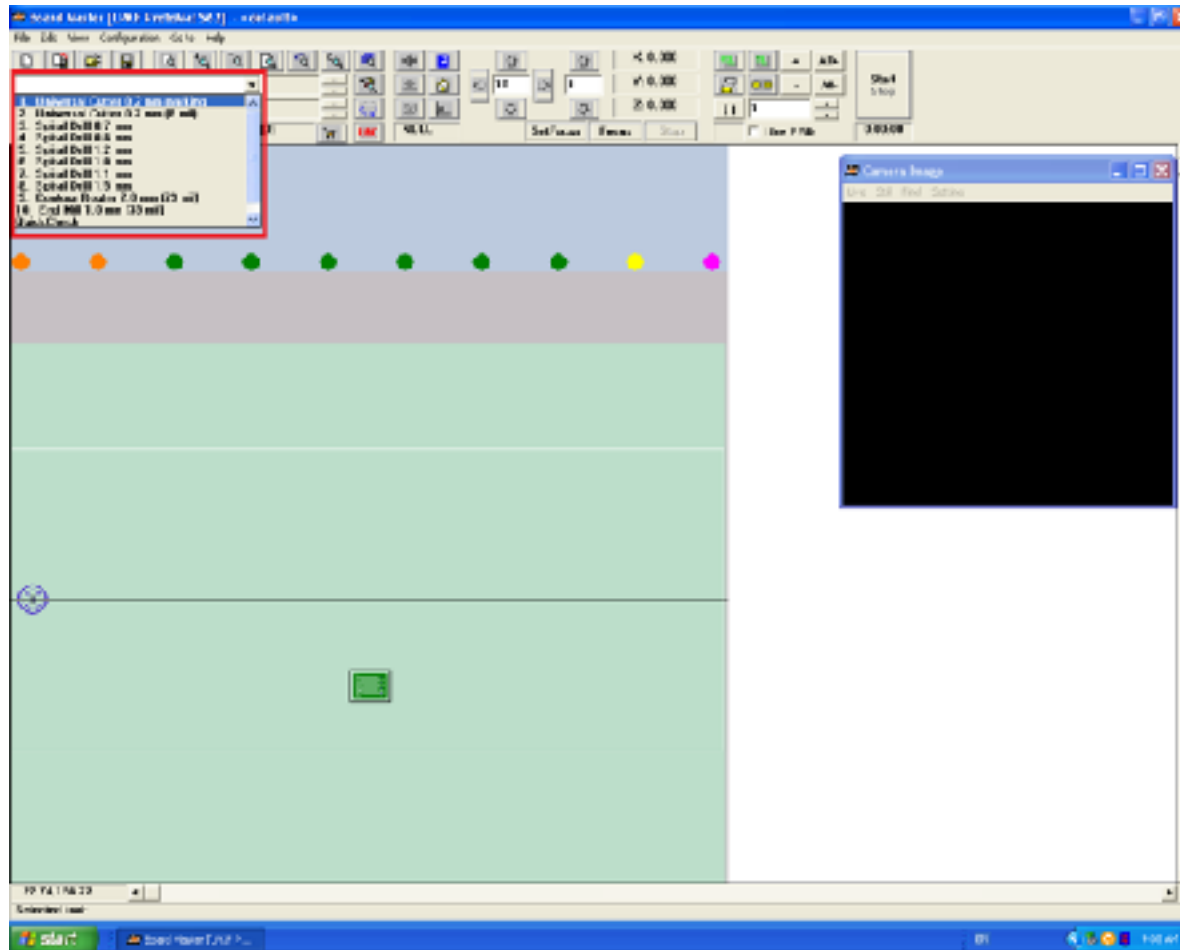


# 所需要的雕刻刀





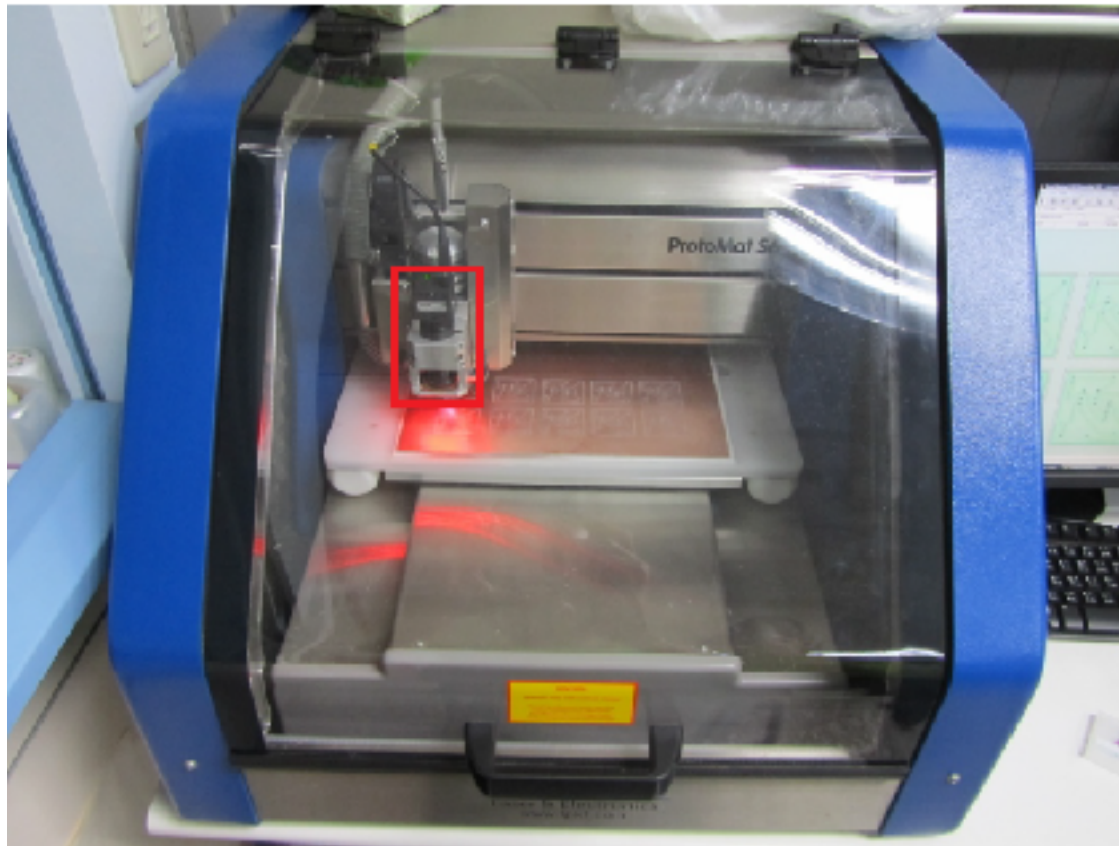
# 選擇所需的雕刻刀





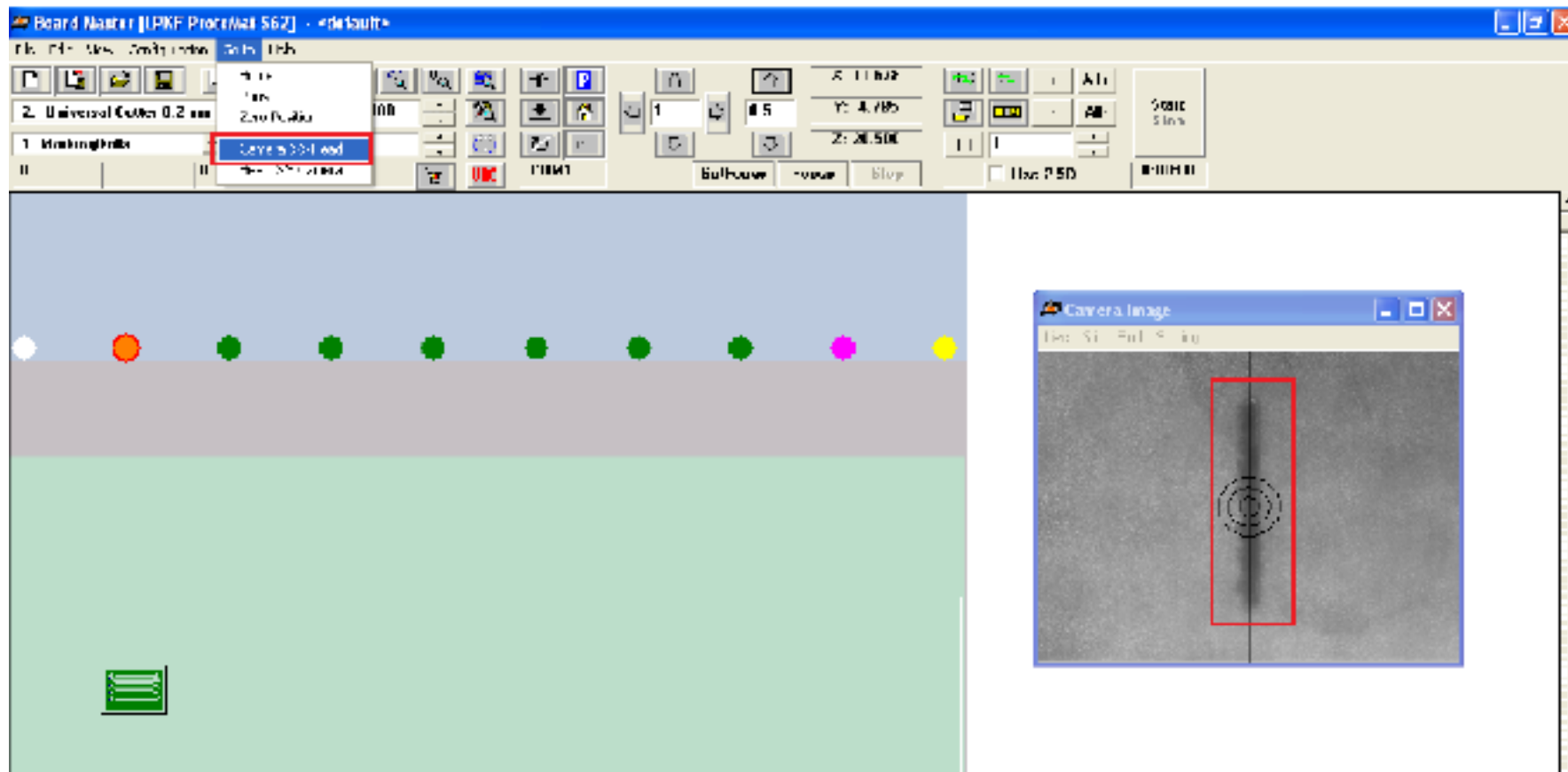


# 雕刻刀&照相機位置



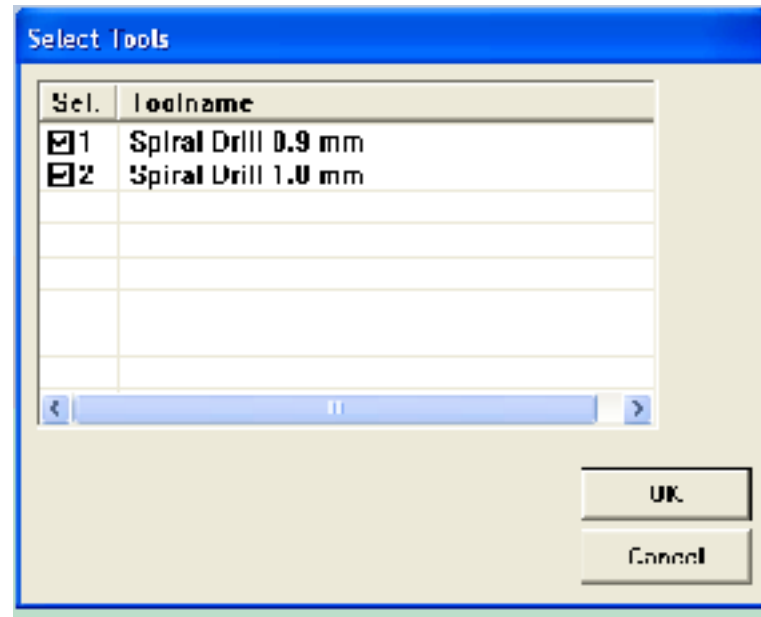
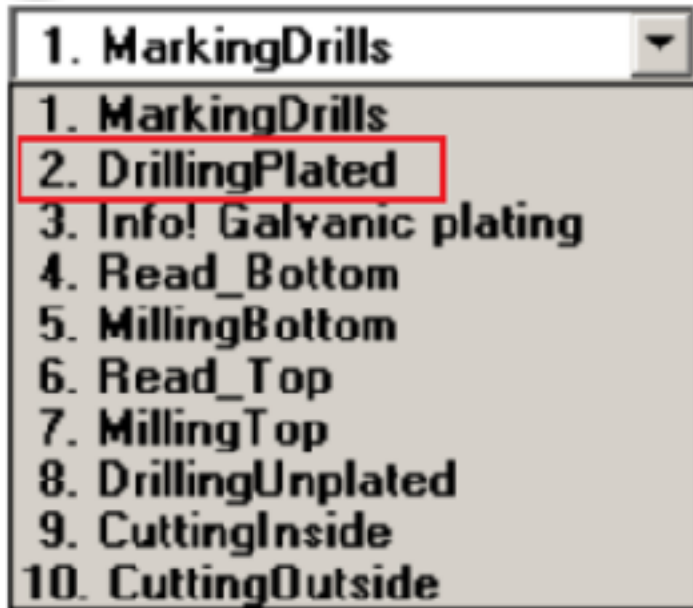


# 移動相機位置





# 鑽洞

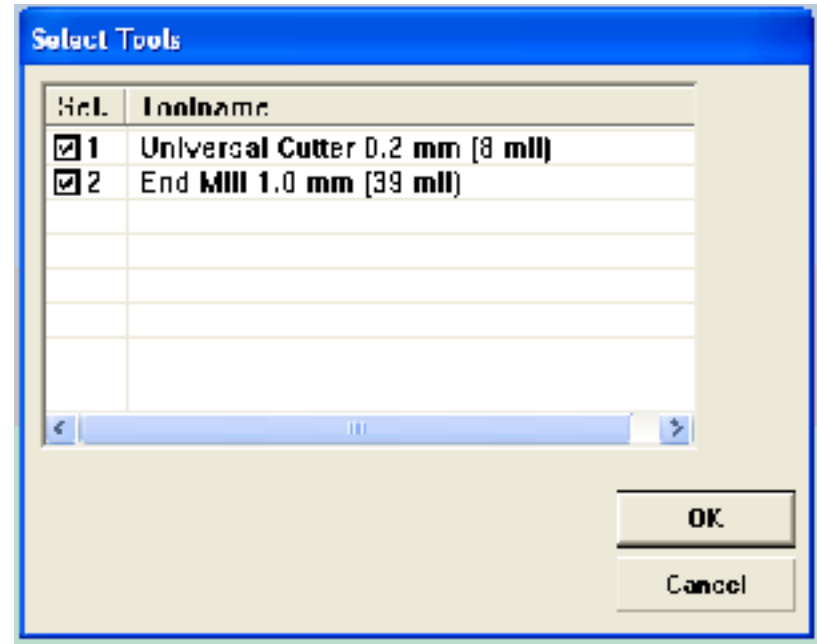


- 如果需要電鍍，要在此步驟完成後先電鍍再繼續下一步的刻線



# 刻線

1. MarkingDrills
- 1. MarkingDrills
  - 2. DrillingPlated
  - 3. Info! Galvanic plating
  - 4. Read Bottom
  - 5. MillingBottom
  - 6. Read\_Top
  - 7. MillingTop
  - 8. DrillingUnplated
  - 9. CuttingInside
  - 10. CuttingOutside





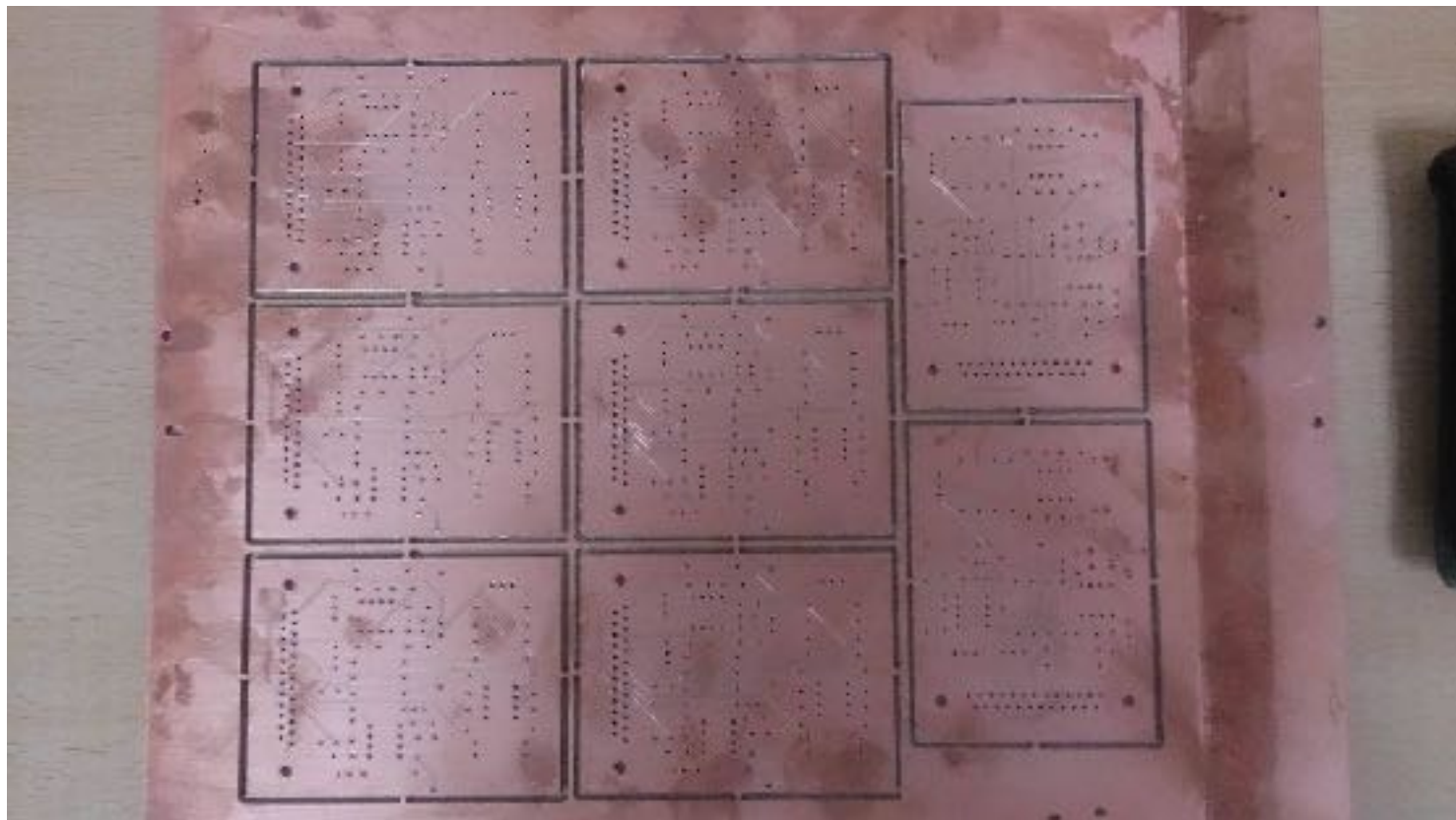
# BoardOutline

- 1. MarkingDrills
- 1. MarkingDrills
- 2. DrillingPlated
- 3. Info! Galvanic plating
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- 5. MillingBottom
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- 7. MillingTop
- 8. DrillingUnplated
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# 雕刻機步驟完成





# 電鍍機



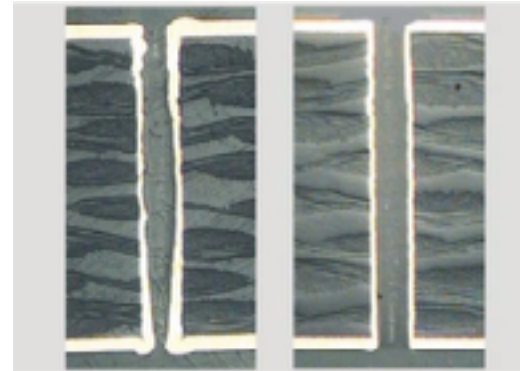
- 第1槽和2槽: 主要做去油清潔的動作
- 第3槽: 讓電路板活化
- 第4槽: 電鍍
- 第5槽: 導孔清洗



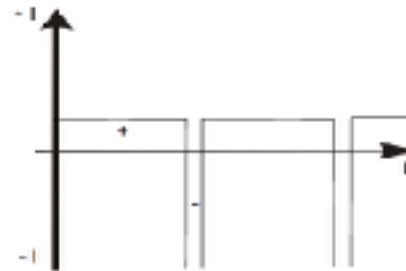
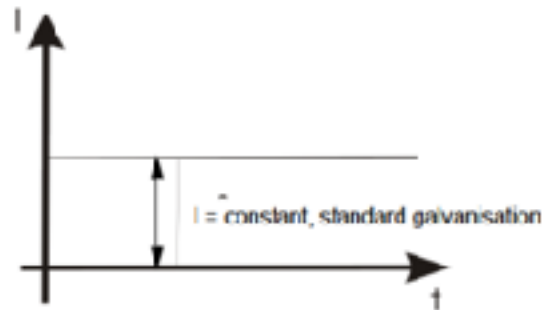


# 電鍍機

- 將孔洞鍍上一層銅，  
使得上下層短路



- Reverse Pulse Plating(RPP) for bores  $\leq 0.4\text{mm}$

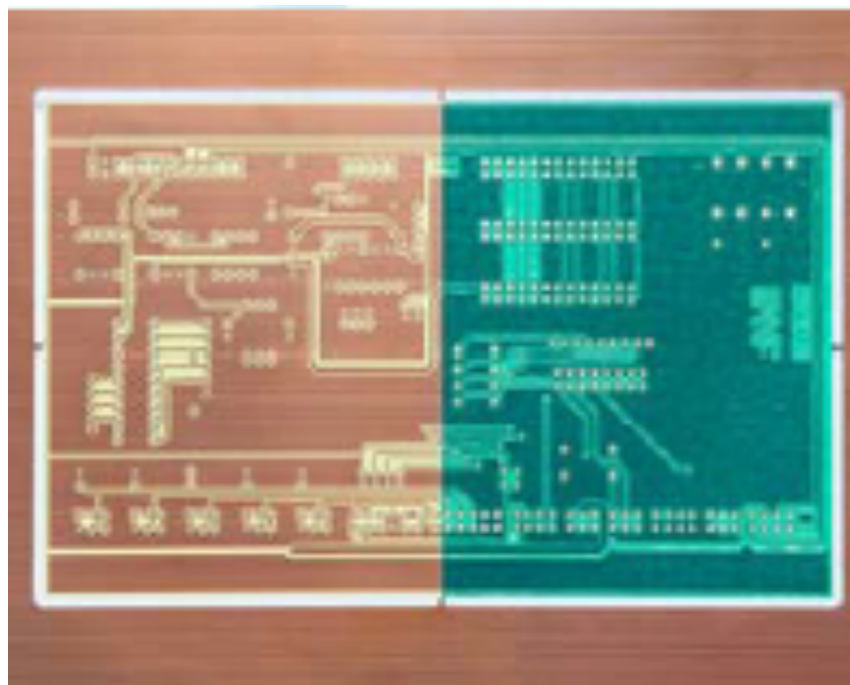






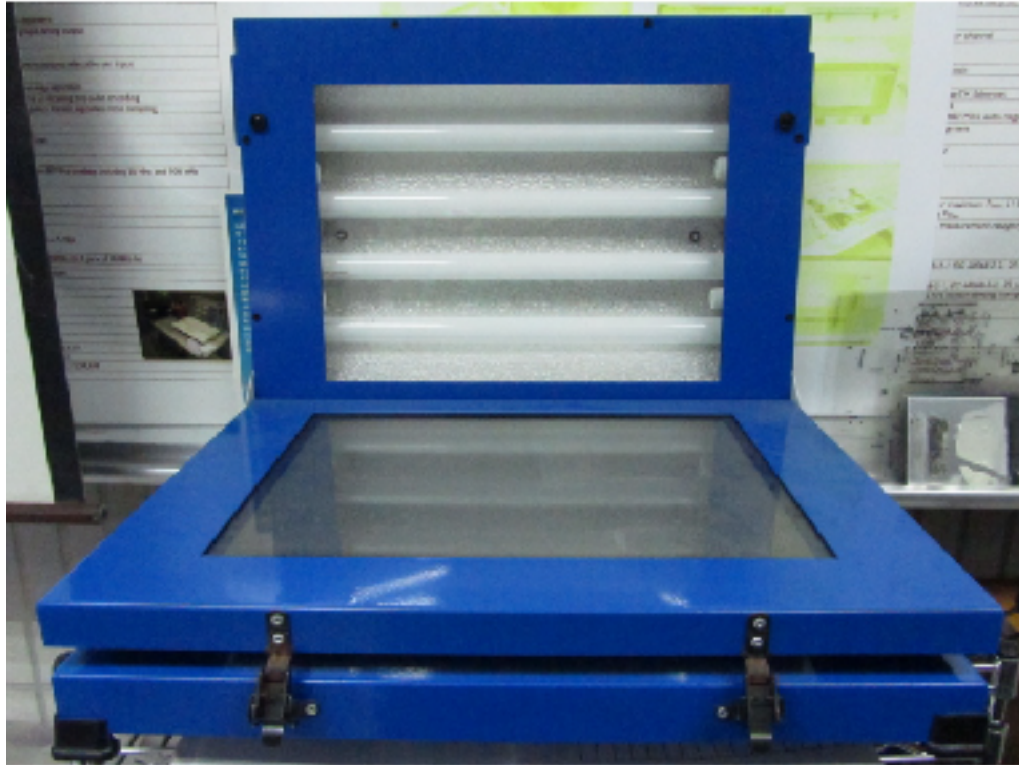
# 防焊綠漆

- 保護電路板上的線路，避免因刮傷造成短路、斷路現象和達成防焊功能。





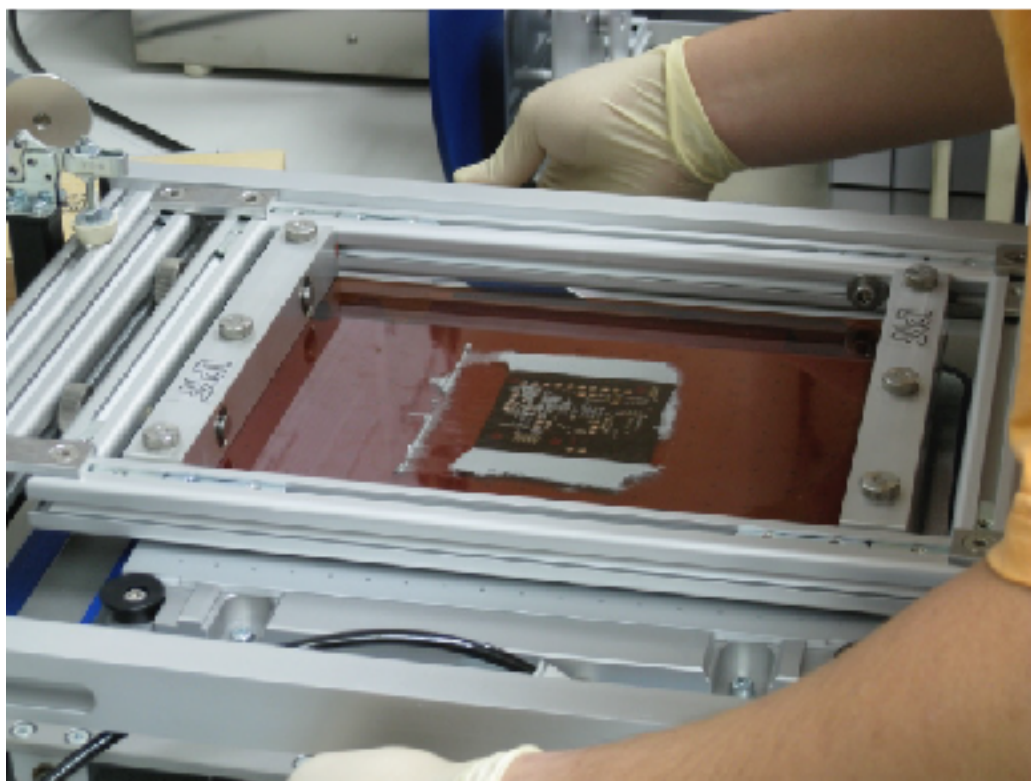
# 紫外線曝光機



- 上完防焊綠漆後，再經過紫外線照射，可以使綠漆固化，而沒有照到紫外線的部分，之後會使用藥劑洗掉，以方便焊接



# 錫膏印刷機



- 將SMD焊點雕刻在stencil上
- 調整stencil表面鬆緊程度
- 對齊焊點將錫膏均勻塗在電路板上





# 半自動貼片機



- Min size: 0201 chip component
- 固定電路板
- 調整氣壓並更換合適吸頭
- 將SMD貼在焊點上，使焊點上的錫膏與電子元件腳位貼合





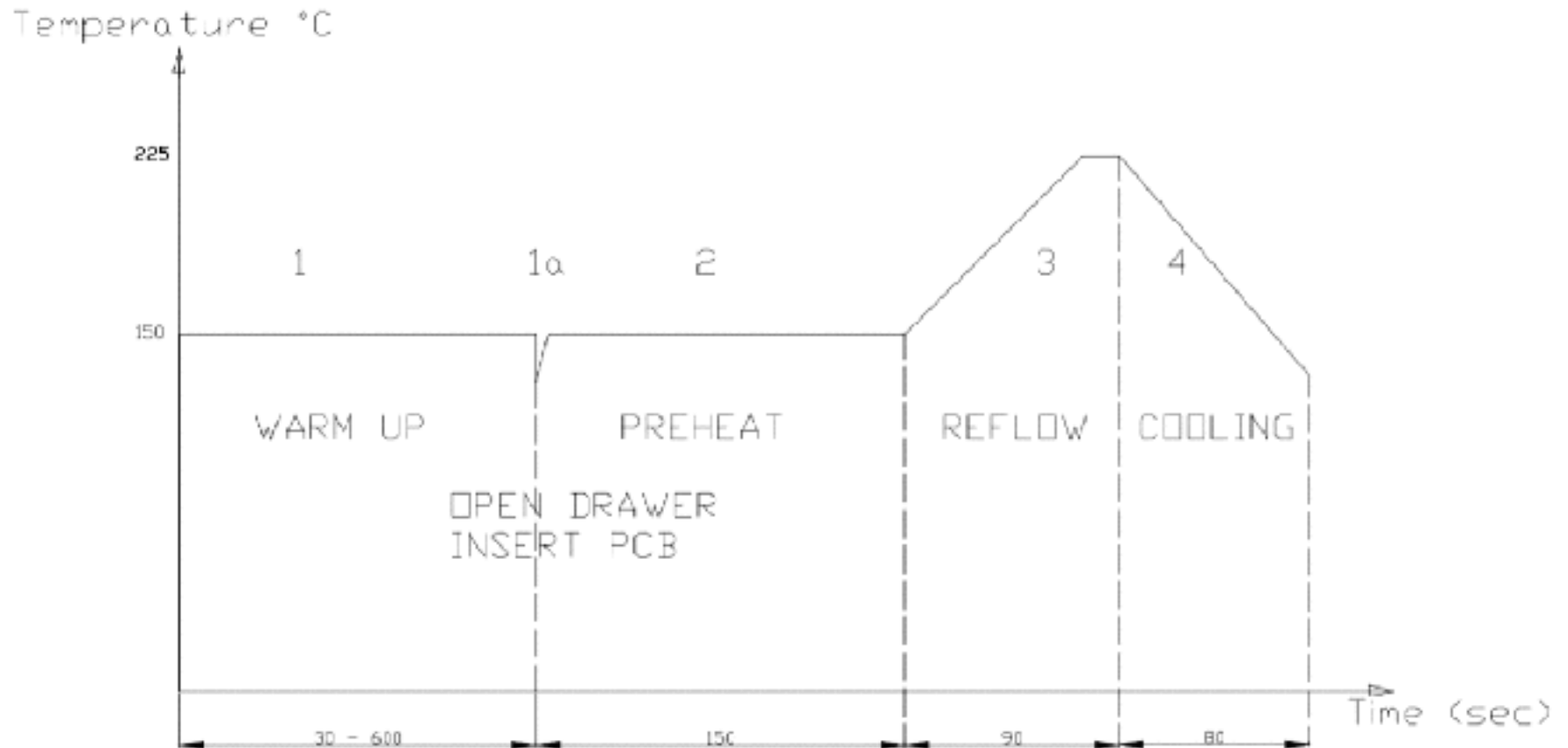
# 迴流焊接爐



- 迴流焊接爐可以將錫膏熔融，冷卻後電子元件就可以焊接在電路板上
- 過程中施放氮氣減少氧化程度



# 迴流焊接爐





# PCB步驟-雙面板

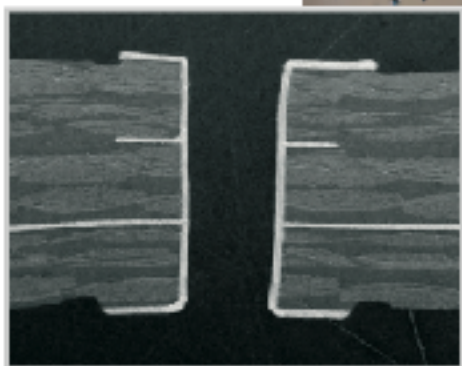
鑽孔

[Marking / Drill]



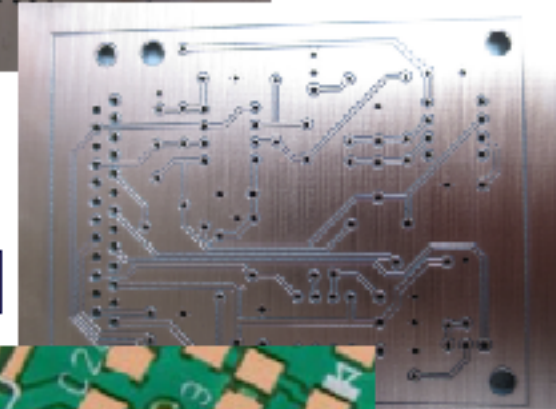
電鍍

[共五槽]

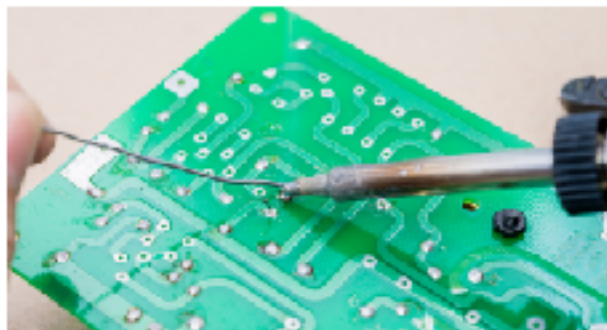


刻線

[Universal cutting / EndMill]



防焊漆



焊接





# 成品

