MIAT-C3X-EVB

軟硬體實驗模組與開發流程介紹

support.wuyang@gmail.com

浯陽科技有限公司

WU-YANG

Technology Co., Ltd.

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Document Title	MIAT-C3X-EVB軟硬體實驗模組與開發流程介紹
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Platform	■ MIAT_C3X ■ MIAT_IOB
Peripheral	Key Switch, LED
Author	■ WU-YANG Technology Co., Ltd.

Outline

- MIAT_C3X實驗板
  - 主要功能介紹
  - 硬體環境設定
- MIAT_IOB實驗板
  - 各個週邊模組功能介紹
- 開發流程介紹
  - 以基本I/O驅動為例
  - 硬體電路配置
  - Quartus II軟體基本使用方法介紹
- 開發流程練習

MIAT_C3X實驗板主要功能介紹

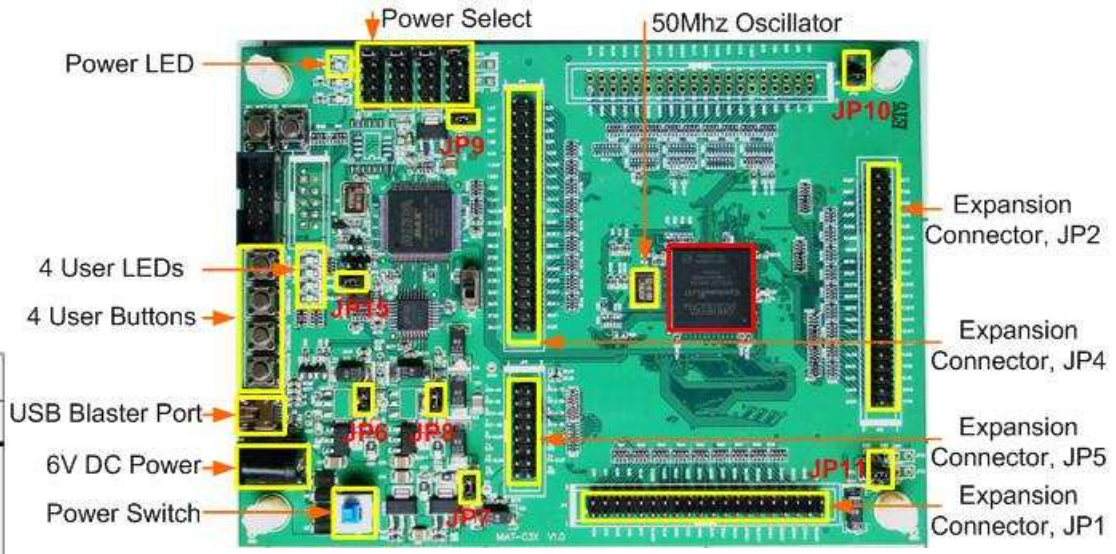
- FPGA編號Altera Cyclone III EP3C25
  - 24,624 Logic Elements
  - 594(66x9) Kbits Memory
  - 66 Multipliers
  - 4 PLLs
  - 20 Global Clock Networks
  - 156 I/O Pin Counts

Table 1–6. Cyclone III FPGA I/O Standards Support *Note (1)*

Type	I/O Standard
Single-Ended I/O	• LVTTL • LVCMOS • SSTL • HSTL • PCI • PCI-X
Differential I/O	• SSTL • HSTL • LVPECL • BLVDS • LVDS • mini-LVDS • RSDS • PPDS

Note to Table 1–6:
(1) PCI Express and Serial Rapid I/O can be supported using an external PHY device.

  - Support Memory Types
    - DDR, DDR2, SDRAM
    - Data Rates up to 400 Mbps
  - FBGA 256



MIAT_C3X正面

MIAT_C3X實驗板主要功能介紹

- FPGA內部可合成記憶體之規格

Table 4–1. Summary of M9K Memory Features (Part 1 of 2)

Feature	M9K Blocks
Maximum performance	315 MHz
Total RAM bits (including parity bits)	9,216
Configurations (depth × width)	8192 × 1 4096 × 2 2048 × 4 1024 × 8 1024 × 9 512 × 16 512 × 18 256 × 32 256 × 36
Parity bits	✓
Byte enable	✓
Packed mode	✓
Address clock enable	✓
Single-port mode	✓
Simple dual-port mode	✓
True dual-port mode	✓

MIAT_C3X實驗板主要功能介紹

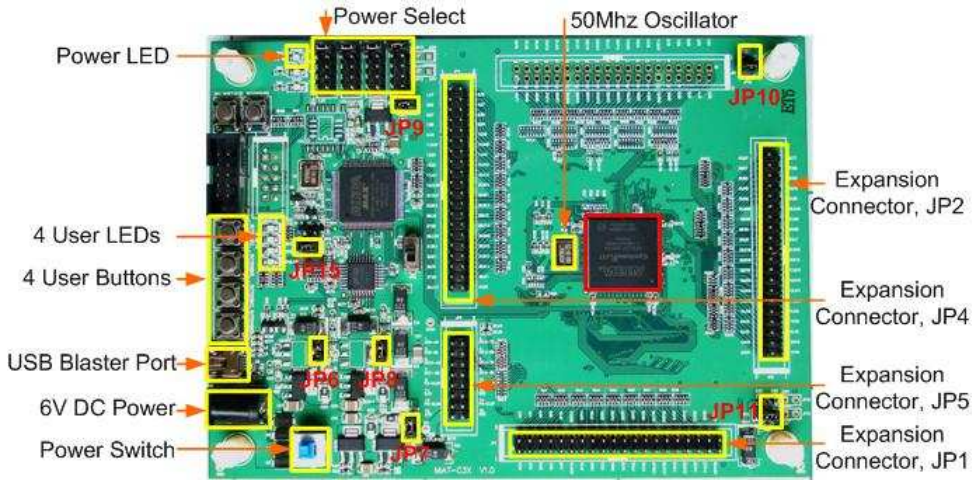
- FPGA內部可合成記憶體之規格

Table 4–1. Summary of M9K Memory Features (Part 2 of 2)

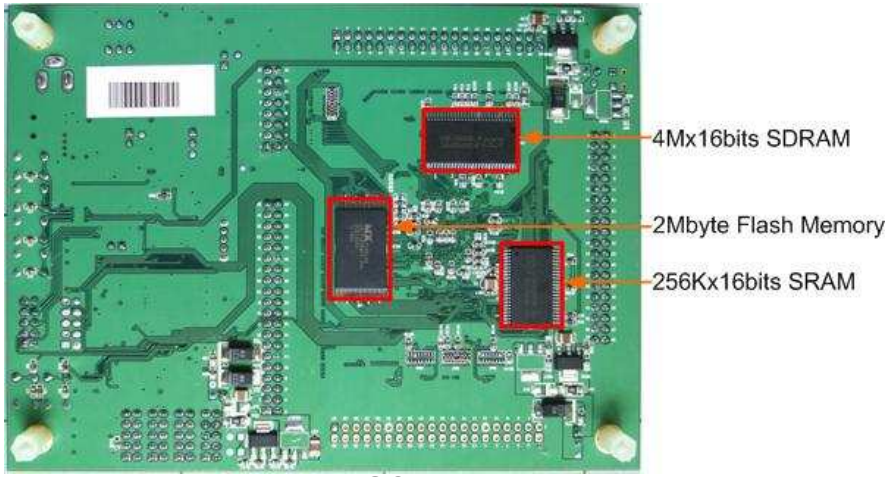
Feature	M9K Blocks
Embedded shift register mode *(1)*	✓
ROM mode	✓
FIFO buffer *(1)*	✓
Simple dual-port mixed width support	✓
True dual-port mixed width support *(2)*	✓
Memory initialization file (**.mif**)	✓
Mixed-clock mode	✓
Power-up condition	Outputs cleared
Register asynchronous clears	Read address registers and output registers only
Latch asynchronous clears	Output latches only
Write/Read operation triggering	Write and Read: Rising clock edges
Same-port read-during-write	Outputs set to “Old Data” or “New Data”
Mixed-port read-during-write	Outputs set to “Old Data” or “Don’t Care”

MIAT_C3X實驗板主要功能介紹

- 50Mhz Oscillator
- 可由USB介面燒錄電路
- 4個使用者測試 LED
- 4個使用者測試按鈕開關
- 核心晶片之I/O接腳以2.54mm間距的2x20PIN排針連接，可彈性擴充週邊。
- I/O接腳邏輯電位可調(1.2V, 1.8V, 2.5V, 2.8V, 3.3V)。
- 外部記憶體
  - 4Mx16bits SDRAM
  - 2Mbyte Flash Memory
  - 256Kx16bits SRAM
- 電源DC6V
- 尺寸：150x110mm



MIAT_C3X正面

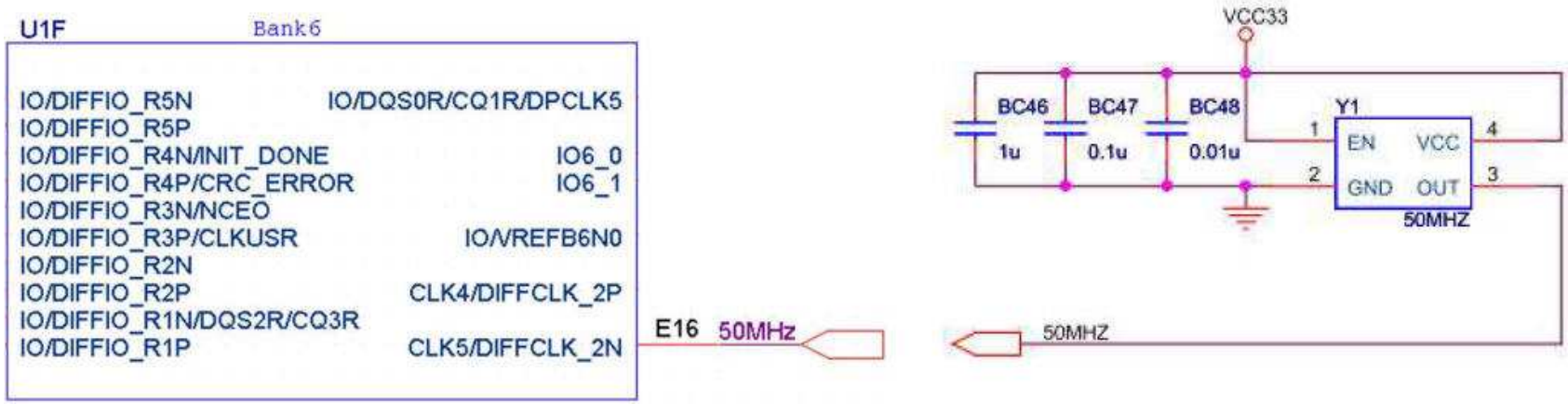


MIAT_C3X反面

MIAT_C3X實驗板主要功能介紹

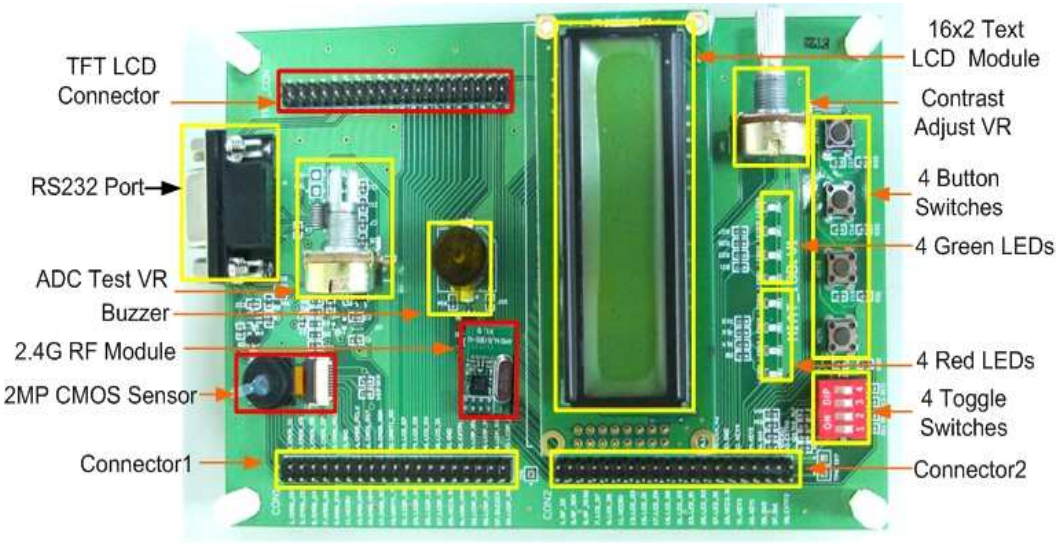
石英晶體振盪器

Signal Name	FPGA Pin Name	Bank No.
50MHz	E16	B6



MIAT_IOB實驗週邊功能介紹

- 2MPixels CMOS Sensor模組
- 2.4G RF模組
- 2x16文字型LCD模組
  (含明暗度調整電阻)
- RS232介面
- AD轉換測試模組
- 蜂鳴器
- 4個紅色LED
- 4個綠色LED
- 4個按鈕開關
- 4 P指撥開關
- TFT LCD 2.54mm連接器
- 尺寸：145x103mm



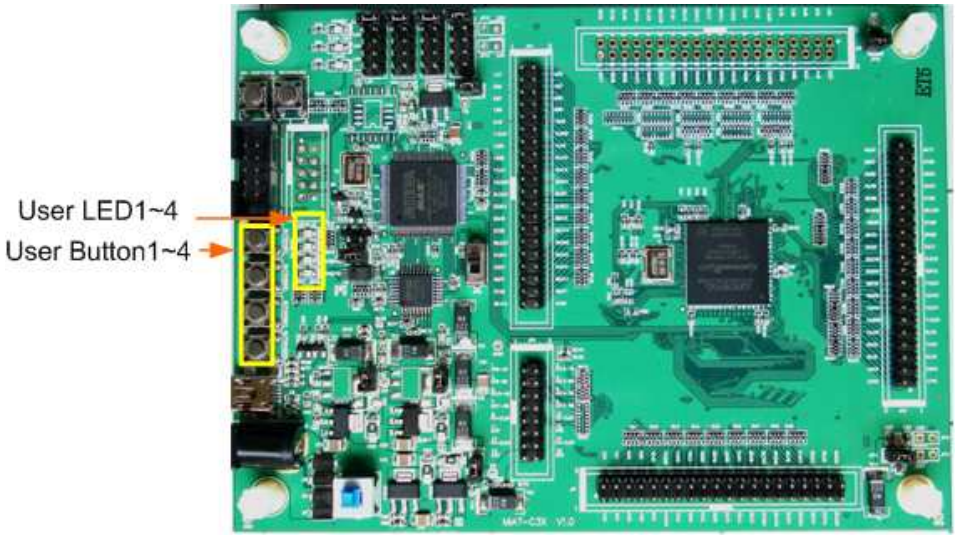
開發流程介紹－以基本I/O驅動為例

- 實驗目的

  學習如何連接與操作簡單的輸入與輸出的元件到FPGA 晶片，其中輸入元件為MIAT_C3X實驗板上的開關Button1~4，輸出元件為LED1~4。

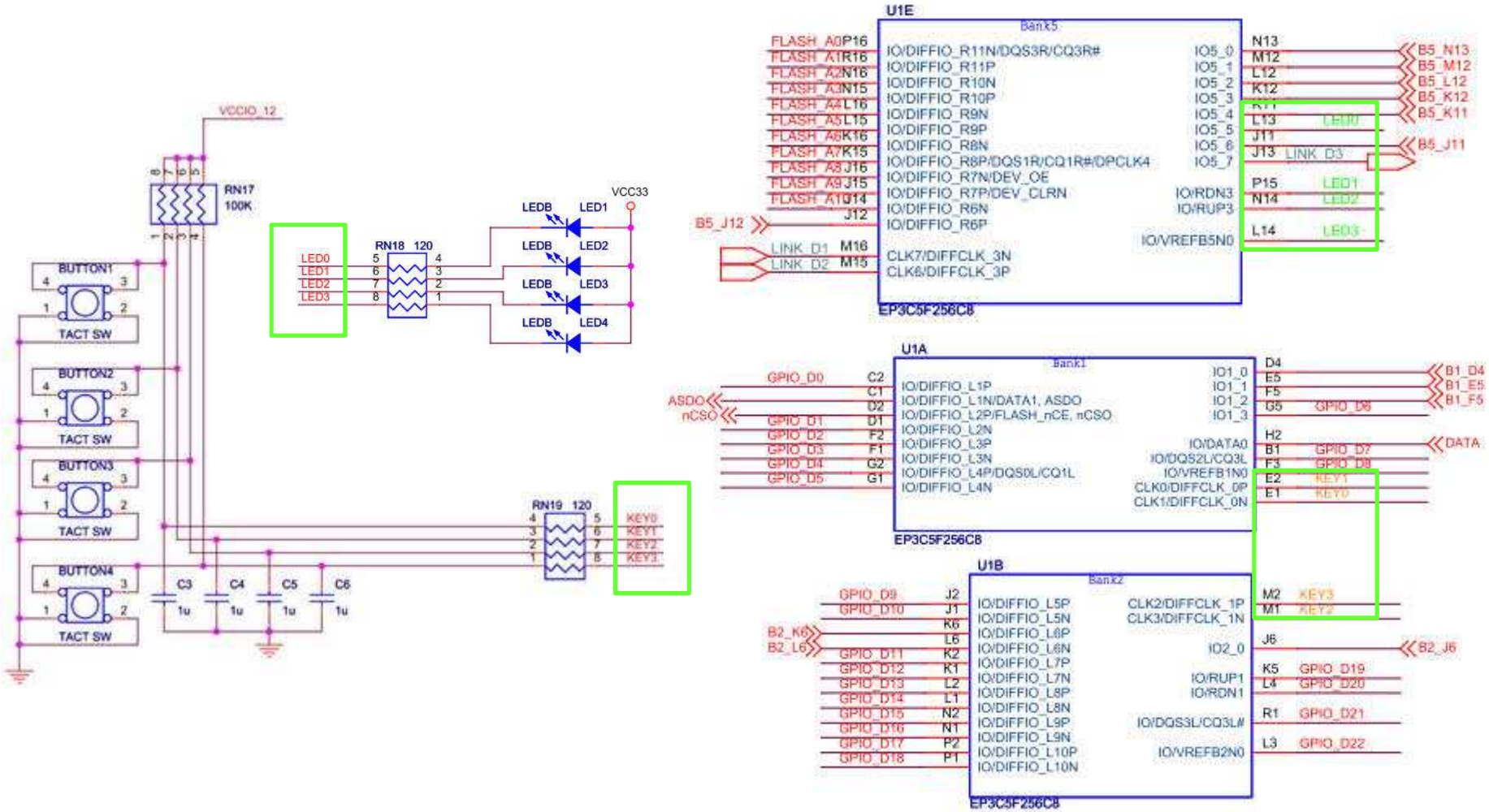
- 實驗原理

  範例一、根據開關、LED 電路圖與FPGA 腳位對照表使用提示的VHDL 程式碼將開關與LED 做連接的動作，當開關Button按下時相對應的LED被點亮，反之LED熄滅。



FPGA Pin Name	I/O assignment
PIN_E1	User Botton1
PIN_E2	User Botton2
PIN_M1	User Botton3
PIN_M2	User Botton4
PIN_L13	User LED1
PIN_P15	User LED2
PIN_N14	User LED3
PIN_L14	User LED4

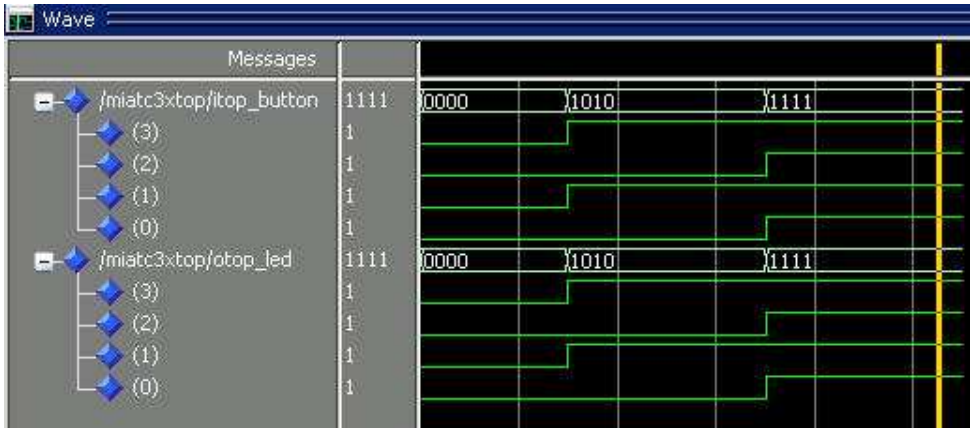
基本I/O硬體電路驅動配置範例



基本I/O驅動範例

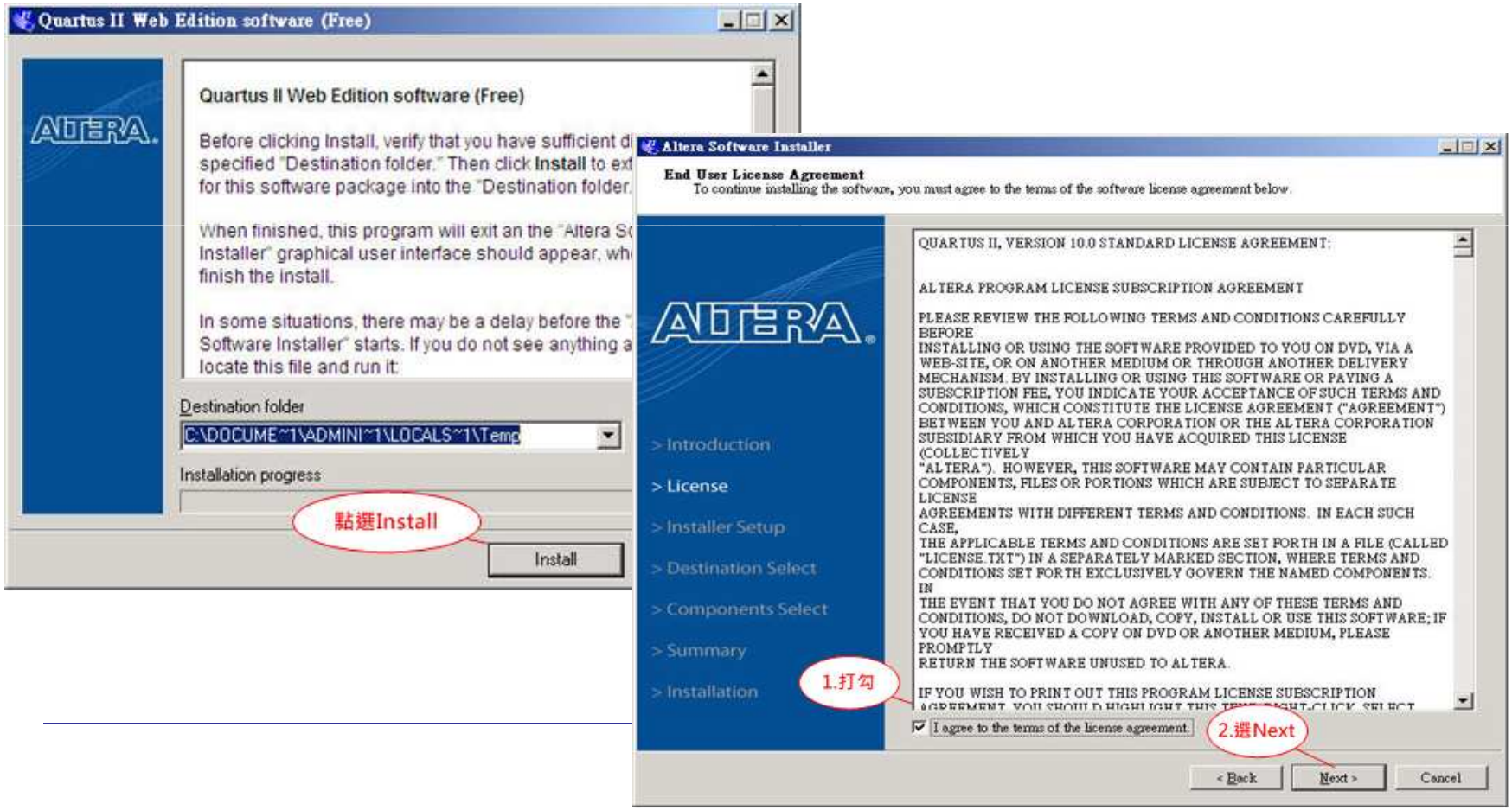
提示的VHDL程式碼(檔案路徑CDROM\MIAT_C3X_EVB_Demonstrations\TESTIO1)

```
library ieee;
use ieee.std_logic_1164.all;
use ieee.std_logic_arith.all;
use ieee.std_logic_unsigned.all;
library work;
entity MIATC3XTOP is
port(
        …
        -- Push Button 1~4
        iTOP_BUTTON : in  std_logic_vector(3 downto 0); -- Push Button

        -- LED 1~4
        oTOP_LED : out std_logic_vector(3 downto 0);      -- LED 4 Bits
        …
);
end MIATC3XTOP;
architecture RTL of MIATC3XTOP is
begin

    oTOP_LED <= iTOP_BUTTON;
--   oTOP_LED(3) <= iTOP_BUTTON(3);
--   oTOP_LED(2 downto 0) <= iTOP_BUTTON(2 downto 0);

end RTL;
```



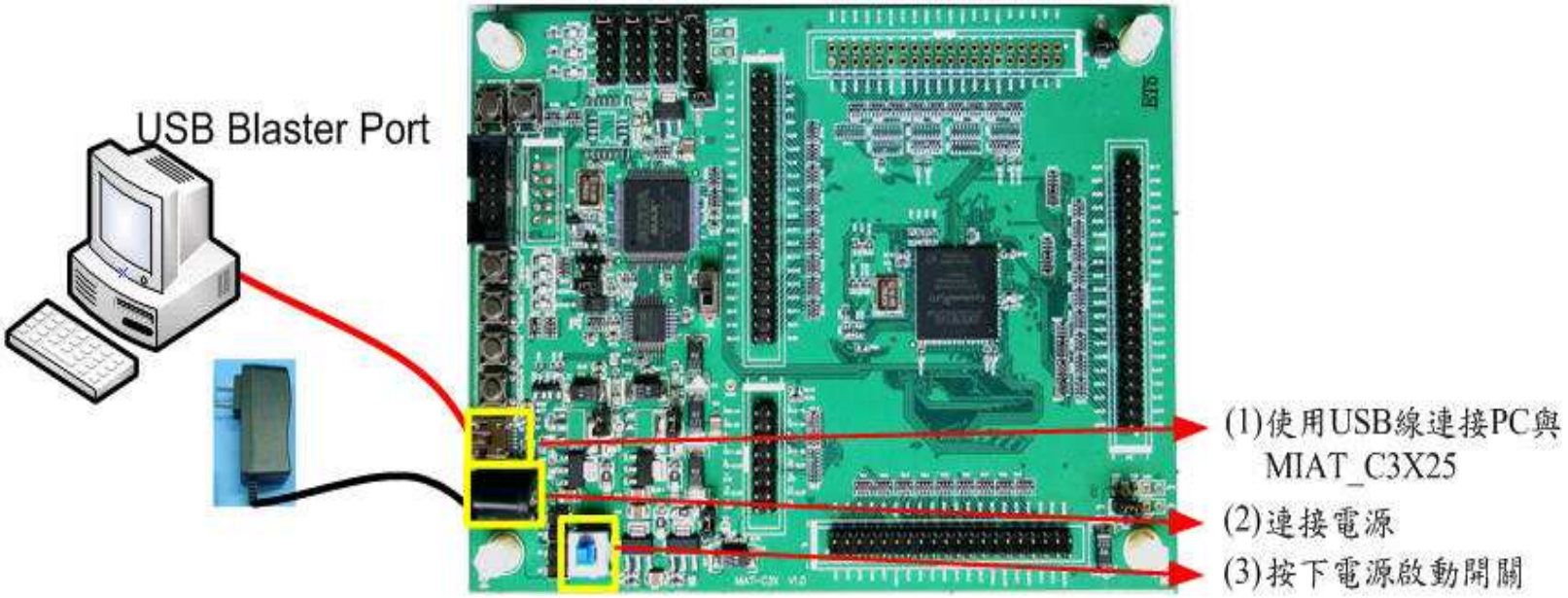
QuartusII軟體安裝

- 安裝10.0_quartus_free_windows.exe，此檔案的目錄位置在光碟內的“\Altera\”，安裝過程注意下列畫面，其他選Next與OK即可完成安裝。



MIAT_C3X實驗板安裝

- 步驟一、將實驗板連接PC

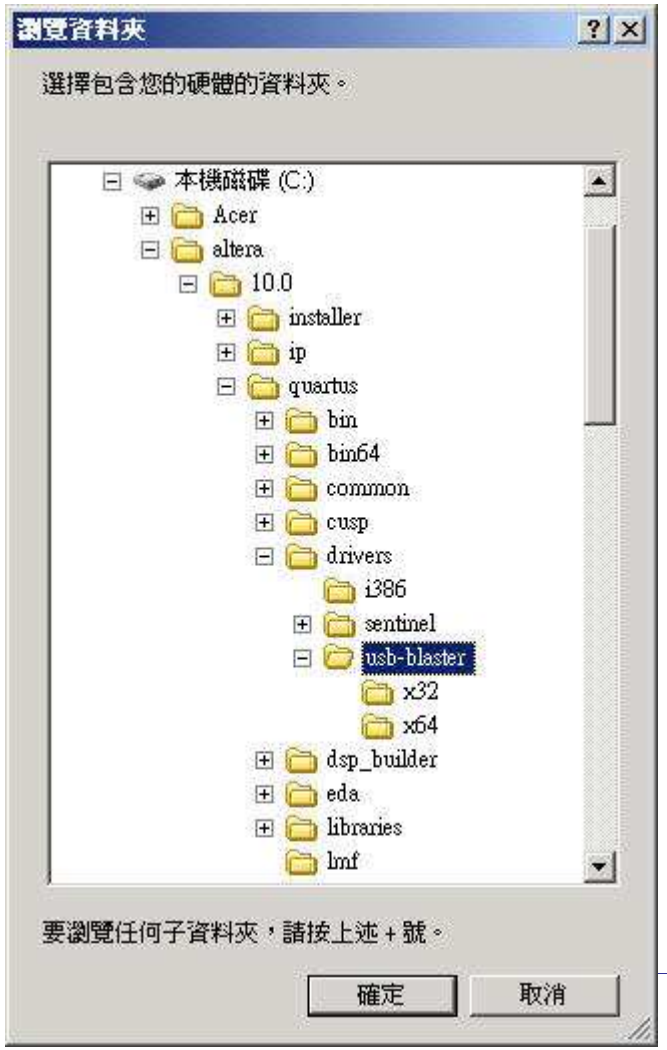


MIAT_C3X實驗板安裝

- 步驟二、驅動程式安裝，當實驗板第一次連接PC時，需安裝USB Blaster驅動程式，驅動程式目錄為C:\altera\10.0\quartus\drivers\usb-blaster 。

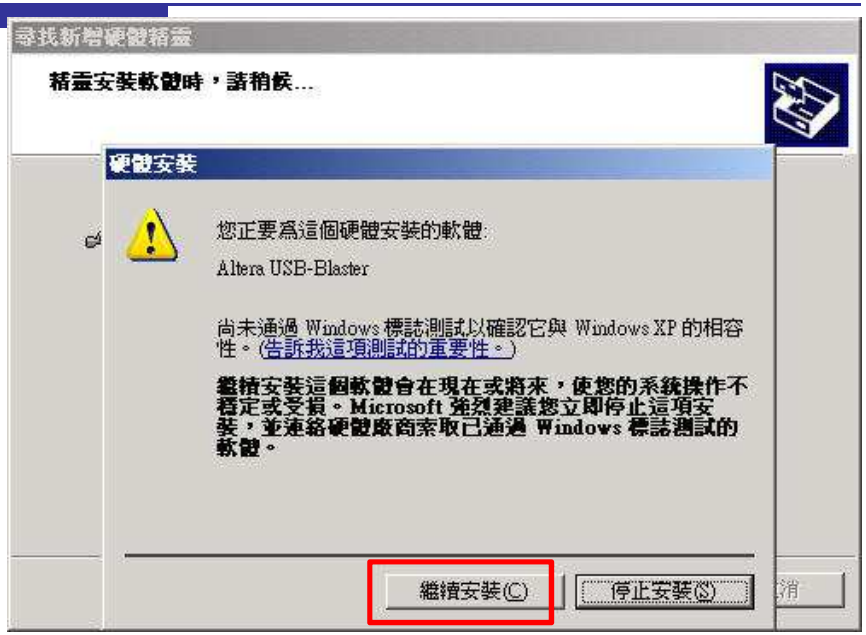
MIAT_C3X實驗板安裝

- 步驟二、驅動程式安裝



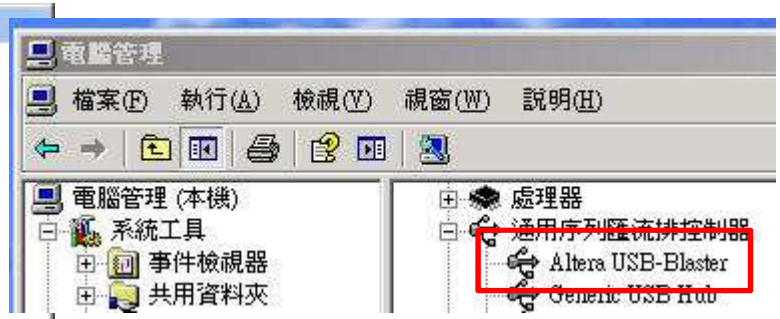
MIAT_C3X實驗板安裝

- 步驟二、驅動程式安裝



MIAT_C3X實驗板安裝

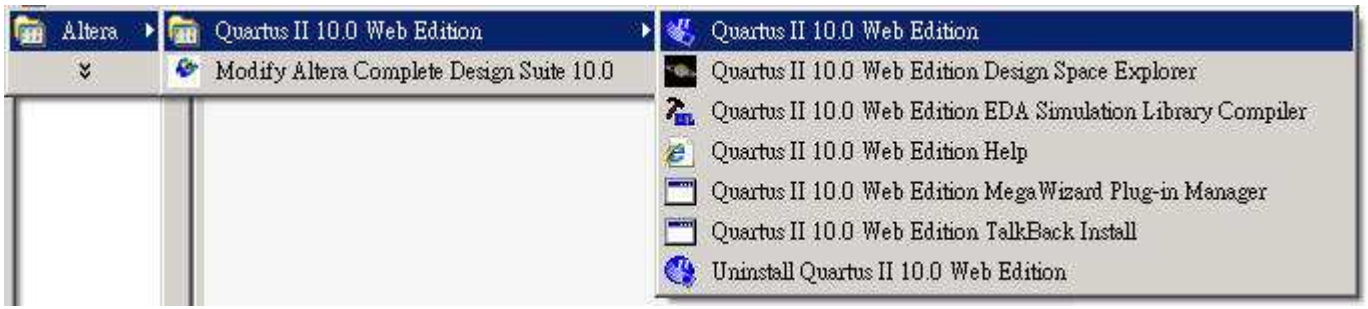
- 步驟二、驅動程式安裝



QuartusII軟體使用方法

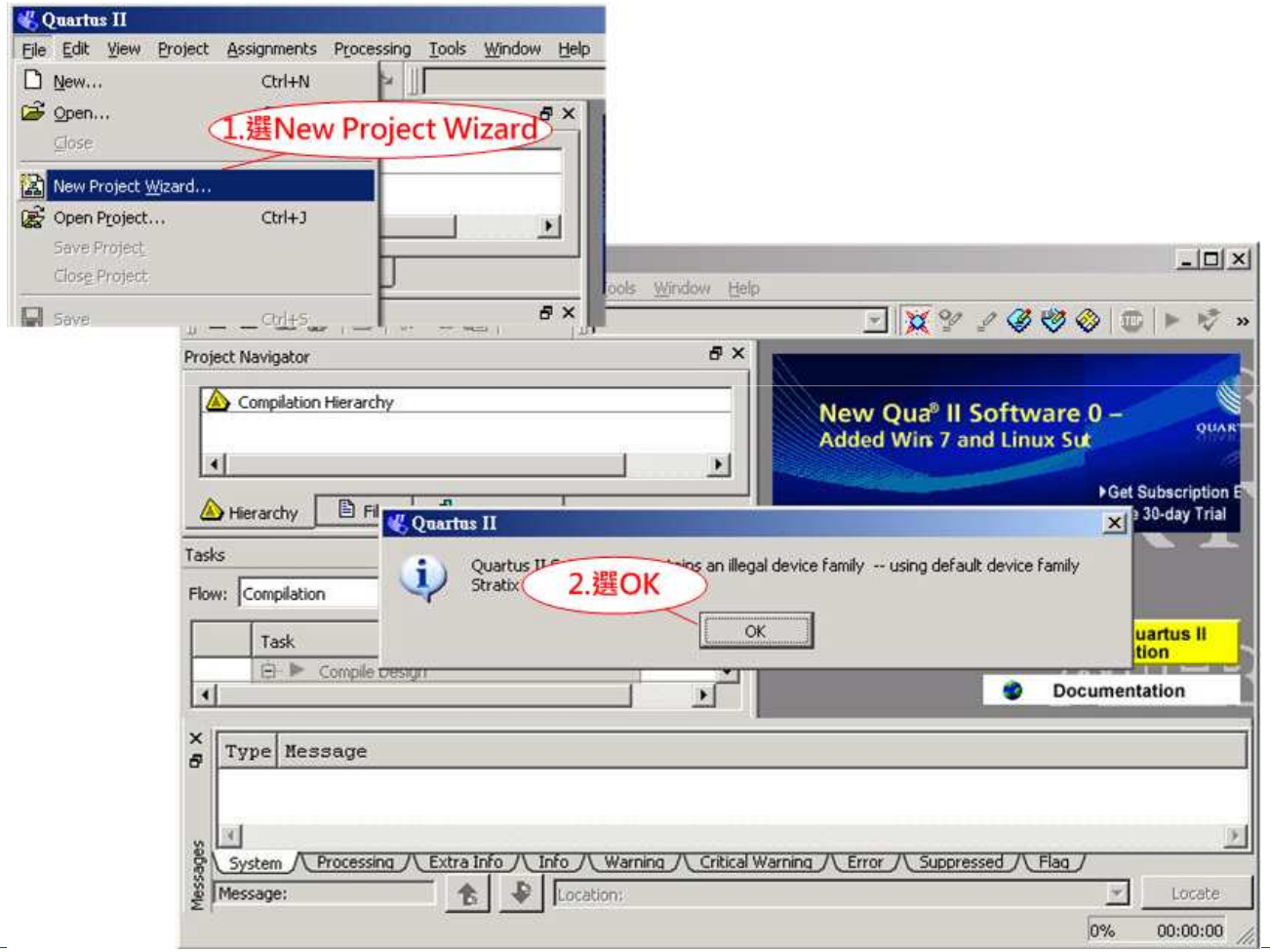
- 假設使用者已安裝QuartusII軟體工具，在此以TESTIO1為範例，目錄於CDROM\MIAT_C3X_EVB_Demonstrations\TESTIO1 ，設定步驟如下：
- 步驟一、 在\D:建立專案目錄並複製MIATC3XTOP.vhd檔案，如下圖

- 步驟二、執行Quartus II



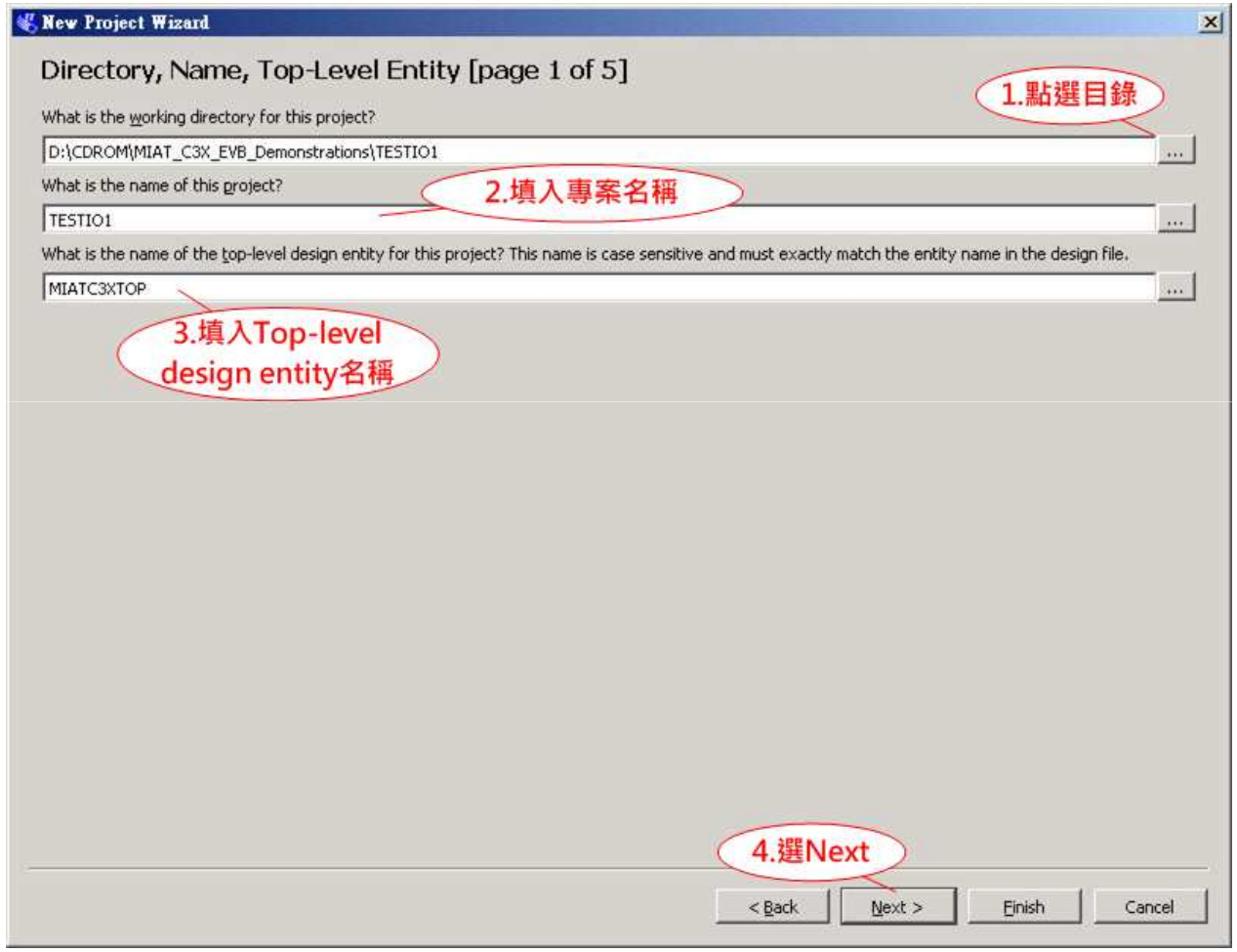
QuartusII軟體使用方法

- 步驟三、建立專案檔(1/6)

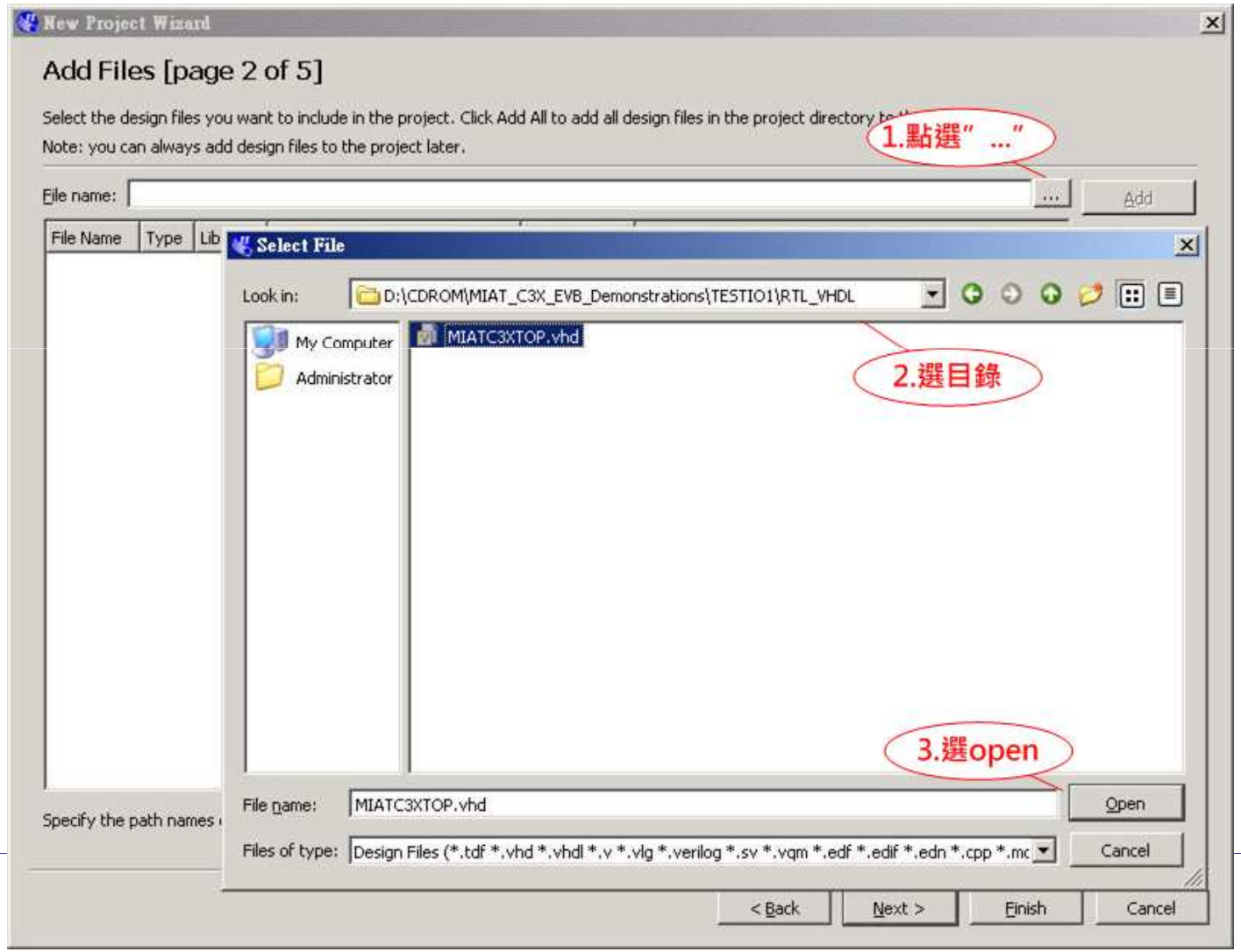


QuartusII軟體使用方法

- 步驟三、建立專案檔(2/6)

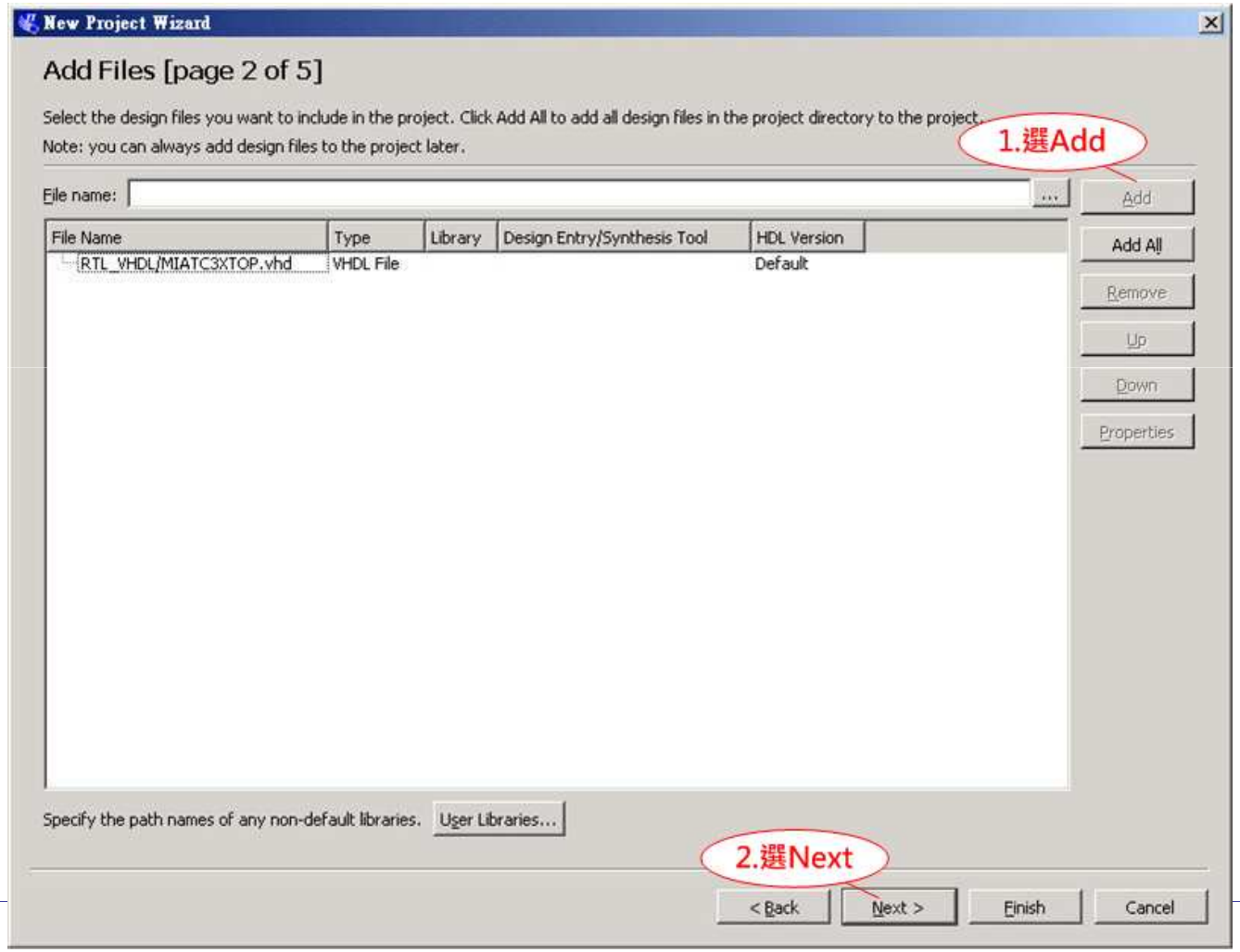


步驟三、建立專案檔(3/6)


New Project Wizard
Add Files [page 2 of 5]
Select the design files you want to include in the project. Click Add All to add all design files in the project directory to
Note: you can always add design files to the project later.
1.點選" ..."
File name:
...
Add
File Name
Type
Lib
Select File
Look in:
D:\CDROM\MIAT_C3X_EVB_Demonstrations\TESTIO1\RTL_VHDL
My Computer
Administrator
MIATC3XTOP.vhd
2.選目錄
3.選open
File name:
MIATC3XTOP.vhd
Open
Files of type:
Design Files (*.tdf *.vhd *.vhdl *.v *.vlg *.verilog *.sv *.vqm *.edf *.edif *.edn *.cpp *.mc
Cancel
Specify the path names
< Back
Next >
Finish
Cancel

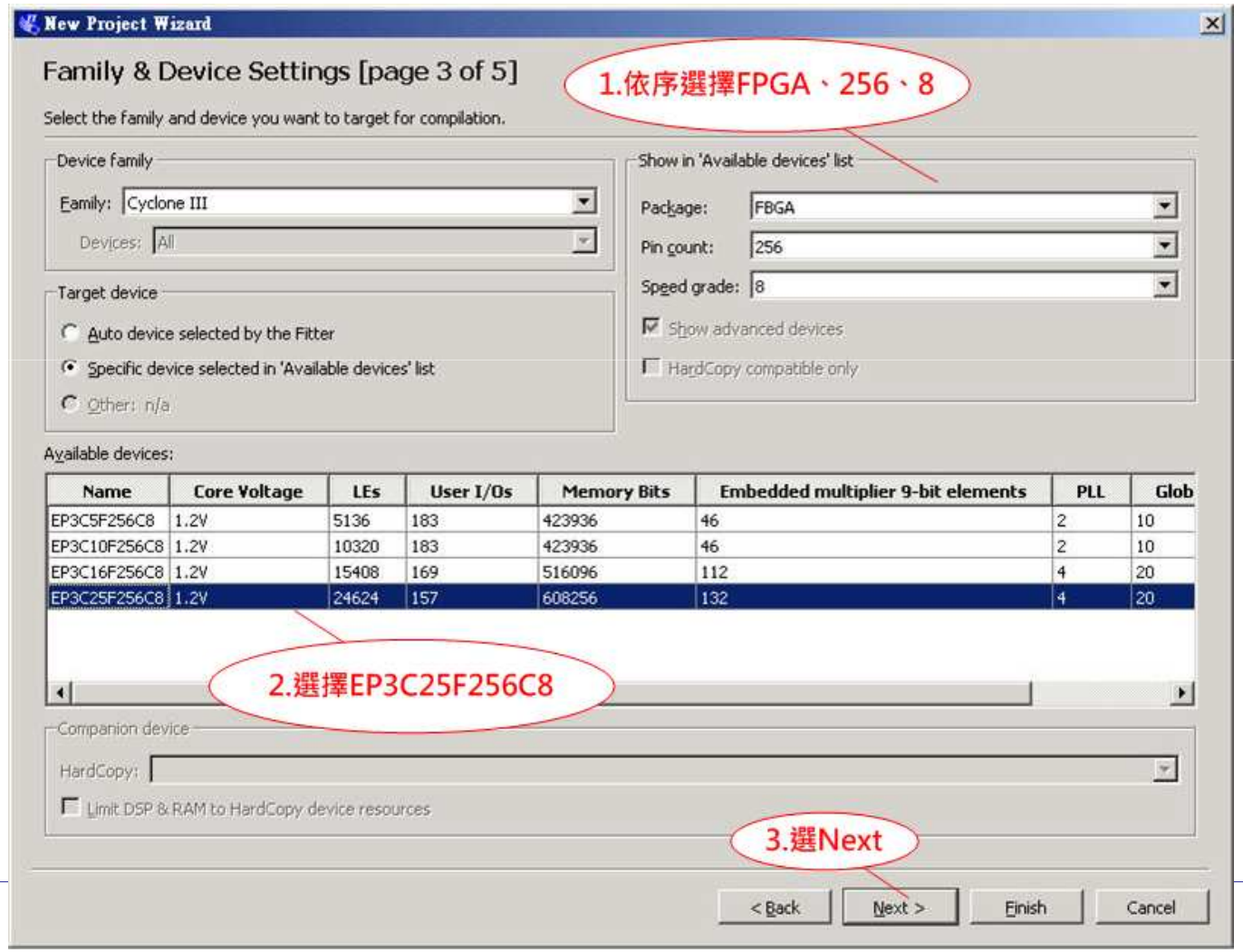
QuartusII軟體使用方法

- 步驟三、建立專案檔(4/6)



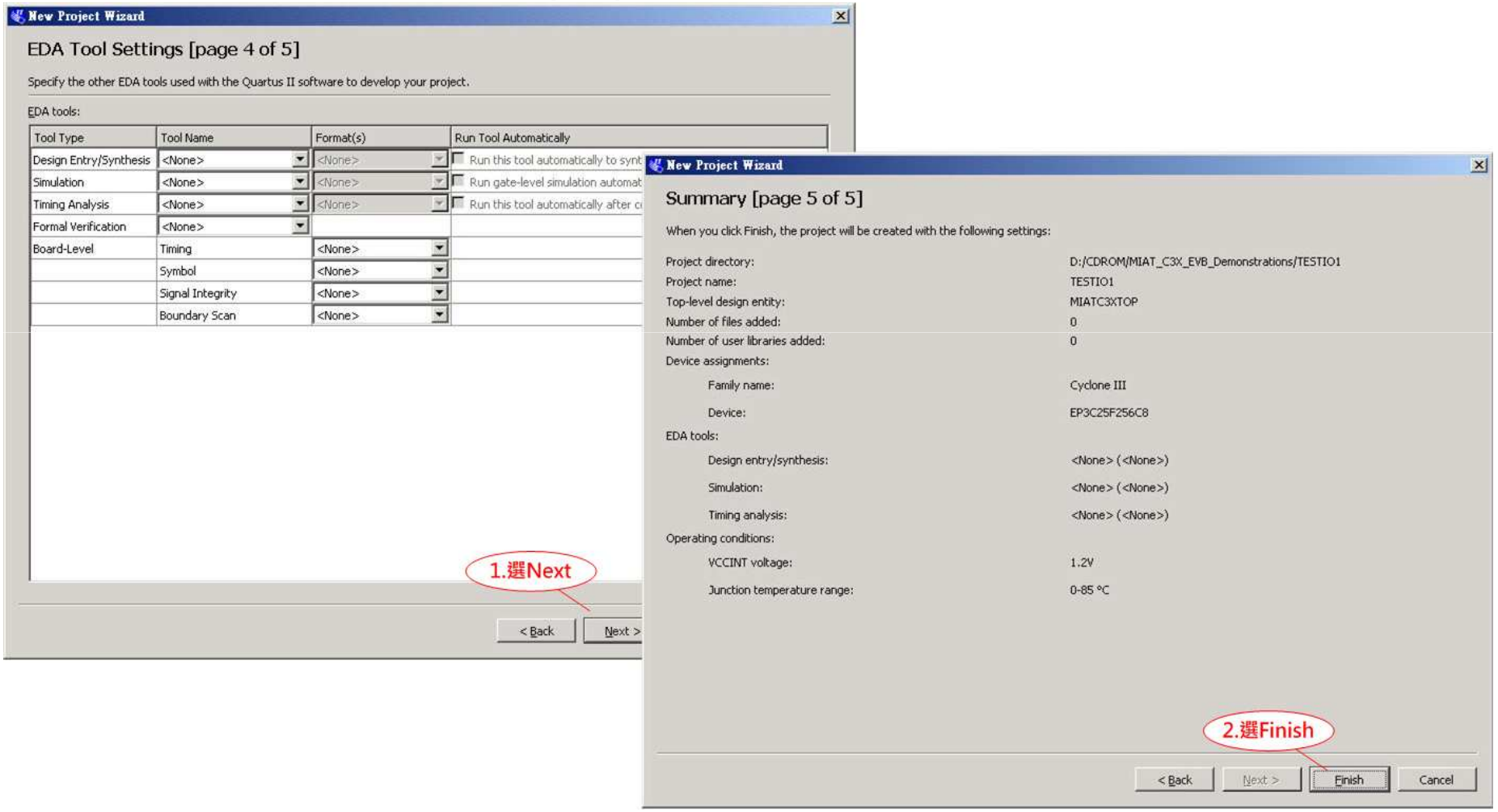
QuartusII軟體使用方法

- 步驟三、建立專案檔(5/6)



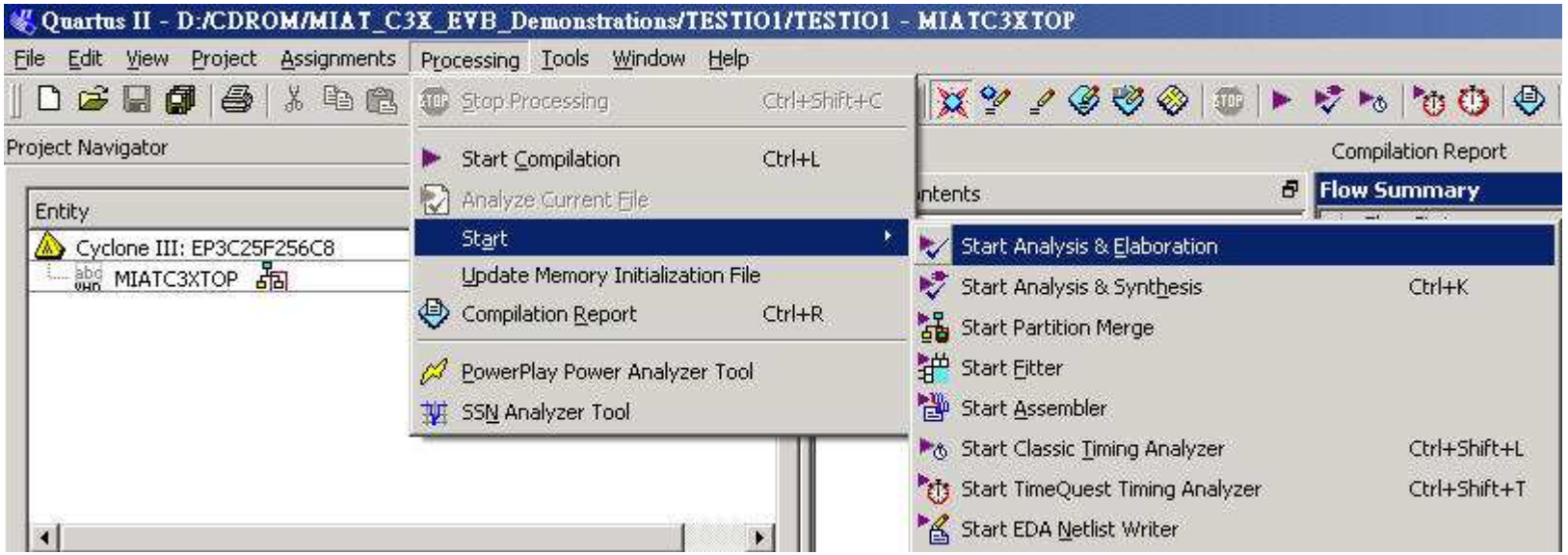
QuartusII軟體使用方法

- 步驟三、建立專案檔(6/6)



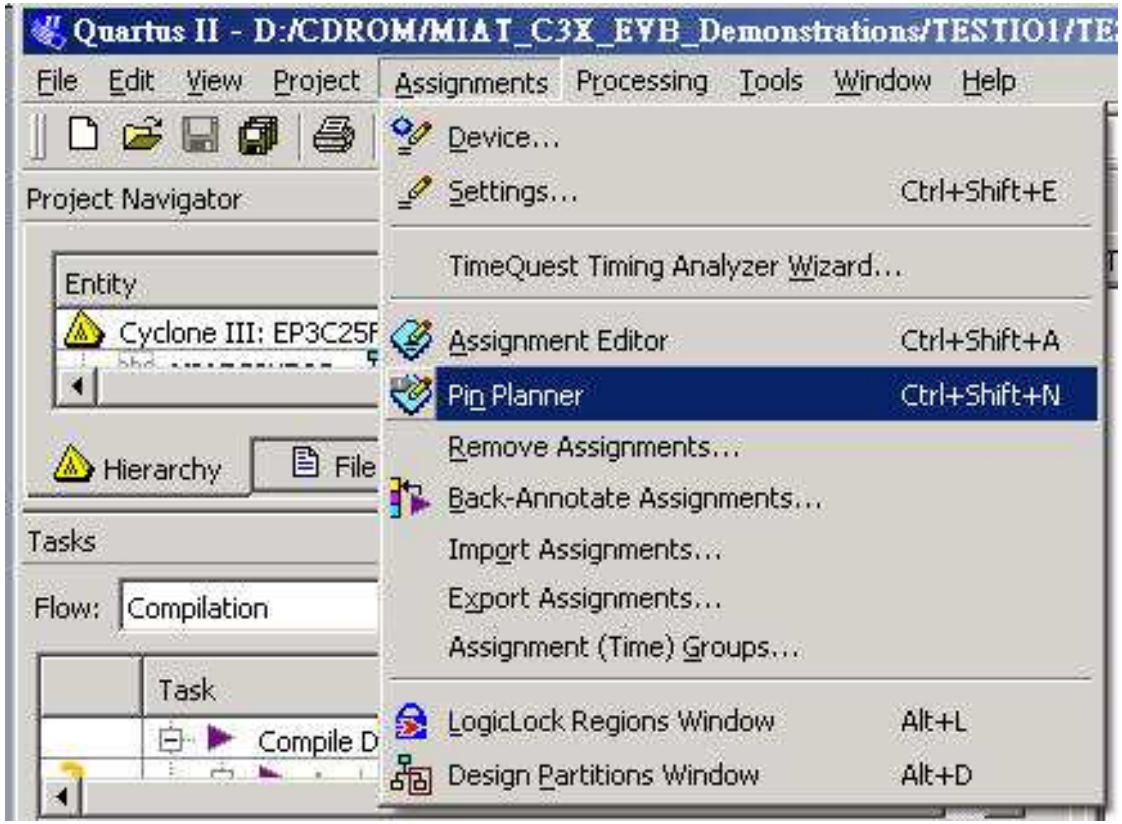
QuartusII軟體使用方法

- 步驟四、執行Analysis & Elaboration



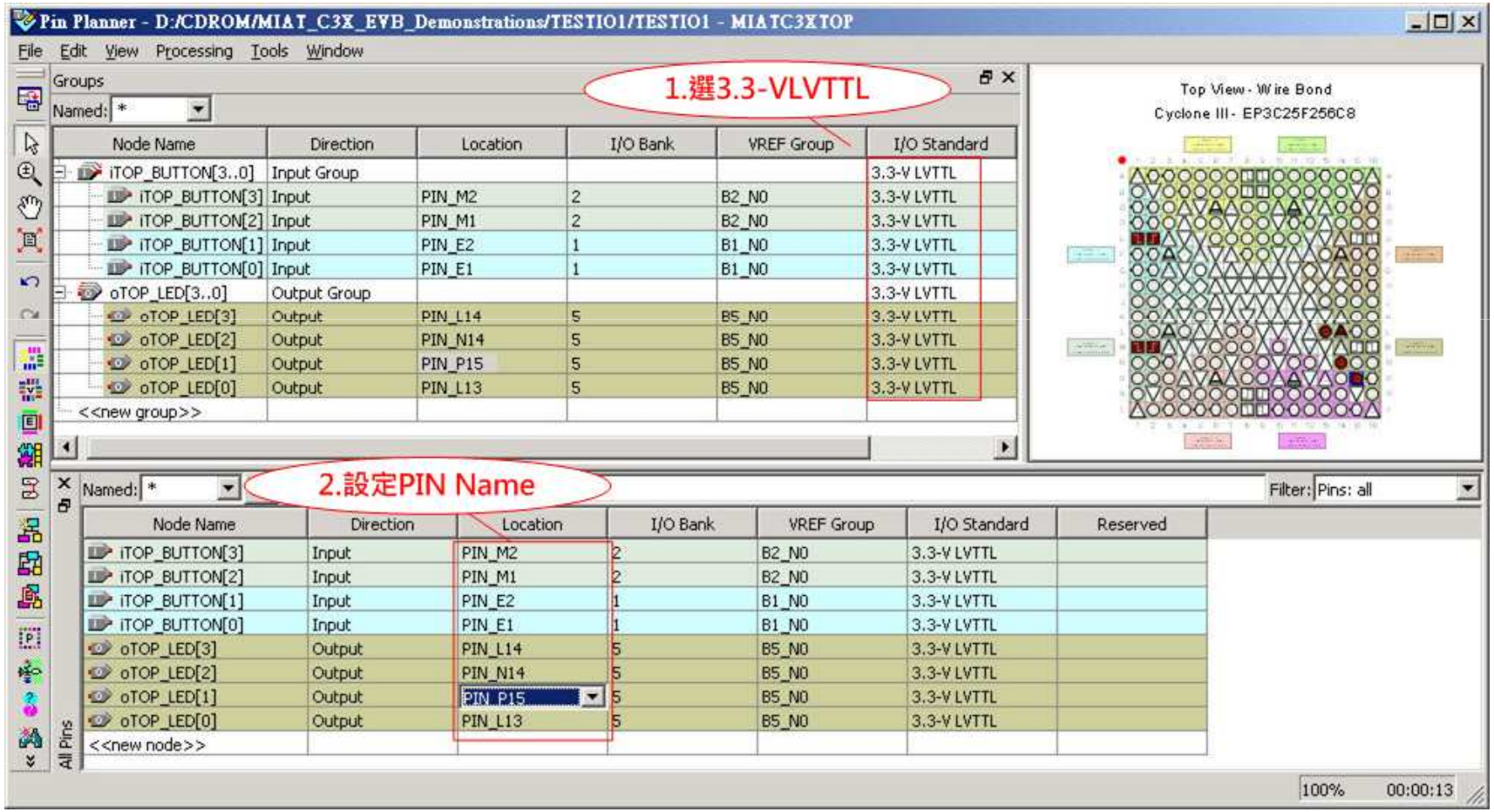
QuartusII軟體使用方法

- 步驟五、執行Pin Planner



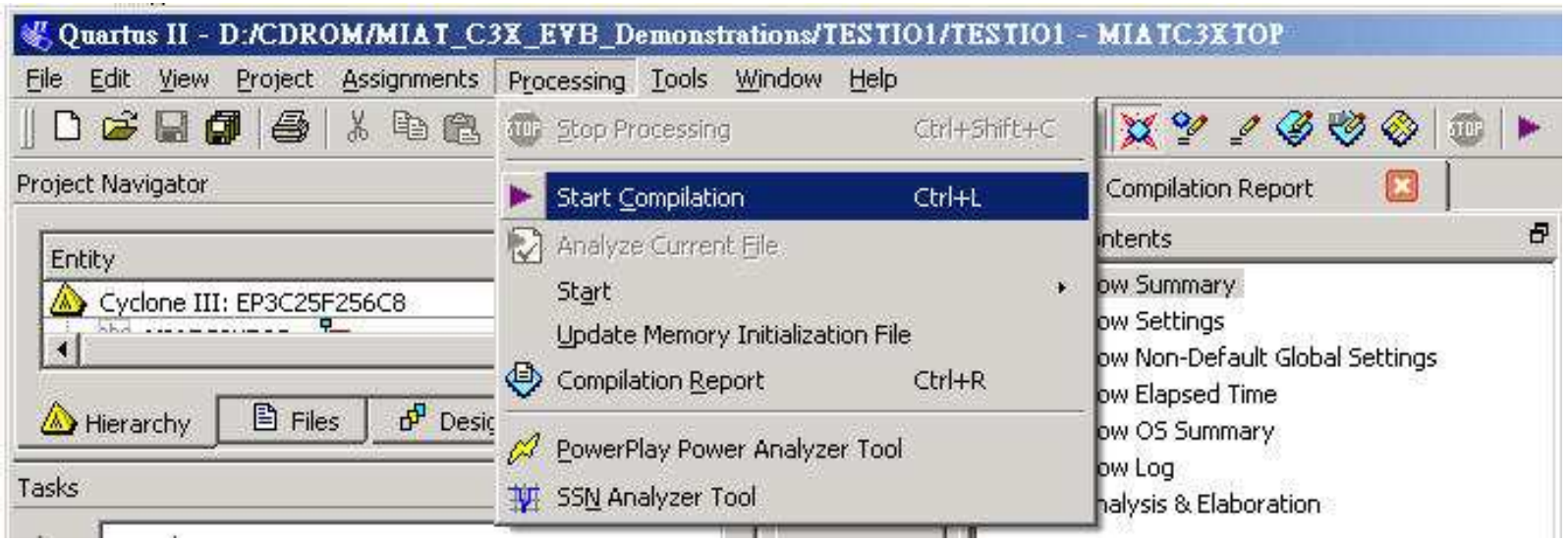
QuartusII軟體使用方法

- 步驟五、執行Pin Planner



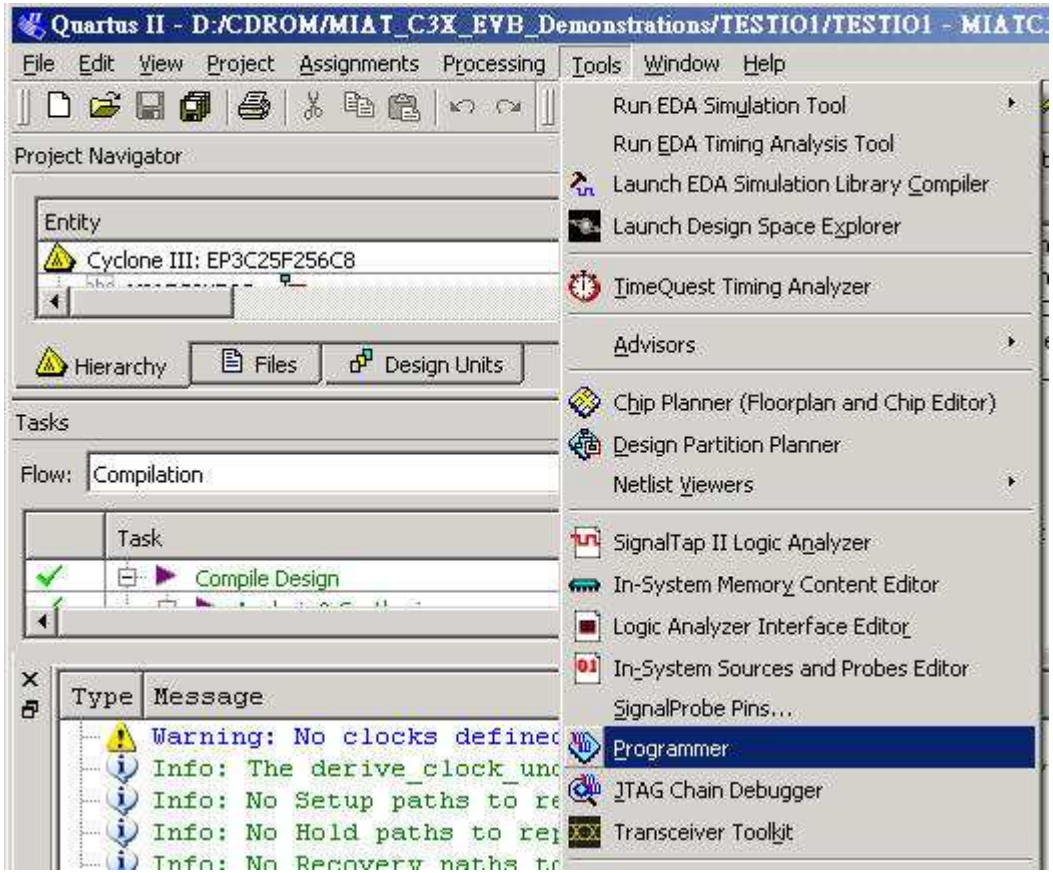
QuartusII軟體使用方法

- 步驟六、執行Start Compilation



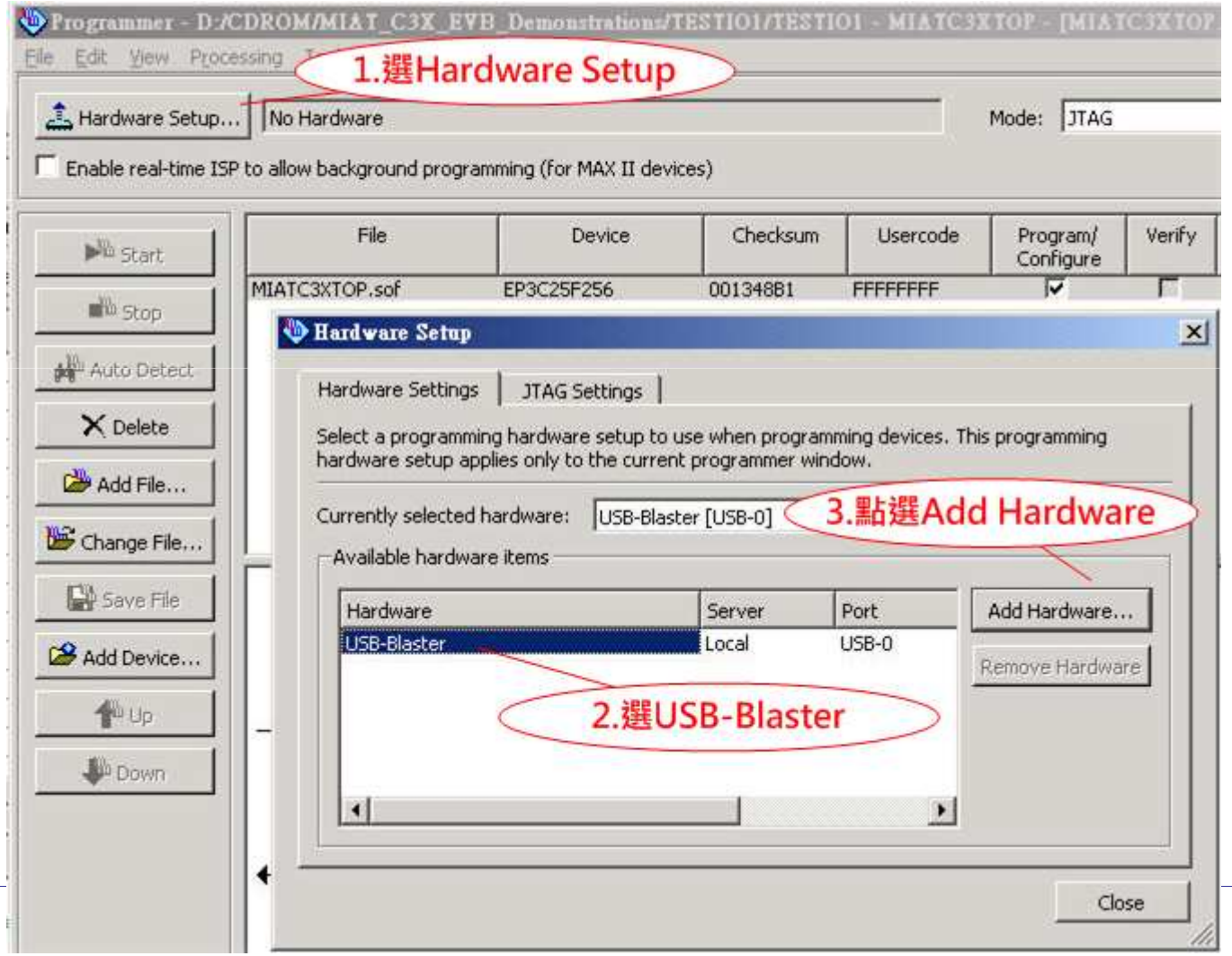
QuartusII軟體使用方法

- 步驟七、執行Programmer



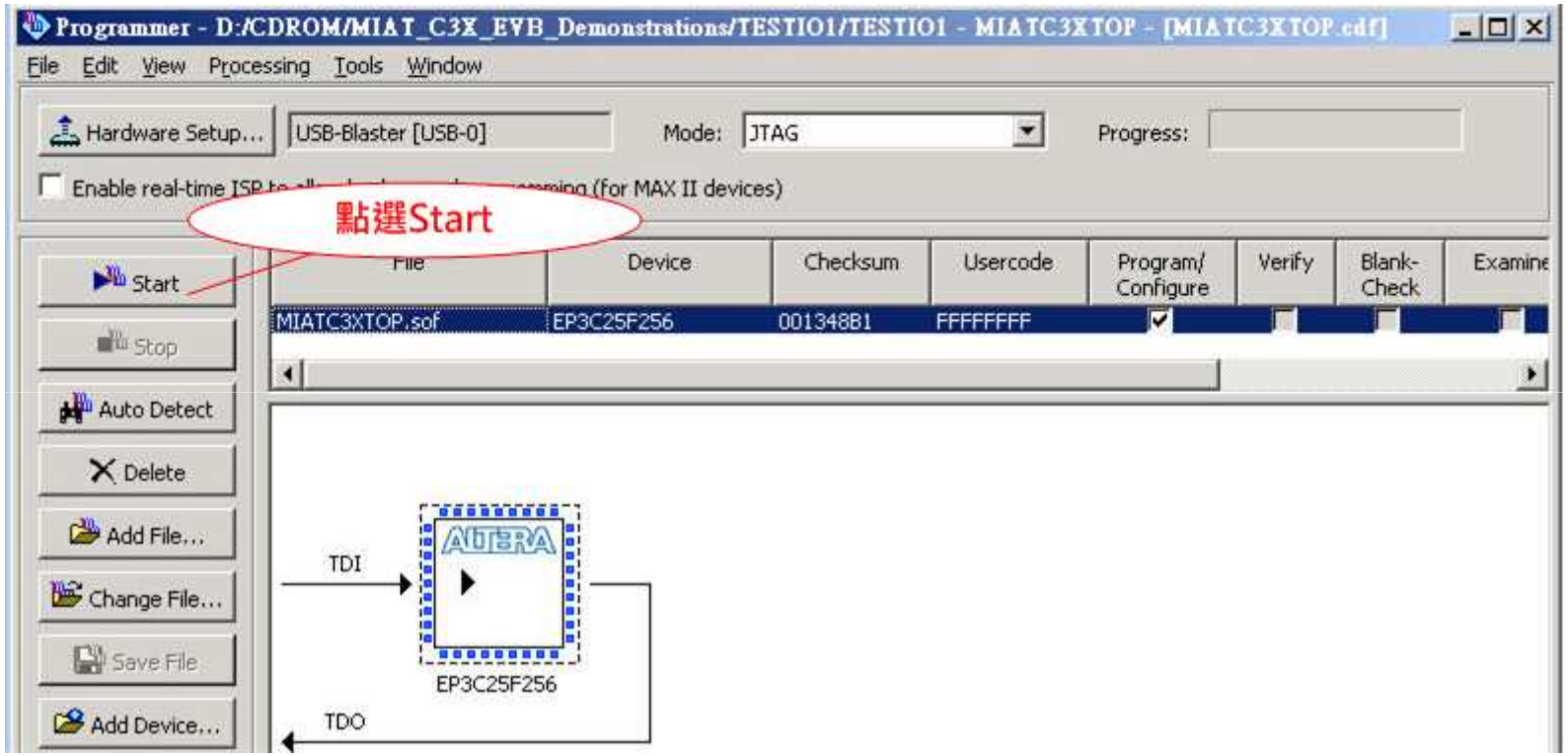
QuartusII軟體使用方法

- 步驟七、執行Programmer

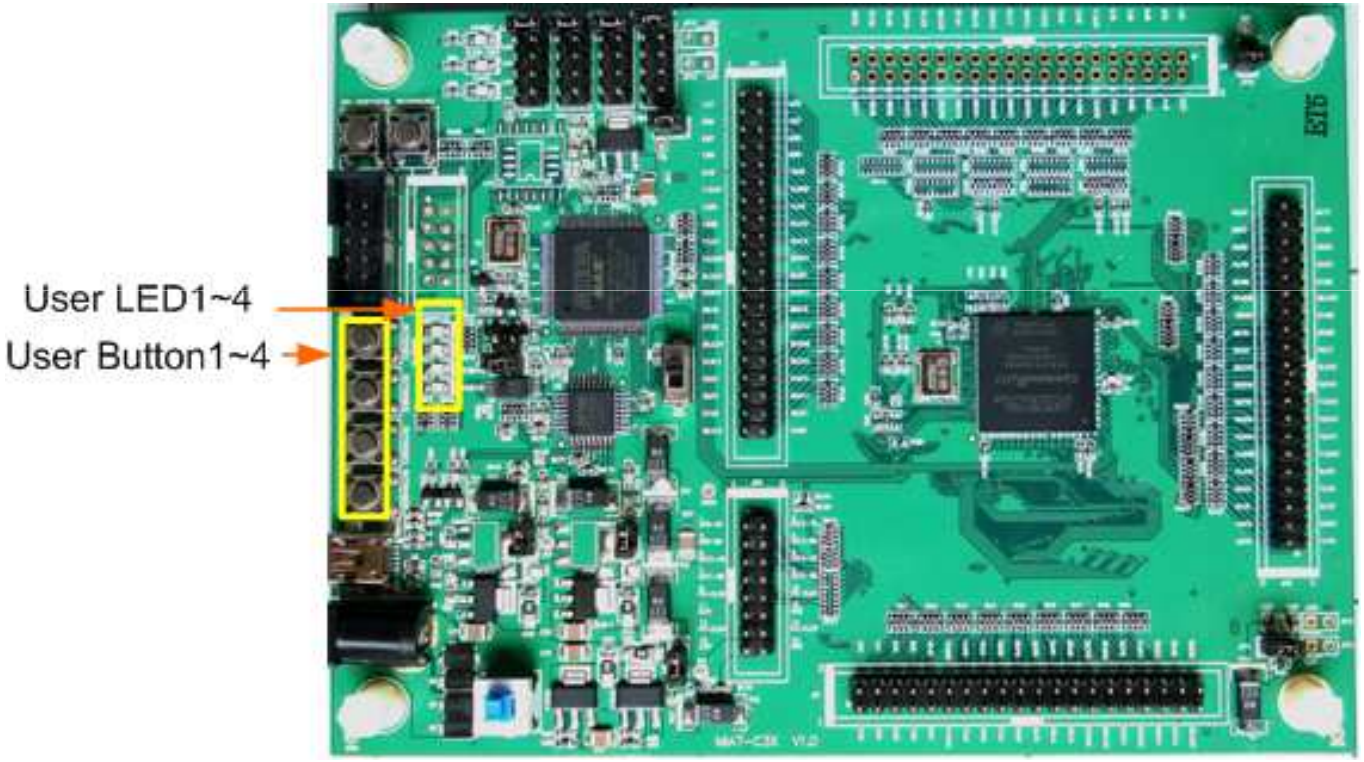


QuartusII軟體使用方法

- 步驟七、執行Programmer



- 步驟八、測試實驗板之Button與LED動作是否正確，當開關Button按下時相對應的LED被點亮，反之LED熄滅。



練習一、開發流程練習

- 步驟一、修改程式碼如下

```
begin

    --oTOP_LED <= iTOP_BUTTON;
    oTOP_LED(3) <= iTOP_BUTTON(3);
    oTOP_LED(2 downto 0)<= iTOP_BUTTON(2 downto 0);

end RTL;
```

步驟二、重新編譯與燒錄至實驗板後重新執行，觀察是否為預期之結果。

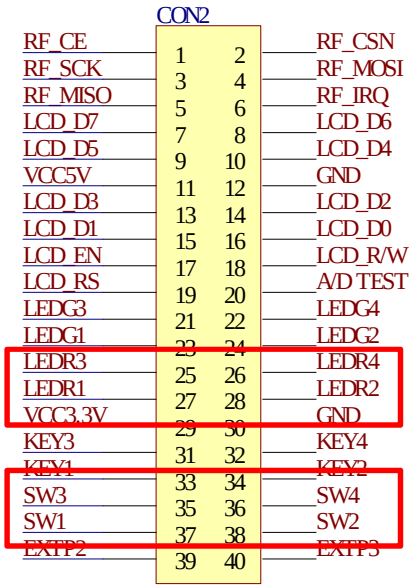
練習二、電路設計修改

- 步驟一、硬體電路配置

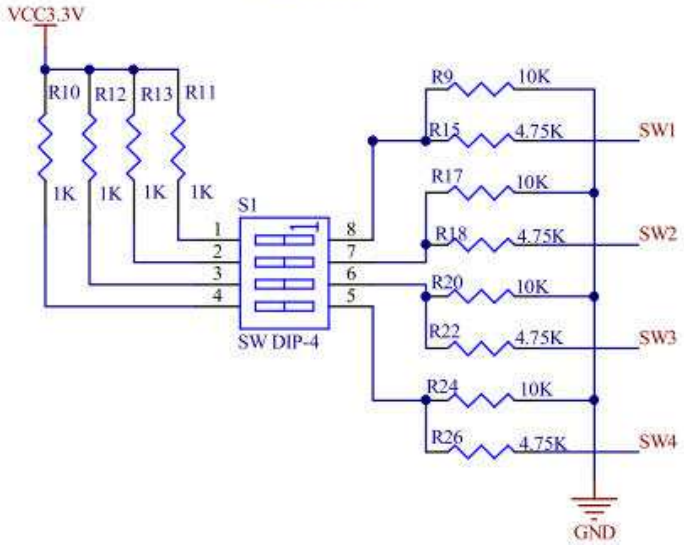
  將練習一之Button1~4與LED1~4改由IOB子板之周邊I/O電路SW1~4與LEDR1~4取代。使用SW控制LEDR之閃爍功能。

- MIAT_IOB之SW與LED之電路圖

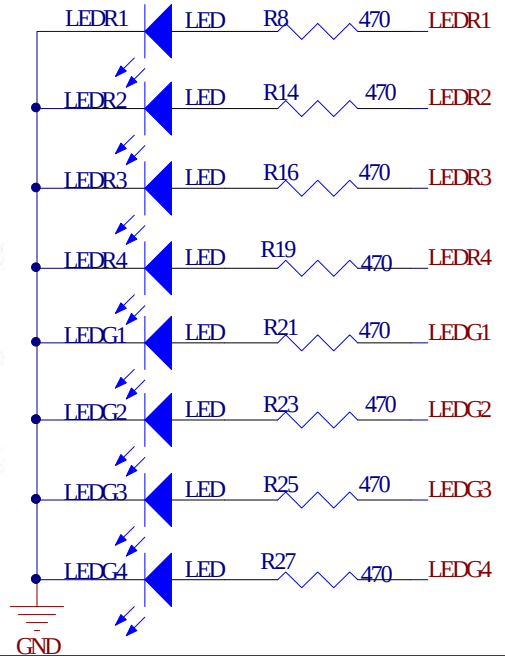
CONNECTOR2



SWITCH

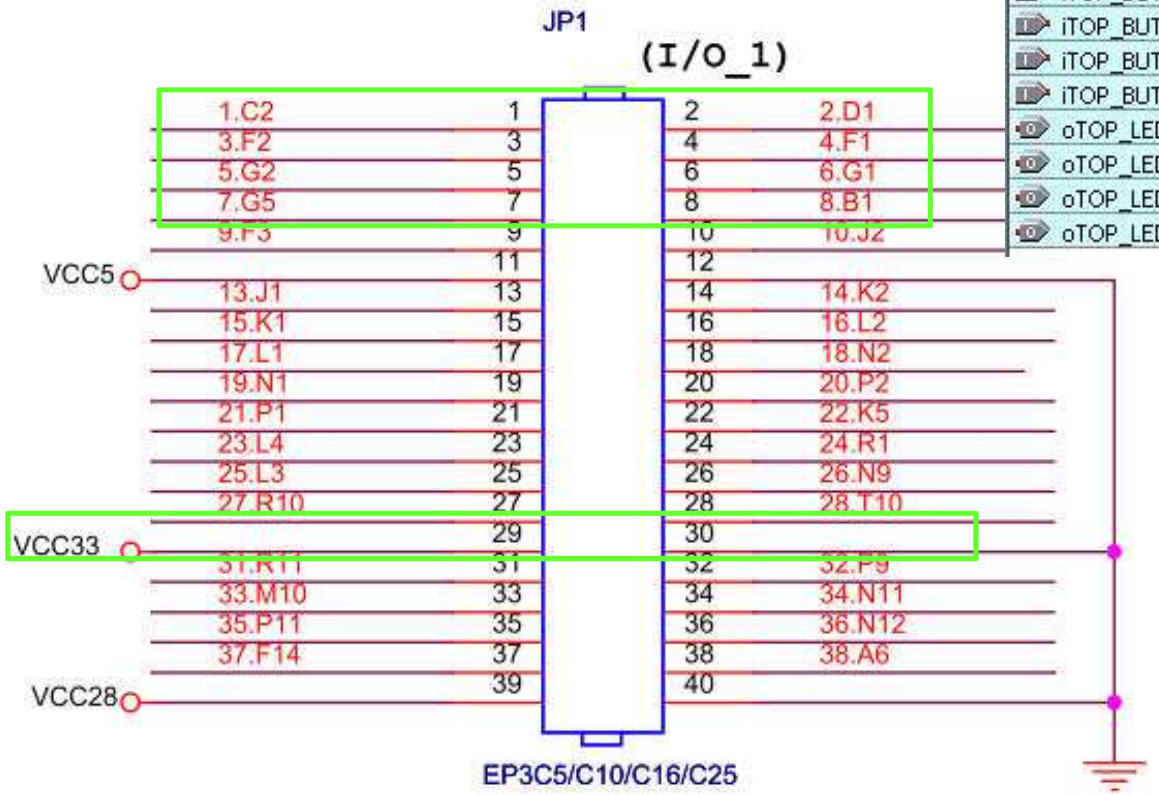


LED



練習二、電路設計修改

- MIAT_C3X 之JP1電路圖

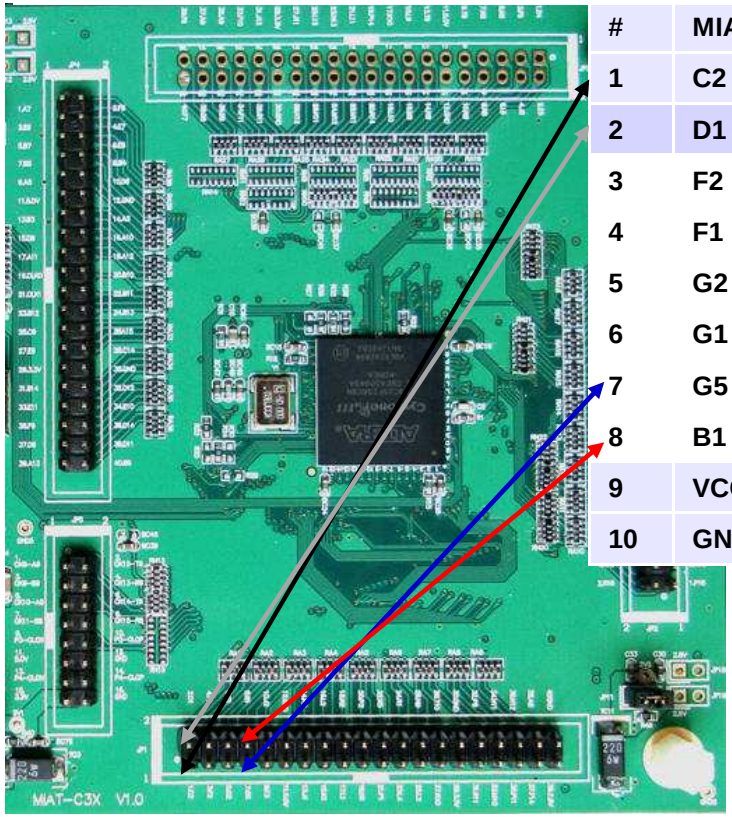


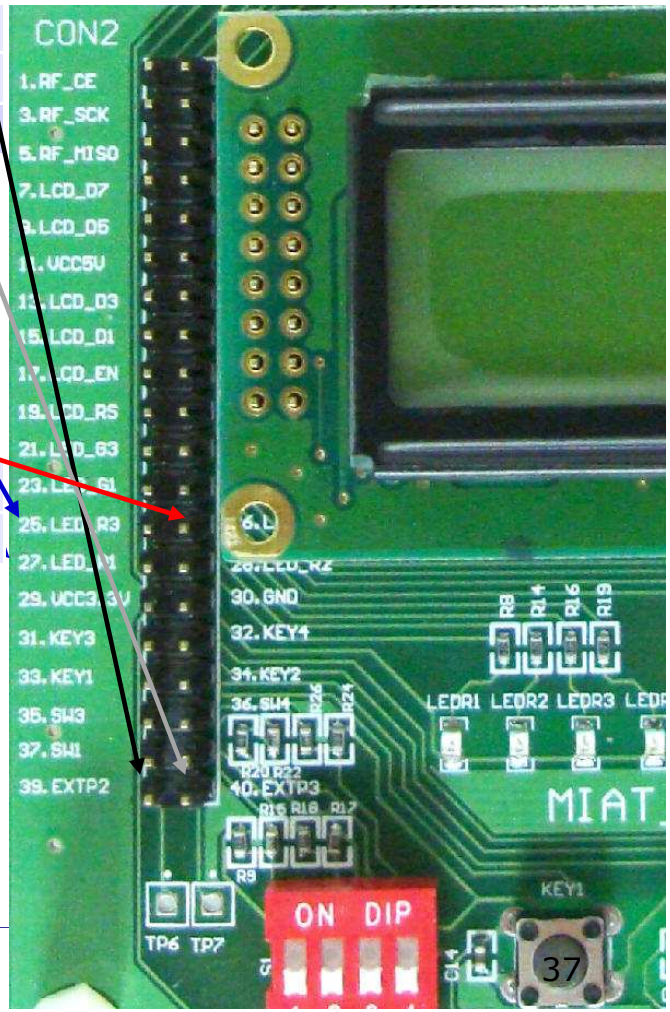
Node Name	Direction	Location
iTOP_BUTTON[3]	Input	PIN_F1
iTOP_BUTTON[2]	Input	PIN_F2
iTOP_BUTTON[1]	Input	PIN_D1
iTOP_BUTTON[0]	Input	PIN_C2
oTOP_LED[3]	Output	PIN_B1
oTOP_LED[2]	Output	PIN_G5
oTOP_LED[1]	Output	PIN_G1
oTOP_LED[0]	Output	PIN_G2

練習二、電路設計修改

- 線路連接

MIAT_C3X	Pin Mapping		MIAT_IOB
	#	MIAT_C3X	MIAT_IOB
	1	C2 (JP1.1)	SW1 (CON2.37)
	2	D1 (JP1.2)	SW2 (2.38)
	3	F2 (JP1.3)	SW3 (2.35)
	4	F1 (JP1.4)	SW4 (2.36)
	5	G2 (JP1.5)	LEDR1 (2.27)
	6	G1 (JP1.6)	LEDR2 (2.28)
	7	G5 (JP1.7)	LEDR3 (2.25)
	8	B1 (JP1.8)	LEDR4 (2.26)
	9	VCC3.3 (JP1.29)	VCC3.3 (2.29)
	10	GND(JP1.30)	GND(2.30)





Q & A

WU-YANG

Technology Co., Ltd.