

24006 PNP67 Lab2_2

使用 APP-MCU-MASTERS24

ATSAME54P20A



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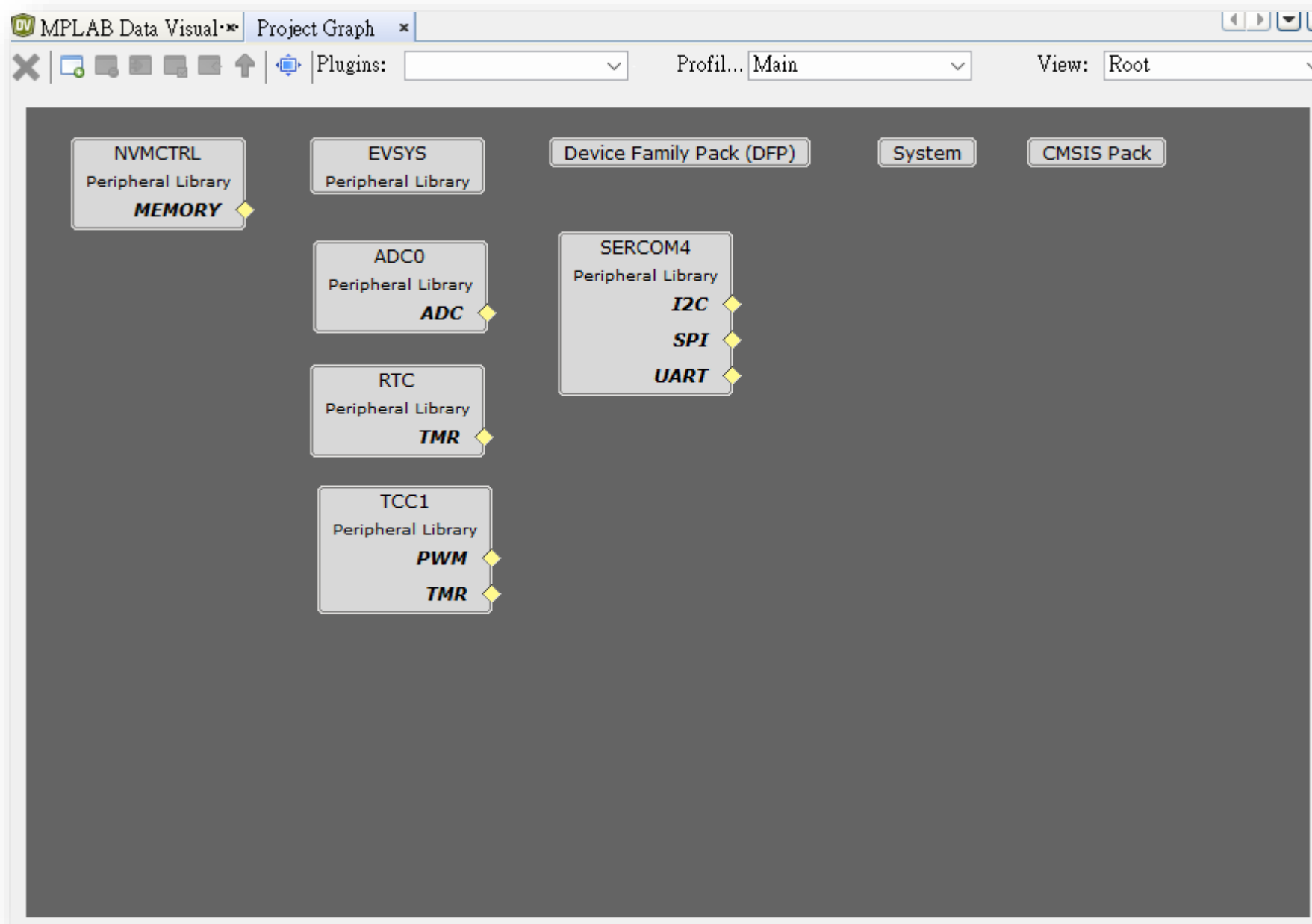
Lab2_2

• Lab2_2 主要功能

- 使用 APP-MCU-MASTERS24 的 VR1 來控制 LED1 的亮度
 - VR1 : ADC0 的 AIN2
 - LED1 : PA14 ， 可以是 TCC1 的 WO2
- 透過 DMA Channel 0 ， 使 ADC0 的轉換結果直接控制 TCC1 的 Duty
- 透過 DMA Channel 1 ， 每一秒鐘將一個 Memory 區塊以 DMA 傳送到 UART (ATSAME54 的 SERCOM4)
 - 以 RTC 來做成 1 秒鐘會中斷一次的 Timer
 - Baud Rate : 115200 bps
- DMA Channel 0 的動作承接自 Lab2_1 ☺

	io_Signals
E54 PB08	io_AN1
E54 PA14	io_LED1
E54 PB04	io_LED2
E54 PB06	io_LED3
E54 PB07	io_LED4
E54 PA15	io_SW1
E54 PC15	io_SW2
E54 PA22	io_CANTX
E54 PA23	io_CANRX
E54 PB05	io_CS
E54 PA17	io_SCK
E54 PA19	io_MISO
E54 PA16	io_MOSI
E54 PA11	io_T1WI
E54 PA06	io_T1RST
E54 PB03	io_T1INH
E54 PB14	io_T1IRQ
E54 PB21	io_STDBY

Lab2_2 的 Project Graph 配置



Lab2_2 ADC0 的設定

ADC0 的 Prescaler 設為 divided by 128，故意讓 ADC 的轉換時間大過 TCC1 Period

The screenshot displays the Microchip Studio configuration interface. On the left, a project tree shows various peripheral libraries: NVMCTRL (Peripheral Library, MEMORY), EVSYS (Peripheral Library), Device Family Pack (DFP), System, CMSIS Pack, ADC0 (Peripheral Library, ADC), SERCOM4 (Peripheral Library, I2C, SPI, UART), RTC (Peripheral Library, TMR), and TCC1 (Peripheral Library, PWM, TMR). The ADC0 peripheral is highlighted with a green border. On the right, the ADC0 configuration panel is shown with the following settings:

- Select Prescaler: Peripheral clock divided by 128
- Select Sample Length (cycles): 4
- **** Conversion Time is 32.0 uS ****
- Select Reference: VDDANA
- Select Conversion Trigger: Free Run
- Enable DMA Sequencing: ☐
- Channel Configuration
 - Select Positive Input: ADC AIN2 Pin
 - Select Negative Input: Internal Ground
- Result Configuration
 - Select Result Resolution: 8-bit result
 - Left Aligned Result: ☐
 - Enable Result Ready Interrupt: ☐
 - Enable Result Ready Event Out: ☐
- Window Mode Configuration: ☐
- Sleep Mode Configuration: ☐

Lab2_2 TCC1 的設定

TCC1 的設定要點為：Period Value = 255，以便讓 ADC0 的 8bit 轉換結果來控制 Duty

The screenshot displays the Microchip MPLAB IDE interface. On the left, the 'Peripheral Library' pane shows various peripherals. The 'TCC1' peripheral is highlighted with a green box, showing its associated 'PWM' and 'TMR' modules. On the right, the 'TCC1' configuration window is open, showing the following settings:

- Enable Slave:** ☐
- Run during Standby:** ☐
- Select Prescaler:** No division
- Prescaler and Counter Synchronization:** Reload or reset counter on next prescaler clock
- Operating Mode:** PWM
- PWM Settings:**
 - Select PWM Type:** NPWM
 - PWM Direction - Count Down:** ☐
 - Period Value:** 255
 - **** PWM Frequency is 187500 Hz ******
 - Enable Period Interrupt:** ☐
 - Enable Period Event Out:** ☐
 - Select Output Matrix:** Default Channel Outputs
- Channel Configurations:**
 - Channel 0:** ☐
 - Channel 1:** ☐
 - Channel 2:**
 - Duty Value:** 128
 - Output Polarity:** Output is ~DIR and set to DIR when co
 - Enable Dead Time:** ☐
 - Swap Outputs:** ☐
 - Enable Compare Match Interrupt:** ☐
 - Enable Compare Match Event OUT:** ☐
 - Enable Compare Match Event IN:** ☐
 - Channel 3:** ☐
- Outputs:**
 - Invert Output 0:** ☐
 - Invert Output 1:** ☐
 - Invert Output 2:** ☒
 - Invert Output 3:** ☐

The bottom status bar shows the text: 'Calculating memory ranges for operation...'

Lab2_2 : RTC 的設定

RTC 的 Compare Value0 設為 0x8000，以便達成可以每一秒鐘中斷一次的 Timer



The screenshot displays the Microchip Studio IDE interface for configuring the RTC peripheral. The left pane shows the 'Peripheral Library' with various components like NVMCTRL, EVSYS, ADC0, SERCOM4, RTC, and TCC1. The 'RTC' component is highlighted. The right pane shows the 'RTC' configuration settings, including 'Hardware Settings', 'Tamper Detection Configuration', 'RTC Operation Mode', and 'RTC MODE 0 Configuration'. The 'Compare Value0' is set to 0x8000, and 'Clear on compare Match' is checked. The 'RTC EVENTS configuration' section shows various event output enable options, with 'Compare 0 Event Output Enable' highlighted.

RTC Configuration Settings:

- Generate Frequency Correction API: ☐
- RTC Count Sync Enable: ☒
- Tamper Detection Configuration: ☐
- RTC Operation Mode: 32-bit Counter with Single 32-bit Compare
- RTC MODE 0 Configuration
 - Enable Interrupts?: ☒
 - RTC Prescaler: DIV1
 - Compare Value0: 0x8000
 - Compare Value1: 0x0
 - Clear on compare Match: ☒
- RTC EVENTS configuration
 - Periodic Interval 0 Event Output Enable: ☐
 - Periodic Interval 1 Event Output Enable: ☐
 - Periodic Interval 2 Event Output Enable: ☐
 - Periodic Interval 3 Event Output Enable: ☐
 - Periodic Interval 4 Event Output Enable: ☐
 - Periodic Interval 5 Event Output Enable: ☐
 - Periodic Interval 6 Event Output Enable: ☐
 - Periodic Interval 7 Event Output Enable: ☐
 - Compare 0 Event Output Enable: ☒
 - Compare 1 Event Output Enable: ☐
 - Overflow Event Output Enable: ☐

Lab2_2 的 Pin Setting

PB08 (AN1) 以及 PA14 (LED1) 為本實驗使用的腳位

Order: Pins Table View <input checked="" type="checkbox"/> Easy View									
Pin Number	Pin ID	Custom Name	Function	Mode	Direction	Latch	Pull Up	Pull Down	Drive Strength
16	PD01		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
17	PB06		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
18	PB07		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
19	PB08		ADC0_AIN2/X1/Y1	Analog	High Impedance	n/a	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
20	PB09		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
21	PA04		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
22	PA05		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
23	PA06		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL

Pin Number	Pin ID	Custom Name	Function	Mode	Direction	Latch	Pull Up	Pull Down	Drive Strength
58	PC14		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
59	PC15		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
60	PA12		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
61	PA13		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
62	PA14	E54_LED1	TCC1_WO2	Digital	High Impedance	n/a	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
63	PA15		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL

io_Signals	
E54 PB08	io_AN1
E54 PA14	io_LED1
E54 PB04	io_LED2
E54 PB06	io_LED3
E54 PB07	io_LED4
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E54 PA22	io_CANTX
E54 PA23	io_CANRX
E54 PB05	io_CS
E54 PA17	io_SCK
E54 PA19	io_MISO
E54 PA16	io_MOSI
E54 PA11	io_T1WI
E54 PA06	io_T1RST
E54 PB03	io_T1INH
E54 PB14	io_T1IRQ
E54 PB21	io_STDBY

Lab2_2 的 Pin Setting

PB12 & PB13 為 UART 腳位， PB04(LED2) 作為 RTC 的 Indicator

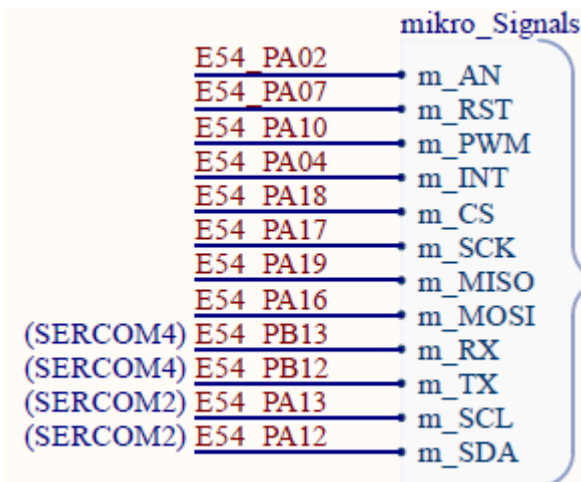
Order: Pins

Table View

☒ Easy View

Pin Number	Pin ID	Custom Name	Function	Mode	Direction	Latch	Pull Up	Pull Down	Drive Strength
40	PB11		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
41	PB12		SERCOM4_PAD0	Digital	High Impedance	n/a	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
42	PB13		SERCOM4_PAD1	Digital	High Impedance	n/a	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
43	PB14		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
44	PB15		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL

Pin Number	Pin ID	Custom Name	Function	Mode	Direction	Latch	Pull Up	Pull Down	Drive Strength
7	PC02		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
8	PC03		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
9	PA02		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
10	PA03		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
11	PB04	E54_LED2	GPIO	Digital	Out	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL
12	PB05		Available	Digital	High Impedance	Low	<input type="checkbox"/>	<input type="checkbox"/>	NORMAL



Lab2_2 中DMAC 的設定

增加 DMA Channel 1 並以 SERCOM4 TX 為 Trigger source

Active Channels List

Channel Number	Trigger
DMAC Channel 0	ADC0_RESRDY
DMAC Channel 1	SERCOM4_Transmit

Add Channel

Remove Selected Channel

☐ Use Linked List Mode

DMA Channel 1 Settings

Enable Interrupt ☐

Trigger Action

One Beat Transfer per DMA Request

Source Address Mode

Increment Address After Every Transfer

Destination Address Mode

Fixed Address Mode

Beat Size

8-bit bus transfer

Burst Length

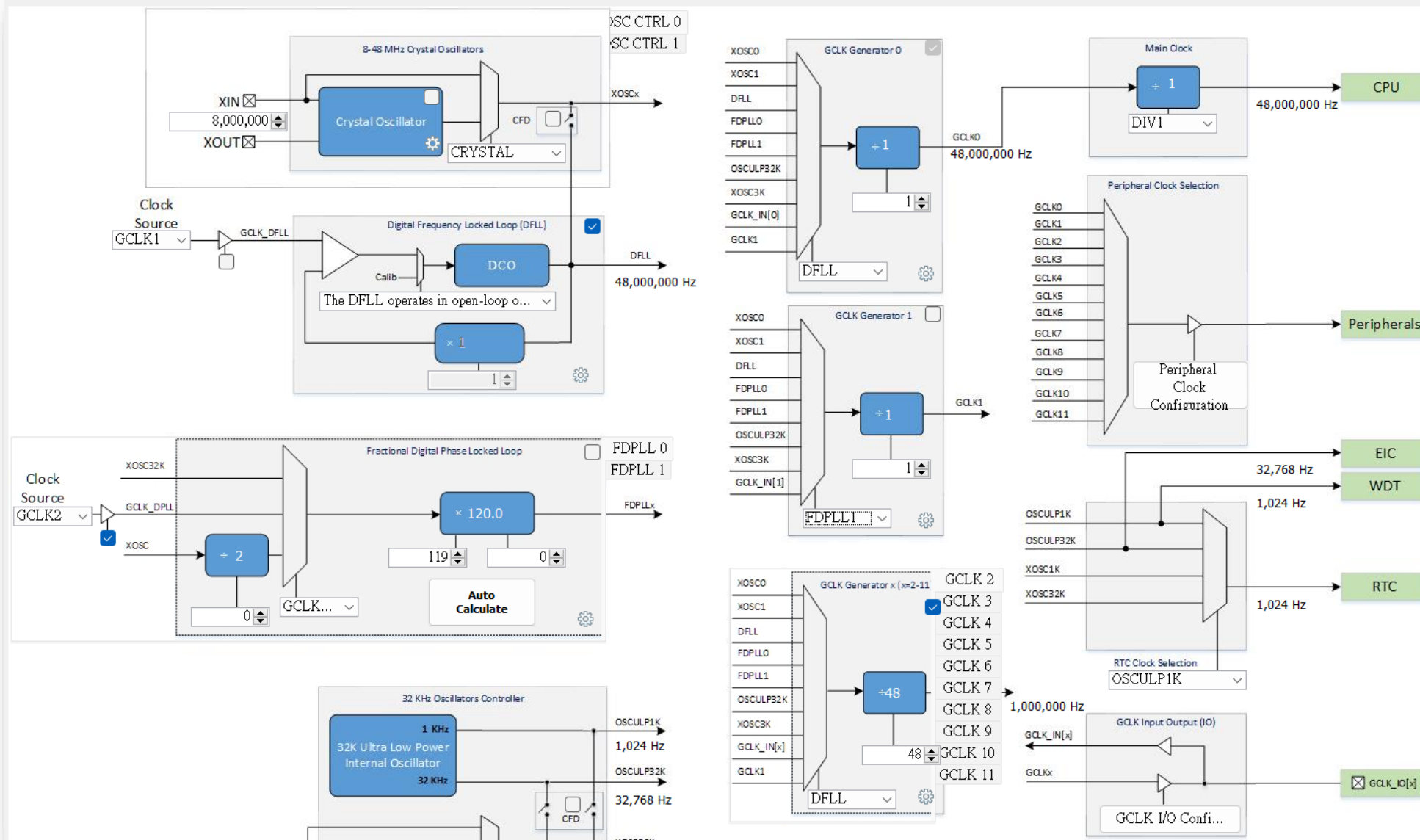
SINGLE

FIFO Threshold

1BEAT

Lab2_2 中Clock 的設定

請注意我們將 Main Clock 由 120Mhz 改為 48 Mhz 並關閉 GCLK1



Lab2_2 中Clock 的設定 - Peripherals

對於使用到的周邊，要記得設定好 clock 的來源才能正常工作

Peripheral Clock Configuration

Peripheral	Enable	Source	Peripheral Clock Frequency
AC	<input type="checkbox"/>	GCLK1	--
ADC0	<input checked="" type="checkbox"/>	GCLK0	48,000,000 Hz
ADC1	<input type="checkbox"/>	GCLK1	--
CAN0	<input type="checkbox"/>	GCLK1	--
CAN1	<input type="checkbox"/>	GCLK1	--
CCL	<input type="checkbox"/>	GCLK1	--
DAC	<input type="checkbox"/>	GCLK1	--
EIC	<input type="checkbox"/>	GCLK1	--
EVSYS_0	<input type="checkbox"/>	GCLK1	--
EVSYS_1	<input type="checkbox"/>	GCLK1	--
EVSYS_10	<input type="checkbox"/>	GCLK1	--
EVSYS_11	<input type="checkbox"/>	GCLK1	--

Close

Peripheral Clock Configuration

Peripheral	Enable	Source	Peripheral Clock Frequency
SERCOM2_CORE	<input type="checkbox"/>	GCLK1	--
SERCOM3_CORE	<input type="checkbox"/>	GCLK1	--
SERCOM4_CORE	<input checked="" type="checkbox"/>	GCLK0	48,000,000 Hz
SERCOM5_CORE	<input type="checkbox"/>	GCLK1	--
SERCOM6_CORE	<input type="checkbox"/>	GCLK1	--
SERCOM7_CORE	<input type="checkbox"/>	GCLK1	--
TC0, TC1	<input type="checkbox"/>	GCLK1	--
TC2, TC3	<input type="checkbox"/>	GCLK1	--
TC4, TC5	<input type="checkbox"/>	GCLK1	--
TC6, TC7	<input type="checkbox"/>	GCLK1	--
TCC0, TCC1	<input checked="" type="checkbox"/>	GCLK0	48,000,000 Hz
TCC2, TCC3	<input type="checkbox"/>	GCLK1	--

Close



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