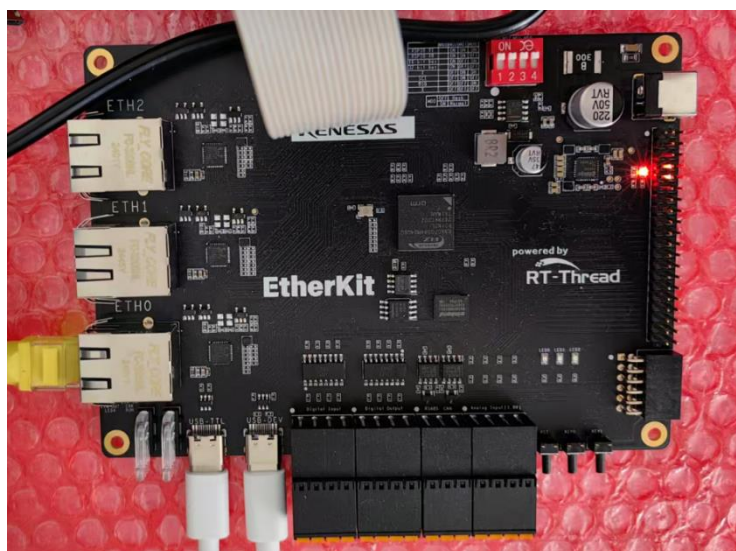


RZN2L GPT 例程操作手册-----基于 Etherkit 开发板

简介

本应用笔记介绍了基于 RZ/N2 Etherkit 开发板的定时器 GPT 的操作：定时、PWM 输出。分别介绍 IDE IAR 和 E2studio 软件下的操作。



开发工具 <ul style="list-style-type: none"> • IDE: IAR EW for Arm 9.50.2 E2studio 2024-01.1 • FSP: RZ/N2 FSP V2.0 • 仿真器: Jlink V12 	实验材料 <ul style="list-style-type: none"> • Etherkit 开发板 • Jlink 仿真器，需支持瑞萨 R52 内核
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实验部分

1.硬件设置及软件安装	2
2 .IAR 环境工程介绍.....	3
3 .E2studio 环境工程介绍	9

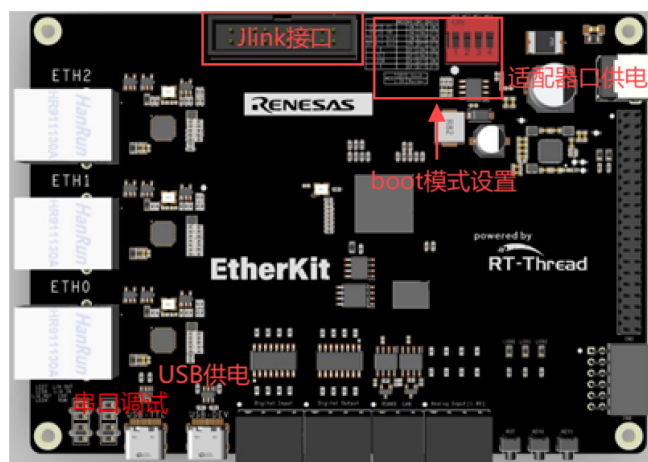
1 .硬件设置及软件安装

本节 EtherKit 开发板硬件设置。

1.1

开发板设置：

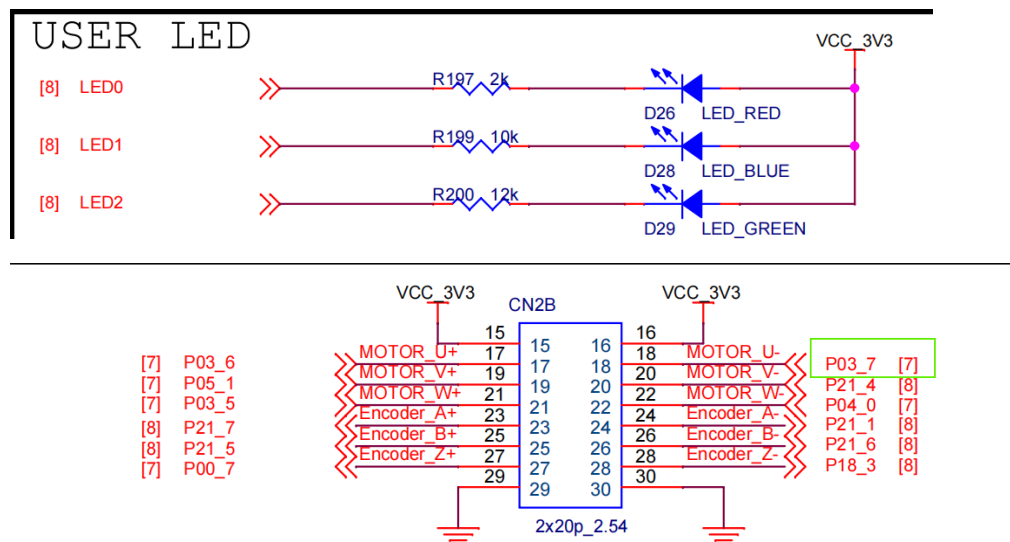
- 供电：可选 USB 供电或适配器供电
- Boot 模式设置：推荐 xSPI0 x1 boot mode
- Jlink v12



1.2

硬件原理图：

本实验用到 LED0，对应 P143 引脚，P037 用作 GPT5 的 PWM 输出引脚。



本节完

2 .IAR 环境工程介绍

本节介绍 IAR 环境下 GPT 工程介绍。

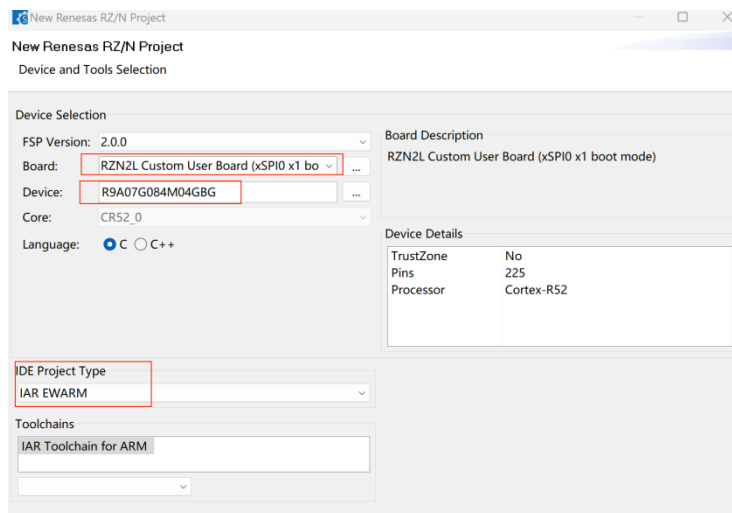
2.1

● 打开 FSP 新建工程：GPT

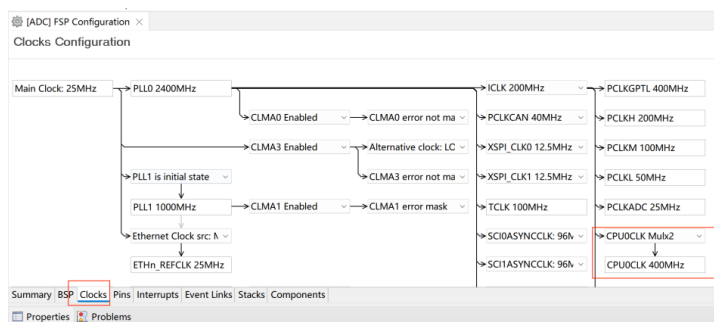
1. Boot 模式选择 RZN2L Custom User Board (XSPI0 x1 boot mode)

芯片型号：R9A07G084M04GBG

IDE Project Type 选择 IAR EWARM

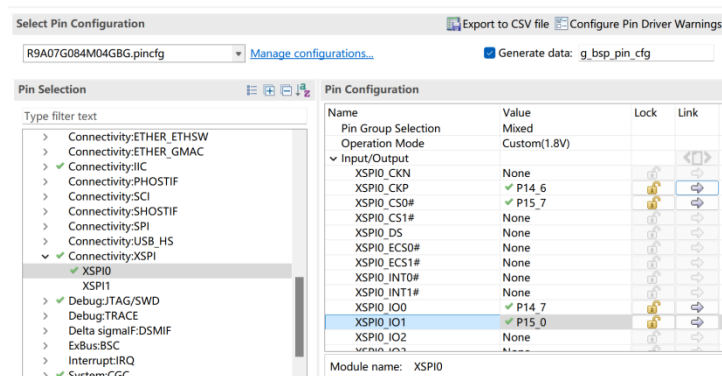


1. 主时钟设置 400MHZ



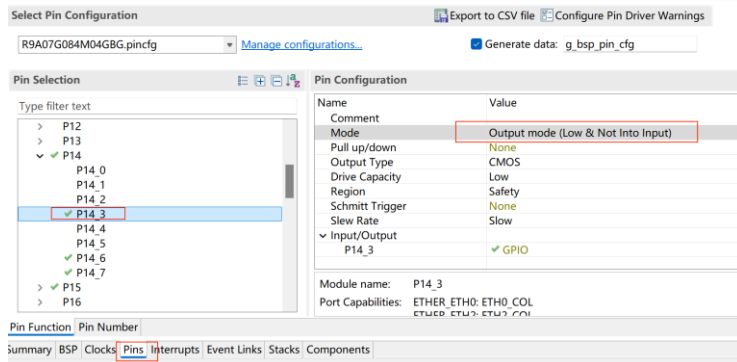
2. 配置 XSPI0

Pin Configuration



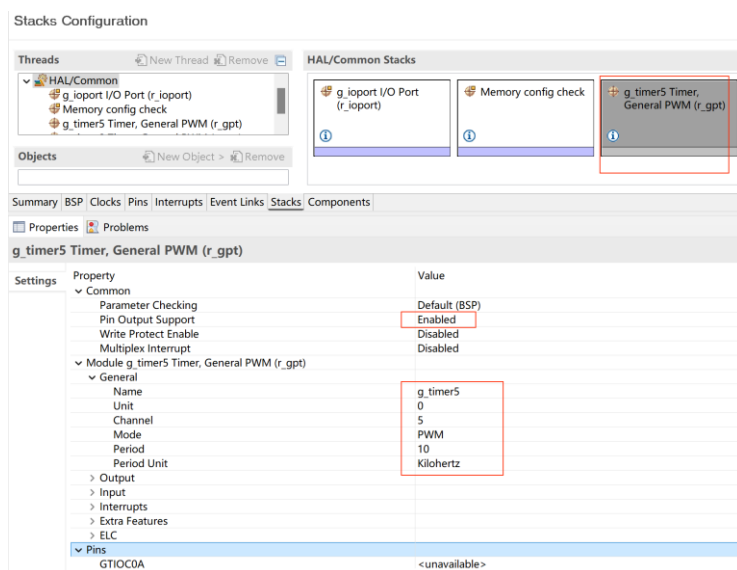
3. P143 引脚配置

P143 设置输出模式，初始电平 0

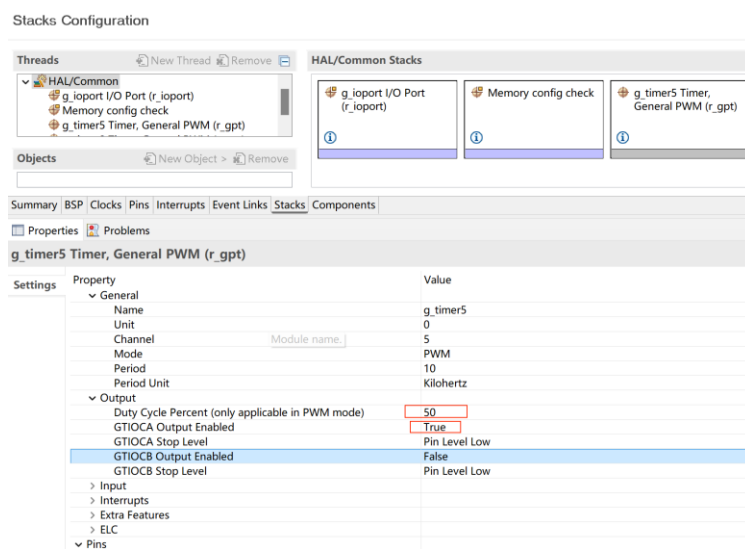


4. 添加 new Stack: GPT5

- 使能 pin 输出功能，设置 GPT5 PWM 模式，PWM 周期 10kHz



- 使能 GTIOCA output 功能, 占空比 50%



- 配置 GPT5 输出引脚，P037 使能

Select Pin Configuration Export to CSV file Configure Pin Driver Warnings

R9A07G084M04GBG.pincfg [Manage configurations...](#) ☒ Generate data: g_bsp_pin_cfg

Pin Selection

Type filter text

- ✓ Timer:GPT
 - GPT
 - GPT0
 - GPT1
 - GPT2
 - GPT3
 - GPT4
 - ✓ GPT5
 - GPT6
 - GPT7
 - GPT8
 - GPT9
 - GPT10
 - GPT11

Pin Configuration

Name	Value
Pin Group Selection	Mixed
Operation Mode	Custom
Input/Output	
GTIOC5A	✓ P03 7
GTIOC5B	None

Module name: GPT5

Pin Function Pin Number

Summary BSP Clocks Pins Interrupts Event Links Stacks Components

Properties Problems

5. 添加 new stack :

- GPT0 Periodic mode, 200ms 周期
- 开中断,设置中断优先级, 设置回调函数 gpt0_callback

Stacks Configuration

Threads

New Thread Remove

- HAL/Common
 - g_ioport I/O Port (r_ioport)
 - Memory config check
 - g_timer5 Timer, General PWM (r_gpt)

Objects

New Object Remove

HAL/Common Stacks

New Stack >

- g_ioport I/O Port (r_ioport)
- Memory config check
- g_timer5 Timer, General PWM (r_gpt)
- g_timer0 Timer, General PWM (r_gpt)

Summary BSP Clocks Pins Interrupts Event Links Stacks Components

Properties Problems

g_timer0 Timer, General PWM (r_gpt)

Settings	Property	Value
	Pin Output Support	Enabled
	Write Protect Enable	Disabled
	Multiplex Interrupt	Disabled
Module g_timer0 Timer, General PWM (r_gpt)	General	
	Name	g_timer0
	Unit	0
	Channel	0
	Mode	Periodic
	Period	200
	Period Unit	Milliseconds
	Output	
	Input	
	Interrupts	
	Callback	gpt0_callback
	Overflow/Crest Interrupt Priority	Priority 16
	Capture A Interrupt Priority	Disabled
	Capture B Interrupt Priority	Disabled
	Trough Interrupt Priority	Disabled
	Dead Time Error Interrupt Priority	Disabled

6. 点击: Generate Project Content 生成代码

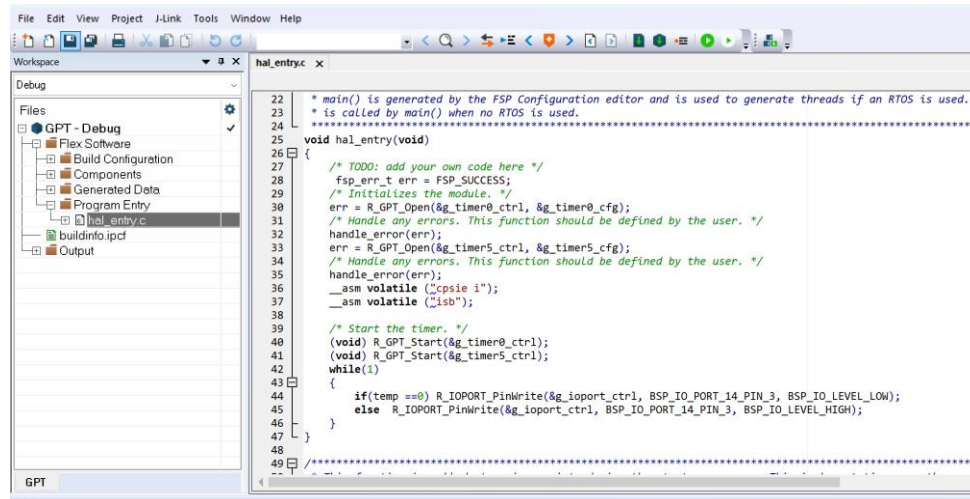
Generate Project Content

New Stack > Extend Stack > Remove

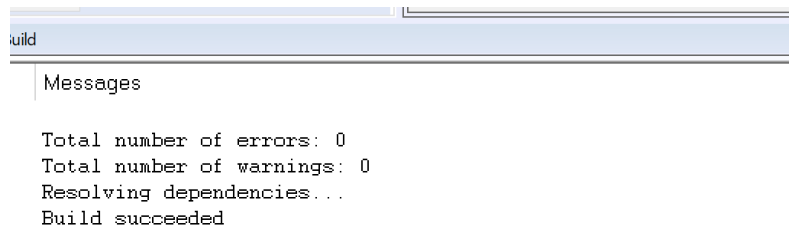
2.2

7. 打开生成的代码

- 仿真器由 Ijet 切换为 Jlink
- 编写用户代码：GPT0 200ms 产生中断，反转 P143 电平，LED0 以 200ms 周期亮灭变化
- GPT5 产生 10Khz PWM



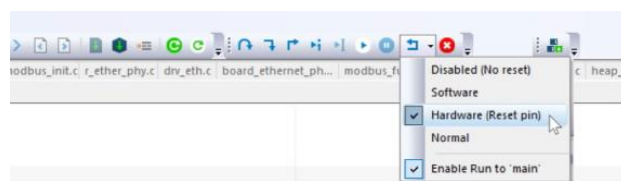
- Rebuild All---编译工程 无报错



2.3

● Download and Debug ---下载程序

- 下载工程到开发板，进入仿真界面
- Debug 复位设置为 Hardware



本节完

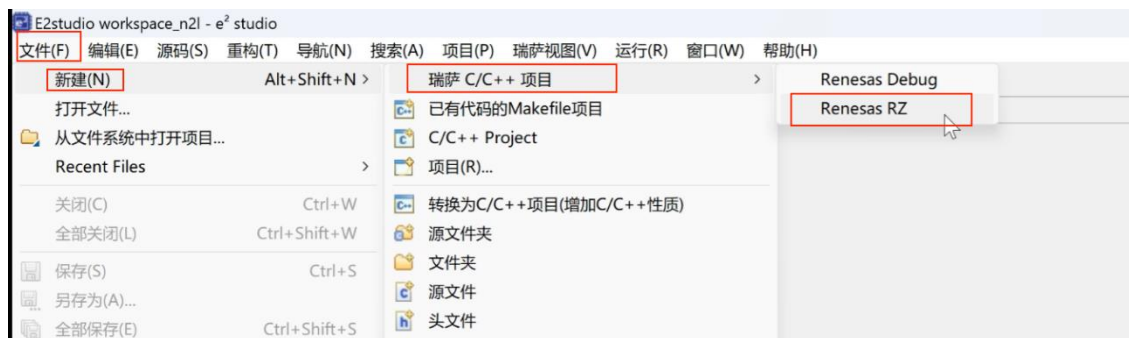
3 .E2studio 环境工程介绍

本节介绍使用 E2studio 环境创建 IIC 工程。

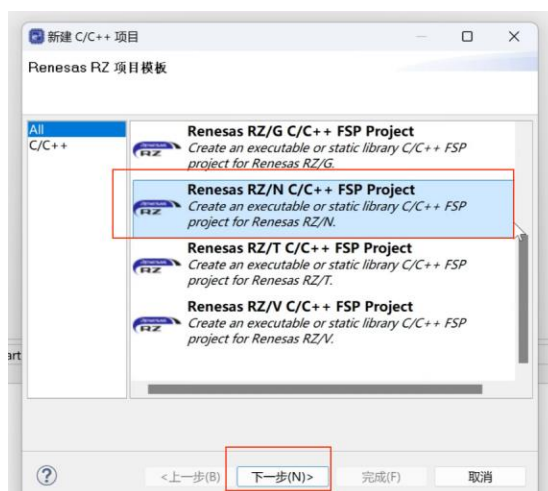
3.1

● 打开 E2studio, 新建工程

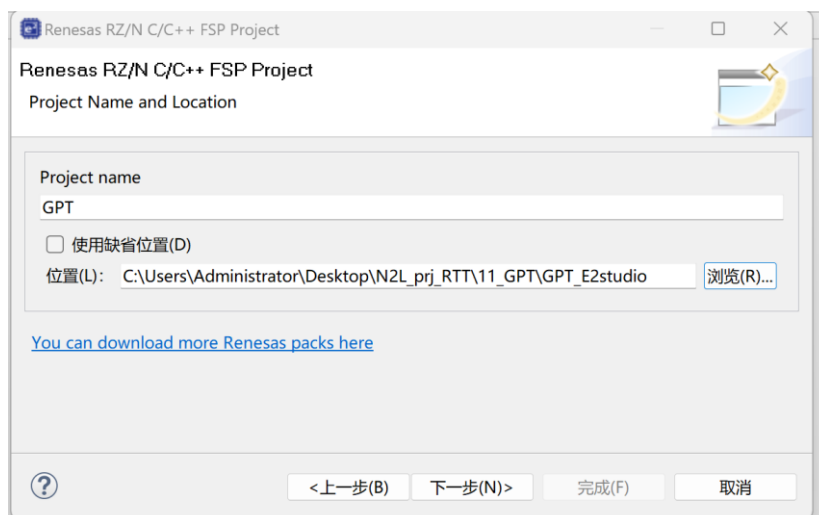
1. 选择 文件--新建--瑞萨 C/C++项目--Renesas RZ:



2. 选择 Renesas RZ/N C/C++ FSP Project

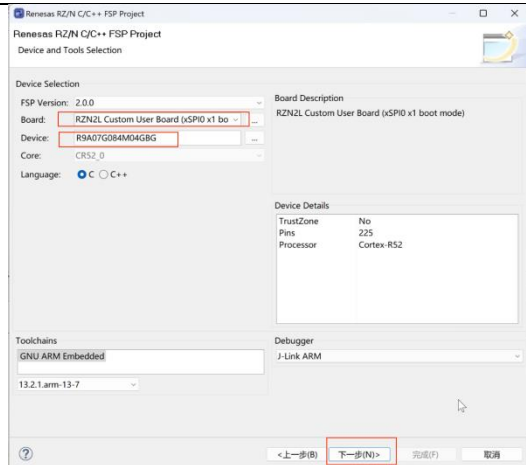


3. 设置项目名称: GPT, 选择工程保存路径

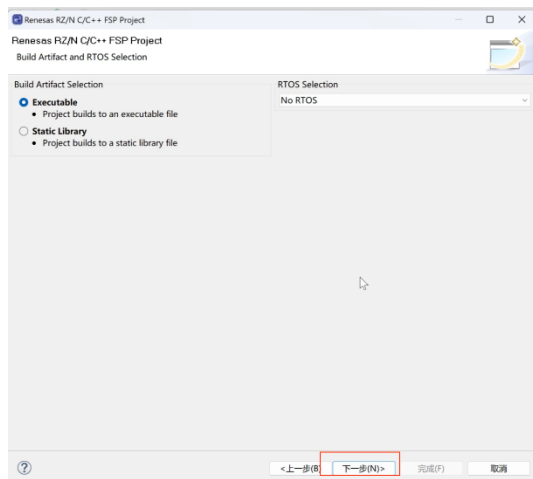


4. Boot 模式选择 RZN2L Custom User Board (XSPI0 x1 boot mode)

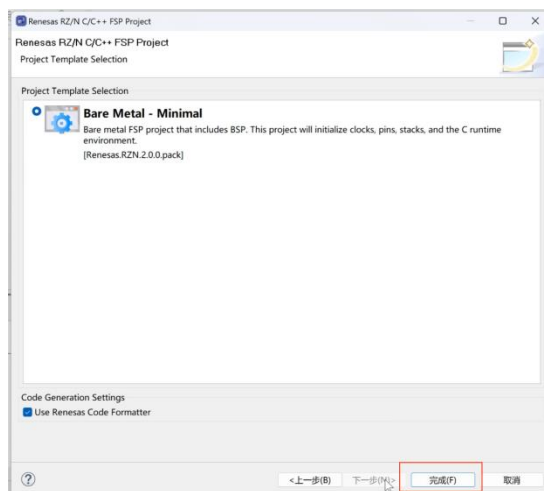
芯片型号: R9A07G084M04GBG



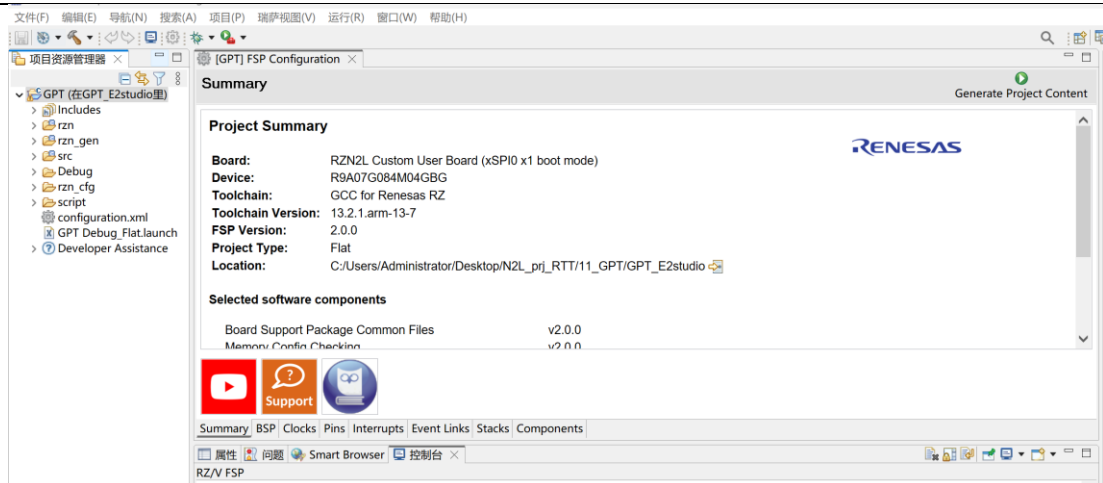
5. 直接下一步



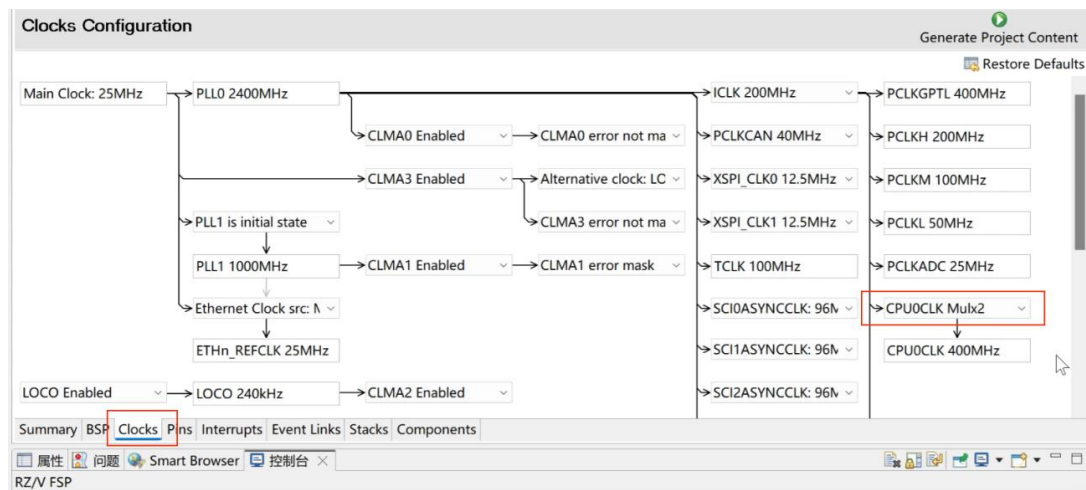
6. 点击 完成



7. 进入到工程界面



8. 设置时钟 CPU0CLK 400MHZ



3.2

9. 配置 XSPI0

The screenshot shows the 'Select Pin Configuration' window for the R9A07G084M04GBG.pincfg. The 'Pin Selection' tree on the left has 'Connectivity:XSPI' expanded, with 'XSPI0' selected. The 'Pin Configuration' table on the right shows the following settings:

Name	Value	Lock	Link
Pin Group Selection	Mixed		
Operation Mode	Custom(1.8V)		
Input/Output			
XSPI0_CKN	None		
XSPI0_CKP	✓ P14_6		
XSPI0_CS0#	✓ P15_7		
XSPI0_CS1#	None		
XSPI0_DS	None		
XSPI0_ECS0#	None		
XSPI0_ECS1#	None		
XSPI0_INT0#	None		
XSPI0_INT1#	None		
XSPI0_IO0	✓ P14_7		
XSPI0_IO1	✓ P15_0		

Module name: XSPI0

10. P143 引脚配置

P143 设置输出模式，初始电平 0

The screenshot shows the 'Select Pin Configuration' window for the R9A07G084M04GBG.pincfg. The 'Pin Selection' tree on the left has 'P14' expanded, with 'P14_3' selected. The 'Pin Configuration' table on the right shows the following settings:

Name	Value
Comment	
Mode	Output mode (Low & Not into Input)
Pull up/down	None
Output Type	CMOS
Drive Capacity	Low
Region	Safety
Schmitt Trigger	None
Slew Rate	Slow
Input/Output	
P14_3	✓ GPIO

Module name: P14_3
Port Capabilities: ETHER_ETH0: ETH0_COL, ETHER_ETH1: ETH1_COL

11. 添加 new Stack: GPT5

- 使能 pin 输出功能，设置 GPT5 PWM 模式，PWM 周期 10kHz

Stacks Configuration

Threads: HAL/Common, g_ioport I/O Port (r_ioport), Memory config check, g_timer5 Timer, General PWM (r_gpt)

Objects: g_timer5 Timer, General PWM (r_gpt)

Summary | BSP | Clocks | Pins | Interrupts | Event Links | **Stacks** | Components

Properties Problems

g_timer5 Timer, General PWM (r_gpt)

Property	Value
Common	
Parameter Checking	Default (BSP)
Pin Output Support	Enabled
Write Protect Enable	Disabled
Multiplex Interrupt	Disabled
Module g_timer5 Timer, General PWM (r_gpt)	
General	
Name	g_timer5
Unit	0
Channel	5
Mode	PWM
Period	10
Period Unit	Kilohertz
Output	
Input	
Interrupts	
Extra Features	
ELC	
Pins	
GTIOCOA	<unavailable>

- 使能 GTIOCA output 功能，占空比 50%

Stacks Configuration

Threads: HAL/Common, g_ioport I/O Port (r_ioport), Memory config check, g_timer5 Timer, General PWM (r_gpt)

Objects: g_timer5 Timer, General PWM (r_gpt)

Summary | BSP | Clocks | Pins | Interrupts | Event Links | **Stacks** | Components

Properties Problems

g_timer5 Timer, General PWM (r_gpt)

Property	Value
General	
Name	g_timer5
Unit	0
Channel	5
Mode	PWM
Period	10
Period Unit	Kilohertz
Output	
Duty Cycle Percent (only applicable in PWM mode)	50
GTIOCA Output Enabled	True
GTIOCA Stop Level	Pin Level Low
GTIOCB Output Enabled	False
GTIOCB Stop Level	Pin Level Low
Input	
Interrupts	
Extra Features	
ELC	
Pins	

- 配置 GPT5 输出引脚，P037 使能

Select Pin Configuration [Export to CSV file](#) [Configure Pin Driver Warnings](#)

R9A07G084M04GBG.pincfg [Manage configurations...](#) ☒ Generate data: g_bsp_pin_cfg

Pin Selection

Type filter text

- Timer:GPT
 - GPT
 - GPT0
 - GPT1
 - GPT2
 - GPT3
 - GPT4
 - GPT5**
 - GPT6
 - GPT7
 - GPT8
 - GPT9
 - GPT10
 - GPT11

Pin Configuration

Name	Value
Pin Group Selection	Mixed
Operation Mode	Custom
Input/Output	
GTIOCSA	✓ P03 7
GTIOCSB	None

Module name: GPT5

Pin Function | Pin Number

Summary | BSP | Clocks | **Pins** | Interrupts | Event Links | Stacks | Components

Properties Problems

12. 添加 new stack :

- GPT0 Periodic mode, 200ms 周期
- 开中断,设置中断优先级, 设置回调函数 gpt0_callback

Stacks Configuration

Threads: HAL/Common

- g_ioport I/O Port (r_ioport)
- Memory config check
- g_timer5 Timer, General PWM (r_gpt)

Objects: g_timer0 Timer, General PWM (r_gpt)

Summary | BSP | Clocks | Pins | Interrupts | Event Links | **Stacks** | Components

Properties | Problems

g_timer0 Timer, General PWM (r_gpt)

Settings	Property	Value
General	Pin Output Support	Enabled
	Write Protect Enable	Disabled
	Multiplex Interrupt	Disabled
	Name	g_timer0
	Unit	0
	Channel	0
	Mode	Periodic
	Period	200
	Period Unit	Milliseconds
	Output	
Input		
Interrupts	Callback	gpt0_callback
	Overflow/Crest Interrupt Priority	Priority 16
	Capture A Interrupt Priority	Disabled
	Capture B Interrupt Priority	Disabled
	Trough Interrupt Priority	Disabled
	Dead Time Error Interrupt Priority	Disabled

8. 点击: Generate Project Content 生成代码

IIC_EEPROM FSP Configuration

Pin Configuration

Select Pin Configuration: R9A07G084M04GBG.pincfg

Export to CSV file | Configure Pin Driver Warnings

Generate data: g_bsp_pin_cfg

Pin Selection

- P21
- P22
- P23
- P24
- Other Pins
- Peripherals
 - Connectivity:CANFD
 - Connectivity:ETHER_ESC
 - Connectivity:ETHER_ETH
 - Connectivity:ETHER_ETHSW
 - Connectivity:ETHER_GMAC
 - Connectivity:IIC
 - IIC0**
 - IIC1
 - IIC2
 - Connectivity:PHOSTIF
 - Connectivity:SCI
 - Connectivity:SHOSTIF

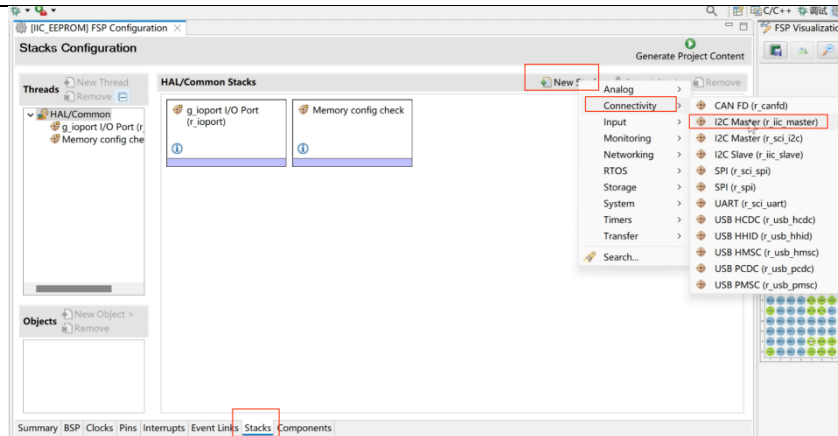
Pin Configuration

Name	Value	Lock	Link
Pin Group Selection	Mixed		
Operation Mode	Custom		
Input/Output			
IIC_SCL0	P13_2		
IIC_SDA0	P13_3		

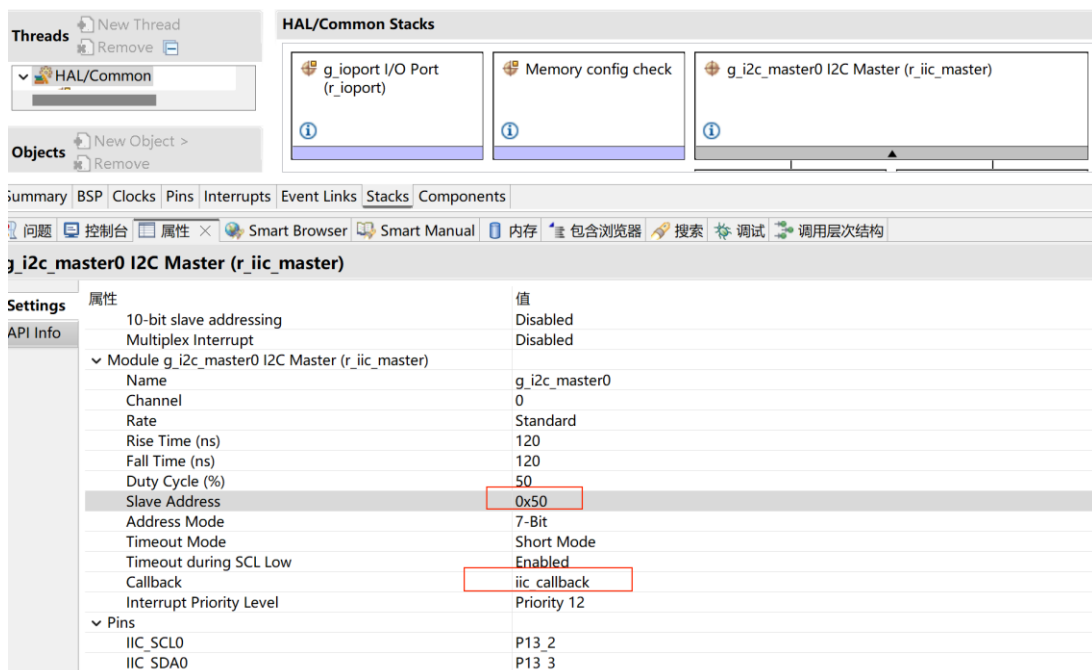
Module name: IIC0

Summary | BSP | Clocks | **Pins** | Interrupts | Event Links | Stacks | Components

9. 添加 NEW Stack: IIC master Stack



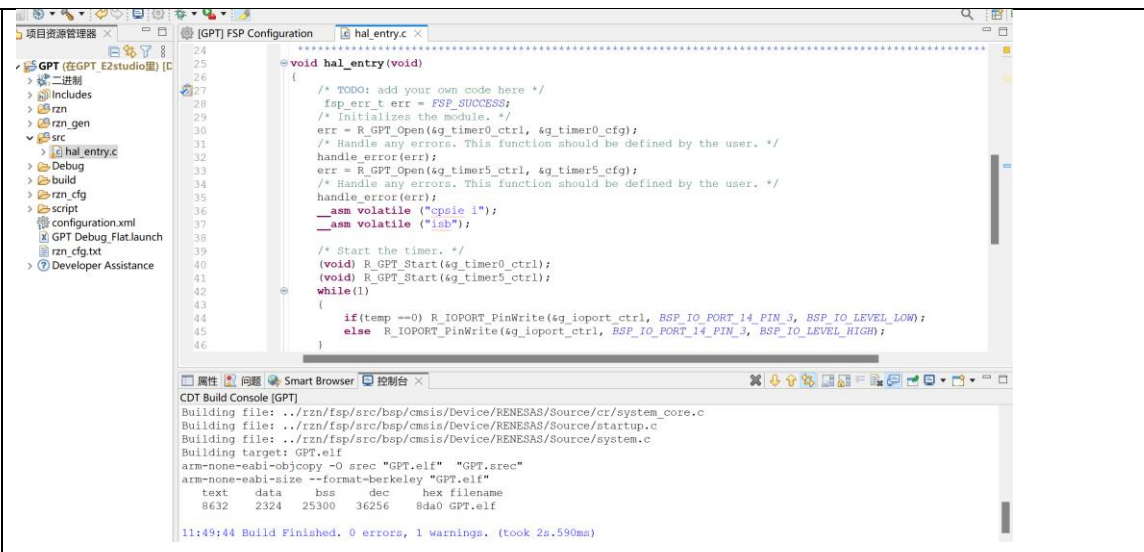

10. 设置回调函数 iic_callback，从机地址 0X50



11. 设置完毕，点击 Generate Project Content 生成代码

12. 用户代码编写

添加用户代码到工程，

	 <pre> 24 25 26 27 void hal_entry(void) 28 { 29 /* TODO: add your own code here */ 30 fsp_err_t err = FSP_SUCCESS; 31 /* Initializes the module. */ 32 err = R_GPT_Open(&g_timer0_ctrl, &g_timer0_cfg); 33 /* Handle any errors. This function should be defined by the user. */ 34 handle_error(err); 35 err = R_GPT_Open(&g_timer5_ctrl, &g_timer5_cfg); 36 /* Handle any errors. This function should be defined by the user. */ 37 handle_error(err); 38 __asm volatile ("cpsie i"); 39 __asm volatile ("isb"); 40 41 /* Start the timer. */ 42 (void) R_GPT_Start(&g_timer0_ctrl); 43 (void) R_GPT_Start(&g_timer5_ctrl); 44 while(1) 45 { 46 if(temp == 0) R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_3, BSP_IO_LEVEL_LOW); 47 else R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_3, BSP_IO_LEVEL_HIGH); 48 } 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 </pre> <pre> CDT Build Console [GPT] Building file: ../rzn/tsp/src/bsp/cmsis/Device/RENESAS/Source/cr/system_core.c Building file: ../rzn/tsp/src/bsp/cmsis/Device/RENESAS/Source/startup.c Building file: ../rzn/tsp/src/bsp/cmsis/Device/RENESAS/Source/system.c Building target: GPT.elf arm-none-eabi-objcopy -O srec "GPT.elf" "GPT.srec" arm-none-eabi-size --format=berkeley "GPT.elf" text data bss dec hex filename 8632 2324 25300 36256 8da0 GPT.elf 11:49:44 Build Finished. 0 errors, 1 warnings. (took 2s.590ms) </pre>
3.3	<ul style="list-style-type: none"> ● 下载代码到开发板 <p>编译代码，无报错。</p> <p>E2studio 在线仿真下载，全速运行</p>
3.4	<p>➤ 全速运行代码。</p> <p>观察 LED0 周期性亮灭。</p> <p>逻辑分析仪或示波器观察 P037 波形。</p> 

本节完