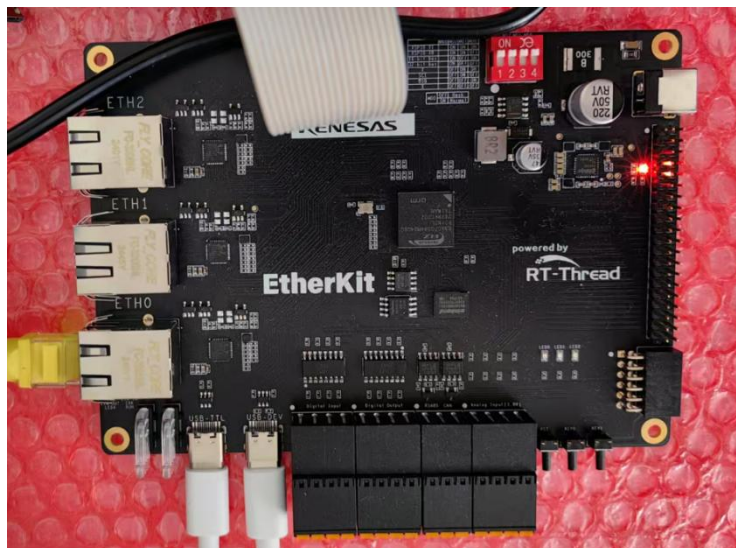


RZN2L key interrupt 例程操作手册-----基于 Etherkit 开发板

简介

本应用笔记介绍了基于 RZ/N2 Etherkit 开发板的 **key interrupt** 例程操作。分别介绍 IDE IAR 和 E2studio 软件下的操作。



开发工具

- 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

- Etherkit 开发板
- Jlink 仿真器, 需支持瑞萨 R52 内核

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	6

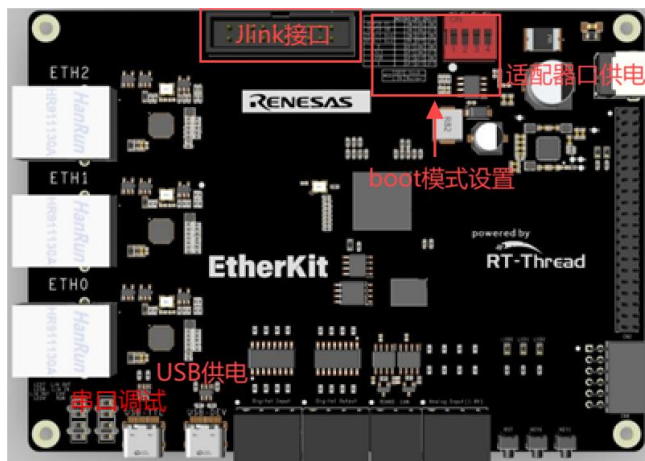
1 .硬件设置及软件安装

本节 EtherKit 开发板硬件设置。

1.1

开发板设置：

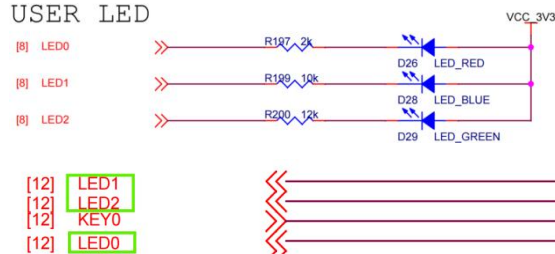
- 供电：可选 USB 供电或适配器供电
- Boot 模式设置：推荐 xSPI0 x1 boot mode
- Jlink v12



1.2

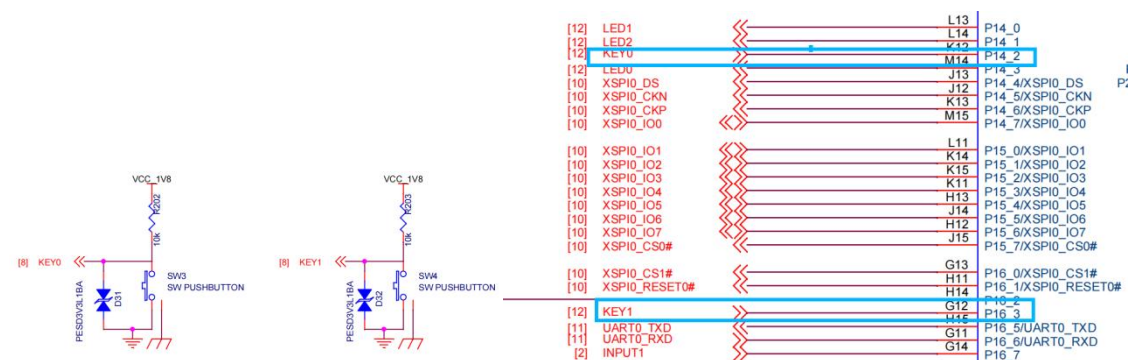
LED 电路：

USER LED



1.3

Key 电路：



本节完

2 .IAR 环境工程介绍

2.1 打开工程：key_interrupt

key_interrupt.ewp

key_interrupt.ewt

key_interrupt

memory regions.icf

2.2 FSP 配置

1. LED1 引脚配置，初始输出高电平，led 灯灭

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

in Selection

Type filter text

- > P10
- > P12
- > P13
- > P14
 - ✓ P14_0
 - ✓ P14_1
 - ✓ P14_2
 - ✓ P14_3
 - ✓ P14_4
 - ✓ P14_5
 - ✓ P14_6
 - ✓ P14_7
- > P15

Pin Configuration

Name	Value	Link
Symbolic Name		
Comment		
Mode	Output mode (High & Not Into Input)	
Pull up/down	None	
Output Type	CMOS	
Drive Capacity	Low	
Region	Safety	
Schmitt Trigger	None	
Slew Rate	Slow	
Input/Output		
Module name:	P14_0	
Port Capabilities:	ETHER_ESC: ESC_SYNC0 ETHER_ESC: ESC_SYNC1	

Function Pin Number

2. Interrupt 引脚配置

中断引脚配置 IRQ6 对应 P14_2，IRQ7 对应 P16_3

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

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

in Selection

Type filter text

- > Delta signalF:DSMIF
- > ExBus:BSC
- > Interrupt:IRQ
 - ✓ IRQ
- > System:CGC
- > System:MBXSEM
- > System:SYSTEM
- > TRG:ADC
- > Timer:CMTW
- > Timer:GPT
- > Timer:GPT_POEG
- > Timer:MTU3
- > Timer:MTU_POEG

Pin Configuration

Name	Value	Lock
IRQ3	None	
IRQ4	None	
IRQ5	None	
IRQ6	✓ P14_2	
IRQ7	✓ P16_3	
IRQ8	None	
IRQ9	None	
IRQ10	None	
IRQ11	None	
IRQ12	None	

Module name: IRQ

Usage: To use IRQ function with output or peripheral modes, change directly in po

Function Pin Number

Primary BSP Clocks Pins Interrupts Event Links Stacks Components

3. 配置中断功能

IRQ6 配置：下降沿中断，设置回调函数 irq6_callback，打开过滤功能

Stacks Configuration

Property	Value
Common	
Parameter Checking	Default (BSP)
Multiplex Interrupt	Disabled
Module g_external_irq6 External IRQ (r_icu)	
Name	g_external_irq6
Channel	6
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is enabled)	PCLK / 64
Callback	irq6_callback
Pin Interrupt Priority	Priority 12
Pins	
IRQ6	P14_2

IRQ7 配置：下降沿中断，设置回调函数 irq7_callback，打开过滤功能

Stacks Configuration

Property	Value
Common	
Parameter Checking	Default (BSP)
Multiplex Interrupt	Disabled
Module g_external_irq7 External IRQ (r_icu)	
Name	g_external_irq7
Channel	7
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is enabled)	PCLK / 64
Callback	irq7_callback
Pin Interrupt Priority	Priority 12
Pins	
IRQ7	P16_3

● 代码说明

中断回调函数中 IRQ6 点亮 LED1，IRQ7 中熄灭 LED1。

```

7  unsigned char g_external_irq_complete6 = 0;
8  unsigned char g_external_irq_complete7 = 0;
9  void irq6_callback (external_irq_callback_args_t * p_args)
10 {
11     (void) p_args;
12     g_external_irq_complete6 = 1;
13     R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_0, BSP_IO_LEVEL_LOW);
14 }
15 void irq7_callback (external_irq_callback_args_t * p_args)
16 {
17     (void) p_args;
18     g_external_irq_complete6 = 1;
19     R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_0, BSP_IO_LEVEL_HIGH);
20 }
21 /*****

```

● 打开 IRQ 功能，使能中断

```

*****
void hal_entry(void)
{
    /* TODO: add your own code here */
    R_ICU_ExternalIrqOpen(&g_external_irq6_ctrl, &g_external_irq6_cfg);
    R_ICU_ExternalIrqOpen(&g_external_irq7_ctrl, &g_external_irq7_cfg);

    __asm volatile ("cpsie i");
    __asm volatile ("isb");

    R_ICU_ExternalIrqEnable(&g_external_irq6_ctrl);
    R_ICU_ExternalIrqEnable(&g_external_irq7_ctrl);
    while(1)
    {
    }
}

```

● Rebuild All---编译工程 无报错

```

uild

Messages

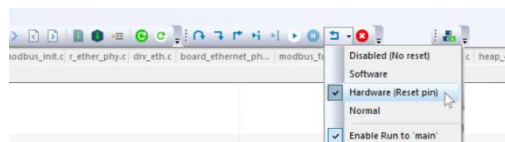
Total number of errors: 0
Total number of warnings: 0
Resolving dependencies...
Build succeeded

```

2.3

● Download and Debug ---下载程序

1. Jlink 正确连接，板子上电
2. 下载工程到开发板，进入仿真界面
3. Debug 复位设置为 Hardware



4. 全速运行代码，观察开发板 led 变化
Key0 按下 LED1 亮，key1 按下 LED1 灭

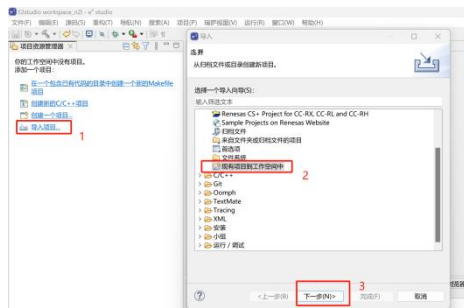
本节完

3 .E2studio 环境工程介绍

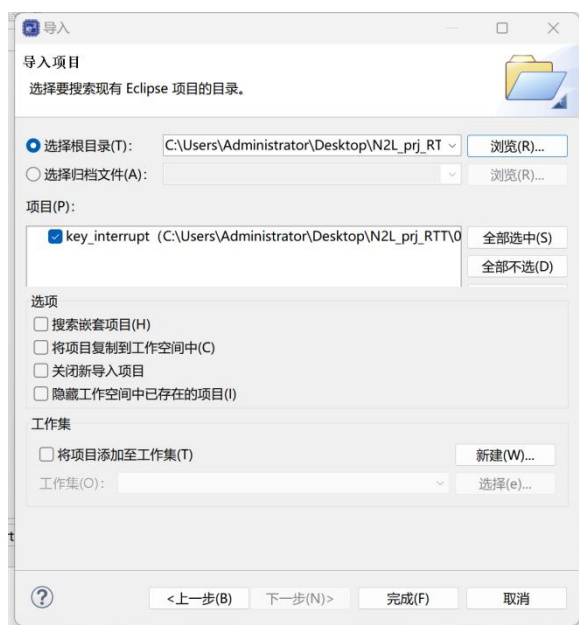
3.1

- 打开 E2studio, 导入工程

1. 选择 文件--导入--下一步:



2. 浏览--指定到工程文件夹---完成



3.2

FSP 配置

1. LED1 引脚配置, 初始输出高电平, led 灯灭

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

in Selection

Type filter text

- > P10
- > P12
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- ✓ P14
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 - P14_3
 - P14_4
 - P14_5
 - ✓ P14_6
 - ✓ P14_7
 - > P15

n Function Pin Number

Pin Configuration

Name	Value	Link
Symbolic Name		
Comment		
Mode	Output mode (High & Not Into Input)	
Pull up/down	None	
Output Type	CMOS	
Drive Capacity	Low	
Region	Safety	
Schmitt Trigger	None	
Slew Rate	Slow	
Input/Output		
Module name:	P14_0	
Port Capabilities:	ETHER_ESC: ESC_SYNC0	

2. Interrupt 引脚配置

中断引脚配置 IRQ6 对应 P14_2, IRQ7 对应 P16_3

Pin Configuration

Export to CSV file Configure Pin Driver Warnings

R9A07G084M04GBG.pincfg Manage configurations... Generate data: g_bsp_pin_cfg

In Selection

Type filter text

- > Delta signalF:DSMIF
- > ExBus:BSC
- > **Interrupt:IRQ**
 - IRQ**
 - > System:CGC
 - > System:MBXSEM
 - > System:SYSTEM
 - > TRG:ADC
 - > Timer:CMTW
 - > Timer:GPT
 - > Timer:GPT_POEG
 - > Timer:MTU3
 - > Timer:MTU3_POEG

Pin Configuration

Name	Value	Lock
IRQ3	None	
IRQ4	None	
IRQ5	None	
IRQ6	✓ P14_2	
IRQ7	✓ P16_3	
IRQ8	None	
IRQ9	None	
IRQ10	None	
IRQ11	None	
IRQ12	None	

Module name: IRQ

Usage: To use IRQ function with output or peripheral modes, change directly in po

Function Pin Number

Summary BSP Clocks Pins Interrupts Event Links Stacks Components

3. 配置中断功能

IRQ6 配置：下降沿中断，设置回调函数 irq6_callback，打开过滤功能

Stacks Configuration

Threads

HAL/Common Stacks

g_ioport I/O Port (r_ioport)

Memory config check

g_external_irq6 External IRQ (r_icu)

g_external_irq7 External IRQ (r_icu)

Objects

g_external_irq6 External IRQ (r_icu)

Settings

Property	Value
Common	
Parameter Checking	Default (BSP)
Multiplex Interrupt	Disabled
Module g_external_irq6 External IRQ (r_icu)	
Name	g_external_irq6
Channel	6
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is	PCLK / 64
Callback	irq6_callback
Pin Interrupt Priority	Priority 12
Pins	
IRQ6	P14_2

IRQ7 配置：下降沿中断，设置回调函数 irq7_callback，打开过滤功能

Stacks Configuration

Threads

HAL/Common Stacks

g_ioport I/O Port (r_ioport)

Memory config check

g_external_irq6 External IRQ (r_icu)

g_external_irq7 External IRQ (r_icu)

Objects

g_external_irq7 External IRQ (r_icu)

Settings

Property	Value
Common	
Parameter Checking	Default (BSP)
Multiplex Interrupt	Disabled
Module g_external_irq7 External IRQ (r_icu)	
Name	g_external_irq7
Channel	7
Trigger	Falling
Digital Filtering	Enabled
Digital Filtering Sample Clock (Only valid when Digital Filtering is	PCLK / 64
Callback	irq7_callback
Pin Interrupt Priority	Priority 12
Pins	
IRQ7	P16_3

● 代码说明

中断回调函数中 IRQ6 点亮 LED1, IRQ7 中熄灭 LED1。

```

7  unsigned char g_external_irq_complete6 =0;
8  unsigned char g_external_irq_complete7 =0;
9  void irq6_callback (external_irq_callback_args_t * p_args)
10 {
11     (void) p_args;
12     g_external_irq_complete6 = 1;
13     R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_0, BSP_IO_LEVEL_LOW);
14 }
15 void irq7_callback (external_irq_callback_args_t * p_args)
16 {
17     (void) p_args;
18     g_external_irq_complete6 = 1;
19     R_IOPORT_PinWrite(&g_ioport_ctrl, BSP_IO_PORT_14_PIN_0, BSP_IO_LEVEL_HIGH);
20 }
21 /*****

```

● 打开 IRQ 功能，使能中断

```

L ****
void hal_entry(void)
{
    /* TODO: add your own code here */
    R_ICU_ExternalIrqOpen(&g_external_irq6_ctrl, &g_external_irq6_cfg);
    R_ICU_ExternalIrqOpen(&g_external_irq7_ctrl, &g_external_irq7_cfg);

    __asm volatile ("%cpsie i");
    __asm volatile ("%isb");

    R_ICU_ExternalIrqEnable(&g_external_irq6_ctrl);
    R_ICU_ExternalIrqEnable(&g_external_irq7_ctrl);
    while(1)
    {
    }
}

```

● 编译工程，无报错

问题 控制台 × 属性 Smart Browser Smart Manual 内存 包含浏览器 搜索

CDT Build Console [key_interrupt]

```

10:35:43 **** 项目key_interrupt配置Debug的构建 ****
make -r --output-sync -j22 all
arm-none-eabi-size --format=berkeley "key_interrupt.elf"
text      data      bss      dec      hex filename
7820      2324      24464    34608    8730 key_interrupt.elf

10:35:44 Build Finished. 0 errors, 0 warnings. (took 186ms)

```

3.3

● 下载代码到开发板

E2studio 在线仿真下载，全速运行

3.4

● 观察开发板 led 变化

Key0 按下 LED1 亮，key1 按下 LED1 灭

本节完