華中科技大學
HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

信息技术导论
——微控制器基础知识

华中科技大学电信学院

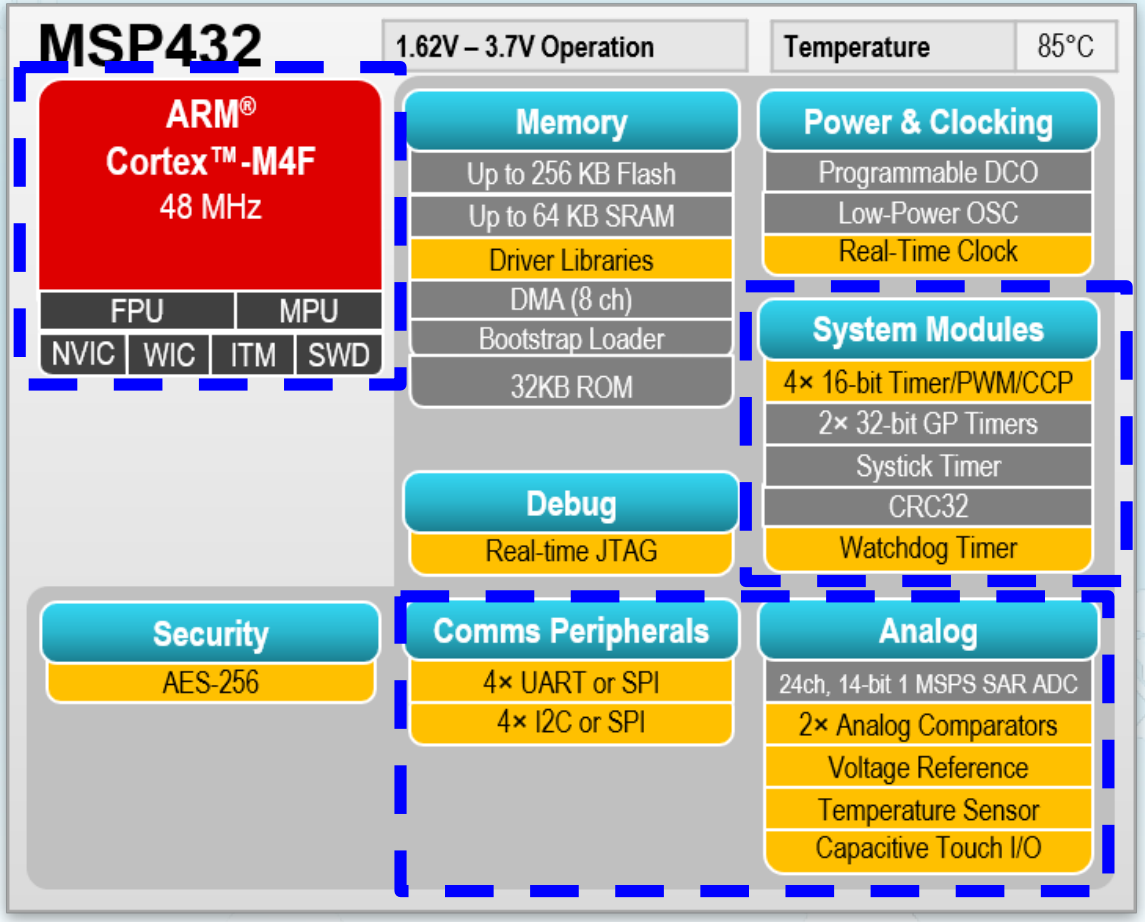
2021级





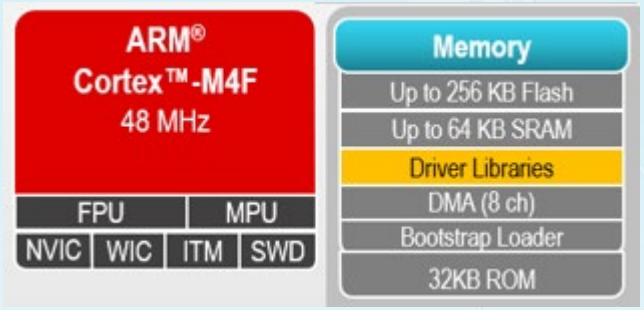

PART1 MSP432介绍

系统框架


MSP432
1.62V – 3.7V Operation
Temperature
85°C
ARM®
Cortex™-M4F
48 MHz
FPU
MPU
NVIC
WIC
ITM
SWD
Memory
Up to 256 KB Flash
Up to 64 KB SRAM
Driver Libraries
DMA (8 ch)
Bootstrap Loader
32KB ROM
Power & Clocking
Programmable DCO
Low-Power OSC
Real-Time Clock
System Modules
4× 16-bit Timer/PWM/CCP
2× 32-bit GP Timers
Systick Timer
CRC32
Watchdog Timer
Debug
Real-time JTAG
Security
AES-256
Comms Peripherals
4× UART or SPI
4× I2C or SPI
Analog
24ch, 14-bit 1 MSPS SAR ADC
2× Analog Comparators
Voltage Reference
Temperature Sensor
Capacitive Touch I/O

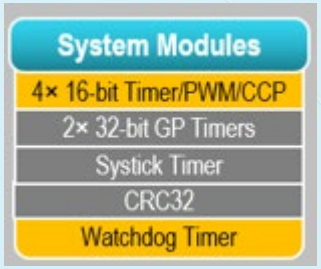
控制器

处理器，主频，存储

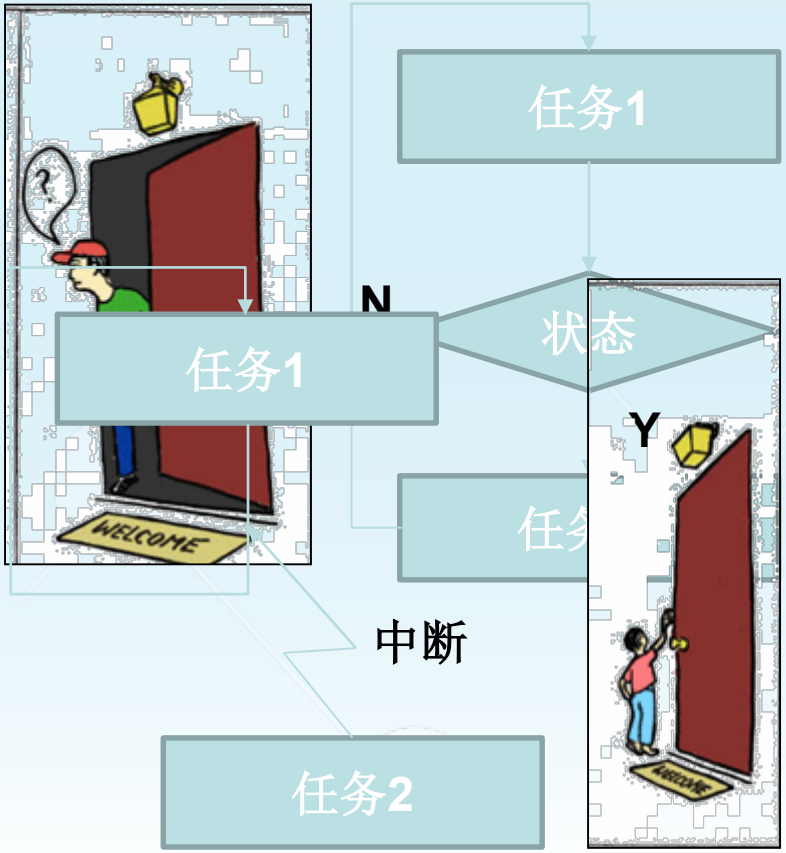


类比

定时器与中断



252
253
254



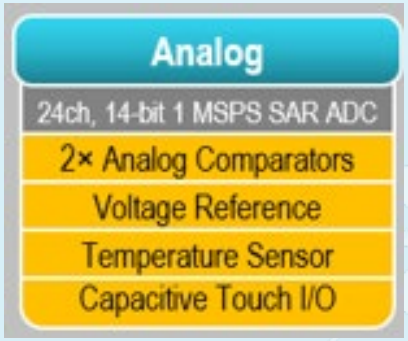
外设接口

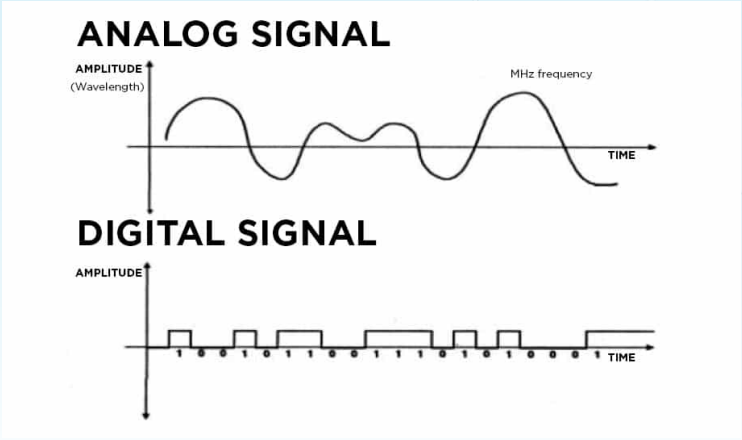
模拟与数字

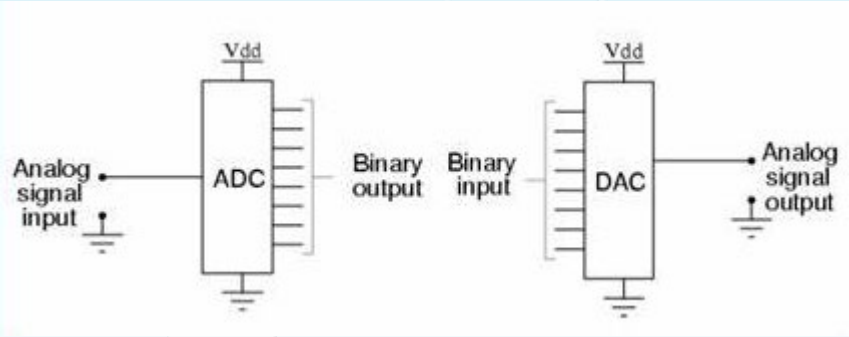
输入输出（Input/Output, I/O）

模数转换器(Analog to Digital Converter, ADC)

数模转换器(Digital to Analog Converter, DAC)





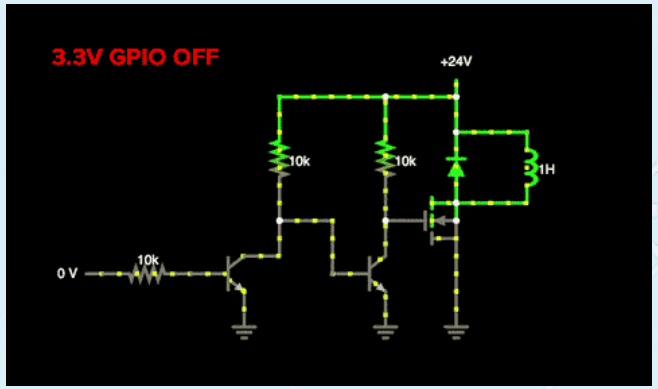


PART 2 GPIO介绍

引脚介绍

GPIO(General-Purpose Intput/Output)

- 多达11个数字I / O端口(Port)，大多数端口包含8条I / O线(Pin)。
- 每条I / O线均可分别配置为输入或输出方向、单独读取或写入、分别配置为上拉或下拉电阻



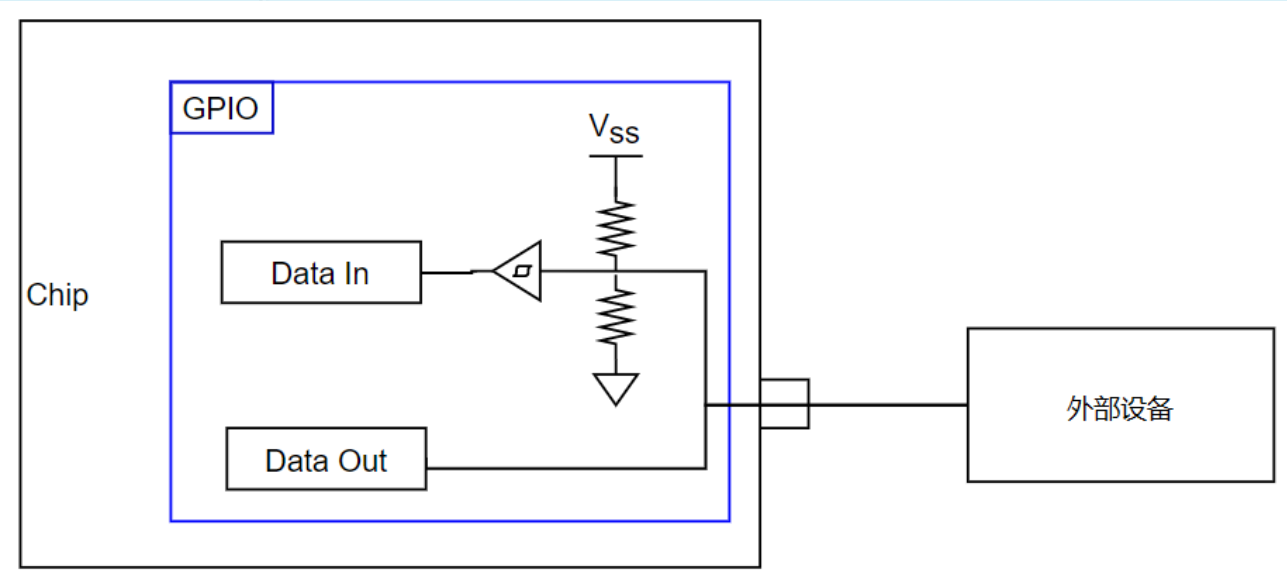
PxDIR	PxREN	PxOUT	I/O Configuration
0	0	x	Input
0	1	0	Input with pulldown resistor
0	1	1	Input with pullup resistor
1	x	x	Output

PxSEL1	PxSEL0	I/O Function
0	0	General purpose I/O is selected
0	1	Primary module function is selected
1	0	Secondary module function is selected
1	1	Tertiary module function is selected

引脚介绍

GPIO 有三种状态，高(High)、低(Low)、高阻(Hi-Z)。

当不进行上拉或下拉时， GPIO悬空，状态由外部环境确定，容易导致误触发。



pull-up 表示预设为 High，适合状态将拉低的外设；

pull-down 表示预设为 Low，适合状态将拉高的外设。

引脚应用

```
volatile uint32_t i;

// Stop watchdog timer
WDT_A_hold(WDT_A_BASE);

// Set P1.0 to output direction
GPIO_setAsOutputPin(
        GPIO_PORT_P1,
        GPIO_PIN0
);

while(1)
{
     // Toggle P1.0 output
    GPIO_toggleOutputOnPin(
        GPIO_PORT_P1,
        GPIO_PIN0
    );
    // Delay
    for(i=100000; i>0; i--);
}
```

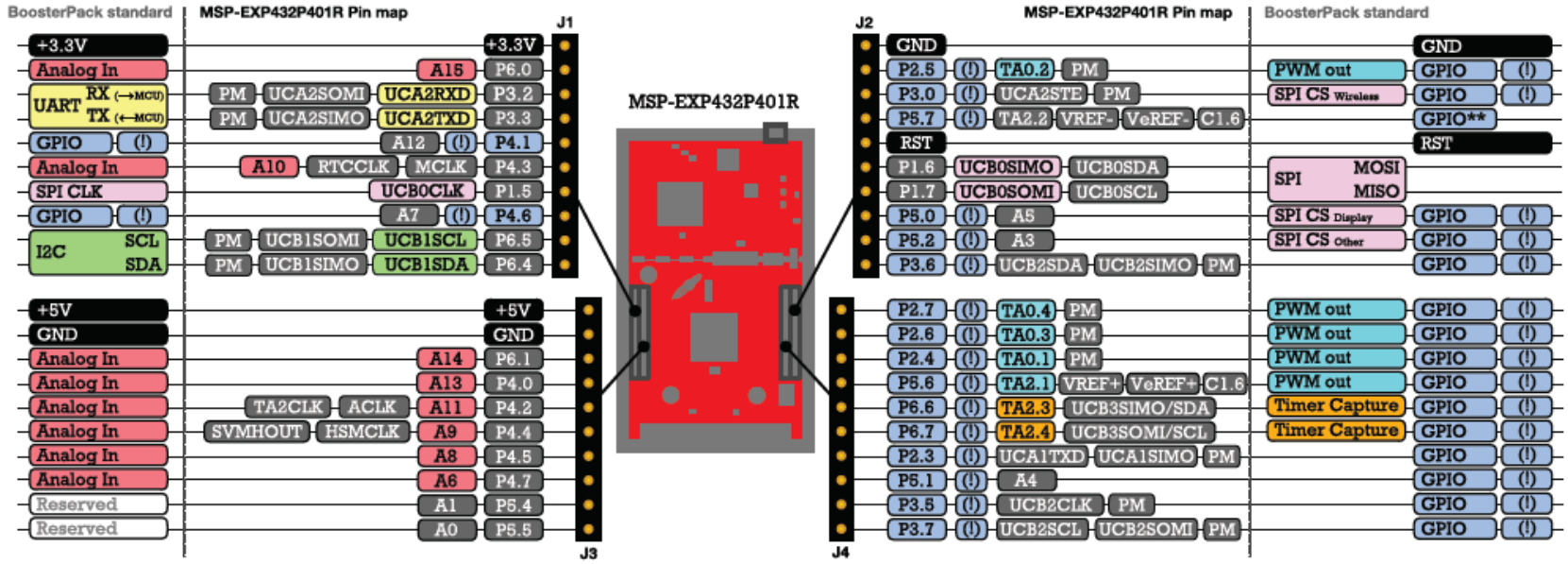
```
volatile uint32_t i;
// Stop watchdog timer
WDTCTL = WDTPW | WDTHOLD;
// Set P1.0 to out-put direction
P1DIR |= 0x01;
while(1)
{
    // Toggle P1.0 using exclusive-OR
    P1OUT ^= 0x01;
    //Delay
    for(i=100000; i>0; i--);
}
```

引脚介绍

Below are the pins exposed @ the MSP-EXP432P401R LaunchPad BoosterPack connector.

Also shown are functions that map with the BoosterPack pinout standard. Refer to the MSP432P401R Datasheet for additional details.
NOTE: Some LaunchPads & BoosterPacks do not 100% comply with the standard, so please check your specific LaunchPad to ensure pin compatibility.

(!) Denotes I/O pins that are interrupt-capable
** Some LaunchPads do not have a GPIO here

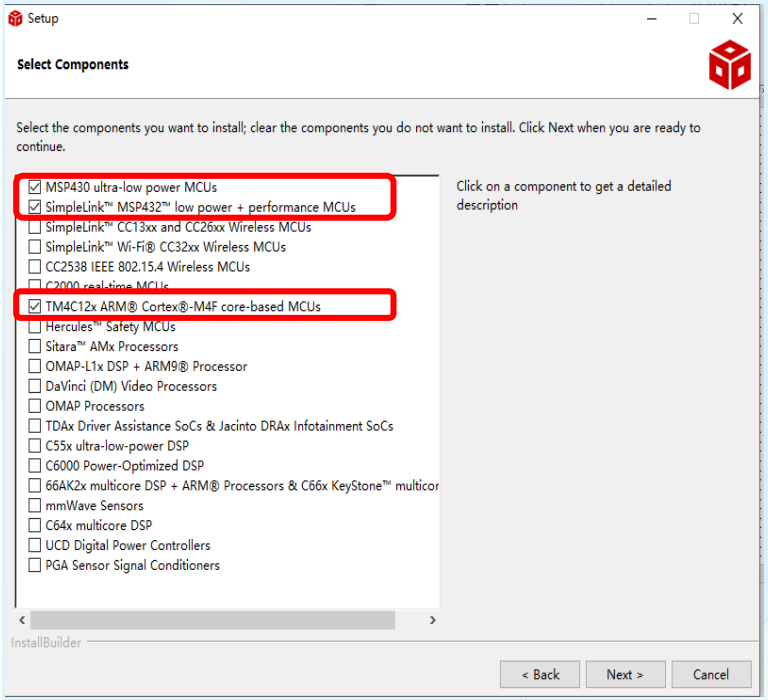


PxSEL1	PxSEL0	I/O Function
0	0	General purpose I/O is selected
0	1	Primary module function is selected
1	0	Secondary module function is selected
1	1	Tertiary module function is selected

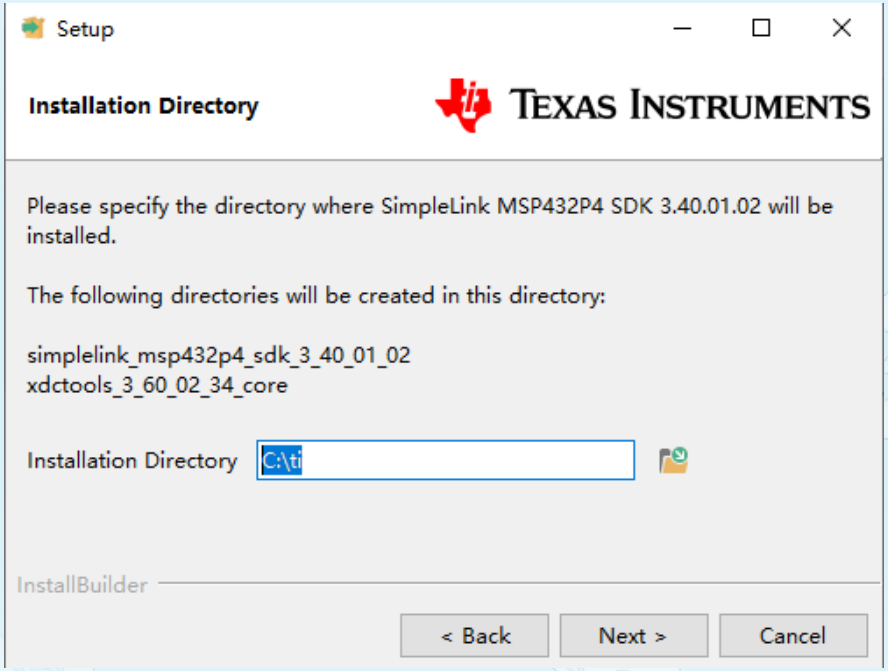
PART 3 软件介绍

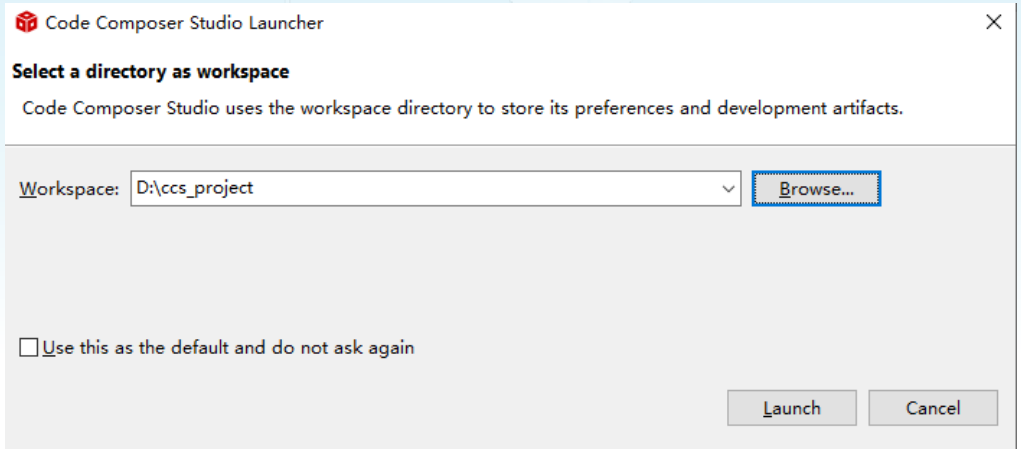
软件安装

ccs_setup_10.2.0.00009.exe

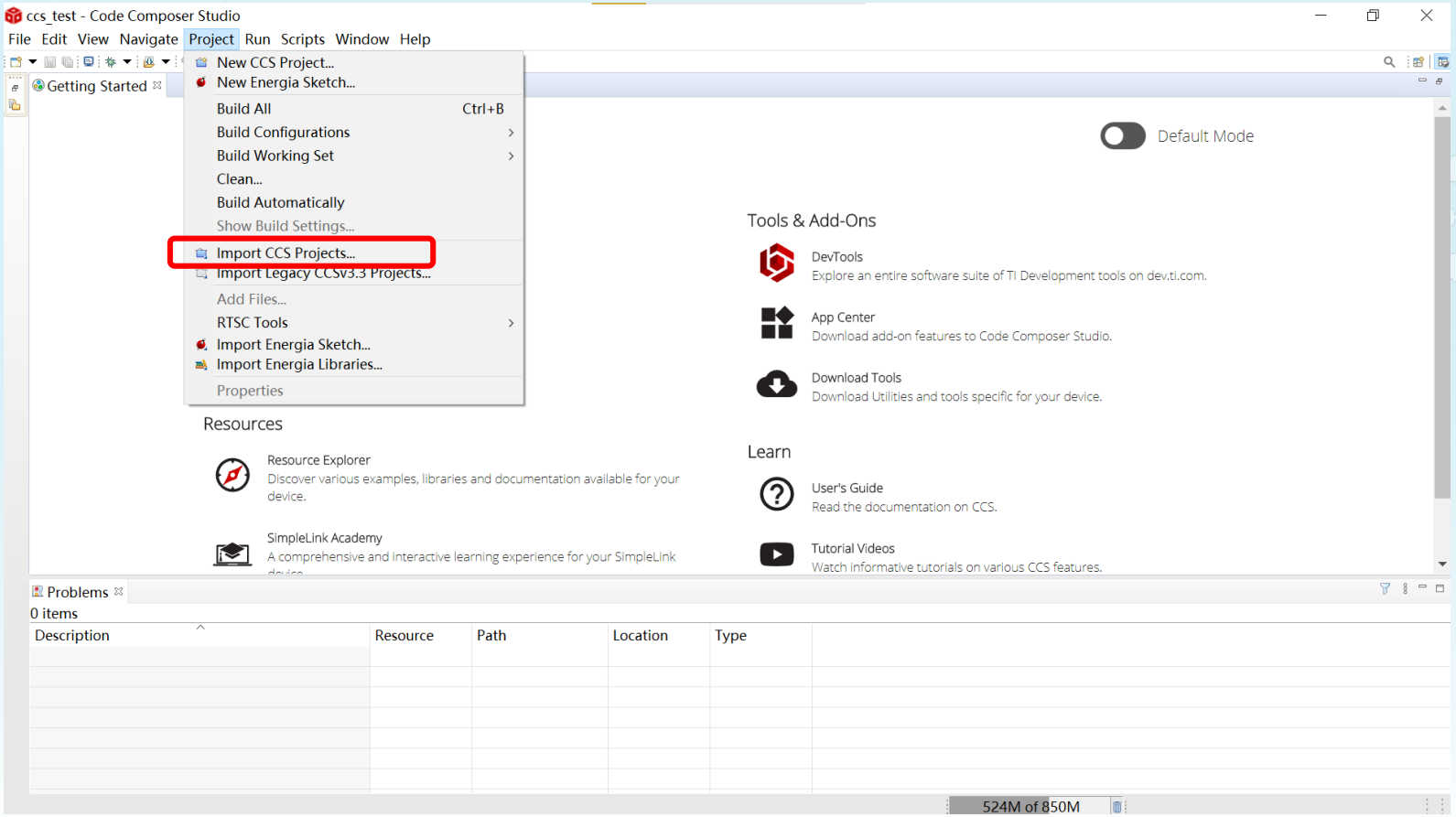


simplelink_msp432p4_sdk_3_40_01_02.exe





导入例程


ccs_test - Code Composer Studio
File Edit View Navigate Project Run Scripts Window Help
New CCS Project...
New Energia Sketch...
Build All Ctrl+B
Build Configurations
Build Working Set
Clean...
Build Automatically
Show Build Settings...
Import CCS Projects...
Import Legacy CCSv3.3 Projects...
Add Files...
RTSC Tools
Import Energia Sketch...
Import Energia Libraries...
Properties
Getting Started
Default Mode
Tools & Add-Ons
DevTools
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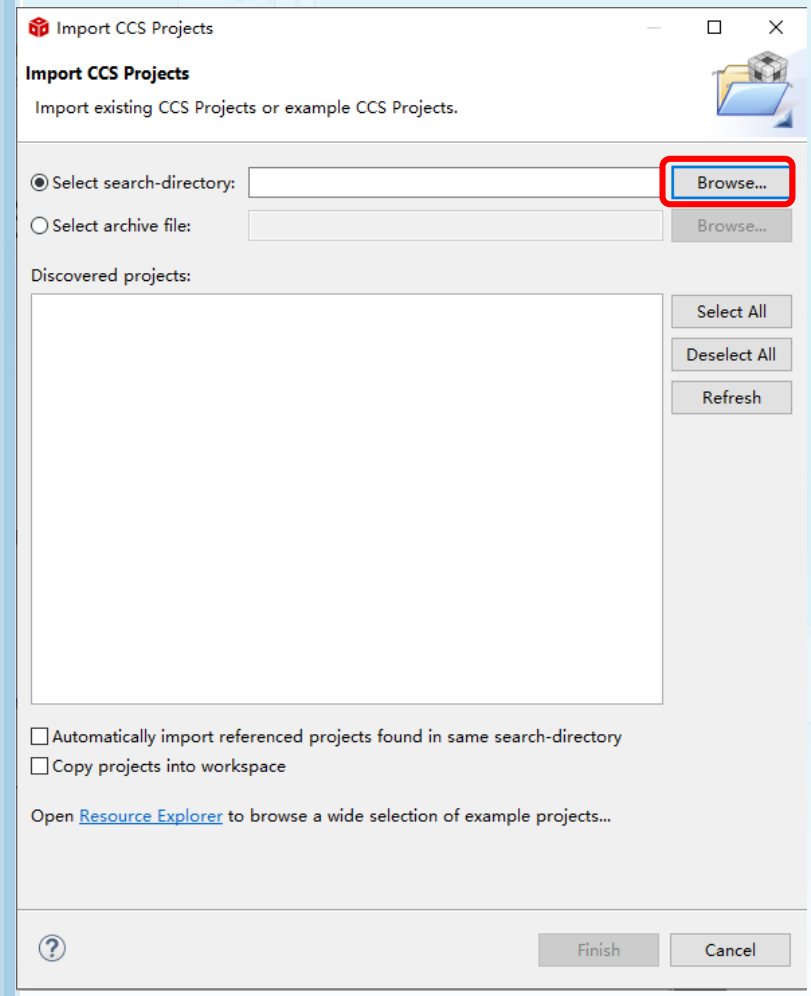
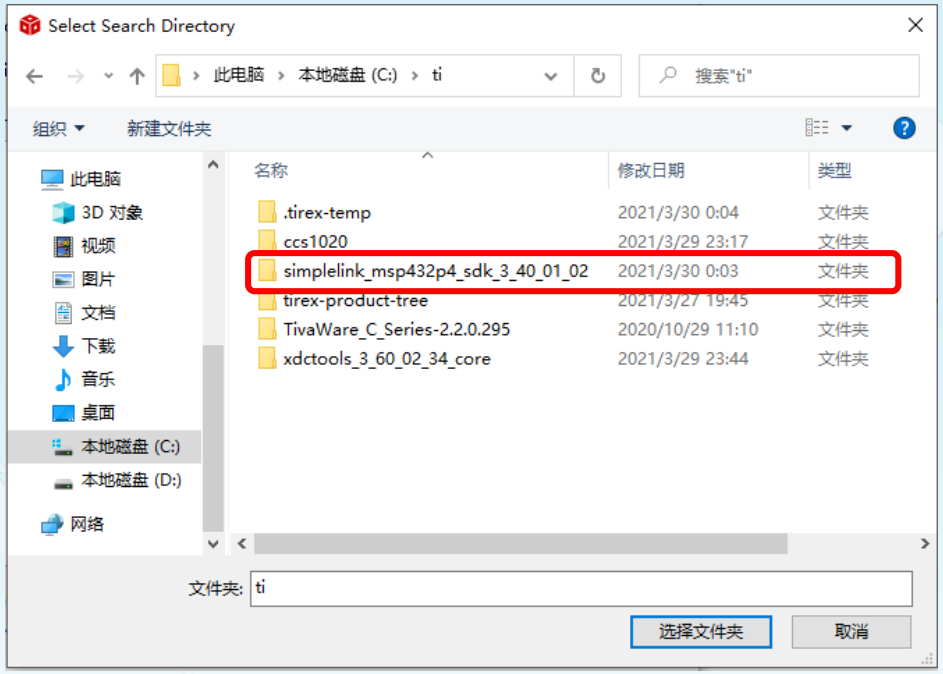
App Center
Download add-on features to Code Composer Studio.
Download Tools
Download Utilities and tools specific for your device.
Resources
Resource Explorer
Discover various examples, libraries and documentation available for your device.
SimpleLink Academy
A comprehensive and interactive learning experience for your SimpleLink
Learn
User's Guide
Read the documentation on CCS.
Tutorial Videos
Watch informative tutorials on various CCS features.
Problems
0 items
Description
Resource
Path
Location
Type
524M of 850M

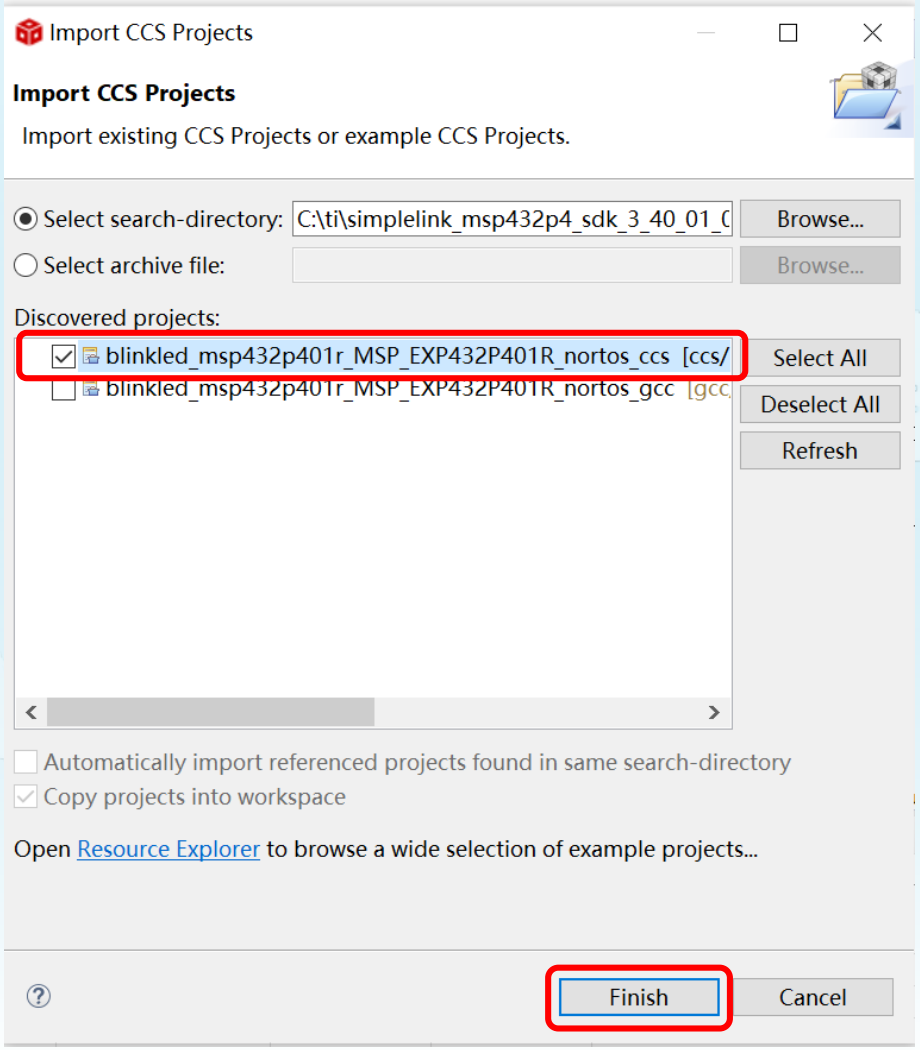
导入例程


Import CCS Projects
Import CCS Projects
Import existing CCS Projects or example CCS Projects.
Select search-directory:
Browse...
Select archive file:
Browse...
Discovered projects:
Select All
Deselect All
Refresh
Automatically import referenced projects found in same search-directory
Copy projects into workspace
Open Resource Explorer to browse a wide selection of example projects...
Finish
Cancel

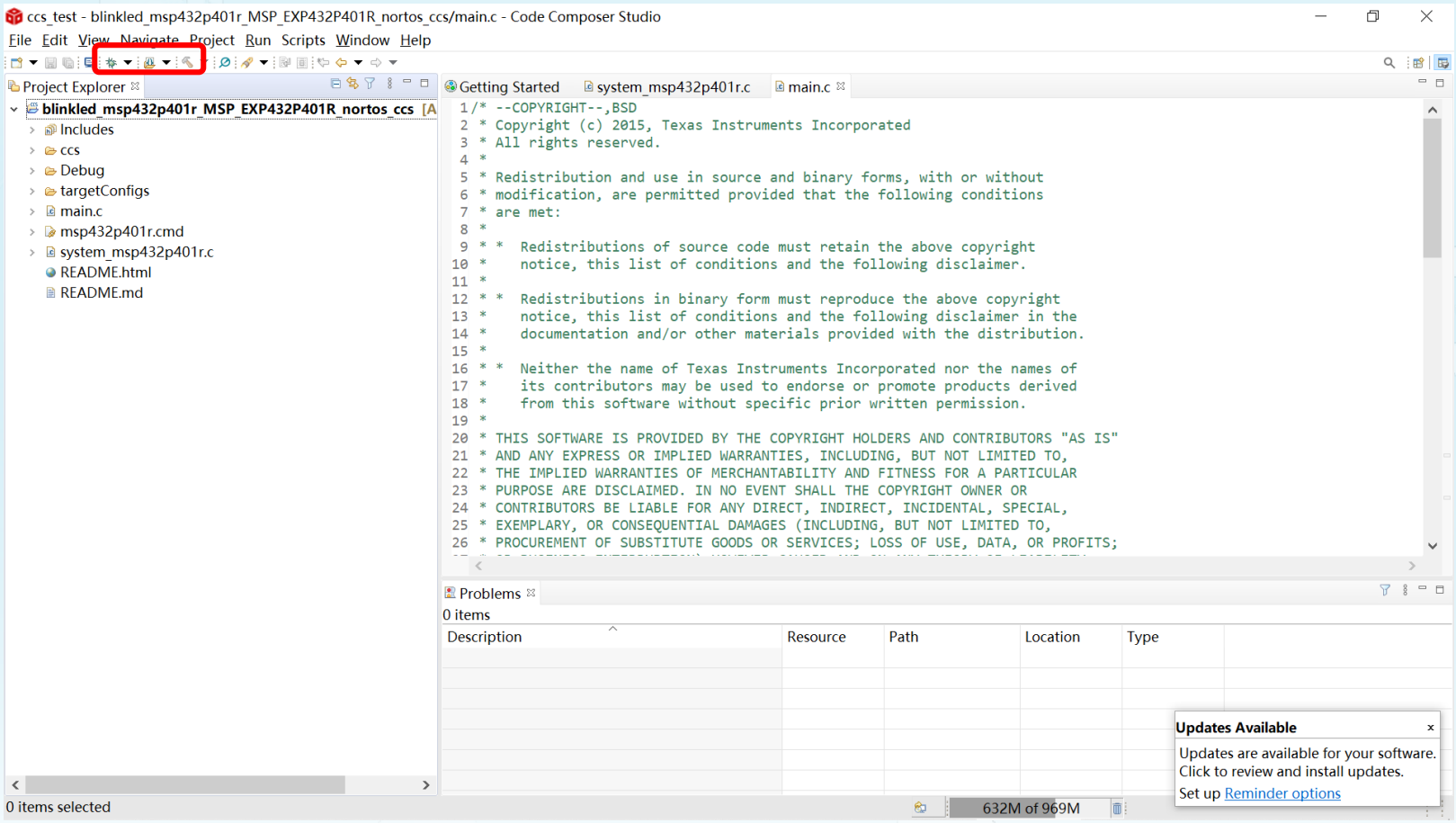

Select Search Directory
此电脑 › 本地磁盘 (C:) › ti
搜索"ti"
组织
新建文件夹
此电脑
3D 对象
视频
图片
文档
下载
音乐
桌面
本地磁盘 (C:)
本地磁盘 (D:)
网络
名称
修改日期
类型
.tirex-temp 2021/3/30 0:04 文件夹
ccs1020 2021/3/29 23:17 文件夹
simplelink_msp432p4_sdk_3_40_01_02 2021/3/30 0:03 文件夹
tirex-product-tree 2021/3/27 19:45 文件夹
TivaWare_C_Series-2.2.0.295 2020/10/29 11:10 文件夹
xdctools_3_60_02_34_core 2021/3/29 23:44 文件夹
文件夹: ti
选择文件夹
取消

导入例程

例程路径：
C:\ti\simplelink_msp432p4_sdk_3_40_01_02\examples\nortos\MSP_EXP432P401R\demos\blinkled_msp432p401r



运行例程


ccs_test - blinkled_msp432p401r_MSP_EXP432P401R_nortos_ccs/main.c - Code Composer Studio
File Edit View Navigate Project Run Scripts Window Help
Project Explorer
blinkled_msp432p401r_MSP_EXP432P401R_nortos_ccs [A
Includes
ccs
Debug
targetConfigs
main.c
msp432p401r.cmd
system_msp432p401r.c
README.html
README.md
Getting Started
system_msp432p401r.c
main.c
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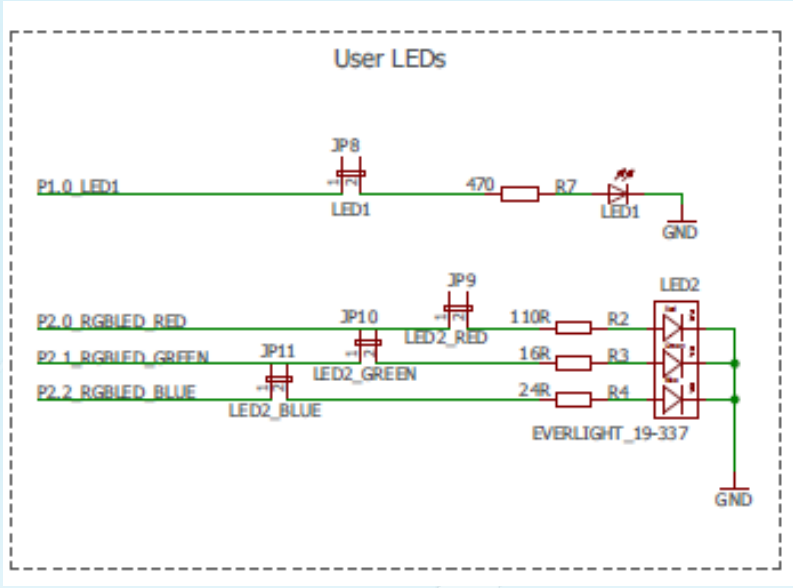
Problems
0 items
Description
Resource
Path
Location
Type
Updates Available
Updates are available for your software.
Click to review and install updates.
Set up Reminder options
0 items selected
632M of 969M

PART3 本周任务

课堂实验

1. 完成CCS软件安装
2. 导入blinkled_msp432p401r示例工程
3. 在例程上实现三色灯控制



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Thank You !