CREATING A NEW PROJECT IN VS CODE IDE

Relevant products: VA416xx microcontroller

DECEMBER 5, 2022

VORAGO TECHNOLOGIES

Contents

1 Introduction

1.1 Purpose of Document

This document is intended to provide instructions on how to add your own user firmware project to the provided VS Code / GCC workspace. Support for this development environment is included in the VA416xx BSP version 2.00 and up. Because of the nature of open source tools, adding a project to the workspace involves editing JSON and other text files, and is not as straightforward as with the licensed tools like Keil or IAR. This step by step set of instructions is based around making a copy of the 'blinky' project, which can then be used as a basis for an end user application.

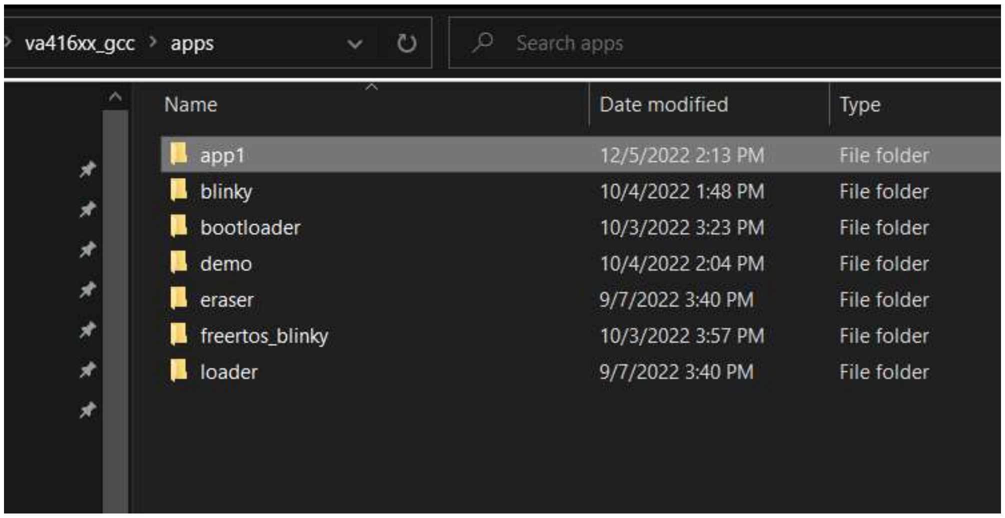
2 Creating the project

2.1 Choose a name for the project and create required folders

The first step is to decide on a name for the project. It will often be typed into the terminal, so it is best to keep it short. Here, we will call the new project 'app1'.

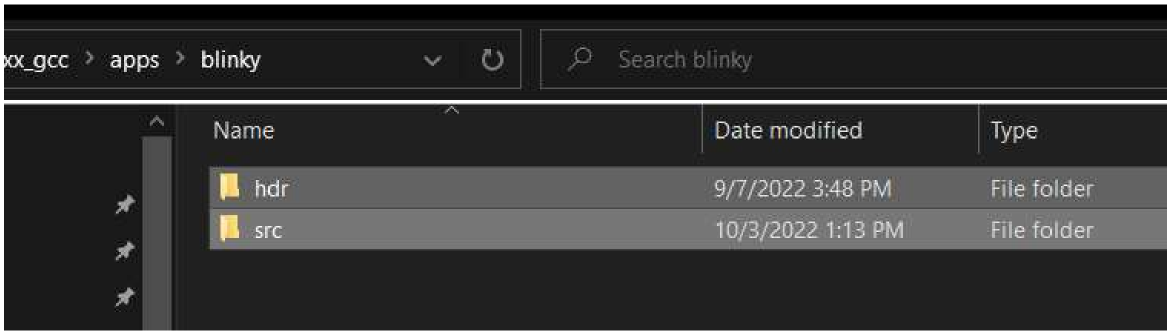
2.1.1 Create directories

In the VS code workspace folder (here it is called 'va416xx_gcc'), under 'apps', create a new folder and name it 'app1'.



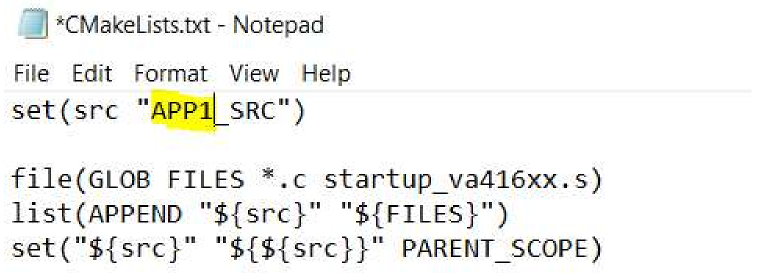
Name	Date modified	Type
app1	12/5/2022 2:13 PM	File folder
blinky	10/4/2022 1:48 PM	File folder
bootloader	10/3/2022 3:23 PM	File folder
demo	10/4/2022 2:04 PM	File folder
eraser	9/7/2022 3:40 PM	File folder
freertos_blinky	10/3/2022 3:57 PM	File folder
loader	9/7/2022 3:40 PM	File folder

Navigate over to the 'blinky' app, and copy the 'hdr' and 'src' folders from blinky project to the 'app1' folder.



Name	Date modified	Type
hdr	9/7/2022 3:48 PM	File folder
src	10/3/2022 1:13 PM	File folder

Navigate into the ‘src’ folder just created in ‘app1’. Open the file ‘CMakeLists.txt’ in a text editor. Change ‘BLINKY_SRC’ to ‘APP1_SRC’. Save and close the file.



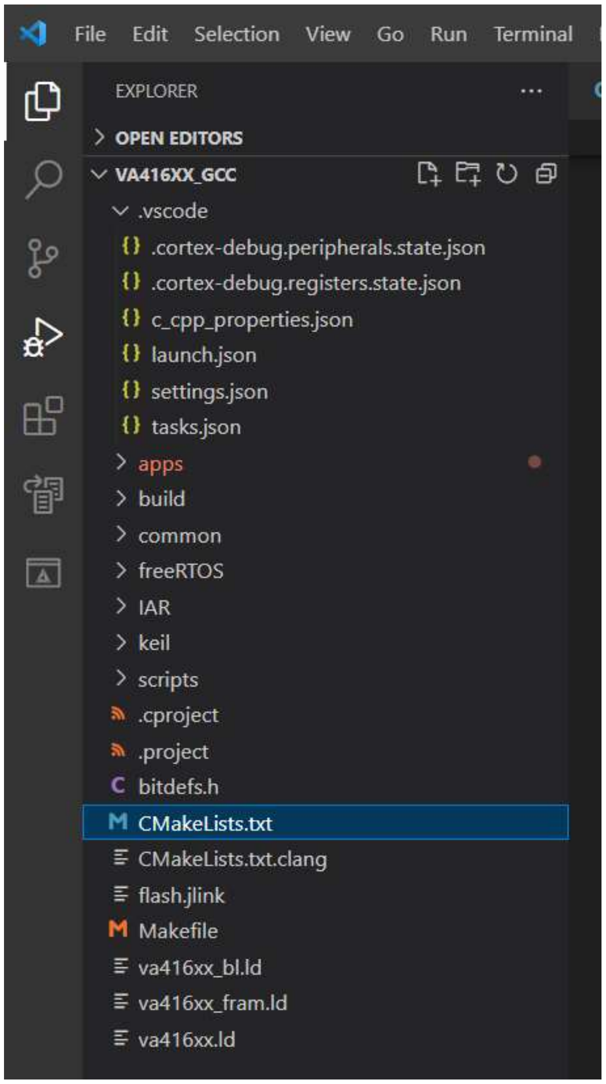
```
set(src "APP1_SRC")

file(GLOB FILES *.c startup_va416xx.s)
list(APPEND "${src}" "${FILES}")
set("${src}" "${${src}}" PARENT_SCOPE)
```

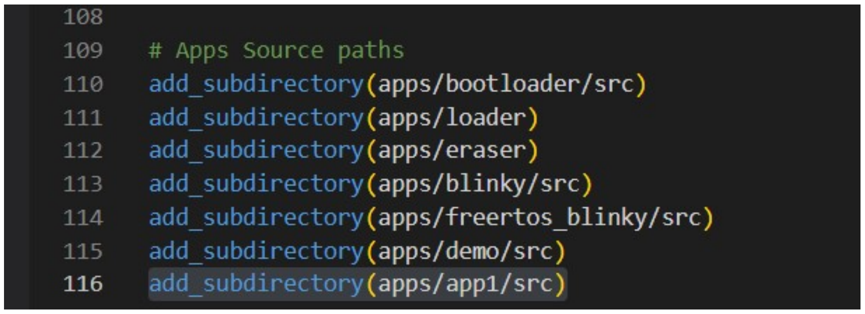
2.2 Setup the makefiles

2.2.1 Edits to top level CMakeLists.txt

In VS code, open $WorkspaceDirectory/CMakeLists.txt.



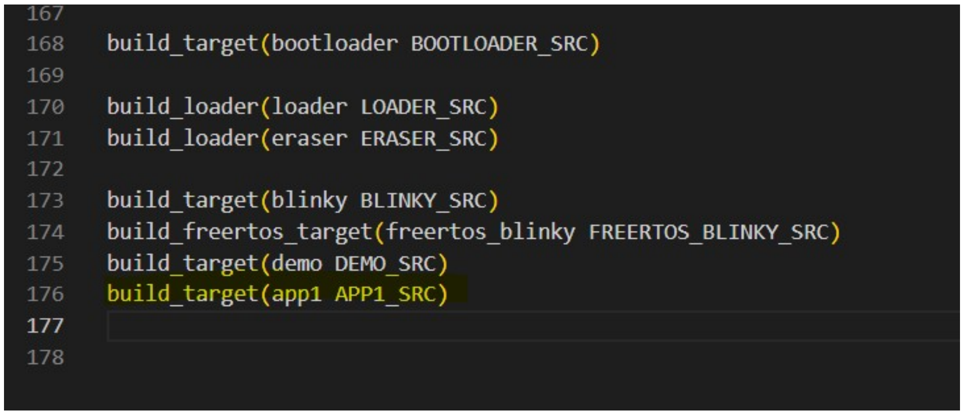
Find the section with the comment '# Apps source paths', and add a line for the app1 project:



```

# Apps Source paths
add_subdirectory(apps/bootloader/src)
add_subdirectory(apps/loader)
add_subdirectory(apps/eraser)
add_subdirectory(apps/blinky/src)
add_subdirectory(apps/freertos_blinky/src)
add_subdirectory(apps/demo/src)
add_subdirectory(apps/app1/src)
```

At the end of the file, add a 'build_target' line for the new application. If the new app is a FreeRTOS project, call 'build_freertos_target' instead of 'build_target'. Save and close the file.



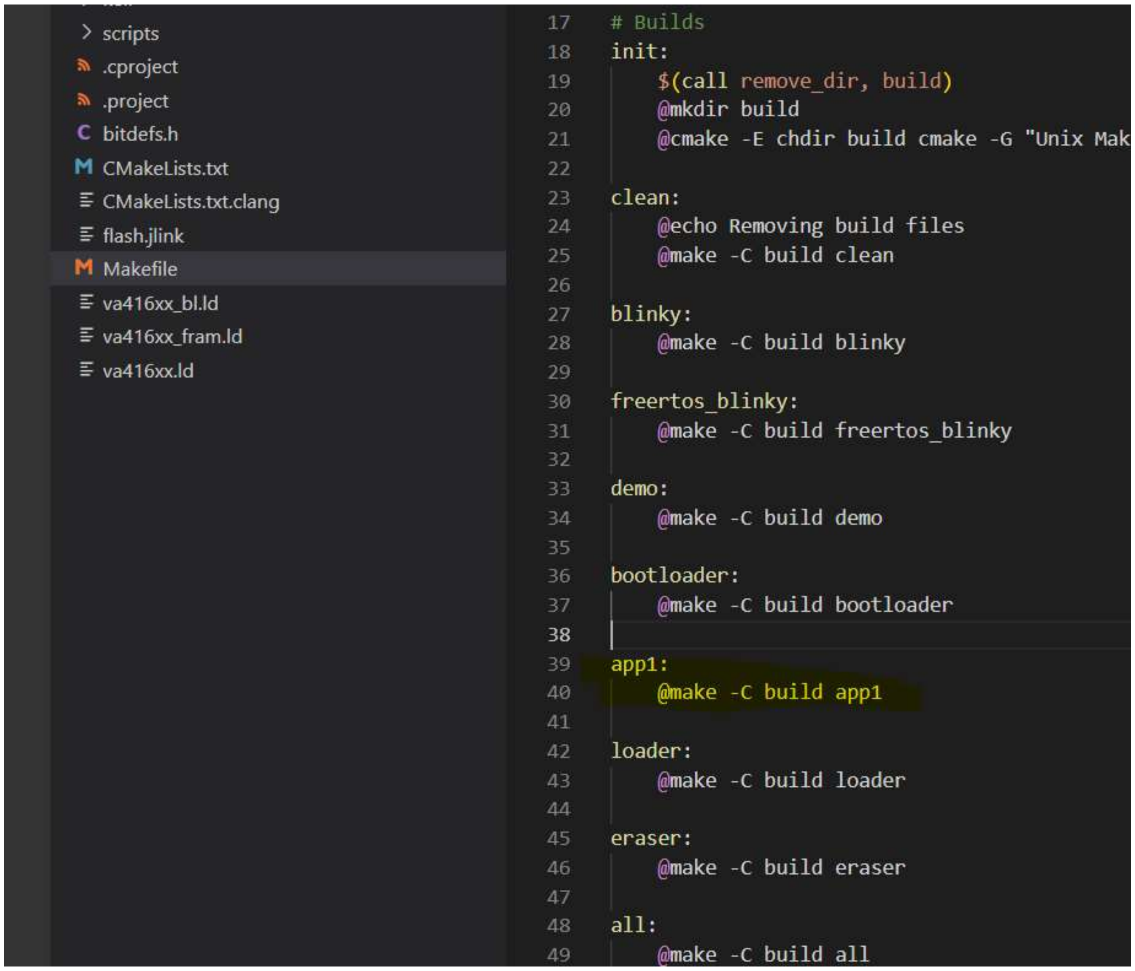
```
build_target(bootloader BOOTLOADER_SRC)

build_loader(loader LOADER_SRC)
build_loader(eraser ERASER_SRC)

build_target(blinky BLINKY_SRC)
build_freertos_target(freertos_blinky FREERTOS_BLINKY_SRC)
build_target(demo DEMO_SRC)
build_target(app1 APP1_SRC)
```

2.2.2 Edits to top level Makefile

Open $WorkspaceDirectory/Makefile. In the '# Builds' section, add a build command for the new app. Then save and close the file.



```
# Builds
init:
	$(call remove_dir, build)
	@mkdir build
	@cmake -E chdir build cmake -G "Unix Mak

clean:
	@echo Removing build files
	@make -C build clean

blinky:
	@make -C build blinky

freertos_blinky:
	@make -C build freertos_blinky

demo:
	@make -C build demo

bootloader:
	@make -C build bootloader

app1:
	@make -C build app1

loader:
	@make -C build loader

eraser:
	@make -C build eraser

all:
	@make -C build all
```

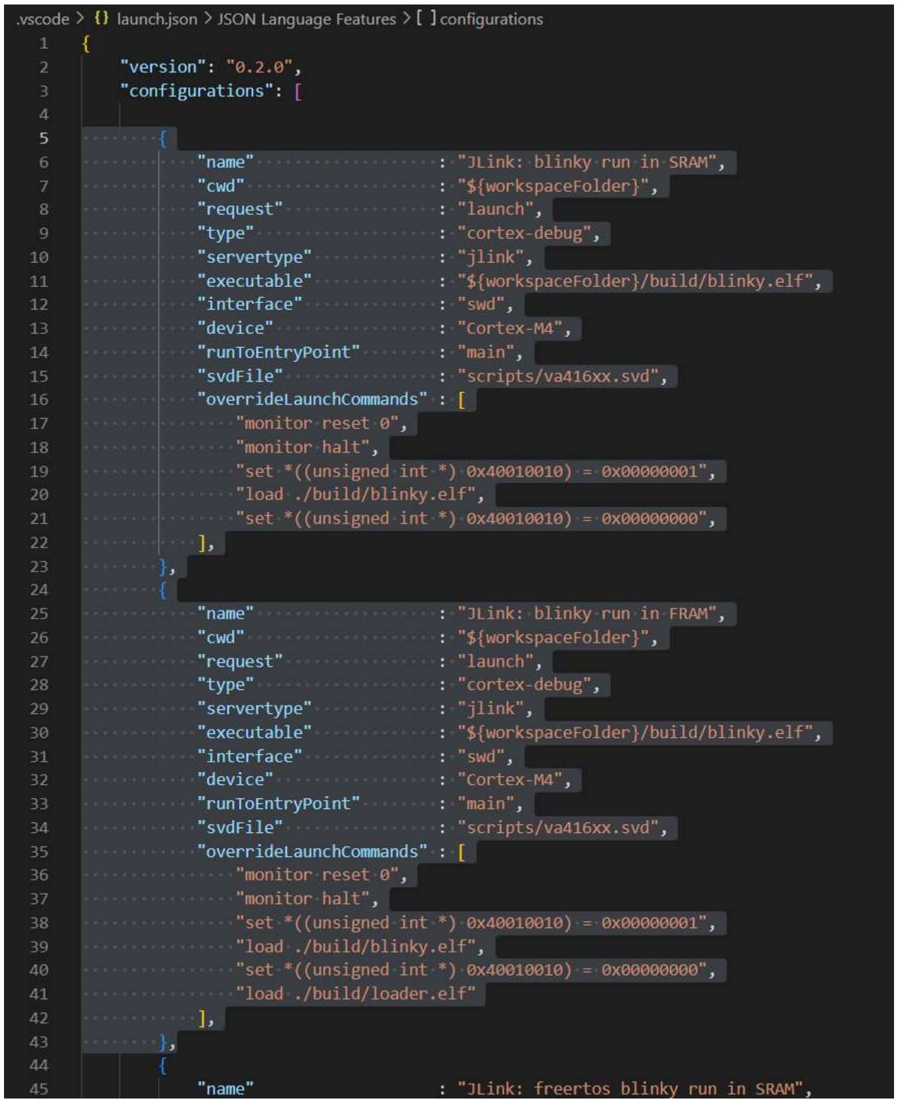
2.3 Edit the VS Code JSON files

Some VS Code configuration files will need to be edited to add the necessary information about the new project. This will tell VS Code how to run/debug the project, for example, and provide include directory information to the IntelliSense configuration.

2.3.1 Editing launch.json

In VS Code, in the ‘Run’ dropdown menu, choose ‘open configurations’. This will open launch.json. Alternatively, it can be opened from the explorer sidebar. This file contains the run/debug information, a ‘run in SRAM’ and ‘run in FRAM’ configuration will need to be added for the new project.

First, select and copy the SRAM and FRAM configuration for the blinky project:

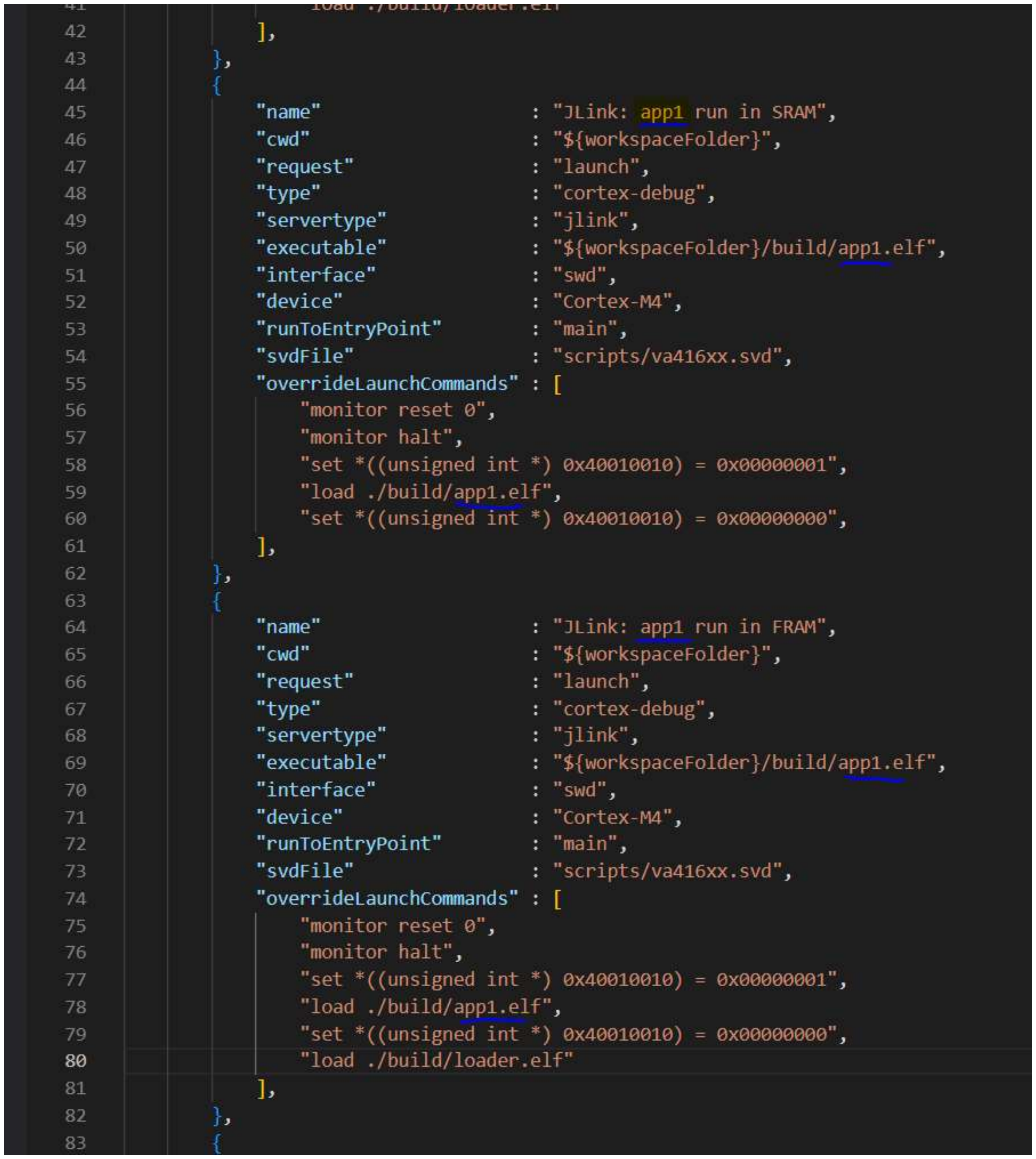


.vscode > {} launch.json > JSON Language Features > [ ] configurations

```
{
    "version": "0.2.0",
    "configurations": [

        {
            "name"                  : "JLink: blinky run in SRAM",
            "cwd"                   : "${workspaceFolder}",
            "request"               : "launch",
            "type"                  : "cortex-debug",
            "servertype"            : "jlink",
            "executable"            : "${workspaceFolder}/build/blinky.elf",
            "interface"             : "swd",
            "device"                : "Cortex-M4",
            "runToEntryPoint"       : "main",
            "svdFile"               : "scripts/va416xx.svd",
            "overrideLaunchCommands" : [
                "monitor reset 0",
                "monitor halt",
                "set *((unsigned int *) 0x40010010) = 0x00000001",
                "load ./build/blinky.elf",
                "set *((unsigned int *) 0x40010010) = 0x00000000",
            ],
        },
        {
            "name"                  : "JLink: blinky run in FRAM",
            "cwd"                   : "${workspaceFolder}",
            "request"               : "launch",
            "type"                  : "cortex-debug",
            "servertype"            : "jlink",
            "executable"            : "${workspaceFolder}/build/blinky.elf",
            "interface"             : "swd",
            "device"                : "Cortex-M4",
            "runToEntryPoint"       : "main",
            "svdFile"               : "scripts/va416xx.svd",
            "overrideLaunchCommands" : [
                "monitor reset 0",
                "monitor halt",
                "set *((unsigned int *) 0x40010010) = 0x00000001",
                "load ./build/blinky.elf",
                "set *((unsigned int *) 0x40010010) = 0x00000000",
                "load ./build/loader.elf"
            ],
        },
        {
            "name"                  : "JLink: freertos blinky run in SRAM",
```

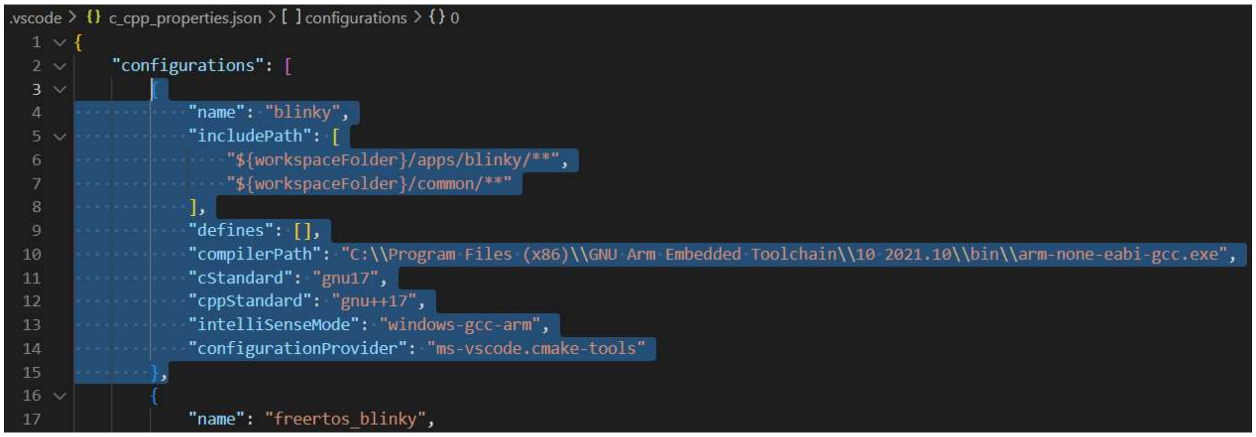
Paste the copy of this configuration just below the blinky config. In the “name” field, replace ‘blinky’ with ‘app1’. Replace occurrences of ‘blinky.elf’ with ‘app1.elf’. Save and close the file.



```
            ],
        },
        {
            "name"                   : "JLink: app1 run in SRAM",
            "cwd"                    : "${workspaceFolder}",
            "request"                : "launch",
            "type"                   : "cortex-debug",
            "servertype"             : "jlink",
            "executable"             : "${workspaceFolder}/build/app1.elf",
            "interface"              : "swd",
            "device"                 : "Cortex-M4",
            "runToEntryPoint"        : "main",
            "svdFile"                : "scripts/va416xx.svd",
            "overrideLaunchCommands" : [
                "monitor reset 0",
                "monitor halt",
                "set *((unsigned int *) 0x40010010) = 0x00000001",
                "load ./build/app1.elf",
                "set *((unsigned int *) 0x40010010) = 0x00000000",
            ],
        },
        {
            "name"                   : "JLink: app1 run in FRAM",
            "cwd"                    : "${workspaceFolder}",
            "request"                : "launch",
            "type"                   : "cortex-debug",
            "servertype"             : "jlink",
            "executable"             : "${workspaceFolder}/build/app1.elf",
            "interface"              : "swd",
            "device"                 : "Cortex-M4",
            "runToEntryPoint"        : "main",
            "svdFile"                : "scripts/va416xx.svd",
            "overrideLaunchCommands" : [
                "monitor reset 0",
                "monitor halt",
                "set *((unsigned int *) 0x40010010) = 0x00000001",
                "load ./build/app1.elf",
                "set *((unsigned int *) 0x40010010) = 0x00000000",
                "load ./build/loader.elf"
            ],
        },
        {
```

2.3.2 Editing c_cpp_properties.json

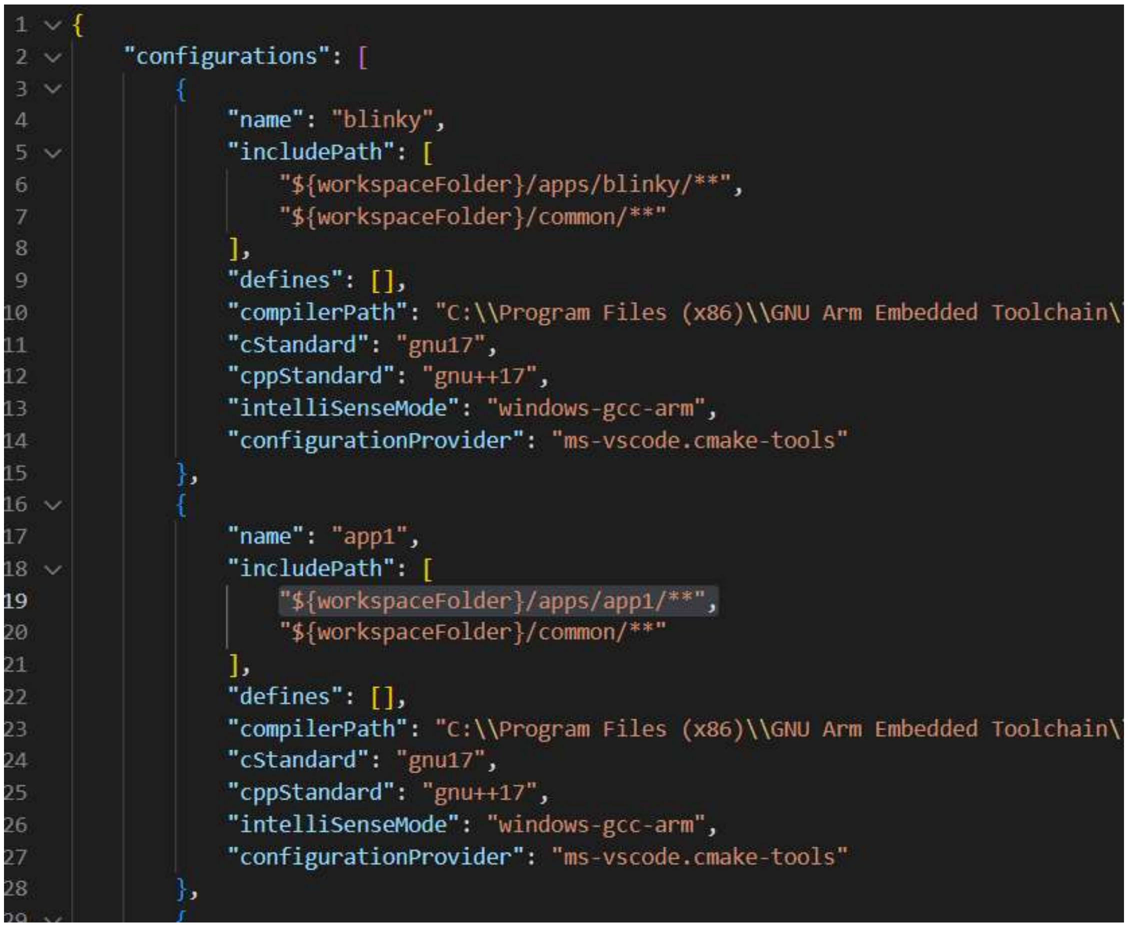
This file defines the IntelliSense configuration. A new configuration for the ‘app1’ project will be created. Open ‘c_cpp_properties.json’. Copy the ‘blinky’ configuration, and paste it below blinky.



.vscode > {} c_cpp_properties.json > [ ] configurations > {} 0

```
{
    "configurations": [
        {
            "name": "blinky",
            "includePath": [
                "${workspaceFolder}/apps/blinky/**",
                "${workspaceFolder}/common/**"
            ],
            "defines": [],
            "compilerPath": "C:\\Program Files (x86)\\GNU Arm Embedded Toolchain\\10 2021.10\\bin\\arm-none-eabi-gcc.exe",
            "cStandard": "gnu17",
            "cppStandard": "gnu++17",
            "intelliSenseMode": "windows-gcc-arm",
            "configurationProvider": "ms-vscode.cmake-tools"
        },
        {
            "name": "freertos_blinky",
```

Edit the new configuration. Change the “name” to ‘app1’, and the “includePath” to include “${workspaceFolder}/apps/app1/**” instead of “${workspaceFolder}/apps/blinky/**”



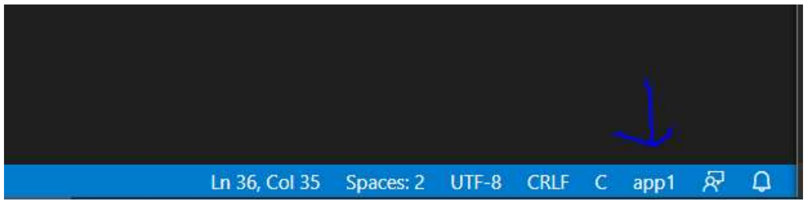
```
{
    "configurations": [
        {
            "name": "blinky",
            "includePath": [
                "${workspaceFolder}/apps/blinky/**",
                "${workspaceFolder}/common/**"
            ],
            "defines": [],
            "compilerPath": "C:\\Program Files (x86)\\GNU Arm Embedded Toolchain\
            "cStandard": "gnu17",
            "cppStandard": "gnu++17",
            "intelliSenseMode": "windows-gcc-arm",
            "configurationProvider": "ms-vscode.cmake-tools"
        },
        {
            "name": "app1",
            "includePath": [
                "${workspaceFolder}/apps/app1/**",
                "${workspaceFolder}/common/**"
            ],
            "defines": [],
            "compilerPath": "C:\\Program Files (x86)\\GNU Arm Embedded Toolchain\
            "cStandard": "gnu17",
            "cppStandard": "gnu++17",
            "intelliSenseMode": "windows-gcc-arm",
            "configurationProvider": "ms-vscode.cmake-tools"
        },
        {
```

Save and close the JSON file.

3 Building and running the new project

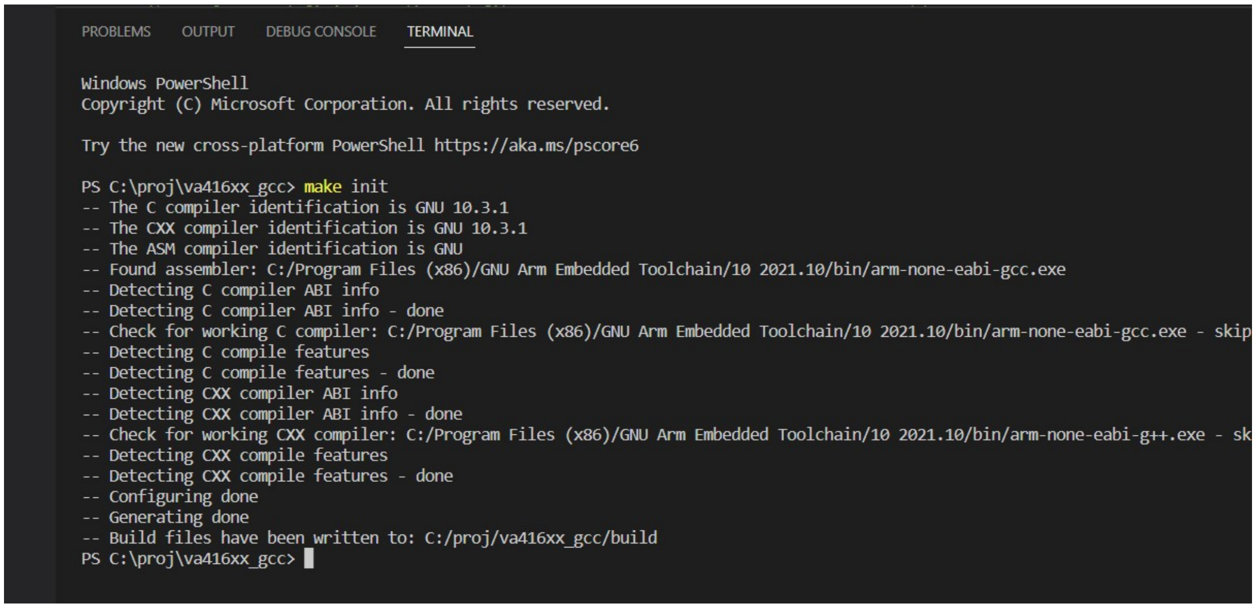
3.1 Setting the new C/C++ configuration

Open apps/app1/src/main.c. In the lower right corner of the VS code window, select the 'app1' configuration. This will tell VS Code where the include paths are for this application, so the autofill and commands like 'go to definition' when right clicking on a function or variable name will work correctly.



3.2 Building the new project

Because the makefiles were edited, a "make init" must be performed. Run this command in the terminal:



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\proj\va416xx_gcc> make init
-- The C compiler identification is GNU 10.3.1
-- The CXX compiler identification is GNU 10.3.1
-- The ASM compiler identification is GNU
-- Found assembler: C:/Program Files (x86)/GNU Arm Embedded Toolchain/10 2021.10/bin/arm-none-eabi-gcc.exe
-- Detecting C compiler ABI info
-- Detecting C compiler ABI info - done
-- Check for working C compiler: C:/Program Files (x86)/GNU Arm Embedded Toolchain/10 2021.10/bin/arm-none-eabi-gcc.exe - skip
-- Detecting C compile features
-- Detecting C compile features - done
-- Detecting CXX compiler ABI info
-- Detecting CXX compiler ABI info - done
-- Check for working CXX compiler: C:/Program Files (x86)/GNU Arm Embedded Toolchain/10 2021.10/bin/arm-none-eabi-g++.exe - sk
-- Detecting CXX compile features
-- Detecting CXX compile features - done
-- Configuring done
-- Generating done
-- Build files have been written to: C:/proj/va416xx_gcc/build
PS C:\proj\va416xx_gcc> 
```
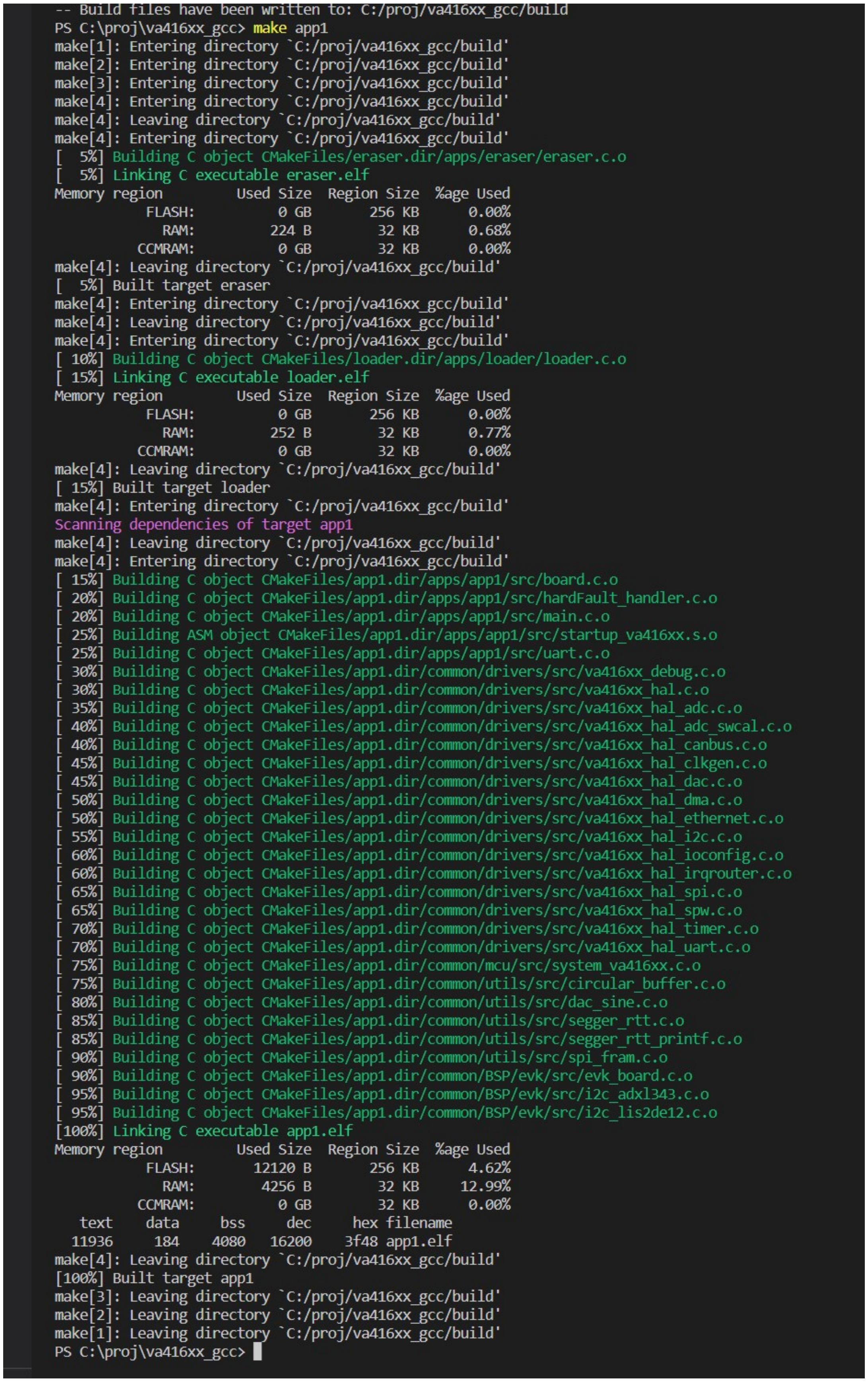
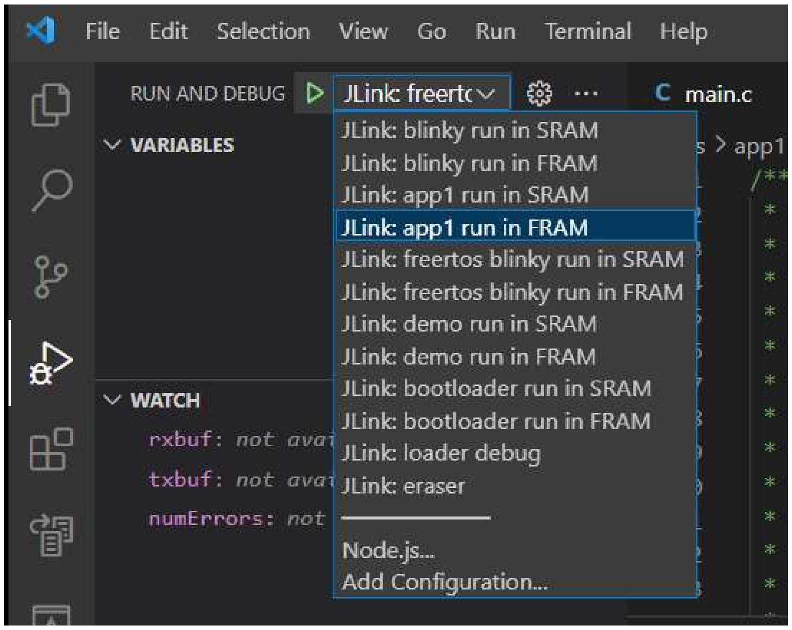

Next, run "make app1":



```
-- Build files have been written to: C:/proj/va416xx_gcc/build
PS C:\proj\va416xx_gcc> make app1
make[1]: Entering directory `C:/proj/va416xx_gcc/build'
make[2]: Entering directory `C:/proj/va416xx_gcc/build'
make[3]: Entering directory `C:/proj/va416xx_gcc/build'
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
[  5%] Building C object CMakeFiles/eraser.dir/apps/eraser/eraser.c.o
[  5%] Linking C executable eraser.elf
Memory region         Used Size  Region Size  %age Used
           FLASH:          0 GB       256 KB      0.00%
             RAM:         224 B        32 KB      0.68%
          CCMRAM:          0 GB        32 KB      0.00%
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
[  5%] Built target eraser
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
[ 10%] Building C object CMakeFiles/loader.dir/apps/loader/loader.c.o
[ 15%] Linking C executable loader.elf
Memory region         Used Size  Region Size  %age Used
           FLASH:          0 GB       256 KB      0.00%
             RAM:         252 B        32 KB      0.77%
          CCMRAM:          0 GB        32 KB      0.00%
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
[ 15%] Built target loader
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
Scanning dependencies of target app1
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
make[4]: Entering directory `C:/proj/va416xx_gcc/build'
[ 15%] Building C object CMakeFiles/app1.dir/apps/app1/src/board.c.o
[ 20%] Building C object CMakeFiles/app1.dir/apps/app1/src/hardFault_handler.c.o
[ 20%] Building C object CMakeFiles/app1.dir/apps/app1/src/main.c.o
[ 25%] Building ASM object CMakeFiles/app1.dir/apps/app1/src/startup_va416xx.s.o
[ 25%] Building C object CMakeFiles/app1.dir/apps/app1/src/uart.c.o
[ 30%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_debug.c.o
[ 30%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal.c.o
[ 35%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_adc.c.o
[ 40%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_adc_swcal.c.o
[ 40%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_canbus.c.o
[ 45%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_clkgen.c.o
[ 45%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_dac.c.o
[ 50%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_dma.c.o
[ 50%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_ethernet.c.o
[ 55%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_i2c.c.o
[ 60%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_ioconfig.c.o
[ 60%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_irqrouter.c.o
[ 65%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_spi.c.o
[ 65%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_spw.c.o
[ 70%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_timer.c.o
[ 70%] Building C object CMakeFiles/app1.dir/common/drivers/src/va416xx_hal_uart.c.o
[ 75%] Building C object CMakeFiles/app1.dir/common/mcu/src/system_va416xx.c.o
[ 75%] Building C object CMakeFiles/app1.dir/common/utils/src/circular_buffer.c.o
[ 80%] Building C object CMakeFiles/app1.dir/common/utils/src/dac_sine.c.o
[ 85%] Building C object CMakeFiles/app1.dir/common/utils/src/segger_rtt.c.o
[ 85%] Building C object CMakeFiles/app1.dir/common/utils/src/segger_rtt_printf.c.o
[ 90%] Building C object CMakeFiles/app1.dir/common/utils/src/spi_fram.c.o
[ 90%] Building C object CMakeFiles/app1.dir/common/BSP/evk/src/evk_board.c.o
[ 95%] Building C object CMakeFiles/app1.dir/common/BSP/evk/src/i2c_adxl343.c.o
[ 95%] Building C object CMakeFiles/app1.dir/common/BSP/evk/src/i2c_lis2de12.c.o
[100%] Linking C executable app1.elf
Memory region         Used Size  Region Size  %age Used
           FLASH:       12120 B       256 KB      4.62%
             RAM:        4256 B        32 KB     12.99%
          CCMRAM:          0 GB        32 KB      0.00%
   text    data     bss     dec     hex filename
  11936     184    4080   16200    3f48 app1.elf
make[4]: Leaving directory `C:/proj/va416xx_gcc/build'
[100%] Built target app1
make[3]: Leaving directory `C:/proj/va416xx_gcc/build'
make[2]: Leaving directory `C:/proj/va416xx_gcc/build'
make[1]: Leaving directory `C:/proj/va416xx_gcc/build'
PS C:\proj\va416xx_gcc>
```

3.3 Running the new project

On the left-hand side of the IDE, click on the ‘Run and debug’ tab. In the Run and Debug dropdown menu, choose the ‘Jlink: app1 run in FRAM’ configuration:



JLink: blinky run in SRAM
JLink: blinky run in FRAM
JLink: app1 run in SRAM
JLink: app1 run in FRAM
JLink: freertos blinky run in SRAM
JLink: freertos blinky run in FRAM
JLink: demo run in SRAM
JLink: demo run in FRAM
JLink: bootloader run in SRAM
JLink: bootloader run in FRAM
JLink: loader debug
JLink: eraser
Node.js...
Add Configuration...

```
rxbuf: not avai
txbuf: not avai
numErrors: not
```

Next, click the green triangle to start the debug session. If in ‘run in FRAM’ mode, the code will be persistent and loaded into NVM on the board. If choosing a ‘run in SRAM’ configuration, the code will only be loaded into RAM and if the processor resets, the code stored in NVM will be booted instead after the reset. It is recommended to run from FRAM unless there is a specific reason to preserve the NVM contents.

4 Conclusion

By following this guide, a copy of the ‘blinky’ project has been made. This new project can be used as a basis for the user application by modifying / adding source files to the application folder. For a different application name, follow the above instructions but replace ‘app1’ with the desired project name. For a new freeRTOS project, follow the above steps but copy the freeRTOS_blinky project instead.