

Lesson 1

Introduction

Lecturer: Harvard Tseng

ARM is a Company

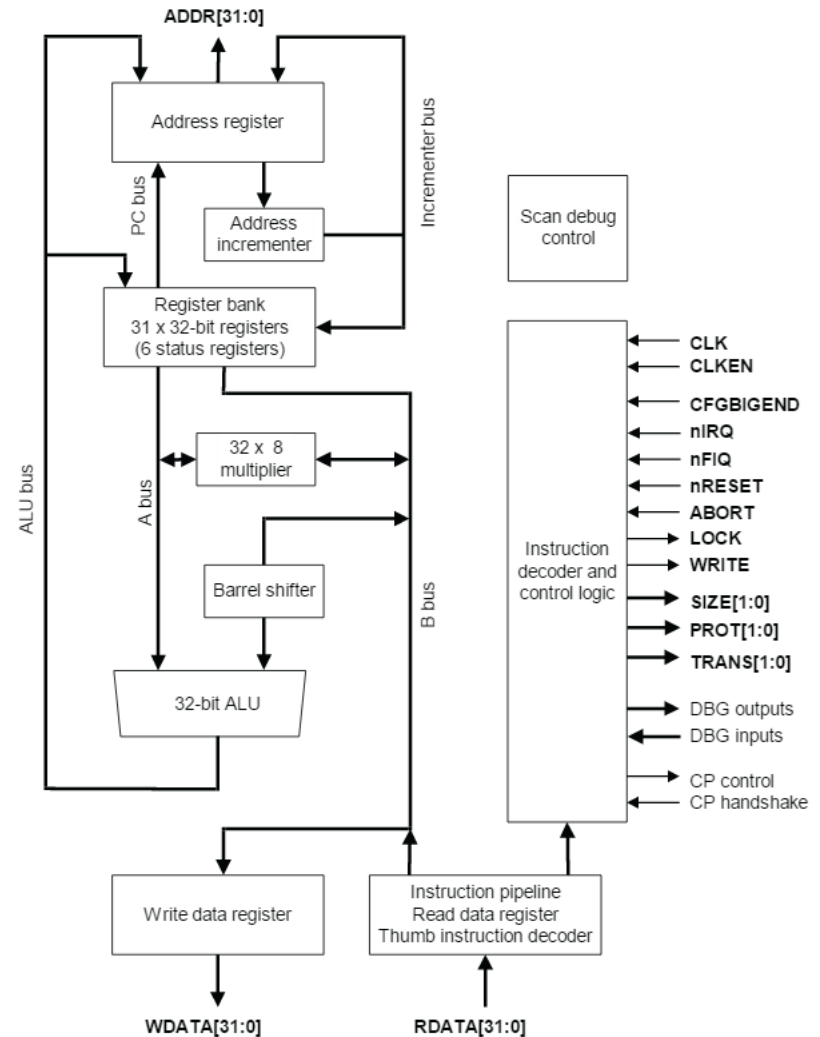


ARM Holding plc (ARM)

Founded	November 27, 1990
Headquarters	Cambridge, England, United Kingdom
Revenue	£968.3 million (2015)
Net income	£339.7 million (2015)
Website	arm.com

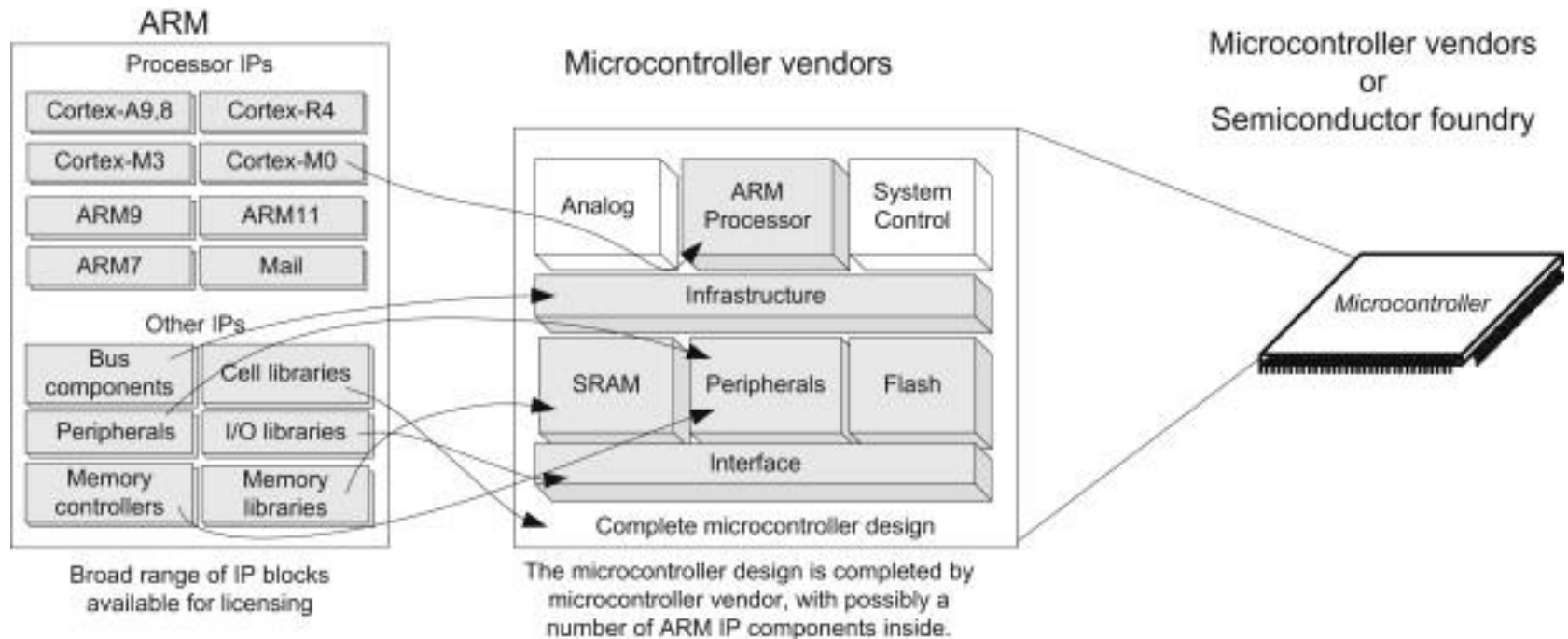
ARM is an Architecture of CPU

- Advanced RISC Machine



How ARM Earns Money?

- By intellectual property (IP) licensing.



Silicon Vendors

- Apple Inc.
- MediaTek Inc.
- Qualcomm Inc.
- ...



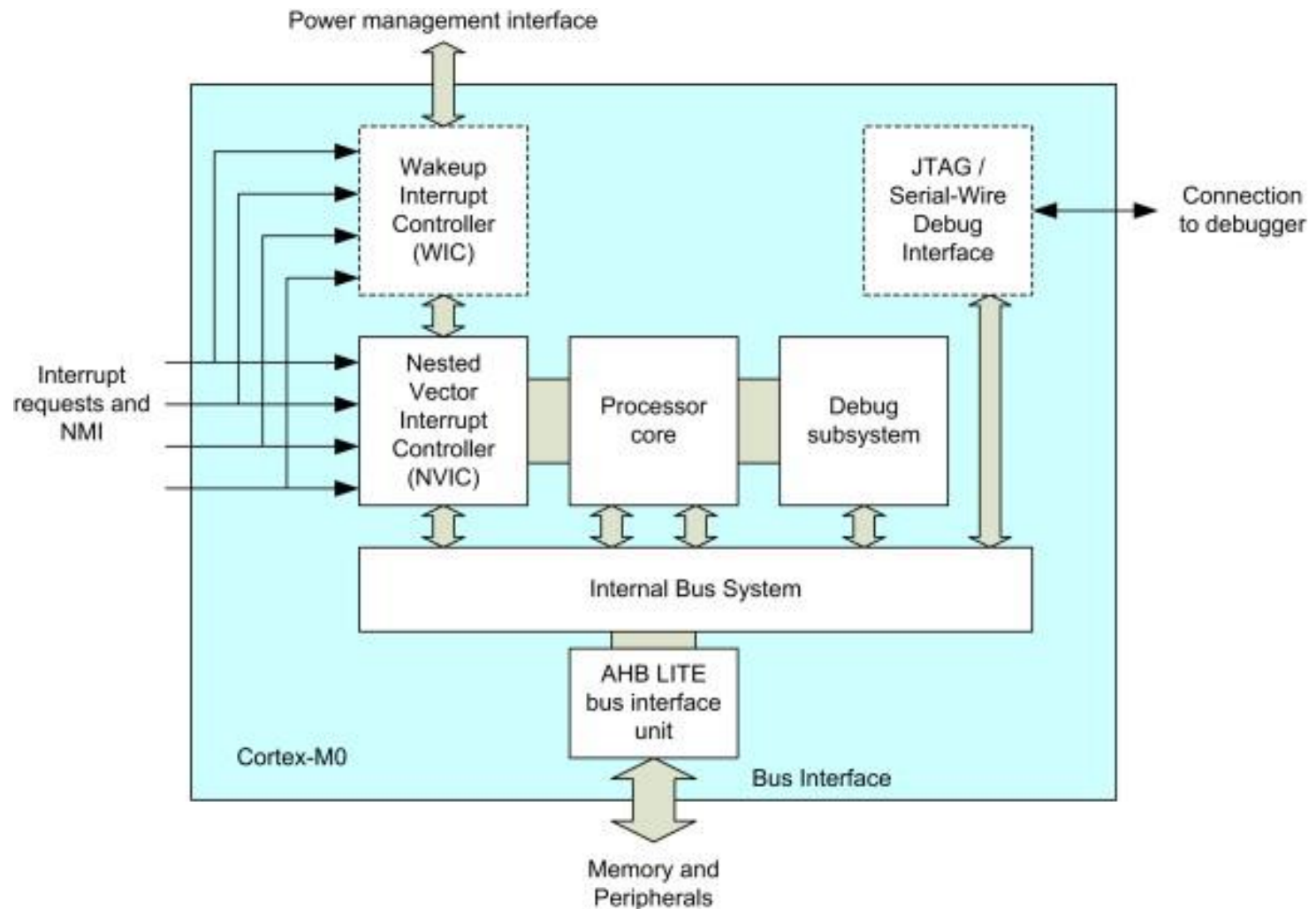
Microcontroller Vendors

- STMicroelectronics (ST)
- Texas Instruments Inc. (TI)
- NXP Semiconductors N.V. (NXP)
- ...



Cortex-M Series

Simplified Block Diagram

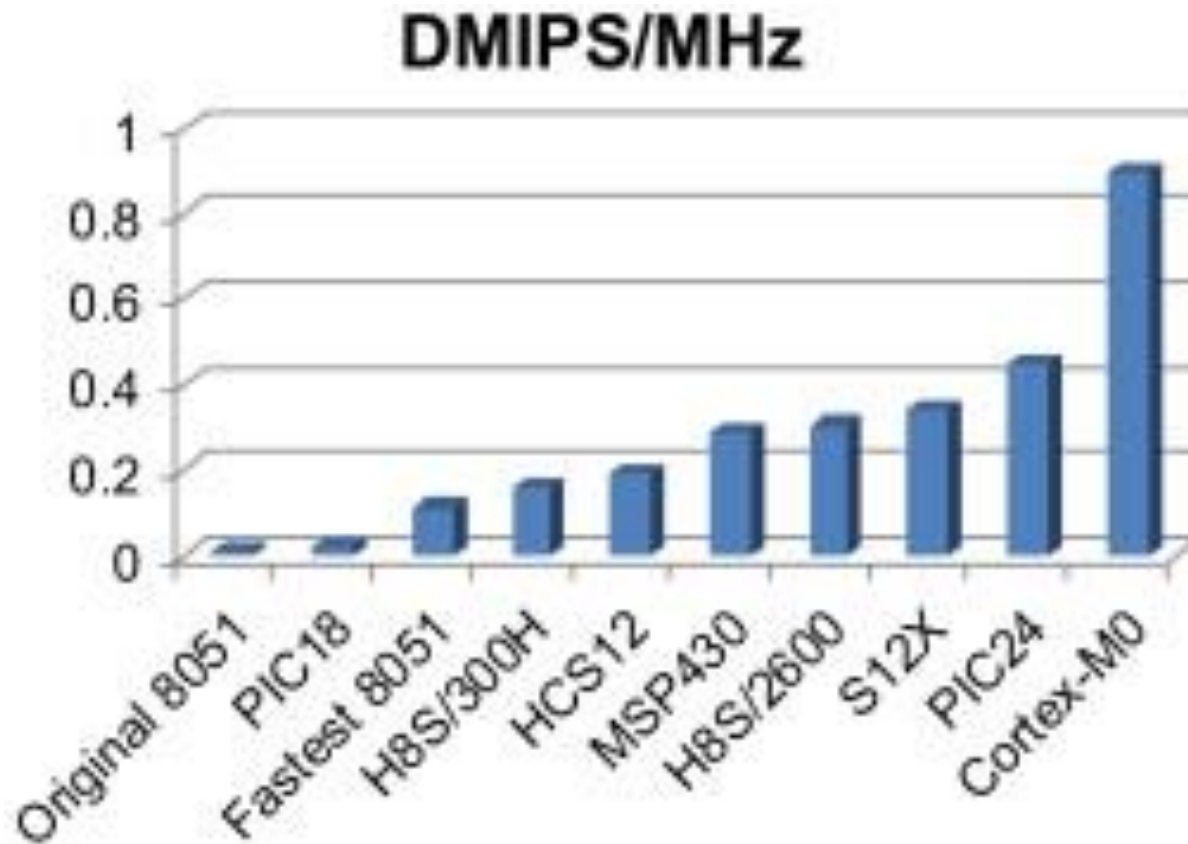


Advantages of the Cortex-M Processor

- Energy Efficiency
- Limitations in 8-Bit and 16-Bit Architectures
- Easy to Use, Software Portability
- Wide Range of Choices

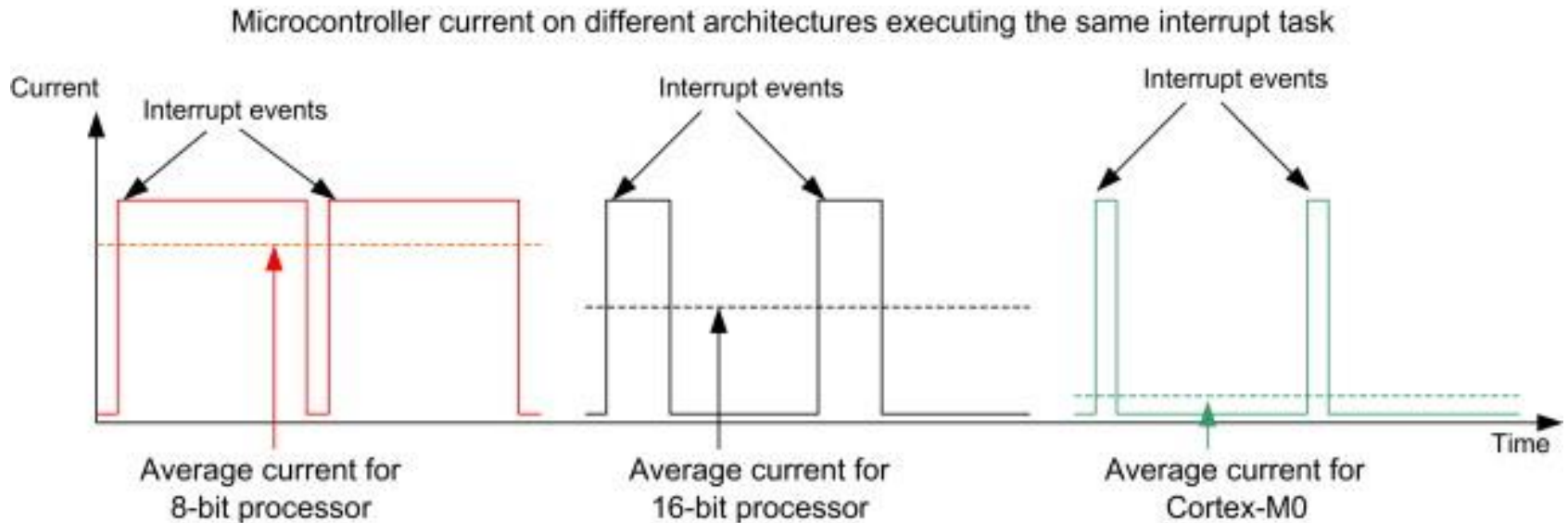
Why choose Cortex-M?

- High efficiency

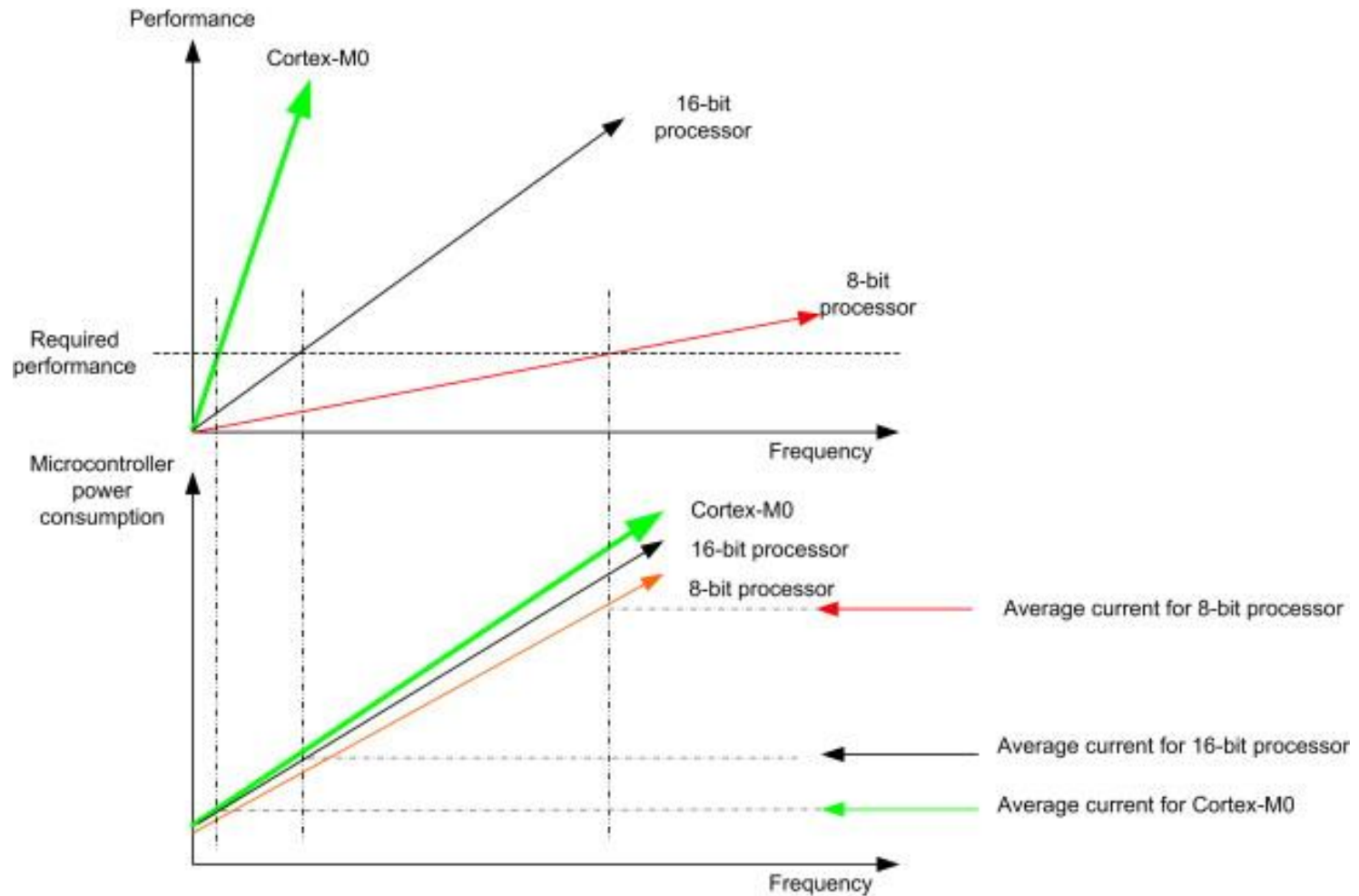


Why choose Cortex-M?

- Low-power features



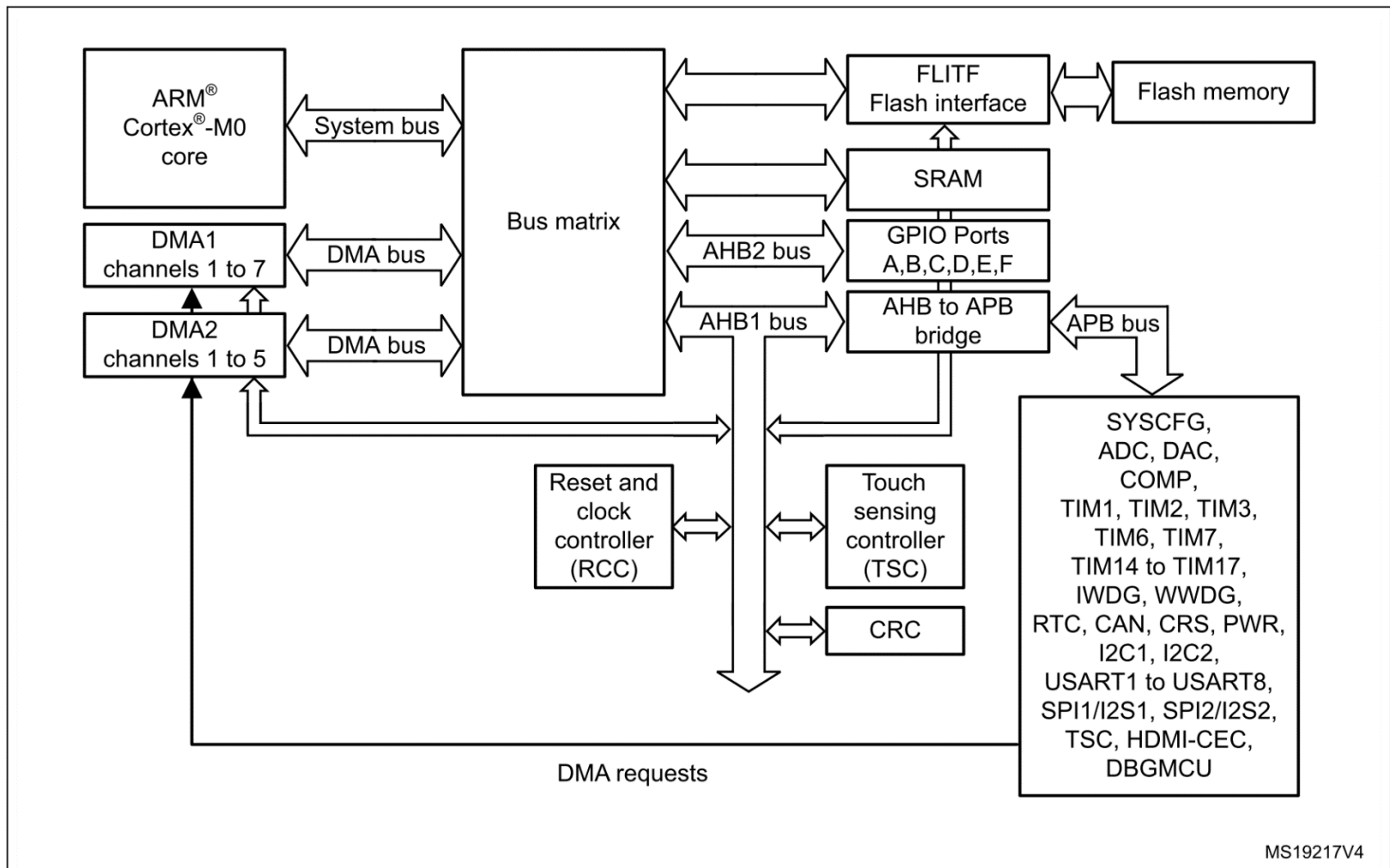
Why choose Cortex-M?

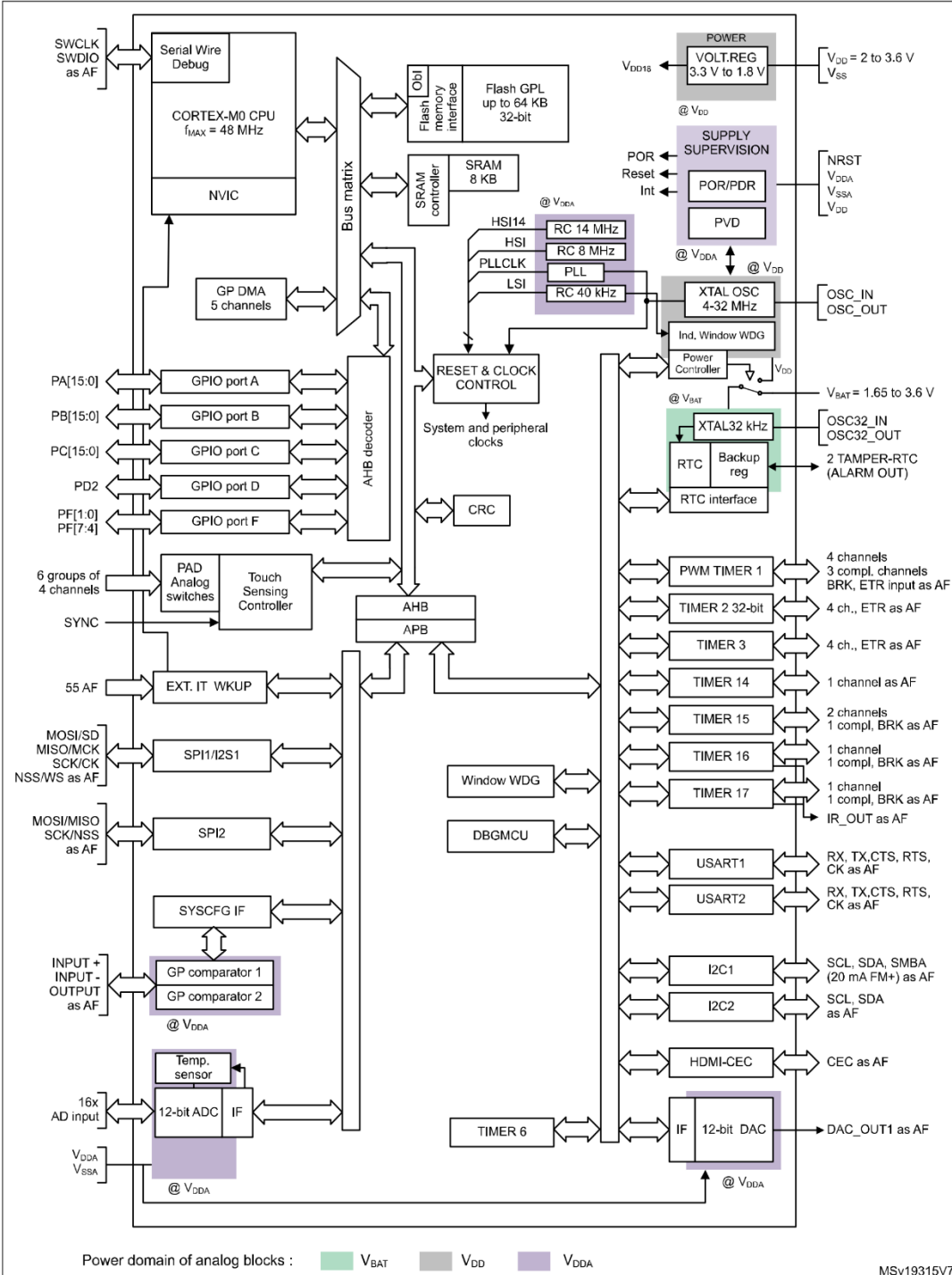


STM32F0x8

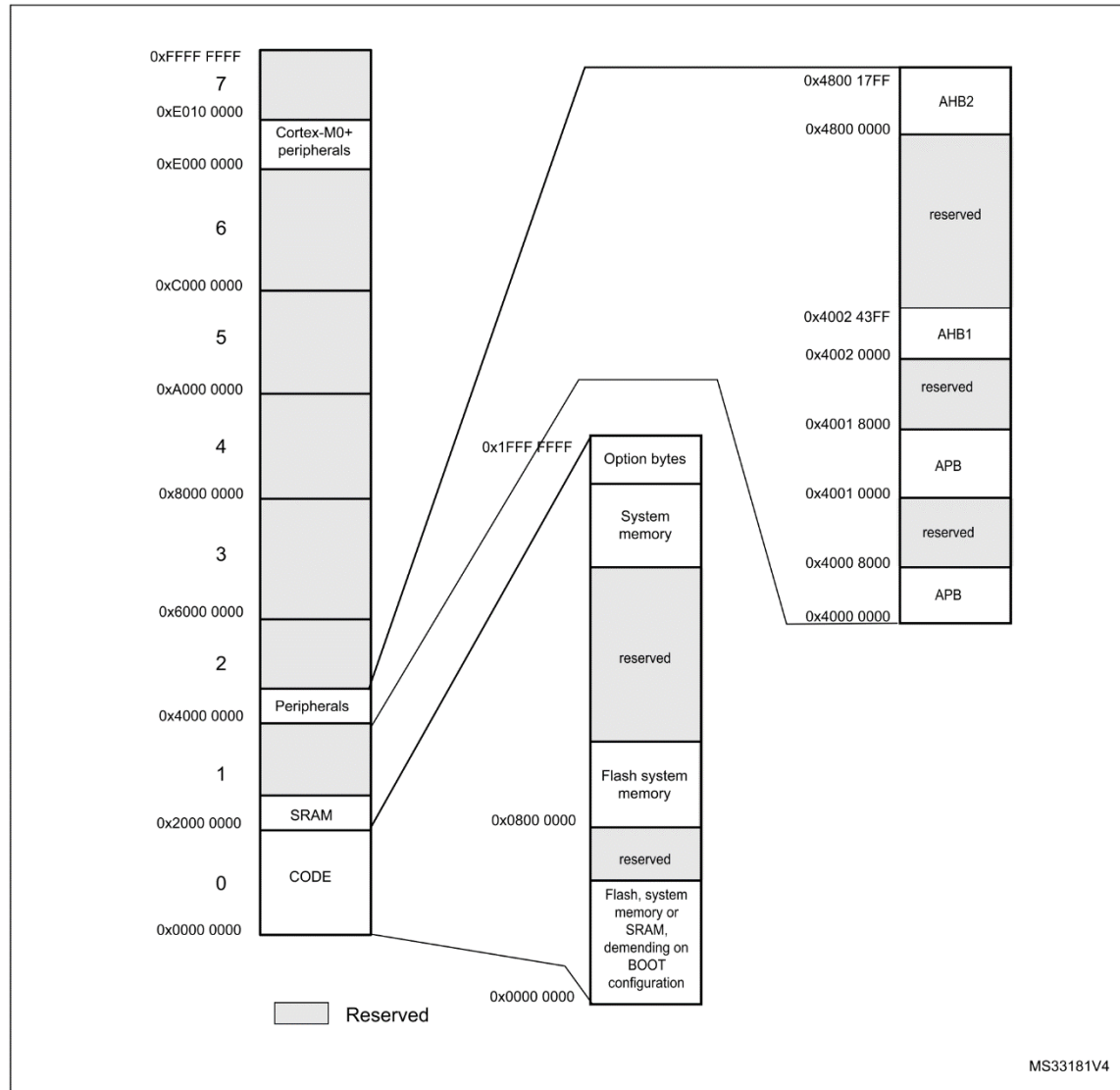
Advanced ARM®-based 32-bit MCUs

System Architecture





Memory Map



Reference Manual

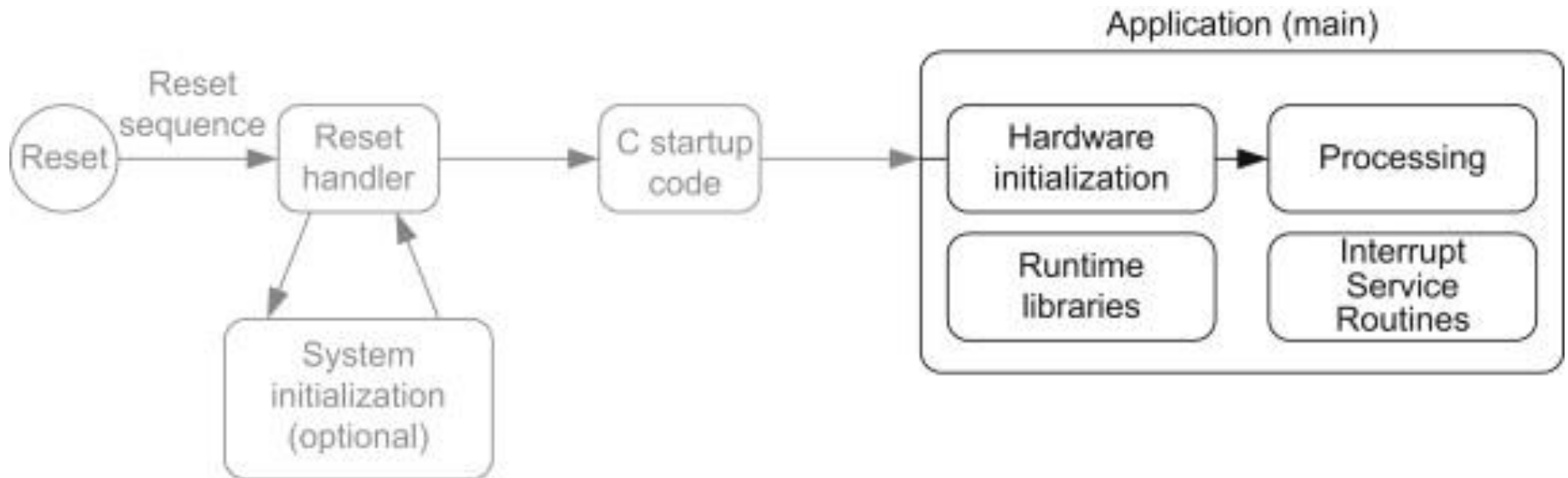
- Some MCU vendors call it datasheet
- [Download](#) (RM0091)

Cortex-M0 Programming

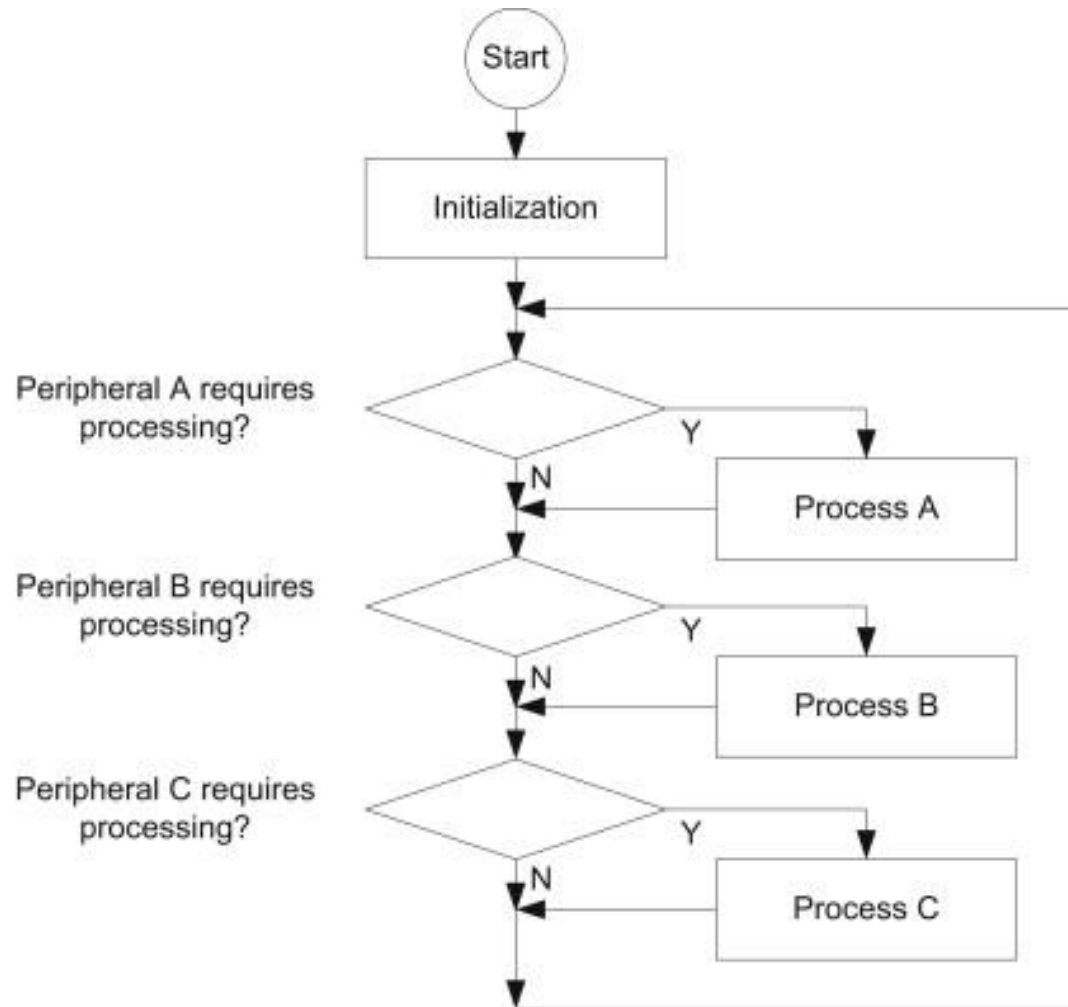
When a Microcontroller Starts

startup_stm32f0xx.s

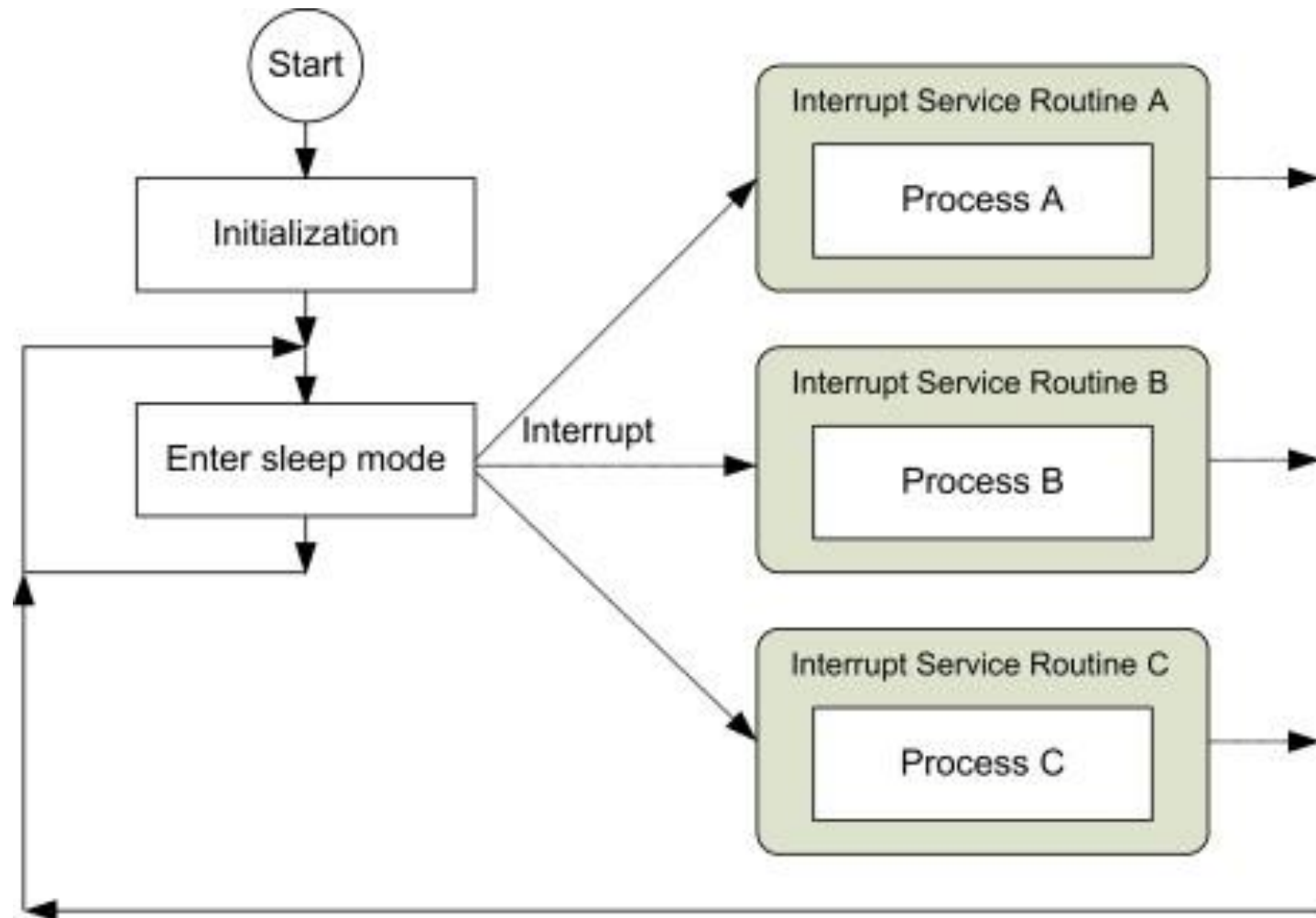
system_stm32f0xx.c



Polling



Interrupt Driven



IDE

Integrated Development Environment

Development Toolchain

- IAR EWARM

- 30-day evaluation edition

- 32-Kbyte Limited QuickStart edition (16-Kbyte limitation for Cortex M0)



- Keil MDK-ARM

- MDK-Lite (32-Kbyte code size limitation)



- ARMmbed

- Free Online Development Tools



- GCC-based IDE

What do IDE Contain?

- C/C++ compilers
- Debuggers

Keil MDK Version 5 Development Kit



Step1. Install IDE

- Download from [website](#).

MDK Editions

MDK is available in various editions. [Compare Editions >](#)

MDK-Lite

Product evaluation, small projects, and education. Code size restricted to 32 Kbyte.

[Learn more >](#)

 [Download & Install](#)

MDK-Cortex-M

For ARM Cortex-M based microcontroller projects.

[Learn more >](#)

 [Request a Quote](#)

MDK-Plus

For Cortex-M, ARM7, ARM9.
Includes middleware (IPv4 Networking, USB Device, File System, Graphics).

[Learn more >](#)

 [Request a Quote](#)

MDK-Professional

For Cortex-M, Cortex-A, ARM7, ARM9. Includes middleware (IPv4/IPv6 Networking, USB Host & Device, File System, Graphics, mbed components).

[Learn more >](#)

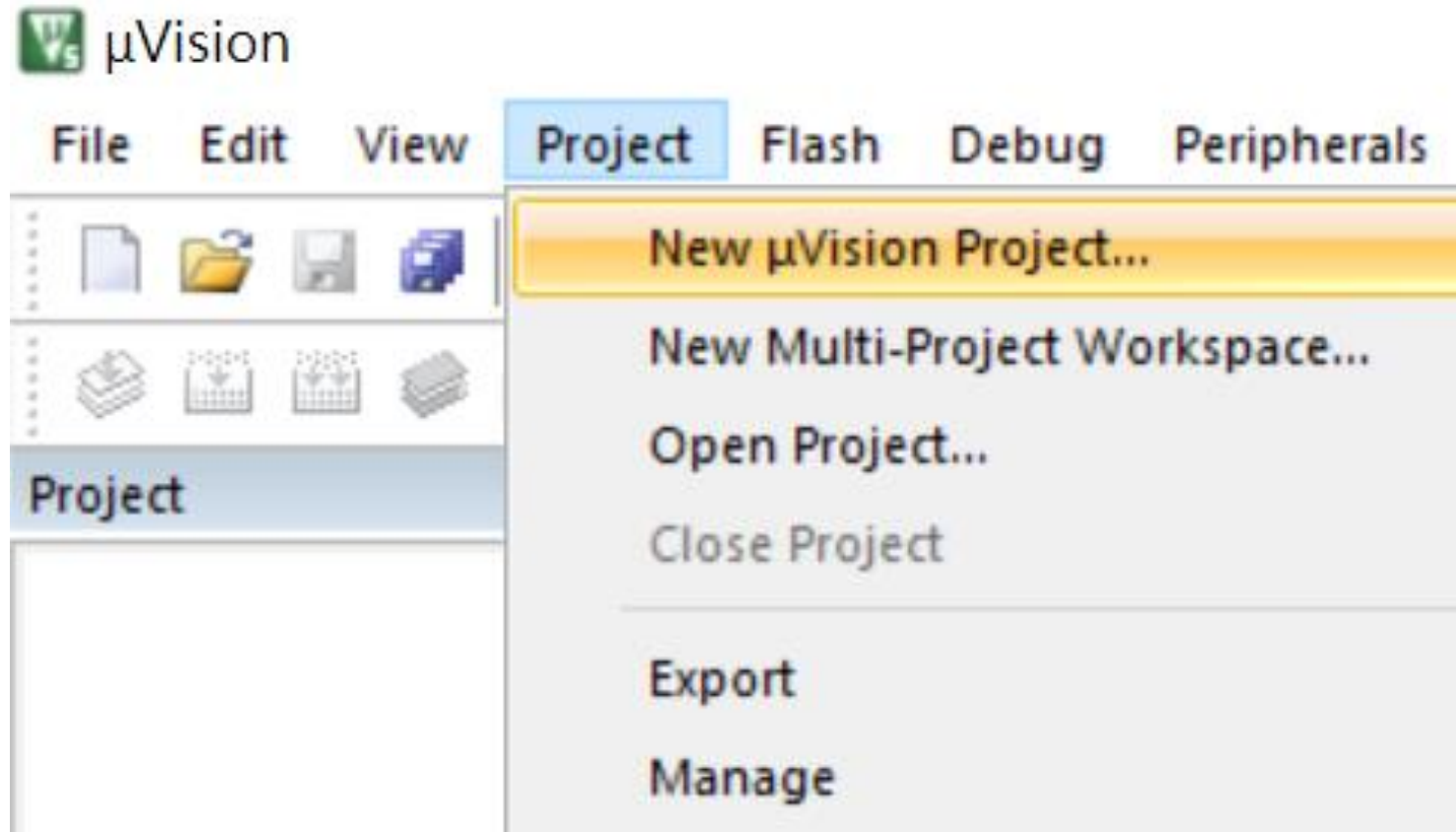
 [Request a Quote](#)

Step2. Install Software Packs

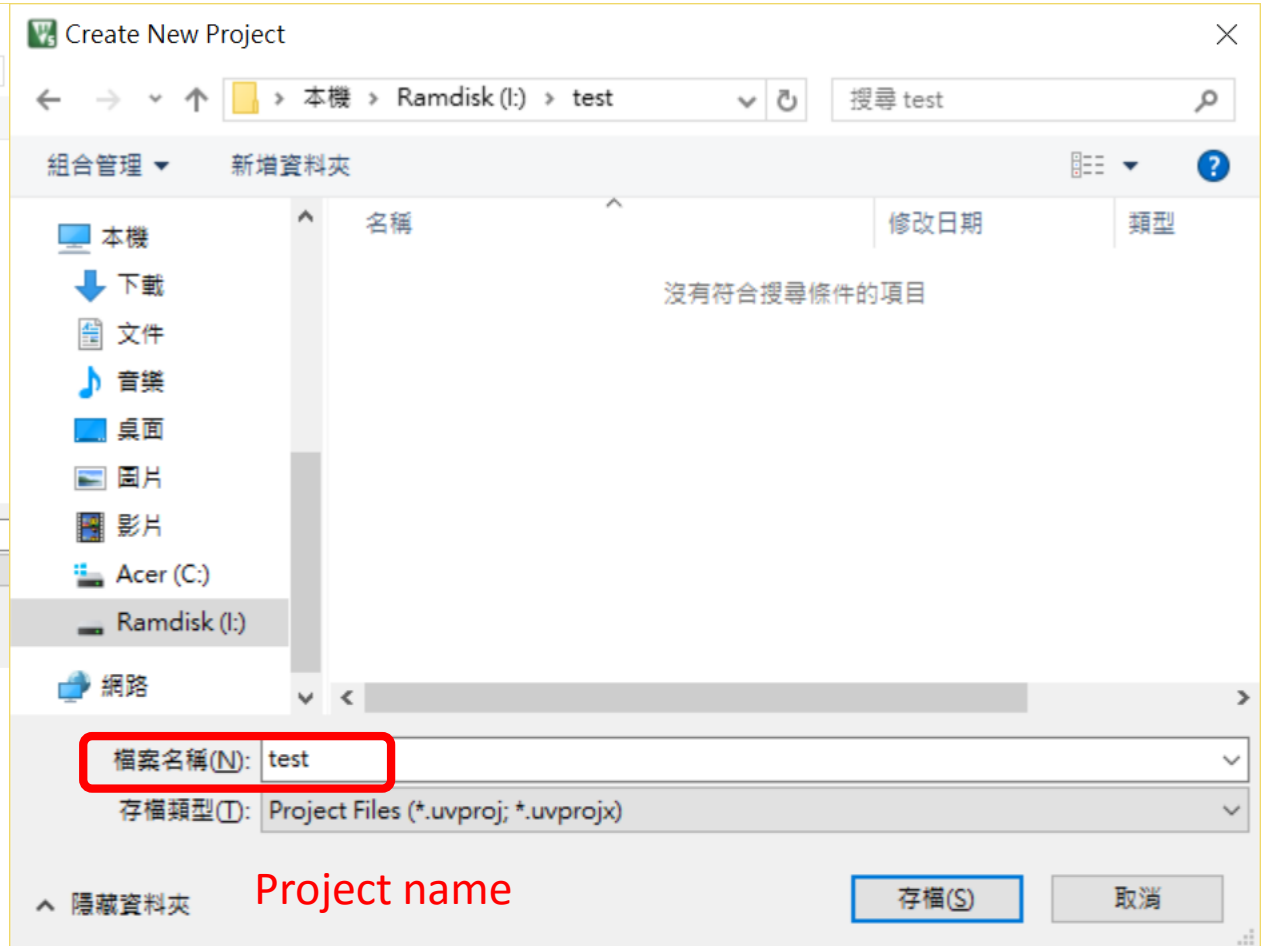
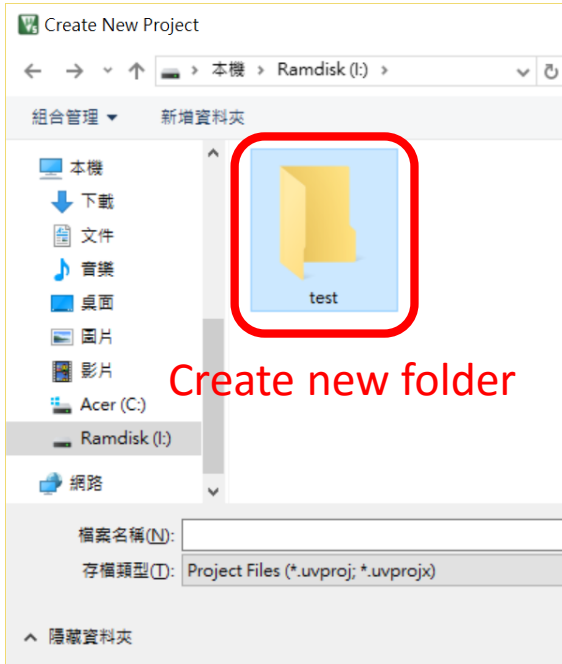
- Download from [website](#).

➤ STMicroelectronics Nucleo Boards Support and Examples	BSP	1.6.0	⬇
➤ STMicroelectronics STM32F0 Series Device Support and Examples	BSP	DFP 1.5.0	⬇
➤ STMicroelectronics STM32F1 Series Device Support, Drivers and Examples	BSP	DFP 2.1.0	⬇
➤ STMicroelectronics STM32F2 Series Device Support, Drivers and Examples	BSP	DFP 2.6.0	⬇
➤ STMicroelectronics STM32F3 Series Device Support and Examples	BSP	DFP 1.3.0	⬇
➤ STMicroelectronics STM32F4 Series Device Support, Drivers and Examples	BSP	DFP 2.9.0	⬇
➤ STMicroelectronics STM32F7 Series Device Support, Drivers and Examples	BSP	DFP 2.7.0	⬇
➤ STMicroelectronics STM32L0 Series Device Support and Examples	BSP	DFP 1.6.0	⬇
➤ STMicroelectronics STM32L1 Series Device Support and Examples	DFP	1.0.2	⬇
➤ STMicroelectronics STM32L4 Series Device Support, Drivers and Examples	BSP	DFP 1.2.0	⬇

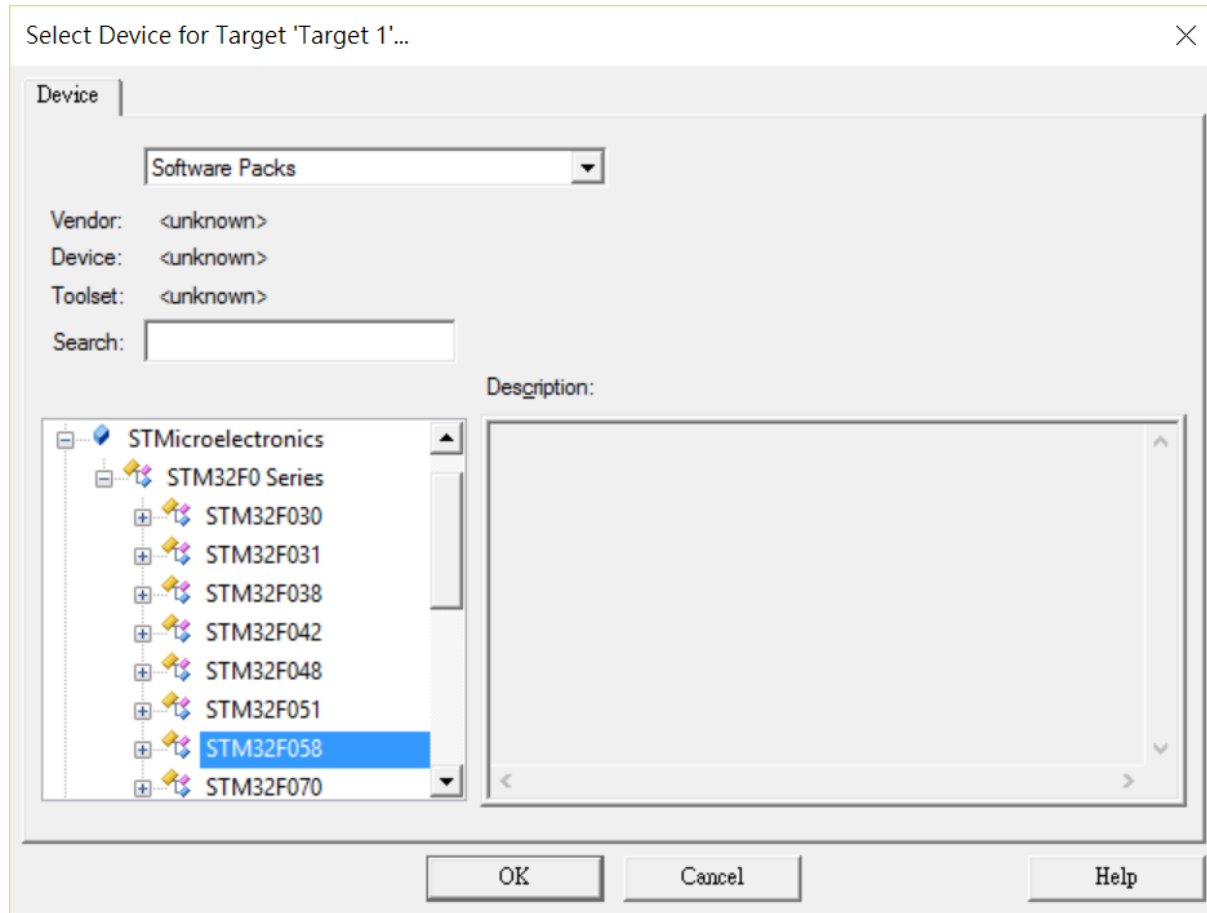
Step3. Create a New Project



Step3. Create a New Project



Step4. Select Device



Step5. Add Software Component

Manage Run-Time Environment

Software Component

- CMSIS
 - CORE
 - DSP
 - RTOS (API)
- CMSIS Driver
- Compiler
- Device
- Startup
- File System
- Graphics
- Network
- USB

Sel.	Variant	Version	Description
<input type="checkbox"/>			Cortex Microcontroller Software Interface Components
<input checked="" type="checkbox"/>		4.3.0	CMSIS-CORE for Cortex-M, SC000, and SC300
<input type="checkbox"/>		1.4.6	CMSIS-DSP Library for Cortex-M, SC000, and SC300
<input type="checkbox"/>		1.0	CMSIS-RTOS API for Cortex-M, SC000, and SC300
			Unified Device Drivers compliant to CMSIS-Driver Specifications
			ARM Compiler Software Extensions
			Startup, System Setup
<input checked="" type="checkbox"/>		2.2.3	System Startup for STMicroelectronics STM32F058xx Devices
	MDK-Pro	6.7.0	File Access on various storage devices
	MDK-Pro	5.32.2	User Interface on graphical LCD displays
	MDK-Pro	7.1.0	IPv4/IPv6 Networking using Ethernet or Serial protocols
	MDK-Pro	6.7.0	USB Communication with various device classes

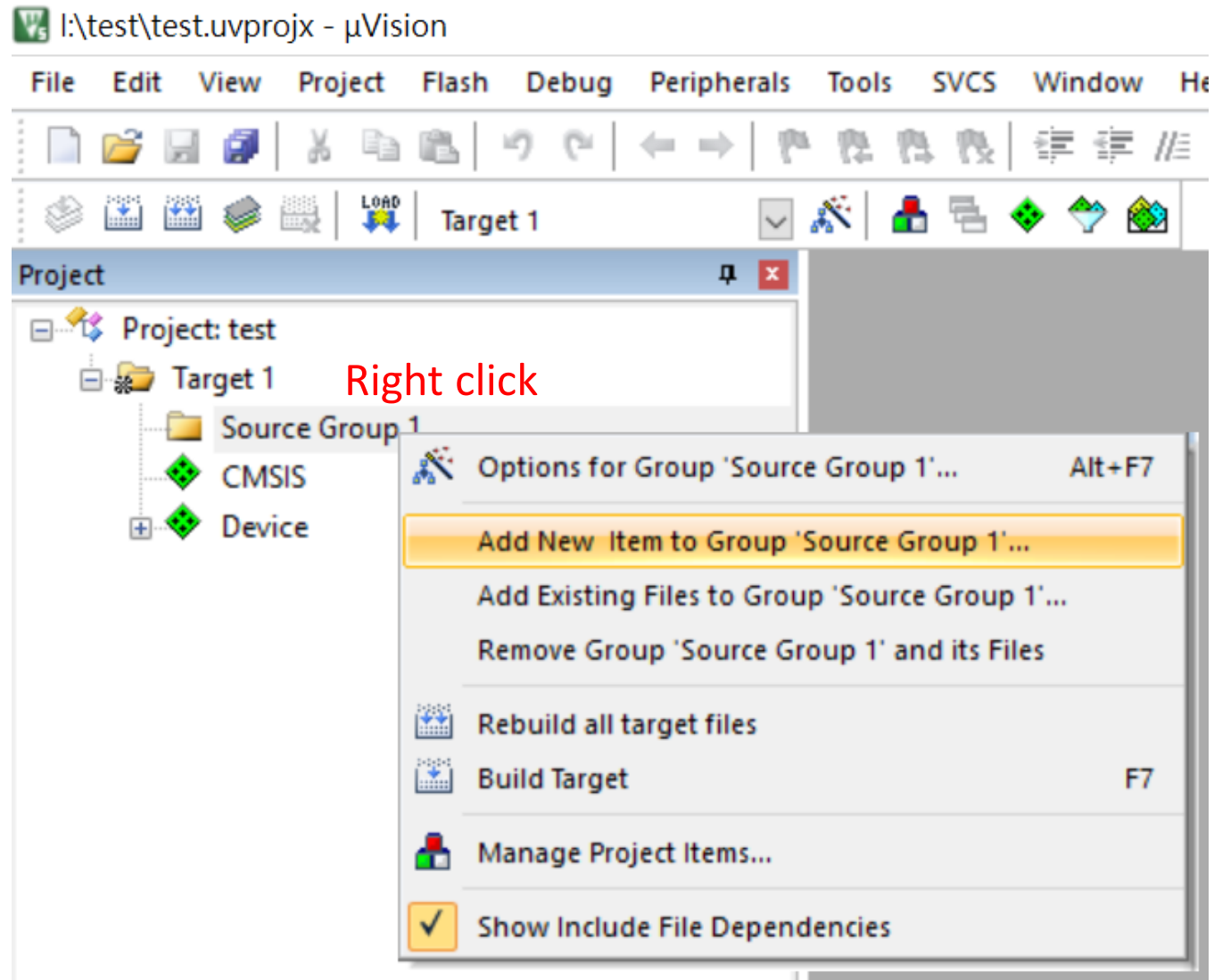
Select these two

core_cmx.h

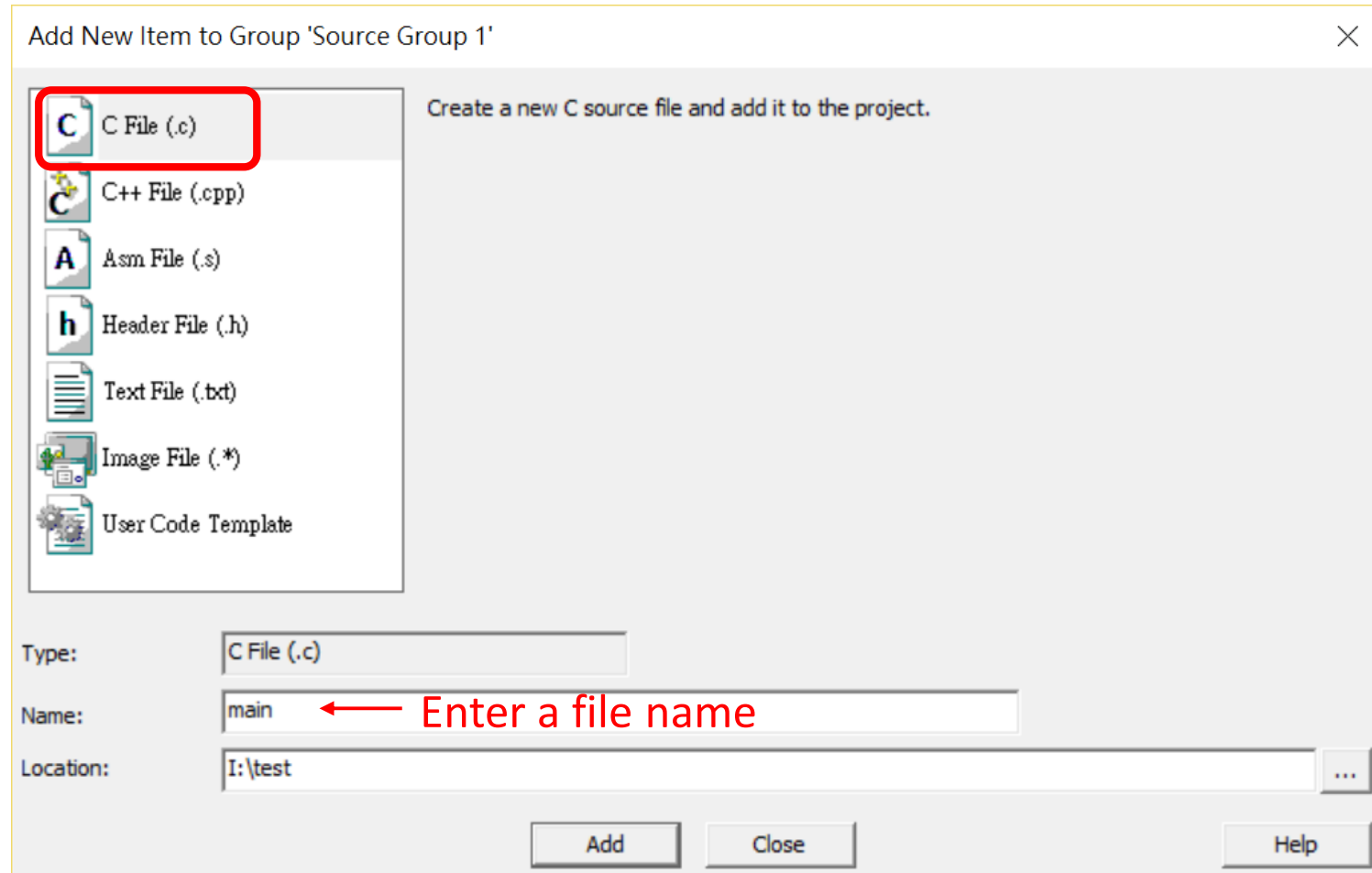
startup_<device>.s

system_<device>.c

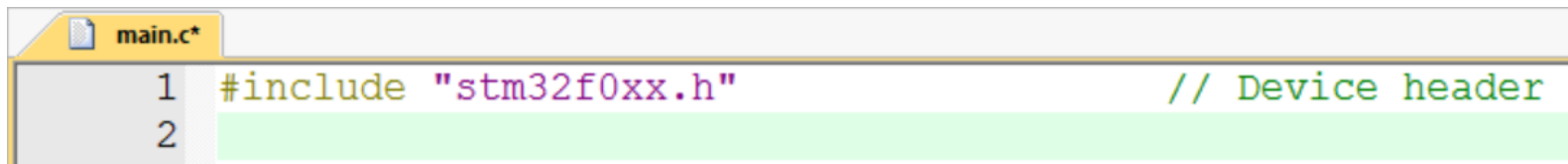
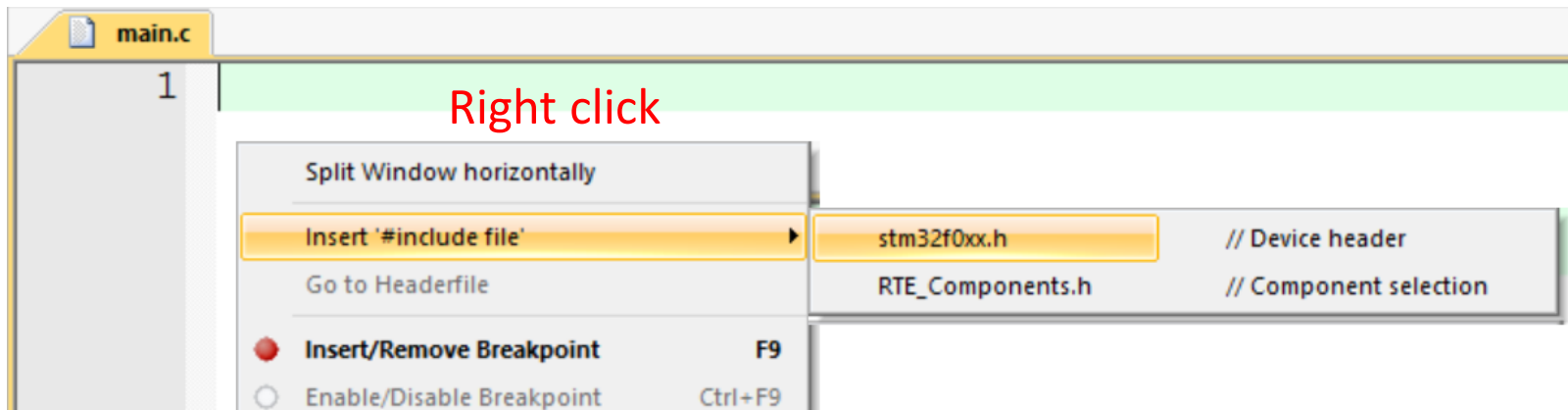
Step6. Add main.c



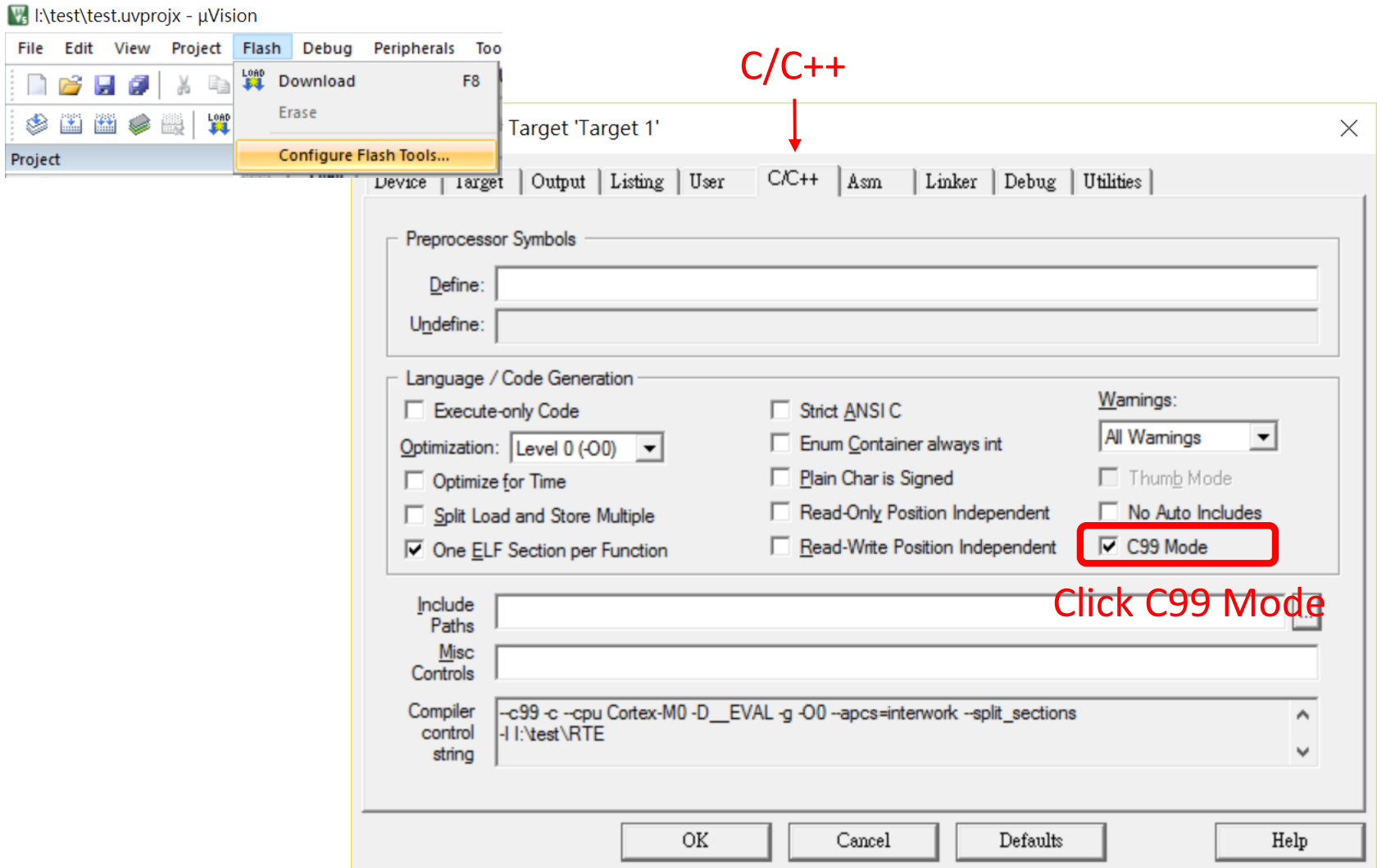
Step6. Add main.c



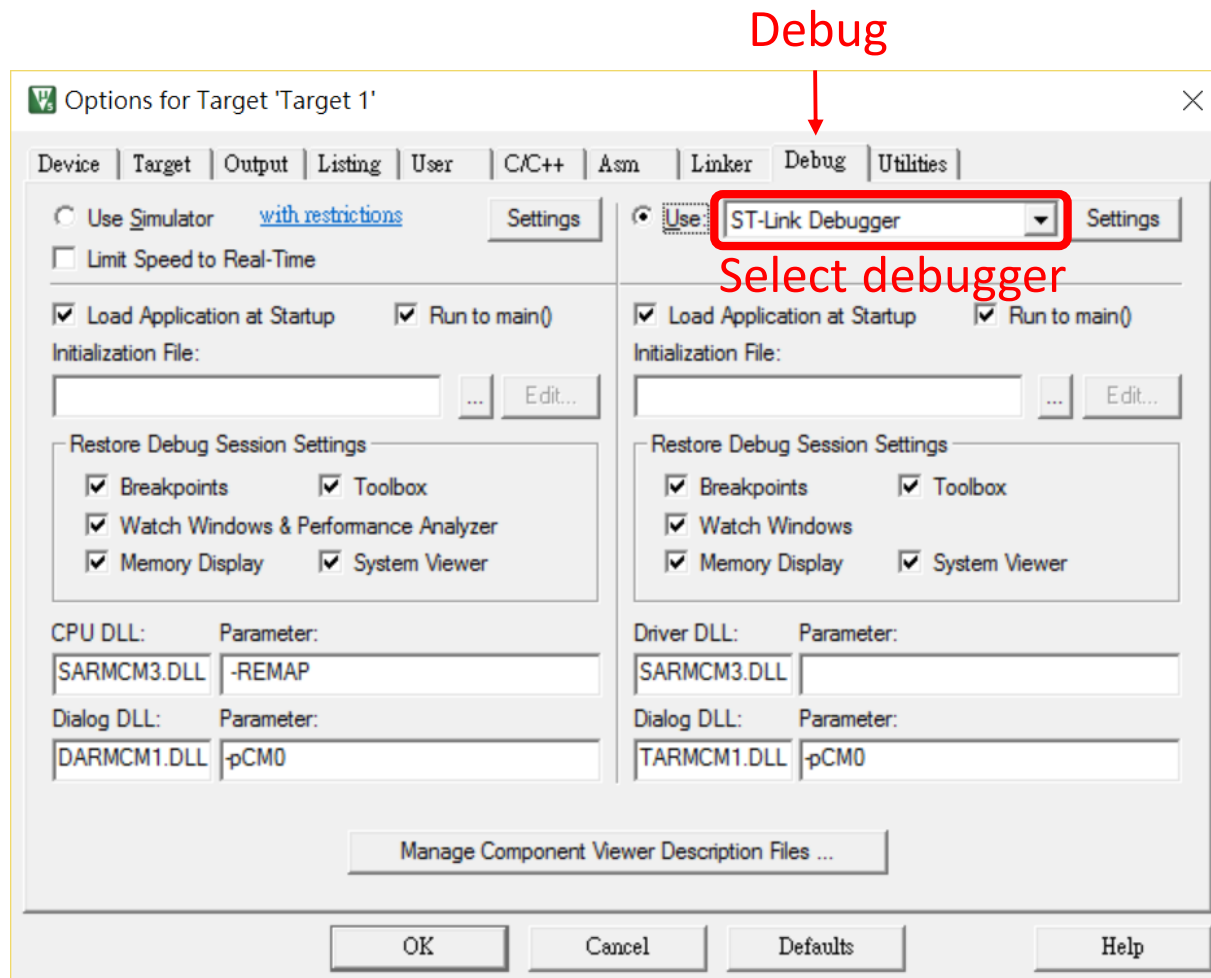
Step7. Include Device Header



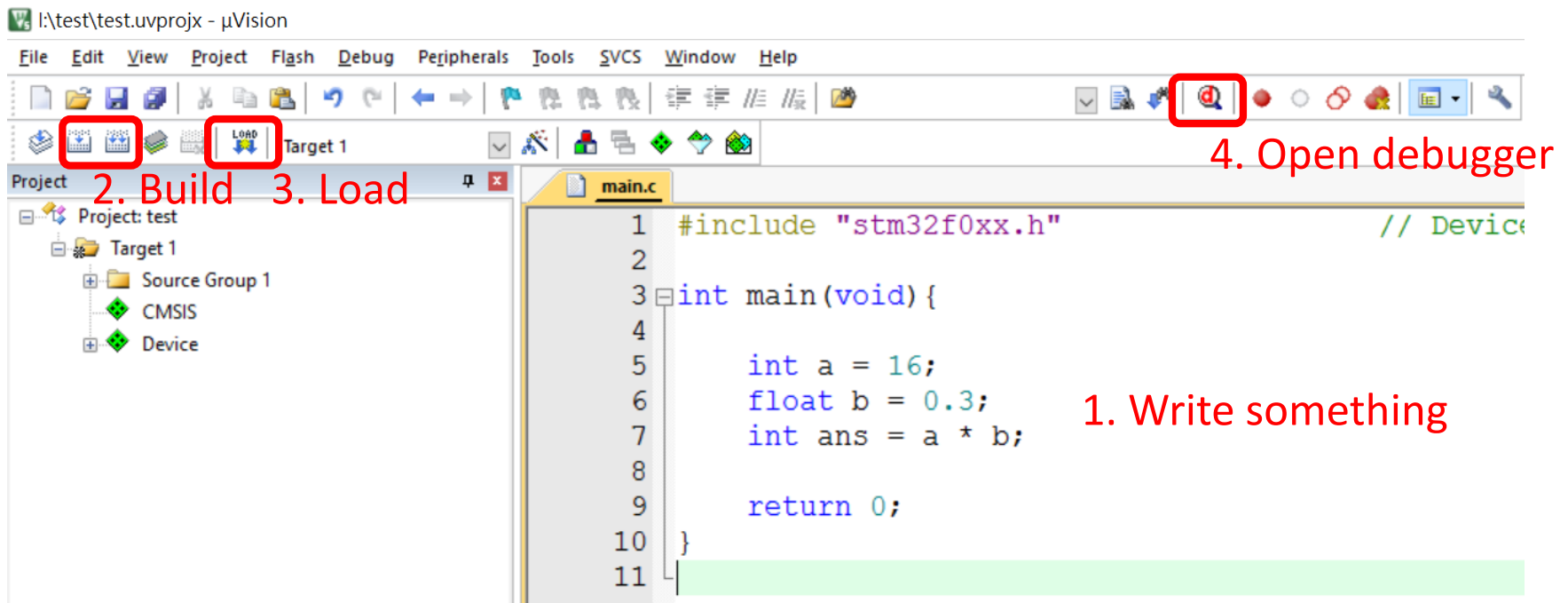
Step8. Configure Flash



Step8. Configure Flash



Step9. Test



Install Debugger USB Driver

- If your board debugger doesn't work, download from [website](#).

Home › Embedded Software › Development Tool Software › **STSW-LINK009**

STSW-LINK009 ACTIVE

ST-Link, ST-Link/V2, ST-Link/V2-1 USB driver signed for XP, Windows7, Windows8

 Download Databrief

QUICK VIEW

DESIGN

GET SOFTWARE



Exercise

Do it back home.

Basic C Operator

```
main.c
1  #include "stm32f0xx.h"
2
3  int a = 3, b = 6, ans;
4  int main(void) {
5      while(1) {
6          ans = a + b;
7          ans = a - b;
8          ans = a * b;
9          ans = a / b;
10         ans = a % b;
11         ans = a | b;
12         ans = a & b;
13         ans = a ^ b;
14         ans = ~ans;
15     }
16     return 0;
17 }
18
```


Use Debugger

- Review answer step by step.
- Monitor the variable you want.
- Set break points.