Embedded Systems Course - Demystifying microcontroller start-up and reset concepts

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Table of contents

Table of contents

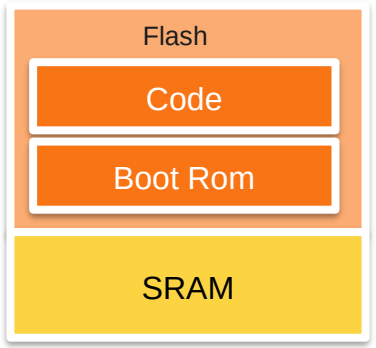
Terminologies related to CPU start-up

- Boot Firmware/Start-up software
  - Boot Firmware is the first instruction sequence that is executed immediately after the reset. This prepares the hardware, for generic application needs of targeted domain where the controller is being used. The execution control is then passed to the application startup code.

- Boot Rom
  - Read Only memory where the boot firmware is located. The firmware is flashed onto the boot rom during fabrication process.

- Reset Vector/Start address
  - The start address of the application start-up code. Provided by silicon or board vendor.
  - Application Startup code further initializes the C environment. Example: Bss init and data copy

- Application software
  - Main() ☺



Generic Microcontroller Start-up flow

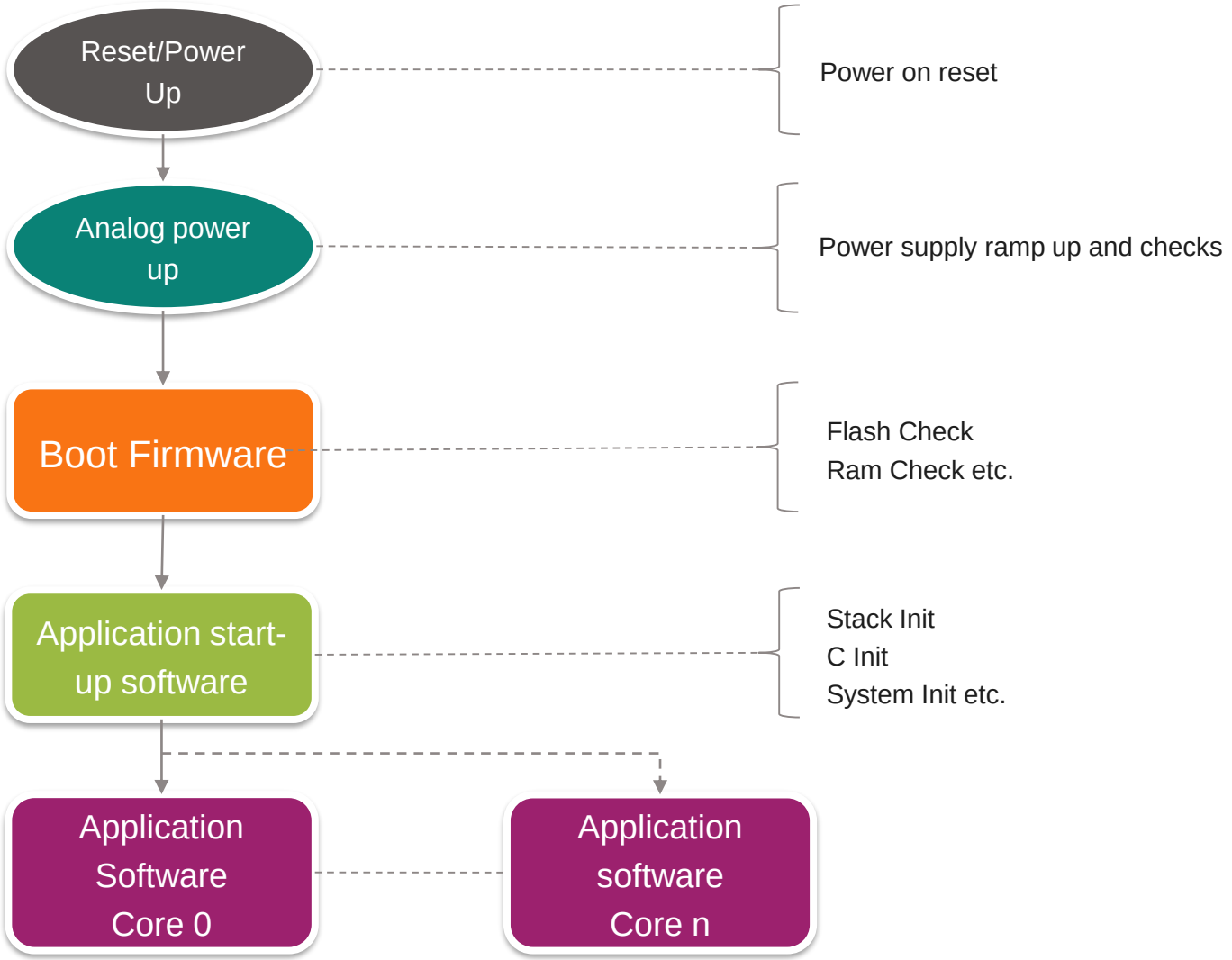
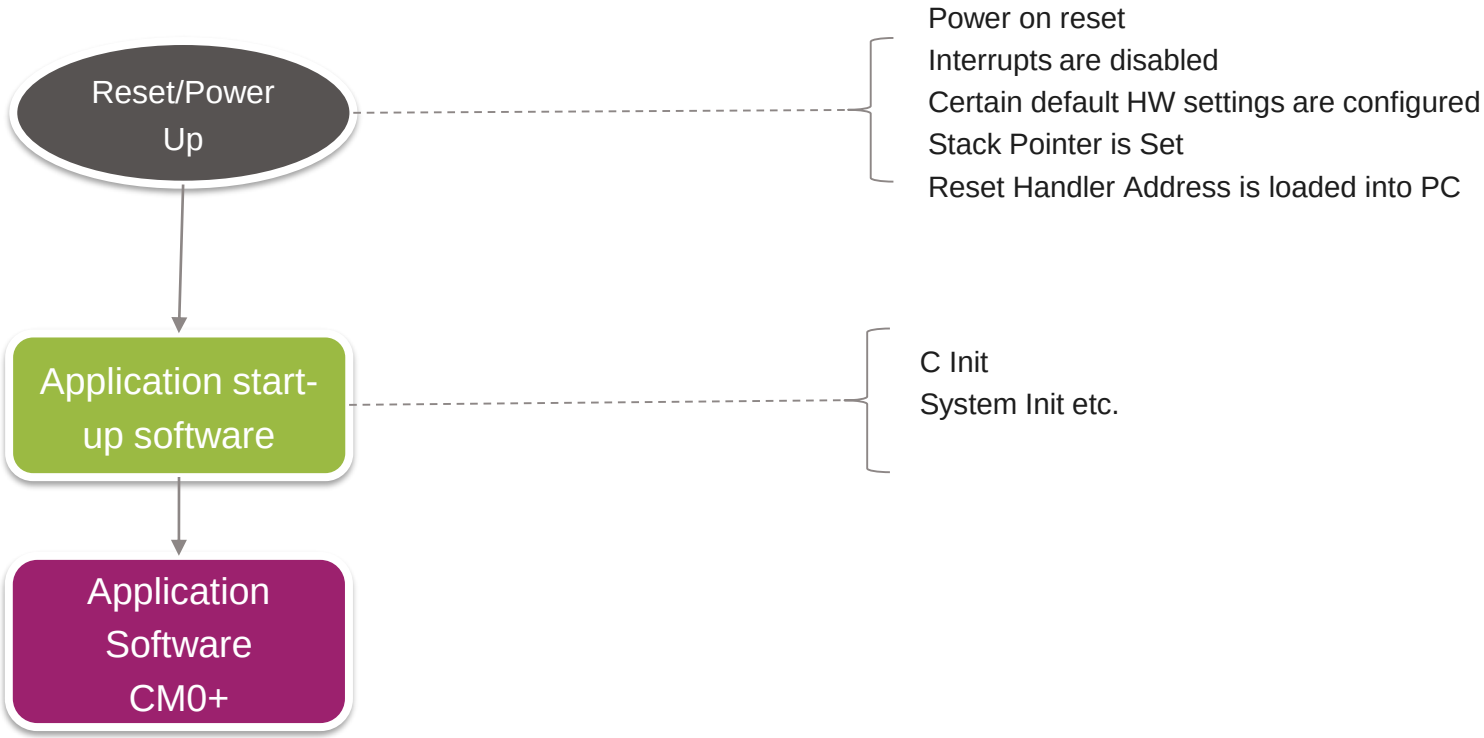
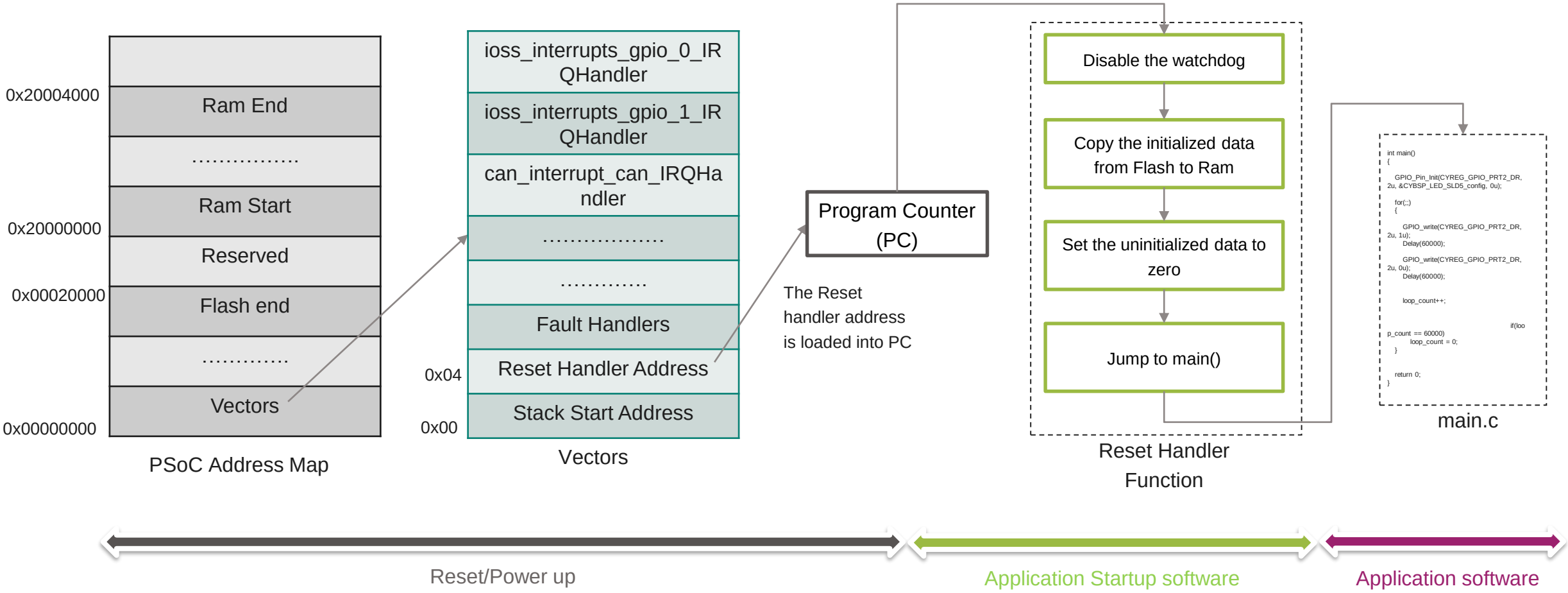


Table of contents

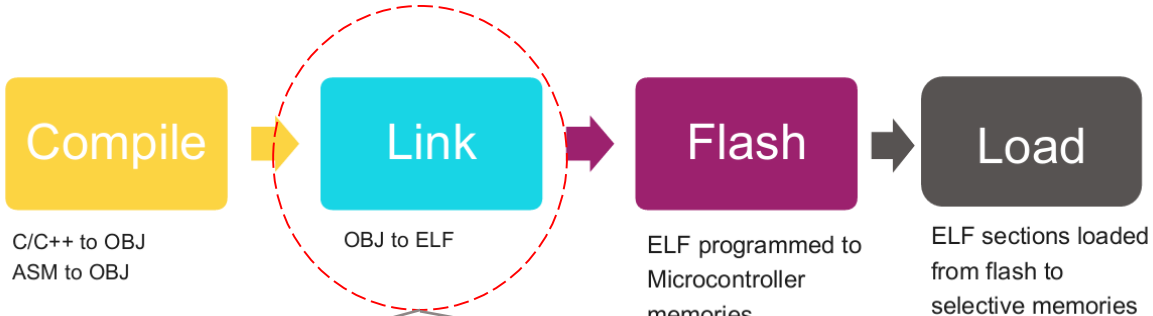
PSoC® Start-up flow



PSoC® Start-up flow



Weak and Strong Symbols/Functions



Strong Symbols

sourceFile1.c

```
/* Strong Symbol */

unsigned int strong_var = 10;
```

sourceFile2.c

```
/* Strong Symbol */

unsigned int strong_var = 10;
```

Weak Symbols

sourceFile1.c

```
/* Weak Symbol */

unsigned int __attribute__((weak)) weak_var = 10;
```

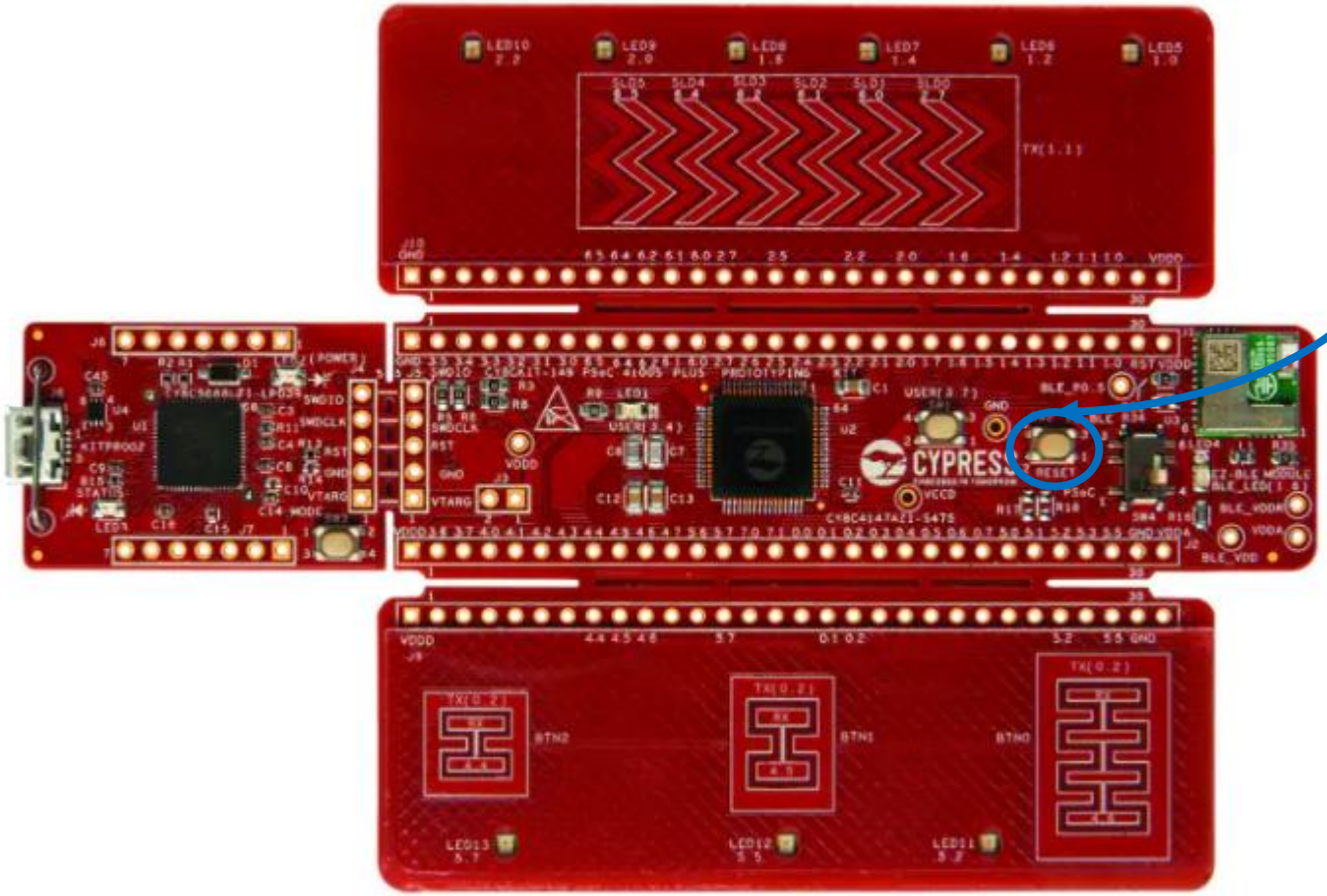
sourceFile2.c

```
/* Strong Symbol */

unsigned int weak_var = 100;
```

Table of contents

What does this Button do ?



What is a Reset ?

Known State

Safe State

Register	Default Value
RegA	0x11
RegB	0x00
RegC	0xAA
RegD	0x23

Register	Default Value
RegA	0x11
RegB	0x00
RegC	0xA**B**
RegD	0x23

Register	Default Value
RegA	0x11
RegB	0x00
RegC	0xA**A**
RegD	0x23

Types of Reset

Cold Reset

Register	Default Value
RegA	0x11
RegB	0x00
RegC	0xAA
RegD	0x23

Register	Run Time Value
RegA	0x15
RegB	0x28
RegC	0xAC
RegD	0x23

Register	Run Time Value
RegA	0x15
RegB	0x28
RegC	0xAD
RegD	0x23

Register	Post Reset Value
RegA	0x11
RegB	0x00
RegC	0xAA
RegD	0x23

Warm Reset

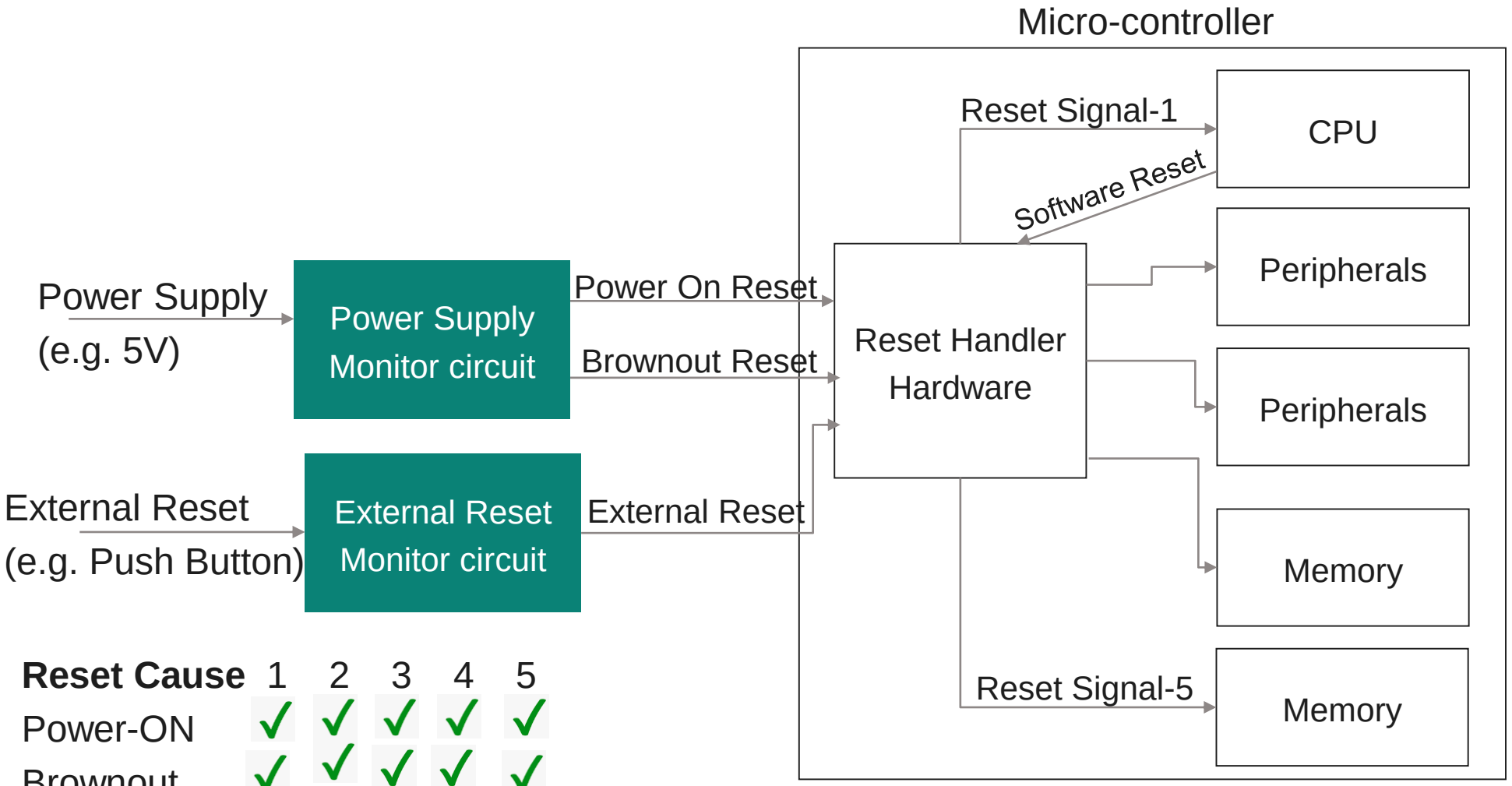
Register	Default Value
RegA	0x11
RegB	0x00
RegC	0xAA
RegD	0x23

Register	Run Time Value
RegA	0x15
RegB	0x28
RegC	0xAC
RegD	0x23

Register	Run Time Value
RegA	0x15
RegB	0x28
RegC	0xAD
RegD	0x23

Register	Post Reset Value
RegA	0x15
RegB	0x28
RegC	0xAA
RegD	0x23

A pictorial view of Reset signal handling



Reset Cause	1	2	3	4	5
Power-ON	✓	✓	✓	✓	✓
Brownout	✓	✓	✓	✓	✓
External	✓		✓		
Software	✓				

This table is an example. The architect of your MCU may decide differently than what is shown here.

Types of Reset in PSoC®

- Power-on reset (POR)
  - to hold the device in reset while the power supply ramps up
- Brownout reset (BOD)
  - to reset the device if the power supply falls below specifications during operation
- Watchdog reset (WRES)
  - to reset the device if firmware execution fails to service the watchdog timer
- Software initiated reset (SRES)
  - to reset the device on demand using firmware
  - Include example to trigger software reset and read the cause register
- External reset (XRES)
  - to reset the device using an external electrical signal
- Protection fault reset (PROT_FAULT)
  - to reset the device if unauthorized operating conditions occur


Infineon