

Getting Started with KL46 freedom board

<Training Topic /Lesson Name>



Lesson Objectives

- *Introduce about the FRD-KL46Z boards and its peripherals*
- *Introduce about the Keil uVision IDE*

Section 1

Hardware

- *Selecting a Hardware*
- *What documents and what to learn*

- *Compatibility*
- *Memory*
- *Available*
- *Power*
- *Cost*
- *Development toolset*
- *Support development*

What documents and what to learn

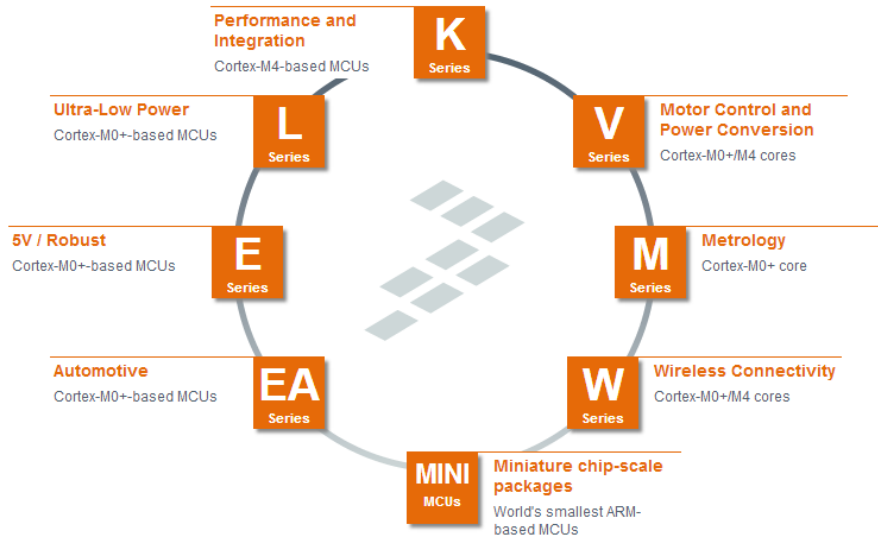
- *Datasheet*
- *User's Manual*
- *Reference Manual*
- *Schematic*
- *Sample Code*
- ...

Section 2

FRDM-KL46Z Overview

- *Freescall Introduction*
- *Kinetis Series MCUs*
- *FRDM-KL46Z*

- *Freescale is a leader in embedded processing solutions for the automotive, consumer, industrial and networking markets.*
- *2010: Freescale announced more than 200 ultra-low-power 32-bit Kinetis MCU. It represents the most scalable portfolio of ARM® Cortex™ microprocessors in the industry with comprehensive enablement for consumer and industrial applications.*



Kinetis L Series MCUs

- World's most energy-efficient ARM-based MCUs
- Up to 48 MHz performance
- 8KB – 256 KB Flash
- Up to 32 KB RAM
- Low power timers and smart peripherals



Figure 2. FRDM-KL46Z main components placement.

- *The FRDM-KL46Z is an ultra-low-cost development platform.*
- *Features include easy access to MCU I/O, battery-ready, low-power operation, a standard-based form factor with expansion board options and a built-in debug interface for flash programming and run-control.*

References:

- *FRDM-KL46Z User's Manual*
- *KL46 Sub-Family Reference Manual*
- *FRDM-KL46Z Schematic*
- *FRDM-KL46 Sample Code*

([FRDM-KL46Z|Freedom Development Platform|Kinetis® MCU | NXP Semiconductors](#))

Section 3

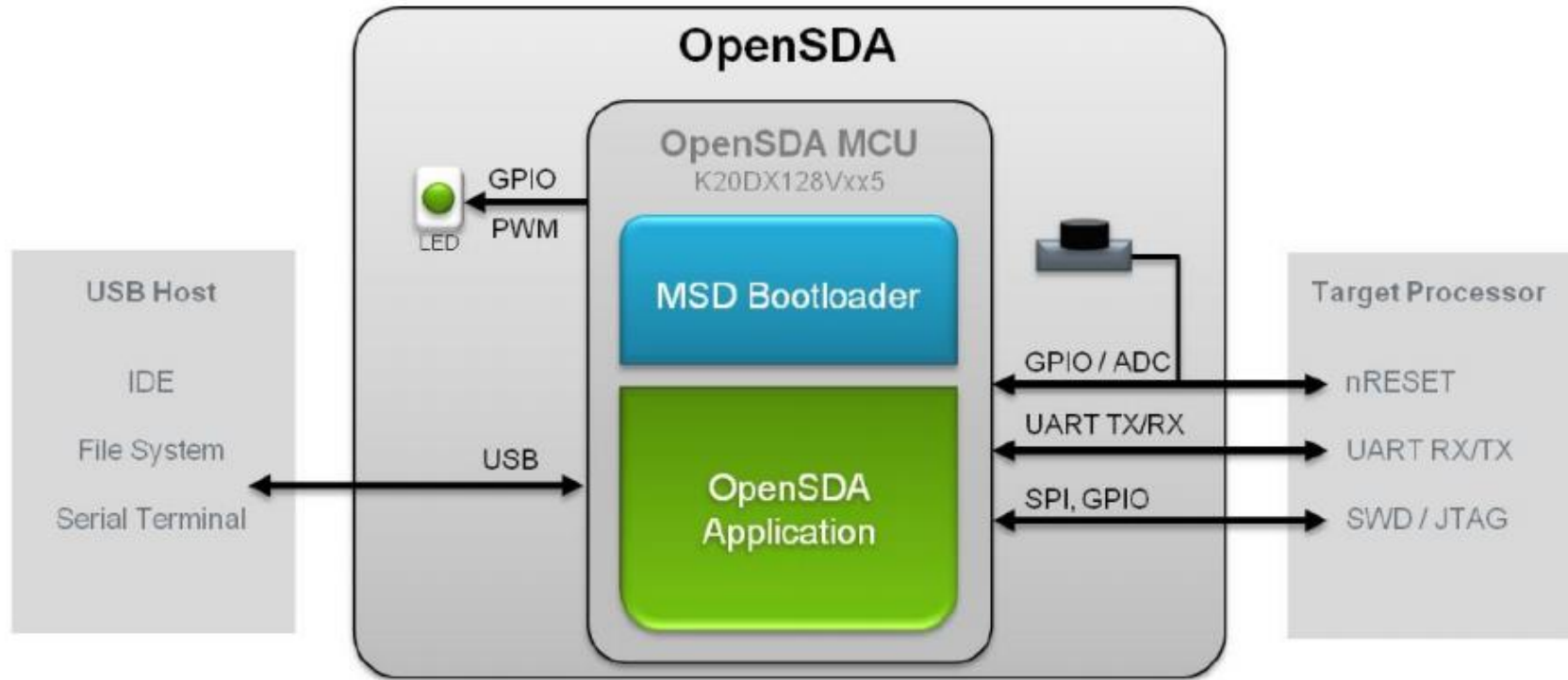
FRDM-KL46Z Hardware Description

- *Components*
- *OpenSDA*
- *MKL46Z4 Microcontroller*

- *Power Supply*
- *OpenSDA*
- *MKL46Z4 Microcontroller*
- *Clock source*
- *USB Interface*
- *Serial Port*
- *Reset*
- *Debug*
- *Segment LCD*
- *Capacitive Touch Slider*
- *Three-axis Accelerometer*
- *Three-axis Digital Magnetometer*
- *LEDs*
- *Visible light sensor*
- *Input/Output Connector*



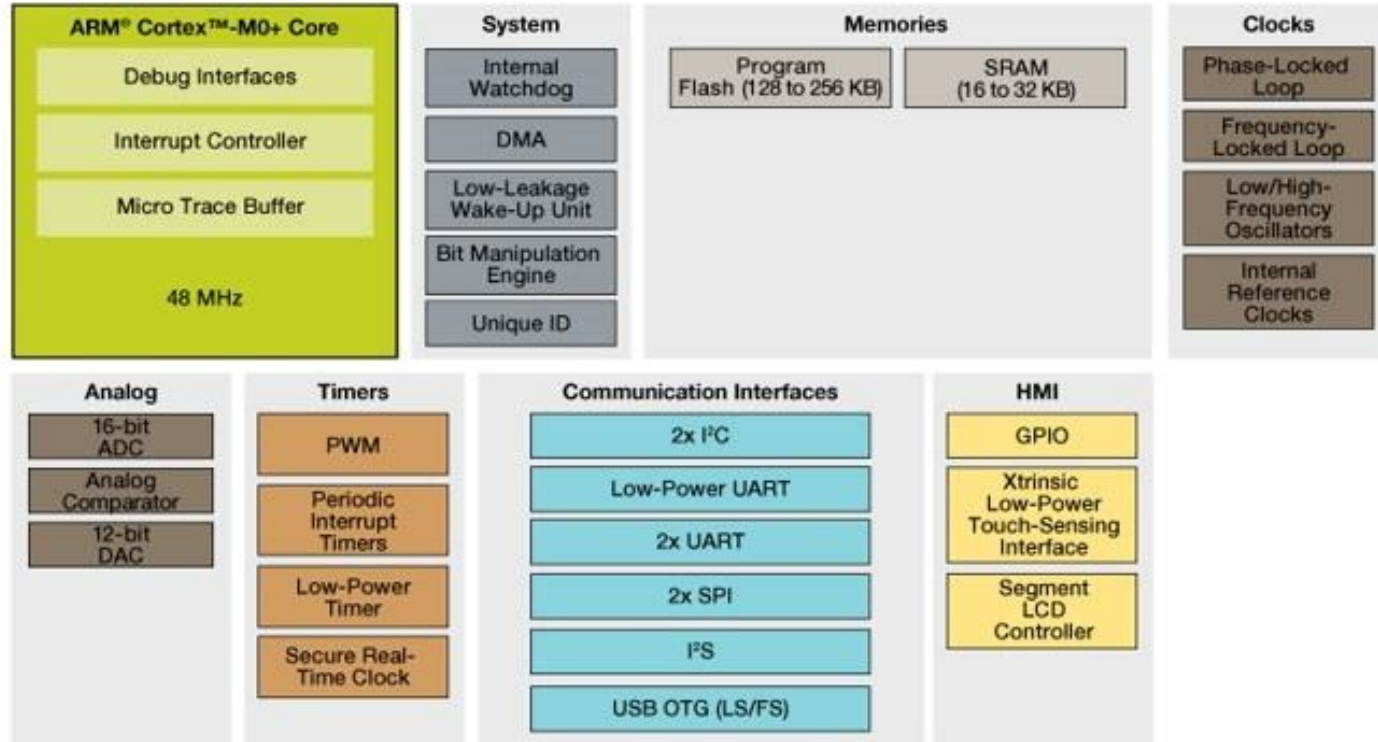
Figure 2. FRDM-KL46Z main components placement.



OpenSDA High-Level Block Diagram

MKL46Z4 Microcontroller

KL4x Family Block Diagram



Section 4

Development Tool chain Overview (KEIL)

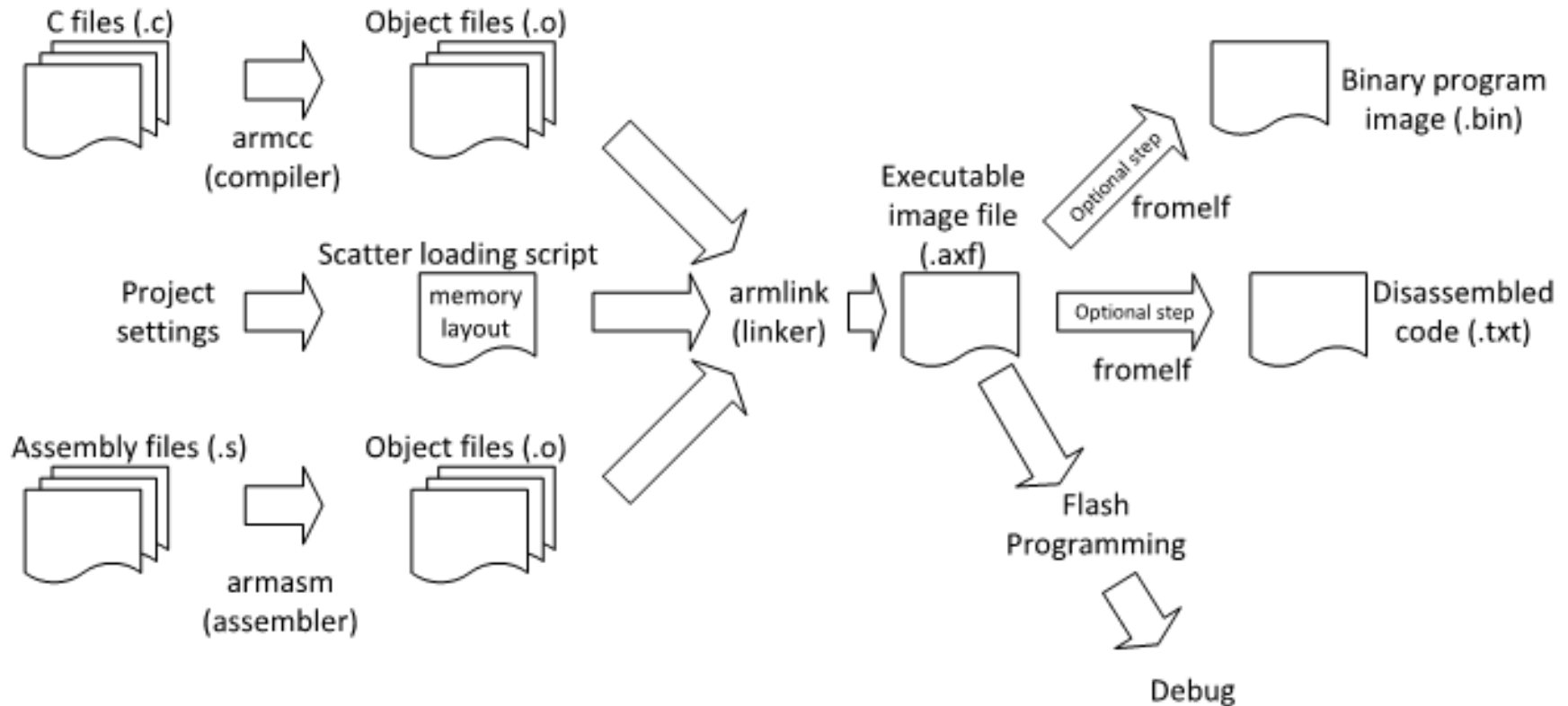
- *Overview*
- *Typical program compilation flow*
- *Getting Started with μ Vision*

MDK-ARM Microcontroller Development Kit

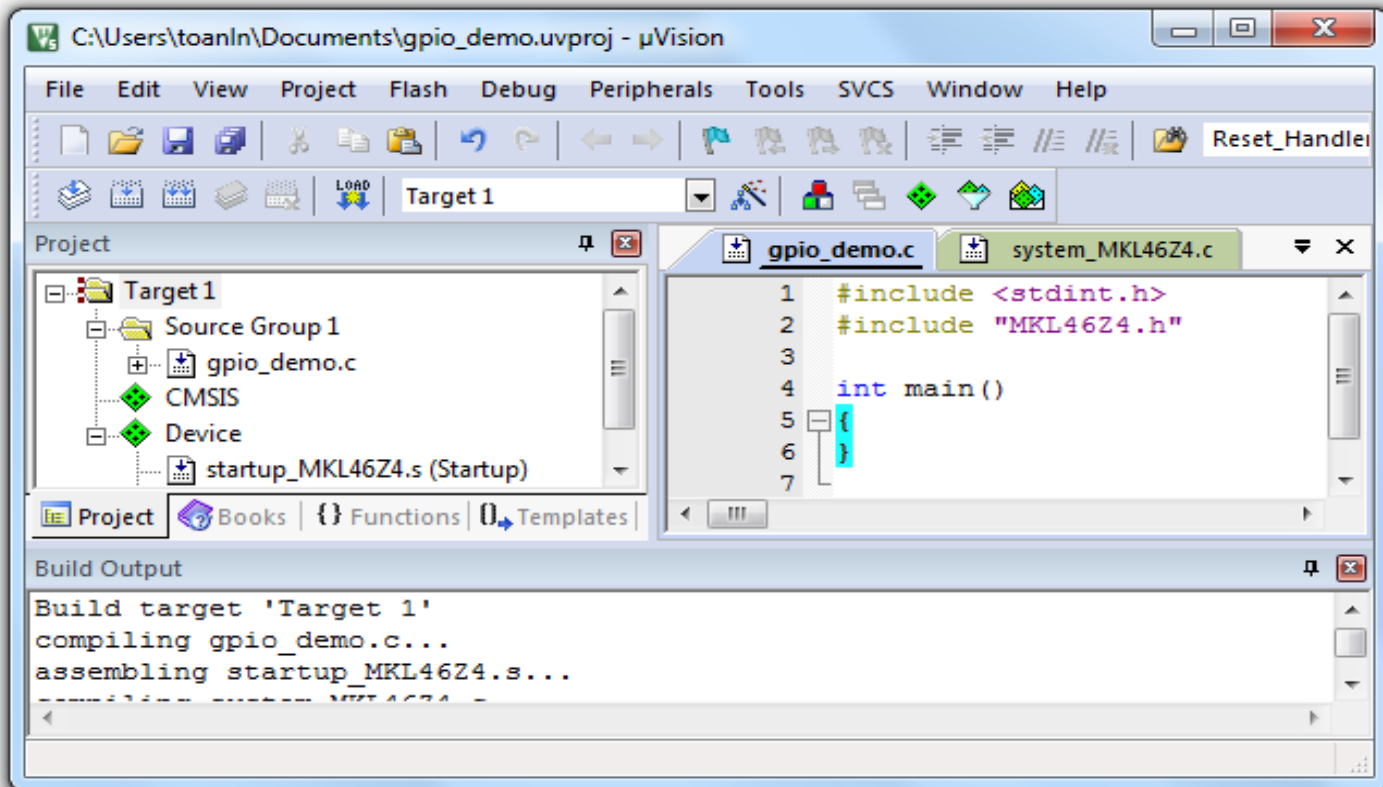


- MDK-ARM Software <https://www.keil.com/demo/eval/arm.htm>
- Patch for KL46 freedom board <https://www.keil.com/dd/chip/6834.htm>

Typical program compilation flow



Getting Started with μ Vision

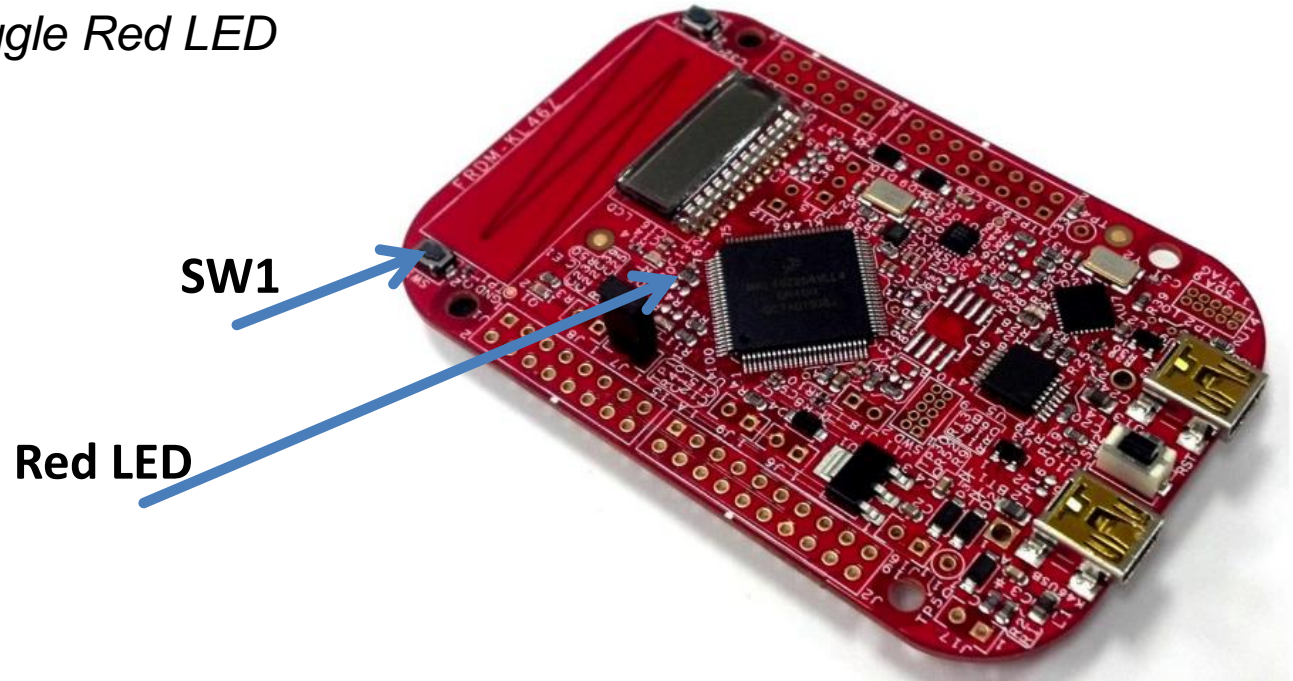


Section 5

FRDM-KL46Z Started Project

- *Requirement*
- *Modules need to used*
- *Project Flow chart with pooling*

- *Using SW1 to control Red LED*
 - ✓ *Press SW1 to toggle Red LED*



PORT Module:

- *The port control and interrupt (PORT) module provides support for port control, and external interrupt functions.*

Features:

- *Pin interrupt on selected pins*
- *Port control*
 - ✓ *Individual pull control fields pullup, pulldown, pull-disable*
 - ✓ *Individual mux control field supporting analog or pin disabled, GPIO, and up to six chip-specific digital functions*

GPIO Module:

- *GPIO (General Purpose Input Output) is a generic pin on a chip whose behavior can be controlled (programmed) through software*

Features:

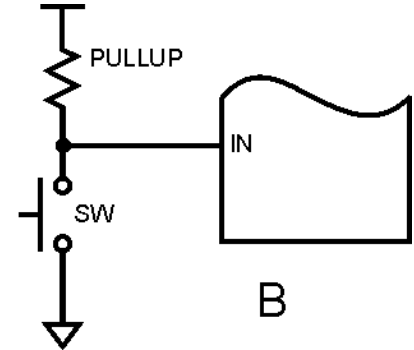
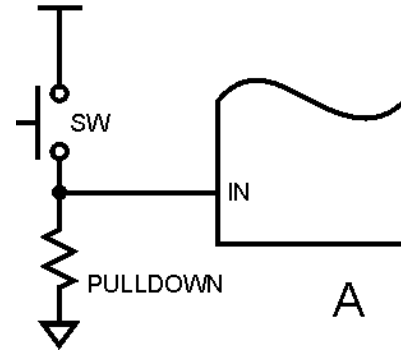
- *Pin input data register visible in all digital pin-multiplexing modes*
- *Pin output data register with corresponding set/clear/toggle registers*
- *Pin data direction register*
- *Zero wait state access to GPIO registers through IOPORT*

Pull-up/down Resistor

Issue: When one pin is configured as an input and nothing is connected to the pin -> program cannot read the pin state (floating or unknown state)

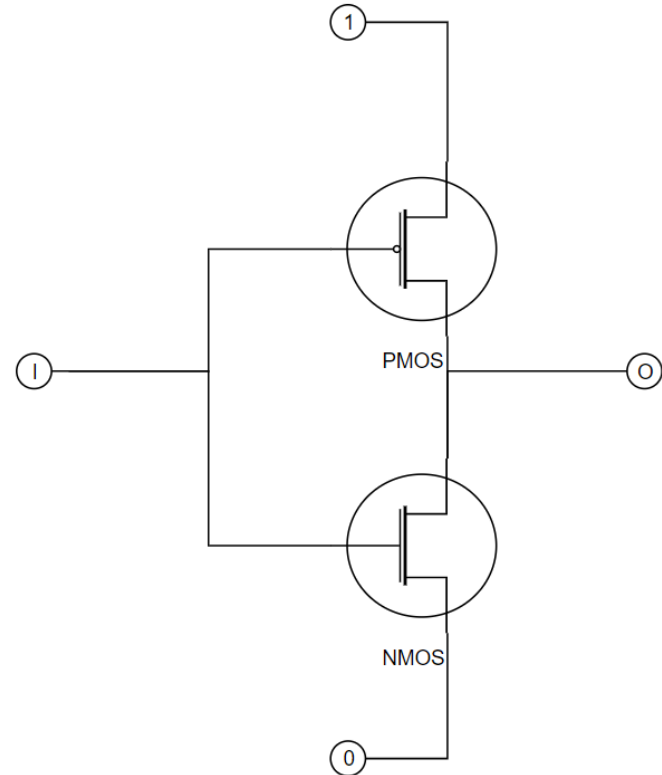
Floating

Floating, high impedance, and tri-stated are three terms that mean the same thing

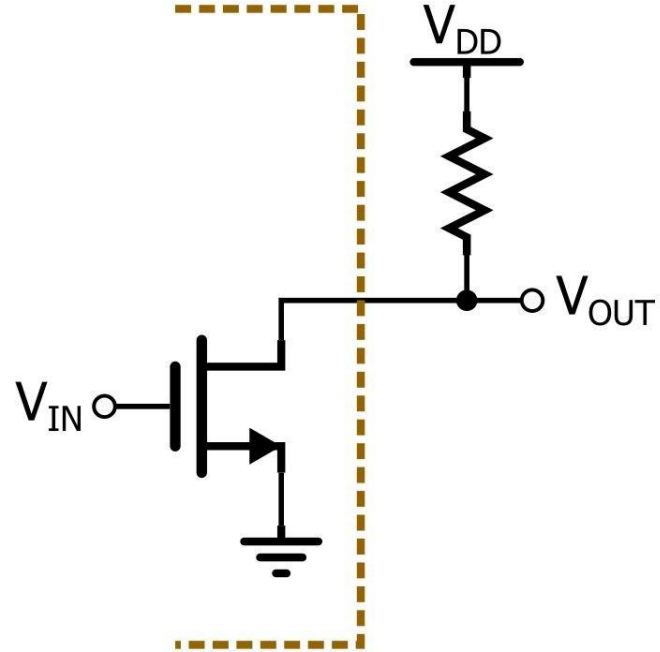
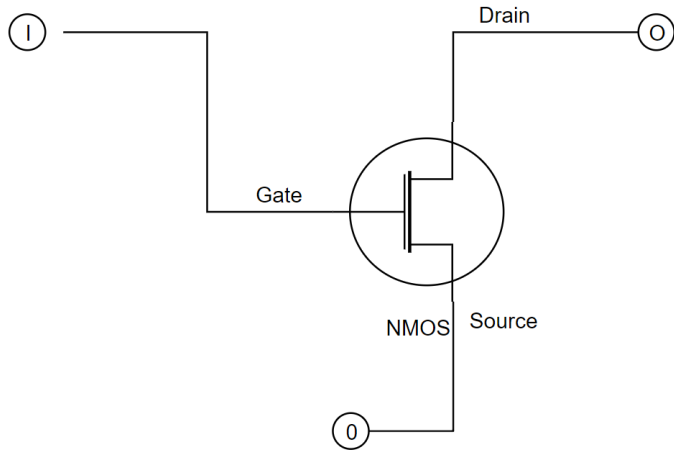


Push-pull

The pin has the ability to “push” the signal high or “pull” it low. It does this using a pair of complementary transistors(CMOS).



Open-Drain



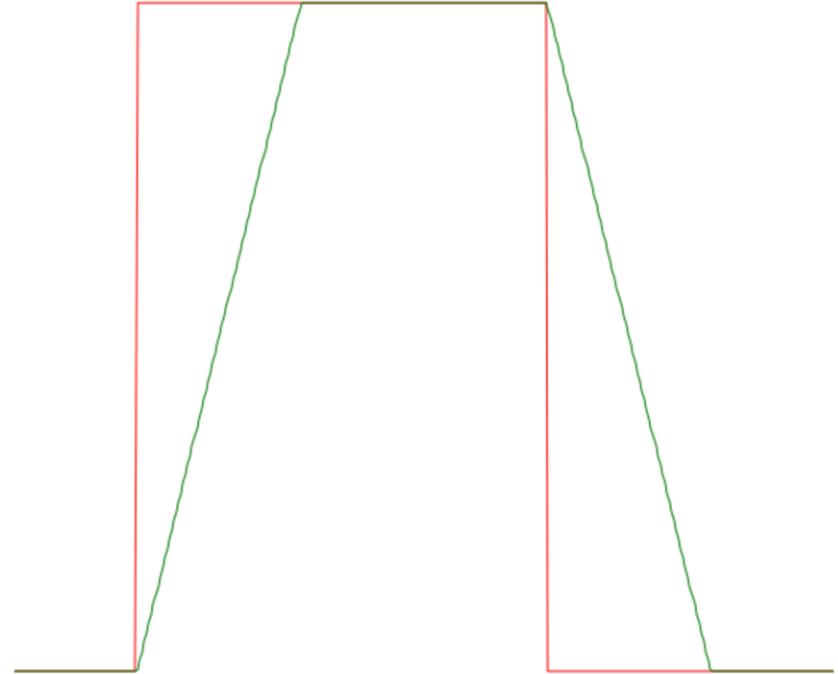
Drive Strength

A typical push-pull output is able to source/sink around $\pm 8\text{mA}$. If you want a nice bright LED indicator, you will use about 20mA which is more than a run-of-the-mill GPIO pin can provide.

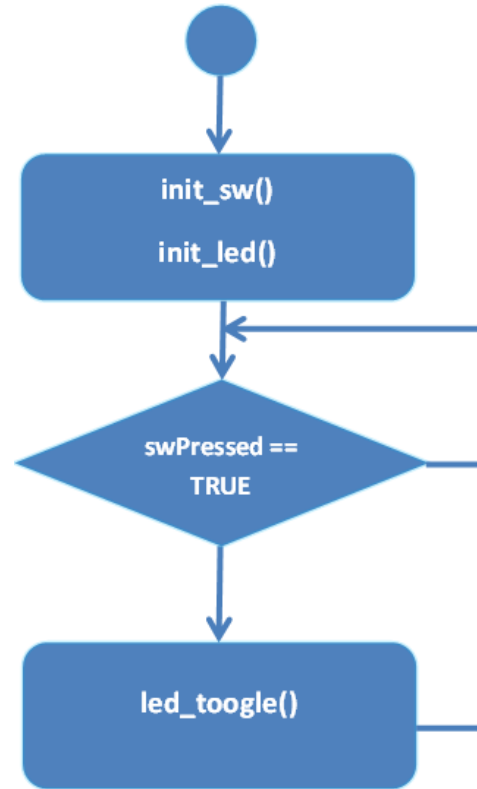
-> Drive Strength output may be up to $\pm 40\text{mA}$.

Slew rate

Slew rate is defined as the change of voltage or current, or any other electrical quantity, per unit of time.



Project Flowchart with pooling



- ***The FRDM-KL46Z features:***
 - ✓ *MKL46Z256VLL4, up to 48MHz Clock, 256KB of flash, 32KB RAM, and loads of analog and digital peripherals.*
 - ✓ *OpenSDA circuit with several options (serial communication, run-control debug, flash programming).*
- ***The MDK-ARM is a complete software development environment for Cortex™-M, Cortex-R4, ARM7™ and ARM9™ processor-based devices***
- ***Getting Started Project with GPIO and PORT modules in KEIL***

Thank you

