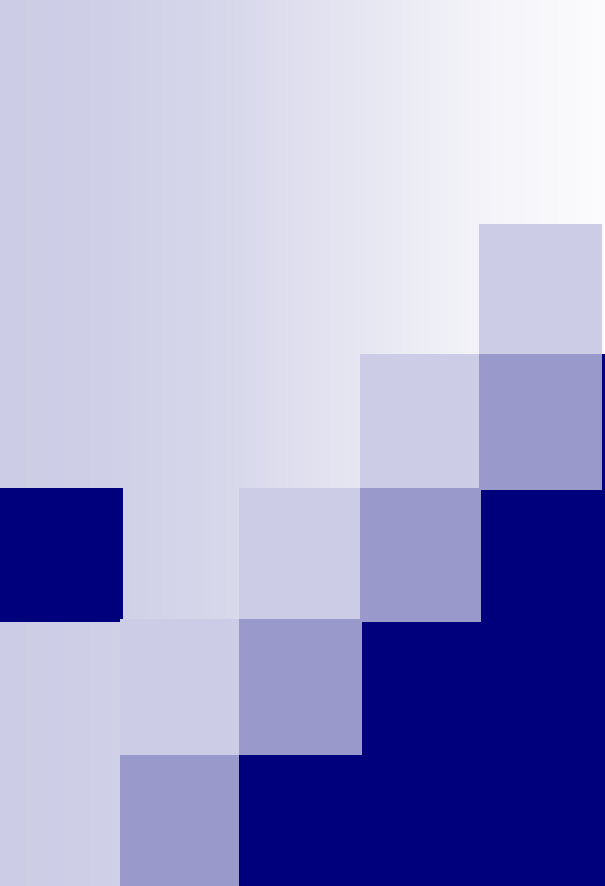




FRDM-KL25Z and tracing

Overview

- Development platform for Kinetis® L Series KL2x microcontrollers (MCUs) built on Arm® Cortex®-M0+ processor
 - MKL25Z128VLK4 MCU – 48 MHz, 128 KB flash, 16 KB SRAM, USB OTG, 80LQFP
- standard form factor with expansion board options
- built-in debug interface for flash programming and run-time control



Top view

KL25Z 80 LQFP

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Capacitive Touch Slider

J1 I/O Header

J10 I/O Header

RGB LED

J2 I/O Header

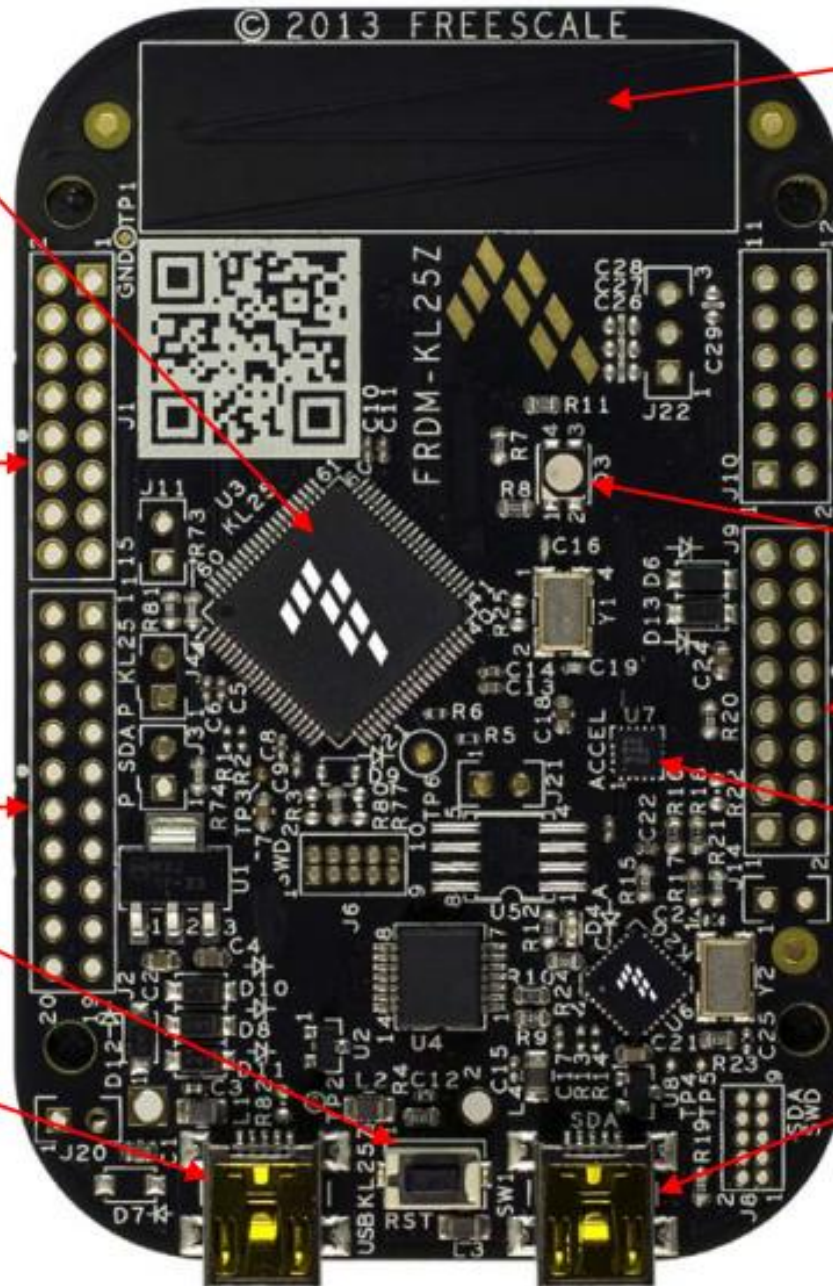
J9 I/O Header

MMA8451Q

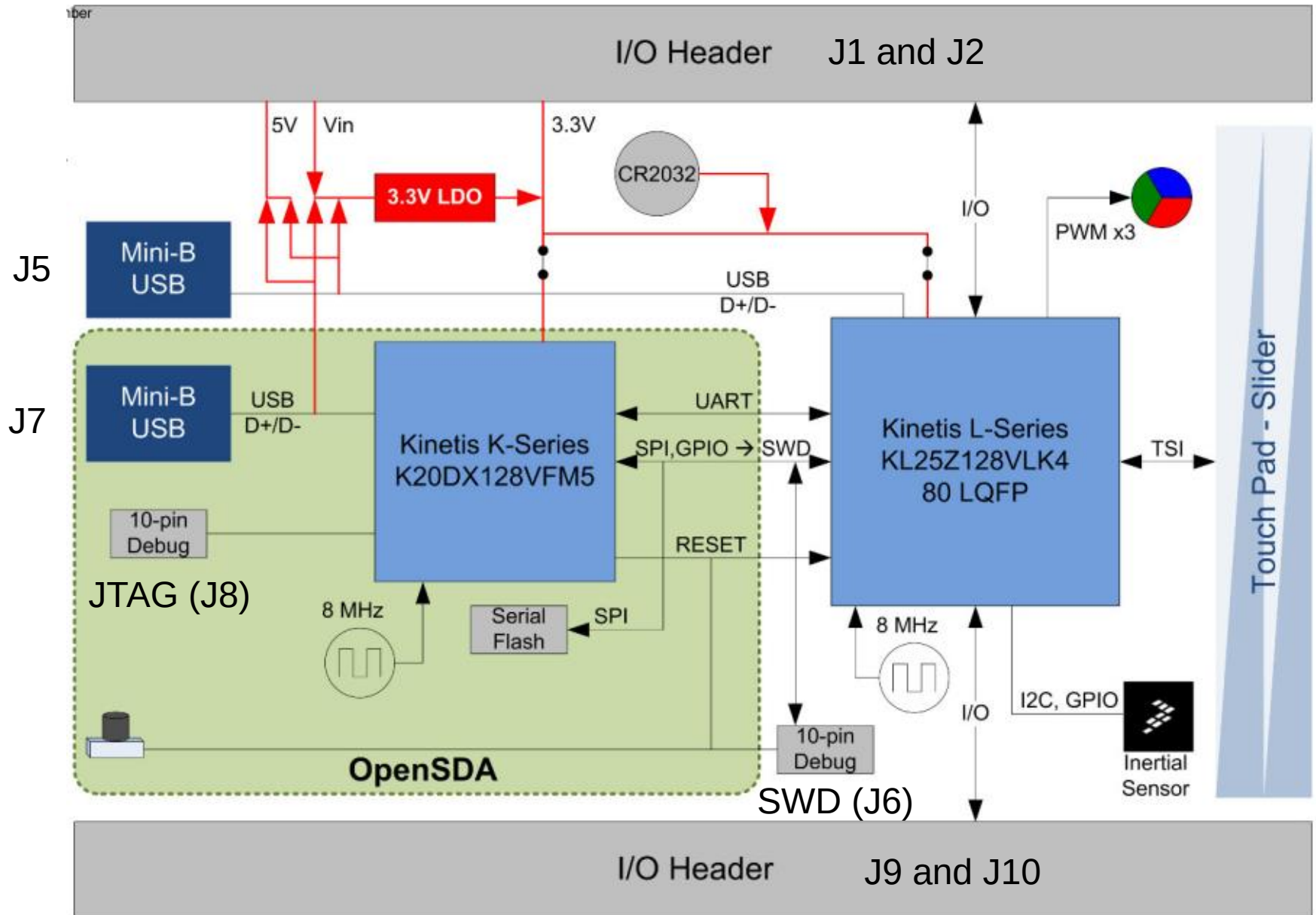
Reset

KL25Z USB

OpenSDA

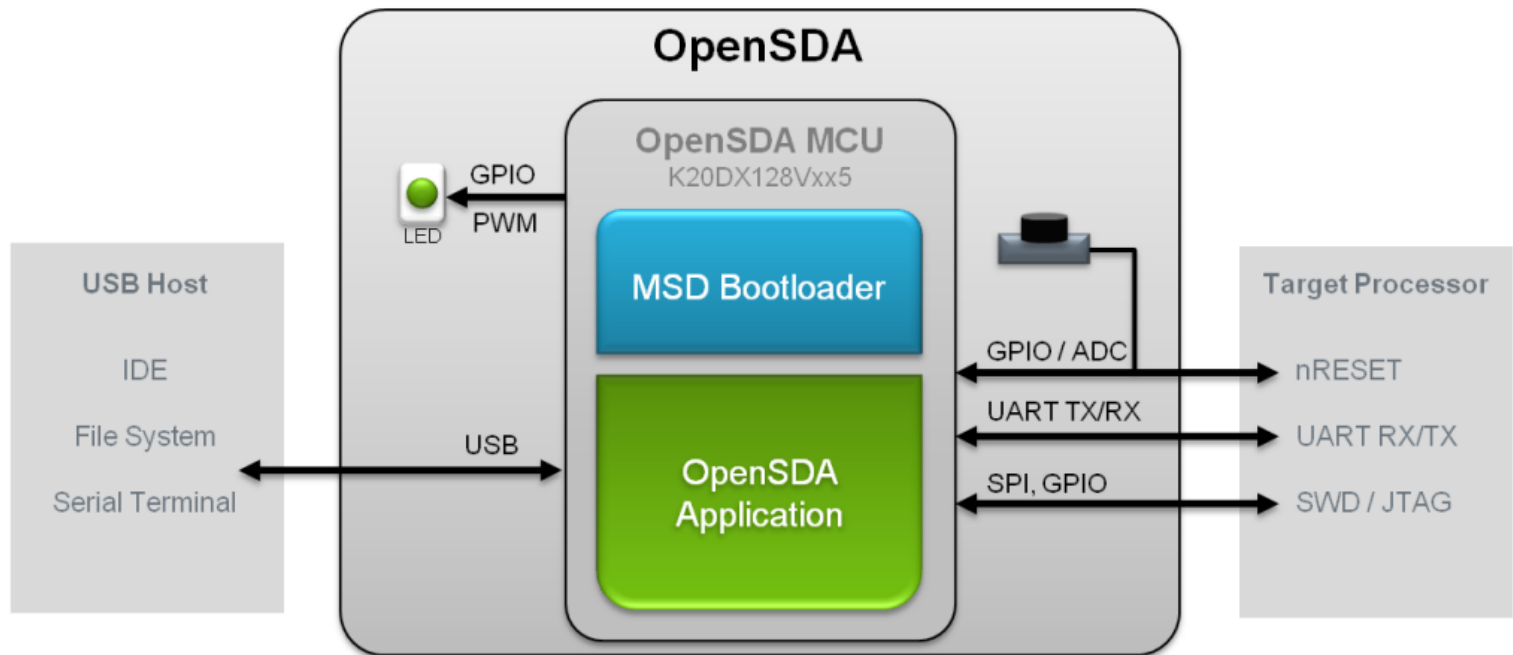


Block diagram



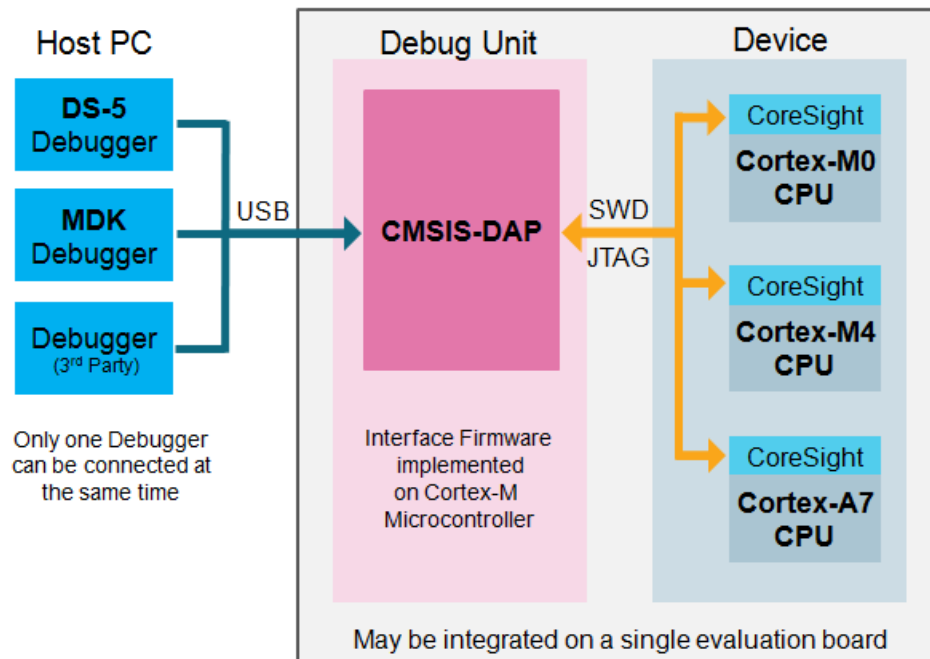
Serial and Debug Adapter (OpenSDA)

- Based on open-sourced CMSIS-DAP bootloader and debug interface
- serial and debug communications between a USB host and an embedded target processor
- based on a Freescale Kinetis K20 family microcontroller with 128 KB of embedded flash and integrated USB controller
- features a mass storage device (MSD) bootloader



CMSIS-DAP debugger

- CMSIS-DAP is the interface firmware for a Debug Unit that connects the Debug Port to USB.
- <http://www.keil.com/support/man/docs/dapdebug/>





I/O

- USB Interface
- serial Port
 - SPI (2)
 - I²C (2)
 - UART (3)
- ADC (16 bit)
- DAC (1x12 bit)
- touch sensor
- GPIO (66)
- 3-axis Accelerometer (Freescale MMA8451Q low-power, three-axis accelerometer interfaced through an I²C bus)
- 3 PWM-capable signals connected to an RGB LED
- pins on the KL25Z microcontroller are named for their general purpose input/output port pin function
 - e.g., 1st pin on Port A is referred to as PTA1

I/O

(usb) uart0_RX
(usb) uart0_TX

PTA1 - 2
PTA2 - 4
PTD4 - 6
PTA12 - 8
PTA4 - 10
PTA5 - 12
PTC8 - 14
PTC9 - 16

1 - PTC7
3 - PTC0
5 - PTC3
7 - PTC4
9 - PTC5
11 - PTC6
13 - PTC10
15 - PTC11

PTE30 - 11
PTE29 - 9
PTE23 - 7
PTE22 - 5
PTE21 - 3
PTE20 - 1

12 - PTC1
10 - PTC2
8 - PTB3
6 - PTB2
4 - PTB1
2 - PTB0

(spi CS)
spi MOSI
spi MISO
spi SCK

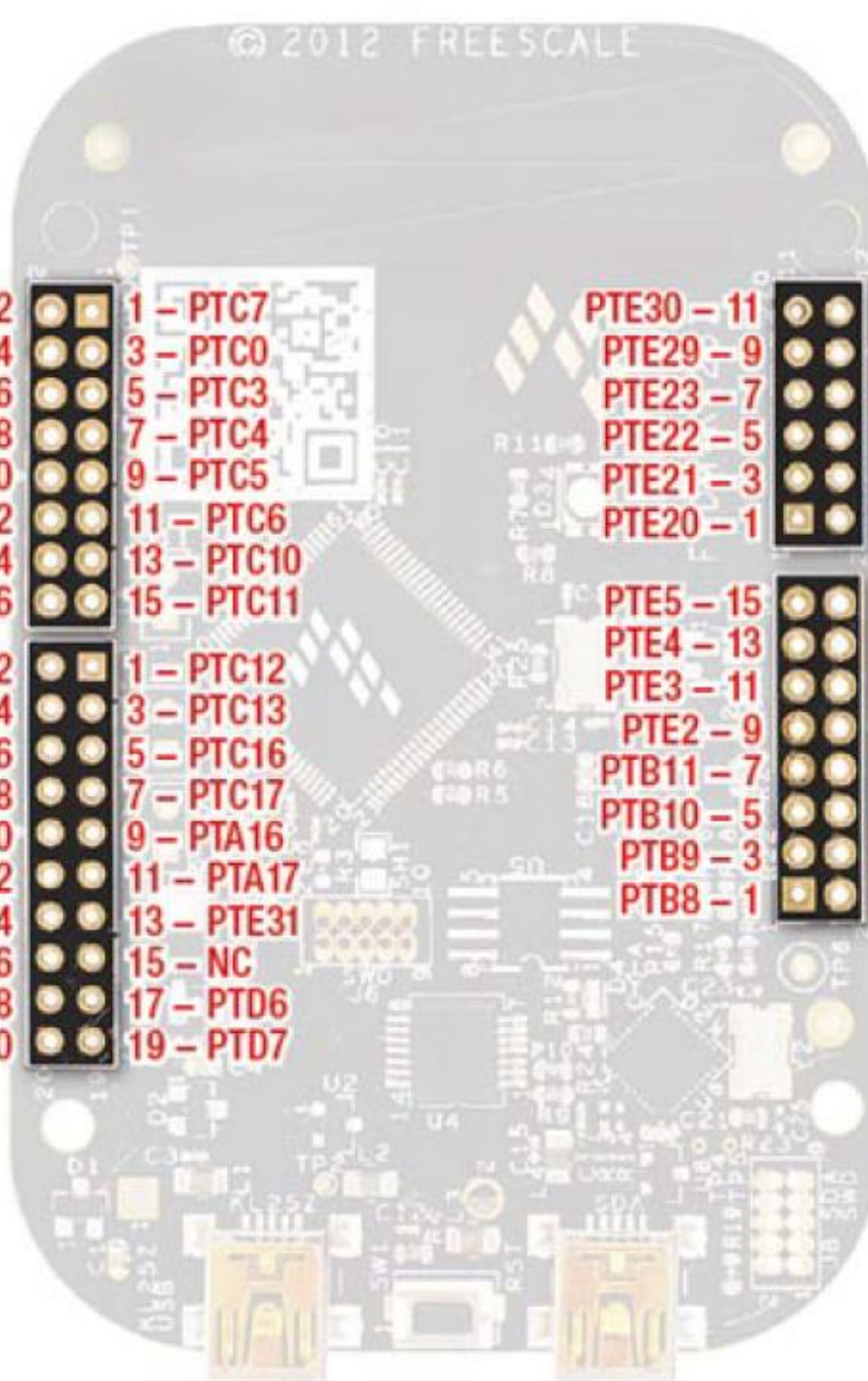
PTA13 - 2
PTD5 - 4
PTD0 - 6
PTD2 - 8
PTD3 - 10
PTD1 - 12
GND - 14
VREFH - 16
PTE0 - 18
PTE1 - 20

1 - PTC12
3 - PTC13
5 - PTC16
7 - PTC17
9 - PTA16
11 - PTA17
13 - PTE31
15 - NC
17 - PTD6
19 - PTD7

PTE5 - 15
PTE4 - 13
PTE3 - 11
PTE2 - 9
PTB11 - 7
PTB10 - 5
PTB9 - 3
PTB8 - 1

16 - P5-9V_VIN
14 - GND
12 - GND
10 - P5V_USB
8 - P3V3
6 - RESET/PTA20
4 - P3V3
2 - SDA_PTD5

uart1 TX; i2c SDA
uart1 RX; i2c SCL





Programming

Several different tools can be used for programming and debugging

- Keil Studio Cloud

- ☐ good and easy online tool, no debugging (at least with Firefox)

- Mbed Studio

- ☐ debugging available

- Mbed CLI

- ☐ command-line tool

- Keil uVision

- ☐ with debugger and tracing; full version needs a license

- MCUX

- ☐ with debugger, proprietary (NXP)

uVision5: Blinky

- Project... Manage... Pack installer:
- File... Import: *Keil.Kinetis_KLxx_DFP.1.15.0.pack*
- Board: select *FRDM-KL25Z (Deprecated)*
- *Pack... ARM::CMSIS: remove version 6.1.0*
- Copy folder *FRDM-KL25* somewhere in your project home
- Project... open project... <project_home>... FRDM-KL25Z...
Blinky: *Blinky.uvprojx*
- Project... Options for target... Debug... *use CMSIS-DAP*
- Project... Options for Target... Target... ARM Compiler: *Use version 6*
- Project... Build target (1 warning generated)
- Flash... Download

uVision5: Blinky_257

- Project... Manage... Pack installer:
- File... Import: *Keil.Kinetis_KLxx_DFP.1.15.0.pack*
- Board: select *FRDM-KL25Z (Deprecated)*
- *Pack... ARM::CMSIS: remove version 6.1.0*
- Copy folder *Blinky_257* somewhere in your project home
- Project... open project... <project_home>... Blinky_257...
Blinky.uvprojx
- Project... Build target (1 warning generated)
- Flash... Download

- Note the instructions to switch on a LED...

Example of tracing (taken from apnt_257)

- Start the *blinky* project
- Select target: CMSIS-DAP-MTB
- Debug... Start Debug Session
- View... Register Window
- View... Disassembly Window
- View... Trace... Trace Data
- Run... and then Stop
- PC will be around 0x26A-0x270:
 - while ((msTicks - curTicks) < dlyTicks);
- The following instruction is BX lr:
 - set R14=LR to 0
- BX operation is not allowed with LR=0 -> Fault!
 - last instruction in Trace Data is B to *HardFault_Handler*

Example of tracing (taken from apnt_257)

- So, we put a breakpoint there
 - Disassembly: click on the first column
- Exit and re-enter Debug
- Repeat
 - now Trace Data shows us how we arrived at *HardFault_Handler*