FRDM-KE04Z Quick Start Guide for KEIL MDK

Board configuration, software, and development tools

Rev. 1.1

Contents

1   Purpose

This Quick Start Guide will familiarize you with KE driver library and related development tools. You will learn the features of the FRDM-KE04Z board, the features of the OpenSDA standard, and how to access driver library and demo examples using KEIL uVision MDK.

2   Getting to know the board

The Freedom board (FRDM-KE04Z) features the Kinetis KE04Z8VFK4 microcontroller and comes with the following features (which are highlighted in the figure below):
- Tri-color LED
- 8Mhz crystal
- MMA8451Q Inertial Sensor
- OpenSDA connection
- Touch Pad (Slider)
- IrDA(infrared)
- Thermistor
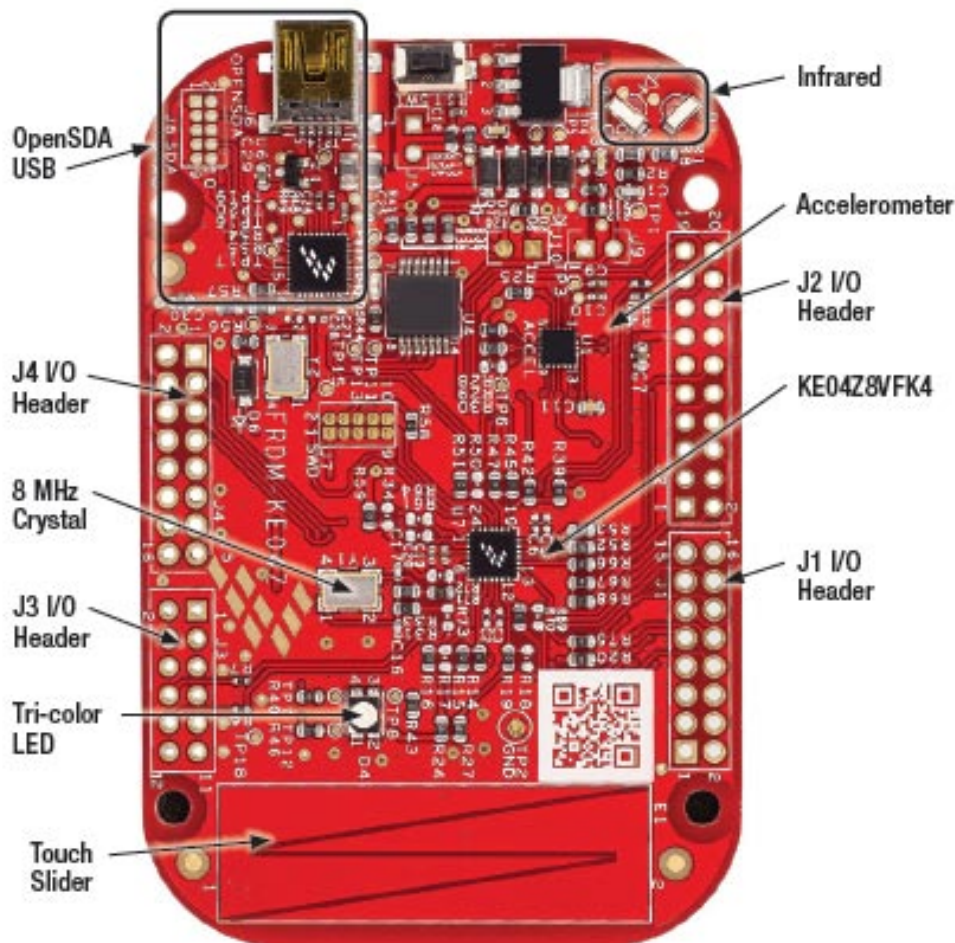
3 OpenSDA Overview

OpenSDA is an open-standard serial and debug adapter. It bridges serial and debug communications between a USB host and an embedded target processor. OpenSDA features a mass storage device bootloader, which offers a quick and easy mechanism for loading applications such as flash programmers, run-control debug interfaces, serial-to-USB converters, and more, onto your Freedom board. Currently, P&E Micro offers two different applications: an MSD application and a debug application.

3.1 MSD Application

This OpenSDA application was developed by P&E Micro and allows the Freedom board to instantiate as a mass storage device on your computer. Once this application properly enumerates, you may program the KE04Z8 on your Freedom board with a binary or SREC file by simply "dragging and dropping" one of these files into FRDM-KE04Z drive that is installed when your Freedom board enumerated. In addition, you will also have serial communication with the KE04Z8.

3.2 Debug Application

This OpenSDA application was also developed by P&E Micro and allows you to program and debug your KE04Z8 on your Freedom board just as any other debugger module would allow. With this application loaded onto your Freedom board, you will also have serial communication with the KE04Z8 available.

4 Download and Install Software and Tools

4.1 Downloading and Installing OpenSDA Drivers

Before you begin, you will need the latest OpenSDA serial drivers installed on your development computer and on FRDM-KE04Z. The latest OpenSDA drivers should already be installed on your FRDM-KE04Z, and your system should be able to automatically find the latest Windows CDC drivers (as they should be pre-installed on the Freedom board). In case they are not, see the OpenSDA user's guide which can be found in your Quick Start Package.

4.2 Downloading and Installing KEIL MDK 5.00 and Tools

4.2.1 Downloading and Installing the KEIL MDK 5.00

To download the KEIL MDK 5.00 (or later), follow these instructions:
1. Navigate to the **MDK-ARM Freescale Edition** download page at www.keil.com/freescale/ and click the MDK-Freescale link at the bottom of the page.
2. Click the Download button from the right-hand side of the page.
3. Follow ARM's downloading and licensing instructions.

4. To install software tools, follow the installer package instructions once you receive your download.

4.2.2 Downloading and Installing the OpenSDA patch for KEIL MDK

To download and install the OpenSDA patch for the KEIL MDK 5.00, follow these instructions:

1. Navigate to the **Freescale Kinetis OSJTAG Drivers V1.16** download page at www.keil.com/download/docs/408.asp.
2. Click on the FSLKINETISDRIVERSV116.EXE link and follow the on screen instructions to save this file to your computer.
3. Next, navigate to the location where you saved this file, double click the executable and follow the on-screen instructions to install the files.
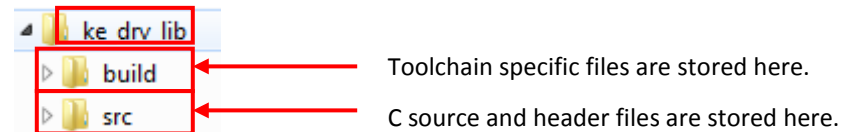
5   Freescale Sample Code

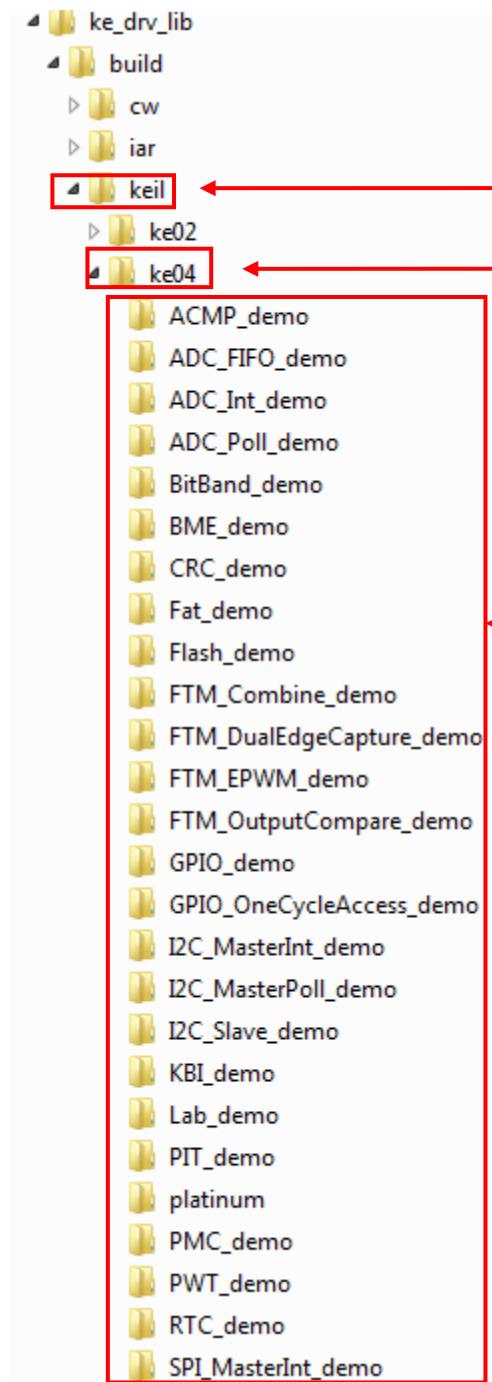The Freescale KE driver library is bare metal code.

5.1 KE Driver Library

5.1.1 KE Driver Library Folder Structure

The KE driver library folder contains two folders at the top level: a build folder and an SRC (source) folder.
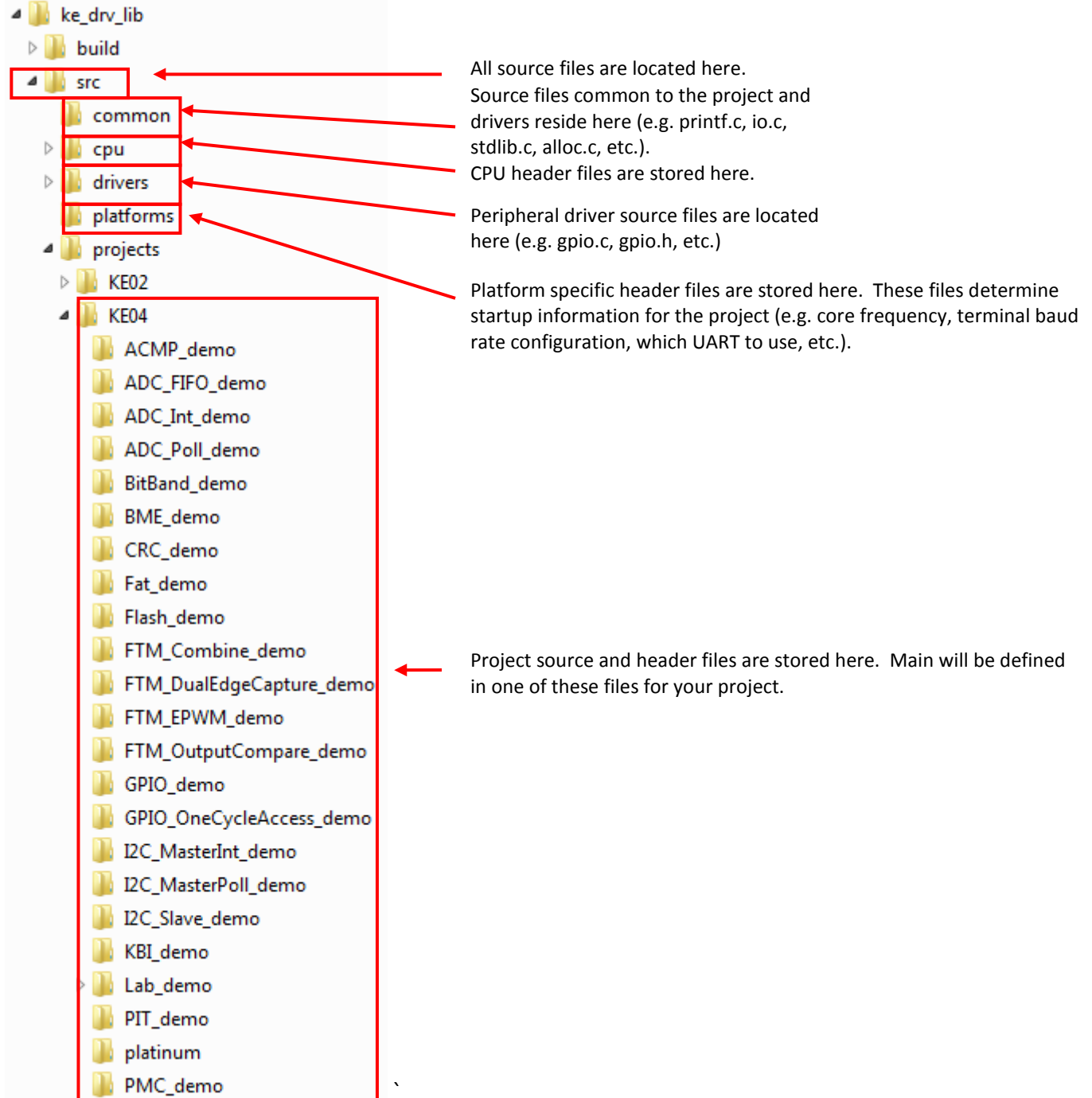

Toolchain specific files are stored here.

C source and header files are stored here.

First, the build folder will be discussed.

ke_drv_lib
  build
    cw
    iar
    keil   ← KEIL MDK uVision projects files are located here.
      ke02
      ke04   ← KE04 KEIL MDK uVision projects files are located here.
        ACMP_demo
        ADC_FIFO_demo
        ADC_Int_demo
        ADC_Poll_demo
   BitBand_demo
        BME_demo
        CRC_demo
        Fat_demo   ← KEIL MDK uVision projects files are stored in these folders. Only toolchain-specific files are stored here, NOT the C source files.
        Flash_demo
        FTM_Combine_demo
        FTM_DualEdgeCapture_demo
        FTM_EPWM_demo
        FTM_OutputCompare_demo
        GPIO_demo
        GPIO_OneCycleAccess_demo
        I2C_MasterInt_demo
        I2C_MasterPoll_demo
        I2C_Slave_demo
        KBI_demo
        Lab_demo
        PIT_demo
        platinum
        PMC_demo
        PWT_demo
        RTC_demo
        SPI_MasterInt_demo

The source folder structure is as follows:

- ke_drv_lib
  - build
  - **src** ← All source files are located here.
    - **common** ← Source files common to the project and drivers reside here (e.g. printf.c, io.c, stdlib.c, alloc.c, etc.).
    - **cpu** ← CPU header files are stored here.
    - **drivers** ← Peripheral driver source files are located here (e.g. gpio.c, gpio.h, etc.)
    - **platforms** ← Platform specific header files are stored here. These files determine startup information for the project (e.g. core frequency, terminal baud rate configuration, which UART to use, etc.).
  - projects
    - KE02
    - KE04
      - ACMP_demo
      - ADC_FIFO_demo
      - ADC_Int_demo
      - ADC_Poll_demo
      - BitBand_demo
      - BME_demo
      - CRC_demo
      - Fat_demo
      - Flash_demo
      - FTM_Combine_demo
      - FTM_DualEdgeCapture_demo ← Project source and header files are stored here. Main will be defined in one of these files for your project.
      - FTM_EPWM_demo
      - FTM_OutputCompare_demo
      - GPIO_demo
      - GPIO_OneCycleAccess_demo
      - I2C_MasterInt_demo
      - I2C_MasterPoll_demo
      - I2C_Slave_demo
      - KBI_demo
      - Lab_demo
      - PIT_demo
      - platinum
      - PMC_demo

5.1.2 Using the Freescale KE driver library code to Jumpstart your Design

The Kinetis E series driver library is provides as a jump start for your design and comes with code examples. We have provided a script that will copy our platinum project and rename it to your desired project name. This script is a single executable that resides in the \build\keil\KE04 folder.
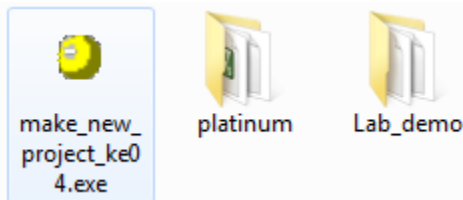
Simply double-click this icon and a command prompt pop-up window will prompt you for a project name, copy the platinum project and rename all of the necessary files for your new project to work correctly.

6   Configure Hardware

1) Using a Mini-B to A USB cable, connect your FRDM-KE04Z board to your development computer. Be sure to plug the Mini-B connection into the OpenSDA port of the FRDM-KE04Z board.
2) No special hardware configuration is necessary to run the demo applications in the code examples unless otherwise specified by the "readme.txt" file located in the project folder.

7   Terminal Program Configuration

The OpenSDA serial port is designed to enumerate just as any other USB to serial converter. Therefore, you will need to open a serial terminal utility (Tera Term, Hyperterm, etc.) and configure your terminal as follows:

- 115200 baud
- 8 data bits
- no parity
- no flow control

8   Loading and Running the Demos in KEIL MDK 5.00

The following instructions describe how to build and flash the Helloworld demo using KEIL 5.00. This document is targeted for users who choose to use the OpenSDA programming and debugging capabilities and it is assumed that you have loaded the P&E Micro Debug application onto your FRDM-KE04Z. If you need assistance in loading this application onto your FRDM-KE04Z, see the OpenSDA user's guide provided in your Quick Start Package.

1) Open KEIL uVision4 (Start->All Programs->KEIL uVision4).

2) Open the project file at **\build\keil\KE04\platinum\ platinum.uvproj.** This can be done by either dragging the **platinum.uvproj** icon into the KEIL Workspace or by selecting Project->Open Project… and pointing KEIL to the project path through the dialog box that pops up.

3) Compile the project by clicking the Build icon or the Rebuild icon (or right clicking on the project and select "Build" or "Rebuild").

4) After compilation completes, download the code to the board and start the debugger by pressing the "Start/Stop Debug Session" button .

5) The code will download, and the debugger screen will come up and pause at the first instruction. Hit the "Run" button to start running.

6) On the terminal you should see the following message:
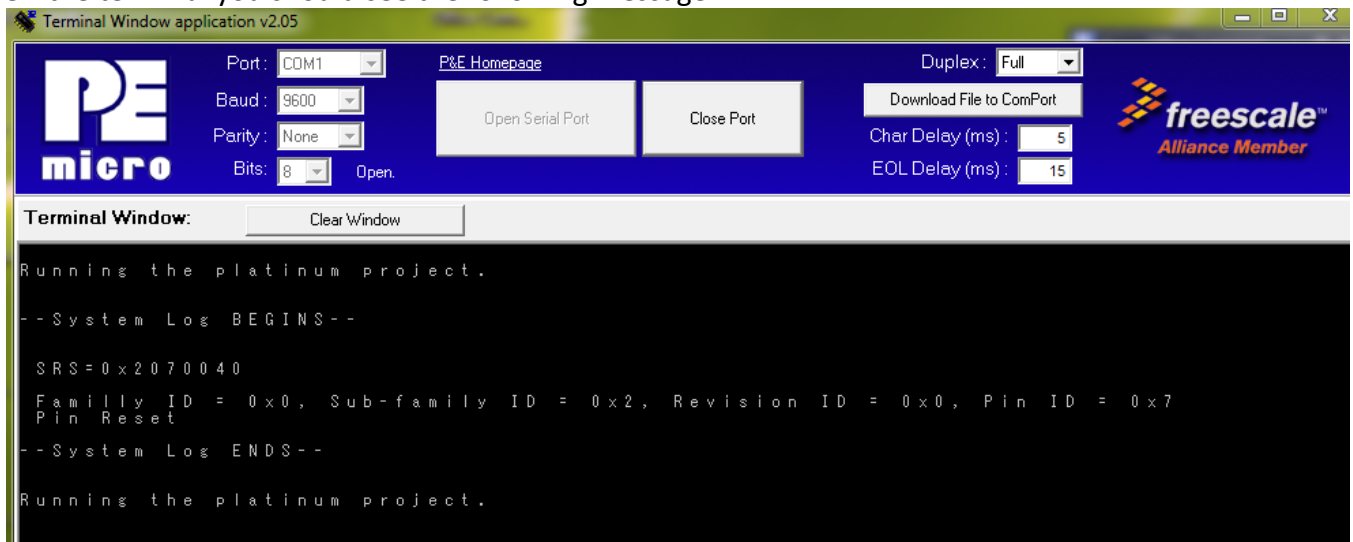
7) The tri-color LED will start blinking.

9   Explore Further

Additional software and lab guides available on www.freescale.com/FRDM-KE04Z.

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