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# **RN2483\_Silica Documentation**

*Release 0*

**Silica**

**Dec 19, 2017**



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**Version** 1.00E

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**Date** 26 Oct 2016

**Reference name** EV-NXPKINCAM-DVK



# CHAPTER 1

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## Embedded Vision NXP

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*FRDM-K82F with TDNx016 board mounting a TD7740 camera module*

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**Note:** Visit [www.avnet-silica.com/embedded-vision](http://www.avnet-silica.com/embedded-vision) to buy this development kit

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**Warning:** The color of the adapter board in the kit can be different than the color on the images in the Quick Start Guide and Developing Guide. However this does not affect the functionality of the board

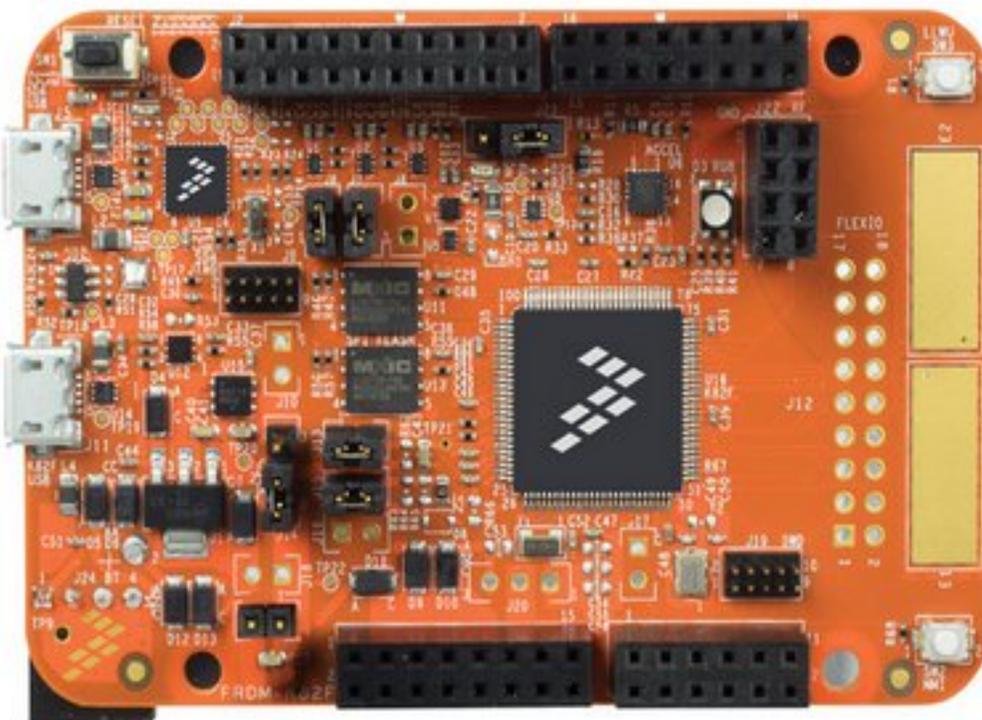
## CHAPTER 2

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### INTRODUCTION

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The **NXP Freedom K82F** is an low-cost development platform for Kinetis K82, K81, and K80 MCUs. Provided with Kinetis MK82FN256VLL15 MCU (ARM® Cortex®-M4 @150 MHz, 256KB SRAM, USB and advanced security).



- Form-factor compatible with the Arduino™ R3 pin layout
- Peripherals enable rapid prototyping, including a six-axis digital accelerometer and magnetometer to create full eCompass capabilities, a tri-colored LED and two user push-buttons for direct interaction, 2x32Mb QuadSPI external flash, FlexIO camera header, touch pads and headers for use with Bluetooth® and 2.4 GHz radio add-on modules

- OpenSDAv2.1, the NXP open source hardware embedded serial and debug adapter running an open source bootloader, offers options for serial communication, flash programming, and run-control debugging

The **TD7740** Image sensor is based on Omnisvision 1/5" OV7740 CMOS VGA sensor.



- Solderless module: Camera Socket (SMK compatible) or Flex connector (FPC: Flat Pack Connector) 8 x 8 mm module mate on standard Camera Module Socket
- Active Image size VGA (640x480) 30 fps, and smaller
- Digital RGB 8/10 bits or YUV 8 bits output
- Lens Focal length 1.3 mm Field of view from H=66° to 128°
- Pixel size 4.2µm x 4.2µm
- Type of filter; dual filter for daylight and night vision, single filter for daylight vision, no filter for higher image quality
- Power supply Analog: 3 to 3.6 V I/O: 1.7 to 3.47 V Core: 1.5V +-5% (internal regulator)
- Typical power requirements Active: 48 mA Standby: 20 µA Core: 1.5V +-5% (internal regulator)
- Operating range -30°/70°C stable image 0°/50°C

## 2.1 Development tools

NXP releases Kinetis® Design Studio including support for FRDM-K82F. The Kinetis® Design Studio (KDS) is a complimentary integrated development environment for Kinetis MCUs that enables robust editing, compiling and debugging of your designs. Based on free, open-source software including Eclipse, GNU Compiler Collection (GCC), GNU Debugger (GDB), and others, the Kinetis Design Studio IDE offers designers a simple development tool with no code-size limitations. Furthermore, Processor Expert® software enables your design with its knowledge base and helps create powerful applications with a few mouse clicks.

### Features

- Eclipse Luna 4.4
- Host operating systems:
  - Windows® 7/8/10 (32 and 64-bit)
  - Linux® 64-bit (Ubuntu 10.04 (deb), RedHat/Centos 7 (rpm))
  - Mac OS X (10.10 and 10.11) with SEGGER J-Link support
- GDB debugger with support for the following debug interface hardware:
  - SEGGER J-Link (w/SEGGER GDB Server, Windows, Linux, Mac)
  - P&E Multilink (w/P&E GDB Server, Windows, Linux)
  - CMSIS-DAP (w/OpenOCD GDB and OpenSDA embedded circuit, Windows, Linux)

- Command Line (CL) debugging with GDB and OpenOCD TCL

Contents:

## 2.1.1 Quick Start Guide

This guide will show you how run the demo. This demo permits you to try immediately the **TD7740** camera. This guide is written using **Windows** Operating System.

### Hardware necessary

- TDNx016 Board
- TD7740 camera
- FRDM-K82F board
- 1 micro-USB cable
- PC with Windows

### The Demo

The demo is already programmed on the FRDM-K82F board. You have only to connect the boards in order to use the demo. Please follow the next steps:

1. Plug the **TD7740** camera to the **TDx016 adapter** board and Connect the board to the **FRDM-K82F** board.



2. Plug in the **micro USB** cable in the USB device port (the one in the middle of the card).



3. The board will enumerate as a generic USB video device called **Flexio Camera Device**. You can then use this device with any video capture software such as “camera” from Windows 10 or *AMCap*. Download and install it if you don’t have camera application on your O.S. Launch it and select the **Flexio Camera Device** device. You will see the frames transmitted at a resolution **QQVGA** of **160x120** pixels.

### Update the Demo

If you need upload the demo in the FRDM-K82F board please follow the next steps:

1. This demo is provided with a **9x2 female connector** already soldered. This will be used to connect the board to the TDN016 board:



2. Install OpenSDA for the NXP K82F board More information can be found at [segger website](#). Click on **J-Link OpenSDA - Board-Specific Firmwares** and download the firmware for the **FRDM-K82F**.

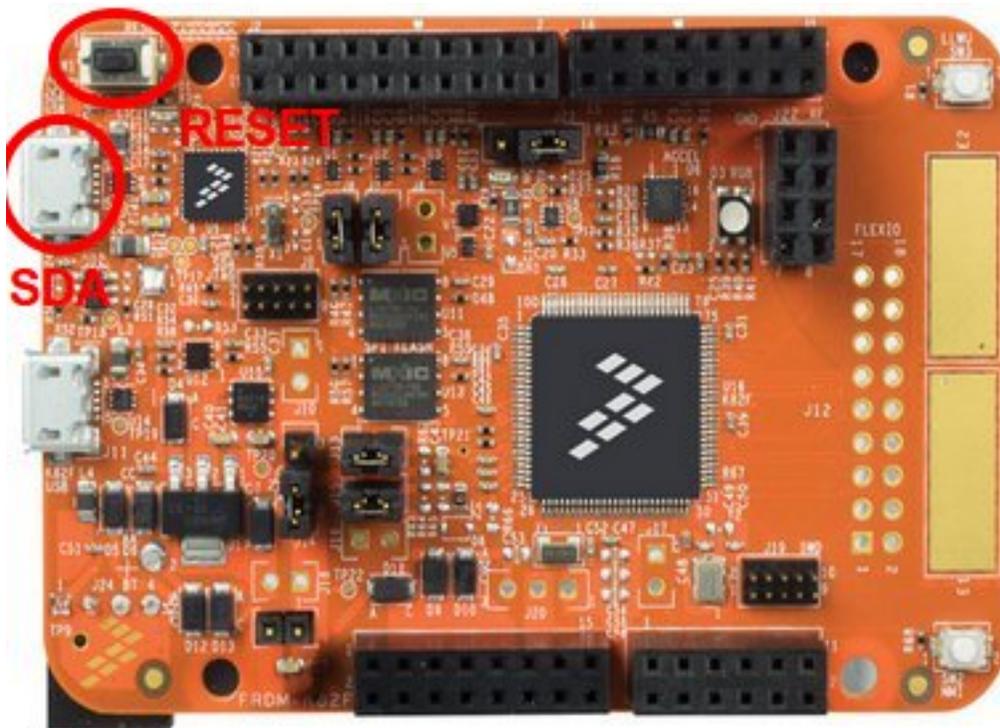
**J-Link OpenSDA - Board-Specific Firmwares**

- Supports all ARM based Freescale boards which comes with on-board OpenSDA
- Implements SWD debug protocol and virtual COM port functionality
- [More information](#)

[Click for downloads](#)

<a href="#">Download</a>	FRDM-K22F	95 KB	[2016-08-01]
<a href="#">Download</a>	FRDM-K64F	107 KB	[2016-08-01]
<a href="#">Download</a>	FRDM-K66F	95 KB	[2016-08-01]
<a href="#">Download</a>	FRDM-K82F	95 KB	[2016-08-01]

3. Start your board in Bootloader mode keeping reset button pressed, while connecting the USB cable to the **SDA USB** port and release it after 1s. Drag'n drop or copy and paste the OpenSDA Application binary file into the **BOOTLOADER** drive from your computer file explorer. After 10 seconds Un-plug and re-plug the USB cable from the SDA USB port **without** keeping reset button pressed.



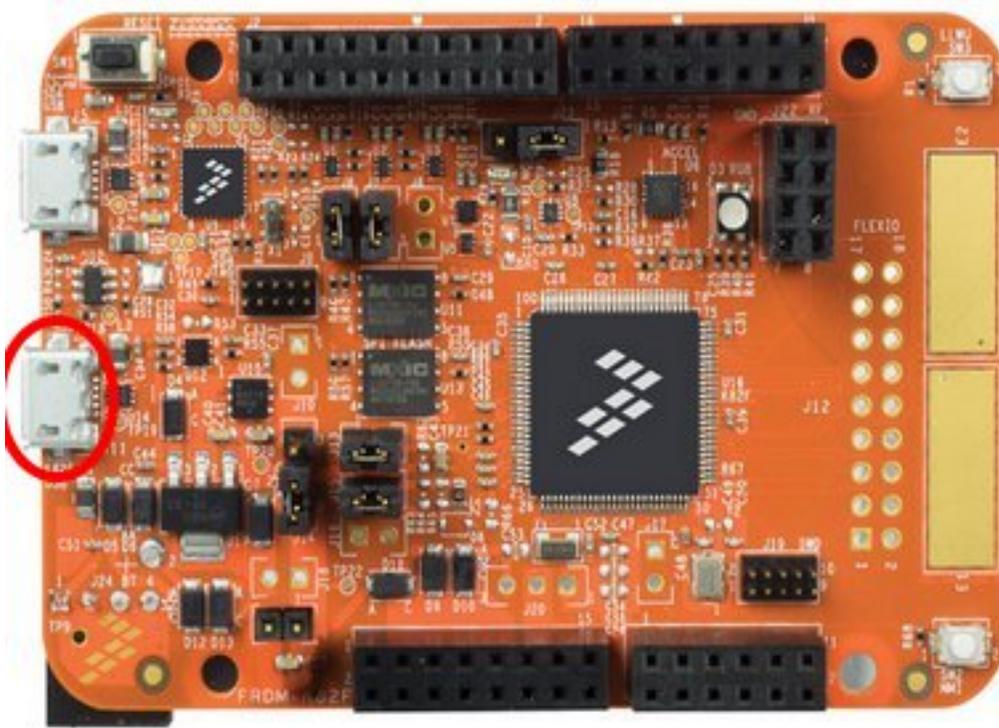
4. Download the demo firmware from [Avnet Silica website](#) and Drag'n drop or copy and paste the firmware into the **MBED** drive from your computer file explorer. After 10 seconds Un-plug and re-plug the USB cable from the SDA USB port **without** keeping reset button pressed.

**Note:** You can build this demo firmware by yourself. Please follow the instructions in the [Developing Guide](#) section.

5. Plug the **TD7740** camera to the **TDx016 adapter** board and Connect the board to the **FRDM-K82F** board.



6. Plug in the **micro USB** cable in the USB device port (the one in the middle of the card).



7. The board will enumerate as a generic USB video device called **Flexio Camera Device**. You can then use this device with any video capture software such as “camera” from Windows 10 or *AMCap*. Download and install it if you don’t have camera application on your O.S. Launch it and select the **Flexio Camera Device** device. You will see the frames transmitted at a resolution **QQVGA** of **160x120** pixels.

## 2.1.2 Developing Guide

This guide will provide instructions to install the development environment needed to compile and debug the demo firmware for the FRDM-K82L. The development system is multiplatform, it supports Windows and Linux. This guide is written using Windows. The main steps are:

- Install Kinetis Design Studio 3.2.0
- Build & Install KSDK 2.0 for FRDM-K82F board
- Import & build the source project

### Install & Update Kinetis Design Studio

1. First up, register at the NXP website [registration form](#) then you can download the IDE from [this page](#). Press on **Download** button.

## Kinetis Design Studio Integrated Development Environment (IDE) ☆

Overview
Documentation
Downloads
Hardware & Tools
Training & Support

**Jump To**

- Overview
- Features
- Supported Devices
- Community Discussions

### Overview

The Kinetis Design Studio (KDS) is a complimentary integrated development environment for Kinetis MCUs that enables robust editing, compiling and debugging of your designs. Based on free, open-source software including Eclipse, GNU Compiler Collection (GCC), GNU Debugger (GDB), and others, the Kinetis Design Studio IDE offers designers a simple development tool with no code-size limitations. Furthermore, Processor Expert software enables your design with its knowledge base and helps create powerful applications with a few mouse clicks.

Additional and new device support is installed through the [Kinetis Software Development Kit \(SDK\)](#).

If you are looking to upgrade to commercial tools that are fully compatible with KDS, [click here](#).

Download

We used Kinetis Design Studio 3.2.0, press on **Downloads for Kinetis Design Studio for Microsoft Windows**.

## Product Information

### Kinetis Design Studio IDE

Select a version. To access older versions, click on the " Previous " tab

Current
Previous

Version	Description	
3.2.0	<a href="#">Downloads for Kinetis Design Studio for Linux 64-bit (DEB).</a>	<a href="#">Download Log</a>
3.2.0	<a href="#">Downloads for Kinetis Design Studio for Linux 64-bit (RPM).</a>	<a href="#">Download Log</a>
3.2.0	<a href="#">Downloads for Kinetis Design Studio for Mac.</a>	<a href="#">Download Log</a>
3.2.0	<a href="#">Downloads for Kinetis Design Studio for Microsoft Windows.</a>	<a href="#">Download Log</a>

Agree the terms and download the file **Installer: Kinetis Design Studio 3.2.0 Installer for Windows**.

## Product Download

### Downloads for Kinetis Design Studio for Microsoft Windows.

Files
License Keys
Notes

Show All Files 
3 Files

+ File Description	File Size	File Name
+ Document: Kinetis Design Studio 3.2.0 Release Notes	674.1 KB	<a href="#">kinetis-design-studio_3.2.0_Release_Notes.pdf</a>
+ Installer: Kinetis Design Studio 3.2.0 Installer for Windows	684.6 MB	<a href="#">kinetis-design-studio_3.2.0.exe</a>
+ Service Pack: Eclipse add-on to add Kinetis SDK V2.x Project Wizard	242.6 KB	<a href="#">Eclipse add-on to add Kinetis SDK V2.x Project Wizard.zip</a>

Next, run the downloaded file **kinetis-design-studio\_3.2.0.exe** following all the default options.

2. Now we have to download and extract the KSDK 2.0 for the **FRDM-K82F** board. We will build the SDK through this website: [nxp website](#). Click on **Build SDK**. You have to register in order to use this feature.

## Kinetis Expert

### System Configuration Tool

Kinetis Expert provides a set of system configuration tools that help users of all levels with a Kinetis-based MCU solution. It is an expert on all things Kinetis – let it be your guide from first evaluation to production development.

Build an SDK

Choose a configuration for a specific evaluation board or a specific MCU, then let Kinetis Expert help you build a custom version of the [Kinetis SDK](#) and locate other software and tools.

Will appear a list of boards, select the **FRDM-K82F**

▼ Kinetis

- FRDM-K22F
- FRDM-K64F
- FRDM-K66F
- FRDM-K82F**
- FRDM-KL02Z
- FRDM-KL03Z
- FRDM-KL25Z
- FRDM-KL26Z
- FRDM-KL27Z
- FRDM-KL28Z
- FRDM-KL43Z

**Name your configuration**

FRDM-K82F

Select Configuration

Now it is necessary build the SDK package before to download. Click on **Build SDK Package**.

Your custom version of the Kinetis SDK is now ready to be packaged! Click the button below to complete the process.

<b>Package name</b>	<b>SDK version</b>	<b>Supported toolchain(s)</b>	<b>Host OS</b>
<input type="text" value="SDK_2.0_FRDM-K82F"/>	<input type="text" value="SDK 2.0"/>	<input type="text" value="Kinetis Design Studio"/>	<input type="text" value="Windows"/>

[Build SDK Package](#)

[SDK API Documentation v2.0](#)

From the **Software Vault** link you will see the message **Pending download approval**. You have to wait some minute.

Tools Software Vault Configur

## File Vault

[Remove all](#)

**Pending download approval**

Show  entries Search:

Name	Configuration	Date	Actions
 <b>SDK_2.0_FRDM-K82F</b> Board: FRDM-K82F, SDK version: KSDK 2.0.0, OS: Windows, Toolchain: KDS, Selected optional items: CMSIS DSP library, FatFS, USB stack, FreeRTOS (98MB)	FRDM-K82F	2016-09-01 10:11 AM GMT	<a href="#">Download</a> <a href="#">Remove</a>

After the approval phase you will can download the SDK built. Accept the terms and download the **evNXPv01.zip** file.

Tools Software Vault Configur

## File Vault

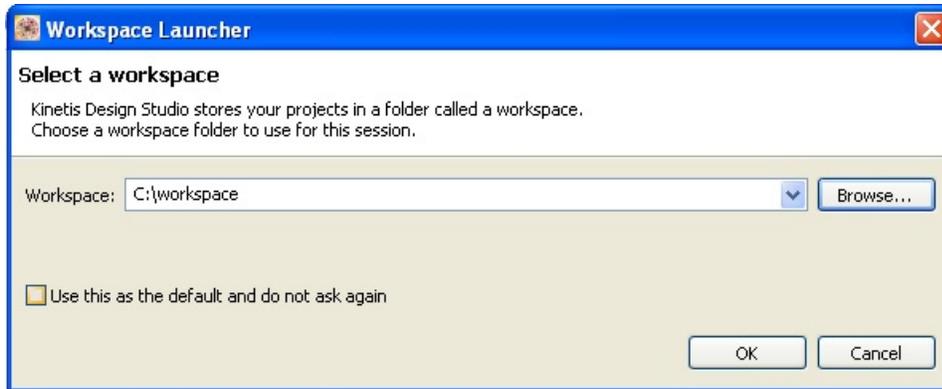
[Remove all](#)

Show  entries Search:

Name	Configuration	Date	Actions
 <b>SDK_2.0_FRDM-K82F</b> Board: FRDM-K82F, SDK version: KSDK 2.0.0, OS: Windows, Toolchain: KDS, Selected optional items: CMSIS DSP library, FatFS, USB stack, FreeRTOS (98MB)	FRDM-K82F	2016-09-01 10:11 AM GMT	<a href="#">Download</a> <a href="#">Remove</a>

## Build the Project

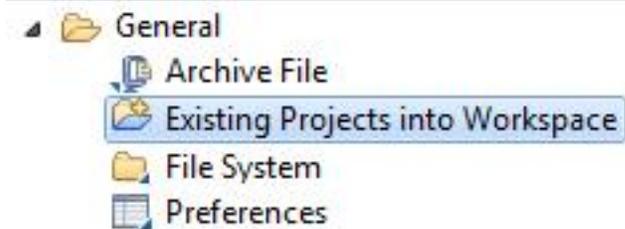
1. Launch KDS and select a directory for the workspace. Our project will be imported in this folder. In this guide we used this path:



2. Follow next steps:

- (a) Unzip the **evNXPv01.zip** file into the workspace creating a new folder named **SDK\_2.0\_FRDM-K82F**.
- (b) Download the sources of the **DEMO\_usb\_device\_video\_flexio\_ov7740** going [here](#)
- (c) unzip it in the folder **UNIT:\[YOUR PATH TO]\workspace\SDK\_2.0\_FRDM-K82F\boards\frdmk82f\demo\_apps**.

3. From the **Kinetis Design Studio** select **File -> import**. Then choose **General -> Existing Projects into Workspace**

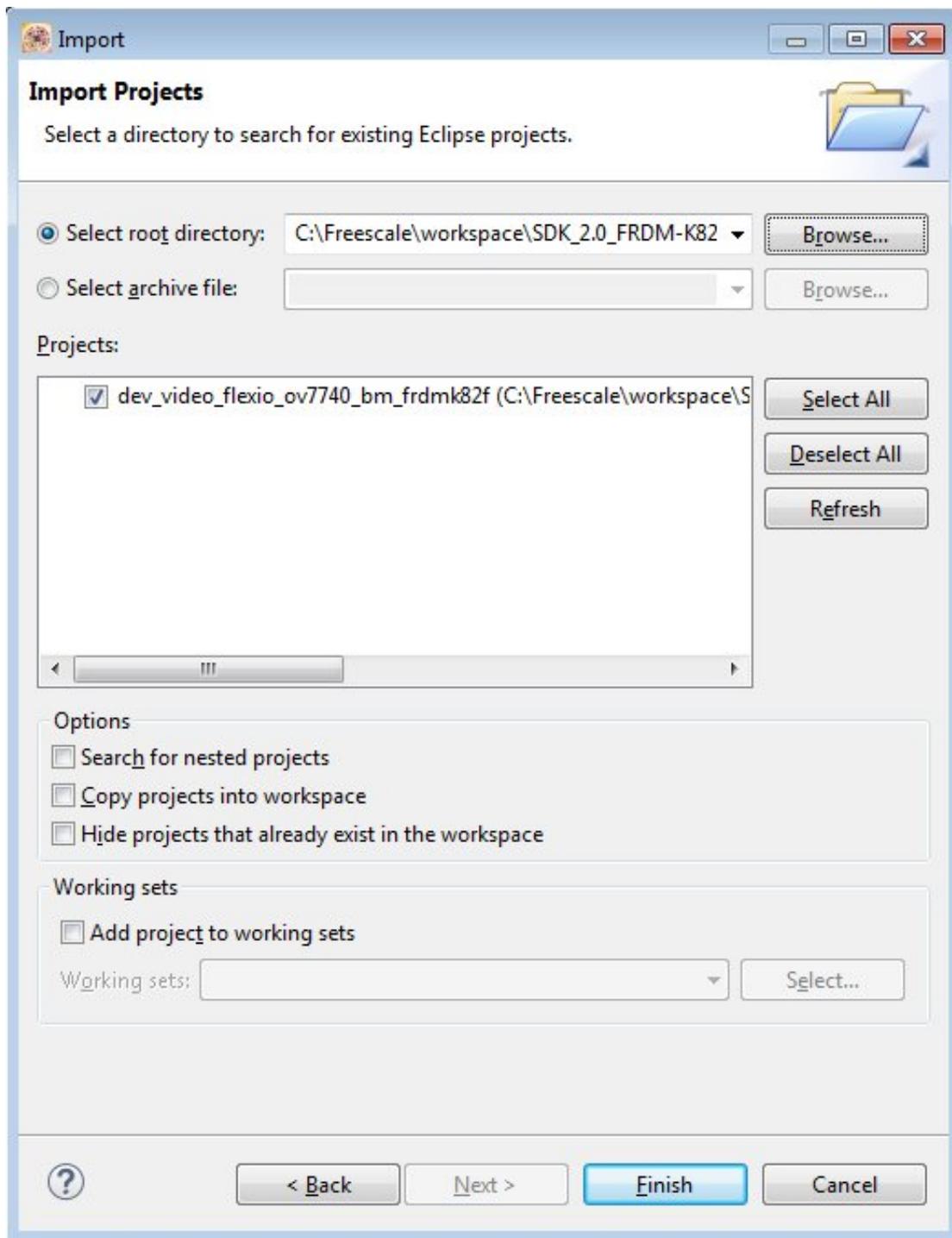


1. In **Select root directory**, click on **Browse** and select the path:

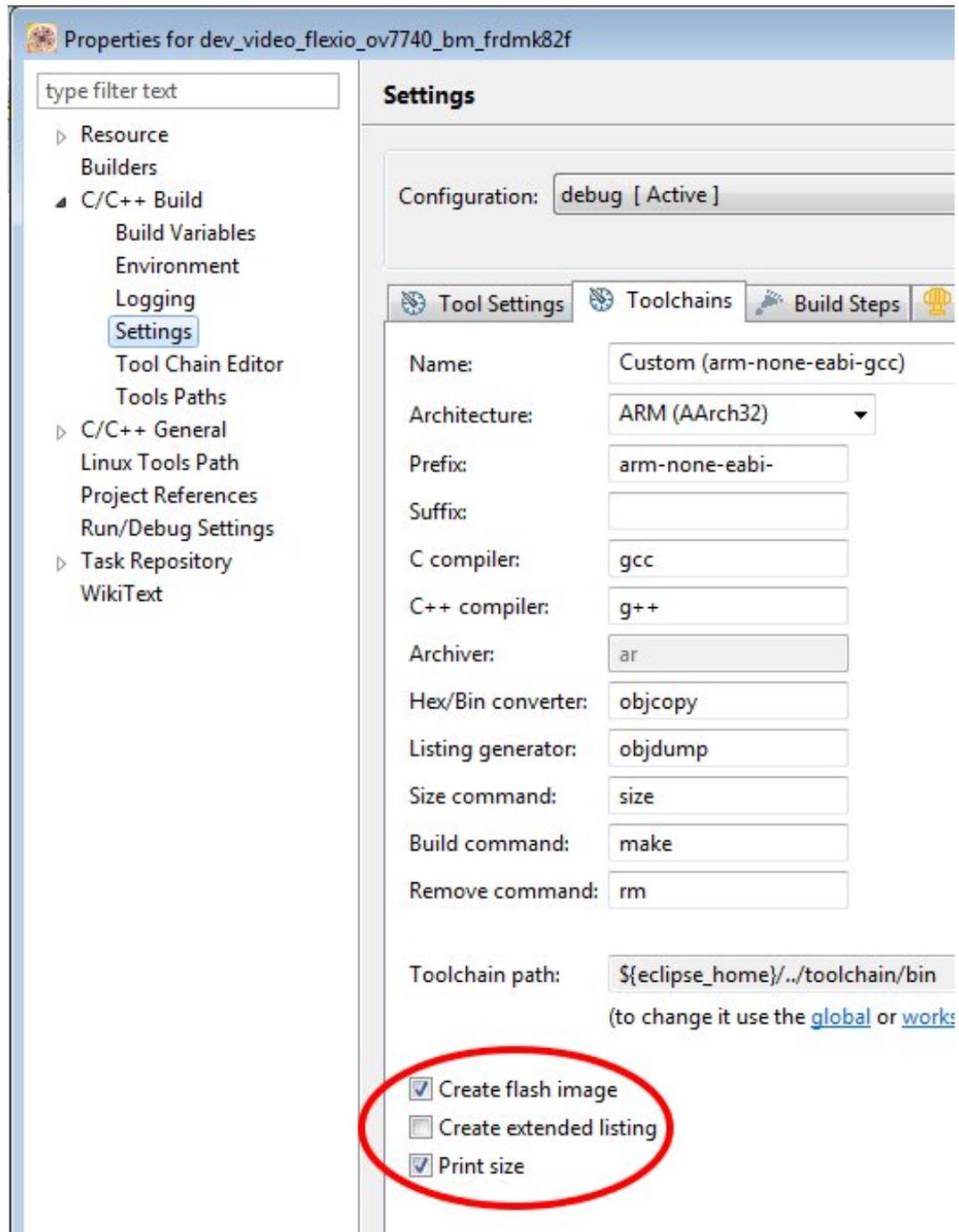
```
UNIT:\\[YOUR PATH TO]\\SDK_2.0_FRDM-K82F\\boards\\frdmk82f\\demo_apps\\DEMO_
→usb_device_video_flexio_ov7740
```

The project should be automatically detected and selected.

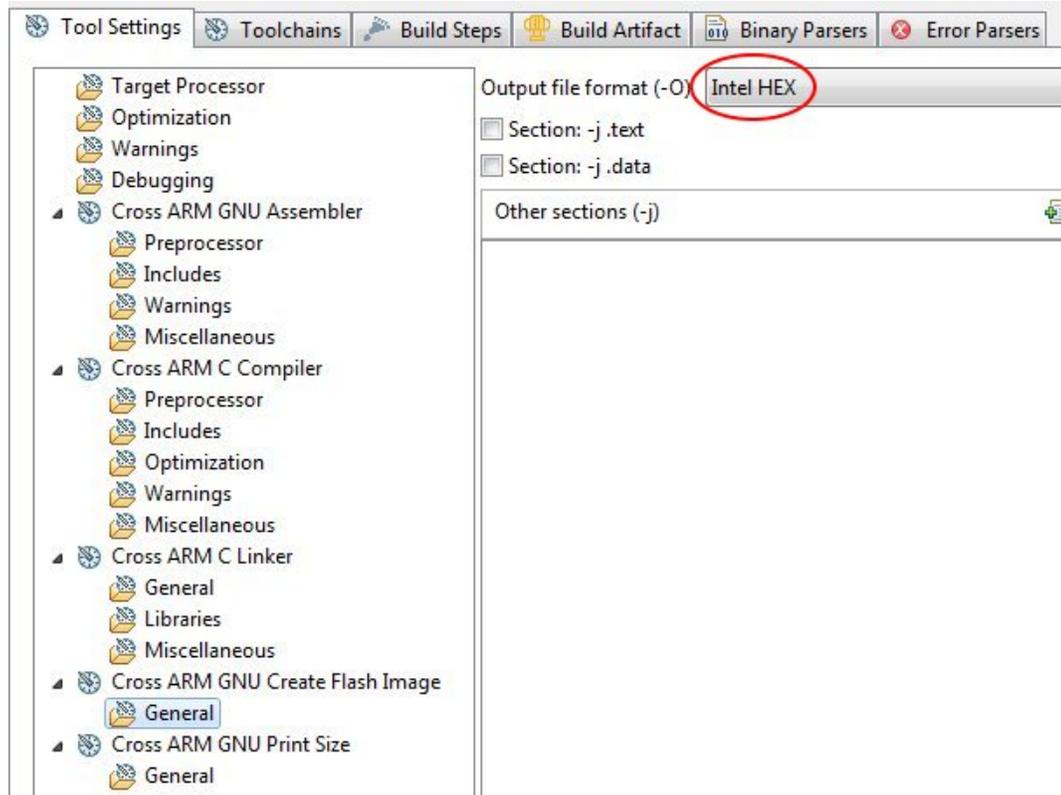
2. Click on **Finish**.



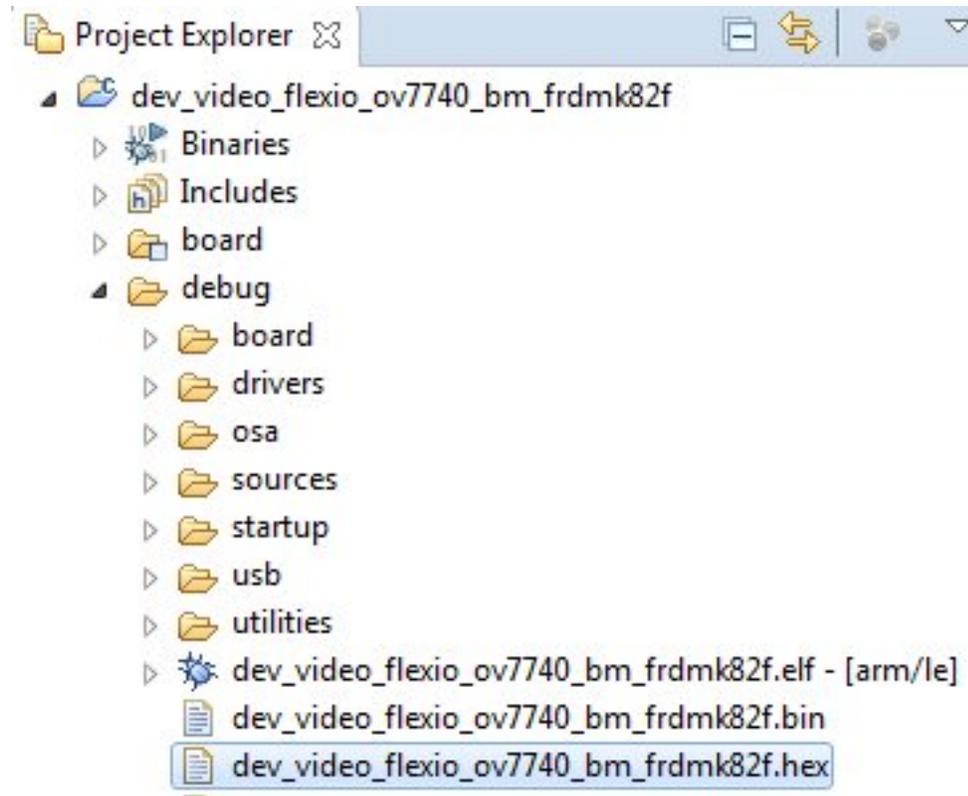
4. Before to build it's necessary setup the configuration of the project to create the **hex** file to upload in the board.
  - (a) Click on **Project -> Properties**
  - (b) select **C/C++ Build -> Settings**
  - (c) click on the **Toolchains** tab, then check the options **Create flash image** and **Print size**.
  - (d) click on **Apply**



- (a) After select the **Tool Settings** tab
- (b) click on **Cross ARM GNU Create Flash Image -> General**
- (c) choose as **Output file format** the **Intel HEX** option.



- (a) click on **Apply**
  - (b) Apply the modifies clicking on **Ok** button
  - (c) build the project selecting **Project -> Build All**.
8. In UNIT:[YOUR PATH TO]\SDK\_2.0\_FRDM-K82F\boards\frdmk82f\demo\_apps\DEMO\_usb\_device\_video\_flexio\_ov7740 folder you will find your hex file: `dev_video_flexio_ov7740_bm_frdmk82f.hex`.



- The **dev\_video\_flexio\_ov7740\_bm\_frdmk82f.hex** file is the firmware demo uploadable in the FRDM-K82F, it is used in *Quick Start Guide*

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