LPC1768-Xplorer

Fig.1

About NGX Technologies

NGX Technologies is a premier supplier of development tools for the ARM7, ARM Cortex M0, M3 and M4 series of microcontrollers. NGX provides innovative and cost effective design solutions for embedded systems. We specialize in ARM MCU portfolio, which includes ARM7, Cortex-M0, M3 & M4 microcontrollers. Our experience with developing evaluation platforms for NXP controller enables us to provide solutions with shortened development time thereby ensuring reduced time to market and lower development costs for our customers. Our cost effective and feature rich development tool offering, serves as a testimony for our expertise, cost effectiveness and quality.

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Table of Contents

1.0 INTRODUCTION

This document is the User Manual for the LPC-1768-Xplorer, a low cost ARM Cortex-M3 based board by NGX Technologies. This document reflects its contents which include system setup, debugging, and software components. This document provides detailed information on the overall design and usage of the board from a systems perspective.

Before proceeding further please refer the quick start guide for LPC-1768-Xplorer features and hardware verification.

For LPC1768-Xplorer Quick Start Guide: Click here.

For the most updated information on the LPC-1768-Xplorer board please refer to NGX'website.

2.0 LPC1768-Xplorer Development Tool Setup

2.1 IDE and debugger

As mentioned in the earlier section, NGX's MCU evaluation platforms are not coupled tightly with any one particular combination of IDE and debugger. The following sections will explain the setup for KEIL and ULINK2 as the IDE and debugger respectively.

2.2 Installation & Configuration of KEIL software

The Installation of KEIL software is explained below:

Step 1: Open the KEIL setup

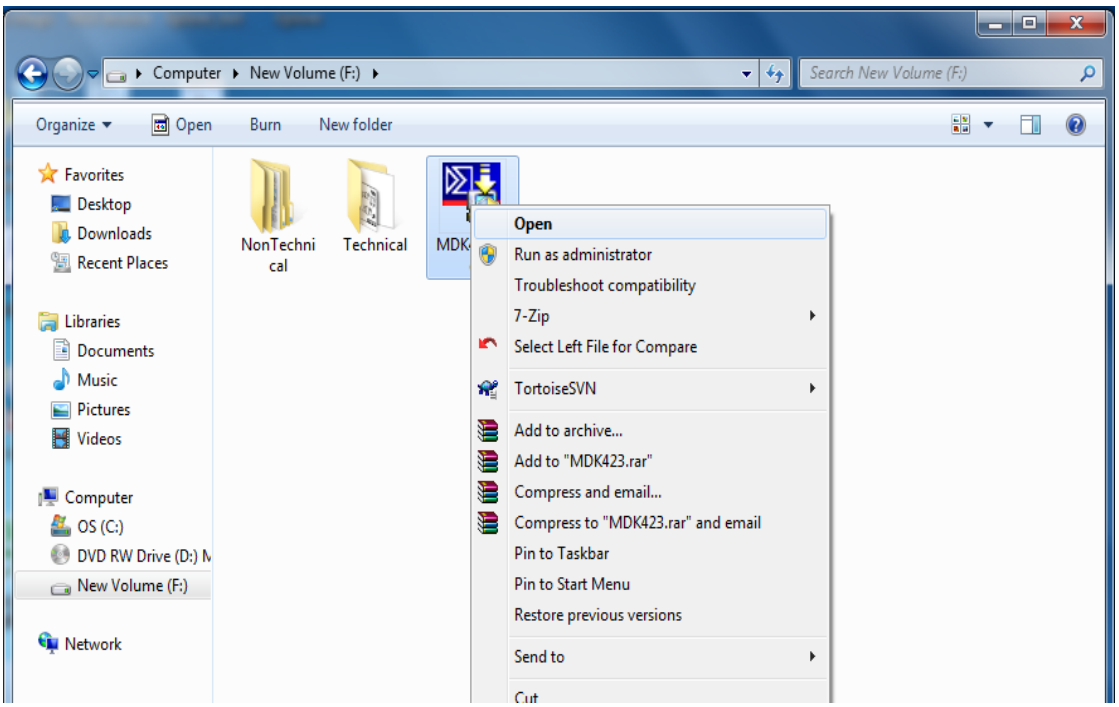

Fig.2

Step 2: Click on Next.

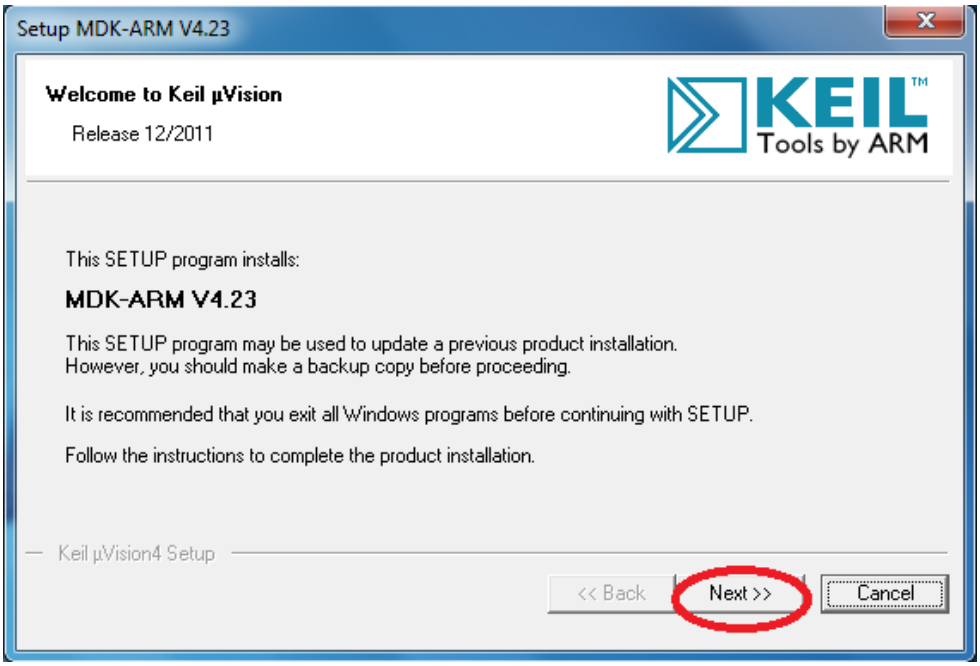

Fig.3

Step 3: Select Terms & conditions check box and click on Next

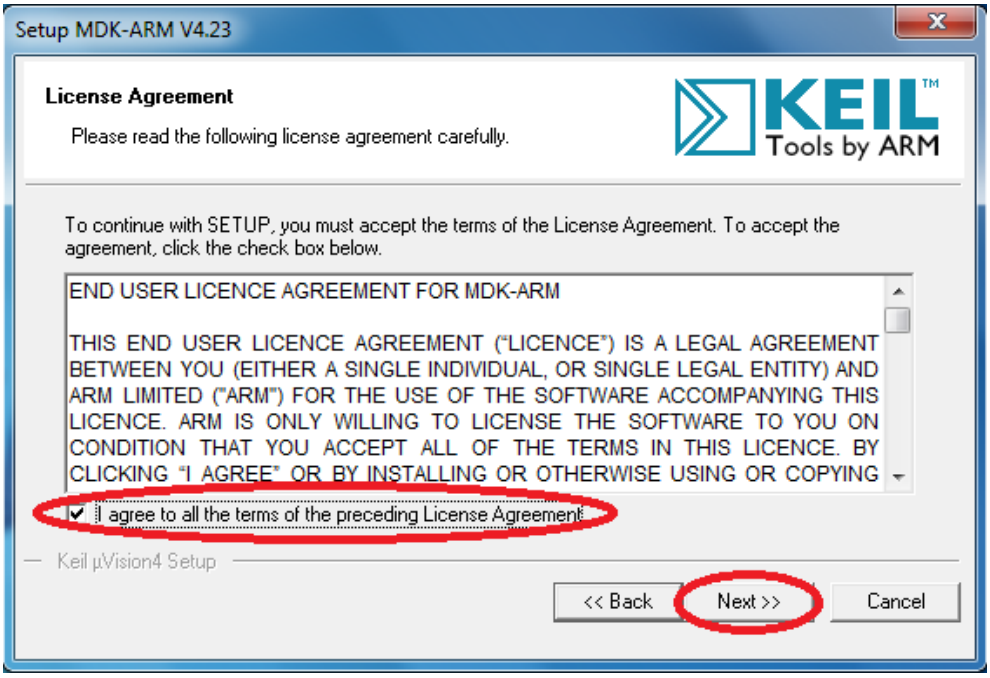

Fig.4

Step 4: Provide the destination path and Click on Next

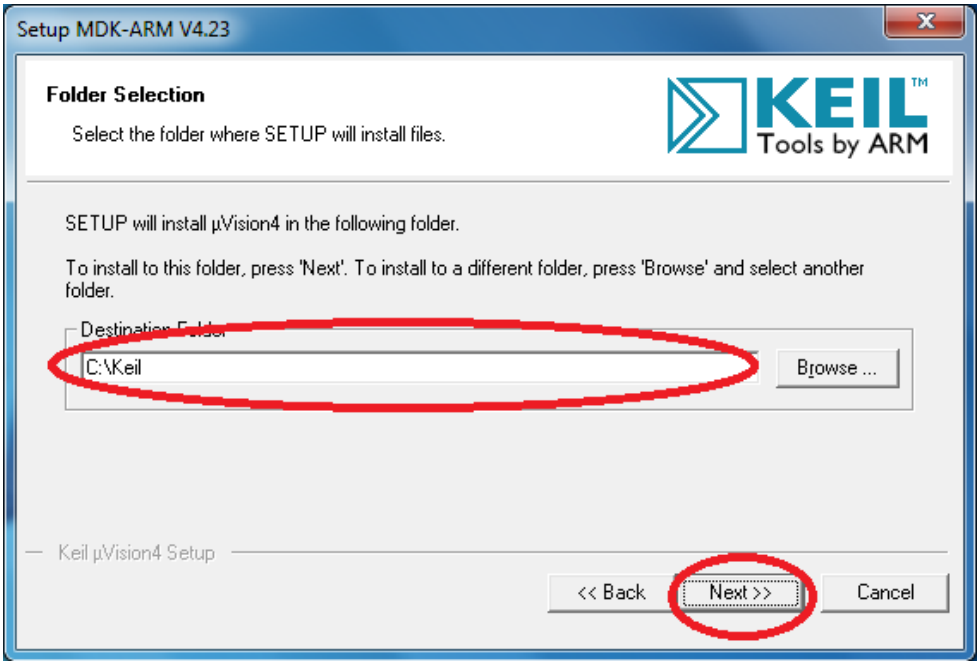

Fig.5

Step 5: Fill your Personal information and Click on Next

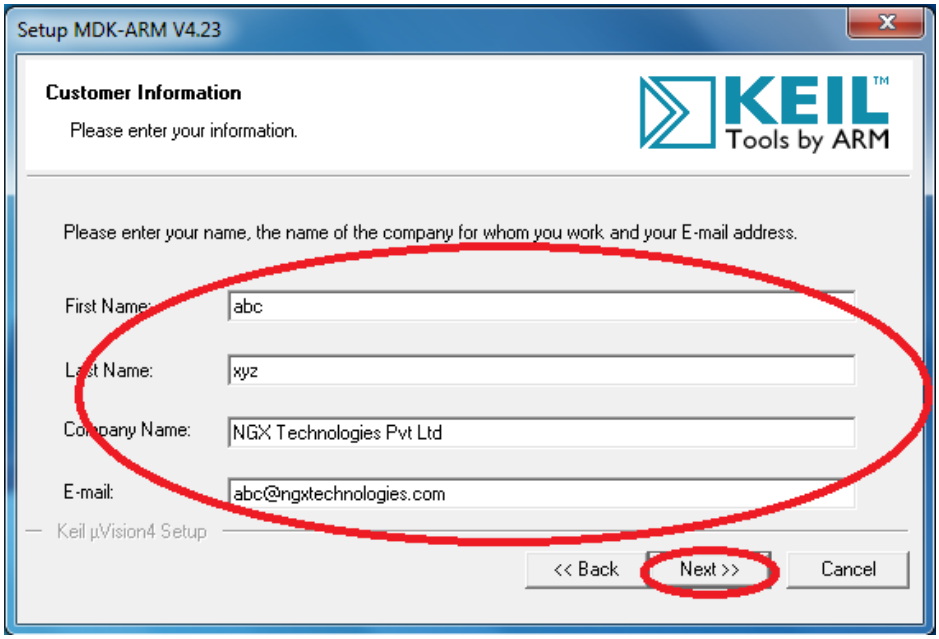

Fig.6

Step 6: Click on Next

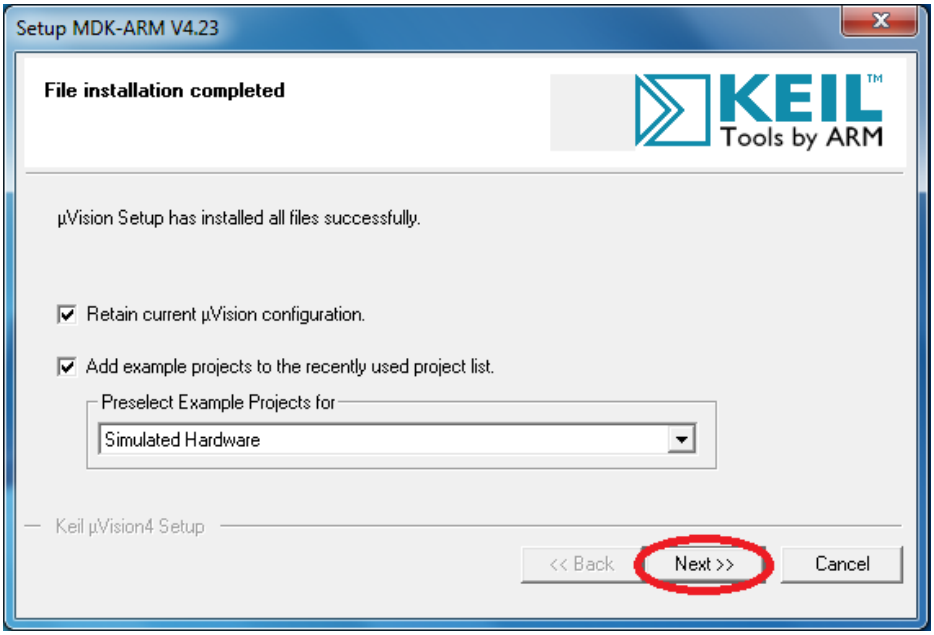

Fig.7

Step 7: Keil µVision4.23 setup is completed. Click on Finish.

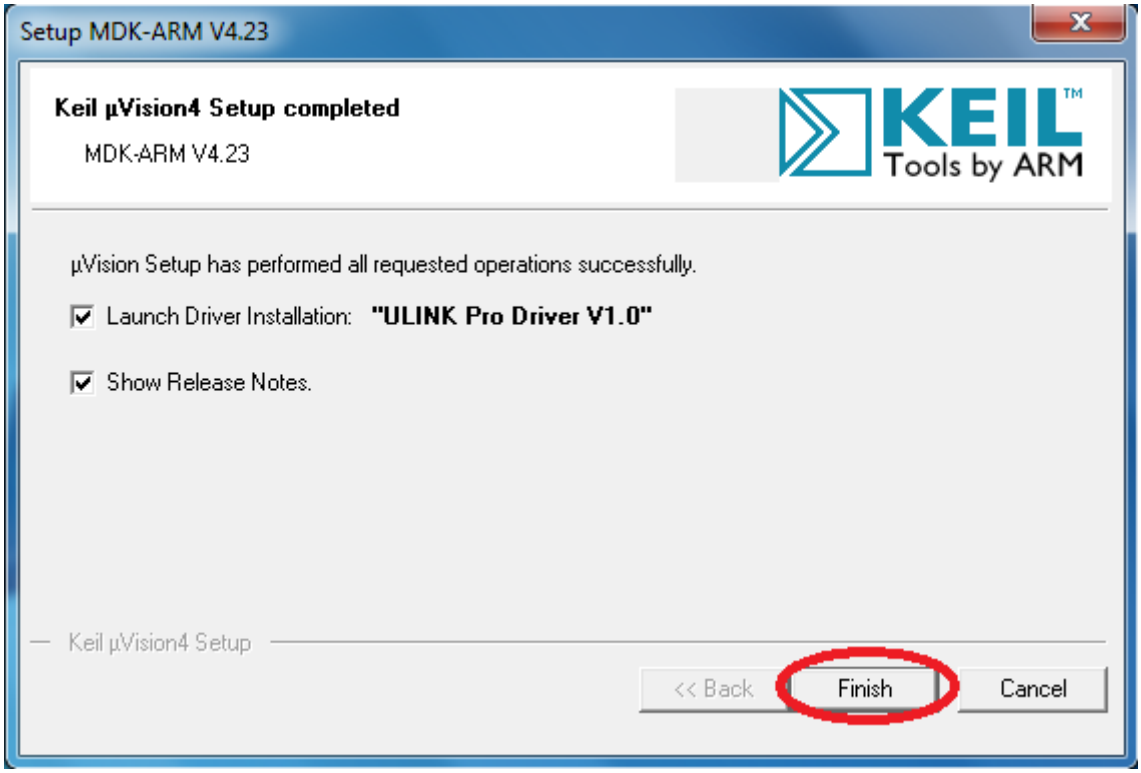

Fig.8

2.3 Setup for ULINK2 and LPC1768-Xplorer Board

The Xplorer board has on board ‘10-pin SWD/JTAG box’; ensure that the ULINK2/ME must havpin SWD/JTAG’ support for development. The ULINK2 debugger, ‘20-pin to 10-pin adapter’ and pin ribbon cable are not a part of the LPC1768 Xplorer package, the user needs to buy separately.
To program/debug the KEIL examples you will need the following and the image shows the components:

- ULINK2
- ARM JTAG to Cortex JTAG Adapter (20-pin to 10-pin Adaptor)
- 10-pin ribbon cable
- LPC1768 Xplorer Board
- One USB AM to Micro B cable

Fig.9

Steps to setup the ULINK2 and LPC1768 Xplorer Board:
(Note: Please refer keil knowledgebase article for Connecting ULINK2/ME 10-pin ribbon cable to NGX Xplorer)

Step 1: Connect one end of 10-pin ribbon cable to ‘20-pin to 10-pin adapter’ as show in following image.

Fig.10

Step 2: Connect other end of 10-pin ribbon cable to '10-pin box header' of the LPC1768 Xplorer board as shown in the following image.

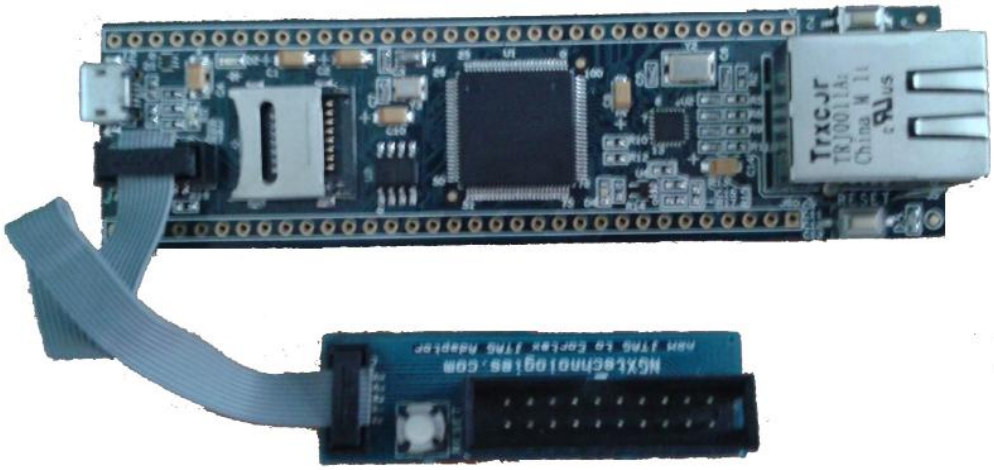

Fig.11

Step 3: Now connect the 'ULINK2 20-pin cable' to '20-pin to 10-pin adapter', connect one end of 'USB AM to Micro B' cable to LPC1768 Xplorer board and other end to computer, connect one end of 'USB type B' to ULINK2 and other end to computer, as shown in the following image.

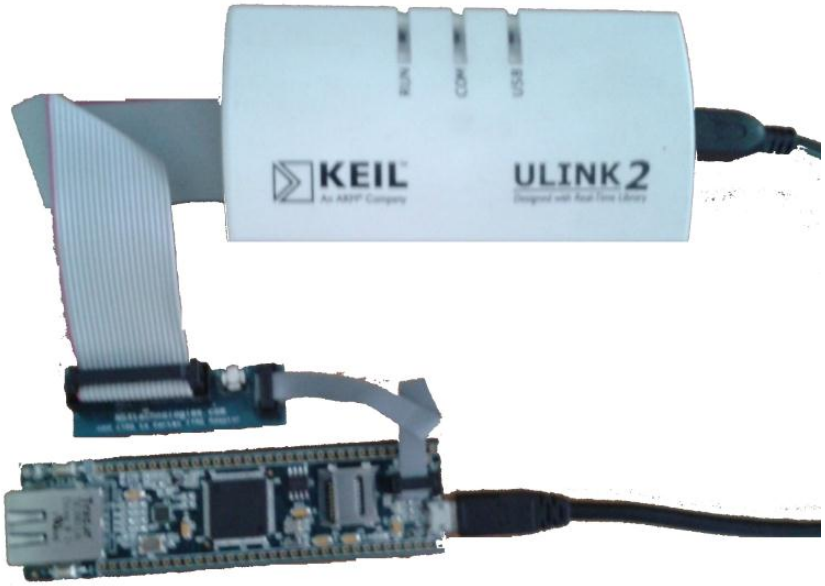

Fig.12

Step 4: The setup is now ready to be used for development with **KEIL IDE** and **ULINK2**.

2.4 Configuration of ULINK2 Debugger

The configuration flow of ULINK2 Debugger is explained below:

Step 1: Open the Keil Workspace, then by clicking on the **target** option, the window opens as shown below. Next click on Debug and then select the ULINK2/ME Cortex Debugger as shown in the image.

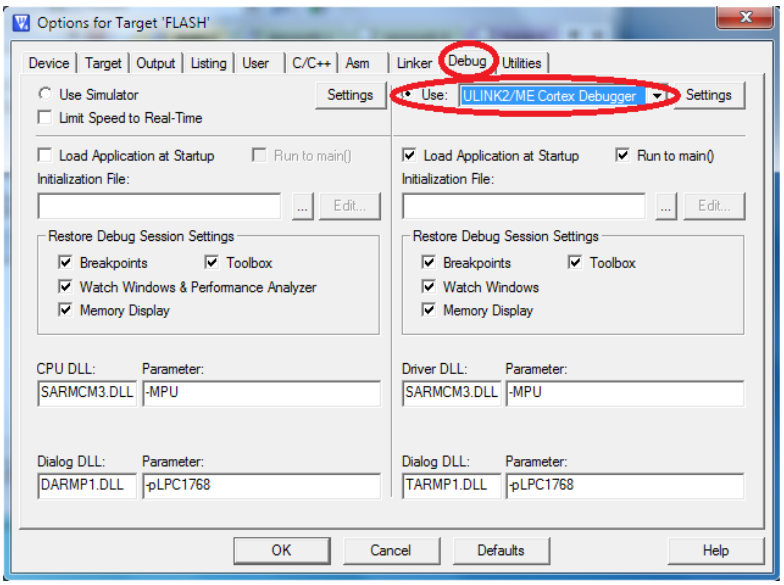

Fig.13

Step 2: Next Click on the settings option, the Cortex-M Target Driver Setup window opens then select JTAG port. After selection of the JTAG port the ULINK2 detected is as shown in the image below

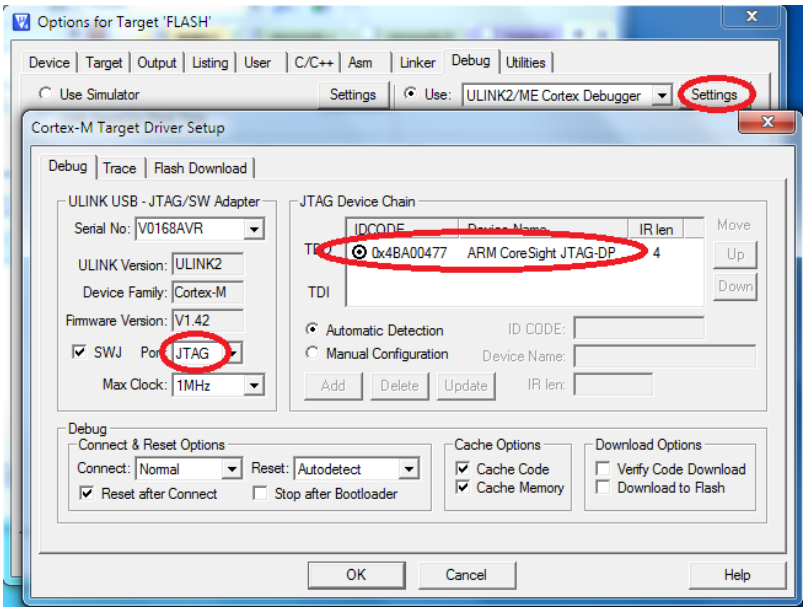

Fig.14

Note: The Cortex M3 can be programed using SW or JTAG.

2.4 Configuring Internal Flash

Step 1: Open the Keil Workspace, then by clicking on the **target** option the widow opens as shown below, click on Utilities and select ULINK2/ME Cortex Debugger

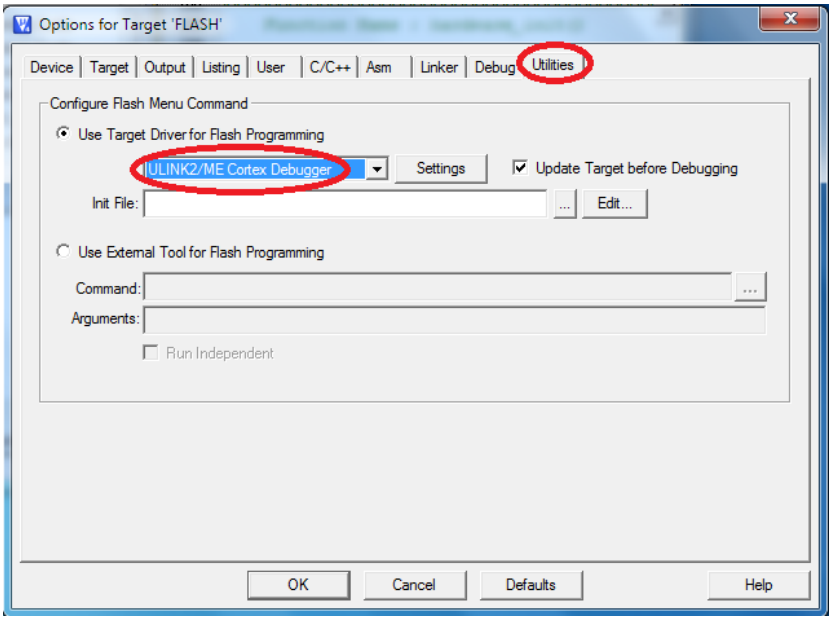

Fig.15

Step 2: Now Click on Settings, then in Cortex-M Target Driver setup click add and select FLASH on LPC17xx Flash programing algorithm and click add.

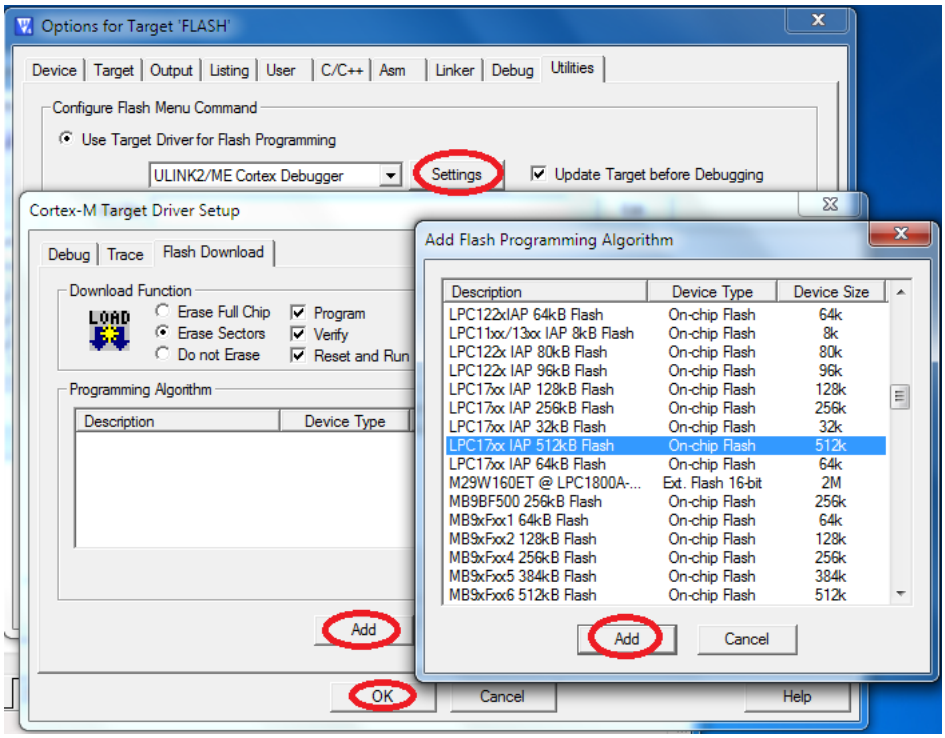

Fig.16

Click OK to complete the ULINK2 Debugger configuration.

3.0 LPC1768-Xplorer Software Development

3.1 Executing the sample projects in KEIL

Please note that the sample programs are available once the product is registered.

Steps to execute the sample project:

Step 1: Open the project folder.
Step 2: Then open the file project_name.uvproj (Example: Blinky.uvproj.)

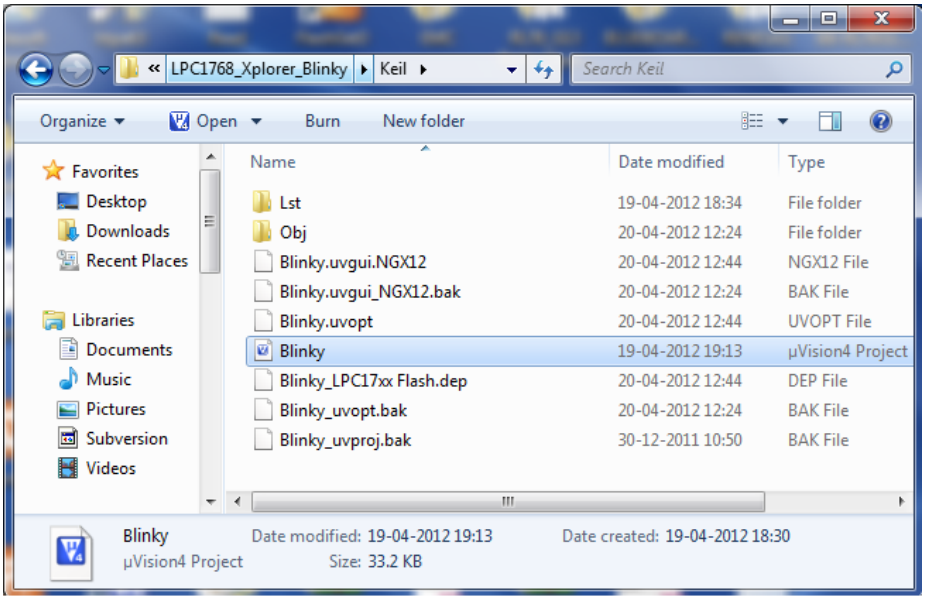

Fig.17

Step 3: This launches the IDE

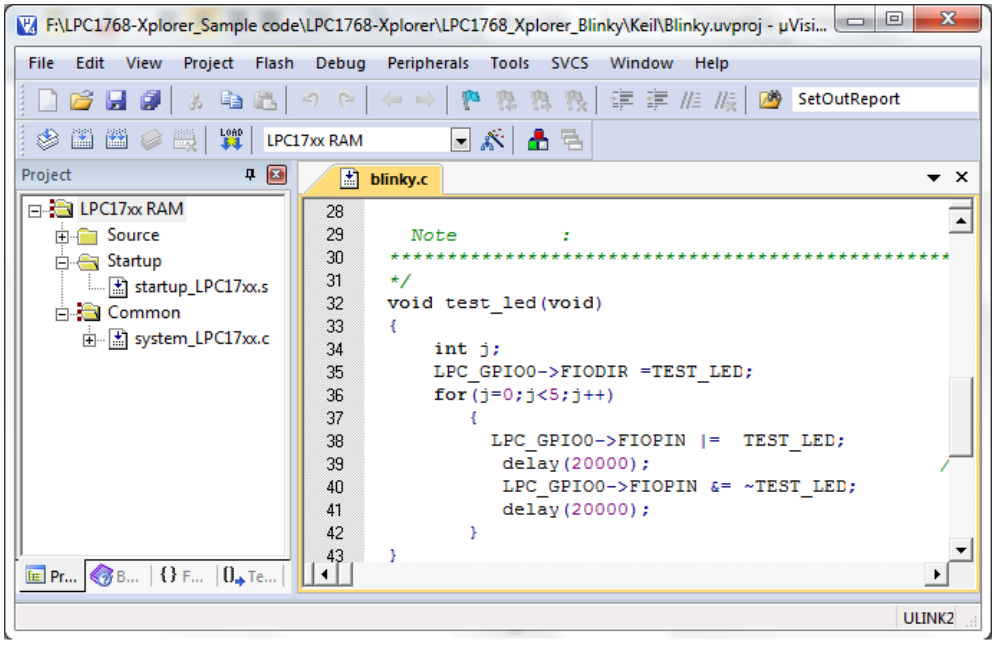

Fig.18

If you are using ulink2 debugger, click Debug on menu bar then click on start/stop debug session; click Run (F5) to execute from the Internal RAM, LED's (D4) on Xplorer should blink.

Steps to execute the sample project in Internal Flash:

Step 4: Select LPC17xx Flash option as shown in the below image.

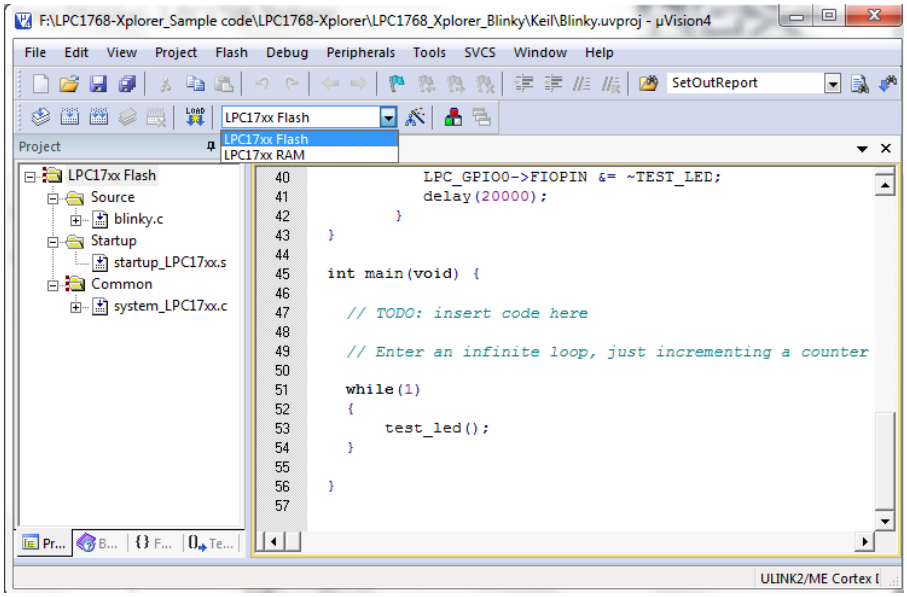

Fig.19

Step 5: Click on Build to build the project as shown in the below image

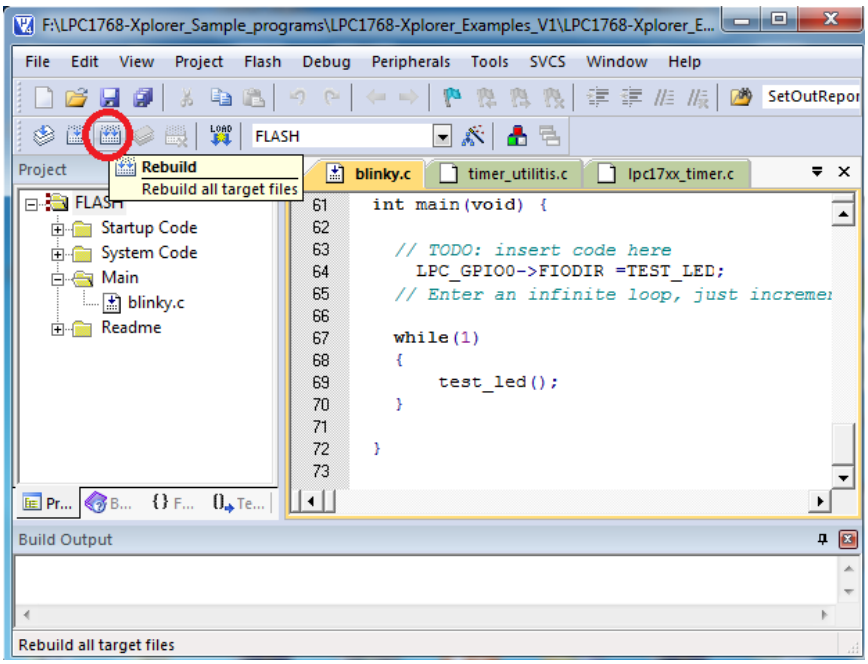

Fig. 20

Step 6: Click on LOAD, the executable is loaded into internal flash. The program can be run by pressing RESET switch or the program can be debugged from the flash by clicking start/stop debug session. Click Run (F5) to execute from the Flash, LED (D4) on Xplorer should blink.

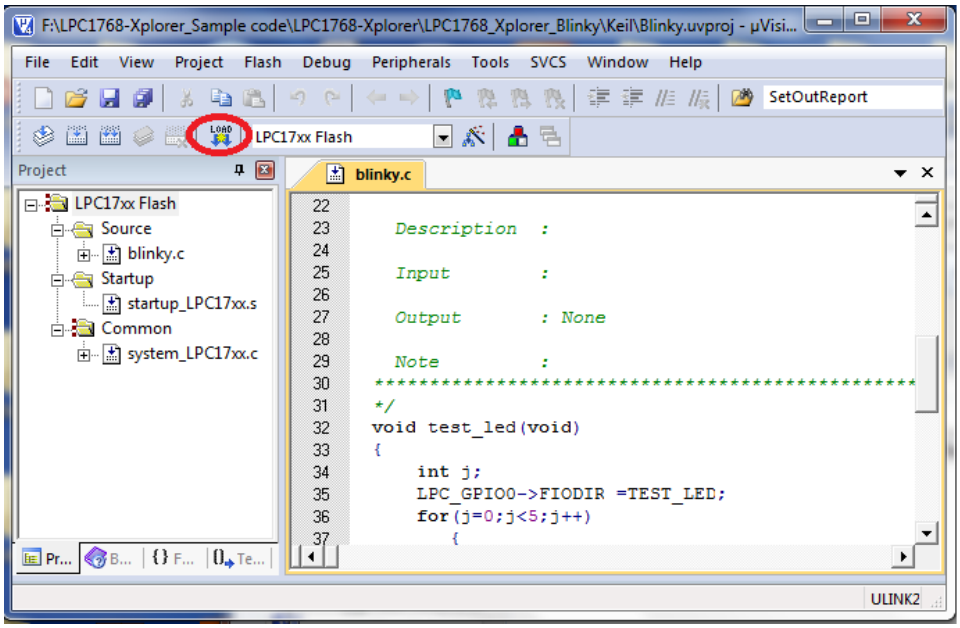

Fig.21

Step 7: To debug the code click on Debug option then click on Start/Stop Debug session as shown in the below image. Press F5 to free run or press F10 to line by line debug.

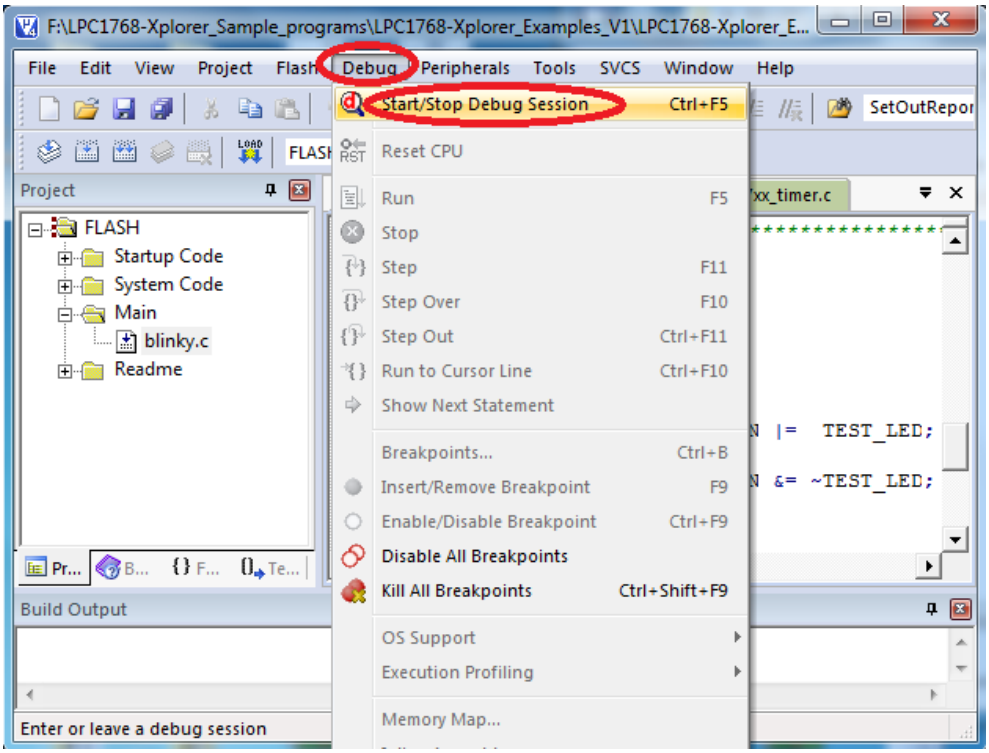

Fig. 22

3.2 Creating New project

Follow the below steps, for creating new project:

Step 1: Open the keil IDE.

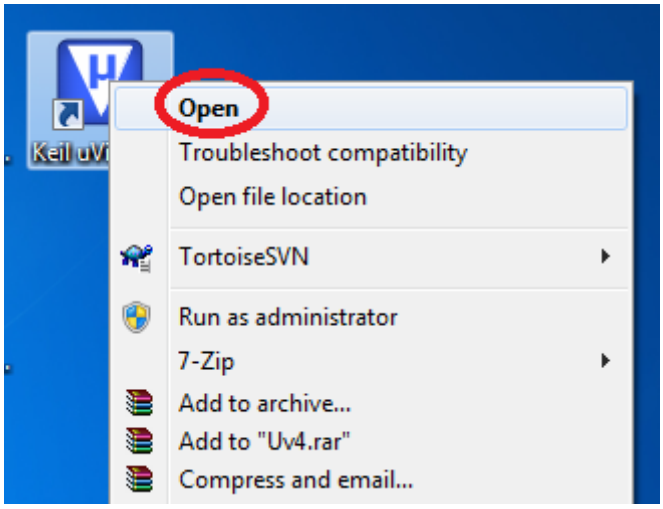

Fig. 23

Step 2: Click on to the Project tab – new uvision project.

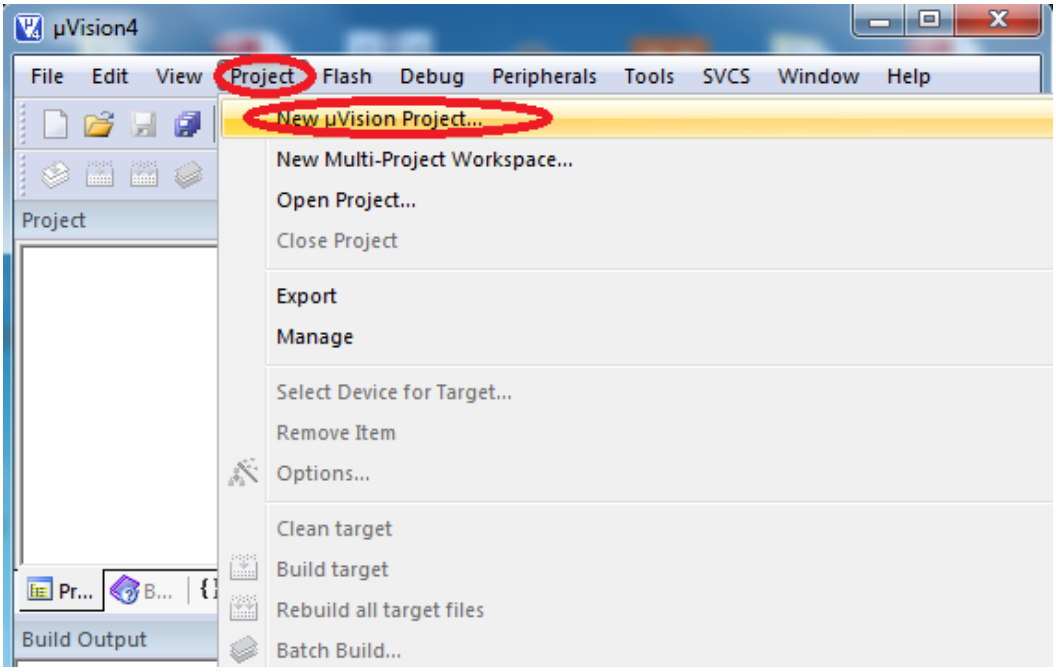

Fig. 24

Step 3: Give project name then click Save.

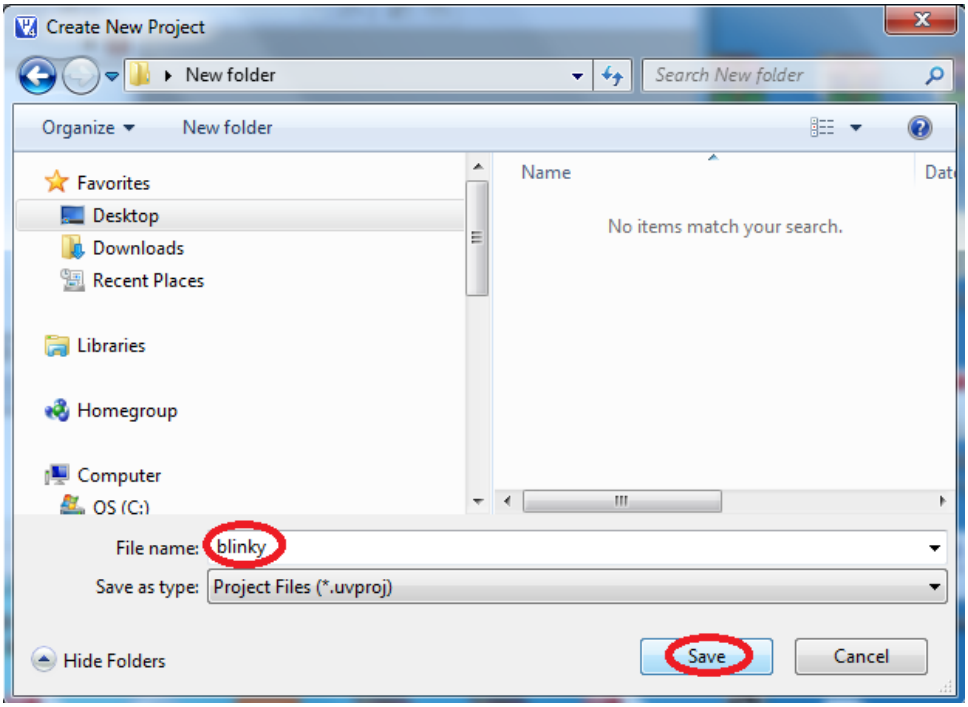

Fig. 25

Step 4: Select the controller.

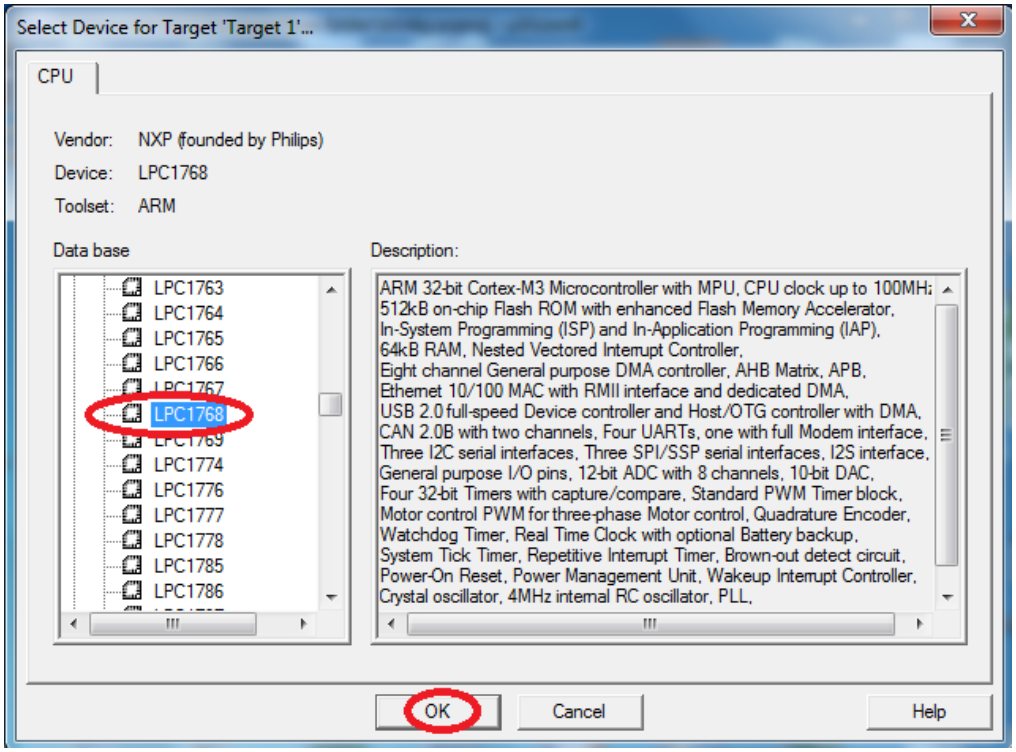

Fig. 26

Step 5: Go to file – new, & start writing the code.

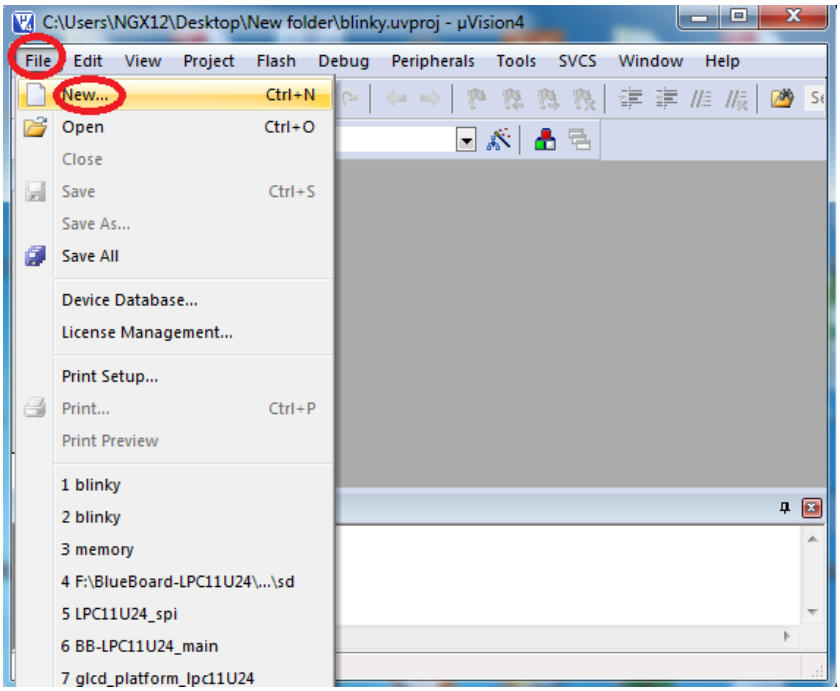

Fig. 27

Step 6: Save the file with some name.

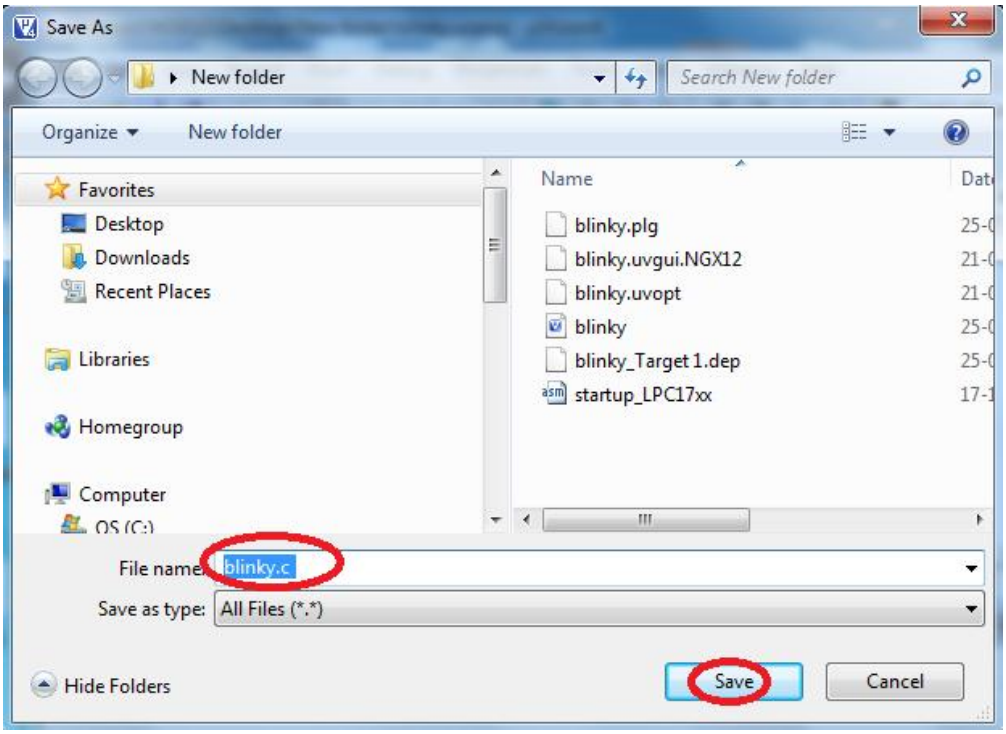

Fig. 28

Step 7: Add the file to the source group as shown in the below image.

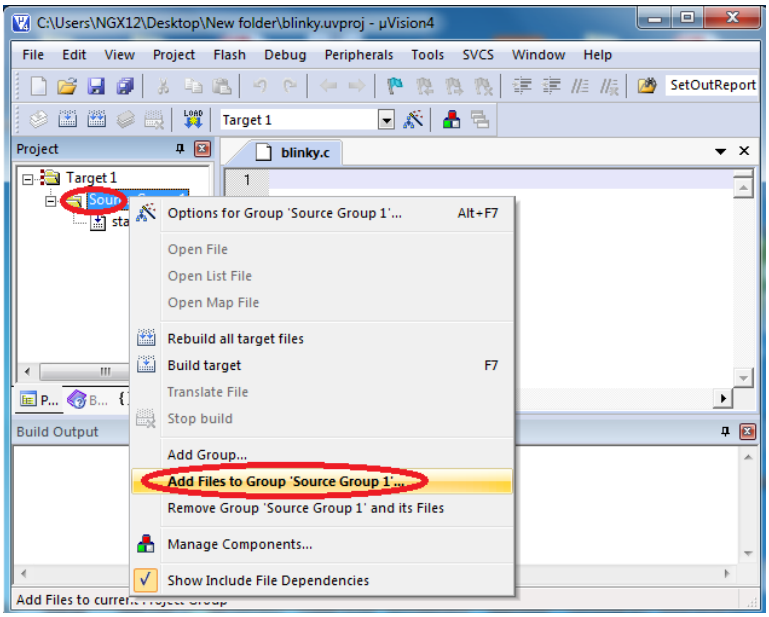

Fig. 29

Step 8: Select the file and click on Add as shown in the below image.

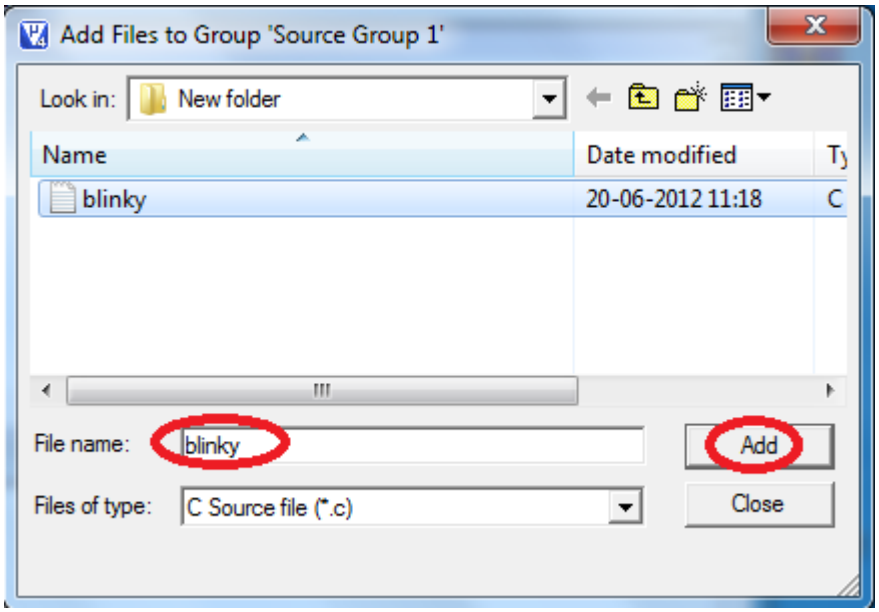

Fig. 30

Hence building the code will create the Hex file.

Step 9: To build, download and debug follow the steps 5, 6 and 7 in section 3.1.

4.0 LPC1768-Xplorer Programming

4.1 Programming options

LPC1768-Xplorer can be programmed using the

- Secondary USB bootloader (USB)
- Debugger (ULINK2)

4.1.1 Secondary bootloader (USB)

In order to program the board through USB we need to get the board under programming mode.

Getting the board in programming mode:

Theory: The secondary bootloader looks for a logic LOW to be present on a pre-defined PIN (ISP pin) during reset. If the ISP pin is held LOW and reset signal is provided to the MCU, the MCU enters into programming mode.

Practical:
On the LPC1768-Xplorer the RESET and ISP signals are connected to buttons provided on the board. Look for the RESET and ISP marking on the board. Therefore to enter into programming mode:

- **Press and hold** the ISP button
- Press the RESET button and release it
- Now release the ISP button
- The board is in the programming mode

Programming through USB is the most convenient way to program the LPC1768-Xplorer. The USB bootloader makes programming the board very simple. You don't require any PC application to program using USB bootloader. Once the board enters the programming mode it appears as a drive on your Windows machine and all you need to do is just drag-n-drop your binary to this drive.

4.1.2 Flashing the board using USB

The pre-build binaries can be used to flashing onto to the board for each peripheral by using the USB bootloader as a Mass storage device. After loading the USB bootloader firmware to the LPC1768-Xplorer board, Press ISP, then RESET; release RESET, then ISP, the mass storage device will appear on your screen. On the board LED D3 glows. Remove firmware.bin file and then place your bin file and then press reset switch to execute the specific code written on to the flash.

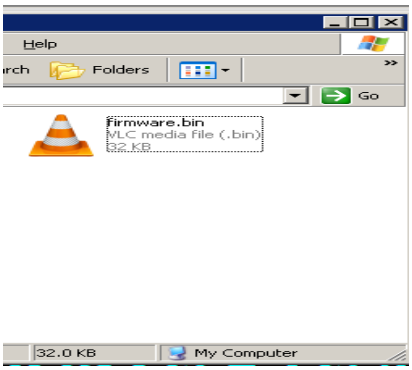

Fig. 31

Flashing the bin file(Drag & drop).

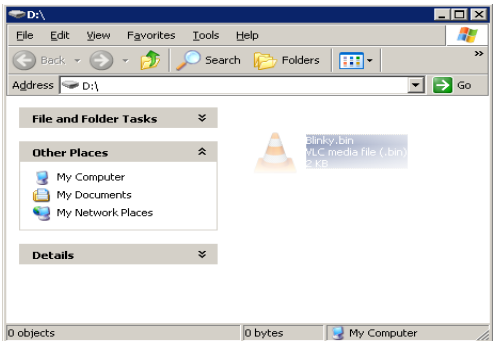

Fig. 32

4.1.3 Creating the Bin file compatible with Secondary USB bootloader

Steps to create bin file that is compatible with the free loader secondary USB bootloader are as follows

Step 1: Open the project, open the Target options..

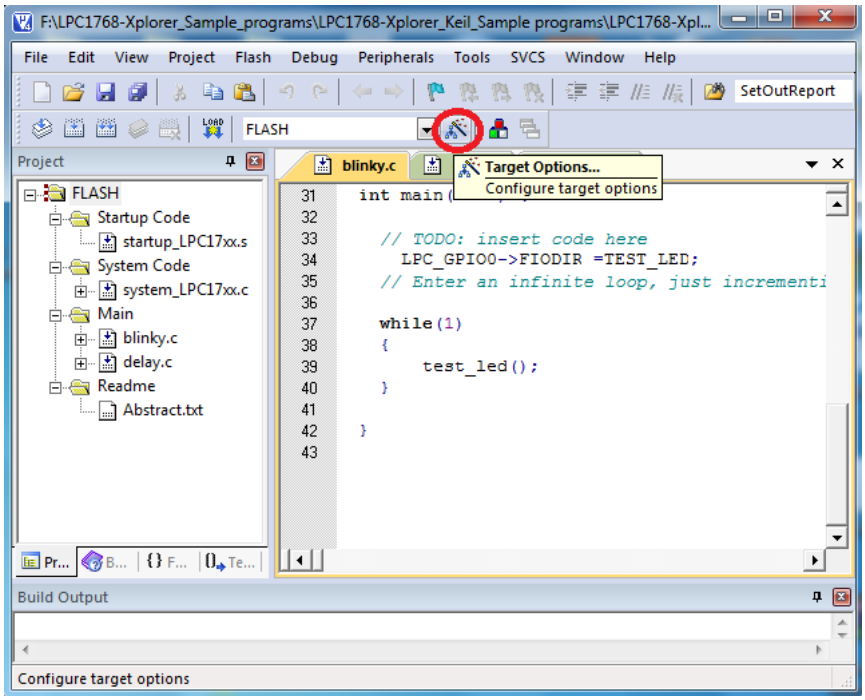

Fig. 33

Step 2: Change the start address of on-chip IROM1 memory from 0 to 0x2000 as shown in fig. below. This is the area where user program is placed and has to run when the controller is reset.

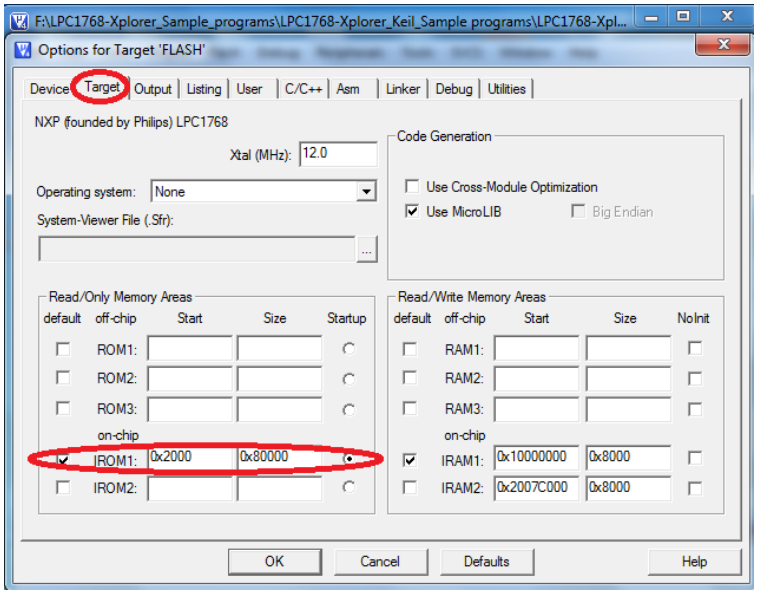

Fig. 34

Step 3: Insert the user command in Run #1 ticking the check box. After compile and build the entire project, from elf it creates hex file along with the hex file there will be another file with the extension .axf. This user command is used to convert .axf file to .bin. Here in fig. Above project_name.axf is converted to project_name.bin which is used for drag drop programming with the USB boot-loader that allows you to enumerate the board as a Mass Storage Device.

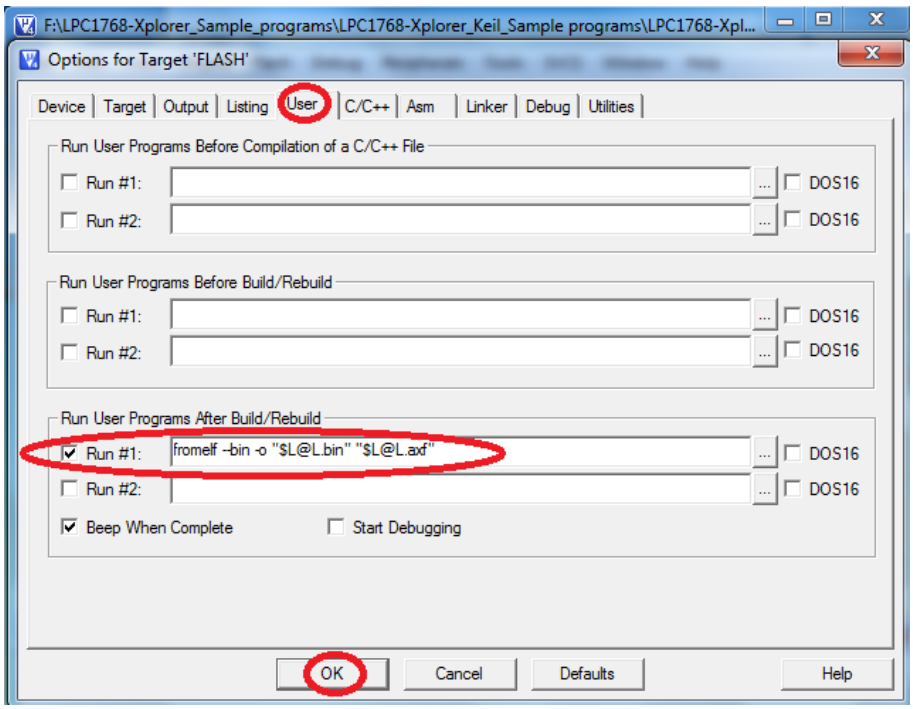

Fig. 35

4.0 Schematic & Board Layout

4.1 Schematic

This manual will be periodically updated, but for the latest documentations please check our website for the latest documents. The Board schematic and sample code are available after the product has been registered on our website.

4.2 Board layout

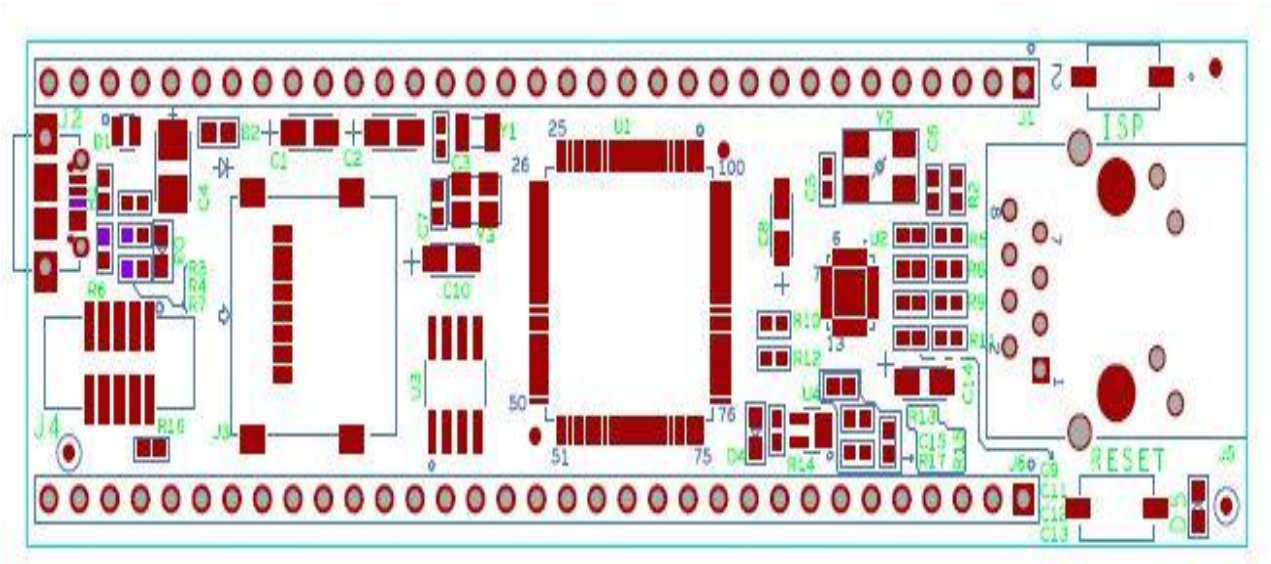

Fig.36

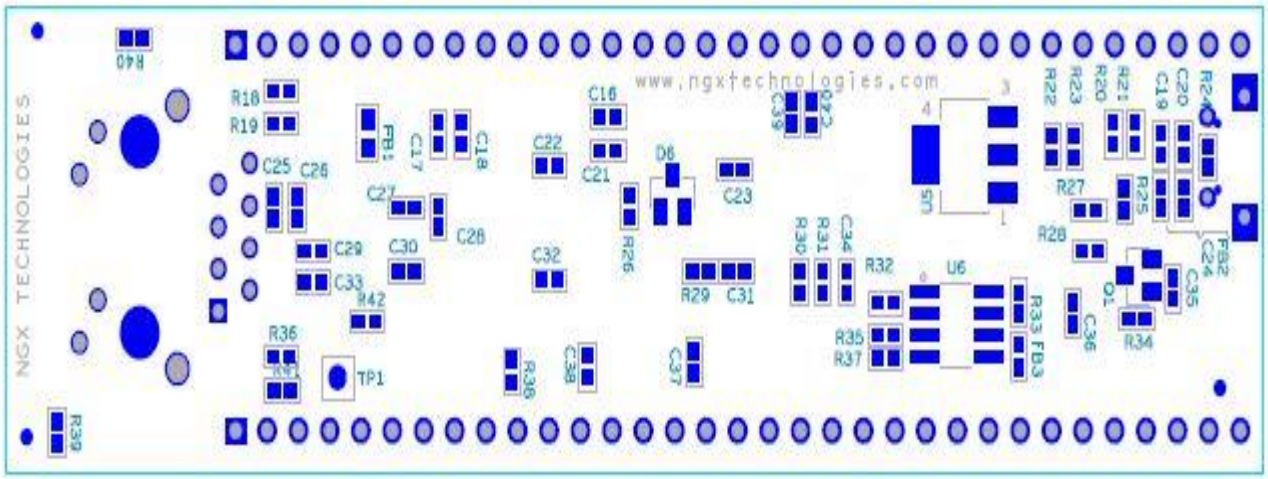

Fig. 37

5.0 CHANGE HISTORY

5.1 Change History

Rev	Changes	Date (dd/mm/yy)	By
1.0	Initial release of the manual	25/06/2012	Veeresh Tumbaragi

About this document:

Revision History

Version: V1.0 author: Veeresh Tumbaragi

Company Terms & Conditions

Legal

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