LPC4350 Gaming Console

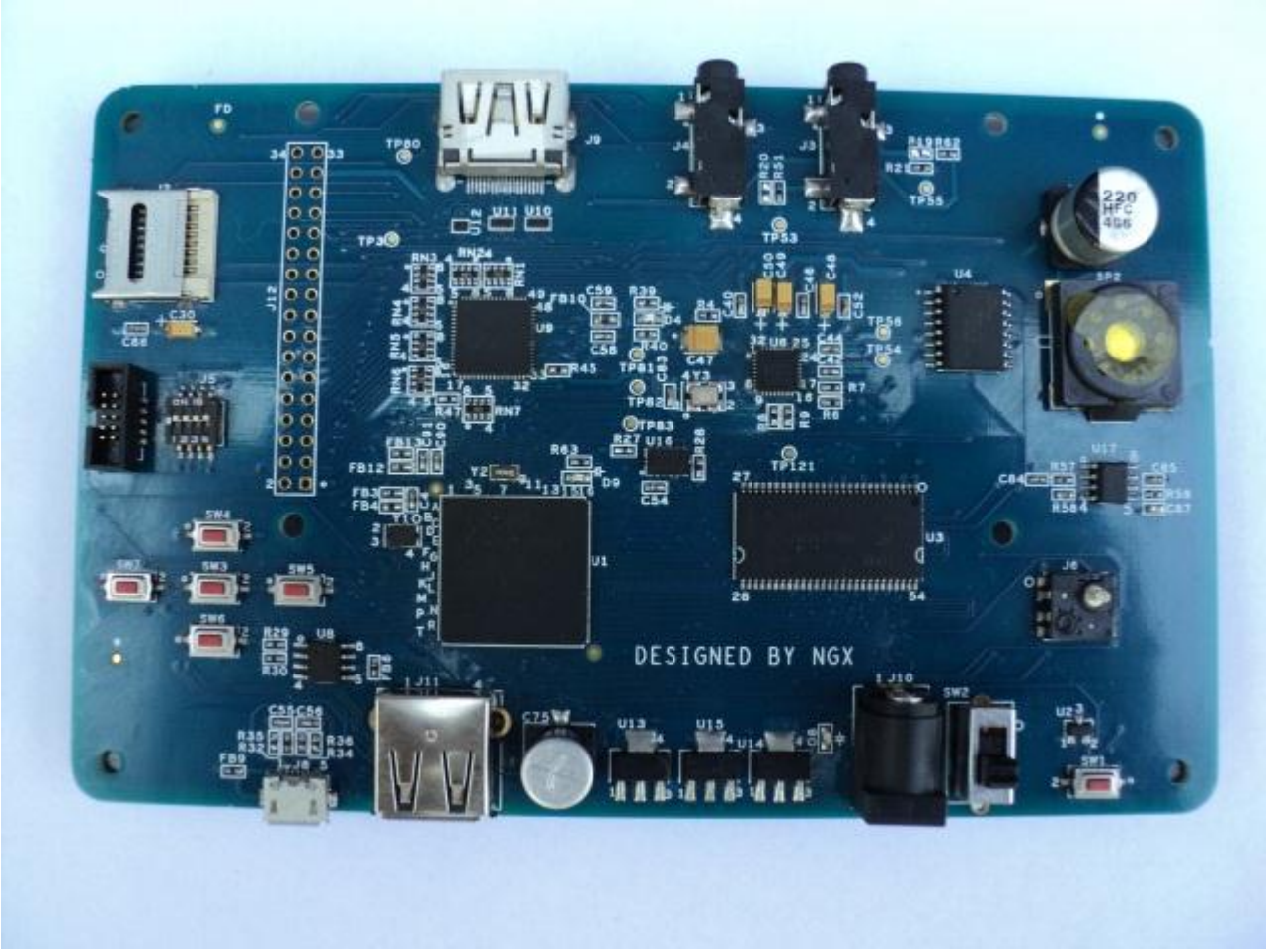


Fig. 1

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-M3, M0 & 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.

Contact Information:

NGX Technologies Pvt. Ltd.
No.216, 5th main Road, R.P.C. Layout,
Vijayanagar 2nd Stage,
Bangalore – 560 104
Phone : +91-80-40925507
email:sales@ngxtechnologies.com

Table of Contents

1.0 INTRODUCTION

This document is the System Reference Manual for 'LPC4350 gaming Console'. It explains the hardware design and procedure to verify the boards.

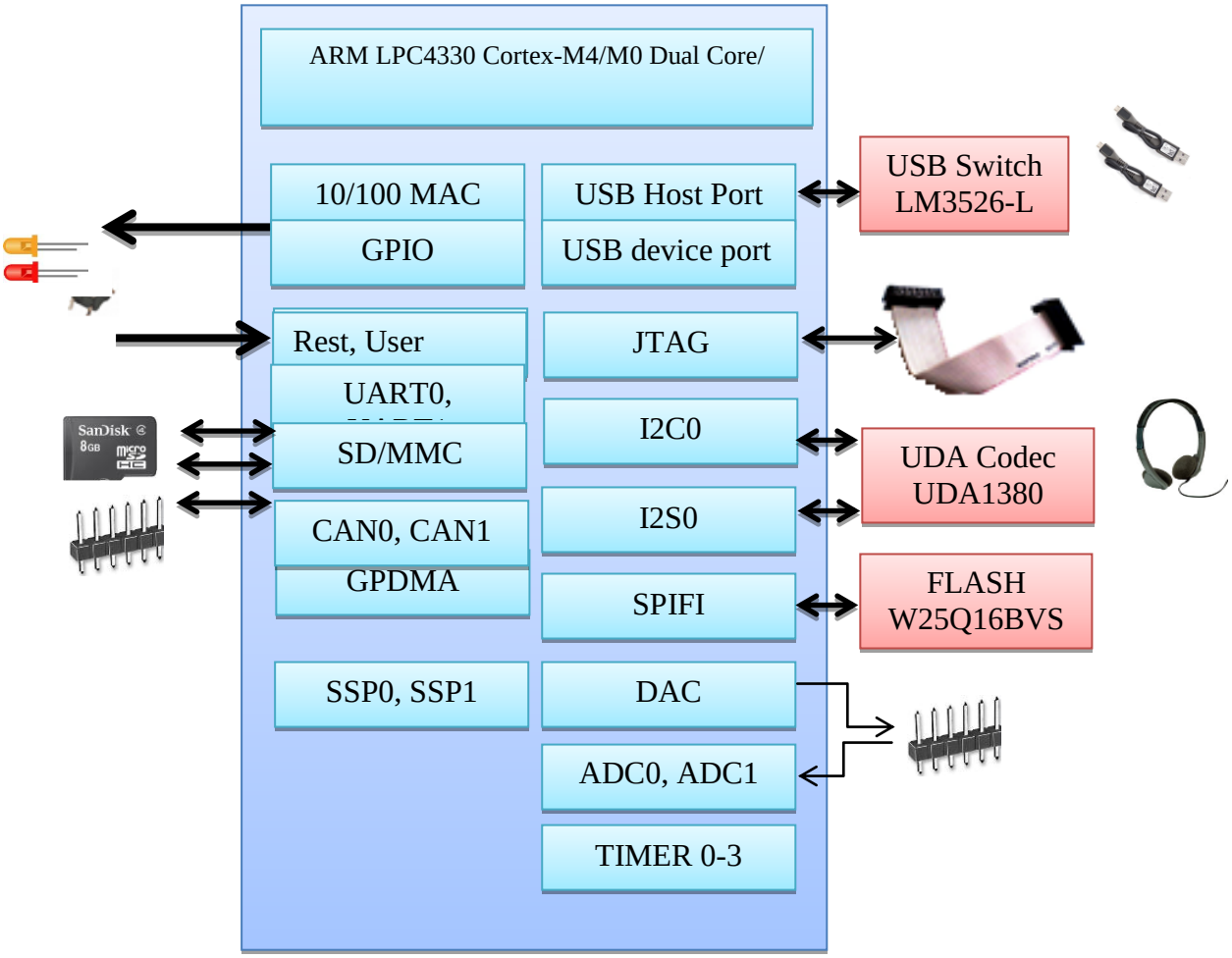
The 'LPC4350 gaming Console' is a platform for designing Gaming Devices. The design is based on LPC4350 dual core (Cortex-M0 and M4) MCU from NXP. It also has a LCD-HDMI converter solution from NXP along with support for external RAM, external Quad Flash and 3-axis accelerometer.

Features

Following are the salient features of the design

- Dimensions: 140mm X 89mm
- Controller: LPC4350, 256 pin BGA
- PCB: 6-layer
- HDMI out using NXPs solutions for LCD to HDMI
- Audio codec and audio jacks
- Two USB ports, one HS (High speed USB host) port and one FS (Full Speed device) port
- 128Mb Spansion Quad flash
- 32 MB external SDRAM
- 3 axis accelerometer from Analog Devices
- Five user input switches
- Joystick (Five way switch)
- One user LED
- One ISP switch and one reset switch
- Boot select switch
- Crystals for controller, RTC and audio codec
- On board USB host power switch
- 10-pin cortex debug header

Design Overview



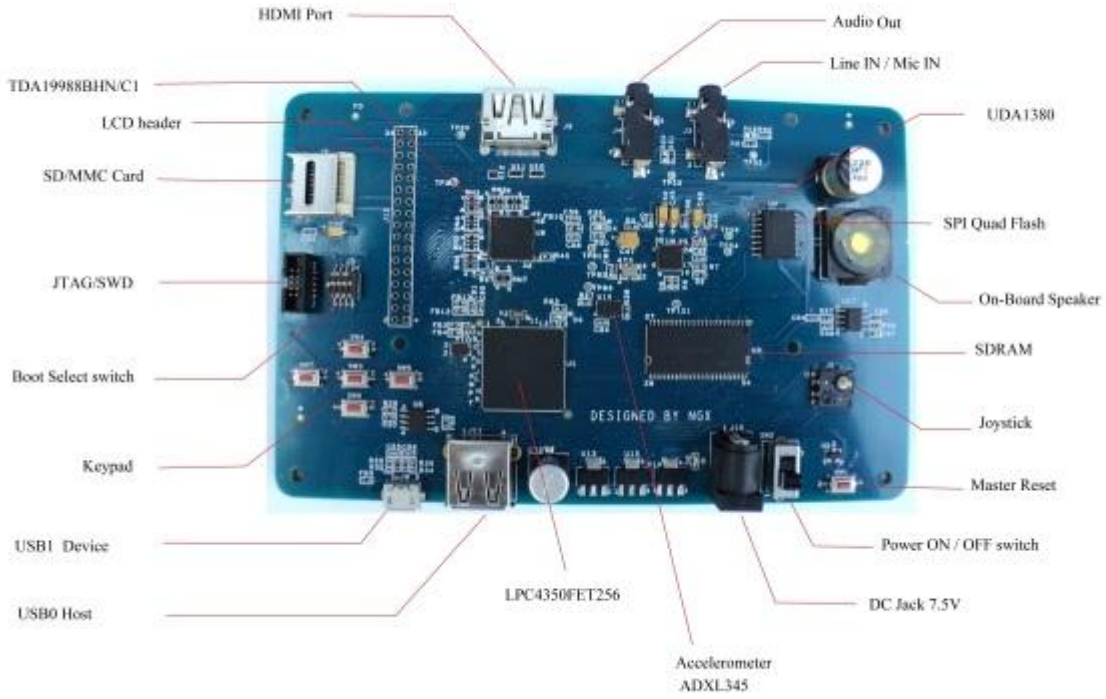
2.0 LPC4350 Gaming Console hardware verification

The LPC4350 Gaming Console platforms ship with a programmed test firmware, that verifies the all the on-board peripherals. It is highly recommended that you verify the board, before you start programming. Also this exercise helps you get acclimatized with the board quickly.

To run the tests you will need the following:

- Power: 7.5 V/1A or USB cable
- PC: Windows7 32-bit machine
- Mini USB type-B cable
- Micro SD card (2 GB formatted with FAT file system)
- 2-GB USB pen drive (Formatted with FAT file system)
- Audio-in (AUX)
- Headphone

2.1 Board Image with pointers to the peripherals



2.2 Powering the Board

The LPC4350 gaming Console can be powered through and external DC supply of 7.5V input or through USB.

Note: The USB power can source only up to 500 mA of current. For applications having higher current requirements we recommend to use an external power supply.

2.3 Verifying all the peripherals on LPC4330-Xplorer

Test Firmware Flow

- The firmware initializes all the hardware peripherals
- After enumerating the USB1 as a Virtual Com Port, the firmware waits for the user to key-in '1' (ASCII) key to display debug messages on USB1 Virtual com. Please note that for the very first time you need to point the Windows Operating system to a appropriate INF file. The details are mentioned in ----------
- It then test the External RAM, SDIO interface, Audio interface, Accelerometer and Input keys/Joystick
- To test the SDIO interface, you need a 2-GB micro SD card (format it with FAT file system)
- For the Audio test you need a head phone and a Line-in AUX cable to feed the audio data, if you remove the headphone during the test you should get the audio out from the on-board speaker
- The test firmware continuously reads the accelerometer and puts the data out over the VCOM
- And as and when the user presses the keys or the Joystick appropriate messages are displayed over the VCOM

USB0 test

To test the USB0 interface one needs a 2-GB USB pen drive with FAT file format.

Note: Currently due to some technical issues the USB0 interface has to be tested separately with a different workspace. Integrating this into one workspace is work in progress.

HDMI interface test

This is work in progress.

The following section explains how the individual tests have to be carried out.

2.3.1 LED

Test setup and verification:
As soon as the 'LPC4350 Gaming Console' is turned ON or reset; the test LED will go ON & OFF for a couple of times, this simple test validates the LED.

2.3.2 USB1 device (Virtual COM port)

Test setup and verification:
For the very first time the Windows machine will ask for the appropriate Virtual COM drivers to be installed. Once the installation is through, the test firmware waits for user intervention. The user needs to execute a hyper-terminal program over the VCOM port and type in ASCII '1' to start the test. If you are able to see the debug messages, you can be sure that the USB1 device interface is fine.

2.3.3 External 32MB RAM

Test setup and verification:
The firmware verifies the entire 32MB of RAM by writing and reading a known pattern onto the external RAM. The RAM part being used is XXXX. The result of the RAM test is displayed over the VCOM port.

2.3.4 Micro SD card

Test setup and verification:
The firmware validates the micro SD card by writing and reading a sector of the SD card connected. Please note that we need to use a micro SD card with FAT file system. The result of this test is displayed over the VCOM port.

NOTE: Please note that we have verified with the Transcend micro SD card. This test basically reads/writes few bytes to the micro SD-card.

2.3.5 Audio interface

Test setup and verification:
For the audio interface the 'LPC4350 Gaming Console' incorporates external audio codec from NXP. The codec is interfaced to the MCU over I2S0 for data and over I2C0 for command interface. The test firmware verifies both the audio-in and audio-out path. To verify the audio interface the user needs to feed some audio data through the audio-in (LINE-IN) interface and then connect a headphone at the audio-out jack. If one is able to hear the same audio data that is being fed over audio-in interface, we have verified the audio interface.

Note: To verify the on-board speaker, remove the headphone from the audio-out jack. The audio data is automatically fed to the speaker input.

2.3.6 3-axis accelerometer

Test setup and verification:
The 'LPC4350 Gaming Console' has a 3-axis accelerometer from 'Analog Devices' for detecting user motions. For some gaming applications this can be used as a source of user input. The accelerometer is connected over the I2C0 bus. The test firmware initializes and calibrates (as mentioned in one of the app notes from Analog devices) the accelerometer and continuously reads the accelerometer data. The data for the corresponding axis are displayed over the VCOM. To verify the accelerometer one needs to tilt and move the 'Gaming Console' and observe the change in data on the VCOM port.

2.3.6 User input switches and Five way Joystick

Test setup and verification:
The design also incorporates five input switches and a five way joystick. The test firmware monitors these input lines to detect user action. In order to make the firmware implementation efficient the five input switch are grouped to generate one single interrupt instead of five different interrupt. And similarly the five way joystick inputs are grouped to generate a single interrupt. To verify a particular input line the user needs press the appropriate input switch and should observe the corresponding switch number being displayed over the VCOM

4.3.8 USB0 host

Test setup and verification:
At the moment the USB0 host test firmware is not a part of the single workspace that verifies all other peripherals. We would need to program a different binary to verify the HOST interface. To verify the host one needs to program the appropriate binary and then connect a pen drive with FAT file format. The pen drive is detected and the content of the first sector of the pen drive are displayed over the VCOM.

Note: Currently due to some technical issues the USB0 interface has to be tested separately with a different workspace. Integrating this into one workspace is work in progress.

4.3.10 Debug Interface

Test setup and verification:
Connect the Ulink2 debugger to the debug port (10 pin), Open the keil project, build the project and click on load/debug option to program or debug as shown in the below images.

Note: We need to user KEIL Version: 4.23 or above

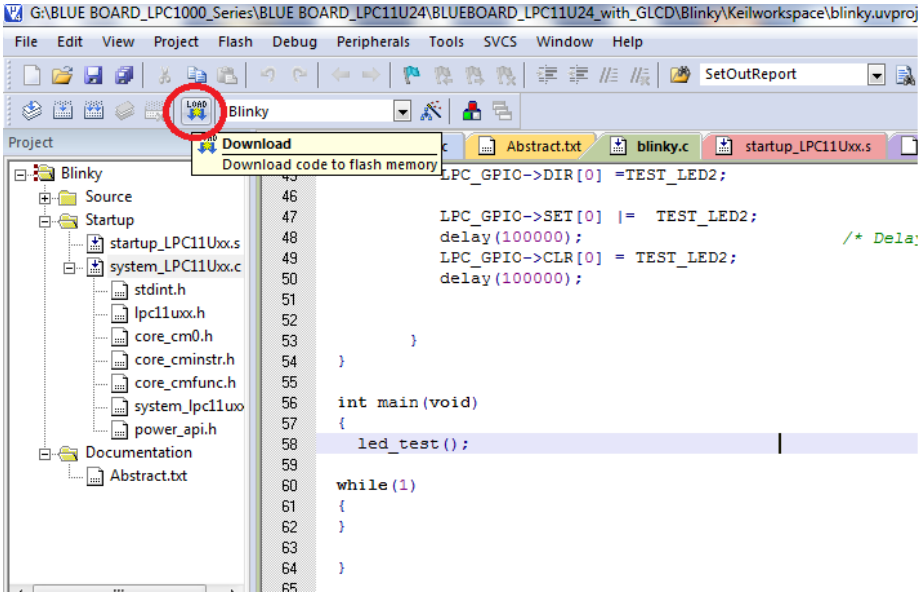


Fig 9

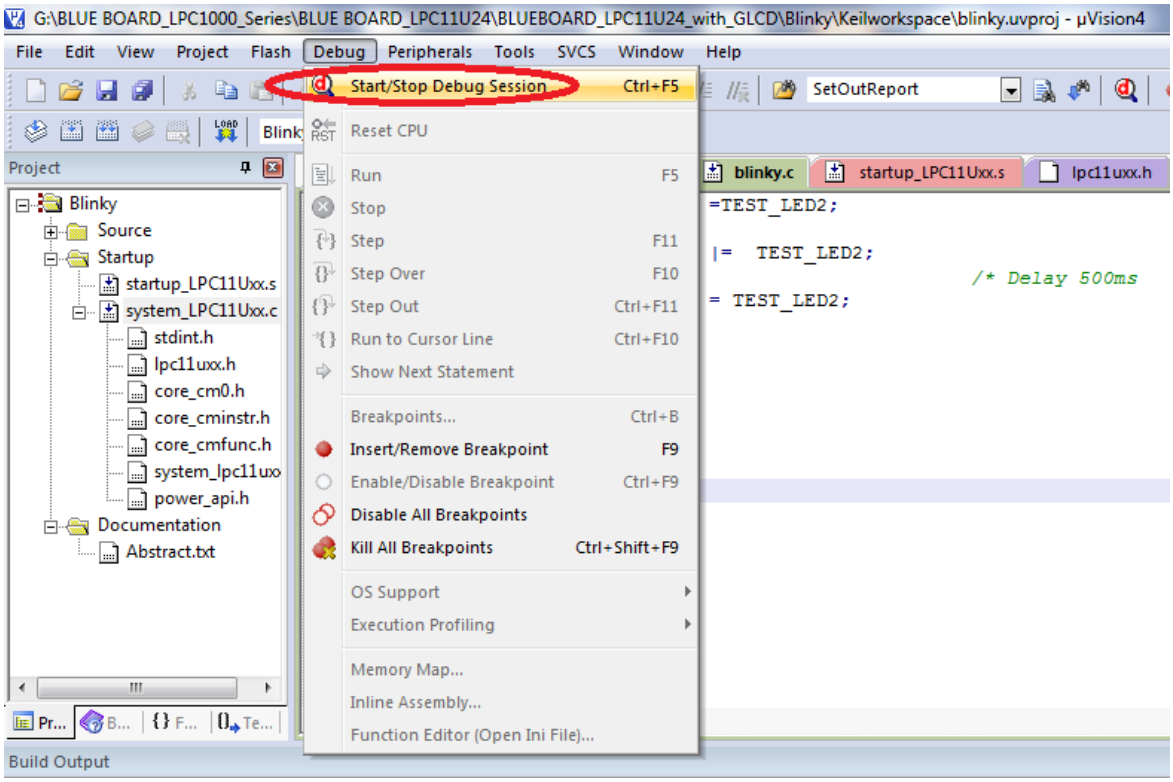

G:\BLUE BOARD_LPC1000_Series\BLUE BOARD_LPC11U24\BLUEBOARD_LPC11U24_with_GLCD\Blinky\Keilworkspace\blinky.uvproj - µVision4
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
Start/Stop Debug Session Ctrl+F5
Reset CPU
Run F5
Stop
Step F11
Step Over F10
Step Out Ctrl+F11
Run to Cursor Line Ctrl+F10
Show Next Statement
Breakpoints... Ctrl+B
Insert/Remove Breakpoint F9
Enable/Disable Breakpoint Ctrl+F9
Disable All Breakpoints
Kill All Breakpoints Ctrl+Shift+F9
OS Support
Execution Profiling
Memory Map...
Inline Assembly...
Function Editor (Open Ini File)...
SetOutReport
Project
Blinky
Source
Startup
startup_LPC11Uxx.s
system_LPC11Uxx.c
stdint.h
lpc11uxx.h
core_cm0.h
core_cminstr.h
core_cmfunc.h
power_api.h
Documentation
Abstract.txt
blinky.c
startup_LPC11Uxx.s
lpc11uxx.h
=TEST_LED2;
|= TEST_LED2;
/* Delay 500ms
= TEST_LED2;
Build Output

Fig 10

5 Development Tool Setup

5.1 IDE and debugger

The following sections will explain the setup for KEIL and ULINK as the IDE and debugger respectively.

5.2 Installation & Configuration of KEIL software

The Installation of KEIL software is explained below:

Step 1: Open the keil setup

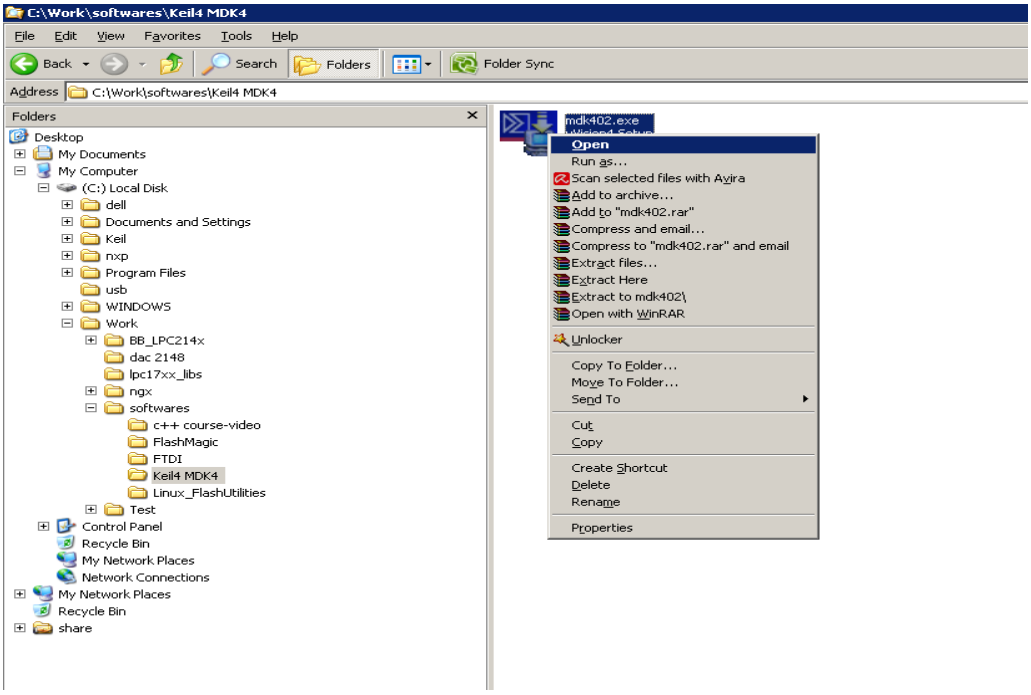


Fig. 11

Step 2: Keil µvision4.02 information

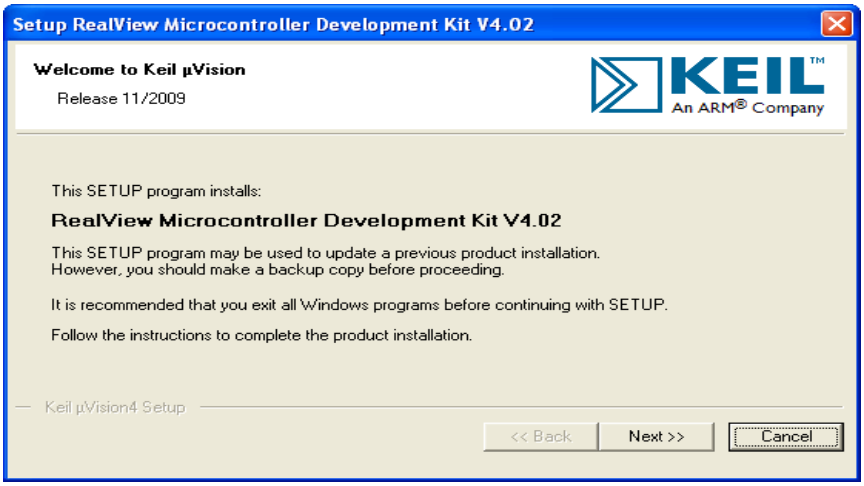


Fig. 12

Step 3: Terms & conditions

Fig. 13

Step 4: Provide the destination path

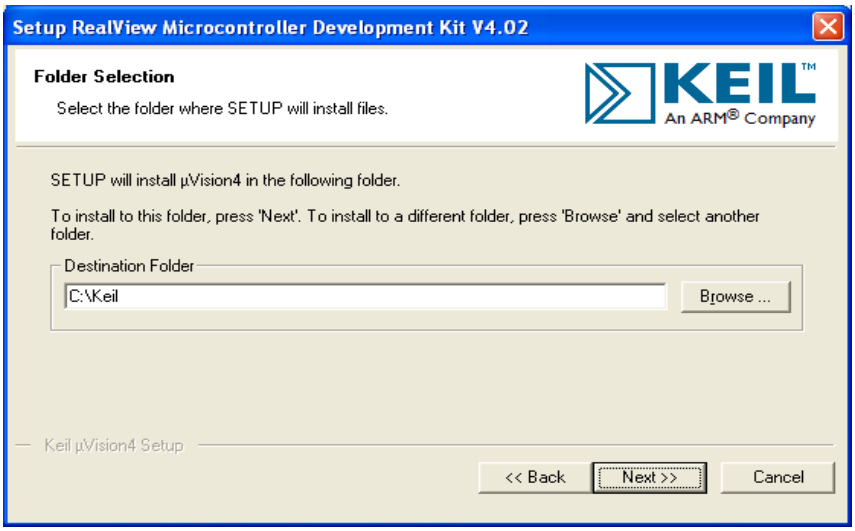


Fig. 14

Step 5: Fill your Personal information

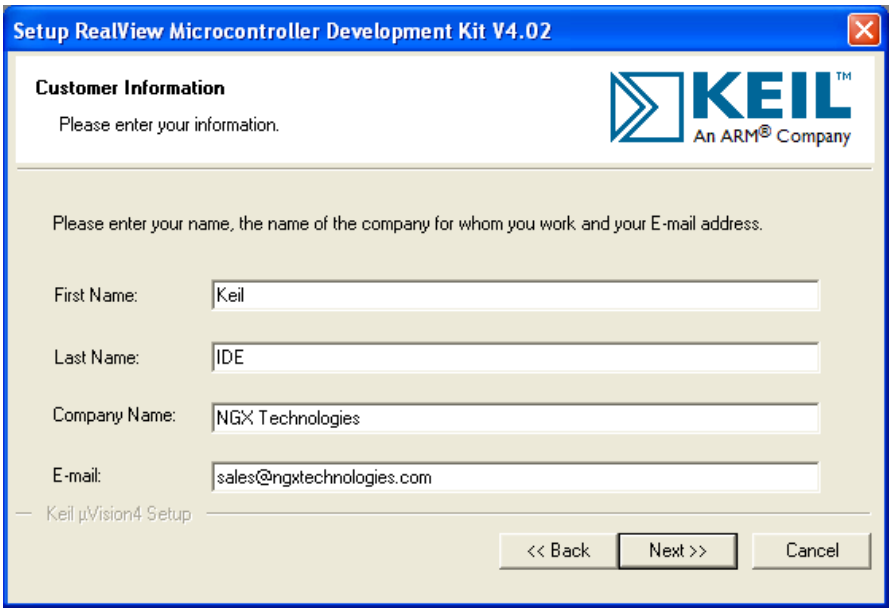


Fig. 15

Step 5: Setup installation

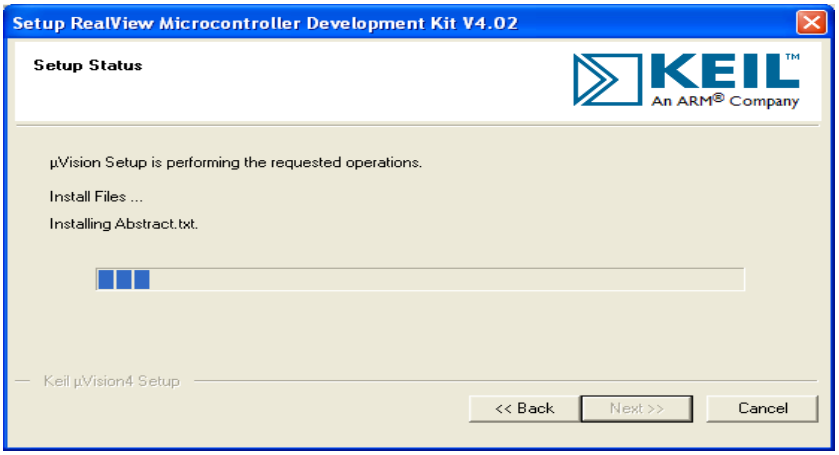


Fig. 16

Step 6: Setup completion

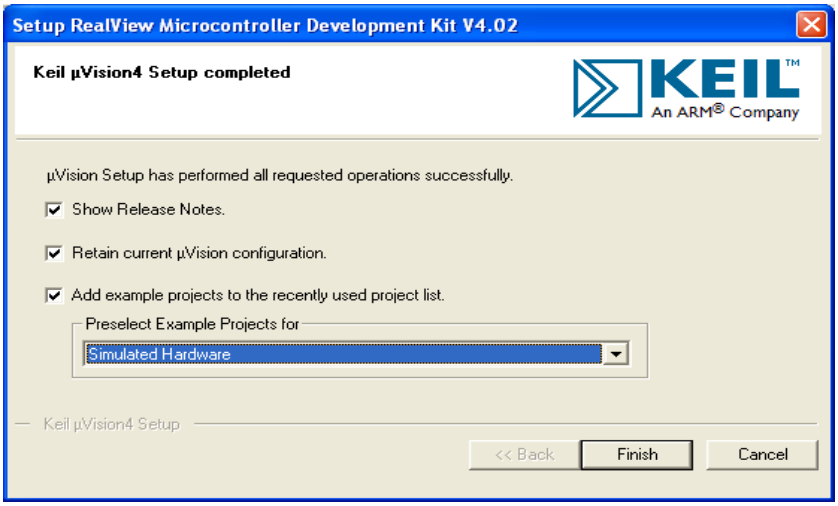


Fig. 17

5.3 Configuration of ULINK Debugger

The configuration flow of ULINK 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 option and select the ULINK2 debugger as shown in the image.

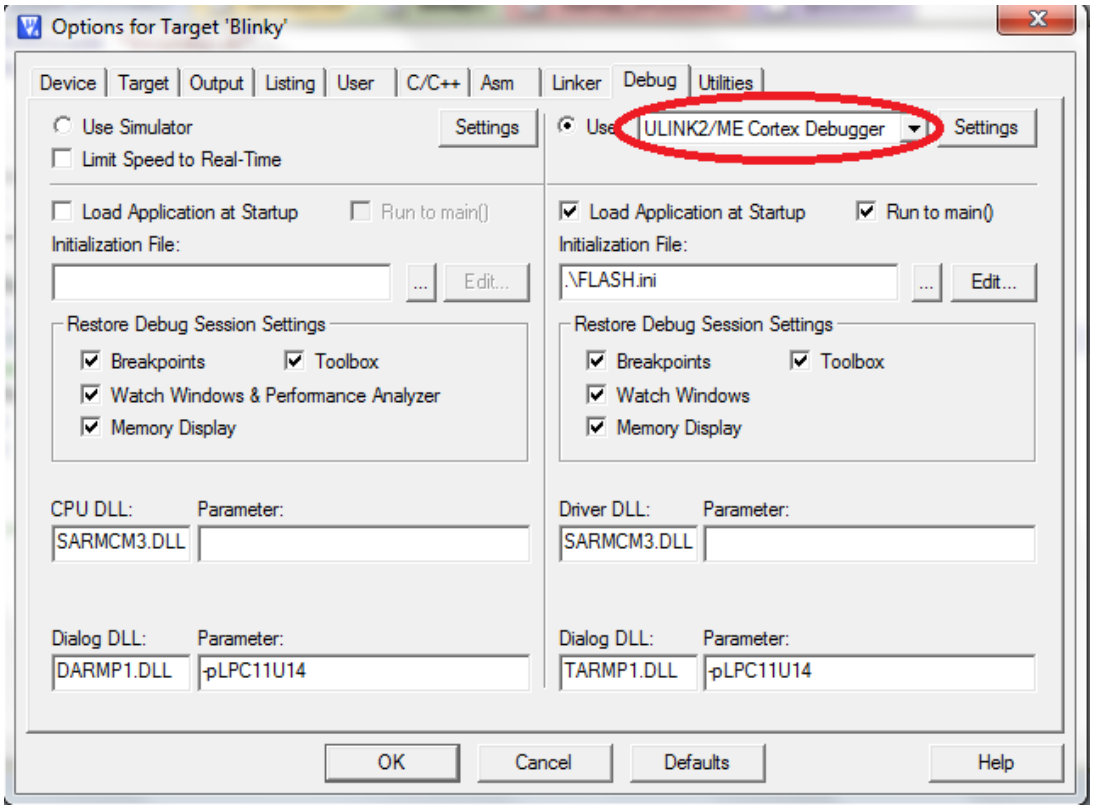


Fig.18

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

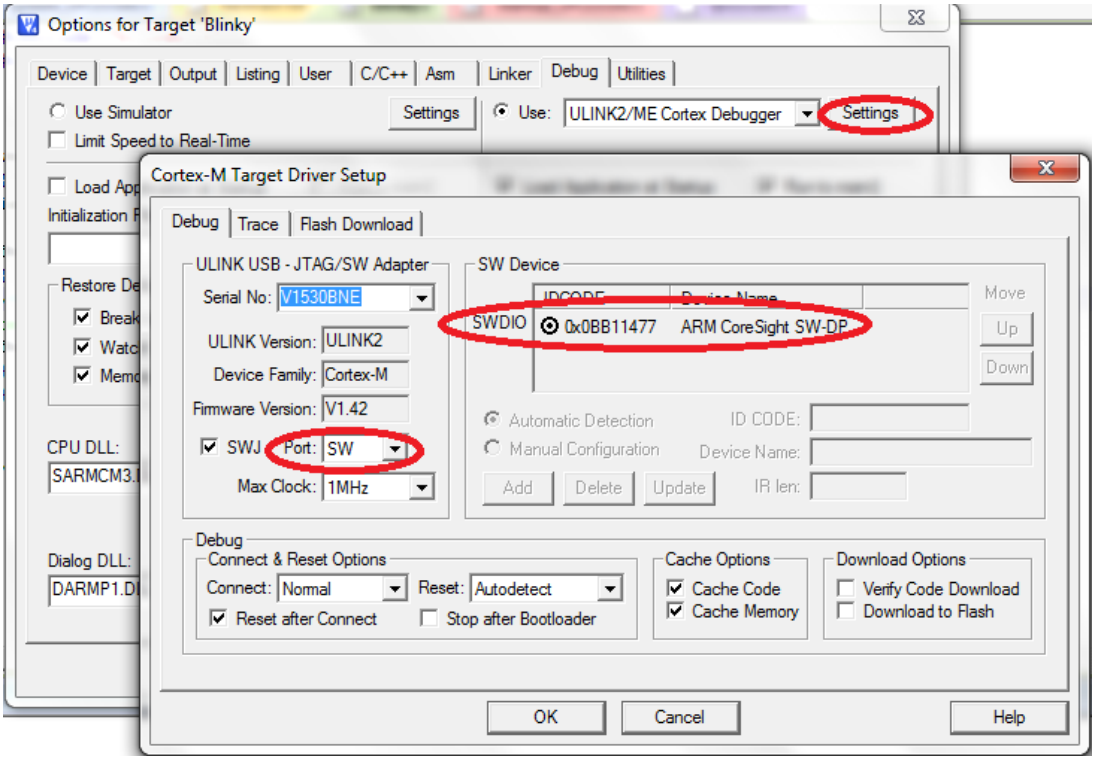


Fig.19

Step 3: Click on Utilities and select ULINK2 Cortex Debugger as shown below

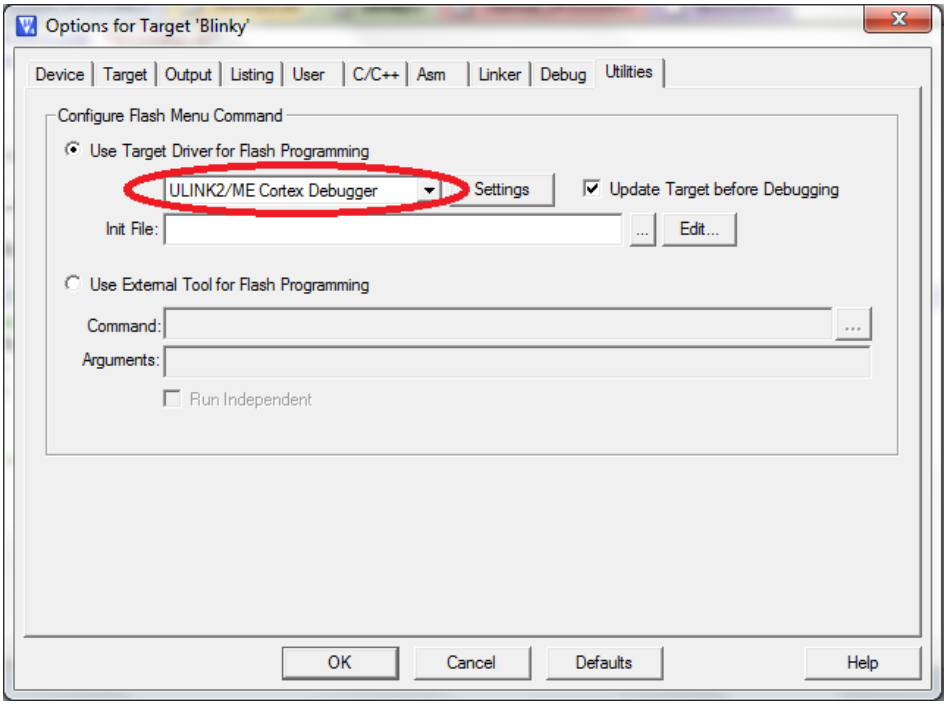


Fig.20

Step 4: By Clicking on Settings the Cortex-M Target Driver Setup window opens, Click on Add to select the flash as shown below

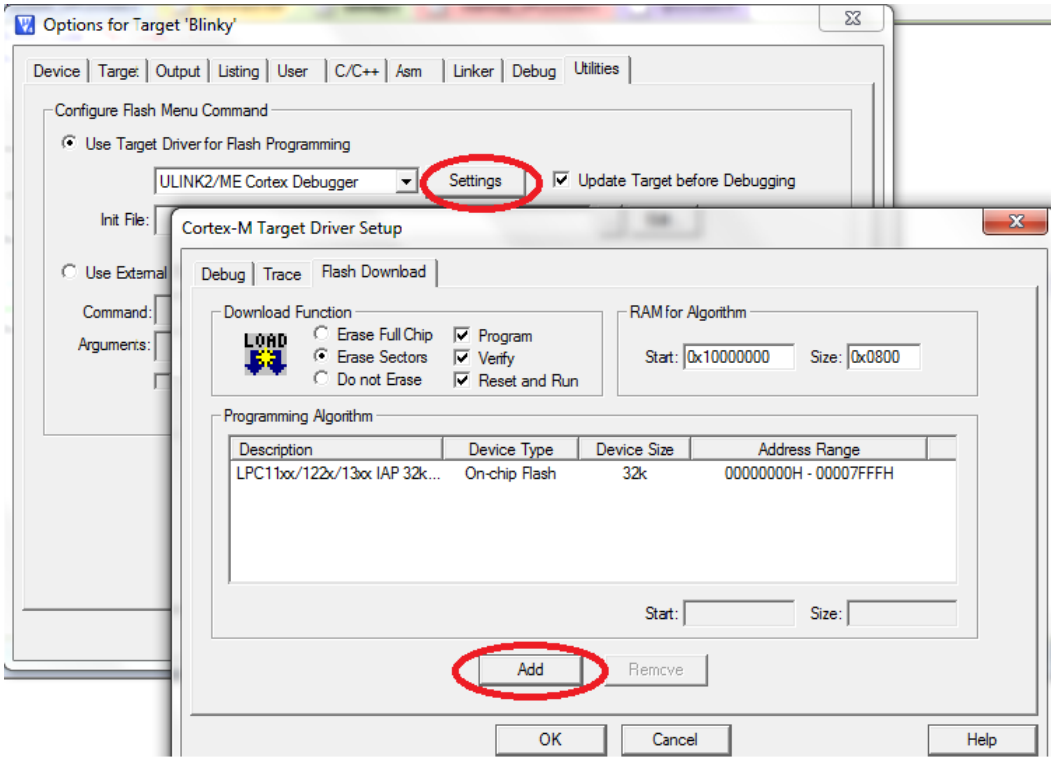


Fig.21

Click OK to complete the ULINK2 Debugger configuration

6 CHANGE HISTORY

6.1 Change History

Rev	Changes	Date (dd/mm/yy)	By
1.0	Initial release of the manual	15/03/2012	Ashwin Athani

About this document:

Revision History

Version: V1.0 author: Ashwin Athani

Company Terms & Conditions

Legal

NGX Technologies Pvt. Ltd. provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, and EDUCATION OR EVALUATION PURPOSES ONLY and is not considered by NGX Technologies Pvt. Ltd to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL and therefore may not meet the technical requirements of these directives or other related directives.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies NGX Technologies from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

NGX Technologies currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive. NGX Technologies assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages.

No license is granted under any patent right or other intellectual property right of NGX Technologies covering or relating to any machine, process, or combination in which such NGX Technologies products or services might be or are used.

Disclaimers

Information in this document is believed to be reliable and accurate. However, NGX Technologies does not give any representations or warranties, expressed or implied, as to the completeness or accuracy of such information and shall have no liability for the consequences of use of such information.

NGX Technologies reserves the right to make changes to information published in this document, at any time and without notice, including without limitation specifications and product descriptions. This document replaces and supersedes all information supplied prior to the publication hereof.

Trademarks

All referenced trademarks, product names, brands and service names are the property of their respective owners.