

BlueBoard-LPC1115



Fig. 1

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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CE certification

NGX Technologies BLUEBOARD-LPC1115 board have been tested for radiated emission as per EN55022 class A standard. The device is under the limits of the standard EN55022 class A and hence CE marked. No other test have been conducted other than the radiated emission (EN55022 class A standard). The device was tested with the ports like USB, Serial, and Power excluding the GPIO ports. Any external connection made to the GPIO ports may alter the EMC behaviour. Usage of this device under domestic environment may cause unwanted interference with other electronic equipment's. User is expected to take adequate measures. The device is not intended to be used in and end product or any subsystem unless the user re-evaluates applicable directive/conformance.



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1.0 INTRODUCTION

This document is the User Manual for the BLUEBOARD-LPC1115, a low cost ARM Cortex-M0 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 BLUEBOARD-LPC1115 features and BLUEBOARD-LPC1115 verification.

For BLUEBOARD-LPC1115 Quick Start Guide: Click here.

For the most updated information on the BLUEBOARD-LPC1115 board please refer to NGX'website.



2.0 BLUEBOARD-LPC1115 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:

Note: We have used **Keil uvision version 4.60** while creating the User manual for this evaluation kit. Please ensure that you are using uvision version 4.60 or above.

Step 1: Open the keil setup



Fig. 2



Step 2: Keil µvision4.60 information Click on Next

Setup MDK-ARM V4.60	X
Welcome to Keil μVision Release 9/2012	
This SETUP program installs: MDK-ARM V4.60	
This SETUP program may be used to update a previous pro However, you should make a backup copy before proceed	oduct installation. ing.
It is recommended that you exit all Windows programs befor	e continuing with SETUP.
Follow the instructions to complete the product installation.	
— Keil μVision4 Setup	<< Back Next >>> Cancel

Fig. 3

Step 3: Terms & conditions

Setup MDK-ARM V4.60	x
License Agreement Please read the following license agreement carefully.	тм
To continue with SETUP, you must accept the terms of the License Agreement. To accept the agreement, click the check box below.	
END USER LICENCE AGREEMENT FOR MDK-ARM THIS END USER LICENCE AGREEMENT ("LICENCE") IS A LEGAL AGREEMENT BETWEEN YOU (EITHER A SINGLE INDIVIDUAL, OR SINGLE LEGAL ENTITY) AND ARM LIMITED ("ARM") FOR THE USE OF THE SOFTWARE ACCOMPANYING THIS LICENCE. ARM IS ONLY WILLING TO LICENSE THE SOFTWARE TO YOU ON CONDITION THAT YOU ACCEPT ALL OF THE TERMS IN THIS LICENCE. BY CLICKING "I AGREE" OR BY INSTALLING OR OTHERWISE USING OR COPYING T	
Image: Notice and Seture Image: Seture <	
Cance	

Fig. 4

User Manual: BlueBoard-LPC1115



Step 4: Provide the destination path and Click on Next

Setup MDK-ARM V4.60		×
Folder Selection Select the folder where SETUP will install files.		
SETUP will install $\mu V ision4$ in the following folder.		
To install to this folder, press 'Next'. To install to a different folder. — Destination Folder	folder, press 'Browse' and sele	ct another
IC:\Keil		Browse
Update Installation: Create backup tool folder		
✓ Backup old files to C:\Keil\Backup.003		
— Keil μVision4 Setup	<< Back Next >>>	Cancel

Fig. 5

Step 5: Fill your Personal information and Click on Next

Setup MDK-ARM V4.6	0	-	×
Customer Informa Please enter your	tion information.		™ ARM
Please enter your i	name, the name of the company for whom	you work and your E-mail address.	_
First Name.			_
Last Name:	xyz		_
Company Name:	NGX Technologies		
E-mail. — Keil uVision4 Setun	abc@ngxtechnologies.com		
		<< Back Next >>> Ca	ancel

Fig. 6



Step 6: Click on Next

Setup MDK-ARM V4.23		X
File installation completed	Tool	s by ARM
µVision Setup has installed all files successfully.		
 Retain current µVision configuration. Add example projects to the recently used project list. 		
Preselect Example Projects for Simulated Hardware	•	
— Keil μVision4 Setup ————————————————————————————————————	< C Back (Next >>)	Cancel

Fig. 7

Step 7: Keil $\mu Vision 4.23$ setup is completed. Click on Finish

Keil µVision4 Setup completed MDK-ARM V4.23	
µVision Setup has performed all requested operations success ↓ Launch Driver Installation: "ULINK Pro Driver V1.0" ↓ Show Release Notes.	ssfully. •
− Keil µVision4 Setup	<< Back Finish Cancel

Fig. 8



2.3 Setup for ULINK2 and BLUEBOARD-LPC1115 Board

The BlueBoard-LPC1115 board has on board 20 pin SWD box, the ULINK2 is not part of the BlueBoard-LPC1115 package, user need to buy separately.

To run the BlueBoard-LPC1115 examples you will need the following and the image shows the each components:

- ULINK2
- BlueBoard-LPC1115 Board
- USB type-B cable



Fig. 9

Connections of components are as shows in the following image.



Fig. 10

The above setup is ready to use for development in Keil IDE.



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 option and select the ULINK2 debugger as shown in the image.

Options for Target 'LPC1115_blinky'	
Device Target Output Listing User C/C++ Asm	Linker Debug Utilities
C Use SimulatorSettings	Use: ULINK2/ME Cortex Debugger Settings
Load Application at Startup Run to main() Initialization File: Edit	Load Application at Startup Initialization File: Initializ
Restore Debug Session Settings Freakpoints Watch Windows & Performance Analyzer Memory Display	Restore Debug Session Settings Image: Breakpoints Image: Toolbox Image: Watch Windows Image: Tracepoints Image: Memory Display
CPU DLL: Parameter: SARMCM3.DLL	Driver DLL: Parameter:
Dialog DLL: Parameter: DARMCM1.DLL pCM0	Dialog DLL: Parameter: TARMCM1.DLL CM0
OK Car	ncel Defaults Help

Fig.11

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

Options for Target 'LPC1115_blinky Device Target Output Listing Use	r C/C++ Asm Linker Debug Utilities	
C Use Simulator	Settings Use: ULINK2/ME Cortex Debugger	 Settings
Cortex-M Target Driver Setup		×
Debug Trace Rash Download ULINK USB - JTAG/SW Adapter Serial No: V1530BNE ULINK Version: ULINK2 Device Family: Cortex-M Firmware Version: V1.42 ✓ SWJ Port Max Clock: IMHz	SW Device Device Name SWDIQ 0x0BB11477 ARM CoreSight SW-DP Image: SwDip of the state	Move Up Down AP: 0x00
Connect & Reset Options Connect: Normal Reset	Cache Options Cache Options Download Op Cache Code Cache Code Cache Memory Download Download Options Cache Code Download Options Download Download	otions de Download d to Flash

Fig.12



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

V Options for Target 'LPC1115_blinky'	×
Device Target Output Listing User C/C++ Asm Linker Debug Utilities	
Configure Flash Menu Command	
OJse Target Driver for Flash Programming	
ULINK2/ME Cortex Debugger 💽 Settings 🔽 Update Target befor	re Debugging
Init File: Edit	
C Use External Tool for Flash Programming	
Command:	
Arguments:	
🔲 Run Independent	
OK Cancel Defaults	Help

Fig.13

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

Device Target Output Listing User C/C++ Asm Linker Debug Utilities)
Configure Rash Menu Command
Use Target Driver for Flash Programming
ULINK2/ME Cotex Debugger
Cartay M Tarant Driver Satur
Debug Trace (Flash Download
Download Function Add Flash Programming Algorithm
LOAD C Erase Full Chip 🔽 Program
C Brase Sectors Verify Description Device Type Device Size A
Up not crase IV Reset and Ru LPC11xx/LPC122x IAP 128k On-chip Flash 128k
Programming Algorithm LPC11xx/13xx IAP 24kB Flash On-chip Flash 24k
Description Device Type LPC11xx/12xx/13xx IAP 4kB Eash On-chip Flash 32k
LPC11xx IAP 40kB Flash On-chip Flash 40k
LPC11xx/122x/13xx IAP 48k On-chip Flash 48k
LPC11xx/122x/13xx IAP 64k On-chip Flash 64k
LPCTIXOTISCTAL OK TIGST ON CHIPTIAST SK
LPC122X IAP solds Plash Ort-chip Flash 96k
LPC407x/8x S25FL032 SPIFI Ext. Flash SPI 4M
LPC17xx IAP 128kB Flash On-chip Flash 128k
LPC17xx IAP 32kB Flash On-chip Flash 32k 🔻
OK Cancel

Fig.14

Click OK to complete the ULINK2 Debugger configuration.



3.0 BLUEBOARD-LPC1115 Software Development

3.1 Executing the sample projects

The sample projects are provided with the available kit.

Steps to execute the sample projects:

Step 1: Open the project folder.

Step 2: Then open the file project_name.uvproj eg blinky.uvproj.

G V Blinky	Keilworkspace • • • Se	arch Keilworkspace	Q
Organize 👻 💟 Open	▼ Burn New folder	:≡ ▼	
🔆 Favorites	▲ Name	Date modified Type	
📃 Desktop	E blinky	17-01-2013 18:02 C File	
🗼 Downloads	blinky	10-10-2011 17:57 H File	
🕮 Recent Places	Blinky.uvopt	17-01-2013 18:39 UVOP	T File
	🖻 Blinky	17-01-2013 18:39 µVisio	n4 Project
🥽 Libraries			
🔞 Homegroup			
🖳 Computer			4
Blinky µVision4 Project	Date modified: 17-01-2013 18:39 Date creat t Size: 15.0 KB	ed: 17-01-2013 15:45	

Fig.15

Step 3: This launches the IDE

F:\BlueBoard-LPC1115\BLUEBOA	RD_LPC1115_Keil_Sample_codes\BLUEBOARD_LPC1115_K
File Edit View Project Flash	Debug Peripherals Tools SVCS Window Help
📄 🖆 🛃 🗿 🕉 🛍 🛍	9 (2) (4 => 陀 🎘 🤼 🦉 🐺 🎼 //½ 🙆 tp_print_dat
🛛 🧇 🕮 🕮 🧼 🧮 🕎 🛛 LPCI	115_blinky 💽 🔊 📥 🔁
Project 🛛 🗜 🔛	▲ blinky.c
LPC1115_blinky StartUp StartUp Startup_LPC11x.s Source Files blinky.c Documentation Abstract.txt	<pre>58 ************************************</pre>
	70 End of File
≝ Pr	

Fig.16



Step 4: Click on Build to build the project as shown in the below image

🔣 F:\BlueBoard-LPC1115\BLUEBOARD_LPC1115_Keil_Sample_codes\BLUEBOARD_LPC1115_K 💶 💷 💻 🌉
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
📄 💕 💂 🕼 🕺 🕹 🛍 🖃 🗠 ሩ 🔶 🥐 🥐 🎇 🎊 🎉 🎼 🎼 //編 🤷 tp_print_dat:
🕸 🎬 🎒 🧼 🗮 🛛 🙀 🛛 LPC1115_blinky 🕢 💽 💉 🖓 📥 🔁
Project Rebuild all target files
□ StartUp 58 ************************************
68 /** 69 ************************************

Fig. 17

Step 5: Click on Load to download as shown in the below image

😨 F:\BlueBoard-LPC1115\BLUEBOARD_LPC1115_Keil_Sample_codes\BLUEBOARD_LPC1115_Keil			
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help			
□ 😂 🛃 🗿 ※ 🔤 🛍 約 🗠 ← → 隆 🎘 🤼 👯 🐺 🕼 //≟ //ఓ //ఓ 💋 tp_print_data			
🔗 🖾 🕮 🥪 🗮 😗 LPC1115_blinky 💽 🔊 🚠 着			
Project Download v X			
Download code to flash memory B LPC1115_blinky StartUp 59 Startup_LPC11xx.s 60 System_LPC11xx.c 61 Source Files 63 While (1) 64 Source Tiles 65 Documentation 65 Source Files 66 Source Files 63 Source Files 64 Source Files 65 Source Files 66 Source Files 66 Source Files 66 Source Files 68 Source Files 68 Source Files 68 Source Files 68 Source Files 68 <t< td=""></t<>			
Build Output 4			
<pre>Program Size: Code=984 RO-data=428 RW-data=16 ZI-data=512 FromELF: creating hex file ".\Flash\Blinky.axf" - 0 Error(s), 0 Warning(s).</pre>			
Ownload code to flash memory			

Fig. 18



Step 6: 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.

😨 F:\BlueBoard-LPC1115\BLUEBOARD_LPC1115_Keil_Sample_codes\BLUEBOARD_LPC1115_Keil 💶 💷 💻 🔀					
File Edit View Project Flash	Deb	Peripherals Tools S	SVCS Window	Help	
🗋 🖆 🛃 🎒 👗 🐴 🕰	S.	Start/Stop Debug Session	Ctrl+F5	🗄 //👷 🖄 tp_print_data	
🛛 🕸 🖾 🥔 🔜 🛛 🗱 LPC1	1 RST	Reset CPU			
Project 🛛 🗜 🔀		Run	F5	▼ ×	
🖃 🛅 LPC1115_blinky	0	Stop		*******	
En et atartura L DC11	$\overline{\{\cdot\}}$	Step	F11		
startup_LPC11xx.s	$\{ j \}$	Step Over	F10		
E G Source Files	{}}	Step Out	Ctrl+F11		
🗄 🖬 blinky.c	*{}	Run to Cursor Line	Ctrl+F10		
Documentation	⇒	Show Next Statement			
		Breakpoints	Ctrl+B	=	
	•	Insert/Remove Breakpoint	F9	.	
E Pr	0	Enable/Disable Breakpoint	Ctrl+F9	F	
Build Output	8	Disable All Breakpoints		д 🖂	
Programming Done. Verify OK.	æ	Kill All Breakpoints	Ctrl+Shift+F9		
Application running		OS Support	÷	-	
۰ III		Execution Profiling	÷	4	
Enter or leave a debug session		Memory Map		h.	

Fig. 19



3.2 Creating New project

Follow the below steps, for creating new project:

Step 1: Open the keil IDE.



Fig. 20

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

👿 µVision4			x			
File Edit View	Pro	sject Flash Debug Peripherals Tools SVCS Window Help				
i 🗋 😂 🖌 🥔		New µVision Project				
Project		New Multi-Project Workspace Open Project Close Project				
		Export Manage				
	Ň	Select Device for Target Remove Item Options				
₽г (8 {.		Clean target Build target Rebuild all target files				
Build Output	٨	Batch Build				

Fig. 21



Step 3: Give project name then click Save.

Organize 🔻 New folder			8== 🗸 🌀
💯 Recent Places	 Name 	^	Date modified
詞 Libraries	E	No items match you	ir search.
🝓 Homegroup			
🖳 Computer			
GS (C:)			
New Volume (F:)			-
File name: blinky		m	

Fig. 22

Step 4: Select the controller.

Select Device for Target 'Target 1'	and the second s	x
CPU Vendor: NXP (founded by Philips) Device: LPC1115/303 Toolset: ARM		
Data base	Description: System - ARM Cortex-M0 processor, running at frequencies of up to 50 MHz ARM Cortex-M0 built-in Nested Vectored Interrupt Controller (NVIC) Non-Maskable Interrupt (NMI) input selectable from several input sources - Serial Wire Debug System Tick timer. Memory - Up to 64 KB on-chip flash programming memory Up to 84 KB on-chip bash programming memory Up to 84 KB on-chip bootloader software. Digital perpherals: - Up to 42 General Purpose I/O (GPIO) prins with configurable pull-up/pull GPIO prins can be used as edge and level sensitive interrupt sources.	
	Cancel H	elp

Fig. 23

Step 5: Click on Yes.



Fig. 24



Step 6: Go to file – new, & start writing the code.



Fig. 25

Step 7: Save the file with some name.



Fig. 26



Step 8: Add the file to the source group as shown in the below image.

😨 F:\BlueBoard-LPC1115\BB-LPC1115\blinky.uvproj - µVision4						
File Edit View	Project Flash Debug Peripherals Tools SVCS Window Help					
🗋 📬 🖬 🗿	¾ 🔤 🕰 🤊 🗠 ← → 🥐 🎘 🎘 🤼 🙀 🛱 🚝 //≟ //☆ 🐲 tp_print_d	at				
8 🗈 🖀 🥥	📖 🙀 Target 1 💽 💉 📥 🔁					
Project	Project 🗜 🔯 🗋 blinky.c 👻 🗙					
🕞 📑 Target 1	60 int main (void)					
	Coptions for Group 'Source Group 1' Alt+F7					
	Open File					
	Open List File					
	Open Map File	"				
ј 🖻 Рг 🌏 В 🛍	Rebuild all target files					
Build Output	Build target F7 📮					
	Translate File	~				
	§ Stop build					
	Add Group	-				
	Add Files to Group 'Source Group 1'	_				
Add Flies to cur	Remove Group 'Source Group 1' and its Files	зŝ				

Fig. 27

Step 9: Select the file and click on Add as shown in the below image.(system_LPC11xx.c file is located in Common/src folder)

Madd Files to Group 'Source Group 1'		x
Look in: 🔒 BB-LPC1115 🗨	← 🗈 📸 🖛	
Name	Date modified	Ту
blinky	18-01-2013 11:14	С
system_LPC11xx	19-01-2012 13:07	С
4	1	•
File name: "blinky.c" "system_LPC11xx.c" Files of type: C Source file (*.c)	Add Close	

Fig. 28

Step 10: To build, download and debug follow the steps 4, 5 and 6 in section 3.1.



4.0 BLUEBOARD-LPC1115 Programming

4.1 Programming options

BlueBoard-LPC1115 can be programmed using the

- On-chip bootloader (UART)
- Debugger (ULINK2)

4.1.1 On-Chip bootloader (UART)

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

Getting the board in programming mode:

Theory: The On-chip 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 BlueBoard-LPC1115 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



4.2 Flashing the Hex file through UART

Step 1: Connect the serial cable to the PC as well as to the board UART0 and open the flash magic tool.

Step 2: Input all the parameters as shown in below Fig.

🐡 Flash Magic - NON PRODUCTION USE ONLY				
File ISP Options Tools Help				
🖻 🖬 🔍 🎯 🗳 🖌 📕 🗲 😻 😨 😂				
Step 1 - Communications Step 2 - Era	se			
Select LPC1115/303 Erase block Flash Bank: Erase block COM Port: COM 1 Erase block Baud Rate: 115200 Interface: Interface: None (ISP) Erase block Oscillator (MHz): 12	0 (0x000000-0x000FFF) 1 (0x001000-0x001FFF) 2 (0x002000-0x002FFF) 3 (0x003000-0x003FFF) 4 (0x004000-0x004FFF) 5 (0x005000-0x005FFF) Flash+Code Rd Prot cks used by Hex File			
Step 3 - Hex File				
Hex File: F:\BlueBoard-LPC1115\BLUEBOARD_LPC1115_Ke	il Sample code Browse			
Modified: Thursday, January 17, 2013, 18:05:25	more info			
Step 4 - Options	p 5 - Start!			
Verify after programming Fill unused Flash Gen block checksums Execute Activate Flash Bank	Start			
Visit the "Flash Magic" home page for info on the latest revision				
www.esacademy.com/software/flashmagic	•			
	3			

Fig. 29

Step 3: Click **Star**t to flash the hex file. Press Reset to run.

NOTE: Make sure that the Board is not powered through USB. Use Flash Magic version 7.02 or above. Please check for your machines COM port number. The COM port number can be different.



5.0 Schematic & Board Layout

5.1 Schematic

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

5.2 Board layout



Fig. 30



6.0 CHANGE HISTORY

6.1 Change History

Rev	Changes	Date (dd/mm/yy)	By
1.0	Initial release of the manual	18/01/2013	Veeresh Tumbaragi

7.0 REFERENCES

In addition to this document, the following references are included on the NGX BLUEBOARD-LPC1115 product and can also be downloaded from <u>www.ngxtechnologies.com</u>:

• NGX BLUEBOARD-LPC1115 schematic for the Development board.

Additional references include:

- Information on development tool being used:
 - Keil uvision 4.60, <u>http://www.keil.com/download/product/</u>
 - Flash magic, <u>http://www.flashmagictool.com/</u>

About this document:

Revision History

Version: V1.0 author: Veeresh Tumbaragi

Company Terms & Conditions

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