

# BlueBoard-LPC11U24/37

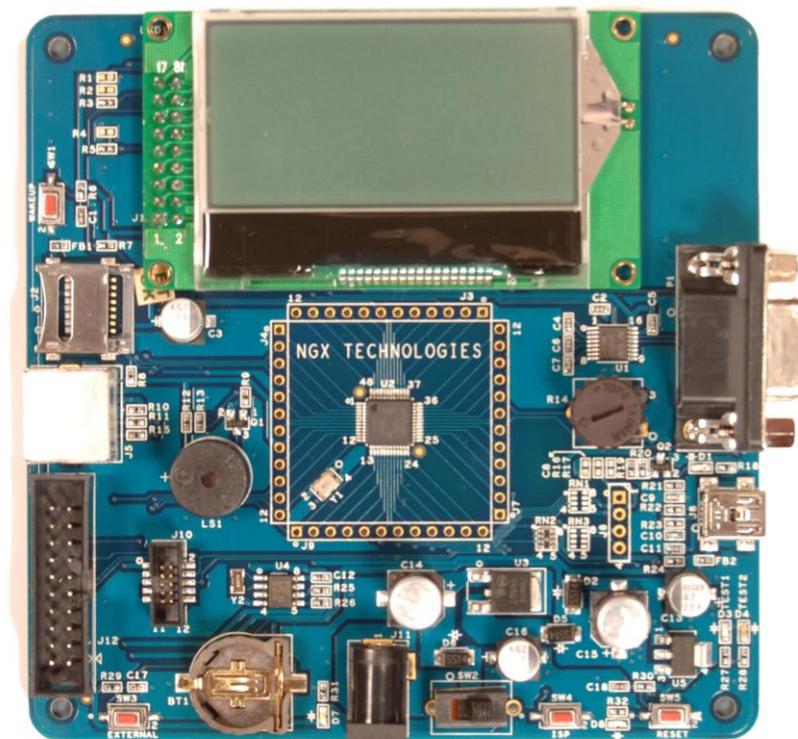


Fig. 1

## User Manuals for BlueBoard-LPC11U24/37:

For KEIL MDK-ARM with ULINK2: [Click here](#)

For LPC-Xpresso with NXP-LPC-Link: [Click here](#)

## Sample projects for BlueBoard-LPC11U24:

For KEIL MDK-ARM: [Click here](#)

For LPC-Xpresso: [Click here](#)

## Sample projects for BlueBoard-LPC11U37:

For KEIL MDK-ARM: [Click here](#)

For LPC-Xpresso: [Click here](#)

## Schematic for BlueBoard-LPC11U24:

[Click here to download Schematic.](#)

## Schematic for BlueBoard-LPC11U37:

[Click here to download Schematic.](#)

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### 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.

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### CE certification

NGX Technologies BLUEBOARD-LPC11U24/37 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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## Table of Contents

1.0 INTRODUCTION.....	4
1.1 Possible Debuggers and IDEs that can be used.....	4
1.2 ULINK2 and KEIL.....	4
1.3 NXP-LPCLink and LPCXpresso.....	5
1.4 NGX CoLinkEx and Coccox CoIDE .....	5
2.0 BLUEBOARD-LPC11U24/37 OVERVIEW.....	7
2.1 INTRODUCTION.....	7
2.2 Board Features.....	7
2.3 Block Diagram .....	8
2.4 MCU Features .....	8
3.0 BLUEBOARD-LPC11U24/37 Hardware Description .....	10
3.1 Introduction .....	10
3.2 Board Image with pointer to each peripheral & connectors.....	10
4.0 BLUEBOARD-LPC11U24/37 hardware verification.....	11
4.1 Board connections .....	11
4.2 Powering the Board.....	12
4.3 Verifying all the peripherals on Blueboard .....	12
4.3.1 LEDs.....	12
4.3.2 Buzzer.....	13
4.3.3 Graphics LCD (GLCD).....	13
4.3.4 RTC .....	13
4.3.5 Micro SD Card .....	13
4.3.6 ADC.....	14
4.3.7 PS/2 Keyboard.....	14
4.3.8 USB .....	14
4.3.9 UART .....	15
4.3.9 External Interrupt Switch & Wakeup Switch.....	16
5.0 CHANGE HISTORY .....	17
5.1 Change History.....	17
6.0 REFERENCES .....	17

## 1.0 INTRODUCTION

This document is the Quick Start Guide for the BLUEBOARD-LPC11U24/37, a low cost ARM Cortex-M0 based board by NGX Technologies. This document reflects its contents which include MCU features, board features and hardware verification and possible debuggers and IDEs that can be used with this board.

### 1.1 Possible Debuggers and IDEs that can be used

- [ULINK2](#) with [KEIL uVision](#)
- [NXP LPCLink](#) with [LPCXpresso](#)
- [NGX CoLinkEx](#) with [Coccox CoIDE](#)
- [Red Probe+](#) with [Red Suite](#) from Code Red
- [I-jet](#) with [IAR Embedded Workbench](#)
- [Segger JLink](#) with [IAR Embedded Workbench](#) or [KEIL uVision](#)

### 1.2 ULINK2 and KEIL

Connect the ULINK2 20-pin cable to 20-pin connector on the board, connect USB cable to the ULINK2 and connect the power supply to the board as shown in the below image. The hardware setup is now ready for programming a BLUEBOARD-LPC11U24/37 board with ULINK2 and KEIL IDE.

*Note: ULINK2 is not a part of the BLUEBOARD-LPC11U24/37 package, User need to buy separately.*



**Fig. 2**

### 1.3 NXP-LPCLink and LPCXpresso

Separate the LPCXpresso controller part and use only the NXP LPC-Link as shown in the below image.

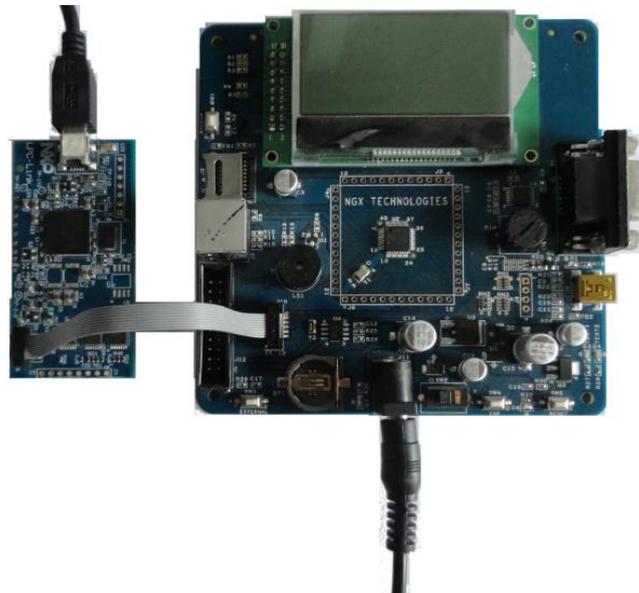


Fig. 3

The BLUEBOARD-LPC11U24/37 board has on board Cortex SWD/JTAG 10-pin box, the one end of the 10-pin cable is connected to LPC-Link and the other end is connected to BLUEBOARD-LPC11U24/37. Make sure that the 10-pin cable notch on the connector is facing towards the arrow mark on the NXP LPC-Link. The hardware setup is now ready for programming a BLUEBOARD-LPC11U24/37 board with NXP LPC-Link and LPCXpresso.

*Note: 10 pin cable is not a part of BLUEBOARD-LPC11U24/37 package, user need to buy separately.*

### 1.4 NGX CoLinkEx and Cocox CoIDE

The 10pin cable is a part of the NGX CoLinkEx package, NGX CoLinkEx is not a part of the BLUEBOARD-LPC11U24/37 package, user need to buy NGX CoLinkEx separately.

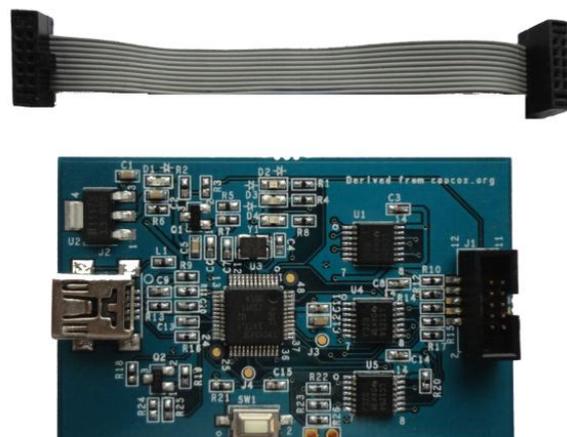


Fig. 4

The BLUEBOARD-LPC11U24/37 board has on board Cortex SWD/JTAG 10-pin box, the one end of the 10-pin cable is connected to NGX CoLinkEx and the other end is connected to BLUEBOARD-LPC11U24/37 as shown in the below image.

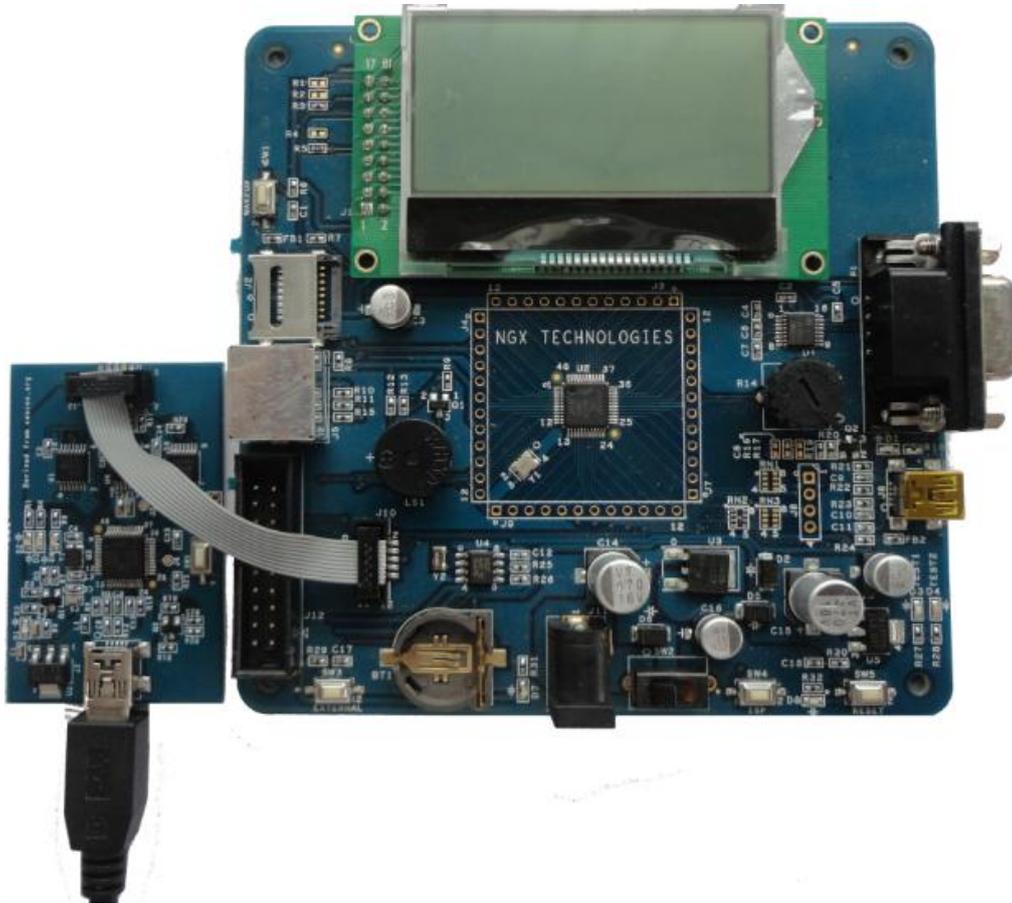


Fig. 5

The hardware setup is now ready for programming a BLUEBOARD-LPC11U24/37 board with NGX CoLinkEx and Cocox CoIDE.

---

## **2.0 BLUEBOARD-LPC11U24/37 OVERVIEW**

### **2.1 INTRODUCTION**

The NGX BLUEBOARD-LPC11U24/37 is a compact and versatile evaluation platform for the NXP's Cortex-M0-based MCU. NGX's evaluation platforms are generally not tied up to any particular debugger or compiler/IDE. However it is not practical to test and ensure that the solution would work out of box with all the available debuggers and compilers/IDE. As long as the compiler supports the particular MCU and the debugger supports the standard debug interfaces like the SWD you can use this platform with any tool. The board is supported by extensive sample examples allowing you to focus on the application development.

### **2.2 Board Features**

Following are the salient features of the board

- ⤴ Dimensions: 110mm X 110mm
- ⤴ Two layer PCB (FR-4 material)
- ⤴ Power: DC 6.5V with power LED On-board linear regulators generate +3.3V/500mA and +5V/500mA from power supply USB connector (as alternate power source)
- ⤴ 10 pin, 20 pin CORTEX debug connector for SWD (Serial Wire Debug)
- ⤴ ISP, Wakeup, External Interrupt and reset switch
- ⤴ 12.0000 MHz crystal for MCU, 32Khz crystal for RTC
- ⤴ Extension headers for all MCU pins
- ⤴ RS232 connector, PS2 connector, Micro SD/MMC card connector, USB type-B mini connector with link-LED
- ⤴ 64x128 parallel graphical LCD with Backlight control
- ⤴ High accuracy external RTC connected on I2C bus
- ⤴ RTC battery holder
- ⤴ 10K pot for ADC

*Note: The BLUEBOARD-LPC11U24/37 has support for both 20 pin and 10 pin debug header. You don't need to buy a 20pin to 10pin converter (board which costs 10-15 USD).*

## 2.3 Block Diagram

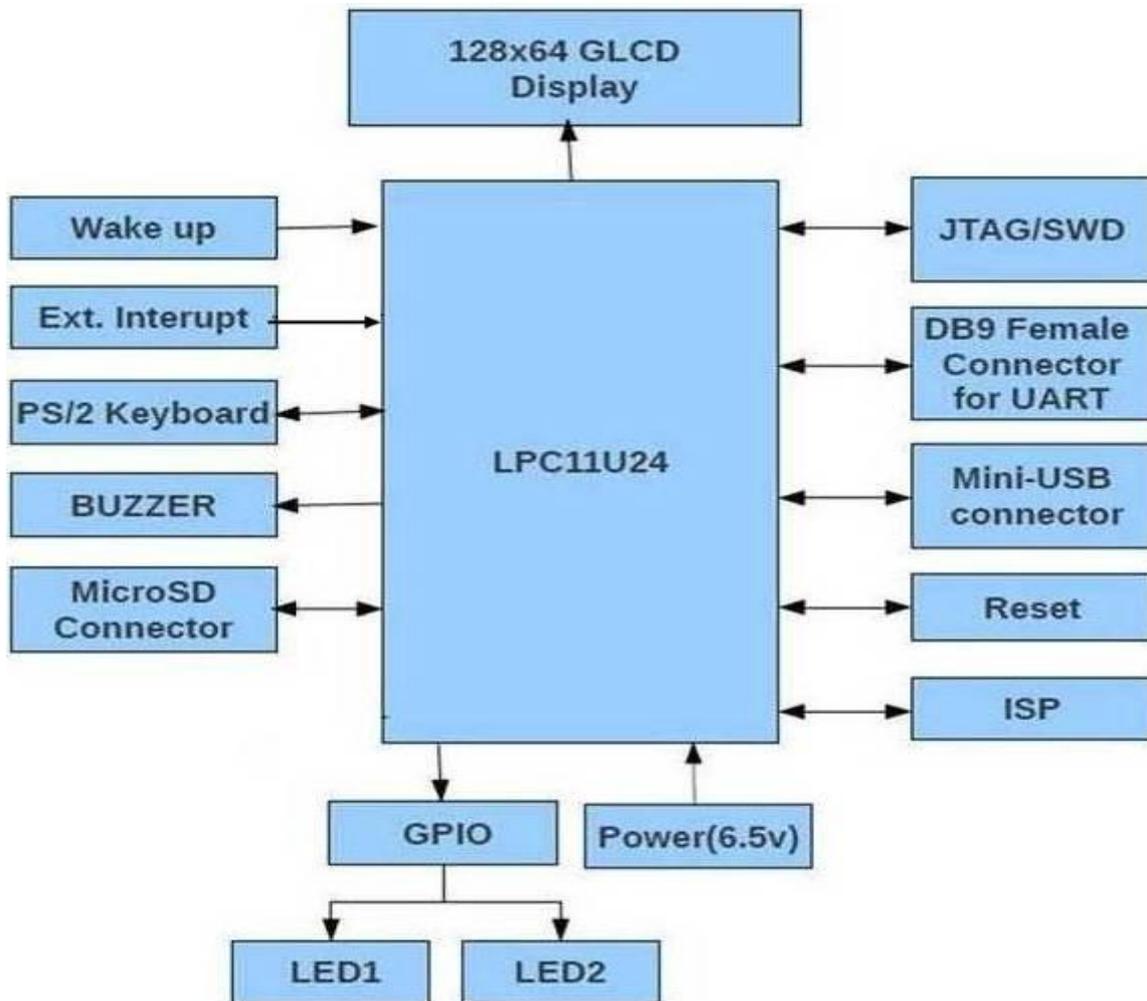


Fig. 6

## 2.4 MCU Features

- 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
- System tick timer
- LPC11U24 offers 32 KB (LPC11U37 offers 128-KB) on-chip flash program memory
- Up to 4 KB on-chip EEPROM data memory
- LPC11U24 offers Up to 10 KB (LPC11U37 offers 12-KB) SRAM data memory
- 16 KB boot ROM
- In-System Programming (ISP) and In-Application Programming (IAP)

- 
- ROM-based USB drivers. Flash updates via USB supported
  - ROM-based 32-bit integer division routines
  - Standard JTAG (Joint Test Action Group) test interface
  - Serial Wire Debug
  - 40 General-Purpose I/O (GPIO) pins
  - Up to 8 GPIO pins can be selected as edge and level sensitive interrupt sources
  - Two GPIO grouped interrupt modules
  - High-current source output driver (20 mA) on one pin
  - High-current sink driver (20 mA) on true open-drain pins
  - Four general-purpose counter/timers
  - Programmable Windowed WatchDog Timer (WWDT)
  - 10-bit ADC with input multiplexing among eight pins
  - USB 2.0 full-speed device controller
  - USART (Universal Synchronous Asynchronous Receiver/Transmitter)
  - Two SSP (Synchronous Serial Port) controllers
  - I2C-bus interface supporting the full I2C-bus specification and Fast-mode Plus
  - Crystal Oscillator with an operating range of 1 MHz to 25 MHz
  - 12 MHz high-frequency Internal RC oscillator (IRC)
  - Internal low-power, low-frequency WatchDog Oscillator (WDO)
  - PLL allows CPU operation up to the maximum CPU rate
  - A second, dedicated PLL is provided for USB
  - Clock output function with divider
  - Integrated PMU (Power Management Unit)
  - Power profiles residing in boot ROM
  - Four reduced power modes
  - Processor wake-up
  - Power-On Reset (POR)
  - Brownout detect with four separate thresholds for interrupt and forced reset
  - Unique device serial number for identification
  - Single 3.3 V power supply (1.8 V to 3.6 V)
  - Temperature range -40 °C to +85 °C

For the most updated information on the MCU please refer to [NXP's website](#).

## 3.0 BLUEBOARD-LPC11U24/37 Hardware Description

### 3.1 Introduction

The NGX BLUEBOARD-LPC11U24/37 is based on ARM Cortex-M0 microcontroller from NXP. LPC11U24 offers 32-KB Flash memory (LPC11U37 offers 128-KB Flash memory), 4-KB on-chip EEPROM data memory, 50-MHz operation, I2C controller with data rate of up to 1 Mbit/s, USB 2.0 full-speed device controller, and wide range of peripherals. Refer to the LPC11U24 and LPC11U37 data sheet for complete device details.

BLUEBOARD-LPC11U24/37 microcontroller is factory-programmed with a quick start demo program. The quick start program resides in the BLUEBOARD-LPC11U24/37 on-chip Flash memory and runs each time power is applied, unless the quick start has been replaced with a user program.

### 3.2 Board Image with pointer to each peripheral & connectors

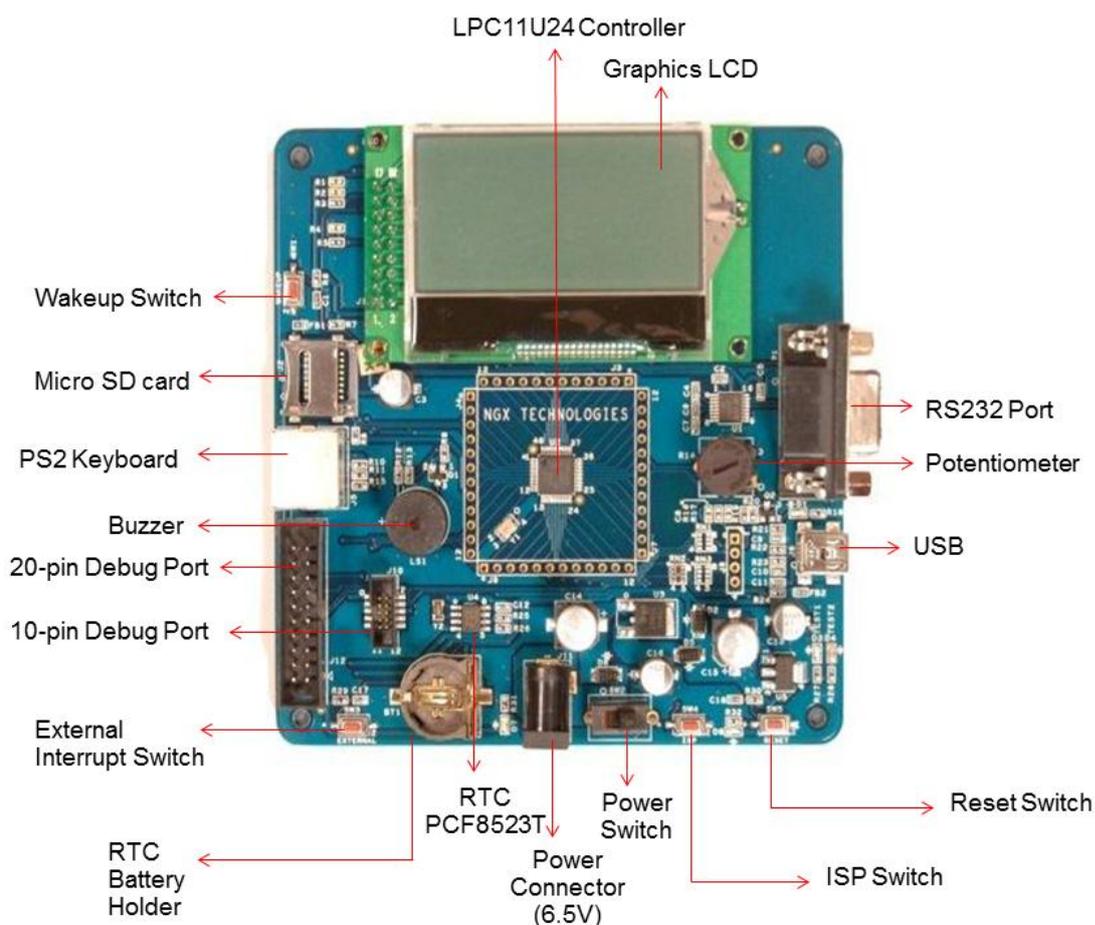


Fig 7

## 4.0 BLUEBOARD-LPC11U24/37 hardware verification

NGX's Blueboard evaluation platforms ship with a factory-programmed test firmware that verifies the Blueboard 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:

- ⤴ NGX BLUEBOARD-LPC11U24/37
- ⤴ Power: DC 6.5V Supply & +5V/500mA from power supply USB cable
- ⤴ PC
- ⤴ Mini USB type-B cable
- ⤴ Serial RS232 cable
- ⤴ PS/2 Keyboard
- ⤴ Micro SD card

### 4.1 Board connections

BlueBoard Peripheral	Schematic labels	MCU pins
Test LEDs	T_LED1	42
	T_LED2	30
Buzzer	BUZZER	45
128X64 Graphical LCD	LCD_D0	2
	LCD_D1	13
	LCD_D2	26
	LCD_D3	38
	LCD_D4	11
	LCD_D5	12
	LCD_D6	24
	LCD_D7	25
	LCD_EN	33
	LCD_R/W	34
	LCD_RS	35
	LCD_CS	36
	NRST	3
	LCD_BL	37
MicroSD card	SCK	31
	MOSI	28
	SSEL	10
	MISO	27
ADC POT	ADC3	32
External RTC	SDA	16
	SCL	15
Keyboard (PS/2)	PS2_DATA	43
	PS2_CLK	48
USB	USB_DM	19
	USB_DP	20

	VBUS	14
UART	RXD TXD	46 47
External Interrupt Switch	EXT_SW	23
Wakeup Switch	WAKEUP	40
SWD (Serial Wire Debug)	NRST SWDIO SWO SWDCLK	3 39 28 29
In system Programming switch	ISP	4
Power supply	Connecting this will provide 3.3V supply to board	44

Table.1

## 4.2 Powering the Board

The Blueboard requires DC supply of 6.5V or 7.5 V, 1A rating to power it up. Alternatively the board could be powered through USB connector.

*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. Please note that the external adaptor is not a part of standard delivery.*

## 4.3 Verifying all the peripherals on Blueboard

The following section focusses on the verification of all the peripherals supported on the Blueboard. The order of the tests is mentioned in the same manners as the flow of the test firmware. We highly recommend that you follow the order of the test. The test firmware is designed in a manner that the user needs to spend as minimum time as possible to verify all the peripherals.

*Note: It is highly recommended that the user tests all the peripherals as soon as the board is received.*

Power up the board and we are all set to verify the Blueboard peripherals. The order of the peripherals that are verified by the firmware are as follows:

### 4.3.1 LEDs

#### Test setup and verification:

As soon as the BlueBoard is turned ON or reset; the test LEDs go ON & OFF for a couple of times, this simple test validates the LEDs.

### 4.3.2 Buzzer

#### Test setup and verification:

When the board is turned ON or reset you will hear a beep after few seconds. This confirms the status of the Buzzer.

### 4.3.3 Graphics LCD (GLCD)

#### Test setup and verification:

After the LEDs blink and buzzer test the next interface that the firmware validates is the GLCD. A message “NGX TECHNOLOGIES” should be displayed on the GLCD.



Fig 8

### 4.3.4 RTC

#### Test setup and verification:

Next, the firmware validates the external RTC connected over I2C bus. The RTC value is read and displayed on the LCD.

*Note: You may place the battery (not part of standard deliverables) for the RTC to retain the time even after power off.*

### 4.3.5 Micro SD Card

#### Test setup and verification:

Insert the Micro SD card in the SD card holder (J2), the status of the SD card will be displayed on GLCD. If the SD card is inserted properly “SD card detected” is displayed on GLCD else it displays “SD card missing”.

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

### 4.3.6 ADC

#### Test setup and verification:

The ADC pin is connected to a potentiometer. To test the ADC rotate the wheel of the potentiometer, as the position varies the ADC value sensed is displayed on the GLCD.

*Note: Since the LPC11U24/37 has a 10-bit ADC, the values of the ADC reading will range from 0x0000 to 0x1023.*

### 4.3.7 PS/2 Keyboard

#### Test setup and verification:

Connect a PS/2 keyboard to PS2 connector. Press any key on the keyboard. The corresponding key gets displayed on the GLCD

### 4.3.8 USB

#### Test setup and verification:

Connect the USB cable to USB connector. The power LED (D7) turns ON. The USB enumeration can be checked in device manager. The BlueBoard enumerates as a Human Interface Device (HID). On a Windows machine this can be confirmed by looking in to the 'Device Manager' under 'Human Interface Devices'.

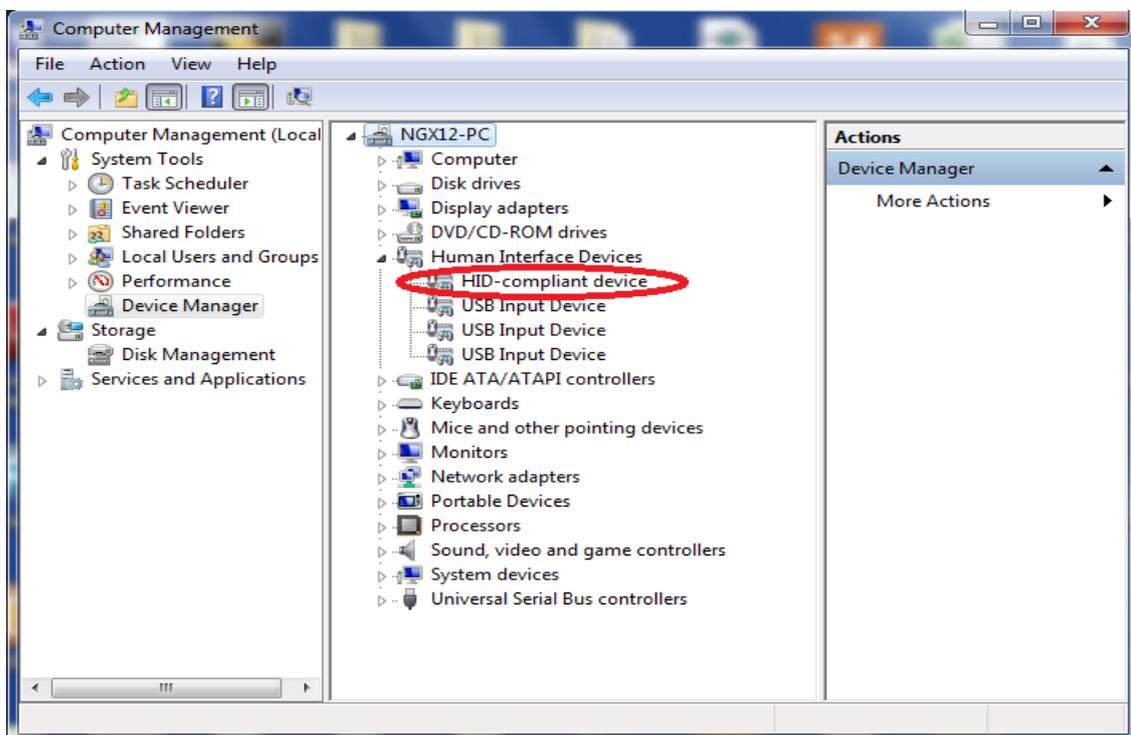


Fig 9

## 4.3.9 UART

### Test setup and verification:

Open the hyper terminal as shown in the below image. To test the UART open the hyper terminal with settings 115200 bps 8N1, i.e.

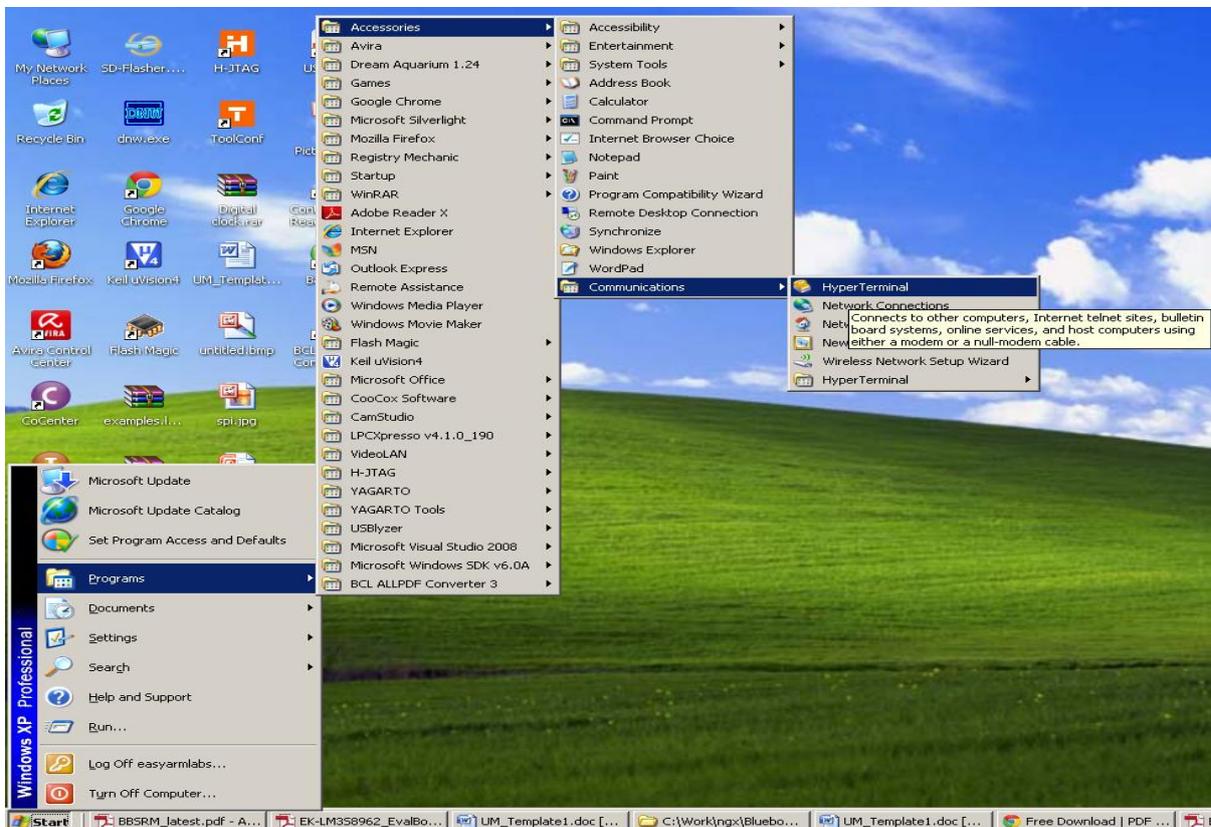
**Baud Rate: 115200 bps**

**Bits: 8**

**Parity: None**

**Stop bits: 1**

**Flow Control: None**



**Fig. 10**

A 'Connect To' window opens where you have to select the COM port. In this example it is COM8. Click OK. A 'COM8 Properties' window appears. Set the values as shown below. Click OK.

*Note: Please check for your machines COM port number. The COM port number can be different.*



Fig. 11

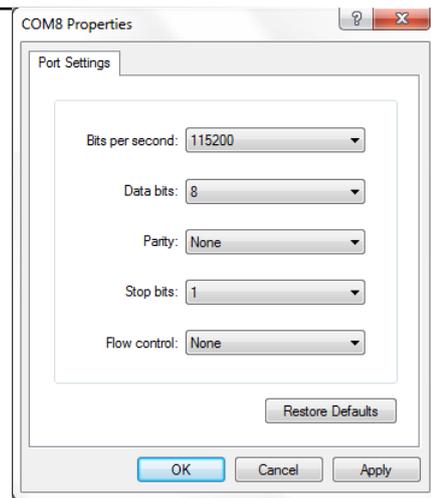


Fig. 12

Next a 'Hyper Terminal' window opens as shown.

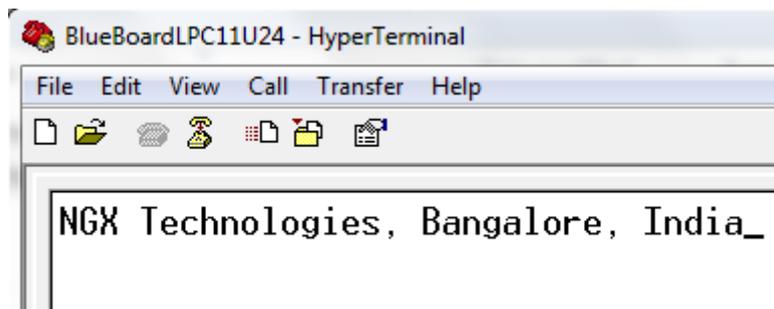


Fig. 13

Make sure the board is powered and the serial port is connected to the board. The key that are typed on the keyboard are echoed back to the hyper terminal.

### 4.3.9 External Interrupt Switch & Wakeup Switch

**Test setup and verification:**

When you press the External Interrupt Switch (External SW3) the controller enters into the deep power down mode, once you press the wake up switch (SW1) the controller wakes up from the deep power down mode.

## 5.0 CHANGE HISTORY

### 5.1 Change History

Rev	Changes	Date (dd/mm/yy)	By
1.0	Initial release of the manual	18/06/2012	Veeresh Tumbaragi

## 6.0 REFERENCES

In addition to this document, the following references are included on the NGX BLUEBOARD-LPC11U24/37 product and can also be downloaded from [www.ngxtechnologies.com](http://www.ngxtechnologies.com):

- NGX BLUEBOARD-LPC11U24/37 schematic for the Development board.

### About this document:

#### Revision History

Version: V1.0 author: Veeresh Tumbaragi

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