BlueBoard-RL78/G13/G14_64pin

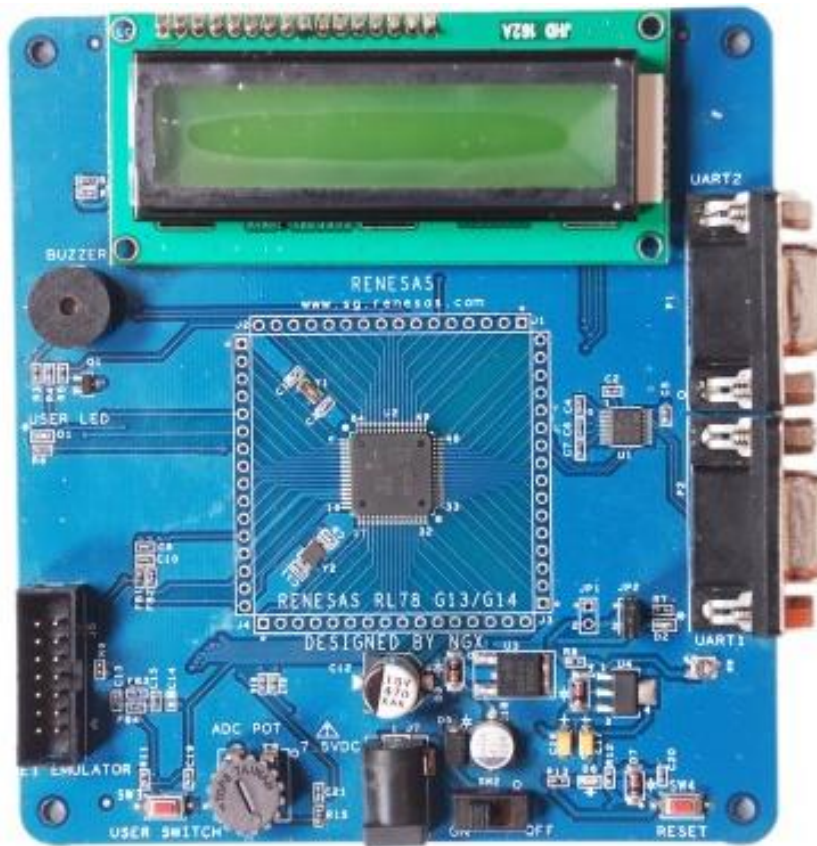

Fig. 1

User Manual for BlueBoard-RL78/G13/G14_64pin:
For CubeSuite+ with E1 Emulator: Click here
For Renesas Flash Programmer with E1 Emulator: Click here

Sample projects for BlueBoard-RL78/G13_64pin:
For CubeSuite+: Click here

Sample projects for BlueBoard-RL78/G14_64pin:
For CubeSuite+: Click here

Schematic for BlueBoard-RL78/G13/G14_64pin:
Click here to download Schematic.

About NGX Technologies

NGX Technologies is a leader in embedded microcontroller product development. We supply reference designs and evaluation modules to silicon companies. Our customers include industry leaders like NXP and RENESAS. Our core business is in helping our customers realize their embedded products.

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1.0 INTRODUCTION

This document is the Quick Start Guide for the BLUEBOARD-RL78/G13/G14_64pin, a low cost RENESAS's RL78/G13/G14_64pin based board by NGX Technologies. This document reflects its contents which include MCU features, hardware description, and hardware verification. This document provides detailed information on board features and hardware verification and possible debuggers and IDEs that can be used with this board.
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1.1 Possible Debuggers and IDEs that can be used
- E1 Emulator with CubeSuite+

1.2 E1 Emulator and CuibeSuite+

Board has 14 pin emulator connector, connect the one end of 14 pin cable to E1 emulator and other end to the 14 pin connector on the board, connect usb cable to E1 emulator and PC and connect the power supply to the board as shown in the below image

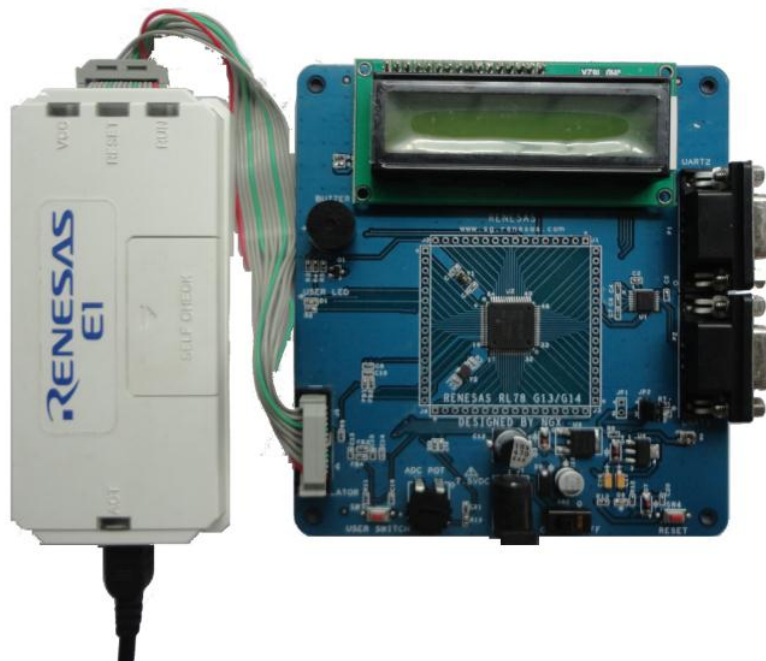*Note: E1 Emulator, 14 pin cable and USB cable are not a part of the BB-RL78/G13/G14_64pin board package.*

Fig. 2

2.0 BLUEBOARD-RL78/G13/G14_64pin OVERVIEW

2.1 INTRODUCTION

The NGX BLUEBOARD-RL78/G13/G14_64pin is a compact and versatile evaluation platform for the RENESAS's RL78/G13/G14_64pin MCU. RENESAS's evaluation platforms are generally tied up to CubeSuite+ and High Performance Workshop compiler/IDE and E1 Emulator. For our development we use E1 Emulator and CubeSuite+ as the debugger and compiler/IDE respectively. 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 120mm
- Two layer PCB (FR-4 material)
- Power: DC 6.5V with power LED On-board linear regulators generate +3.3V/500mA
- 14 pin CORTEX debug connector for Emulator connection
- User Switch and reset switch
- 12.0000 MHz crystal for MCU
- Extension headers for all MCU pins
- Test LED
- Character LCD
- Two RS232 connectors
- 10K pot for ADC
- Buzzer

2.3 Block Diagram

```
                    ┌──────────────────────┐
                    │  2X16 Character LCD   │
                    └──────────────────────┘
                               ↑
  ┌──────────┐        ┌──────────────────┐      ┌──────────────┐
  │   LED    │ ←──────│                  │─────→│  DB9 female  │
  └──────────┘        │                  │      │  connector   │
                      │                  │      │  for UART2   │
  ┌──────────┐        │                  │      └──────────────┘
  │   User   │ ──────→│                  │      ┌──────────────┐
  │  switch  │        │   RL78/G13/G14   │←────→│  DB9 female  │
  └──────────┘        │      _64pin      │      │  connector   │
                      │                  │      │  for UART1   │
  ┌──────────┐        │                  │      └──────────────┘
  │  14 pin  │        │                  │      ┌──────────────┐
  │ emulator │←──────→│                  │←─────│    Reset     │
  │connector │        │                  │      └──────────────┘
  └──────────┘        │                  │
                      │                  │      ┌──────────────┐
  ┌──────────┐        │                  │      │    Power     │
  │  Buzzer  │←───────│                  │←─────│   (6.5V)     │
  └──────────┘        └──────────────────┘      └──────────────┘
```
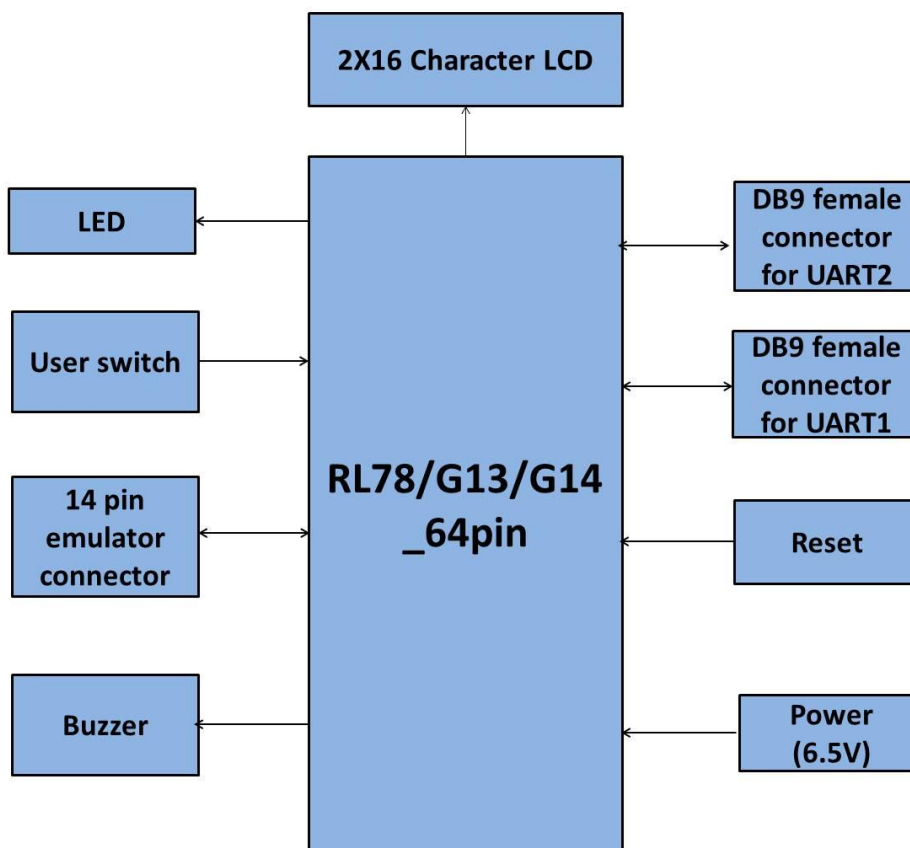
Fig. 3

2.4 MCU Features

- Minimum instruction execution time can be changed from high speed (0.03125μs: @ 32 MHz operation with high-speed on-chip oscillator) to ultra low-speed (30.5μs: @ 32.768 kHz operation with subsystem clock)
- General-purpose register: 8 bits × 32 registers (8 bits × 8 registers × 4 banks)
- ROM: 64 KB, RAM: RL78/G13 4 KB, RL78/G14 5.5 KB, Data flash memory: 4 KB
- On-chip high-speed on-chip oscillator
- Select from (for RL78/G14 only 64 MHz (TYP.), 48 MHz (TYP.)), 32 MHz (TYP.), 24 MHz (TYP.), 16 MHz (TYP.), 12 MHz (TYP.), 8 MHz (TYP.), 4 MHz (TYP.), and 1MHz (TYP.)
- On-chip single-power-supply flash memory (with prohibition of block erase/writing function)
- Self-programming (with boot swap function/flash shield window function)
- On-chip debug function

- On-chip power-on-reset (POR) circuit and voltage detector (LVD)
- On-chip watchdog timer (operable with the dedicated low-speed on-chip oscillator)
- On-chip multiplier and divider/multiply-accumulator
- 16 bits $\times$ 16 bits = 32 bits (Unsigned or signed)
- 32 bits $\div$ 32 bits = 32 bits (Unsigned)
- 16 bits $\times$ 16 bits + 32 bits = 32 bits (Unsigned or signed)
- On-chip key interrupt function
- On-chip clock output/buzzer output controller
- On-chip BCD adjustment
- I/O ports: 16 to 120 (N-ch open drain: 0 to 4)
- Timer
  - 16-bit timer: 8 to 16 channels
  - Watchdog timer: 1 channel
  - Real-time clock: 1 channel (Correction clock output)
  - Interval timer: 1 channel
- Serial interface
- CSI
- UART/UART (LIN-bus supported)
- I2C/Simplified I2C communication
- Different potential interface: Can connect to a 2.5/3 V device when operating at 4.0 V to 5.5 V
- 8/10-bit resolution A/D converter (VDD = EVDD =1.6 to 5.5 V): 6 to 26 channels
- Standby function: HALT, STOP, SNOOZE mode
- Power supply voltage: VDD = 1.6 to 5.5 V
- Operating ambient temperature: TA = -40 to +85°C

For the most updated information on the MCU please refer to RENESAS's website.

3.0 BLUEBOARD-RL78/G13/G14_64pin Hardware Description

3.1 Introduction

The NGX BLUEBOARD-RL78/G13/G14_64pin is based on RL78/G13/G14_64pin microcontroller from RENESAS. RL78/G13/G14_64pin offers 64-KB Flash memory, 32-MHz operation, ADC: Up to 20 channels, 10-bit resolution, 2.1µs conversion time, D/A converter: 2 channels, 8-bit resolution, On-chip temperature sensor and wide range of peripherals. Refer to the RL78/G12/G13/G14 data sheet for complete device details.

BLUEBOARD-RL78/G13/G14_64pin microcontroller is factory-programmed with a quick start demo program. The quick start program resides in RL78/G13/G14_64pin on-chip Flash memory and runs each time power is applied, unless the quick start has been replaced with a user program.

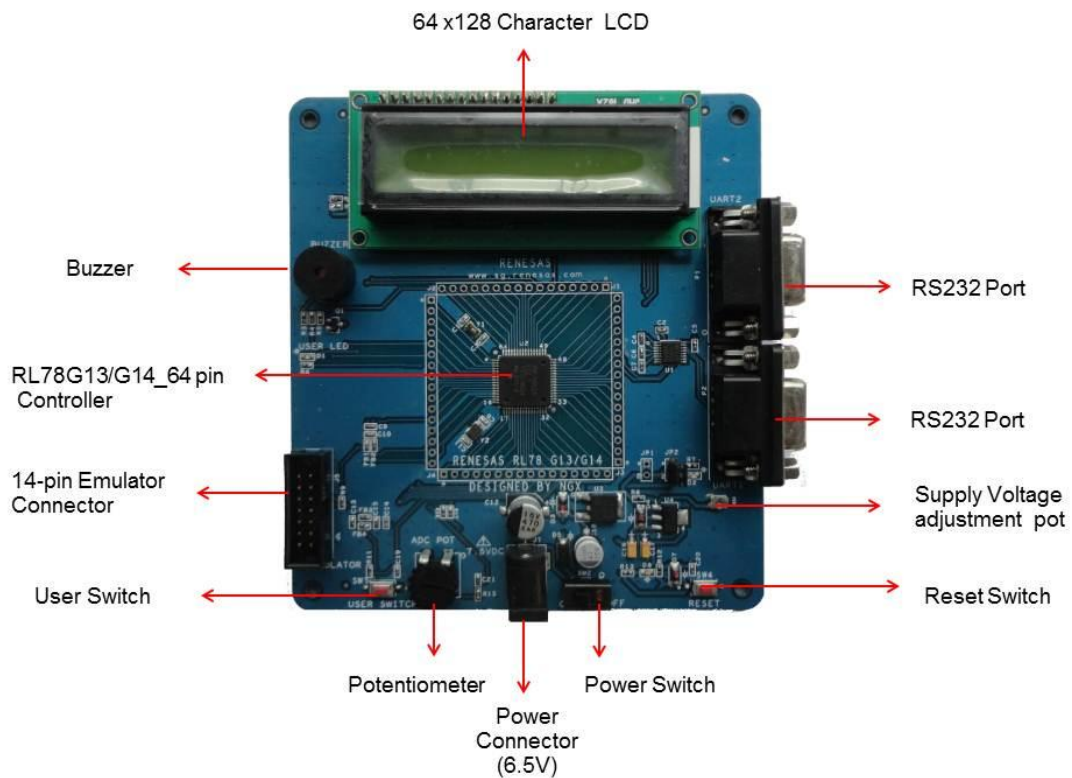## 3.2 Board Image with pointer to each peripheral & connectors

Fig 4

4.0 BLUEBOARD-RL78/G13/G14_64pin hardware verification

NGX's BlueBoard-RL78/G13/G14_64pin board evaluation platforms ship with a factory-programmed test firmware that verifies the 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:

- BLUEBOARD-RL78/G13/G14_64pin
- Power: DC 6.5V Supply
- PC
- Serial RS232 cable

4.1 Board connections

BlueBoard Peripheral	Schematic labels	MCU pins
User LED	LED	21
Buzzer	BUZZER	64
User Switch	INTP1	33
Reset Switch	NRST	6
Character LCD	LCD_D0	29
	LCD_D1	28
	LCD_D2	27
	LCD_D3	26
	LCD_D4	25
	LCD_D5	24
	LCD_D6	23
	LCD_D7	22
	LCD_RS	17
	LCD_R/W	18
	LCD_EN	19
	LED+	20
ADC	ANI2	54
UART1	RXD1	59
	TXD1	60
UART2	RXD2	42
	TXD2	43
E1 Emulator	TOOL0	5
	NRST	6
Power Supply	Vdd_MCU	15

Table.1

4.2 Powering the Board

The BLUEBOARD-RL78/G13/G14_64pin requires DC supply of 6.5V.1A rating to power it up, alternatively the board could be powered through Emulator.

4.3 Verifying all the peripherals of the board

The following section focusses on the verification of all the peripherals supported on the board. 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 board peripherals. The order of the peripherals that are verified by the firmware are as follows:

4.3.1 LED

Test setup and verification:
As soon as the board is turned ON or reset; the test LED (D1) go ON & OFF for a couple of times, this simple test validates the LED.

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 User Switch

Test setup and verification:
When you press the User Switch, LED (D1) toggles.

4.3.4 Character LCD

Test setup and verification:
A message "WELCOME TO NGX TECHNOLOGIES" should be displayed on the Character LCD.

4.3.5 RTC

Test setup and verification:
Next, the firmware validates the internal RTC. The RTC value is read and displayed on the character LCD.

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 LCD display.

Note: Since the RL78G13/G14 has a 10-bit ADC, the values of the ADC reading will range from 0x0000 to 0x1023.

4.3.7 UART1 & UART2

Note: The UART1 and UART2 test is not there in the factory-programmed test firmware , user need to load the UART1 and UART2 sample firmware separately then follow the below steps. To load the firmware follows the steps in section 3.2 in the <u>user manual</u>.

Test setup and verification:
Open the hyper terminal as shown in the below image. To test the UART1& UART 2 open the hyper terminal with settings 9600bps 8N1, i.e.
Baud Rate: 9600 bps
Bits: 8
Parity: None
Stop bits: 1
Flow Control: None

Fig 5

A 'Connect To' window opens where you have to select the COM port. In this example it is COM26.Click OK. A 'COM26 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.
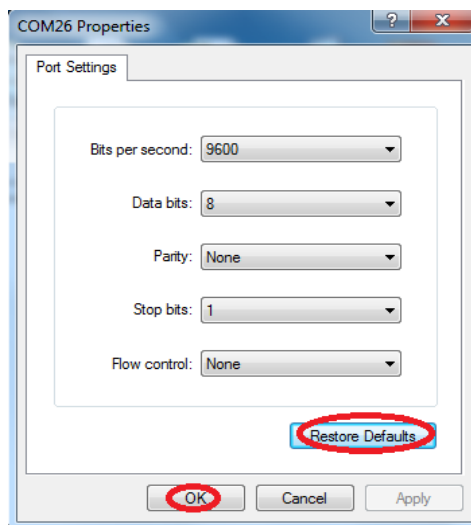

Fig 6   **Fig 7**

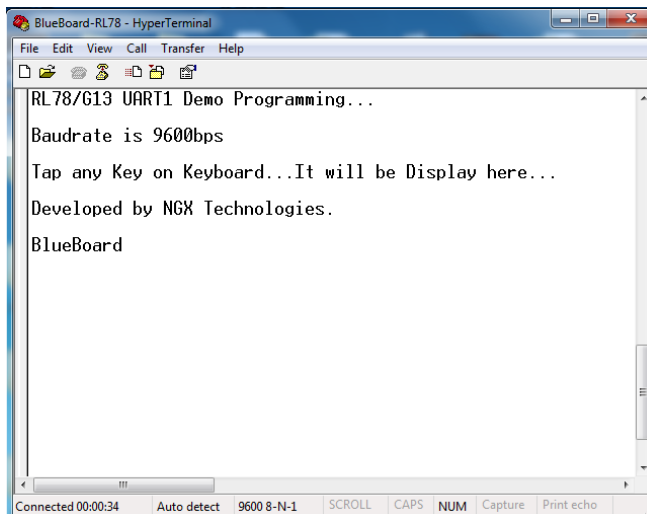Next a 'Hyper Terminal' window opens as shown.

Fig 8

4.3.8 Supply Voltage Adjustment Pot

Test setup and verification: This pot demonstrates the MCU can work for variable voltages i.e 1.6 V to 5.5 V. We have verified user LED (D1) blinky at voltage 1.8V.
Adjust the pot to set the voltage between the specified ranges and test the user LED (D1) blinky, LED (D1) should toggle.

5.0 CHANGE HISTORY

5.1 Change History

Rev	Changes	Date (dd/mm/yy)	By
1.0	Initial release of the Quick Start Guide	28/05/2012	Veeresh Tumbaragi

6.0 REFERENCES

In addition to this document, the following references are included on the NGX BLUEBOARD-RL78/G13/G14_64pin   product and can also be downloaded from www.ngxtechnologies.com:

- NGX BLUEBOARD-RL78/G13/G14_64pin schematic for the Development board.

Additional references include:

- Information on development tool being used:
  - CubeSuite+, http://sg.renesas.com/products/tools/ide/ide_cubesuite_plus/

About this document:

Revision History

Version: V1.0 author: Veeresh Tumbaragi

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