User's Manual

RENESAS

Renesas Demonstration Kit (RDK) for RX62N

User's Manual: Hardware

32

RENESAS MCU
RX Family / RX600 Series / RX62N Group

R20UT2531EU0100

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Precautions

This Renesas Demonstration Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

- Ensure attached cables do not lie across the equipment
- Reorient the receiving antenna
- Increase the distance between the equipment and the receiver
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected
- Power down the equipment when not in use
- Consult the dealer or an experienced radio/TV technician for help NOTE: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

The Renesas Demonstration Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Table of Contents

Chapter 1. Preface

Cautions

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All rights reserved. The RDK design, documentation, and demo software are intended to improve understanding and time-to-market for RX62N-based designs. Duplication of the design, documentation, and demonstration software is encouraged.

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Website: http://www.renesas.com/

Glossary

ADC	Analog to Digital Converter		MCU	Microcontroller Unit
CPU	Central Processing Unit		NC	No Connection
DAC	Digital to Analog Converter		PC	Program Counter
EMC	Electromagnetic compatibility		RAM	Random Access Memory
ESD	Electrostatic Discharge		RCAN	Renesas Controller Area Network
HEW	High-performance Embedded Workshop		ROM	Read-Only Memory
I/O	Input / Output		RDK	Renesas Demonstration Kit
LCD	Liquid Crystal Display		SDRAM	Synchronous Dynamic Random Access Memory
LED	Light Emitting Diode			

Chapter 2. Purpose

This RDK is an evaluation and demonstration tool for Renesas RX62N microcontrollers. The goal is to provide the user with a powerful debug and demonstration platform targeted at common applications. A set of human/machine interfaces are tightly integrated with the features of the RX62N and the software demonstration programs providing the user with an accessible platform to rapidly evaluate and customize.

Target Applications and Features:

- Audio

    o Stereo audio driver connected to the PWM interface

    o On-board microphone to demonstrate sampling, FFT/FPU capabilities

    o Volume Control Potentiometer

    o Micro SD card interface for audio and data files

- Motor Control

    o 3 – Phase motor control algorithm representation with LEDs

    o Motor control algorithm speed variation through volume control potentiometer

- Gaming

    o 3 – Axis Accelerometer (Digital)

    o User pushbutton switches

    o Develop and submit your sample programs to demonstrate these features to the online community: http://www.renesasrulz.com/community/renesas_products/rx

- Communications

    o 10/100 Ethernet Interface connected to an internal Ethernet MAC (1588 compatible)

    o USB Interface connected to an internal USB controller (Host, Device and OTG)

    o RS-232 Interface

    o CAN Interface

    o I2C, SPI with Debug through the Beagle connector from Total Phase

- User Code and Application Debugging

    o On-board J-Link Lite for high-quality source code debugging

    o User circuit breadboard area

The Renesas RDK user experience is complemented by the online Renesas ecosystem:

- Renesas Interactive: www.RenesasInteractive.com

  - Free Online Learning

- Renesas Rulz: www.RenesasRulz.com

  - Online community

  - Online user forums

  - www.RenesasRules.com/RX62N - Online support site for this RDK

- University Program: www.RenesasUniversity.com

  - Support for Professors and Students

  - Support for University Kits (QSKs)

- Renesas Microcontroller Samples (America Customers)

  - Free of charge

  - Request directly from www.America.Renesas.com/samples

Chapter 3.Power Supply

3.1. Requirements

This RDK gets its power from the Segger J-Link Lite USB connection or optionally from a regulated 5V power supply.

The optional power jack is a center positive connector using a 2.1 mm barrel.

Warning

The RDK is neither under nor over-voltage protected. Use a 5v !REGULATED! center positive supply which can source at least 1 Amp.

3.2. Power – Up Behavior

When the RDK is purchased it has the 'Release' or stand-alone code from Example #4 pre-programmed into the Renesas microcontroller. The code exercises the user LEDs, LCD, PWM, ADC, Potentiometer, and Ethernet interfaces. The LCD powers up with the message: "Micrium", "uC/OS-III", "uC/TCP-IP" message. If the Ethernet interface is active, and a DHCP server is present, the RDK will receive an IP Address, subnet mask and Gateway address. All will be displayed on the LCD. If no DHCP server is found, the RDK uses the default settings of:

IP Address = 169.254.24.194

Subnet Mask= 255.255.0.0

Gateway = 0.0.0.0

After acquiring the network address either by the DHCP server or by default, the speed of the motor control LEDs are under the control of the potentiometer. Turning the potentiometer adjusts the desired frequency of the Motor Control LEDs. The output frequency is also measured and both are displayed on the bottom of the LCD.

Chapter 4. Board Layout

4.1. Component Layout

The following diagram shows the top layer component layout.

Figure 4-1: Board Layout

4.2. Board Dimensions

The following diagram gives the board dimensions and connector positions. All through hole connectors are on a common 0.1″ grid for easy interfacing.
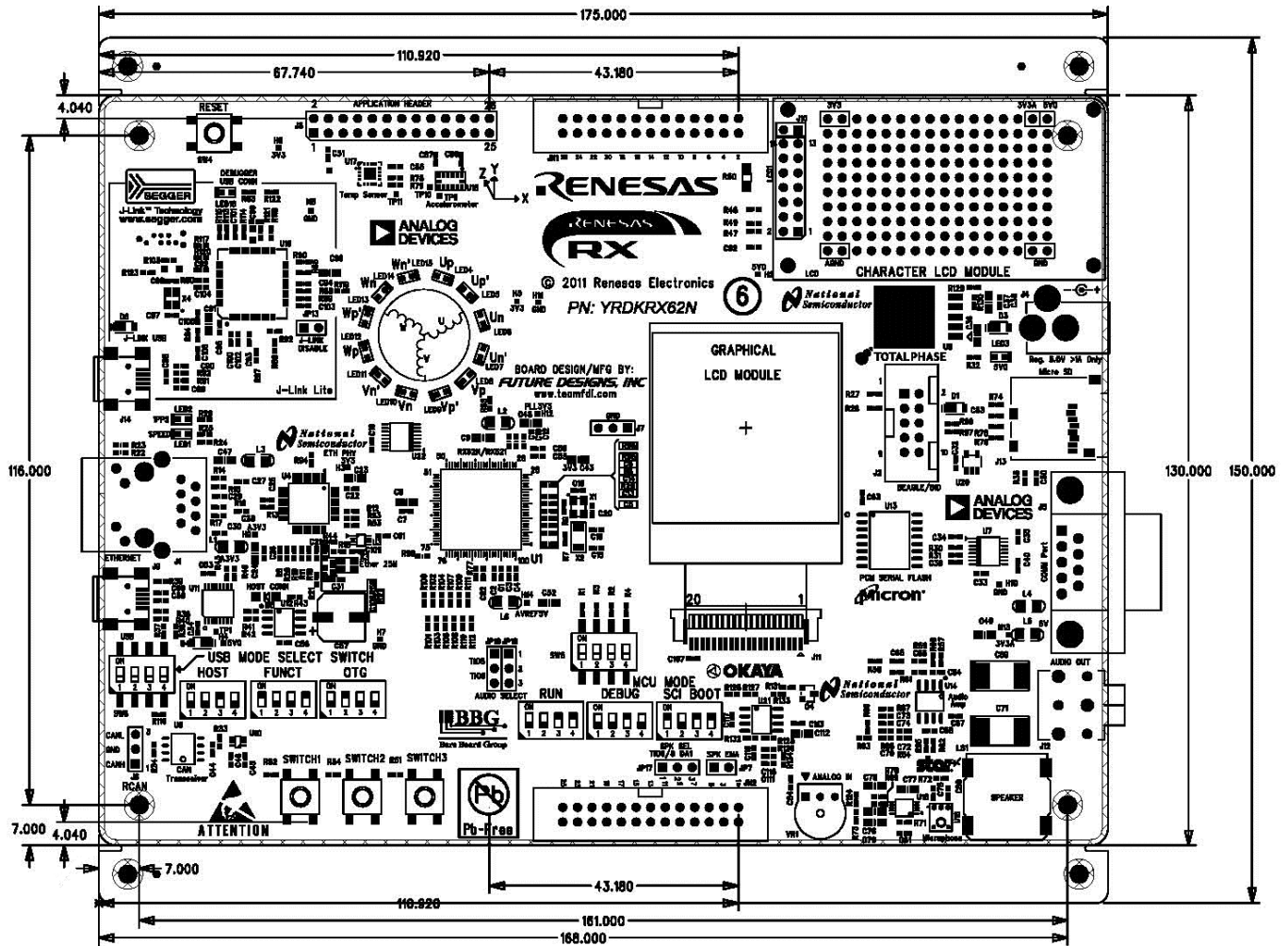

Figure 4-2: Board Dimensions

Chapter 5. Block Diagram

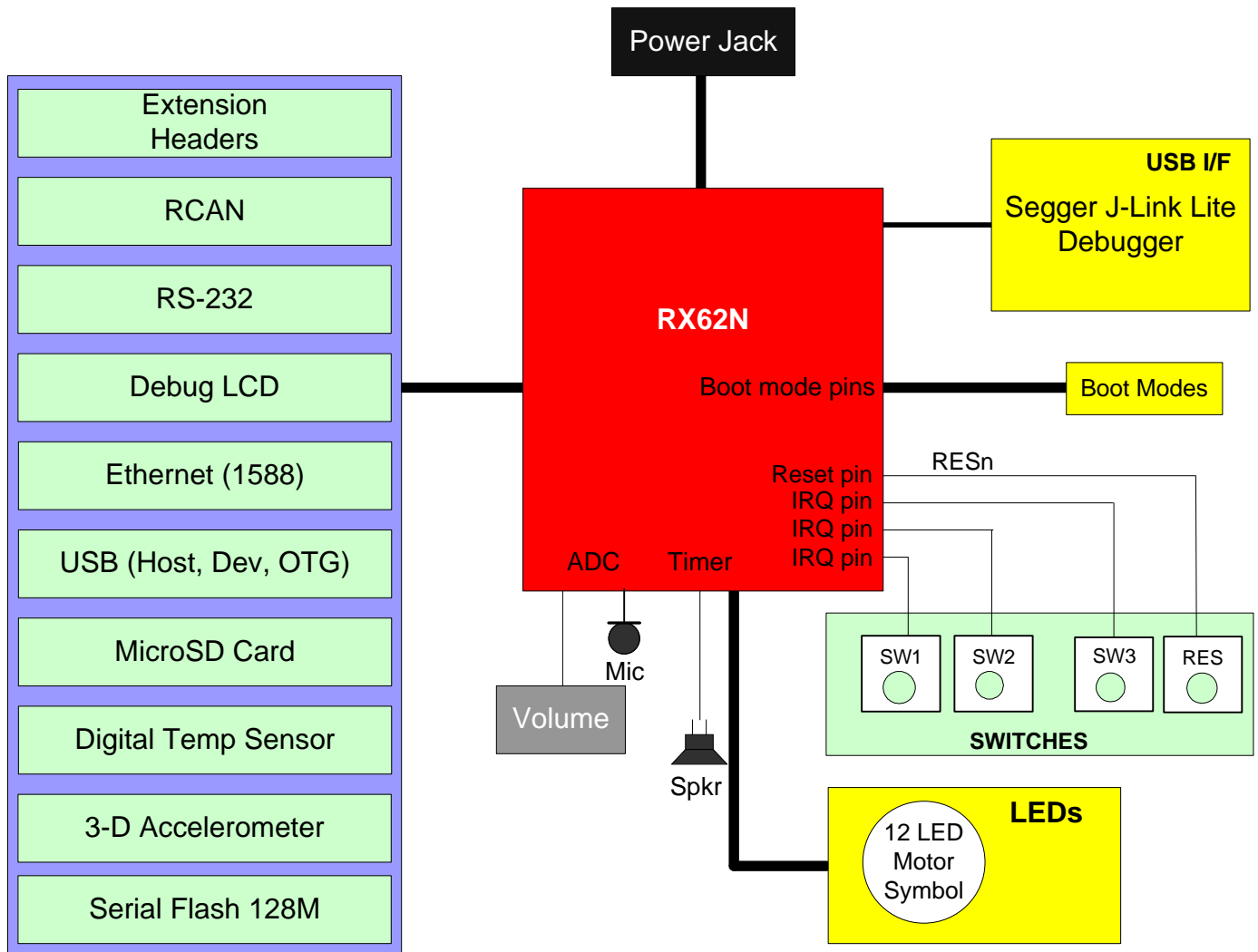Figure 5-1 shows the CPU board components and their connectivity.

Figure 5-1: Block Diagram

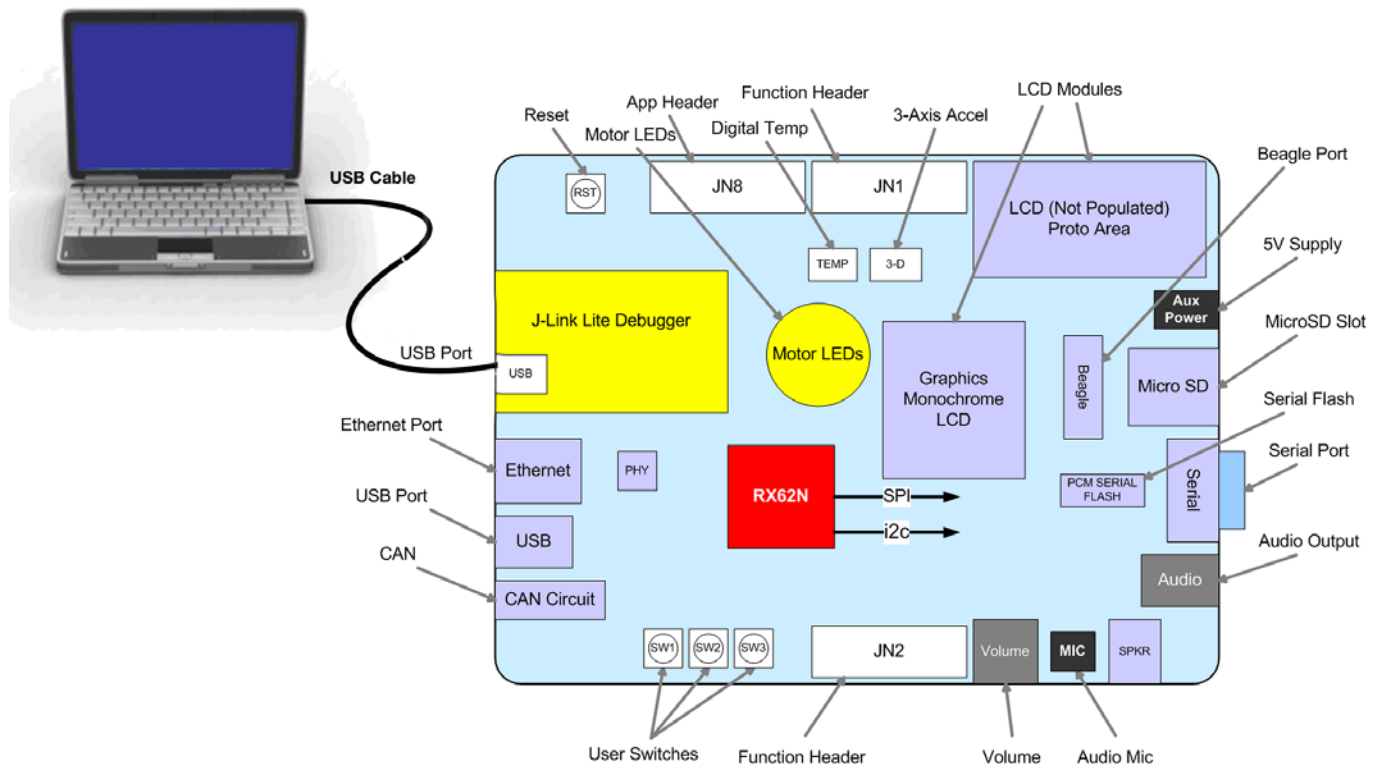**Figure 5-2** shows host PC connection to the RDK board.

Figure 5-2: RDK Connections

Chapter 6. User Circuitry

6.1. Switches

There are five switches located on the CPU board. The function of each switch and its connection are shown in Table 6-1.

Switch	Function	Microcontroller
SW1	Connects to an IRQ line for user controls.	**IRQ8**, Pin 95
SW2	Connects to an IRQ line for user controls.	**IRQ9**, Pin 93
SW3	Connects to an IRQ line for user controls.	**IRQ10**, Pin 92
SW4 (RESET)	When pressed, the RDK microcontroller and JLink circuit are reset.	**RES#** , Pin 10

Table 6-1: Switch Functions

6.2. Debug LCD Module

A debug LCD module is supplied on the RDK. The debug LCD module uses an SPI interface to reduce the pin allocation. Software contrast control is also provided. The module supplied with the RDK uses 3.3v.   The display is a 96 x 64 graphics display and uses a white LED backlight.   As of hardware revision 6, a backlight control has been added to the design.   The backlight is on by default and can be toggled OFF by setting P21 low.   The backlight brightness can be also controlled by using MTU pin TIOCIB.   Note there is a footprint, LCD1, for a 2 x 8 character display.   This display is not populated – but can be used in a standard 4 bit nibble configuration if desired.

Table 6-2 shows the pin allocation and signal names used for the graphics LCD connector.

J11					
Pin	Circuit Net Name	Device Pin	Pin	Circuit Net Name	Device Pin
1	+5V Backlight Positive Anode	-	2	GND	-
3	GND	-	4	GND	-
5	GND	-	6	LCD-CS	50
7	RSTOUT# (Inverted RESET_IO Pin 49)	49 inv	8	LCD-RS	43
9	+3.3V	-	10	+3.3V	-
11	SCK	47	12	MOSI	46
13	MOSI	46	14	MOSI	46
15	+3.3V	-	16	+3.3V	-
17	+3.3V	-	18	+3.3V	-
19	GND	-	20	+3.3V	-

Table 6-2: Debug LCD Module Connections

6.3. LEDs

There are 17 LEDs on the RDK board. The green 'POWER' LED (LED3) lights when the board is powered. The Segger J-Link Lite Debugger Interface has an LED (LED16) that illuminates when the Debugger USB Interface is connected to a host PC. There are12 user LEDs (see table 6-3) that are connected to IO ports and will light when their corresponding port pin is set low.   The 12 user LEDs are arranged to show the winding phases of a motor control circuit. The remaining 2 LED's (LED2 and LED1) are Ethernet specific, and are not accessed directly from the MCU.

Table 6-3, below, shows the user LED pin references and their corresponding microcontroller port pin connections.

LED Reference (As shown on silkscreen)	Color	Microcontroller Port Pin & NET	Microcontroller Pin Number
LED4 (Up)	Green	LED6	81
LED6 (Un)	Red	LED3	84
LED8 (Vp)	Green	LED5	82
LED10 (Vn)	Red	LED2	85
LED12 (Wp)	Green	LED4	83
LED14 (Wn)	Red	LED1	86
LED5 (Up')	Green	LED12	75
LED7 (Un')	Red	LED9	78
LED9 (Vp')	Green	LED11	76
LED11 (Vn')	Red	LED8	79
LED13 (Wp')	Green	LED10	77
LED15 (Wn')	Red	LED7	80
LED2 (1PPS ENET)	Red	PE9	N/A
LED1 (Speed ENET)	Green (On for 100BT)	PE11	N/A
LED3 (Power)	Green	-	N/A
LED16 (Segger J-Link Lite)	Green	-	N/A
D5 (USB Power)	Green	-	N/A

Table 6-3: LED Port

6.4. Micron Serial Flash

A Micron Phase Change Memory (PCM) serial flash is provided for user non-volatile storage. PCM memory has greater write endurance than standard serial flash. This part, NP5Q128A13ESFC0E, is 128 megabit and is accessed by the SPI Bus.

6.5. MicroSD Memory Card Slot

A MicroSD memory card slot is provided for file system data storage. This is configured to use SPI mode rather than nibble mode.

6.6. Audio (Audio Out, Mic, Speaker, Volume Potentiometer)

An amplified stereo audio output jack is provided and connected to the timer circuit.   TIOCA8A is used for Right audio channel and comes out on CPU pin 64. TIOC8B is used for the Left audio channel and comes out on CPU pin 63.   The stereo amp is powered by a National Semi LM4808.   An on-board Analog Devices Inc. (ADI) Silicon microphone (ADMP401) is connected to the ADC channel AN5 (CPU pin 89) using an ADI SSM2167 low voltage Microphone preamplifier.   A single turn potentiometer is connected to the ADC channel AN4 (CPU pin 90) of the microcontroller. This may be used to vary the input analog voltage value to this pin between 3V3A and Ground. The potentiometer is used as a volume control in the Demo Application.   Note that the default is to have JP7, SPK EN, fitted.   This enables the on-board Star Micronics speaker.   Removing this jumper disables the on-board speaker.   Remove the jumper to use the headphone audio jack.   As of hardware revision 6, the on-board speaker is now powered by a LM4889 audio power amplifier to increase volume output. The amplifier can be disabled by setting PE7 low.

Note: The potentiometer is fitted to offer an easy way of supplying a variable analog input to the controller. It does not necessarily reflect the accuracy of the controllers ADC. Please see the device manual for details.

6.7. Serial port

The Serial module allows the MCU to communicate to a Host PC through the RS-232 connector, J5, using RS232Rx and RS232Tx. The serial port is configured in DCE mode allowing direct connection to a PC without a Null modem. The serial module can also be used as a serial debug port.   Table 6-4 contains details of the specific pin functions and their locations.

Description	Function	MCU Pin	Connector Pin
TXD2	Serial Transmission Pin	44	J5.2
RXD2	Serial Reception Pin	42	J5.3

Table 6-4: Serial port pin details

6.8. RCAN

The RCAN module can be controlled by the MCU through the CTx0 (Port pin P32) and CRx0 (Port pin P33) lines, or controlled externally through the header connections CTx0 and CRx0.   The Table 6-5 contains details of the specific pin functions and their locations.   Note that an 8 pin Renesas R2A25416SP CAN transceiver is fitted to the board.

Description	Function	MCU Pin	Header Pin
CTx0	RCAN Transmission Pin	18	CAN High J6.1
CRx0	RCAN Reception Pin	17	CAN Low J6.3

Table 6-5: RCAN port pin details

6.9. USB

The USB module can be configured as Host, Device or OTG with the correct switch settings on SW6.

Function / Device / Slave mode: This mode does not take any external power circuitry to implement.   Simply put the SW6 DIP switches to the proper setting as in table 6-7 and configure the software appropriately.

Host mode: Connect the included MiniAB to Host adapter Cable to have the proper cable connection for USB Host.   This mode uses U12 and associated passive circuitry to create USB Power.   Set SW6 DIP switches to the settings shown in table 6-7. Note that you will have to add an external 5V <u>regulated</u> supply that sources 1 Amp or greater to J4 in order to meet the USB Specification for power delivery (500ma).

OTG: Set SW6 DIP switches to the settings shown in table 6-7.   Note that the Maxim MAX3353EEUE and associated circuitry will create the proper USB OTG voltages.   Note the Maxim IC must be configured in software using the I2C bus (Address 0x58) for proper operation. Note that you will have to add an external 5V regulated supply that sources more than 1 Amp to J4 in order to meet the USB Specification for power delivery (500ma).

Table 6-6 contains details of the USB signal descriptions and pin connections. **Table 6-7** details how to set the SW6 DKP switches for each USB mode.

Description	Function	Microcontroller Pin Number
USB_VBUS	USB cable connection monitor pin	30
USD+	USB data I/O pin	37
USD-	USB data I/O pin	36
VCC_USB	Power supply pin for USB built-in transceiver	35
VSS_USB	Ground pin for USB built-in transceiver	38
USB_DPUPEA	Pull-up control pin A	25
USB _ID_EXT	OTG USB ID	28
USB_OVRCURA_DPUPEB	Host / OTG Over-current detect / Function Pull-up control pin B	32
USB_DRPD	D- Pull Down	26
USB_DPRPD	D+ Pull Down	23
USB0_EXICEN	Expansion	27

Table 6-6: USB Pin Definitions

USB DIP Switch Settings (SW6)				
Mode No.	SW6.1	SW6.2	SW6.3	SW6.4
USB Host	OFF	OFF	ON	OFF
USB Function / device/ slave	ON	OFF	OFF	ON
USB On the Go (OTG)	OFF	ON	OFF	OFF

Table 6-7: USB DIP Switch SW6 settings

6.10. Ethernet

The Ethernet module conforms to the Ethernet or IEEE802.3 media access control (MAC) standard. Ethernet controller is connected to the direct memory access controller for Ethernet controller (E-DMAC) and carries out high-speed data transfer to and from the memory. In addition, Ethernet controller is connected to DP83640 physical receiver chip enabling it to perform transmission and reception of Ethernet frames. Note that the chip is configured in Reduced Pin-count mode (RMII).

The Ethernet PHY is configured at power-on reset for Auto-Negotiation, advertising 10Base-T and 100Base-TX in both full and half-duplex modes. Each unit is pre-programmed with a unique IEEE assigned MAC address ranging from 00:30:55:08:00:01 to 00:30:55:08:FF:FF. If there is a problem with the pre-programmed MAC address, the demonstration code will default to 00:30:55:08:00:00.   The MAC address programmed into the part at the factory is shown on the back of the board. The MAC address is stored at the end of data block 15 at memory address 0x107FF0.

Table 6-8 contains details of the signal descriptions and pin connections. All connections to the MCU are direct.

Net Name	Function	MCU Pin Number
ETH_CLK	Transmit/Receive Clock	58
TX_EN	Transmit Enable	56
RMII_TXD0	Transmit Data, Bit 1	55
RMII_TXD1	Transmit Data, Bit 2	54
RMII_MAS	Master Mode (high)	NC
RX_ER	Receive Error	57
RMII_RXD0	Receive Data, Bit 1	59
RMII_RXD1	Receive Data, Bit 2	61
CRS	Carrier Sense	53
MDC	Management Data Clock	66
MDIO	Management data I/O	67
ETH-IRQ	IEEE1588 signaling pin	98

Table 6-8: Ethernet Module Connections

The National Semiconductor 10/100 DP83640 Precision PHYTER® Ethernet PHY supports the IEEE1588 Precision Time Protocol (PTP) providing precision clock synchronization for real-time industrial connectivity. The RDK includes a GPIO/Interrupt connection between the PHY and the RX62N for PTP event processing, and a direct LED connection for timing indications. The DP83640 captures a time stamp at the physical layer level with an accuracy of <10ns.   **Note:** National Semiconductor recommends using the **DP83848J** as it is less expensive if 1588 is not necessary.

6.11. 3 – Axis Accelerometer

The RDK includes an Analog Devices ADXL345 3–axis accelerometer.   The part is connected to I2C SDA (Micro Pin 33) and SCL (Micro Pin 34).

6.12. Digital Temp Sensor

An ADT7420 Digital Temperature Sensor is also on the RDK. It is connected to the I2C SDA (Micro Pin 33) and SCL pins (Micro Pin 34).

6.13. Option Links and Jumper Settings

Table 6-9 and 6-10 detail the function of the various option links contained on the RX62N RDK. The default configuration is indicated by **BOLD** text. **Table 6-9** details the Ethernet LED Configuration Resistor.

Ethernet Configuration Options				
Reference	Function	Fitted	Alternative (Removed)	Related To
R12	Ethernet Configuration	LED Configuration – Link/Activity (J1.L), Speed (LED14), Collision (J1.R)	**LED Configuration – Link (J1.L), Speed (LED14), Activity (J1.R)**	-

Table 6-9: Ethernet Configuration Options

Table 6-10 below describes the function of the jumper headers.

Jumper Settings				
Reference	Function	Open	Short	Notes
JP7	Speaker Enable	Headphone Active	**Speaker Enabled**	Headphones may work to some extent with jumper fitted – but will not work optimally
JP9	CAN terminator disable	Removes the CAN termination resistor – useful in some debugging situations	**CAN terminator active**	Cut the trace between the pads to 'open' the circuit
JP10	Switch 3 Isolation	Removes Switch 3 from P42/AN2 Circuit	**Switch 3 acts on P42/AN2**	Cut the trace between the pads to 'open the circuit
JP11	Switch 3 Isolation	Removes Switch 2 from P41/AN1 Circuit	**Switch 2 acts on P41/AN1**	Cut the trace between the pads to 'open the circuit
JP12	Switch 3 Isolation	Removes Switch 1 from P40/AN0 Circuit	**Switch 1 acts on P40/AN0**	Cut the trace between the pads to 'open the circuit
JP13	J-Link Disable	**J-Link Lite debugger is active and works normally**	J-Link Lite is disabled with all output high impedance. This is useful for running a program without the debugger or using the boot mode of the RX62N	-
JP14*	Boot Mode Enable*	**TXD1 and TXD2 are not shorted – normal operation**	TXD1 And TXD2 are shorted – which allows UART Boot Mode	UART Boot Mode also requires JP13 Short and SW5 configured for Boot Mode. J5 can then Boot the RX62N Micro.
JP15*	Boot Mode Enable*	**RXD1 and RXD2 are not shorted – normal operation**	RXD1 And RXD2 are shorted – which allows UART Boot Mode	UART Boot Mode also requires JP13 Short and SW5 configured for Boot Mode. J5 can then Boot the RX62N Micro.
J7	GND	N/A	N/A	Convenient Scope Ground Pins

Table 6-10: Jumper header settings

* Only present in board Revision that has a circled 2 above the Okaya LCD

6.14. Oscillator Sources

All crystals are provided by Epson Electronics America.   A crystal is fitted on the RDK and used to supply the main clock to the Renesas microcontroller. Table 6-11 details the crystals that are fitted on the RX62N RDK.

Component	Function	Frequency
Crystal (X1)	CPU/USB Clock	12 MHz
Crystal (X2)	CPU/RTC Clock	32.768 KHz
Crystal (X3)	Ethernet Clock	25 MHz
Crystal (X4)	J-Link Lite System	18.432 MHz

Table 6-11: Oscillators / Resonators

6.15. Reset Circuit

The RDK includes a user reset switch which to reset both the RX62N MCU and Debugger MCU. This is connected to the internal reset circuit on the RX62N (RES#) and reset input on the Segger J-Link Debugger (TRESin). The Segger MCU can also control this pin via its TRESout pin for debugging purposes.

There is a peripheral reset control line connected to PC2 (pin 49) on the RX62N which can be used to reset major peripherals at once. This includes the Ethernet PHY, Beagle Port, Application Header, and Debug LCD.

6.16. Total Phase Beagle Debug Header

The Beagle I2C/SPI Protocol Analyzer is a non-intrusive USB-based bus monitor that can capture, display, and filter I2C and SPI data as it appears on the bus. Using both the Data Center Software and Beagle analyzer, users can easily view I2C bus traffic (up to 4 MHz) and SPI bus traffic (up to 24 MHz) in real time. Additional functionality allows engineers to filter data against a wide variety of parameters, or instantly search for specific hexadecimal or ASCII data patterns during a live capture. The Beagle analyzer is fully supported on Windows, Linux, and Mac OS X, and comes with free software, free APIs, free technical support, and free software/firmware upgrades.

Total Phase manufactures powerful and affordable USB, I2C, SPI, and CAN tools for embedded systems engineers. The complete line of Total Phase host adapters and protocol analyzers are the development and debugging tools of choice for Fortune 500 companies, small businesses, and research institutions all over the world.

For more technical information, online demos, and ordering information, visit www.totalphase.com.

Chapter 7. Modes

This RDK supports the 3 CPU modes: Single Chip Mode, Boot Mode and USB Boot Mode. These modes are selected by SW5 MD0 and MD1 pins.   Placing the switch in the 'On' position sets the value to a logic '0', and the 'Off' position sets the value to a logic '1'. The base configurations should only be set when the RDK is powered off.

Mode No.	MD1 (1)	MD0 (2)
Single Chip Mode	1 (OFF)	1 (OFF)
UART 0 Boot Mode	0 (ON)	1 (OFF)
USB Boot Mode	1 (OFF)	0 (ON)
Do Not Use	0 (ON)	0 (ON)

Table 7-1: MCU Operating Modes Table

The RDK can also be configured to run in either Big-Endian or Little-Endian memory configuration mode.

Memory Mode	MDE (3)
Little Endian	0 (ON)
Big Endian	1 (OFF)

Table 7-2: Endian Order Selection Table

The RDK can also be placed into either Debug Mode or Run Mode via switch 4 on SW5. Placing the switch in the 'OFF' position selects Debug mode, the 'ON' position selects the default Run mode.

Debug Mode	EMLE (4)
Debug	0 (ON)
Run (Default)	1 (OFF)

Table 7-3: Debug/Run Mode Selection Table

Chapter 8. Programming Methods

The RDK is intended for use with HEW and includes an integrated Segger J-Link Lite debugger. Refer to RX62N Group Hardware Manual for details of programming the microcontroller without using these tools. The on-board J-Link Lite is pre-programmed at the factory and configured for normal operation.   The debugger can be disabled by fitting a jumper to the J-Link disable 2-pin header.   This is useful if the board needs to be put into either USB or UART boot mode.   The J-Link Lite is located in the upper left section of the RX62N RDK.   Should the Segger Micro become inoperable – it will need to be returned to Renesas for repair.

Chapter 9. Headers

9.1. Extension Headers

Table 9-1 shows the controller pin headers and their corresponding microcontroller connections. The header pins connect directly to the microcontroller pin.

JN1 Extension Header					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	5V0	-	2	Ground	-
3	3V3	-	4	Ground	-
5	3V3A	97	6	AGND	94, 99
7	AVREF3V3	96	8	RESET#	10
9	P40/AN0	95	10	P41/AN1	93
11	P42/AN2	92	12	P43/AN3	91
13	NC	-	14	PC2/LCD-CS	50
15	P51/LCD-RS	43	16	PE4/LCD-D0	74
17	PE5/LCD-D1	73	18	PE6/LCD-D2	72
19	PE7/LCD-D3	71	20	PC6/MOSI	46
21	PC7/MISO	45	22	PC5/SCK	47
23	PC0/SFL-CS	52	24	PC4/SD-CS	48
25	P13/SDA	33	26	P12/SCL	32

Table 9-1: JN1 Extension Header

JN2 Extension Header					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	RSTOUT#	-*	2	P53/BCLK	41
3	P35/NMI	15	4	Ground	-
5	P54/PWMLP	40	6	NC	-
7	NC	-	8	P21	27
9	PA0	70	10	PA1	69
11	PA2	68	12	NC	-
13	PD0/LED1	86	14	PD1/LED2	85
15	PD2/LED3	84	16	PD3/LED4	83
17	PD4/LED5	82	18	PD5/LED6	81
19	PD6/LED7	80	20	PD7/LED8	79
21	PE0/LED9	78	22	PE1/LED10	77
23	PE2/LED11	76	24	PE3/LED12	75
25	NC	-	26	NC	-

Table 9-2: JN2 Extension Header

* The RSTOUT# signal connects to the MCU via a the U3A buffer PIN 49

J8 Application Header					
Pin	Circuit Net Name	MCU Pin	Pin	Circuit Net Name	MCU Pin
1	NC	-	2	GND	-
3	PVIN3V3	-	4	GND	-
5	NC	-	6	NC	-
7	NC	-	8	NC	-
9	NC	-	10	NC	-
11	NC	-	12	NC	-
13	NC	-	14	NC	-
15	SPI_CS	51	16	/RESET	10
17	PWR_OFF	74*	18	NC	-
19	SPI_DIN	46	20	SPI_CLK	47
21	UART_IN	18*	22	SPI_DOUT	45
23	SPI_INTR	100	24	UART_OUT	17
25	GPIO	73*	26	GPIO	72*

Table 9-3: J8 Extension Header

* Only present in board Revision that has a circled 2 above the Okaya LCD

Chapter 10.Code Development

10.1. Overview

Note: For all code debugging using Renesas software tools, the CPU board must be connected to a PC USB port via the on-board Segger J-Link Lite debugger.

Due to the continuous process of improvements undertaken by Renesas the user is recommended to review the information provided on the Renesas website at www.renesas.com/rdkRX62N to check for the latest updates to the Compiler and Debugger manuals.

10.2. Compiler Restrictions

We provided both the GNU and Renesas Toolchains with this kit.

The GNU Toolchain has NO restrictions and was used with ALL the Micrium uC/OS-III example projects.

The Renesas Toolchain is fully functional for a period of 60 days from first use. After the first 60 days of use have expired, the compiler will default to a maximum of 128k (code and data). To use the Renesas toolchain with programs greater than this size you will need to purchase the full version tools from your Renesas distributor

Warning: The protection software for the compiler will detect changes to the system clock. Changing the system clock back in time may cause the trial period to expire prematurely.

10.3. Breakpoint Support

Breakpoint support is directly supported by Segger J-Link Lite emulator.

10.4. Memory Map

Address	Region
H'0000 0000	On-Chip RAM
H'0001 8000	Reserved Area
H'0008 0000	Peripheral I/O Registers
H'0010 0000	On-chip ROM (data flash)
H'0010 8000	Reserved Area
H'007F 8000	FCU-RAM
H'007F A000	Reserved Area
H'007F C000	Peripheral I/O Registers
H'007F C500	Reserved Area
H'007F FC00	Peripheral I/O Registers
H'0080 0000	Reserved Area
H'00F8 0000	OnChip ROM (program ROM) (Write Only)
H'0100 0000	On-Chip Flash
H'FEFF E000	OnChip ROM (FCU firmware) (Read Only)
H'FF00 0000	Reserved
H'FFF8 0000	OnChip ROM (program ROM) (Read Only)
H'FFFF FFFF	

Table 10-1: Memory Map

Chapter 11. Component Placement
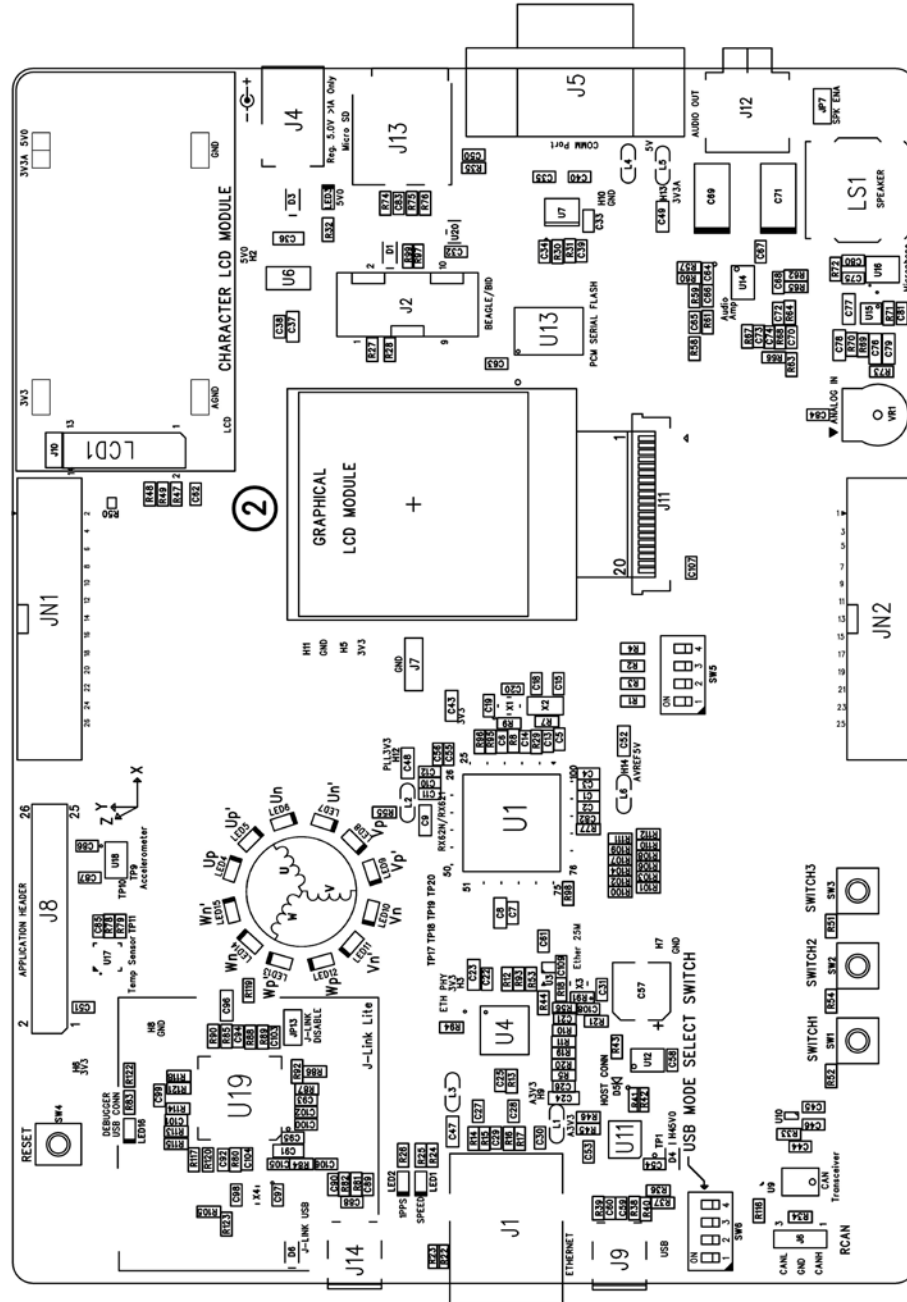
Table 1-1: Hardware Revisions 1-5 Component Placement
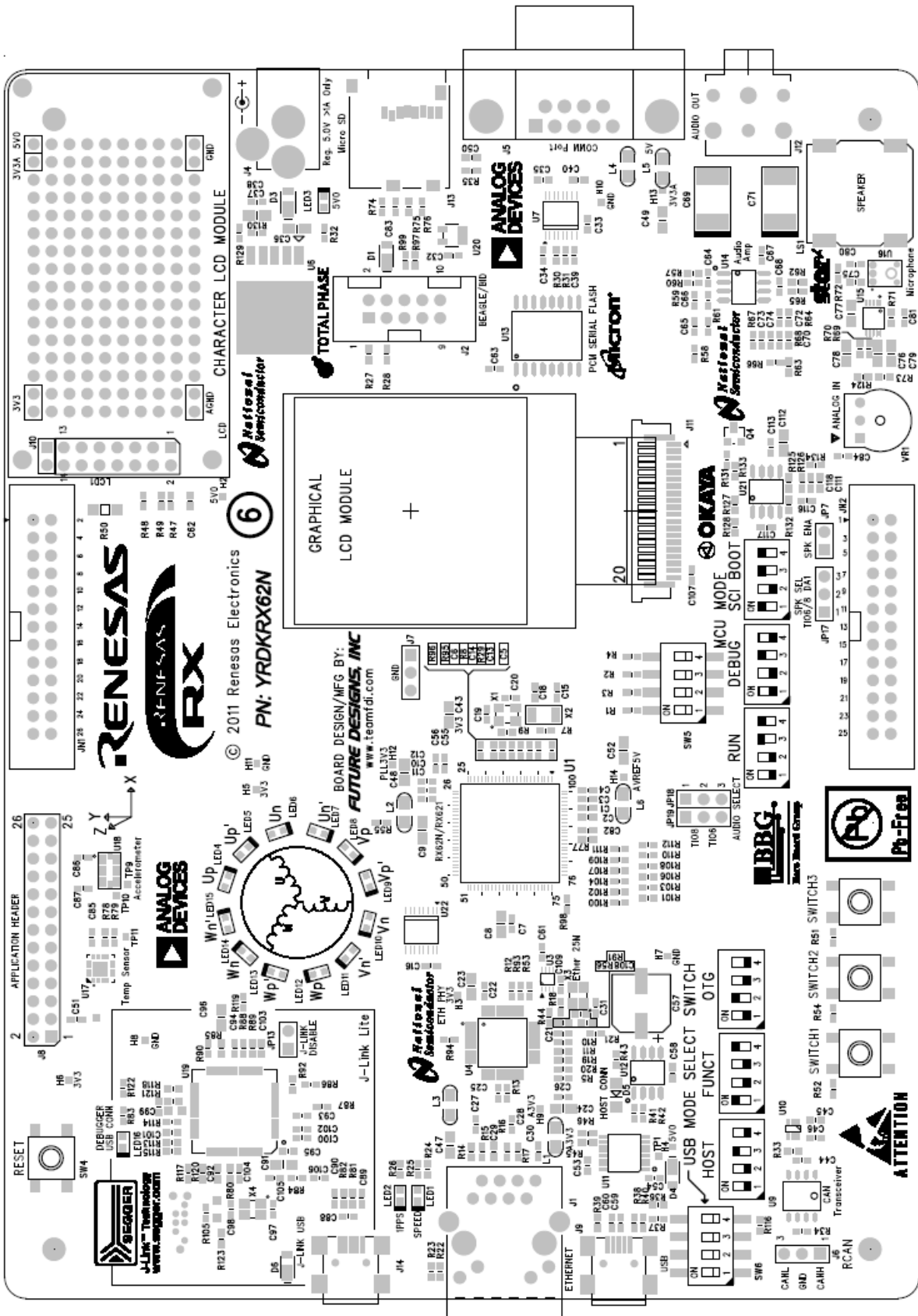
Table 1-2: Hardware Revision 6 Component Placement

Chapter 12. Additional Information

12.1. Hardware Partner Information

Hardware partners played an integral role in the definition, development, and deployment of this RDK. Without their numerous contributions, this project would not have been possible.   Contributors include National Semiconductor for the DP83640 Precision PHYTER - IEEE1588 Precision Time Protocol Ethernet transceiver and their LM4808 audio amplifier and LM1117 3.3v regulator.   Analog Devices supplied the ADXL345 3-Axis Accelerometer, SSM2167 microphone preamplifier and ADMP401 digital microphone as well as the ADT7420 temp sensor and ADM3101E RS-232 line driver / receiver. Micron contributed their Phase Change Serial Flash Memory (NP5Q128A13ESFC0E).   Okaya provided the 96 x 64 backlit graphics LCD.   Segger provided all the Debugger circuitry for their J-Link Lite. NDK characterized and provides all 4 essential crystals supporting the MCU and Ethernet PHY. TotalPhase provided the connectors to interface to their beagle serial channel debugger.   And finally, Future Designs, Inc. provided the hardware customization, schematic capture, PCB design and layout, manufacturing, and Supply Chain Management services for this RDK. For more information or to contact our partners please refer to their websites:

- Analog Devices – http://www.analog.com
- Future Designs – http://www.teamfdi.com
- Micron – http://www.micron.com
- National Semiconductor – http://www.national.com
- NDK - http://www.ndk.com/en/
- Okaya – http://www.okaya.com
- Segger – http://www.segger.com
- Totalphase – http://www.totalphase.com
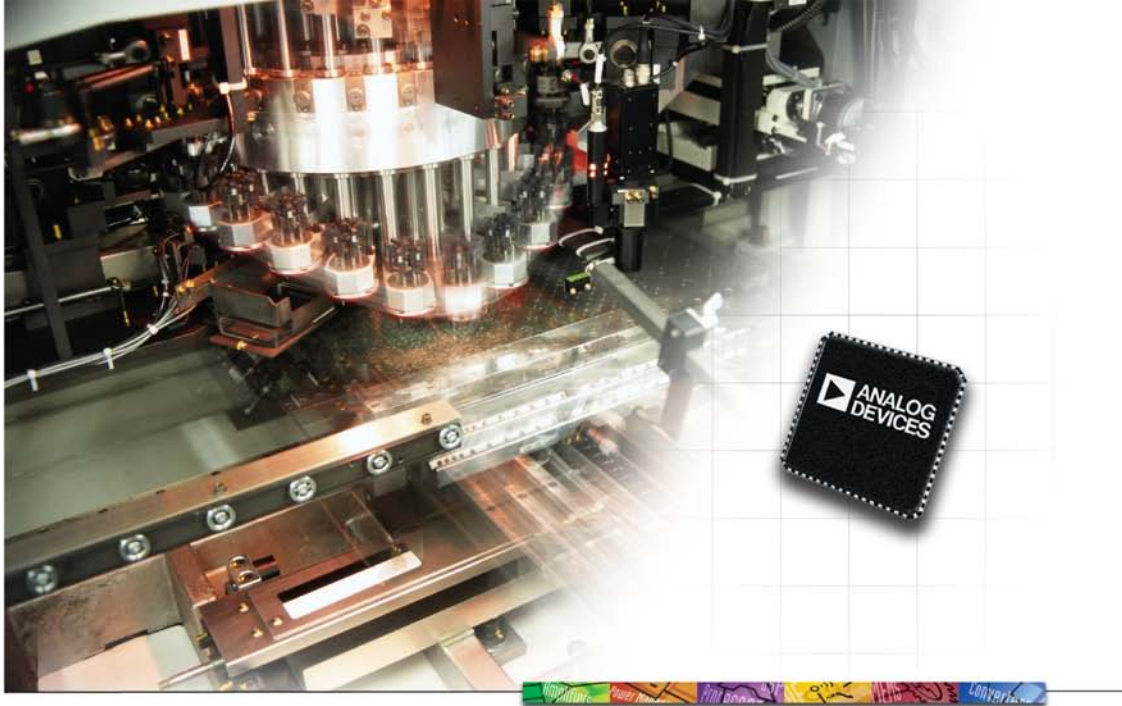
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Analog Devices sets the standard for innovation and excellence in signal processing. Our comprehensive portfolio of linear, mixed signal, MEMS and digital processing technologies are backed by leading design tools, applications support, and systems-level expertise. These solutions play a fundamental role in converting, conditioning, and processing real-world inputs such as light, sound, temperature, motion, and pressure into electrical signals to be used in a wide array of electronic equipment.

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Analog Devices Products Featured in the Renesas Demonstration Kit

ADXL345 Low Power, 3-Axis Digital *i*MEMS Accelerometer
- ±2 g, ±4 g, ±8 g, and ±16 g ranges
- Ultralow power
  - From 30 µA to 140 µA in full measurement mode
  - 0.1 µA in standby mode at VS = 2.5 V (typ)
- Supply Voltage: 2.0 V to 3.6 V
- 10-bit to 13-bit / 4mg resolution
- SPI and I²C digital interfaces
- Temp range: −40°C to +85°C
- 3 mm × 5 mm × 1 mm LGA package

ADMP401 Analog Output, Omni-Directional *i*MEMS Microphone
- SNR: 62 dBA
- Flat Frequency Response: 100 Hz to 15 kHz
- PSRR: 70 dBV
- Sensitivity: -42 dBV
- Current Consumption: < 250 µA
- 4.72 mm × 3.76 mm × 1.00 mm SMT package

SSM2167 Low Power Microphone Preamp
- Low shutdown current < 2 µA
- Adjustable compression ratio and noise gate threshold
- Low noise and distortion: 0.2% THD + N
- 20 kHz bandwidth
- Single 3 V operation

ADT7420 High Accuracy, 16-Bit Digital Temp Sensor
- ±0.25°C temp accuracy from −20°C to +105°C
- I²C-compatible interface
- Supply voltages: 2.7 V to 5.5 V
- Operating temperature: −40°C to +150°C
- LFCSP package

ADM3101 ±15 kV ESD Protected, Single-Channel RS-232 Line Driver/Receiver
- Conforms to EIA/TIA-232E and CCITT V.28 Specifications
- Data Rate: 460 kbps
- 0.1 µF charge pump capacitors
- Contact discharge: ±8 kV ap discharge: ±15 kV

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ANALOG DEVICES

Quartz Crystal Units

■ Model Names of Surface-mount (SMD) Products

Our system for surface-mount (SMD) product model names is as follows:

Configuration of model names of surface-mount products

①②③④⑤⑥⑦⑧
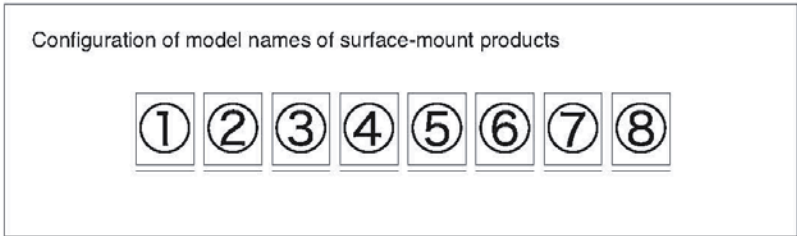
① Symbol for NDK: N

② Symbols for products: See Table 1.

Table 1 Symbols for products

Product symbol	Product
X	Crystal oscillator
T	Temperature-compensated crystal oscillator (TCXO)
H	Oven-controlled crystal oscillator (OCXO)
V	Voltage-controlled crystal oscillator (VCXO)
P	Simple packaged crystal oscillator (SPXO)
Z	Crystal clock oscillator
M	Monolithic filter
S	SAW device

③④ The nominal length (mm) of a product main body in the longitudinal direction is expressed in two digits. The third digit is rounded off.

⑤⑥ The nominal length (mm) of a product main body in the lateral direction is expressed in two digits. The third digit is rounded off.

   Examples: 6.0 mm x 3.5 mm is expressed as 6035.

   11.8 mm x 5.5 mm is expressed as 1255.

⑦ Symbols for constituent materials and sealing methods: See Table 2.

Table 2 Symbols for sealing methods

Product sealing category	Symbol	Product sealing method	Package material	
			Base	Cover
Hermetic sealing	C	Adhesive sealing	Ceramics	
	M	Resin molding	Resin	
	P	Adhesive sealing	Resin	
	G	Glass sealing	Ceramics	
	R	Resistance weld sealing	Ceramics	Metal
	S, D	Seam weld sealing	Ceramics	Metal
	A	Au/Sn sealing	Ceramics	Metal
Non-hermetic sealing	W	——	Board	Metal
	X	——	Board	Non-metal
	Y	——	Mold	Metal
	Z	——	Mold	Non-metal
Others	B	A printed board on which multiple crystal elements were mounted with a nameplate attached to its top surface		

⑧ Detailed symbols for the order of model name registration: A to Z

   When products designed as lead-mount ones have been converted during secondary processing into surface-mount ones,

   the product model names given before secondary processing are conventionally used to describe them.

   Example: AT-41CD2 (AT-41 with a pedestal)

cu13_090920_modelname_e

National Semiconductor
10/100 PHYTER®

DP83640

The IEEE 1588 Precision Time Protocol (PTP) is an important improvement to Ethernet systems that provides precise time synchronization for applications such as test and measurement, factory automation, and telecommunications. National Semiconductor's DP83640 Precision PHYTER transceiver is the industry's first to add the IEEE 1588 PTP functionality to a fully-featured, 10/100 Mbps Ethernet PHY.

Wireless BTS Timing Sync Using IEEE 1588
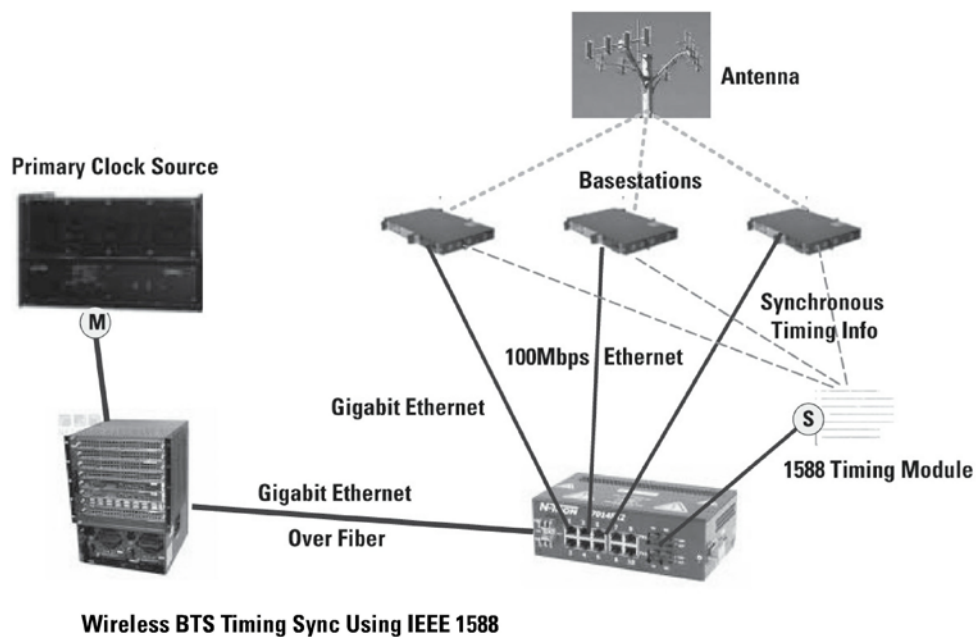
High-Speed Industrial Ethernet

Product ID	Temp Range (°C)	Number of Ports	Interface	Typ Power (mW)	Package
DP83640*	-40 to 85	10/100 Single	MII/RMII	280	LQFP-48
DP83848I	-40 to 85	10/100 Single	MII/RMII/SNI	265	LQFP-48
DP83848VYB	-40 to 105	10/100 Single	MII/RMII/SNI	265	LQFP-48
DP83848J	-40 to 85	10/100 Single	MII/RMII	265	LLP-40
DP83849I	-40 to 85	10/100 Dual	MII/RMII	300/Port	TQFP-80

*IEEE 1588

national.com/ethernet

National Semiconductor

OKAYA

Color TFT LCDs

- Size (Diagonal) : 3.5" - 7"
- Resolution: QVGA – WVGA
- Backlight: LED
- Interface: 18 bit TTL RGB
- Touch Panel: Resistive, capacitive, projected capacitive
- Daylight readable options

Chip On Glass (COG)

- Custom and Standard
- No PCB, light weight, low cost
- Minimum external components
- Text, graphic and segment type
- High resolution/duty displays
- RGB or white LED backlight

Custom LCDs

- Full or semi custom
- Color, graphic, COG, panels
- Ruggedized displays
- System on display
- Tailor made form factor

Graphic LCDs

- Wide range of size & resolutions
- TAB, COG, COB ICs
- Yellow green, blue , white, LED backlights
- Extended and wide operating temp range
- Semi and full custom options
- Touch panels available
- TN, STN, FSTN, ASTN technology

Alpahnumeric/Text LCDs

- 8 character x 1 line to 40 character x 4 lines
- COG, COB ICs
- Yellow green, blue, white LED backlights
- TAB, COG, COB ICs
- Extended and wide operating temp range
- Semi and full custom options
- TN, STN, FSTN, ASTN technology

800 852 0122   www.okaya.com   lcdsales@okaya.com

Renesas Contact Information

For details on how to use High-performance Embedded Workshop (HEW), refer to the HEW manual available on the web site.

For information about the RX62N series microcontrollers refer to the RX600 Group hardware manual.

For information about the RX62N assembly language, refer to the RX Series Software Manual.

Online technical support and information is available at: http://www.renesas.com/renesas_starter_kits

Technical Contact Details

America: techsupport.rta@renesas.com

Europe: tools.support.eu@renesas.com

Japan: csc@renesas.com

General information on Renesas Microcontrollers can be found on the Renesas website at: http://www.renesas.com/

Tools Marketing

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