User's Manual

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RX23W Group

Renesas Solution Starter Kit for RX23W
User's Manual

RENESAS 32-Bit MCU
RX Family / RX200 Series

Renesas Electronics
www.renesas.com

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
7. Prohibition of access to reserved addresses
   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
8. Differences between products
   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Disclaimer

By using this Renesas Solution Starter Kit (RSSK), the user accepts the following terms:

The RSSK is not guaranteed to be error free, and the entire risk as to the results and performance of the RSSK is assumed by the User. The RSSK is provided by Renesas on an “as is” basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, title and non-infringement of intellectual property rights with regard to the RSSK. Renesas expressly disclaims all such warranties. Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this RSSK, even if Renesas or its affiliates have been advised of the possibility of such damages.

Precautions

The following precautions should be observed when operating any RSSK product:

This Renesas Solution Starter 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 Solution Starter Kit does not represent an ideal reference design for an end product and does not fulfil the regulatory standards for an end product.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the CPU Board hardware functionality, and electrical characteristics. It is intended for users designing sample code on the CPU Board platform, using the many different incorporated peripheral devices.

The manual comprises of an overview of the capabilities of the RSSK product, but does not intend to be a guide to embedded programming or hardware design.

Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

The following documents apply to the RX23W Group. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's Manual	Describes the technical details of the CPU Board hardware.	Renesas Solution Starter Kit for RX23W User's Manual	R20UT4446EG
Tutorial Manual	Provides a guide to setting up RSSK environment, running sample code and debugging programs.	Renesas Solution Starter Kit for RX23W Tutorial Manual	R20UT4447EG
Quick Start Guide	Provides simple instructions to setup the RSSK and run the first sample.	Renesas Solution Starter Kit for RX23W Quick Start Guide	R20UT4448EG
Smart Configurator Tutorial	Provides a guide to code generation and importing into the e^2 studio IDE.	Renesas Solution Starter Kit for RX23W Smart Configurator Tutorial Manual	R20UT4449EG
Schematics	Full detail circuit schematics of the CPU Board.	Renesas Solution Starter Kit for RX23W Schematics	R20UT4445EG
Hardware Manual	Provides technical details of the RX23W microcontroller.	RX23W Group User's Manual: Hardware	R01UH0823EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analog-to-Digital Converter
BC	Battery Charging
BLE	Bluetooth® Low Energy The Bluetooth® word mark and logos are registered trademarks owned be Bluetooth SIG, inc. and any use of such marks by Renesas Electronics Corporation is under license.
bps	bits per second
CAN	Controller Area Network
CPU	Central Processing Unit
DAC	Digital-to-Analog Converter
DIP	Dual In-line Package
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
DNF	Do Not Fit
E1 / E2 Lite	Renesas On-chip Debugging Emulator
EEPROM	Electronically Erasable Programmable Read Only Memory
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
GLCDC	Graphic LCD Controller
I2C (IIC)	Philips™ Inter-Integrated Circuit Connection Bus
IRQ	Interrupt Request
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LIN	Local Interconnect Network
MCU	Micro-controller Unit
MTU	Multi-Function Timer Pulse Unit
n/a (NA)	Not Applicable
n/c (NC)	Not Connected
NMI	Non-maskable Interrupt
OTG	On The Go™
PC	Personal Computer
PDC	Parallel Data Capture Unit
PLL	Phase Locked Loop
Pmod™	This is a Digilent Pmod™ Compatible connector. Pmod™ is registered to Digilent Inc. Digilent-Pmod_Interface_Specification
POE	Port Output Enable
PWM	Pulse Width Modulation
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read Only Memory
RSSK	Renesas Solution Starter Kit
RTC	Real Time Clock
SCI	Serial Communications Interface
SPI	Serial Peripheral Interface
SSI	Serial Sound Interface
TFT	Thin Film Transistor
TSIP-Lite	Trusted Secure IP Lite
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
WDT	Watchdog Timer

Table of Contents

1. Overview

1.1 Purpose

This CPU Board is an evaluation tool for Renesas microcontrollers. This manual describes the technical details of the CPU Board hardware.

1.2 Features

This RSSK provides an evaluation of the following features:

- Renesas microcontroller programming
- User code debugging
- User circuitry such as switches, LEDs and a potentiometer

  Through the provided set of sample applications.

The RSSK board contains all the circuitry required for microcontroller operation.

1.3 Board specification

Board specification was shown in **Table 1-1** below.

Table 1-1: Board Specification

Item	Specification	
Part Number (Ordering Number)	RTK5523W8AS00000BJ	RTK5523W8BS00000BJ
Board part Number	RTK5523W8AC00001BJ	RTK5523W8BC00001BJ
Microcontroller	Part No : R5F523W8ADBL *2	Part No : R5F523W8BDBL *2
	Package : 85-pin TFBGA	
	On-Chip Memory : ROM 512KB, RAM 64KB	
On-Board Memory	I2C EEPROM: 2Kbit	
Input Clock	RX23W RF/Main : 32MHz	
	RX23W Main(Reserve) : 8MHz	
	RX23W Sub : 32.768kHz (Low-CL)	
Power Supply	DC Power Jack : 5 V Input	
	Power Supply IC : 5V Input, 3.3V Output	
	Power Supply IC : 5V Input, 5V Output(For USB Host)	
Debug Interface	E1/E2 Lite 14-pin box header	
DIP Switch	Mode Configuration : 2-pole x 1	
	For User I/O : 4-pole x 1	
Push Switch	Reset Switch x 1	
	User Switch x 2	
Potentiometer(for ADC)	Single-turn, 10kΩ	
LED	5V Power indicator: green x 1	
	3.3V Power Indicator : green x 1	
	User : green x 1, orange x 1, red x 2	
BLE Interface	Connector : MM8030-2610RJ3 x 1	
	Chip Antenna : ANT016008LCS2442MA2 x 1	
	Range of frequency: 2402 to 2480 MHz	
	Maximum transmission output power: 0dBm (in 4dBm output mode)	
CAN	Connector : 2.54mm pitch, 3-pin x 1	
	CAN Driver : R2A25416SP *3 x 1	
USB	USB0-Function : USB-Micro B	
	USB0-Host : USB-Type A	
USB to Serial Converter Interface	Connector : USB-Micro B	
	USB Serial Driver x 1	
Pmod™	PMOD1 : Angle type, 12-pin Connector	
	PMOD2 : Angle type, 12-pin Connector	
Touch Interface	Slider x 1(electrode x 4), Key x 1(electrode x 1)	
MCU Header *1	2.54 mm pitch x 44	

*1: The connector is not included in the product.

*2: R5F523W8ADBL has a built-in Bluetooth® encryption circuit.
R5F523W8BDBL has a Bluetooth® encryption circuit and encryption function (TSIP-Lite).

*3: This CAN driver has Non-promotion status, so do not use this CAN driver on your system.

2. Power Supply

2.1 Requirements

This RSSK is supplied with an E1 debugger or E2 Lite debugger. The debugger is able to power the RSSK board with up to 200mA. When the RSSK is connected to another system, that system can supply power to the RSSK. This board has an optional centre-positive supply connector using a 2.0mm barrel power jack.

This CPU board supports one external voltage input. Details of the external power supply connection are shown in **Table 2-1 and Table 2-2** below. The default power configuration is shown in **bold, blue text.**

Table 2-1: PWR connector Requirements

Connector	Supply voltage
PWR	Input 5VDC

Table 2-2: Main Power Supply Requirements

Supply Source *1	J3 Setting	J13 Setting	J10 Setting	J5 Setting	J4 Setting	R37	R44	R35	Board_5V	Board_VCC *2 UC_VCC
E2 Lite / E1(3.3V)	**Open**	**Open**	**Short**	**1-2 Short**	**1-2 Short**	**Fit**	**DNF**	**DNF**	**N/A** *3, 4, 5, 6	**3.3V**
PWR connector	**Open**	Short	**Short**	2-3 Short	don't care	**Fit**	**DNF**	**DNF**	5V *4, 5	**3.3V**
	Open	Short	**Short**	**1-2 Short**	**1-2 Short**	**Fit**	**DNF**	**DNF**	5V *3, 4	**3.3V**
	Open	Short	**Short**	don't care	don't care	DNF	Fit	**DNF**	5V *3, 4, 5	1.8V *7
USB0_2	2-3 Short	Short	**Short**	**1-2 Short**	2-3 Short	**Fit**	**DNF**	**DNF**	5V *3, 5	**3.3V**
USBCN0	1-2 Short	Short	**Short**	**1-2 Short**	**1-2 Short**	**Fit**	**DNF**	**DNF**	5V *3, 4	**3.3V**

*1: 5V can't be supplied with the E1 emulator.
*2: 5V Pmod™ interface in all setting can't be used.
*3: USB host interface can't be used.
*4: USB function (bus-power) can not be used.
*5: USB function (self-power) can not be used.
*6: USB CAN and EEPROM 5V interface can't be used.
*7: User LED can't be used.

The compatible plug of the AC adapter is center plus, outer diameter 5.5 mm, inner diameter 2.1 mm.

The main power supply connected to PWR should supply a minimum of 5W to ensure full functionality.

When using USB in function mode, be sure to set J5 to 1-2 Short. Also, do not plug in both USB0_1 and USB0_2 cables at the same time.

3. Board Layout

3.1 Component Layout

Figure 3-1 below shows the top component layout of the board.

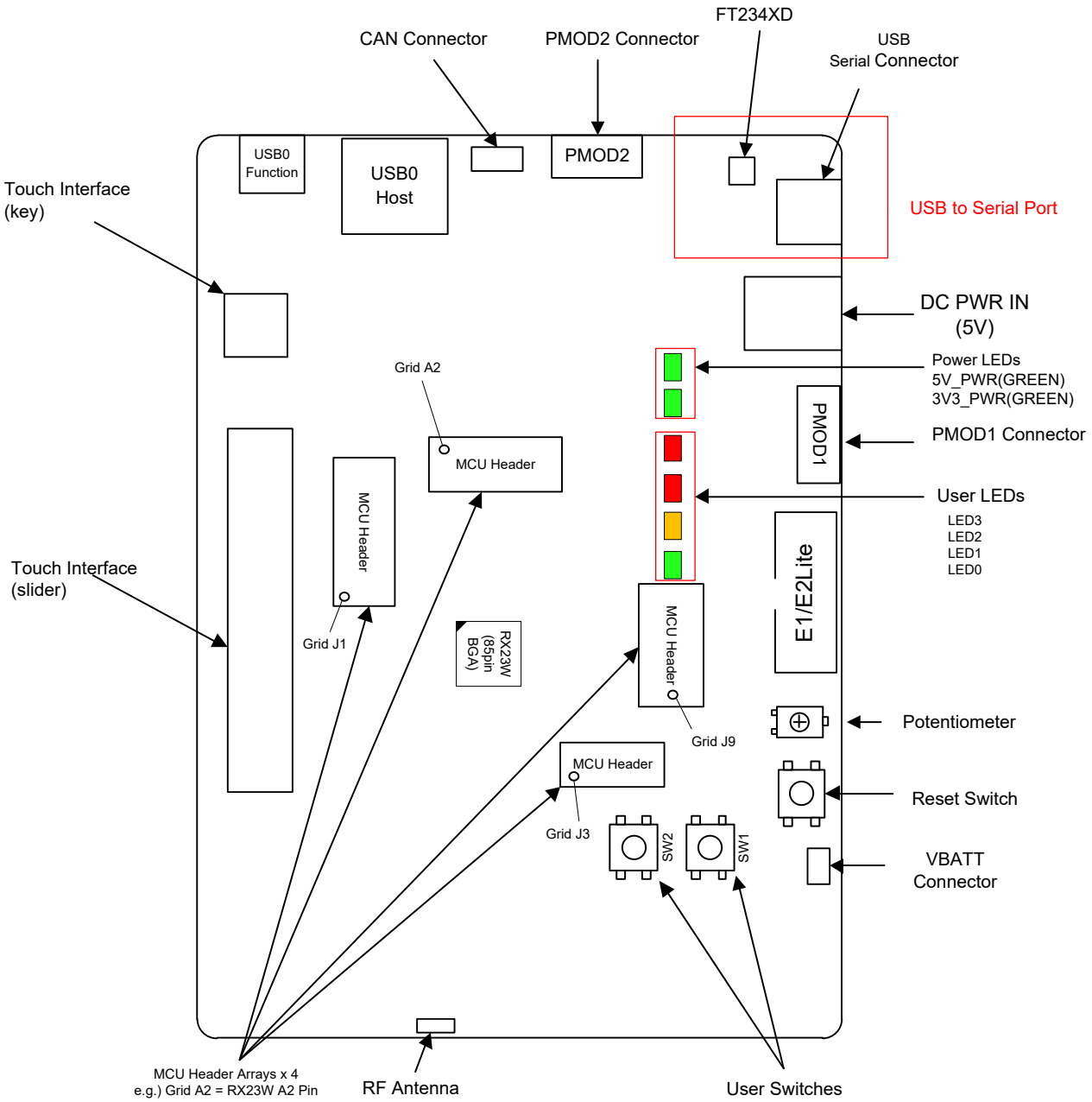

Figure 3-1: Board Layout

3.2 Board Dimensions

Figure 3-2 below gives the board dimensions and connector positions. All the through-hole connectors are on a common 2.54mm pitch grid for easy interfacing.

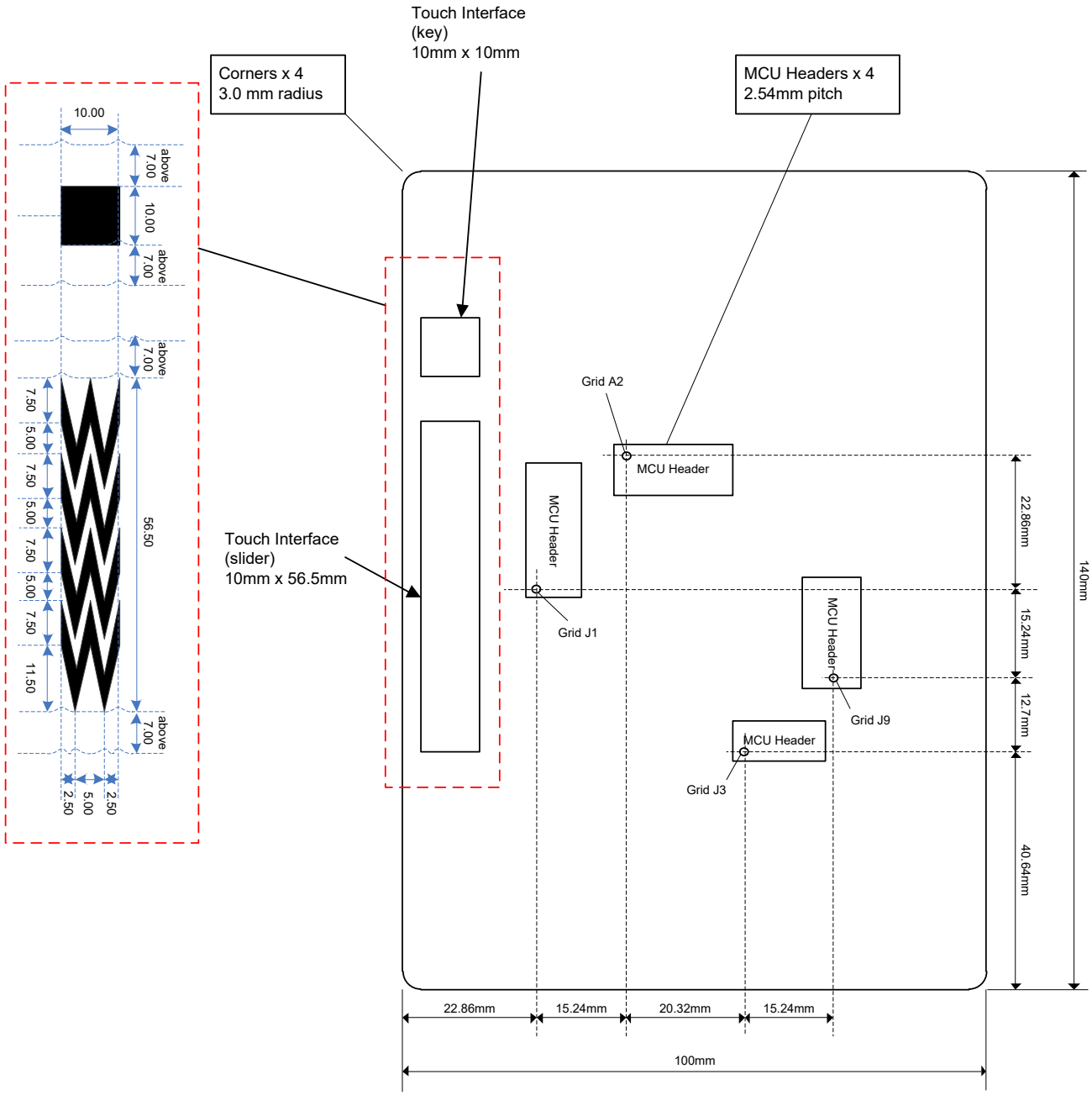

Figure 3-2: Board Dimensions

3.3 Component Placement

Figure 3-3 below shows placement of individual components on the top-side. Component types and values are shown on the board schematics.

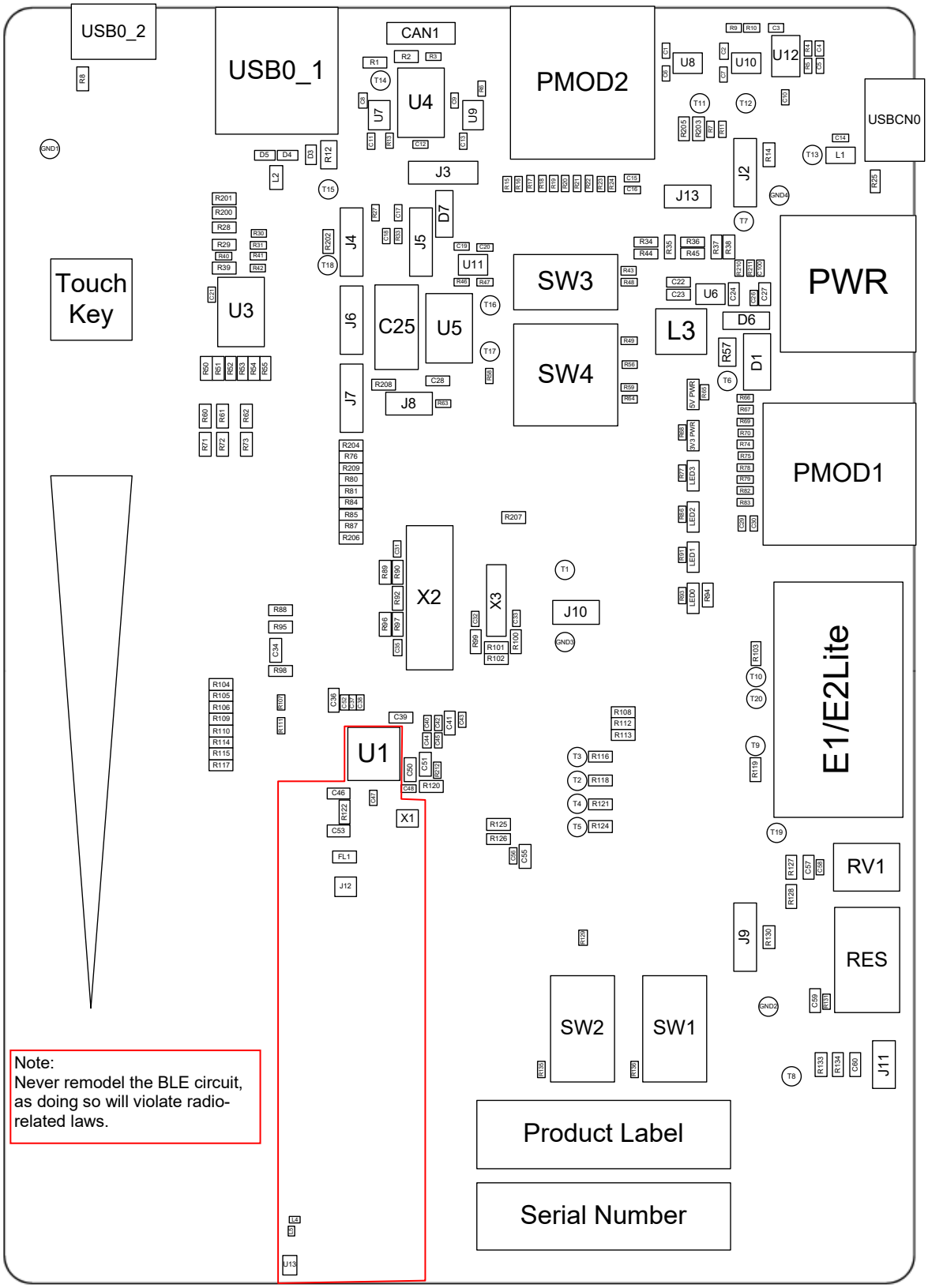

Figure 3-3: Top-Side Component Placement

4. Connectivity

4.1 Internal Board Connections

The diagram below shows the CPU board components and their connectivity to the MCU.

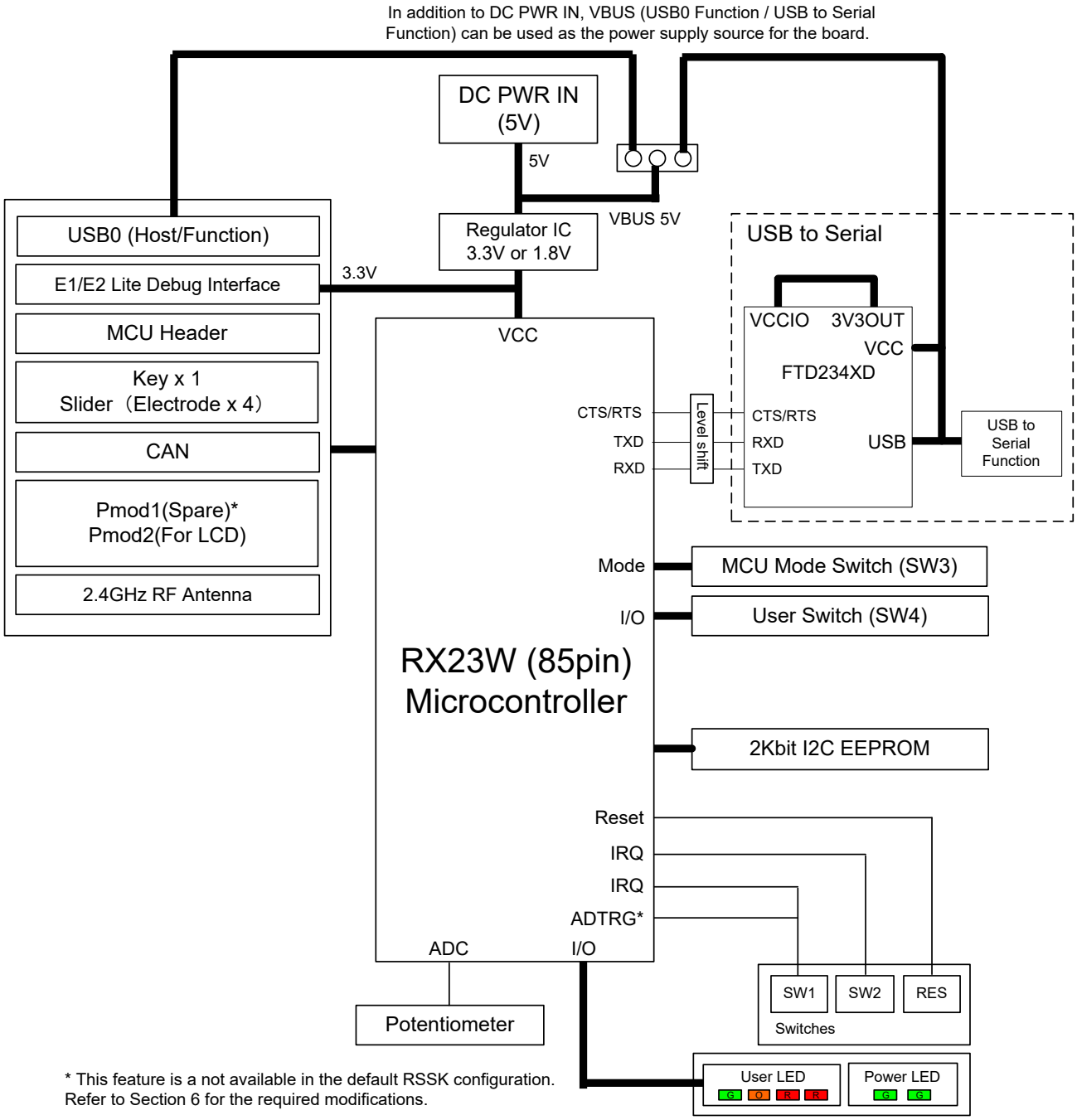

Figure 4-1: Internal Board Block Diagram

4.2 Debugger Connections

Figure 4-2 below shows the connections between the CPU board, E1/E2 Lite debugger and the host PC.

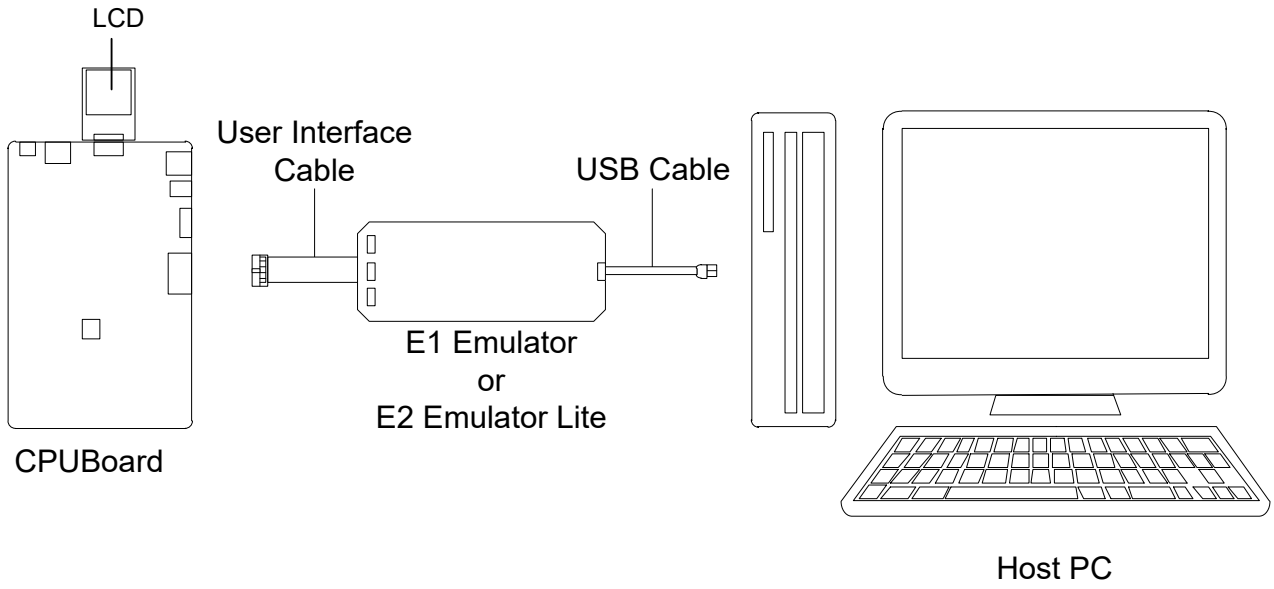

Figure 4-2: Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

A reset control circuit is fitted to the CPU board to generate the required reset signal, and is triggered from the RES switch. Refer to 'RX23W Group User's Manual: Hardware' for details regarding the reset signal timing requirements, and the CPU board schematics for information regarding the reset circuitry in use on the board.

5.2 Clock Circuit

A clock circuit is fitted to the CPU board to generate the required clock signal to drive the MCU, and associated peripherals. Refer to 'RX23W Group User's Manual: Hardware' Manual for details regarding the clock signal requirements, and the CPU board schematics for information regarding the clock circuitry in use on the CPU board. Details of the oscillators fitted to the board are listed in **Table 5-1** below.

Table 5-1: Crystal

Crystal	Function	Default Placement	Frequency	Device Package
X1	RF/Main MCU crystal for RX23W *1	Fitted	32MHz	Encapsulated, SMT
X2	Main(Reserve) MCU crystal for RX23W *1	Fitted	8MHz	Encapsulated, SMT
X3	Real time Clock for RX23W	Fitted	32.768kHz *2	Encapsulated, SMT

*1: If HOCO is selected as the MCU operating clock, the USB function cannot be used.
*2: The Sub clock oscillator drive circuit is low power to achieve excellent standby power consumption. The Crystal and associated capacitors must have a capacitance equal or less than 6pF to ensure this oscillator is accurate. The oscillator will function at higher loads, but operation to specification is not guaranteed.

5.3 Switches

There are five switches located on the CPU board. The function of each switch and its connection is shown in **Table 5-2 and Table 5-3**. For further information regarding switch connectivity, refer to the CPU board schematics.

Table 5-2: Push Switch Connections

Switch	Function	MCU	
		Signal (Port)	Pin
RES	When pressed, the microcontroller is reset.	RES#	B6
SW1	Connects to an ADTRG0 input for ADC controls.	P07	C7
	Connects to an IRQ1 input for user controls.	P31	B4
SW2	Connects to an IRQ0 input for user controls.	P30	A2

Table 5-3: DIP Switch Connections

Switch		Function	MCU	
			Signal (Port)	Pin
SW3	Pin 1	Refer to section 6.2 for the setting contents.	MD/FINED	B7
	Pin 2	Refer to section 6.2 for the setting contents.	PC7	F1
SW4	Pin 1	User switch.	P45	E9
	Pin 2		P46	E8
	Pin 3		PB0	J6
	Pin 4		PE4	J8

5.4 LEDs

There are 6 LEDs on the CPU board. The function of each LED, its colour, and its connections are shown in **Table 5-4**.

Table 5-4: LED Connections

LED	Colour	Function	MCU	
			Port	Pin
3V3 PWR	Green	Indicates the status of the Board_VCC power rail.	NC	NC
5V PWR	Green	Indicates the status of the Board_5V power rail.	NC	NC
LED0	Green	User operated LED.	P41	C8
LED1	Orange	User operated LED.	P42	D8
LED2	Red	User operated LED.	P43	D9
LED3	Red	User operated LED.	P44	E10

5.5 Potentiometer

A single-turn potentiometer is connected as a potential divider to analog input AN000, pin C9. The potentiometer can be used to create a voltage between Board_VCC and AVSS0.
Refer to the maker site for specification of the potentiometer (VISHAY with part number TS53 series).

The potentiometer offers an easy method of supplying a variable analog input to the microcontroller. It does not necessarily reflect the accuracy of the controller's ADC. Refer to refer to 'RX23W Group User's Manual: Hardware' for further details.

5.6 Pmod™

The CPU board has connectors for the Digilent Pmod™ interface. The operation can be checked by connecting the LCD module to the PMOD 2 connector.

Care should be taken when installing the LCD module to ensure pins are not bent or damaged. The LCD module is vulnerable to electrostatic discharge (ESD); therefore appropriate ESD protection should be used.

The Digilent Pmod™ Compatible headers use an SPI interface. **Figure 5-1** below shows Digilent Pmod™ Compatible Header Pin Numbering. Connection information for the Digilent Pmod™ Compatible header is provided in **Table 5-5 and Table 5-6** below.

Please note that the connector numbering adheres to the Digilent Pmod™ standard and is different from all other connectors on the RSSK designs. Details can be found in the Digilent Pmod™ Interface Specification Revision: November 20, 2011.

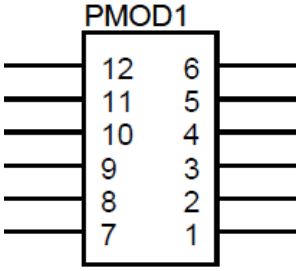

Figure 5-1: Digilent Pmod™ Compatible Header Pin Numbering

Table 5-5: Pmod™1 Header Connections

Digilent Pmod™ Compatible Header Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD1-CS *1	P31	B4	7	PMOD1-IRQ *1	PB1	J5
2	PMOD1-MOSI *1	P26	B2	8	PMOD1-IO1	PD3	F9
3	PMOD1-MISO *1	P30	A2	9	PMOD1-IO2	P05	B9
4	PMOD1-SCK	P27	B3	10	PMOD1-IO3	PB7	J3
5	GROUND	-	-	11	GROUND	-	-
6	Board_VCC	-	-	12	Board_VCC	-	-

*1: This connection is a not available in the default RSSK configuration - refer to §6 for the required modifications.

Table 5-6: Pmod™2 Header Connections

Digilent Pmod™ Compatible Header Connections							
Pin	Circuit Net Name	MCU		Pin	Circuit Net Name	MCU	
		Port	Pin			Port	Pin
1	PMOD2-CS	PE3	H8	7	PMOD2-IRQ	PB1	J5
2	PMOD2-MOSI	PE1	J9	8	PMOD2-IO1	PB3	H4
3	PMOD2-MISO	PE2	H9	9	PMOD2-IO2	P03	B8
4	PMOD2-SCK	PE0	G9	10	PMOD2-IO3	PJ3	C6
5	GROUND	-	-	11	GROUND	-	-
6	Board_VCC	-	-	12	Board_VCC	-	-

5.7 USB Serial Port

A USB serial port is implemented in a FT234XD and is connected to the RX23W Serial Communications Interface (SCI) module. Connections between the USB to Serial converter and the microcontroller are listed in **Table 5-7** below.

Table 5-7: Serial Port Connections

Signal Name	Function	MCU	
		Port	Pin
SERIAL-TXD	SCI8 Transmit Signal.	PC7	F1
	SCI1 Transmit Signal. *2	P26	B2
SERIAL-RXD	SCI8 Receive Signal.	PC6	F2
	SCI1 Receive Signal. *2	P30	A2
SERIAL-CTS *1	Clear To Send.	PC4	G1
SERIAL-RTS *1	Request To Send.	PC4	G1

*1: This connection is a not available in the default CPU board configuration - refer to §6 for the required modifications. CTS / RTS can be used exclusively. For details, refer to 'RX23W Group User's Manual: Hardware'.

*2: This connection is a not available in the default RSSK configuration - refer to §6 for the required modifications.

USB serial driver made by FTDI is required for USB serial communication. Please download from the URL below. Please contact FTDI for installation method of USB serial driver and questions.
https://www.ftdichip.com/Drivers/D2XX.htm

5.8 Controller Area Network (CAN)

A CAN transceiver IC is fitted to CPU board, and connected to the CAN MCU peripheral. For further details regarding the CAN protocol and supported modes of operation, please Refer to 'RX23W Group User's Manual: Hardware'. The connections for the CAN microcontroller signals are listed in **Table 5-8** below.

Table 5-8: CAN Connections

CAN Signal	Function	MCU	
		Port	Pin
CAN0TX	CAN Data Transmission.	P14	C1
CAN0RX	CAN Data Reception.	P15	C2

5.9 Universal Serial Bus (USB)

This CPU board is fitted with a USB Host socket (type A) and a Function socket (type Micro B). USB module USB0 is connected to the Host and Function socket, and can operate as either a Host or Function device. The connection for the USB0 module is shown in **Table 5-9** below.

Table 5-9: USB0 Module Connections

USB Signal	Function	MCU	
		Port	Pin
USB0-DP	D+ I/O pin of the USB on-chip transceiver	USB0_DP	E1
USB0-DM	D– I/O pin of the USB on-chip transceiver	USB0_DM	D1
USB0-VBUS	USB cable connection monitor pin	PB5 *1	J4
		P16 *2	C3
USB0-VBUSEN	VBUS (5V) supply enable signal for external power supply chip	P26	B2
USB0-OVRCURB	External overcurrent detection signals	P22	C4

*1: Can't be used as USB-VBUS in USB boot mode.

*2: This connection is a not available in the default RSSK configuration - refer to §6 for the required modifications.

5.10 I²C Bus (Inter-IC Bus)

The RX23W features two I²C (Inter-IC Bus) interface modules. RIIC0 is connected to a 2Kbit EEPROM. **Table 5-10** below details the connected device, and their connection to the MCU.

Table 5-10: I²C Bus Connections

I²C Bus signal	Function	MCU	
		Port	Pin
E2P-SDA	Data	P17	B1
E2P-SCL	Clock	P16	C3

5.11 Serial Sound Interface (SSI)

The RX23W microcontroller has one channel of serial digital sound interface (SSI), connected to the MCU Headers. **Table 5-11** shows the connection relationship.

Table 5-11: SSI Connections

SSI Signal *1	Function	MCU	
		Port	Pin
SSITXD0	Serial data output	P17	B1
SSIRXD0	Serial data input	P26	B2
SSIWS0	Word select	P27	B3
AUDIO_MCLK	Audio master clock	P30	A2
SSISCK0	Serial bit clock	P31	B4

*1: This connection is a not available in the default RSSK configuration - refer to §6 for the required modifications.

5.12 Touch Interface

The RX23W microcontroller is fitted with a four Touch Interface (slider) and one Touch Interfaces (key). **Table 5-12** below details the connected devices, and their connections to the MCU.

Table 5-12: Touch Interface Connections

Touch Signal	Function	MCU	
		Port	Pin
TS4	Capacitance measurement terminal (Touch key)	P25	A1
TS23	Capacitance measurement terminal (Upper of touch slider)	PC5	G2
TS27	Capacitance measurement terminal (Middle upper of touch slider)	PC3	H1
TS30	Capacitance measurement terminal (Middle lower of touch slider)	PC2	H2
TS35	Capacitance measurement terminal (Lower of touch slider)	PC0	J1
TSCAP	LPF (Low-pass filter) connection terminal	PC4	G1

5.13 Bluetooth® Low Energy (BLE)

When running any Bluetooth® Low Energy (BLE) software, a unique Bluetooth Device address should be used. A unique Renesas allocated Bluetooth Device address is attached to the PCB on the bottom side as a sticker.

The CPU board has one Bluetooth® Low Energy (BLE) interface. **Table 5-13** below details the connected devices, and their connections to the MCU.

Table 5-13: Bluetooth® Low Energy (BLE) Connections

BLE Signal	Function	MCU	
		Port	Pin
CLKOUT_RF	RF clock output terminal	P47	F10
ANT	RF single transceiver RF single input / output terminal	ANT	K2
XTAL1_RF	32 MHz resonator connection terminal	XTAL1_RF	K7
XTAL2_RF	32 MHz resonator connection terminal	XTAL2_RF	K6
DCLOUT	Power supply output connection terminal for RF transceiver *1	DCLOUT	K9
DCLIN_A	Power supply output connection terminal for RF transceiver *1	DCLIN_A	G10
DCLIN_D	Power supply output connection terminal for RF transceiver *1	DCLIN_D	H10

*1: Circuit configuration used linear regulator when shipping the product.

5.14 MCU Header

The CPU board has four MCU headers, and some RX23W pins are connected to the MCU headers. **Figure 5-2** shows an example of pin numbers.

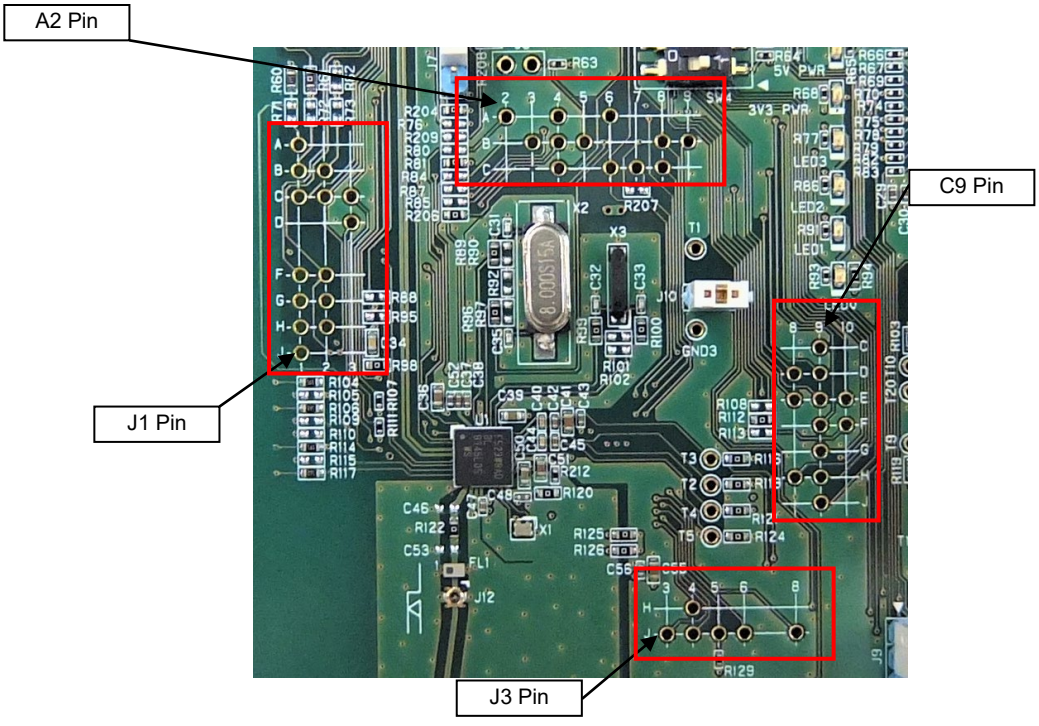

Figure 5-2: Example of MCU Header pin numbers

6. Configuration

6.1 Modifying the RSSK

This section lists the option links that are used to modify the way CPU board operates in order to access different configurations. Configurations are made by modifying link resistors or headers with movable jumpers or by configuration DIP switches

A link resistor is a 0Ω surface mount resistor, which is used to short or isolate parts of a circuit. Option links are listed in the following sections, detailing their function when fitted or removed. **Bold, blue text** indicates the default configuration that the CPU board is supplied with. Refer to the component placement diagram (§3) to locate the option links, jumpers and DIP switches.

When removing soldered components, always ensure that the CPU board is not exposed to a soldering iron for intervals greater than 5 seconds. This is to avoid damage to nearby components mounted on the board.

When modifying a link resistor, always check the related option links to ensure there is no possible signal contention or short circuits. Because many of the MCU's pins are multiplexed, some of the peripherals must be used exclusively. Refer to 'RX23W Group User's Manual: Hardware' and CPU board schematics for further information.

In the table in this section, "pin" expression is omitted, so please read as follows.
Example: U9.4 -> U9.4pin
J7(1-2 short) -> J7(1pin-2pin short)

6.2 MCU Operating Modes

Table 6-1 below details the option links associated with configuring the MCU Operating Modes.

Table 6-1: MCU Operating Modes Switch Settings

SW3 Pin1	SW3 Pin2	J8 *1	Configuration	Related Links
OFF	**OFF(don't care)**	**Open(don't care)**	**Single Chip Mode**	-
OFF	**OFF**	**Open(don't care)**	**Boot Mode(FINE Interface)**	-
ON	**OFF**	**Open(don't care)**	Boot Mode (SCI Interface) *2	R205, R209, J7
ON	ON	Open	Boot Mode (USB Interface) (Bus-powered) *3	**J5 (1-2 Short)**, J3 (2-3 Short), R201, X2
		Short	Boot Mode (USB Interface) (Self-powered) *3	**J5 (1-2 Short), J3 (Open)** , R201, X2

*1: Jumper J8 is not mounted on the board at the time of product shipment.

*2: The USB serial port that can be used in the factory setting, does not support boot mode (SCI interface). When using boot mode (SCI interface), change the port used to P26 and P30 according to § 6.17.

*3: USB-VBUS, which can be used in the factory setting, does not support boot mode (USB interface). When using the boot mode (USB interface), refer to § 6.18 and change the port used to P16. You also need an external clock (X2). Change the option link referring to § 6.5.

6.3 E1/E2 Lite Debugger Configuration

Table 6-2 below details the function of the option links associated with E1/E2 Lite Debugger Configuration.

Table 6-2: E1/E2 Lite Debugger Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208
PC7	F1	PC7	**EMU-UB**	-	-	**E1.10**	-	-
			DSW-UB			**SW3.2**	-	-
			PC7	-	-	**PC7**	-	-
			SERIAL-TXD	**R203**	-	**U8.2**	**J7 (1-2pin short)**	-
RESn	B6	-	**EMU-RESn**	-	-	**E1.13**	-	-
			SW-RESn	-	-	**RES(Switch)**	-	-
MD_FINED	B7	-	**EMU-MD_FINED**	-	-	**E1.7**	-	-
			DSW-MD_FINED	-	-	**SW3.1**	-	-

6.4 Power Supply Configuration

Table 6-3 below details the function of the option links associated with Power Supply Configuration.

Table 6-3: Power Supply Configuration Option Links

Reference	Configuration	Fit	DNF	Related Links
USB0_2	Connect 5V Power rail to VBUS0.	J3 (2-3 short), **J5 (1-2 short)**	-	**U6.1, U6.2**
USBCN0	**Connect 5V Power rail to FT234_5V.**	**J3 (1-2 short), J5 (1-2 short)**	-	**U6.1, U6.2**
USB_5V	**Connect 5V power rail to USB_5V.**	**R57**	-	**U5.2, U5.3**
U6 Output	Connect U6 Output power rail to Board_VCC.	J13 (short)	-	-
Board_5V	**Connect 5V power rail to Board_5V.**	-	-	U3.8, **U6.1, U6.2**
Board_VCC	**Connect Board_VCC power rail to UC_VCC.**	-	-	**E1.8, U3.8**
UC_VCC	**Connect Board_VCC power rail to UC_VCC.**	**J10 (short)**	-	**U1**
	Enable current probe for measurement MCU current consumption.	-	J10 (open)	**U1**
VBATT	**Connect UC_VCC power rail to VBATT.**	**R133**	**R134**	**U1**
	J11 [*1] connected to VBATT of MCU .	R134	R133	**U1**

[*1]: J11 is a power connector for VBATT, not a jumper. Do not short-circuit J11 Pin 1 and Pin 2 because the power supply is directly connected to ground.

Table 6-4 below details the function of the jumpers associated with the Power Supply Configuration.

Table 6-4: Power Supply Configuration Jumper Settings

Reference	Jumper Position	Configuration	Related Links.
J10	**Short**	**Connect Board_VCC power rail to UC_VCC.**	-
	Open	Enable current probe for measurement MCU current consumption.	-
J13	Short	Enable U6 Output power.	-
	Open	**Disable U6 Output power.**	-
J3	1-2 Short	Enable USBCN0(FT234_5V).	-
	2-3 Short	Enable USB0_2(VBUS0).	**J5 (1-2 short)**
	All open	**Disable USBCN0(FT234_5V), USB0_2(VBUS0).**	-

6.5 Clock Configuration

Table 6-5 below details the function of the option links associated with Clock Configuration.

Table 6-5: Clock Configuration Option Links

Reference	Configuration	Fit	DNF	Related Links
P47/CLKOUT_RF	**Connect CLKOUT_RF to P36/EXTAL.**	**R112, R89**	**R113, R108, R92, R90, R97**	**X2**
	Connect CLKOUT_RF to MCU header.	R113	R112	P47
XTAL1_RF, XTAL2_RF	**Connect 32MHz crystal (X1) to RX23W.**	-	-	-
XTAL, EXTAL	Connect 8MHz crystal (X2) to RX23W.	R90, R97	R89, R96	-
	Disconnect 8MHz crystal (X2) from RX23W and connect to MCU header.	**R89, R96,** R108	**R90, R97, R92,** R112	P36, **P37**
XCIN, XCOUT	**Connect 32.768kHz crystal (X3) to RX23W.**	**R100, R99**	**R102**	-
	Disconnect X2 from RX23W.	R102	R100, R99	-

6.6 Analog Power and ADC Configuration

Table 6-6 below details the function of the option links associated with Analog Power and ADC Configuration.

Table 6-6: Analog Power and ADC Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P07	C7	P07	SW1	R207	-	SW1	-	R206
			P07	-	-	**P07**	-	-
RV1-ADC	C9	P40	**RV1-ADC**	-	-	**RV1**	-	-
						P40	-	-
VREFH0	C10	-	**UC_VCC**	**R121**	-	-	-	-
VREFL0	D10	-	**GROUND**	**R124**	-	-	-	-
AVCC0-1	B10	-	**UC_VCC**	**R118**	**R127** or R128	-	-	-
			Board_VCC	**R128,** R127	R118	-	-	-
AVSS0-1	A10	-	**GROUND**	**R116**	-	-	-	-

6.7 CAN Configuration

Table 6-7 below details the function of the option links associated with CAN Configuration.

Table 6-7: CAN Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
CAN0RX	C2	P15	**CAN0RX**	-	-	**U9.3**	-	-
						P15	-	-
CAN0TX	C1	P14	**CAN0TX**	-	-	**U7.3**	-	-
						P14	-	-

6.8 I2C & EEPROM Configuration

Table 6-8 and **Table 6-9** below detail the function of the option links associated with I2C & EEPROM Configuration.

Table 6-8: I2C & EEPROM Configuration Option Links (1)

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P17	B1	P17	**E2P-SDA**	**R61**	**R72**	**U3.5**	-	-
			SSITXD0	R72	R61	P17	-	-
E2P-SCL	C3	P16	**E2P-SCL**	**R200**	**R201**	**U3.6**	-	-
			USB0-VBUS	R201	R200	**J4.2**	R202	-
			P16	-	-	**P16**	-	-

Table 6-9: I2C & EEPROM Configuration Option Links (2)

Reference	Configuration	Fit	DNF	Related Links
SDA0, SCL0	**Connect pull-up resistors to Board_VCC.**	**R29**	**R28**	**U3**
	Connect pull-up resistors to Board_5V.	R28	R29	**U3**
WP	EEPROM Write protect.	R39	-	**U3**
A0, A1, A2	**Device address (0xA6).**	**R50, R52, R55**	**R51, R53, R54**	**U3**
	Device address (0xA4).	**R50,** R53, **R55**	**R51,** R52, **R54**	**U3**

6.9 IRQ & Switch Configuration

Table 6-10 below details the function of the option links associated with IRQ & Switch Configuration.

Table 6-10: IRQ & Switch Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P07	C7	P07	SW1	R207	-	SW1	-	R206
			P07	-	-	**P07**	-	-
JP-UPSEL	B5	P35	**JP-UPSEL**	-	-	**J8.2**	-	-
						P35	-	-
P31	B4	P31	PMOD1-CS	R87	**R85**, R206	PMOD1.1	-	-
			SSISCK0	R85	**R87**, R206	P31	-	-
			SW1	**R206**	**R87, R85**	**SW1**	-	**R207**-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208
DIP-SW1	E8	P46	**DIP-SW1**	-	-	**SW4.2**	-	-
						P46	-	-
DIP-SW0	E9	P45	**DIP-SW0**	-	-	**SW4.1**	-	-
						P45	-	-
PB1 *1	J5	PB1	PMOD1-IRQ	J9 (2-3pin short)	-	PMOD1.7	-	-
			PMOD2-IRQ	**J9 (1-2pin short)**	-	**PMOD2.7**	-	-
			PB1	-	-	**PB1**	-	-
DIP-SW2	J6	PB0	**DIP-SW2**	-	-	**SW4.3**	-	-
						PB0	-	-
DIP-SW3	J8	PE4	**DIP-SW3**	-	-	**SW4.4**	-	-
						PE4	-	-

*1: PMODx-IRQ can be multi-connection interrupts by mounting R130.

6.10 LED Configuration

Table 6-11 below details the function of the option links associated with LED Configuration.

Table 6-11: LED Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
LED3	E10	P44	LED3	-	-	LED3.K	-	-
						P44	-	-
LED2	D9	P43	LED2	-	-	LED2.K	-	-
						P43	-	-
LED1	D8	P42	LED1	-	-	LED1.K	-	-
						P42	-	-
LED0	C8	P41	LED0	-	-	LED0.K	-	-
						P41	-	-

6.11 MCU Header Configuration

Table 6-12 and Table 6-13 below details the function of the option links associated with MCU Header Configuration.

Table 6-12: MCU Header Configuration Option Links(1)

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P07	C7	P07	SW1	R207	-	SW1	-	R206
			P07	-	-	**P07**	-	-
PMOD1-IO2	B9	P05	**PMOD1-IO2**	-	-	**PMOD1.9**	-	-
						P05	-	-
PMOD2-IO2	B8	P03	**PMOD2-IO2**	-	-	**PMOD2.9**	-	-
						P03	-	-
P17	B1	P17	**E2P-SDA**	**R61**	**R72**	**U3.5**	-	-
			SSITXD0	R72	R61	P17	-	-
P16	C3	P16	**E2P-SCL**	**R200**	**R201**	**U3.6**	-	-
			USB0-VBUS	R201	R200	**J4.2**	R202	-
			P16	-	-	**P16**	-	-
CAN0RX	C2	P15	**CAN0RX**	-	-	**U9.3**	-	-
						P15	-	-
CAN0TX	C1	P14	**CAN0TX**	-	-	**U7.3**	-	-
						P14	-	-
P27	B3	P27	**PMOD1-SCK**	**R81**	**R84**	**PMOD1.4**	-	-
			SSIWS0	R84	R81	P27	-	-
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
P25	A1	P25	**TS4**	**R60**	**R71**	**Touch KEY**	-	-
			CON-P25	R71	R60	P25	-	-
USB0-OVRCURB	C4	P22	**USB0-OVRCURB**	-	-	**U11.3**	-	-
						P22	-	-
P21	D3	P21	**P21**	-	-	**P21**	-	-
P37	A6	P37	-	R97	**R92**, R96	X2.2	-	-
			P37	**R96**	**R92, R97**	**P37**	-	-
P36	A4	P36	**CLKOUT_RF**	**R89**	**R92, R90**	**U1.F10**	**R112**	**R113, R108**
						P36	R113	R112
			-	R90	**R92**, R89	X2.1	-	-
JP-UPSEL	B5	P35	**JP-UPSEL**	-	-	**J8.2**	-	-
						P35	-	-
P31	B4	P31	PMOD1-CS	R87	**R85**, R206	PMOD1.1	-	-
			SSISCK0	R85	**R87**, R206	P31	-	-
			SW1	**R206**	**R87, R85**	**SW1**	-	**R207**-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208
P47	F10	P47	**P47**	**R112**	**R113**	**U1.A4**	**R89**	**R92, R90, R108**
				R113	R112	P47	-	-
DIP-SW1	E8	P46	**DIP-SW1**	-	-	**SW4.2**	-	-
						P46	-	-
DIP-SW0	E9	P45	**DIP-SW0**	-	-	**SW4.1**	-	-
						P45	-	-
LED3	E10	P44	**LED3**	-	-	**LED3.K**	-	-
						P44	-	-
LED2	D9	P43	**LED2**	-	-	**LED2.K**	-	-
						P43	-	-

Table 6-13: MCU Header Configuration Option Links(2)

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
LED1	D8	P42	LED1	-	-	LED1.K	-	-
						P42	-	-
LED0	C8	P41	LED0	-	-	LED0.K	-	-
						P41	-	-
PMOD1-IO3	J3	PB7	PMOD1-IO3	-	-	PMOD1.10	-	-
						PB7	-	-
PB5	J4	PB5	USB0-VBUS	R202	-	J4.2	-	R201
			PB5	-	-	PB5	-	-
PMOD2-IO1	H4	PB3	PMOD2-IO1	-	-	PMOD2.8	-	-
						PB3	-	-
PB1	J5	PB1	PMOD1-IRQ	J9 (2-3pin short)	-	PMOD1.7	-	-
			PMOD2-IRQ	J9 (1-2pin short)	-	PMOD2.7	-	-
			PB1	-	-	PB1	-	-
DIP-SW2	J6	PB0	DIP-SW2	-	-	SW4.3	-	-
						PB0	-	-
PC7	F1	PC7	EMU-UB	-	-	E1.10	-	-
			DSW-UB			SW3.2	-	-
			PC7	-	-	PC7	-	-
			SERIAL-TXD	R203	-	U8.2	J7 (1-2pin short)	-
PC6	F2	PC6	SERIAL-RXD	R208	-	U10.2	-	R209
			PC6	-	-	PC6	-	-
PC5	G2	PC5	TS23	R104	R105	Touch Slider (Upper)	-	-
			CON-PC5	R105	R104	PC5	-	-
PC4	G1	PC4	TSCAP	R98	R88, R95	C34	-	-
			SERIAL-CTSRTS	R88	R98, R95	J2.2	-	-
			CON-PC4	R95	R88, R98	PC4	-	-
PC3	H1	PC3	TS27	R106	R109	Touch Slider (Middle Upper)	-	-
			CON-PC3	R109	R106	PC3	-	-
PC2	H2	PC2	TS30	R114	R110	Touch Slider (Middle Lower)	-	-
			CON-PC2	R110	R114	PC2	-	-
PC0	J1	PC0	TS35	R117	R115	Touch Slider (Lower)	-	-
			CON-PC0	R115	R117	PC0	-	-
PMOD1-IO1	F9	PD3	PMOD1-IO1	-	-	PMOD1.8	-	-
						PD3	-	-
DIP-SW3	J8	PE4	DIP-SW3	-	-	SW4.4	-	-
						PE4	-	-
PMOD2-CS	H8	PE3	PMOD2-CS	-	-	PMOD2.1	-	-
						PE3	-	-
PMOD2-MISO	H9	PE2	PMOD2-MISO	-	-	PMOD2.3		
						PE2	-	-
PMOD2-MOSI	J9	PE1	PMOD2-MOSI	-	-	PMOD2.2		
						PE1	-	-
PMOD2-SCK	G9	PE0	PMOD2-SCK	-	-	PMOD2.4		
						PE0	-	-
PMOD2-IO3	C6	PJ3	PMOD2-IO3	-	-	PMOD2.10	-	-
						PJ3	-	-

6.12 PMOD1 Configuration

Table 6-14 below details the function of the option links associated with PMOD1 Configuration.

Table 6-14: PMOD1 Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PMOD1-IO2	B9	P05	**PMOD1-IO2**	-	-	**PMOD1.9**	-	-
						P05	-	-
P27	B3	P27	**PMOD1-SCK**	**R81**	**R84**	**PMOD1.4**	-	-
			SSIWS0	R84	R81	P27	-	-
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
P31	B4	P31	PMOD1-CS	R87	**R85**, R206	PMOD1.1	-	-
			SSISCK0	R85	**R87**, R206	P31	-	-
			SW1	**R206**	**R87, R85**	**SW1**	-	**R207**-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208
PMOD1-IO3	J3	PB7	**PMOD1-IO3**	-	-	**PMOD1.10**	-	-
						PB7	-	-
PB1	J5	PB1	PMOD1-IRQ	J9 (2-3pin short)	-	PMOD1.7	-	-
			PMOD2-IRQ	**J9 (1-2pin short)**	-	**PMOD2.7**	-	-
			PB1	-	-	**PB1**	-	-
PMOD1-IO1	F9	PD3	**PMOD1-IO1**	-	-	**PMOD1.8**	-	-
						PD3	-	-

6.13 PMOD2 Configuration

Table 6-15 below details the function of the option links associated with PMOD2 Configuration.

Table 6-15: PMOD2 Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
PMOD2-IO2	B8	P03	**PMOD2-IO2**	-	-	**PMOD2.9**	-	-
						P03	-	-
PMOD2-IO1	H4	PB3	**PMOD2-IO1**	-	-	**PMOD2.8**	-	-
						PB3	-	-
PB1	J5	PB1	PMOD1-IRQ	J9 (2-3pin short)	-	PMOD1.7	-	-
			PMOD2-IRQ	**J9 (1-2pin short)**	-	**PMOD2.7**	-	-
			PB1	-	-	**PB1**	-	-
PMOD2-CS	H8	PE3	**PMOD2-CS**	-	-	**PMOD2.1**	-	-
						PE3	-	-
PMOD2-MISO	H9	PE2	**PMOD2-MISO**	-	-	**PMOD2.3**		
						PE2	-	-
PMOD2-MOSI	J9	PE1	**PMOD2-MOSI**	-	-	**PMOD2.2**		
						PE1	-	-
PMOD2-SCK	G9	PE0	**PMOD2-SCK**	-	-	**PMOD2.4**		
						PE0	-	-
PMOD2-IO3	C6	PJ3	**PMOD2-IO3**	-	-	**PMOD2.10**	-	-
						PJ3	-	-

6.14 Bluetooth® Low Energy (BLE)

Table 6-16 below details the function of the option links associated with Bluetooth® Low Energy (BLE) Configuration.

Table 6-16: Bluetooth® Low Energy (BLE) Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
ANT	K2	-	**ANT**	**R122**	-	**FL1.1**	-	-

6.15 Serial Sound Interface (SSI)

Table 6-17 below details the function of the option links associated with Serial Sound Interface (SSI) Configuration.

Table 6-17: Serial Sound Interface (SSI) Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P17	B1	P17	**E2P-SDA**	**R61**	**R72**	**U3.5**	-	-
			SSITXD0	R72	R61	P17	-	-
P27	B3	P27	**PMOD1-SCK**	**R81**	**R84**	**PMOD1.4**	-	-
			SSIWS0	R84	R81	P27	-	-
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
P31	B4	P31	PMOD1-CS	R87	**R85**, R206	PMOD1.1	-	-
			SSISCK0	R85	**R87**, R206	P31	-	-
			SW1	**R206**	**R87, R85**	**SW1**	-	**R207**-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208

6.16 Touch Interface Configuration

Table 6-18 below details the function of the option links associated with Touch Interface configuration.

Table 6-18: Touch Interface Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P25	A1	P25	**TS4**	**R60**	**R71**	**Touch KEY**	-	-
			CON-P25	R71	R60	P25	-	-
PC5	G2	PC5	**TS23**	**R104**	**R105**	**Touch Slider (Upper)**	-	-
			CON-PC5	R105	R104	PC5	-	-
PC4	G1	PC4	**TSCAP**	**R98**	**R88, R95**	**C34**	-	-
			SERIAL-CTSRTS	R88	R98, **R95**	J2.2	-	-
			CON-PC4	R95	**R88**, R98	PC4	-	-
PC3	H1	PC3	**TS27**	**R106**	**R109**	**Touch Slider (Middle Upper)**	-	-
			CON-PC3	R109	R106	PC3	-	-
PC2	H2	PC2	**TS30**	**R114**	**R110**	**Touch Slider (Middle Lower)**	-	-
			CON-PC2	R110	R114	PC2	-	-
PC0	J1	PC0	**TS35**	**R117**	**R115**	**Touch Slider (Lower)**	-	-
			CON-PC0	R115	R117	PC0	-	-

6.17 USB to Serial Configuration

Table 6-19 below details the function of the option links associated with USB to Serial Configuration.

Table 6-19: USB to Serial Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
P30	A2	P30	PMOD1-MISO	J6 (2-3pin short)	**R76, R80, R209**	PMOD1.3	-	-
			SW2	**J6 (1-2pin short)**	**R76, R80, R209**	**SW2**	-	-
			EMU-RXD	R76	J6 (open), **R80, R209**	E1.11	-	-
			AUDIO_MCLK	R80	J6 (open), **R76, R209**	P30	-	-
			SERIAL-RXD	R209	J6 (open), **R76, R80**	U10. 2	-	R208
PC7	F1	PC7	**EMU-UB**	-	-	**E1.10**	-	-
			DSW-UB			**SW3.2**	-	-
			PC7	-	-	**PC7**	-	-
			SERIAL-TXD	**R203**	-	**U8.2**	**J7 (1-2pin short)**	-
PC6	F2	PC6	**SERIAL-RXD**	**R208**	-	**U10.2**	-	**R209**
			PC6	-	-	**PC6**	-	-
PC4	G1	PC4	**TSCAP**	**R98**	**R88, R95**	**C34**	-	-
			SERIAL-CTSRTS	R88	R98, **R95**	J2.2	-	-
			CON-PC4	R95	**R88**, R98	PC4	-	-

6.18 USB Configuration

Table 6-20 below details the function of the option links associated with the USB Configuration.

Table 6-20: USB Configuration Option Links

Signal name	MCU		MCU Peripheral Selection			Destination Selection		
	Pin	Port	Signal	Fit	DNF	Interface /Function	Fit	DNF
P16	C3	P16	**E2P-SCL**	**R200**	**R201**	**U3.6**	-	-
			USB0-VBUS	R201	R200	**J4.2**	R202	-
			P16	-	-	**P16**	-	-
P26	B2	P26	PMOD1-MOSI	J7 (2-3pin short), **R204**	**R62, R73, R205**	PMOD1.2	-	-
			EMU-TXD	J7 (2-3pin short), R62	R204, **R73, R205**	E1.5	-	-
			SSIRXD0	J7 (2-3pin short), R73	R204, **R62, R205**	P26	-	-
			SERIAL-TXD	J7 (2-3pin short), R205	R204, **R62, R73**	U8.2	-	R203
			USB0-VBUSEN	**J7 (1-2pin short)**	-	**U5.4**	-	-
USB0-OVRCURB	C4	P22	**USB0-OVRCURB**	-	-	**U11.3**	-	-
						P22	-	-
PB5	J4	PB5	**USB0-VBUS**	**R202**	-	**J4.2**	-	**R201**
			PB5	-	-	**PB5**	-	-
USB0-DP	E1	-	**USB0-DP**	-	-	**USB0_1.3**	-	-
						USB0_2.3	-	-
USB0-DM	D1	-	**USB0-DM**	-	-	**USB0_1.2**	-	-
						USB0_2.2	-	-

Table 6-21 below details the function of the jumpers associated with the USB Configuration.

Table 6-21: USB Configuration Jumper Option Links

Reference	Jumper Position	Configuration	Related Links
J4	**Short Pin1-2**	**Self-powered**	**J5 (1-2 short), J3 (open)**
	Short Pin2-3	Bus-powered	**J5 (1-2 short),** J3 (2-3 short)
	All open	DO NOT SET.	**J5 (1-2 short)**
J5	**Short Pin1-2**	**USB0 Function mode**	-
	Short Pin2-3	USB0 Host mode	-
	All open	DO NOT SET.	-

When using USB in function mode, be sure to set J5 to 1-2 Short. Also, do not plug in both USB0_1 and USB0_2 cables at the same time.

7. Code Development

7.1 Overview

For all code debugging using Renesas software tools, the CPU board must be connected to a PC via an E1/E20/E2 Lite debugger. An E1/E2 Lite debugger is supplied with this RSSK product.

For further information regarding the debugging capabilities of the E1/E20/E2 Lite debuggers, refer to 'E1/E20 Emulator, E2 Emulator Lite - Additional Document for User's Manual' (R20UT0399EJ).

7.2 Compiler Restrictions

The compiler supplied with this RSSK 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 compiler with programs greater than this size you need to purchase the full tools from your distributor.

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

7.3 Mode Support

The MCU supports Single Chip and Boot Modes (SCI and USB), which are configured on the CPU board. Details of the modifications required can be found in §6.2. All other MCU operating modes are configured within the MCU's registers, which are listed in 'RX23W Group User's Manual: Hardware'.

Only ever change the MCU operating mode whilst the MCU is in reset, or turned off; otherwise the MCU may become damaged as a result.

7.4 Debugging Support

The E1 Emulator or E2 Emulator Lite (as supplied with this RSSK) supports break points, event points (including mid-execution insertion) and basic trace functionality. It is limited to a maximum of 8 on-chip event points, 256 software breaks and 256 branch/cycle trace. For further details, refer E1/E20 Emulator User's Manual (R20UT0398EJ) or E2 Emulator Lite User's Manual (R20UT3240EJ).

7.5 Address Space

For the MCU address space details, refer to the 'Address Space' section of 'RX23W Group User's Manual: Hardware'.

8. Additional Information

Technical Support

For information about the RX23W Group microcontrollers refer to ‘RX23W Group User’s Manual: Hardware’.

For information about the RX assembly language, refer to ‘RX Family User’s Manual: Software’.

Technical Contact Details

Please refer to the contact details listed in section 9 of the “*Quick Start Guide*”

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

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9. Certification of Compliance

The Renesas Solution Starter kit for RX23W has obtained certificates of compliance with the laws and regulations stated below.
Since the use of this product in countries and regions that require compliance with other regulations may lead to the violation of the laws; confirm the regulations of such countries in which the product is to be used.
The use of this product in a Faraday-shielded chamber or box may be required.

9.1 Radio-Related Laws

Japan: Type certification (authentication number: 001-A16430)
Europe: CE (RE)
North America: FCC (FCC ID: 2AEMXRX23WSKB85), ISED (ISED: 20194-RX23WSKB85)

RE Directive

Hereby, Renesas Electronics Corporation declares that the radio equipment type RTK5523W8AC00001BJ (TSIP Version: RTK5523W8BC00001BJ) is in compliance with Directive 2014/53/EU.

FCC/ISED Regulatory

Since this module is not sold to general end users directly, there is no user manual of the module.
For the details about this module, please refer to the specification sheet of the module.
This module should be installed in the host device according to the interface specification (installation procedure).
The following information must be indicated on the host device of this module;

FCC ID: 2AEMXRX23WSKB85
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ISED: 20194-RX23WSKB85

[for FCC]
FCC CAUTION
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment has very low levels of RF energy that is deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.

This device complies with FCC Part **15.203** because the antenna is not removable from this device.

[for ISED]
This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : 1) l'appareil ne doit pas produire de brouillage; 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment has very low levels of RF energy that is deemed to comply without maximum permissive exposure evaluation (MPE). But it is desirable that it should be installed and operated keeping the radiator at least 20cm or more away from person's body.
Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement émet une énergie RF très faible qui est considérée conforme sans évaluation de l'exposition maximale autorisée. Cependant, il est souhaitable qu'il devrait être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.
HVIN and PMN of this product is "RTK5523W8AC00001BJ" (TSIP Version: RTK5523W8BC00001BJ).

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RX23W Group

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