

RX23W Group

Target Board for RX23W User's Manual

RENESAS 32-Bit MCU
RX Family / RX200 Series

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Precautions

The following precautions should be observed when operating Target Board for RX23W product:

The Target Board for RX23W is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this product and any sensitive equipment. Its use outside the laboratory, classroom, and study area or in area not conform to the protection requirements of the Electromagnetic Compatibility Directive could lead to prosecution.

This 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 any harmful interference to radio or television reception occurs by turning the equipment off or on, you are encouraged 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
- Contact the dealer or an experienced radio/TV technician for help

NOTE: It is recommended that wherever possible shielded interface cables are used.

This product is potentially susceptible to certain EMC phenomena. It is recommended to take following measures in order to migrate them;

- Do not use mobile phones within 10m of the product when in use.
- Take ESD precautions when handling the equipment.

The Target Board for RX23W neither represents an ideal reference design for an end product nor fulfils 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 Target Board hardware functionality, and electrical characteristics, and 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 are attached at the end of each section and in the Usage Notes section, not within the body of the text.

The revision history only shows the summary of revised or added parts, and does not include all revisions. Refer to the text in this manual for details.

The following documents apply to the RX23W Group. Make sure to use the latest versions for reference, available on the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's Manual	Describes the technical details of the Target Board for RX23W hardware.	Target Board for RX23W User's Manual	T.B.D.
Schematics	Describes circuit schematics of the Target Board for RX23W in full detail	Target Board for RX23W Schematics	T.B.D.
BOM LIST	Describes Bill of Materials of the Target Board for RX23W	Target Board for RX23W BOM LIST	T.B.D.
Application Note	Sample code description.	Target Board for RX23W Application Note	T.B.D.
User's Manual: Hardware	Provides technical details of the RX23W microcontroller.	RX23W Group User's Manual: Hardware	T.B.D.

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
CPU	Central Processing Unit
DIP	Dual In-line Package
DNF	Do Not Fit
IDE	Integrated Development Environment
IRQ	Interrupt Request
HOCO	High-Speed On-Chip Oscillator
LOCO	Low-Speed On-Chip Oscillator
LED	Light Emitting Diode
MCU	Micro-controller Unit
n/a (NA)	Not Applicable
n/c (NC)	Not Connected
PC	Personal Computer
Pmod™	Digilent Pmod™ Compatible connector. Pmod™ is registered to Digilent Inc. Digilent-Pmod Interface Specification
RAM	Random Access Memory
RFP	Renesas Flash Programmer
ROM	Read Only Memory
SPI	Serial Peripheral Interface
USB	Universal Serial Bus
BLE	Bluetooth Low Energy

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1. Overview

1.1 Contents

Thank you for purchasing the Renesas evaluation tool "Target Board for RX23W". This product consists of the following item.

Target Board for RX23W

1.2 Purpose

The Target Board for RX23W is an evaluation tool for Renesas microcontrollers. This manual describes the technical details of the Target Board for RX23W hardware.

1.3 Features

The Target Board for RX23W includes the following features:

- Renesas microcontroller programming
- User code debugging
- Switch, LED user circuit
- Sample application^{*1}
- Sample peripheral function initialization code^{*1}

^{*1}: Available for download on the Renesas website.

1.4 Preparation

Install the integrated development environment (IDE) and necessary other software from the following URL on the host PC (before you get started).

<https://www.renesas.com/development-tools>

1.5 Board Specification Table

Table 1-1 shows the Target Board for RX23W specifications.

Table 1-1: Board Specification Table

Item	Specification
Evaluation MCU	Part No: R5F523W8ADNG
	Package: 56-Pin QFN
	On-chip memory: ROM 512KB+8KB, RAM 64KB
Board Size	Size: 54.0mm x 90.0mm
	Thickness: 1.6mm
Power Supply	USB connector: 5V Input
	Power supply IC: 5V Input, 3.3V Input
	For external power supply header ^{*1} : 3.3V Input, 2-pin, x 1
Current Consumption	Max. 200mA
Current Consumption Measurement Header ^{*1}	Header: 2-pin, x 1
Main Clock ^{*1}	Surface mount type: HC-49
Sub Clock ^{*1}	Lead type: 2.54mm Pitch Through Hole x 3
	Lead type: Through Hole x 2 (KYUSHU DENTSU CO., LTD.: NC-26 Equivalent)
Bluetooth Low Energy	Bluetooth Low Energy Circuit x 1
	Range of frequency: 2402MHz to 2480MHz
	Maximum transmitted output power: 4dBm +2dB
Push Switch	Reset switch x 1
	User switch x 1
LED	Power indicator: green x 1
	User: green x 2
	ACT LED: green x 1
USB Connector	Connector: USB-micro B, 5-pin, x 2
Pmod™ Connector ^{*1}	Connector: Angle type, 12-pin
Arduino™ Headers ^{*1}	2.54mm pitch headers for connection to Arduino™ shields ^{*1}
MCU Header ^{*1}	Header: 28-pin, x 2
Cut Pattern	21 places
Power Selection Header ^{*1}	Header: 3-pin, x 1
Emulator Reset Switch	DIP Switch, x 1

^{*1}: Parts are not mounted (DNF).

1.6 Block Diagram

Figure 1-1 shows the block diagram of the Target Board for RX23W.

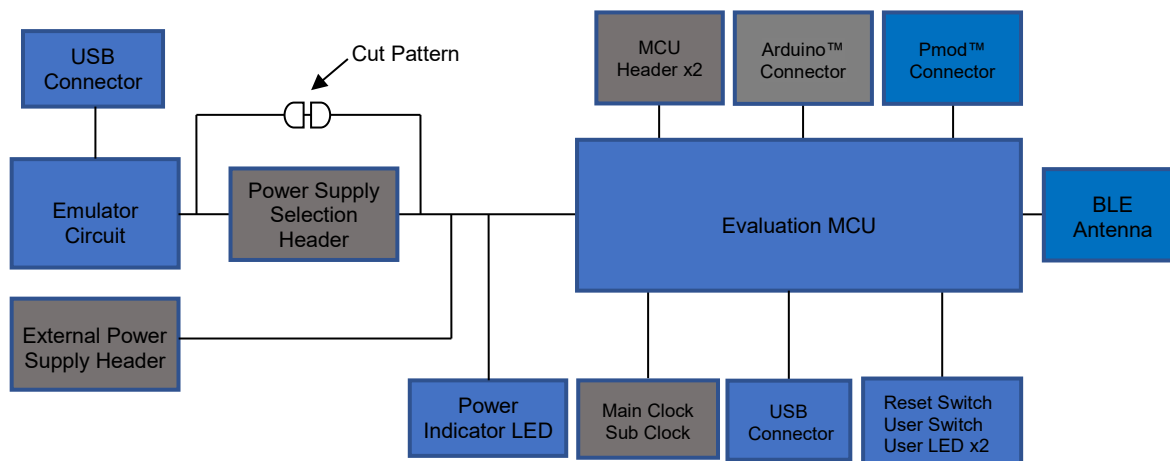


Figure 1-1: Block Diagram

2. Board Layout

Figure 2-1 shows the external appearance of the top side of Target Board for RX23W.

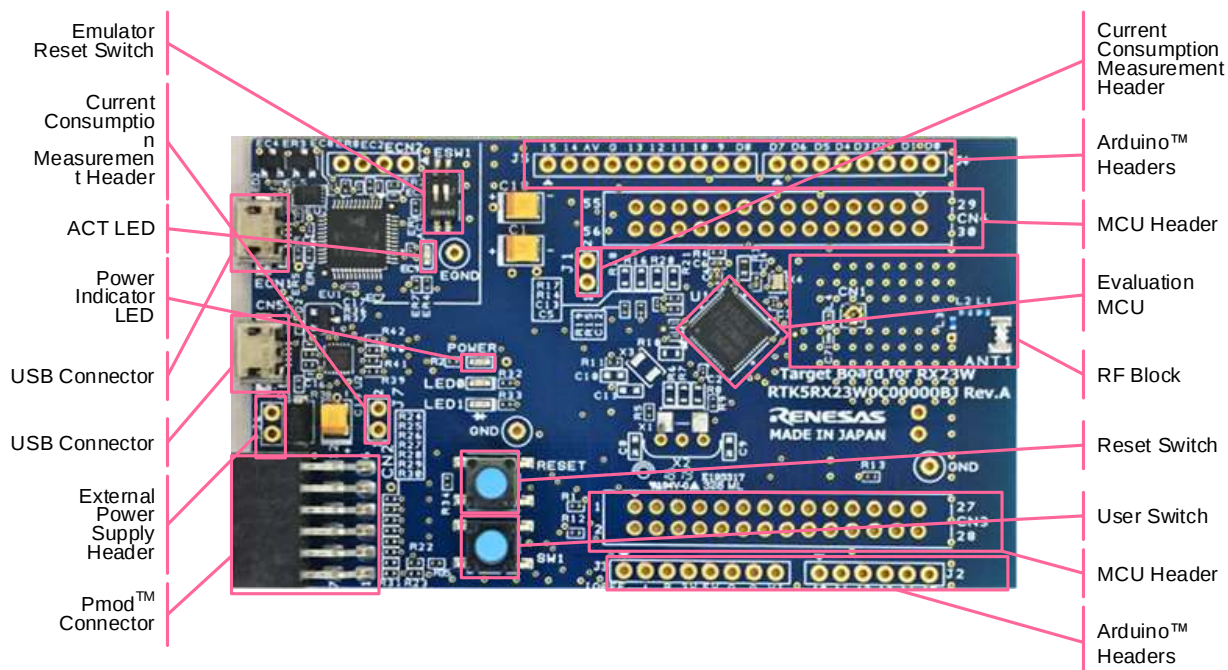


Figure 2-1: Board Layout (Top Side)

Figure 3-1 shows the parts layout of Target Board for RX23W.

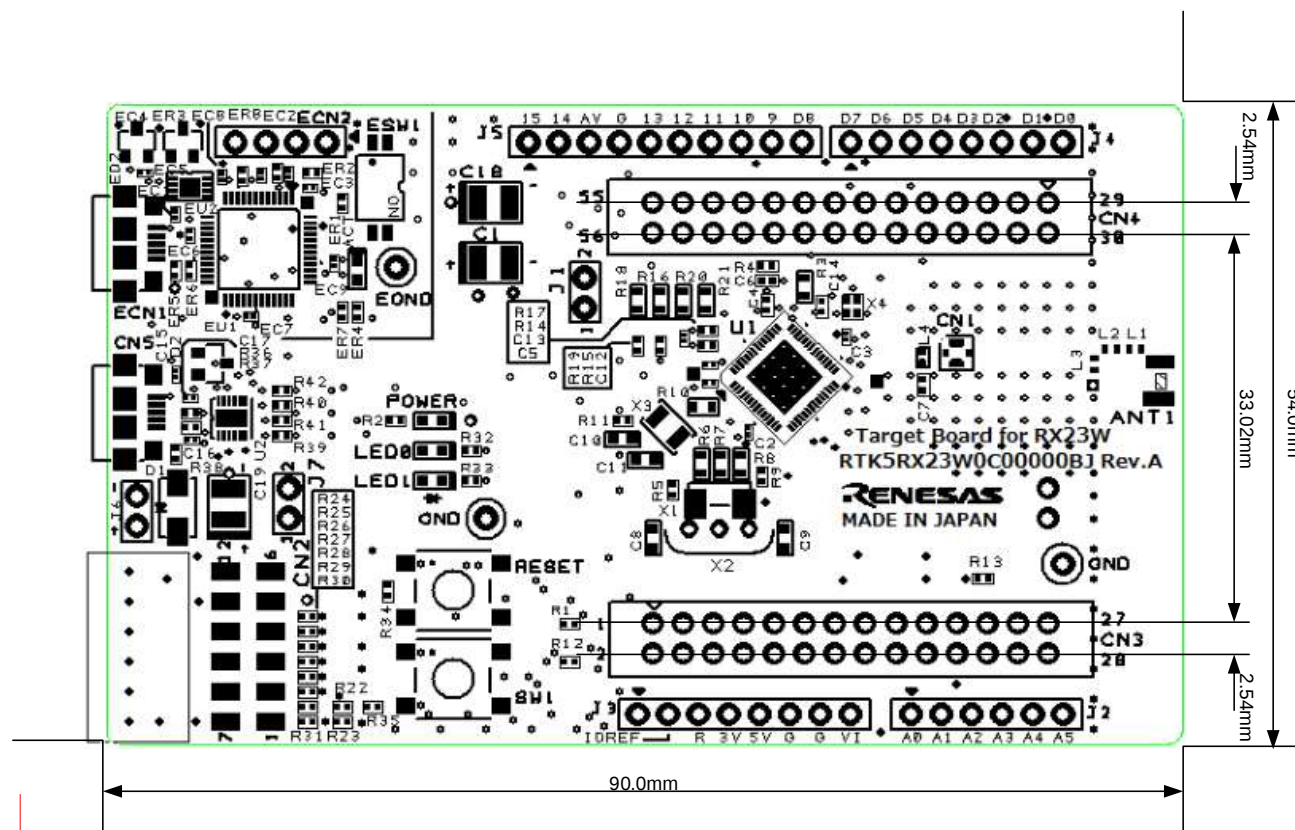


Figure 3-1: Parts Layout

4. Operating Environment

Figure 4-1 shows the operating environment of the Target Board for RX23W. Install the integrated development environment (IDE) from the following URL on the host PC. All the other required drivers are will be automatically installed with the IDE.

<https://www.renesas.com/rxtb>

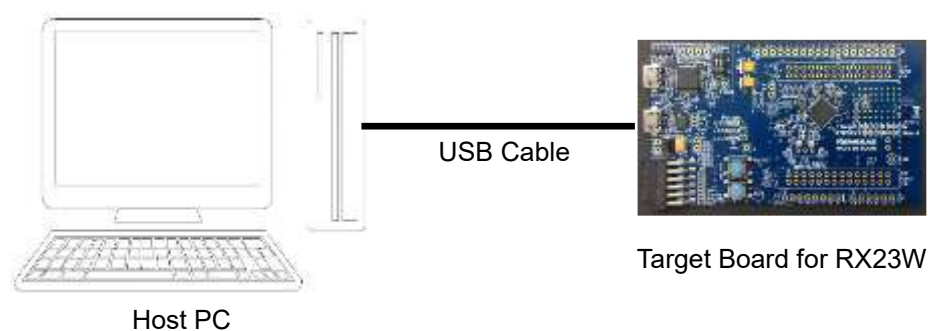


Figure 4-1: Operating Environment

5. User Circuit

5.1 Evaluation MCU

The MCU specification for the power supply, system clock, and reset at the time of shipment are as follows;

Power supply: 3.3 V fixed (including analog power supply)

System clock: Operated with on-chip oscillator

Reset: Reset switch, IDE reset instruction

5.2 Bluetooth Low Energy

This board is equipped with Bluetooth Low Energy circuit.

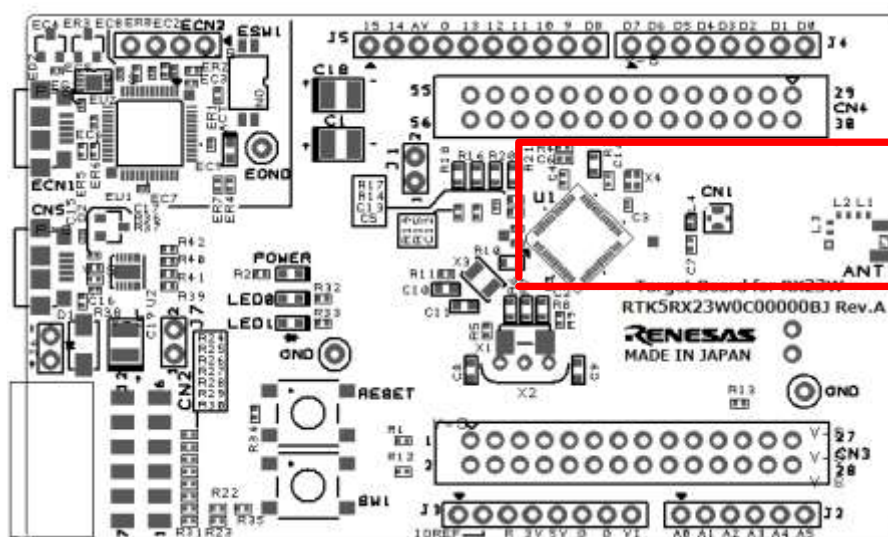


Figure 5-1 : Circuit of Bluetooth Low Energy

Caution

Never modify the Bluetooth Low Energy circuit. Doing so will violate the Radio Law.

5.3 Emulator

This board has an emulator. When shipped from the factory, the switch is off and the emulator is in reset. If you are using an emulator, set the switches as shown in Table 5-1. The connector shape is USB micro -B for Integrated Development Environment (IDE) and for Renesas Flash Programmer (RFP). Connect to the computer via the USB cable. If the power supply on the host side is ON, the Target Board for RX23W will be automatically power-supplied with the cable connection.

Note: USB cable is not included in the package

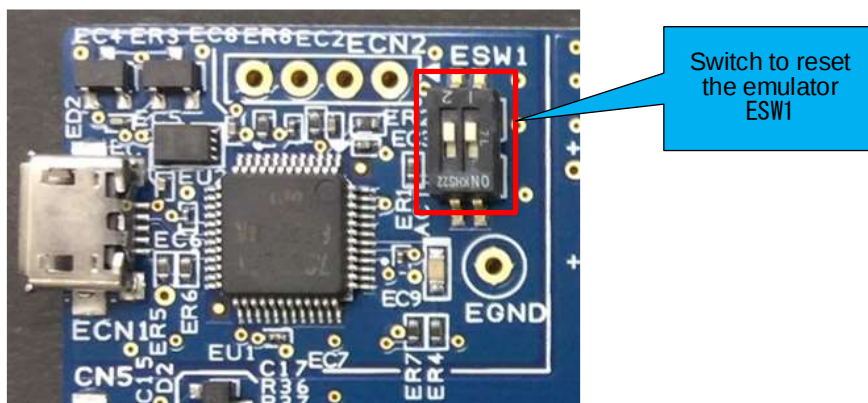


Figure 5-2 : Switch to reset the emulator ESW1

Table 5-1: Switch to reset the emulator ESW1

ESW1	Function		
1ch	Not functional	—	—
2ch	Switch to reset the emulator	OFF	The emulator is reset Emulator is not available
		ON	Emulator is available

5.4 USB Serial Port

The USB connector CN5 is connected to the FTDI USB serial conversion module and can be used as a virtual COM port. The USB serial connection relationship is shown below.

Table 5-2 : Serial Port Connections

Signal Name	Function	MCU	
		Port	Pin
TXD	Transmit Signal.	PC7	23
RXD	Receive Signal.	PC6	24
CTS	Clear To Send.	*1	
RTS	Request To Send.	*1	

*1: 製品出荷時は接続されていません。

When the CPU board is first connected to a PC running Windows™ with the USB/Serial connection, the PC will look for a driver. This driver is installed during the installation process, so the PC should be able to find it. The PC will report that it is installing for a driver and then report that a driver has been installed successfully, as shown in **Figure 5-2**. The exact messages may vary depending upon operating system.。

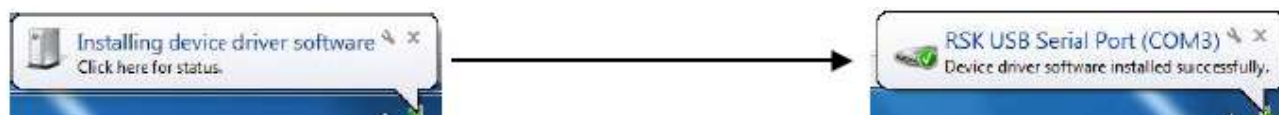


Figure 5-3 : USB-Serial Windows™ Installation message

If you do not have the driver, please download the driver installer from the following FTDI HP.

5.5 ACT LED

The ACT LED displays the operation status of the emulator control software. The lighting conditions are shown below. The lighting color is green.

Light On: Indicates that the emulator is connected to the target.

Flickering: Indicates that the host machine (PC) has recognized the emulator.

Light Off: Indicates that the emulator cannot be used for some reason. (Including power off)

5.6 Power LED

The power LED lights on, when the board is power- supplied. The lighting color is green.

5.7 User LED

The user LED is an optional LED to be used if necessary the board is mounted with LED 0 and LED 1, connected to the following ports respectively. The lighting color is green.

LED0: 30pin, Port PC0

LED1: 35pin, Port PB0

5.8 External Power Supply Header

When operating the evaluation MCU at an arbitrary voltage, or requiring current more than the USB current capacity, use the external power supply header (J6) for power supply. The available voltage depends on the evaluation MCU. When using this header, cut SS19. Figure 5-4 show the position of the cut pattern, Figure 5-5 shows the position of the external power supply header. (header parts are not mounted)

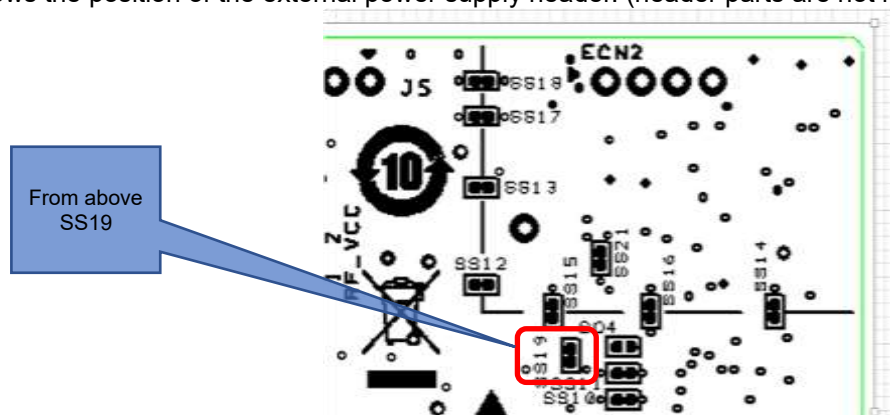


Figure 5-4: Position of Pattern SS19

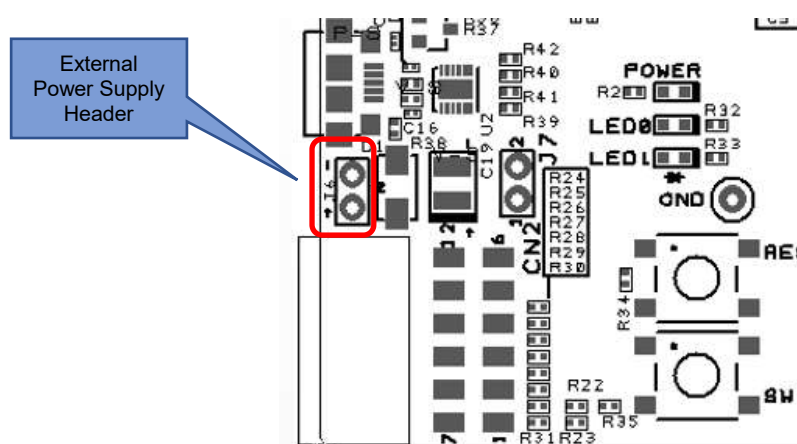


Figure 5-5: Position of External Power Supply

5.9 Pmod™ Connector

The Pmod™ connector (PMOD1) has a through hole at a pitch of 2.54 mm and is connected to the evaluation MCU according to Pmod™ Interface Type 2 A. Note that the Pmod™ connector has the pin assignment different from other headers. **Figure 5-6** shows the pin assignment of the Pmod™ connector and **Table 5-3** shows the signal assign of the Pmod™ connector. The channel for RSP is assigned to 0, and the channel for interrupts is assigned to IRQ5 respectively. (Connector parts are not mounted)

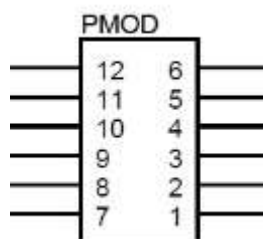


Figure 5-6: Pmod™ Connector Pin Assignment (Top View)

Table 5-3: Pmod™ Connector Signal Assignment

Pmod™ Connector							
Pin	Circuit Net Name	Evaluation MCU		Pin	Circuit Net Name	Evaluation MCU	
		Port	Pin			Port	Pin
1	PMOD1-CS	P31	11	7	PMOD1-IRQ	PB1	33
2	PMOD1-MOSI	P26	14	8	PMOD1-RST	PD3	47
3	PMOD1-MISO	P30	12	9	PMOD1-IO0	P05	55
4	PMOD1-SCK	P27	13	10	PMOD1-IO1	PB7	31
5	GROUND	-	-	11	GROUND	-	-
6	TARGET_VCC	-	-	12	TARGET_VCC	-	-

5.10 Arduino™ ヘッダ

The Arduino™ header (J2,J3,J4,J5) has a through hole at a pitch of 2.54 mm and is connected to the evaluation MCU according to Arduino™ UNO R3. Table 5-4 shows the signal assign of the Arduino™ header. The channel for interrupts is assigned to IRQ4 respectively. (Connector parts are not mounted)

Table 5-4: J2(Analog 6 pin Header Signal Assignment)

Pin	Signal Name	spec	MCU	
			Signal	Pin
1	A0	AD input	AN001	51
2	A1		AN005	50
3	A2		AN006	49
4	A3		AN007	48
5	A4		AN018	43
6	A5		AN019	42

Table 5-5: J3(Power 8 pin Header Signal Assignment)

Pin	Signal Name	spec	MCU	
			Signal	Pin
1	Reserved		—	—
2	IOREF		VCC	—
3	RESET			—
4	3V3	Power	VCC	—
5	5V			—
6	GND		GND	—
7	GND		GND	—
8	VIN		VCC	—

Table 5-6: J4(Digital 8 pin Header Signal Assignment)

Pin	Signal Name	spec	MCU	
			Signal	Pin
8	D0/RX	GPIO/RxD	PC2/RxD5	29
7	D1/TX	GPIO/TxD	PC3 /TxD5	27
6	D2	GPIO	PC0	30
5	D3/PWM/INT	GPIO/PWM/IRQ	PB7/MTIOC3B	31
4	D4/INT	GPIO/IRQ	PB1/IRQ4	33
3	D5/PWM/INT	GPIO/PWM/IRQ	P14/MTIOC3A/IRQ4	18
2	D6/PWM	GPIO/PWM	PE4/MTIOC4D	41
1	D7	GPIO	PB0	35

Table 5-7: J5(Analog 6 pin Header Signal Assignment)

Pin	Signal Name	spec	MCU	
			Signal	Pin
10	D8	GPIO	P31	11
9	D9/PWM	GPIO/PWM	PC6/MTIOC3C	24
8	D10/PWM	GPIO/PWM	PC5/MTIOC3B	25
7	D11/MOSI/PWM	GPIO/PWM	P26/SMOSI1/MTIOC2A	14
6	D12/MISO	GPIO	P30/SMISO1	12
5	D13/SCK	GPIO	P27/SCK1	13
4	GND			
3	ADREF			
2	SDA	II2 data	SDA	15
1	SCK	II2clock	SCL	16

5.11 Current Consumption Measurement Header

The current consumption measurement header (J7) is used for measuring current consumption of the evaluation MCU. The current consumption can be measured by connecting an ammeter to the evaluation MCU. Note that the cut pattern (SS20) should be cut when using this header. **Figure 5-7** shows the position of the header and cut pattern. (header parts are not mounted)

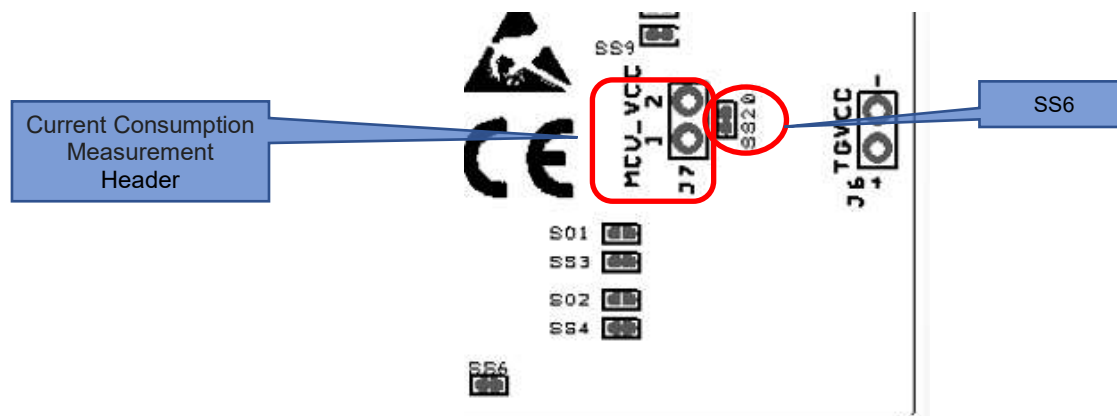


Figure 5-7: Position of Current Consumption Measurement Header and SS6 Cut Pattern

5.12 MCU Header

The MCU header is installed with two 28-pin headers (CN3, CN4). The headers are allocated with interval of 2.54 mm pitch. The evaluation MCU and the header are connected according to each pin number as 1pin to 1pin, and 2pin to 2pin in order until 56pin. (except 1, 3, 4, 19, 22, 28, 32, 37, 38, 39, 40, 41, 42, 44, 45, 46 pins) (header parts are not mounted)

5.13 RESET Switch

Press the RESET switch to turn on the hard reset for the evaluation MCU.

5.14 User Switch

The user switch (SW 1) is an optional switch to be used if necessary. It is connected to 17 pin and P15 port of the evaluation MCU. The interrupt is assigned to IRQ 5.

5.15 Cut Pattern

All cut patterns are set to the connected state at the time of factory shipment. Cut or repair soldering if necessary.

Figure 5-8 show the example of the cut patterns

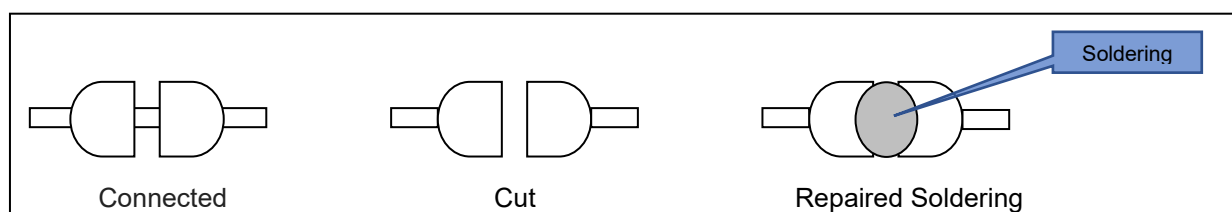


Figure 5-8: Cut Pattern Treatment Example

When repairing the cut pattern on the bottom side, repair soldering for SS19 shown in Figure 5-4.

6. Configuration

6.1 Modifying the Target Board for RX23W

This section describes how to change the Target Board for RX23W setting by using option link resistance.

An option link resistor is a 0Ω surface mount resistor, which is used to short or isolate a part of circuits. See the 6.2 below for the list of option links by function. Fit or remove the option link resistor to switch functions by referring to the list. **Bold fonts in blue** indicates the default configuration at the shipment. For the position of option links, see the chapter 3 “Part Layout”.

When removing soldered components, do not press a soldering iron on the Target Board for RX23W for more than 5 seconds to avoid any damage around the target area.

6.2 Analog Power Supply

The option links for analogue power supply are shown in **Table 6-1** and **Table 6-2**

Table 6-1: 12bit A/D, 12bit D/A Analog Power Supply Option Link

12bit A/D, 12bit D/A Analog power supply source	Fit	DNF	Remarks
3.3V on the board	R15, R19	R16, R18	-
MCU Header	R16, R18	R15, R19	The bypass capacitors of C13 are invalid.

Table 6-2: 12bit A/D Reference Voltage Option Link

12bit A/D Reference voltage supply source	Fit	DNF	Remarks
3.3V on the board	R14, R17	R20, R21	-
MCU Header	R20, R21	R14, R17	The bypass capacitors of C12 are invalid.

6.3 On-chip Oscillator

The option links for on-chip oscillator operation are shown in **Table 6-3**, **Table 6-4**.

Table 6-3: HOCO Option Link

HOCO setting	Fit	DNF	Remarks
Oscillation	R5, R9	R6, R8	-
Stop	R6, R8	R5, R9	Mount a crystal resonator on X1 or X2 and load capacitance on C8, C9.

Table 6-4: LOCO Option Link

LOCO setting	Fit	DNF	Remarks
Oscillation	R11	-	-
Stop	-	R11	Mount a crystal resonator on X3 and load capacitance on C10, C11

7. Handling Precautions

7.1 Board Thickness

Please be extra careful when handling the Target Board for RX23W as the board is thin (1.6 mm).

7.2 Additional Load

When adding loads by USB power supply, the maximum operational current is 300 mA at 3.3 V, current is 100 mA at 5 V operation.

When adding loads by external power supply, the maximum operational current is 500 mA under any operating voltage.

7.3 Substrate Remodelling

Any modification of the board (including changing the cut pattern) shall be conducted on a user's own responsibility.

7.4 Target Board connection limit

It is not possible to connect to multiple Target Boards from the same host PC.

8. Code Development

Figure 8-1 shows the setting of e2 studio when creating a new project for the Target Board for RX23W.

Debug hardware: Select [E2 Lite (RX)].

Power supply from the emulator: Select [No].

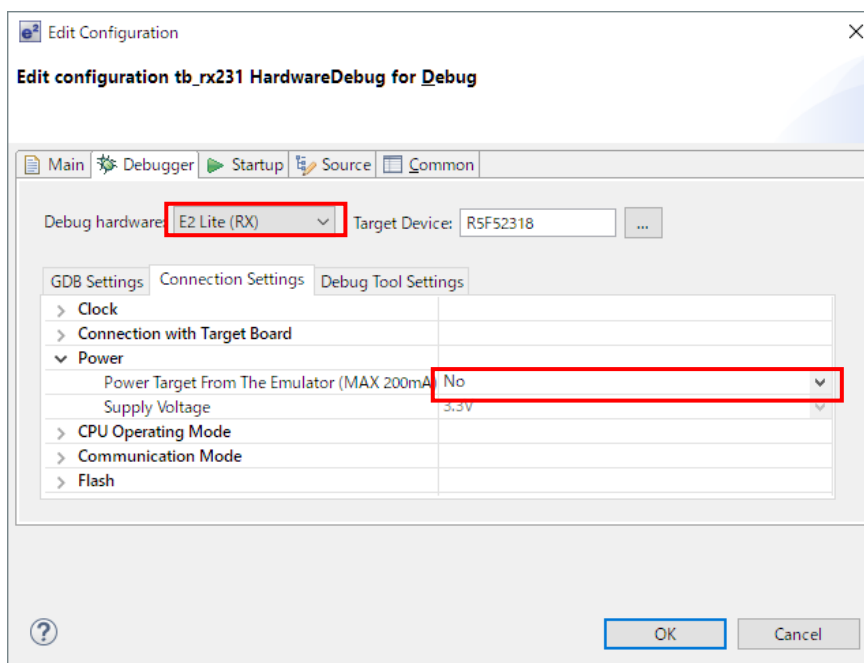


Figure 8-1: e2 studio settings

(Note) Do not connect another Target Board to your PC while connecting the Target Board for RX23W.

9. Additional Information

Technical Support

For details on the RX23W Group microcontrollers, refer to the RX23W Group Hardware Manual.

For details on the RX assembly language, refer to the RX Family Software Manual.

The latest information is available from the WEB site <https://www.renesas.com/rxtb>.

Technical Contact Details

America: techsupport.america@renesas.com

Europe: <https://www.renesas.com/en-eu/support/contact.html>

Global & Japan: <https://www.renesas.com/support/contact.html>

General information on Renesas microcontrollers can be found on the Renesas website at:
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Appendix A. Conformity Assessment

Target Board for RX23W conforms to the laws and regulations that are described in the following.

FCC/ISED Regulatory

Since this module is not sold to general end users directly, there is no user manual of module.

For the details about this module, please refer to the specification sheet of 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: 2AEMXRX23WTBQ56

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.

IC: 20194-RX23WTBQ56

[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 it 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 it 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 "RTK5RX23W0C00000BJ".

Korea Radio Regulations

MSIP-xxx-xxx-RX23WTBQ56

해당 무선설비는 전파혼신 가능성이 있으므로 인명안전과 관련된 서비스는 할 수 없습니다.

China SRRC

1.
 - 使用频率: 2.4 - 2.4835 GHz
 - 等效全向辐射功率(EIRP):
天线增益<10dBi 时: ≤ 100 mW 或 ≤ 20 dBm
 - 最大功率谱密度:
天线增益<10dBi 时: ≤ 20 dBm / MHz (EIRP)
 - 载频容限: 20 ppm
 - 带外发射功率(在 2.4-2.4835GHz 频段以外)
 ≤ -80 dBm / Hz (EIRP)
 - 杂散发射(辐射)功率(对应载波 ± 2.5 倍信道带宽以外):
 ≤ -36 dBm / 100 kHz (30 - 1000 MHz)
 ≤ -33 dBm / 100 kHz (2.4 - 2.4835 GHz)
 ≤ -40 dBm / 1 MHz (3.4 - 3.53 GHz)
 ≤ -40 dBm / 1 MHz (5.725 - 5.85 GHz)
 ≤ -30 dBm / 1 MHz (其它 1 - 12.75 GHz)
2. 不得擅自更改发射频率、加大发射功率(包括额外加装射频功率放大器), 不得擅自外接天线或改用其它发射天线;
3. 使用时不得对各种合法的无线电通信业务产生有害干扰; 一旦发现有干扰现象时, 应立即停止使用, 并采取措施消除干扰后方可继续使用;
4. 使用微功率无线电设备, 必须忍受各种无线电业务的干扰或工业、科学及医疗应用设备的辐射干扰;
5. 不得在飞机和机场附近使用。

RE Directive

Hereby, Renesas Electronics Corporation declares that the radio equipment type RTK0EN0001D01001BZ is in compliance with Directive 2014/53/EU.

REVISION HISTORY	Target Board for RX23W User's Manual
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		Page	Summary
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RX23W Group

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