User's Manual

32

RX130 Group

Target Board for RX130 User's Manual

RENESAS 32-Bit MCU

RX Family / RX100 Series

Renesas Electronics
www.renesas.com

Rev.1.01 Jul 2018

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(Rev.4.0-1 November 2017)

Precautions

The following precautions should be observed when operating any Target Board for RX130 product:

The Target Board 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 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 RX130 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 RX130 hardware.	Target Board for RX130 User's Manual	R20UT4169EJ
Schematics	Describes circuit schematics of the Target Board for RX130 in full detail	Target Board for RX130 Schematics	R20UT4166EJ
BOM LIST	Describes Bill of Materials of the Target Board for RX130	Target Board for RX130 BOM LIST	R12TU0043EJ
Application Note	Sample code description.	Target Board for RX130 Application Note	R20AN0469EJ
User's Manual: Hardware	Provides technical details of the RX130 microcontroller.	RX130 Group User's Manual: Hardware	R01UH0560EJ

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

Table of Contents

1. Overview

1.1 Contents

Thank you for purchasing the Renesas evaluation tool "Target Board for RX130". This product consists of the following item.

Target Board for RX130

1.2 Purpose

The Target Board for RX130 is an evaluation tool for Renesas microcontrollers. This manual describes the technical details of the Target Board for RX130 hardware.

1.3 Features

The Target Board for RX130 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 RX130 specifications.

Table 1-1: Board Specification Table

Item	Specification
Evaluation MCU	Part No: R5F51308ADFP
	Package: 100-pin LFQFP
	On-chip memory: ROM 512KB+8KB, RAM 48KB
Board Size	Size: 53.34mm x 90.0mm
	Thickness: 0.8mm
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
	Lead type: 2.54mm Pitch Through Hole x 3
Sub Clock *1	Lead type: Through Hole x 2 (KYUSHU DENTSU CO., LTD.: NC-26 Equivalent)
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-mini B, 5-pin
Pmod™ Connector *1	Connector: Angle type, 12-pin
MCU Header *1	Header: 50-pin, x 2
Cut Pattern	8 places
Power Selection Header *1	Header: 3-pin, x 1
Emulator Reset Header *1	Header: 2-pin, x 1

*1: Parts are not mounted (DNF).

1.6 Block Diagram

Figure 1-1 shows the block diagram of the Target Board for RX130.

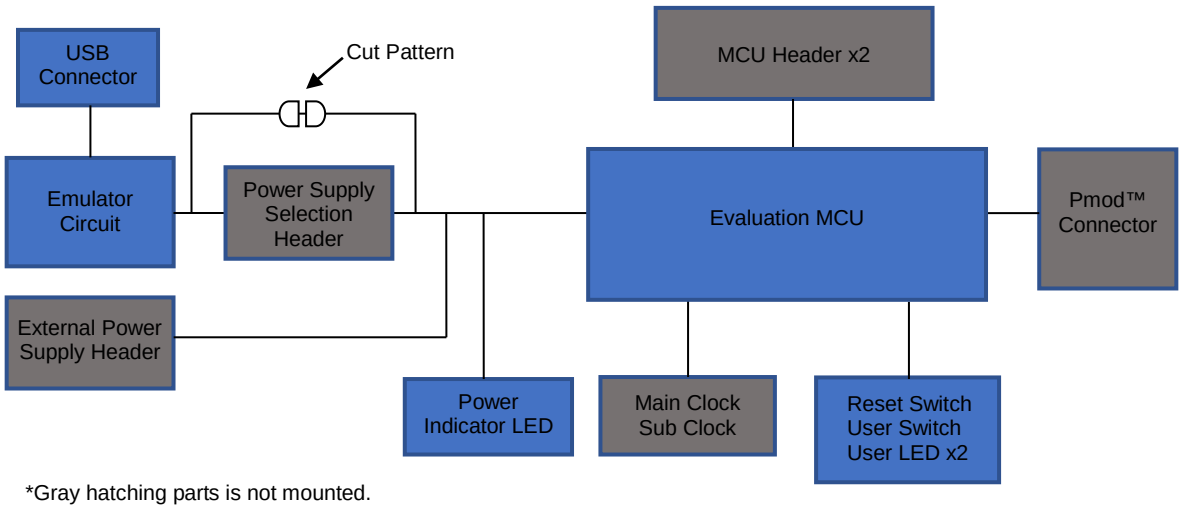

Figure 1-1: Block Diagram

2. Board Layout

Figure 2-1 shows the external appearance of the top side of Target Board for RX130.

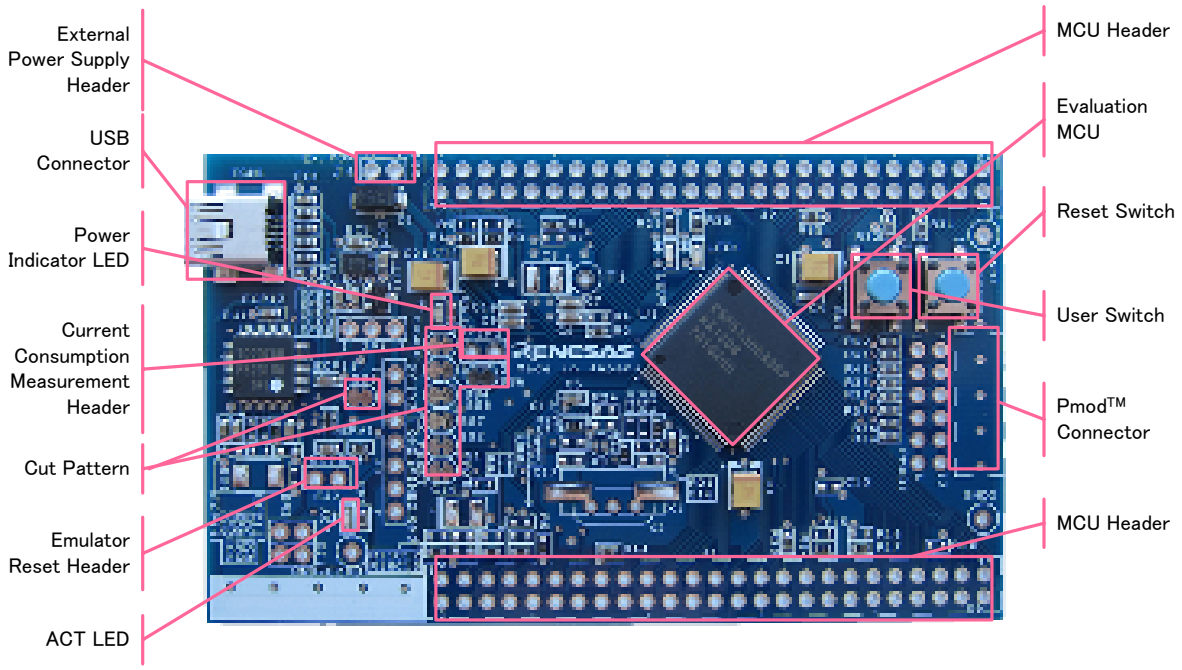

Figure 2-1: Board Layout (Top Side)

3. Parts Layout

Figure 3-1 shows the parts layout of Target Board for RX130.

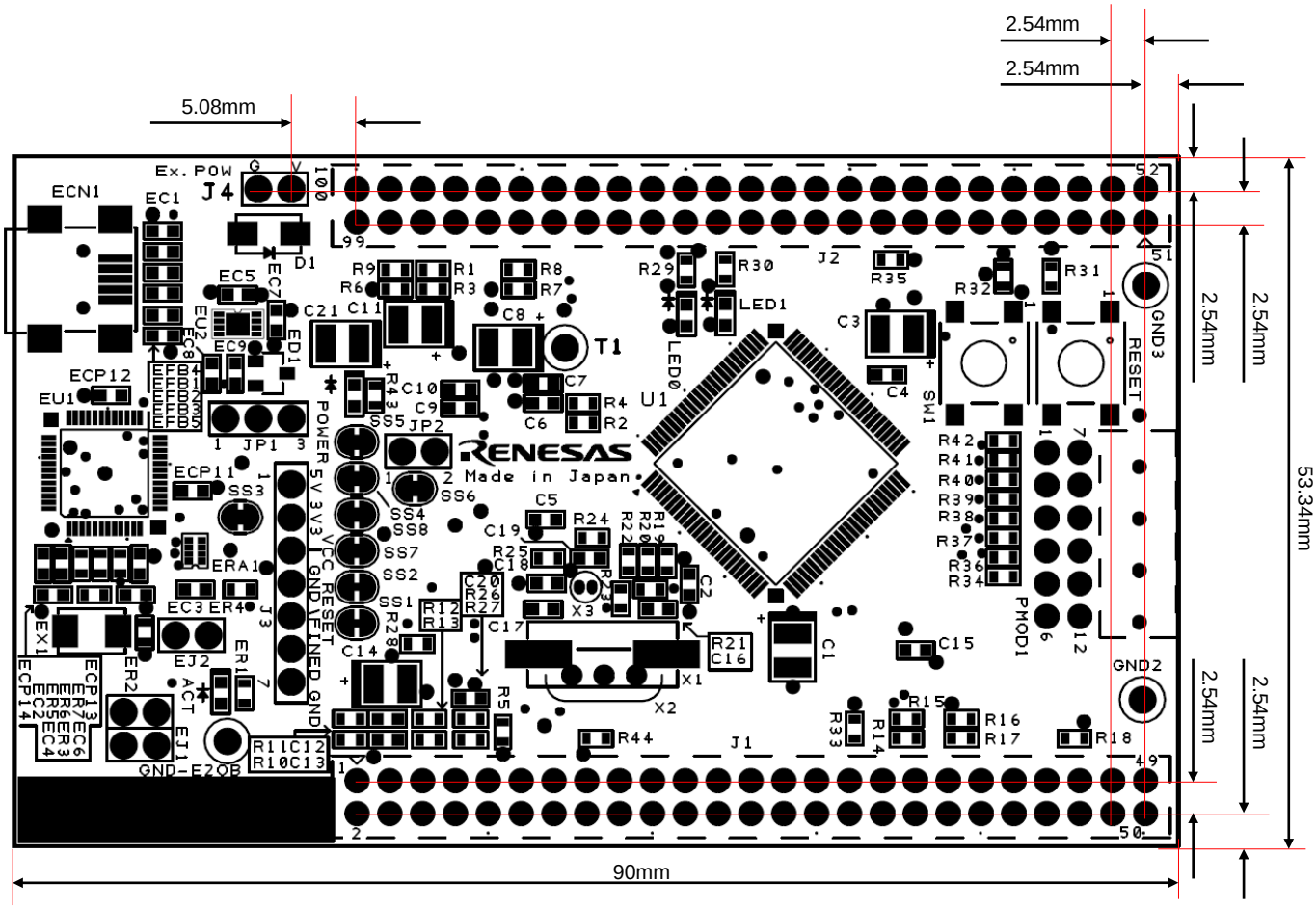

Figure 3-1: Parts Layout

4. Operating Environment

Figure 4-1 shows the operating environment of the Target Board for RX130. 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

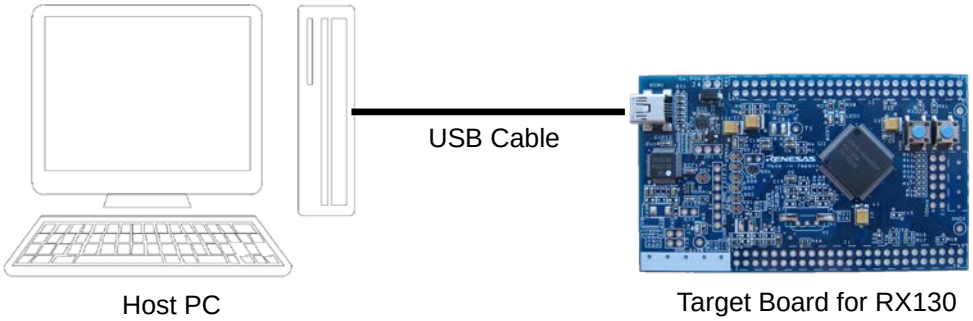

Figure 4-1: Operating Environment

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 USB Connector

The connector shape is USB mini -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 will be automatically power-supplied with the cable connection.
Note: USB cable is not included in the package.

5.3 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)

5.4 Power LED

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

5.5 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: 80pin, Port PD6
LED1: 79pin, Port PD7

5.6 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 5-1** shows the pin assignment of the Pmod ™ connector and **Table 5-1** 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)

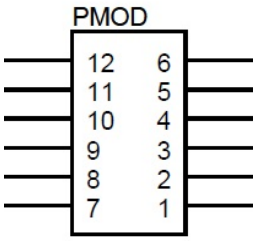

Figure 5-1: Pmod™ Connector Pin Assignment (Top View)

Table 5-1: 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	PA4	66	7	PMOD1-IRQ	P15	31
2	PMOD1-MOSI	PA6	64	8	PMOD1-RST	P17	29
3	PMOD1-MISO	PA7	63	9	PMOD1-IO0	PC3	49
4	PMOD1-SCK	PA5	65	10	PMOD1-IO1	PC2	50
5	GROUND	-	-	11	GROUND	-	-
6	TARGET_VCC	-	-	12	TARGET_VCC	-	-

5.7 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 (J4) for power supply. The available voltage depends on the evaluation MCU. When using this header, cut SS1, SS2, SS4, SS5, SS7, SS8 and the bottom side cut pattern and separate the emulator and the target electrically. **Figure 5-2 and Figure 5-4** show the position of the cut pattern, **Figure 5-3** shows the position of the external power supply header. (header parts are not mounted)

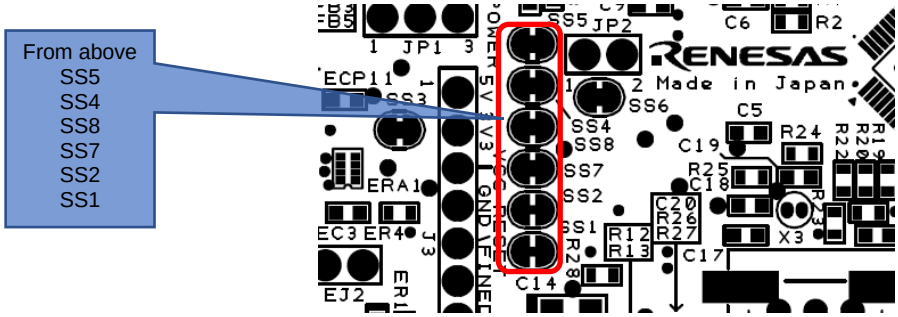

Figure 5-2: Position of Pattern SS1, SS2, SS4, SS5, SS7, SS8

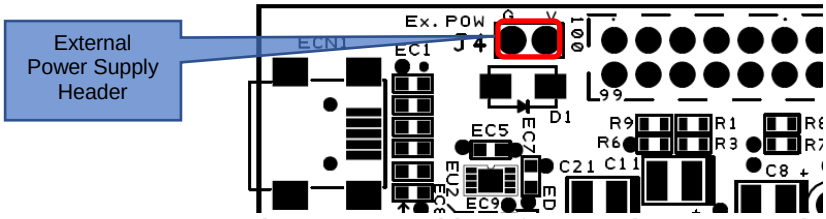

Figure 5-3: Position of External Power Supply

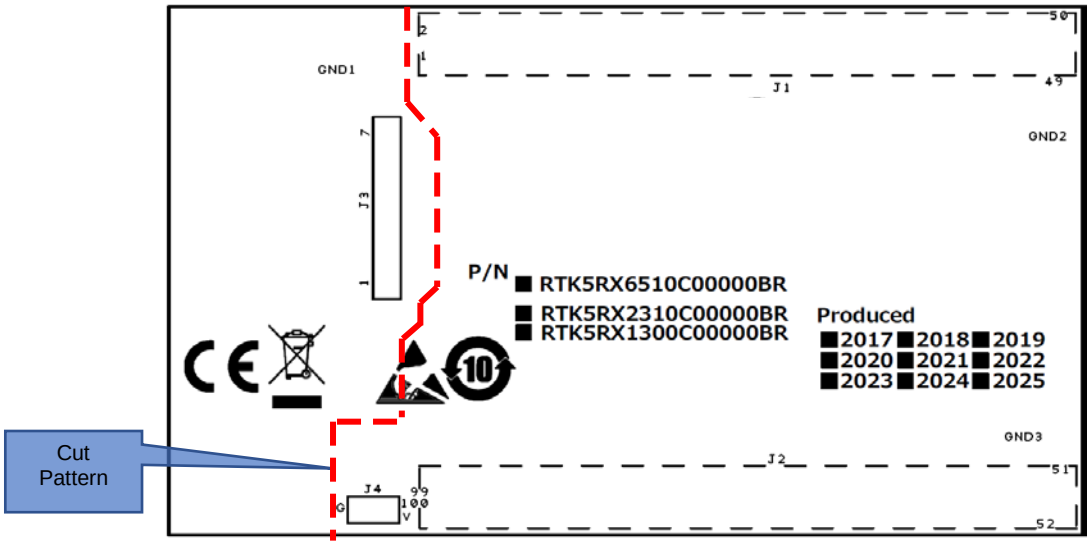

Figure 5-4: Position of Bottom Side Cut Pattern.

5.8 Current Consumption Measurement Header

The current consumption measurement header (JP2) 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 (SS6) should be cut when using this header. **Figure 5-5** shows the position of the header and cut pattern. (header parts are not mounted)

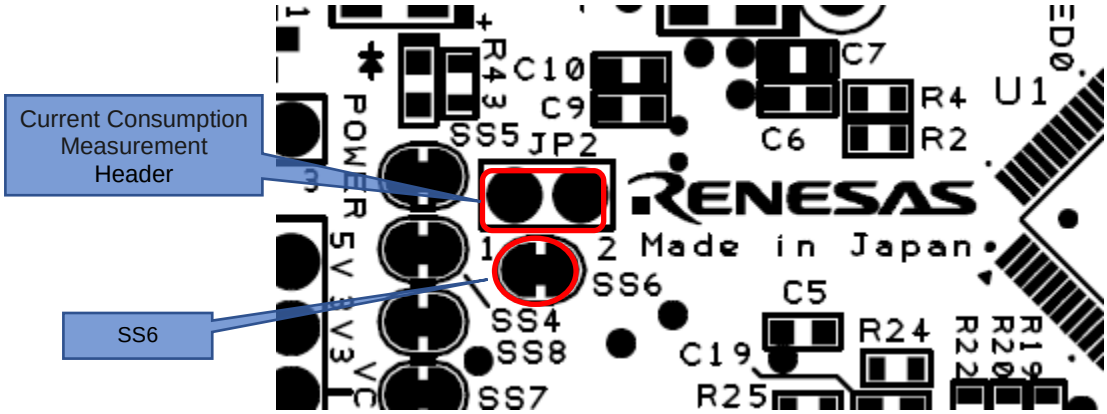

Figure 5-5: Position of Current Consumption Measurement Header and SS6 Cut Pattern

5.9 MCU Header

The MCU header is installed with two 50-pin headers (J1, J2). 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 100pin. (except 5, 8, 9 pins) (header parts are not mounted)

5.10 RESET Switch

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

5.11 User Switch

The user switch (SW 1) is an optional switch to be used if necessary. It is connected to 59pin and PB 1 port of the evaluation MCU. The interrupt is assigned to IRQ 4.

5.12 Cut Pattern

All cut patterns are set to the connected state at the time of factory shipment. Cut or repair soldering if necessary. **Figure 5-6** show the example of the cut patterns.

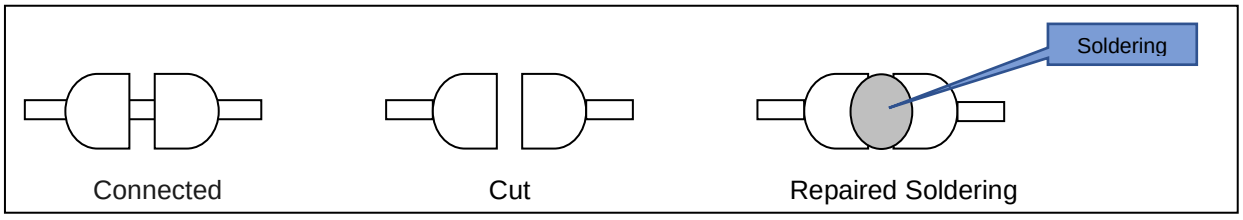

Figure 5-6: Cut Pattern Treatment Example

When repairing the cut pattern on the bottom side, repair soldering for SS7 and SS8 shown in **Figure 5-2**.

5.13 Emulator Reset Header

The emulator enters the forced reset state by short-circuiting the emulator reset header (EJ2). The evaluation MCU can be operated independently without controlling the IDE. **Figure 5-7** shows the emulator reset header position. (header parts are not mounted)

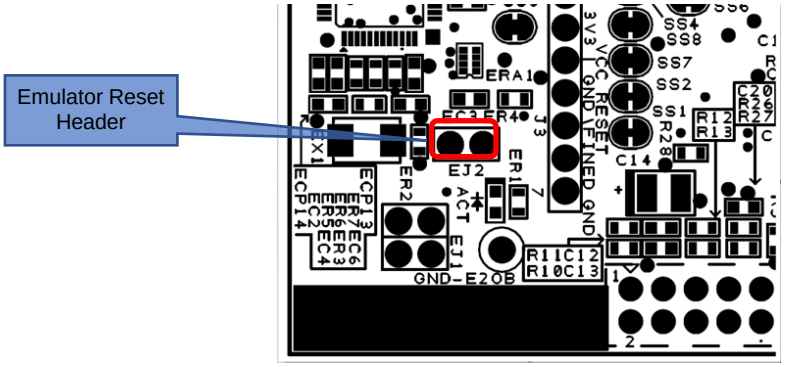

Figure 5-7: Position of Emulator Reset Header

5.14 Power Supply Selection Header

The operating voltage of the evaluation MCU can be changed. (5 V or 3.3 V) To change the operating voltage, mount the header (JP 1) and cut the cut pattern (SS 3). **Figure 5-8** shows the 5V output and **Figure 5-9** shows the header status of 3.3V output. The position of the SS3 cut pattern is shown in **Figure 5-8**. 3.3 V is selected by SS 3 as the initial state at the time of shipment.

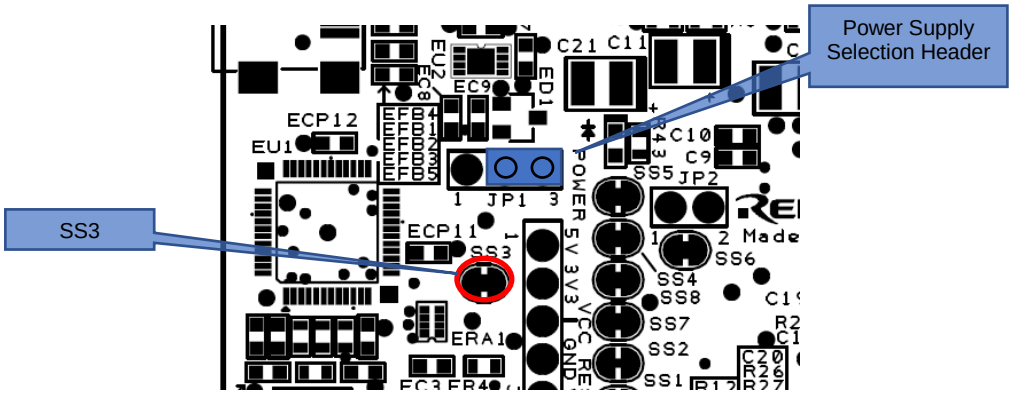

Figure 5-8: Header setting of 5V output, SS3 cut pattern position

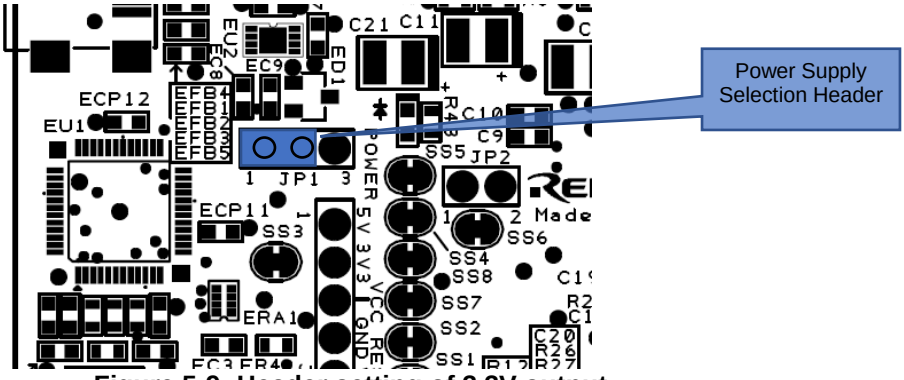

Figure 5-9: Header setting of 3.3V output

6. Configuration

6.1 Modifying the Target Board for RX130

This section describes how to change the Target Board for RX130 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 RX130 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, Table 6-2.**

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

12bit A/D, D/A Analog power supply source	Fit	DNF	Remarks
3.3V on the board	**R3, R6**	**R1, R9**	-
MCU Header	R1, R9	R3, R6	-

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	**R4, R7**	**R2, R8**	-
MCU Header	R2, R8	R4, R7	The bypass capacitors of C6, C7, C8 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	**R19, R23**	**R20, R22**	-
Stop	R20, R22	R19, R23	Mount a crystal resonator on X1 or X2 and load capacitance on C16, C17.

Table 6-4: LOCO Option Link

LOCO setting	Fit	DNF	Remarks
Oscillation	**R25**	**-**	-
Stop	-	R25	Mount a crystal resonator on X3 and load capacitance on C18, C19.

7. Handling Precautions

7.1 Board Thickness

Please be extra careful when handling the Target Board for RX130 as the board is thin (0.8 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 RX130.

Debug hardware: Select [E2 Lite (RX)].
Power supply from the emulator: Select [No].

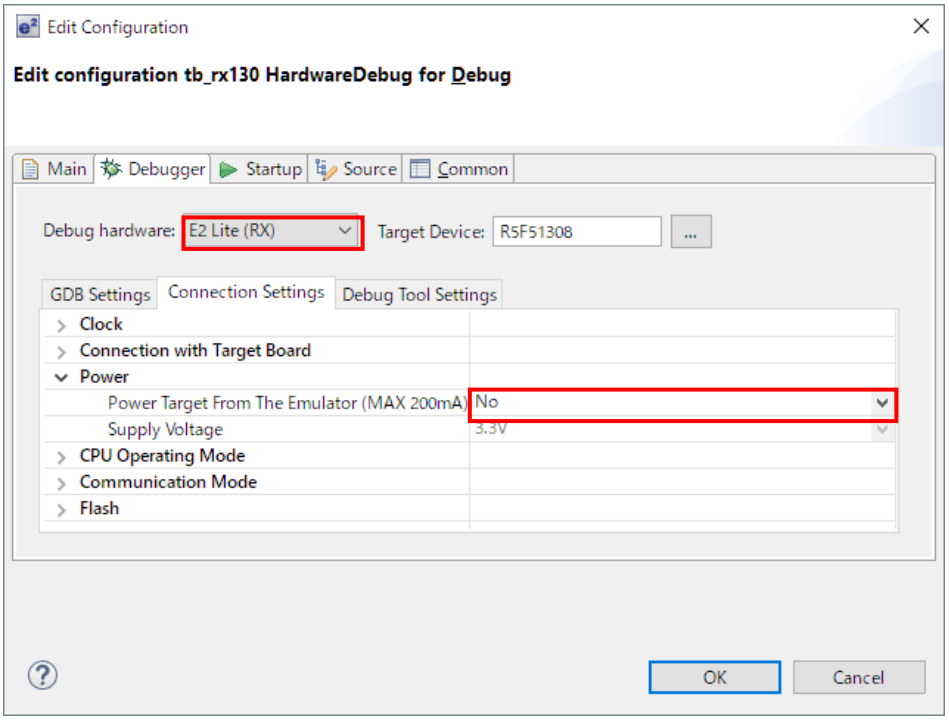

Figure 8-1: e2 studio settings

(Note) Do not connect another Target Board to your PC while connecting the Target Board for RX130.

9. Additional Information

Technical Support
For details on the RX130 Group microcontrollers, refer to the RX130 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

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REVISION HISTORY	Target Board for RX130 User's Manual

Rev.	Date	Description	
		Page	**Summary**
1.00	Oct 13, 2017	-	First Edition issued.
1.01	Jul 20, 2018	7	Section 1.4 Changes URL. Changes the wording.
		8	Section 1.6 Adds Block Diagram.
		12	Section 5.2 Clarified the application.
		16	Section 5.14 Partly changed wording, added factory condition.
		18	Section 7.4 Removes Communication with RFP.
		18	Section 7.4 Adds Target Board connection limit.
		19	Section 8 Words of note unified in Target Board.

Target Board for RX130 User's Manual

Publication Date:	Rev. 1.00	Oct 13, 2017
	Rev. 1.01	Jul 20, 2018

Published by: Renesas Electronics Corporation

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