

RL78/G15 Fast Prototyping Board

User's Manual

16

16-Bit Single-Chip Microcontrollers
RL78 Family

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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.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the basic specifications and correct usage of this product.

The target users are those who will be using it in evaluating MCUs and debugging programs.

The target readers of this manual require basic knowledge regarding the facilities of MCUs and debuggers.

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 Handling Precautions 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 RL78/G15 Fast Prototyping Board. Be sure to refer to the latest versions of these documents.

| Document Type | Description | Document Title | Document No. |
|--------------------------------|--|--|------------------------------|
| User's manual | Hardware specifications | RL78/G15 Fast Prototyping Board User's Manual | R12UM0042EJ (this manual) |
| Circuit schematics | Circuit schematics | RL78/G15 Fast Prototyping Board Circuit Schematics | R12TU0169EJ |
| Parts list | Parts list | RL78/G15 Fast Prototyping Board BOM LIST | R12TU0170EJ |
| User's manual for the hardware | Hardware specifications of the MCU (pin assignments, memory maps, peripheral function specifications, electrical characteristics, timing charts) and descriptions of operation | RL78/G15 User's Manual: Hardware | R01UH0959EJ |
| Application note | Usage of the RL78 debugging functions using the serial port | RL78 Debugging Functions Using the Serial Port | R20AN0632EJ |

2. List of Abbreviations and Acronyms

| Abbreviation | Full Form |
|--------------|---|
| Arduino™ Uno | Connectors compatible with the Arduino™ Uno R3 board are mounted on the fast prototyping board. |
| Pmod™ | Peripheral module |
| CPU | Central Processing Unit |
| DIP | Dual In-line Package |
| DNF | Do Not Fit |
| Grove | A connector that is compatible with Grove modules can be mounted on the fast prototyping board. |
| 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 |
| RAM | Random Access Memory |
| RFP | Renesas Flash Programmer |
| ROM | Read Only Memory |
| SPI | Serial Peripheral Interface |
| USB | Universal Serial Bus |
| TPU | Timer Pulse Unit |
| UART | Universal Asynchronous Receiver/Transmitter |
| WDT | Watchdog timer |

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1. Overview

This user's manual describes the RL78/G15 Fast Prototyping Board (RTK5RLG150C00000BJ) (hereinafter referred to as "this product").

1.1 Purpose

This product is an evaluation tool for a Renesas MCU. This user's manual describes the hardware specifications, ways of setting switches, and the basic setup procedure.

1.2 Features

- Programming of the Renesas MCU
- Debugging of user code
- User circuits for switches and LEDs
- Pmod™ connector*
- Arduino™ connector*

Note: We do not guarantee connection to all types of these connectors. For details on the connector specifications, refer to the descriptions in this document.

1.3 Preparation

- Watch the video on "Getting Started with Fast Prototyping Board for RL78 Family".
<https://www.renesas.com/video/getting-started-fast-prototyping-board-rl78-family>
- Install the integrated development environment (IDE) and required software on the host PC.
<https://www.renesas.com/development-tools>
- Prepare a micro-USB cable for data transfer.
- Refer to the following Web page and prepare the E2 emulator if required.
<https://www.renesas.com/e2>
- Refer to the following Web page and prepare the E2 emulator Lite if required.
<https://www.renesas.com/e2lite>

1.3.1 Installing the e² studio IDE

For details on the procedure for installation, watch the video on “e² studio Quick Start Guide Video for RL78 Family - Installation”.

<https://www.renesas.com/software-tool/rl78-software-tool-course>

1. Download the installer for the latest version of the e² studio from the following Web page.
<https://www.renesas.com/software-tool/e-studio>
2. Unzip the downloaded zip file and run the installer file.
3. Select “RL78” for [Device Families].
4. Confirm that the latest version of Renesas CCRL has been selected as the compiler.
5. Select the [I accept the terms of the Software Agreements] checkbox and then click on the [Install] button.
6. When the software produces an installer window in the middle of installation, proceed with installation according to the instructions from the wizard.
7. After installation has finished, click on the [OK] button.

1.3.2 Installing the CS+ IDE

1. Download the installer for the latest version of CS+ for CC from the following Web page.
<https://www.renesas.com/software-tool/cs>
2. Unzip the downloaded zip file and run the installer file.
3. Click on [Begin CS+ Startup].
4. Confirm that [Tools for RL78 family] has been selected.
5. After installation has finished, click on the [OK] button.

1.4 Board Specification Table

Table 1-1 shows the board specifications.

Table 1-1 Board Specification Table

| Item | Specification |
|--|--|
| Evaluation MCU (RL78/G15 with 20 pins) | Part No.: R5F12068ASP |
| | Package: 20-pin LSSOP |
| | On-chip memory: 8-KB ROM, 1-KB RAM, 1-KB data flash memory |
| Board size | 53.34 mm x 68.58 mm |
| Power-supply voltage | VDD: 2.4 V to 5.5 V |
| Power-supply circuit*2 | USB connector: VBUS (5 V) or 3.3 V (default) |
| | External power supply: 2.4 V to 5.5 V |
| | E2 emulator or E2 emulator Lite |
| Current drawn | Max. 200 mA |
| Main clock*1 | OSC1: Crystal oscillator (surface-mount technology (SMT)) for the main system clock |
| | OSC2: Crystal oscillator or ceramic resonator (lead type) for the main system clock |
| Sub-clock | — |
| Push switches | Reset switch x 1 |
| | User switch x 1 |
| LEDs | Power indicator: green x 1 |
| | User: green x 2 |
| USB connector | Connector: Micro USB Type-B |
| Arduino™ connectors | Connectors: 6 pins x 1, 8 pins x 2, 10 pins x 1 The interfaces are compatible with the Arduino™ Uno R3 board. |
| Pmod™ connector | Connector: Angle type, 12 pins (2 x 6) x 1 |
| MCU headers*1 | Headers: 10 pins x 2 |
| USB-to-serial converter | Used as the interface with the RL78 COM port debug tool. FT232RQ from FTDI x 1 |
| USB-to-serial converter reset header | Header: 2 pins x 1 (open-circuit by default) |
| Current measurement header*1 | Header: 2 pins x 1 |
| Power-supply selection header*2 | Header: 3 pins x 1 |
| Emulator connector*1 | 14-pin connector for connecting an E2 emulator or E2 emulator Lite Emulator selection headers: 2 pins x 3 |

Notes: 1. This part is not mounted.

2. The intended source of power for the evaluation MCU on the board as shipped is VBUS (5 V). Setting a jumper is required if power is to be supplied from other sources. For details, refer to Chapter 5, User Circuits.

1.5 Block Diagram

Figure 1-1 shows the block diagram of this product.

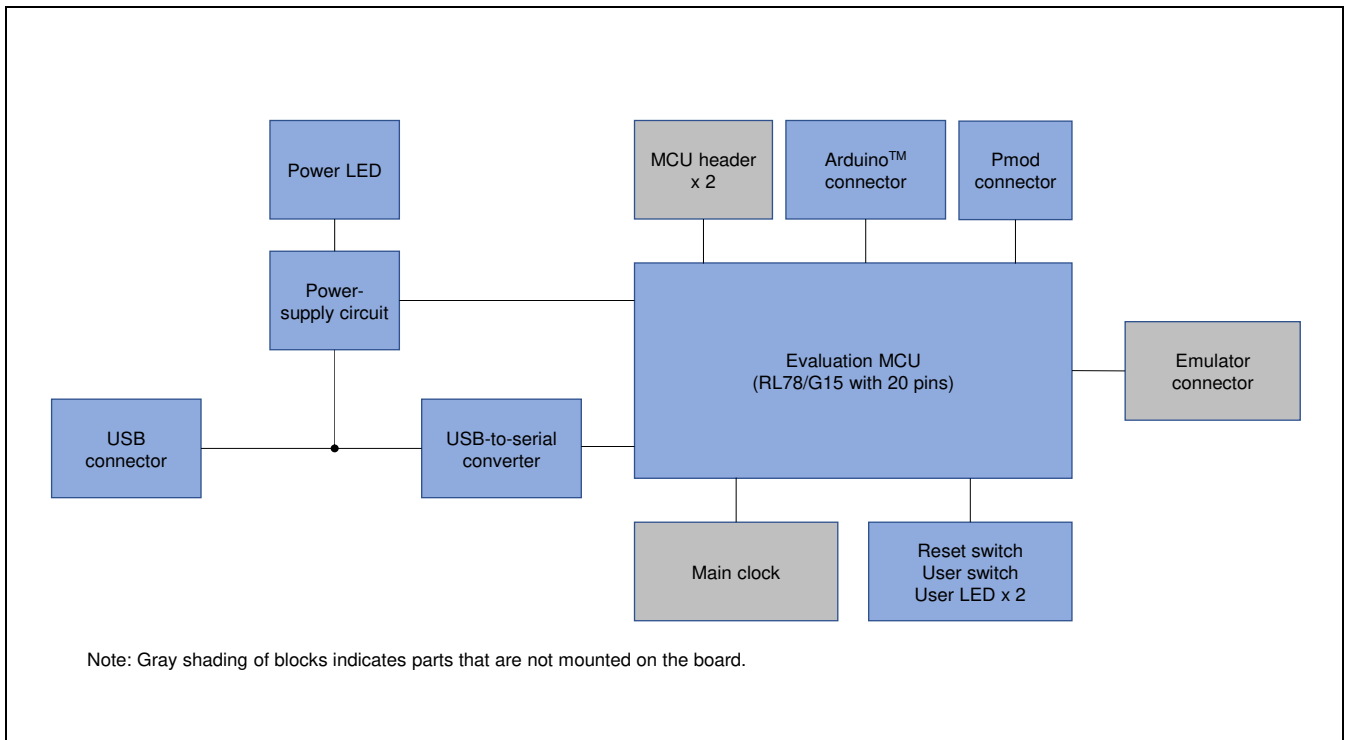


Figure 1-1 Block Diagram

2. Board Layout

Figure 2-1 shows the external appearance of the top side of this product.

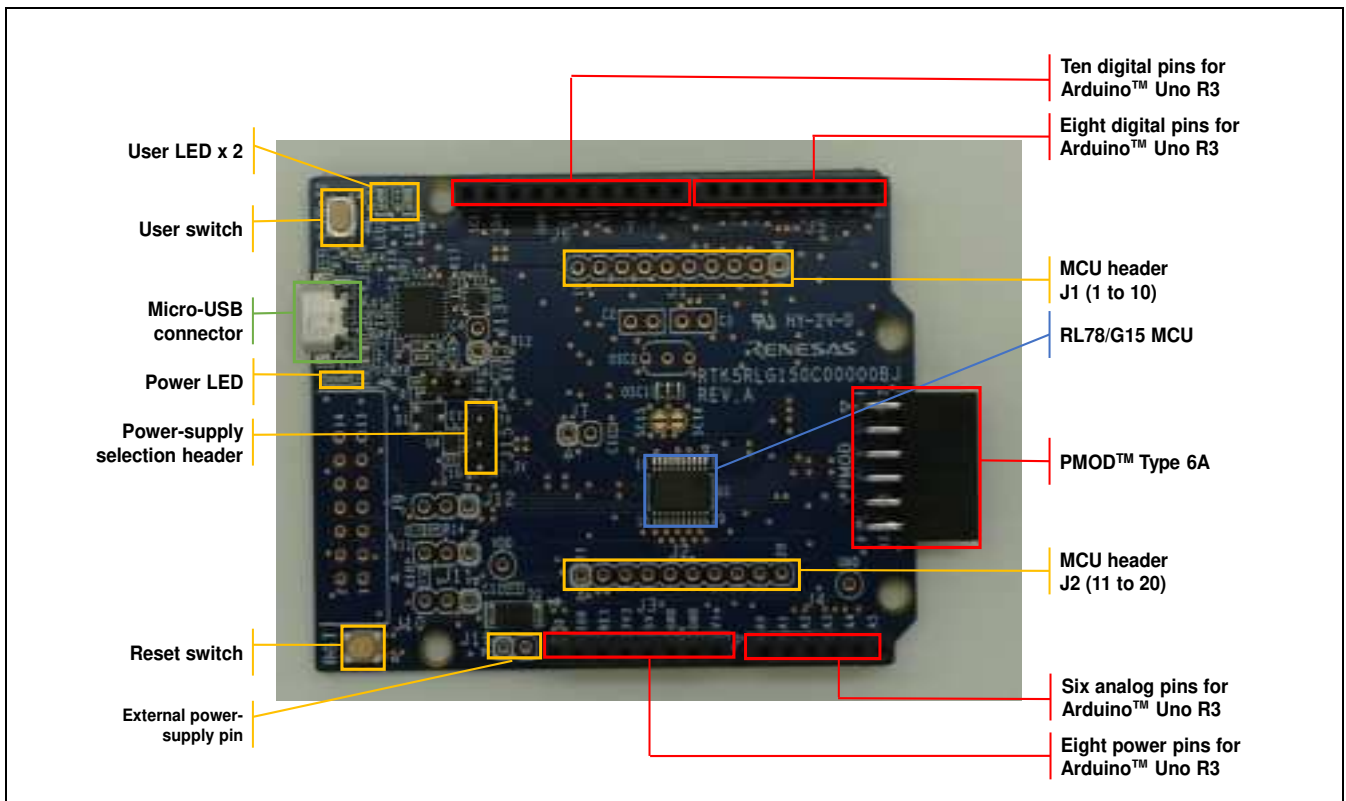


Figure 2-1 Board Layout (Top Side)

3. Parts Layout

Figure 3-1 shows the parts layout of this product.

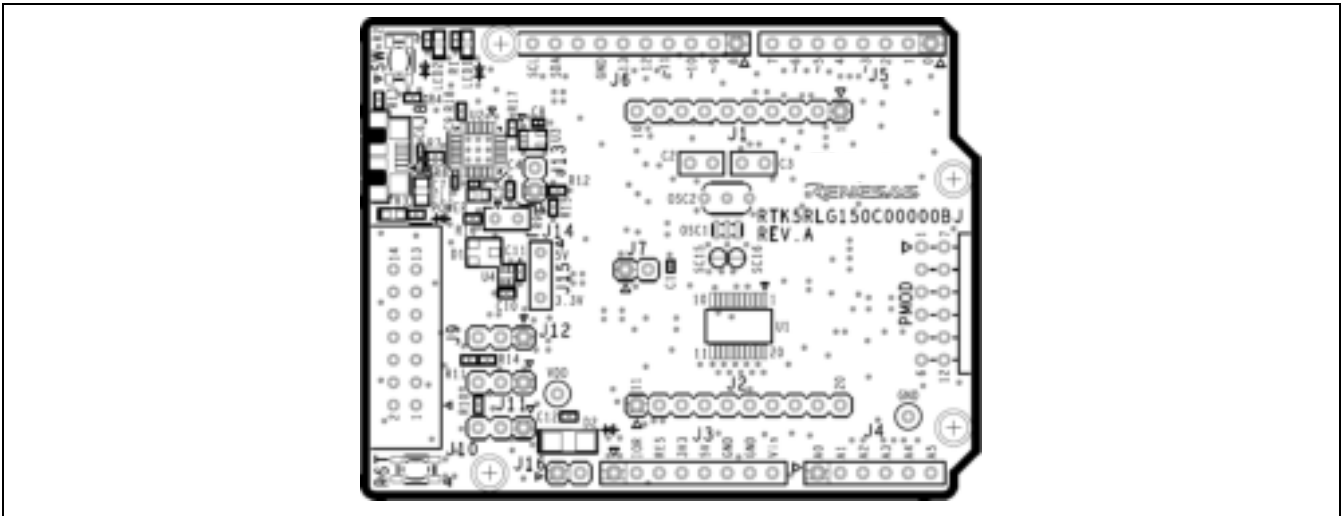


Figure 3-1 Parts Layout

Figure 3-2 shows the external dimensions of this product.

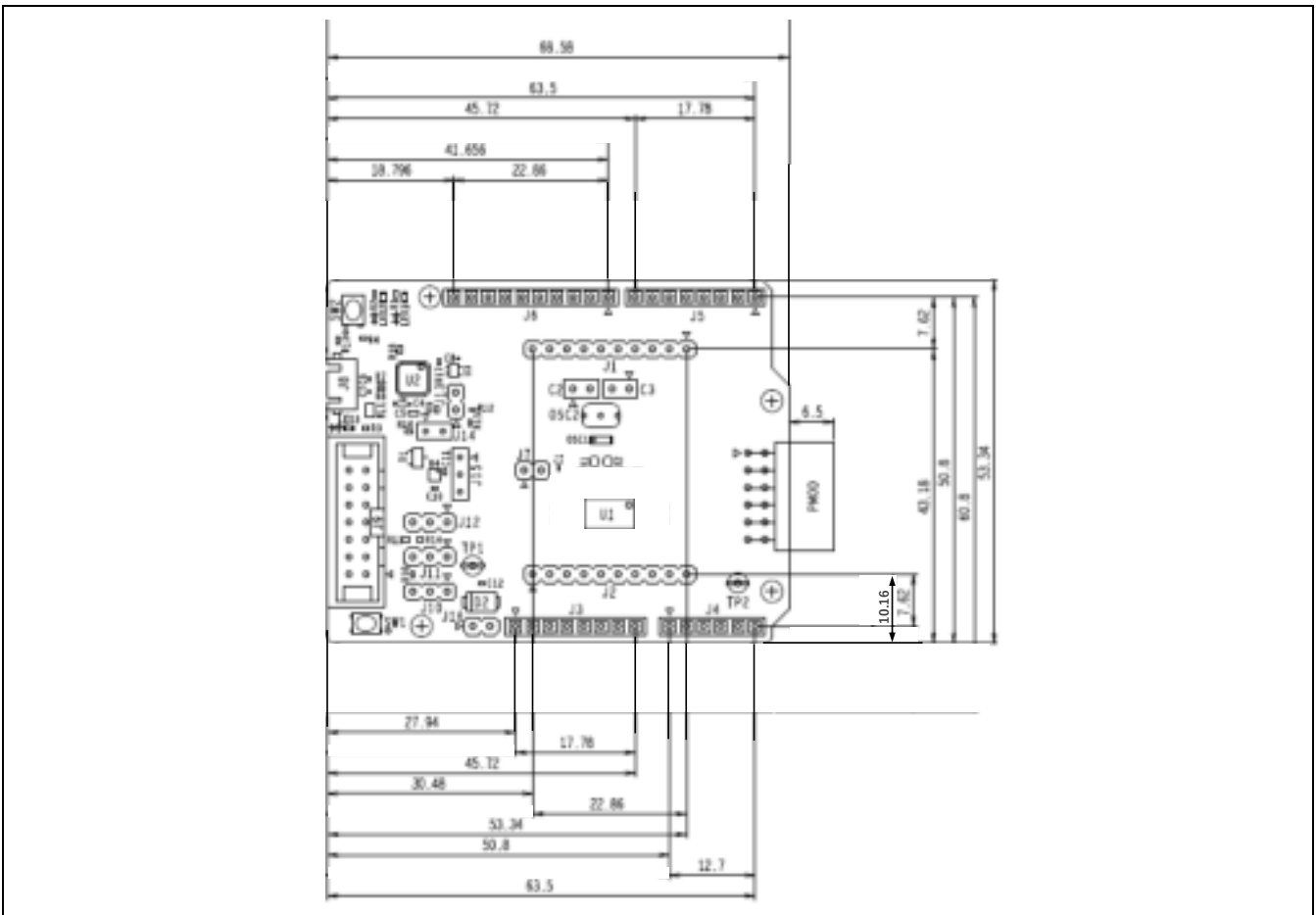


Figure 3-2 External Dimensions

4. Operating Environment

Figure 4-1 shows the operating environment of this product. Install the IDE on the host PC you are using.

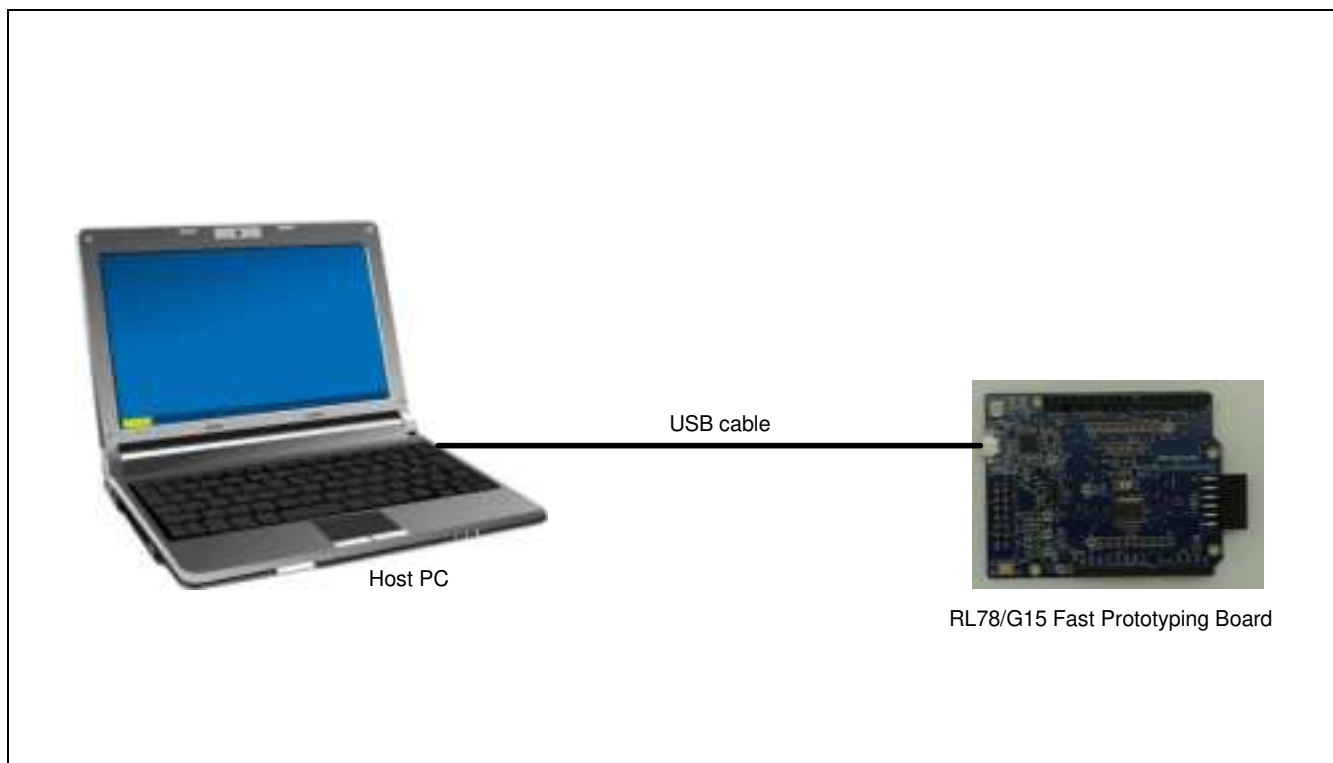


Figure 4-1 Operating Environment

5. User Circuits

5.1 Evaluation MCU

The specifications for the power supply, system clock, and reset of the evaluation MCU (RL78/G15) at the time of shipment are as follows.

- Power supply: 5 V (VBUS) supplied from the USB (including the analog power supply)
- System clock: Operation with an on-chip oscillator
- Reset: Directed by the reset switch or IDE

5.2 USB Connector

The connector shape is micro-USB Type-B. It serves as a power-supply input and an interface for communications with the RL78 COM port debug tool (through USB-to-serial conversion). Connect the USB connector to the host PC by a USB cable. If the power supply on the host side is on, the power is supplied to this product at the same time as connection of the cable.

Note: The package does not include a USB cable. Do not connect a USB cable while the emulator is supplying power.

5.3 Power LED

While the power LED is illuminated, VDD power is being supplied. The LED is green.

5.4 User LEDs

The optional user LEDs can be used for any purpose. LED1 and LED2 are mounted on the board and are respectively connected to the following ports. The LEDs are green.

- LED1: Pin 2, connected to port P20
- LED2: Pin 1, connected to port P21

5.5 Arduino™ Connectors

The specification of the Arduino™ connectors is on the assumption that Arduino™ shields are to be connectable. However, we do not guarantee connection to all types of Arduino™ shield. Confirm the specifications of this product against any Arduino™ shield you intend to use.

Figure 5-1 and Table 5-1 show the pin assignments of the Arduino™ connectors.

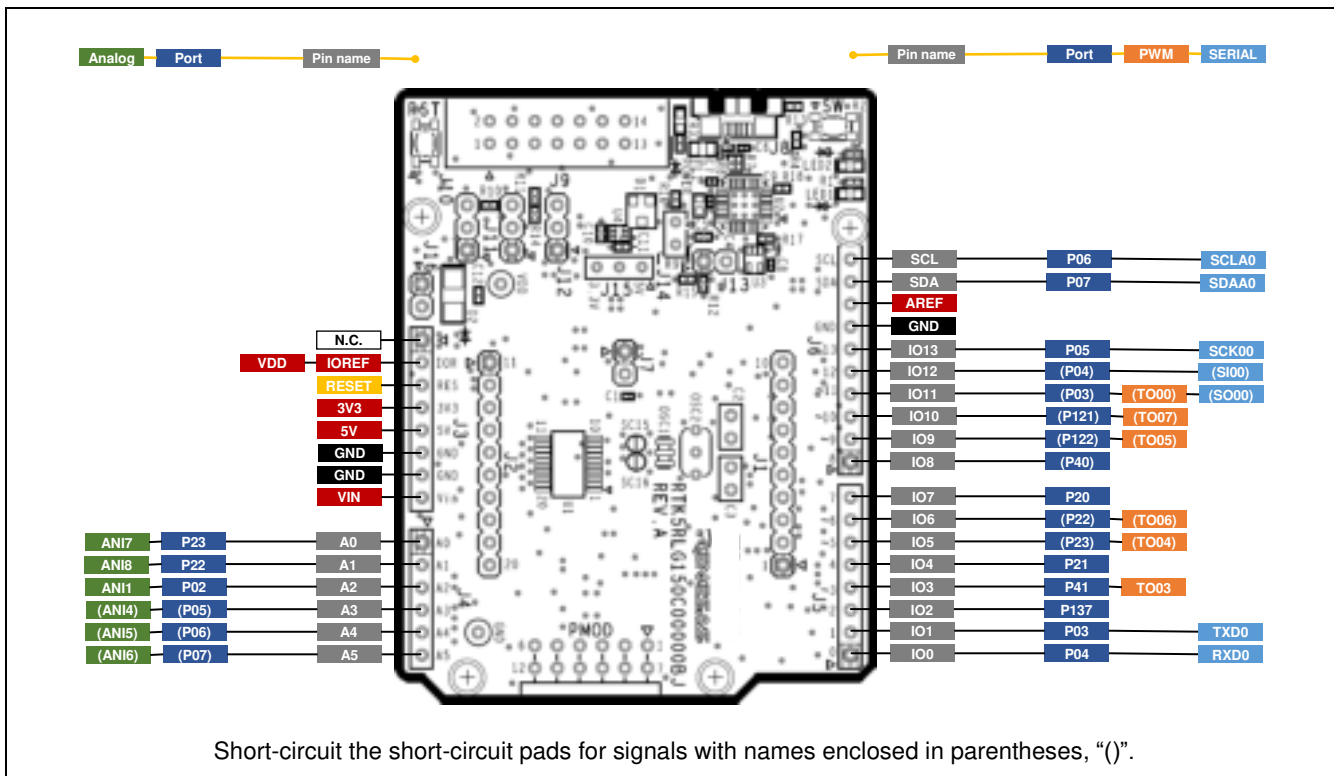


Figure 5-1 Pin Assignments of the Arduino™ Connectors

Table 5-1 Pin Assignments of the Arduino™ Connectors

| Part No. in the Circuit Schematics | Name of Arduino™ Signal*1 | RL78/G15*2 *3 | | | | | | |
|------------------------------------|---------------------------|---------------|--------------|--------|--------|--------|----------|--------|
| | | Pin | Power Supply | Port | Analog | PWM | Serial | Others |
| J3-1 | N.C. | - | - | - | - | - | - | - |
| J3-2 | IOREF | 10 | VDD | - | - | - | - | - |
| J3-3 | RESET | 5 | - | - | - | - | - | RESET |
| J3-4 | 3V3 | - | - | - | - | - | - | - |
| J3-5 | 5V | - | - | - | - | - | - | - |
| J3-6 | GND | 9 | VSS | - | - | - | - | - |
| J3-7 | GND | 9 | VSS | - | - | - | - | - |
| J3-8 | VIN | - | - | - | - | - | - | - |
| J4-1 | A0 | 19 | - | P23 | ANI7 | - | - | - |
| J4-2 | A1 | 20 | - | P22 | ANI8 | - | - | - |
| J4-3 | A2 | 13 | - | P02 | ANI1 | - | - | - |
| J4-4 | A3 | (16) | - | (P05) | (ANI4) | - | - | - |
| J4-5 | A4 | (17) | - | (P06) | (ANI5) | - | - | - |
| J4-6 | A5 | (18) | - | (P07) | (ANI6) | - | - | - |
| J5-1 | IO0 | 15 | - | P04 | - | - | [RxD0] | - |
| J5-2 | IO1 | 14 | - | P03 | - | - | [TxD0] | - |
| J5-3 | IO2 | 6 | - | P137 | - | - | - | INTP0 |
| J5-4 | IO~3 | 3 | - | P41 | - | TO03 | - | INTP4 |
| J5-5 | IO4 | 1 | - | P21 | - | - | - | - |
| J5-6 | IO~5 | (19) | - | (P23) | - | (TO04) | - | - |
| J5-7 | IO~6 | (20) | - | (P22) | - | (TO06) | - | - |
| J5-8 | IO7 | 2 | - | P20 | - | - | - | - |
| J6-1 | IO8 | (4) | - | (P40) | - | - | - | TOOL0 |
| J6-2 | IO~9 | (7) | - | (P122) | - | (TO05) | - | - |
| J6-3 | IO~10 | (8) | - | (P121) | - | (TO07) | - | - |
| J6-4 | IO~11 | (14) | - | (P03) | - | - | ([SO00]) | - |
| J6-5 | IO12 | (15) | - | (P04) | - | - | ([SI00]) | - |
| J6-6 | IO13 | 16 | - | P05 | - | - | [SCK00] | - |
| J6-7 | GND | 9 | VSS | GND | - | - | - | - |
| J6-8 | ADREF | - | - | - | - | - | - | - |
| J6-9 | SDA | 18 | - | P07 | - | - | SDAA0 | - |
| J6-10 | SCL | 17 | - | P06 | - | - | SCLA0 | - |

Notes: 1. "x" in IOx and IO~x means a pin number for the Arduino™ IDE. The Arduino™ IDE will be supported in the future.

2. Short-circuit the short-circuit pads for signals with names enclosed in parentheses, "()".

3. When using a signal with "[]", require PIORx register setting.

5.6 MCU Headers

The MCU headers are provided as through holes J1 and J2 for a total of 10 pins. The pin headers have a pitch of 2.54 mm and the evaluation MCU is connected to the through holes for the headers.

Table 5-2 shows the pin assignments of the MCU headers.

Table 5-2 Pin Assignments of the MCU Headers

| Part No. in the Circuit Schematics | RL78/G15 | | |
|------------------------------------|----------|---|---------|
| | Pin | Port and Peripheral Modules | Others |
| J1-1 | 1 | P21/ANI9/IVCMP1/(INTP7)/(TO00) | LED2 |
| J1-2 | 2 | P20/ANI10/IVREF1/(INTP1)/(TI00)/(TI03/TO03)/((SCK01))/((SCL01)) | LED1 |
| J1-3 | 3 | P41/TI03/TO03/VCOUT1/(INTP4)/(TI02/TO02)/((SDA01))/((SO01)) | |
| J1-4 | 4 | P40/TOOL0/INTP2/(TI01/TO01)/(PCLBUZ0) | TOOL0 |
| J1-5 | 5 | P125*/RESET | RST |
| J1-6 | 6 | P137/INTP0/TI00 | SW |
| J1-7 | 7 | P122/X2/EXCLK/TI05/TO05/(INTP2) | X2 |
| J1-8 | 8 | P121/X1/TI07/TO07/(INTP3) | X1 |
| J1-9 | 9 | - | |
| J1-10 | 10 | - | |
| J2-1 | 11 | P00/SO00/TXD0/TOOLTXD/INTP6/(SCK01/SCL01)/(SCLA0) | TOOLTXD |
| J2-2 | 12 | P01/ANI0/SI00/RXD0/TOOLRXD/SDA00/INTP5/(TI02/TO02)/(SI01)/(SDA01)/(SDAA0) | TOOLRXD |
| J2-3 | 13 | P02/ANI1/VCOUT0/SCK00/SCL00/PCLBUZ0/INTP7/(TI01/TO01)/(SO01) | |
| J2-4 | 14 | P03/ANI2/IVCMP0/(TI00)/TO00/INTP4/((SO00/TXD0)) | |
| J2-5 | 15 | P04/ANI3/IVREF0/TI01/TO01/INTP3/((SI00/RXD0/SDA00))/((SO00/TXD0)) | |
| J2-6 | 16 | P05/ANI4/SO01/TI02/TO02/(INTP6)/((SCK00/SCL00))/((SI00/RXD0/SDA00)) | |
| J2-7 | 17 | P06/ANI5/SI01/SDA01/SCLA0/(INTP7)/(PCLBUZ0)/(SCK00/SCL00) | |
| J2-8 | 18 | P07/ANI6/SCK01/SCL01/SDAA0/(TO03)/(INTP5) | |
| J2-9 | 19 | P23/ANI7/(SCL01)/(INTP6)/TI04/TO04 | |
| J2-10 | 20 | P22/ANI8/(SDA01)/TI06/TO06/(INTP5) | |

Note: When the RL78 COM port debug tool is in use, use of the P125/RESET pin as P125 is prohibited.

5.7 Pmod™ Connector

The specification of the Pmod™ connector is on the assumption that Pmod™ modules are to be connectable.

The Pmod™ connector is assumed to be connected to the Pmod™ Interface Type 6A module*1. Using the short-circuit pads*2 to switch the wiring also allows connection of the Pmod™ connector to a Type 2A or 3A module*1.

Notes: 1. For details on the Pmod™ module from Renesas, refer to the Web site at:

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

- Obtaining the configuration in Figure 5-2 requires switching the wiring by using the short-circuit pads.

However, we do not guarantee connection to all types of Pmod™ module. Confirm the specifications of this product against any Pmod™ module you intend to use.

Figure 5-2 and Table 5-3 show the pin assignments of the Pmod™ connector.

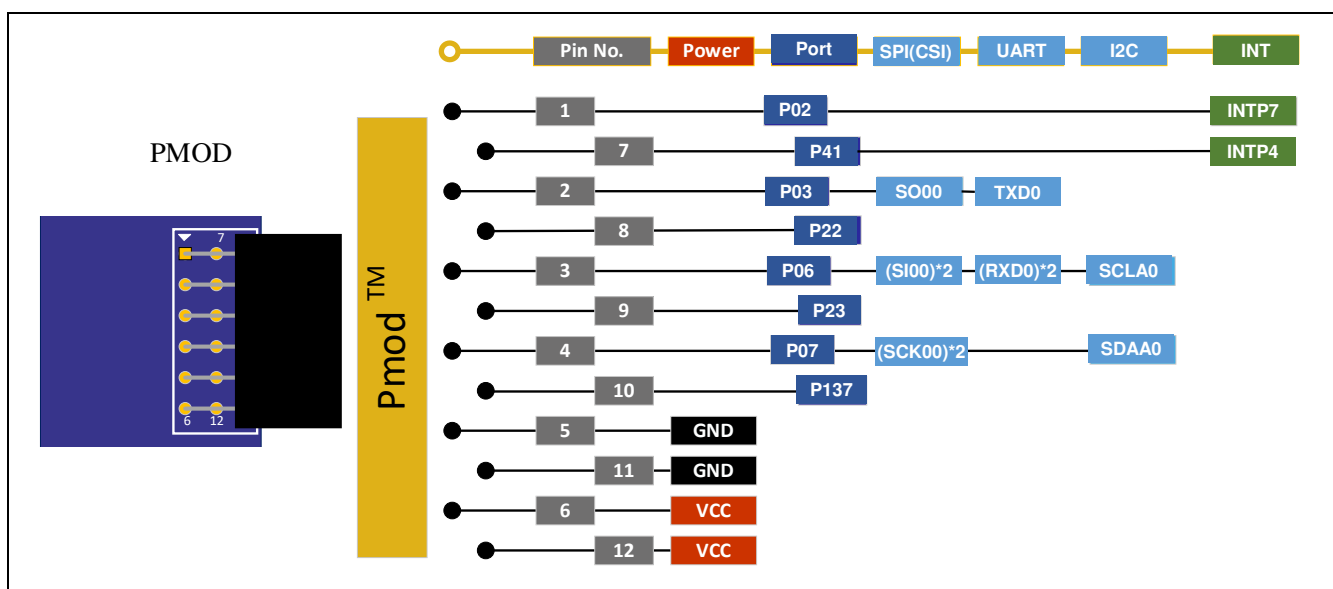


Figure 5-2 Pin Assignments of the Pmod™ Connector

Table 5-3 Pin Assignments of Pmod™

| Pin No. of Pmod™ | Name of Pmod™ Signal* ¹ [Type 6A (2A/3A)] | RL78/G15* ¹ | |
|------------------|---|------------------------|--|
| | | Pin | Signal Name [Type 6A (2A/3A)] |
| 1 | INT(SS/CTS) | 13 | INTP7/(P02) |
| 2 | RESET(MOSI/TXD) | 14 | P03/([SO00]/[TXD0]) |
| 3 | SCL(MISO/RXD) | 17 (15) | P06/SCLA0 (P04/[SI00]/[RXD0])* ² |
| 4 | SDA(SCK/RTS) | 18 (16) | P07/SDAA0 (P05/[SCK00])* ² |
| 5 | GND | - | GND |
| 6 | VCC | - | VCC |
| 7 | IO1(INT/GPIO) | 3 | P41/([INTP4]) |
| 8 | IO2(RESET/GPIO) | 20 | P22 |
| 9 | IO3(GPIO) | 19 | P23 |
| 10 | IO4(GPIO) | 6 | P137 |
| 11 | GND | - | GND |
| 12 | VCC | - | VDD |

Notes: 1. The signal names enclosed in parentheses, “()”, are specified for use with a Type 2A or 3A module.

2. To use the signals for Type 2A or 3A, make the following changes to settings.

Pattern for cutting [SS03]: cut

Pattern for cutting [SS04]: cut

Short-circuit pad [SC01]: short-circuit

Short-circuit pad [SC02]: short-circuit

3. When using a signal with “[]”, require PIORx register setting.

5.8 Clock

Clock circuits are provided to handle the clock sources for the evaluation MCU. For details on the specifications of the evaluation MCU, refer to the RL78/G15 User's Manual: Hardware. For details on the clock circuit of this product, refer to the circuit schematics of the RL78/G15 Fast Prototyping Board. Table 5-4 shows the details of the clocks on the RL78/G15 Fast Prototyping Board.

Table 5-4 Details of Clocks

| Clock | Function and Usage | State as Shipped | Frequency | Package for the Oscillator |
|-------|---|------------------|-----------|----------------------------|
| OSC1* | Crystal oscillator for the main system clock | Not mounted | n/a | SMT |
| OSC2* | Crystal oscillator or ceramic resonator for the main system clock | Not mounted | n/a | Lead type |

Note: Use the main system clock by cutting the patterns for cutting [SS34] and [SS35] and short-circuiting the short-circuit pads [SC15] and [SC16].

5.9 Reset Switch

Pressing the reset switch (RST) applies a hardware reset to the evaluation MCU.

5.10 User Switch

An optional user switch (SW) is mounted. It is connected to pin 6 of the evaluation MCU, which operates as pin function P137. The INTP0 interrupt is multiplexed on the same pin.

5.11 USB-to-Serial Converter

A USB-to-serial converter (FT232RQ) from FTDI is mounted on the board and is usable with the standard driver of Windows 10. For other operating systems, install the driver by downloading from the following Web site of FTDI.

<http://www.ftdichip.com/Drivers> -> VCP Drivers

The USB-to-serial converter reset header (J14) is open-circuit; it is recognized as a COM port when the host PC is connected to this board via a USB cable.

As the interface with the RL78 COM port debug tool, the USB-to-serial converter enables debugging and programming of the evaluation MCU. Refer to Chapter 7, Developing Code. Note that the P40, P01, and P00 pins of the evaluation MCU are respectively occupied as the TOOL0, TOOLRxD, and TOOLTxD functions.

When the RL78 COM port debug tool is in use, use of the P125/RESET pin as the P125 port pin is prohibited. Do not make the option byte setting for using P125.

For the method of COM port debugging, refer to the application note, RL78 Debugging Functions Using the Serial Port (R20AN0632).

When the USB-to-serial converter is not used as the interface with the RL78 COM port debug tool, using the RxD0 and TxD0 functions of the P01 and P00 pins enables UART communications between the host PC and the evaluation MCU. The user needs to prepare the terminal software, such as TeraTerm.

5.12 USB-to-Serial Converter Reset Header

The USB-to-serial converter is placed in the forced reset state by short-circuiting its reset header (J14). If the evaluation MCU alone is to operate without the use of the RL78 COM port debug tool, place the USB-to-serial converter in the reset state. This allows the use of P01 (RxD0) and P00 (TxD0) as facilities other than for a UART, such as port pins, while a reset is being applied to the USB-to-serial converter. Even if P01 and P00 are used as facilities other than for a UART, such as port pins, the board must be connected to the host PC by using the USB cable. Figure 5-3 shows the position of the USB-to-serial converter reset header.

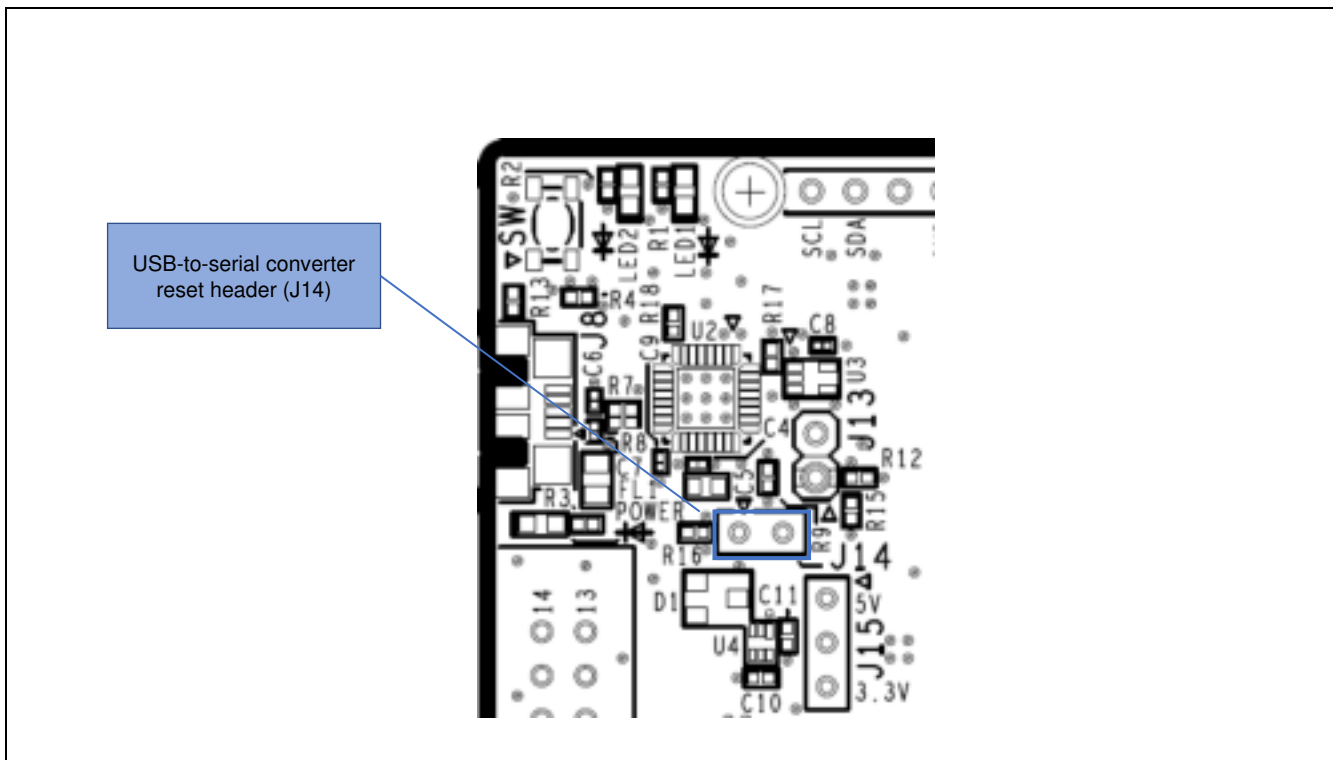


Figure 5-3 Position of the USB-to-Serial Converter Reset Header (Top Side)

5.13 Power-Supply Selection Header

The operating power (VDD) of the evaluation MCU can be changed to 5 V or 3.3 V or to supply from the emulator or external power with the use of a header (J15). Only change the jumper setting of J15 while power is not being supplied.

- 1-2 of J15 being short-circuit selects a 5-V power supply. This is the default setting as shipped (Figure 5-4).
- 2-3 of J15 being short-circuit selects a 3.3-V power supply (Figure 5-5).
- J15 being open-circuit selects supply from the emulator or external power (Figure 5-6).

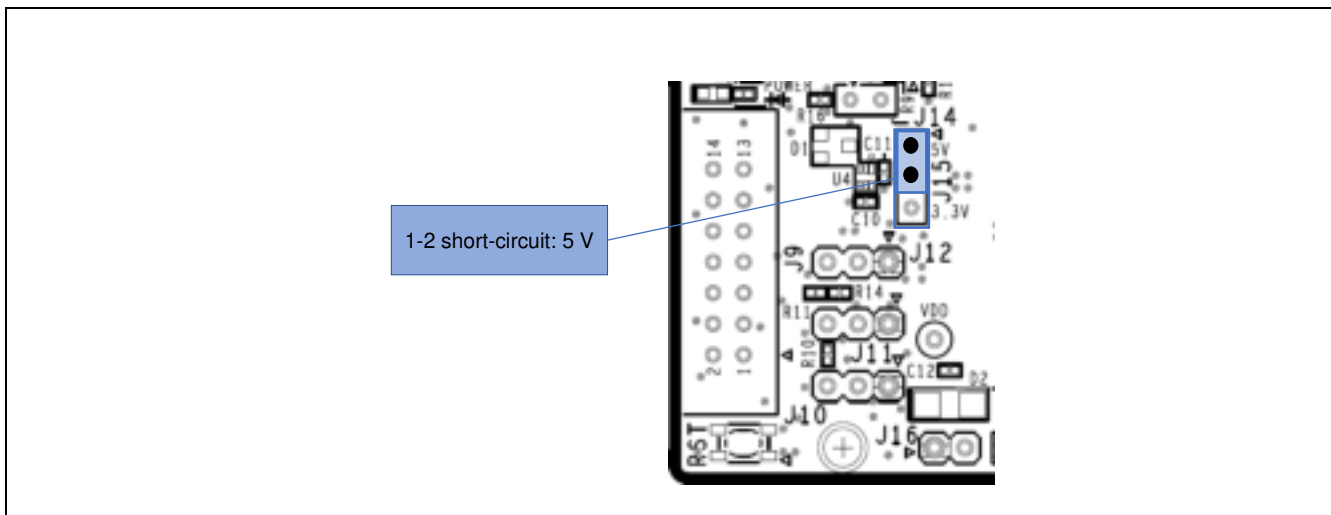


Figure 5-4 Setting of the Header to Select a 5-V Power Supply (Top Side)

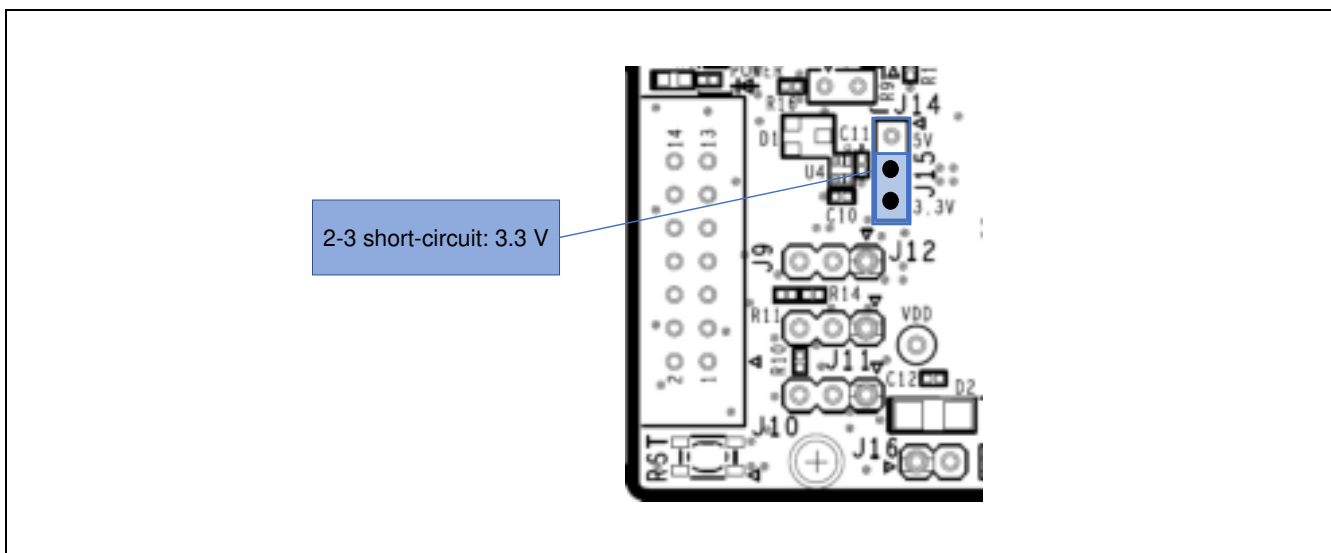


Figure 5-5 Setting of the Header to Select a 3.3-V Power Supply (Top Side)

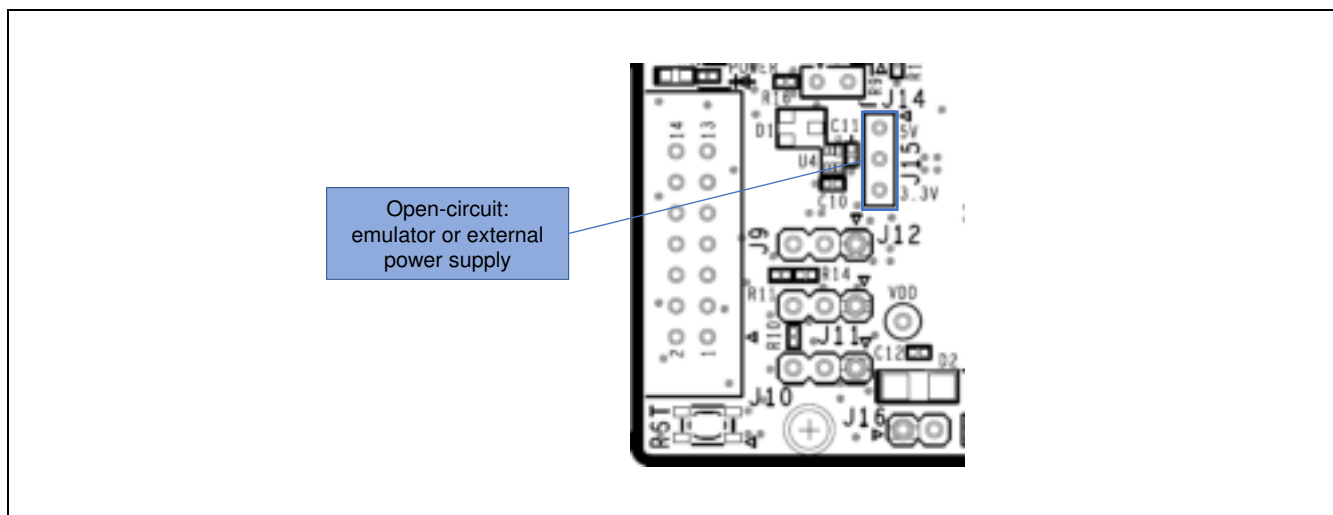


Figure 5-6 Setting of the Header to Select Supply from the Emulator or External Power (Top Side)

5.14 External Power Supply

When the evaluation MCU is to have a desired power-supply voltage, or when more current is required, use an external power supply. The usable voltages depend on the evaluation MCU.

Destinations for the connection of an external power supply:

- VDD: pin J16-1 on the external power-supply header
- GND: pin J16-2 on the external power-supply header

Figure 5-7 shows the positions of the external power supply.

When an external power supply is used, confirm that the I/O voltages for Arduino™ shields or Pmod modules are correct.

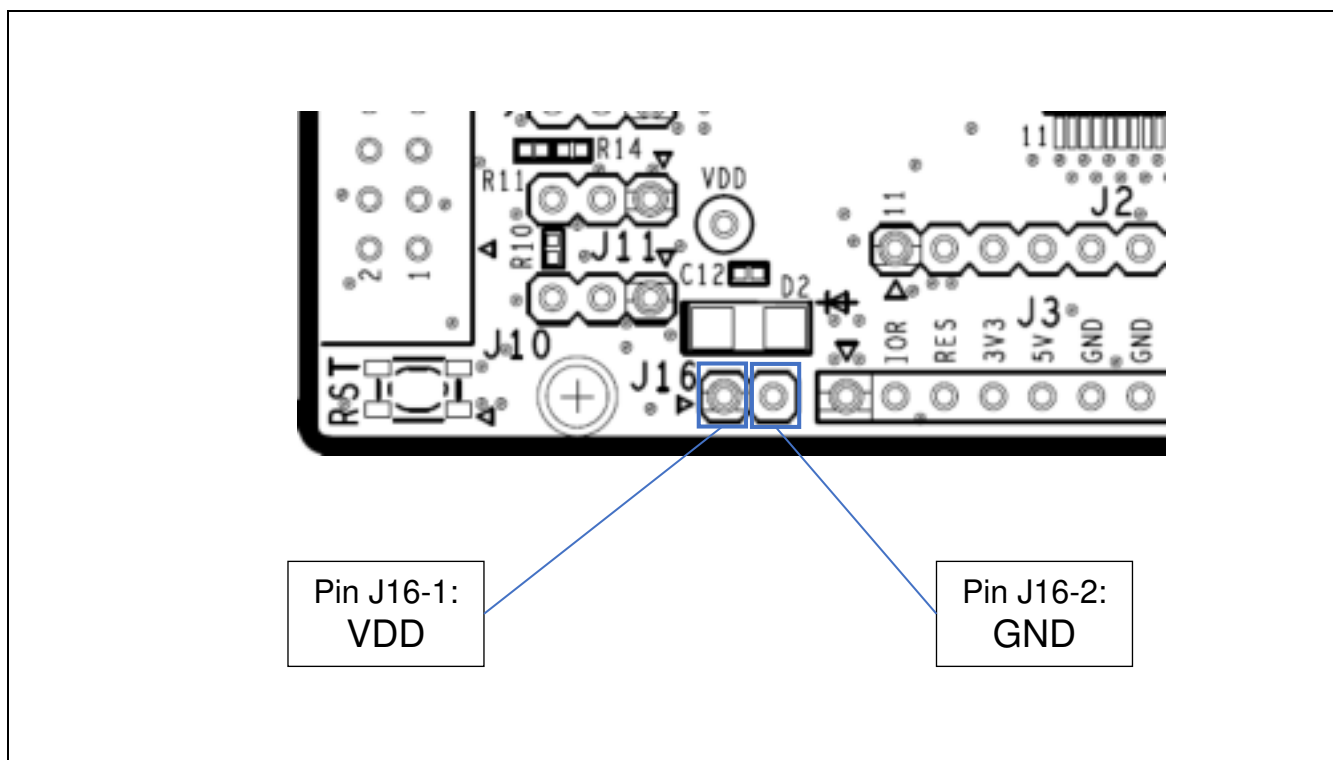


Figure 5-7 Positions of the Destinations for Connection of an External Power Supply (Top Side)

5.15 Current Measurement Header

This header (J7) is used to measure the current drawn by the evaluation MCU (J7 header components are not mounted). Connecting an ammeter to this product enables measurement of the current being drawn by the evaluation MCU. Take care to cut the given pattern for cutting (SS30) if this header is to be used. Figure 5-8 shows the positions of the current measurement header and pattern for cutting.

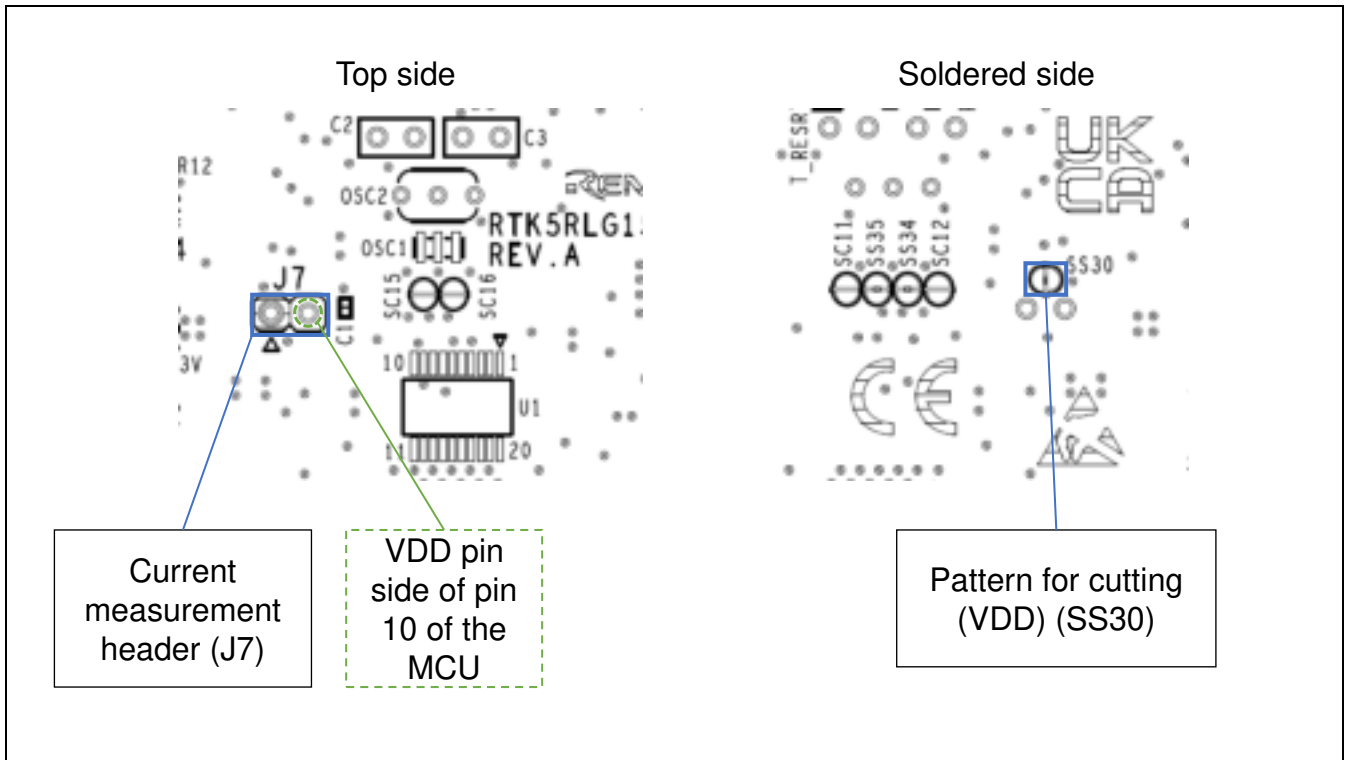


Figure 5-8 Positions of the Current Measurement Header and Pattern for Cutting (VDD)

Insert an ammeter between the sockets of the current measurement header (J7) to measure the current. Cut the pattern for cutting (SS27) (Figure 5-10) and turn down the LED to reduce the current drawn with an MCU other than the evaluation MCU.

Figure 5-9 is a block diagram of the power-supply lines related to the measurement of current drawn. For a block diagram of the power-supply circuit as a whole, refer to Figure 6-2.

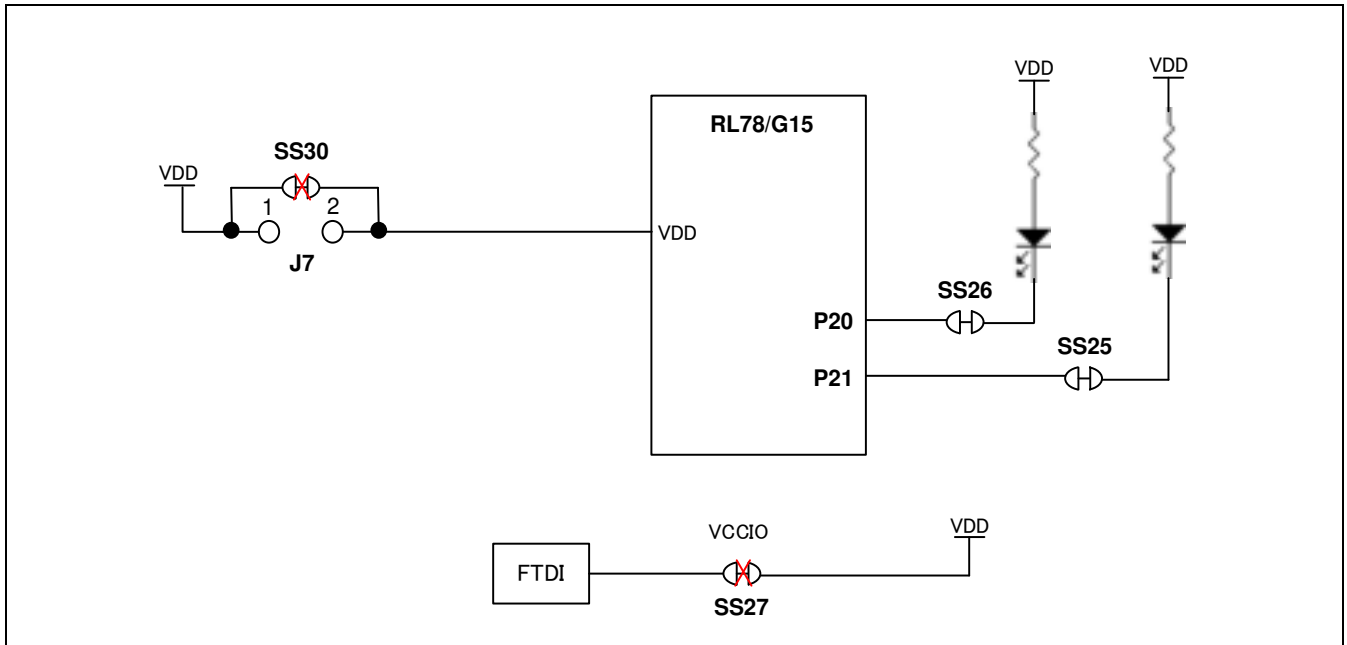


Figure 5-9 Block Diagram of the Headers Related to Current Measurement

5.16 Pattern for Cutting the I/O Power Supply for the USB-to-Serial Converter

If you intend to use this board without connecting a USB connector, cut the given pattern for cutting (SS27). Figure 5-10 shows the position of the pattern for cutting.

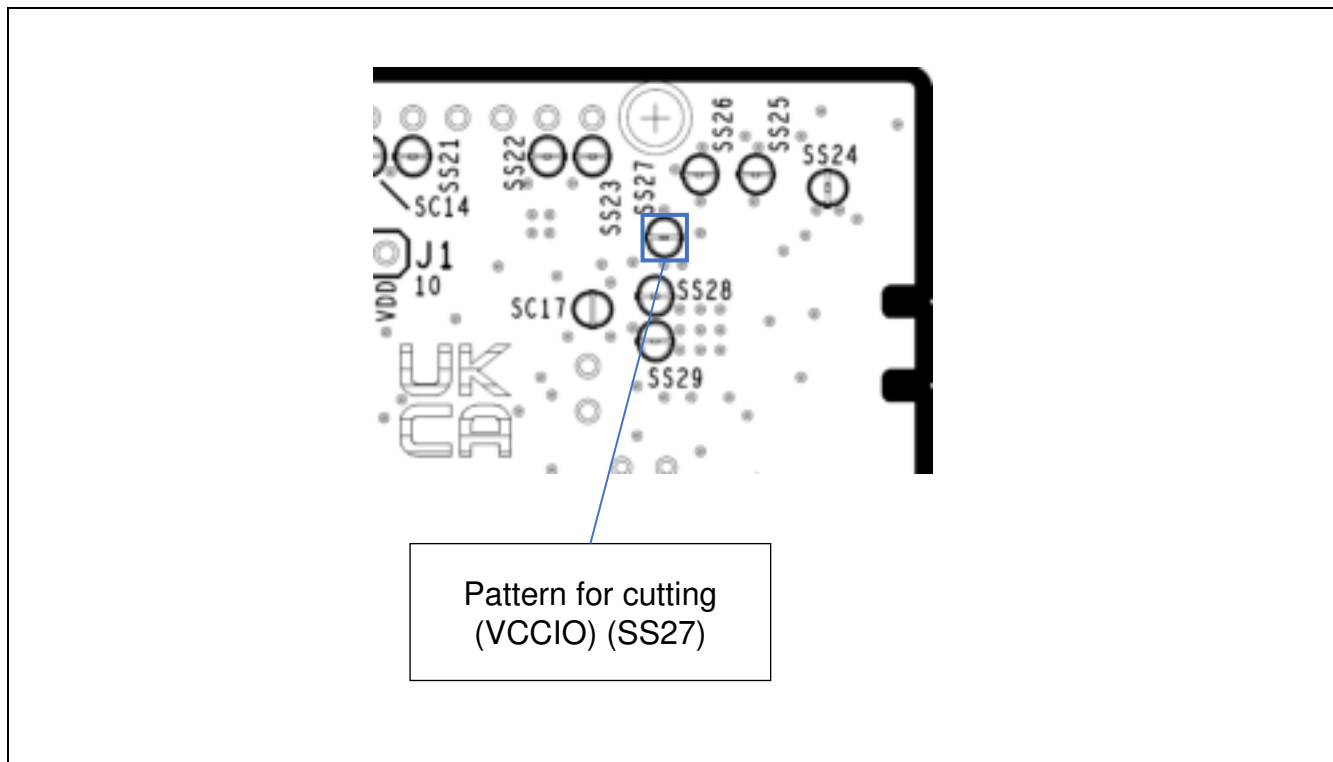


Figure 5-10 Position of the Pattern for Cutting (VCCIO)

5.17 Emulator Connector

This 14-pin connector (J9) is used to connect this product to an on-chip debugging E2 emulator or E2 emulator Lite, from Renesas Electronics, incorporating programming facilities. The emulator is used for programming or debugging the evaluation MCU.

To connect the emulator, change the circuit as follows.

- J9: 14-pin connector must be mounted.
- J10, J11, and J12: pins 2-3 are short-circuit
- Pattern for cutting [SS31]: cut
- Pattern for cutting [SS32]: cut
- Pattern for cutting [SS33]: cut

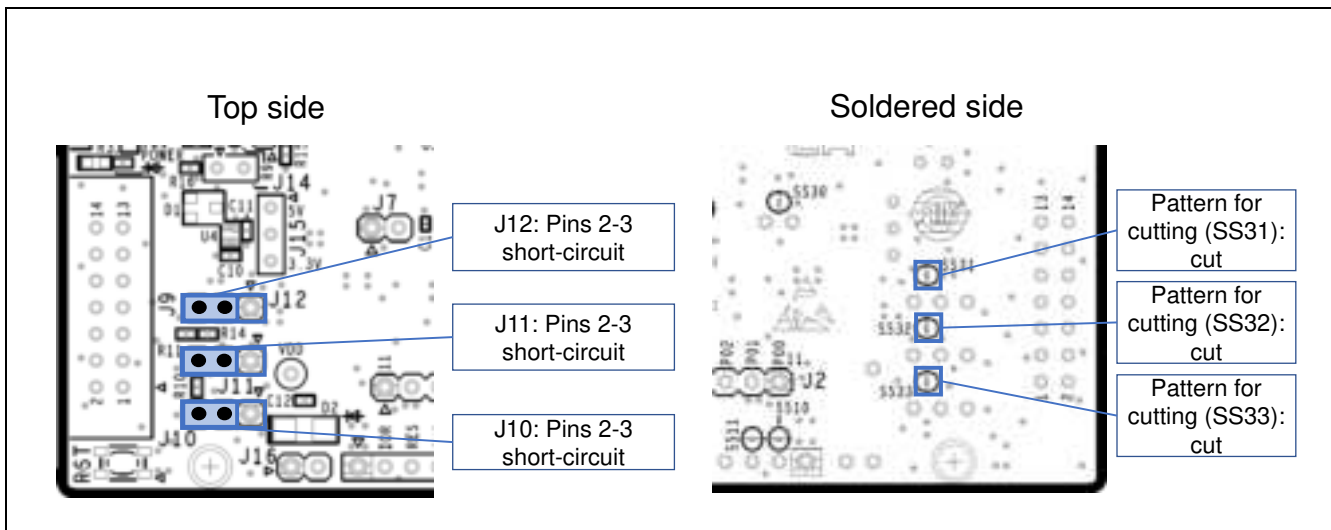


Figure 5-11 Settings for Use with the Emulator Connector

For the usage of the emulator, refer to the E1/E20/E2 Emulator, E2 emulator Lite Additional Document for User's Manual (Notes on Connection of RL78) (R20UT1994).

If you use COM port debugging with the use of the USB-to-serial converter, make the following change to settings as follows.

- J10, J11, and J12: pins 1-2 are short-circuit
For patterns for cutting (SS31, SS32, and SS33) that have been cut, solder need not to be applied.

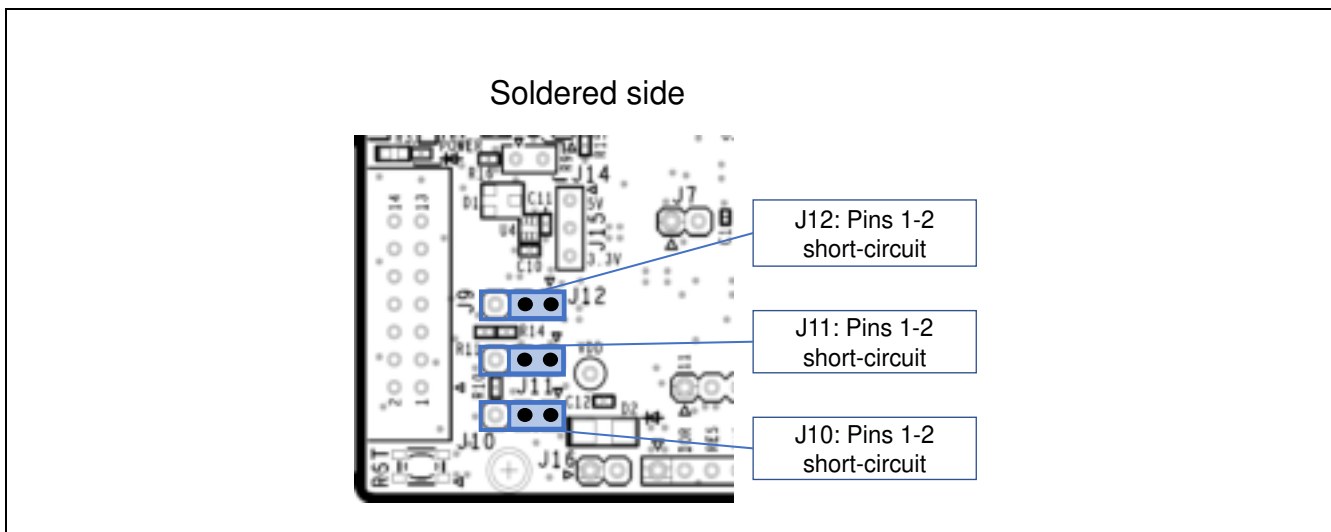


Figure 5-12 Settings for Use with COM Port Debugging

6. Handling Precautions

6.1 Power to be Supplied

When power is supplied to this product through the USB or from an emulator, note that the total current of VDD, 5 V, and 3.3 V should not exceed the maximum current of 200 mA.

6.2 Remodeling the Board

Any modification of the board (including cutting the patterns for cutting) shall be conducted at the user’s own responsibility.

The following shows the settings of jumpers as shipped.

- J14: open-circuit
- J15: pins 1-2 are short-circuit

In this document, “short-circuit pads” refers to pairs of pads for short-circuiting by solder.

“Pattern for cutting” refers to a narrow signal pattern in the middle part between two short-circuit pads. When you cut the pattern for cutting, do not cut over the silkscreened frame of a white ellipse.

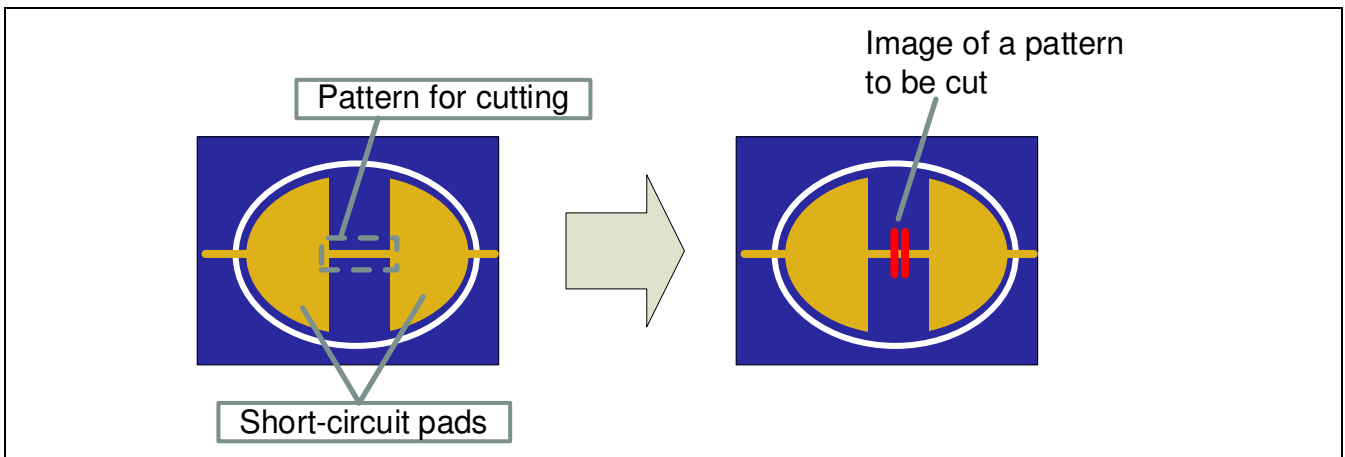
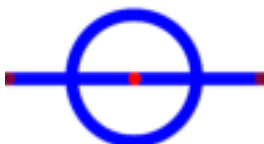
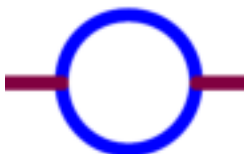


Figure 6-1 Pattern for Cutting and Short-circuit Pads

In some cases, a pattern for cutting may not be visible because it has been covered with coating of a resist. Also refer to the circuit schematics.



In the circuit schematics, the symbol to the left indicates an SS short-circuit pad, for which the default state is short-circuit and that there is a pattern for cutting between short-circuit pads.



In the circuit schematics, the symbol to the left indicates an SC short-circuit pad, for which the default state is open-circuit and that there are only short-circuit pads without any pattern for cutting.

6.3 Power Supplies and Usage Conditions

Different power supplies can be selected. Table 6-1 shows the relationship between power-supply sources and usage conditions.

Figure 6-2 shows the block diagram of the power-supply circuit.

Table 6-1 Power-Supply Sources and Usage Conditions

| Power-Supply Source | Usage Condition | | | | |
|--------------------------------|--------------------------------------|---------------------------------------|------------------------------------|----------------------------|---|
| | Power supplied to the evaluation MCU | Use of Arduino™ shields* ¹ | Use of Pmod™ modules* ¹ | Use of an emulator and IDE | Jumper setting* ² |
| USB* ⁴ (default) | 5 V or 3.3 V | Possible | Possible | Possible* ³ | Not required <ul style="list-style-type: none"> J15: 1-2 short-circuit: 5 V (default) Required <ul style="list-style-type: none"> J15: 2-3 short-circuit: 3.3 V |
| External power supply | 2.4 V to 5.5 V | Possible | Possible | Possible* ³ | Required <ul style="list-style-type: none"> J15: open-circuit |
| Emulator | E2 Lite: 3.3 V E2: 2.4 V to 5.0 V | Possible* ⁵ | Possible | Possible | Required <ul style="list-style-type: none"> J15: open-circuit |

- Notes:
1. Connecting the RL78/G15 Fast Prototyping Board to an Arduino™ shield or a Pmod™ module shall be conducted at the user's own responsibility and should only proceed after confirming the specifications of the power supply and interfaces. When an Arduino™ shield requires the supply of 5-V or 3.3-V power, connect the host PC to this board via the USB cable.
 2. Requirements for modifications after shipment are stated in this column.
 3. Use the IDE in a state where power is being supplied from a source other than the emulator.
 4. If power to be supplied to this product other than via the USB, make J15 open-circuit and cut the pattern for cutting (VCCIO) (Figure 5-10).
 5. The shape of the Arduino™ shield may make using this product with the emulator difficult.

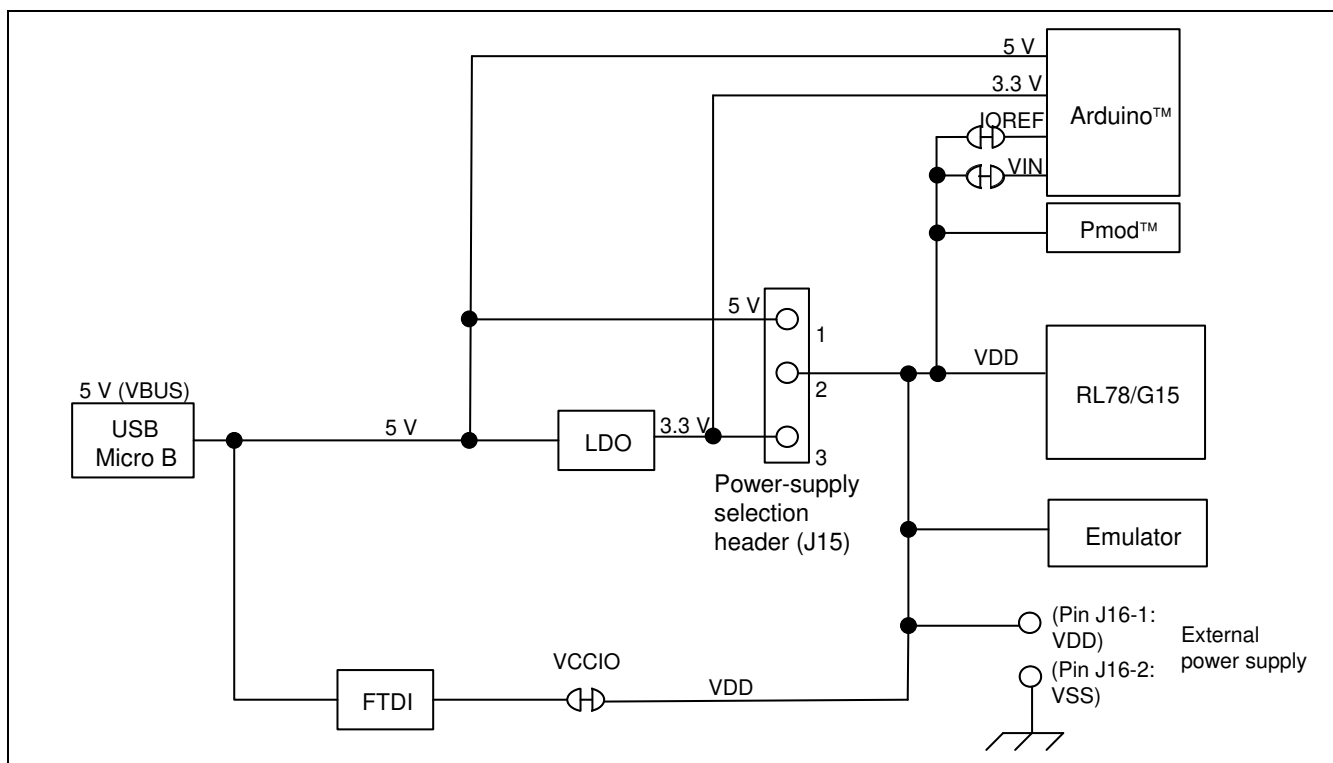


Figure 6-2 Block Diagram of the Power-Supply Circuit

6.4 Precautions when using P00/TxD0

In this product, If you write a user program to the target MCU that starts UART transmission output to the P00/TxD0 line when the power is turned on, immediately after resetting the USB-serial converter, or before the host PC recognizes the USB-serial converter as the COM port, the USB-serial converter device may become unstable, and you may not be able to connect to Renesas Flash Programmer or terminal software.

In such a case, hold down the reset switch, turn on the power (connect the USB cable), wait until the host PC recognizes it as a COM port (about 3 seconds), then release the reset switch.

Alternatively, while holding down the reset switch, reset the USB-serial converter (short J14 once and return it to open), wait until the host PC recognizes it as a COM port (about 3 seconds), then release the reset switch.

Then erase the user program with Renesas Flash Programmer.

7. Developing Code

Use the e² studio or CS+, both of which support the evaluation MCU (RL78/G15).

7.1 Using the e² studio

Figure 7-1 shows the settings of the e² studio when it is to be connected to the RL78/G15 Fast Prototyping Board.

- [Debug hardware]: Select [COM port (RL78)].
- [Target Device]: Select [R5F12068ASP].
- [Connection with Target Board]:
 - [COM Port]: Select the COM port number for assignment to the RL78/G15 FPB from the pull-down list.
 - [Reset control pin]: Select [DTR].

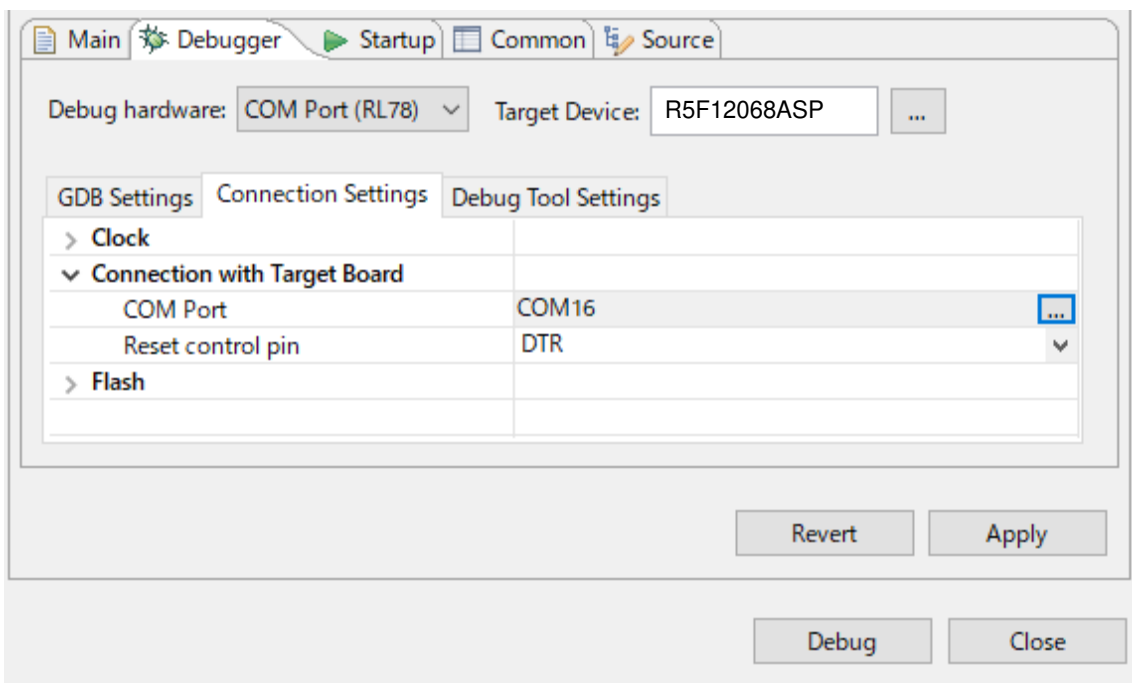


Figure 7-1 Settings of the e² studio

7.2 Using CS+

Figure 7-2 and Figure 7-3 show the settings of CS+ when it is to be connected to the RL78/G15 Fast Prototyping Board.

[Using Debug Tool]:

Select [RL78 COM Port] from [Using Debug Tool] in the [Debug] menu.

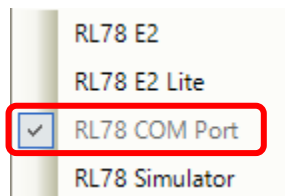


Figure 7-2 Panel for Selecting the Debug Tool

[Connection with Target Board]:

[Communication port]: Select the COM port number for assignment to the RL78/G15 FPB from the pull-down list.

[Reset control pin]: Select [DTR].

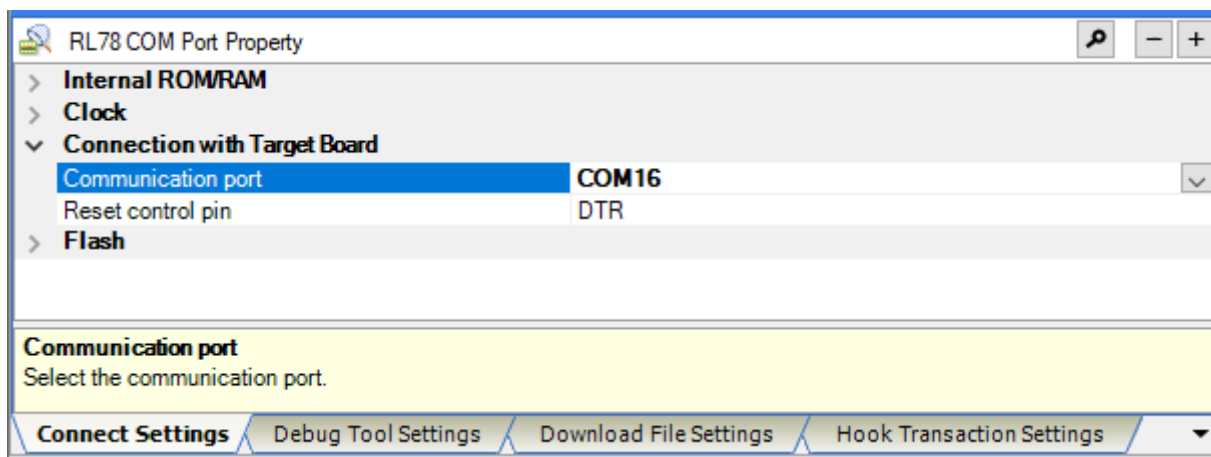


Figure 7-3 [Connect Settings] Tabbed Page of CS+

For details and points for caution, refer to the following application note for the RL78 COM port debug tool.

- RL78 Debugging Functions Using the Serial Port (R20AN0632)

8. Additional Information

Technical Support

For details on the usage of the IDE, refer to its help menu.

For details on the evaluation MCU (RL78/G15), refer to the RL78/G15 User's Manual: Hardware.

For details on the RL78 assembly language, refer to the RL78 Family User's Manual: Software.

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

Note

Do not install the RL78/G15 Fast Prototyping Board or sample code into your product.

The operation of sample code is not guaranteed. Confirm the operation on your own responsibility.

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