User's Manual

16

# RL78/F25
# Fast Prototyping Board

User's Manual

16-Bit Single-Chip Microcontrollers

RL78 Family



Renesas Electronics
www.renesas.com

Rev.1.00 Apr 2026

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(Rev.5.0-1 October 2020)

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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.

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# Precautions

This Fast Prototyping 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 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. 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 10 m of the product when in use.

• The user is advised to take ESD precautions when handling the equipment.

The Evaluation Kit does not represent an ideal reference design for an end product and does not fulfil the regulatory standards for an end product.

# Proprietary Notice

# 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/F25 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/F25 Fast Prototyping Board User's Manual | R20UT5803EJ (this manual) |
| Circuit schematics | Circuit schematics | RL78/F25 Fast Prototyping Board Circuit Schematics | R20UT5804EJ |
| Parts list | Parts list | RL78/F25 Fast Prototyping Board BOM LIST | R12TU5802EJ |
| User's manual for the hardware | Hardware specifications (pin assignments, memory maps, peripheral function specifications, electrical characteristics, timing charts) and descriptions of operation | RL78/F25 User's Manual: Hardware | R01UH1061EJ |

## 2. List of Abbreviations and Acronyms

| Abbreviation | Full Form |
|---|---|
| BoM | Bill of Materials |
| COM | Communication Port |
| CPU | Central Processing Unit |
| DIP | Dual In-line Package |
| DNF | Do Not Fit |
| FPB | Fast Prototyping Board |
| GPIO | General Purpose Input Output |
| Grove | A connector that is compatible with Grove modules can be mounted on the fast prototyping board. |
| $I^2C$ | Inter-Integrated Circuit |
| IDE | Integrated Development Environment |
| IRQ/INT | Interrupt Request |
| HOCO | High-Speed On-Chip Oscillator |
| LOCO | Low-Speed On-Chip Oscillator |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| MCU | Micro-controller Unit |
| MISO | SPI Master In Slave Out |
| MOSI | SPI Master Out Slave In |
| n/a (NA) | Not applicable |
| n/c (NC) | Not connected |
| PC | Personal Computer |
| PWM | Pulse Width Modulation |
| RAM | Random Access Memory |
| RFP | Renesas Flash Programmer |
| ROM | Read Only Memory |
| RXD | Serial Receive Data |
| SCK | SPI Serial Clock |
| SCL | $I^2C$ Serial Clock line |
| SDA | $I^2C$ Serial Data line |
| SMD | Surface Mount Device |
| SPI | Serial Peripheral Interface |
| TXD | Serial Transmit Data |
| UART | Universal Asynchronous Receiver/Transmitter |
| USB | Universal Serial Bus |

# Table of Contents

# 1. Overview

This user's manual describes the RL78/F25 Fast Prototyping Board (RTK7RLF250S00001BJ) (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
- CAN transceiver and CAN connector
- Pmod™ connector Note
- Arduino® connector Note
- Grove connector Note
- Debug connector for an E2 emulator or E2 emulator Lite

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".
  renesas.com/gs-fpb-rl78
- Install the integrated development environment (IDE) and required software on the host PC.
  https://www.renesas.com/development-tools
- Prepare a USB 2.0 Type-C™ 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 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/F25) | Part No.: R7F125FPL3AFB-C |
| | Package: 100-pin LFQFP |
| | On-chip memory: 512 KB ROM, 40 KB RAM, 16 KB data flash memory |
| Board size | 53.34 mm × 99.06 mm |
| Power-supply voltage | VDD: 2.7 V to 5.5 V |
| Power-supply circuit Note 2 | USB connector: VBUS (5 V) or 3.3 V (default) |
| | External power supply: 2.7 V to 5.5 V |
| | E2: 2.7 V to 5.0 V<br>E2 emulator Lite: 3.3 V |
| Current drawn | Max. 300 mA |
| Main clock | X1: Crystal oscillator (surface-mount technology (SMT)) for the main system clock |
| Sub-clock | XT1: Crystal oscillator (SMT) for the sub-clock |
| Push switches | Reset switch × 1 |
| | User switch × 1 |
| LEDs | Power indicator: green × 1 |
| | User: green × 2 |
| Pmod™ | Right-angle type, 12 pins (6 × 2 columns) × 2 |
| Arduino® connectors | Connectors: 10 pins × 1, 8 pins × 5<br>The interfaces are compatible with the Arduino® MEGA 2560 board. |
| MCU header Note 1 | Header: 30 pins (15 × 2 columns) × 1, 20 pins (10 × 2 columns) × 1 |
| USB connector | Connector: USB Type-C™ |
| USB-to-serial converter | Used as the interface with the RL78 flash programming tool.<br>FT232RNQ from FTDI × 1 |
| Emulator connector | 14-pin connector for connecting an E2 emulator or E2 emulator Lite |
| Grove connector | Interface for Grove modules<br>$I^2C$ × 2 |
| CAN FD transceiver | CAN FD transceiver × 1 |
| CAN connector | CAN connector × 1 |

Notes: 1. This part is not mounted.

2. The intended source of power for the evaluation MCU on the board as shipped is a 3.3 V supply generated from USB 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.

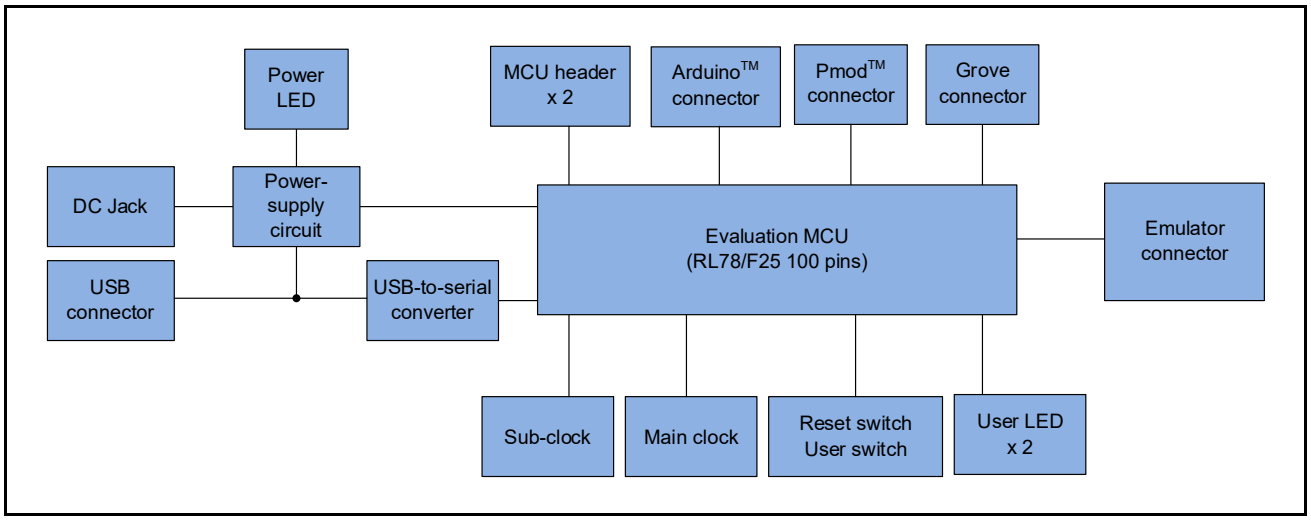


**Figure 1-1 Block Diagram**

# 2. Board Layout

Figure 2-1 and Figure 2-2 show the external appearance of this product.

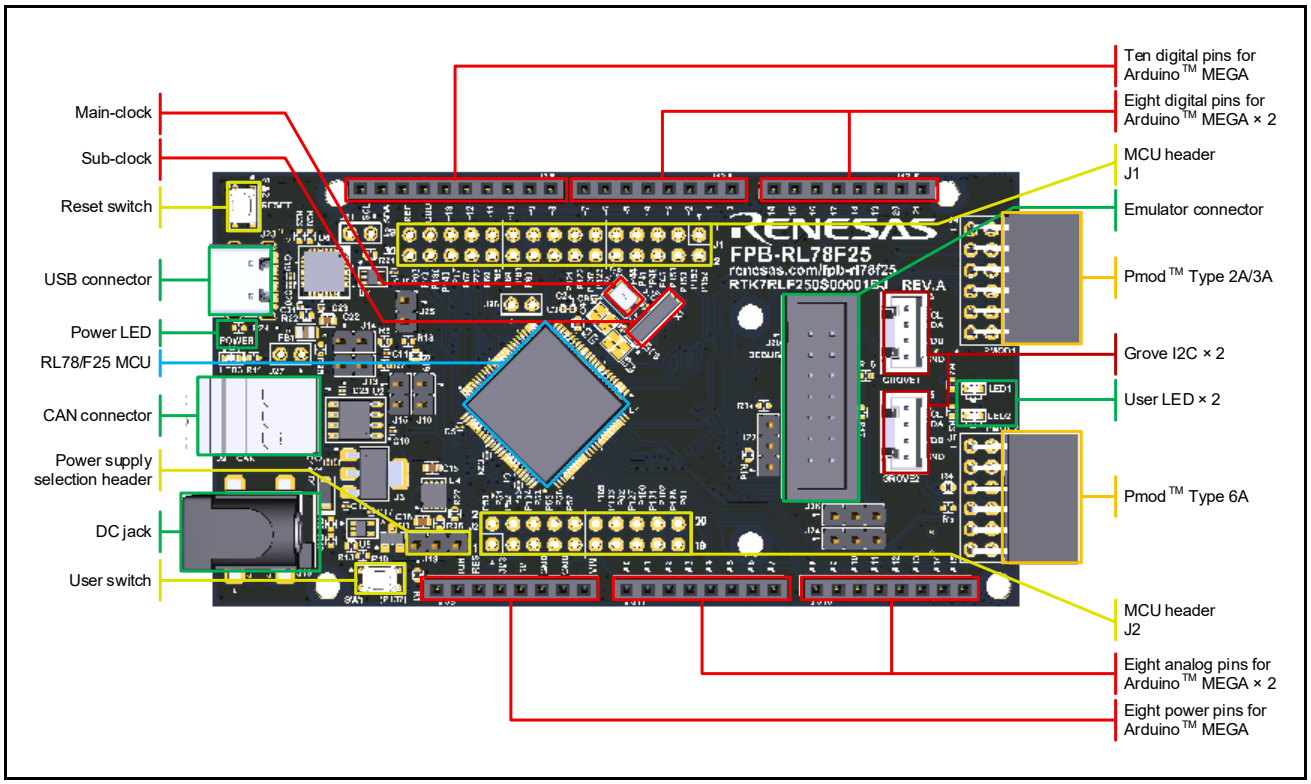


**Figure 2-1 Board Layout (Top Side)**

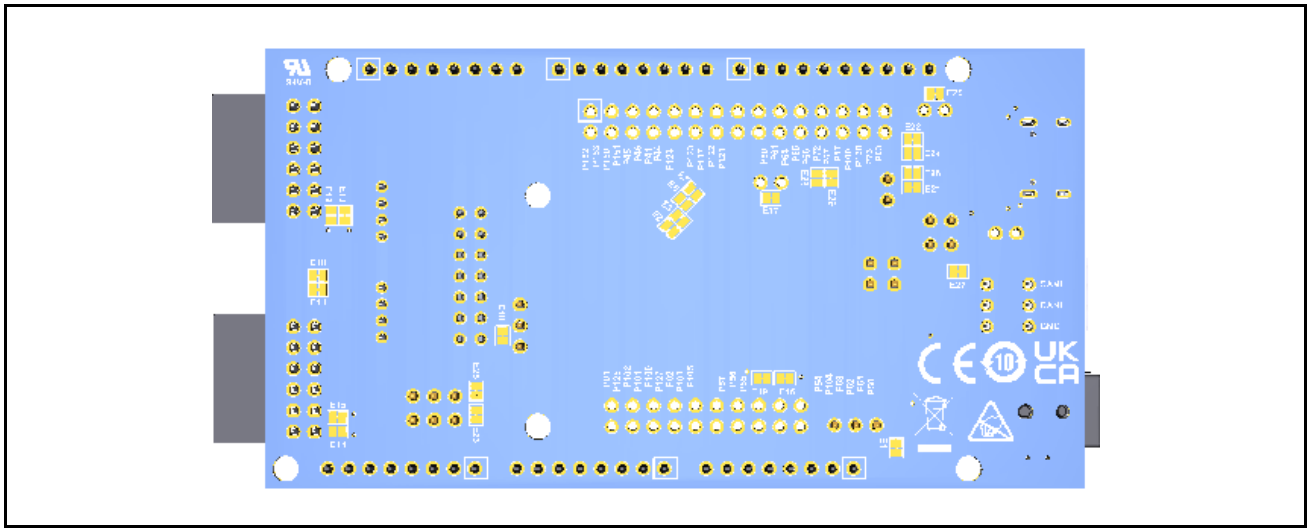

**Figure 2-2 Board Layout (Soldered Side)**

# 3. Parts Layout

Figure 3-1 and Figure 3-2 show the parts layout of this product.

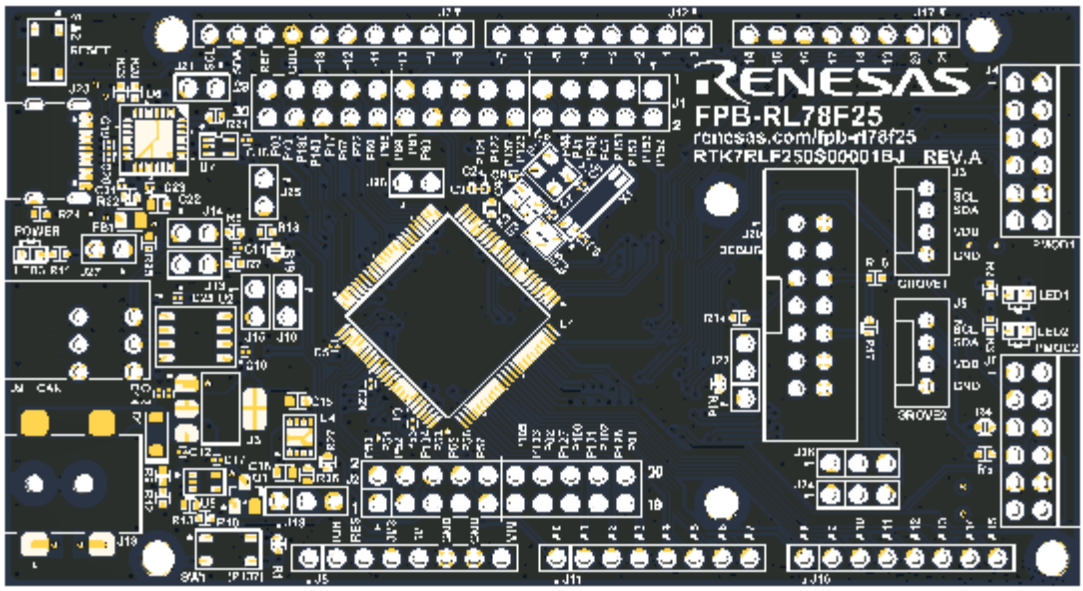


**Figure 3-1 Parts Layout (Top Side)**

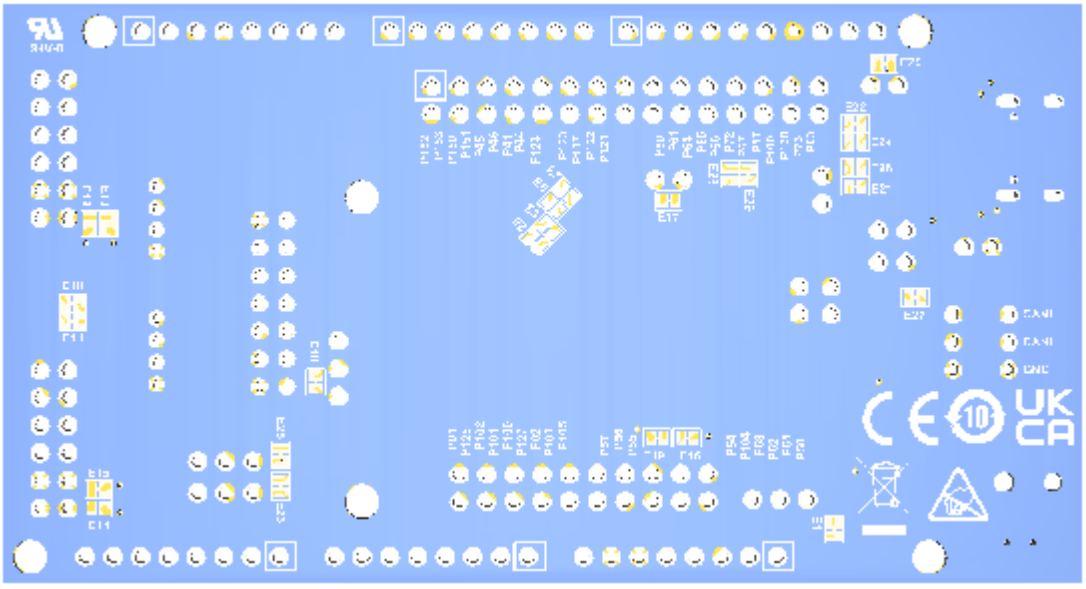

**Figure 3-2 Parts Layout (Soldered Side)**

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

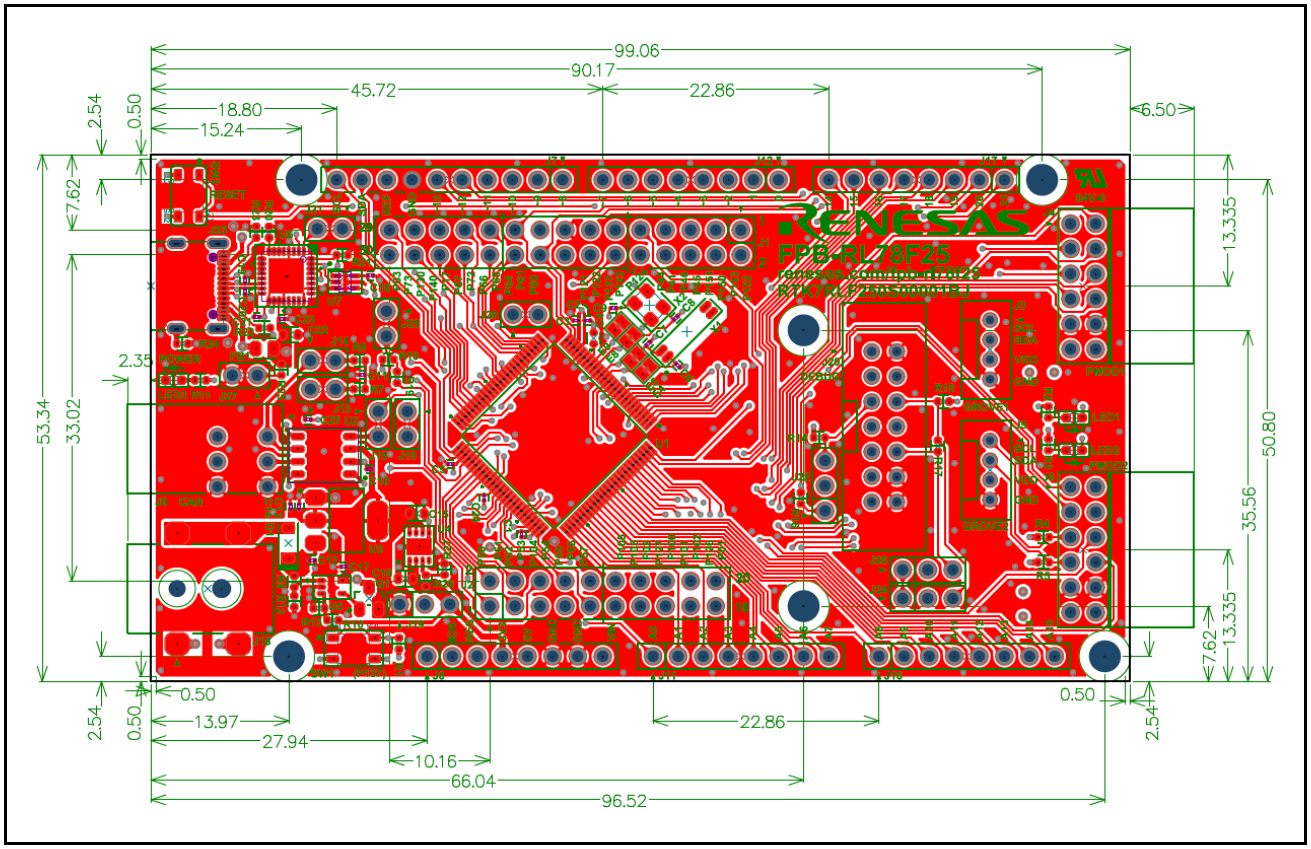


**Figure 3-3 External Dimensions**

# 4. Operating Environment

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

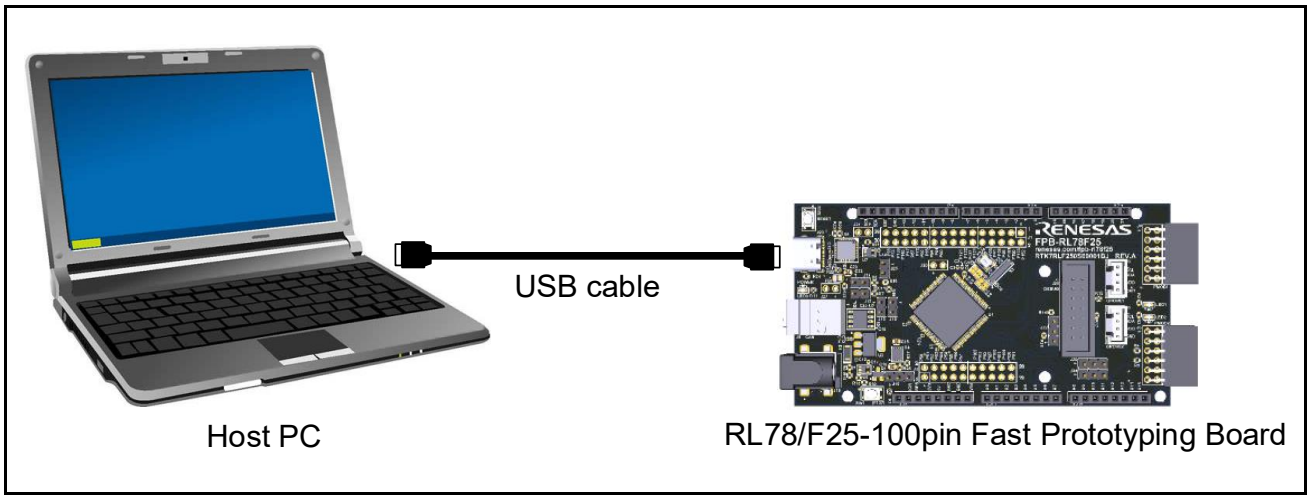


**Figure 4-1 Operating Environment**

# 5. User Circuits

## 5.1 Evaluation MCU

The specifications for the power supply, system clock, and reset of the evaluation MCU (RL78/F25) at the time of shipment are as follows.

- Power supply: 3.3 V generated from USB VBUS (5 V)
- System clock: Operation with an on-chip oscillator
- Reset: Directed by the reset switch or IDE

## 5.2 USB Connector

The connector is USB 2.0 Type-C™. It serves as a power-supply input and an interface for communications with the RL78 flash memory programming 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: This 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 56, connected to port P50
- LED2: Pin 57, connected to port P51

## 5.5 Pmod™ Connectors

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

Pmod 1 (J4) is assumed to be connected to the Pmod Interface Type 2A or 3A module Note.

Pmod 2 (J6) is assumed to be connected to the Pmod Interface Type 6A module Note.

Note: For details on the Pmod module from Renesas, refer to the Web site at:
https://www.renesas.com/quickconnect.

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 5-1, Table 5-1 and Table 5-2 show the pin assignments of the Pmod connectors.

When using the functions enclosed in parentheses in the diagram and tables, change the peripheral I/O redirection register (PIORx) from its default setting. Refer to RL78/F22, F25 User's Manual: Hardware for details.

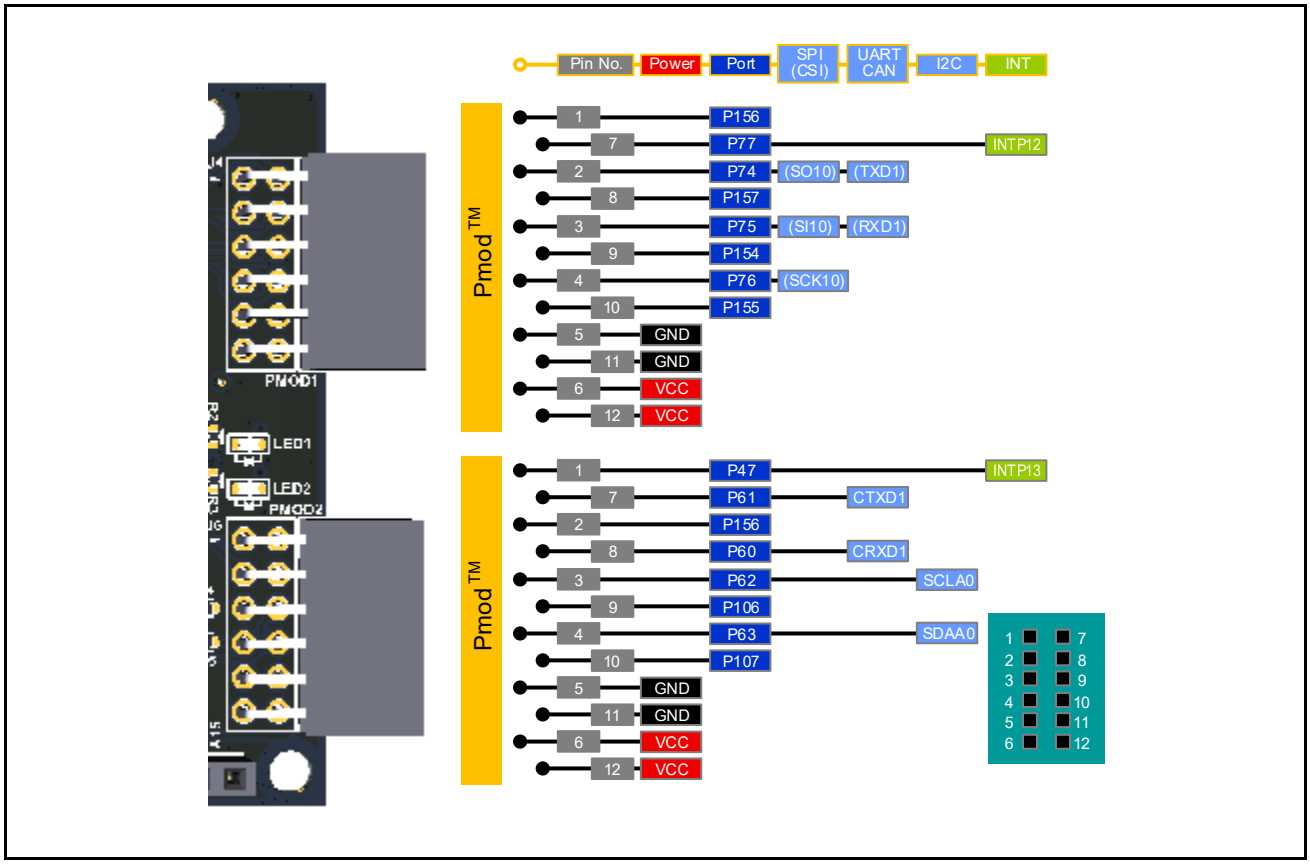


**Figure 5-1 Pin Assignment of the Pmod Connectors**

**Table 5-1 Pin Assignments of Pmod 1 (J4)**

| Pmod 1 | | RL78/F25 | Pmod 1 Configuration | |
|---|---|---|---|---|
| Pin | Type 2A/3A | Signal/Bus | Short | Open |
| J4-1 | CS/CTS | P156 | – | – |
| J4-2 | MOSI/TXD | P74/(SO10)/(TXD1) | – | – |
| J4-3 | MISO/RXD | P75/(SI10)/(RXD1) | – | – |
| J4-4 | SCK/RTS | P76/(SCK10) | – | – |
| J4-5 | GND | $EV_{SS0}$, $EV_{SS1}$ | – | – |
| J4-6 | VCC | $EV_{DD0}$, $EV_{DD1}$ | E13 | E12 |
| J4-7 | INT/GPIO | P77/INTP12 | – | – |
| J4-8 | RESET/GPIO | P157 | – | – |
| J4-9 | CS2/GPIO | P154 | – | – |
| J4-10 | CS3/GPIO | P155 | – | – |
| J4-11 | GND | $EV_{SS0}$, $EV_{SS1}$ | – | – |
| J4-12 | VCC | $EV_{DD0}$, $EV_{DD1}$ | E13 | E12 |

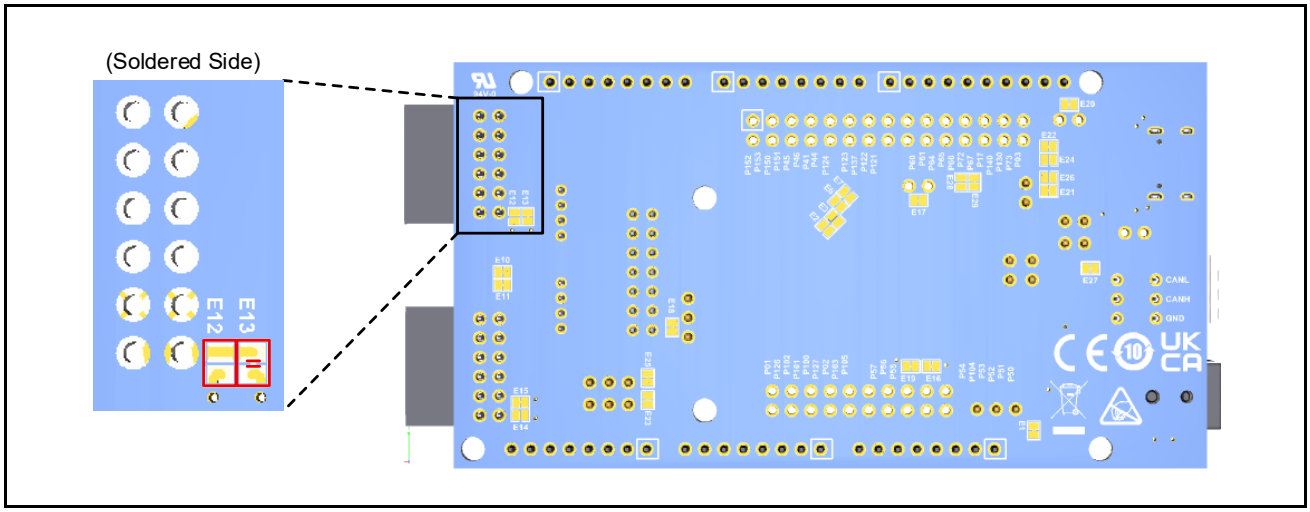


**Figure 5-2 Assignments of Jumper Solder for Pmod 1**

**Table 5-2 Pin Assignments of Pmod 2 (J6)**

| Pmod 2 | | RL78/F25 | Pmod 2 Configuration | |
|---|---|---|---|---|
| Pin | Type 6A | Signal/Bus | Short | Open |
| J6-1 | INT | P47/INTP13 | – | – |
| J6-2 | RESET | P156 | – | – |
| J6-3 | SCL | P62/SCLA0 | – | R4 |
| J6-4 | SDA | P63/SDAA0 | – | R5 |
| J6-5 | GND | $EV_{SS0}$, $EV_{SS1}$ | – | – |
| J6-6 | VCC | $EV_{DD0}$, $EV_{DD1}$ | E15 | E14 |
| J6-7 | IO1 | P61/CTXD1 | – | – |
| J6-8 | IO2 | P60/CRXD1 | – | – |
| J6-9 | IO3 | P106 | – | – |
| J6-10 | IO4 | P107 | – | – |
| J6-11 | GND | $EV_{SS0}$, $EV_{SS1}$ | – | – |
| J6-12 | VCC | $EV_{DD0}$, $EV_{DD1}$ | E15 | E14 |

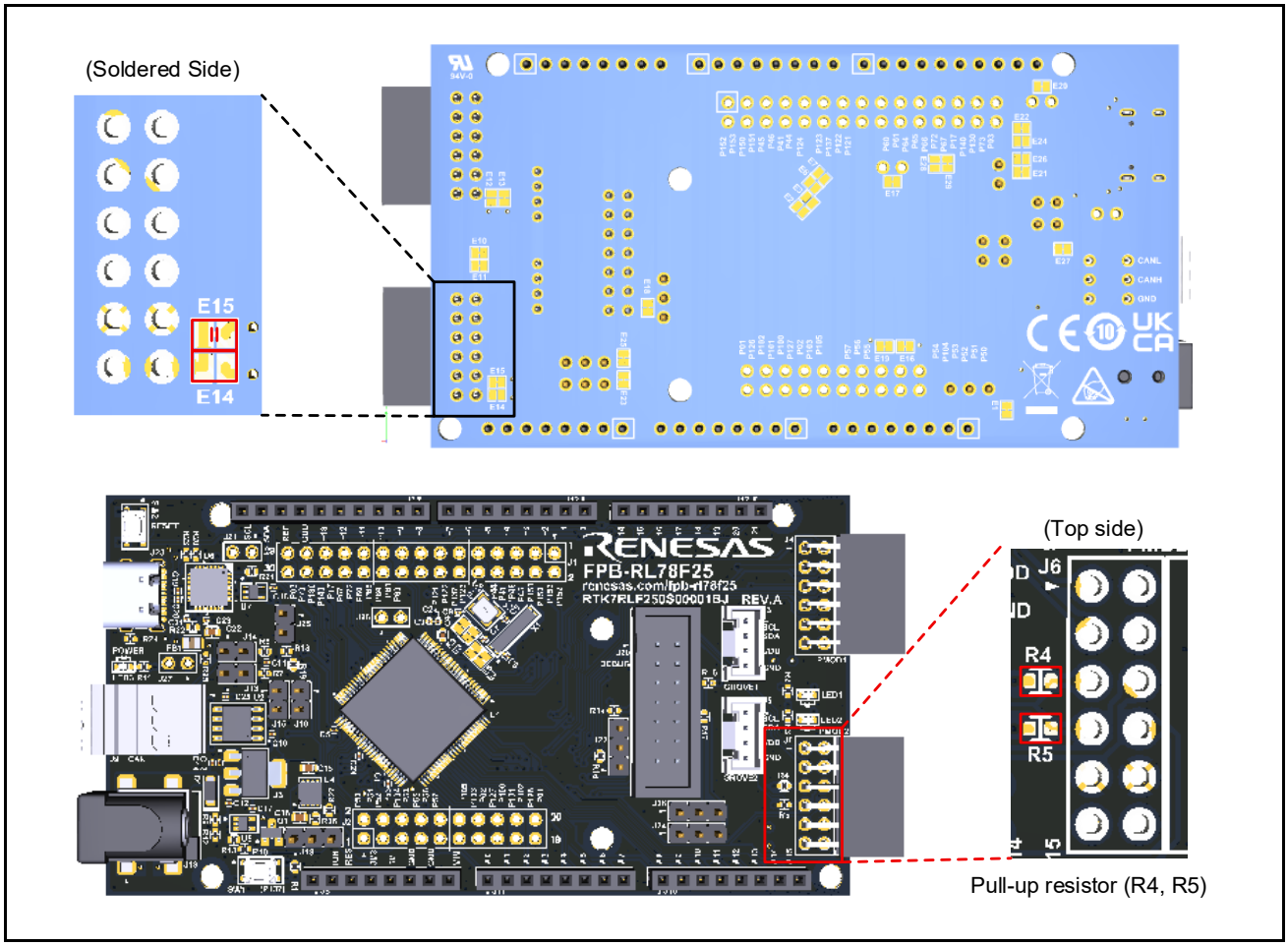


**Figure 5-3 Assignments of Jumper Solder for Pmod 2**

## 5.6 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 5-4 and Table 5-3 show the pin assignment of the Arduino connectors.

When using the functions enclosed in parentheses in the diagram and tables, change the peripheral I/O redirection register (PIORx) from its default setting. Refer to RL78/F22, F25 User's Manual: Hardware for details.

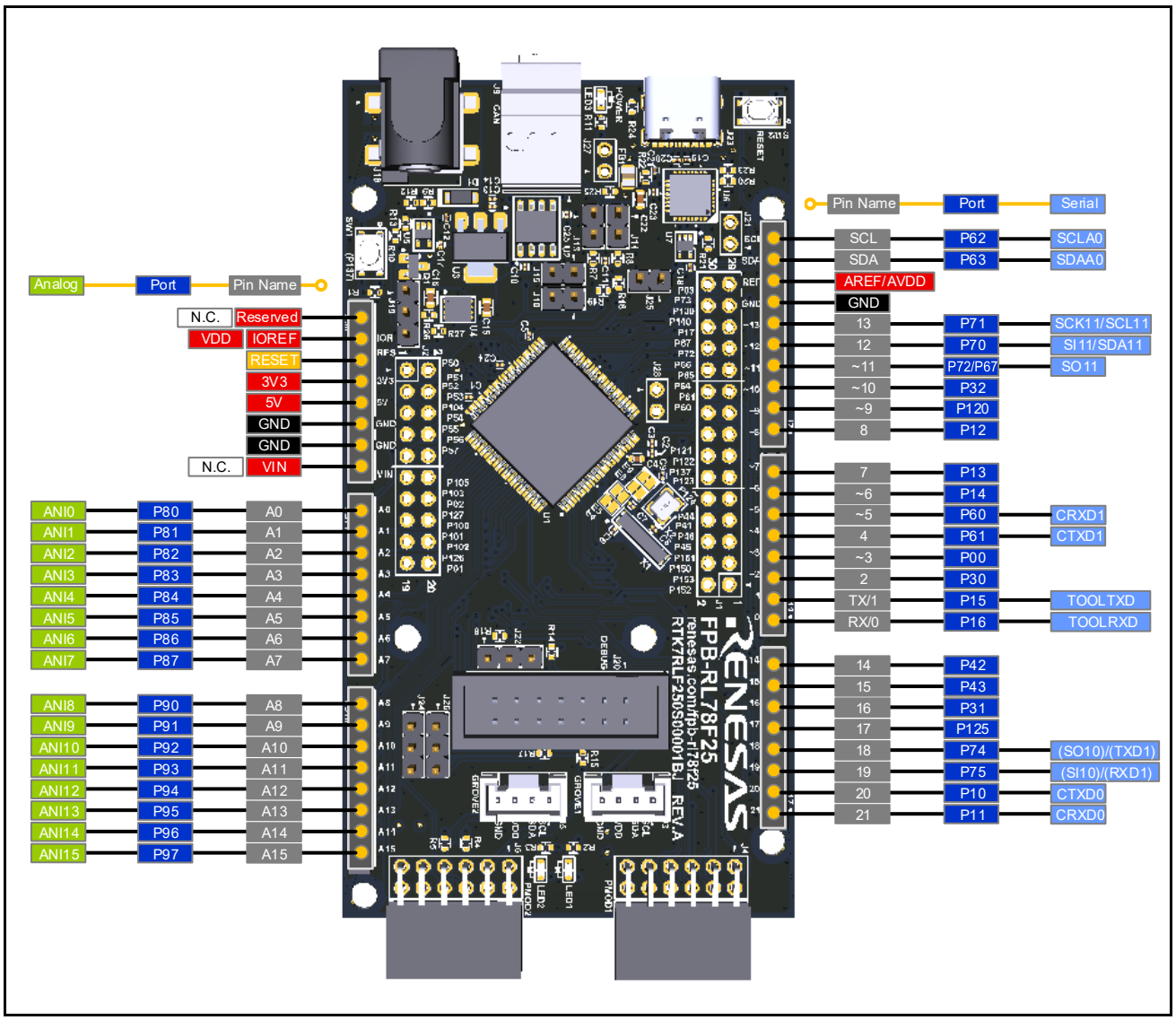


**Figure 5-4 Pin Assignment of the Arduino Connectors**

**Table 5-3 Pin Assignment of the Arduino Connectors (1/2)**

| Pin No. in the Circuit Schematics | Name of Arduino Signal | RL78/F25 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Pin | Power Supply | Port | Analog | PWM | Serial |
| J8-1 | N.C. | – | – | – | – | – | – |
| J8-2 | IOREF | 23, 53 | $EV_{DD0}$, $EV_{DD1}$ | – | – | – | – |
| J8-3 | RESET | 13 | – | – | – | – | – |
| J8-4 | 3V3 | – | – | – | – | – | – |
| J8-5 | 5V | – | – | – | – | – | – |
| J8-6 | GND | 20, 21, 43 | $V_{SS}$, $EV_{SS0}$, $EV_{SS1}$ | – | – | – | – |
| J8-7 | GND | 20, 21, 43 | $V_{SS}$, $EV_{SS0}$, $EV_{SS1}$ | – | – | – | – |
| J8-8 | VIN | – | – | – | – | – | – |
| J11-1 | A0 | 75 | – | P80 | ANI0 | – | – |
| J11-2 | A1 | 76 | – | P81 | ANI1 | – | – |
| J11-3 | A2 | 77 | – | P82 | ANI2 | – | – |
| J11-4 | A3 | 78 | – | P83 | ANI3 | – | – |
| J11-5 | A4 | 79 | – | P84 | ANI4 | – | – |
| J11-6 | A5 | 80 | – | P85 | ANI5 | – | – |
| J11-7 | A6 | 81 | – | P86 | ANI6 | – | – |
| J11-8 | A7 | 82 | – | P87 | ANI7 | – | – |
| J16-1 | A8 | 83 | – | P90 | ANI8 | – | – |
| J16-2 | A9 | 84 | – | P91 | ANI9 | – | – |
| J16-3 | A10 | 85 | – | P92 | ANI10 | – | – |
| J16-4 | A11 | 86 | – | P93 | ANI11 | – | – |
| J16-5 | A12 | 87 | – | P94 | ANI12 | – | – |
| J16-6 | A13 | 88 | – | P95 | ANI13 | – | – |
| J16-7 | A14 | 89 | – | P96 | ANI14 | – | – |
| J16-8 | A15 | 90 | – | P97 | ANI15 | – | – |

**Table 5-3 Pin Assignment of the Arduino Connectors (2/2)**

| Pin No. in the Circuit Schematics | Name of Arduino Signal | RL78/F25 | | | | | |
|---|---|---|---|---|---|---|---|
| | | Pin | Power Supply | Port | Analog | PWM | Serial |
| J17-1 | 21 | 63 | – | P11 | – | – | CRXD0 |
| J17-2 | 20 | 64 | – | P10 | – | – | CTXD0 |
| J17-3 | 19 | 41 | – | P75 | – | – | (SI10)/(RXD1) |
| J17-4 | 18 | 42 | – | P74 | – | – | (SO10)/(TXD1) |
| J17-5 | 17 | 99 | – | P125 | – | – | – |
| J17-6 | 16 | 55 | – | P31 | – | – | – |
| J17-7 | 15 | 9 | – | P43 | – | – | – |
| J17-8 | 14 | 10 | – | P42 | – | – | – |
| J12-1 | RX/0 | 52 | – | P16 | – | – | TOOLRXD |
| J12-2 | TX/1 | 54 | – | P15 | – | – | TOOLTXD |
| J12-3 | 2 | 50 | – | P30 | – | – | – |
| J12-4 | ~3 | 34 | – | P00 | – | – | – |
| J12-5 | 4 | 25 | – | P61 | – | – | CTXD1 |
| J12-6 | ~5 | 24 | – | P60 | – | – | CRXD1 |
| J12-7 | ~6 | 60 | – | P14 | – | – | – |
| J12-8 | 7 | 61 | – | P13 | – | – | – |
| J7-1 | 8 | 62 | – | P12 | – | – | – |
| J7-2 | ~9 | 100 | – | P120 | – | – | – |
| J7-3 | ~10 | 49 | – | P32 | – | – | – |
| J7-4 | ~11 | 45/31 Note | – | P72/P67 Note | – | (TO02) Note | SO11 Note |
| J7-5 | 12 | 47 | – | P70 | – | – | SI11/SDA11 |
| J7-6 | 13 | 46 | – | P71 | – | – | SCK11/SCL11 |
| J7-7 | GND | 74 | $AV_{SS}/AV_{REFM}$ | – | – | – | – |
| J7-8 | ADREF | 73 | $AV_{DD}/AV_{REFP}$ | – | – | – | – |
| J7-9 | SDA | 27 | – | P63 | – | – | SDAA0 |
| J7-10 | SCL | 26 | – | P62 | – | – | SCLA0 |

Note J7-4 (~11) is connected to 45-pin (P72/SO11) by default. If you want to connect it to 31-pin (P67/(TO02)), cut Jumper Trace Cut (E29) and connect E28.

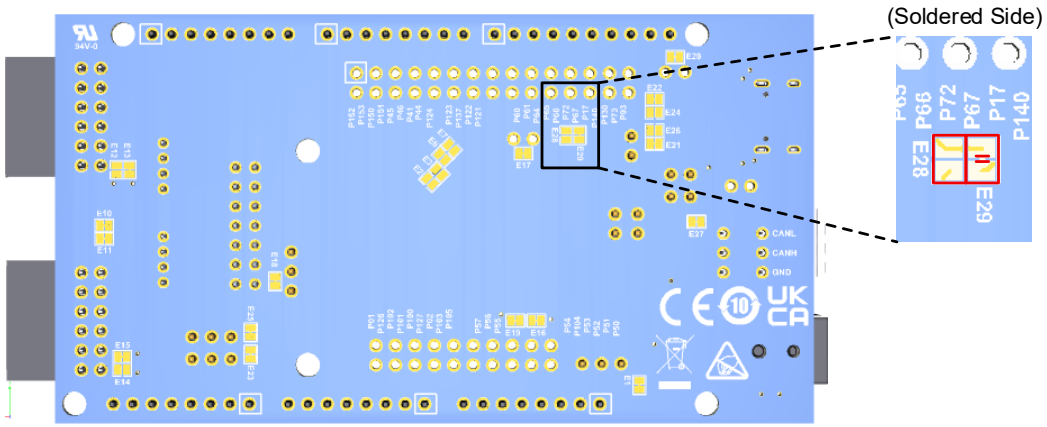


**Figure 5-5 Assignment of Jumper Solder (E28, E29)**

## 5.7 MCU Headers

The MCU headers are provided as through hole J1 (30 pins) and J2 (20 pins). The pin headers have a pitch of 2.54 mm and the evaluation MCU is connected to the through holes for the MCU header.

Table 5-4 shows the pin assignments of the MCU headers.

When using the functions enclosed in parentheses in the tables, change the peripheral I/O redirection register (PIORx) from its default setting. Refer to RL78/F22, F25 User's Manual: Hardware for details.

**Table 5-4 Pin Assignment of the MCU Header (J1) (1/2)**

| Pin No. in the Circuit Schematics | RL78/F25 | | Pmod | Arduino | Grove |
|---|---|---|---|---|---|
| | Pin | Pin Function | | | |
| J1-1 | 1 | P153/(SCK11) | – | – | – |
| J1-2 | 2 | P152/(SI11) | – | – | – |
| J1-3 | 3 | P151/(SO11) | – | – | – |
| J1-4 | 4 | P150/(SSI11) | – | – | – |
| J1-5 | 6 | P46/(TI12)/(TO12) | – | – | – |
| J1-6 | 7 | P45/(TI10)/(TO10) | – | – | – |
| J1-7 | 8 | P44/(TI07)/(TO07) | – | – | – |
| J1-8 | 11 | P41/TI10/TO10/TRJIO0/TRD0RES/(SI10)/(RXD1)/VCOUT0/SNZOUT2 | – | – | – |
| J1-9 | – | – | – | – | – |
| J1-10 | 14 | P124/XT2/EXCLKS | – | – | – |
| J1-11 | 15 | P123/XT1 | – | – | – |
| J1-12 | 16 | P137/INTP0 | – | – | – |
| J1-13 | 17 | P122/X2/EXCLK | – | – | – |
| J1-14 | 18 | P121/X1 | – | – | – |
| J1-15 | 20 | $V_{SS}$ | – | – | – |
| J1-16 | 22 | $V_{DD}$ | – | – | – |
| J1-17 | – | N.C. | – | – | – |
| J1-18 | 24 | P60/(TO01)/(SCK00)/(SCL00)/CRXD1/TS0 | Pmod 2: 8 | ~5 | – |
| J1-19 | 25 | P61/(TO02)/(SI00)/(SDA00)/(RXD0)/CTXD1/TS1 | Pmod 2: 7 | 4 | – |
| J1-20 | 28 | P64/(TI14)/(TO14)/(SNZOUT3)/TS4 | – | – | – |
| J1-21 | 29 | P65/(TI16)/(TO16)/(SNZOUT2)/TS5 | – | – | – |
| J1-22 | 30 | P66/(TI00)/(TO00)/TS6 | – | – | – |
| J1-23 | 45 | P72/ANI26/SO11/(CTXD0)/SNZOUT6/TS13 | – | – | – |
| J1-24 | 31 | P67/(TI02)/(TO02)/TS7 | – | – | – |
| J1-25 | 51 | P17/TI00/TO00/TRDIOB1/SCK00/SCL00/INTP3/TS16 | – | – | – |
| J1-26 | 37 | P140/TRD1RES/PCLBUZ0 | – | – | – |
| J1-27 | 38 | P130/RESOUT | – | – | – |
| J1-28 | 44 | P73/ANI27/SSI11/(CRXD0)/SNZOUT7/TS12 | – | – | – |
| J1-29 | 48 | P03/(RTC1HZ) | – | – | – |
| J1-30 | – | N.C. | – | – | – |

**Table 5-4 Pin Assignment of the MCU Header (J2) (2/2)**

| Pin No. in the Circuit Schematics | RL78/F25 | | Pmod | Arduino | Grove |
|---|---|---|---|---|---|
| | Pin | Pin Function | | | |
| J2-1 | 56 | P50/(SSI01)/(INTP3)/TS19 Note 1 | – | – | – |
| J2-2 | 57 | P51/(SO01)/INTP11/TS20 Note 2 | – | – | – |
| J2-3 | 58 | P52/(SCK01)/(STOPST)/TS21 | – | – | – |
| J2-4 | 59 | P53/(SI01)/INTP10/TS22 | – | – | – |
| J2-5 | 72 | P104/ANI20 | – | – | – |
| J2-6 | 65 | P54/(TI11)/(TO11)/SSI10/TS27 | – | – | – |
| J2-7 | 66 | P55/(TI13)/(TO13)/TS28 | – | – | – |
| J2-8 | 67 | P56/(TI15)/(TO15)/(SNZOUT1)/TS29 | – | – | – |
| J2-9 | 68 | P57/(TI17)/(TO17)/(SNZOUT0)/TS30 | – | – | – |
| J2-10 | 73 | $AV_{DD}/AV_{REFP}$ | – | ADREF | – |
| J2-11 | 74 | $AV_{SS}/AV_{REFM}$ | – | GND | – |
| J2-12 | 71 | P105/ANI21 | – | – | – |
| J2-13 | 94 | P103/ANI19 | – | – | – |
| J2-14 | 95 | P02/(TI06)/(TO06) | – | – | – |
| J2-15 | 96 | P127/(TI03)/(TO03) | – | – | – |
| J2-16 | 91 | P100/ANI16 | – | – | – |
| J2-17 | 92 | P101/ANI17 | – | – | – |
| J2-18 | 93 | P102/ANI18 | – | – | – |
| J2-19 | 97 | P126/(TI01)/(TO01) | – | – | – |
| J2-20 | 98 | P01/(TI04)/(TO04) | – | – | – |

Notes 1: P50 is connected to LED1 by default. If you want to disconnect it from LED1, cut the Jumper Trace Cut (E10).

2: P51 is connected to LED2 by default. If you want to disconnect it from LED2, cut the Jumper Trace Cut (E11).

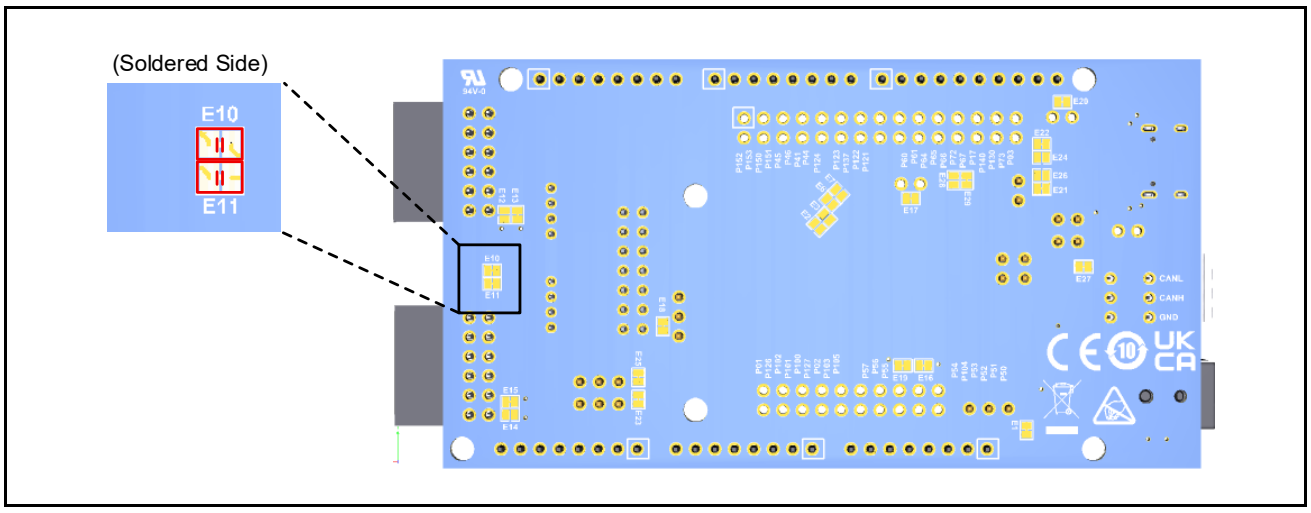


**Figure 5-6 Assignment of Jumper Solder (E10, E11)**

## 5.8 Grove Connector

The specification of the grove connectors (J3, J5) is on the assumption that Grove modules are to be connectable through I²C. If a connector is mounted, however, connection to all Grove modules (through I²C) is not guaranteed. Use this connector after having confirmed the specifications of this product and Grove modules (through I²C) you intend to use.

Figure 5-7 and Table 5-5 show the pin assignments of the Grove connector.

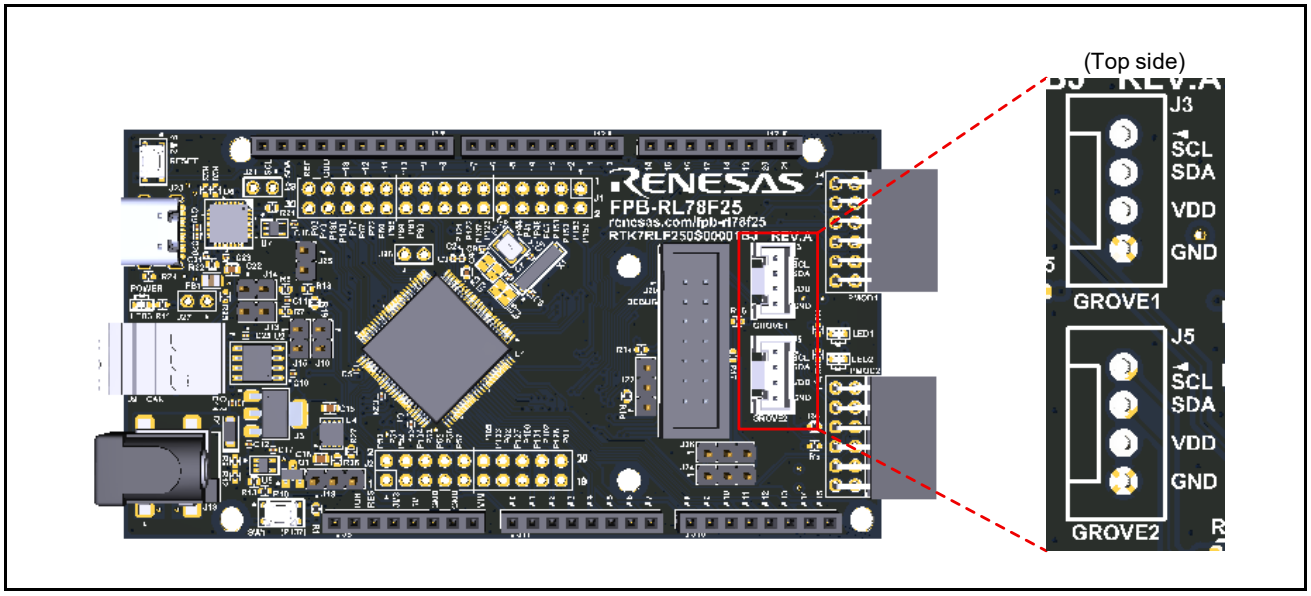


**Figure 5-7 Pin Assignment of the Grove Connectors**

**Table 5-5 Pin Assignment of the Grove Connectors**

| Grove 1 Connector | | | | |
|---|---|---|---|---|
| Part No. in the Circuit Schematics | RL78/F25 | | | |
| | Pin | Power Supply | Port | I²C |
| J3-1 | 46 | – | P71 | SCL11 |
| J3-2 | 47 | – | P70 | SDA11 |
| J3-3 | – | VDD | – | – |
| J3-4 | – | GND | – | – |

| Grove 2 Connector | | | | |
|---|---|---|---|---|
| Part No. in the Circuit Schematics | RL78/F25 | | | |
| | Pin | Power Supply | Port | I²C |
| J5-1 | 26 | – | P62 | SCLA0 |
| J5-2 | 27 | – | P63 | SDAA0 |
| J5-3 | – | VDD | – | – |
| J5-4 | – | GND | – | – |

## 5.9 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/F25 User's Manual: Hardware. For details on the clock circuit of this product, refer to the circuit schematics of the RL78/F25 Fast Prototyping Board. Table 5-6 shows the details of the clocks on the RL78/F25 Fast Prototyping Board.

**Table 5-6 Details of Clocks**

| Part No. in the Circuit Schematics | Evaluation MCU | Function and Usage | Frequency | Package for the Oscillator |
|---|---|---|---|---|
| X1 Note 1 | P123/XT1<br>P124/XT2 | Crystal oscillator for the Sub-clock<br>SSP-T7-FL-4.4pF | 32.768 kHz | SMT |
| X2 Note 2 | P121/X1<br>P122/X2 | Crystal oscillator for the main system clock<br>ABM8-20.000MHZ-10-B1U-T | 20.0 MHz | SMT |

Notes 1: P123 and P124 are connected to the X1 circuit (32.768 kHz) in the circuit diagram by default. If you want to disconnect them from the X1 circuit and use them as input ports, cut the Jumper Trace Cut (E4, E5) and short the Jumper Solder Bridge (E2, E3).

2: P121 and P122 are connected to the X2 circuit (20.0 MHz) in the circuit diagram by default. If you want to disconnect them from the X2 circuit and use them as input ports, cut the Jumper Trace Cut (E8, E9) and short the Jumper Solder Bridge (E6, E7).

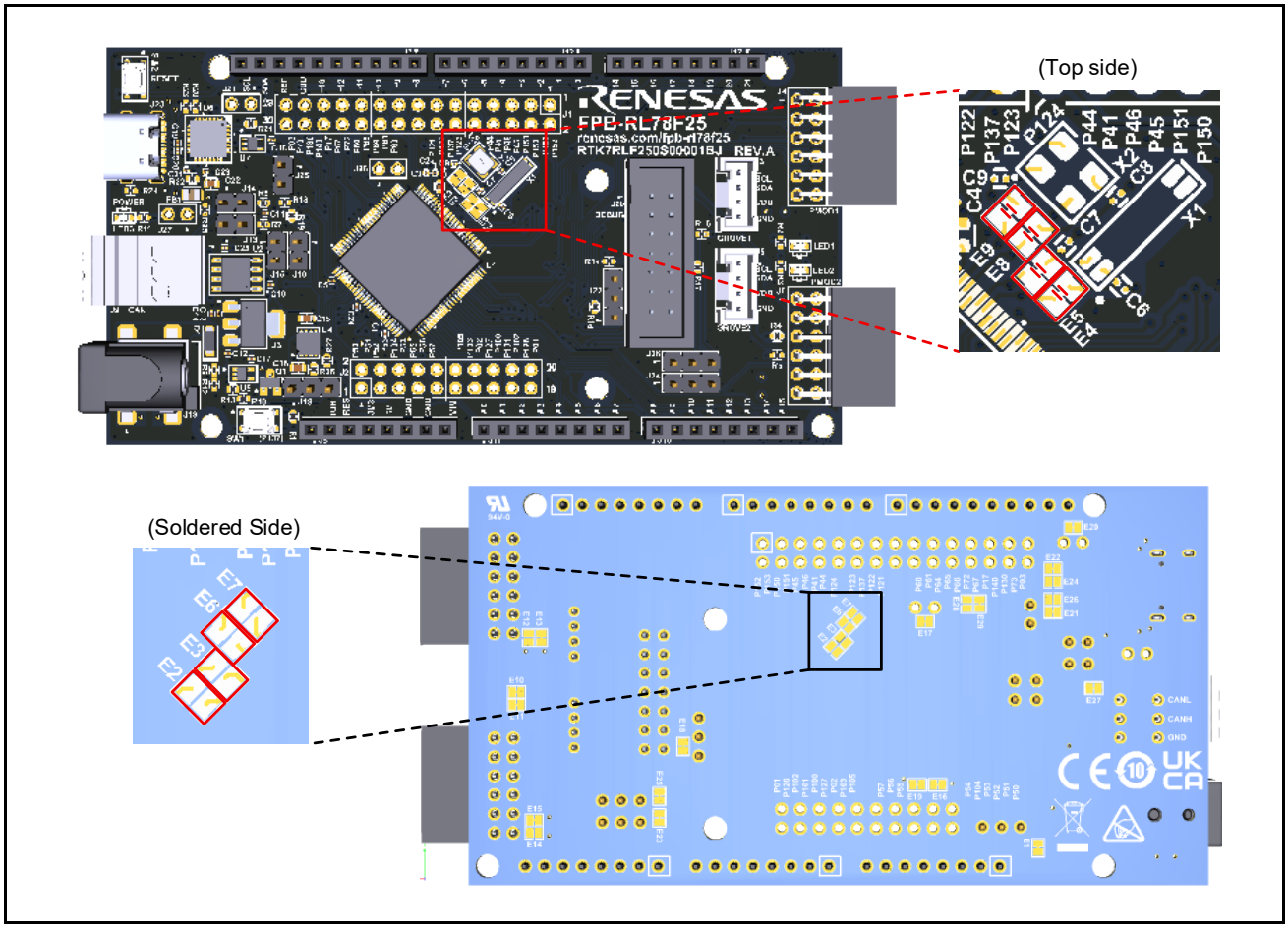


**Figure 5-8 Assignments of Jumper Solder (E2 to E9)**

## 5.10 Reset Control

The evaluation MCU can be reset via the E2/E2 Lite emulator, reset switch (SW2) input, Arduino Shield, or USB-UART communication path. The reset signal is selected using the Jumper connectors (J24, J26).

Reset control specifications are shown in Table 5-7.

**Table 5-7 Reset Control Specifications**

| Jumper (J24) | Jumper (J26) | Jumper Solder (E23) | Jumper Solder (E25) | Reset Input for Evaluation MCU | | | |
|---|---|---|---|---|---|---|---|
| | | | | SW2 Input | Arduino Shield Input | USB-UART Input | E2/E2 Lite Input |
| 1-2 | 1-2 | Short | Short | Enabled | Enabled | Enabled | Disabled |
| 2-3 | 2-3 | Open | Open | Disabled | Disabled | Disabled | Enabled |
| Other than the above | | | | Setting prohibited | | | |

*: The top row is the default connection.

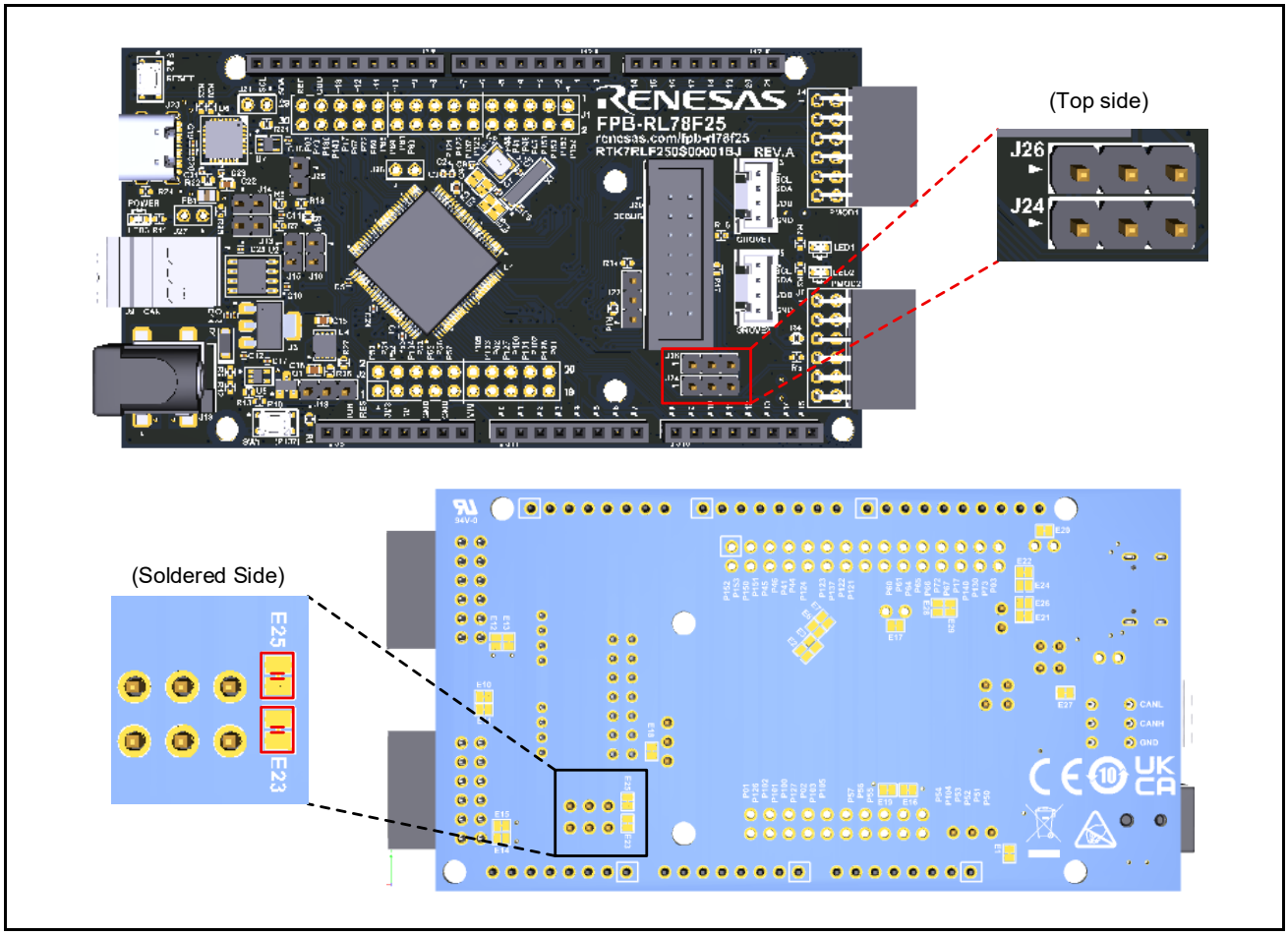


**Figure 5-9 Assignments of Jumper Connector (J24, J26) and Jumper Solder (E23, E25)**

## 5.11 User Switch

An optional user switch (SW1) is mounted. It is connected to 16-pin of the evaluation MCU, which operates as pin function P137. The INTP0 interrupt is multiplexed on the same pin. If you want to disconnect P137 from SW1 and use it as an input port, cut Jumper Trace Cut (E1).

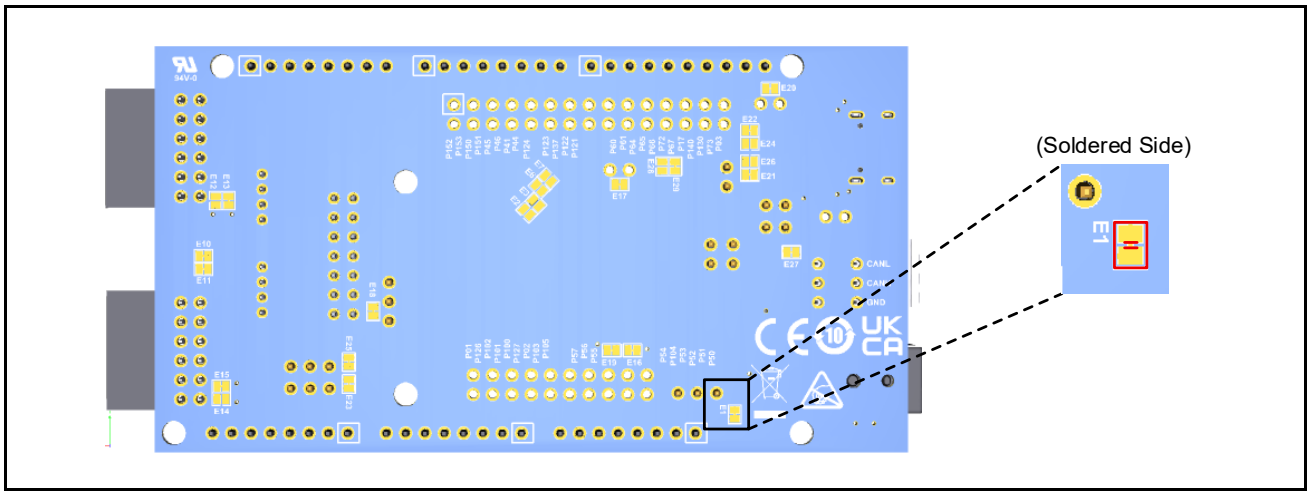


**Figure 5-10 Assignments of Jumper Solder (E1)**

## 5.12 USB-to-Serial Converter

A USB-to-serial converter (FT232RNQ) 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.

https://www.ftdichip.com DRIVERS -> VCP Drivers

As the interface with the RL78 flash programming tool, the USB-to-serial converter enables programming of the evaluation MCU. Note that the P40, P16, and P15 pins of the evaluation MCU are respectively occupied as the TOOL0, TOOLRXD, and TOOLTXD functions.

The USB-to-serial converter will be reset by shorting the Jumper Connector (J27, not fitted). If you want to use P16 (TOOLRXD) and P15 (TOOLTXD) as the pin functions of the evaluation MCU, cut the Jumper Trace Cut (E21, E23).

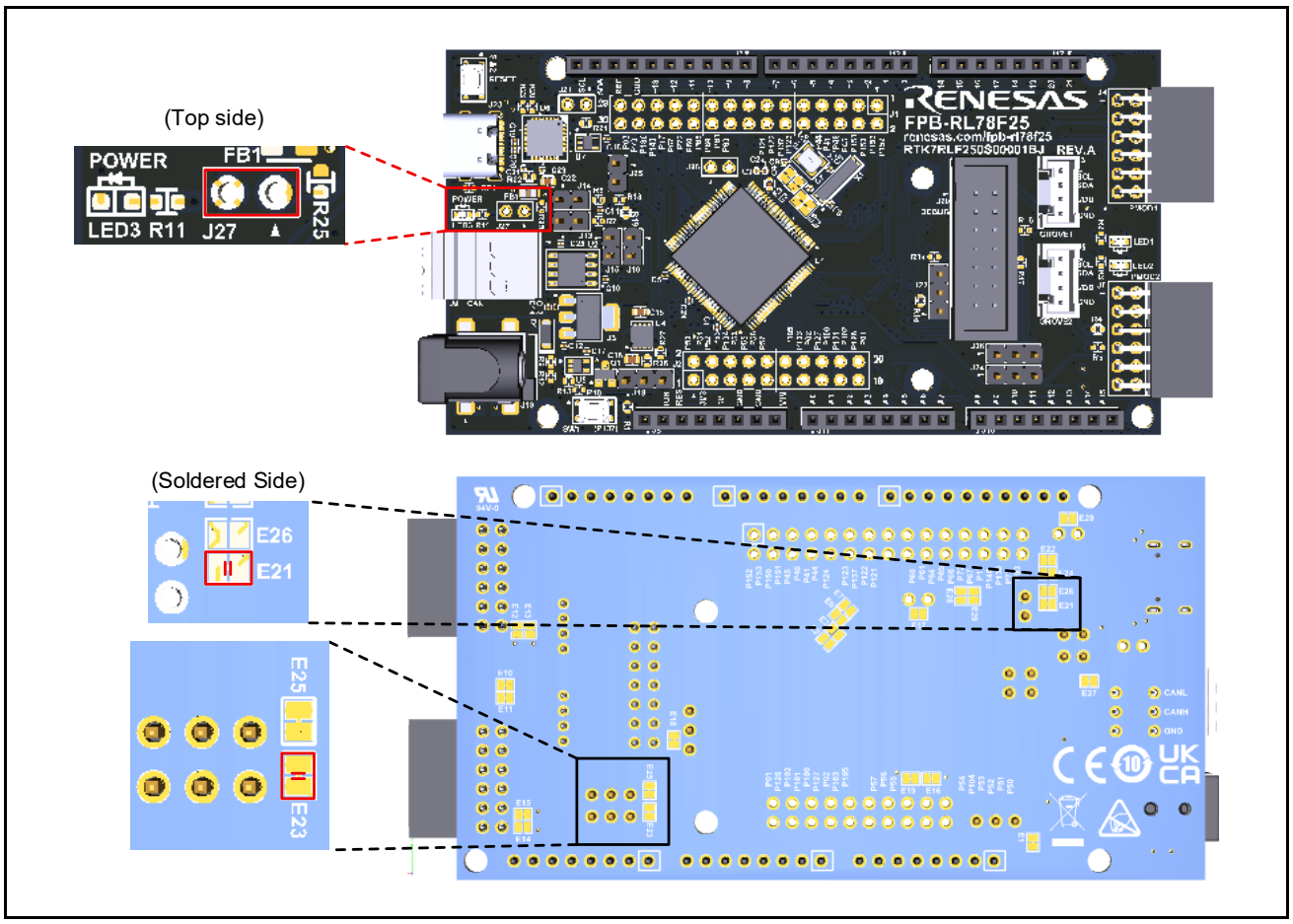


**Figure 5-11 Assignments of Jumper Connector (J27) and Jumper Solder (E21, E23)**

## 5.13 Power-Supply Selection Header

The power supply for this board can be selected from the DC jack, USB VBUS (5V), E2/E2 Lite emulator, or the MCU header (external power supply). The supply voltage (5 V or 3.3 V) can also be selected using the Jumper connector (J19).

- 1-2 of J19 being short-circuit selects a 5 V power supply (default connection).
- 2-3 of J19 being short-circuit selects a 3.3 V power supply
- J19 being open-circuit selects supply from the emulator or external power.

When changing the J19 selection, be sure to do so with the power supply turned off. If you are not using the USB VBUS (5V) supply, leave the Jumper connector (J19) open. Also, leave the Jumper connector (J21) open and cut the Jumper Trace Cut (E20).

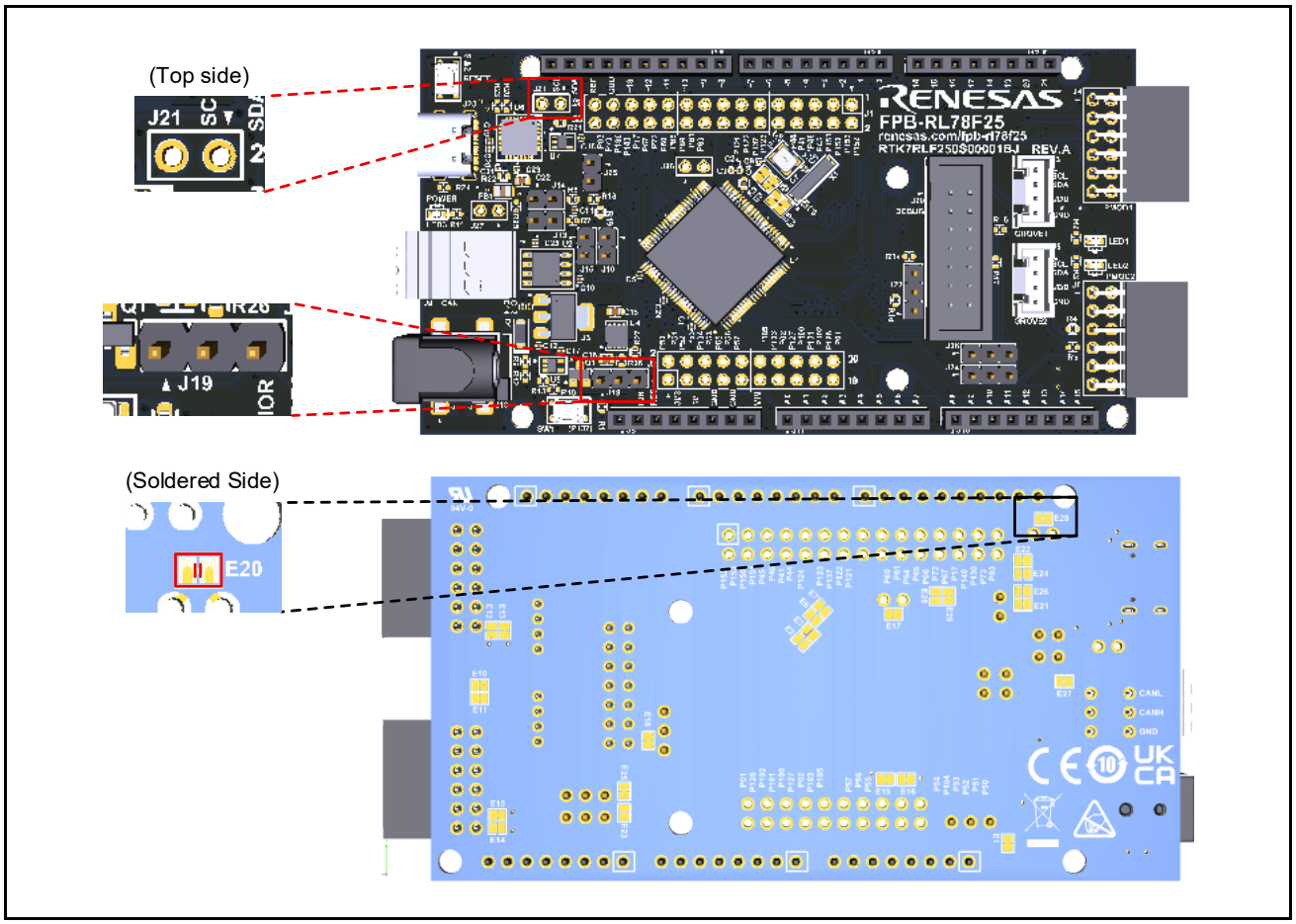


**Figure 5-12 Assignments of Jumper Connector (J19, J21) and Jumper Solder (E20)**

## 5.14 CAN Connector

The evaluation MCU is a product equipped with a 2-channel CAN FD/Classical CAN controller. This board is equipped with a CAN FD transceiver and CAN connector compatible with CAN0 (P10/CTXD0, P11/CRXD0). When using termination resistors on this board, connect the CAN circuit terminator connectors (J13, J14). Additionally, if you want to use P10 and P11 of the evaluation MCU for other port functions, disconnect the Jumper connectors (J10, J15).

CAN1 (P61/CTXD1, P60/CRXD1) is connected to Arduino® connector and MCU header. If you want to use CAN1, connect it to the CAN transceiver circuit from the Arduino® connector (J12-5, J12-6) and MCU header (J1-18, J1-19).

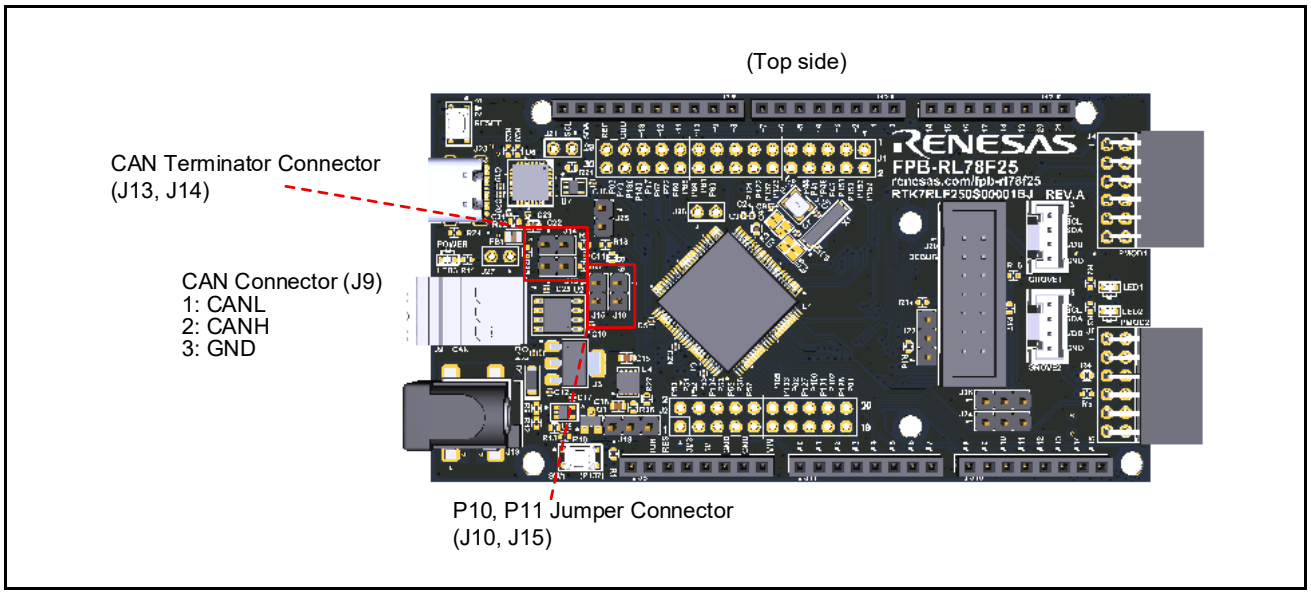


**Figure 5-13 Assignment of CAN Connector and Jumper Connectors (J10, J15)**

## 5.15 Emulator Connector

This 14-pin connector (J20) 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.

- J22, J24, and J26: pins 2-3 are short-circuit
- Jumper Trace Cut E18: cut
- Jumper Trace Cut E23: cut
- Jumper Trace Cut E25: cut

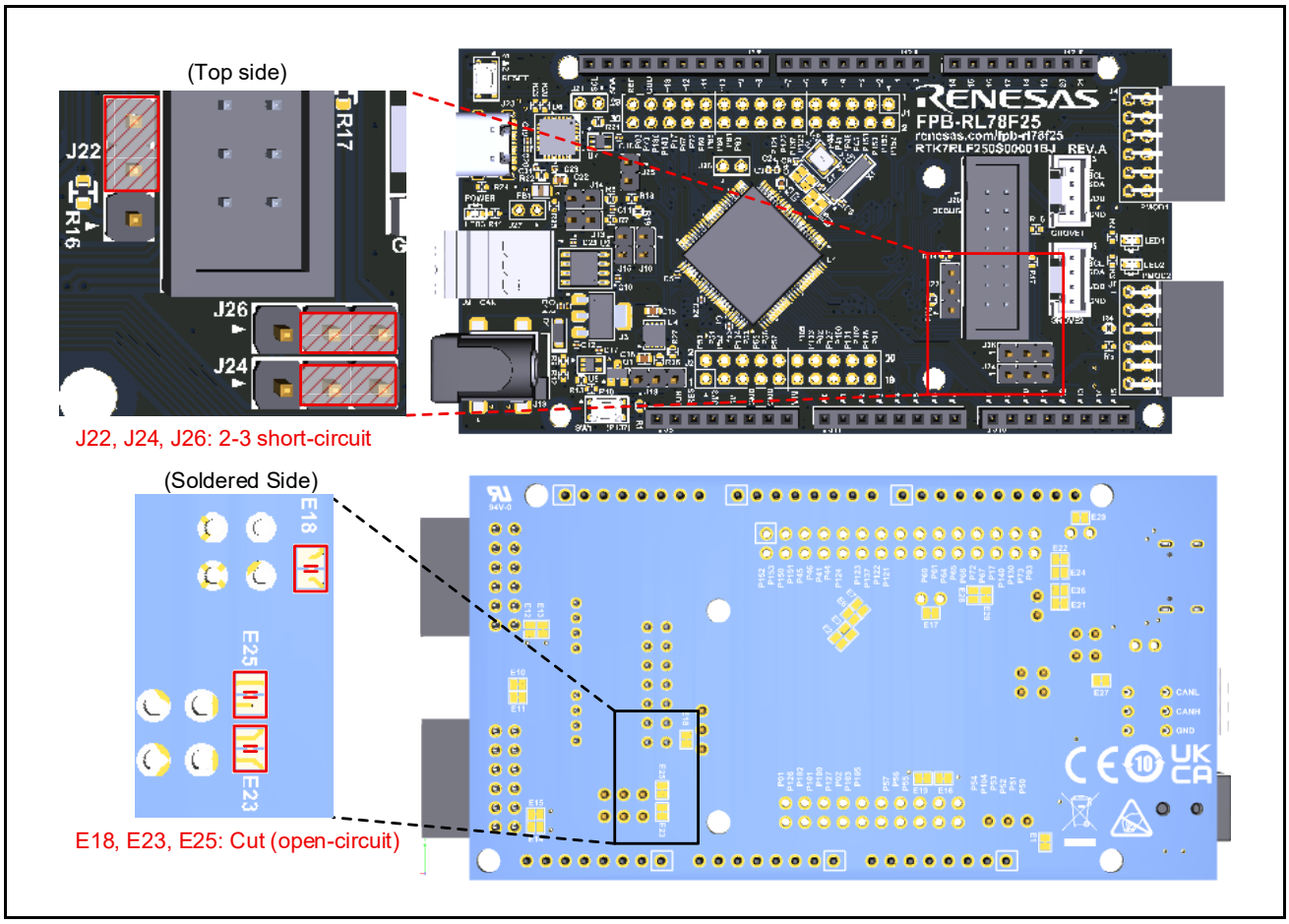


**Figure 5-14 Settings for Use with the Emulator Connector**

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).

After the changes to the circuit have been made to connect the emulator as described in the previous page, if you want to restore the settings to those for use of the USB-to-serial converter, make the following change of setting as follows.

- J22, J24, and J26: pins 1-2 are short-circuit

For the patterns that were cut on the previous page, solder need not to be applied.

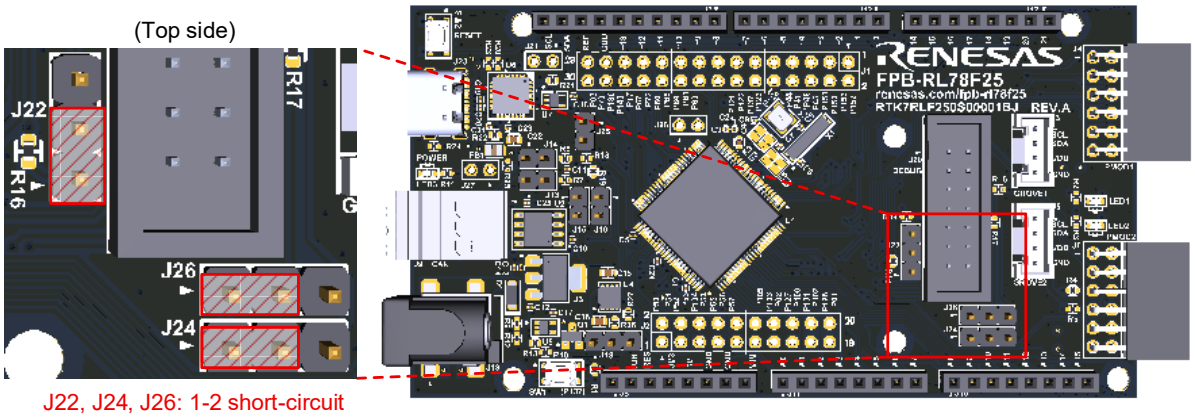


**Figure 5-15 Settings for Use with USB-to-UART Converter**

# 6. Handling Precautions

## 6.1 Power to be Supplied

When power is to be supplied to this product through the USB or the DC jack, 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 Jumper Trace Cut and short-circuiting the Jumper Solder Bridge) shall be conducted at the user's own responsibility.

The following shows the settings of jumpers as shipped.

- J19: pins 1-2 are short-circuit (VDD: 3.3 V)
- J24, J26: pins 1-2 are short-circuit (using a reset from the COM port)

## 6.3 Copper Jumpers

Copper jumpers are of two types, designated **Jumper Trace Cut (short)** and **Jumper Solder Bridge (open)**.

A **Jumper Trace Cut (short)** is provided with a narrow copper trace connecting its pads. The silk screen overlay printing around a Jumper Trace Cut (short) is a solid box. To isolate the pads, cut the trace between pads adjacent to each pad, then remove the connecting copper foil either mechanically or with the assistance of heat. Once the etched copper trace is removed, the Jumper Trace Cut (short) is turned into a Jumper Solder Bridge (open) for any later changes.

A **Jumper Solder Bridge (open)** is provided with two isolated pads that may be joined together by one of three methods:

- Solder may be applied to both pads to develop a bulge on each and the bulges joined by touching a soldering iron across the two pads.
- A small wire may be placed across the two pads and soldered in place.
- A SMD zero-ohm resistor, inch size 0805, 0603, or 0402, may be placed across the two pads and soldered in place. A zero-ohm resistor shorts the pads together.

For any copper jumper, the connection is considered **short-circuit** if there is an electrical connection between the pads (default for Jumper Trace Cut (short)). The connection is considered **open** if there is no electrical connection between the pads (default for Jumper Solder Bridge (open)).

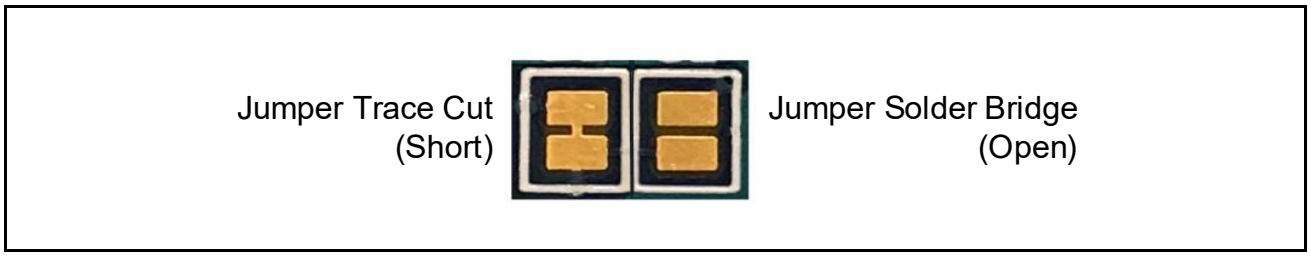


**Figure 6-1 Copper Jumpers**

## 6.4 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 Shieds Note1 | Use of Pmod or Grove modules Note 1 | Use of an emulator and IDE | Jumper setting |
| USB Note 3 | 5 V or 3.3 V | Possible | Possible | Possible Note 2 | J19: 1-2 short-circuit: 5 V<br>J19: 2-3 short-circuit: 3.3 V |
| DC jack Note 4 | 5 V or 3.3 V | Possible | Possible | Possible Note 2 | J19: 1-2 short-circuit: 5 V<br>J19: 2-3 short-circuit: 3.3 V |
| External power supply Note 4 | 2.7 V to 5.5 V | Possible | Possible | Possible Note 2 | J19: open |
| Emulator Note 4 | E2 Lite: 3.3 V<br>E2: 2.7 V to 5 V | Not possible | Possible | Possible | J19: open |

Notes: 1. Connecting the RL78/F25 Fast Prototyping Board to an Arduino shield, a Pmod module, or a Grove 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 the Arduino Shield requires a 5 V or 3.3 V supply, power it via the DC jack or USB connection.

2. Use the IDE in a state where power is being supplied from a source other than the emulator.
3. When using USB power supply, connect the Jumper connector (J21) or Jumper Trace Cut (E20).
4. When using other than USB power supply, open the Jumper connector (J21) and cut the Jumper Trace Cut (E20).

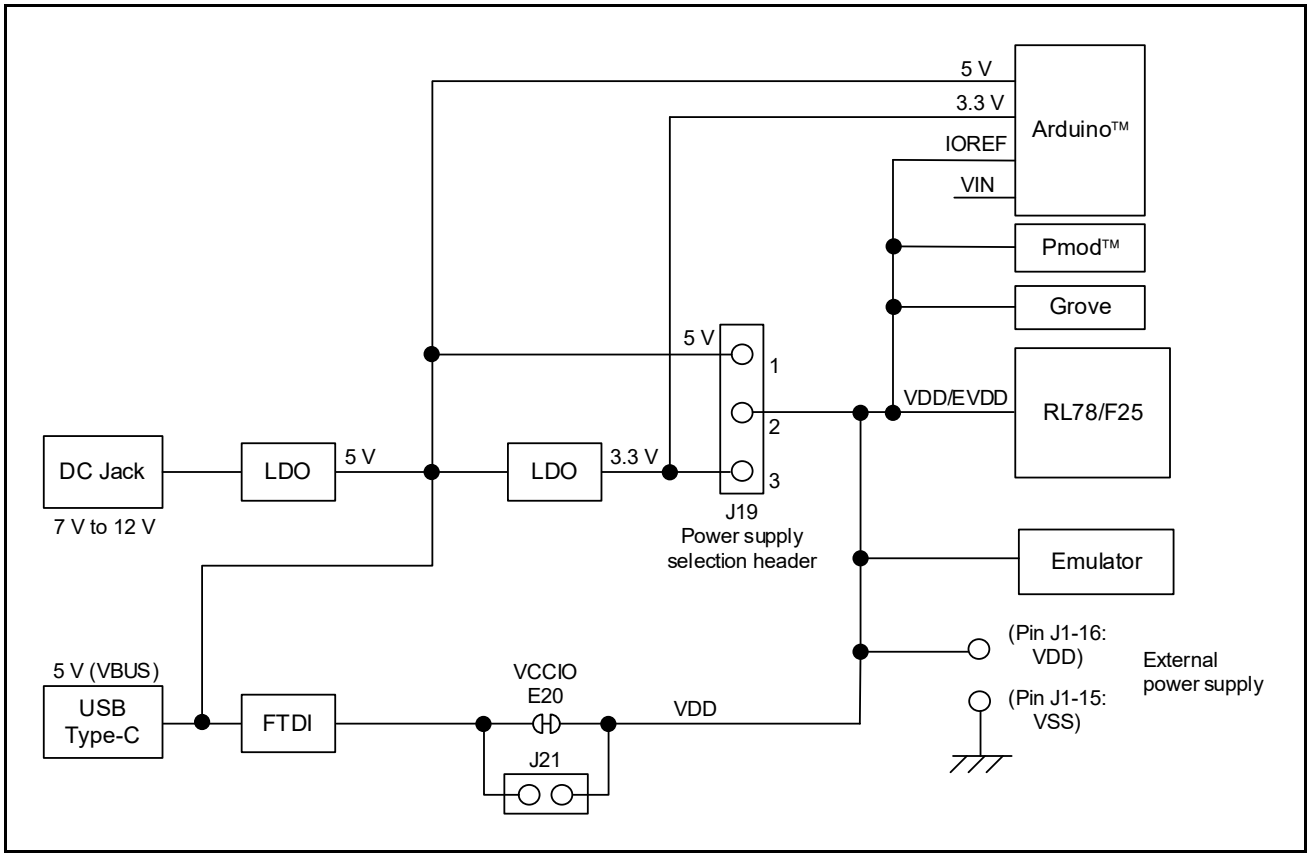


**Figure 6-2 Block Diagram of the Power-Supply Circuit**

## 6.5 Note on Using USB-to-Serial Converter

In this product, if a user program is written to the evaluation MCU that starts UART transmission output on the P15/TOOLTXD line before the USB-to-Serial converter is recognized as a COM port by the host PC when the power is turned on or immediately after the USB-to-Serial converter is released from reset state, the operation of the USB-to-Serial converter will become unstable and it may become impossible to connect to the Renesas Flash Programmer or terminal software.

If this happens, do one of the following:

- Press and hold the reset switch, turn it on (connect the USB cable), wait enough for the host PC to recognize it as a COM port (about 3 seconds), and then release the reset switch.
- Press and hold the reset switch, reset the USB to serial converter (short-circuit the J27 and return it to its original state (open)), wait enough for the host PC to recognize it as a COM port (about 3 seconds), and then release the reset switch.

Then use Renesas Flash Programmer to clear the user program.

# 7. Development Code

Use the e$^2$ studio or CS+, both of which support the evaluation MCU (RL78/F25).

For the usage of the E2 emulator and E2 emulator Lite, refer to the help system or user's manual of the e$^2$ studio or CS+.

When debugging by connecting the RL78/F25 Fast Prototyping Board and E2, E2 emulator Lite, refer to the "5.15 Emulator Connector". The connection configuration between the RL78/F25 Fast Prototyping Board and the E2, E2 emulator Lite is shown in the diagram below.

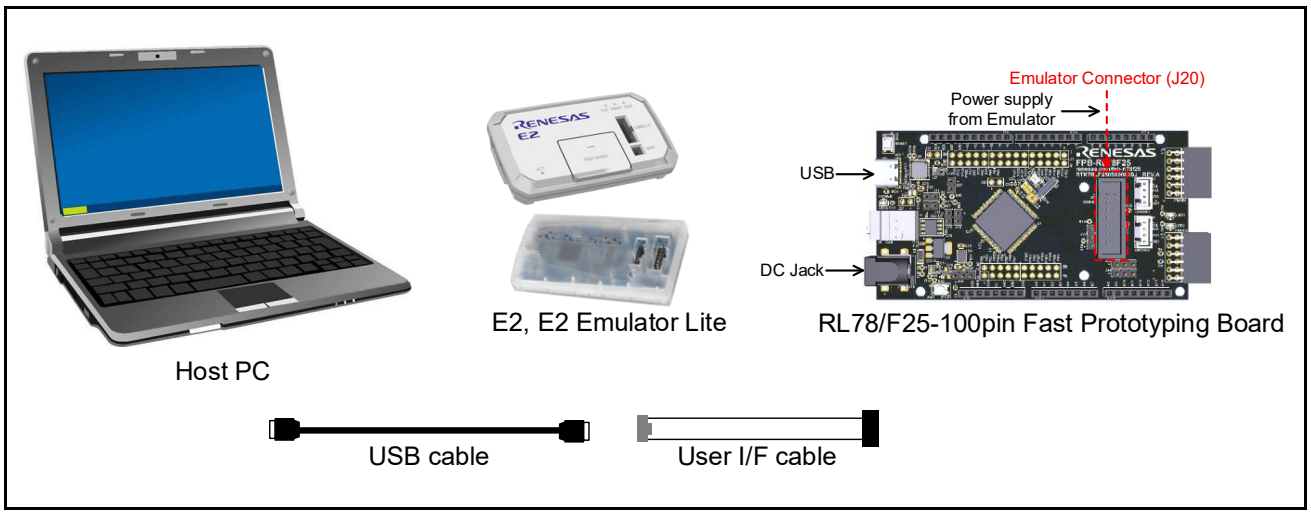


**Figure 7-1 Emulator Connection Configuration**

# 8. Certifications

The RL78/F25 Fast Prototyping Board meets the following certifications/standards. See page 4 of this user's manual for the disclaimer and precautions.

## 8.1 EMC/EMI Standards

- CE Class A (EMC)

  This product is herewith confirmed to comply with the requirements set out in the Council Directives on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility Directive 2014/30/EU.

  Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures to correct this interference.

- UKCA Class A (EMC)

  This product is in conformity with the following relevant UK Statutory Instrument(s) (and its amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016.

  Warning – This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures to correct this interference.

- Taiwan: Chinese National Standard 13438, C6357 compliance, Class A limits
- Australia/New Zealand AS/NZS CISPR 32:2015, Class A

## 8.2 Material Selection, Waste, Recycling and Disposal Standards

- EU RoHS
- China SJ/T 113642014, 10-year environmental protection use period.
- WEEE Directive (2012/19/EU) & The Waste Electrical and Electronic Equipment Regulations 2013

The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the UK and European Union.

This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner.

Renesas Electronics Europe GmbH can take back end of life equipment. Register for this service at;
https://www.renesas.com/eu/en/support/regional-customer-support/weee

## 8.3 Safety Standards

- UL 94V-0

# 9. Design and Manufacturing Information

The RL78/F25 Fast Prototyping Board design and manufacturing information is available at: https://www.renesas.com/fpb-rl78lf25.

- FPB-RL78F25 v1 Design Package File Name: fpb-rl78f25-v1-designpackage.zip
- FPB-RL78F25 v1 Design Package Contents: See Table 9-1.

**Table 9-1 FPB-RL78F25 v1 Design Package Contents**

| File Type | Content | File/Folder Name |
|---|---|---|
| File (PDF) | Schematics | RL78/F25 Fast Prototyping Board Schematic (r20ut5804ej0100-fpb-rl78f25-v1-schematicspdf) |
| File (PDF) | BOM | RL78/F25 Fast Prototyping Board BOM List (r20ut5802ej0100-fpb-rl78f25-v1-bom.pdf) |
| File (PDF) | Design drawings | fpb-rl78f25-v1-mechdwg.pdf |
| File (PDF) | 3D drawing | fpb-rl78f25-v1-3d.pdf |
| Folder | Manufacturing file | Manufacturing Files |
| Folder | Design file | Design Files - Altium |

# 10. Website and Support

Visit the following URLs to learn about the kit and the RL78 family of microcontrollers, download tools and documentation, and get support.

| | |
|---|---|
| RL78 Fast Prototyping Board resources | https://www.renesas.com/fpb-rl78f25 |
| RL78 Product Information | renesas.com/rl78 |
| RL78 Product Support Forum | https://community.renesas.com/mcu-mpu/rl78/ |
| Renesas Support | renesas.com/support |

# 11. APPENDIX

## 11.1 Pin Assignment of Evaluation MCU

**Table 11-1 Evaluation MCU Pin Assignment List (1/3)**

| Pin No. | Pin Function | Arduino Connector | Pmod Connector | Grove Connector | MCU Header | Others |
|---|---|---|---|---|---|---|
| 1 | P153/(SCK11) | | | | J1-1 | |
| 2 | P152/(SI11) | | | | J1-2 | |
| 3 | P151/(SO11) | | | | J1-3 | |
| 4 | P150/(SSI11) | | | | J1-4 | |
| 5 | P47/INTP13 | | J6-1 | | | |
| 6 | P46/(TI12)/(TO12) | | | | J1-5 | |
| 7 | P45/(TI10)/(TO10) | | | | J1-6 | |
| 8 | P44/(TI07)/(TO07) | | | | J1-7 | |
| 9 | P43/(LRXD0) | J17-7 | | | | |
| 10 | P42/(LTXD0) | J17-8 | | | | |
| 11 | P41/TI10/TO10/TRJIO0/TRD0RES/(SI10)/(RXD1)/VCOUT0/SNZOUT2 | | | | J1-8 | |
| 12 | P40/TOOL0 | | | | | Emulator I/F, USB-UART circuit |
| 13 | RESET | J8-3 | | | J1-9 | Emulator I/F, Reset circuit |
| 14 | P124/XT2/EXCLKS | | | | J1-10 | Sub-OSC |
| 15 | P123/XT1 | | | | J1-11 | Sub-OSC |
| 16 | P137/INTP0 | | | | J1-12 | SW1, USB-UART circuit |
| 17 | P122/X2/EXCLK | | | | J1-13 | Main-OSC |
| 18 | P121/X1 | | | | J1-14 | Main-OSC |
| 19 | REGC | | | | | C4 |
| 20 | $V_{SS}$ | J8-6, J8-7 | | | J1-15 | |
| 21 | $EV_{SS0}$ | J8-6, J8-7 | | | | |
| 22 | $V_{DD}$ | | | | J1-16 | C2 |
| 23 | $EV_{DD0}$ | J8-2 | | | | C3 |
| 24 | P60/(TO01)/(SCK00)/(SCL00)/CRXD1/TS0 | J12-6 | J6-8 | | J1-18 | |
| 25 | P61/(TO02)/(SI00)/(SDA00)/(RXD0)/CTXD1/TS1 | J12-5 | J6-7 | | J1-19 | |
| 26 | P62/(TO03)/(SO00)/(TXD0)/SCLA0/TS2 | J7-10 | J6-3 | J5-1 | | |
| 27 | P63/(TO07)/(SSI00)/SDAA0/TS3 | J7-9 | J6-4 | J5-2 | | |
| 28 | P64/(TI14)/(TO14)/(SNZOUT3)/TS4 | | | | J1-20 | |
| 29 | P65/(TI16)/(TO16)/(SNZOUT2)/TS5 | | | | J1-21 | |
| 30 | P66/(TI00)/(TO00)/TS6 | | | | J1-22 | |
| 31 | P67/(TI02)/(TO02)/TS7 | J7-4 Note | | | J1-24 | |
| 32 | P154/LRXD2/(SNZOUT7) | | J4-9 | | | |
| 33 | P155/LTXD2/(SNZOUT6) | | J4-10 | | | |
| 34 | P00/(TI05)/(TO05)/INTP9 | J12-4 | | | | |
| 35 | P156/(SNZOUT5) | | J4-1, J6-2 | | | |

Note J7-4 (~11) is connected to 45-pin (P72/SO11) by default. If you want to connect it to 31-pin (P67/(TO02)), cut Jumper Trace Cut (E29) and connect E28.

**Table 11-1 Evaluation MCU Pin Assignment List (2/3)**

| Pin No. | Pin Function | Arduino Connector | Pmod Connector | Grove Connector | MCU Header | Others |
|---|---|---|---|---|---|---|
| 36 | P157/(SNZOUT4) | | J4-8 | | | |
| 37 | P140/TRD1RES/PCLBUZ0 | | | | J1-26 | |
| 38 | P130/RESOUT | | | | J1-27 | |
| 39 | P77/(SSI10)/INTP12/TS8 | | J4-7 | | | |
| 40 | P76/(SCK10)/TS9 | | J4-4 | | | |
| 41 | P75/(SI10)/(RXD1)/TS10 | J17-3 | J4-3 | | | |
| 42 | P74/ANI28/(SO10)/(TXD1)/TS11 | J17-4 | J4-2 | | | |
| 43 | $EV_{SS1}$ | J8-6, J8-7 | | | | |
| 44 | P73/ANI27/SSI11/(CRXD0)/SNZOUT7/ TS12 | | | | J1-28 | |
| 45 | P72/ANI26/SO11/(CTXD0)/SNZOUT6/ TS13 | J7-4 Note | | | J1-23 | |
| 46 | P71/ANI25/TI17/TO17/SCK11/SCL11/ (LRXD2)/INTP6/SNZOUT5/TS14 | J7-6 | | J3-1 | | |
| 47 | P70/ANI24/TI15/TO15/SI11/SDA11/ (LTXD2)/INTP8/SNZOUT4/TS15 | J7-5 | | J3-2 | | |
| 48 | P03/(RTC1HZ) | | | | J1-29 | |
| 49 | P32/TI16/TO16/(SO11)/INTP7 | J7-3 | | | | |
| 50 | P30/TI01/TO01/TRDIOD1/SSI00/INTP2/ SNZOUT0 | J12-3 | | | | |
| 51 | P17/TI00/TO00/TRDIOB1/SCK00/SCL00/ INTP3/TS16 | | | | J1-25 | |
| 52 | P16/TI02/TO02/TRDIOC1/SI00/SDA00/ RXD0/TOOLRXD/TS17 | J12-1 | | | | USB-UART |
| 53 | $EV_{DD1}$ | J8-2 | | | | C5 |
| 54 | P15/TI05/TO05/TRDIOA1/(TRDIOA0)/ (TRDCLK0)/SO00/TXD0/RTC1HZ/ TOOLTXD/TS18 | J12-2 | | | | USB-UART |
| 55 | P31/TI14/TO14/(INTP2)/STOPST | J17-6 | | | | |
| 56 | P50/(SSI01)/(INTP3)/TS19 | | | | J2-1 | LED1 |
| 57 | P51/(SO01)/INTP11/TS20 | | | | J2-2 | LED2 |
| 58 | P52/(SCK01)/(STOPST)/TS21 | | | | J2-3 | |
| 59 | P53/(SI01)/INTP10/TS22 | | | | J2-4 | |
| 60 | P14/TI06/TO06/TRDIOC0/SCK01/SCL01/ LRXD0/TS23 | J12-7 | | | | |
| 61 | P13/TI04/TO04/TRDIOA0/TRDCLK0/ SI01/SDA01/LTXD0/TS24 | J12-8 | | | | |
| 62 | P12/TI11/TO11/(TRDIOD0)/SO10/TXD1/ INTP5/SNZOUT3/TSCAP | J7-1 | | | | C24 (for TSCAP pin) |
| 63 | P11/TI12/TO12/(TRDIOB0)/SI10/SDA10/ RXD1/CRXD0/LRXD1/TS25 | J17-1 | | | | CAN circuit |
| 64 | P10/TI13/TO13/TRJO0/SCK10/SCL10/ CTXD0/LTXD1/TS26 | J17-2 | | | | CAN circuit |
| 65 | P54/(TI11)/(TO11)/SSI10/TS27 | | | | J12-6 | CAN circuit |
| 66 | P55/(TI13)/(TO13)/TS28 | | | | J12-7 | |
| 67 | P56/(TI15)/(TO15)/(SNZOUT1)/TS29 | | | | J12-8 | |
| 68 | P57/(TI17)/(TO17)/(SNZOUT0)/TS30 | | | | J12-9 | |
| 69 | P107/(LRXD1) | | J6-10 | | | |
| 70 | P106/(LTXD1) | | J6-9 | | | |

Note J7-4 (~11) is connected to 45-pin (P72/SO11) by default. If you want to connect it to 31-pin (P67/(TO02)), cut Jumper Trace Cut (E29) and connect E28.

**Table 11-1 Evaluation MCU Pin Assignment List (3/3)**

| Pin No. | Pin Function | Arduino Connector | Pmod Connector | Grove Connector | MCU Header | Others |
|---|---|---|---|---|---|---|
| 71 | P105/ANI21 | | | | J2-12 | |
| 72 | P104/ANI20 | | | | J2-5 | |
| 73 | $AV_{DD}/AV_{REFP}$ | J7-8 | | | J2-10 | C1 |
| 74 | $AV_{SS}/AV_{REFM}$ | J7-7 | | | J2-11 | |
| 75 | P80/ANI0/ANO0 | J11-1 | | | | |
| 76 | P81/ANI1 | J11-2 | | | | |
| 77 | P82/ANI2/IVCMP00 | J11-3 | | | | |
| 78 | P83/ANI3/IVCMP01 | J11-4 | | | | |
| 79 | P84/ANI4/IVCMP02 | J11-5 | | | | |
| 80 | P85/ANI5/IVREF0/IVCMP03 | J11-6 | | | | |
| 81 | P86/ANI6 | J11-7 | | | | |
| 82 | P87/ANI7 | J11-8 | | | | |
| 83 | P90/ANI8 | J16-1 | | | | |
| 84 | P91/ANI9 | J16-2 | | | | |
| 85 | P92/ANI10 | J16-3 | | | | |
| 86 | P93/ANI11 | J16-4 | | | | |
| 87 | P94/ANI12 | J16-5 | | | | |
| 88 | P95/ANI13 | J16-6 | | | | |
| 89 | P96/ANI14 | J16-7 | | | | |
| 90 | P97/ANI15 | J16-8 | | | | |
| 91 | P100/ANI16 | | | | J2-16 | |
| 92 | P101/ANI17 | | | | J2-17 | |
| 93 | P102/ANI18 | | | | J2-18 | |
| 94 | P103/ANI19 | | | | J2-13 | |
| 95 | P02/(TI06)/(TO06) | | | | J2-14 | |
| 96 | P127/(TI03)/(TO03) | | | | J2-15 | |
| 97 | P126/(TI01)/(TO01) | | | | J2-19 | |
| 98 | P01/(TI04)/(TO04) | | | | J2-20 | |
| 99 | P125/ANI22/TI03/TO03/TRDIOB0/SSI01/(LRXD1)/INTP1/SNZOUT1 | J17-5 | | | | |
| 100 | P120/ANI23/TI07/TO07/(TO13)/TRDIOD0/SO01/(SCK10)/(LTXD1)/INTP4 | J7-2 | | | | |

## 11.2 List of Connectors

**Table 11-2 Connector List**

| No. in the Circuit Schematics | Connector Name | Connector Specifications |
|---|---|---|
| J1 | MCU header | MCU Header (15 × 2) |
| J2 | MCU header | MCU Header (10 × 2) |
| J3 | Grove connector | Grove 1 |
| J4 | Pmod™ (Type 2A/3A) connector | Pmod 1 |
| J5 | Grove connector | Grove 2 |
| J6 | Pmod™ (Type 6A) connector | Pmod 2 |
| J7 | Arduino connector | Arduino™ MEGA 2560 (10-pin) |
| J8 | Arduino connector | Arduino™ MEGA 2560 (8-pin) |
| J9 | CAN connector | CAN I/F |
| J10 | CAN0 pin connector | Connection between P10/CTXD0 and CAN transceiver |
| J11 | Arduino connector | Arduino™ MEGA 2560 (8-pin) |
| J12 | Arduino connector | Arduino™ MEGA 2560 (8-pin) |
| J13 | CAN circuit terminator connector | Junction of CAN terminator |
| J14 | CAN circuit terminator connector | Junction of CAN terminator |
| J15 | CAN0 pin connector | Connection between P11/CRXD0 and CAN transceiver |
| J16 | Arduino connector | Arduino™ MEGA 2560 (8-pin) |
| J17 | Arduino connector | Arduino™ MEGA 2560 (8-pin) |
| J18 | DC jack connector | Connector for DC jack power supply |
| J19 | Supply voltage selection connector | Connector for supply voltage selection (5 V or 3.3 V) |
| J20 | Emulator connector | Connector for E2/E2 Lite emulator |
| J21 | USB VBUS power supply connector | USB VBUS power supply junction |
| J22 | TOOL0 signal selection connector | Switching between E2/E2 Lite emulator and USB-to-Serial converter signal |
| J23 | USB connector | USB 2.0 Type-C |
| J24 | RESET signal selection connector | Emulator/USB-to-UART reset signal switching |
| J25 | RESET signal selection connector | Junction of the reset signal for USB-UART communication |
| J26 | RESET signal selection connector | Emulator/USB-to-UART reset signal switching |
| J27 | FT232RNQ reset connector | FT232RNQ reset connection |
| J28 | MCU-VDD junction connector | Connection between MCU-VDD and VDD |

## 11.3 List of Jumper Solders

**Table 11-3 Jumper Solder List**

| No. in the Circuit Schematics | Default | Jumper Solder Name | Jumper Solder Specifications |
|---|---|---|---|
| E1 | Short | P137 pin connection | P137 and SW1 connection |
| E2 | Open | P124 pin connection | P124 and MCU header connection |
| E3 | Open | P123 pin connection | P123 and MCU header connection |
| E4 | Short | P124 pin connection | P124 and sub-clock circuit connection |
| E5 | Short | P123 pin connection | P123 and sub-clock circuit connection |
| E6 | Open | P122 pin connection | P122 and MCU header connection |
| E7 | Open | P121 pin connection | P121 and MCU header connection |
| E8 | Short | P122 pin connection | P122 and main-clock circuit connection |
| E9 | Short | P121 pin connection | P121 and main-clock circuit connection |
| E10 | Short | P50 pin connection | P50 and LED1 connection |
| E11 | Short | P51 pin connection | P51 and LED2 connection |
| E12 | Open | Pmod 1 (VCC) connection switching | Pmod 1 (VCC) and 5.0 V signal connection |
| E13 | Short | Pmod 1 (VCC) connection switching | Pmod 1 (VCC) and VDD voltage connection |
| E14 | Open | Pmod 2 (VCC) connection switching | Pmod 2 (VCC) and 5.0 V signal connection |
| E15 | Short | Pmod 2 (VCC) connection switching | Pmod 2 (VCC) and VDD voltage connection |
| E16 | Short | $AV_{DD}$ pin connection | $AV_{DD}$ and VDD voltage connection |
| E17 | Short | $V_{DD}$ pin connection | $V_{DD}$ and VDD voltage connection |
| E18 | Short | P40/TOOL0 pin connection | P40/TOOL0 and USB-UART signal connection |
| E19 | Short | $AV_{SS}$ pin connection | $AV_{SS}$ and GND voltage connection |
| E20 | Short | VDD signal connection | VDD signal and USB VBUS supply voltage connection |
| E21 | Short | P16 pin connection | P16 and USB-UART (TXD) connection |
| E22 | Short | P15 pin connection | P15 and USB-UART (RXD) connection |
| E23 | Short | RESET pin connection | RESET and USB-UART RESET signal connection |
| E24 | Open | RTS signal connection | USB-UART RTS signal connection |
| E25 | Short | RESET pin connection | RESET and RESET signal of USB-UART connection |
| E26 | Open | DTR signal connection | RESET and DTR signal of USB-UART connection |
| E27 | Short | VIO pin connection | VIO pin of CAN transceiver and VDD connection |
| E28 | Open | P67 pin connection | P67 and Arduino connector (J7-4) connection |
| E29 | Short | P72 pin connection | P72 and Arduino connector (J7-4) connection |

| Revision History | RL78/F25 Fast Prototyping Board User's Manual |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Apr.30.26 | — | First Edition issued |

RL78/F25 Fast Prototyping Board User's Manual

Publication Date: Rev.1.00 Apr.30.26

Published by: Renesas Electronics Corporation

RL78/F25

Renesas Electronics Corporation

R20UT5803EJ0100