

RX14T Group

Fast Prototyping Board for RX14T Microcontroller Group
FPB-RX14T v1 User's Manual

Renesas RX Family
RX100 Series

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1. Precaution against Electrostatic Discharge (ESD)

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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.
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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.).
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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.

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Renesas RX Family

FPB-RX14T v1 User's Manual

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List of Abbreviations and Acronyms**Table 1. List of Abbreviations and Acronyms**

Abbreviation	Full Form
BoM	Bill of Materials
CS	Chip Select
CTS	Clear to Send
EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EU	European Union
FPB	Fast Prototyping Board
GPIO	General Purpose Input Output
I ² C (or IIC)	Inter-Integrated Circuit
IDE	Integrated Development Environment
I/F	Interface
INT	Interrupt
I/O	Input/Output
IRQ	Interrupt Request
LED	Light Emitting Diode
LFQFP	Lead Free Quad Flat Package
MCU	Micro Controller Unit
MISO	Master In Slave Out
MOSI	Master Out Slave In
NC (or N.C.)	Not Connected
PWM	Pulse Width Modulation
RIIC	Renesas I ² C
RSPI	Renesas SPI
RTC	Real Time Clock
RTS	Request to Send
RXD	Receive Data
S12ADE	12-bit Analog to Digital Converter
SCI	Serial Communications Interface
SCK	Serial Clock
SCL	Serial Clock Line
SDA	Serial Data Line
SMD	Surface Mount Device
SPI	Serial Peripheral Interface
TXD	Transmit Data
UART	Universal Asynchronous Receiver Transmitter
USB	Universal Serial Bus

1. Board Overview

The FPB-RX14T v1, a Fast Prototyping Board for the RX14T MCU, enables users to seamlessly evaluate the features of the RX14T MCU and develop embedded systems applications using the e² studio IDE. Users can use on-board features along with their choice of popular ecosystem add-on modules to bring their big ideas to life.

The key features of the FPB-RX14T v1 are categorized in two groups (consistent with the architecture of the board) as follows:

MCU Native Pin Access

- R5F514T5AMFM MCU (referred to as RX MCU)
 - Max 48 MHz, 32-bit RX CPU (RXv2)
 - 128 KB ROM, 12 KB RAM
 - 64-pin, LFQFP package
- Native pin access through 2 x 32-pin breakout pin headers (not fitted)
- RX MCU current measurement point for precision current consumption measurement
- RX MCU on-chip oscillators as clock

System Control and Ecosystem Access

- Two 5 V input sources
 - USB
 - External power supply (using 2-pin header [not fitted])
- On-board debugger / programmer (E2 emulator On Board (referred as E2OB, FINE Interface))
- LEDs and switches
 - Two User LEDs (green)
 - Power LED (green) indicating availability of regulated power
 - Debug LED (yellow) indicating the debug connection
 - One User switch
 - One Reset switch
- Two popular ecosystem expansions
 - Two Digilent Pmod (UART / SPI / I²C) connectors
 - Arduino Uno R3 (referred to as Arduino) connector
- SCI Interface Connector (not fitted)
 - Supports UART connection
 - Supports connection with the MC-COM Renesas Flexible Motor Control Communication Board (Product part number: RTK0EMXC90S00000BJ)

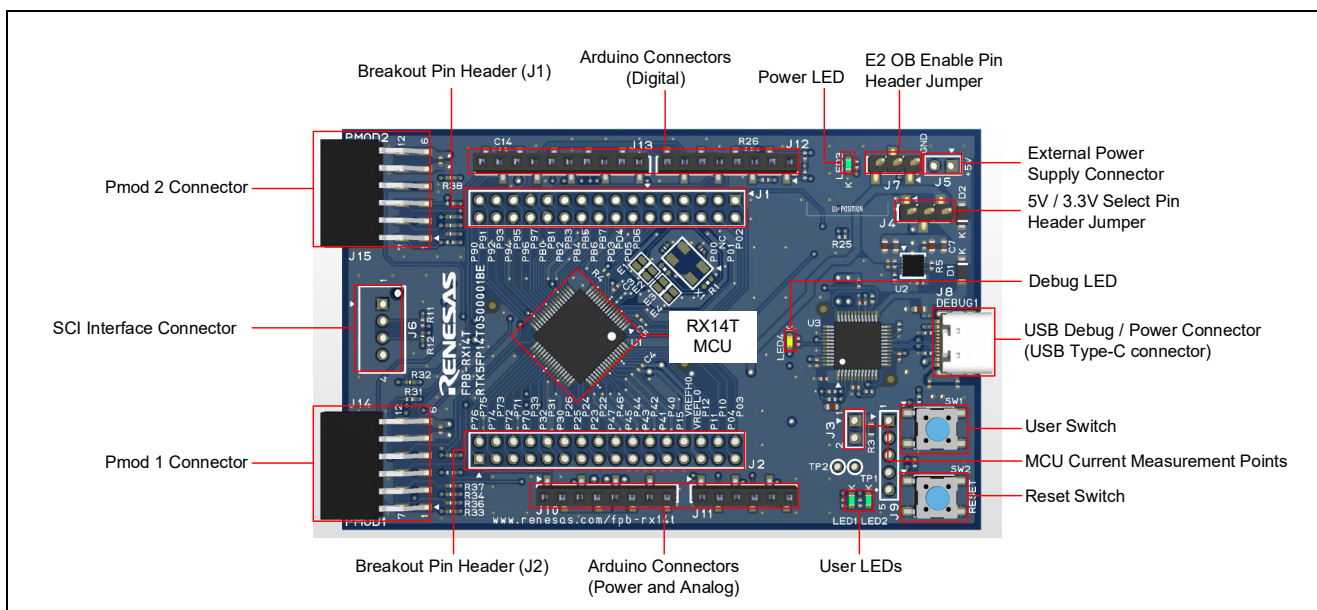


Figure 1. FPB-RX14T v1 Top Side

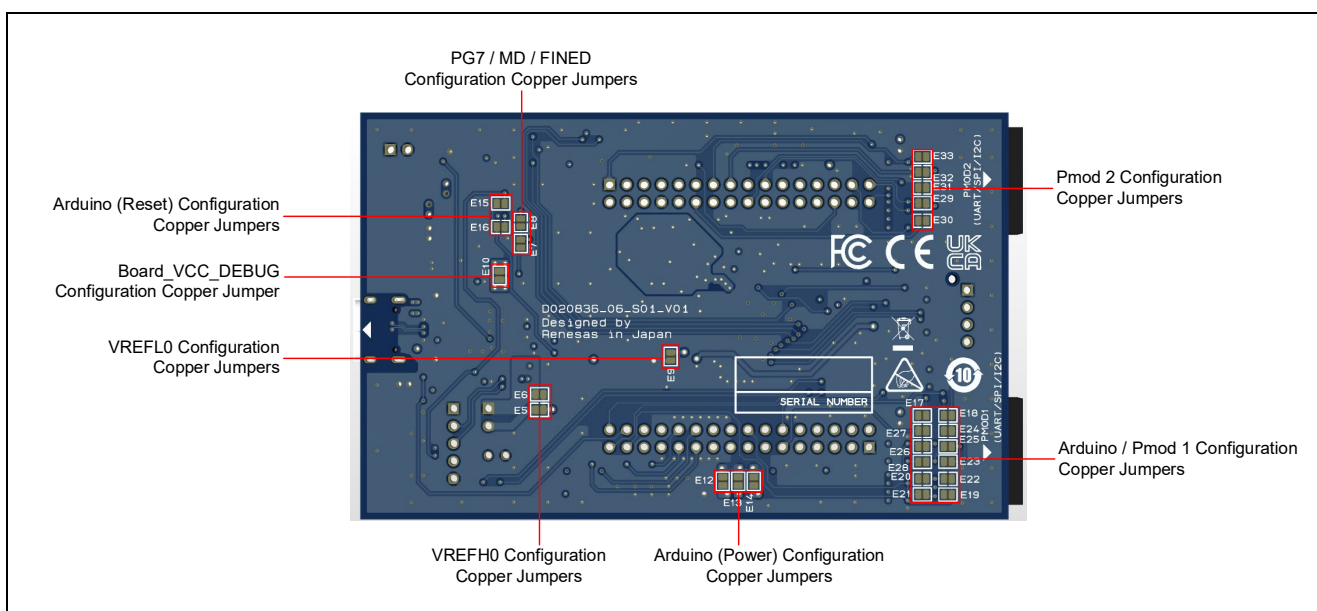


Figure 2. FPB-RX14T v1 Bottom Side

1.1 Assumptions and Advisory Notes

1. It is assumed that the user has a basic understanding of microcontrollers and embedded systems hardware.
2. An Integrated Development Environment (IDE) such as e² studio is required to develop embedded applications on FPB-RX14T v1.

2. Box Contents

1. FPB-RX14T
2. Printed Quick Start Guide

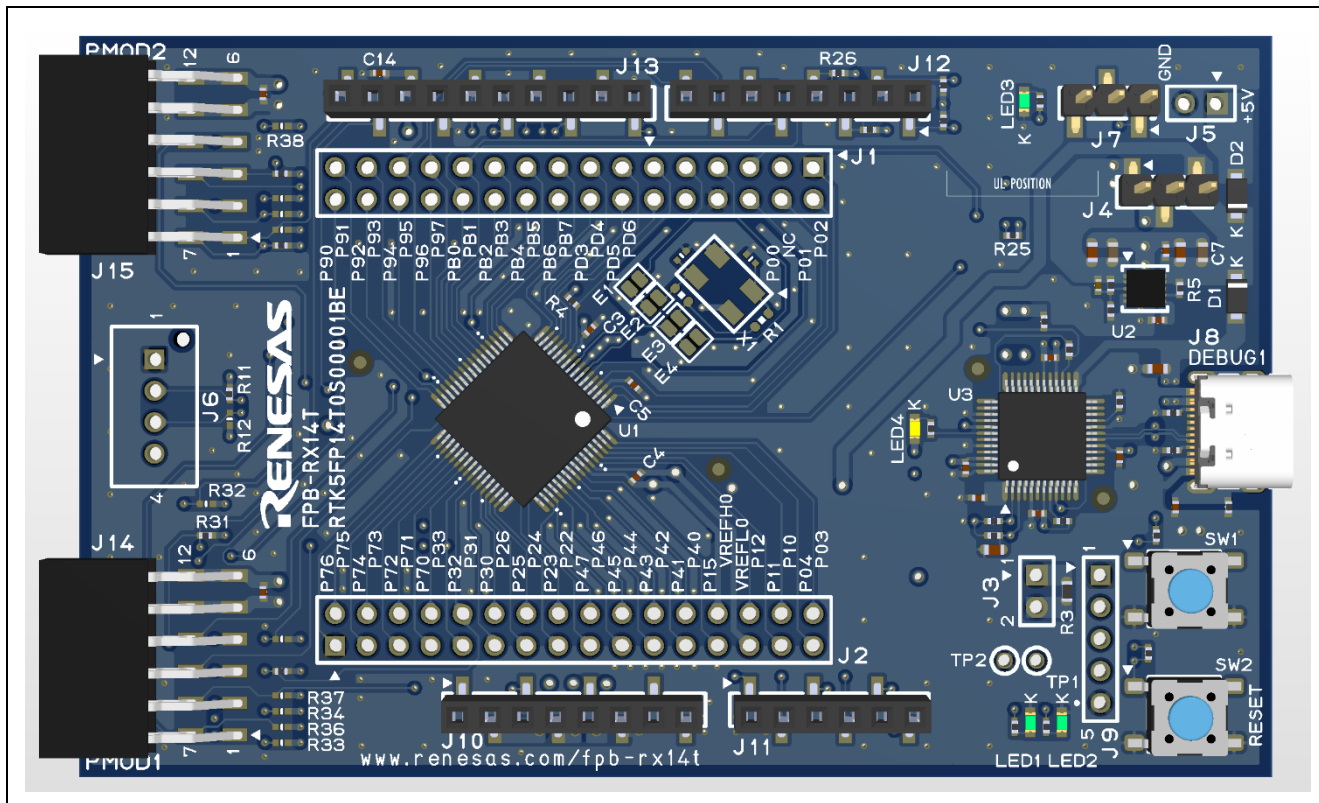


Figure 3. FPB-RX14T v1

3. Ordering Information

- FPB-RX14T v1 orderable part number: RTK5FP14T0S00001BE

Note: The underlined character in the orderable part number represents the kit version.

4. Hardware Architecture and Default Configuration

4.1 Board Architecture

The FPB-RX14T v1 is designed with an architecture similar to other boards in the FPB series. Alongside the RX MCU there is an on-board programmer / debugger, pin headers for access to all the pins on the RX MCU, a power supply regulator, some LEDs and switches, and several ecosystem I/O connectors (Pmod and Arduino).

Table 2. Board Architecture

Category	Features	Function present on all similar boards	Functionality is:
MCU Native Pin Access	RX MCU, breakout pin headers for all RX MCU I/O and power, 2-pin header for RX MCU current measurement (not fitted)	Yes	MCU dependent
System Control and Ecosystem Access	Power, debugger, user LEDs and switch, reset switch, ecosystem connectors, SCI interface connector (not fitted)	Yes	Same or similar across other FPB boards

4.2 Block Diagram

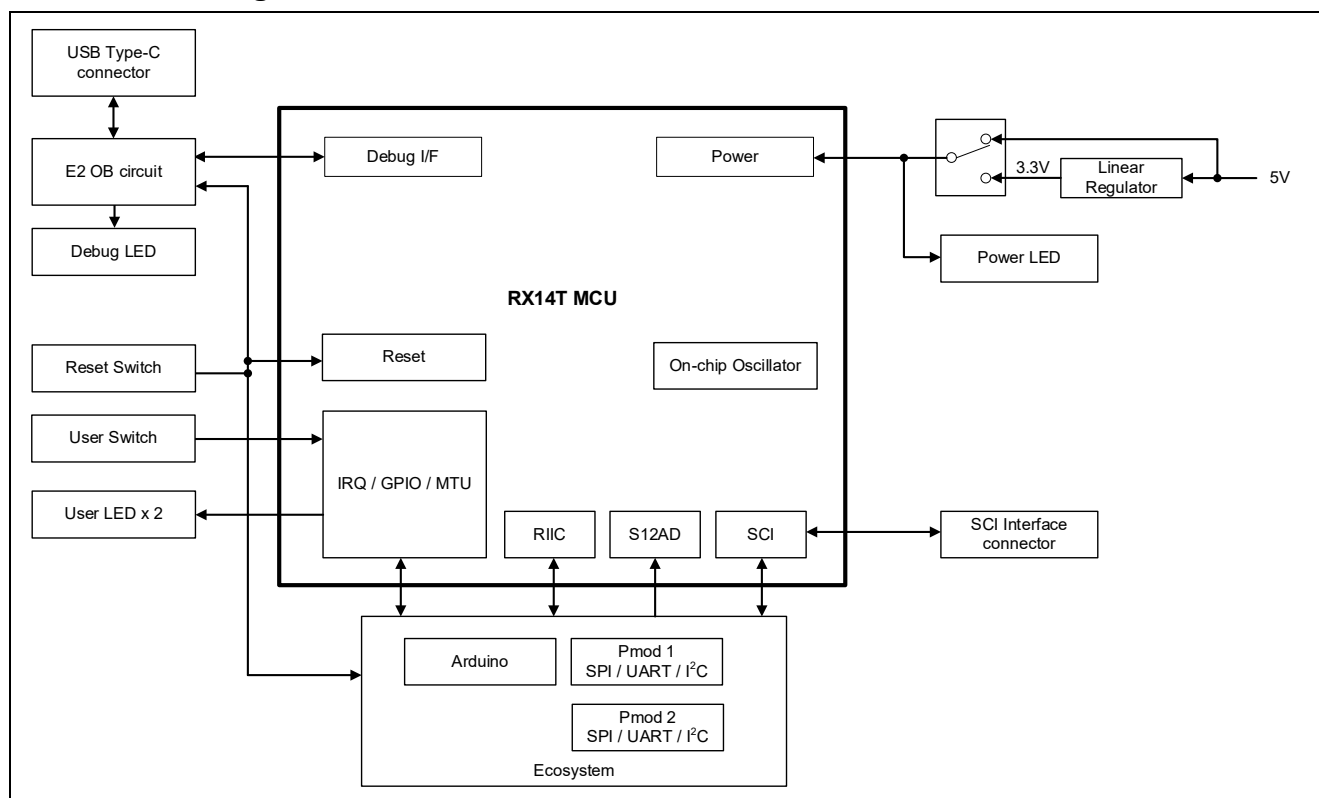


Figure 4. FPB-RX14T v1 Block Diagram

4.3 Component Placement and Dimension

Reference number for components on the FPB-RX14T v1 are shown below.

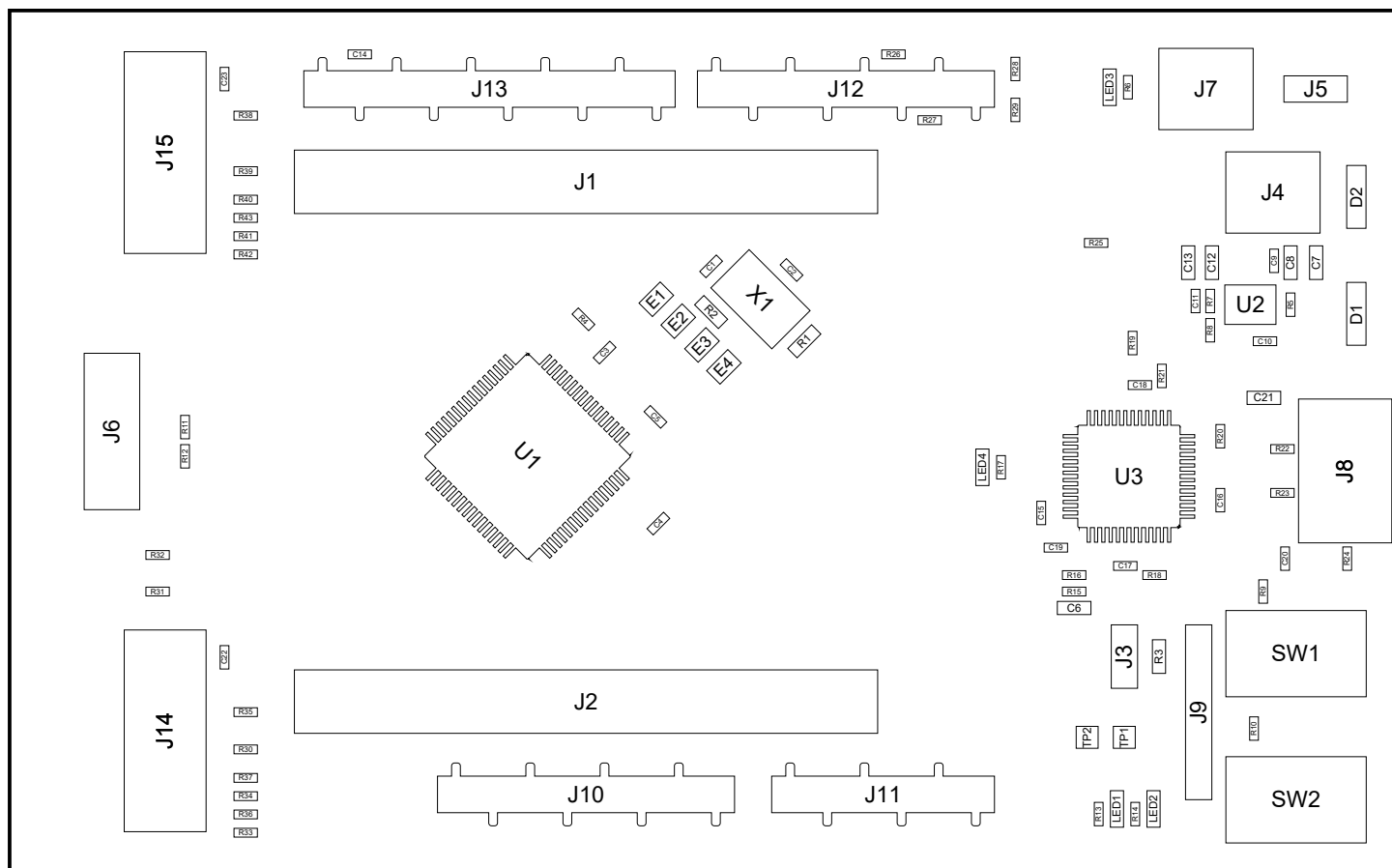


Figure 5. Reference number for components on the FPB-RX14T v1 (top side)

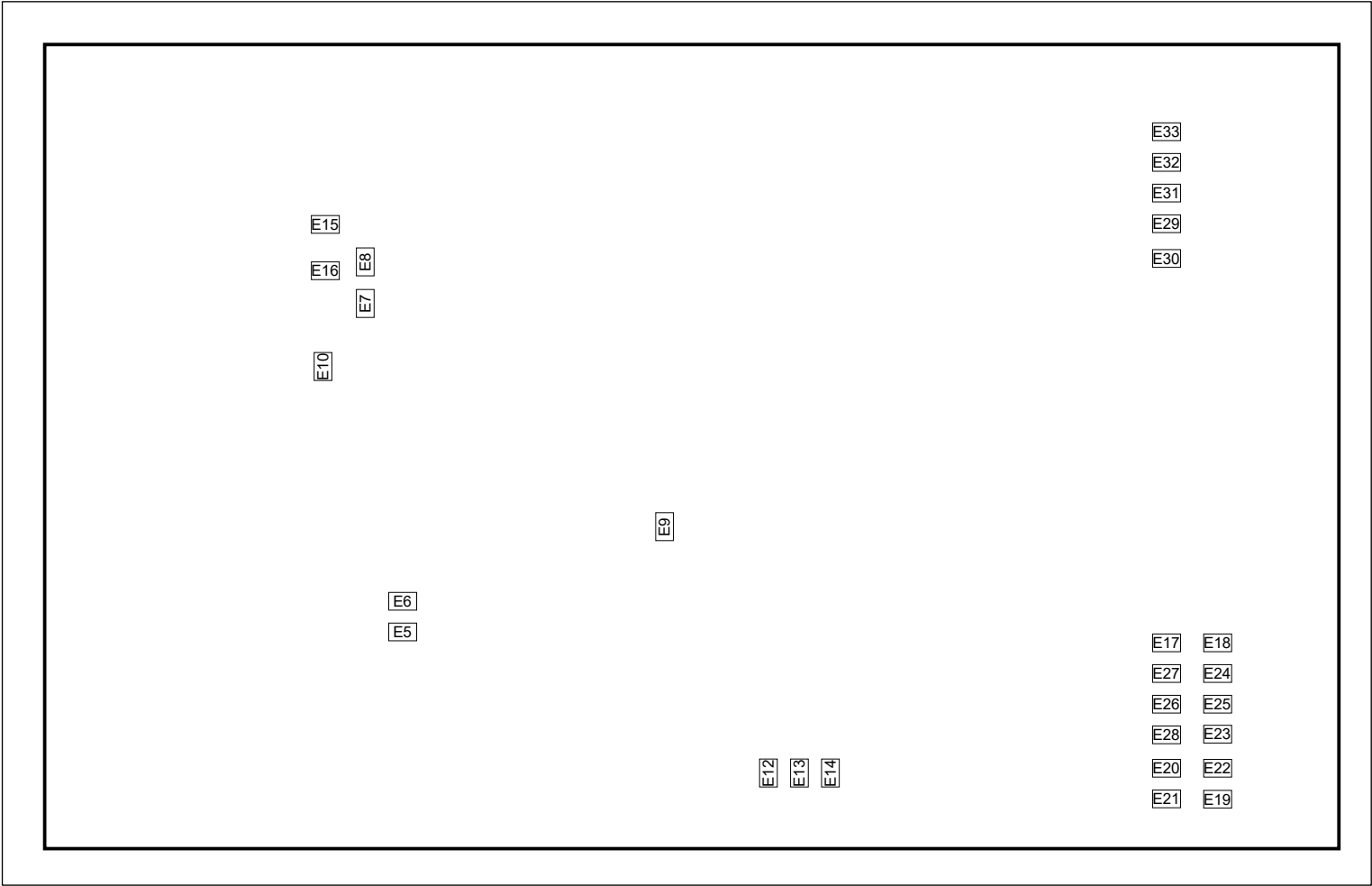


Figure 6. Reference number for components on the FPB-RX14T v1 (bottom side)

Dimension of the FPB-RX14T v1 is shown below.

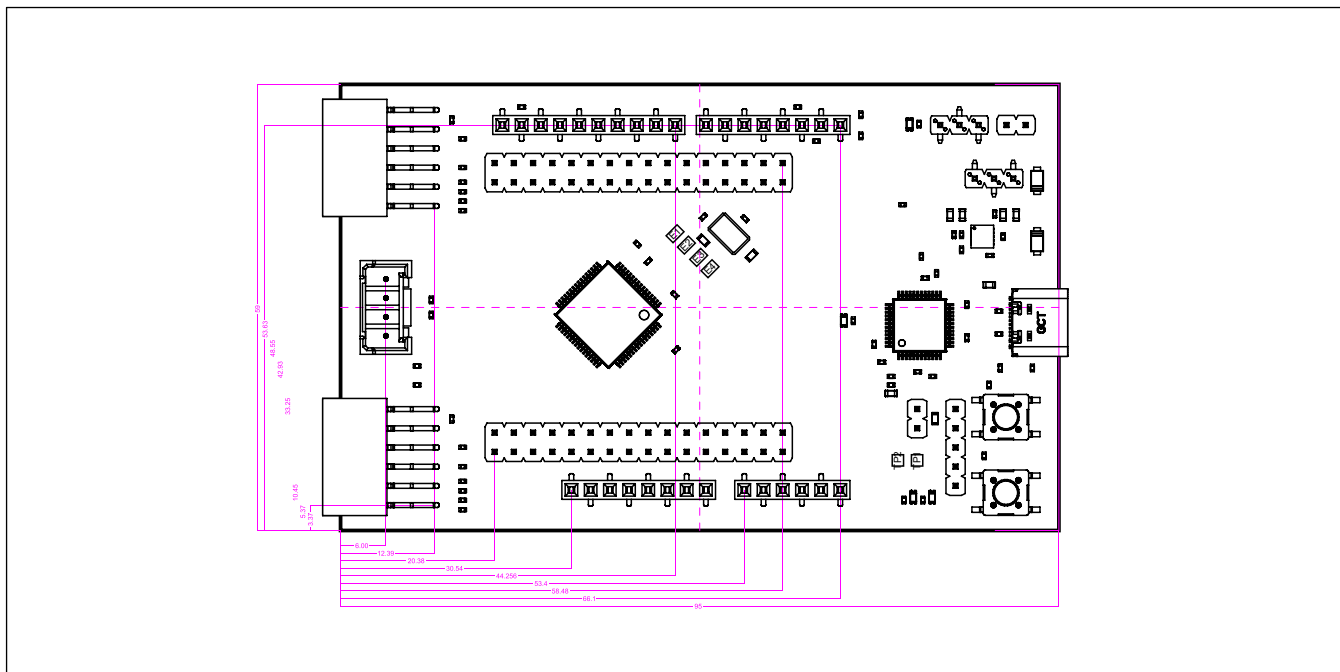


Figure 7. Dimension of the FPB-RX14T v1

4.4 Jumper Settings

Two types of jumpers are provided on the FPB-RX14T v1.

1. Copper jumpers (trace-cut type and solder-bridge type)
2. Traditional pin header jumpers

The following sections describe each type and their default configuration.

4.4.1 Copper Jumpers

Copper jumpers are of two types, designated **trace-cut** and **solder-bridge**.

A **trace-cut jumper** is provided with a narrow copper trace connecting its pads. The silk screen overlay printing around a trace-cut jumper 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 trace-cut jumper is turned into a solder-bridge jumper for any later changes.

A **solder-bridge** jumper 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 0Ω SMD resistor may be placed across the two pads to short the pads together by soldering.

For any copper jumper, the connection is considered **closed** if there is an electrical connection between the pads (default for trace-cut jumpers.) The connection is considered **open** if there is no electrical connection between the pads (default for the solder-bridge jumpers).

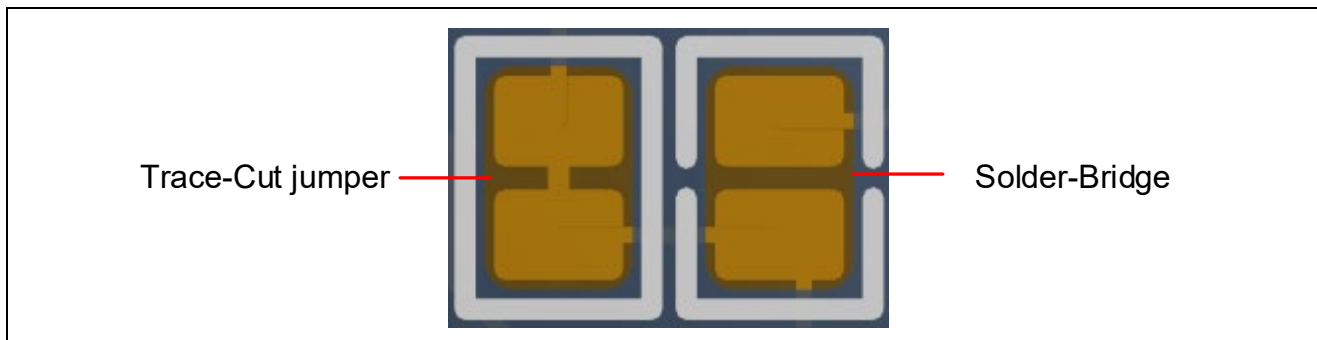


Figure 8. Copper Jumpers

4.4.2 Traditional Pin Header Jumpers

These jumpers are traditional small pitch jumpers that require an external shunt to open/close them. The traditional pin header jumpers on the FPB-RX14T v1 are 0.1" (2.54 mm) pitch headers and use compatible 2.54 mm shunt jumpers.

4.4.3 Default Jumper Configuration

The following table describes the default settings for each jumper on the FPB-RX14T v1. This includes copper jumpers (reference number Ex) and traditional pin header jumpers (reference number Jx). This also includes some 0Ω resistors (reference number Rx) because the resistors are used as jumper function.

Function for copper jumper Ex in the table describe function at Closed. The circuit group for each jumper is the reference number found in the board schematic (available in the Design Package). Functional details for many of the listed jumpers may be found in sections associated with each functional area of the kits.

Table 3. Default Jumper Settings

Location	Circuit Group	Default (Open / Closed) (Fitted / Not fitted)	Function
J4	Power Supply	Jumper on pins 2-3	Connect Board_VCC to 5.0 V
J7	E2OB	Jumper on pins 1-2 (Refer to section 5.2 in detail)	At jumper on pins 1-2, E2 OB is held in reset (Standalone operation mode)
			At jumper on pins 2-3, E2 OB is enabled (Debug on-board mode)
E1	MCU	Closed	At closed, connect P36 (EXTAL) to breakout pin header J1
E2	MCU	Open	At closed, connect P36 (EXTAL) to crystal oscillator X1
E3	MCU	Open	At closed, connect P37 (XTAL) to crystal oscillator X1
E4	MCU	Closed	At closed, connect P37 (XTAL) to breakout pin header J1
E5	MCU	Open	At closed, connect P14 (VREFH0) to UC_VCC
E6	MCU	Closed	At closed, connect P14 (VREFH0) to Board_VCC
E7	MCU	Closed	At closed, connect PG7 (MD / FINED) to E2 OB
E8	MCU	Open	At closed, connect PG7 (MD / FINED) to breakout pin header J1
E9	MCU	Closed	At closed, connect P13 (VREFL0) to GND
E10	Power Supply	Closed	At closed, connect Board_VCC to Board_VCC_DEBUG (Do not open this copper jumper)
E12	Arduino	Closed	At closed, connect 5.0 V to Arduino (5V)
E13	Arduino	Closed	At closed, connect 3.3 V to Arduino (3.3V)
E14	Arduino	Closed	At closed, connect Board_VCC to Arduino (IOREF)
E15	Arduino	Closed	At closed, connect RES# to Arduino (RESET)
E16	Arduino	Open	At closed, connect P00 (IRQ4) to Arduino (RESET)
E17	Arduino	Closed	At closed, connect P30 (SCK6) to Arduino (D13 / SCK)
E18	Arduino	Open	At closed, connect PB4 (RXD6 / SMISO6) to Arduino (D12 / MISO)
E19	Arduino	Closed	At closed, connect P11 (TXD6 / SMOSI6 / MTIOC3A) to Arduino (D11 / MOSI / PWM)
E20	Pmod 1	Open	At closed, connect PB7 (CTS6# / RTS6#) to Pmod 1 (CTS / CS / INT)
E21	Pmod 1	Closed	At closed, connect P22 (IRQ2) to Pmod 1 (CTS / CS / INT)
E22	Pmod 1	Open	At closed, connect P11 (TXD6 / SMOSI6 / MTIOC3A) to Pmod 1 (TXD / MOSI)
E23	Pmod 1	Closed	At closed, connect PB4 (RXD6 / SMISO6) to Pmod 1 (TXD / MOSI)
E24	Pmod 1	Open	At closed, connect PB4 (RXD6 / SMISO6) to Pmod 1 (RXD / MISO / SCL)
E25	Pmod 1	Closed	At closed, connect P26 (SCL0) to Pmod 1 (RXD / MISO / SCL)
E26	Pmod 1	Open	At closed, connect PB7 (CTS6# / RTS6#) to Pmod 1 (RTS / SCK / SDA)

Location	Circuit Group	Default (Open / Closed) (Fitted / Not fitted)	Function
E27	Pmod 1	Open	At closed, connect P30 (SCK6) to Pmod 1 (RTS / SCK / SDA)
E28	Pmod 1	Closed	At closed, connect P31 (SDA0) to Pmod 1 (RTS / SCK / SDA)
E29	Pmod 2	Closed	At closed, connect PB5 (TXD1 / SMOSI1 / SSDA1) to Pmod 2 (TXD / MOSI)
E30	Pmod 2	Open	At closed, connect PD7 to Pmod 2 (TXD / MOSI)
E31	Pmod 2	Open	At closed, connect PB5 (TXD1 / SMOSI1 / SSDA1) to Pmod 2 (RTS / SCK / SDA)
E32	Pmod 2	Open	At closed, connect PD4 (SCK1) to Pmod 2 (RTS / SCK / SDA)
E33	Pmod 2	Closed	At closed, connect PD6 (RTS1#) to Pmod 2 (RTS / SCK / SDA)
R3	MCU CURRENT MEASUREME NT	Fitted (Refer to section 6.2 in detail)	At fitted, connect Board_VCC to UC_VCC
			At not fitted, the RX MCU current can be measured over this jumper

5. System Control and Ecosystem Access

The FPB-RX14T v1 provides a power supply regulator, an on-board debugger, simple I/O (switches and LEDs), and popular I/O ecosystem connectors. These are all described in detail below.

5.1 Power

The FPB-RX14T v1 is designed for 5 V operation. An on-board Linear Regulator is used to convert the 5 V supply to a 3.3 V supply. The 3.3 V supply is used to power the RX MCU and other peripheral features by default.

The 3.3 V supply is used to power the RX MCU and other peripheral features by shorting pin 1 and 2 of the pin header jumper J4. The 5 V supply is used to power the RX MCU and other peripheral features by shorting pin 2 and 3 of the pin header jumper J4.

RX MCU specifies power-on VCC rising gradient. When supplying the 5 V to the RX MCU, the power-on VCC rising gradient depends on capability of the power supply that supplies 5 V to the FPB-RX14T v1 because input 5 V to the FPB-RX14T v1 is supplied to the RX MCU through the reverse protection diode.

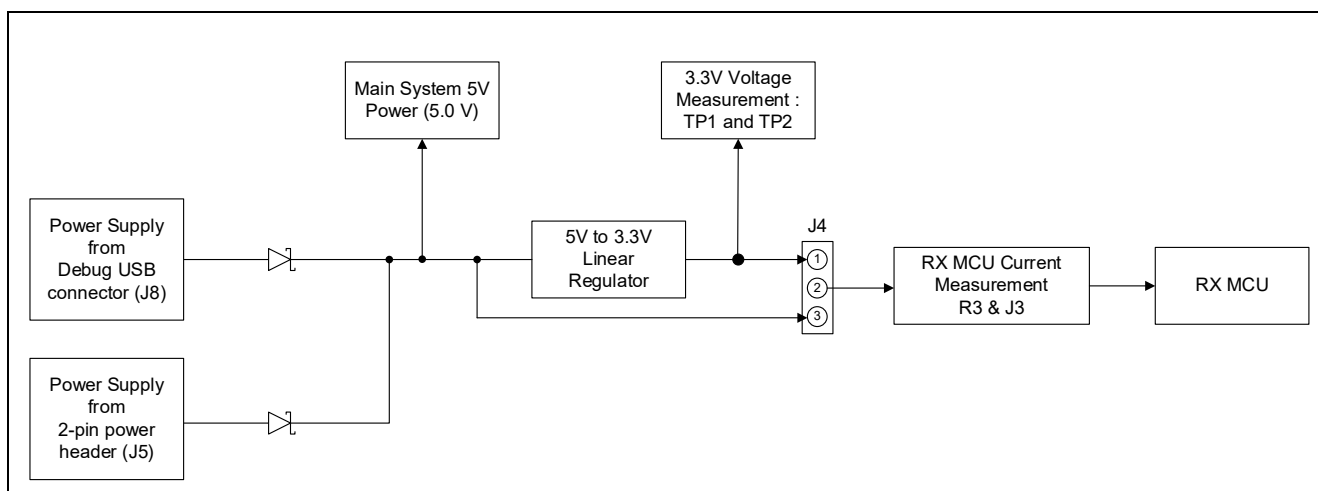


Figure 9. Power Supply

5.1.1 USB

5 V may be supplied from a host PC to the USB connector (J8) labelled DEBUG1 on the board. Power from this source is connected to the main system 5 V power. Reverse current protection is provided between this connector and the main system 5 V power.

5.1.2 Header Connector J5

5 V may be supplied from an external power supply to connector J5. J5 is a standard 2-pin header on a 0.1" (2.54 mm) pitch. Pin 1 is 5 V, and pin 2 is GND. Power from this source is connected to the main system 5 V power. Reverse current protection is provided between J5 and the main system 5 V power.

5.1.3 Power Supply Considerations

Voltage of Main System 5 V Power will be lower than the power supply voltage because of the forward voltage (max 0.55V@1A) of the reverse current protection diode. Main System 5 V Power supplies to external devices connected to Arduino, Pmod 1, Pmod 2 and SCI interface connector.

The maximum current that could be supplied to the FPB-RX14T v1 is as shown below, and this includes the current consumed by external boards connected to the ecosystem connectors and breakout pin headers.

Power supply from USB: max. 500 mA

Power supply from J5: max. 1 A

5.1.4 Power-up Behavior

When powered, the Power LED (LED3) colored green turns on and blinky example project which is pre-programmed starts and User LED1 and LED2 start blinking.

5.2 Debug and Programming

The FPB-RX14T v1 can be debugged and programmed using the E2 OB.

The FPB-RX14T v1 supports Debug on-board mode in which can debug and program by E2 OB circuit and Standalone operation mode in which RX MCU operates as standalone by disabling E2 OB circuit. The mode can be configured by pin header jumper J7.

Table 4. Operating mode

J7	Operating mode
Jumper on pins 2-3	Debug on-board mode
Jumper on pins 1-2	Standalone operation

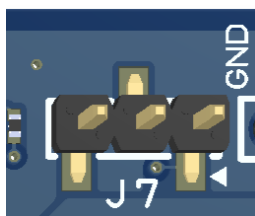


Figure 10. Pin header jumper J7

5.2.1 E2 OB

USB DEBUG1 (USB Type-C) connector (J8) connects the E2 OB to a host PC, allowing re-programming and debugging of the RX MCU firmware.

The E2 OB connects to the RX MCU using the FINE interface. Please note that connecting the same host PC to multiple FPB-RX14T v1 is not possible.

Table 5. USB Debug Connections

USB Debug Connector		FPB-RX14T v1
Pin	Description	Signal
J8-A4/B9	VBUS	+5V_USB_DBG
J8-A9/B4	VBUS	+5V_USB_DBG
J8-A5	CC1	5.1kΩ pull-down
J8-B5	CC2	5.1kΩ pull-down
J8-A6	D+1	USBDBG_DP
J8-B6	D+2	USBDBG_DP
J8-A7	D-1	USBDBG_DM
J8-B7	D-2	USBDBG_DM
J8-A8	SBU1	N.C.
J8-B8	SBU2	N.C.
J8-A1/B12	GND	GND
J8-A12/B1	GND	GND

A yellow indicator, LED4, shows the status of the debug interface. When the FPB-RX14T v1 is powered, and LED4 is blinking, it indicates that the host PC recognizes the E2 OB circuit. When LED4 is on solid, it indicates that the host PC is connected to the E2 OB circuit.

5.2.2 Settings in e² studio and Renesas Flash Programmer

FPB-RX14T v1 needs to be configured in Debug on-board shown in [Table 4](#) when the MCU is debugged or re-programmed with e² studio. [Figure 11](#) shows the settings for e² studio when creating a new project for the FPB-RX14T v1.

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

[Target Device]: Select [R5F514T5]

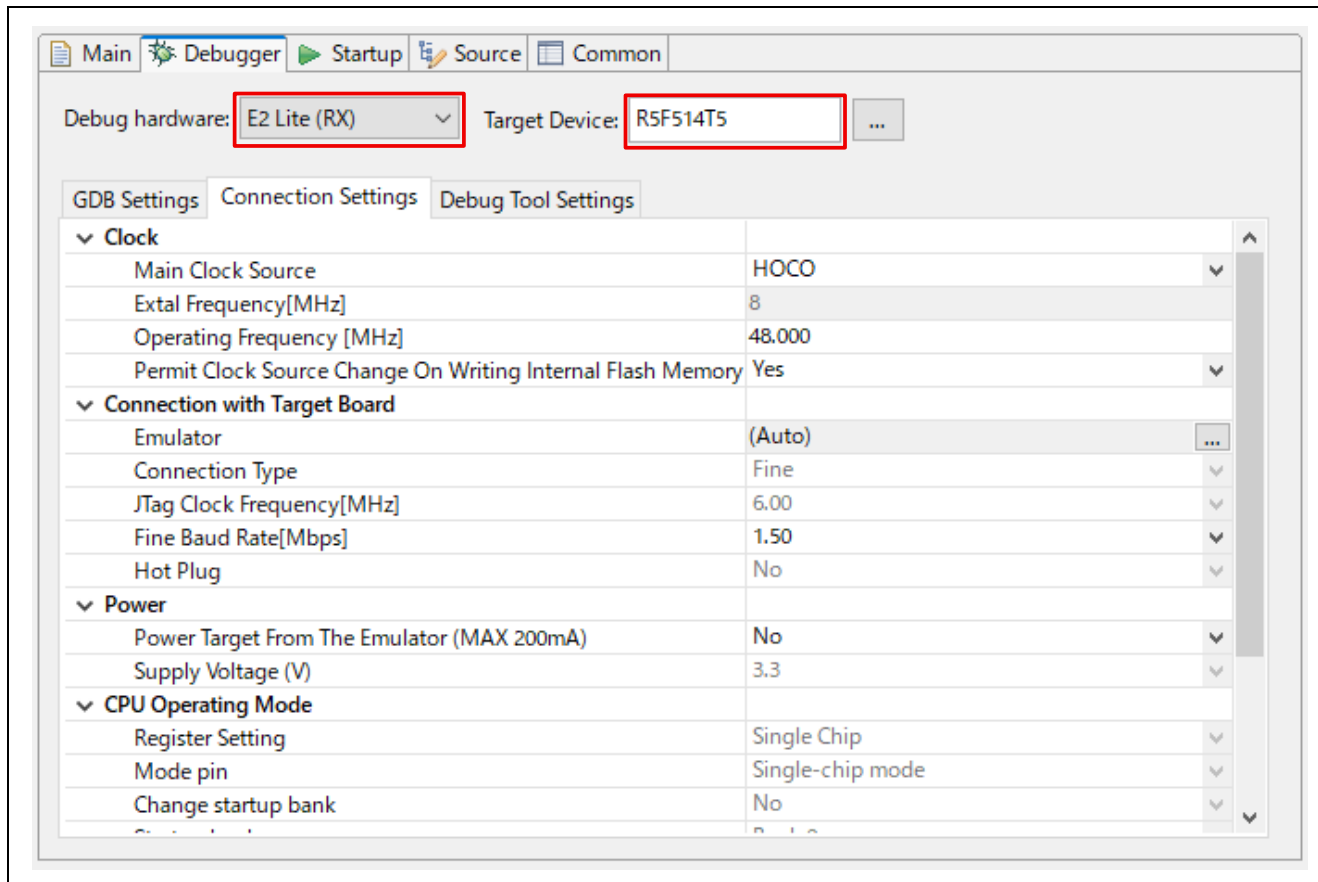


Figure 11. e² studio Setting

FPB-RX14T v1 needs to be configured in Debug on-board shown in [Table 4](#) when the MCU is re-programmed with Renesas Flash Programmer. [Figure 12](#) shows the settings for Renesas Flash Programmer when creating a new project for the FPB-RX14T v1.

Connect an USB cable between the FPB-RX14T v1 and a host PC and create a new project.

[Microcontroller]: Select [RX100]

[Project Name]: Define project name

[Project Name]: Select project folder location

[Tool]: Select [E2 emulator Lite]

[Tool Details]: Select [FINE]

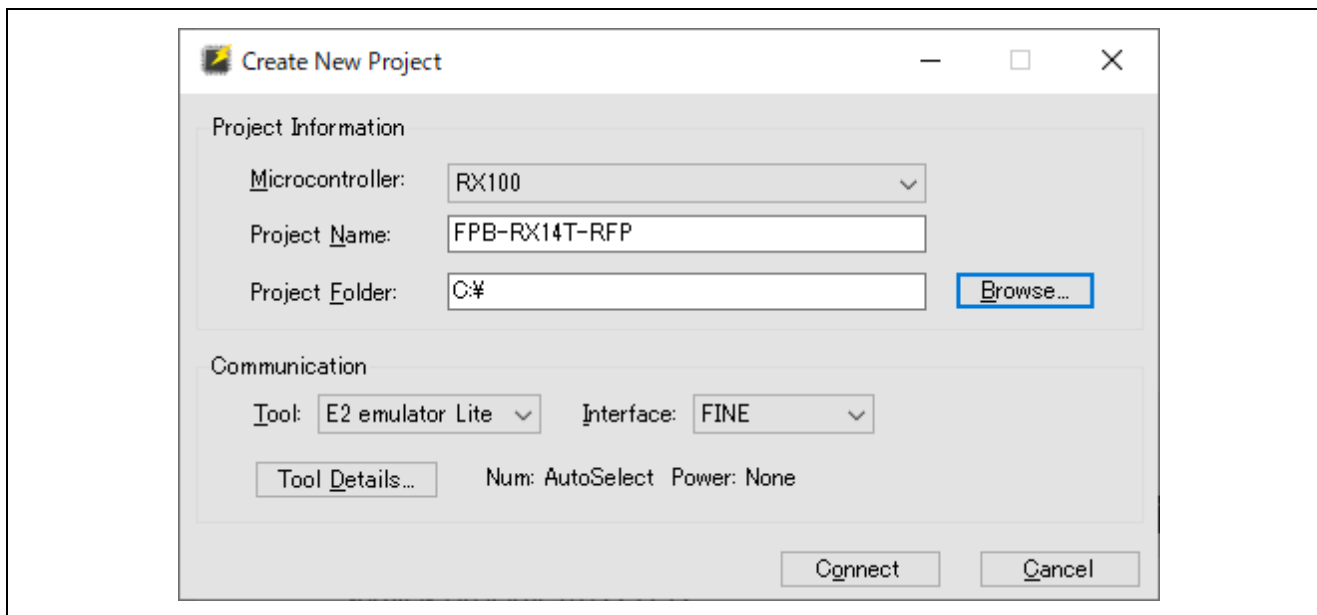


Figure 12. Renesas Flash Programmer Settings

5.3 Ecosystem

The Ecosystem connectors provide users the means to connect several third party add-on modules compatible with two popular ecosystems using the following connectors:

1. Two Digilent Pmod (UART / SPI / I²C) connectors
2. Arduino connectors

Note: We do not guarantee connection to all types of third party add-on modules. Confirm the specifications of this product and any third party add-on modules you intend to use.

5.3.1 Diligent Pmod Connectors

5.3.1.1 Pmod 1

A 12-pin Pmod Type-2A (expanded SPI), Type-3A (expanded UART) and Type-6A (expanded I²C) connector is provided at connector J14 labelled PMOD1. At Type-2A, the RX MCU acts as the SPI master, and the connected module acts as an SPI slave device. At Type-6A, the RX MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave.

Table 6. Pmod 1 Connections

Pmod 1 Connector				FPB-RX14T v1	Pmod 1 Configuration	
Pin	Option Type-2A	Option Type-3A	Default Type-6A	Signal	Closed	Open
J14-1	CS	CTS / GPIO		PB7 (CTS6# / RTS6#) ^{*1 *2}	E20	E21
			INT	P22 (IRQ2)	E21	E20
J14-2	MOSI	TXD		P11 (TXD6 / SMOSI6 / MTIOC3A) ^{*1 *3}	E22	E19, E23
			RESET	PB4 (RXD6 / SMISO6) ^{*3}	E23	E18, E22, E24
J14-3	MISO	RXD		PB4 (RXD6 / SMISO6) ^{*1 *3}	E24	E18, E23, E25
			SCL	P26 (SCL0) ^{*3}	E25	E24
J14-4	SCK			P30 (SCK6) ^{*1 *3}	E27	E17, E26, E28
		RTS / GPIO		PB7 (CTS6# / RTS6#) ^{*1 *2}	E26	E20, E27, E28
			SDA	P31 (SDA0) ^{*3}	E28	E26, E27
J14-5	GND			GND		
J14-6	VCC			Board_VCC		
J14-7	GPIO / INT (slave to master)			PB3 (IRQ3)		
J14-8	GPIO / RESET (master to slave)			P03		
J14-9	GPIO / CS2			P04		
J14-10	GPIO / CS3			PD5		
J14-11	GND			GND		
J14-12	VCC			Board_VCC		

*1. Open at shipping.

*2. PB7 can be used as either CTS6# or RTS6#.

*3. The signals are shared with Arduino.

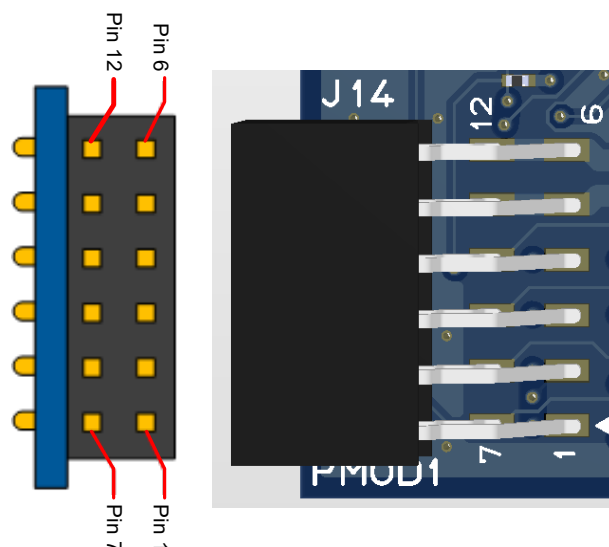


Figure 13. Pmod 1 Connector

Pmod Type-2A / 3A Operation

The option for SPI (Type-2A) or UART (Type-3A) can be configured at Pmod 1. To configure the FPB-RX14T v1 to use the Type-2A or Type-3A, configure the copper jumpers using [Table 6](#). Following figure shows the copper jumpers to use the Type-2A or Type-3A.

Note: VCC power that supplies to J14-Pin6 and Pin12 is Board_VCC same as RX MCU power. Board_VCC voltage is selectable either 3.3 V or 5 V by configuring pin header J4.

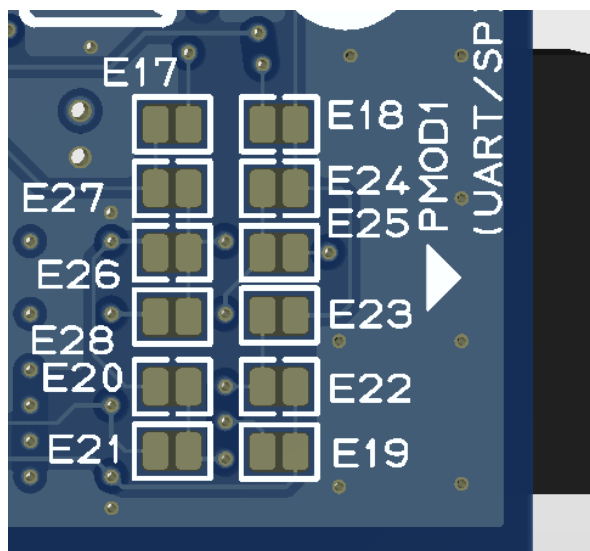


Figure 14. Pmod 1 Copper Jumpers (bottom side)

5.3.1.2 Pmod 2

A 12-pin Pmod Type-2A (expanded SPI), Type-3A (expanded UART) and Type-6A (expanded I²C) connector is provided at connector J15 labelled PMOD2. At Type-2A, the RX MCU acts as the SPI master, and the connected module acts as an SPI slave device. At Type-6A, the RX MCU acts as a two-wire serial master, and a connected module acts as a two-wire serial slave.

Table 7. Pmod 2 Connections

Pmod 2 Connector				FPB-RX14T v1	Pmod 2 Configuration	
Pin	Option Type-2A	Default Type-3A	Option Type-6A	Signal	Closed	Open
J15-1	CS	CTS / GPIO	INT	P02 (CTS1# / IRQ5)		
J15-2	MOSI	TXD		PB5 (TXD1 / SMOSI1 / SSDA1) *1	E29	E30, E31
			RESET	PD7 *2	E30	E29
J15-3	MISO	RXD	SCL	PB6 (RXD1 / SMISO1 / SSCL1)		
J15-4	SCK			PD4 (SCK1) *2	E32	E31, E33
		RTS / GPIO		PD6 (RTS1#)	E33	E31, E32
			SDA	PB5 (TXD1 / SMOSI1 / SSDA1) *1 *2	E31	E29, E32, E33
J15-5	GND			GND		
J15-6	VCC			Board_VCC		
J15-7	GPIO / INT (slave to master)			P93 (IRQ1)		
J15-8	GPIO / RESET (master to slave)			P91		
J15-9	GPIO			P90		
J15-10	GPIO			P70		
J15-11	GND			GND		
J15-12	VCC			Board_VCC		

*1. PB5 can be used as either TXD1 / SMOSI1 or SSDA1.

*2. Open at shipping.

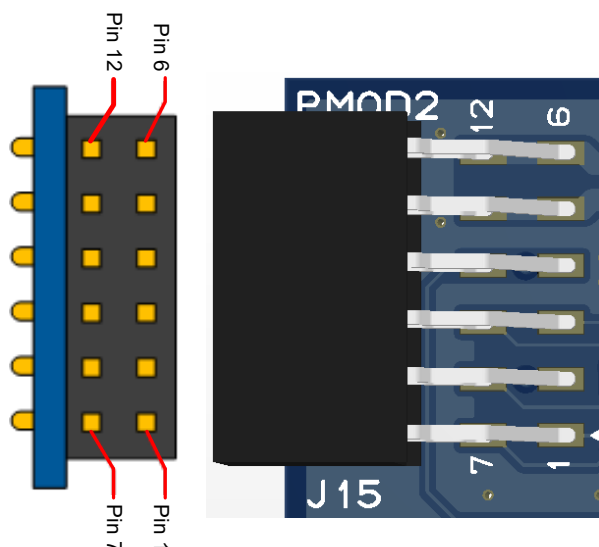


Figure 15. Pmod 2 Connector

Pmod Type-2A / 6A Operation

The option for SPI (Type-2A) or I²C (Type-6A) can be configured at Pmod 2. To configure the FPB-RX14T v1 to use the Type-2A or Type-6A, configure the copper jumpers using [Table 7](#). Following figure shows the copper jumpers to use the Type-2A or Type-6A.

Note: VCC power that supplies to J15-Pin6 and Pin12 is Board_VCC same as RX MCU power. Board_VCC voltage is selectable either 3.3 V or 5 V by configuring pin header J4.

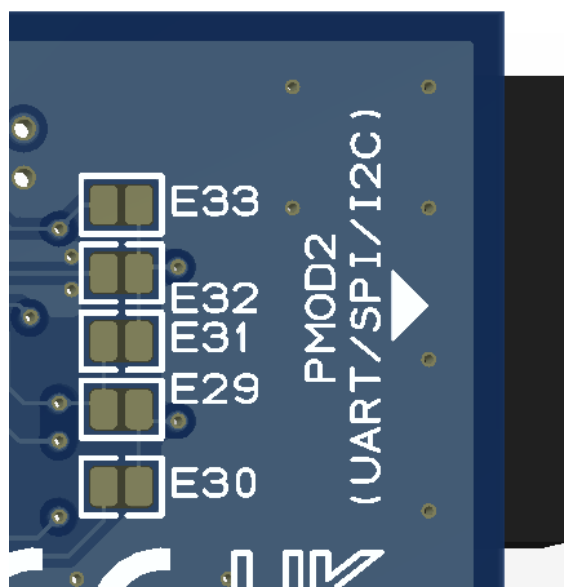


Figure 16. Pmod 2 Copper Jumpers (bottom side)

5.3.2 Arduino Connector

Arduino compatible connector interface is provided at connector J10, J11, J12 and J13.

Table 8. Arduino Connections

Arduino Compatible Connector		FPB-RX14T v1	Arduino Configuration	
Pin	Description	Signal	Closed	Open
J10-1	NC	NC		
J10-2	IOREF	Board_VCC	E14	
J10-3	RESET	RES#	E15	E16
		P00 (IRQ4) *1	E16	E15
J10-4	3.3V	3.3 V	E13	
J10-5	5 V	5 V	E12	
J10-6	GND	GND		
J10-7	GND	GND		
J10-8	VIN	NC		
J11-1	A0	P40 (AN000)		
J11-2	A1	P41 (AN001)		
J11-3	A2	P42 (AN002)		
J11-4	A3	P43 (AN003)		
J11-5	A4	P44 (AN004)		
J11-6	A5	P45 (AN005)		
J12-1	D0 / RX	P76 (RXD12)		
J12-2	D1 / TX	P96 (TXD12)		
J12-3	D2 / INT	P71 (IRQ6)		
J12-4	D3 / INT / PWM	P72 (IRQ7 / MTIOC4A)		
J12-5	D4	PB0		
J12-6	D5 / PWM	PB1 (MTIOC0A)		
J12-7	D6 / PWM	P95 (MTIOC2A)		
J12-8	D7	P97		
J13-1	D8	P94		
J13-2	D9 / PWM	P75 (MTIOC4C)		
J13-3	D10 / SS / PWM	P33 (MTIOC0C)		
J13-4	D11 / MOSI / PWM	P11 (TXD6 / SMOSI6 / MTIOC3A) *2	E19	E22
J13-5	D12 / MISO	PB4 (RXD6 / SMISO6) *1 *2	E18	E23, E24
J13-6	D13 / SCK	P30 (SCK6) *2	E17	E27
J13-7	GND	GND		
J13-8	AREF	VREFH0		
J13-9	SDA	P31 (SDA0) *2		
J13-10	SCL	P26 (SCL0) *2		

*1. Open at shipping.

*2. The signal is shared with Pmod 1.

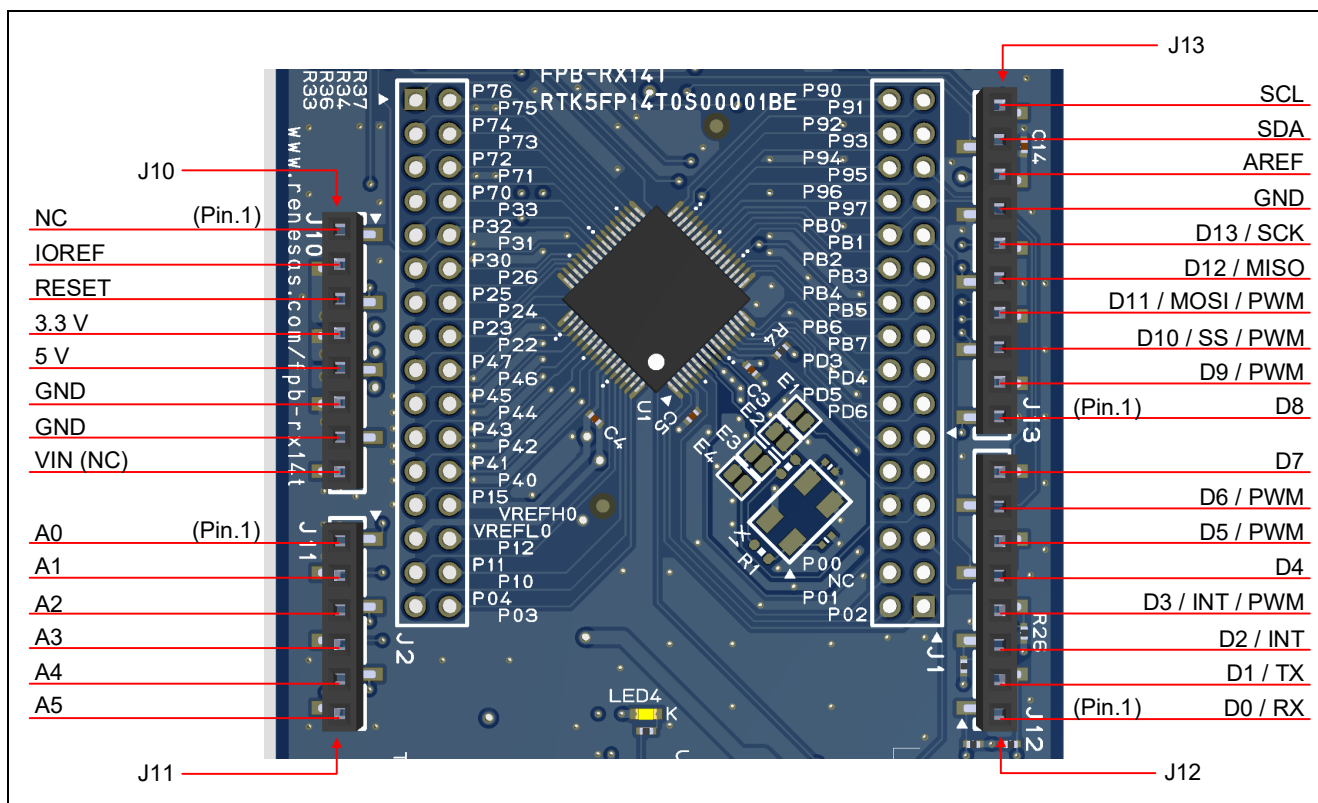


Figure 17. Arduino Connectors

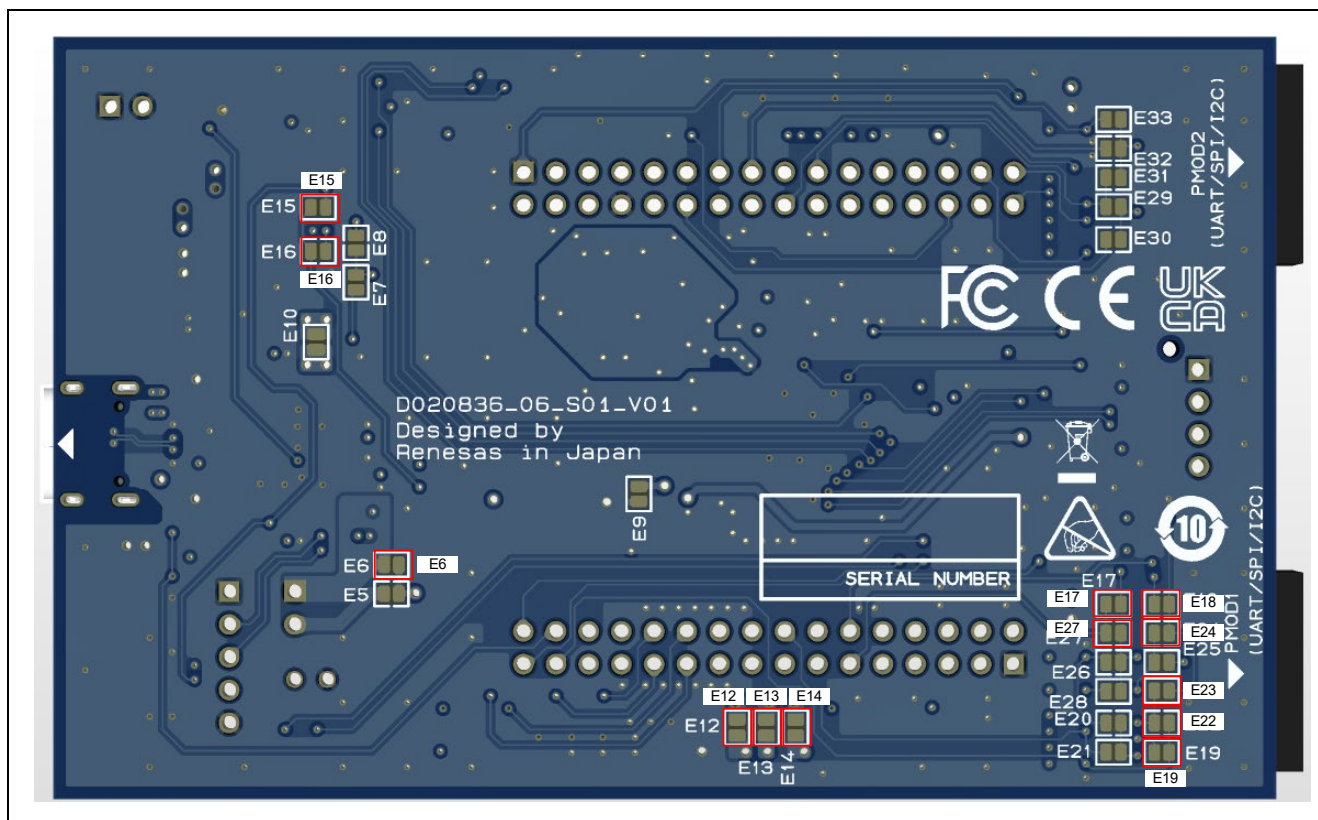


Figure 18. Arduino Copper Jumpers (bottom side)

Arduino Shield Considerations

AREF (J13-Pin8) output from Arduino Shield is connected to VREFH0 (Analog reference voltage supply pin for the 12-bit A/D converter) of RX MCU, however, Board_VCC is connected to VREFH0 at default condition. When Arduino AREF supplies power to VREFH0, the user must disconnect VREFH0 from Board_VCC power. Copper jumper E6 is provided on the FPB-RX14T v1 to disconnect VREFH0 from on-board Board_VCC power.

The FPB-RX14T v1 supplies 5 V power to J10-Pin5 of Arduino Shield through copper jumper E12, however, some of the RX MCU pins which are connected to Arduino Shield are not 5 V tolerant. When the FPB-RX14T v1 supplies 5 V power to Arduino Shield, however Board_VCC = 3.3 V, the user must confirm the RX14T Group User's Manual: Hardware and the specification of Arduino Shield you intend to use. Cut copper jumper E12 for disabled supplying 5 V to Arduino Shield.

5.4 Miscellaneous

5.4.1 LED

Four LEDs are provided on the FPB-RX14T v1.

Functions of the LEDs on the FPB-RX14T v1 is described in the following table. User LEDs turn on when RX MCU ports output high level.

Table 9. FPB-RX14T v1 LED Functions

LED			FPB-RX14T v1
Designator	Color	Function	Signal
LED1	Green	User LED	P32 (MTIOC3C)
LED2	Green	User LED	P92 (MTIOC1A)
LED3	Green	Power LED	Board_VCC
LED4	Yellow	Debug LED	E2 OB circuit



Figure 19. User LEDs

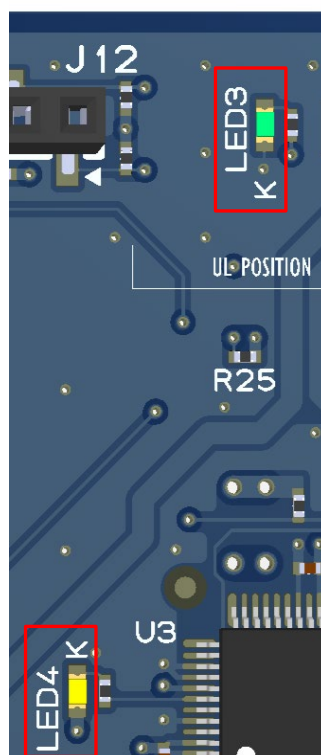


Figure 20. Power LED and Debug LED

5.4.2 User and Reset Switches

Two miniature, momentary, mechanical push-button type SMD switches are mounted on the FPB-RX14T v1.

Pressing the reset switch (SW2) generates a reset signal to reset the RX MCU. The signal which is connected to the user switch (SW1) is at low level while the user switch is pressed.

Table 10. FPB-RX14T v1 Switches

Switch			FPB-RX14T v1
Designator	Function	Button Color	Signal
SW1	User Switch	Blue	P10 (IRQ0)
SW2	Reset Switch	Blue	RES#

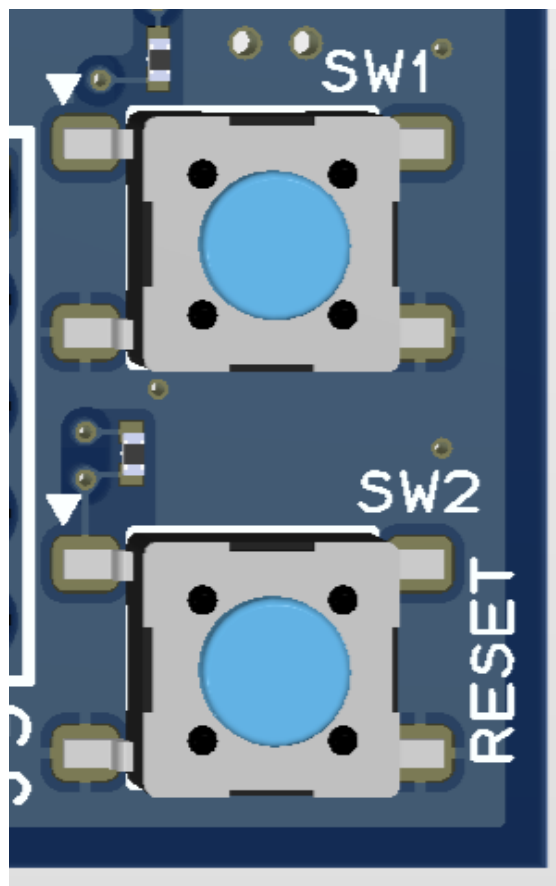


Figure 21. Reset (SW2) and User Switch (SW1)

5.4.3 SCI Interface Connector

A 4-pin male connector for communicating the MC-COM Renesas Flexible Motor Control Communication Board (Product part number: RTK0EMXC90S00000BJ) is provided at connector J6 (not fitted) on the FPB-RX14T v1.

Table 11. SCI Interface Connections

SCI Interface Connector	FPB-RX14T v1
Pin	Signal
J6-1	GND
J6-2	P24 (RXD5)
J6-3	P23 (TXD5)
J6-4	Board_VCC

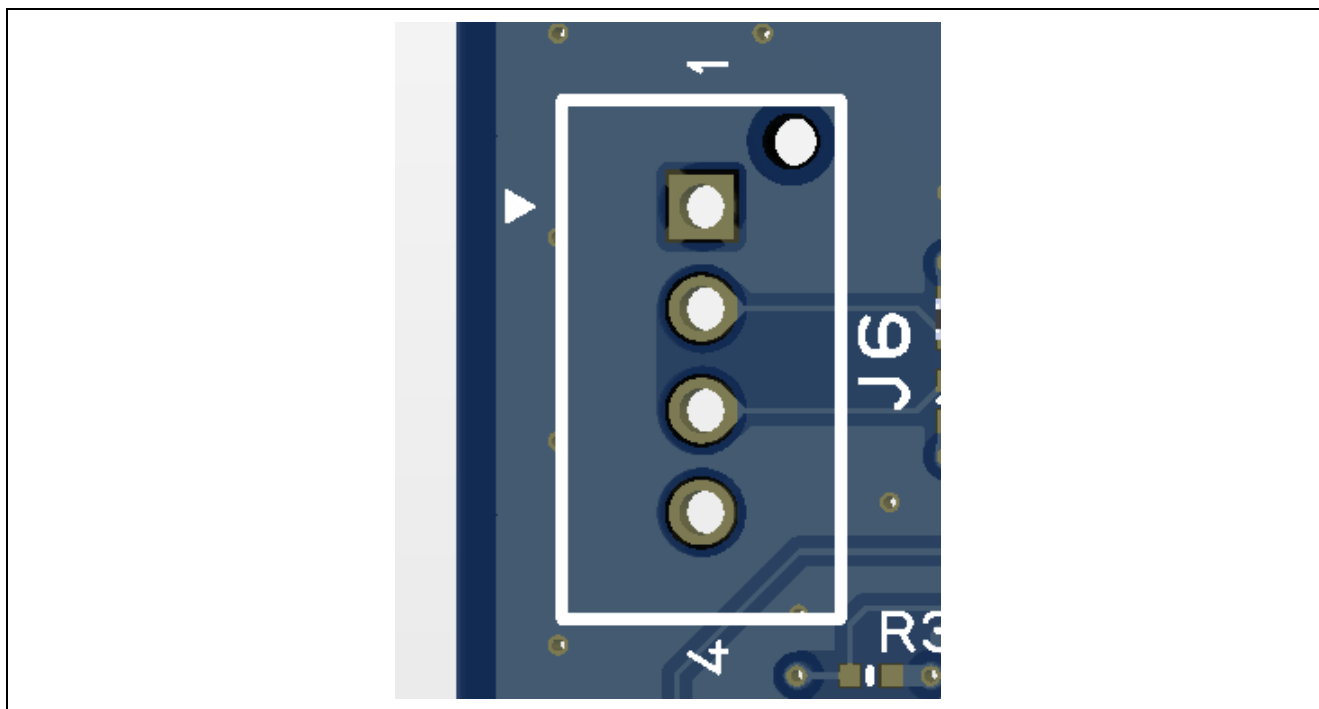


Figure 22. SCI Interface Connector (J6)

6. MCU Native Pin Access

6.1 Breakout Pin Headers

The FPB-RX14T v1 pin headers (not fitted), J1 and J2, provide access to RX MCU interface signals. Each header pin is labelled with the power or port connected to that pin (Some header pins aren't labelled because of not enough space.). Refer to the RX14T Group User's Manual: Hardware for details of each port function, and the FPB-RX14T v1 schematic for pin header port assignments.

The placement of the breakout pin headers allows for a standard 2.54 mm (0.100") breadboard to be placed on both pin headers. This can be used for prototyping and testing of custom circuitry for use with the RX MCU.

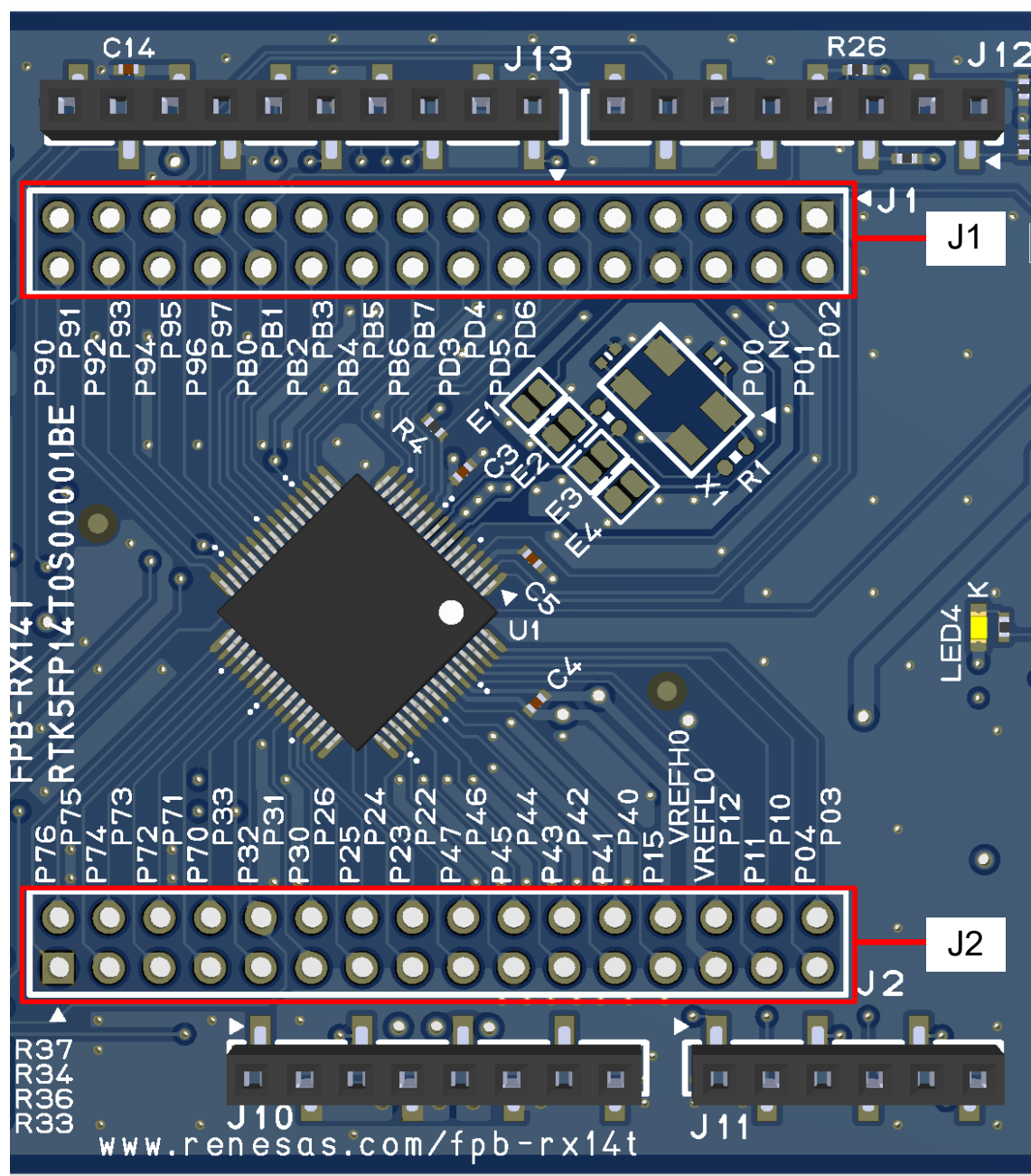


Figure 23. Breakout Pin Headers J1 and J2

6.2 MCU Current Measurement

Two pin header J3 (not fitted) is provided on the FPB-RX14T v1 to measure the RX MCU current.

Resistor R3 is 0Ω (SMD 0603). It should be removed in order to measure the current consumption using an ammeter connected between the pin header pins.

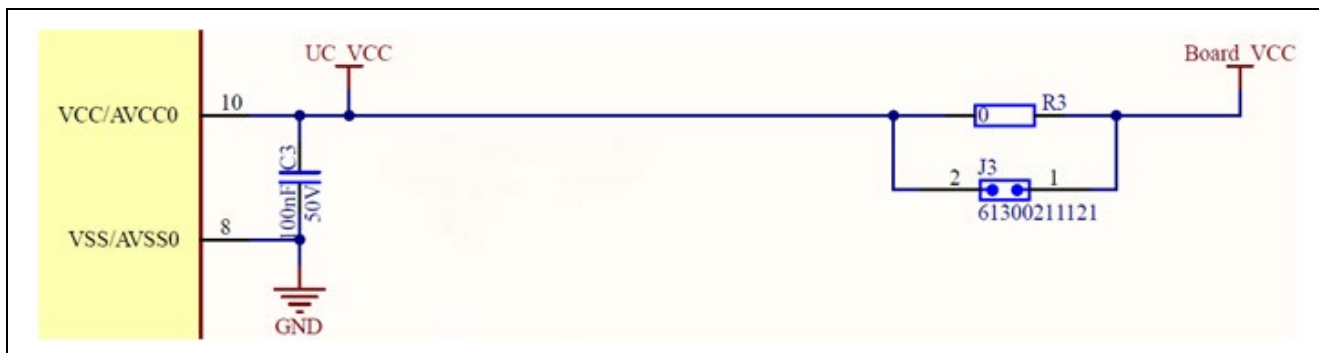


Figure 24. RX MCU Current Measurement Circuit

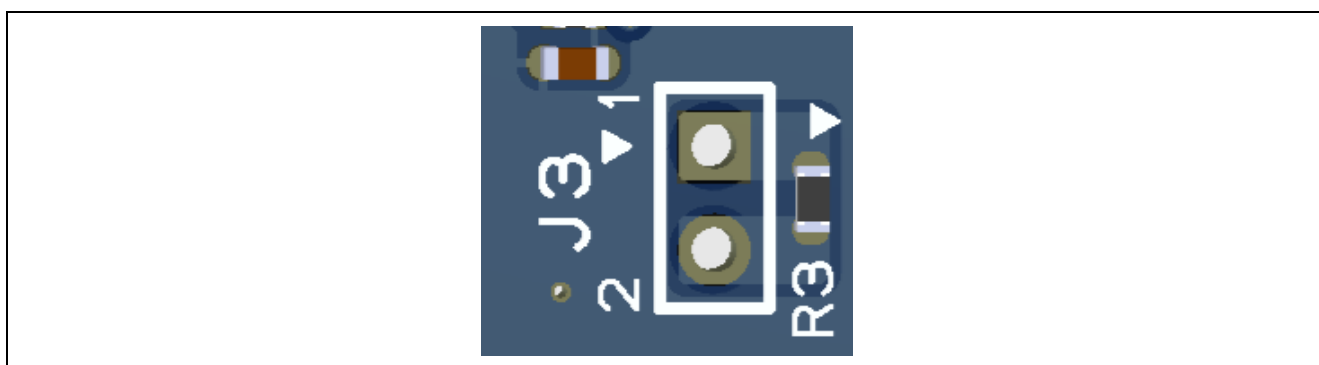


Figure 25. RX MCU Current Measurement Pin Header J3 and R3

7. Recommended Components

[Table 12](#) lists recommended part numbers for the components that can be fitted as required.

Table 12. Recommended Components

Designator(s)	Description	Manufacturer	Part Number
X1	8 MHz Crystal	Abracon	ABM3B-8.000MHZ-10-1-U
J1, J2	32-way male header	Würth Elektronik	61303221121
J3, J5	2-way male header	Würth Elektronik	61300211121
J6	4-pin male header	Molex	53375-0410
R1 *1	Damping Resistor of crystal oscillator X1	-	The resistance must be adjusted by users.
R2 *1	Feedback Resistor of crystal oscillator X1	-	The resistance must be adjusted by users.
R40 *2	Pull-up Resistor	Yageo	RC0402FR-072K2L
R12, R32, R33, R34, R35, R36, R37, R38, R41, R43	Pull-up Resistors	Yageo	RC0402FR-0710KL
C1, C2 *3	Loading Capacitors	-	The capacitance must be adjusted by users.

*1. Pads of chip resistance (size 0603) are provided on the FPB-RX14T v1.

*2. Pads of chip resistance (size 0402) are provided on the FPB-RX14T v1.

*3. Pads of chip capacitance (size 0402) are provided on the FPB-RX14T v1.

8. Certifications

The FPB-RX14T v1 meets the following certifications/standards. See page 4 of this user's manual for the disclaimer and precautions.

8.1 EMC/EMI Standards

- FCC Notice (Class A)



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

NOTE- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

- Innovation, Science and Economic Development Canada ICES-003 Compliance:
CAN ICES-3 (A)/NMB-3(A)

- 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 design and manufacturing information for the FPB-RX14T v1 is available in the “FPB-RX14T v1 Design Package” available on renesas.com/fpb-rx14t.

- Design package file name: fpb-rx14t-v1-designpackage.zip
- Design package contents

Table 13. FPB-RX14T v1 Design Package Contents

File Type	Content	File / Folder Name
File (PDF)	Schematics	fpb-rx14t-v1-schematics
File (PDF)	Mechanical Drawing	fpb-rx14t-v1-mechdwg
File (PDF)	3D Drawing	fpb-rx14t-v1-3d
File (EXCEL)	BoM	fpb-rx14t-v1-bom
Folder	Manufacturing Files	Manufacturing Files
Folder	Design Files	Design Files-Altium

10. Website and Support

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

FPB-RX14T Resources	renesas.com/fpb-rx14t
RX Kit Information	renesas.com/rx/kits
RX Product Information	renesas.com/rx
RX Product Support Forum	renesas.com/rx/forum
RX Videos	renesas.com/rx/videos
RX Kit Feedback and Feature Request	renesas.com/rx/kitfeedback
Renesas Support	renesas.com/support

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Sep.30.25	—	Initial release

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