User's Manual

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RE01 Group

Evaluation Kit RE01 1500KB User's Manual

RE Family / RE0 Series

Renesas Electronics
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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

   Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Disclaimer

By using this Evaluation Kit, the user accepts the following terms:

The Evaluation Kit is not guaranteed to be error free, and the entire risk as to the results and performance of the Evaluation Kit is assumed by the User. The Evaluation Kit is provided by Renesas on an “as is” basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, title and non-infringement of intellectual property rights with regard to the Evaluation Kit. Renesas expressly disclaims all such warranties. Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this Evaluation Kit, even if Renesas or its affiliates have been advised of the possibility of such damages.

Precautions

The following precautions should be observed when operating any Evaluation Kit product:

This Evaluation Kit 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. However, 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 10m 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.

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with an understanding of the Evaluation Kit Evaluation Board hardware functionality, and electrical characteristics. It is intended for users designing sample code on the Evaluation Kit Evaluation Board platform, using the many different incorporated peripheral devices.

The manual comprises of an overview of the capabilities of the Evaluation Kit product, but does not intend to be a guide to embedded programming or hardware design.

Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes 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 Evaluation Kit for RE01 1500KB. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's Manual	Describes the technical details of the Evaluation Kit hardware.	Evaluation Kit for RE01 1500KB User's Manual	R20UT4379EJ (This manual)
Quick Start Guide	Provides simple instructions setup the Evaluation Kit for RE01 1500KB and run the first sample.	Evaluation Kit for RE01 1500KB Quick Start Guide	R20UT4562EJ
Schematics	Full detail circuit schematics of the Evaluation Kit Main Board.	Evaluation Kit for RE01 1500KB main board schematics	R20UT4563EJ
Schematics	Full detail circuit schematics of the Evaluation Kit MIP-LCD Expansion Board.	Evaluation Kit for RE01 1500KB MIP-LCD Expansion board schematics	R20UT4564EJ
Hardware Manual	Provides technical details of RE01 device.	RE01 Group Products with 1.5-Mbyte Flash Memory User's Manual: Hardware	R01UH0796EJ

2. List of Abbreviations and Acronyms

Abbreviation	Full Form
ADC	Analog-to-Digital Converter
APN	Application Notes
bps	bits per second
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DAC	Digital-to-Analog Converter
DIP	Dual In-line Package
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
DNF	Do Not Fit
E2	Renesas On-chip Debugging Emulator
e^2 studio	Renesas Eclipse-based Integrated Development Environment
EEPROM	Electronically Erasable Programmable Read Only Memory
EH	Energy Harvesting
EHC	Energy Harvesting Control Circuit
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
GPT	General PWM Timer
I^2C (IIC)	Philips™ Inter-Integrated Circuit Connection Bus
I-jet	IAR System JTAG Emulator
IRQ	Interrupt Request
J-Link OB	SEGGER On-board debug probe
LDO	Low Dropout
LED	Light Emitting Diode
MIP-LCD	Memory In Pixel - Liquid Crystal Display
n/a (NA)	Not Applicable
n/c (NC)	Not Connected
NMI	Non-maskable Interrupt
OTG	On The Go
PC	Personal Computer
PDC	Parallel Data Capture Unit
PLL	Phase Locked Loop
Pmod™	This is a Digilent Pmod™ Compatible connector. Pmod™ is registered to Digilent Inc. Digilent-Pmod_Interface_Specification
POE	Port Output Enable
PWM	Pulse Width Modulation
RAM	Random Access Memory
RFP	Renesas Flash Programmer
ROM	Read Only Memory
RTC	Real Time Clock
SCI	Serial Communications Interface
SFR	Special Function Registers
SPI	Serial Peripheral Interface
TFT	Thin Film Transistor
TPU	Timer Pulse Unit
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus
WDT	Watchdog Timer

Table of Contents

1. Overview

1.1 Purpose

This Evaluation Kit is an evaluation tool for Renesas RE01 device. This manual describes the technical details of the Evaluation Kit hardware.

1.2 Kit Contents

Kit contents included in the Evaluation Kit are shown in Table 1-1.

Table 1-1: Kit Contents

No	Kit Contents	
1	Main board	Part No.: RTK70E015DC00000BE
2	MIP-LCD Expansion board	Part No.: RTK70E015DB00000BE
3	Solar panel	Part No.: AM-1815CA (Panasonic)
4	USB cable	Type-A male to micro-B male
5	IC clip	Red, Black

1.3 Board specification

Board specification was shown in Table 1-2, Table 1-3.

Table 1-2: Board Specification

Item	Specification
Target Device	Part No: R7F0E015D2CFB
	Package: 144-pin LFQFP
	On-Chip Memory: ROM 1.5MB, RAM 256KB
On-Board Memory	SPI Serial Flash: 64Mbit
Input Clock	RE01 Main: 32MHz
	RE01 Sub: 32.768kHz
	RX621(SEGGER J-Link OB) Main: 12MHz
Power Supply	DC Power Jack: 5 V Input
	Power Supply IC: 5V Input, 3.3V Output
	Power Supply IC: 2.6V Input, 3.3V Output (For peripheral circuit power when EH function enable)
Debug Interface*1	I-jet / J-Link™ / E2 20-pin box header
	USB Connector for J-Link™ OB
Slide Switch	Mode Configuration: 1-pole x 2
	For Normal / EH Switch: 3-pole x 2
Push Switch	Reset Switch x 1
	User Switch x 3
Potentiometer (for ADC)	Single-turn: 10kΩ
LED	5V Power indicator: green x 1
	User: green x 1, orange x 1, red x 1
USB	USB Function: USB-MicroB
	USB Host: USB-TypeA
MLCD	FPC: 0.3mm pitch,19-pin x 1
	MIP-LCD*5: TN0104ANVAANN-GN00(KYOCERA)
USB to Serial Converter Interface	Connector: USB-MicroB
	Driver: USB Interface IC (Part Number FT230XQ)
MIP-LCD Expansion Board Interface *2	2.54mm pitch: 12 pin x 1(PMOD1)
Pmod™	PMOD1 *2: Angle type, 12-pin Connector
	PMOD2: Angle type, 12-pin Connector
External Battery Interface	3.5mm pitch: 2-pin x 1 *3
Sensor Board Interface	2.54mm pitch: 8-pin x 1 *4
Solar Panel Interface	2.54mm pitch: 2-pin x 1
Arduino UNO Interface	2.54mm pitch: 10-pin x 1 (J6),8-pin x 2 (J10, J18),6-pin x 1 (J19)
RE01 Header *4	2.54mm pitch: 36-pin x 4 (J7, J8, J9, J21)

*1: Use each debugger exclusively. When using J-Link™ OB, do not connect other emulators.
*2: PMOD1 is used both on MIP-LCD Expansion Board and Pmod™.
*3: The external battery is not included in the Evaluation Kit.
*4: The connector is not included in the Evaluation Kit.
*5: This parallel-comm type MIP-LCD is not included in the Evaluation Kit. (The serial-comm type MIP-LCD is included in the Evaluation Kit as MIP-LCD Expansion Board.)

Table 1-3: MIP-LCD Expansion Board Specification

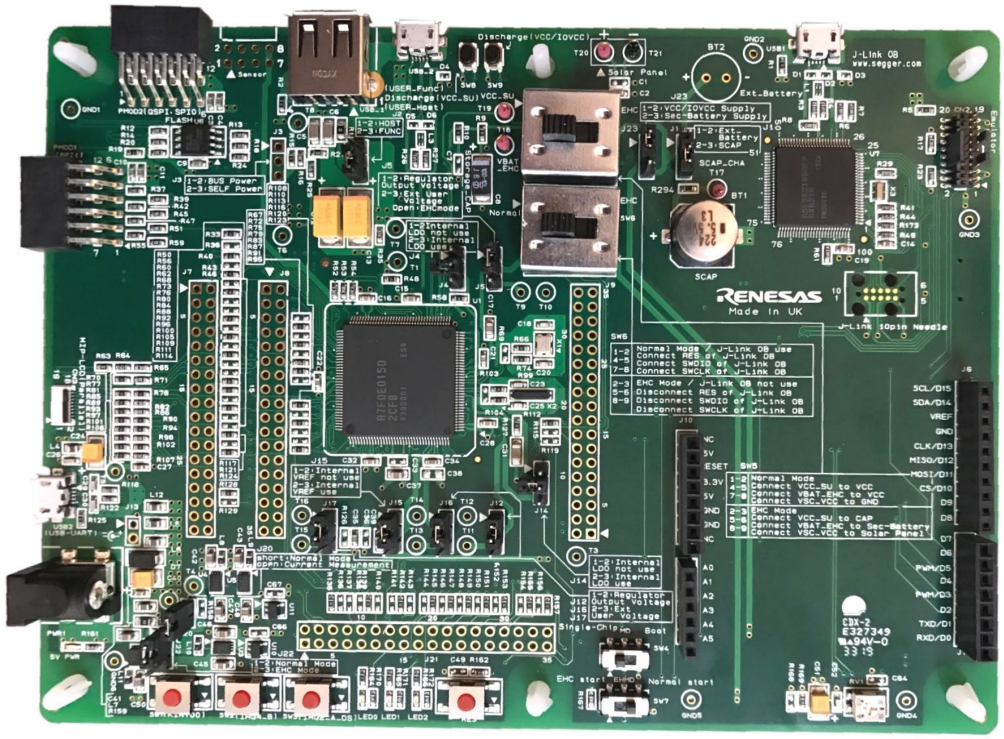
Item	Specification
MIP-LCD	Part No: TN0181ANVNANN-AN00[*1] (KYOCERA)
	Size: 1.81 inch
	Resolution: 200dpi (256(H) x 256(V))
Main Board Interface	2.54mm pitch: 12-pin x 1(PMOD1)

[*1]: Please contact KYOCERA.

When removing soldered components, always ensure that the Evaluation Kit is not exposed to a soldering iron for intervals greater than 5 seconds. This is to avoid damage to nearby components mounted on the board.

1.4 Board Exterior

Figure 1-1 show the exterior of main board. Figure 1-2 show the exterior of MIP-LCD Expansion board.



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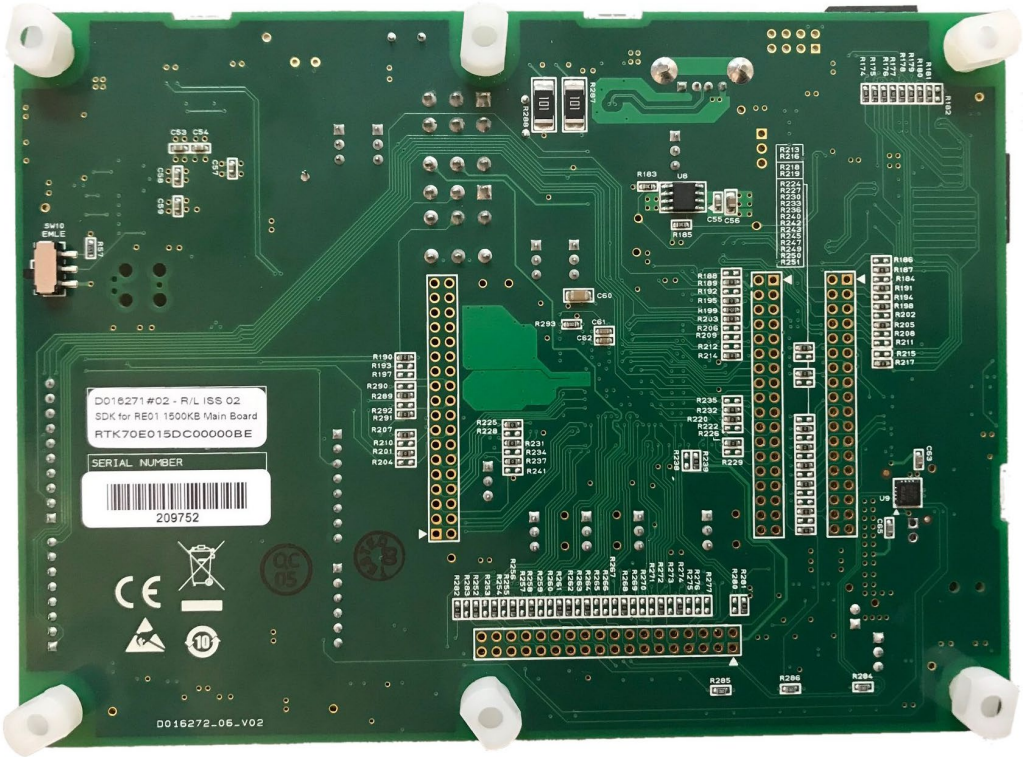
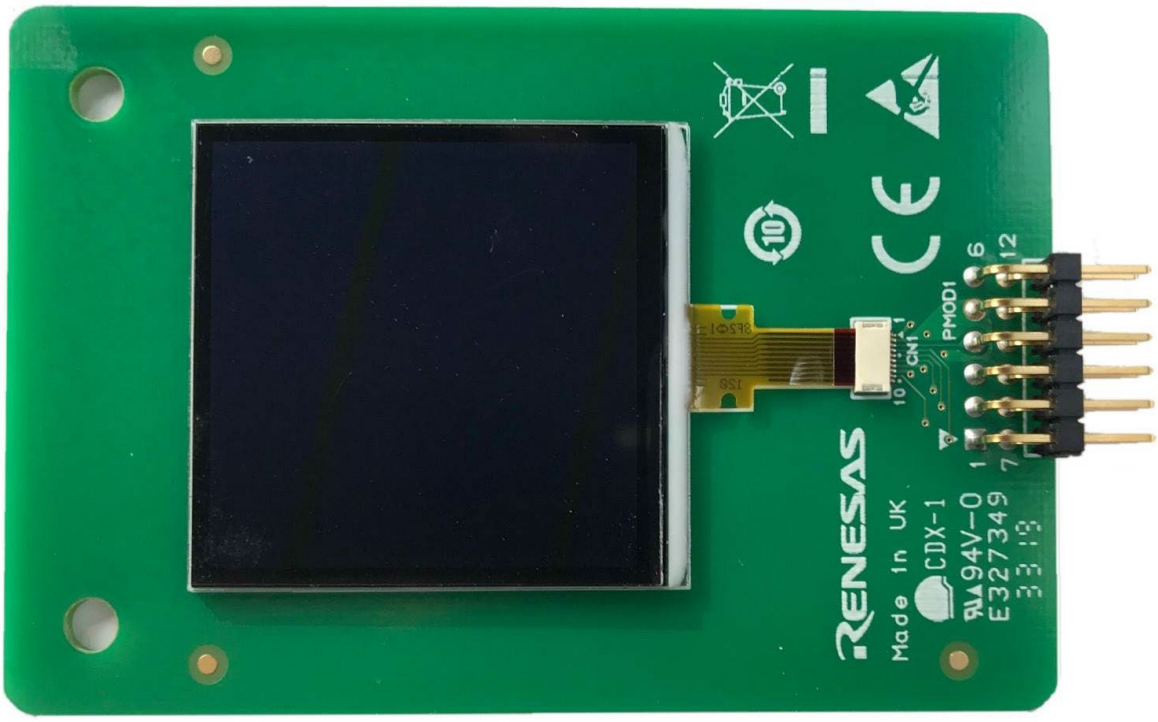


Bottom

Figure 1-1: Main Board External View



Top

Bottom

Figure 1-2: MIP-LCD Expansion Board External View

2. Board Layout

2.1 Board Function & Default Kit Configuration

Figure 2-1 and Figure 2-2 show the functions of the Evaluation Kit Board.Table 2-1, Table 2-2 and Table 2-3 show their setting details.

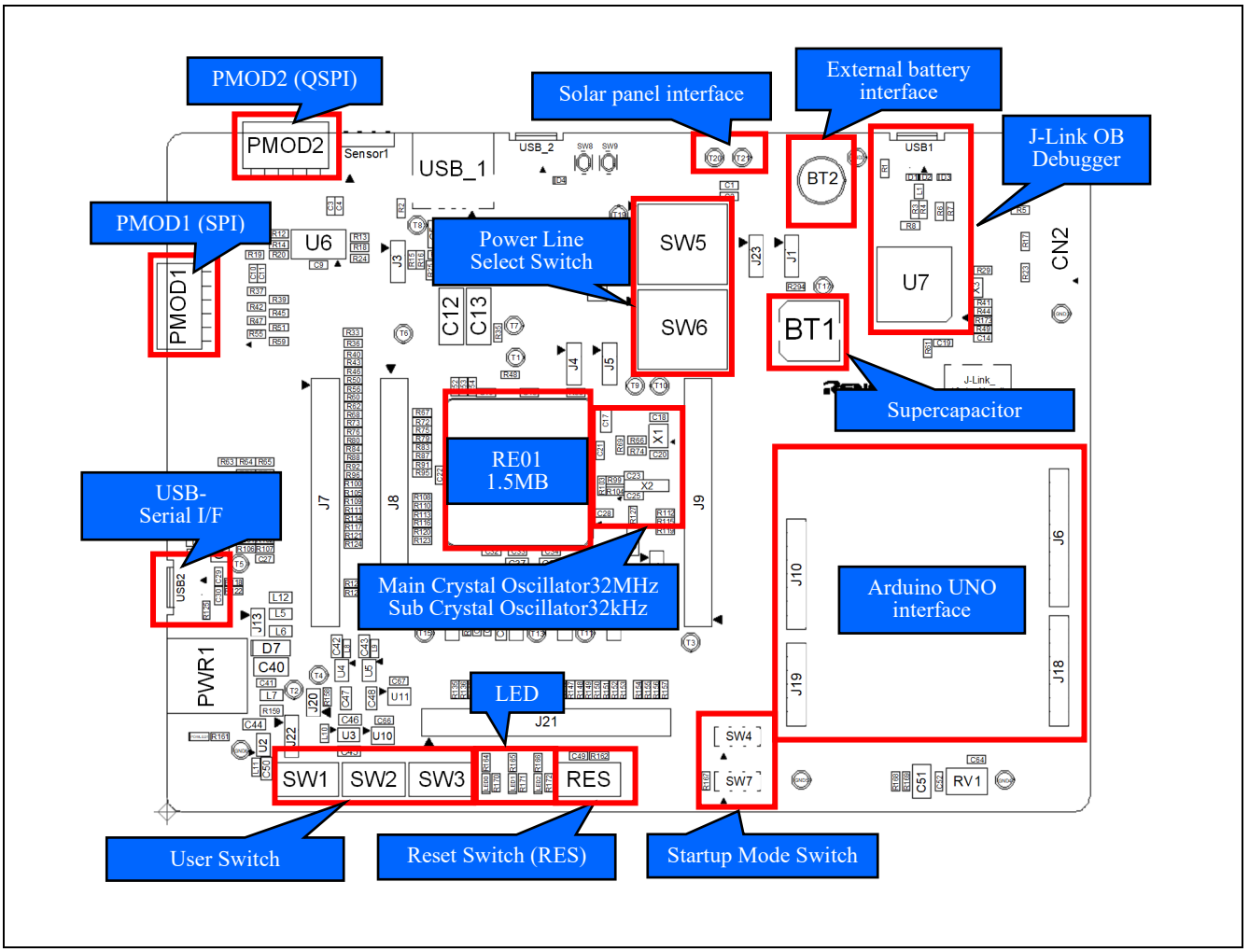


Figure 2-1: Board Function1

Table 2-1: Switch Function

Item	Function	Setting (* is the default kit configuration, as supplied.)
RES	Main Board Reset	-
SW1,2,3	User Control Switch	-
SW4, SW7	Startup Mode Setting	See Table 2-2 for details.
SW5 SW6	Operation Mode Select	Normal: Normal mode* EHC : EHC mode

Table 2-2: Mode Settings

Mode Setting		Startup Mode (* is the default kit configuration, as supplied.)
SW4(MD)	SW7(EHMD)	
High	High	Energy Harvest Startup Mode
	Low	Normal Startup Mode *
Low	-	SCI/USB Boot Mode

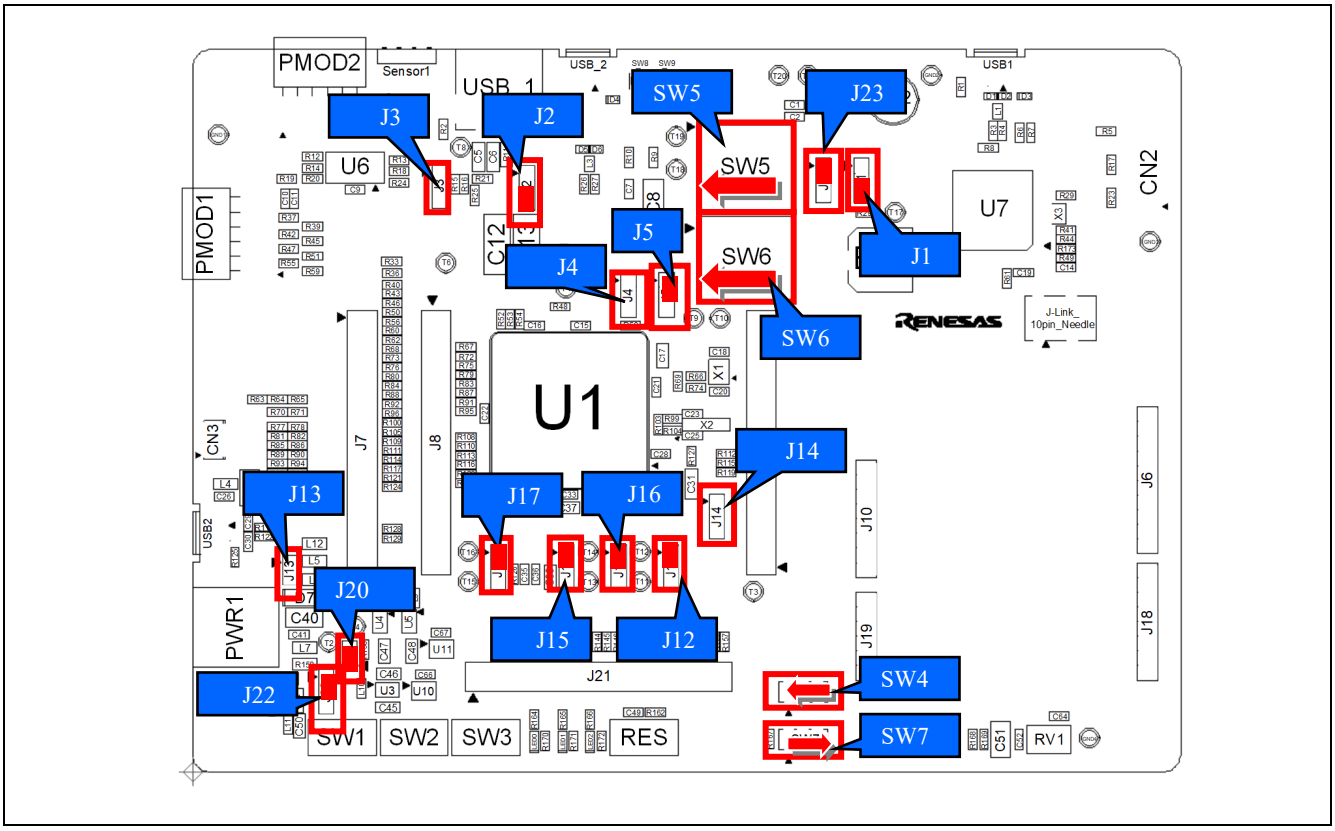


Figure 2-2: Board Function2 (The default kit configuration, as supplied)

Table 2-3: Jumper Function

Item	Function	Setting (* is the default kit configuration, as supplied.)
J1	Battery Select（VBAT）	1-2 short: USE BT2 Battery 2-3 short: USE Super Capacitor *
J2	USBFS Host/Function Select	1-2 short: Host Mode 2-3 short: Function Mode *
J3 *2	Self/Bus-powered Configuration	1-2 short: Bus-powered *1 2-3 short: Self-powered Open : Self-powered *
J4	VCL Select	1-2 short: Built-in LDO not used 2-3 short: Not used Open : Built-in LDO used *
J5	VCC/IOVCC Supply Voltage Select	1-2 short: Normal Mode * 2-3 short: External User Voltage Open : EHC Mode
J12	IOVCC Supply Voltage Select	1-2 short: Normal/EHC Mode * 2-3 short: External User Voltage
J13 *2	VBUS Select	Open: VBUS not used * Short: VBUS used
J14	VCLH Select	1-2 short: Built-in LDO not used 2-3 short: Not used Open : Built-in LDO used *
J15	Internal VREF USE/NOT USE Select	1-2 short: Internal VREF NOT USE * 2-3 short: Internal VREF USE
J16	AVCC0 Supply Voltage Select	1-2 short: Normal/EHC Mode * 2-3 short: External User Voltage
J17	VREFH0 Supply Voltage Select	1-2 short: Normal/EHC Mode * 2-3 short: External User Voltage
J20	Current measurement point	Open: Measure Current * Short: Not Measure Current
J22	Power Line Select	1-2 short: Normal Mode * 2-3 short: EHC Mode
J23	Supply Voltage Select	1-2 short: Voltage Supply from RE01 VCC/IOVCC pin* 2-3 short: Battery Supply

*1: R15 resistor must be removed.
*2: At the time of product shipment, jumpers J3 and J13 are not mounted on the board.

2.2 Board Dimensions

Figure 2-3, Figure 2-4 show the board dimensions and connector positions. All the through-hole connectors are on a common 2.54mm pitch grid for easy interfacing.

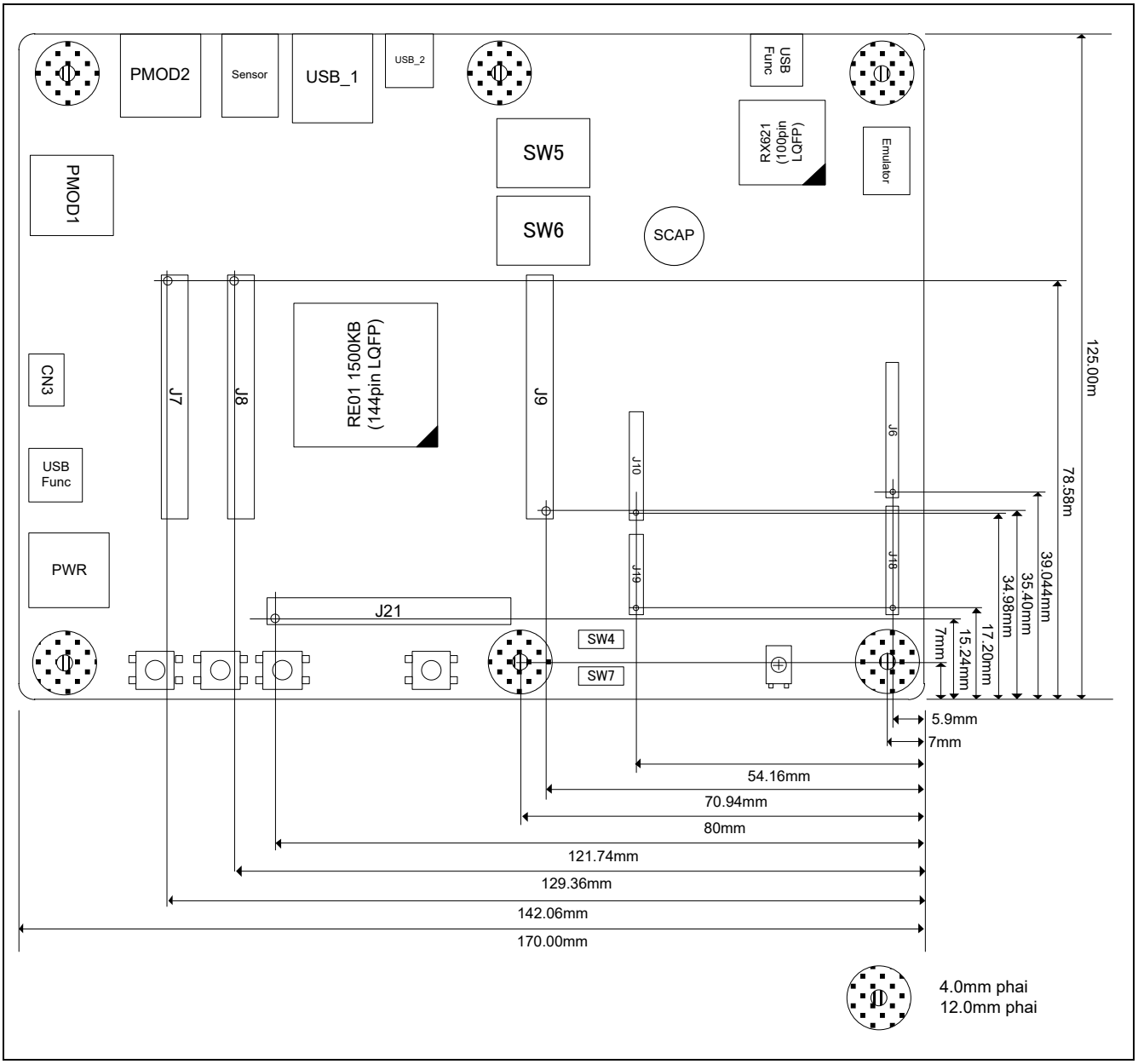


Figure 2-3: Main Board Dimensions

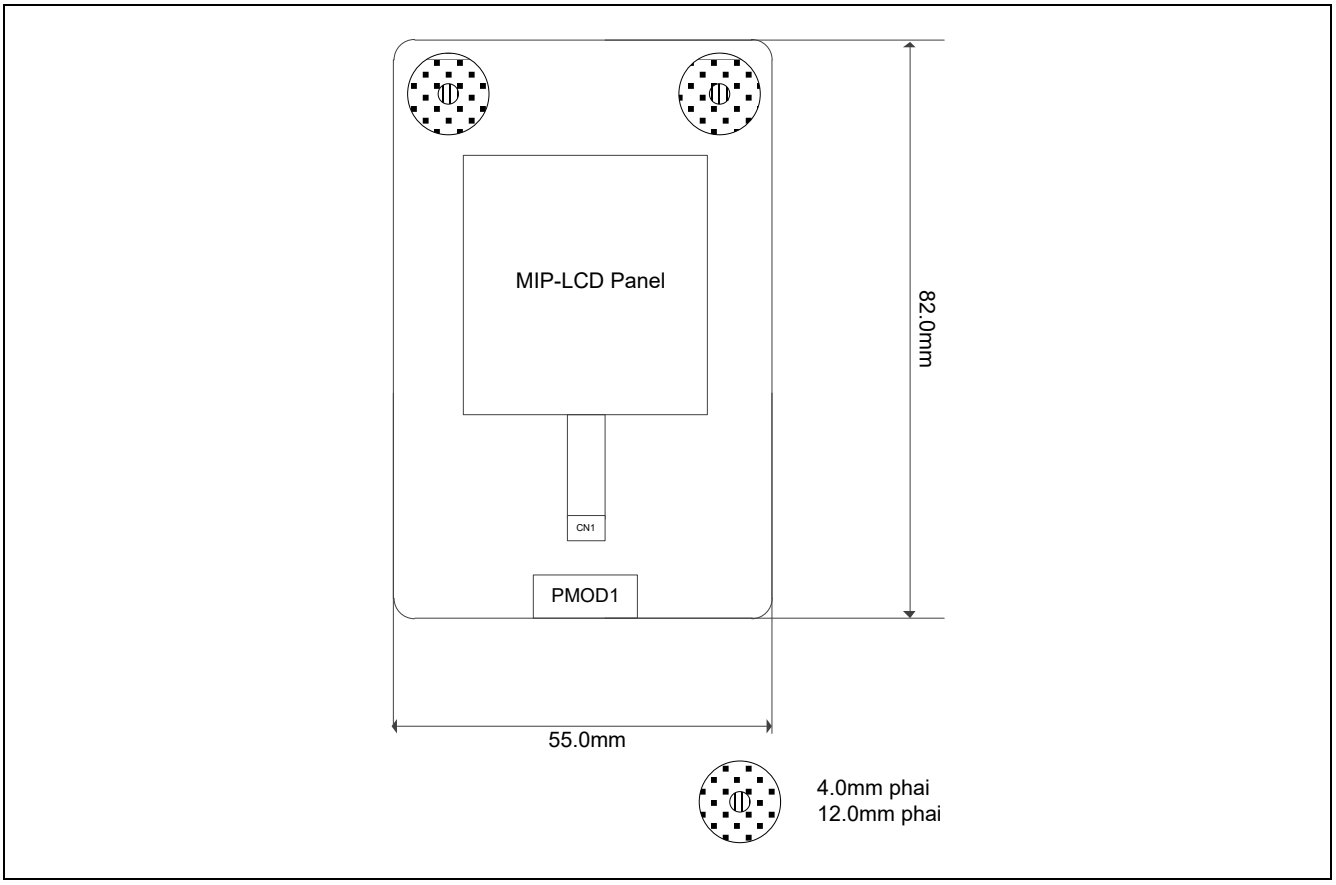


Figure 2-4: MIP-LCD Expansion Board Dimensions

2.3 Component Placement

Figure 2-5, Figure 2-6, Figure 2-7 show placement of individual components of Evaluation Kit. Component types and values are shown on the board schematics.

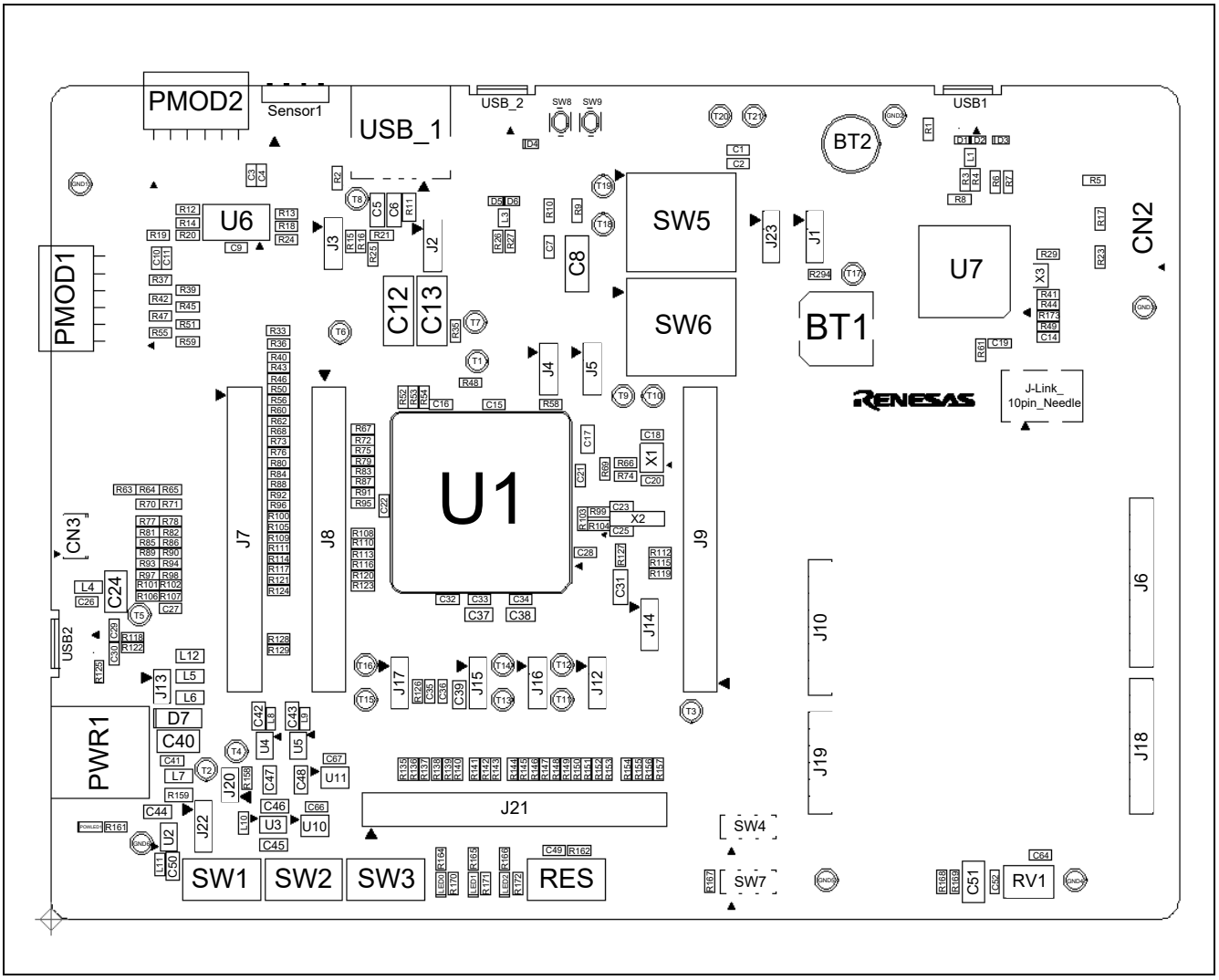


Figure 2-5: Main Board Component Placement (Top)

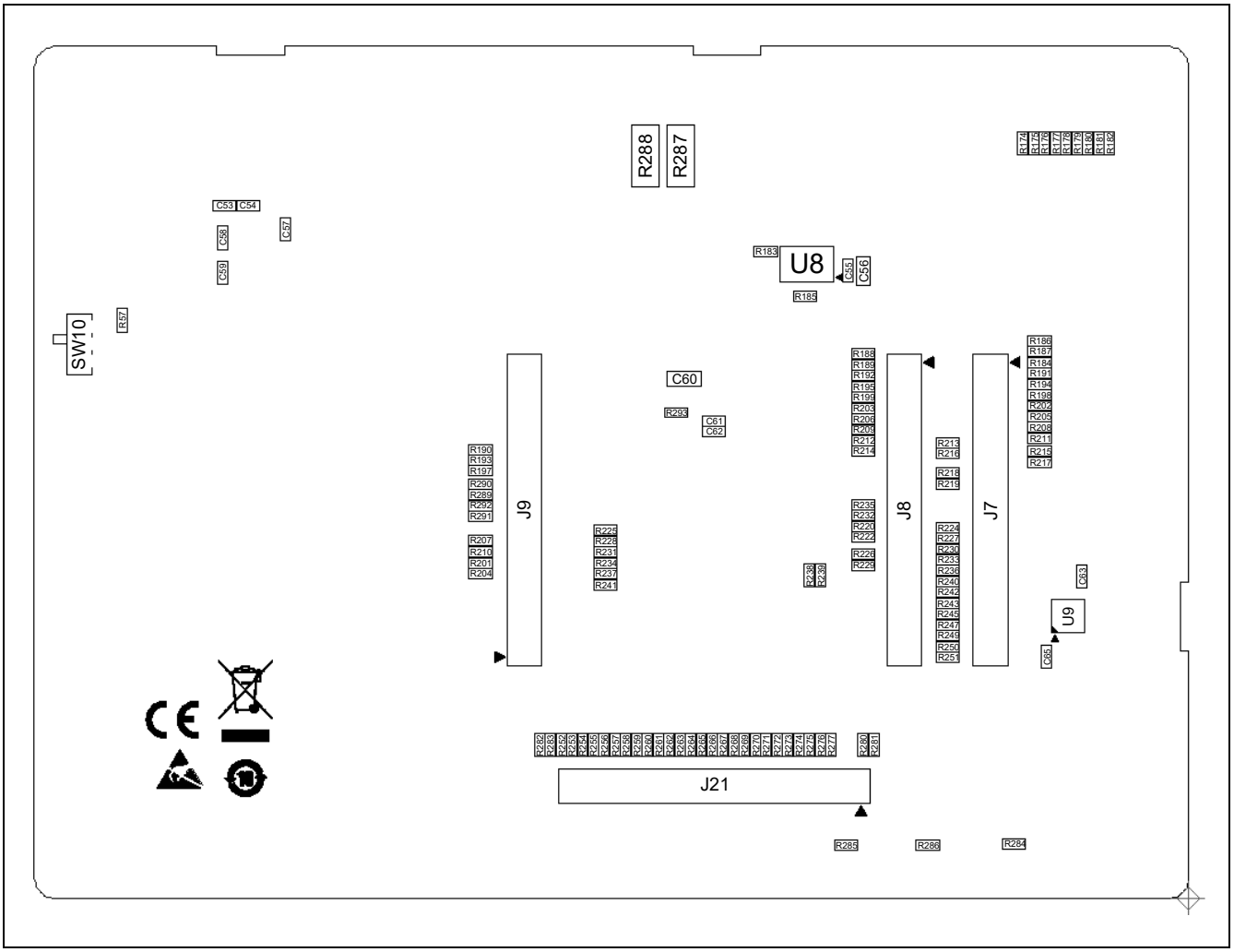


Figure 2-6: Main Board Component Placement (Bottom)

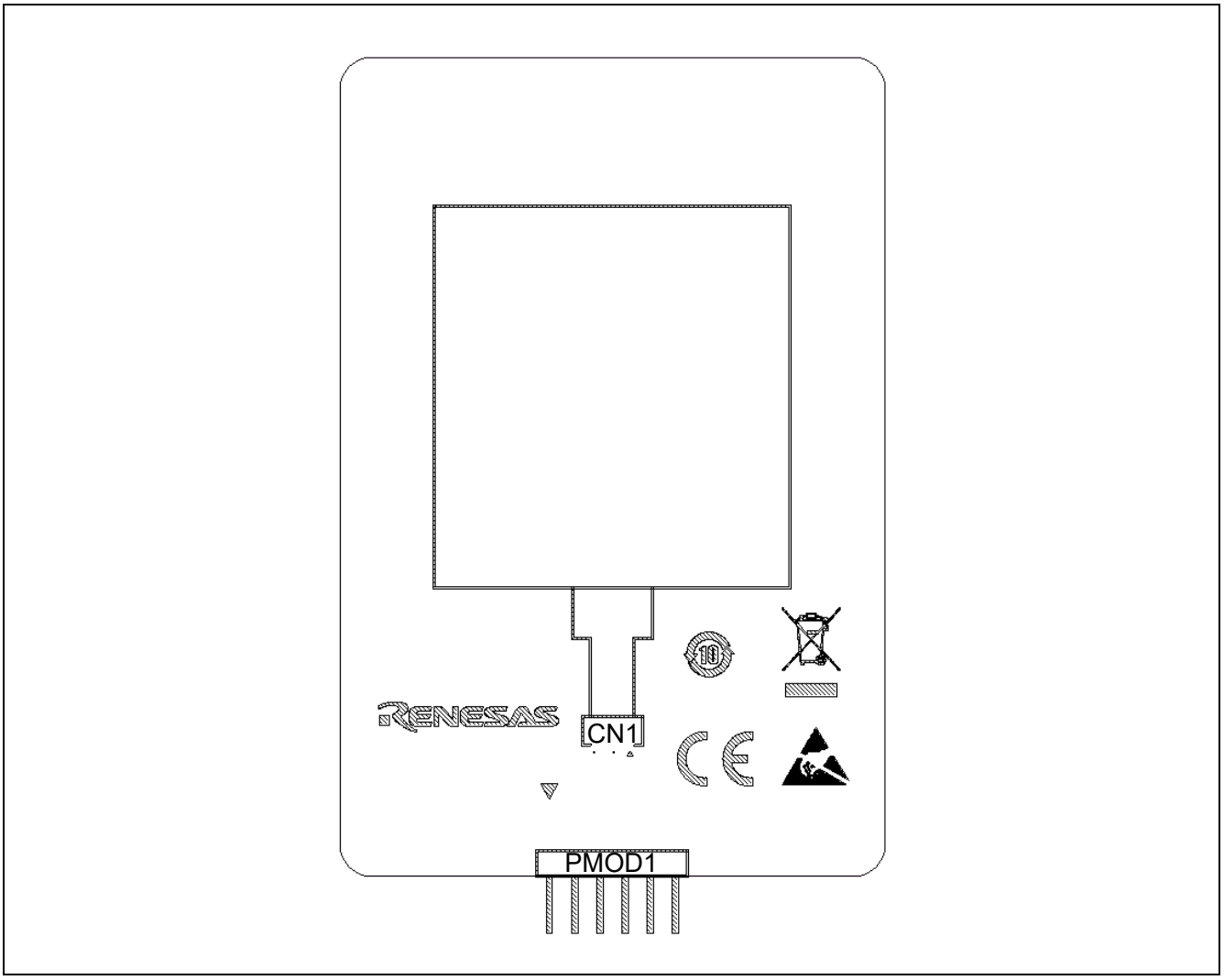


Figure 2-7: MIP-LCD Expansion Board Component Placement (Top)

3. Internal Board Connections

Figure 3-1 shows the Evaluation Kit components and their connectivity to RE01. The pin connection are listed in Table 3-1, Table 3-2 and Table 3-3.

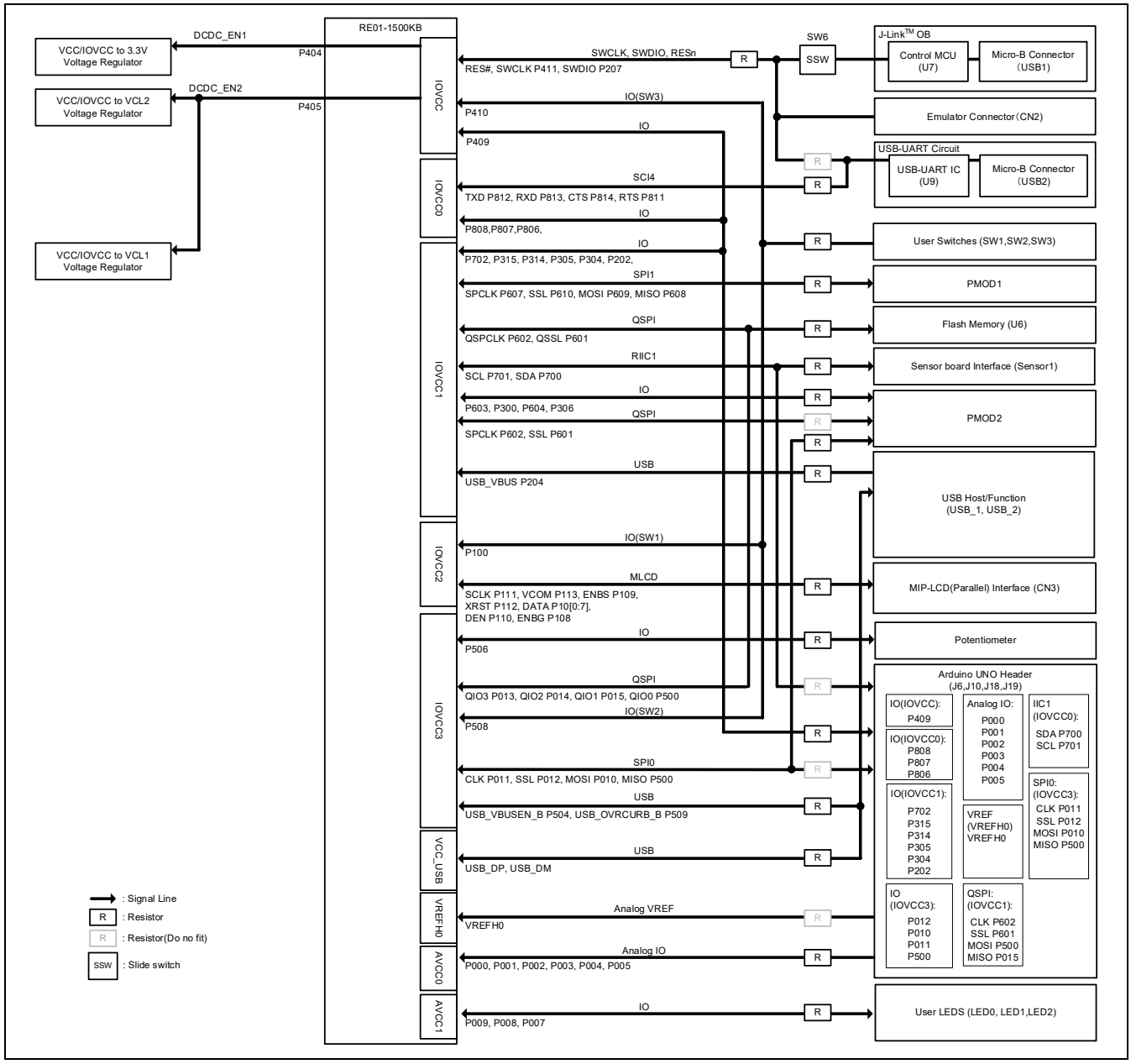


Figure 3-1: Internal Board Block Diagram

Table 3-1: List of RE01 functions, pin number and header connections (1/3)

Category	Function	Port	RE01 Pin No.	Main board Pin header	Power Domain
Clock	EXTAL	-	19	-	IOVCC
	XTAL	-	18	-	IOVCC
	XCIN	-	16	-	IOVCC
	XCOUT	-	15	-	IOVCC
Switch	RES	RES#	34	J9-RESn	IOVCC
	SW1	P100	99	J7-P100	IOVCC2
	SW2	P508	107	J7-P508	IOVCC3
	SW3	P410	23	J9-P410	IOVCC
DCDC	DCDC_EN1	P404	29	J9-P404	IOVCC
	DCDC_EN2	P405	28	J9-P405	IOVCC
LED	LED0	P009	125	J21-P009	AVCC1
	LED1	P008	126	J21-P008	AVCC1
	LED2	P007	127	J21-P007	AVCC1
PMOD1*	PMOD1-SSLB0_B	P610	73	J7-P610	IOVCC1
	PMOD1-MOSIB_B	P609	74	J7-P609	IOVCC1
	PMOD1-MISOB_B	P608	75	J7-P608	IOVCC1
	PMOD1-RSPCKB_B	P607	76	J7-P607	IOVCC1
	PMOD1-INT	P606	77	J7-P606	IOVCC1
	PMOD1-RESET	P605	78	J7-P605	IOVCC1
	PMOD1-IO0	P302	70	J8-P302	IOVCC1
	PMOD1-IO1	P303	69	J8-P303	IOVCC1
PMOD2*	PMOD2-SSLA0_B_QSSL_A	P012, P601**	121, 82	J21-P012, J7-P601	IOVCC3, IOVCC1
	PMOD2-MOSIA_B_QIO0_A	P010, P500**	123, 115	J21-P010, J21-P500	IOVCC3, IOVCC3
	PMOD2-MISOA_B_QIO1_A	P500**, P015**	115, 118	J21-P500, J21-P015	IOVCC3, IOVCC3
	PMOD2-RSPCKA_B_QSPCLK_A	P011, P602**	122, 81	J21-P011, J7-P602	IOVCC3, IOVCC1
	PMOD2-IO0_QIO2_A	P603, P014**	80, 119	J7-P603, J21-P014	IOVCC1, IOVCC3
	PMOD2-IO1_QIO3_A	P300, P013**	72, 120	J8-P300, J21-P013	IOVCC1, IOVCC3
	PMOD2-IO2	P604	79	J7-P604	IOVCC1
	PMOD2-IO3	P306	64	J8-P306	IOVCC1
USB-Serial	USB SERIAL-TXD	P812	143	J21-P812	IOVCC0
	USB SERIAL-RXD	P813	142	J21-P813	IOVCC0
	USB SERIAL-CTS	P814	141	J21-P814	IOVCC0
	USB SERIAL-RTS	P811	144	J21-P811	IOVCC0

Table 3-2: List of RE01 functions, pin number and header connections (2/3)

Category	Function	Port	RE01 Pin No.	Main board Pin header	Power Domain
MIP-LCD	MLCD_VCOM	P113	84	J7-P113	IOVCC2
	MLCD_ENBS	P109	88	J7-P109	IOVCC2
	MLCD_XRST	P112	85	J7-P112	IOVCC2
	MLCD_SI7*1	P100	99	J7-P100	IOVCC2
	MLCD_SI6	P101	98	J7-P101	IOVCC2
	MLCD_SI5	P102	97	J7-P102	IOVCC2
	MLCD_SI4	P103	96	J7-P103	IOVCC2
	MLCD_SI3	P104	95	J7-P104	IOVCC2
	MLCD_SI2	P105	94	J7-P105	IOVCC2
	MLCD_SI1	P106	93	J7-P106	IOVCC2
	MLCD_SI0	P107	92	J7-P107	IOVCC2
	MLCD_DEN	P110	87	J7-P110	IOVCC2
	MLCD_SCLK	P111	86	J7-P111	IOVCC2
	MLCD_ENBG	P108	89	J7-P108	IOVCC2
Flash Memory	QSPI-QSSL_A	P601	82	J7-P601	IOVCC1
	QSPI-QIO1_A	P015	118	J21-P015	IOVCC3
	QSPI-QIO2_A	P014	119	J21-P014	IOVCC3
	QSPI-QIO0_A	P500	115	J21-P500	IOVCC3
	QSPI-QSPCLK_A	P602	81	J7-P602	IOVCC1
	QSPI-QIO3_A	P013	120	J21-P013	IOVCC3
Arduino UNO (J6)	ARDUINO-IO6	P702	52	J8-P702	IOVCC1
	ARDUINO-IO7	P202	49	J8-P202	IOVCC1
	ARDUINO-SSLA0_B**	P012	121	J21-P012	IOVCC3
	ARDUINO-MOSIA_B**	P010	115	J21-P010	IOVCC3
	ARDUINO-MISOA_B**	P500	115	J21-P500	IOVCC3
	ARDUINO-RSPCKA_B**	P011	122	J21-P011	IOVCC3
	VREFH0	-	137	-	VREFH0
	ARDUINO-SDA1	P700	54	J8-P700	IOVCC1
	ARDUINO-SCL1	P701	53	J8-P701	IOVCC1
Arduino UNO (J18)	ARDUINO-RXD5_B	P314	56	J8-P314 /J18-1	IOVCC1
	ARDUINO-TXD5_B	P315	55	J8-P315 /J18-2	IOVCC1
	ARDUINO-IO0	P808	5	J9-P808 /J18-3	IOVCC0
	ARDUINO-IO1	P807	6	J9-P807 /J18-4	IOVCC0
	ARDUINO-IO2	P806	7	J9-P806 /J18-5	IOVCC0
	ARDUINO-IO3	P409	24	J9-P409 /J18-6	IOVCC
	ARDUINO-IO4	P304	68	J8-P304 /J18-7	IOVCC1
	ARDUINO-IO5	P305	65	J8-P305 /J18-8	IOVCC1

Table 3-3: List of RE01 functions, pin number and header connections (3/3)

Category	Function	Port	**RE01** Pin No.	**Main board** Pin header	Power Domain
Arduino UNO (J10)	Board_5V	-	-	-	-
	ARDUINO-RESn	RES#	34	J9-RESn /J10-3	IOVCC
	LP_PRODUCT_3V3	-	-	-	-
	Board_5V	-	-	-	-
Arduino UNO (J19)	ARDUINO-AN000	P000	136	J21-P000 /J19-1	AVCC0
	ARDUINO-AN001	P001	135	J21-P001 /J19-2	AVCC0
	ARDUINO-AN002	P002	133	J21-P002 /J19-3	AVCC0
	ARDUINO-AN003	P003	132	J21-P003 /J19-4	AVCC0
	ARDUINO-AN004	P004	131	J21-P004 /J19-5	AVCC0
	ARDUINO-AN005	P005	130	J21-P005 /J19-6	AVCC0
Sensor Board	RIIC-SCL1**	P701	53	J8-P701	IOVCC1
	RIIC-SDA1**	P700	54	J8-P700	IOVCC1
Potentiometer	RV1-ADC	P506	109	J21-P506	IOVCC3
Universal Serial Bus	USB_DP	USB_DP	44	-	VCC_USB
	USB_DM	USB_DM	43	-	VCC_USB
	USB_VBUS	P204	47	J21-P204	IOVCC1
	USB_VBUSEN_B	P504	111	J21-P504	IOVCC3
	USB_OVRCURB_B	P509	106	J7-P509	IOVCC3

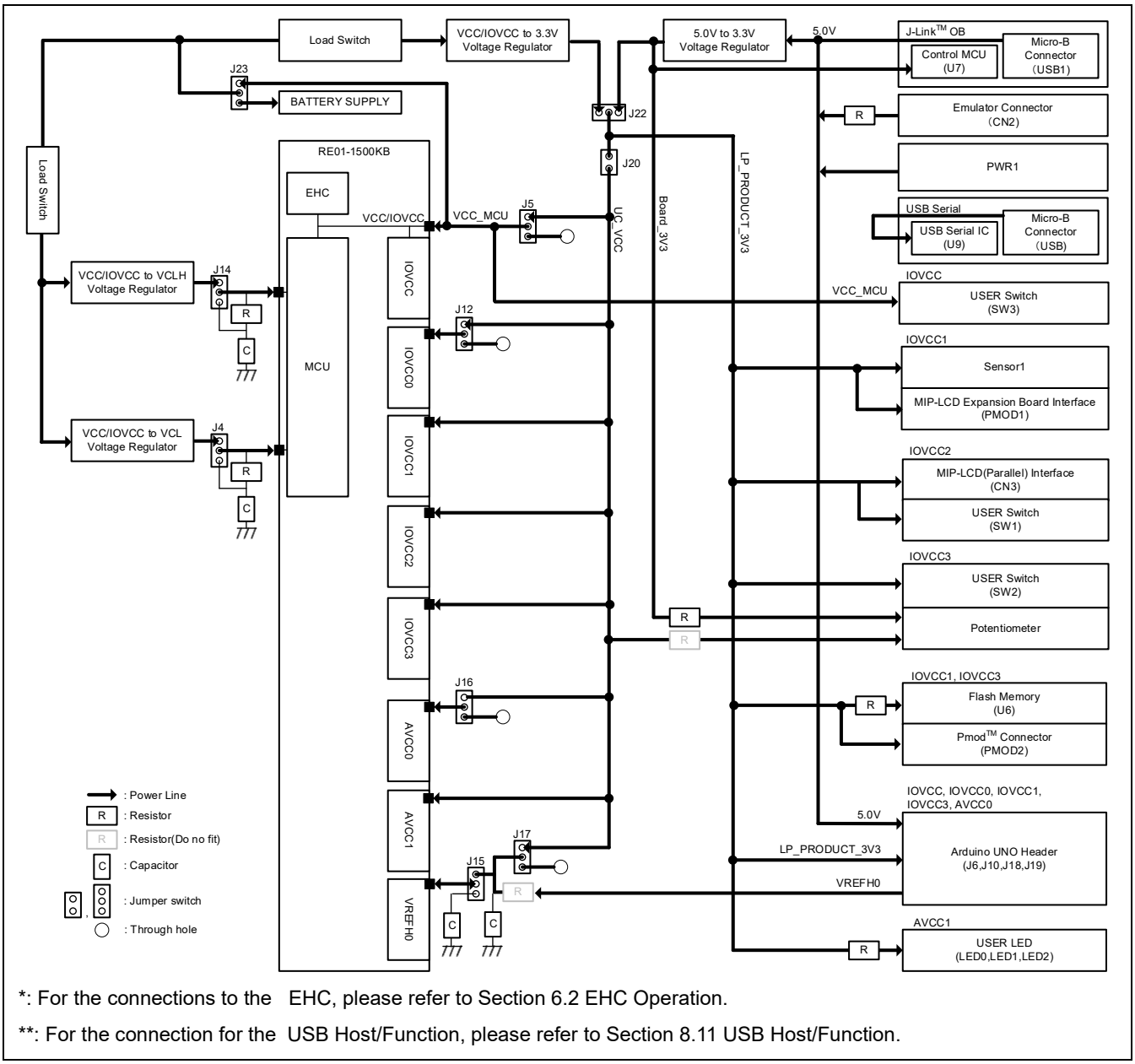
*: Please refer to Section 8.5 Pmod™ Interface for the relationship with the pin number of the PMOD connector.

**: Not connected by default. Please change the resistor based on your application.

4. Power Source

4.1 Power System

Figure 4-1 shows the power supply diagram of the Evaluation Kit.
For the connections to the EHC, please refer to Section 6.2 EHC Operation.
For the connections for the USB Host/Function, please refer to Section 8.11 USB Host/Function.



*: For the connections to the EHC, please refer to Section 6.2 EHC Operation.

**: For the connection for the USB Host/Function, please refer to Section 8.11 USB Host/Function.

Figure 4-1: Power Supply System Diagram

4.2 Power Supply

The Evaluation Kit can draw power from the emulator, USB cable, or DC Power Jack. Details are shown in Figure 4-2 and Table 4-1 . If the Evaluation Kit is connected to another system, supply power to the Evaluation Kit from that system.

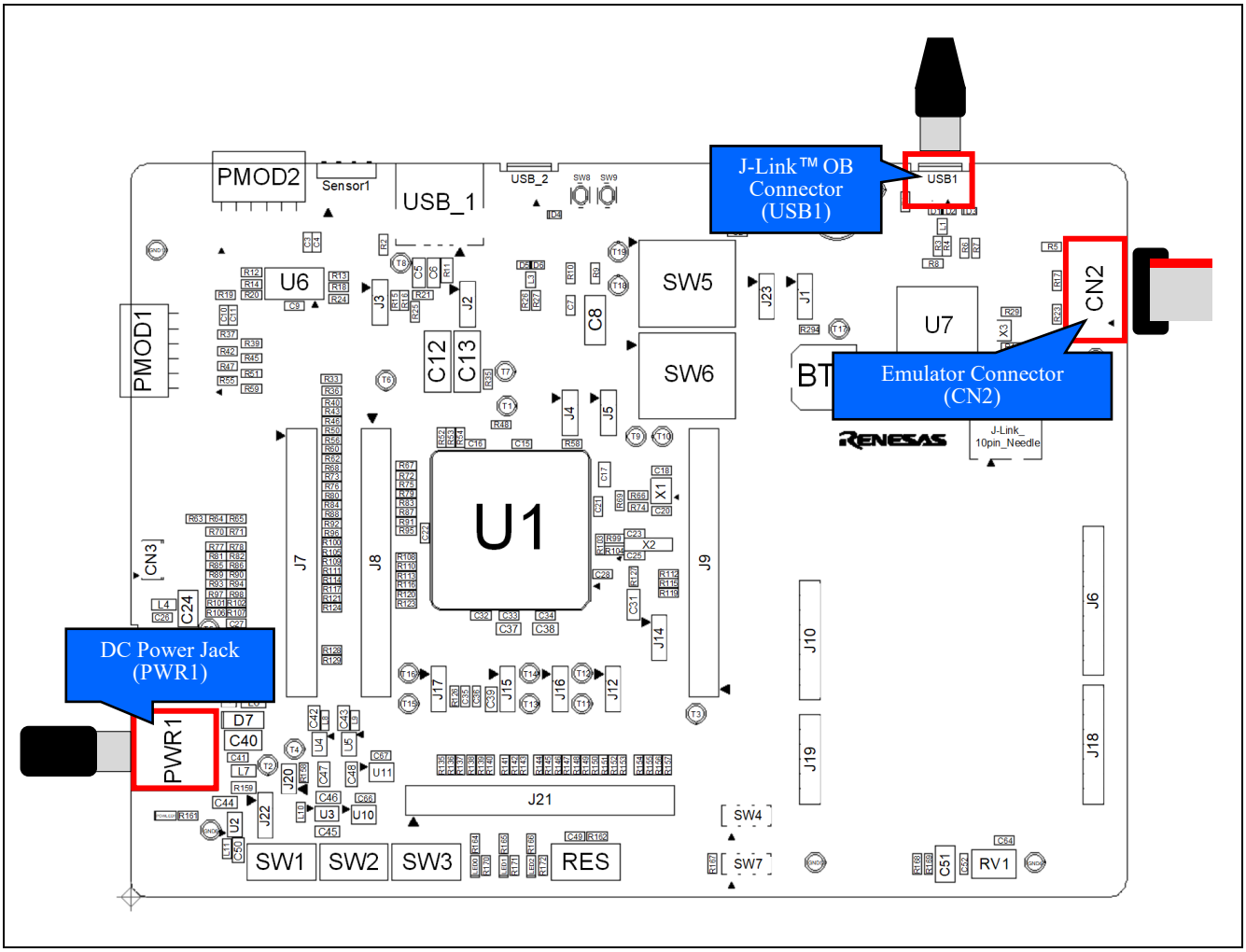


Figure 4-2: Power Supply Arrangement

Table 4-1: Power Supply Specifications

Supply source	Supply Voltage	Supply Current
I-jet (CN2)	5V	Maximum 420mA
J-Link™ (CN2)	5V	Maximum 300mA
J-Link™ OB(USB1)	5V	Maximum 500mA
AC Adapter (PWR1) *1	5VDC	1A

*1: The main power supply connected to PWR1 should supply a minimum of 5W to ensure full functionality.

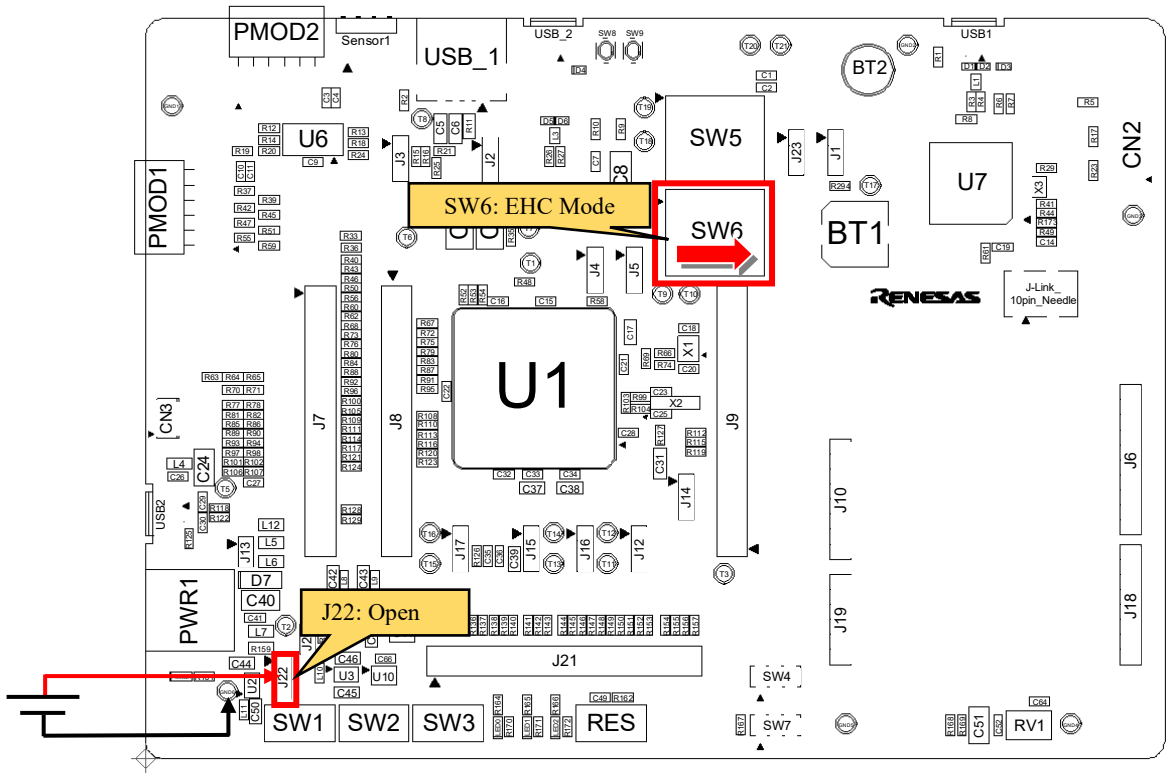
4.3 External User Voltage Supply

It is possible to supply voltage to RE01 power terminal by using external power supply. This allows the entire or individual power domain to operate at any voltage (1.62 – 3.6V).

4.3.1 All power pins

Details are shown in Figure 4-3 and Table 4-2. Follow the steps below when supplying voltage from external power supply to all RE01 power pins:

1. Open J22 jumper.
2. Set SW6 to EHC.
3. Supply voltage (1.62V-3.6V) from pin 2 of J22 using an external power supply.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 4-3: Components Layout

Table 4-2: Configuration Details

Reference	Position	Settings
J22	Open	External user voltage supply
SW6	2-3, 5-6, 8-9 short	EHC Mode

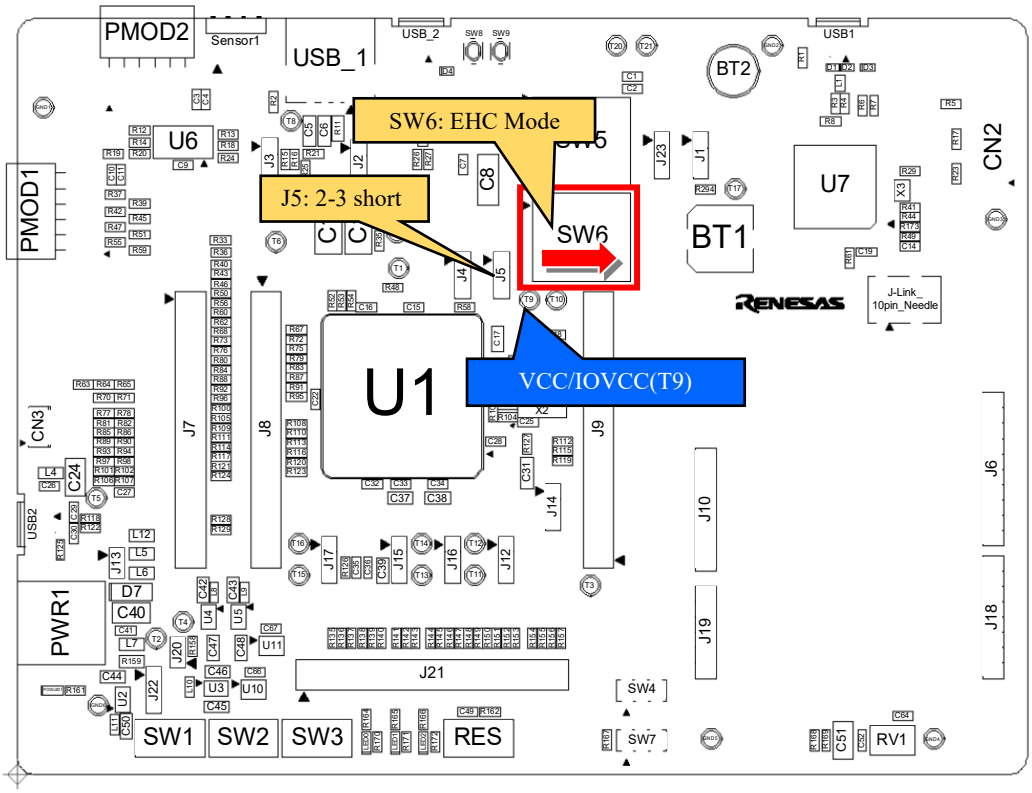
Keep the following in mind when using this feature:

- The debugger cannot be used because there is a difference between the debugger voltage and the supply voltage of RE01. If you want to use it, please follow Table 5-2 of the application note "Maintenance free power management by RE energy harvesting controller" (R01AN4837).

4.3.2 VCC/IOVCC

Details are shown in Figure 4-4 and Table 4-3. Follow the steps below when supplying voltage from external power supply to VCC/IOVCC pin:

1. Mount the test pin on T9.
2. Set J5 to 2-3 short.
3. Set SW6 to EHC.
4. Supply voltage (1.62V-3.6V) from T9 using an external power supply.
5. Supply voltage to power supply pins other than VCC / IOVCC.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 4-4: Components Layout

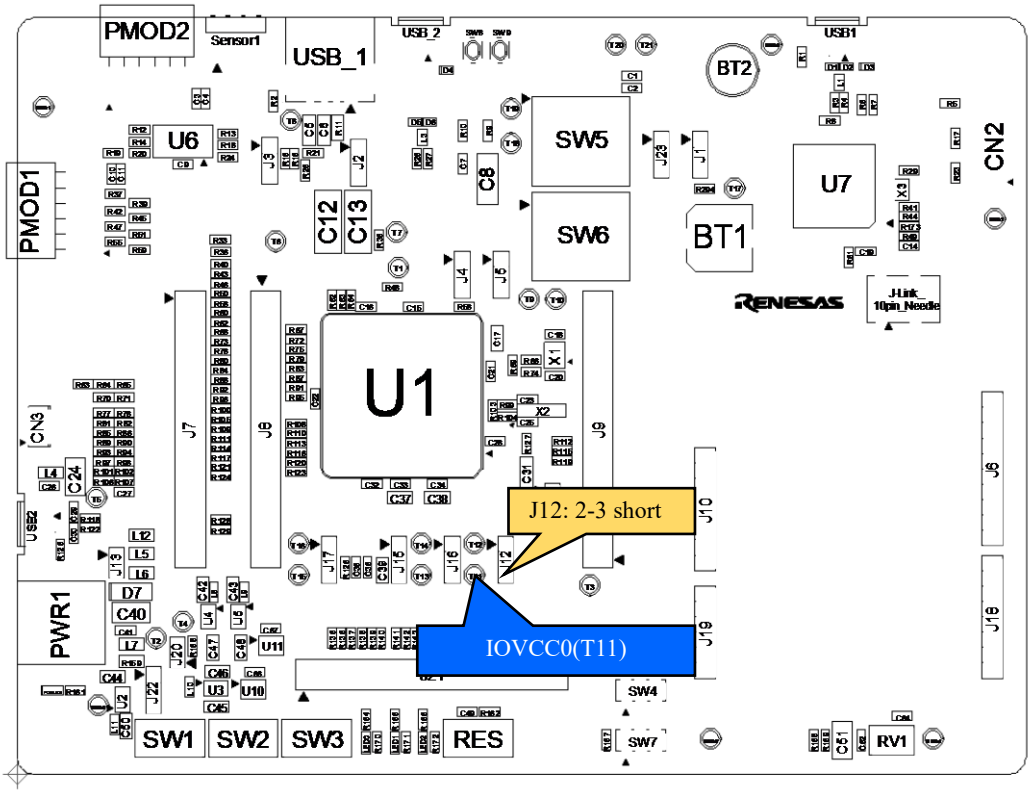
Table 4-3: Configuration Details

Reference	Position	Settings
J5	2-3 short	External user voltage supply
SW6	2-3, 5-6, 8-9 short	EHC Mode

4.3.3 IOVCC0

Details are shown in Figure 4-5 and Table 4-4. Follow the steps below when supplying voltage from external power supply to IOVCC0 pin:

1. Mount the test pin on T11.
2. Set J12 to 2-3 short.
3. Supply voltage to power supply pins other than IOVCC0.
4. Supply voltage (1.62V-3.6V) from T11 using an external power supply.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 4-5: Components Layout

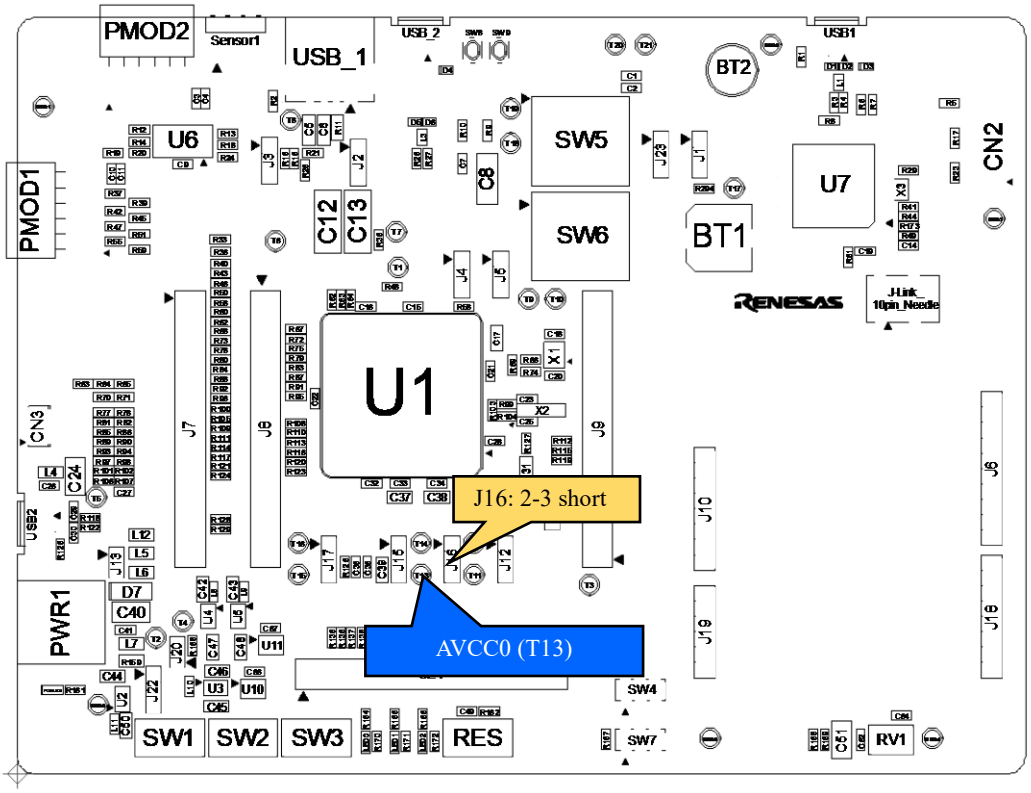
Table 4-4: Configuration Details

Reference	Position	Settings
J12	2-3 short	External user voltage supply

4.3.4 AVCC0

Details are shown in Figure 4-6 and Table 4-5. Follow the steps below when supplying voltage from external power supply to AVCC0 pin:

1. Mount the test pin on T13.
2. Set J16 to 2-3 short.
3. Supply voltage to power supply pins other than AVCC0.
4. Supply voltage (1.62V-3.6V) from T13 using an external power supply.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 4-6: Components Layout

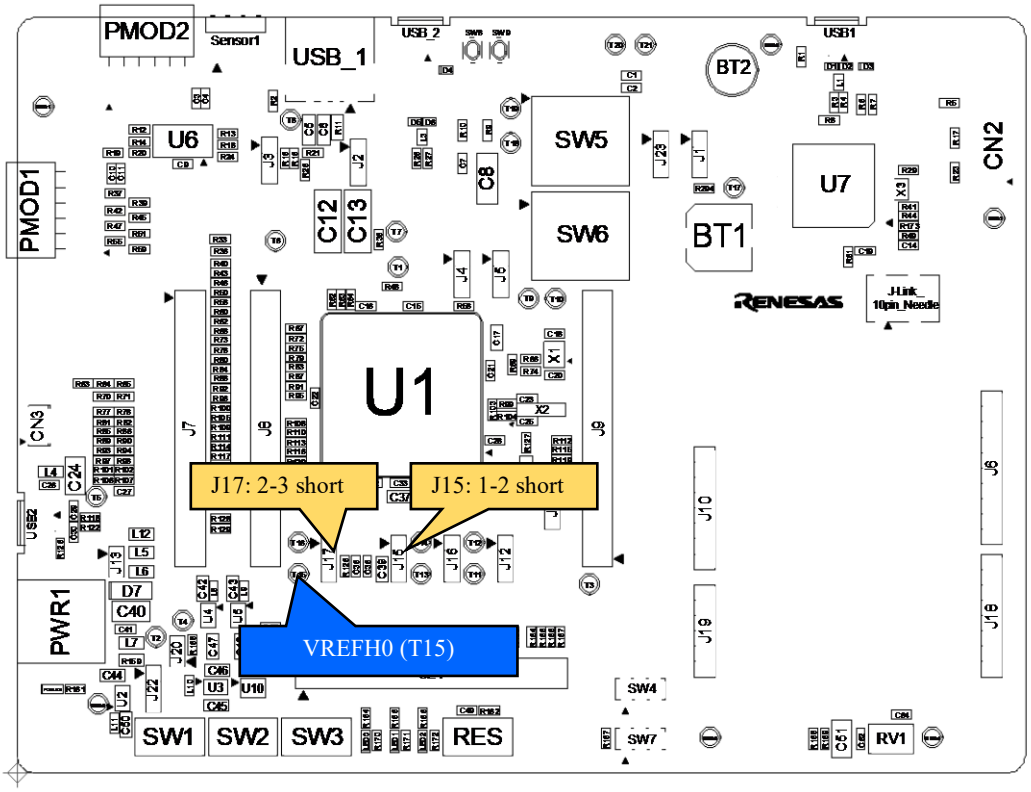
Table 4-5: Configuration Details

Reference	Position	Settings
J16	2-3 short	External user voltage supply

4.3.5 VREFH0

Details are shown in Figure 4-7 and Table 4-6. Follow the steps below when supplying voltage from external power supply to VREFH0 pin:

1. Mount the test pin on T15.
2. Set J17 to 2-3 short.
3. Set J15 to 1-2 short.
4. Supply voltage to power supply pins other than VREFH0.
5. Supply voltage (1.62V-AVCC0) from T15 using an external power supply.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 4-7: Components Layout

Table 4-6: Configuration Details

Reference	Position	Settings
J15	1-2 short	Internal VREF not use
J17	2-3 short	External user voltage supply

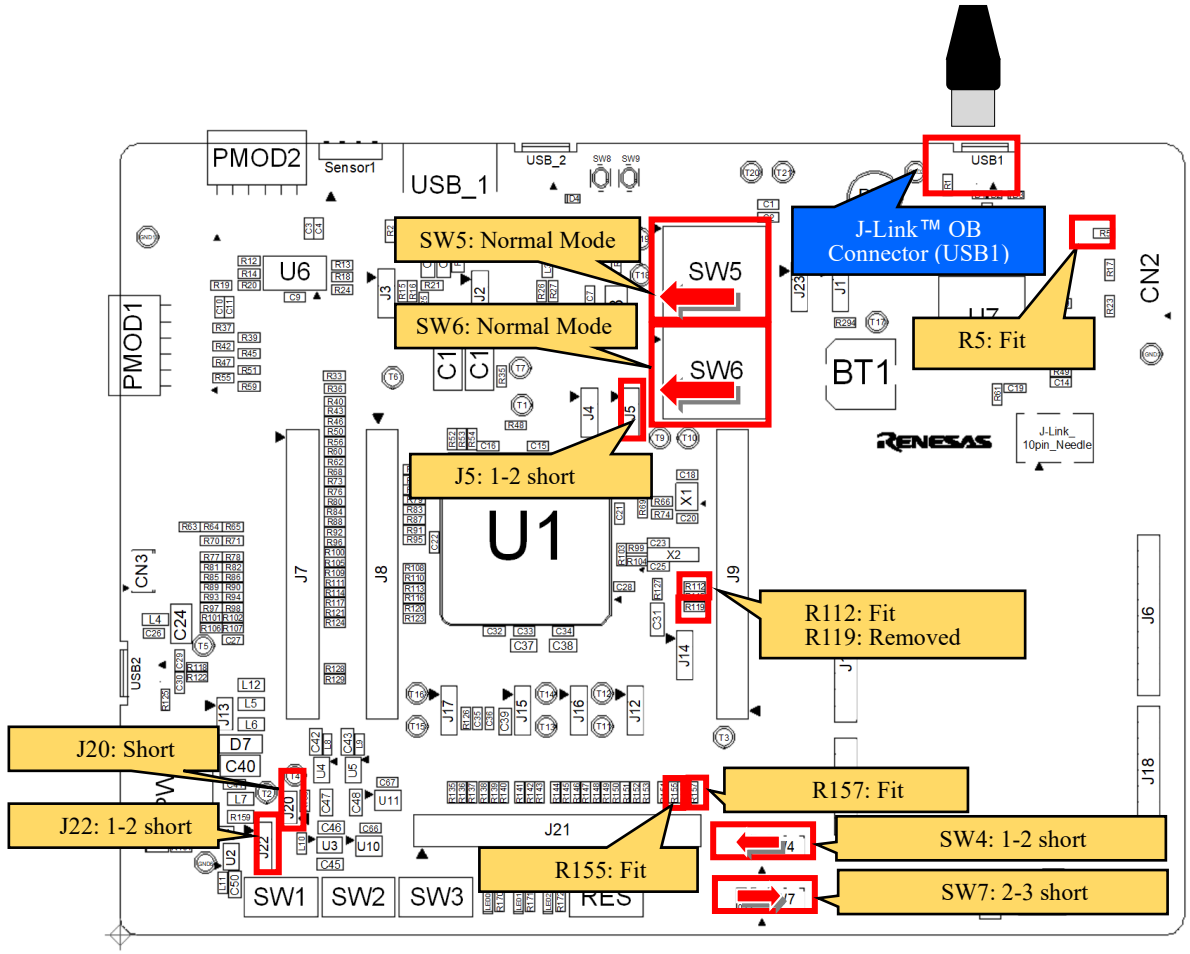
5. Debug

5.1 J-Link™ OB

This main board is equipped with Segger J-Link™ OB. RE01 debugging is possible by connecting the USB cable to the board and the host PC.

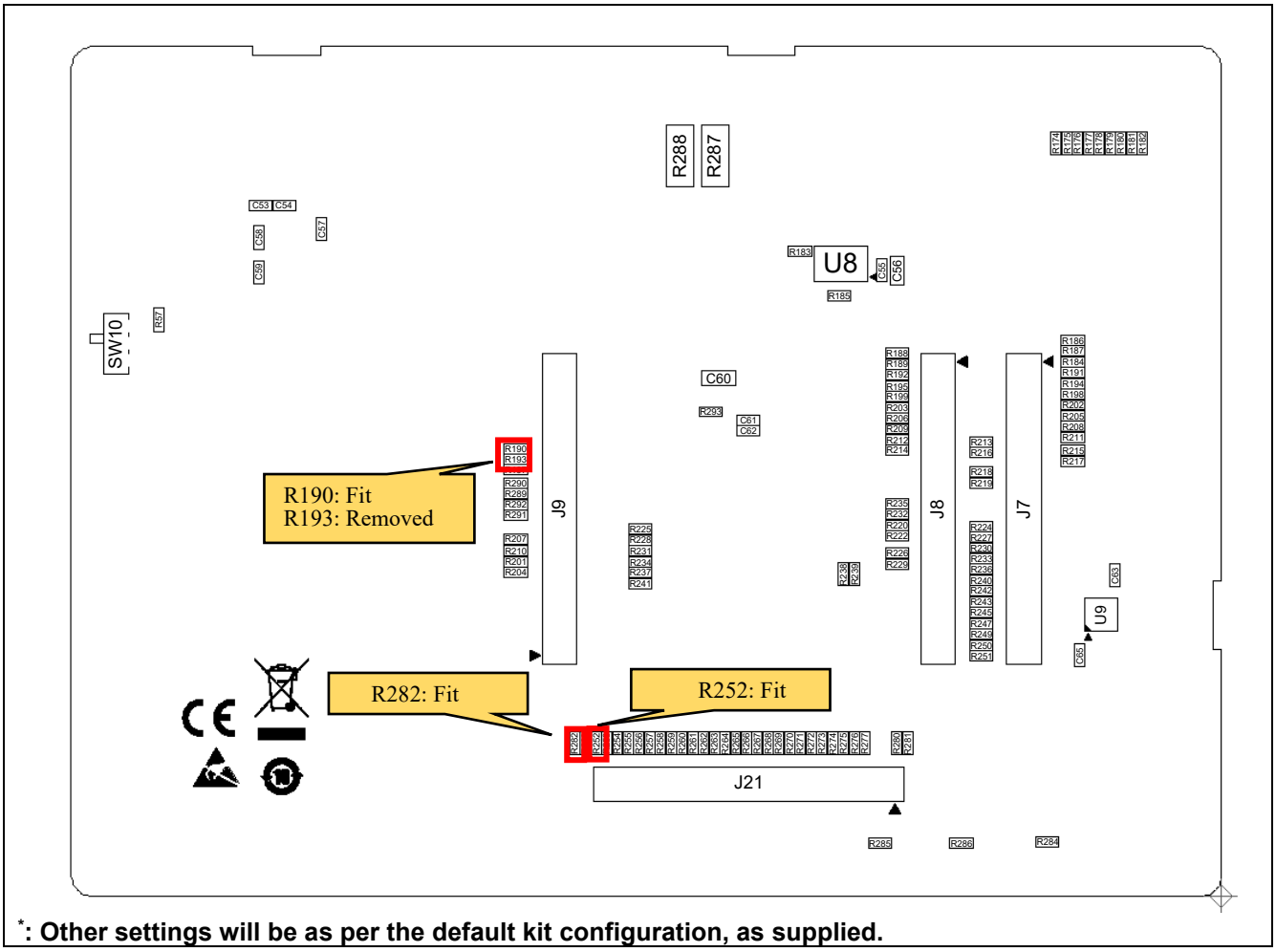
5.1.1 Component Layout and Settings

Switch settings are required to use J-Link™ OB. For details, see the settings in Figure 5-1, Figure 5-2 and Table 5-1. The kit will be supplied pre-configured for J-Link™ OB as default.
Figure 5-3 and Figure 5-4 show the connection relationship between the power supply and signals in this setting change.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-1: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-2: Component Layout (Bottom)

Table 5-1: Configuration Details

Reference	Position	Settings
SW4	1-2 short *1	Normal Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	1-2, 4-5, 7-8 short *1	Normal Mode
SW7	2-3 short *1	Normal Mode
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Removed *1	
R112, R190,	Fit *1	
R155, R157, R252, R282	Fit *1	
R5	Fit *1	E2 emulator is not to be used

*1: The default kit configuration, as supplied.

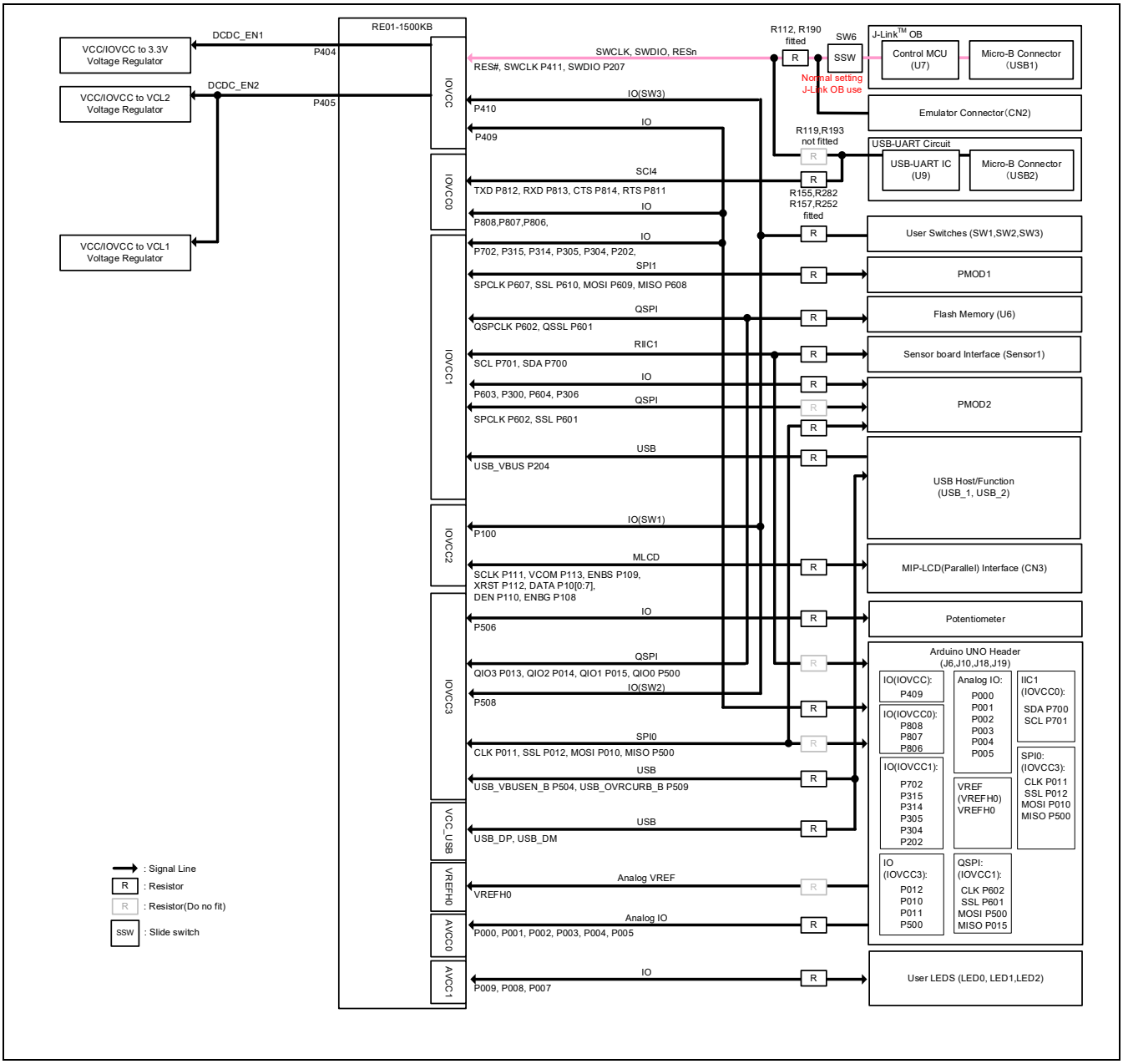


Figure 5-3: Block diagram of Signal line (J-Link™ OB)

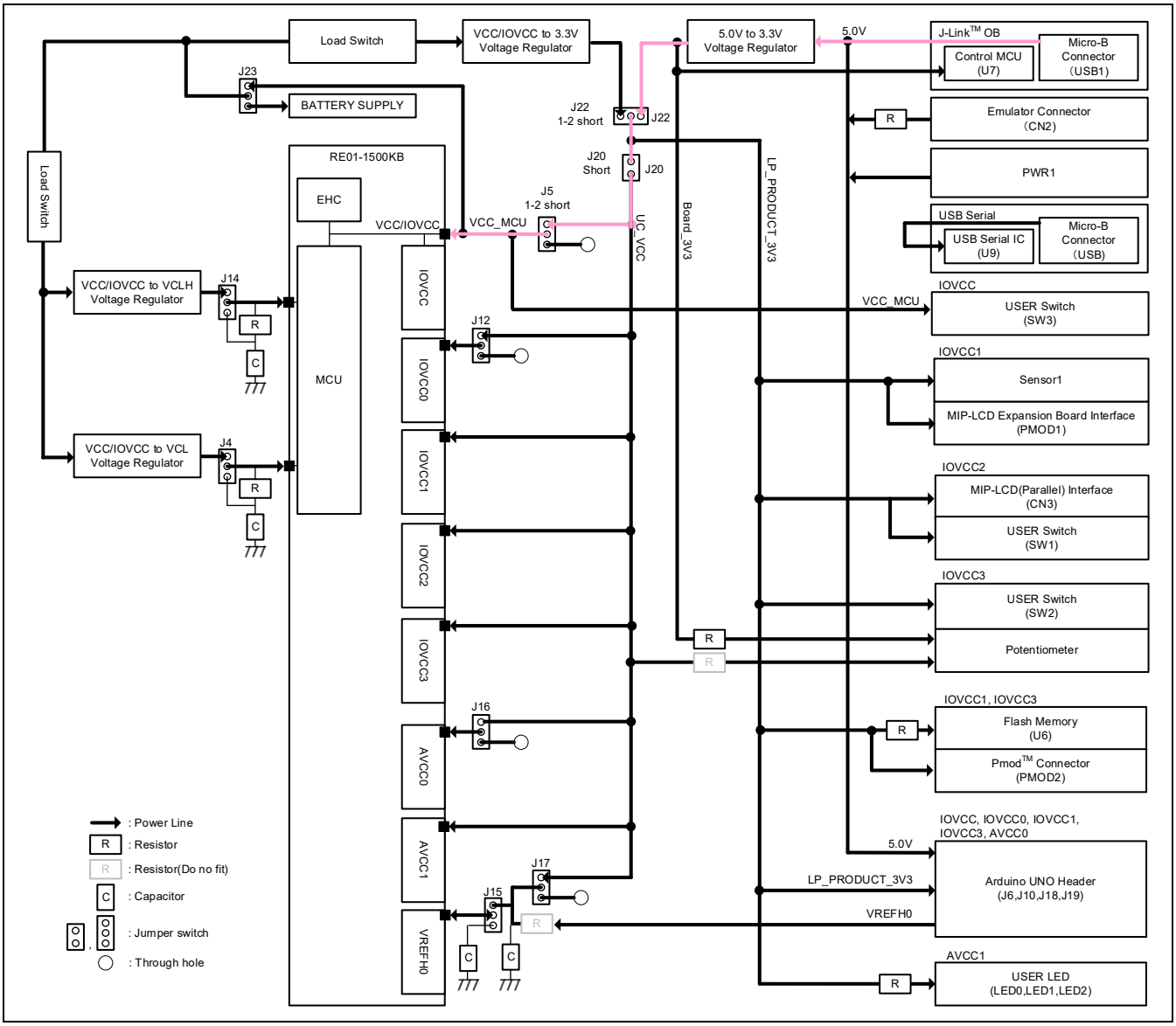


Figure 5-4: Block diagram of Power line (J-Link™ OB)

5.1.2 Debugger Connection

Figure 5-5 shows the connections between the main board (J-Link™ OB) and the host PC. When using J-Link™ OB, do not connect the board to other emulators.

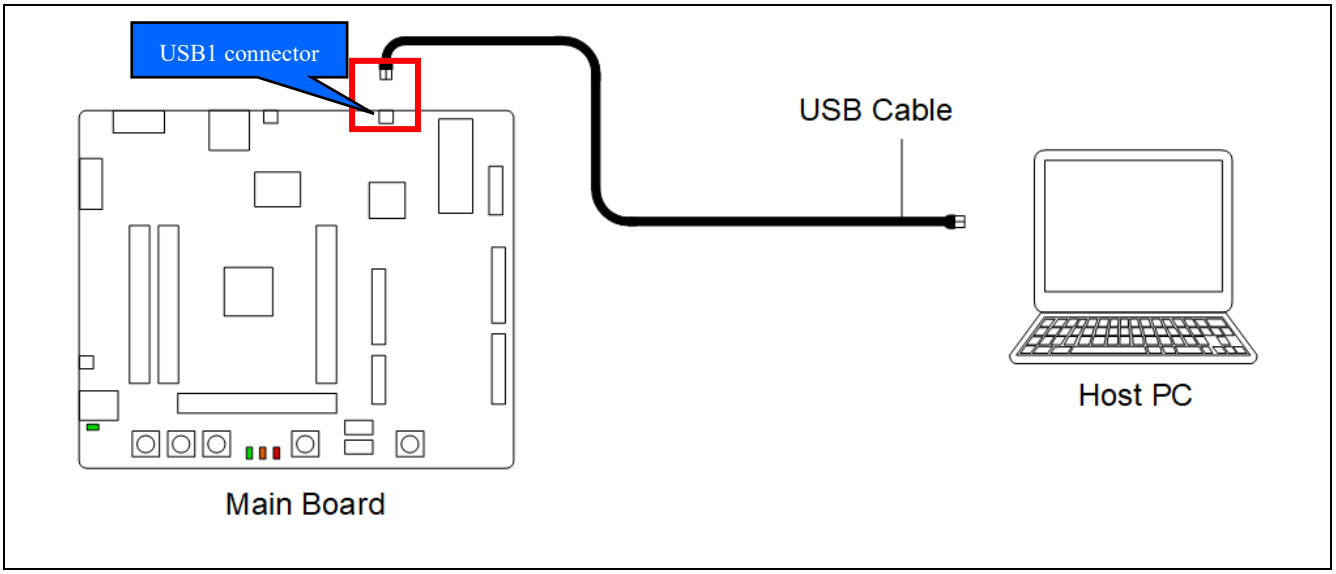


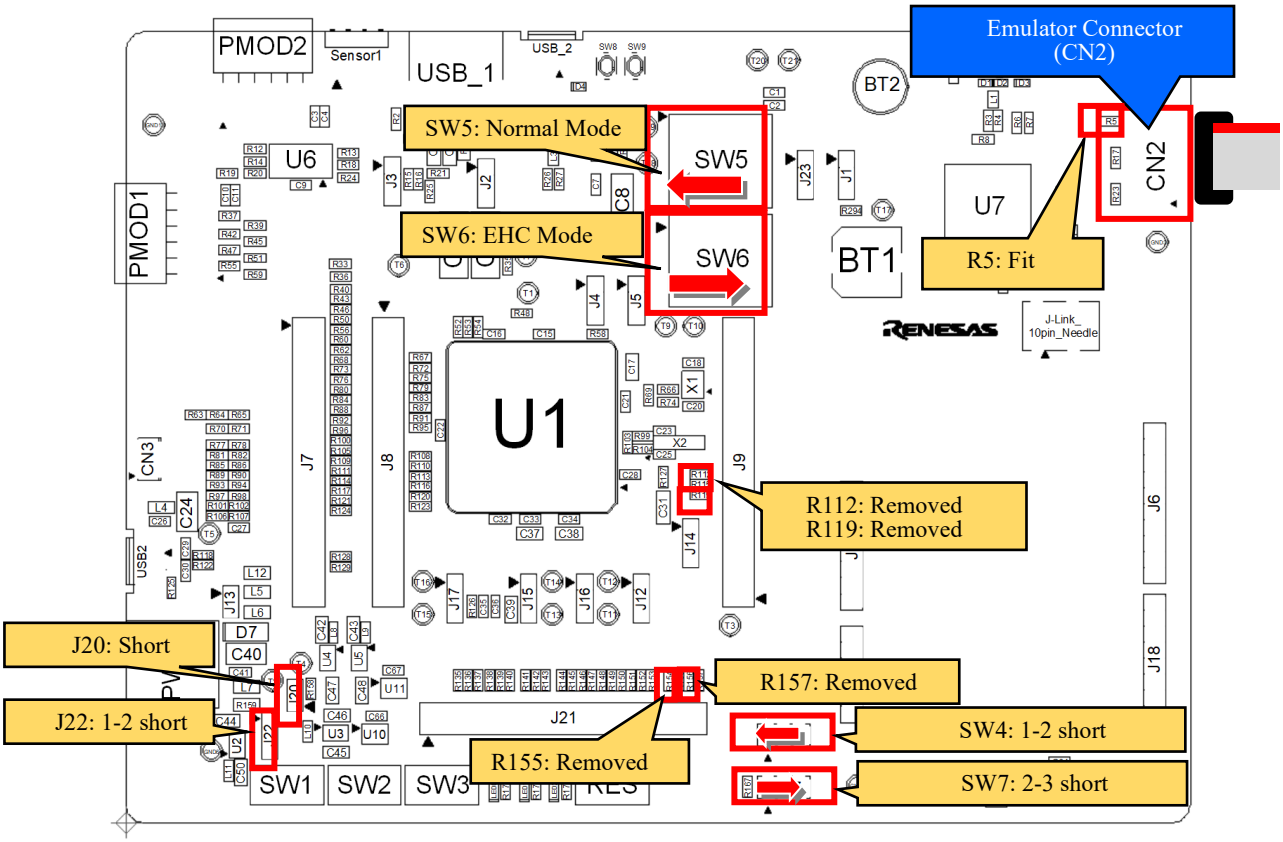
Figure 5-5: Debugger Connection Diagram

5.2 I-jet/J-Link™

The main board can be connected to an IAR I-jet or Segger J-Link™ emulator. RE01 debugging is possible by using either of these emulators.

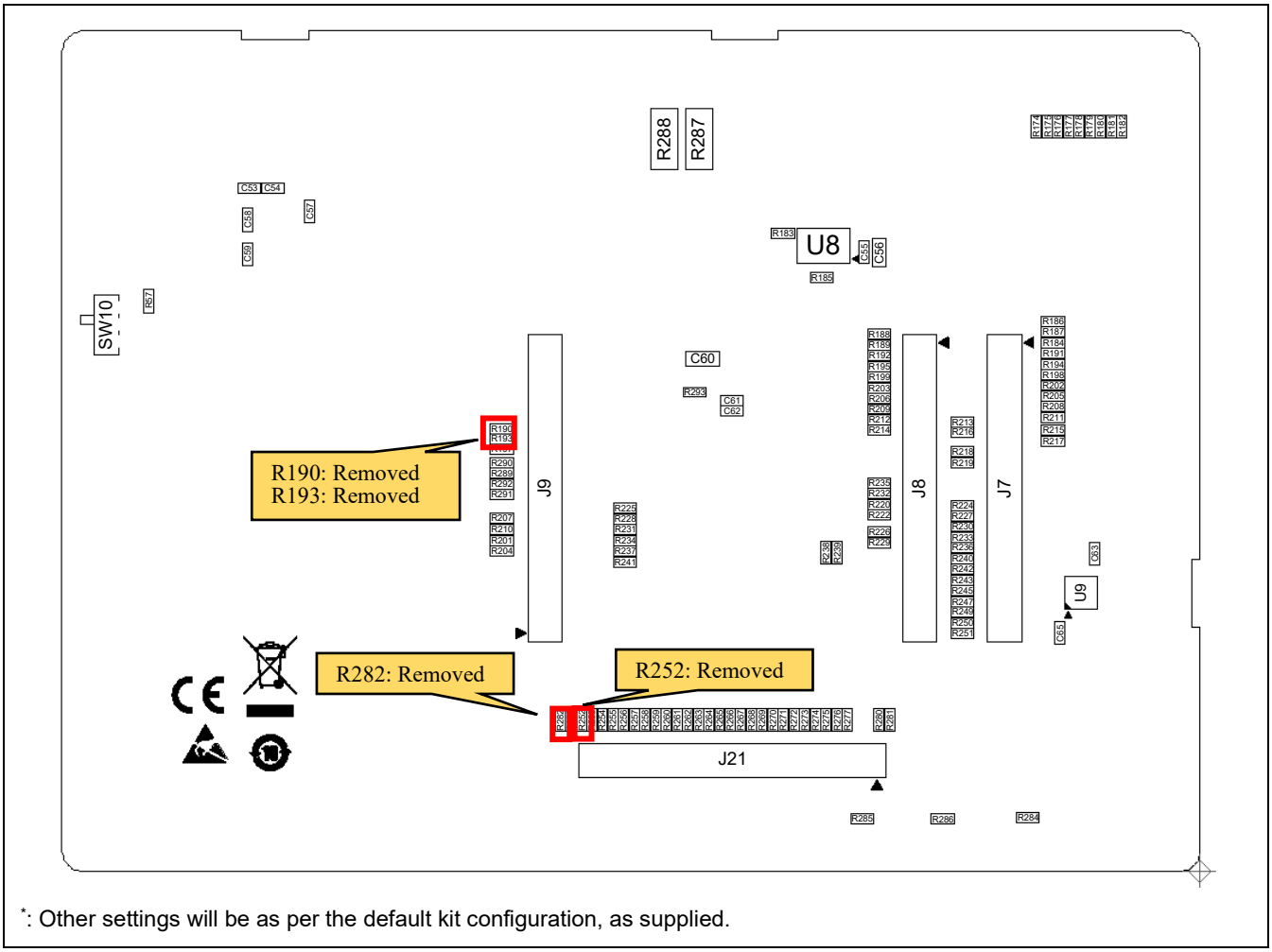
5.2.1 Component Layout and Settings

To use the emulator, switch settings are required. For details, see the settings in Figure 5-6, Figure 5-7 and Table 5-2. This function is not supported in default configuration, as supplied.
Figure 5-8 and Figure 5-9 show the connection relationship between the power supply and signals in this setting change.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-6: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-7: Component Layout (Bottom)

Table 5-2: Configuration Details

Reference	Position	Settings
SW4	1-2 short *1	Normal Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode (J-Link™ OB not used)
SW7	2-3 short *1	Normal Mode
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Removed*1	
R112, R190,	Removed	
R155, R157, R252, R282	Removed	
R5	Fit *1	E2 emulator not used

*1: The default kit configuration, as supplied.

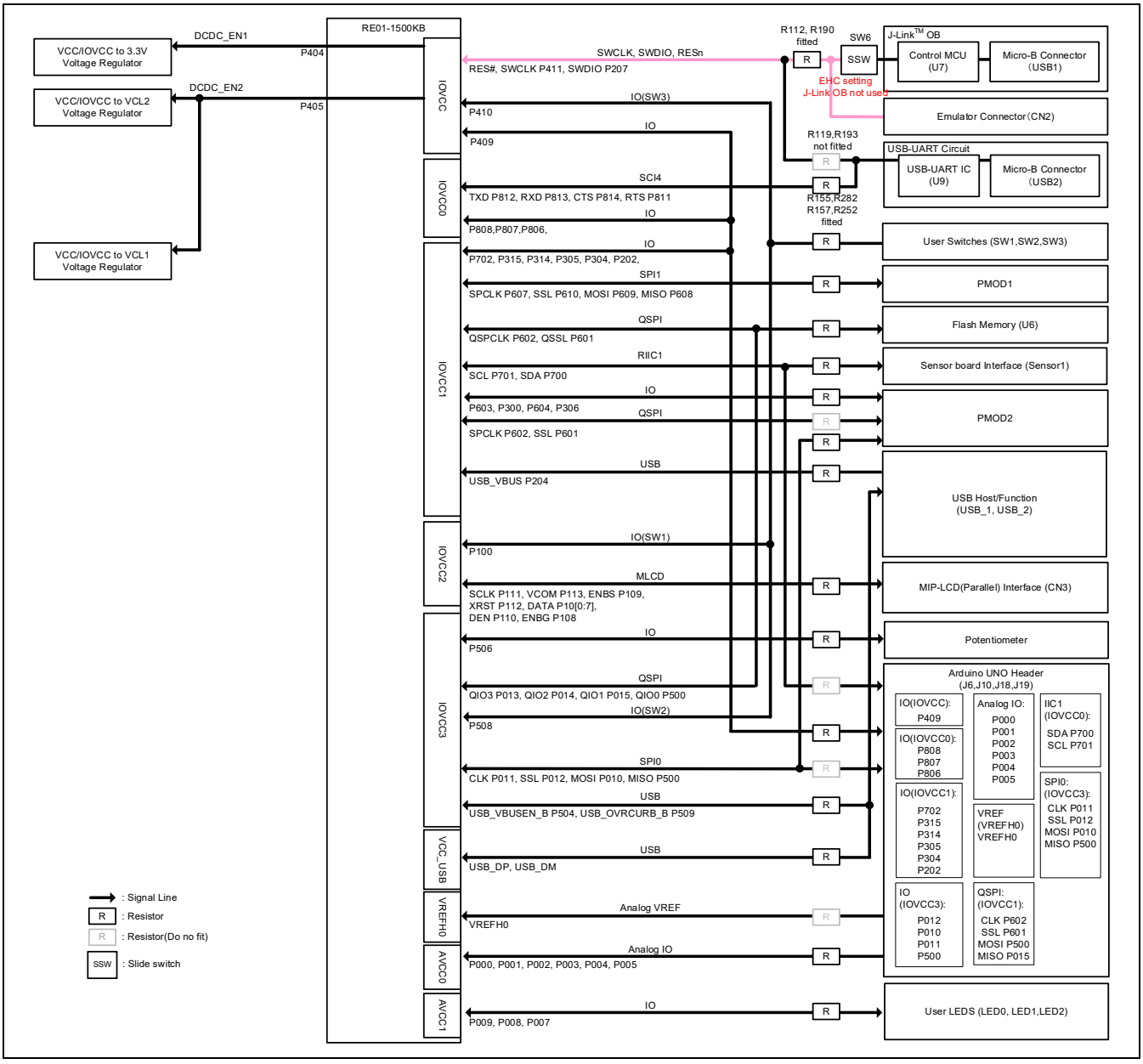


Figure 5-8: Block diagram of Signal line (I-jet™, J-Link™)

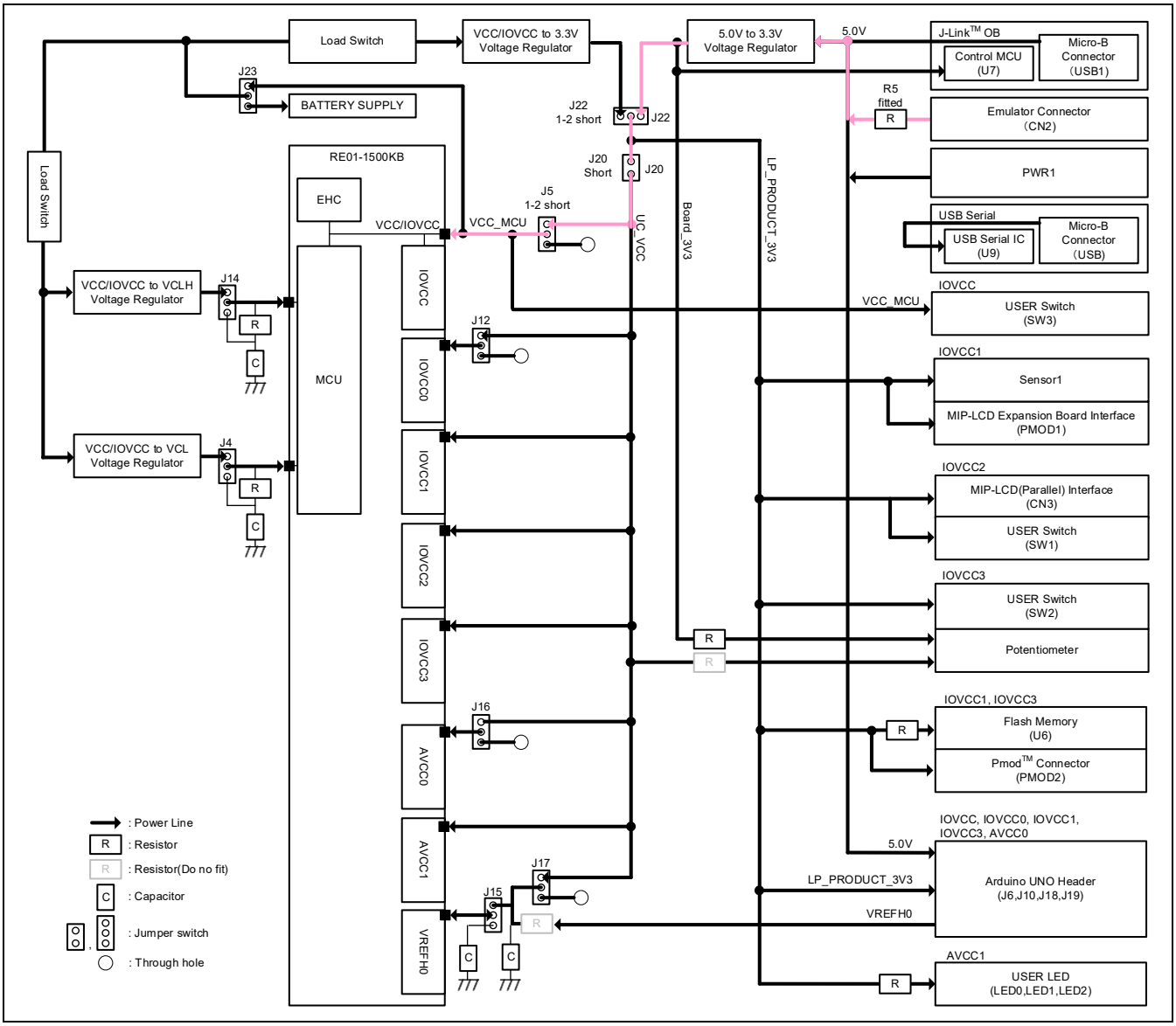


Figure 5-9: Block diagram of Power line (I-jet™, J-Link™)

5.2.2 Debugger Connection

Figure 5-10 shows the connections between the main board, emulator and the host PC. When using the I-jet/J-Link™ emulator, do not use other emulators.

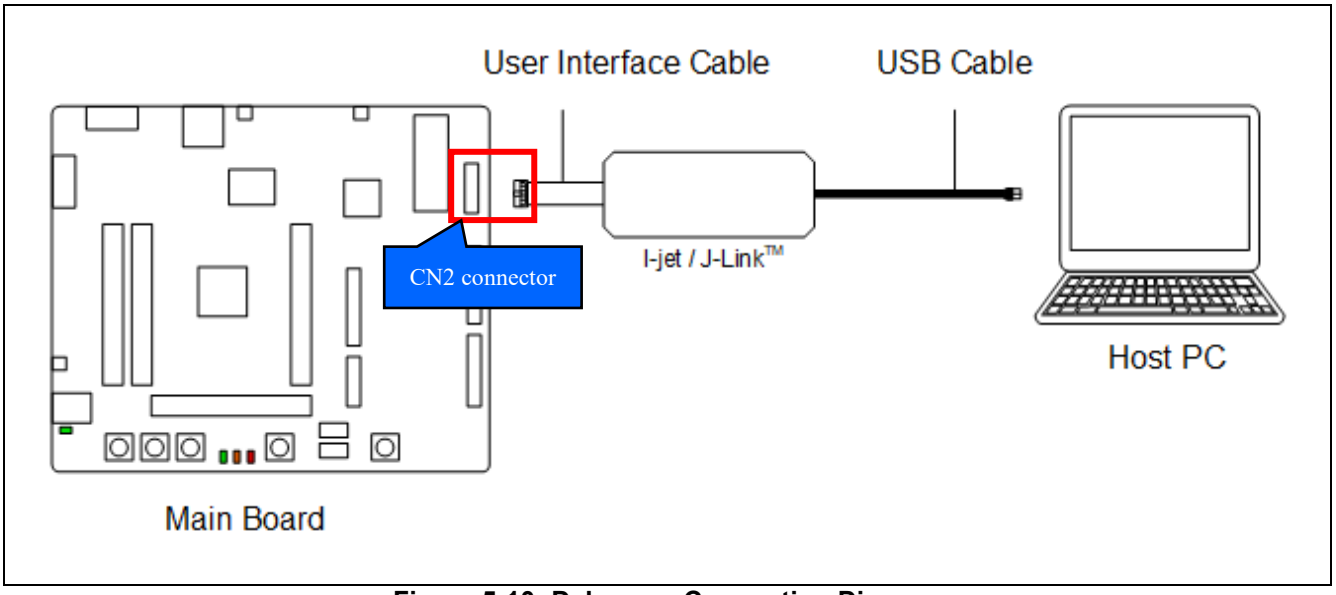


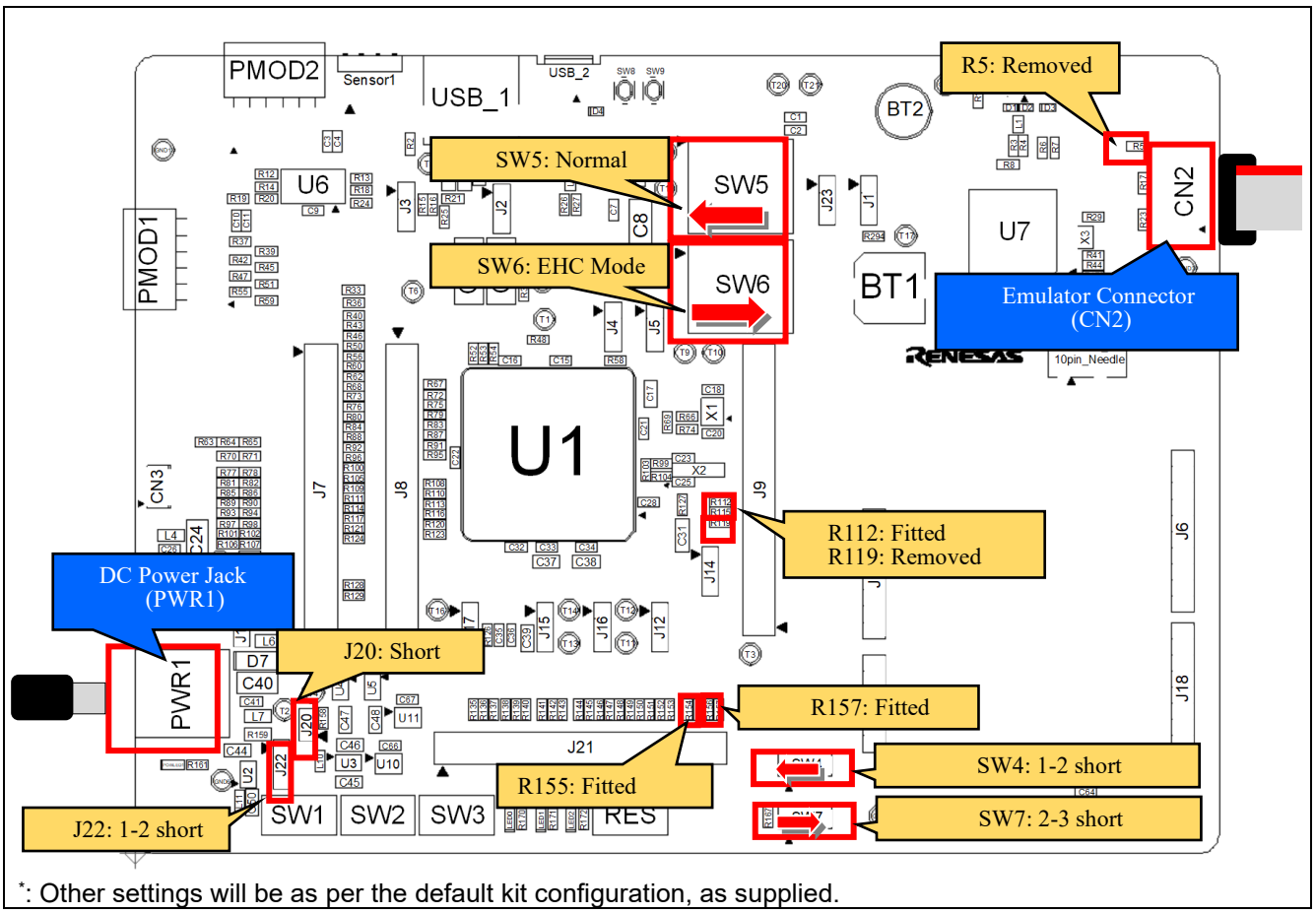
Figure 5-10: Debugger Connection Diagram

5.3 E2 Emulator

The main board can be connected to a Renesas E2 emulator, RE01 debugging is possible by using this emulator.

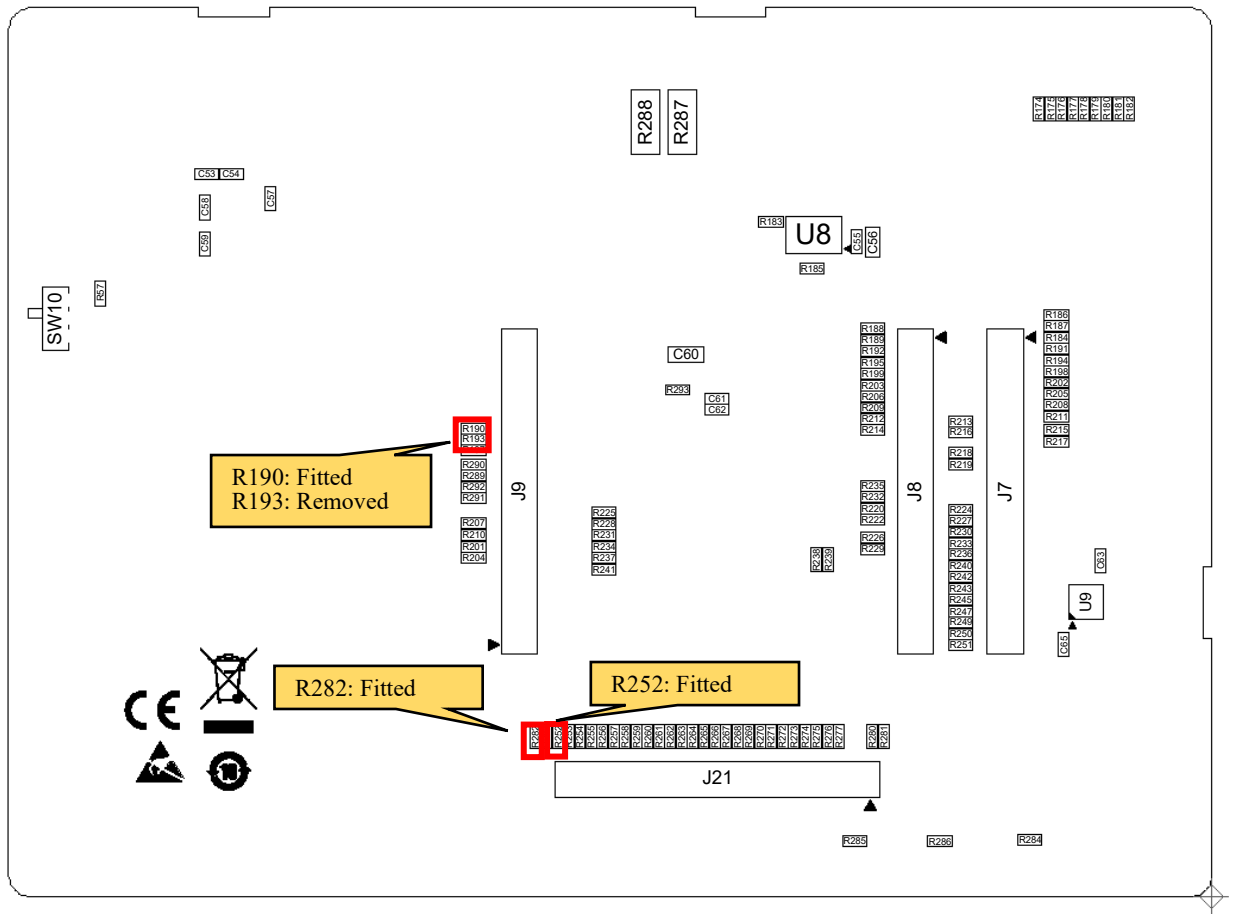
5.3.1 Component Layout and Settings

To use the emulator, several settings to switches and resistors must be made. For details, see the settings in Figure 5-11, Figure 5-12 and Table 5-3. This function is not supported in default configuration, as supplied.
Figure 5-13 and Figure 5-14 show the connection relationship between the power supply and signals in this setting change.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-11: Component Layout



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-12: Component Layout (Bottom)

Table 5-3: Configuration Details

Reference	Position	Settings
SW4	1-2 short *1	Normal Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode (J-Link™ OB not used)
SW7	2-3 short *1	Normal Mode
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Removed *1	
R112, R190,	Fitted *1	
R155, R157, R252, R282	Fitted *1	
R5	Removed	E2 emulator used

*1: The default kit configuration, as supplied.

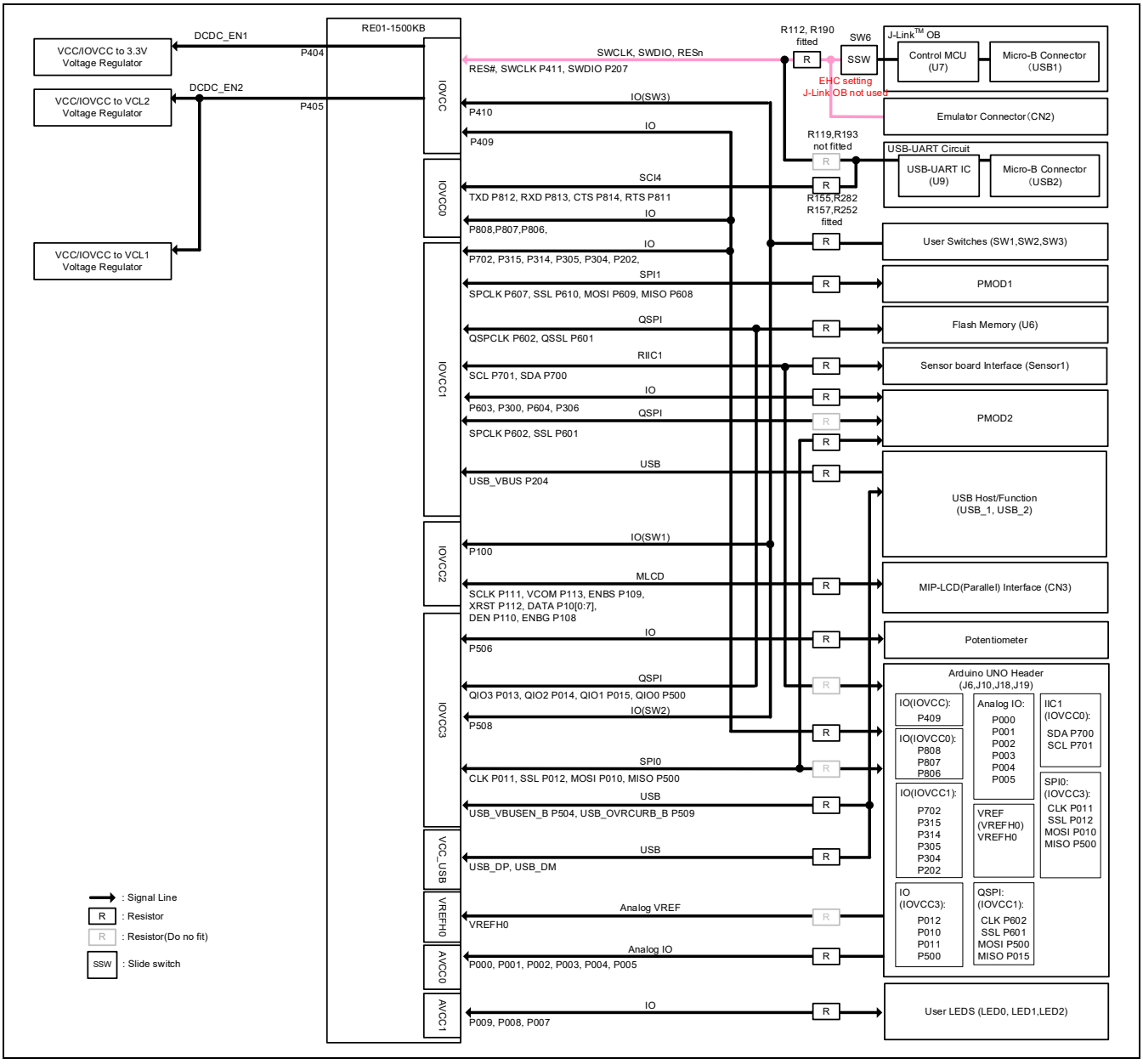


Figure 5-13: Block diagram of Signal line (E2)

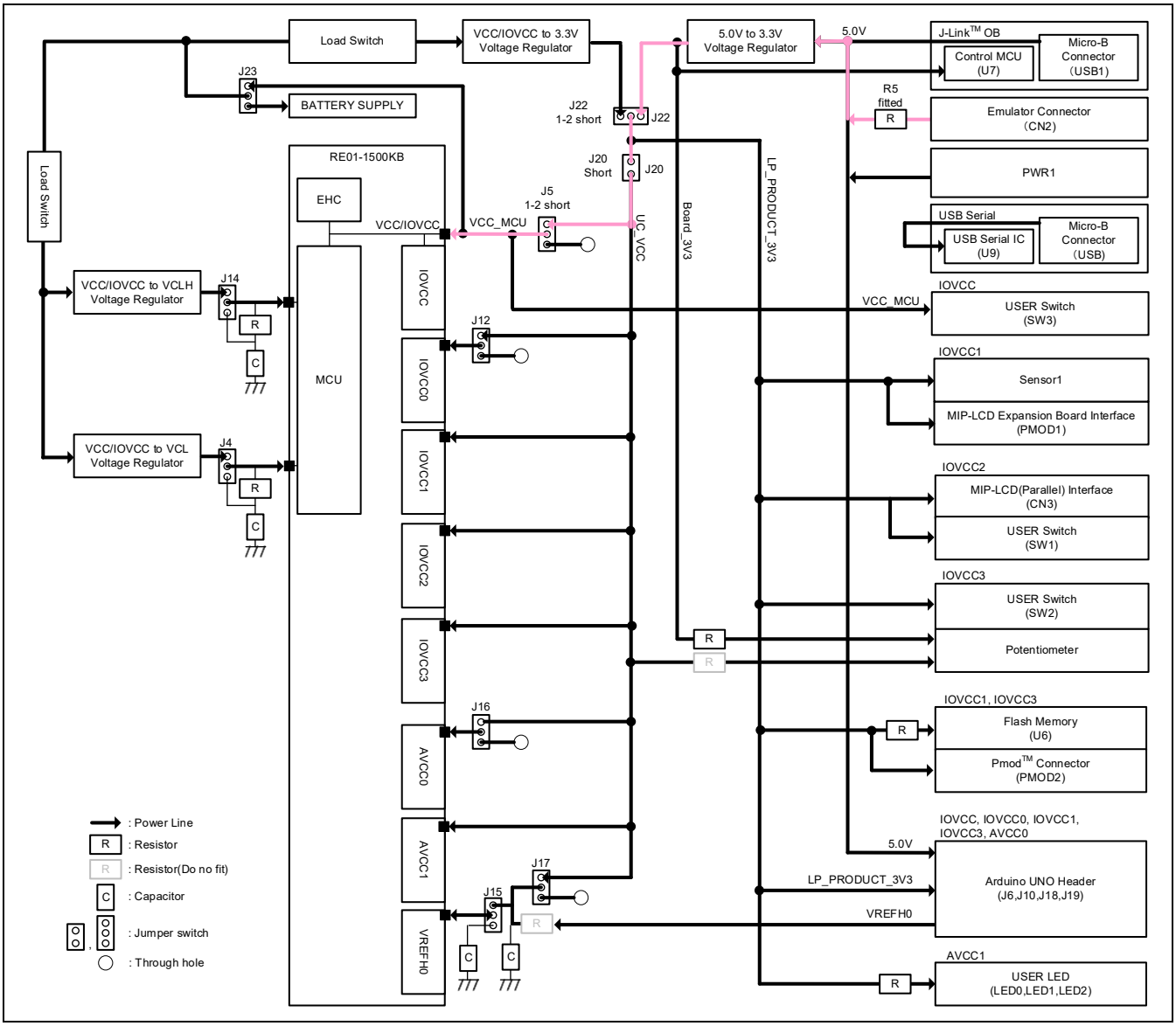


Figure 5-14: Block diagram of Power line (E2)

5.3.2 Debugger Connection

Figure 5-15 shows the connection between the main board, emulator and the host PC. When using the E2 emulator, do not use other emulators.

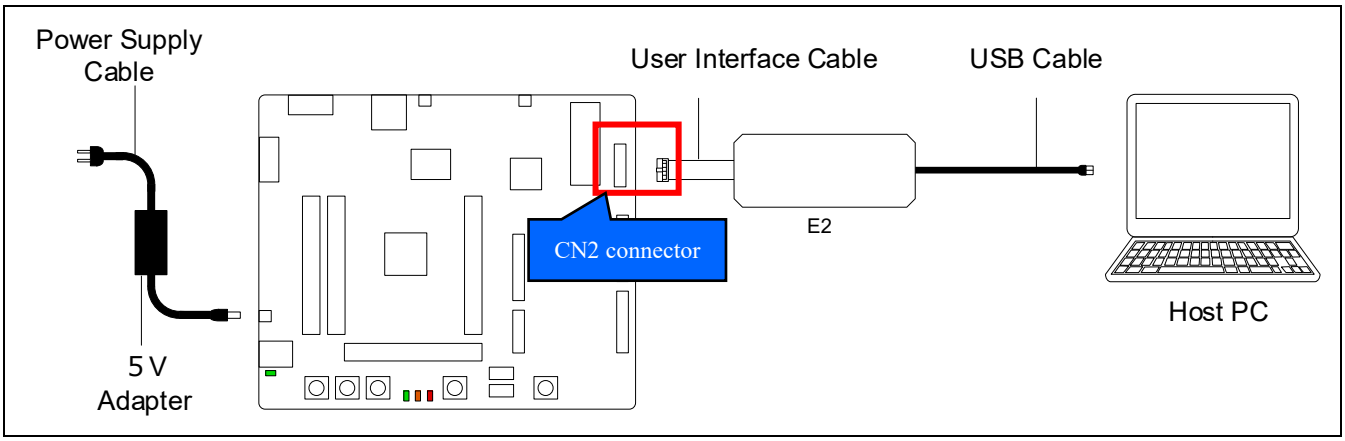


Figure 5-15: Debugger Connection Diagram

5.4 Flash Programmer -Renesas Flash Programmer-

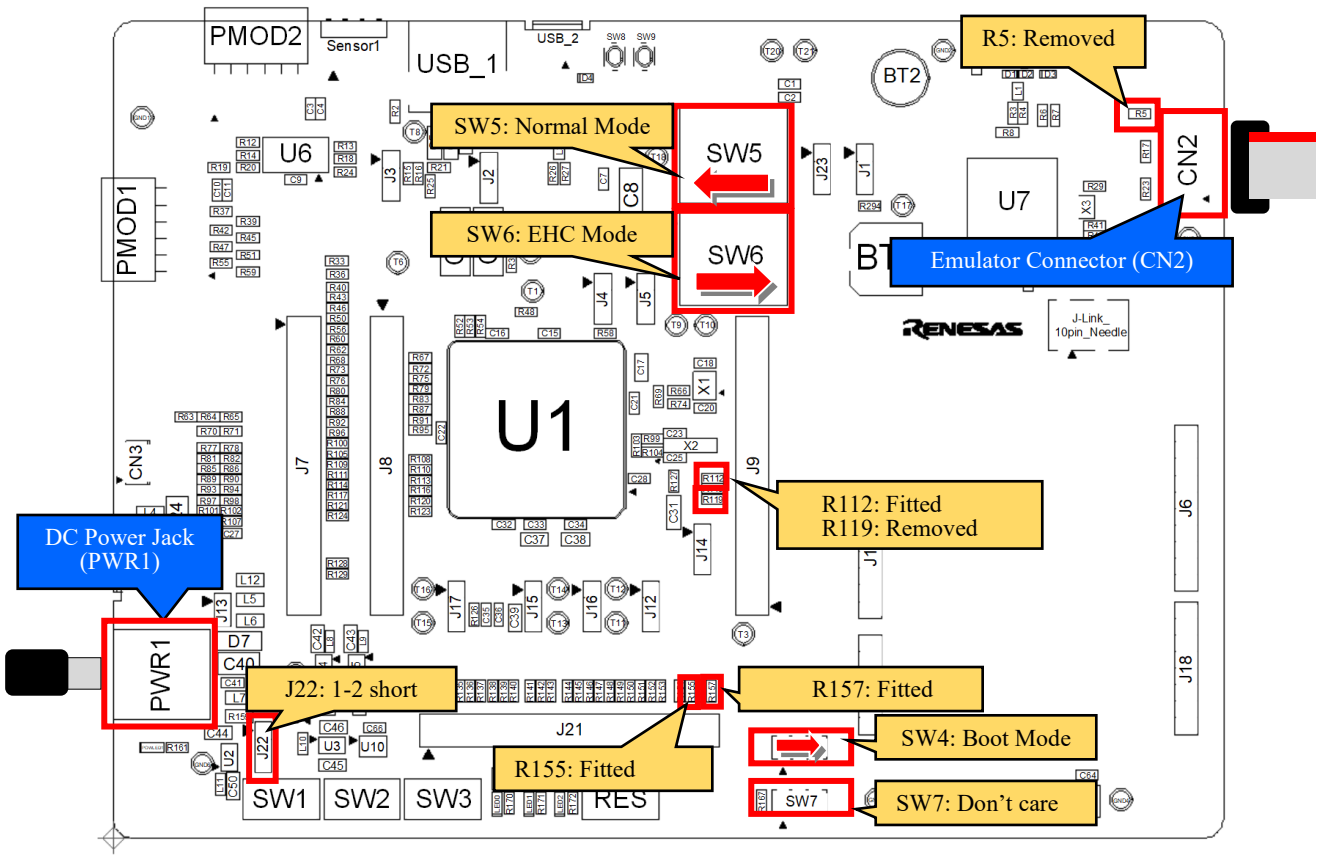
The main board supports Renesas Flash Programmer (RFP) for writing programs to the RE01's built-in flash memory. Writing can be performed using E2 emulator or USB cable.

5.4.1 When using E2 Emulator

A program can be written from the host PC to RE01's built-in flash memory via an E2 emulator.

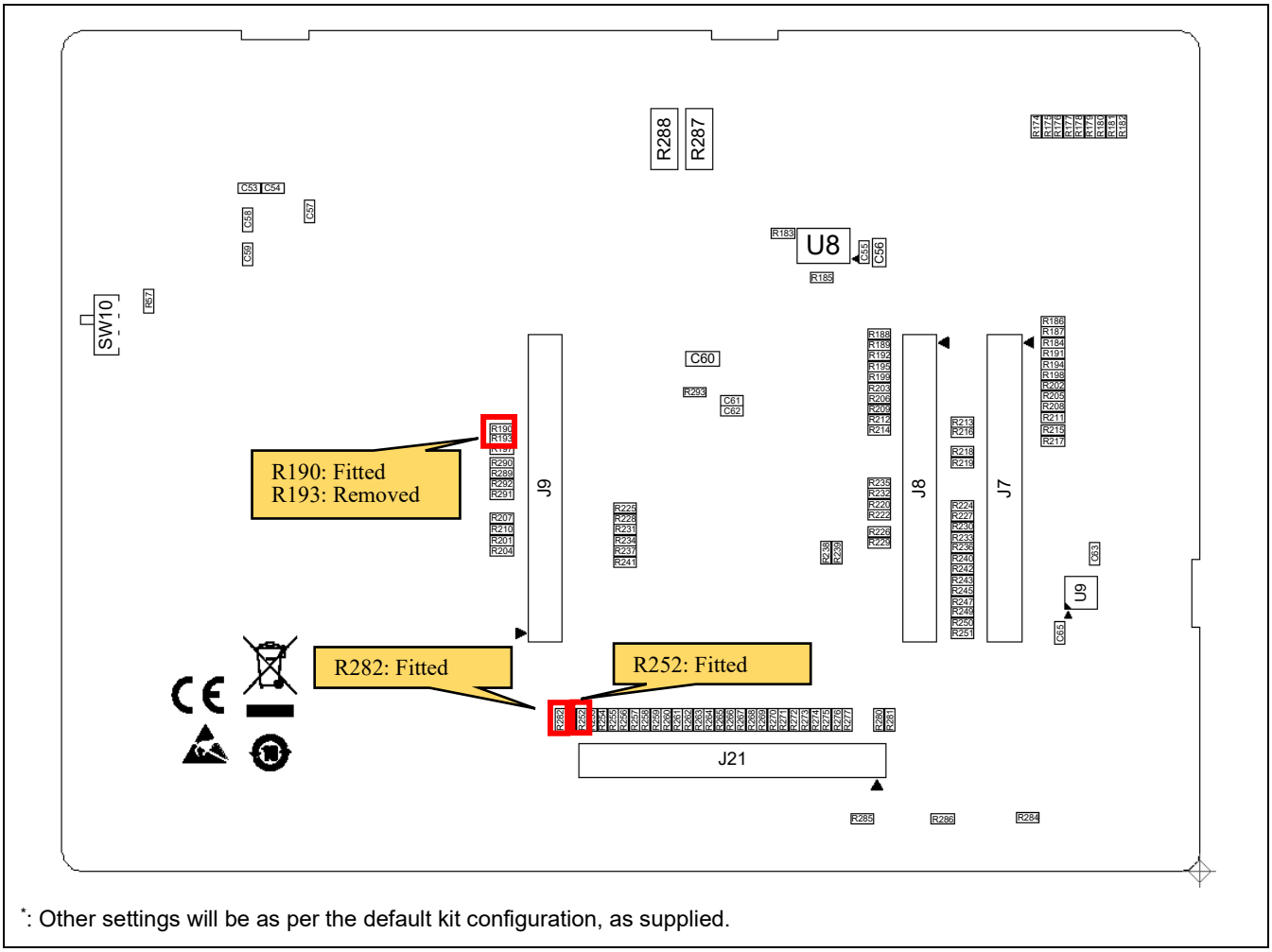
5.4.1.1 Component Layout and Settings

To use RFP, several settings to switches and resistors must be made. For details, see the settings in Figure 5-16, Figure 5-17 and Table 5-4. This function is not supported in default configuration, as supplied.
Figure 5-18 and Figure 5-19 show the connection relationship between the power supply and signals in this setting change.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-16: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-17: Component Layout (Bottom)

Table 5-4: Configuration Details

Reference	Position	Settings
SW4	2-3 short	SCI/USB Boot Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode (J-Link™ OB not used)
SW7	Don't care	SCI/USB Boot Mode
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Removed *1	Not use USB-Serial for SCI boot
R112, R190,	Fit *1	
R155, R157, R252, R282	Fit *1	
R5	Removed	E2 emulator used

*1: The default kit configuration, as supplied.

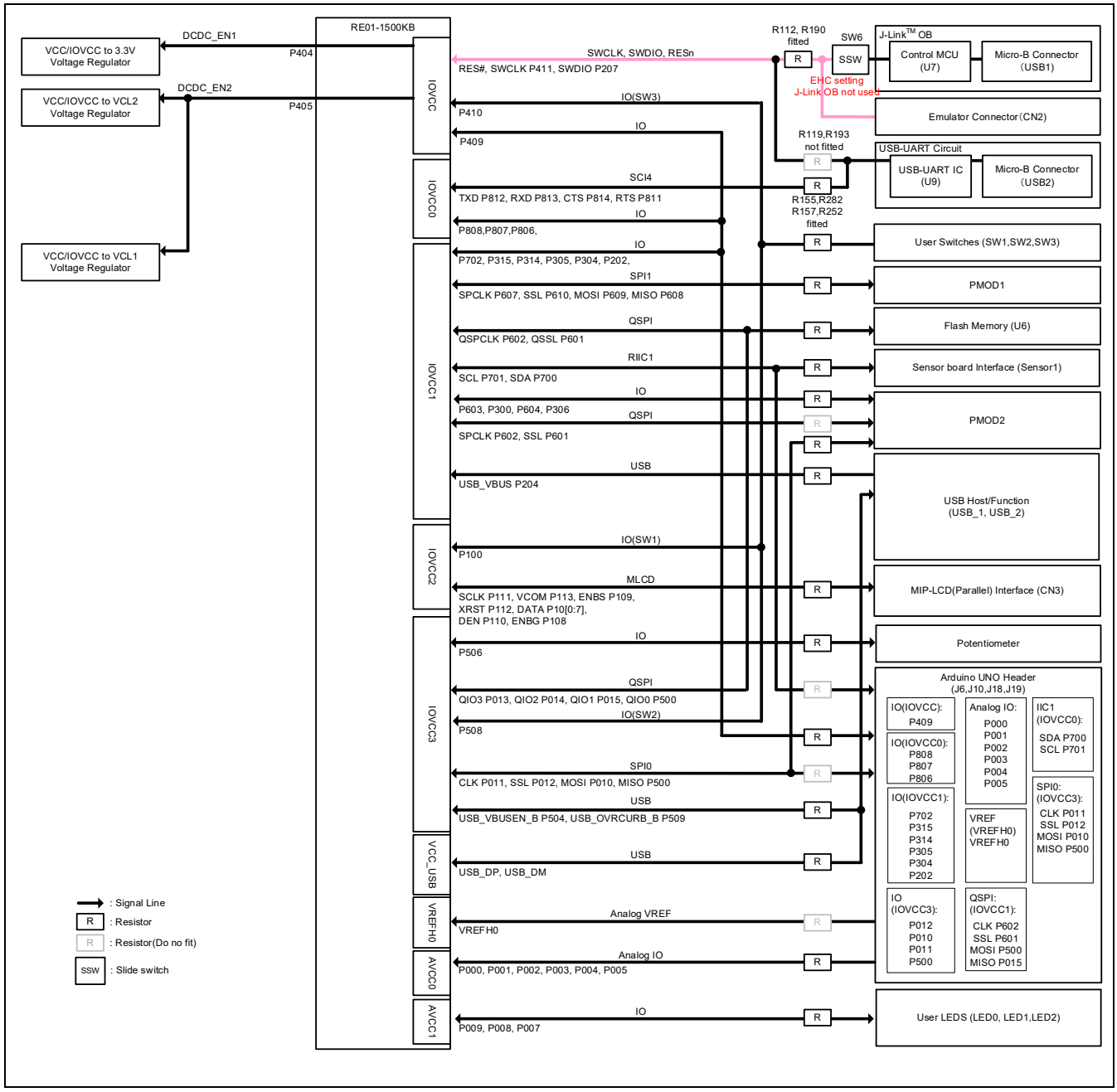


Figure 5-18: Block diagram of Signal line (RFP with E2)

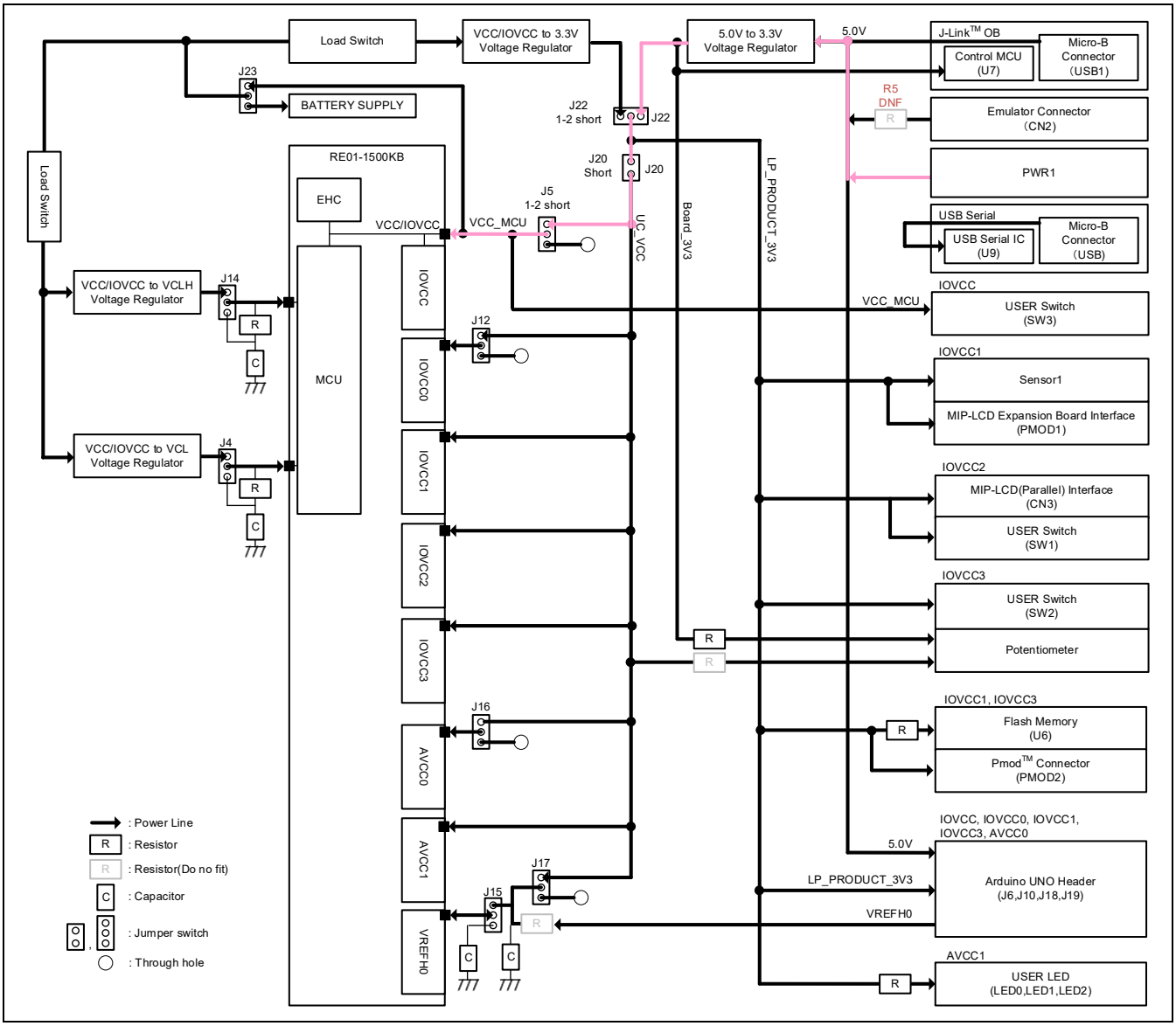


Figure 5-19: Block diagram of Power line (RFP with E2)

5.4.1.2 How To Use

Follow the procedures below.

1. Set the switches and resistors on the main board as shown in Table 5-4.
2. Connect the emulator connector (CN2) to the host PC via E2 emulator.
3. Connect the DC Power Jack (5VDC) to an AC adapter.
4. Start RFP on host PC.
5. On RFP, select File -> Create New Project. Insert new project name.
6. Click the “Connect” button on the RFP.
7. When the connection is established, “Operation Completed” will be displayed on the RFP.
8. Select the program to write.
9. Click the “Start” on the RFP.
10. After writing is completed, “Operation Completed” will be displayed on the RFP.

5.4.1.3 Debugger Connection

Figure 5-20 shows the connections between main board, emulator and host PC. When using an E2 emulator for flash programmer, do not use other emulators.

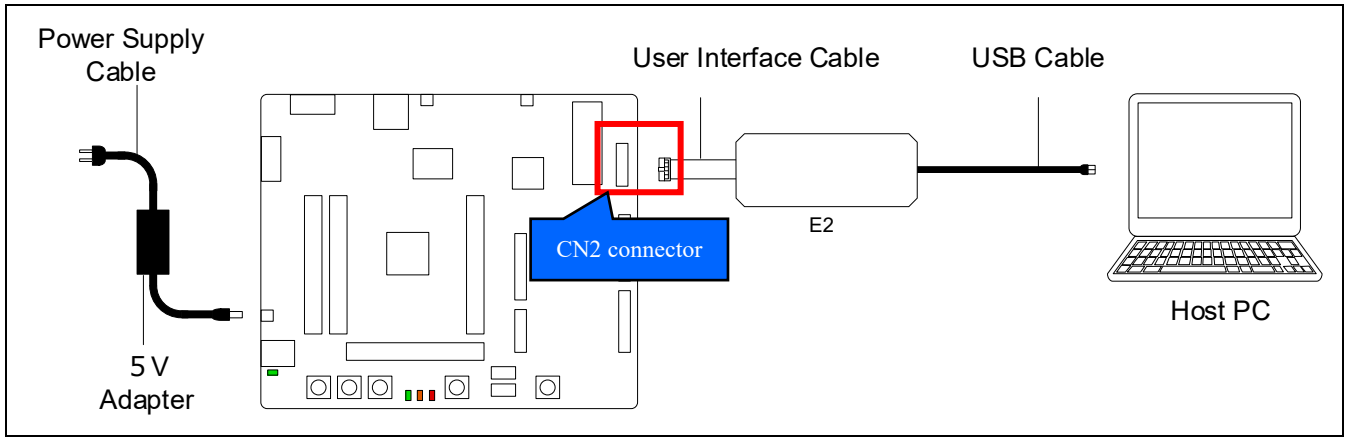


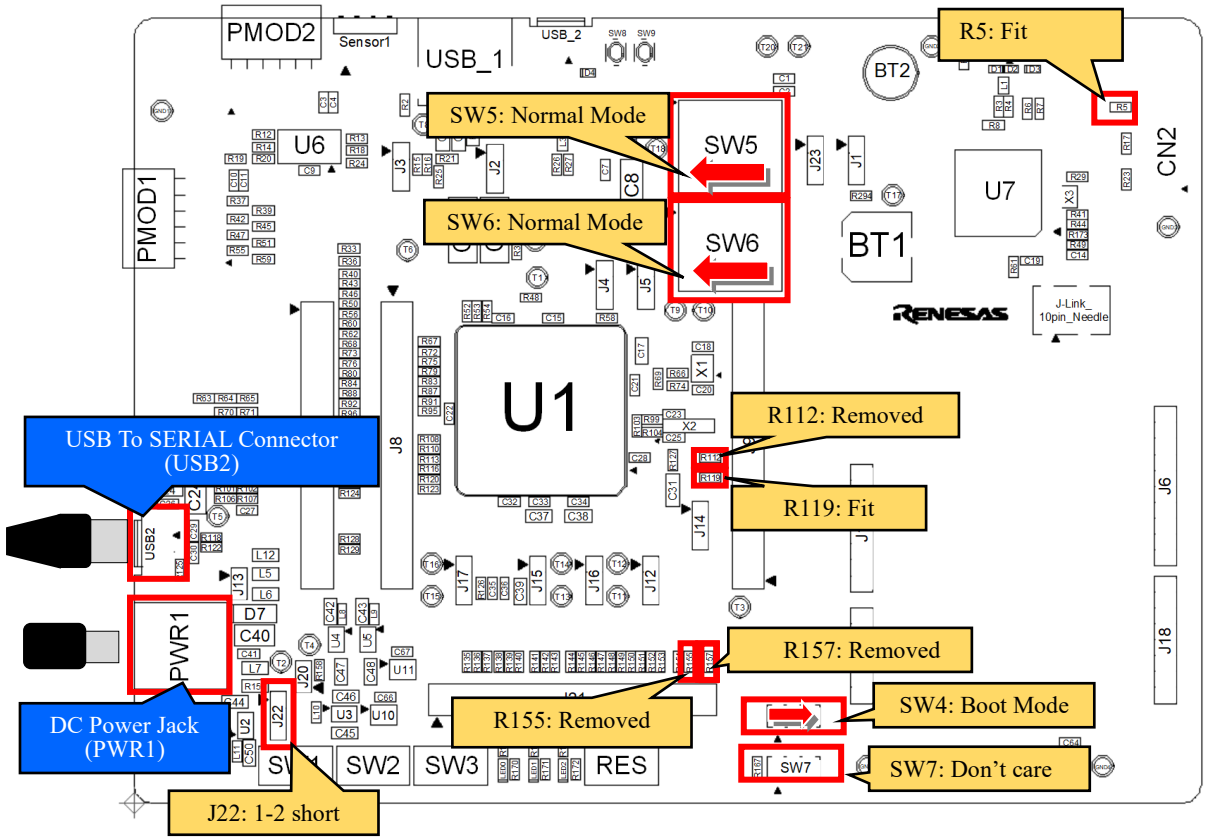
Figure 5-20: Debugger Connection Diagram

5.4.2 When using the USB Cable (SCI boot)

A program can be written from the host PC to RE01's built-in flash memory using a USB cable.

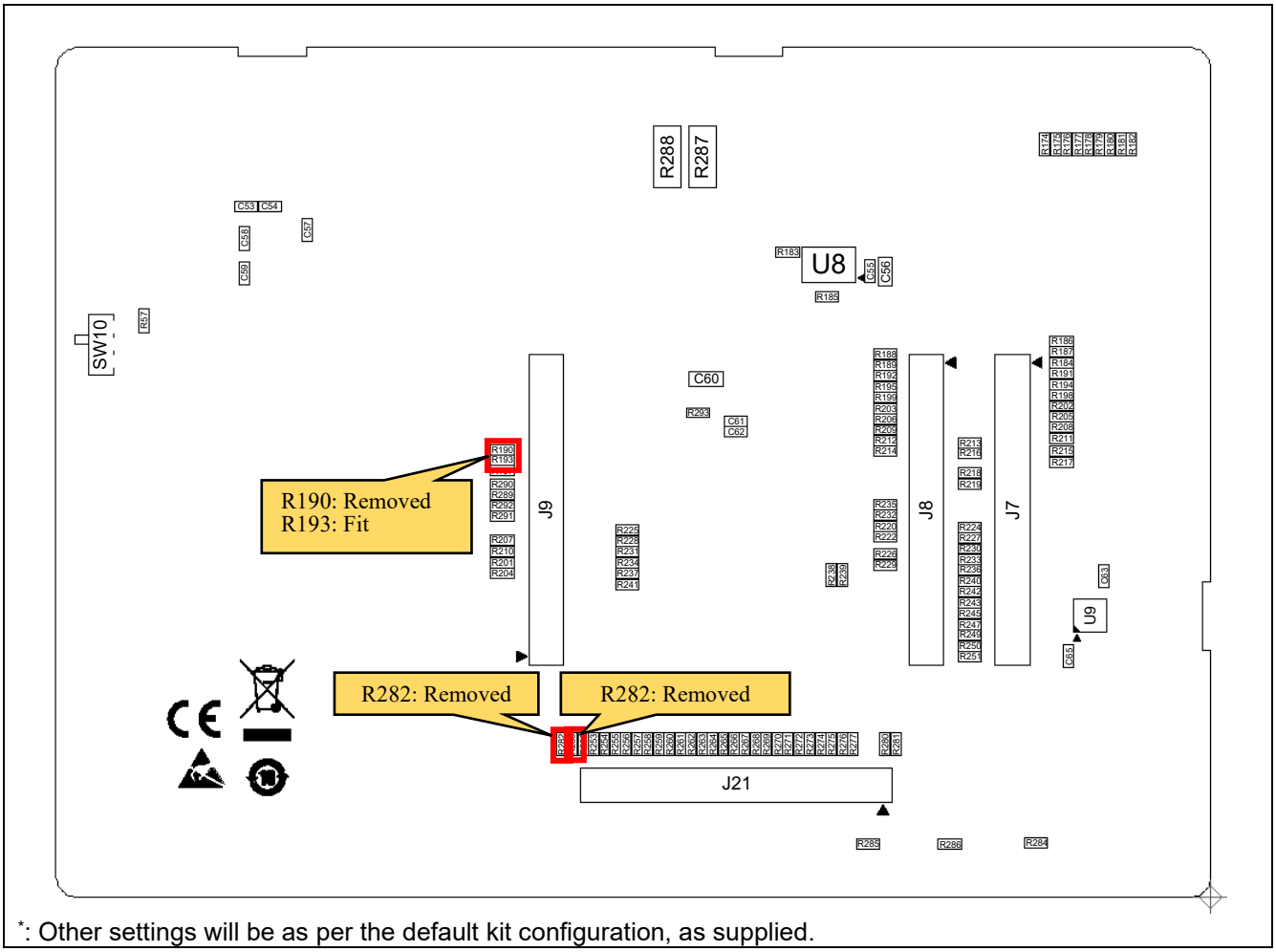
5.4.2.1 Component Layout and Settings

Figure 5-21 and Figure 5-22 shows the component layout. To use RFP, several settings to switches and resistors must be made. This function is not supported in the default configuration, as supplied.
For details, see the settings in Figure 5-23, Figure 5-24 and Table 5-5.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-21: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 5-22: Component Layout (Bottom)

Table 5-5: Configuration Details

Reference	Position	Settings
SW4	2-3 short	SCI/USB Boot Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode (J-Link™ OB not used)
SW7	Don't care	EH start-up/Normal start-up Mode
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Removed	USB serial used
R112, R190,	Fit *1	
R155, R157, R252, R282	Removed	
R5	Fit *1	

*1: The default kit configuration, as supplied.

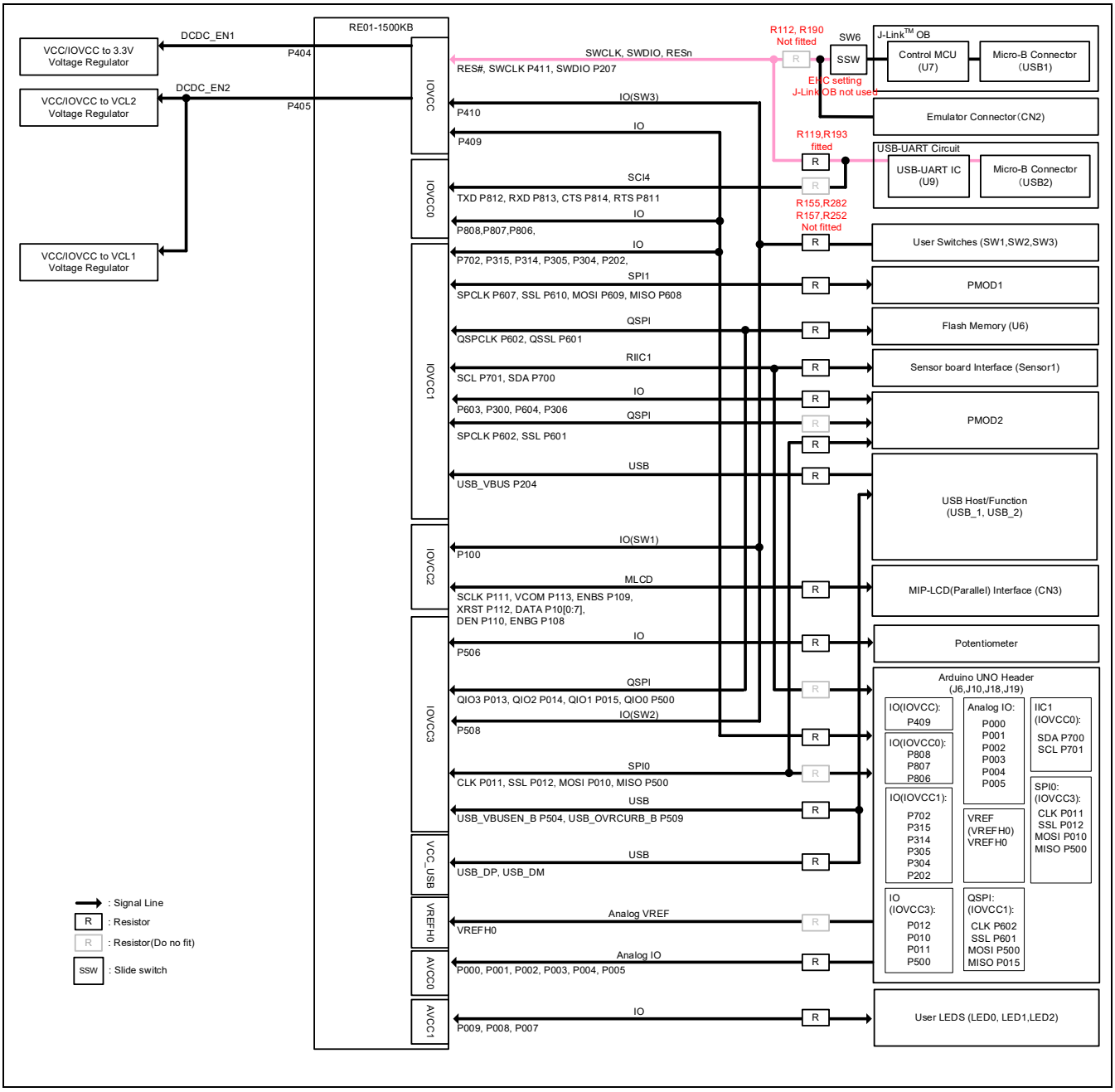


Figure 5-23: Block diagram of Signal line (RFP with USB serial)

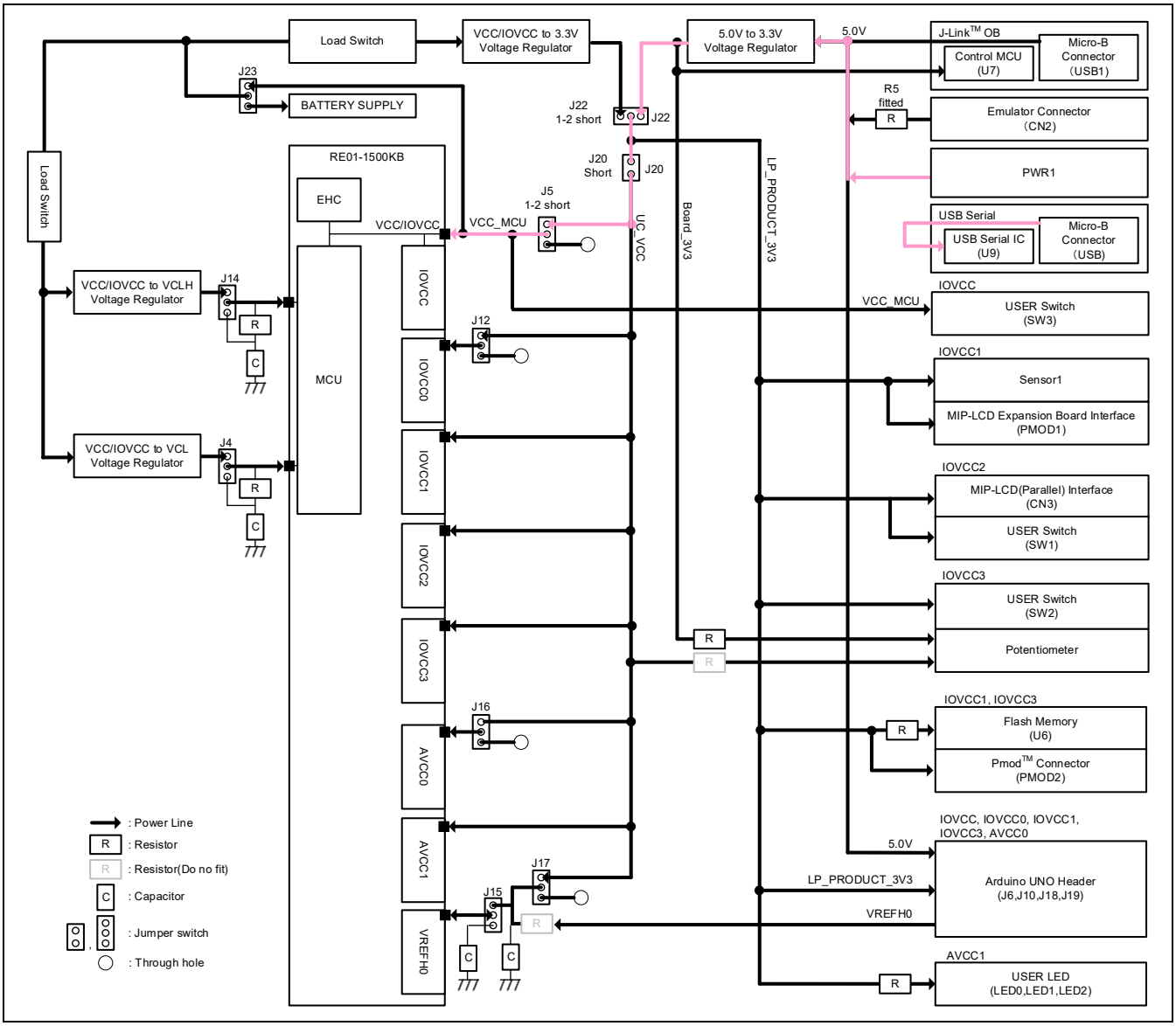


Figure 5-24: Block diagram of Power line (RFP with USB serial)

5.4.2.2 How to Use

Follow the procedures below.

1. Set the switches and resistors on the main board as shown in Table 5-5.
2. Connect the USB serial connector (USB2) to host PC via USB cable.
3. Connect the DC Power Jack (5VDC) to an AC adapter.
4. Start RFP on host PC.
5. On RFP, select File -> Create New Project,
   Insert new project name, and choose “USB Serial Port” in the Tool Details.
6. Press the RES switch on the main board once.
7. Click the “Connect” button on the RFP.
8. When the connection is completed, “Operation Completed” will be displayed on the RFP.
9. Select the program to write.
10. Press the RES switch on the main board once.
11. Click the “Start” on the RFP.
12. After writing is completed, “Operation Completed” will be displayed on the RFP.

5.4.2.3 Debugger Connection

Figure 5-25 shows the connections between main board and host PC. When using a USB cable for flash programmer, do not use emulators.

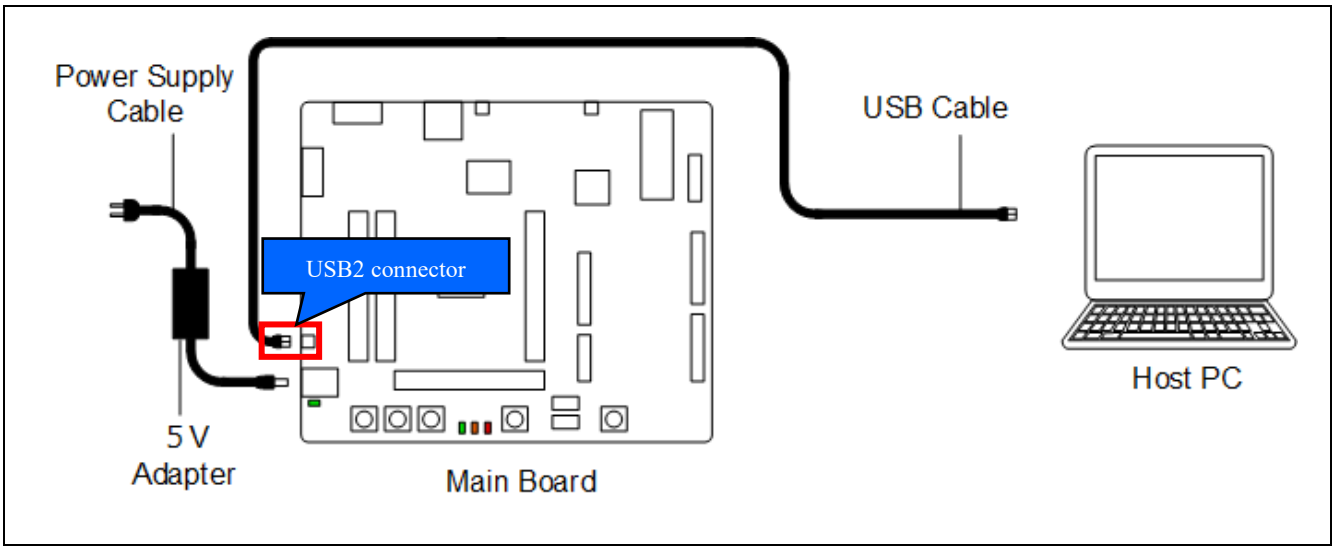


Figure 5-25: Debugger Connection Diagram

5.4.3 When using the USB Cable (USB boot)

A program can be written from the host PC to RE01's built-in flash memory using a USB cable.

5.4.3.1 Component Layout and Settings

Figure 5-26 and Figure 5-27 shows the component layout. To use RFP, several settings to switches and resistors must be made. This function is not supported in the default configuration, as supplied.
For details, see the settings in Figure 5-28, Figure 5-29 and Table 5-6.

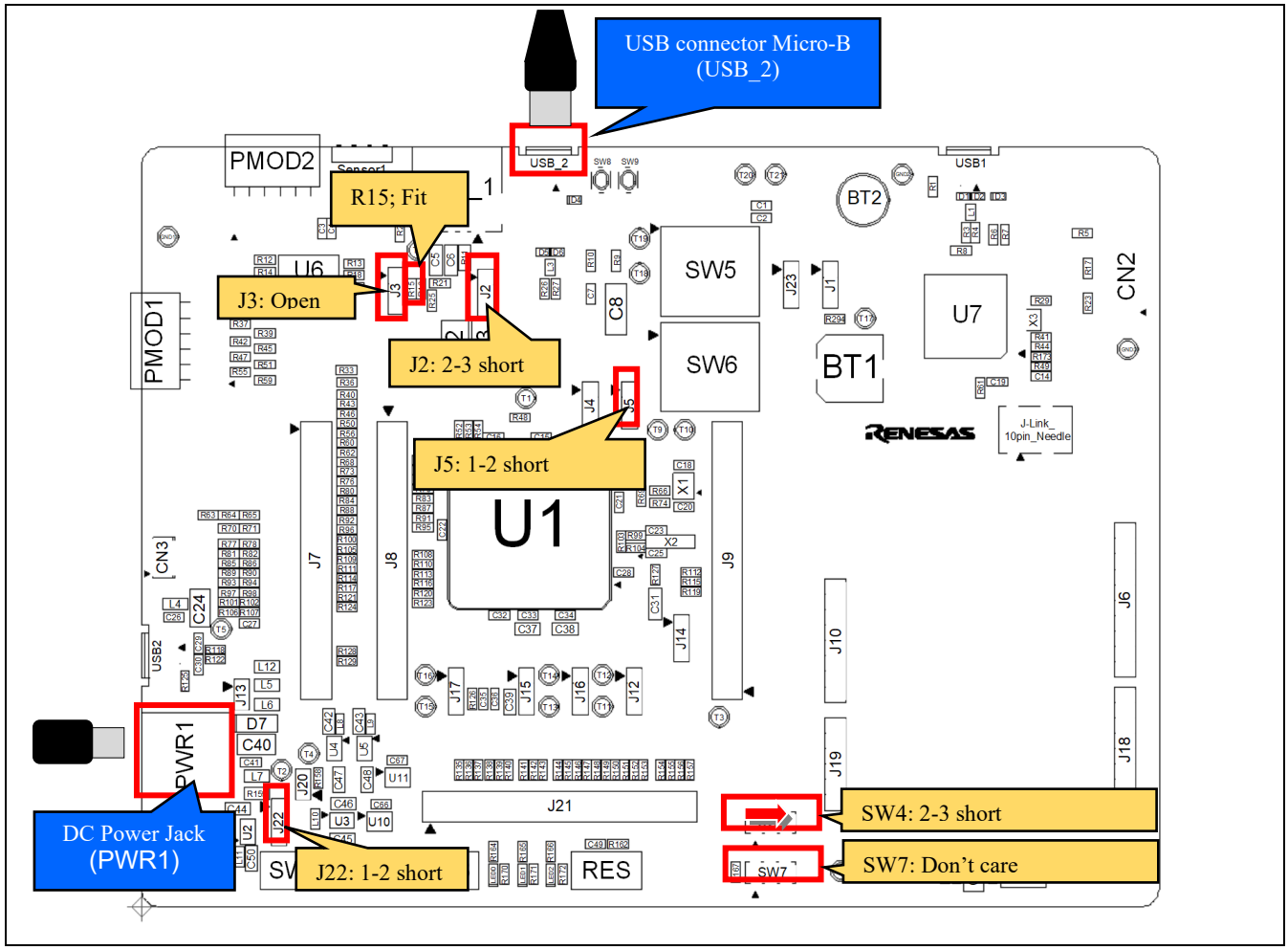


Figure 5-26: Component Layout (Top)

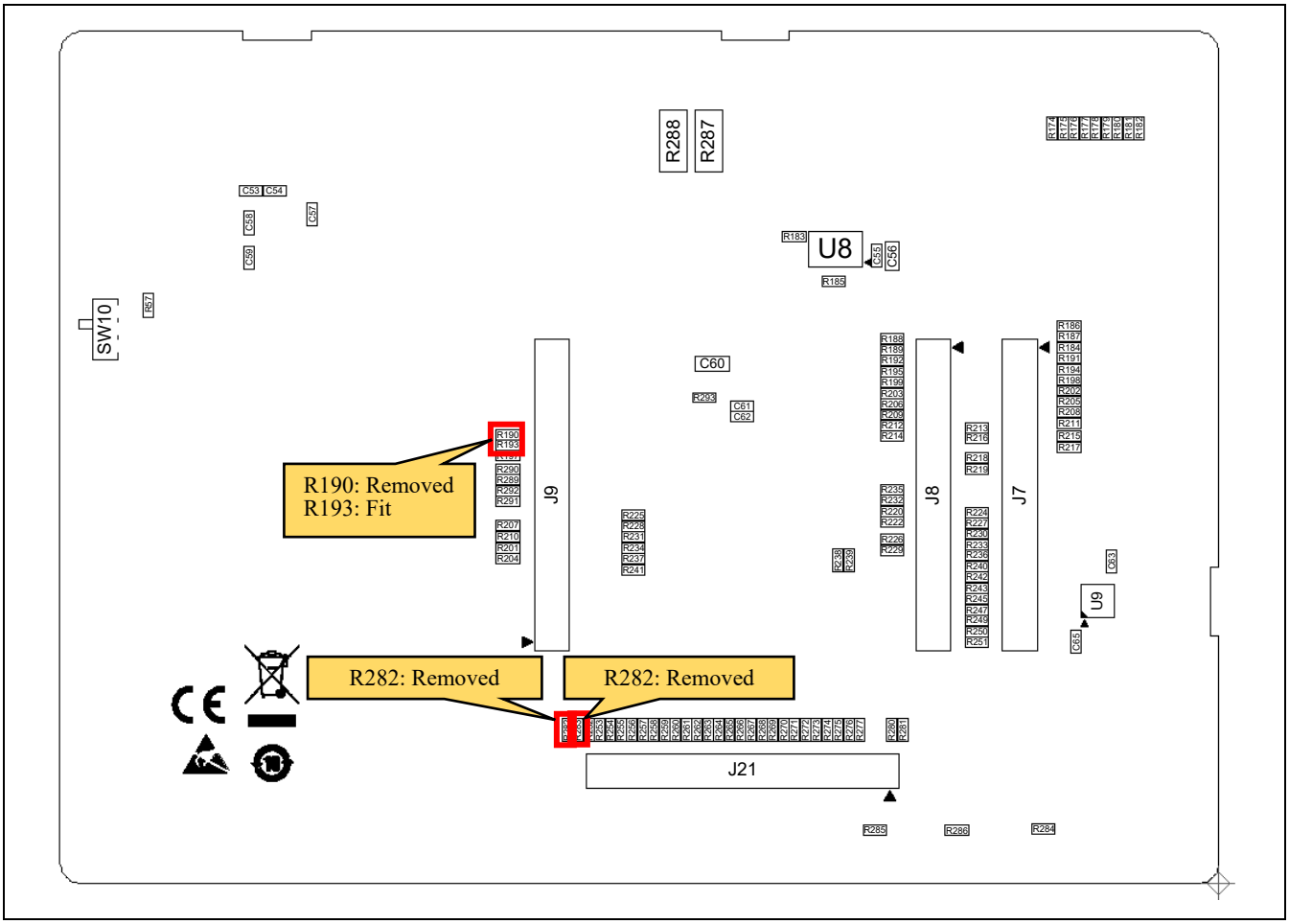


Figure 5-27: Component Layout (Bottom)

Table 5-6: Configuration Details

Reference	Position	Settings
SW4	2-3 short	SCI/USB Boot Mode
SW5	1-2, 4-5, 7-8 short *1	Normal Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode (J-Link™ OB not used)
SW7	Don't care	SCI/USB Boot Mode
J2	2-3 short	Function Mode
J3	Open*1	Self-powered
J5	1-2 short *1	Normal Mode
J20	Short *1	Not current measurement
J22	1-2 short *1	Normal Mode
R119, R193	Fit	USB serial used
R112, R190,	Removed	
R155, R157, R252, R282	Removed	
R5	Fit *1	
R15	Fit *1	Self-powered

*1: The default kit configuration, as supplied.

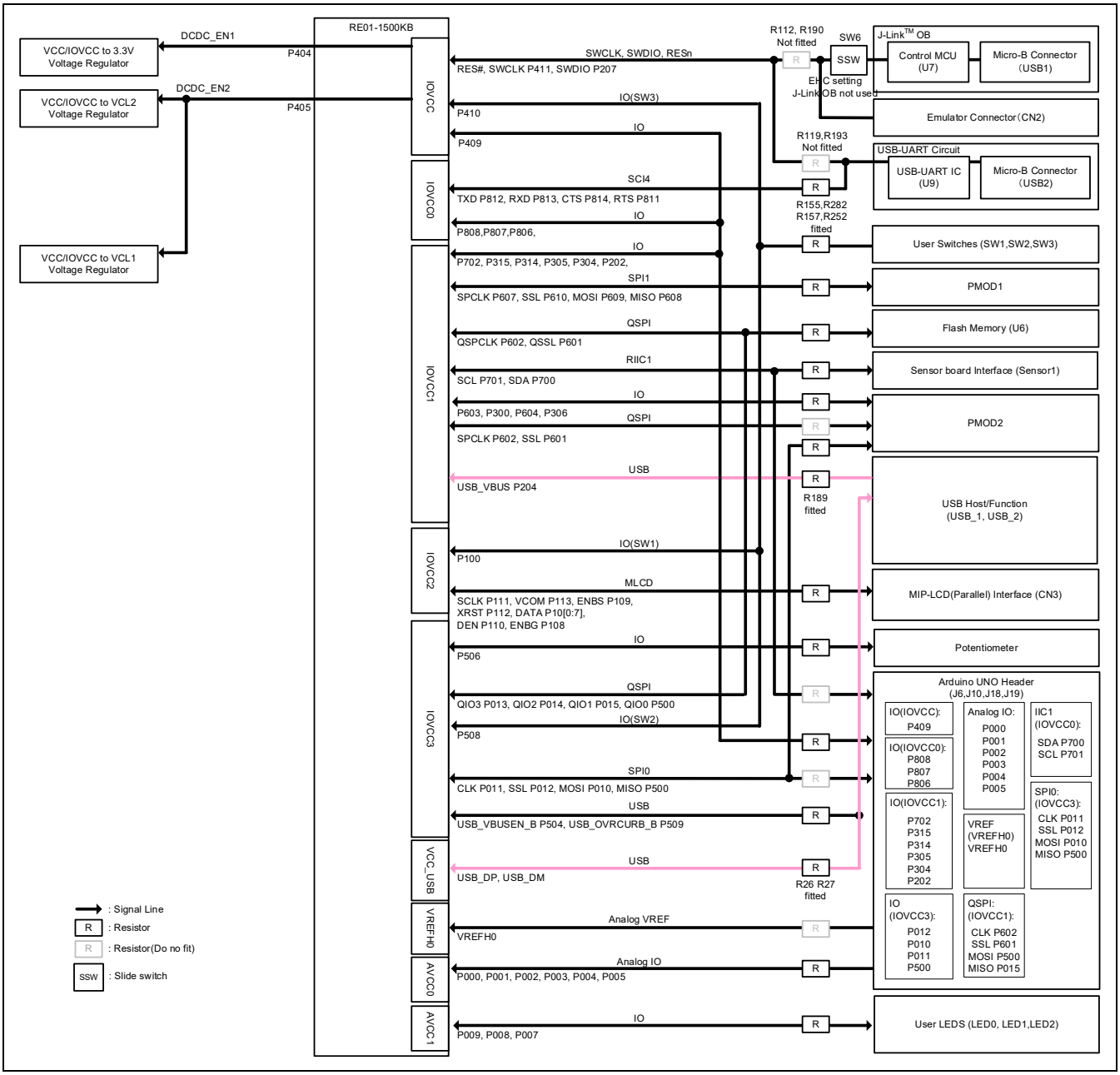


Figure 5-28: Block diagram of Signal line (RFP with USB boot)

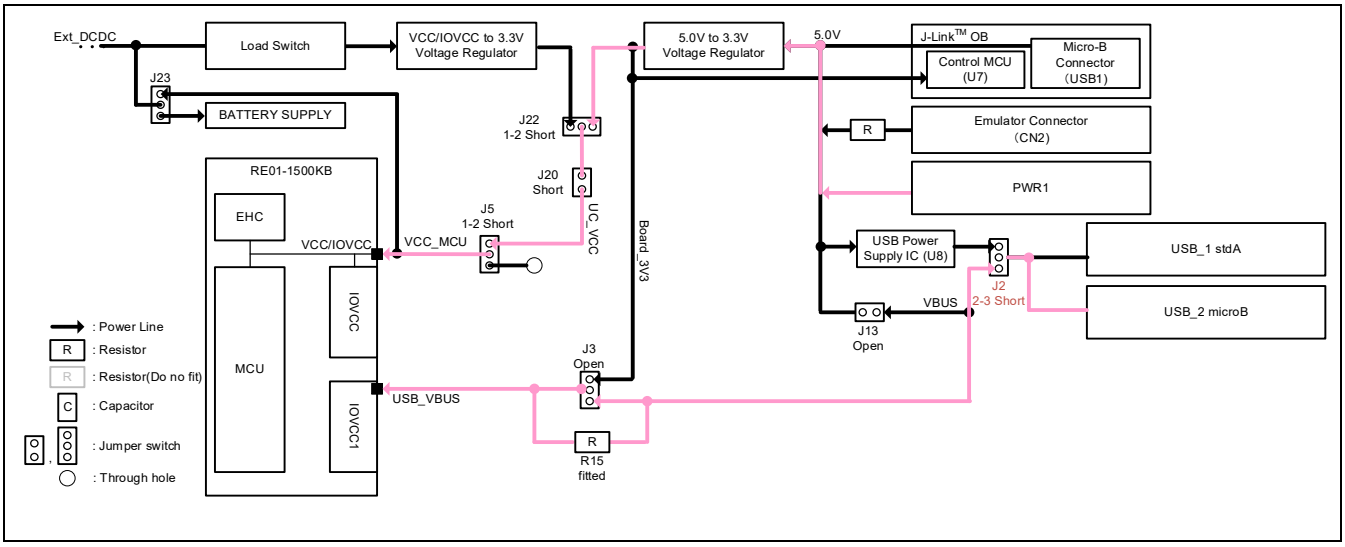


Figure 5-29: Block diagram of Power line (RFP with USB boot)

5.4.3.2 How to Use

Follow the procedures below.

1. Set the switches and resistors on the main board as shown in Table 5-6.
2. Connect the USB connector (USB_2) to host PC via USB cable.
3. Connect the DC Power Jack (5VDC) to an AC adapter.
4. Start RFP on host PC.
5. On RFP, select File -> Create New Project,
   Insert new project name, and choose “RE USB Boot(CDC)” in the Tool Details.
6. Press the RES switch on the main board once.
7. Click the “Connect” button on the RFP.
8. When the connection is completed, “Operation Completed” will be displayed on the RFP.
9. Select the program to write.
10. Press the RES switch on the main board once.
11. Click the “Start” on the RFP.
12. After writing is completed, “Operation Completed” will be displayed on the RFP.

5.4.3.3 Debugger Connection

Figure 5-30 shows the connections between main board and host PC. When using a USB cable for flash programmer, do not use emulators.

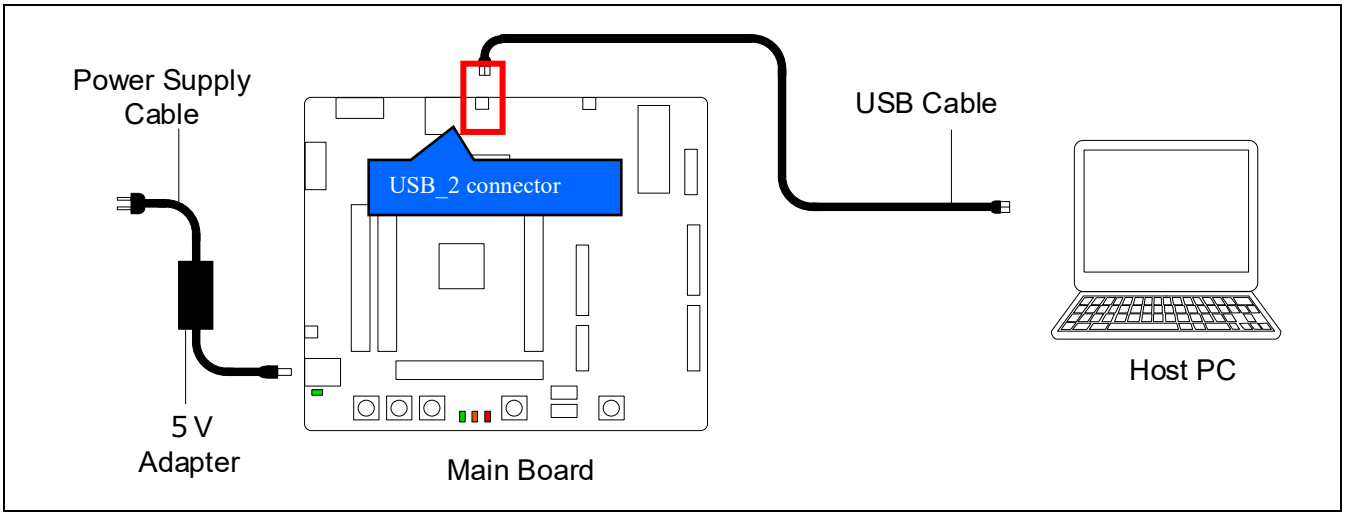


Figure 5-30: Debugger Connection Diagram

5.5 Flash Programmer -SEGGER J-Flash Lite-

This main board supports SEGGER J-Flash Lite for writing programs to RE01's internal flash memory. Writing can be performed by using either the J-LinkTM OB or J-LinkTM emulator.

5.5.1 Connection and Settings

When using J-Link™ OB, please refer to Section 5.1.1.
When use J-Link™ emulator, please refer to Section 5.2.1.

5.5.2 How to use

Follow the procedures below.

1. Set the switches and resistors on the main board according to the previous section.
2. Connect to the host PC with a USB cable. (When using the J-LinkTM emulator, connect via the emulator)
3. Start J-Flash Lite on the host PC.
4. Select the Device you are using on the J-Flash Lite.
5. Make sure that Interface is selected as SWD, and press the "OK" button.
6. Select the file you want to write from the Data File.
7. Press the "Program Device" button.
8. When the writing is completed, "Downloading.... Done" will be displayed at the end of the log.

5.6 Emulator connection in EHC mode

This main board cannot be debugged during the EHC operation in the default kit configuration, as supplied. However, with the modifications guided below and by following the instructions, it is possible to connect an emulator and perform debugging during the EHC operation.

Note: Disable the power supply from the emulator.

5.6.1 The modifications to be required

When debugging the RE01 during the EHC operation, two points should be noted as shown in Table 5-7. When debugging an EHC operation program using the main board while maintaining debugger connections, the measures described in Table 5-8 should be taken.

Table 5-7: Points to be Noted when Debugging Energy Harvesting Startup Program

Point to Note	Description
Increased power consumption with debugger connected	With a debugger connected, the power consumption of most microcontrollers increases due to operation of specialized circuits.
Mismatch of communication levels with the debugger	The voltage supplied from a power generation element varies depending on the environment. Depending on the hardware configuration, this voltage variation may cause mismatches in the communication levels of the debugger and target chip.

Table 5-8: Measures to Take when Using Evaluation Kit for Debugging with Emulator Connections Maintained

Problem	Measures Using the main board
Increased power consumption with debugger connected	Either adjust the power generation environment of the power generation element, or use a current source to supply adequate power to VSC_VCC.
Mismatch of communication levels with the debugger	J-Link OB cannot be used. A separate emulator should be prepared and connected to the MIPI20 connector (CN2). In addition, when using EK-RE01 1500KB main board, the following two measures should be taken. 1. Power supply input from the emulator that has been prepared to the board should be disabled. 2. The circuit line to the Vin pin -J22 of I-Jet/E2 connector (CN2) should be cut out, and the Vin pin and VCC/IOVCC connected. (A schematic circuit diagram appears in Figure 5-31; a modified example is shown in Figure 5-32.)

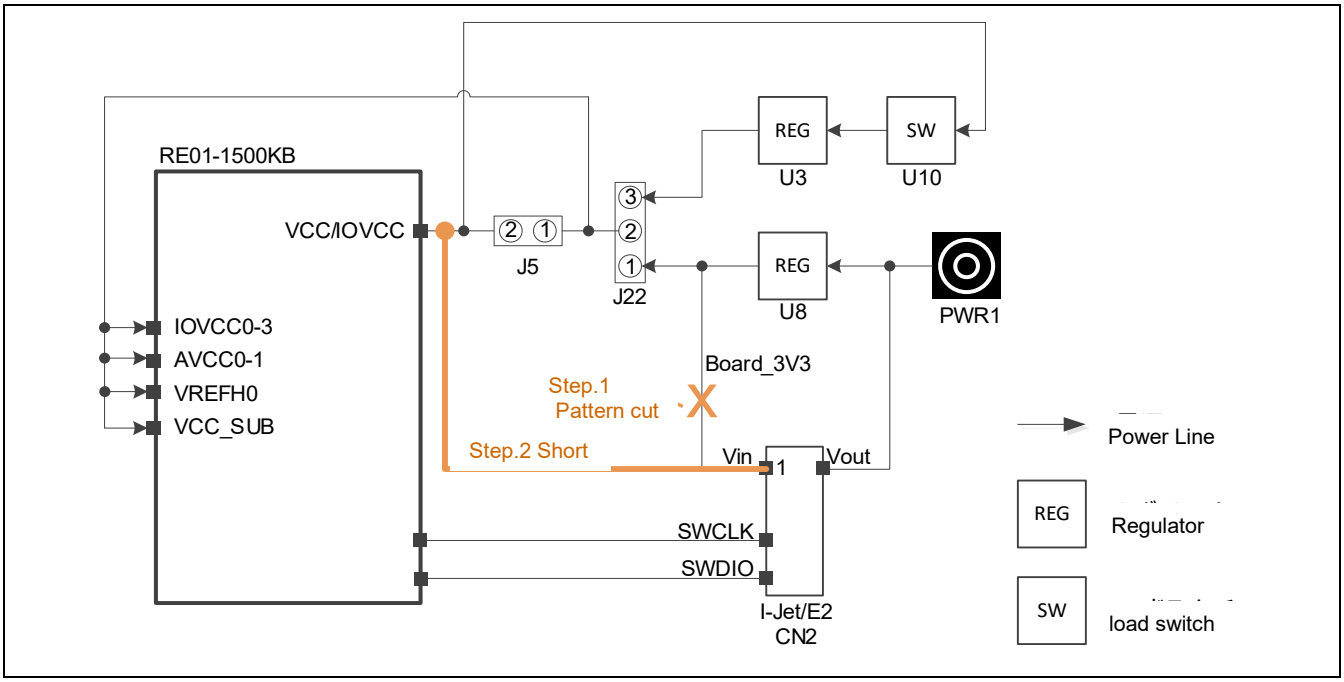


Figure 5-31: Schematic Diagram of Measure to Use with Evaluation Kit to Maintain Emulator Connections during Energy Harvesting Startup

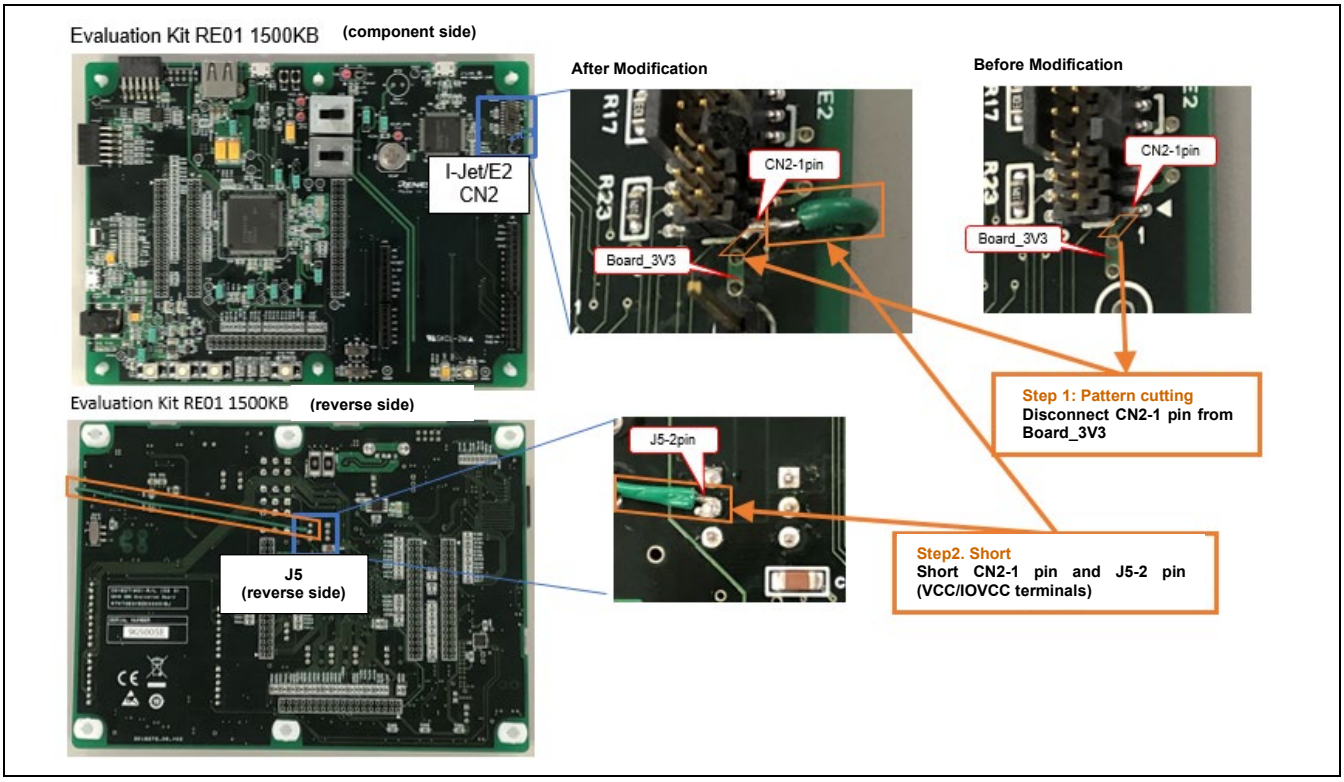


Figure 5-32: Example of Measure Taken with Evaluation Kit to Maintain Debugger Connections during Energy Harvesting Startup

(Photos show items in development, and so the silkscreen printing differs from that of commercial products)

5.6.2 Connection and settings

After setting the board to the EHC operation by referring to Section 6.2 EHC Operation, connect the current source and the emulator as shown in Figure 5-33.

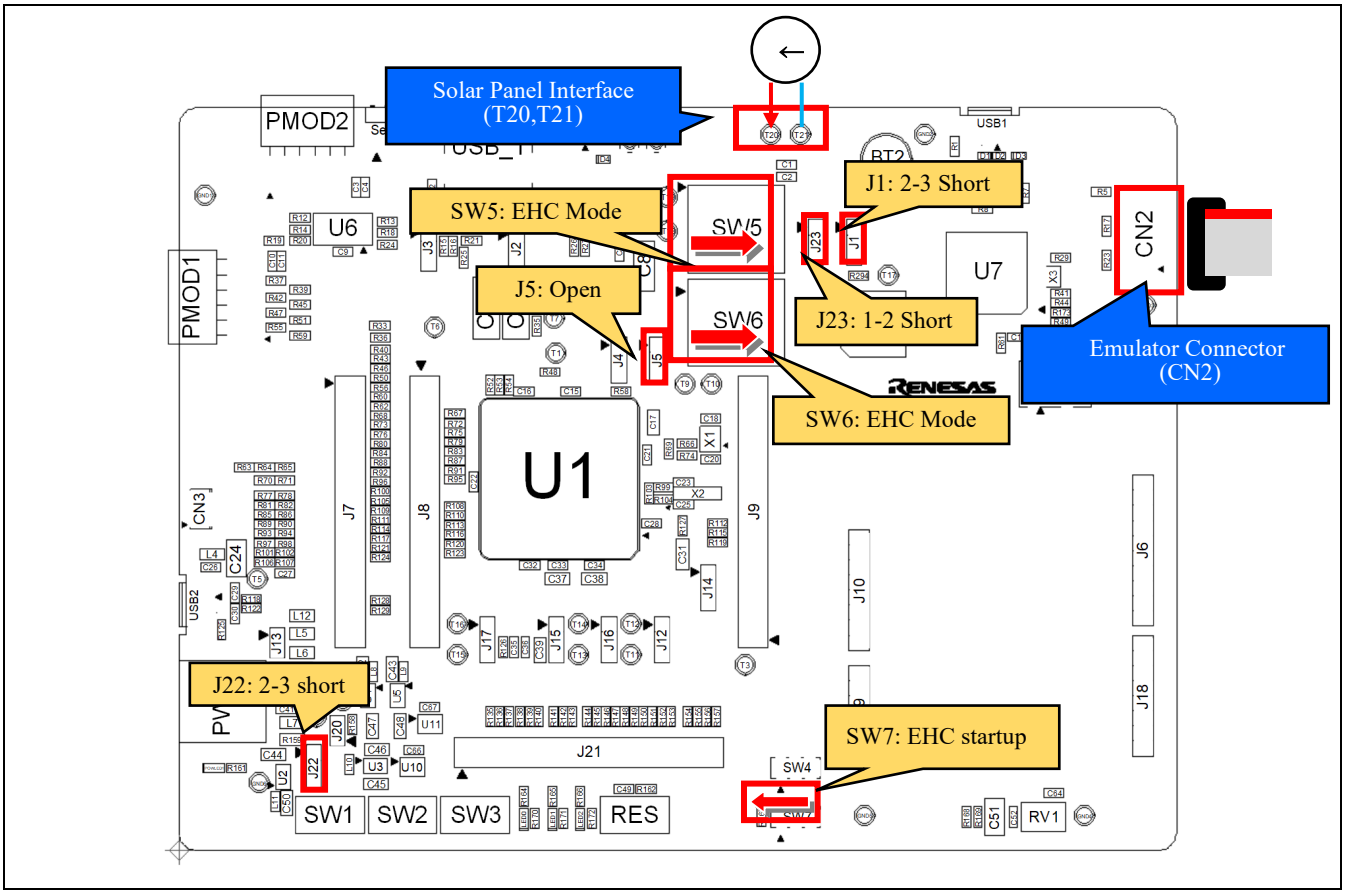


Figure 5-33: Connection and settings for debugging during the EHC operation

5.6.3 Debugging Procedure

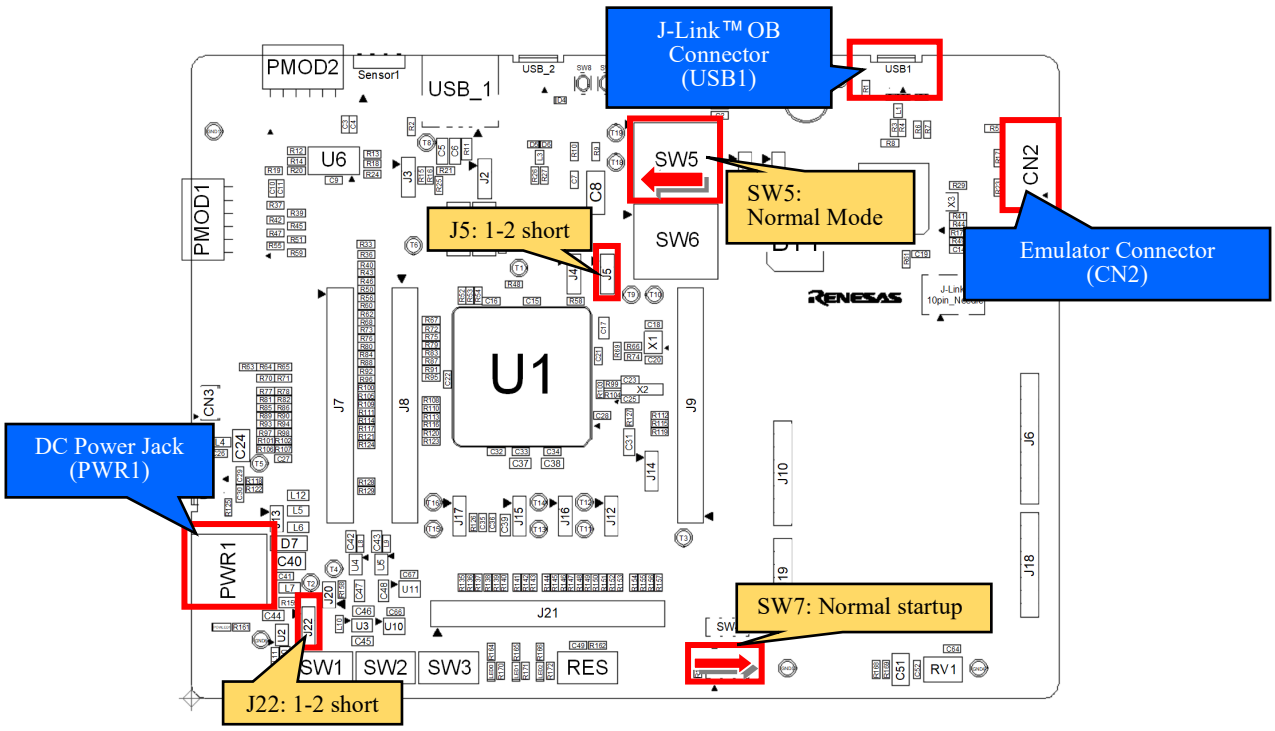
Follow the steps below to debug.

1. Set the current setting of the current source to a few mA (10 mA or less).
2. Input the current from the current source to the main board.
3. Operate the IDE to debug.

6. Operation / Startup mode setting

6.1 Normal Operation

The normal operation of the main board is for power to be supplied from an emulator or external PSU. Figure 6-1 shows the component layout. For normal operation, the settings in Table 6-1 must be made.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 6-1: Component Layout

Table 6-1: Configuration Details

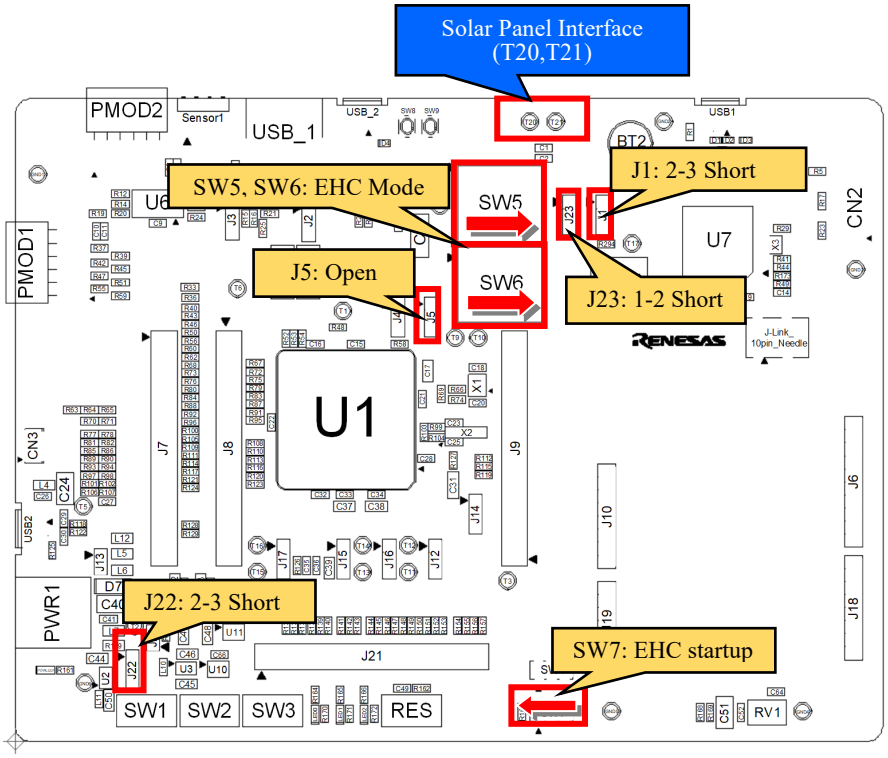
Reference	Position	Settings
J5	1-2 short	Normal Mode
J22	1-2 short	Normal Mode
SW5	1-2, 4-5, 7-8 short	Normal Mode
SW7	Low	Normal startup

6.2 EHC Operation

RE01 incorporates an Energy Harvest Circuit (EHC), which can operate even with the weak power from the power generating element. On this main board, some peripheral circuits can be powered by supplying voltage to VSC_VCC pin of RE01 from the solar panel.
See Table 8-1 for the peripheral circuits that can be used in EHC operation.

6.2.1 Component Layout and Settings

To use EHC operation mode, several settings to switches must be made. For details, see the settings in Figure 6-2 and Table 6-2. Figure 6-3 and Figure 6-4 show the connection relationship between the power supply and signals in this setting change.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 6-2: Component Layout

Table 6-2: Configuration Details

Reference	Position	Settings
J1	1-2 short	External battery used
	2-3 short	Supercapacitor used
J5	Open	EHC Mode
J22	2-3 short	EHC Mode
J23	1-2 short	Voltage Supply from RE01 VCC/IOVCC pin
	2-3 short	External Battery or supercapacitor used
SW5	2-3, 5-6, 8-9 short	EHC Mode
SW6	2-3, 5-6, 8-9 short	EHC Mode
SW7	High	EHC startup

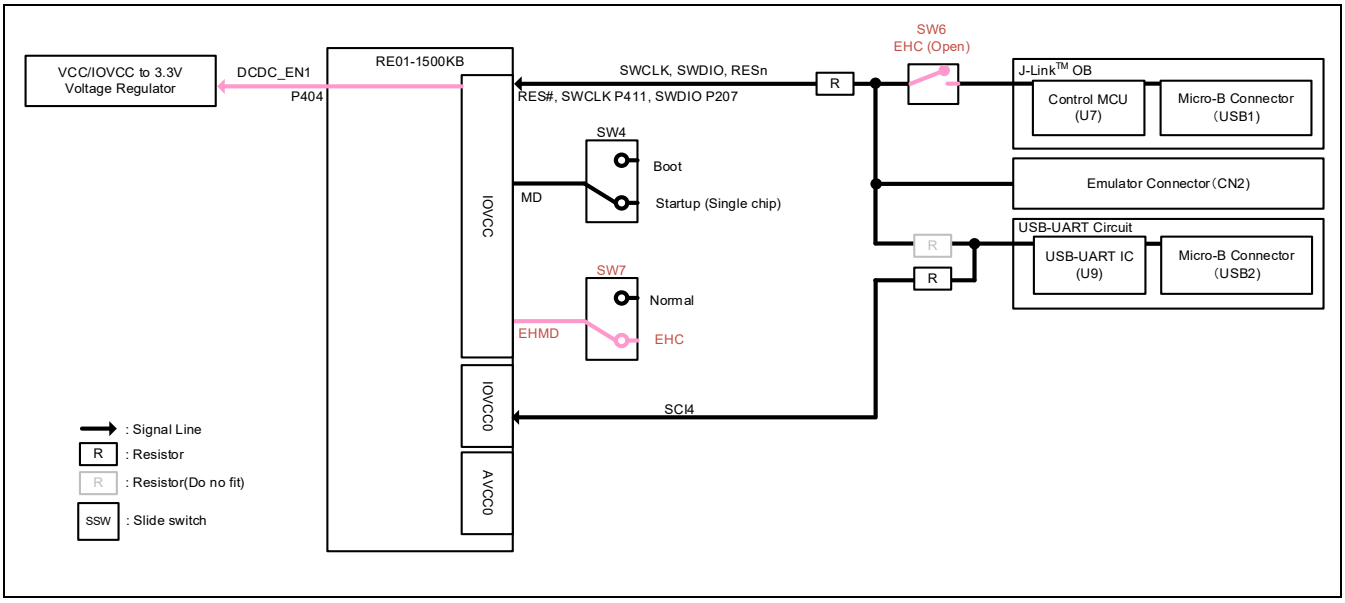


Figure 6-3: Block diagram of Signal line (EHC Operation)

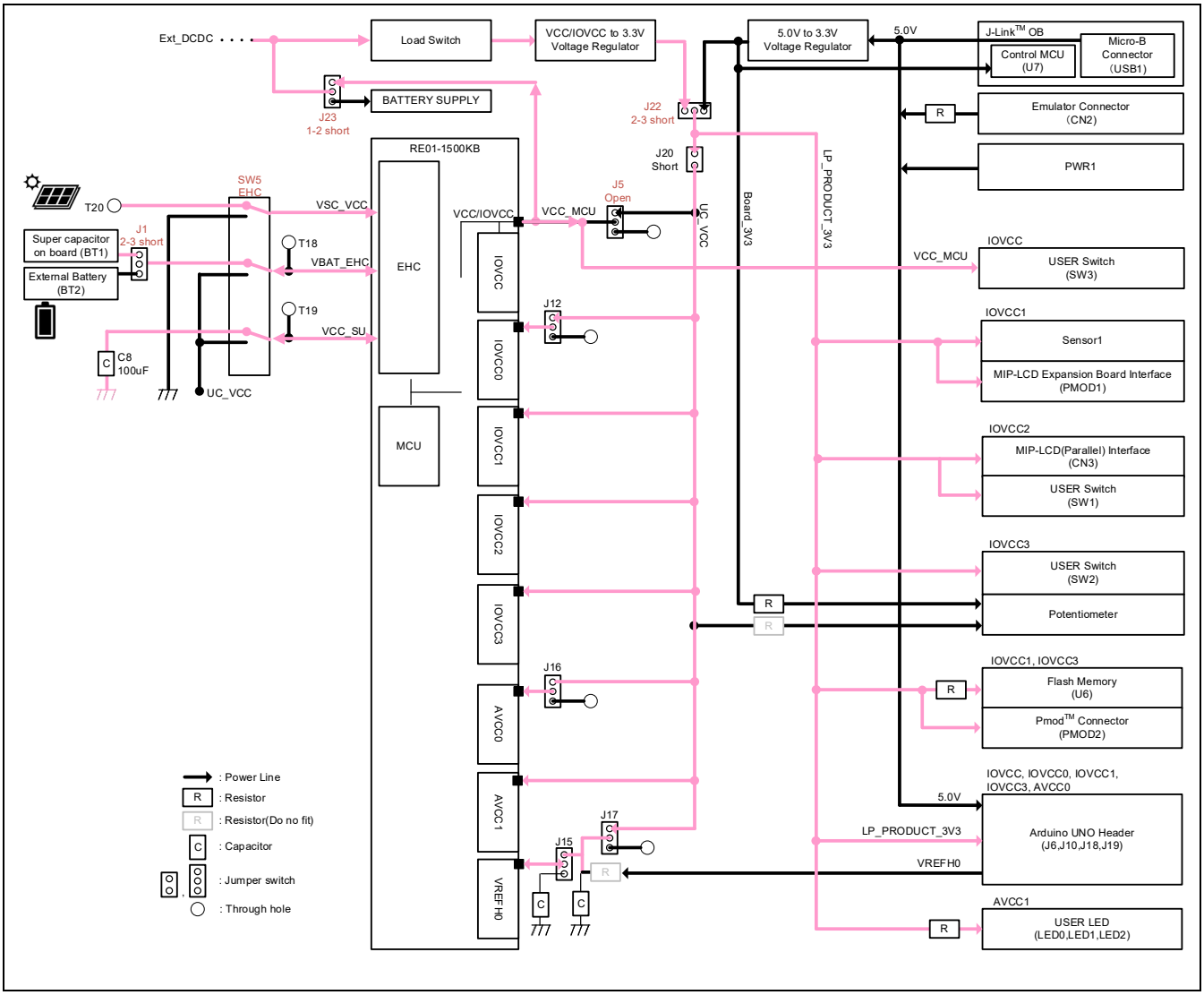


Figure 6-4: Block diagram of Power line (EHC Operation)

6.2.2 EHC Power Supply

6.2.2.1 Power Generating Element

This kit includes a solar panel. To use this, it must be connected to the solar panel interface, via T20 and T21. See Figure 6-5.
When using a power generating element other than the solar cell supplied with the kit, , select the power generation element that matchs the input conditions of RE01. For details, refer to "RE01 Group User Manual: Hardware 13.5.3 Selecting a Power Generating Element"

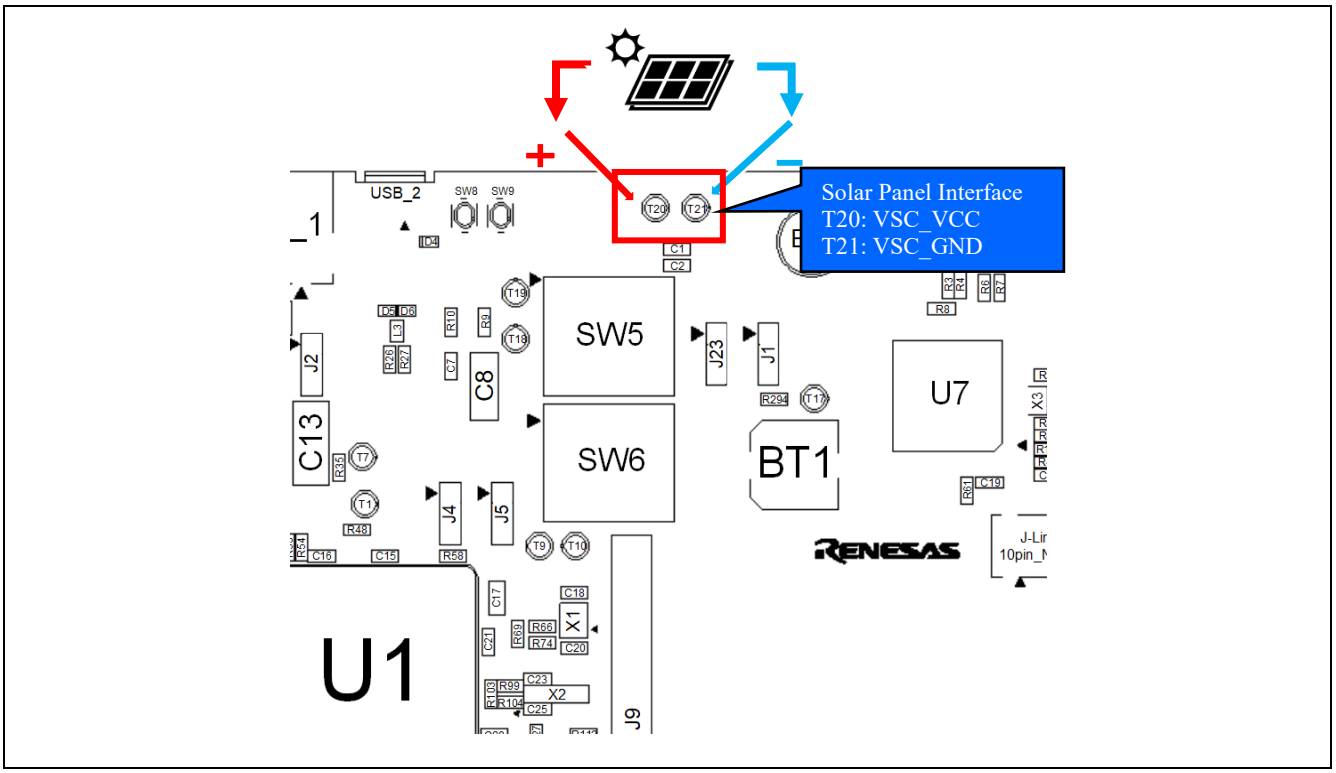
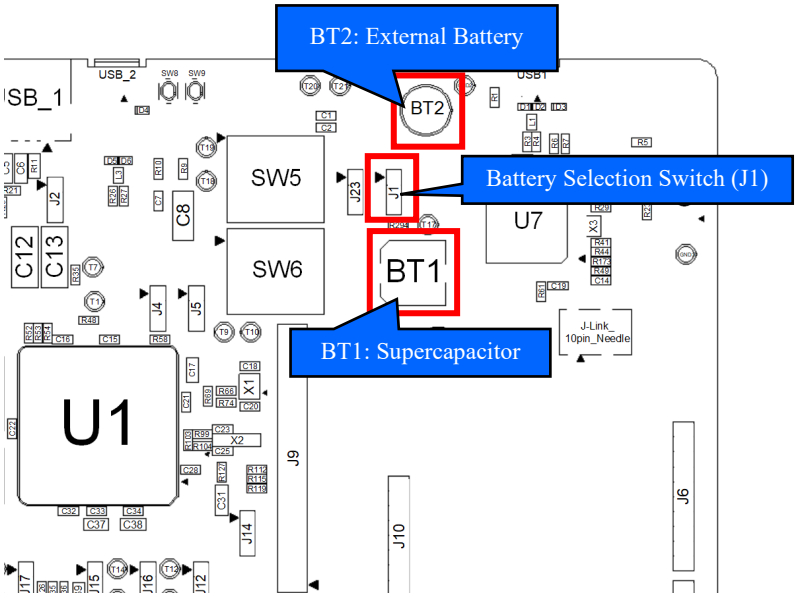


Figure 6-5: Solar Panel Connection

6.2.2.2 Supercapacitor / External Battery

Either a supercapacitor or an external battery can be connected to VBAT_EHC pin of the RE01. Switches required setting in order to use a supercapacitor or external battery.
Figure 6-6 shows the component layout, and Table 6-3 shows details of setting.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 6-6: Component Layout for Supercapacitor/External Battery

Table 6-3: External Battery settings

Reference	Position	Settings
J1	Shorted Pin1-2	External Battery settings used
	Shorted Pin2-3	Supercapacitor used

- When using a supercapacitor, ensure that it is charged. For charging, connect a stabilized power supply to the test point (T17). Adjust the charging voltage match to the setting value specified by Secondary Battery (VBAT) Charging Voltage Select bit (VBATSEL) in Option Function Selection Register 1 (OFS1) of RE01.
- When using external battery, you will need to mount an external battery. The connection is shown in Table 6-4. The recommended external battery is the SLB series (Nichicon). The solar panel supplied with this Evaluation Kit*1 can supply 42µA. Depending on the operational settings of RE01, charging the recommended external battery can take some. Please consider charging the battery externally, before connecting to the main board.

*1: Panasonic AM-1815CA, Operating Voltage 3.0V, Operating current 42µA (Fluorescent light : 200lx(25℃))

Table 6-4: External Battery (BT2)

External Battery (BT2)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	RE-BATTERY_VCC	VBAT_EHC	39	2	GROUND	-	-

6.2.2.3 Storage Capacitor

The main board has a 100uF power storage capacitor connected to VCC_SU pin of RE01. Depending on your design requirements, it may be necessary to alter the capacitance connected to VCC_SU pin. If necessary, mount a capacitor on the C7 footprint (size: 1608).
Figure 6-7 shows Component Layout.

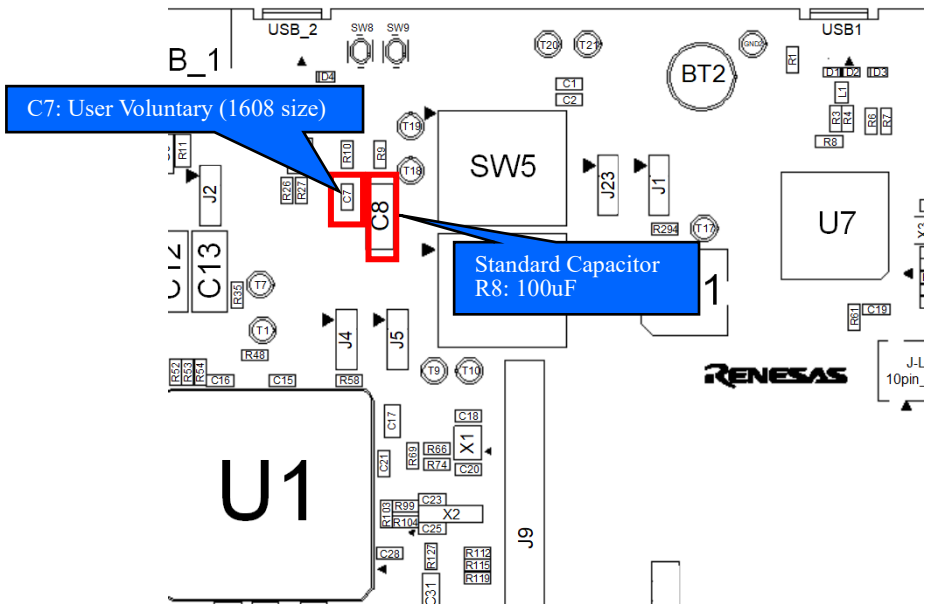


Figure 6-7: Component Layout for Storage Capacitor

6.2.3 DCDC Converter Control

When using the energy harvesting function to drive the peripheral circuits, the DC-DC converter must be enabled to supply voltage to the peripheral circuits. The DC-DC converter is controlled by P404 pin of RE01. To enable the DC-DC converter, output a high level from P404 pin. In addition, make sure that there is enough charging voltage in the external battery or the supercapacitor. This voltage equals to the value of VBATSEL setting (2.6 or 3.0V).

6.2.4 Power supply selection to peripheral circuits(J23)

When using the energy harvesting function to power peripheral circuits, you can select the power source to supply. Switch the setting to change the power source.
Figure 6-2 shows the component layout, and Table 6-5 shows details of setting. Figure 6-8 and Figure 6-9 shows the image of power supply select.

Table 6-5: Power Supply Selection

Reference	Position	Settings
J23	Shorted Pin1-2	Voltage Supply from RE01 VCC/IOVCC pin
	Shorted Pin2-3	Battery Supply

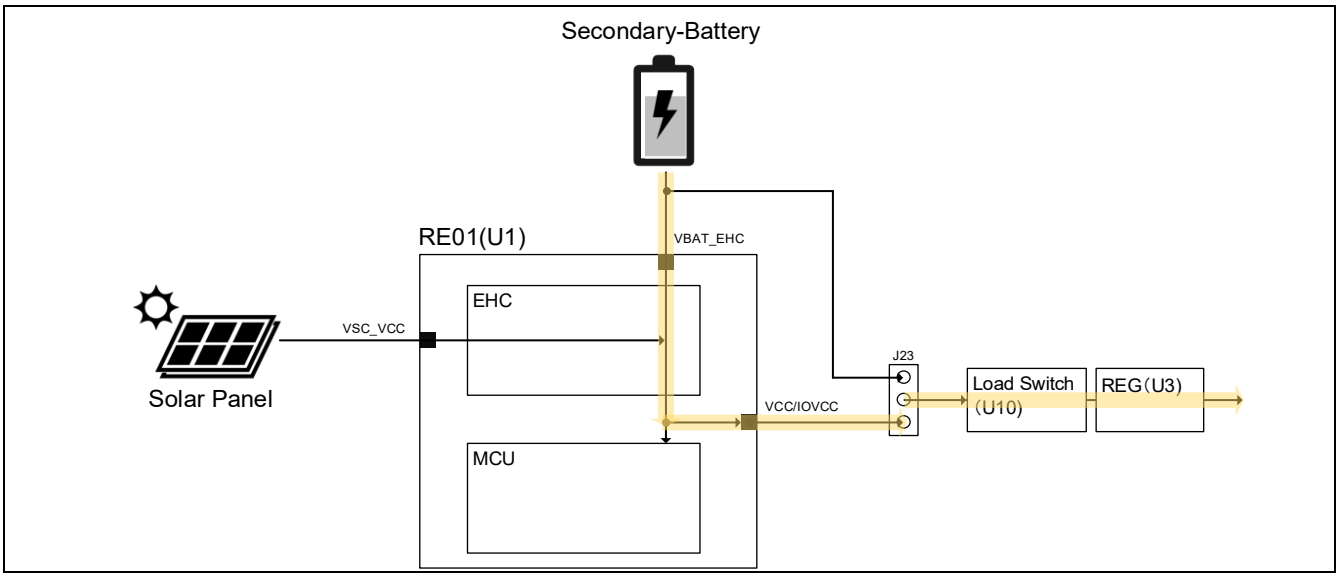


Figure 6-8: Power supply from the VCC / IOVCC pin of RE01

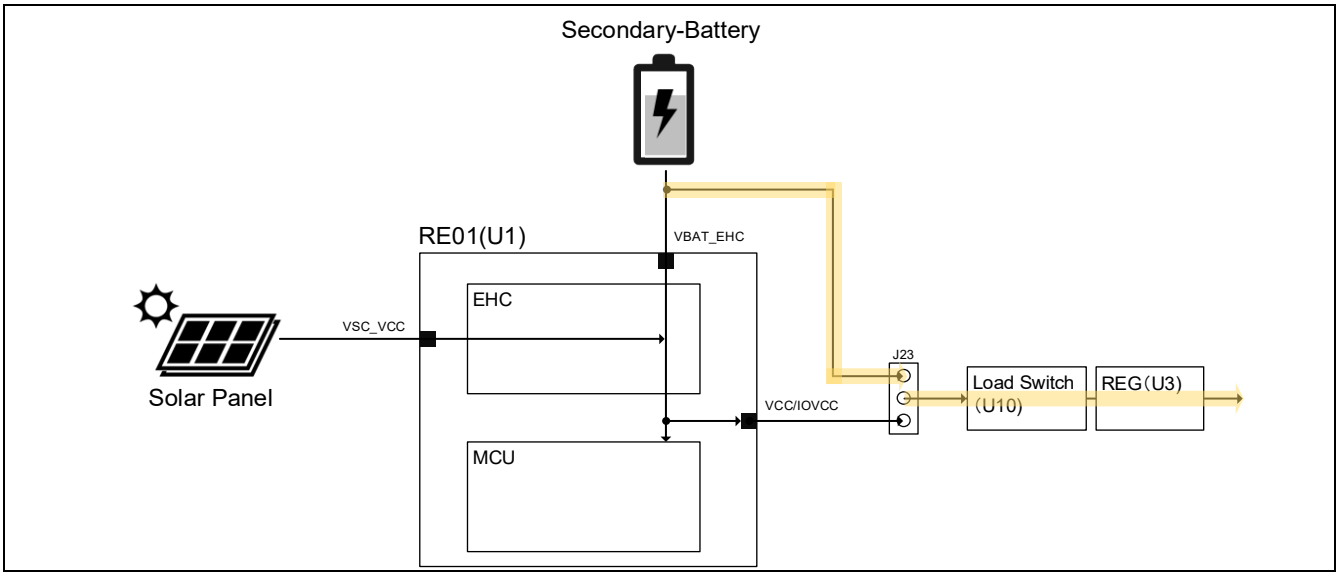


Figure 6-9: Power supply from battery

7. Current Measurement Circuit

This main board allows the user to measure the current consumption of the RE01 or the entire main board.

7.1 Current measurement when using the on-board regulator 3.3V

This section shows how to measure the current consumption in normal startup mode at 3.3V using the regulator mounted on the board. The current flow to be measured is shown in Figure 7-1.

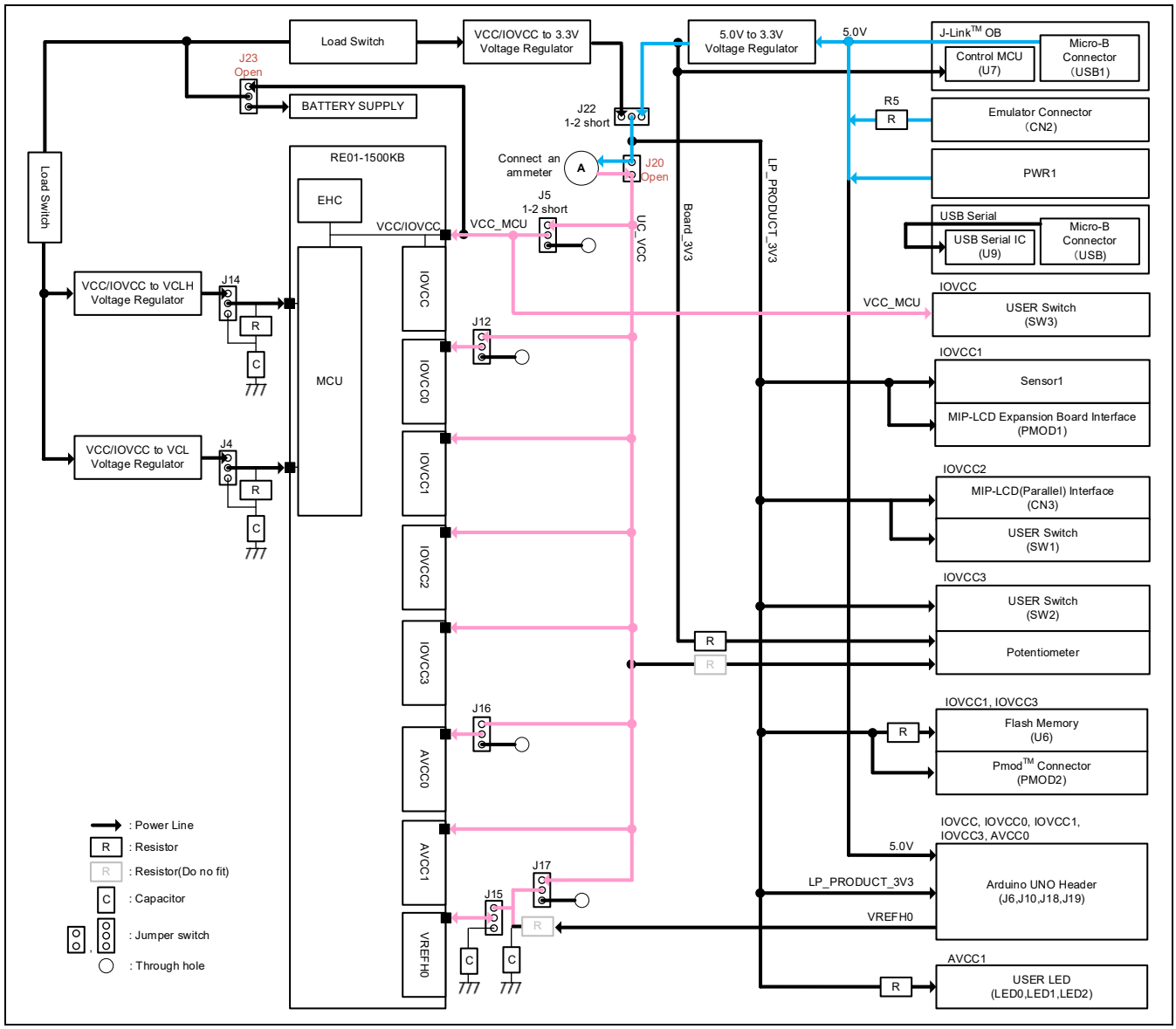
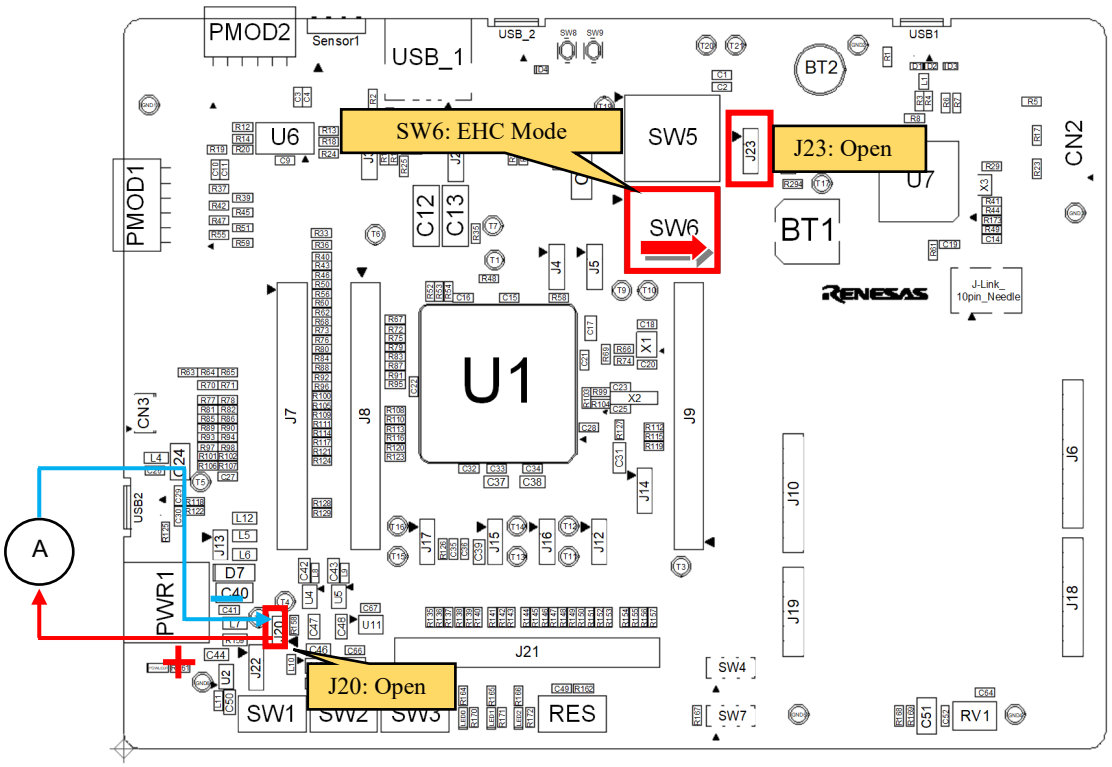


Figure 7-1: Current flow with default settings

7.1.1 Component Layout and Setting during Current Measurement.

Switch settings are required to measure the current. Details are shown in Figure 7-2 and Table 7-1.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 7-2: Component Layout

Table 7-1: Configuration Details

Reference	Position	Settings
J20	Open	Current measurement connection terminal
J23	Open	Shut off EHC power supply (J-Link OB not used)
SW6	2-3, 5-6, 8-9 short	EHC Mode

7.1.2 How to use

Follow the steps shown below. Program must be downloaded into the internal flash memory of RE01 in advance.

1. Open J20.
2. Connect an ammeter to current measurement points (J20.1 and J20.2).
3. Supply the board by using stand-alone power supply.

7.2 Current measurement when not using on-board 3.3V regulator

In this section, the method to measure the current during normal startup without using the on-board regulator is described. The current flow to be measured is shown in Figure 7-3.

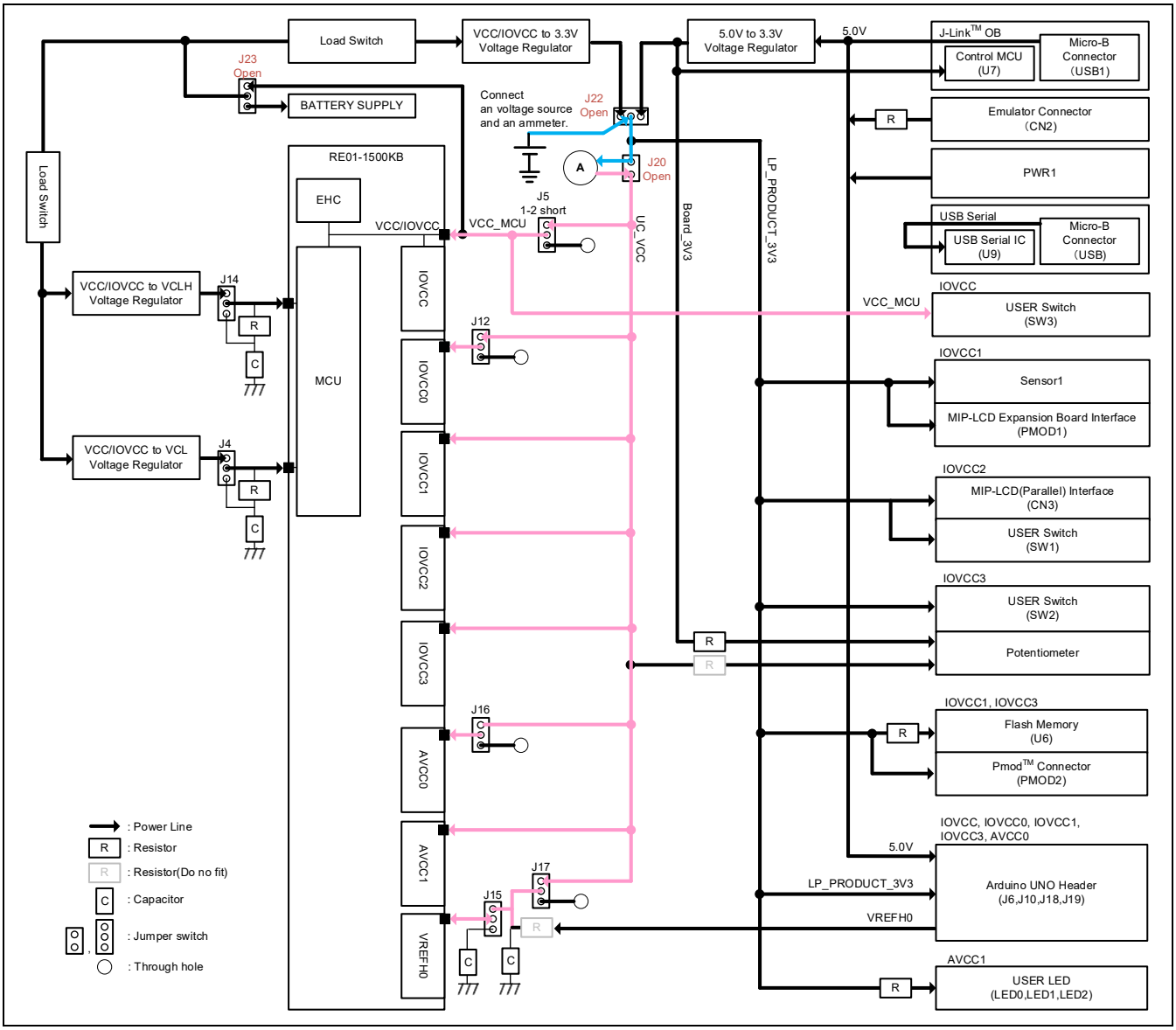
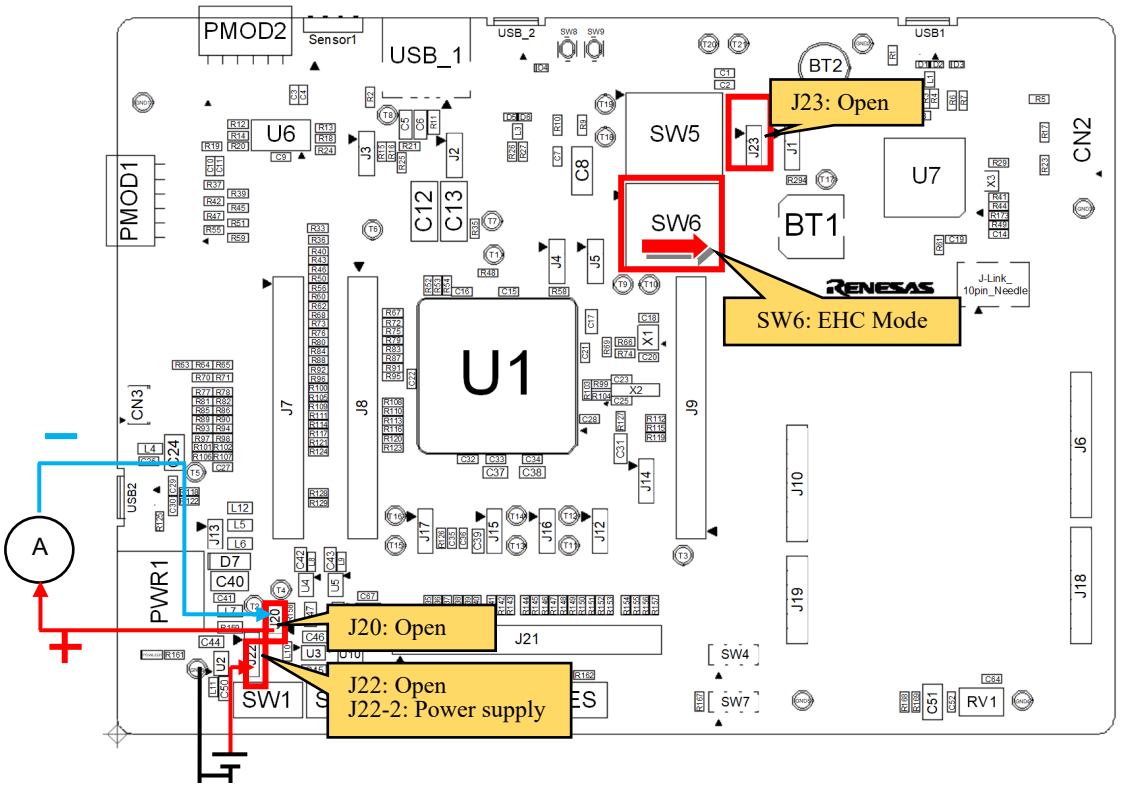


Figure 7-3: Current flow when on-board regulator 3.3V is not used

7.2.1 Settings for current measurement

Set up the board as shown in Figure 7-4 and Table 7-2, and connect a voltage source and an ammeter.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 7-4: Component Layout and Settings (Current Measurement, on-board regulator 3.3V not used)

Reference	Position	Settings
J20	Open	Current measurement connection terminal
J22	Open	Shut off the on-board regulator connection
J23	Open	Shut off EHC power supply (J-Link OB not used)
SW6	2-3, 5-6, 8-9 short	EHC Mode

Table 7-2: Configuration Details

7.2.2 How to use

Follow the steps shown below. Program must be downloaded into the internal flash memory of RE01 in advance.

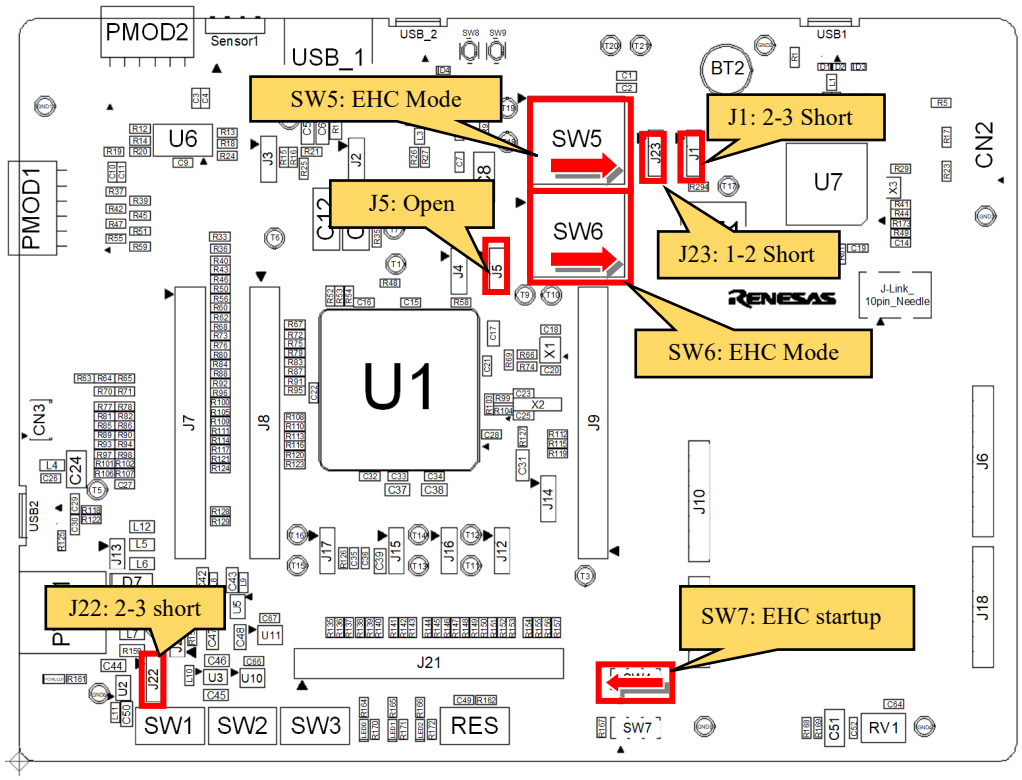
1. Open J20.
2. Connect an ammeter to current measurement points (J20.1 and J20.2). And connect a voltage source to J22-2
3. Supply power to the board by the voltage source.

7.3 Current measurement during EHC operation

This board can measure the current of the entire system even in EHC mode. This section describes how to measure the current in EHC mode.

7.3.1 Settings for current measurement

Configure the board according to Figure 7-5, and connect the voltage source and ammeter according to Figure 7-6.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 7-5: Component Layout and Settings (Current Measurement, EHC mode)

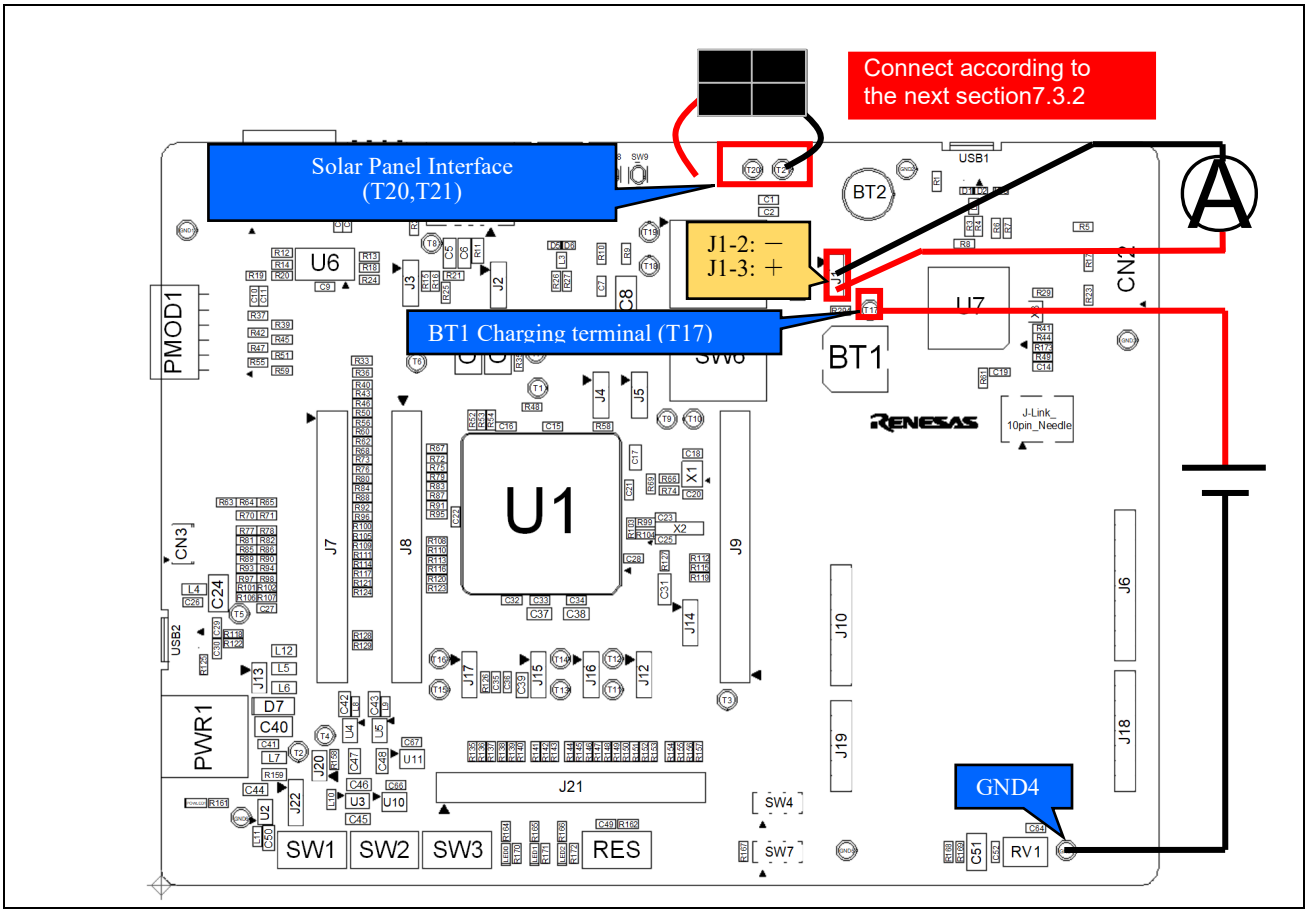


Figure 7-6: Connection for current measurement in EHC mode

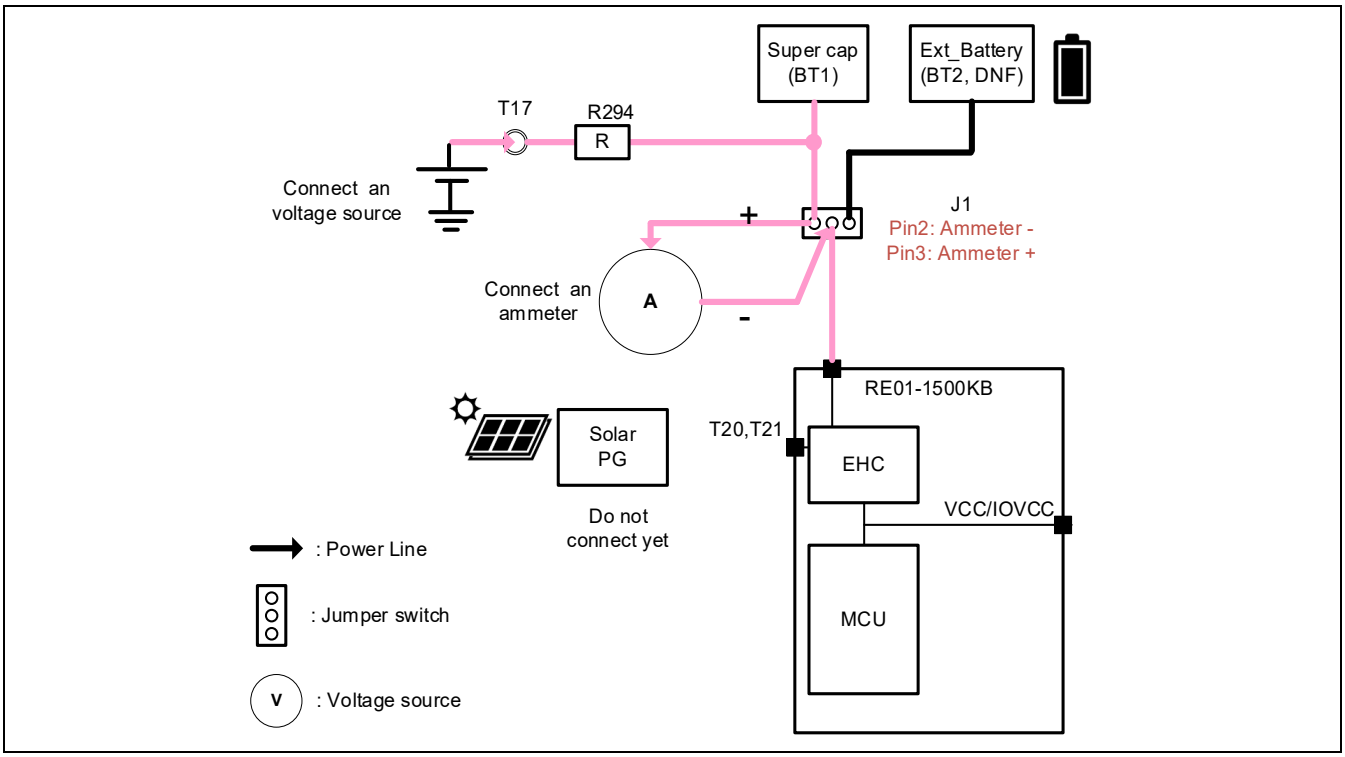


Figure 7-7: Block diagram of the connection current measurement in EHC mode (when using the super capacitor mounted on the board)

7.3.2 How to use

After setting up and connecting the voltage source and ammeter according to the previous section, measure the current according to the following procedure.

1. Apply a voltage to VBAT from a voltage power source that is higher than the threshold voltage for transition to steady state.
2. Supply power from VSC_VCC and allow the system to transition to steady state.
3. Turn off the supply of VSC_VCC so that the system can operate only with power from VBAT.
4. Measure the current consumption of the entire system with the connected ammeter.

When using an external rechargeable battery or super capacitor with BT2, connect the voltage source to J1 pin 1 and the ammeter to J1 pin 1 (+) and pin 2 (-).

8. Peripheral Circuits

8.1 Available Peripheral Circuits in each Operation Mode

Table 8-1 shows the peripheral circuits that can be used in each operation mode.

Table 8-1: Peripheral Circuits that can be used in each Operation Mode

Item	Normal startup	EHC startup
Reset Circuit	○	○
Clock Circuit	○	○
Switches	○	○
LEDs	○	○
Potentiometer	○	X
Pmod™	○	○
MIP-LCD Expansion Board Interface	○	○
USB Serial Conversion	○	○
MLCD	○	○
Flash Memory (QSPI)	○	○
USB	○	X
Arduino UNO	○	○
Sensor Board Interface	○	○
Current Measurement Circuit	○	○

8.2 Reset Circuit

This main board has a RE01 built-in power-on reset circuit and a reset circuit triggered by pressing a switch. When power is supplied, RE01 is reset by the built-in power-on reset circuit. Pressing RES switch also resets RE01.
Refer to "RE01 Group User's Manual: Hardware" for details regarding the reset specifications of RE01, and "Evaluation Kit Main Board schematics" for information regarding the reset circuitry in use on the main board.

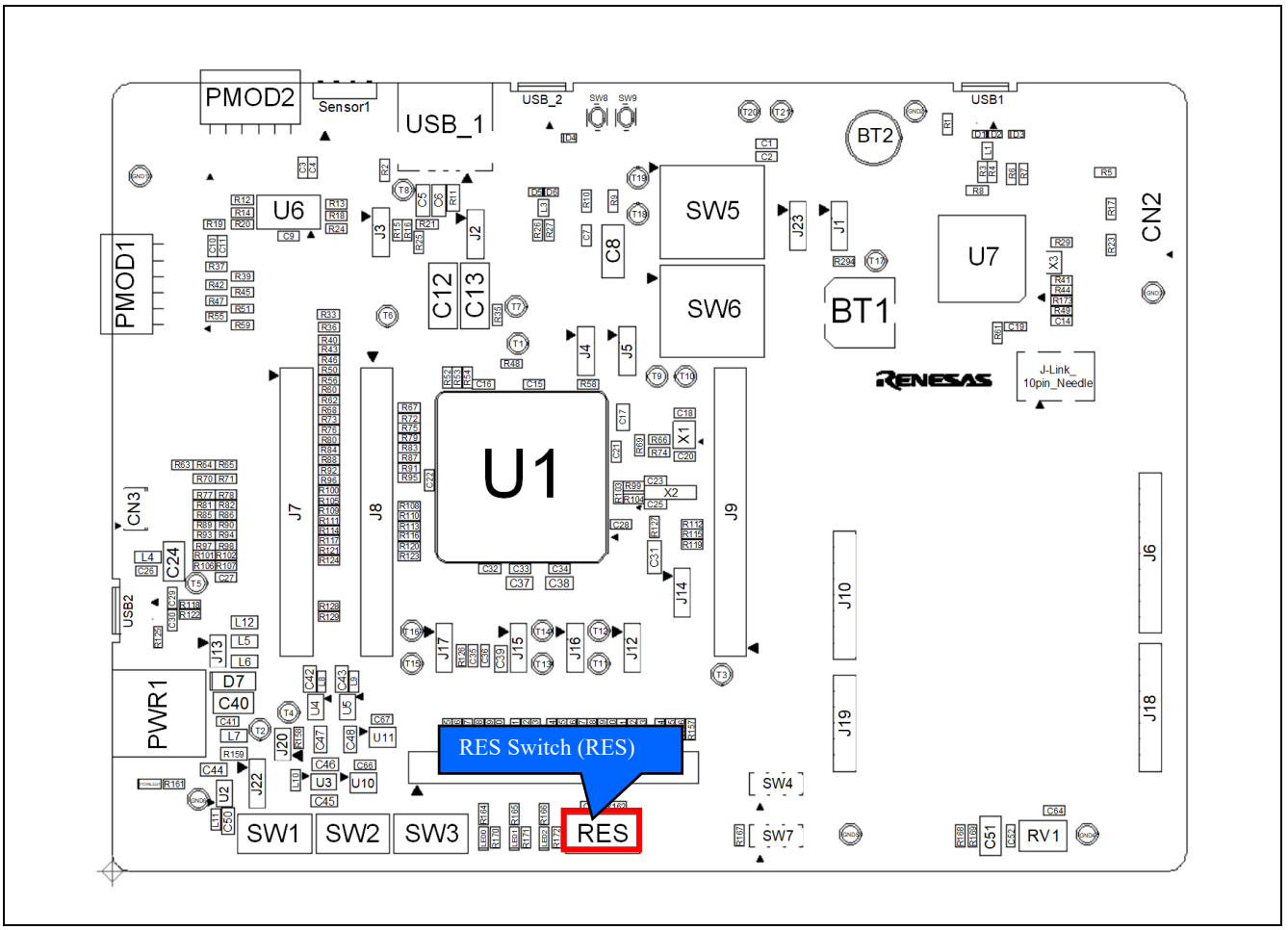


Figure 8-1: Component Layout

8.3 Clock Circuit

This main board has clock circuits for clock source of RE01 and clock source of RX621. Refer to “RE01 Group User’s Manual: Hardware” and “RX621 Group Hardware Manual” for details regarding the clock specifications, and “Evaluation Kit Main Board schematics” for information regarding the clock circuitry in use on the main board of RE01 and RX621. Figure 8-2 shows the component layout, and Table 8-2 shows details of crystals mounted on the main board.

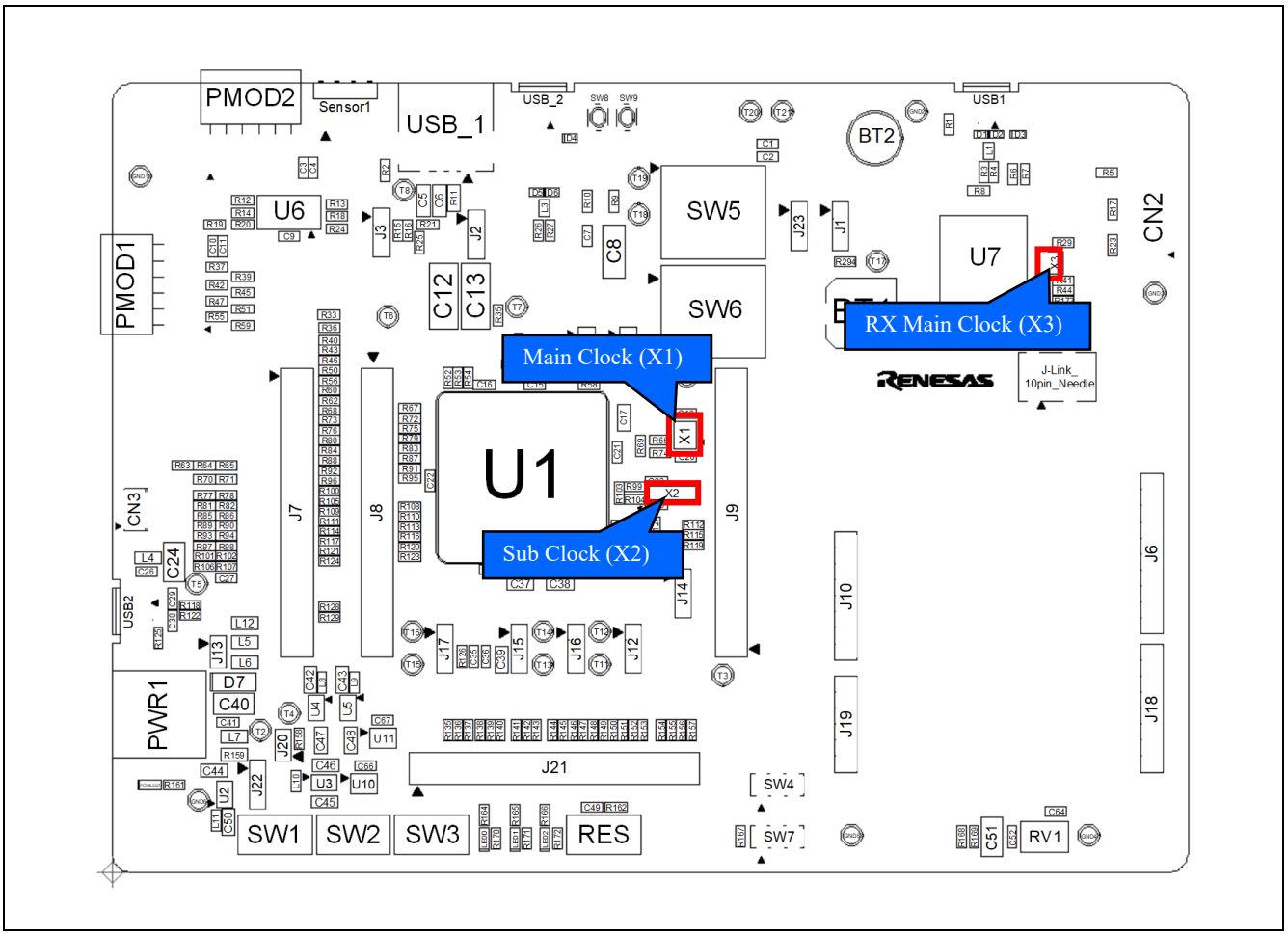


Figure 8-2: Component Layout

Table 8-2: Details of Crystals

Crystal	Function	Default Placement	Frequency	Device Package
X1	Main crystal for RE01	Fitted	32MHz	Encapsulated, SMT
X2	Sub crystal for RE01	Fitted	32.768kHz	Encapsulated, SMT
X3	Main crystal for RX621	Fitted	12MHz	Encapsulated, SMT

8.4 Switches

This main board has 10 switches. Figure 8-3 and Figure 8-4 shows the component layout, and Table 8-3 shows the function of each switch and their connections.

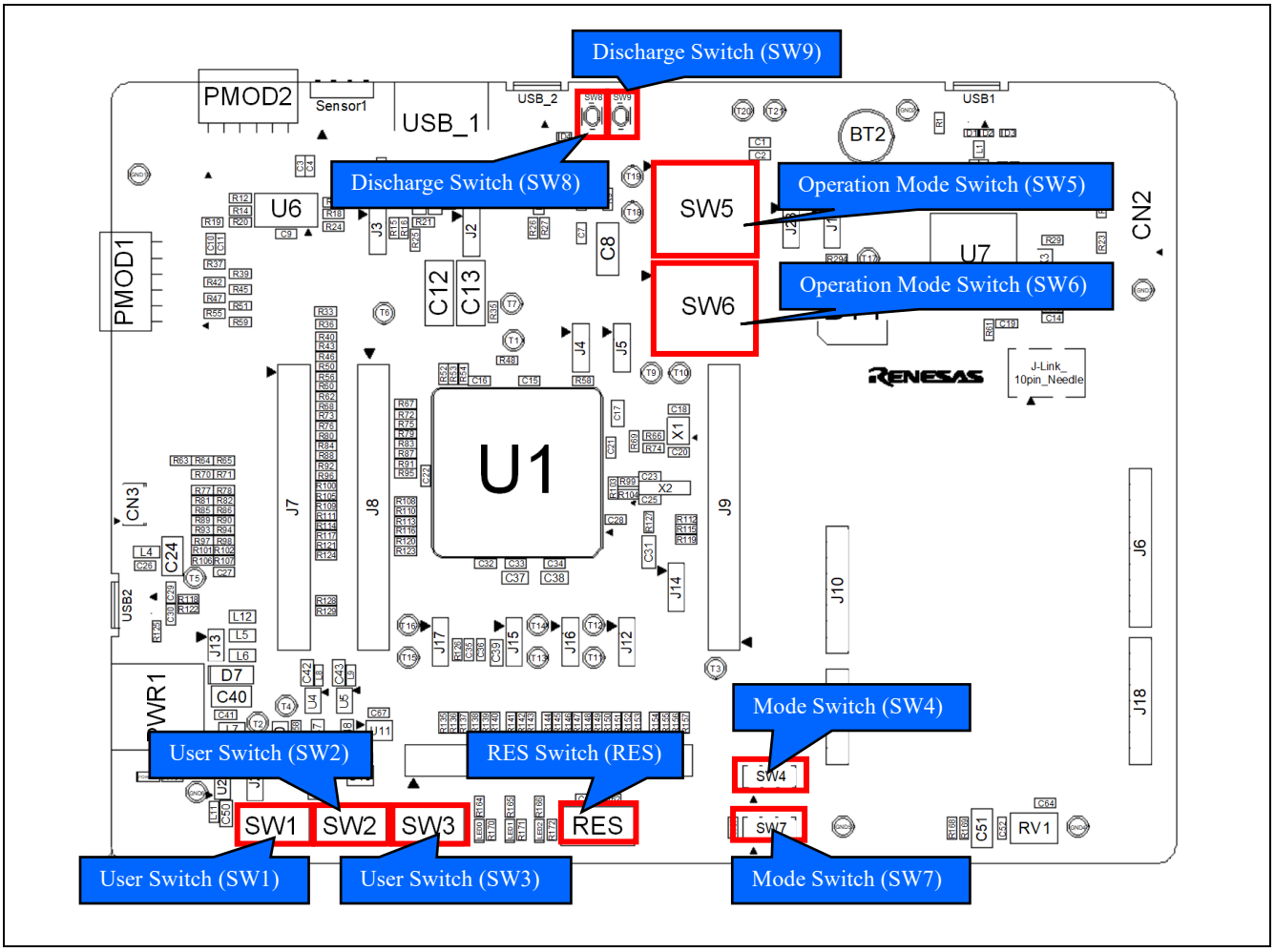


Figure 8-3: Component Layout (Top)

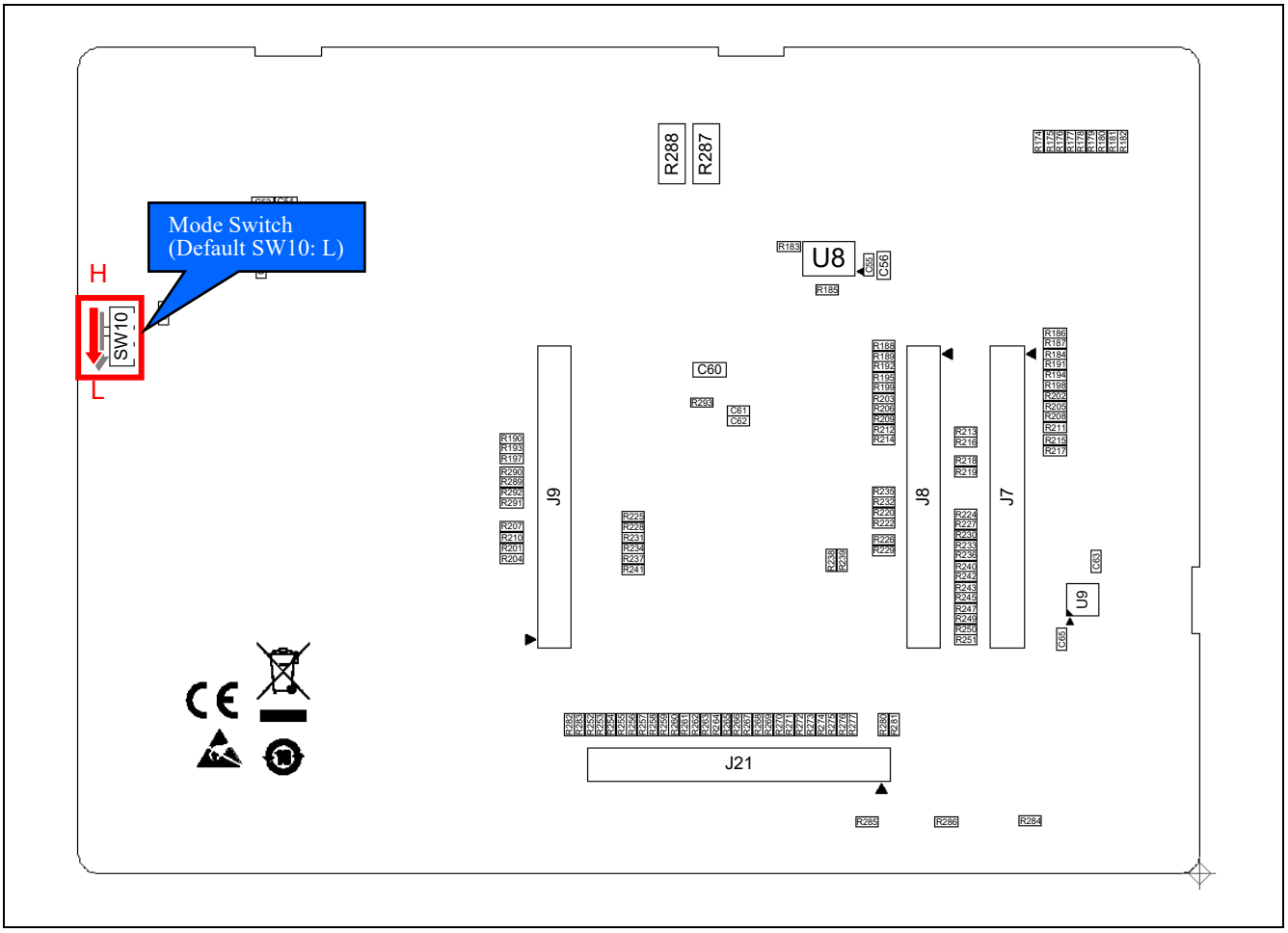


Figure 8-4: Component Layout (Bottom)

Table 8-3: Switches and Connections

Switch	Function	RE01	
		Signal (Port)	Pin
RES	Asserts reset signal to RE01.	RES#	34
SW1	Connects to KINT00 for user controls.	P100	99
SW2	Connects to IRQ4_B for user controls.	P508	107
SW3	Connects to IRQ2_A_DS for user controls.	P410	23
SW4	Selects RE01 startup mode.	MD	35
SW7		EHMD	30
SW5,6	Selects EHC operation mode and Normal operation mode.	VCC_SU	38
		VBAT_EHC	39
		VSC_VCC	40
SW8	Discharge of VCC_SU storage capacitors (C7, C8).	VCC_SU	38
SW9	Discharge of C17 capacitor.	VCC/IOVCC	20
SW10	Selects mode setting of RX microcomputer *1.	-	-

*1: No need to set SW10. Please stay settings fixed as product shipment. (Setting SW10: Low)

8.5 LEDs

This main board has 4 LEDs. Figure 8-5 shows the component layout, and Table 8-4 shows each luminary color of LEDs and their connections.

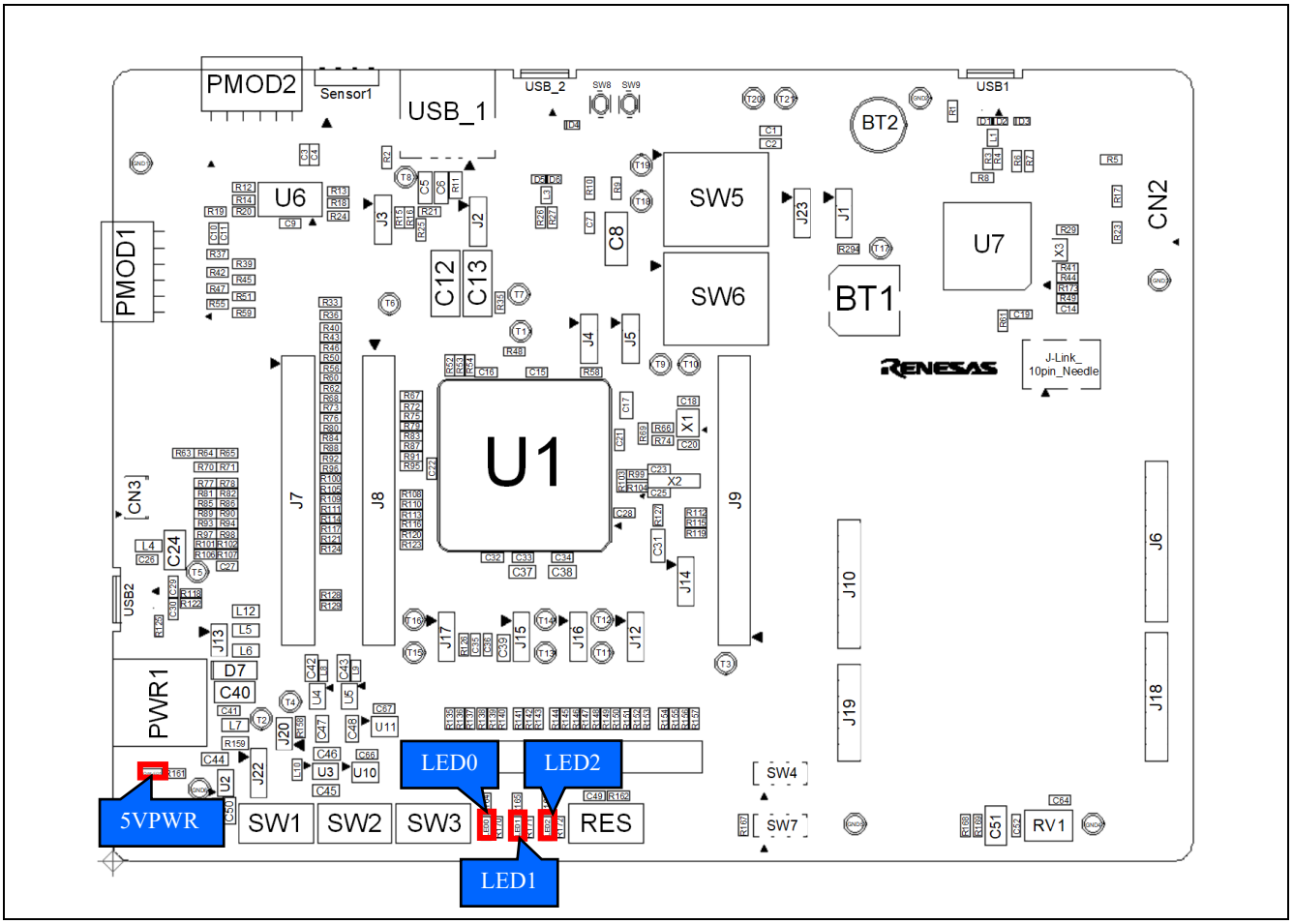


Figure 8-5: Component Layout

Table 8-4: LEDs and Connections

LED	Color	Function	RE01	
			Port	Pin
5VPWR	Green	Board_5V Power line indicator	NC	NC
LED0	Green	User LED	P009	125
LED1	Orange	User LED	P008	126
LED2	Red	User LED	P007	127

8.6 Potentiometer

A single-turn potentiometer is connected to AN028 (Port P506, Pin 109) of RE01, to provide a variable analog voltage, between GROUND potential and the Board_3V3.
Refer to the manufacturer's website for specification of the potentiometer (Maker: Bourns, Inc. - Part Number: 3314 series).
Refer to the APN (R01AN4702, R01AN4701) for how to use the analog input.

* : The potentiometer offers an easy method of supplying a variable analog input to the RE01. It does not necessarily reflect the accuracy of the RE01's ADC.

Figure 8-6 shows the component layout for potentiometer.

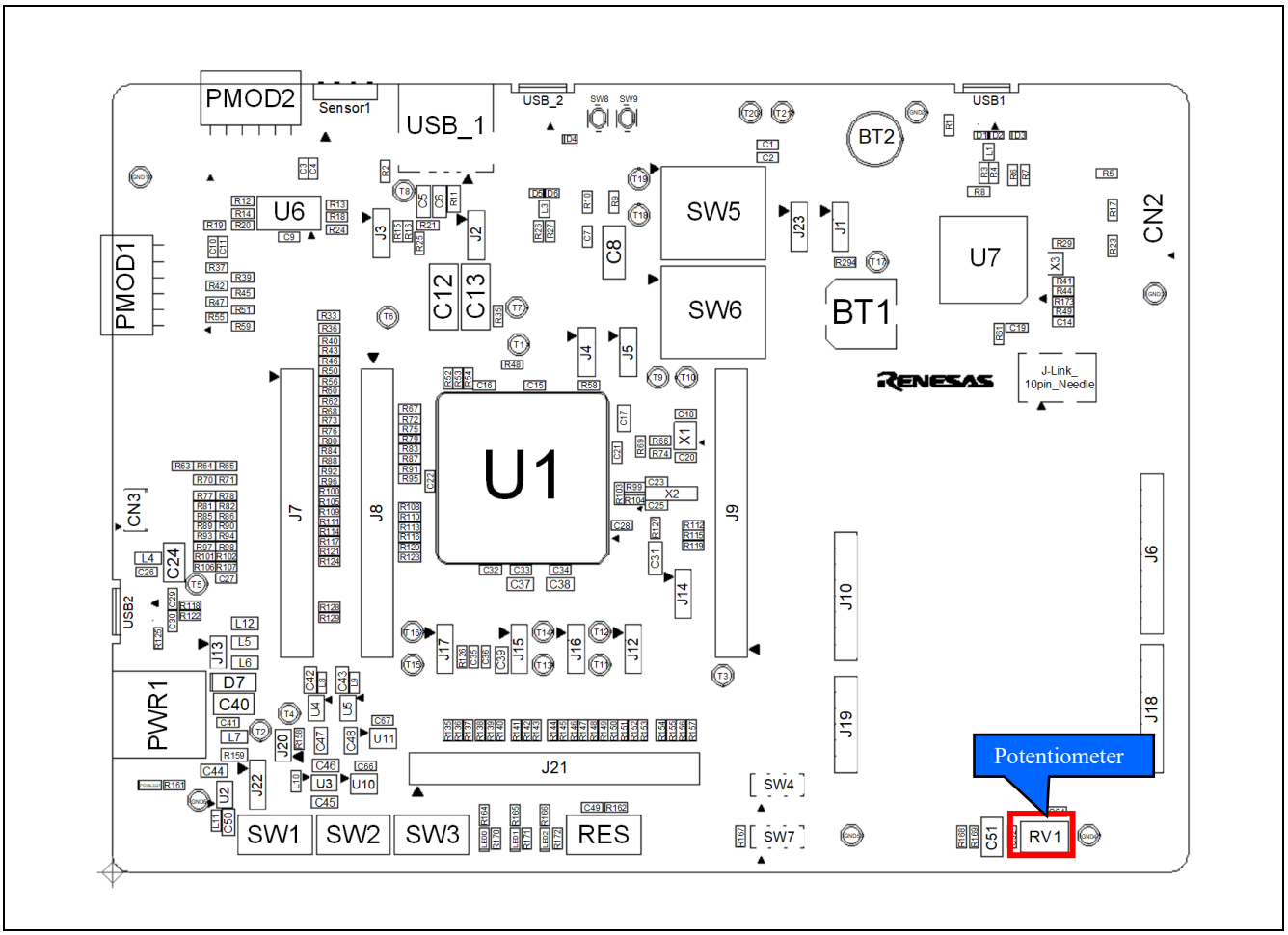


Figure 8-6: Component Layout

8.7 Pmod™

8.7.1 Pmod™

This main board has connectors for Digilent Pmod™ interface. To PMOD1 and PMOD2, compatible PMOD module must be connected. Also, the bundled MIP-LCD Expansion board can be connected to PMOD1. Figure 8-7 shows the component layout.

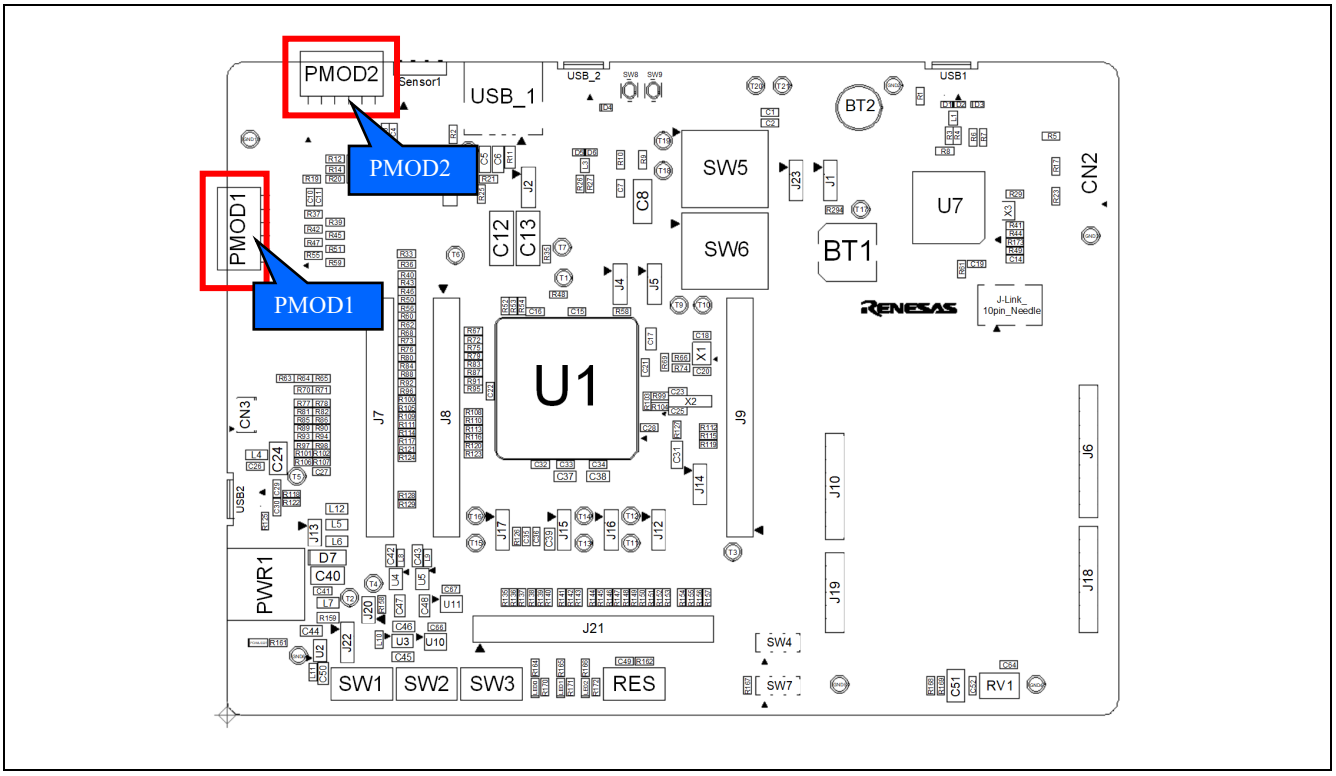


Figure 8-7: Component Layout

The Digilent Pmod™ use an SPI interface. Table 8-5 shows PMOD1's connections, and Table 8-6 shows PMOD2's connections.
Please note that the connector numbering adheres to the Digilent Pmod™ standard and is different from other connectors pin designs. Refer to Digilent Pmod™ Interface Specification for details.

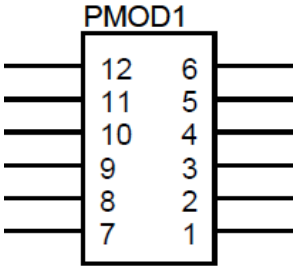


Figure 8-8: Digilent Pmod™ Pin Numbering

Table 8-5: Pmod™ Connector PMOD1

Pin	Circuit Net Name	RE01		Pin	Circuit Net Name	RE01	
		Port	Pin			Port	Pin
1	PMOD1-SSLB0_B	P610	73	7	PMOD1-INT	P606	77
2	PMOD1-MOSIB_B	P609	74	8	PMOD1-RESET	P605	78
3	PMOD1-MISOB_B	P608	75	9	PMOD1-IO0	P302	70
4	PMOD1-RSPCKB_B	P607	76	10	PMOD1-IO1	P303	69
5	GROUND	-	-	11	GROUND	-	-
6	LP_PRODUCT_3V3	-	-	12	LP_PRODUCT_3V3	-	-

Table 8-6: Pmod™ Connector PMOD2

Pin	Circuit Net Name	RE01		Pin	Circuit Net Name	RE01	
		Port	Pin			Port	Pin
1	PMOD2-SSLA0_B_QSSL_A	P012 P601*1	121 82	7	PMOD2-IO0_QIO2_A	P603 P014*1	80 119
2	PMOD2-MOSIA_B_QIO0_A	P010 P500*1	123 115	8	PMOD2-IO1_QIO3_A	P300 P013*1	72 120
3	PMOD2-MISOA_B_QIO1_A	P500 P015	115 118	9	PMOD2-IO2	P604	79
4	PMOD2-RSPCKA_B_QSPCLK_A	P011 P602*1	122 81	10	PMOD2-IO3	P306	64
5	GROUND	-	-	11	GROUND	-	-
6	LP_PRODUCT_3V3	-	-	12	LP_PRODUCT_3V3	-	-

*1: Is not connected in the default kit configuration, as supplied.

8.7.2 MIP-LCD Expansion Board Interface

The MIP-LCD Expansion board, supplied with this kit, should be connected to the PMOD1 interface, on the main board. PMOD1 is also used for PMOD module connection.
MIP-LCD (KYOCERA with part number TN0181ANVNANN-AN00*1) loaded on MIP-LCD Expansion board uses RE01's built-in Serial Peripheral Interface (SPI).
Refer Figure 8-9 shows the component layout, and Table 8-5 shows connections of PMOD1.

*1: Please contact KYOCERA.

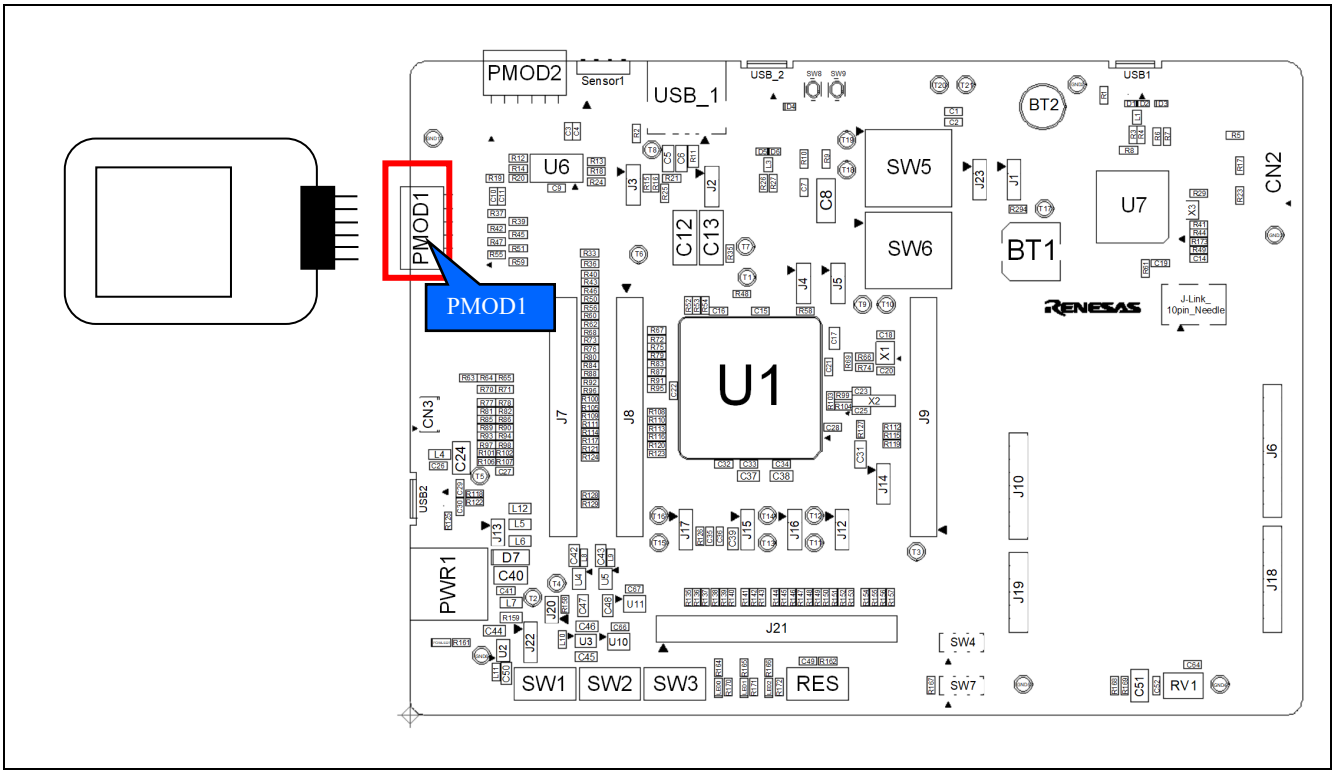
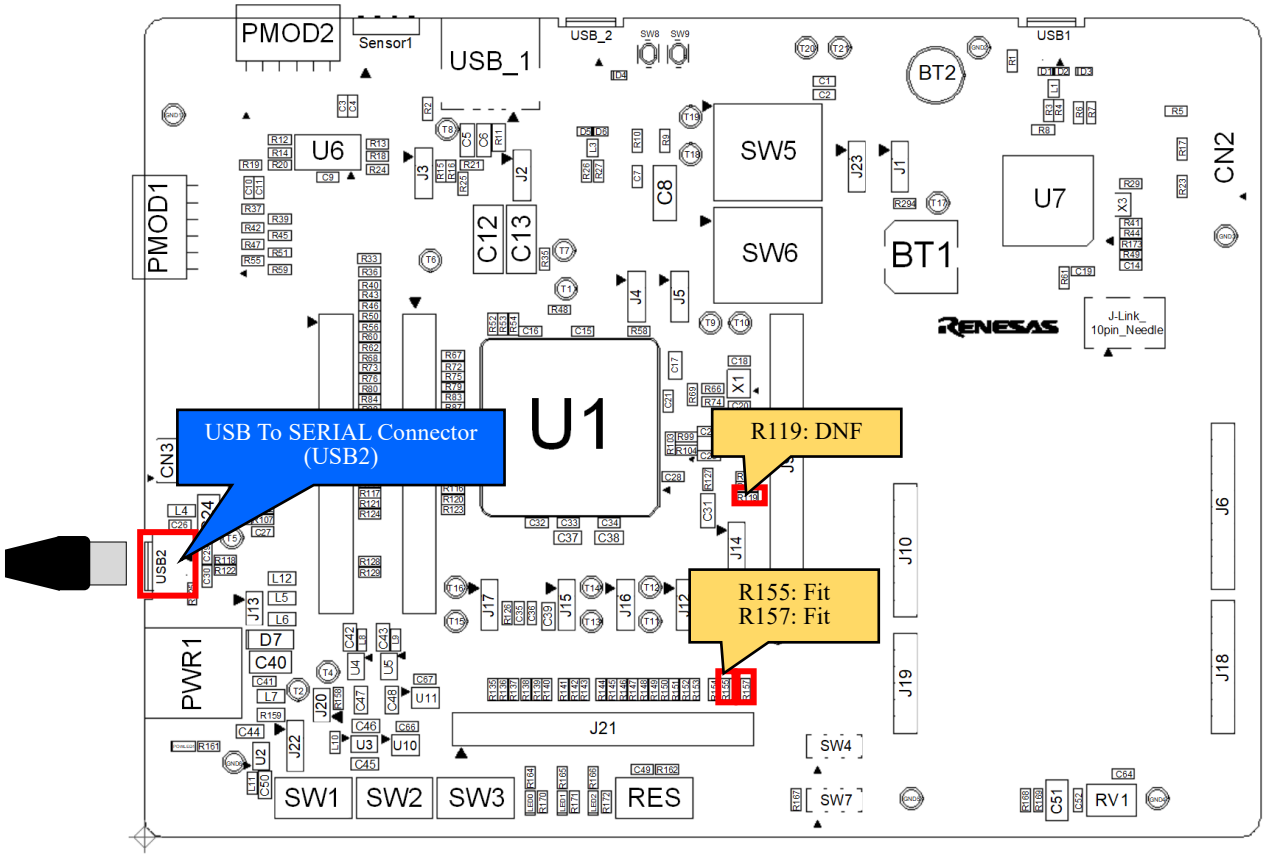


Figure 8-9: Component Layout

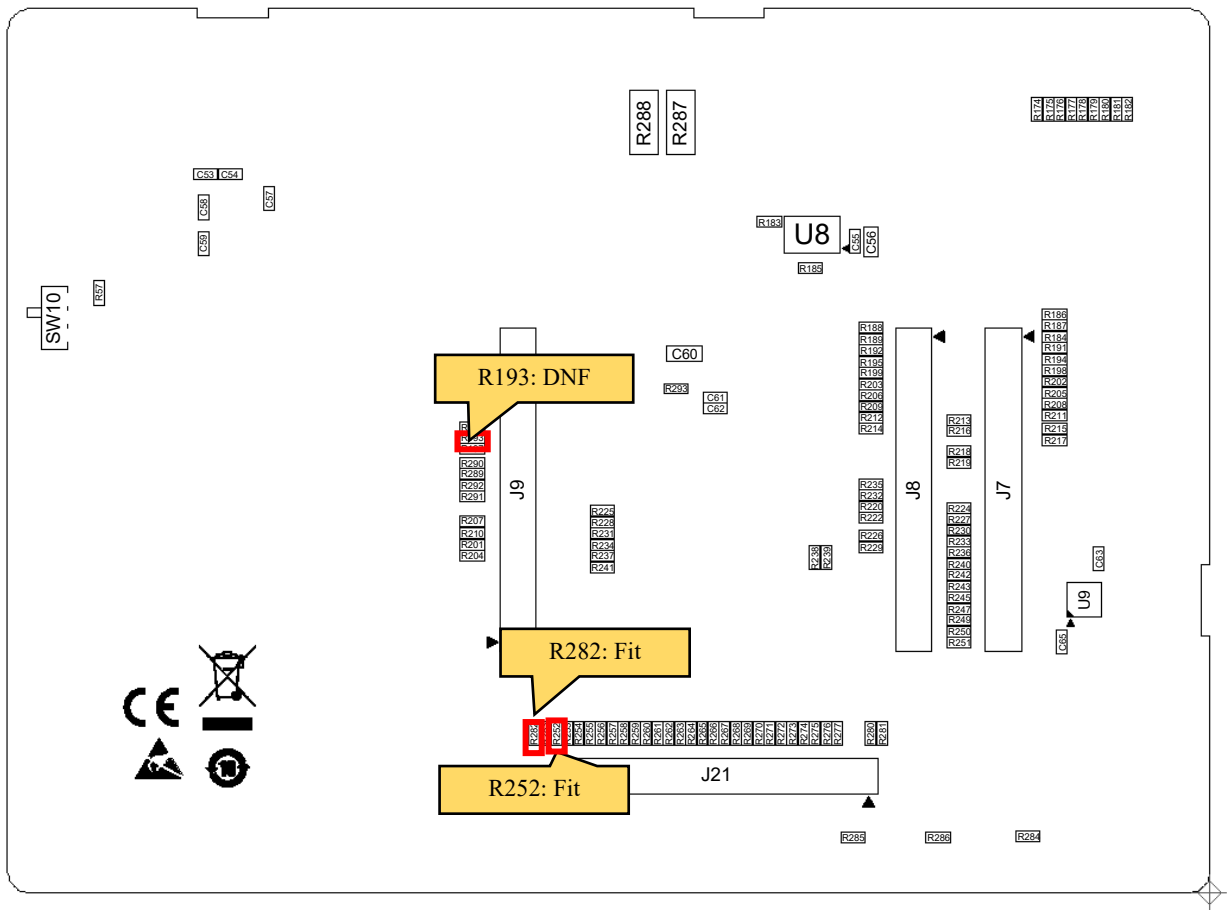
8.8 USB Serial Conversion

SCI4 port of the RE01's built-in serial communication interface (SCI) has been connected to USB serial converter (FT230XQ (FTDI chip)) in the default kit configuration. The USB port will now expose a virtual COM port. Figure 8-10 and Figure 8-11 shows the component layout, and Table 8-8 shows connections of USB serial.
To enable this functionality, several optional resistors must be in place. Resistors must be mounted as shown in Figure 8-10, Figure 8-11 and Table 8-7. The default kit configuration, as supplied, will have these resistors in place and the USB functionality enabled.



*1: The USB serial connector is only wired to provide power to a limit number of circuits, on the RE01. To power those circuits that are not wired, you must use an external PSU.
*2: Other settings will be as per the default kit configuration, as supplied.

Figure 8-10: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-11: Component Layout (Bottom)

Table 8-7: Configuration Details

Reference	Settings
R119, R193	DNF
R155, R282	Fit
R157, R252	Fit

Table 8-8: USB Serial Connections

Signal Name	Function	RE01	
		Port	Pin
USB SERIAL-TXD	SCI4 Transmit Signal.	P812	143
USB SERIAL-RXD	SCI4 Receive Signal.	P813	142
USB SERIAL-CTS	Clear To Send.	P814	141
USB SERIAL-RTS	Request To Send.	P811	144

Driver software provided by FTDI chip must be installed on the host PC to use functionality. Required driver software is as below.

- VIRTUAL CON PORT(VCP) Drivers

The installer of driver software can be downloaded from the following URL.

http://www.ftdichip.com/Products/ICs/FT230X.html

8.9 MLCD (Memory in Pixel Liquid Crystal Display) Interface

8.9.1 MLCD Function

RE01 has 1 channel of MIP Liquid Crystal Controller (MLCD) as built-in, and can be connected to Parallel MIP-LCD (Maker: KYOCERA, Part number: TN0104ANVAANN-GN00*1) through FPC connector (CN3) on the main board. Figure 8-12 and Figure 8-13 shows the component layout, and Table 8-10 shows connections of MLCD.
To use this functionality, several resistor changes must be made. Resistors must be mounted as shown in Figure 8-13 and Table 8-9.
*1: Please contact KYOCERA.

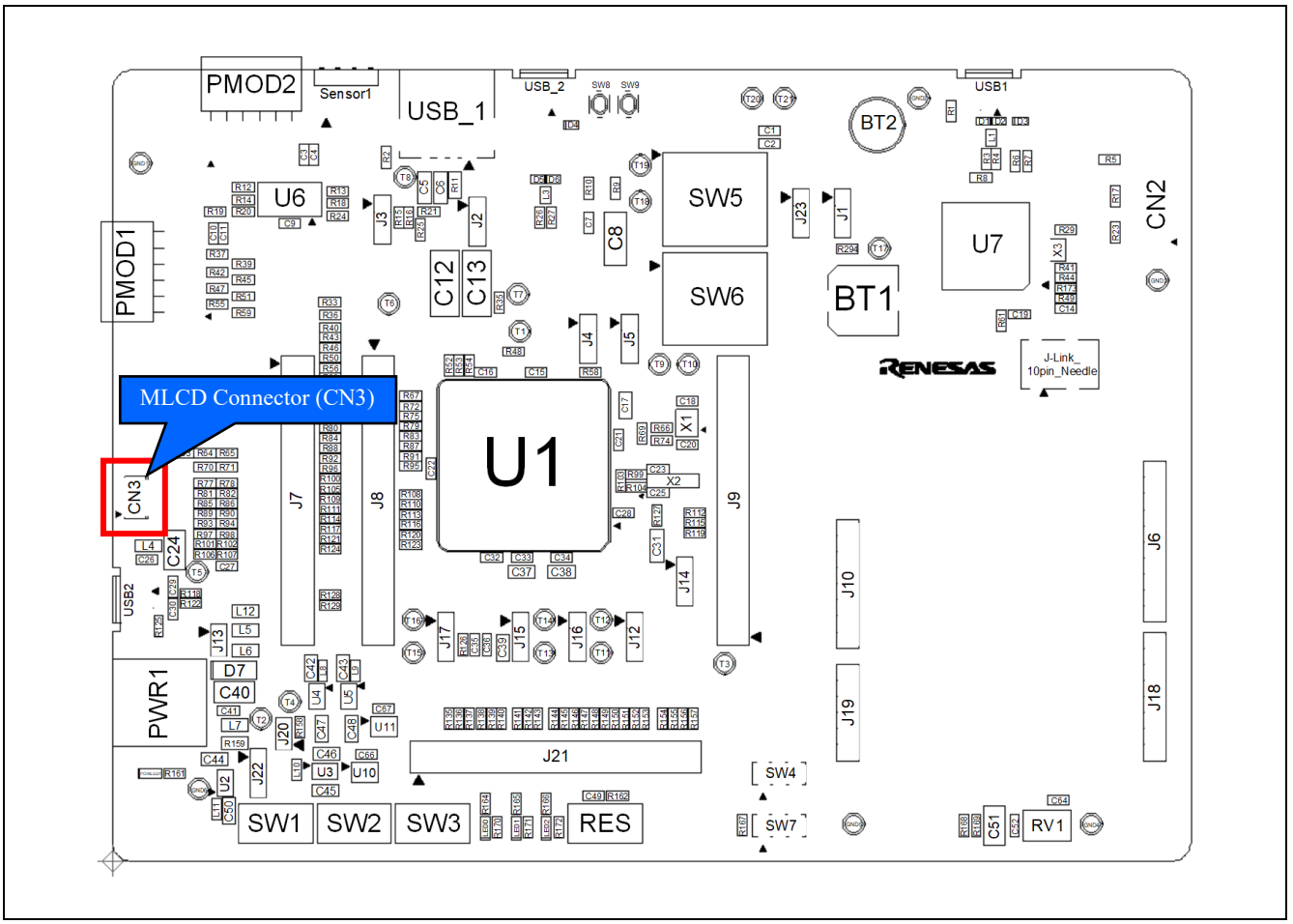
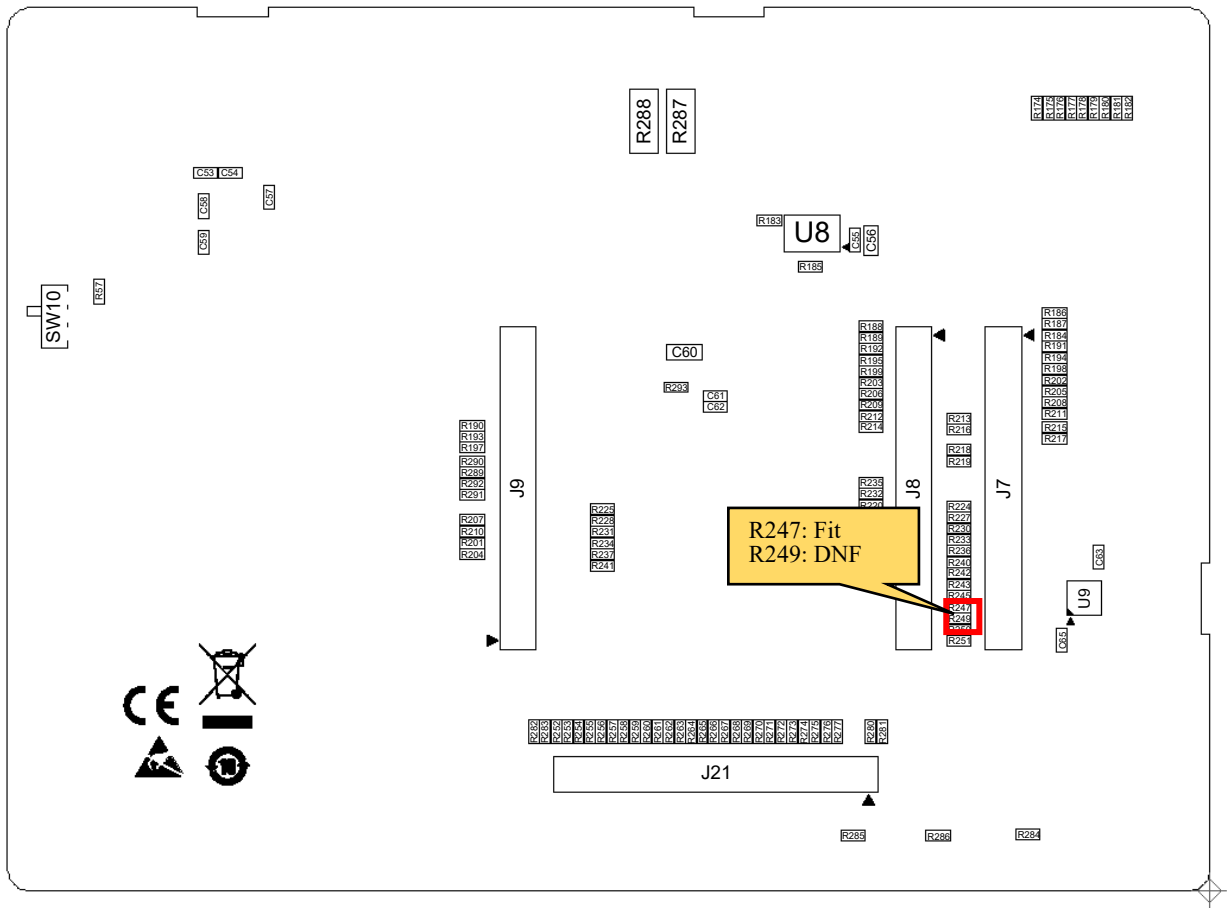


Figure 8-12: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-13: Component Layout (Bottom)

Table 8-9: Configuration Details

Reference	Settings
R247	Fit
R249	DNF

Table 8-10: MLCD Connections

Signal name	Function	RE01	
		Port	Pin
MLCD_VCOM	Common electrode polarity signal pin	P113	84
MLCD_XRST	LCD control output pin	P112	85
MLCD_SCLK	Serial output clock pin for communications	P111	86
MLCD_DEN	Data identification signal pin	P110	87
MLCD_ENBS	Horizontal data enable pin	P109	88
MLCD_ENBG	Vertical data enable pin	P108	89
MLCD_SI0	Image data signal pin	P107	92
MLCD_SI1		P106	93
MLCD_SI2		P105	94
MLCD_SI3		P104	95
MLCD_SI4		P103	96
MLCD_SI5		P102	97
MLCD_SI6		P101	98
MLCD_SI7*1		P100	99

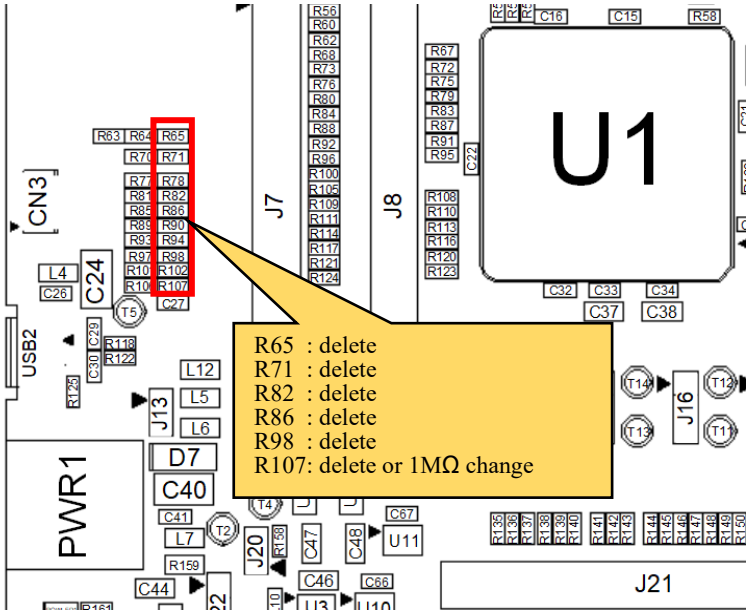
*1: Is not connected in the default kit configuration, as supplied.

8.9.2 Reducing power consumption of Parallel MIP-LCD

When using the Parallel MIP-LCD, the current consumption is increased due to the pull-down resistors. Implement the following steps to reduce current consumption:

- Remove the pull-down resistor of R65/R71/R82/R86/R98
- Change or remove the pull-down resistor of R107 to about 1MΩ.
  In case of removing, need to be P112 of RE01 is low level output.

Figure 8-14 shows positions of resistors to be changed for reducing power consumption of Parallel MIP-LCD.

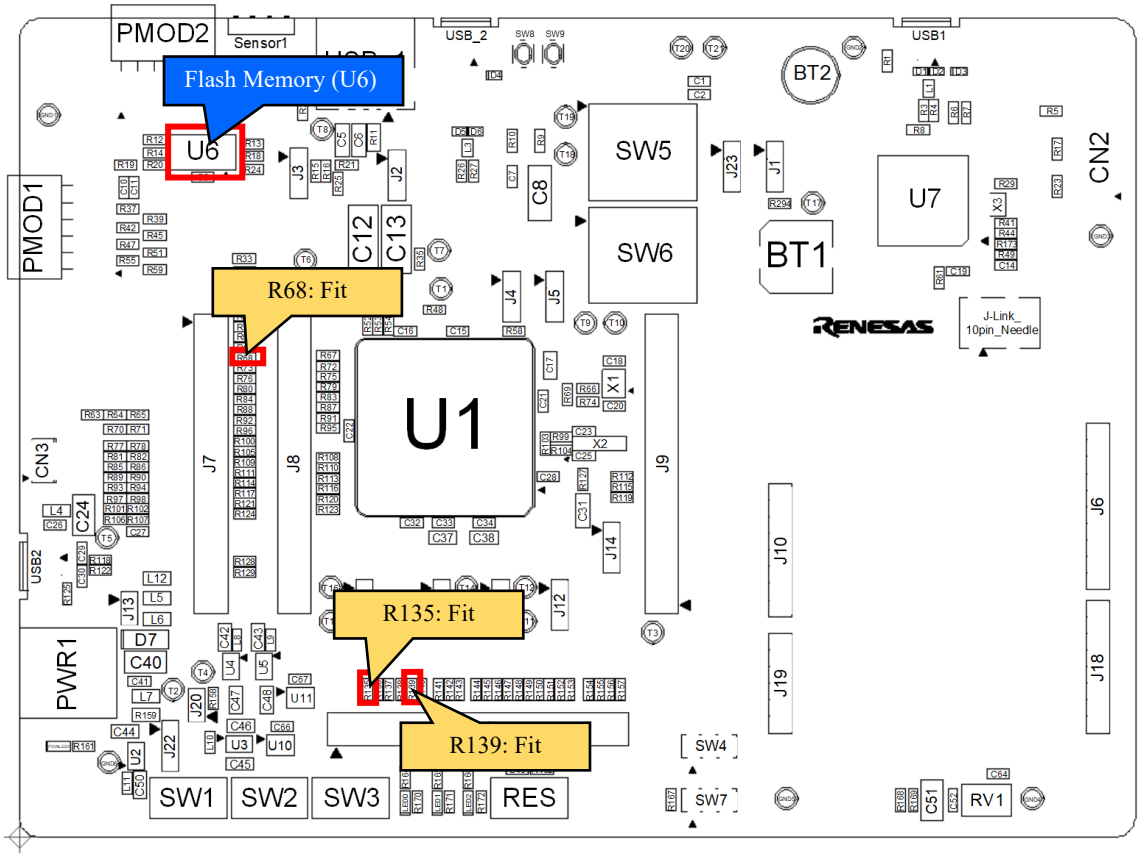


*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-14: Countermeasures to reduce power consumption of Parallel MIP-LCD

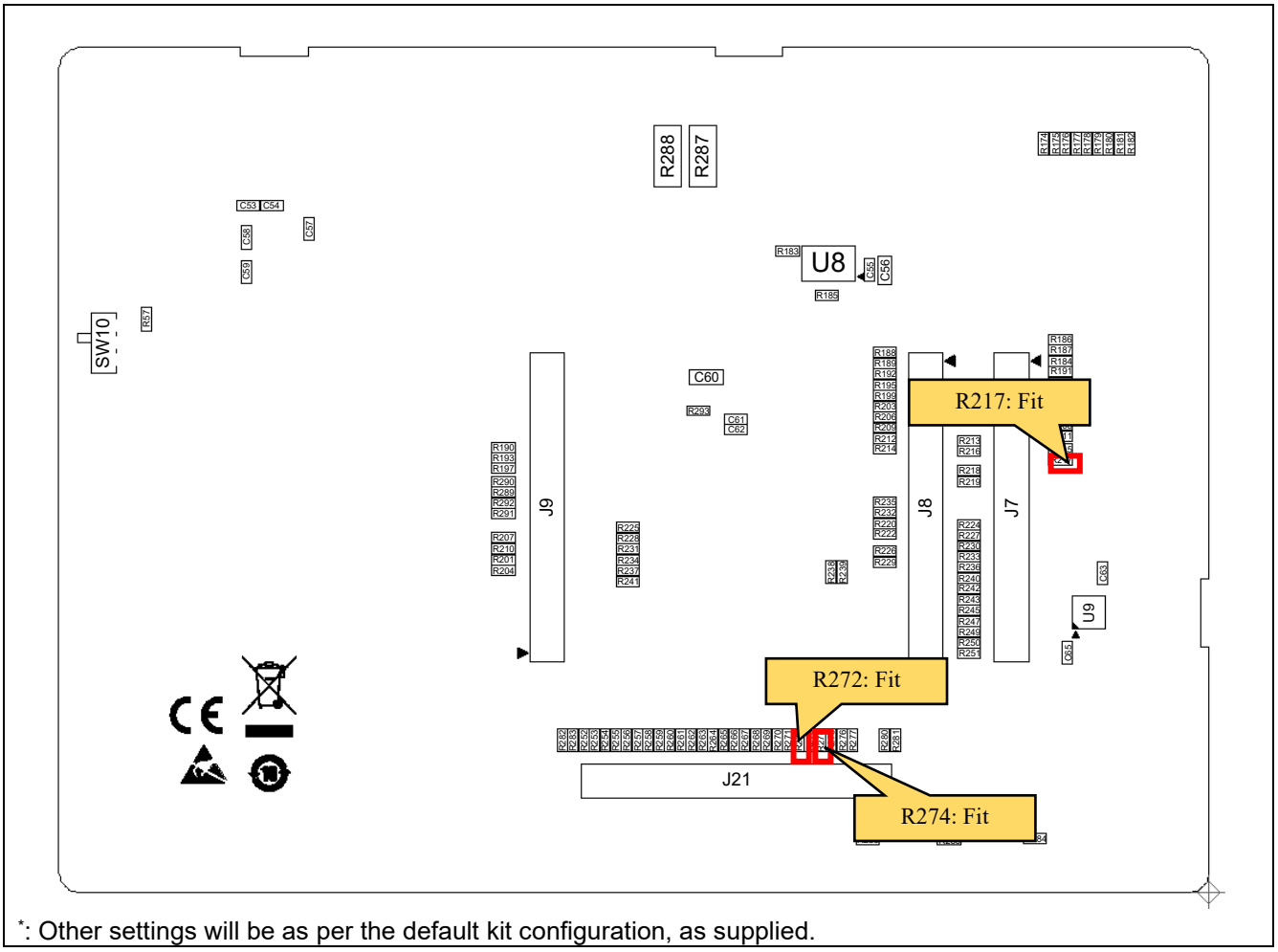
8.10 Flash Memory (QSPI)

The main board is supplied with flash memory. Fitted is a 64MB Flash Memory manufactured by Macronix (MX25R6435FM2IL0).
The flash memory is connected to RE01's built-in Quad Serial Peripheral Interface modules (QSPI).
Figure 8-15, Figure 8-16 shows the component layout, and Table 8-11 shows Flash Memory connections.
To enable this functionality, several optional resistors must be in place. Resistors must be mounted as shown in Figure 8-15, Figure 8-16 and Table 8-11. The default kit configuration, as supplied, will have these resistors in place.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-15: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-16: Component Layout (Bottom)

Table 8-11: Configuration Details

Reference	Settings
R68, R135, R139, R217, R272, R274	Fit

Table 8-12: Flash Memory Connections

Pin	Signal Name	RE01		Pin	Signal Name	RE01	
		Port	Pin			Port	Pin
1	QSPI_QSSL_A	P601	82	5	QSPI_QIO0_A	P500	115
2	QSPI_QIO1_A	P015	118	6	QSPI_QSPCLK_A	P602	81
3	QSPI_QIO2_A	P014	119	7	QSPI_QIO3_A	P013	120
4	GROUND	-	-	8	LP_PRODUCT_3V3	-	-

8.11 USB Host/Function

This main board has USB connectors (Type-A, Micro-B). RE01 built-in USB can operate as either a Host or Function device. Table 8-13 shows USB connections.

Table 8-13: USB Module Connections

USB Signal name	Function	RE01	
		Port	Pin
USB_DP	D+ I/O pin of the USB on-chip transceiver	USB_DP	44
USB_DM	D- I/O pin of the USB on-chip transceiver	USB_DM	43
USB_VBUS	USB cable connection monitor pin	P204	47
USB_VBUSEN_B	VBUS enable signal for the external power supply IC	P504	111
USB_OVRCURB_B	Overcurrent pin for USB	P509	106

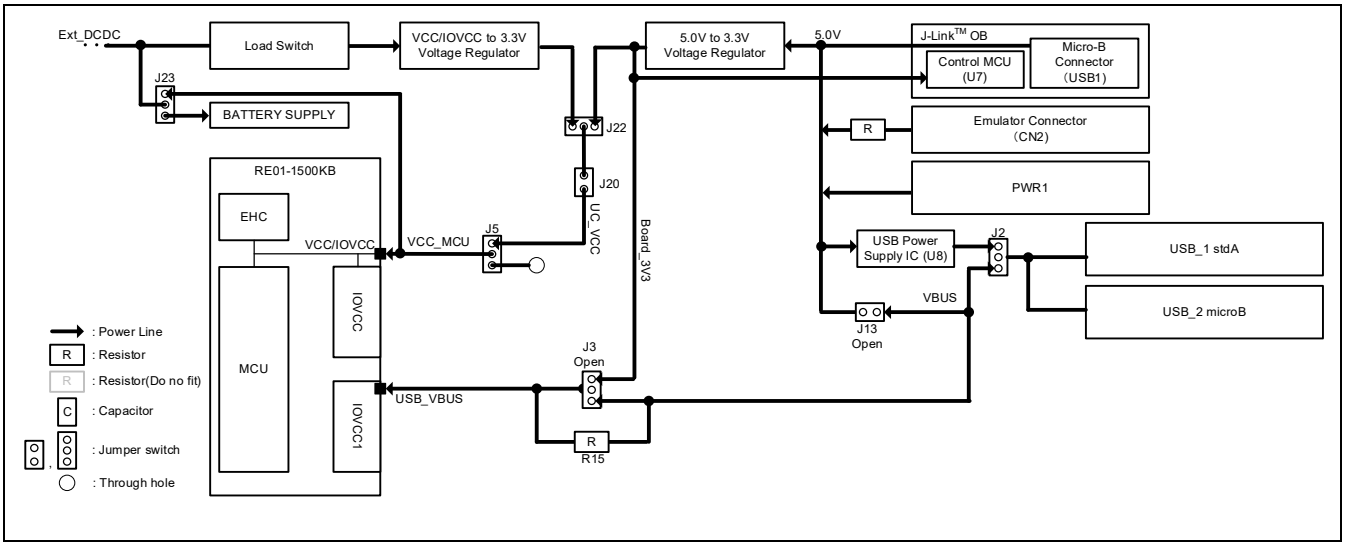
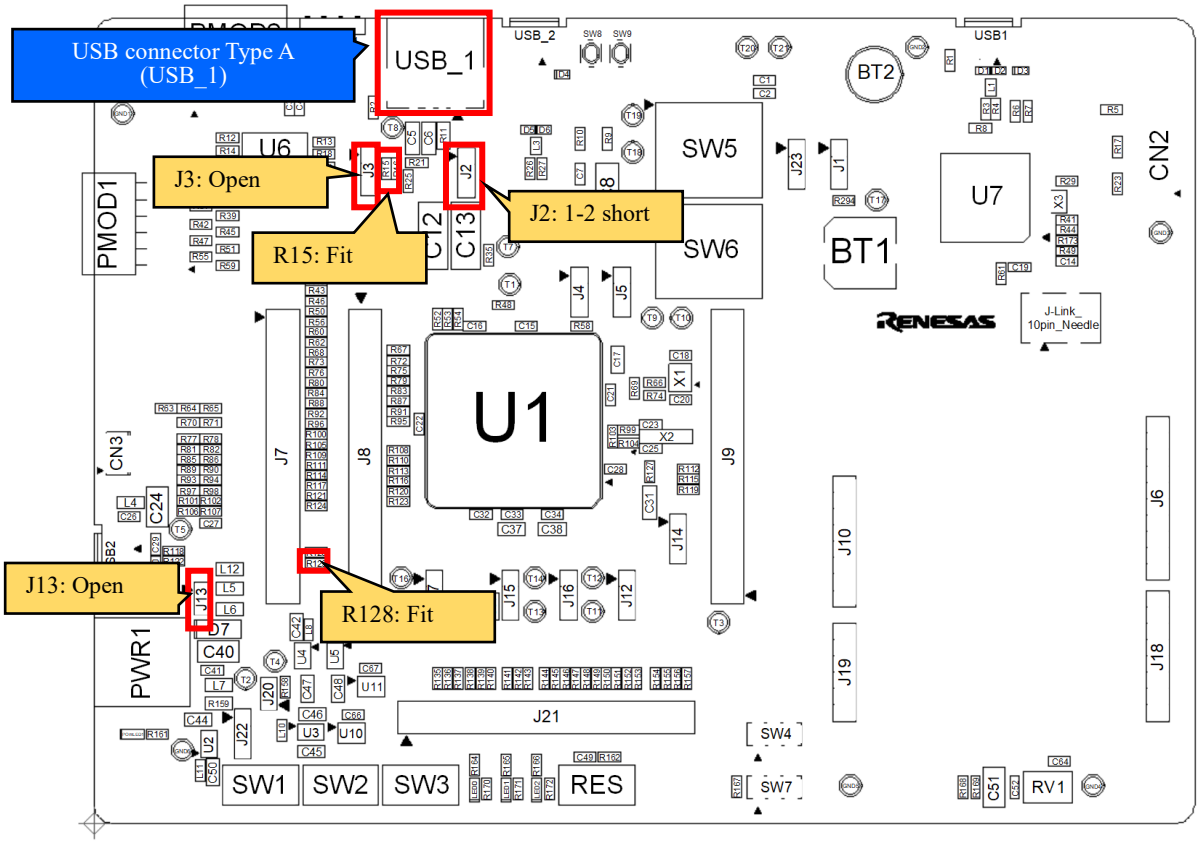


Figure 8-17: Block diagram of USB Host/Function Power line

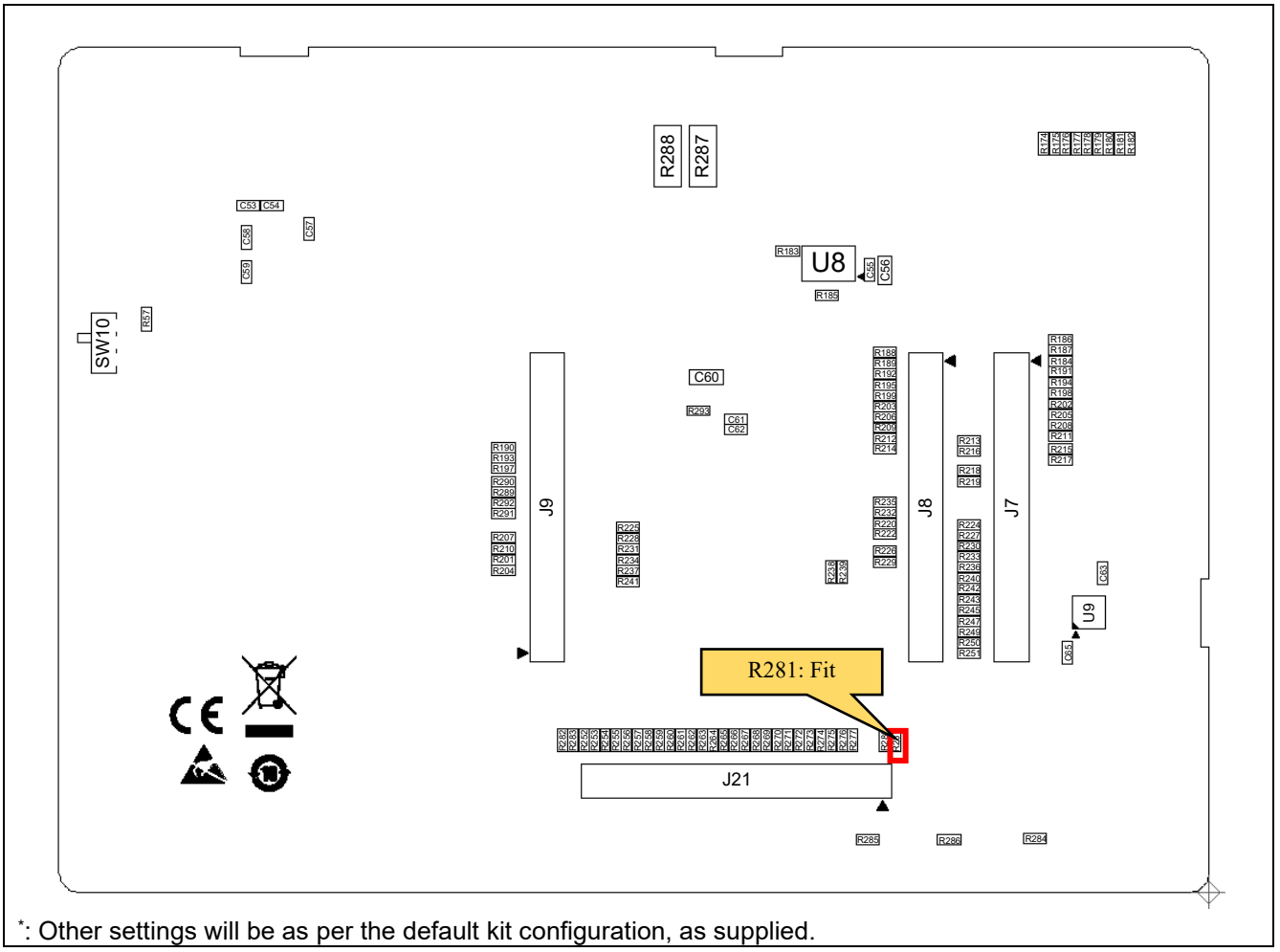
8.11.1 Host Controller Mode

To enable this functionality, several optional resistors must be in place and switch settings made. For details, see the settings in Figure 8-18, Figure 8-19 and Table 8-14. The default kit configuration, as supplied, will have these resistors in place and switches set as required.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-18: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-19: Component Layout (Bottom)

Table 8-14: Configuration Details

Reference	Position	Settings
R128, R281	Fit *1	-
R15	Fit *1	-
J2	1-2 short	Host Controller Mode
J3	Open *1	Self-powered
J13	Open *1	VBUS not used

*1: The default kit configuration, as supplied.

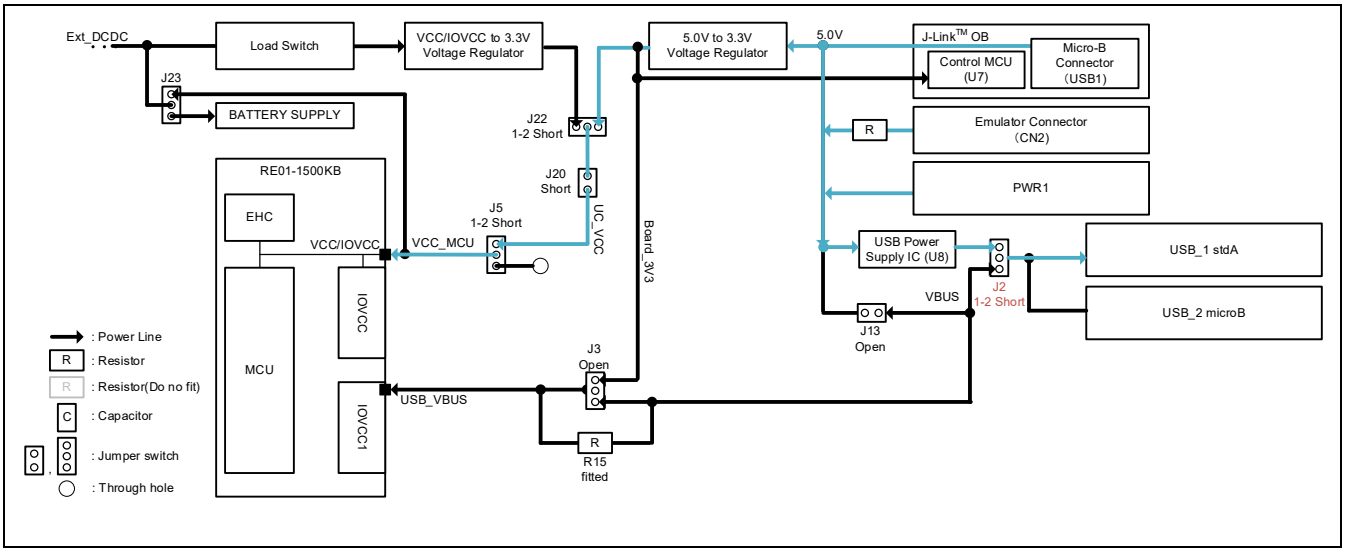
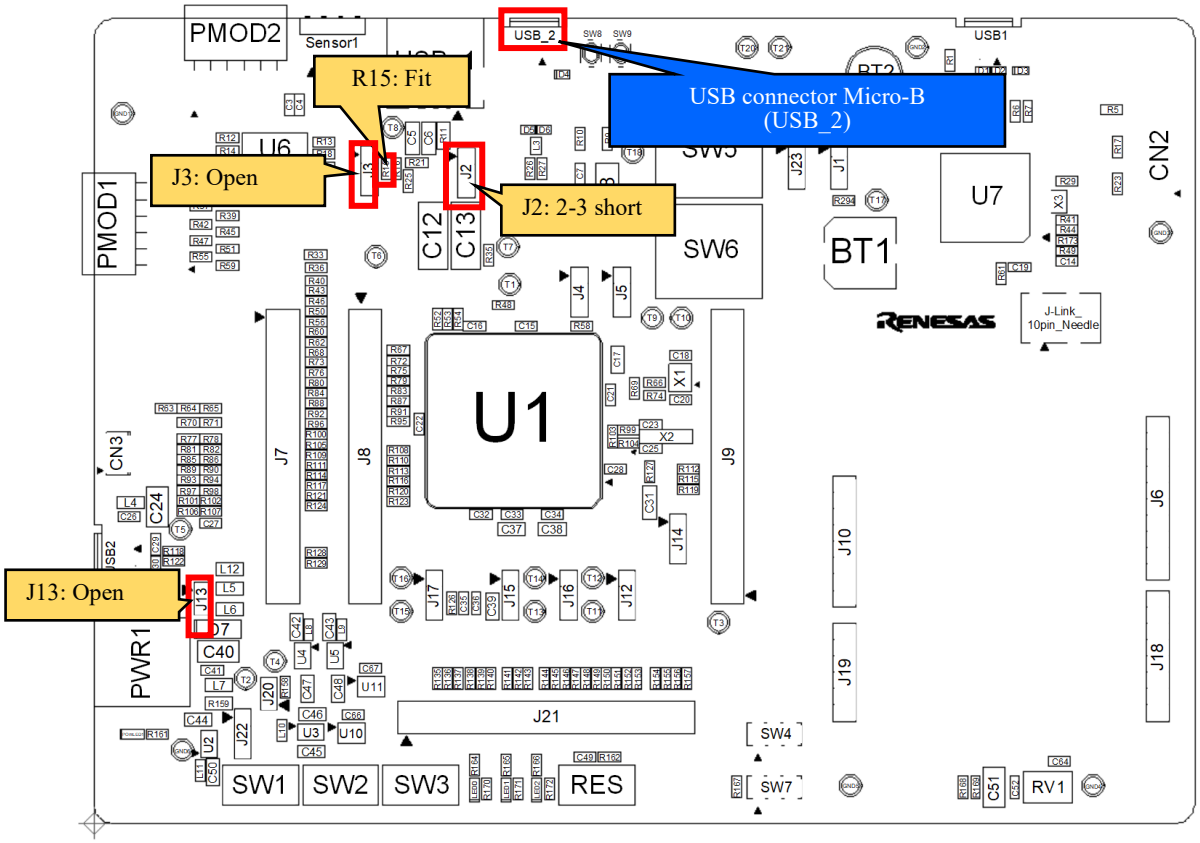


Figure 8-20: Block diagram of USB Host Power line

8.11.2 Function Controller Mode (Self Power)

To enable this functionality, several optional resistors must be in place and switch settings made. For details, see the settings in Figure 8-21 and Table 8-15. The default kit configuration, as supplied, will have these resistors in place and switches set as required.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-21: Component Layout

Table 8-15: Configuration Details

Reference	Position	Settings
R15	Fit	-
J2	2-3 short	Function Controller Mode
J3	Open	Self-powered
J13	Open	VBUS not used

The settings in the table above are supported in the default configuration, as supplied.

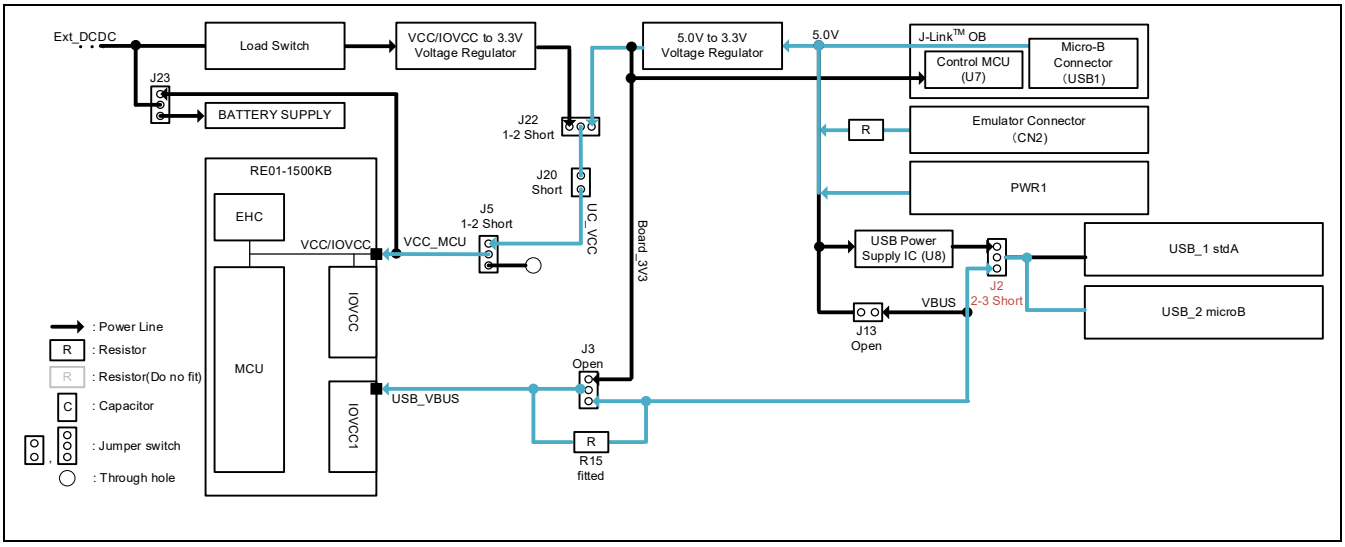
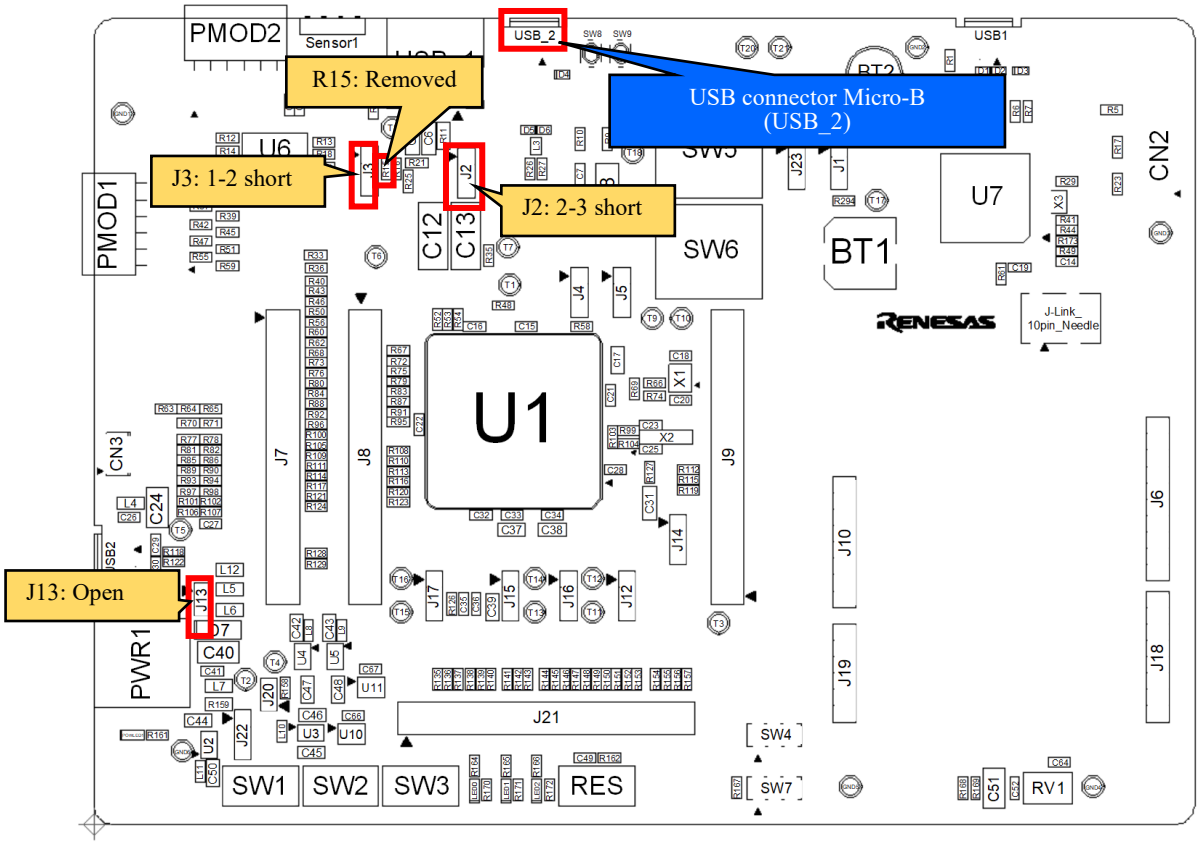


Figure 8-22: Block diagram of USB Function Power line (Self power)

8.11.3 Function Controller Mode (Bus Power)

By mounting Jumper J3, it is possible to use as bus-powered device.
To enable this functionality, several optional resistors must be in place and switch settings made. For details, see the settings in Figure 8-23 and Table 8-16.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-23: Component Layout

Table 8-16: Configuration Details

Reference	Position	Settings
R15	Removed	-
J2	2-3 short *1	Function Controller Mode
J3	1-2 short	Bus-powered
J13	Short	VBUS used

*1: The default kit configuration, as supplied.

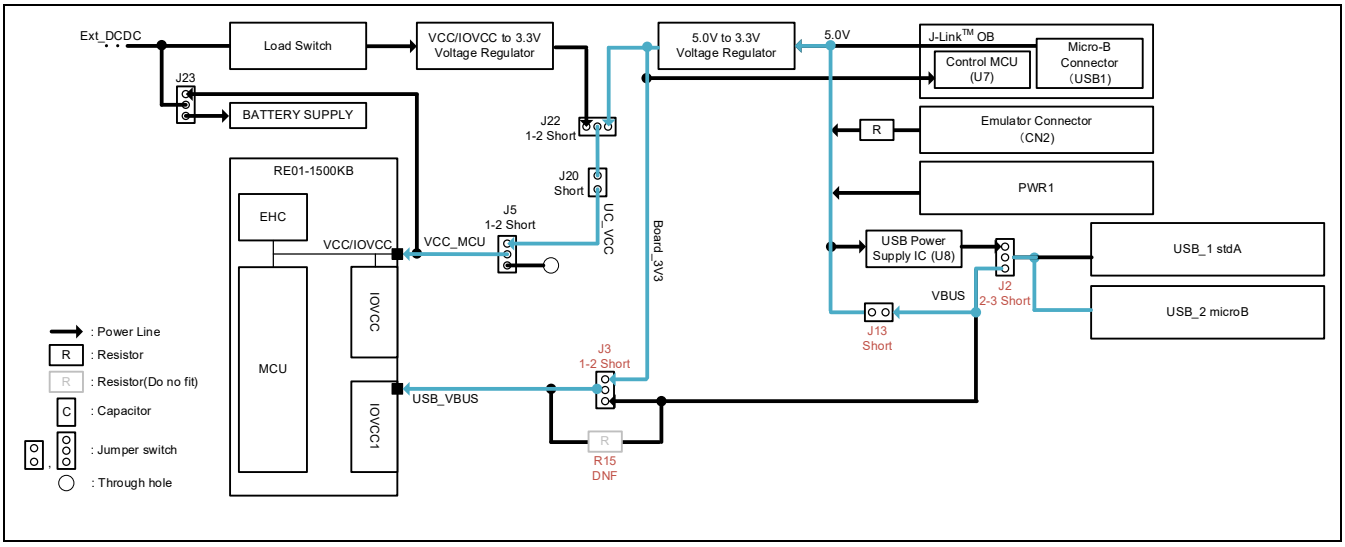
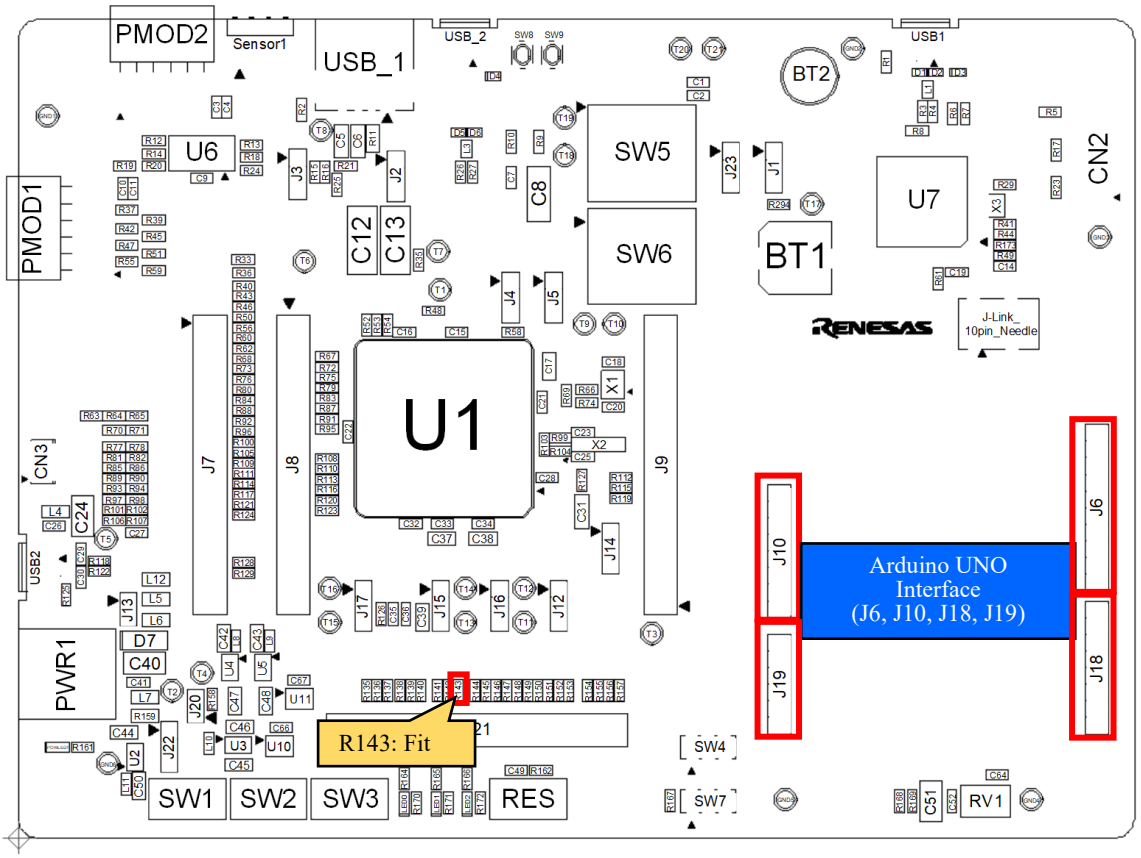


Figure 8-24: Block diagram of USB Function Power line (Bus power)

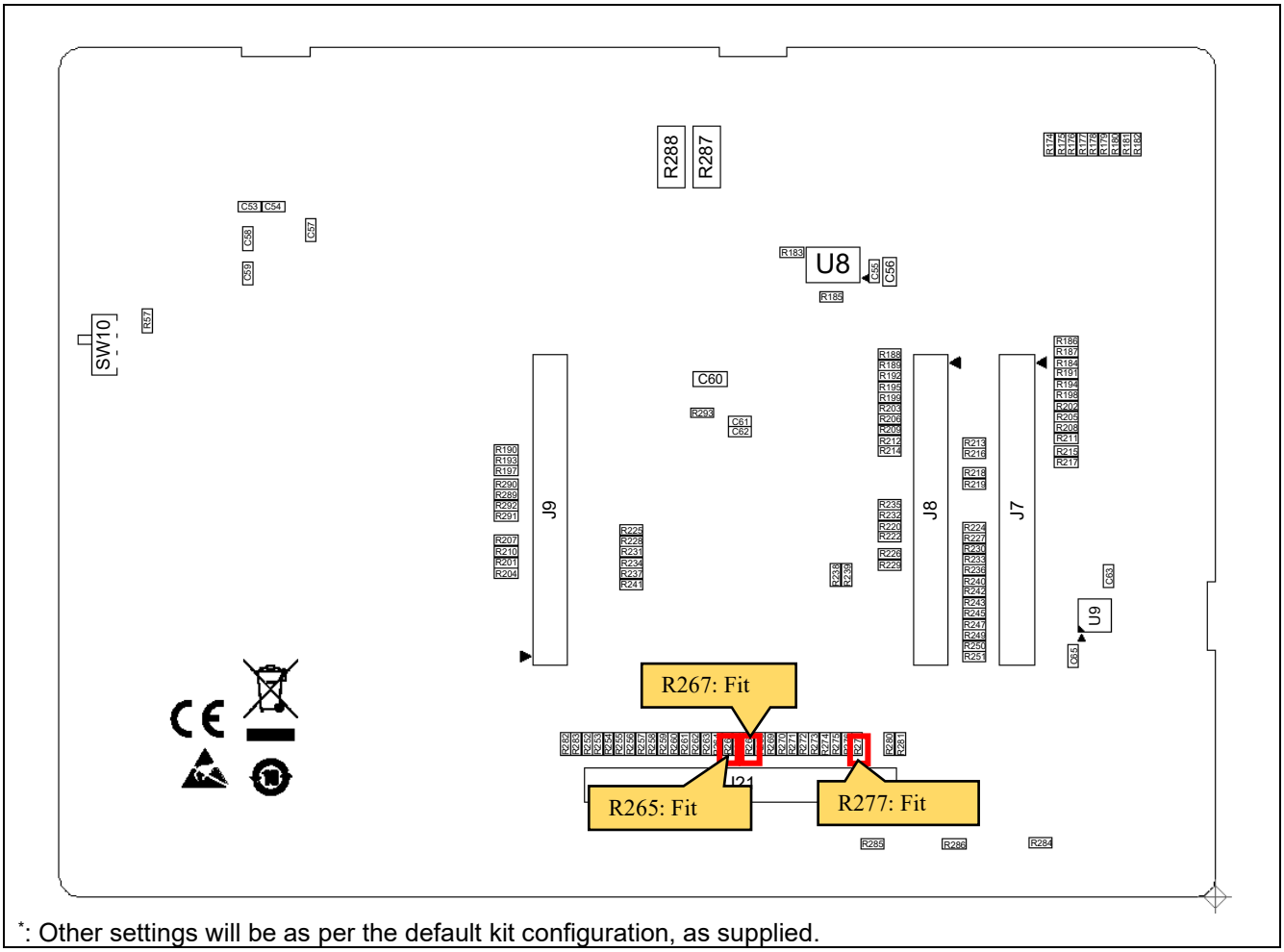
8.12 Arduino UNO Interface

This main board provides an Arduino UNO interface connector, to allow connection to 'Shields'. Figure 8-25 and Figure 8-26 shows the component layout, Table 8-17 shows details of settings, and Table 8-18, Table 8-19, Table 8-20 and Table 8-21 shows Arduino UNO interface connections.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-25: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-26: Component Layout (Bottom)

Table 8-17: Configuration Details

Reference	Setting
R143, R265, R267, R277	Fit

Table 8-18: Arduino UNO Interface Connections (1)

Arduino UNO Interface Connector (J6)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	ARDUINO-IO6	P702 (IOVCC1)	52	6	ARDUINO-RSPCKA_B*1	P011 (IOVCC3)	122
2	ARDUINO-IO7	P202 (IOVCC1)	49	7	GROUND	-	-
3	ARDUINO-SSLA0_B*1	P012 (IOVCC3)	121	8	VREFH0	- (VREFH0)	-
4	ARDUINO-MOSIA_B*1	P010 (IOVCC3)	123	9	ARDUINO-SDA1	P700 (IOVCC1)	54
5	ARDUINO-MISOA_B*1	P500 (IOVCC3)	115	10	ARDUINO-SCL1	P701 (IOVCC1)	53

*1: Is not connected in the default kit configuration, as supplied.

Table 8-19: Arduino UNO Interface Connections (2)

Arduino UNO Interface Connector (J10)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	NC	-	-	5	Board_5V	-	-
2	Board_5V	-	-	6	GROUND	-	-
3	ARDUINO-RESn	RES# (IOVCC)	34	7	GROUND	-	-
4	LP_PRODUCT_3V3	-	-	8	NC	-	-

Table 8-20: Arduino UNO Interface Connections (3)

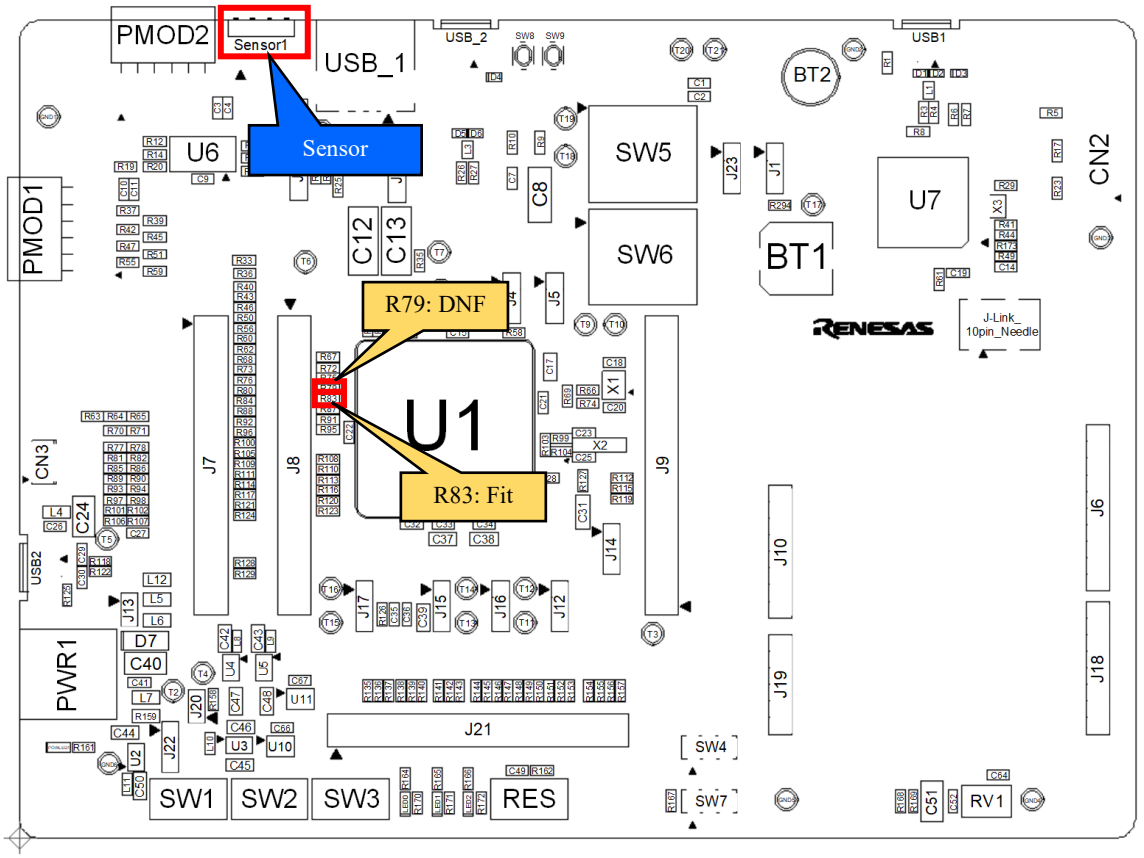
Arduino UNO Interface Connector (J18)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	ARDUINO-RXD5_B	P314 (IOVCC1)	56	5	ARDUINO-IO2	P806 (IOVCC0)	7
2	ARDUINO-TXD5_B	P315 (IOVCC1)	55	6	ARDUINO-IO3	P409 (IOVCC)	24
3	ARDUINO-IO0	P808 (IOVCC0)	5	7	ARDUINO-IO4	P304 (IOVCC1)	68
4	ARDUINO-IO1	P807 (IOVCC0)	6	8	ARDUINO-IO5	P305 (IOVCC1)	65

Table 8-21: Arduino UNO Interface Connections (4)

Arduino UNO Interface Connector (J19)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	ARDUINO-AN000	P000 (AVCC0)	136	4	ARDUINO-AN003	P003 (AVCC0)	132
2	ARDUINO-AN001	P001 (AVCC0)	135	5	ARDUINO-AN004	P004 (AVCC0)	131
3	ARDUINO-AN002	P002 (AVCC0)	133	6	ARDUINO-AN005	P005 (AVCC0)	130

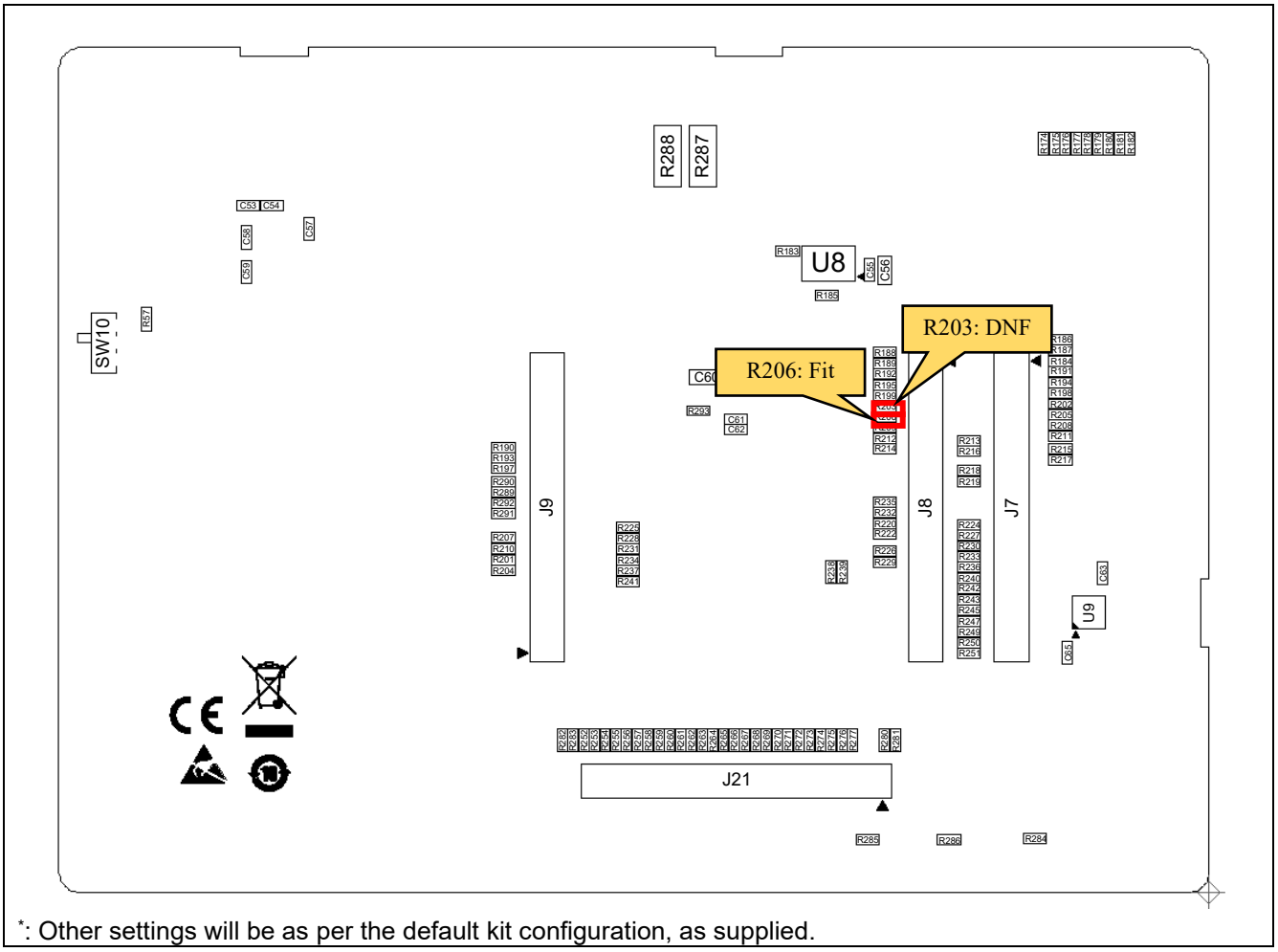
8.13 Sensor Board Interface

This main board has through-hole patterns that can be connected to the conventional sensor board with I2C interface. Figure 8-27 and Figure 8-28 shows the component layout, and Table 8-23 shows connections of sensor board interface.
To enable this functionality, several optional resistors must be in place and switch settings made. For details, see the settings in Figure 8-27, Figure 8-28 and Table 8-22.



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-27: Component Layout (Top)



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-28: Component Layout (Bottom)

Table 8-22: Configuration Details

Reference	Settings
R83, R206	Fit
R79, R203	DNF

Table 8-23: Sensor Board Interface Connections

Sensor Board Interface Connector (Sensor1)							
Pin	Signal name	RE01		Pin	Signal name	RE01	
		Port	Pin			Port	Pin
1	RIIC-SCL1*1	P701	53	5	GROUND	-	-
2	RIIC-SCL1*1	P701	53	6	GROUND	-	-
3	RIIC-SDA1*1	P700	54	7	LP_PRODUCT_3V3	-	-
4	RIIC-SDA1*1	P700	54	8	LP_PRODUCT_3V3	-	-

*1: Is not connected in the default kit configuration, as supplied.

8.14 External DCDC Circuit

Normally, the internal power supply of RE01 uses a built-in regulator (LDO). However, RE01 can enable an even lower power consumption by supplying power to the internal power supply from an external DCDC converter instead of the internal LDO. Figure 8-29 shows an overview of operation when using a built-in regulator, and Figure 8-30 shows an overview of operation when using an external DC / DC converter.
For external DC / DC, Renesas ISL9123 is mounted on the board and can be evaluated immediately.

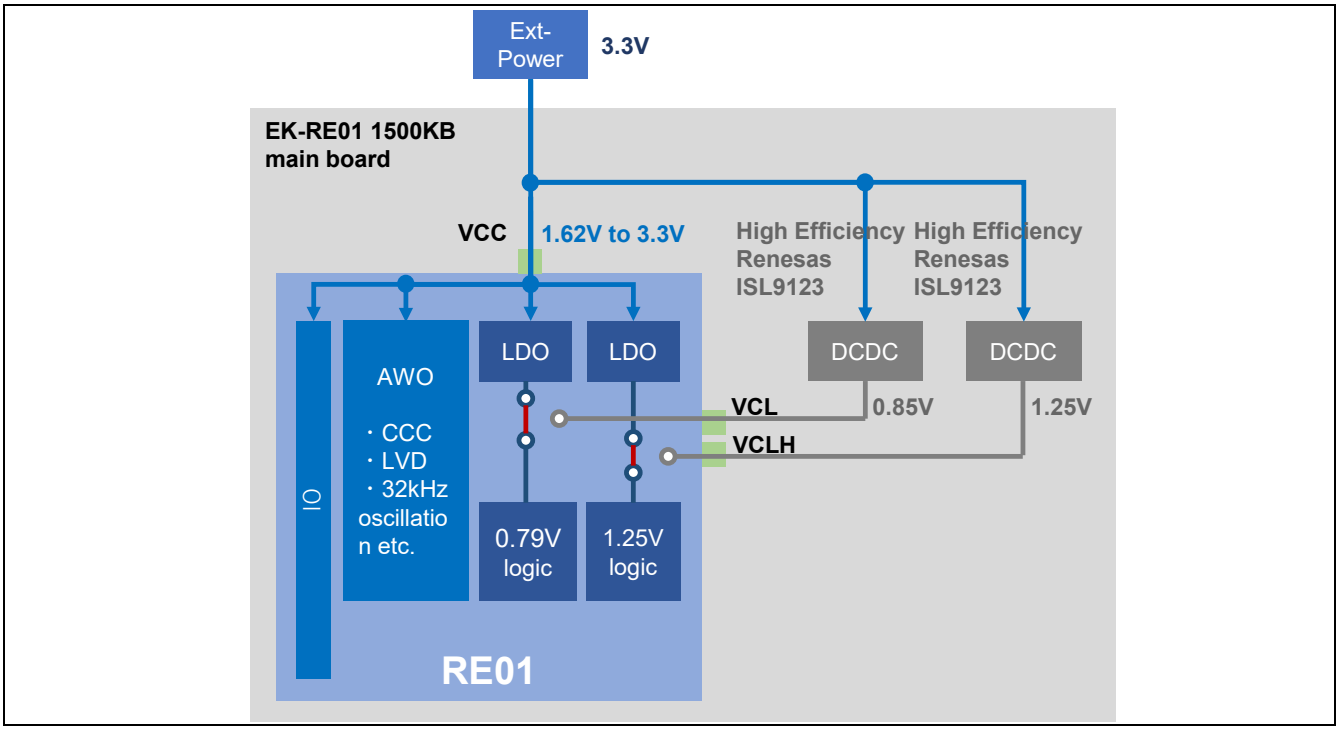


Figure 8-29: Overview of operation when using a built-in regulator

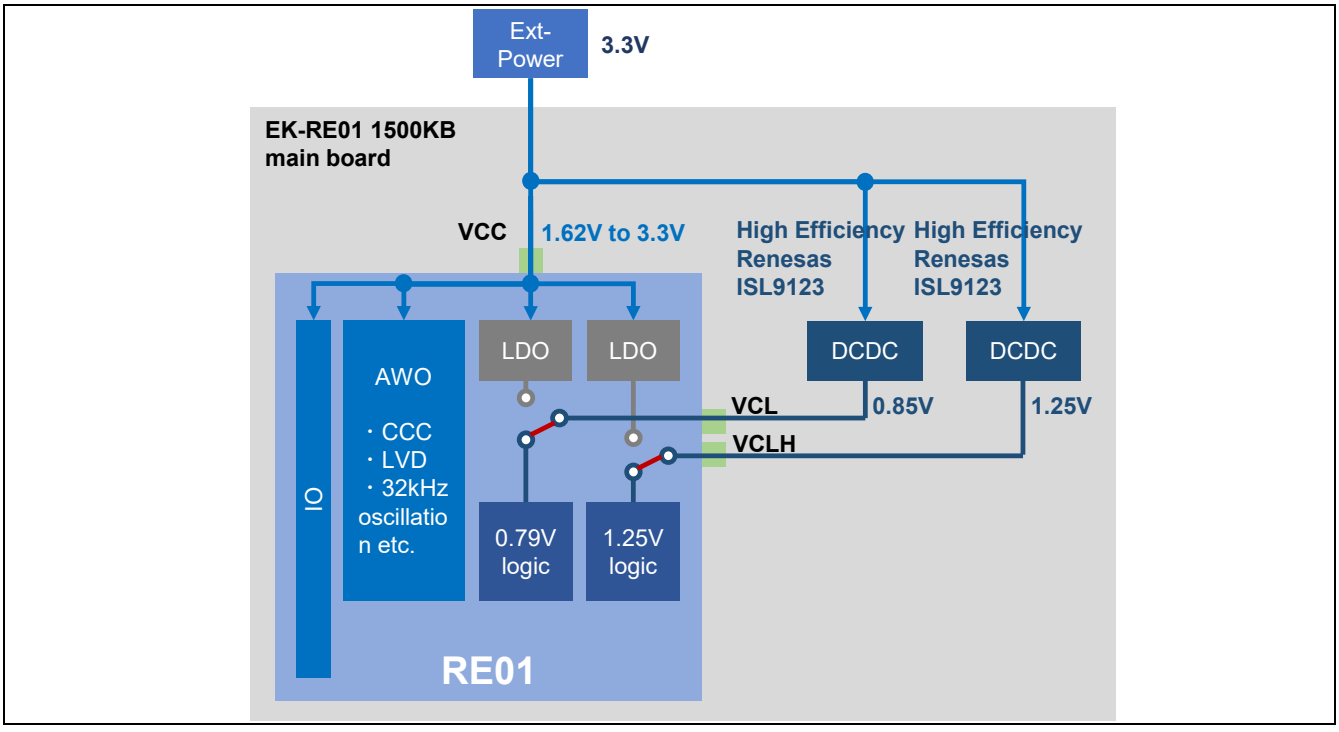
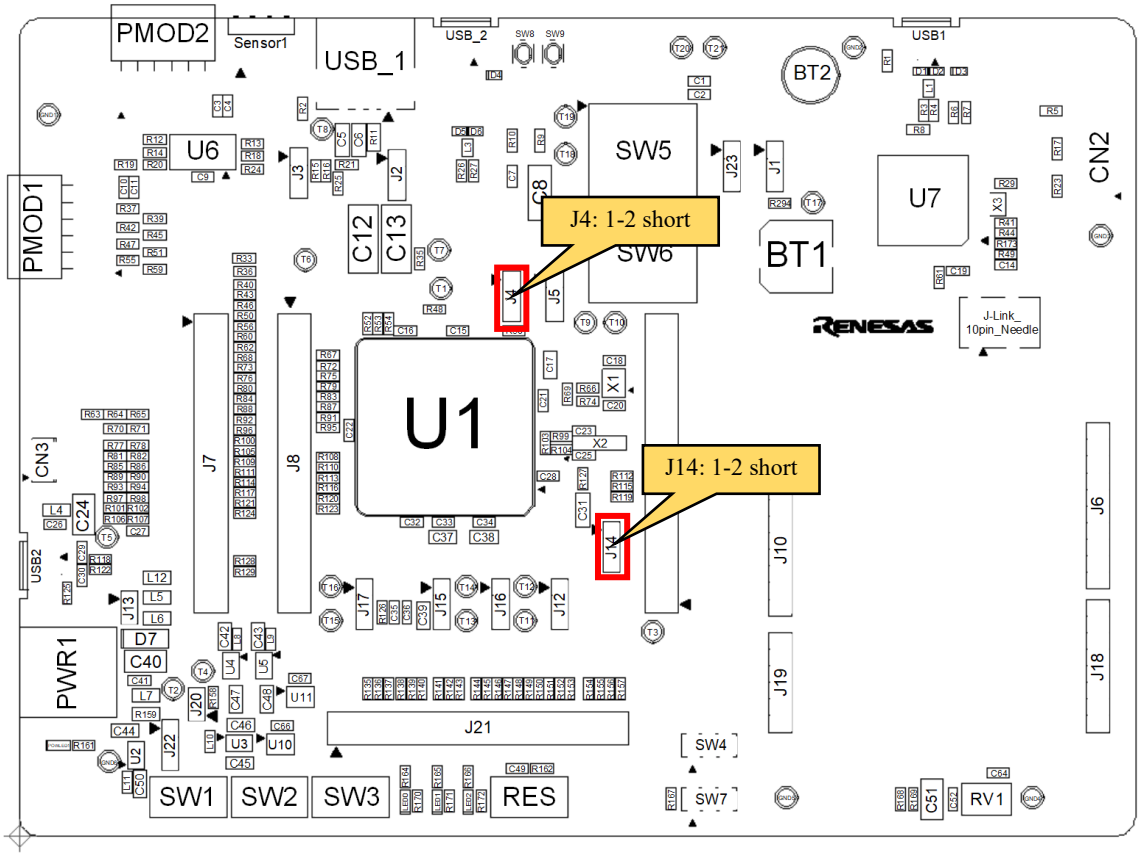


Figure 8-30: Overview of operation when using an external DC/DC converter

Figure 8-31 shows the component layout. To enable this functionality, several optional resistors must be in place and switch settings made. For details, see the settings in Figure 8-31, Table 8-24. For details on the usage and benefits of external DC / DC, refer to the application note " RE01 1500KB Group How to reduce power consumption by using the external DC/DC converter " (R01AN5364).



*: Other settings will be as per the default kit configuration, as supplied.

Figure 8-31: Component Layout

Table 8-24: Configuration Details

Reference	Position	Settings
J4, J14	1-2 short	Built-in LDO not use (External DCDC use)

9.Headers

9.1 RE01 Headers

This main board has RE01 headers, which can be used to observe general purpose ports of RE01.
Table 9-1 shows connections of RE01 header J9, Table 9-2 shows connections of RE01 header J7, Table 9-3 shows connections of RE01 header J8, and Table 9-4 shows connections of the RE01 header J21.

Table 9-1: RE01 Header J9 Connections

RE01 Header J9					
Pin	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**	**Pin**	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**
1	3.3V Board_3V3	-	2	5.0V Board_5V	-
3	P810 J9-P810	1	4	P809 J9-P809	4
5	P808 J9-P808	5	6	P807 J9-P807	6
7	P806 J9-P806	7	8	P805 J9-P805	8
9	P804 J9-P804	9	10	P803 J9-P803	10
11	P802 J9-P802	11	12	P801 J9-P801	12
13	P800 J9-P800	13	14	P411 J9-P411	22
15	P410 J9-P410	23	16	P409 J9-P409	24
17	P408 J9-P408	25	18	P407 J9-P407	26
19	P406 J9-P406	27	20	P405 J9-P405	28
21	P404 J9-P404	29	22	P207 J9-P207	33
23	RES# J9-RESn	34	24	P200 J9-P200	36
25	Reserved NC	NC	26	P205 J9-P205	46
27	Reserved NC	NC	28	Reserved NC	NC
29	Reserved NC	NC	30	Reserved NC	NC
31	Reserved NC	NC	31	Reserved NC	NC
33	Reserved NC	NC	34	Reserved NC	NC
35	GND GROUND	-	36	GND GROUND	-

Table 9-2: RE01 Header J7 Connections

RE01 Header J7					
Pin	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**	**Pin**	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**
1	P610 J7-P610	73	2	P609 J7-P609	74
3	P608 J7-P608	75	4	P607 J7-P607	76
5	P606 J7-P606	77	6	P605 J7-P605	78
7	P604 J7-P604	79	8	P603 J7-P603	80
9	P602 J7-P602	81	10	P601 J7-P601	82
11	P600 J7-P600	83	12	P113 J7-P113	84
13	P112 J7-P112	85	14	P111 J7-P111	86
15	P110 J7-P110	87	16	P109 J7-P109	88
17	P108 J7-P108	89	18	P107 J7-P107	92
19	P106 J7-P106	93	20	P105 J7-P105	94
21	P104 J7-P104	95	22	P103 J7-P103	96
23	P102 J7-P102	97	24	P101 J7-P101	98
25	P100 J7-P100	99	26	Reserved NC	100
27	P514 J7-P514*1	101	28	P513 J7-P513*1	102
29	P512 J7-P512*1	103	30	P511 J7-P511	104
31	P510 J7-P510	105	31	P509 J7-P509	106
33	P508 J7-P508	107	34	P507 J7-P507	108
35	GND GROUND	-	36	GND GROUND	-

*1: When using as an output port, attach a pull-up resistor.

Table 9-3: RE01 Header J8 Connections

RE01 Header J8					
Pin	Function (General IO port/Power) Circuit Net Name	RE01 Pin	Pin	Function (General IO port/Power) Circuit Net Name	RE01 Pin
1	3.3V Board_3V3	-	2	5.0V Board_5V	-
3	P204 J8-P204	47	4	P203 J8-P203	48
5	P202 J8-P202	49	6	P704 J8-P704	50
7	P703 J8-P703	51	8	P702 J8-P702	52
9	P701 J8-P701	53	10	P700 J8-P700	54
11	P315 J8-P315	55	12	P314 J8-P314	56
13	P313 J8-P313	57	14	P312 J8-P312	58
15	P311 J8-P311	59	16	P310 J8-P310	60
17	P309 J8-P309	61	18	P308 J8-P308	62
19	P307 J8-P307	63	20	P306 J8-P306	64
21	P305 J8-P305	65	22	P304 J8-P304	68
23	P303 J8-P303	69	24	P302 J8-P302	70
25	P301 J8-P301	71	26	P300 J8-P300	72
27	Reserved NC	NC	28	Reserved NC	NC
29	Reserved NC	NC	30	Reserved NC	NC
31	Reserved NC	NC	31	Reserved NC	NC
33	Reserved NC	NC	34	Reserved NC	NC
35	GND GROUND	-	36	GND GROUND	-

Table 9-4: RE01 Header J21 Connections

RE01 Header J21					
Pin	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**	**Pin**	**Function (General IO port/Power)** **Circuit Net Name**	**RE01 Pin**
1	3.3V Board_3V3	-	2	5.0V Board_5V	-
3	P506 J21-P506	109	4	P505 J21-P505	110
5	P504 J21-P504	111	6	P503 J21-P503	112
7	P502 J21-P502	113	8	P501 J21-P501	114
9	P500 J21-P500	115	10	P015 J21-P015	118
11	P014 J21-P014	119	12	P013 J21-P013	120
13	P012 J21-P012	121	14	P011 J21-P011	122
15	P010 J21-P010	123	16	P009 J21-P009	125
17	P008 J21-P008	126	18	P007 J21-P007	127
19	P006 J21-P006	129	20	P005 J21-P005	130
21	P004 J21-P004	131	22	P003 J21-P003	132
23	P002 J21-P002	133	24	P001 J21-P001	135
25	P000 J21-P000	136	26	P815 J21-P815	140
27	P814 J21-P814	141	28	P813 J21-P813	142
29	P812 J21-P812	143	30	P811 J21-P811	144
31	Reserved NC	NC	31	Reserved NC	NC
33	Reserved NC	NC	34	Reserved NC	NC
35	GND GROUND	-	36	GND GROUND	-

10. Code Development

10.1 Overview

There are several ways to debug the program code for this device:

- Connect Main Board to PC through IAR development tool I-jet emulator
- Connect Main Board to PC through Segger development tool J-Link OB that is designed on Main Board
- Connect Main Board to PC through Segger development tool J-Link emulator
- Connect Main Board to PC through Renesas development tool E2 emulator and E2 emulator Lite.

Refer to the manufacturer's website for more details about each emulator.

10.2 Mode Support

This Evaluation Kit supports Normal Operation Mode / Energy Harvest Operation Mode and Boot Modes (SCI and USB). The settings related to modes change are described in §5 and 6. Refer to “RE01 Group User’s Manual: Hardware” for detailed information about RE01 operating modes and registers.

Only change the RE01 operating mode when the Evaluation Kit is in reset or turned off; otherwise the RE01 may be damaged.

10.3 Address Space

For the RE01 address space details, refer to the ’Address Space’ section of “RE01 Group User’s Manual: Hardware”.

11. Additional Information

Technical Support

For information about the RE01 refer to the RE01 Group User's Manual: Hardware.

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REVISION HISTORY	RE01 Group Evaluation Kit RE01 1500KB User's Manual

Rev.	Date	Description	
		Page	Summary
1.00	Jun 26, 2019	-	First Edition issued.
2.00	Aug 04, 2020	-	Renewal of configuration
2.01	Dec 15, 2020	9	Added Chapter 1.2 Kit Contents
		10	Added the part number of MIP-LCD to Table 1-2
			Added notes
		15	Added the default kit configuration to Figure 2-2
		16	Modified the description about J23 in Table 2-3
		22	Modified the Block Diagram Figure 3-1
		23 - 25	Added the lists of connections
		26	Modified Figure 4-1 Power Supply System Diagram
		28 - 32	Change the structure of Section 4.3
		33 - 65	Detailed description of settings throughout Chapter 5.
			Added signal line diagrams and power supply diagrams to each section
		47	Modified the E2 connection diagram in Section 5.3.2
		53	Modified the title of Section 5.4.2
		58	Added Section 5.4.3 RFP (USB Boot)
		62	Added Section 5.5 Segger J-Flash
			Added Section 5.6 Emulator connection in EHC mode
		67	Modified the description about J23 in Table 6-2 EHC operation setting
		68	Added the signal line and the power line diagrams in the EHC operation
		72	Added Section 6.2.4 Power supply selection in the EHC operation
		75	Added Section 7.2 Current measurement when not using on-board 3.3V regulator
		76	Added Section 7.3 Current measurement during EHC operation
		97 – 104	Added the power line diagrams in each settings of Section 8.11
		105	Added the power domain to Arduino connection lists Table 8-18 to Table 8-21
		110	Added the block diagram to Section 8.14 External DCDC Circuit
2.02	Mar. 4, 2022		Chapter 5.3.1, Corrected errors in changing settings when debugging with E2
			Chapter 5.4.1, Corrected errors in changing settings when using RFP with E2
			Chapter 8.8, Added settings for using USB-UART IC.

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