User's Manual

32

# RE01 Group

## Evaluation Kit RE01 256KB (EK-RE01 256KB)

## User's Manual

RE Family／RE0 Series



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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.Objective and Target Users

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 256KB. 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 RE01 256KB User's Manual | R20UT4801EJ (This manual) |
| Quick Start Guide | Provides simple instructions setup the Evaluation Kit for RE01 256KB and run the first sample. | Evaluation Kit RE01 256KB Quick Start Guide | R20UT4808EJ |
| Schematics | Full detail circuit schematics of the Evaluation Kit Main Board. | Evaluation Kit RE01 256KB main board schematics | R20UT4802EJ |
| Schematics | Full detail circuit schematics of the MIP-LCD Expansion Board. | MIP-LCD expansion board schematics | R20UT4564EJ |
| Hardware Manual | Provides technical details of the RE01 device. | RE01 Group Products with 256-Kbyte Flash Memory User's Manual: Hardware RE01 | R01UH0894JJ |

## 2. List of Abbreviations and Acronyms

| Abbreviation | Full Form |
|---|---|
| BLE | Bluetooth Low Energy |
| DNF | Do Not Fit |
| E2 | Renesas On-chip Debugging Emulator |
| EH | Energy Harvesting |
| EHC | Energy Harvesting Control Circuit |
| EMC | Electromagnetic Compatibility |
| ESD | Electrostatic Discharge |
| FPC | Flexible Printed Circuits |
| I-jet™ | IAR System® JTAG Emulator |
| J-Link™ | SEGGER debug probe |
| J-Link™ OB | SEGGER On-board debug probe |
| IRQ | Interrupt Request |
| LDO | Low Dropout |
| LED | Light Emitting Diode |
| MIP-LCD | Memory In Pixel - Liquid Crystal Display |
| MLCD | Memory In Pixel - Liquid Crystal Display |
| n/c (NC) | Not Connected |
| PC | Personal Computer |
| Pmod™ | This is a Digilent Pmod™ Compatible connector. Pmod™ is registered to Digilent Inc.<br>Digilent-Pmod_Interface_Specification |
| RAM | Random Access Memory |
| RFP | Renesas Flash Programmer |
| SCI | Serial Communications Interface |
| SPI | Serial Peripheral Interface |
| USB | Universal Serial Bus |

# 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.: RTK70E0118C00001BJ |
| 2 | MIP-LCD Expansion board | Part No.: RTK70E015DB00000BJ |
| 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 Specifications

Board specifications are shown in **Table 1-2、Table 1-3.**

**Table 1-2: Board Specifications**

| Item | Specifications |
|---|---|
| Target Device | Part No.: R7F0E01182CFP |
| | Package: 100-pin LFQFP |
| | On-chip memory: ROM 256KB, RAM 128KB |
| On-Board Memory | SPI Serial Flash: 64Mbit |
| Input Clock | RE01 Main: 32MHz |
| | RE01 Sub: 32.768kHz |
| Power Supply | Debugger: 5V Input |
| | Power Supply IC: 5V Input, 3.3V Output |
| | Power Supply IC: 2.6V Input, 3.3V Output (For peripheral circuit power supply when using energy harvesting function) |
| | Power Supply IC: 2.6V or 3.3V Input, 1.25V Output (external DC/DC) |
| | Power Supply IC: 2.6V or 3.3V Input, 0.85V Output (external DC/DC) |
| Debug Interface*1 | I-jet™ / J-Link™ / E2 20-pin box header |
| | USB Connector for J-Link™ OB |
| Slide Switch | Operation Mode Configuration: double-pole, double-throw x 4 |
| | Start-up Mode Configuration: single-pole, double-throw x 2 |
| | Internal LDO Configuration: double-pole, single-throw x 2 |
| Push Switch | Reset Switch x 1 |
| | User Switch x 2 |
| | Discharge Switch x 2 |
| LED | Power Indicator: (Green) x 1 |
| | For users: (Orange) x 1, (Red) x 1 |
| | J-Link™ OB Power Indicator: (Green) x 1 |
| MLCD | FPC Connector: 0.3mm pitch,19 pin x 1 |
| | MIP-LCD*5: TN0104ANVAANN-GN00(KYOCERA) |
| USB Serial Converter Interface | Connector: USB-MicroB |
| | Driver: USB Interface IC (Part No. FT230XQ) |
| MIP-LCD Expansion Board Interface *2 | 2.54mm pitch: 12 pin x 1(PMOD1) |
| Pmod™ | PMOD1 *2: Angle type、12-pin connector |
| External Battery Interface | 3.5mm pitch: 2 pin x 1*3 |
| 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: 50 pin x 2 (J7, J8, J9, J21) |

*1: Use each debugger exclusively. When using J-Link OB, do not connect to other emulators. When using another emulator, do not connect to J-Link OB.
*2: PMOD1 is used both for MIP-LCD Expansion Board and Pmod™.
*3: The external battery is not included in this product.
*4: The connector is not included in this product.
*5: The MIP-LCD is not included in this product.

**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.

## 1.4 Board Exterior

The exterior of Evaluation Kit RE01 256KB is shown in this chapter. **Figure 1-1** and **Figure 1-2** show the exterior of the main board. **Figure 1-3** and **Figure 1-4** show the exterior of MIP-LCD expansion board.

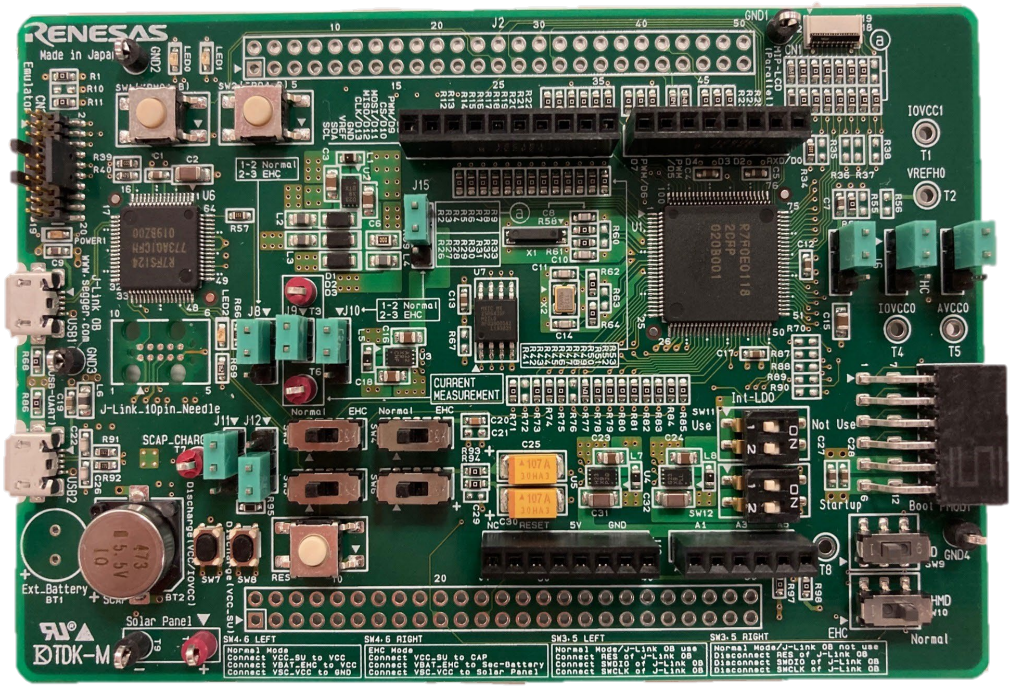



**Figure 1-1: Main Board (Top)**

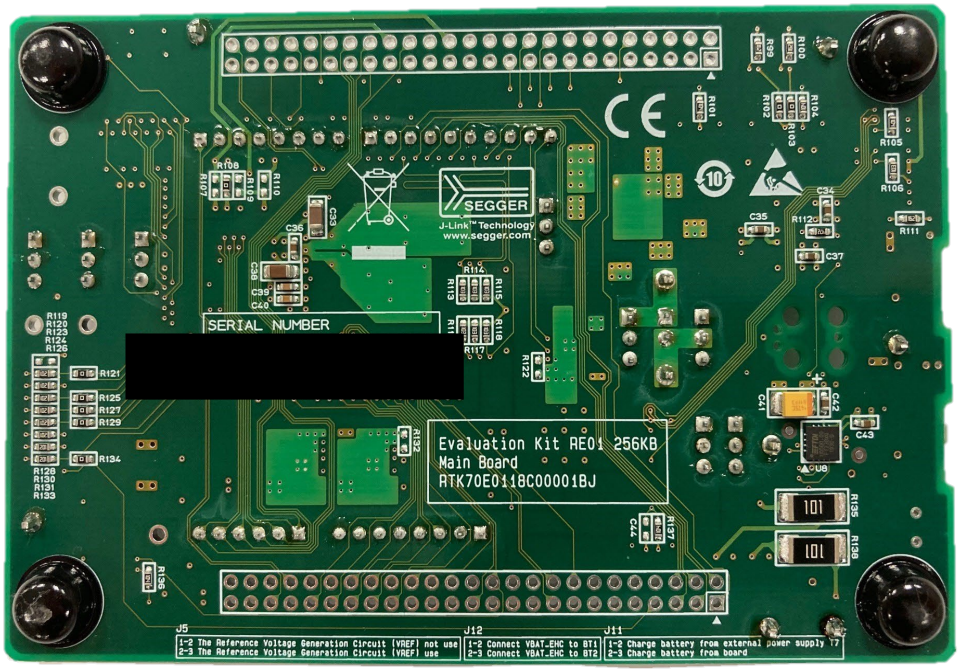



**Figure 1-2: Main Board (Bottom)**


**Figure 1-3: MIP-LCD Expansion Board (Top)**


**Figure 1-4: MIP-LCD Expansion Board (Bottom)**

# 2. Board Layout

## 2.1 Component Layout

The component layout of Evaluation Kit are shown in **Figure 2-1** and **Figure 2-2.**

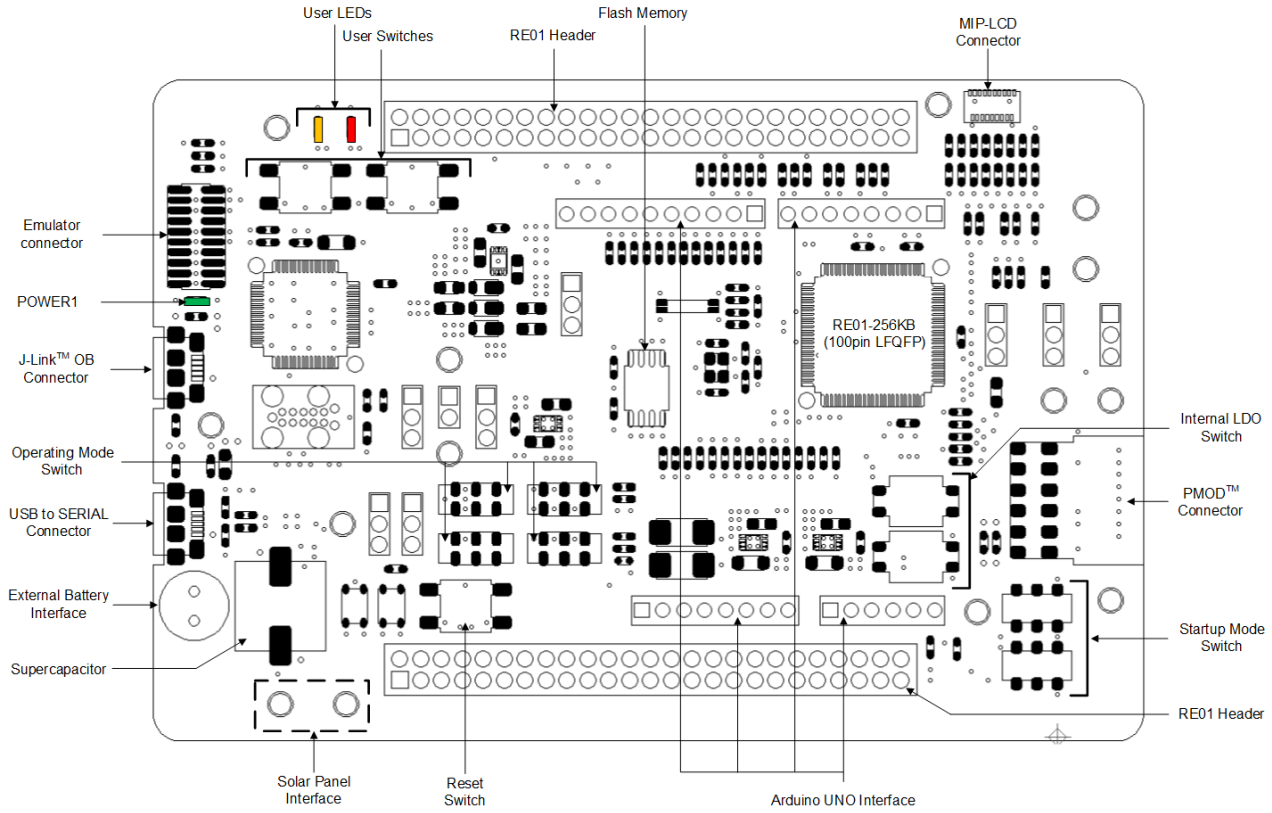



**Figure 2-1: Main Board Layout**

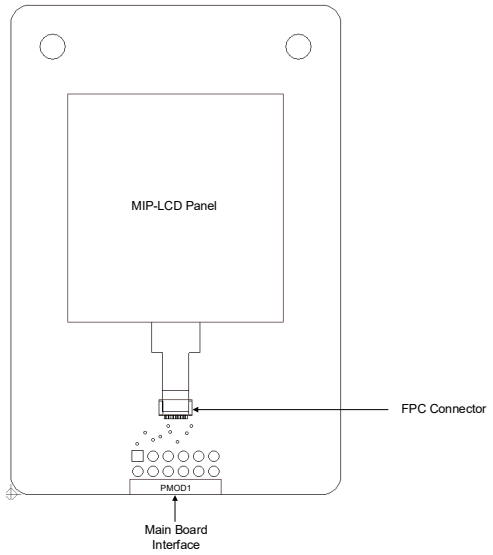



**Figure 2-2: MIP-LCD Expansion Board Layout**

## 2.2 Board Dimensions

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

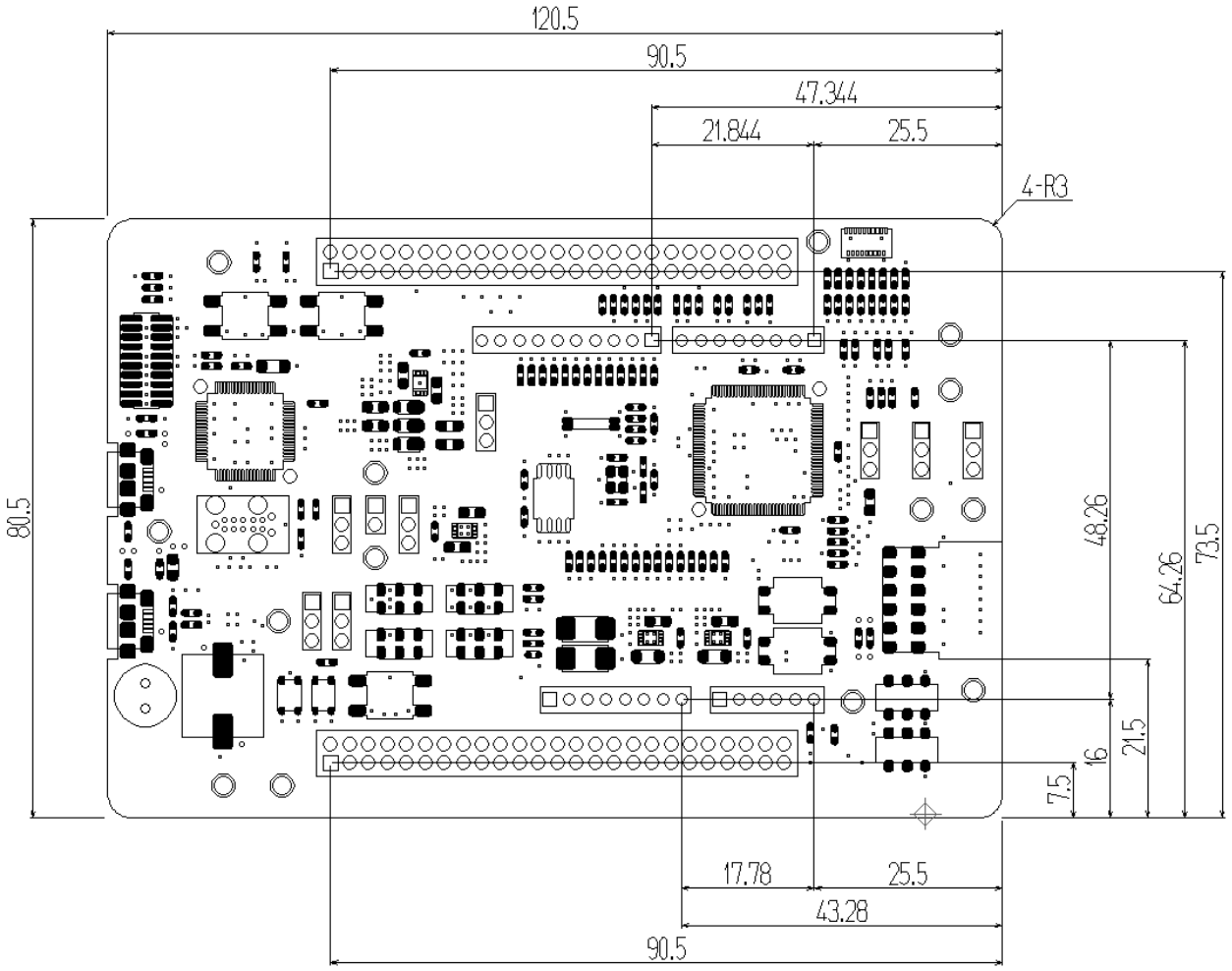



**Figure 2-3: Main Board Dimensions (Unit: mm)**

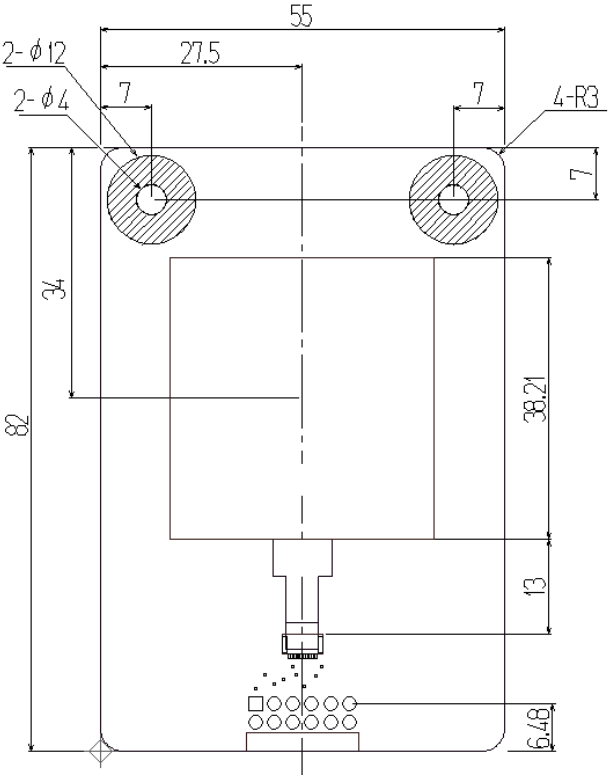



**Figure 2-4: MIP-LCD Expansion Board Dimension (Unit: mm)**

## 2.3 Component Placement

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

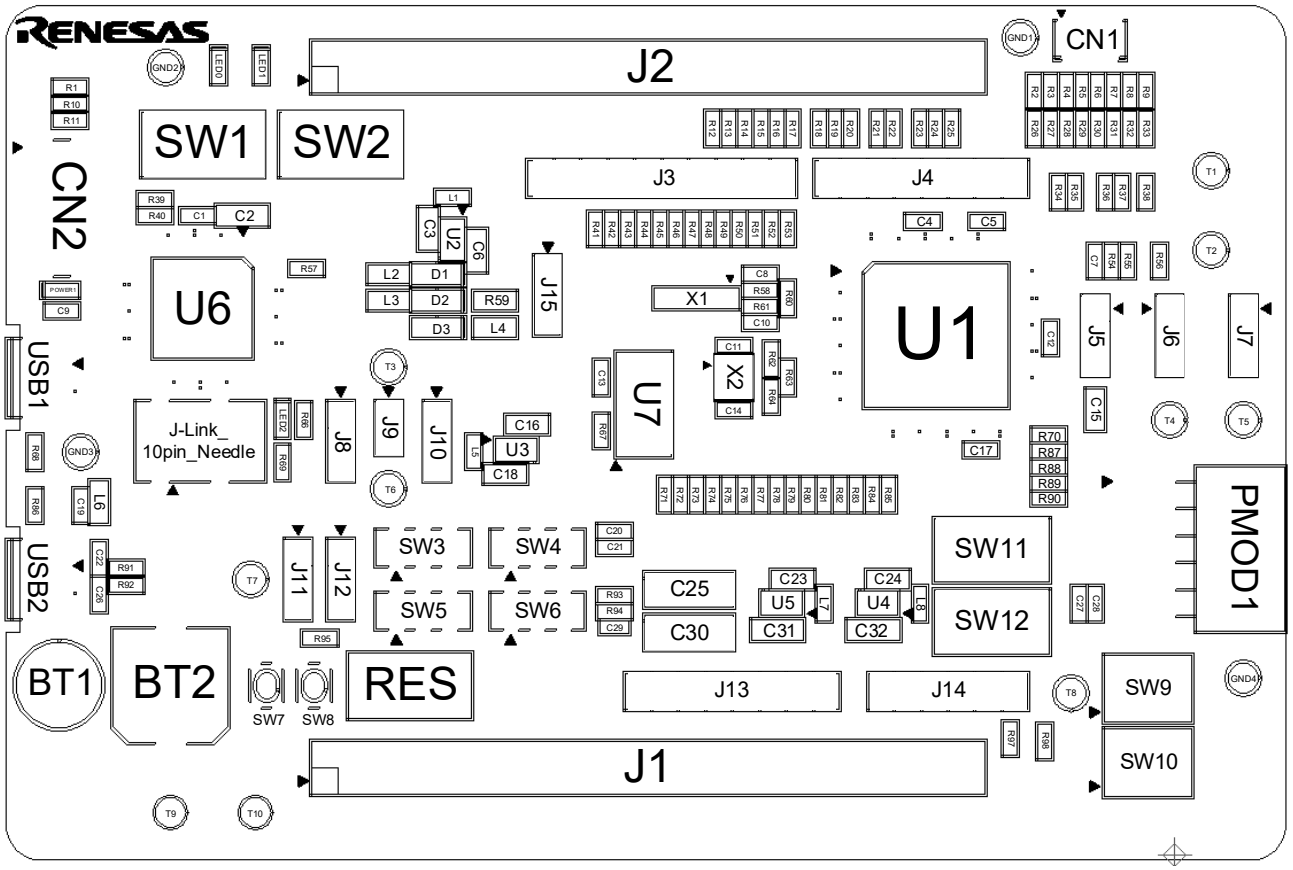



**Figure 2-5: Main Board Component Placement (Top-Side View)**

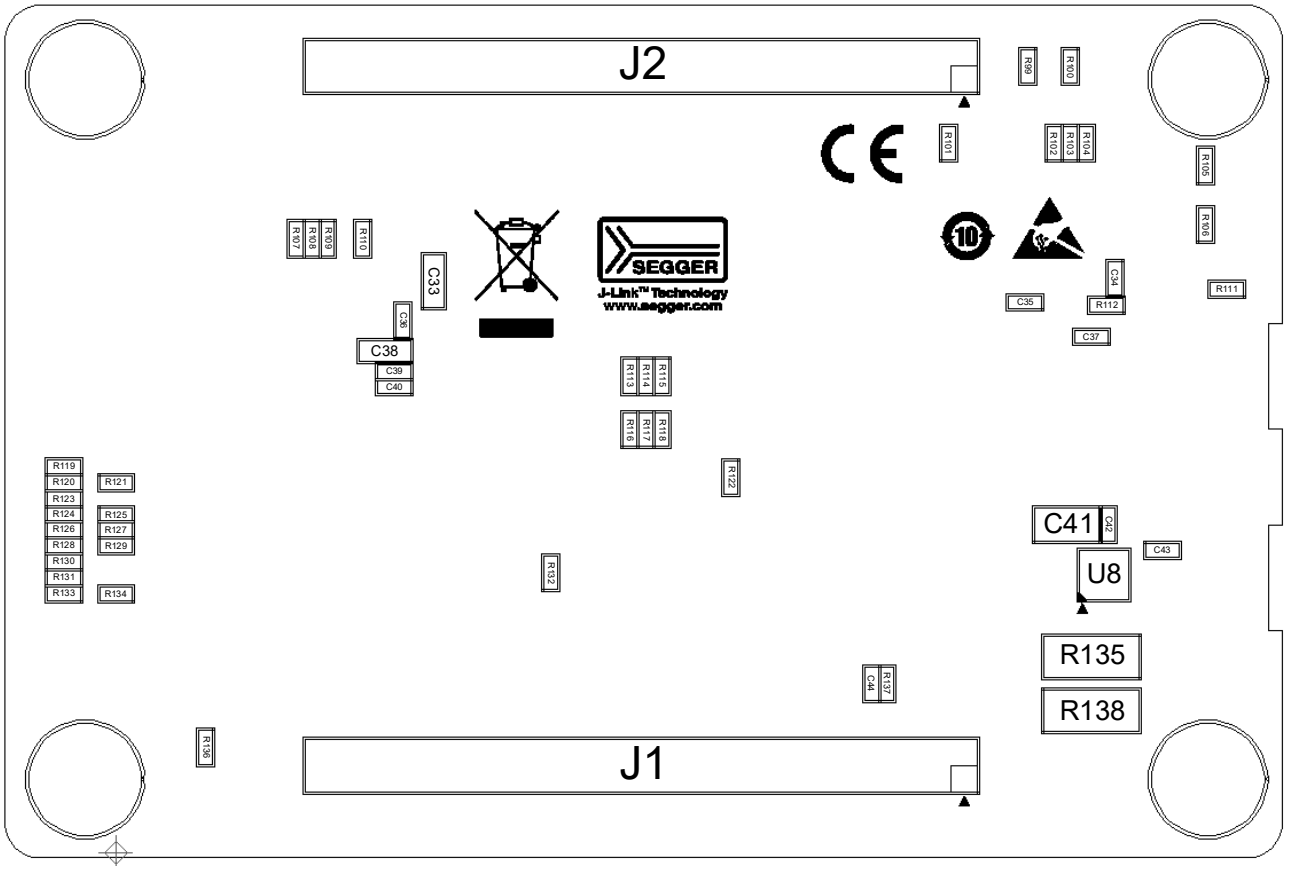



**Figure 2-6**: **Main Board Component Placement (Bottom-Side View)**

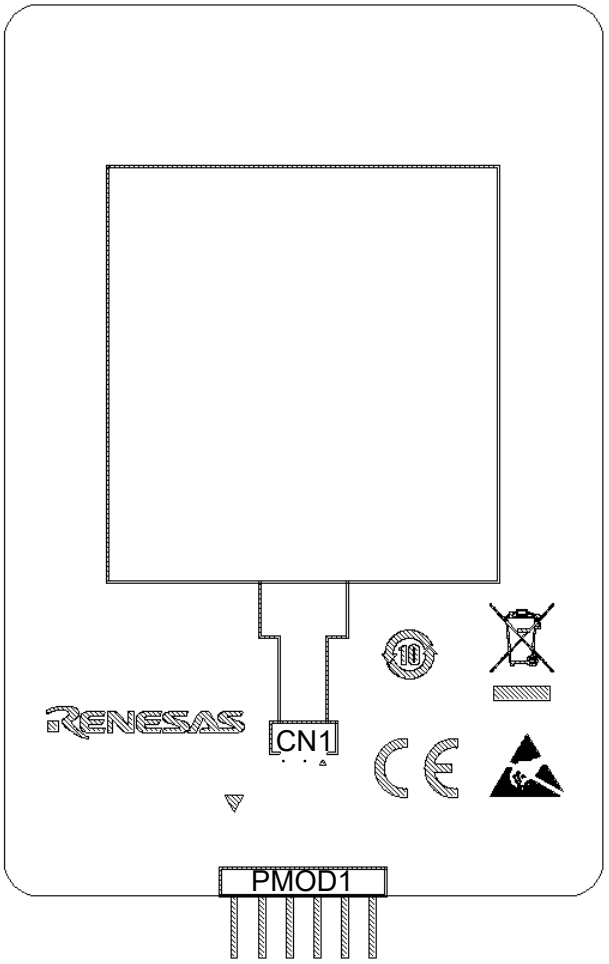



**Figure** 2-7: **MIP-LCD Component Placement (Top-Side View)**

## 2.4 Board Initial Settings

The switch settings of the default kit configuration are as follows. The component layout is shown in **Figure 2-8** and the detailed settings are shown in **Table 2-1**.

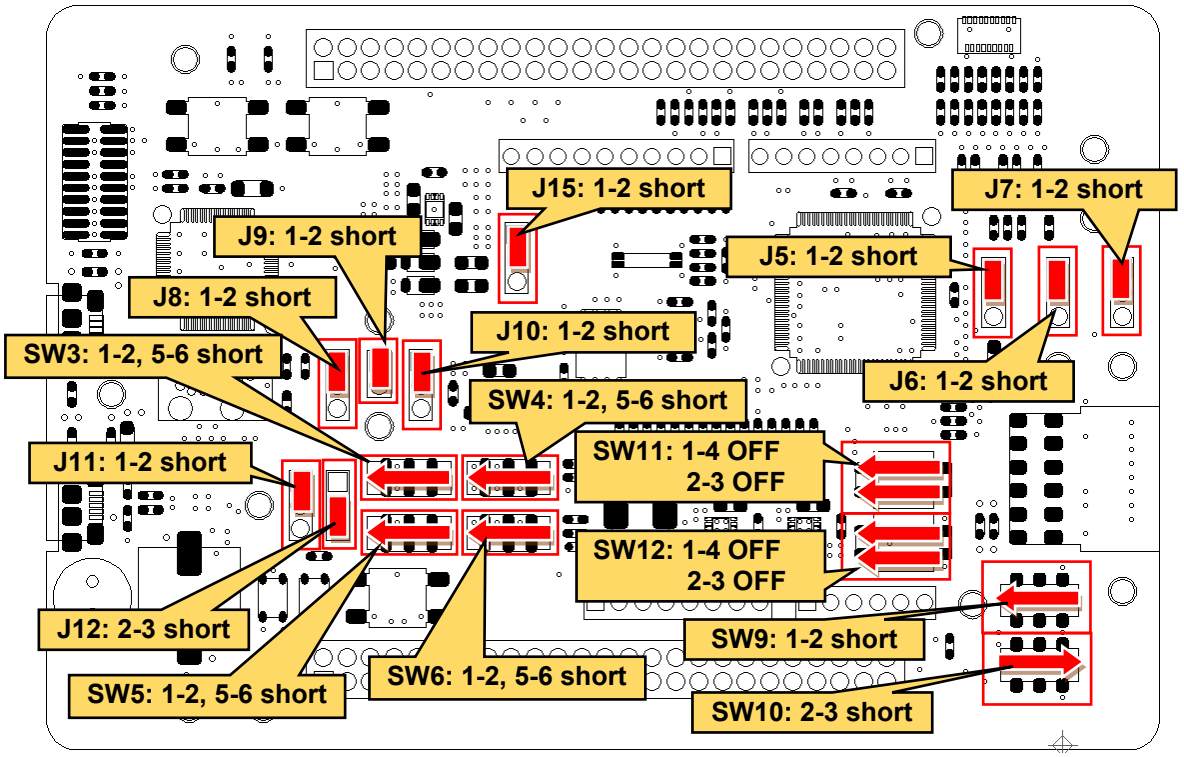



**Figure** 2-8**: Component Layout and Settings**

**Table 2-1: Board Initial Settings**

| Item | Function | Setting | |
|---|---|---|---|
| SW3, SW5 | Operation mode setting (Emulator setting) | 1-2, 5-6: short | Normal mode (using J-Link™ OB) |
| SW4, SW6 | Operation mode setting | 1-2, 5-6: short | Normal mode |
| SW9 | Start-up mode setting | 1-2: short | Normal start-up |
| SW10 | | 2-3: short | |
| SW11, SW12 | Internal LDO setting | 1-4: OFF<br>2-3: OFF | Internal LDO use |
| J5 | Reference voltage generation circuit setting | 1-2: short | Reference voltage generation circuit not used |
| J6 | IOVCC0 power supply setting | 1-2: short | Use output voltage from DCDC converter |
| J7 | IOVCC1 power supply setting | 1-2: short | Use output voltage from DCDC converter |
| J8 | Operation mode setting | 1-2: short | Normal operation |
| J9 | Current measurement setting | 1-2: short | Current measurement not performed |
| J10 | Operation mode setting | 1-2: short | Normal start-up |
| J11 | Supercapacitor charging method selection | 1-2: short | Charge from external power supply |
| J12 | Secondary battery selection | 2-3: short | Supercapacitor |
| J15 | Operation mode setting | 1-2: short | Normal start-up |

# 3.Internal Board Connections

**Figure 3-1** shows the connectivity between Evaluation Kit and RE01. The pin connections are listed in **Table 3-1** and **Table 3-2**.

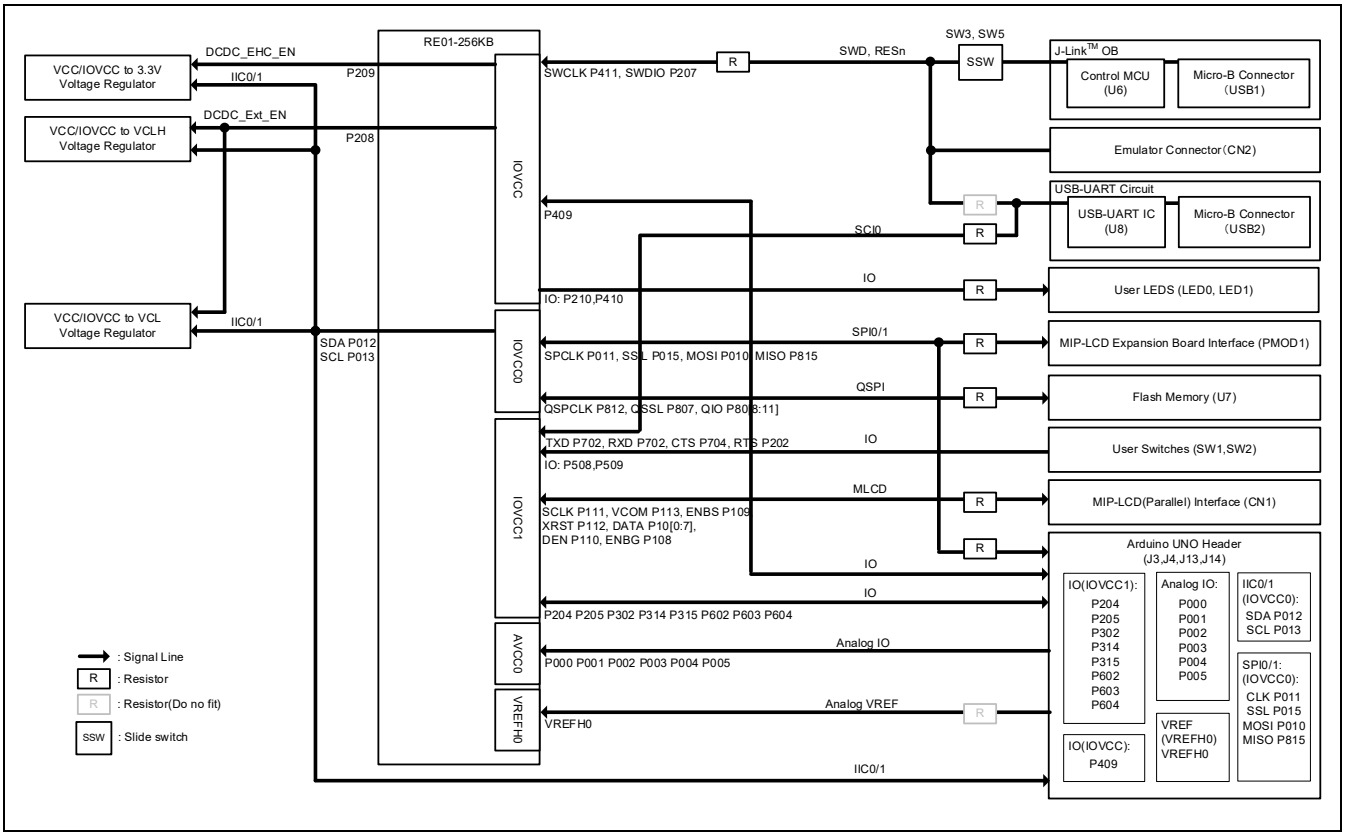



**Figure 3-1: Internal Board Block Diagram**

**Table 3-1: List of RE01 functions, pin number and header connections(1/2)**

| Category | Function | Port | RE01 Pin No. | Main board Pin header | Power Domain |
|---|---|---|---|---|---|
| Clock | EXTAL | - | 13 | - | IOVCC |
| | XTAL | - | 12 | - | IOVCC |
| | XCIN | - | 10 | - | IOVCC |
| | XCOUT | - | 9 | - | IOVCC |
| Switch | RES | RES# | 23 | J1-23 | IOVCC |
| | SW1 | P509 | 74 | J2-24 | IOVCC1 |
| | SW2 | P508 | 75 | J2-25 | IOVCC1 |
| LED | LED0 | P210 | 32 | J1-32 | IOVCC |
| | LED1 | P410 | 17 | J1-17 | IOVCC |
| PMOD* | PMOD_SSLA1_B_P015 | P015 | 92 | J2-42 | IOVCC0 |
| | PMOD_MOSIA_B_P010 | P010 | 97 | J2-47 | IOVCC0 |
| | PMOD_MISOA_B_CTS4_C | P815 | 98 | J2-48 | IOVCC0 |
| | PMOD_RSPCKA_B_P011 | P011 | 96 | J2-46 | IOVCC0 |
| | PMOD_INT_AGTWOA1_B_P814 | P814 | 99 | J2-49 | IOVCC0 |
| | PMOD_RESET_RXD4_C | P813 | 100 | J2-50 | IOVCC0 |
| | PMOD_IO0_P014 | P014 | 93 | J2-43 | IOVCC0 |
| | PMOD_IO1 | P806 | 7 | J1-7 | IOVCC0 |
| USB-Serial | USB_SCI_TXD | P703 | 40 | J1-40 | IOVCC |
| | USB_SCI_RXD | P702 | 41 | J1-41 | IOVCC |
| | USB_SCI_CTS | P704 | 39 | J1-39 | IOVCC1 |
| | USB_SCI_RTS | P202 | 38 | J1-38 | IOVCC1 |
| MIP-LCD | MLCD_VCOM | P113 | 56 | J2-6 | IOVCC1 |
| | MLCD_ENBS | P109 | 60 | J2-10 | IOVCC1 |
| | MLCD_XRST | P112 | 57 | J2-7 | IOVCC1 |
| | MLCD_SI7 | P100 | 71 | J2-21 | IOVCC1 |
| | MLCD_SI6 | P101 | 70 | J2-20 | IOVCC1 |
| | MLCD_SI5 | P102 | 69 | J2-19 | IOVCC1 |
| | MLCD_SI4 | P103 | 68 | J2-18 | IOVCC1 |
| | MLCD_SI3 | P104 | 67 | J2-17 | IOVCC1 |
| | MLCD_SI2 | P105 | 66 | J2-16 | IOVCC1 |
| | MLCD_SI1 | P106 | 65 | J2-15 | IOVCC1 |
| | MLCD_SI0 | P107 | 64 | J2-64 | IOVCC1 |
| | MLCD_DEN | P110 | 59 | J2-9 | IOVCC1 |
| | MLCD_SCLK | P111 | 58 | J2-8 | IOVCC1 |
| | MLCD_ENBG | P108 | 61 | J2-11 | IOVCC1 |

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

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

| Category | Function | Port | RE01 Pin No. | Main board Pin header | Power Domain |
|---|---|---|---|---|---|
| Flash Memory | QSPI_QSSL_A | P807 | 6 | J1-6 | IOVCC0 |
| | QSPI_QIO1_A | P810 | 3 | J1-3 | IOVCC0 |
| | QSPI_QIO2_A | P809 | 4 | J1-4 | IOVCC0 |
| | QSPI_QIO0_A | P811 | 2 | J1-2 | IOVCC0 |
| | QSPI_QSPCLK_A | P812 | 1 | J1-1 | IOVCC0 |
| | QSPI_QIO3_A | P808 | 5 | J1-5 | IOVCC0 |
| Arduino UNO (J3) | ARDUINO_IO8 | P409 | 18 | J1-18/J3-1 | IOVCC |
| | ARDUINO_IO9_GTIOC2A_B | P302 | 48 | J1-48/J3-2 | IOVCC1 |
| | ARDUINO_SSLA1_B | P015 | 92 | J2-42/J3-3 | IOVCC0 |
| | ARDUINO_MOSIA_B | P010 | 97 | J2-47/J3-4 | IOVCC0 |
| | ARDUINO_MISOA_B | P815 | 98 | J2-48/J3-5 | IOVCC0 |
| | ARDUINO_RSPCKA_B | P011 | 96 | J2-46/J3-6 | IOVCC0 |
| | ARDUINO_VREF** | - | 84 | J3-8 | VREFH0 |
| | ARDUINO_SDA0* | P012 | 95 | J2-45/J3-9 | IOVCC0 |
| | ARDUINO_SCL0* | P013 | 94 | J2-44/J3-10 | IOVCC0 |
| Arduino UNO (J4) | ARDUINO_IO0_RXD5_B | P314 | 45 | J1-45/J4-1 | IOVCC1 |
| | ARDUINO_IO1_TXD5_B | P315 | 44 | J1-44/J4-2 | IOVCC1 |
| | ARDUINO_IO2_IRQ7_B | P204 | 36 | J1-36/J4-3 | IOVCC1 |
| | ARDUINO_IO3_IRQ8_C | P205 | 35 | J1-35/J4-4 | IOVCC1 |
| | ARDUINO_IO4 | P602 | 53 | J2-3/J4-5 | IOVCC1 |
| | ARDUINO_IO5_GTIOC5A_B | P603 | 52 | J2-2/J4-6 | IOVCC1 |
| | ARDUINO_IO6_GTIOC5B_B | P604 | 51 | J2-1/J4-7 | IOVCC1 |
| | ARDUINO_IO7 | P300 | 50 | J1-50J4-8 | IOVCC1 |
| Arduino UNO (J13) | IOVCC0**/IOVCC1/AVCC0** | - | 91/46/78 | J13-1 | IOVCC0/IOVCC1/ AVCC0 |
| | LP_3V3 | - | - | J13-2 | - |
| | RESn | RES# | 23 | J1-23/ J13-3 | IOVCC |
| | LP_3V3 | - | - | J13-4 | - |
| | Board_5V | - | - | J13-5 | - |
| | VCC_MCU | - | 14 | J1-14/J13-8 | IOVCC |
| Arduino UNO (J14) | ARDUINO_AN000 | P000 | 89 | J2-49/J14-1 | AVCC0 |
| | ARDUINO_AN001 | P001 | 88 | J2-48/J14-2 | AVCC0 |
| | ARDUINO_AN002 | P002 | 87 | J2-37/J14-3 | AVCC0 |
| | ARDUINO_AN003 | P003 | 86 | J2-36/J14-4 | AVCC0 |
| | ARDUINO_AN004 | P004 | 85 | J2-35/J14-5 | AVCC0 |
| | ARDUINO_AN005 | P005 | 82 | J2-32/J14-6 | AVCC0 |

*: The default kit configuration uses a transfer rate of 50kbps or less. To increase the transfer rate, change the resistor values (R21, R22).

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

# 4. Power Supply

## 4.1 Power Supply System

**Figure 4-1** shows power supply system diagram of Evaluation kit.

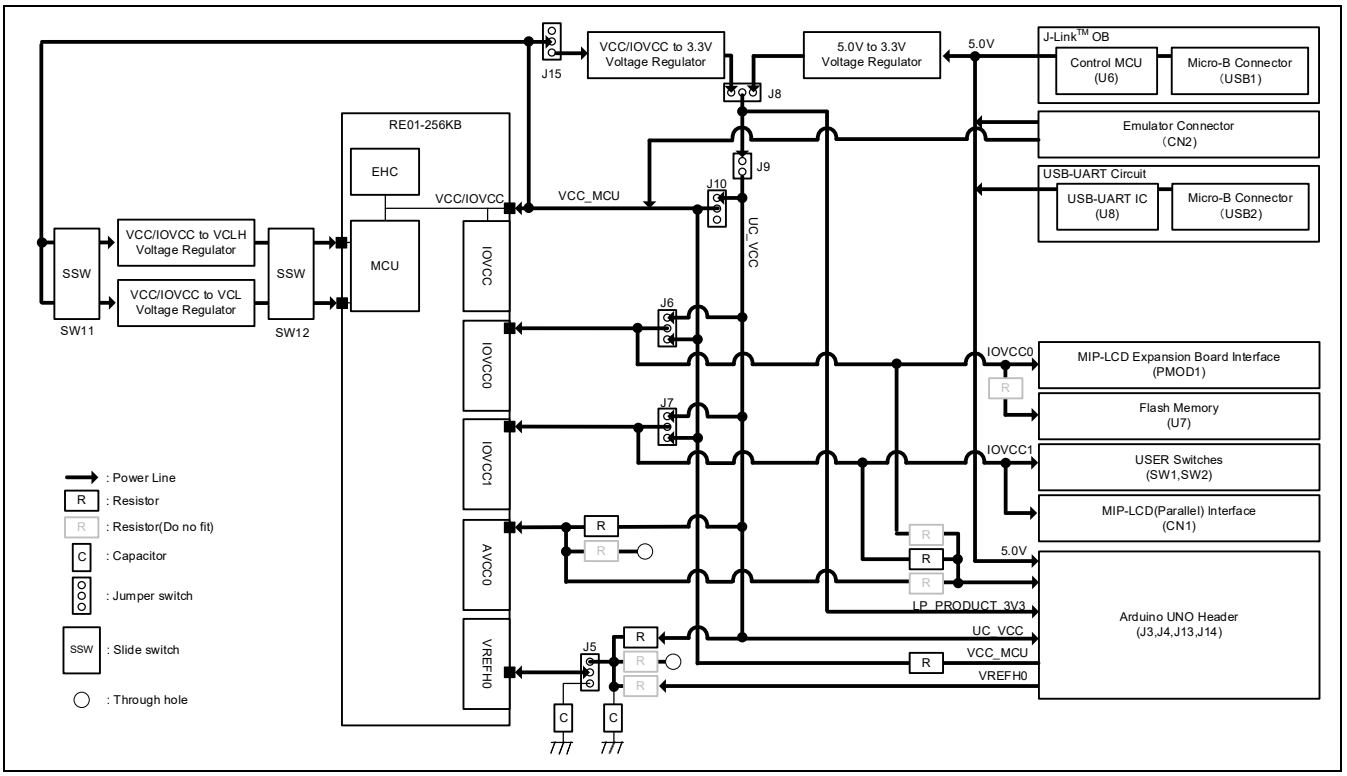



**Figure 4-1: Power Supply System Diagram**

## 4.2 Power Supply Source

Evaluation Kit is supplied by emulator through USB cable. The details of power supply components are shown in **Figure 4-2** and **Table 4-1.** When the Evaluation Kit is connected to another system then that system should supply power to the Evaluation Kit.

When operating in stand-alone mode, connect a USB cable to USB1 or USB2 and supply the voltage through VBUS. At that time, do not use J-Link™ OB or USB serial function.

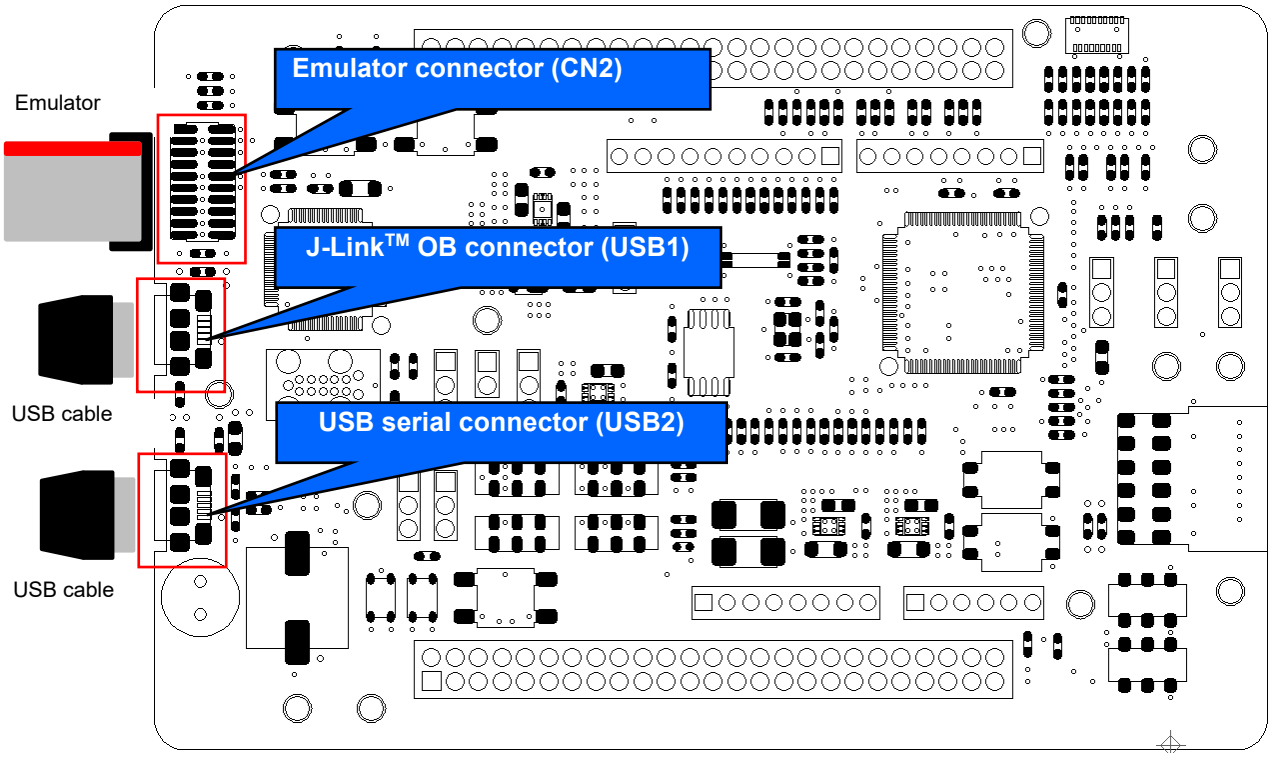



**Figure 4-2: Components Layout (power supply)**

**Table 4-1: Power Supply Specifications**

| Source | Supply voltage | Supply current |
|---|---|---|
| I-jet™ (CN2) | 5V | Maximum 420mA |
| J-Link™ OB (USB1) | 5V | Maximum 500mA |
| J-Link™ (CN2) | 5V | Maximum 300mA |
| E2 (CN2) | 3.3V | Maximum 200mA |
| USB serial (USB2) | 5V | Maximum 500mA |

## 4.3 External Power 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). Normally, the emulator supplies voltage equivalent to 3.3V, which is the voltage value after reduction by the regulator. (excluding device which can supply 3.3V)

### 4.3.1 All power pins

**Figure 4-3** shows the component layout. Follow the steps below when supplying voltage from external power supply to all RE01 power pins:

1. Set SW3 and SW5 to EHC.
2. Open J8 jumper pin 1-2 and 2-3.
3. Supply voltage (1.62V-3.6V) from pin 2 of J8 or T6 using an external power supply.

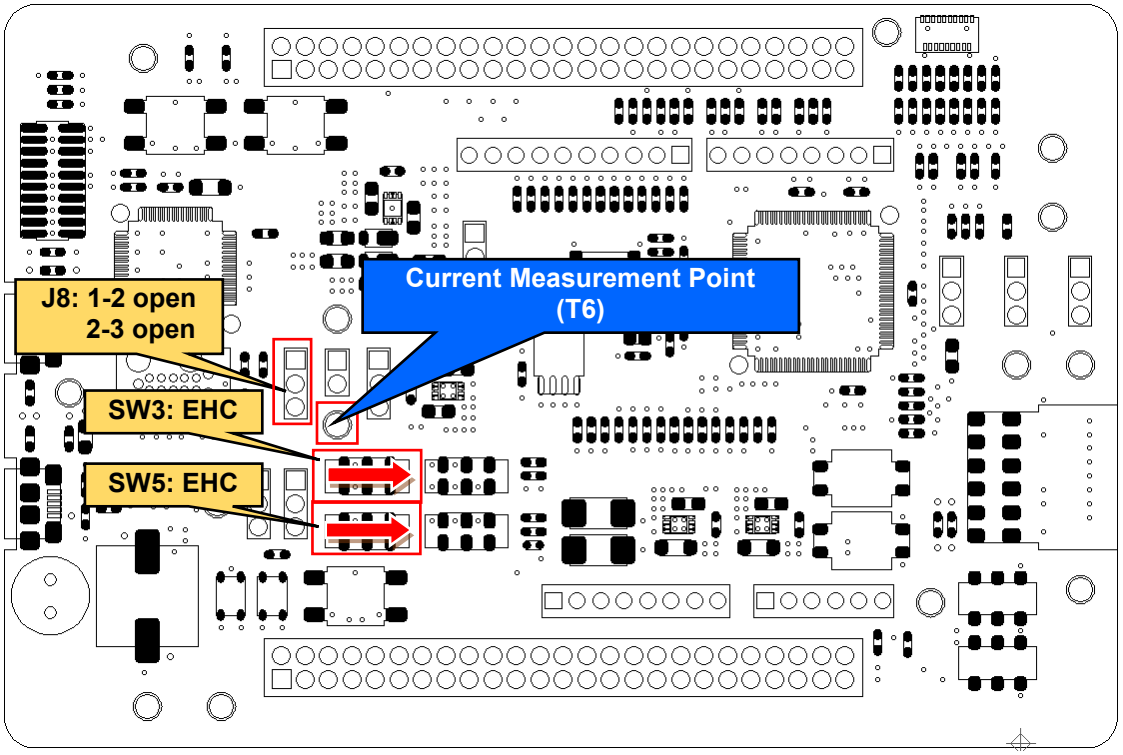



**Figure 4-3: Component Layout and Setting (External Power Supply)**

Keep the following in mind when using this feature:

- Debugging using J-Link OB is not possible. Please use another emulator. For details on the other emulators, refer to chapter 6 Debug.
- When using the E2 emulator, do not supply power from the emulator.

### 4.3.2 IOVCC0

**Figure 4-4** shows the component layout. Follow the steps below when supplying voltage from external power supply to IOVCC0 pin:

1. Open J6 jumper pin 1-2 and 2-3.
2. Supply voltage (1.62V – 3.6V) to any power supply pins other than IOVCC0 pin.
3. Supply voltage to T4.

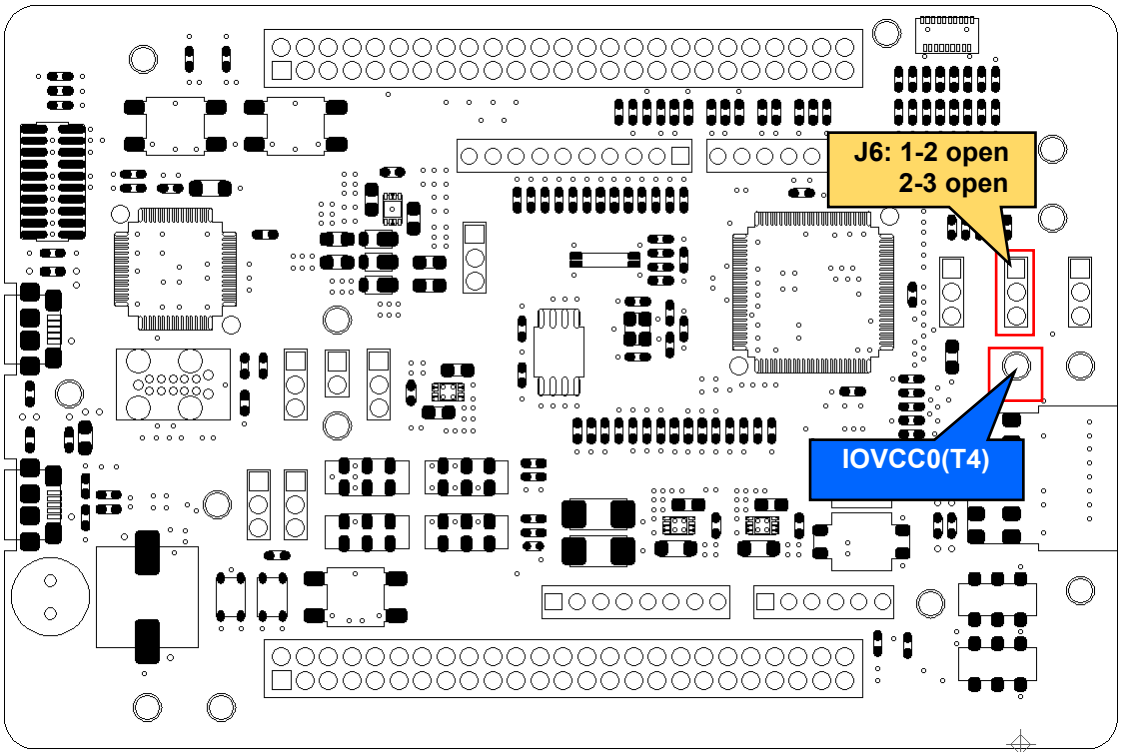



**Figure 4-4: Component Layout and setting (External Power Supply)**

### 4.3.3 IOVCC1

**Figure 4-5** shows the component layout. Follow the steps below when supplying voltage from external power supply to IOVCC1 pin:

1. Open J7 jumper pin 1-2 and 2-3.
2. Supply voltage (1.62V – 3.6V) to any power supply pins other than IOVCC1 pin.
3. Supply voltage to T1.

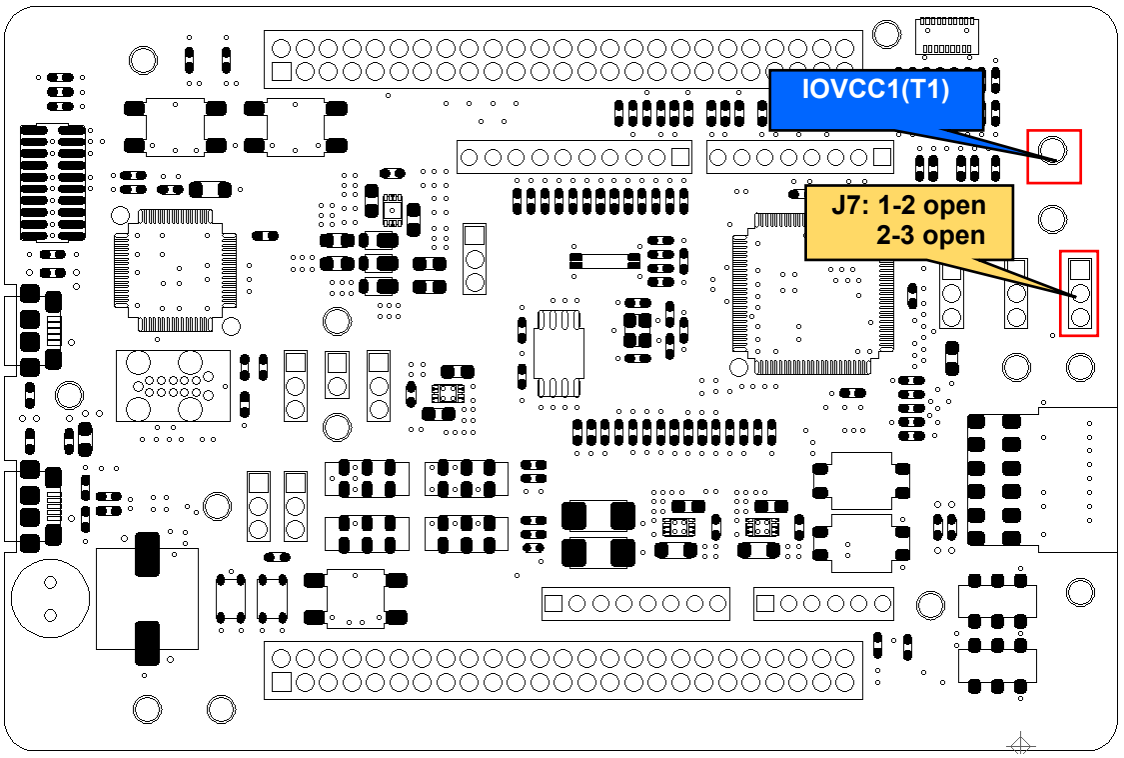



**Figure 4-5: Component Layout and Setting (External Power Supply)**

### 4.3.4 AVCC0

The component layout are shown in **Figure 4-6** and **Figure 4-7**. Follow the steps below when supplying voltage from external power supply to AVCC0 pin:

1. Remove R108.
2. Fit R107.
3. Supply voltage (1.62V – 3.6V) to any power supply pins other than AVCC0 pin.
4. Supply voltage to T5.

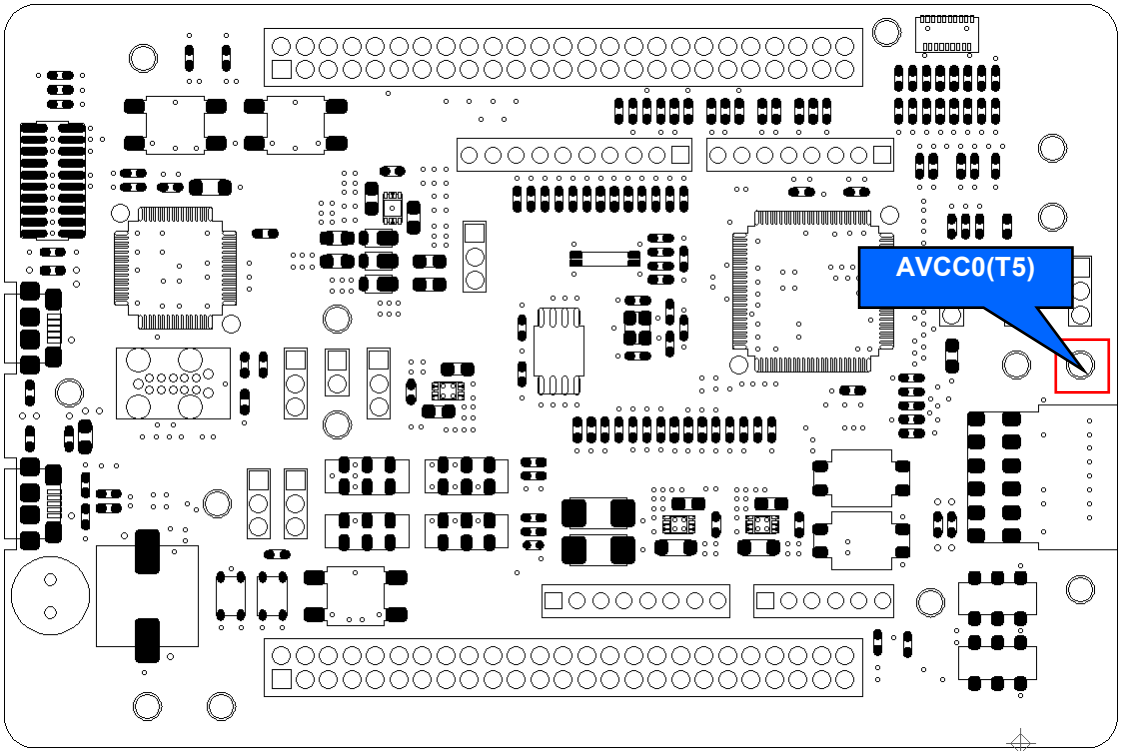



**Figure 4-6: Component Layout (External Power Supply (Top))**

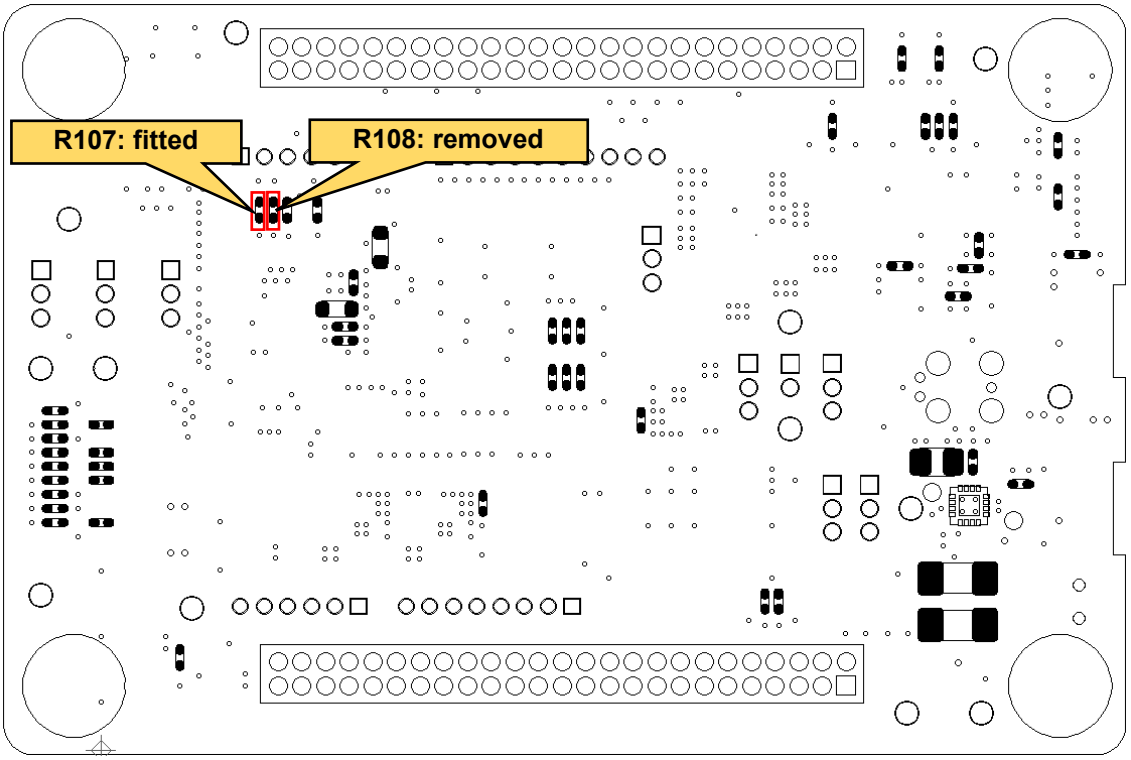



**Figure 4-7: Component Layout (External Power Supply (Bottom))**

### 4.3.5 VREFH0

The component layout and settings are shown in **Figure 4-8**. Follow the steps below when supplying voltage from external power supply to VREF0 pin:

1. Remove R54 and R55
2. Fit R56.
3. Short J5 jumper pin 1-2.
4. Supply voltage (1.62V – AVCC0) to any power supply pins other than VREF0 pin.
5. Supply voltage to T2.

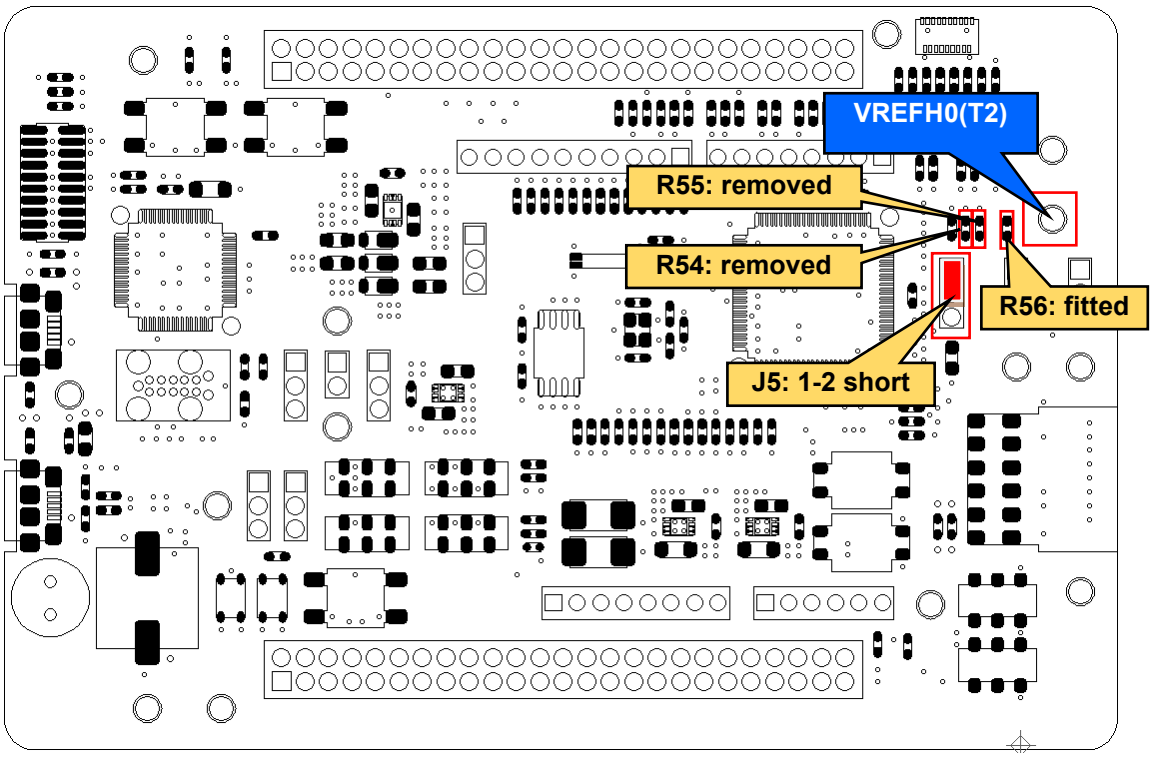


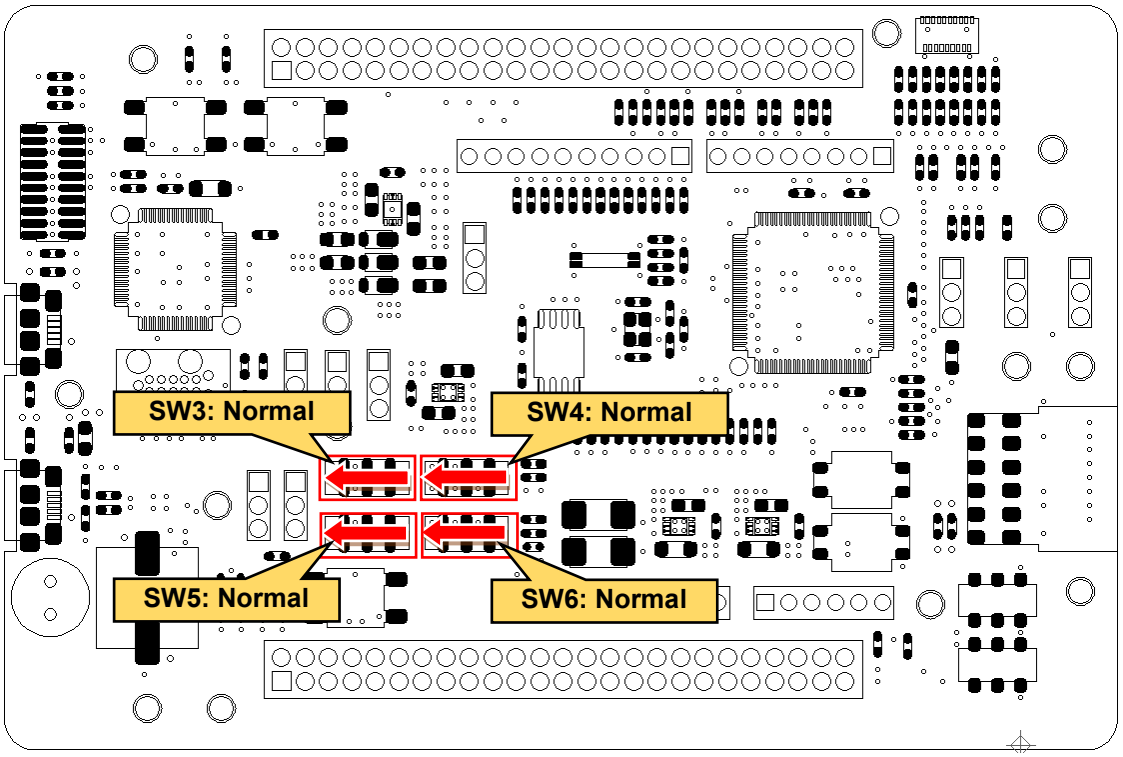

**Figure 4-8: Component Layout and Settings (External Power Supply)**

# 5. Operation/Start-up Mode

Evaluation Kit for RE01 supports 2 operation and start-up modes: normal and energy harvesting (hereinafter, EHC).

## 5.1 Normal Operation

In normal operation, power is supplied from emulator or external power supply. To use normal operation mode, several switch settings must be made. The layout and details of the switch setting are shown in **Figure 5-1** and **Table 5-1**.




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

**Figure 5-1: Component Layout and Settings (Normal Operation)**

**Table 5-1: Configuration Details (Normal Operation)**

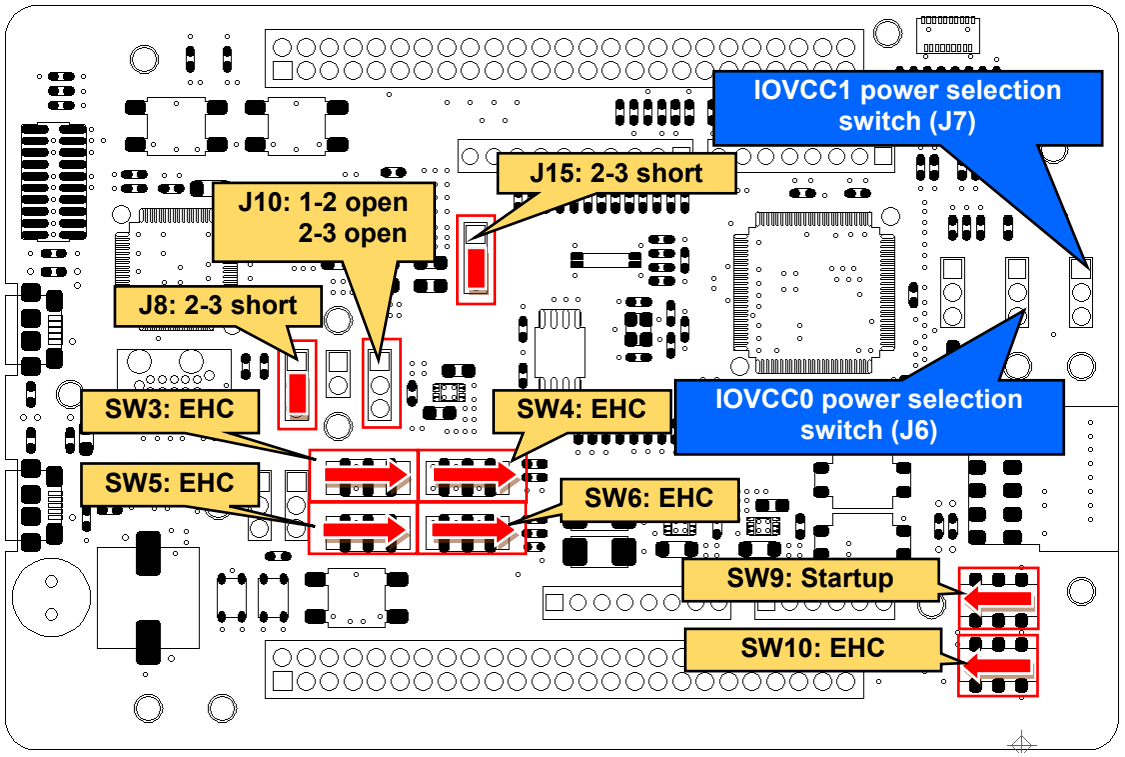
| Component Name | Setting | |
|---|---|---|
| SW3, SW5*1 | 1-2, 5-6 | Normal Operation *2 |
| SW4, SW6 | 1-2, 5-6 | Normal Operation *2 |

*1: Also depends on debug function used. For more information, refer to Section 6. Debug.
*2: The settings are supported in default configuration, as supplied.

## 5.2 EHC Operation

RE01 supports energy harvesting function. In EHC operation, the power is supplied from the included solar panel. User circuit can start operating when voltage is supplied to VSC_VCC pin of RE01.

Switch settings are required to operate the energy harvesting function. The related component layout and setting details are shown in **Figure 5-2, Table 5-2**, and **Table 5-3.** For more information of energy harvesting control circuit for RE01 specifications, refer to RE01 Group User's Manual's Hardware.




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

**Figure 5-2: Component Layout and Settings (EHC Operation)**

**Table 5-2: Configuration Details (EHC Operation)**

| Component Name | Setting | |
|---|---|---|
| J8 | 2-3 | short |
| J10 | 1-2, 2-3 | open |
| J15 | 2-3 | short |
| SW3–SW6 | 2-3, 6-7 | EHC |
| SW9 | 1-2 | Startup*1 |
| SW10 | 1-2 | EHC |

*1: The setting is supported in default configuration, as supplied.

**Table 5-3: Switch Details (J6, J7)**

| Component Name | Settings | |
|---|---|---|
| J6 | 1-2 | Supply voltage generated by DC/DC converter to IOVCC0 pin of RE01 |
| | 2-3 | Supply voltage generated by VCC/IOVCC pin of RE01 to IOVCC0 pin of RE01 |
| J7 | 1-2 | Supply voltage generated by DC/DC converter to IOVCC1 pin of RE01 |
| | 2-3 | Supply voltage generated by VCC/IOVCC pin of RE01 to IOVCC1 pin of RE01 |

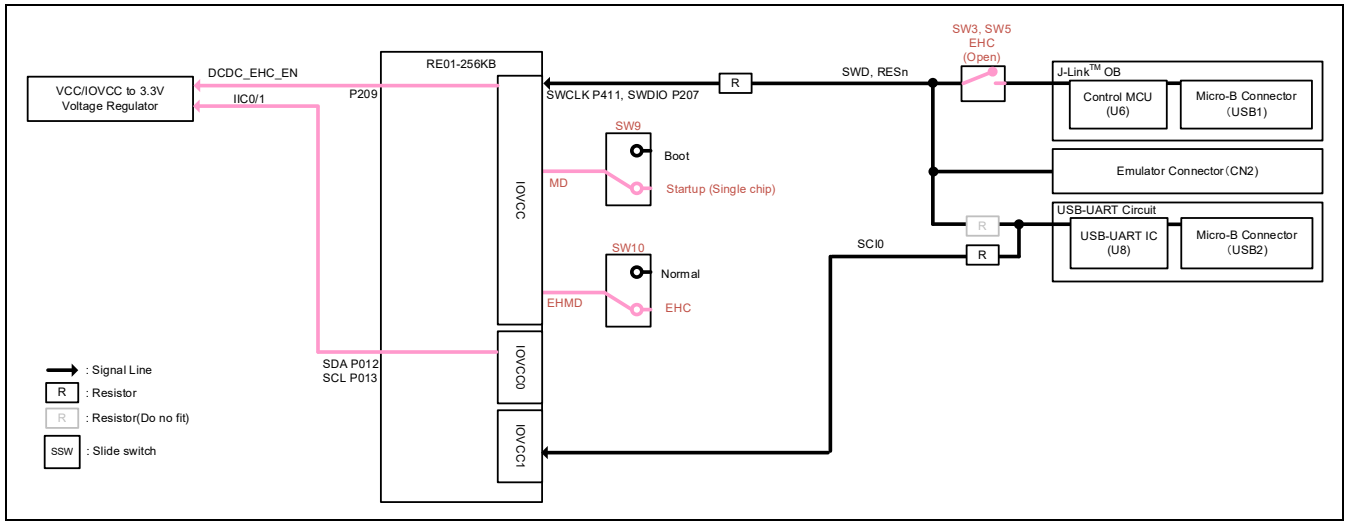



**Figure 5-3: Block diagram of Signal line (EHC Operation)**

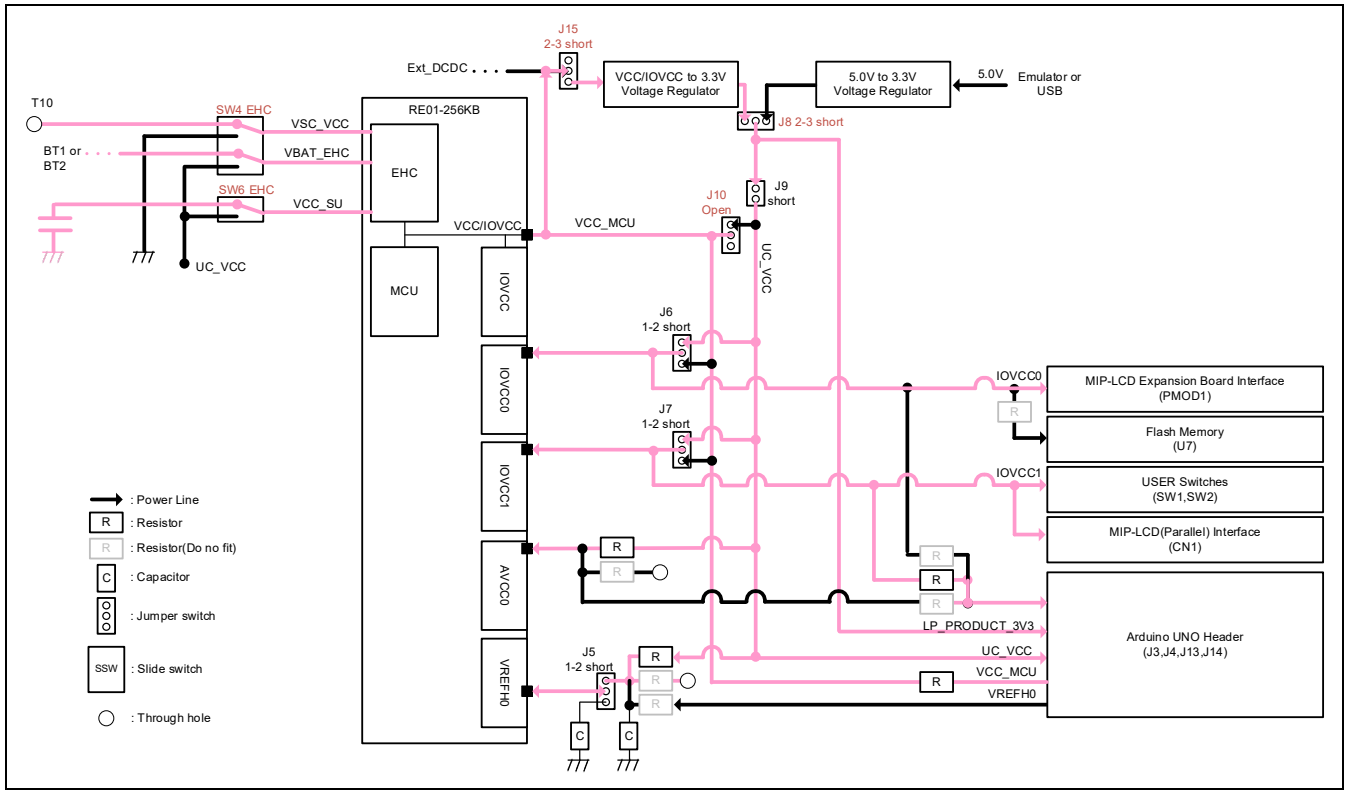



**Figure 5-4: Block diagram of Power line (EHC Operation)**

### 5.2.1 Solar Panel

This product is equipped with solar panel interface (T9, T10). The component layout and details are displayed in **Figure 5-5** and **Table 5-4**. Connect the included solar panel to T9 and T10 using the attached IC clip.

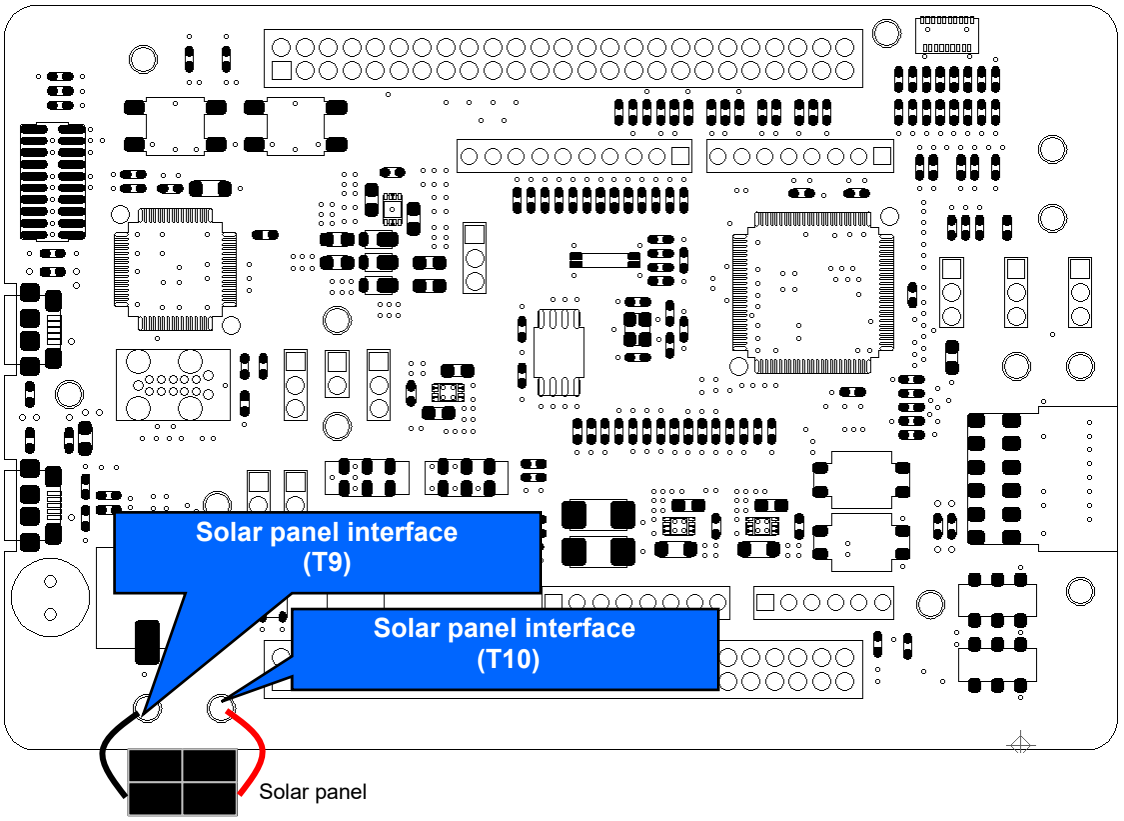



**Figure 5-5: Component Layout (EHC Operation)**

**Table 5-4: Solar Panel Interface**

| Solar Panel Interface (T9, T10) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Name** | **RE01** | | **Pin** | **Name** | **RE01** | |
| | | **Port** | **Pin** | | | **Port** | **Pin** |
| T9 | GROUND | - | - | T10 | - | VSC_VCC | 29 |

### 5.2.2 Supercapacitor / External Battery

Supercapacitor / external battery can be connected to VBAT_EHC pin in RE01. Switch settings are required in order to use supercapacitor / external battery. Component layout and configuration details are shown in **Figure 5-6** and **Table 5-5**.

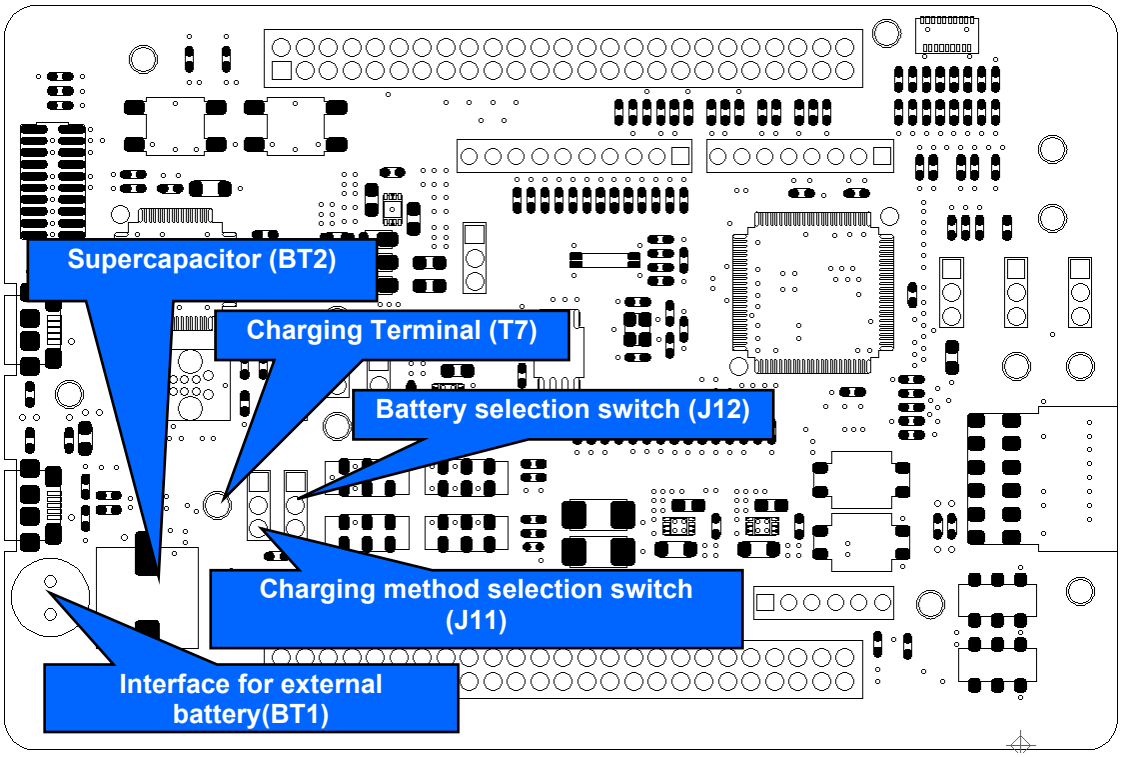



**Figure 5-6: Component Layout (EHC Operation)**

**Table 5-5: Switch Configuration(J12)**

| Component Name | Setting | |
|---|---|---|
| J12 | 1-2 | External battery |
| | 2-3 | Supercapacitor |

When using supercapacitor, the supercapacitor itself may need to be charged because it may have been discharged. There are 2 charging methods that can be selected through switch setting. The related component layout and settings are shown in **Figure 5-6** and **Table 5-6.**

When charging, use J12 in the open setting.

- Charging from external power supply
  Connect a stabilized power supply to the charging terminal (T7).
- Charging from the voltage converted on board supplied by an emulator
  Connect an emulator to CN2 port or a USB cable to USB1/USB2 port.

Set the charging voltage (2.6V or 3.0V) to the value specified in Secondary Battery (VBAT) Charging Voltage Select Bit (VBATSEL) in Option Function Select Register 1 (OFS1).

**Table 5-6: Switch Configuration(J11)**

| Component Name | Setting | |
|---|---|---|
| J11 | 1-2 | Charging from external power supply |
| | 2-3 | Charge by using board voltage |

**Set J11 to 1-2** after charging is completed.

Make sure that the external battery is already installed before selecting the external battery. The component layout and setting are described in **Figure 5-6** and **Table 5-7.**

The recommended external battery is SLB Series (Nichicon). Because the included solar panel*1 generates 42μA, it might take time to charge the recommended external battery, depending on the operation setting of RE01. Depending on your evaluation content, consider charging before mounting.

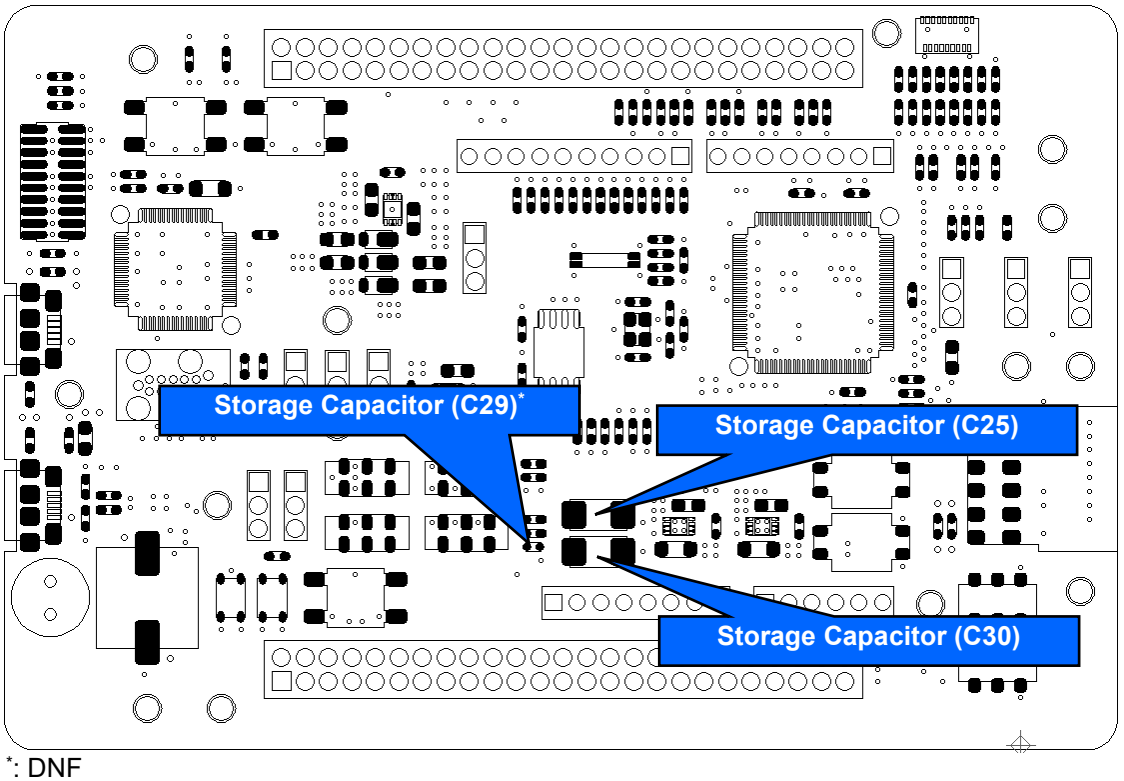
*1: Panasonic AM-1815CA operating voltage 3.0 V, operating current 42.0μA (white fluorescent lamp-200lx(25ºC))

**Table 5-7: External Battery (BT2)**

| External Battery (BT2) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Signal Name | RE01 | | Pin | Signal Name | RE01 | |
| | | Port | Pin | | | Port | Pin |
| 1 | - | VBAT_EHC | 28 | 2 | GROUND | - | - |

### 5.2.3 Storage Capacitor

RE01 has a 200uF capacitor connected to the VCC_SU pin. Depending on your board environment, it may be necessary to change the capacitor's capacitance connected to VCC_SU pin. If necessary, mount a capacitor on C29 (size: 1608). Component layout is shown in **Figure 5-7**. For more information about storage capacitor specifications, refer to RE01 Group User's Manual's Hardware.




*: DNF

**Figure 5-7: Component Layout (EHC Operation)**

### 5.2.4 DC/DC Converter Control

DC/DC converter must be enabled to supply the voltage to the user circuit when using energy harvesting function. To enable DC/DC converter, output a high level from P209 and make sure that there is enough charging voltage in external battery/supercapacitor. This voltage equals to the value of VBATSEL setting (2.6V or 3.0V).

### 5.2.5 How to Use

#### 5.2.5.1 When Operating Peripheral Circuits after Steady Operation Period

Follow the steps below to operate peripheral circuits after EHC steady operation period. The settings below are intended for the case where supercapacitor (charged) is used. The program has to be downloaded to RE01 internal flash memory in advance.

Sample code is also available on Renesas website, entitled “Maintenance free power management by RE energy harvesting controller (R01AN4837)”.

1. Follow the setting shown in **Figure 5-2** and **Table 5-2**.
2. Follow the setting shown in **Figure 5-8** and **Table 5-8**.
3. Connect the solar panel to the solar panel interface (T9 and T10).

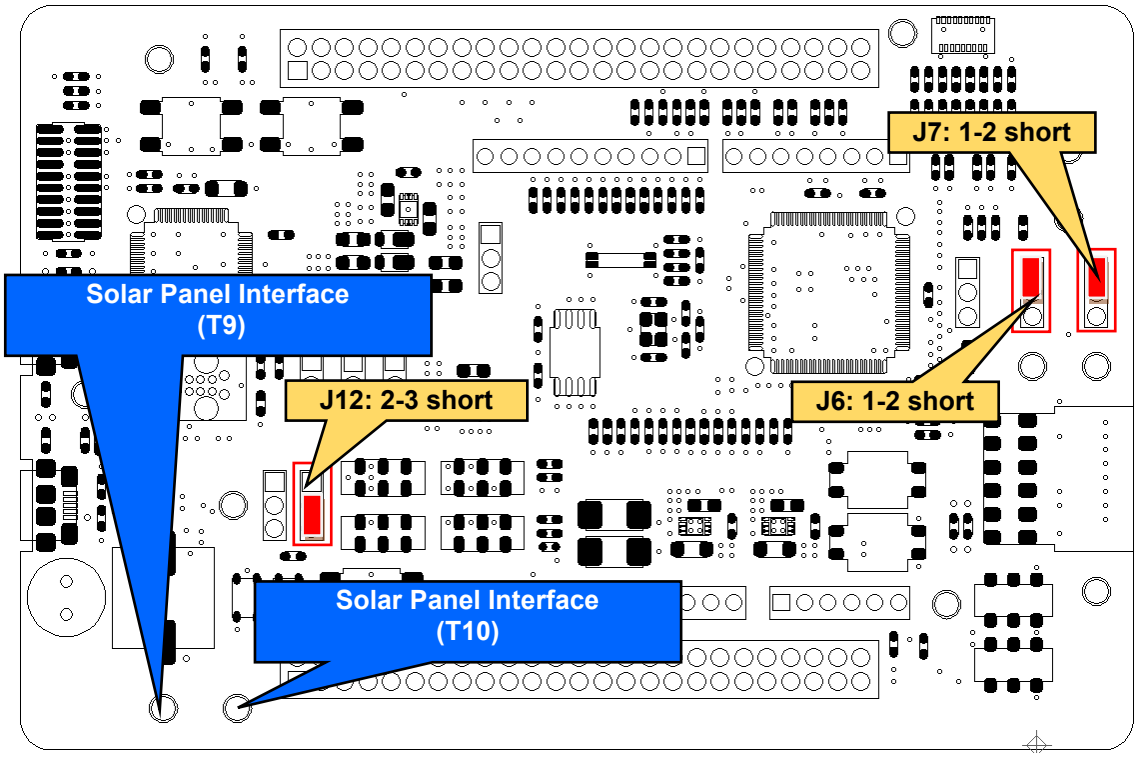



**Figure 5-8: Component Layout and Settings (EHC Operation)**

**Table 5-8: Configuration Details (EHC Operation)**

| Component Name | Setting | |
|---|---|---|
| J6, J7 | 1-2 | short |
| J12 | 2-3 | short |

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

#### 5.2.5.2 When using the MIP-LCD Expansion Board During Secondary Battery Charging Period

Follow the steps below to operate MIP LCD expansion board during secondary battery charging period. The setting below are intended for the case where supercapacitor (charged) is used. The program has to be downloaded to RE01 internal flash memory in advance.

Sample code is also available on Renesas website, entitled “Energy harvesting launch operation and quick start SMIP display demo using Evaluation Kit RE01 256KB (R01AN5406)”.

1. Follow the settings shown in **Figure 5-2** and **Table 5-2**.
2. Follow the settings shown in **Figure 5-9** and **Table 5-9**.
3. Connect MIP-LCD expansion board to the PMOD connector (PMOD1). (Refer to Section 8.5.1 MIP-LCD Expansion Board for more details).
4. Connect the solar panel to solar panel interface (T9, T10).

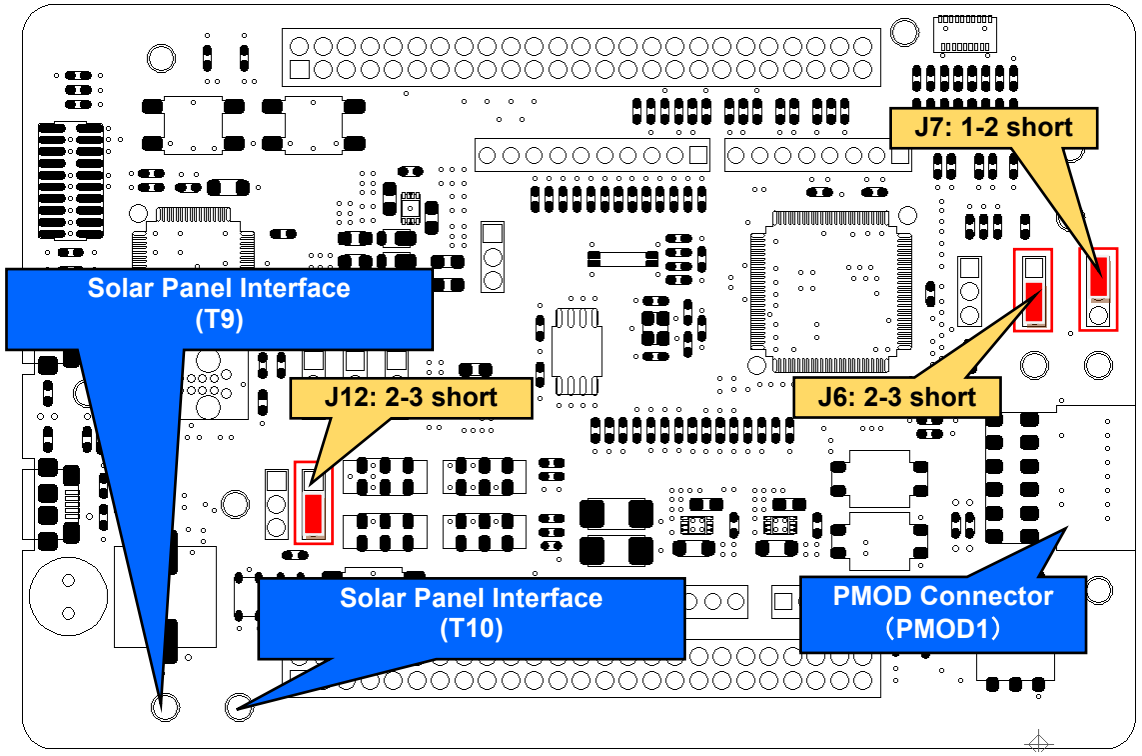



**Figure 5-9: Component Layout and Settings (EHC Operation)**

**Table 5-9: Configuration Details (EHC Operation)**

| Component Name | Setting | |
|---|---|---|
| J6 | 2-3 | short |
| J7 | 1-2 | short*1 |
| J12 | 2-3 | short*1 |

*1: The settings are supported in default configuration, as supplied.

#### 5.2.5.3 When using Parallel MIP-LCD during Secondary Battery Charging Period

Follow the steps below to operate parallel MIP LCD during secondary battery charging period. The setting below are intended for the case where supercapacitor (charged) is used. The program has to be downloaded to RE01 internal flash memory in advance.

1. Follow the settings shown in **Figure 5-2** and **Table 5-2**.
2. Follow the settings shown in **Figure 5-10** and **Table 5-10.**
3. Connect parallel MIP-LCD to the MIP-LCD connector (CN1). (Refer to Section 8.7 MLCD (Memory In Pixel Liquid Crystal Display) Interface for more details).
4. Connect the solar panel to solar panel interface (T9, T10).

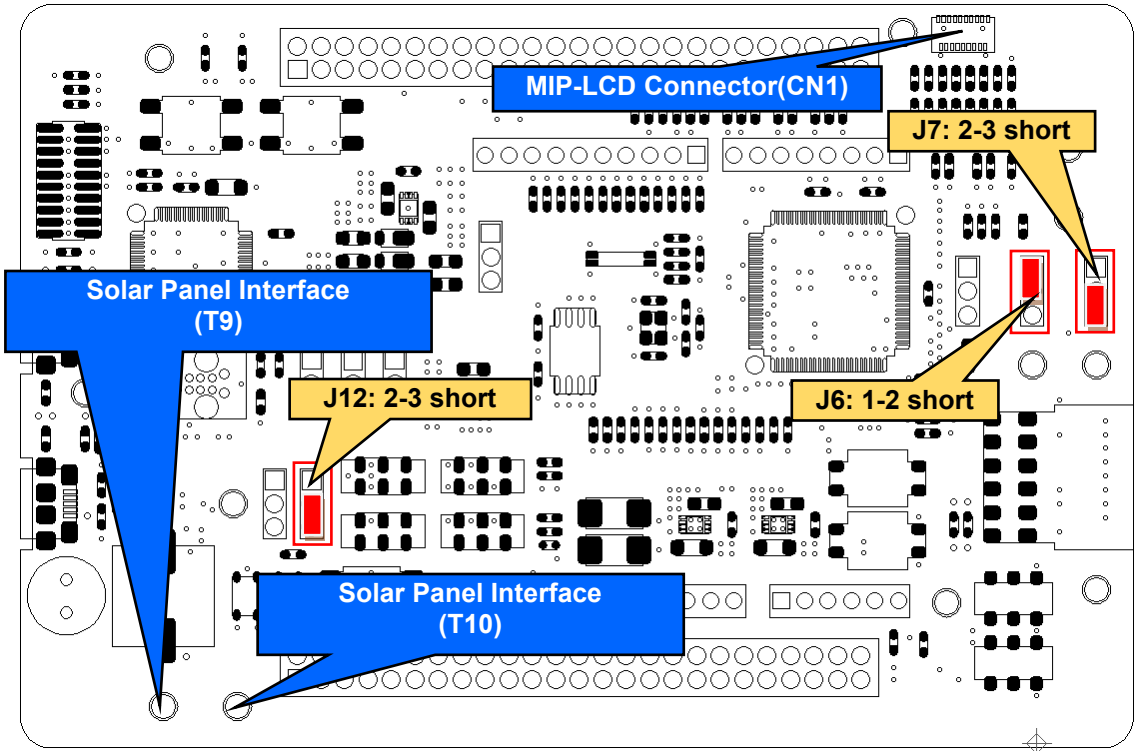



**Figure 5-10: Component Layout and Settings (EHC Operation)**

**Table 5-10: Configuration Details (EHC Operation)**

| Component Name | Setting | |
|---|---|---|
| J6 | 1-2 | short*1 |
| J7 | 2-3 | short |
| J12 | 2-3 | short*1 |

*1: The settings are supported in default configuration, as supplied.

#### 5.2.5.4 Discharge Switch (SW7, SW8)

Discharge switches are included in the main board. SW7 is used to discharge RE01 VCC/IOVCC power supply line. SW8 is used to discharge storage capacitors (C25, C29, and C30). This discharge switches must be used when the user uses energy harvesting function, operate the main board, then restart the energy harvesting function again from the beginning. Press the discharge switches before using energy harvesting function every time the energy harvesting function is started up from the beginning. The discharge switches are shown in **Figure 5-11.**

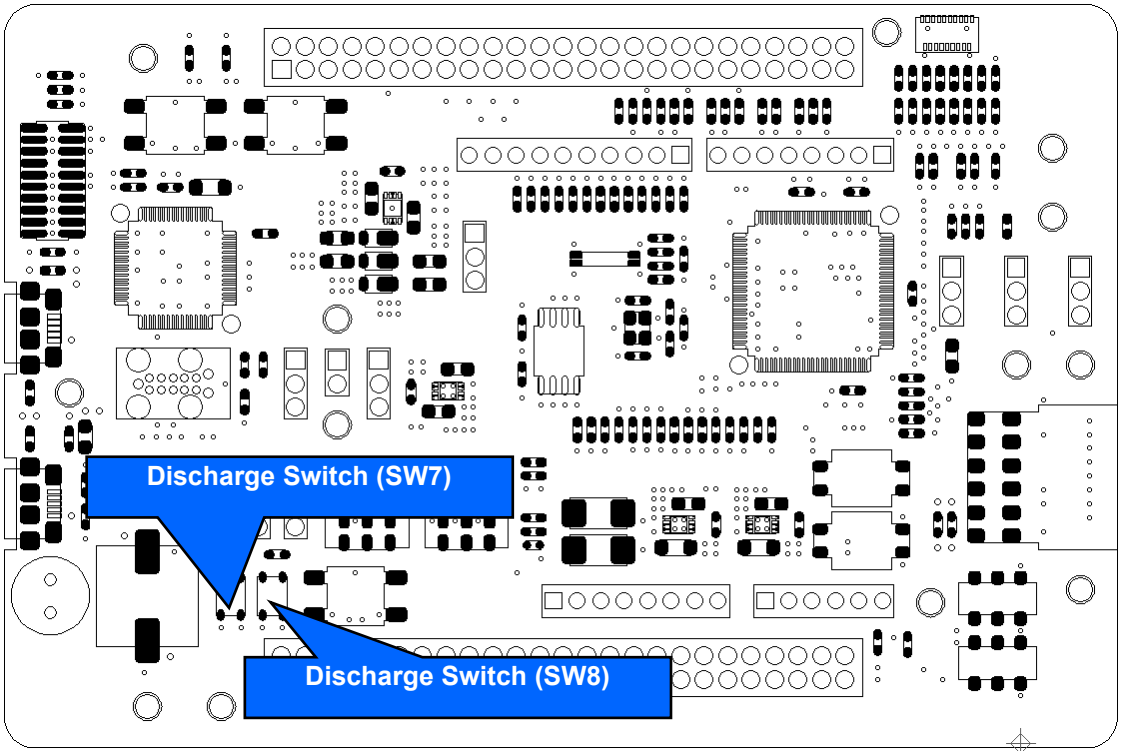



**Figure 5-11: Component Layout (EHC Operation)**

## 5.3 RE01 Start-up Mode

RE01 supports 3 start-up modes. Switch settings are necessary to select the start-up mode. Component layout and settings related to start-up modes are explained in **Figure 5-12** and **Table 5-11**. For more details of start-up modes for RE01, refer to RE01 Group User's Manual's Hardware.

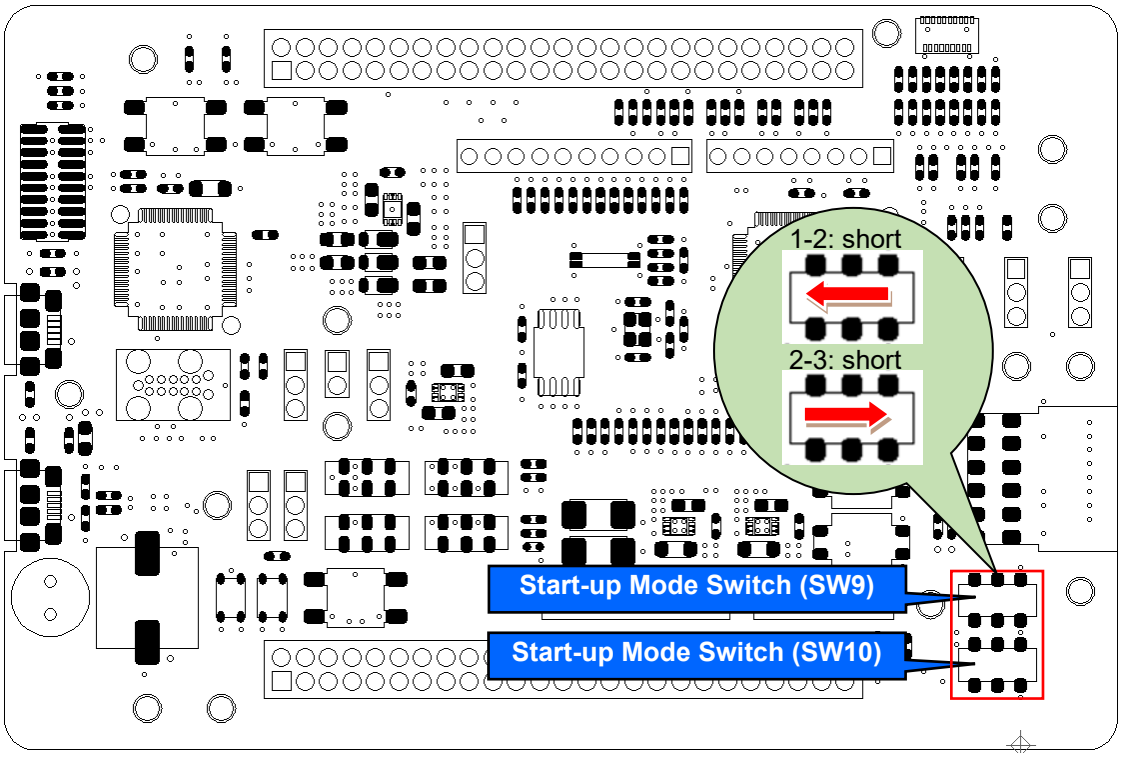



**Figure 5-12: Component Layout (RE01 Start-up Mode)**

**Table 5-11: Configuration Details (RE01 Start-up Mode)**

| Switch Setting | | Start-up Mode |
|---|---|---|
| MD (SW9) | EHMD (SW10) | |
| 1-2: short | 1-2: short | Energy Harvest Start-up Mode |
| 1-2: short | 2-3: short | Normal Start-up Mode *1 |
| 2-3: short | -*2 | SCI/USB Boot Mode |

*1: The setting is supported in default configuration, as supplied.
*2: Don't care

# 6. Debug

This board supports emulators as listed in **Table 6-1**.

**Table 6-1: Supported Emulators**

| Supported Emulator | Chapter Reference |
|---|---|
| J-Link™ OB | 6.1, 6.5 |
| J-Link™ | 6.2, 6.5 |
| I-Jet™ | 6.2 |
| E2 | 6.3, 6.4 |

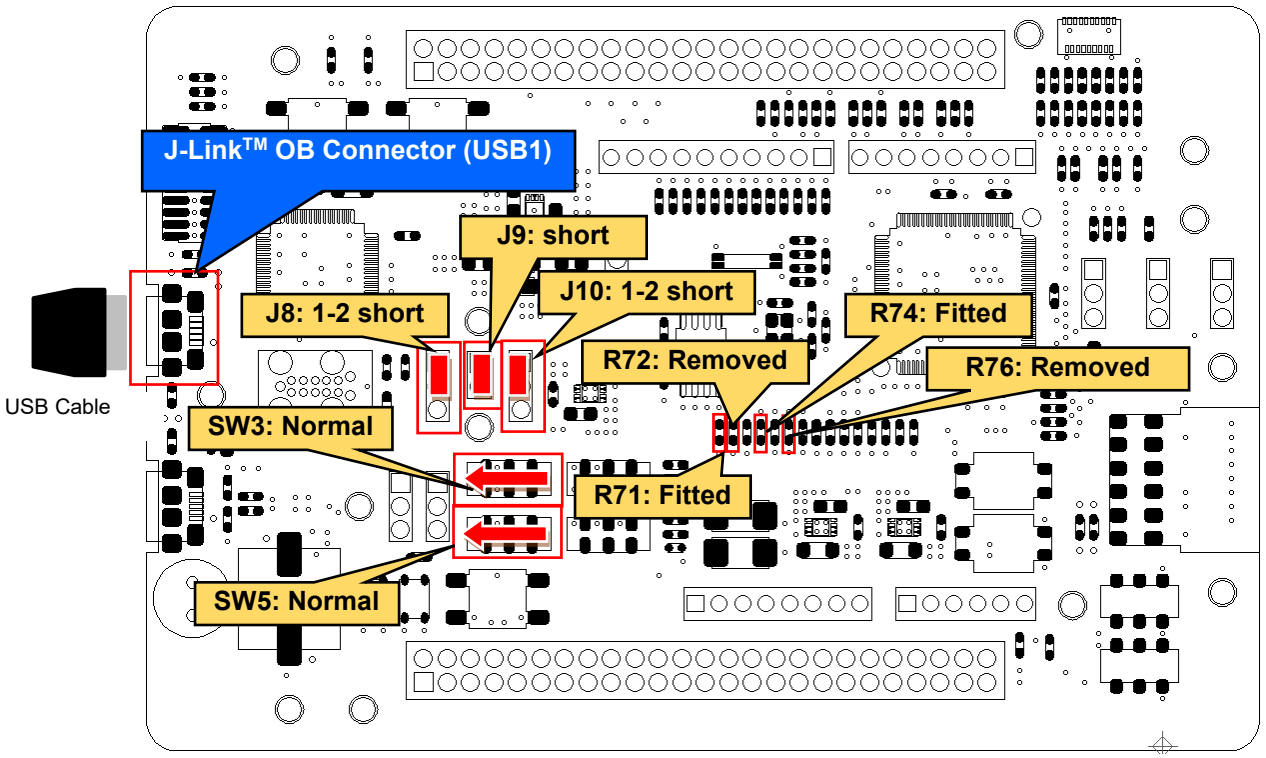
## 6.1 J-Link™ OB

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

### 6.1.1 Component Layout and Settings when using J-Link™ OB

When using J-Link™ OB, several switch and resistor settings must be set. **Figure 6-1** and **Table 6-2** shows the component layout and detailed settings for using J-Link™ OB**.** This function is supported in the default configuration, as supplied.

**Figure 6-2** and **Figure 6-3** show the connection relationship between the power supply and signals in this setting change.



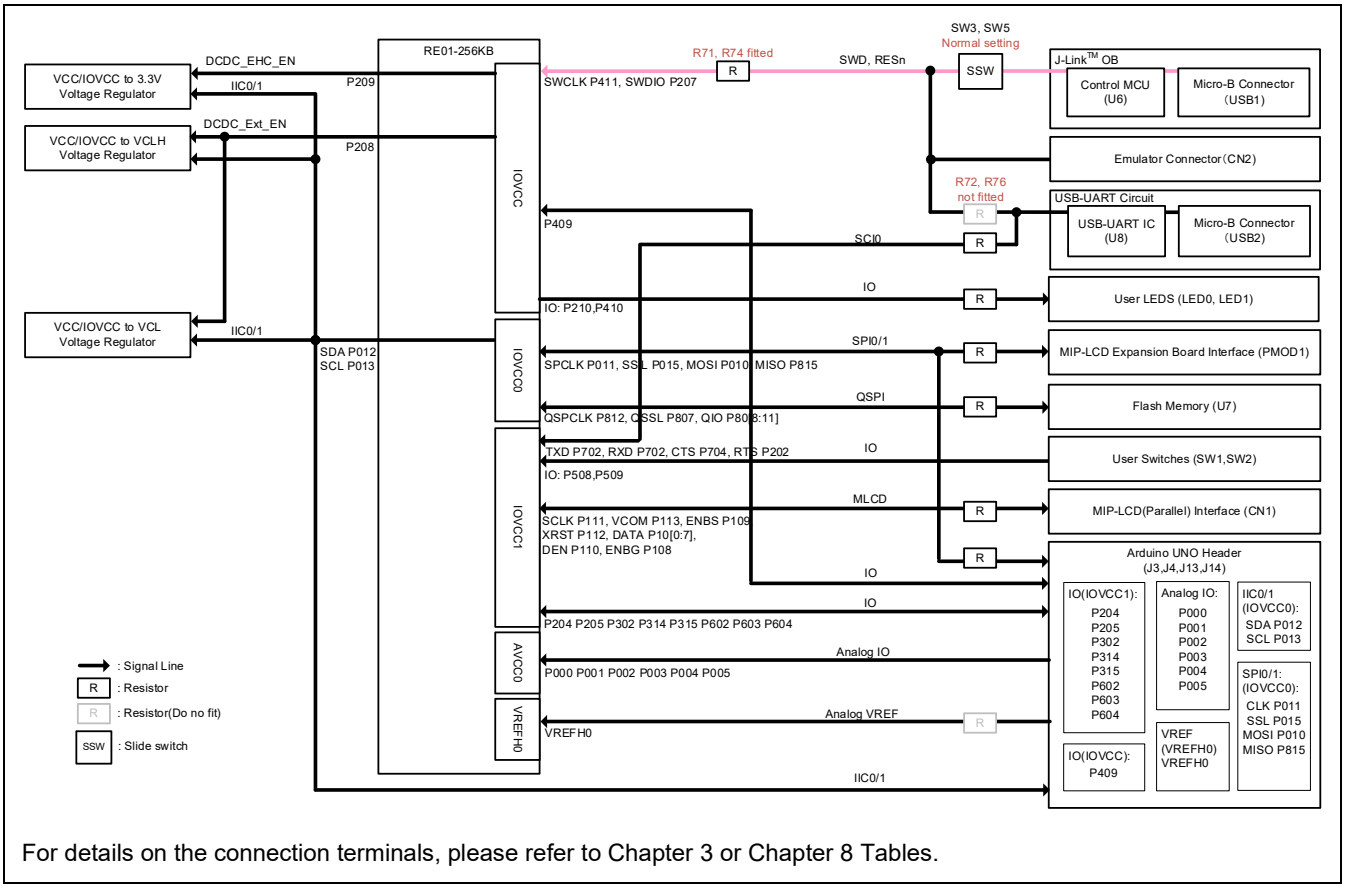

Other settings will be as per the default kit configuration, as supplied.

**Figure 6-1: Component Layout and Settings (J-Link™ OB)**

**Table 6-2: Configuration Details (J-Link™ OB)**

| Component | Setting | |
|---|---|---|
| SW3, SW5 | 1-2, 5-6 | Normal |
| J8 | 1-2 | short |
| J9 | - | short |
| J10 | 1-2 | short |
| R71, R74 | Fitted | |
| R72, R76 | Removed | |

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




For details on the connection terminals, please refer to Chapter 3 or Chapter 8 Tables.

**Figure 6-2: Block diagram of Signal line (J-Link™ OB)**

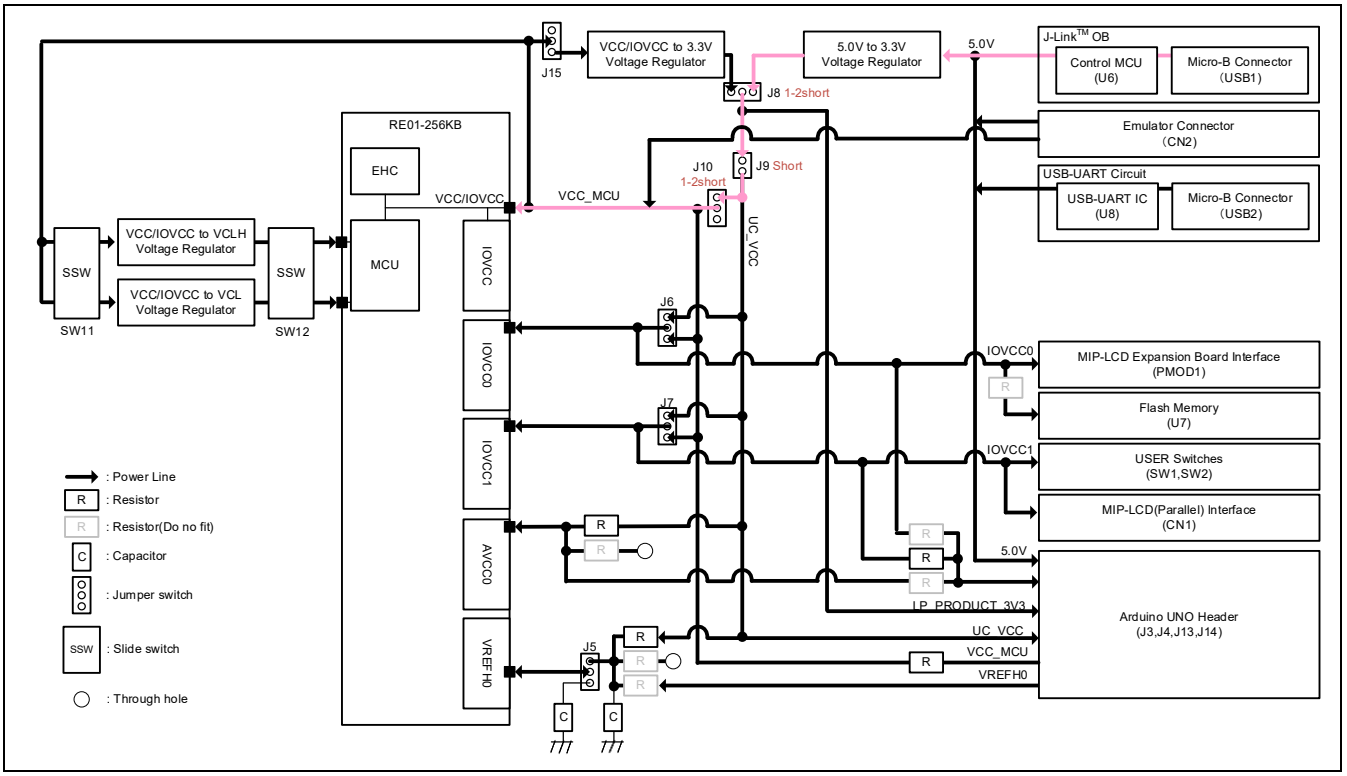



**Figure 6-3: Block diagram of Power line (J-Link™ OB)**

### 6.1.2 Debugger Connections

**Figure 6-4** shows the connections between main board (J-Link OB) and host PC. When using J-Link OB, do not connect to other emulators.

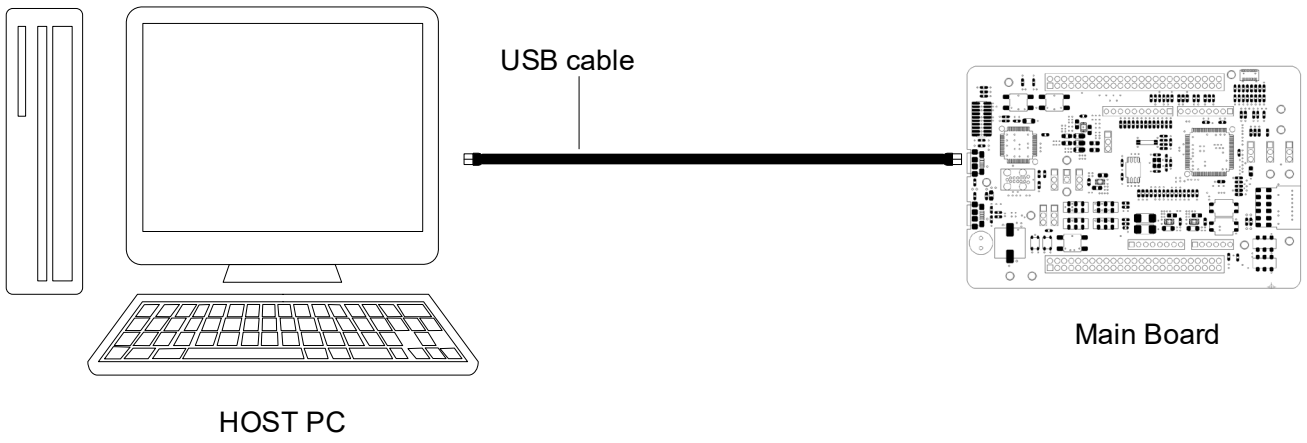



**Figure 6-4: Debugger Connection Diagram (J-Link™ OB)**

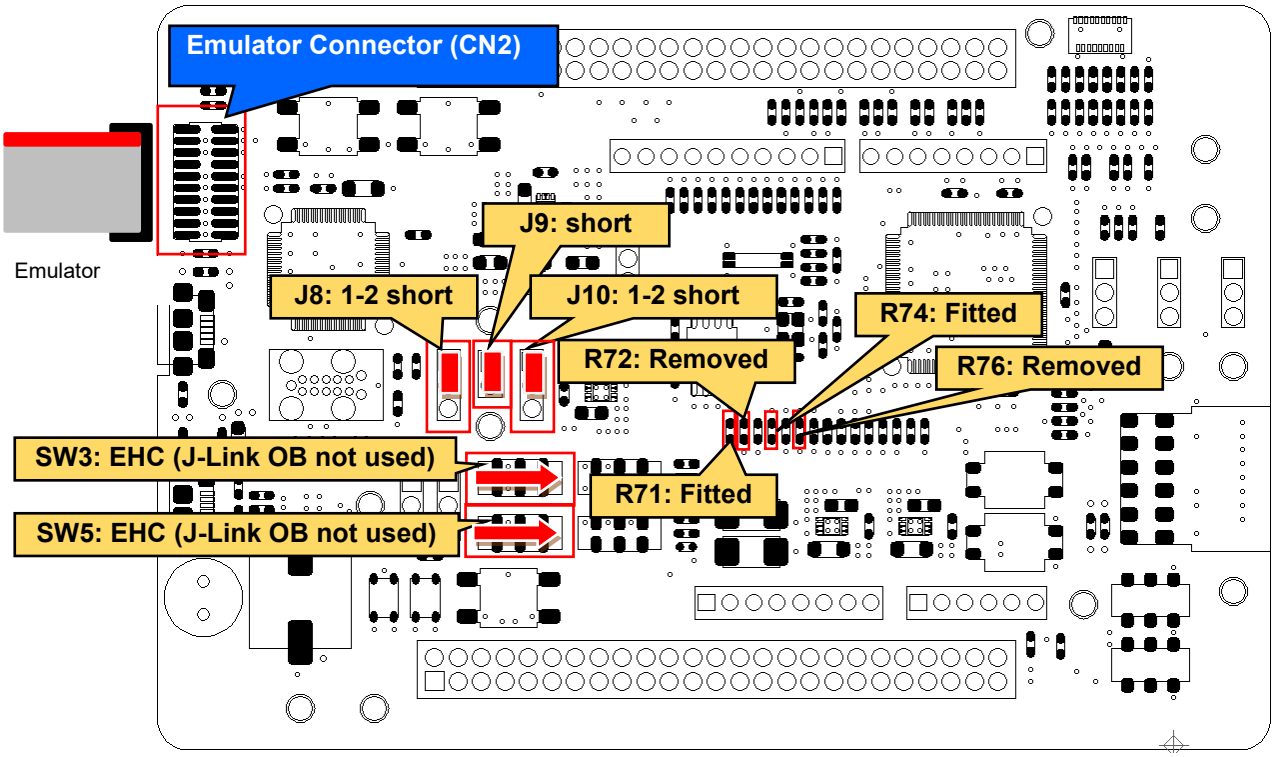
## 6.2 I-jet™, J-Link™

This main board can connect to IAR I-jet emulator or Segger J-Link™ emulator. RE01 can be debugged by using these emulators.

### 6.2.1 Component Layout and Settings when using I-jet™, J-Link™

When using the emulator, several switch and resistor settings must be set. **Figure 6-5** and **Table 6-3** shows the component layout and detailed settings. This function is not supported in the default configuration, as supplied.

**Figure 6-6** and **Figure 6-7** show the connection relationship between the power supply and signals in this setting change.



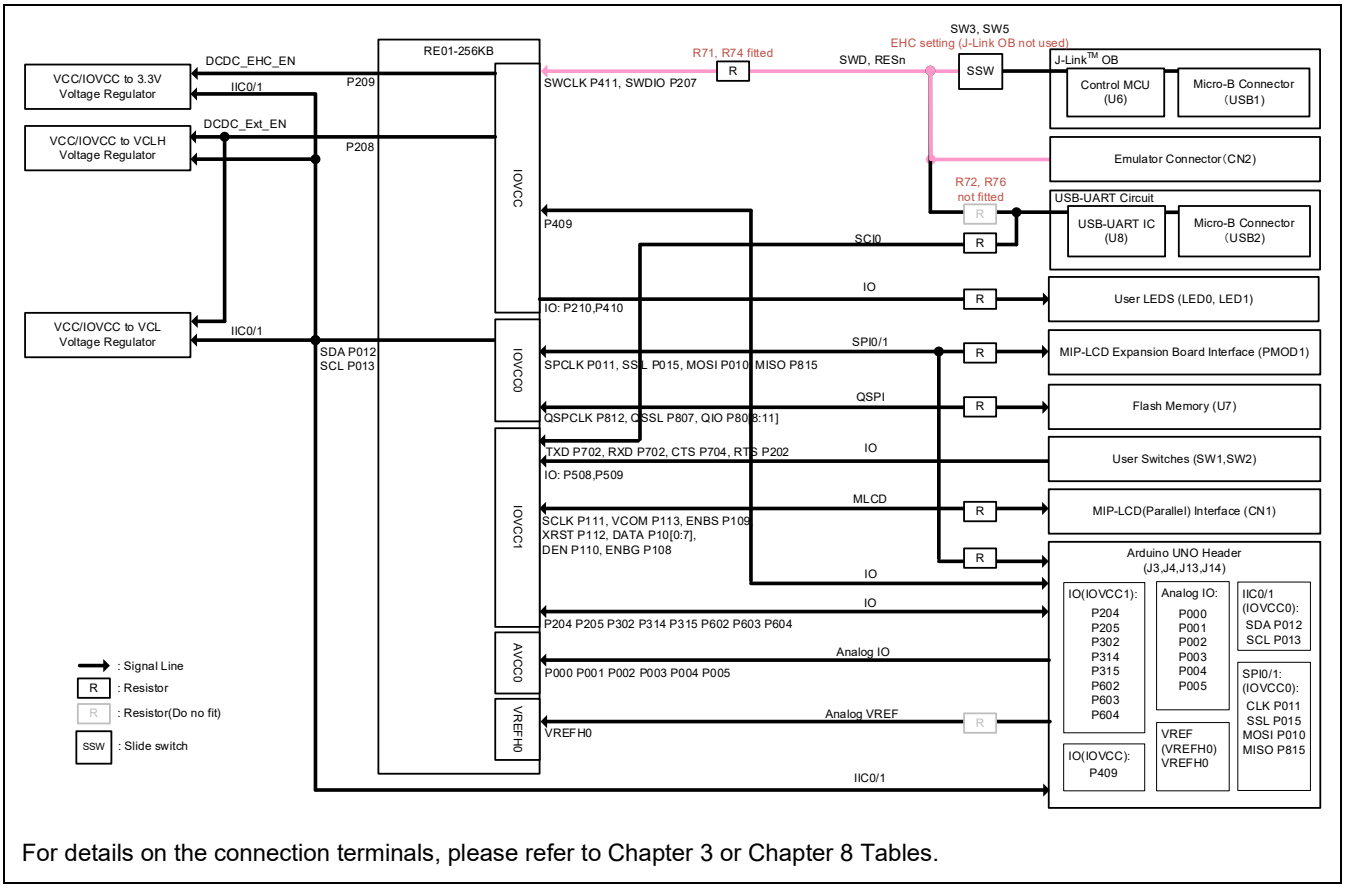

Other settings will be as per the default kit configuration, as supplied.

**Figure 6-5: Component Layout and Settings (I-jet™, J-Link™)**

**Table 6-3: Configuration Details (I-jet™, J-Link™)**

| Component | Setting | |
|---|---|---|
| SW3, SW5 | 2-3, 6-7 | EHC (J-Link OB not used) |
| J8 | 1-2 | short*1 |
| J9 | - | short*1 |
| J10 | 1-2 | short*1 |
| R71, R74 | Fitted*1 | |
| R72, R76 | Removed*1 | |

*1: The settings are supported in default configuration, as supplied.




For details on the connection terminals, please refer to Chapter 3 or Chapter 8 Tables.

**Figure 6-6: Block diagram of Signal line (I-jet™, J-Link™)**

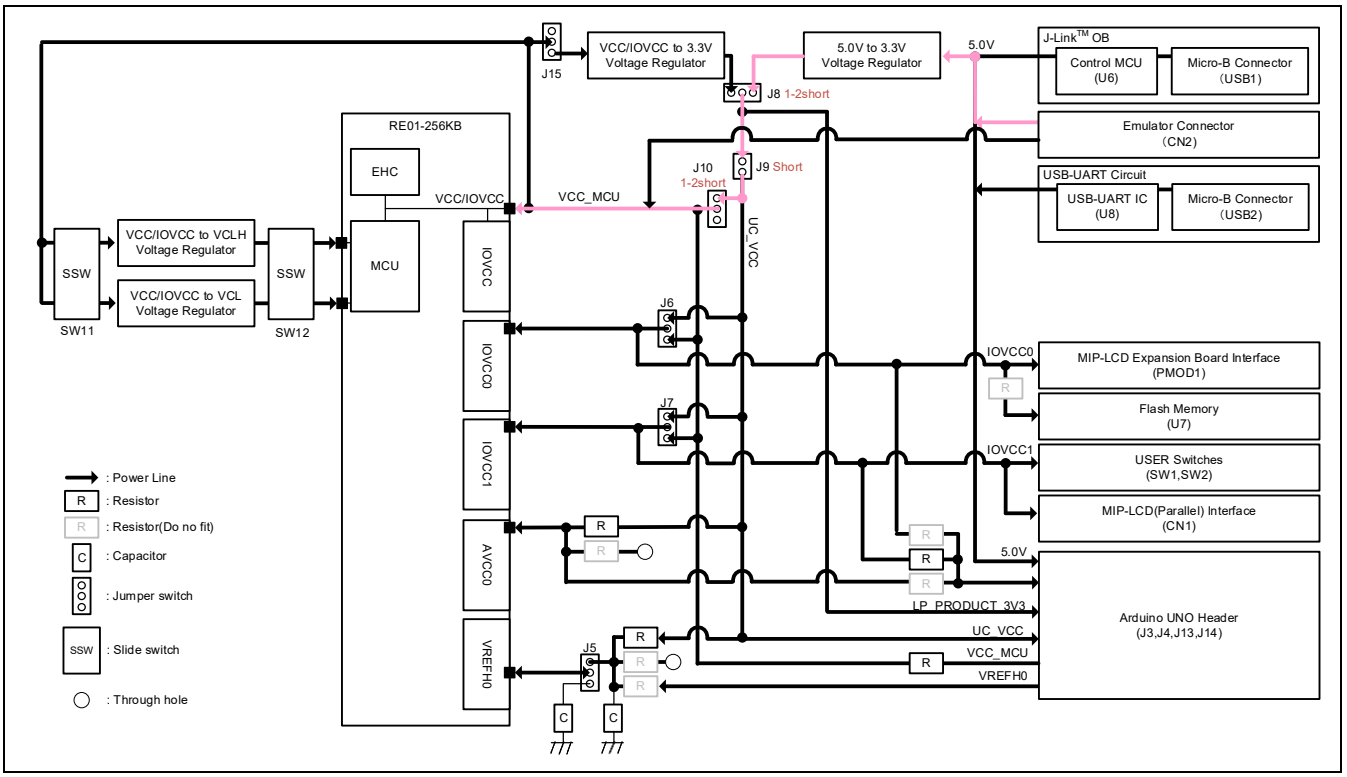



**Figure 6-7: Block diagram of Power line (I-jet™, J-Link™)**

### 6.2.2 Debugger Connections

**Figure 6-8** shows the connections between main board, emulator, and host PC.

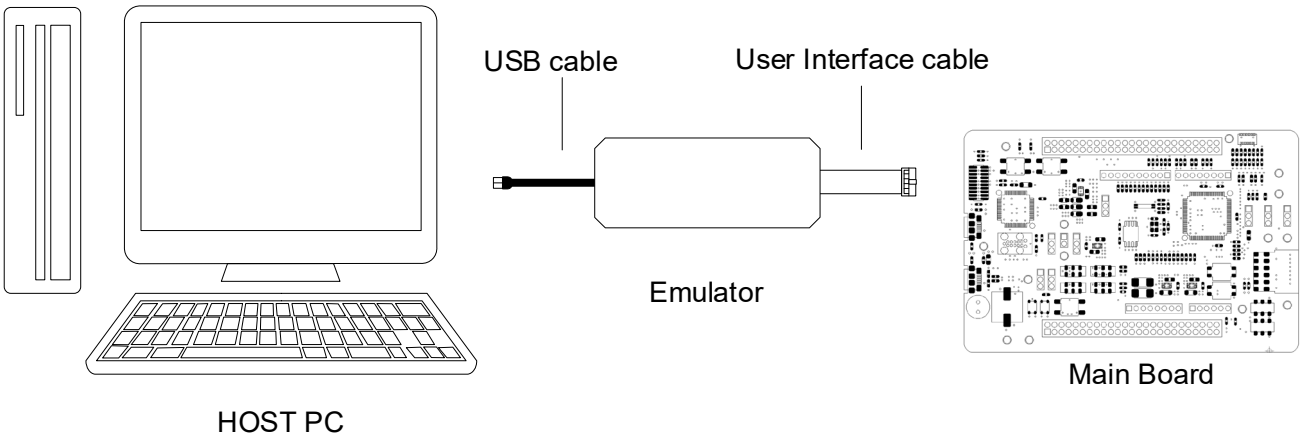



**Figure 6-8: Debugger Connection Diagram (Excluding J-Link™ OB)**

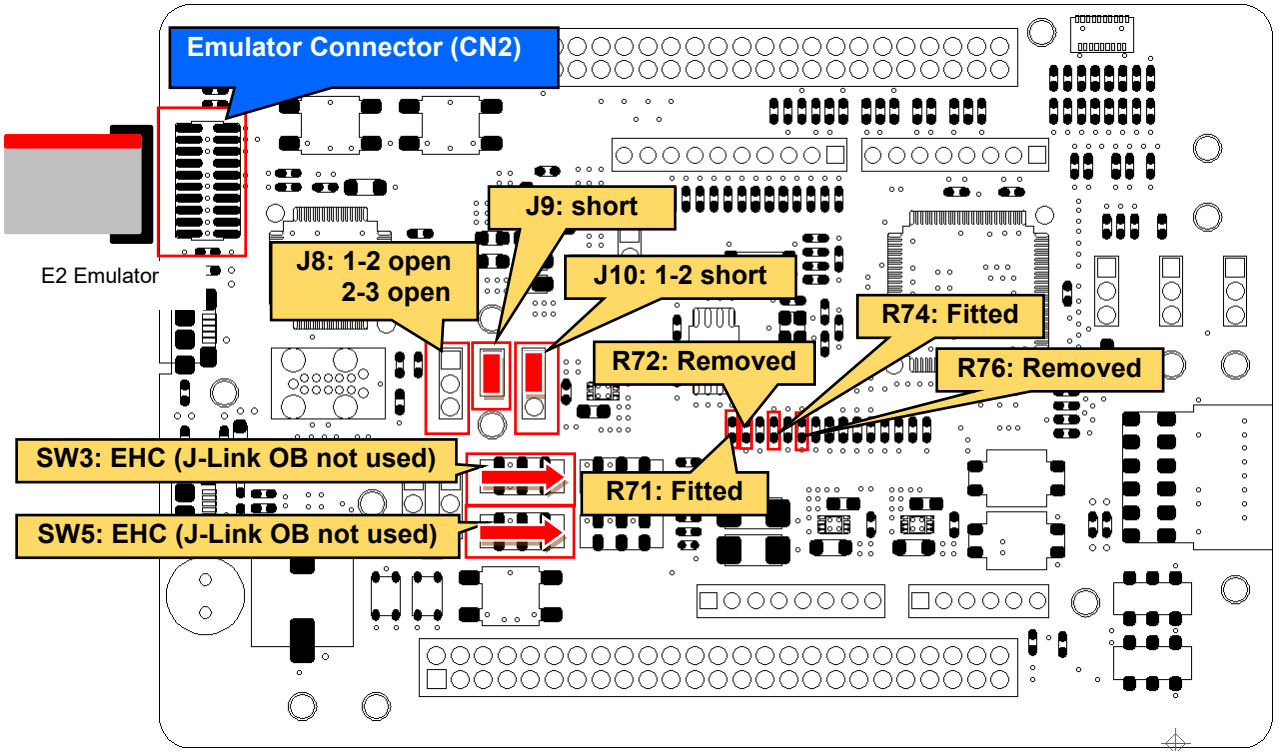
## 6.3 E2

This main board can connect to Renesas E2 emulator. RE01 can be debugged by using this emulator.

### 6.3.1 Component Layout and Settings when using E2

When using the emulator, several switch and resistor settings must be set. **Figure 6-9** and **Table 6-4** shows the component layout and detailed settings. This function is not supported in the default configuration, as supplied.

**Figure 6-10** and **Figure 6-11** show the connection relationship between the power supply and signals in this setting change.



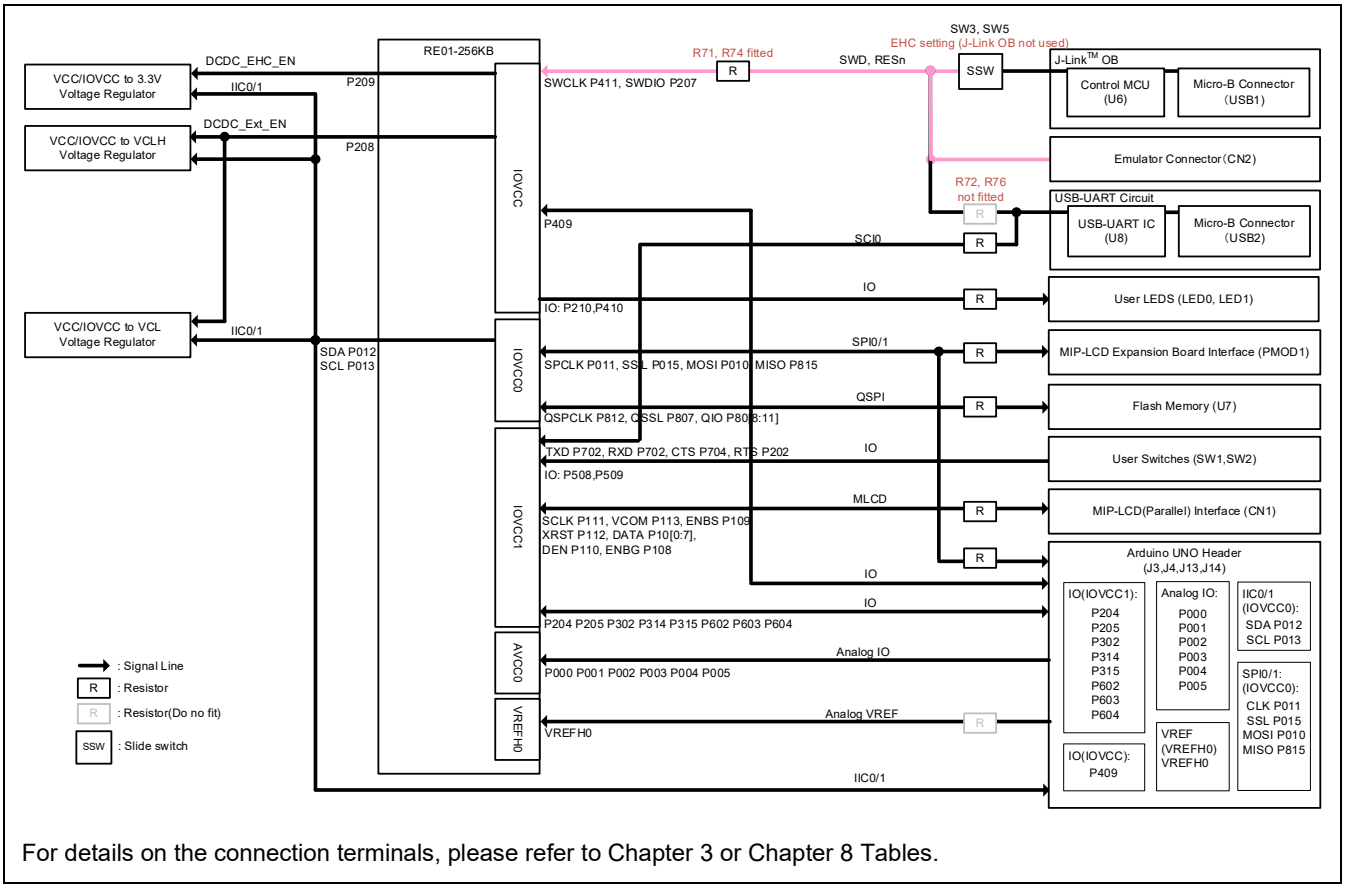

Other settings will be as per the default kit configuration, as supplied.

**Figure 6-9: Component Layout and Settings (E2)**

**Table 6-4: Configuration Details (E2)**

| Component | Setting | |
|---|---|---|
| SW3, SW5 | 2-3, 6-7 | EHC (J-Link OB not used) |
| J8 | 1-2, 2-3 | open |
| J9 | - | short*1 |
| J10 | 1-2- | short*1 |
| R71, R74 | Fitted*1 | |
| R72, R76 | Removed*1 | |

*1: The setting is supported in default configuration, as supplied.




For details on the connection terminals, please refer to Chapter 3 or Chapter 8 Tables.

**Figure 6-10: Block diagram of Signal line (E2)**

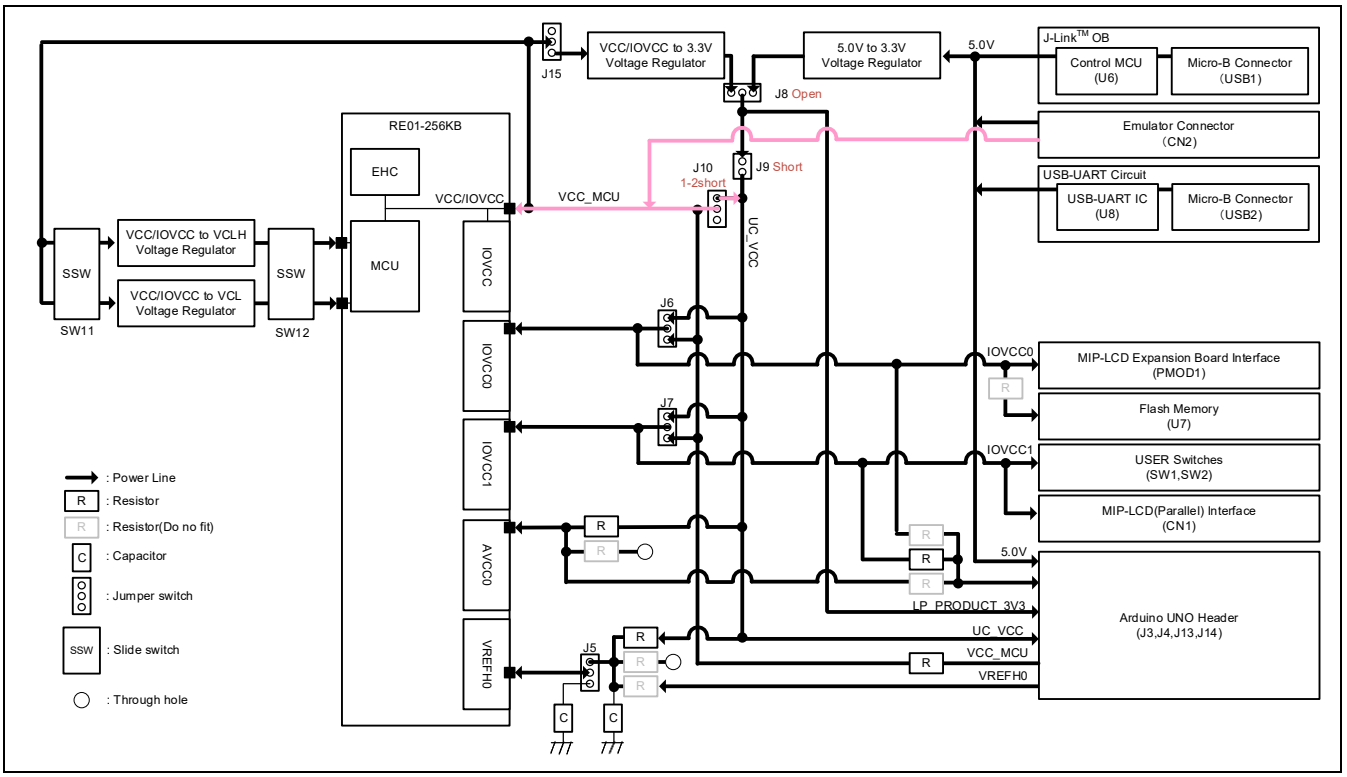



**Figure 6-11: Block diagram of Power line (E2)**

### 6.3.2 Debugger Connections

The connection between the main board, emulator, and host PC is the same as in **Figure 6-8**.

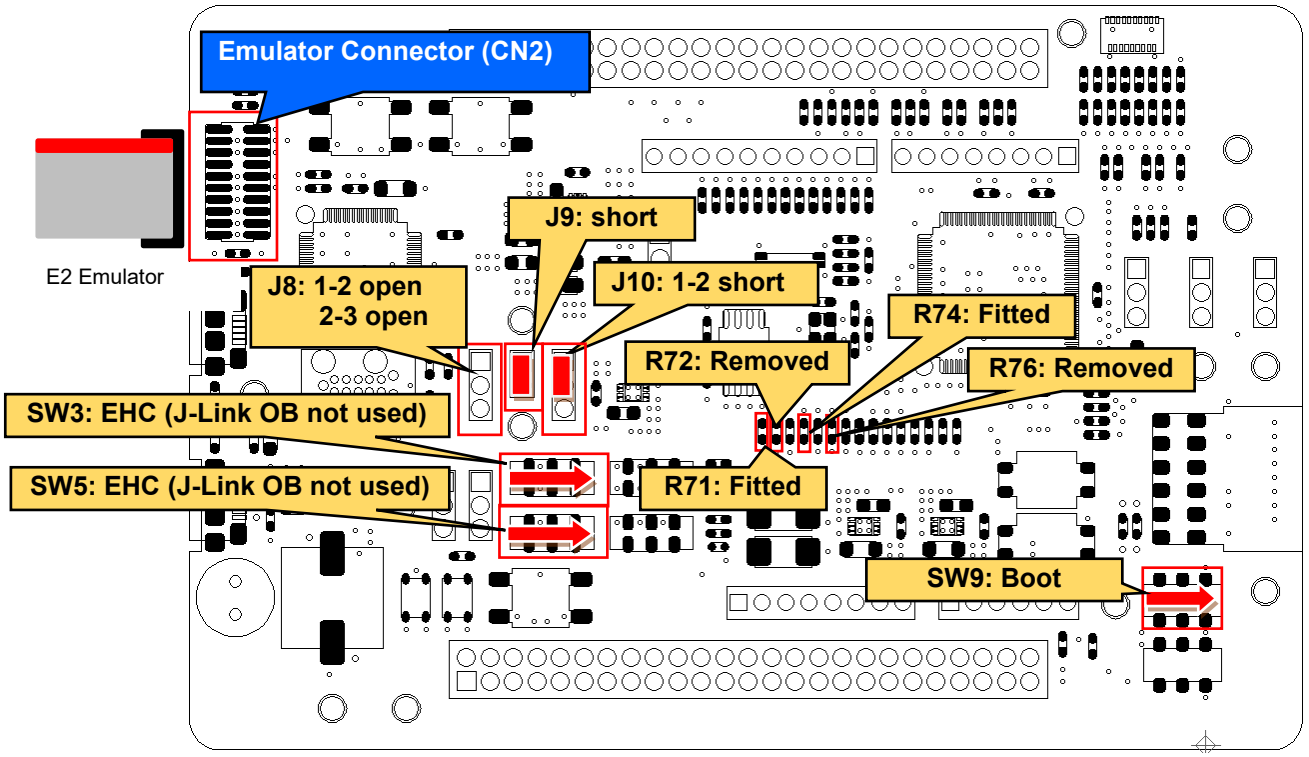
## 6.4 Flash Programmer -Renesas Flash Programmer-

This main board supports Renesas Flash Programmer (RFP) for writing programs to RE01's internal flash memory. Writing can be performed by using E2 emulator and an USB cable.

### 6.4.1 When using E2 Emulator

A program can be written from host PC to RE01's internal flash memory via E2 emulator. To use RFP, switch and resistor settings must be set. Component layout and detailed settings are shown in **Figure 6-12** and **Table 6-5**. This function is not supported in the default configuration, as supplied.

**Figure 6-13** and **Figure 6-14** show the connection relationship between the power supply and signals in this setting change.



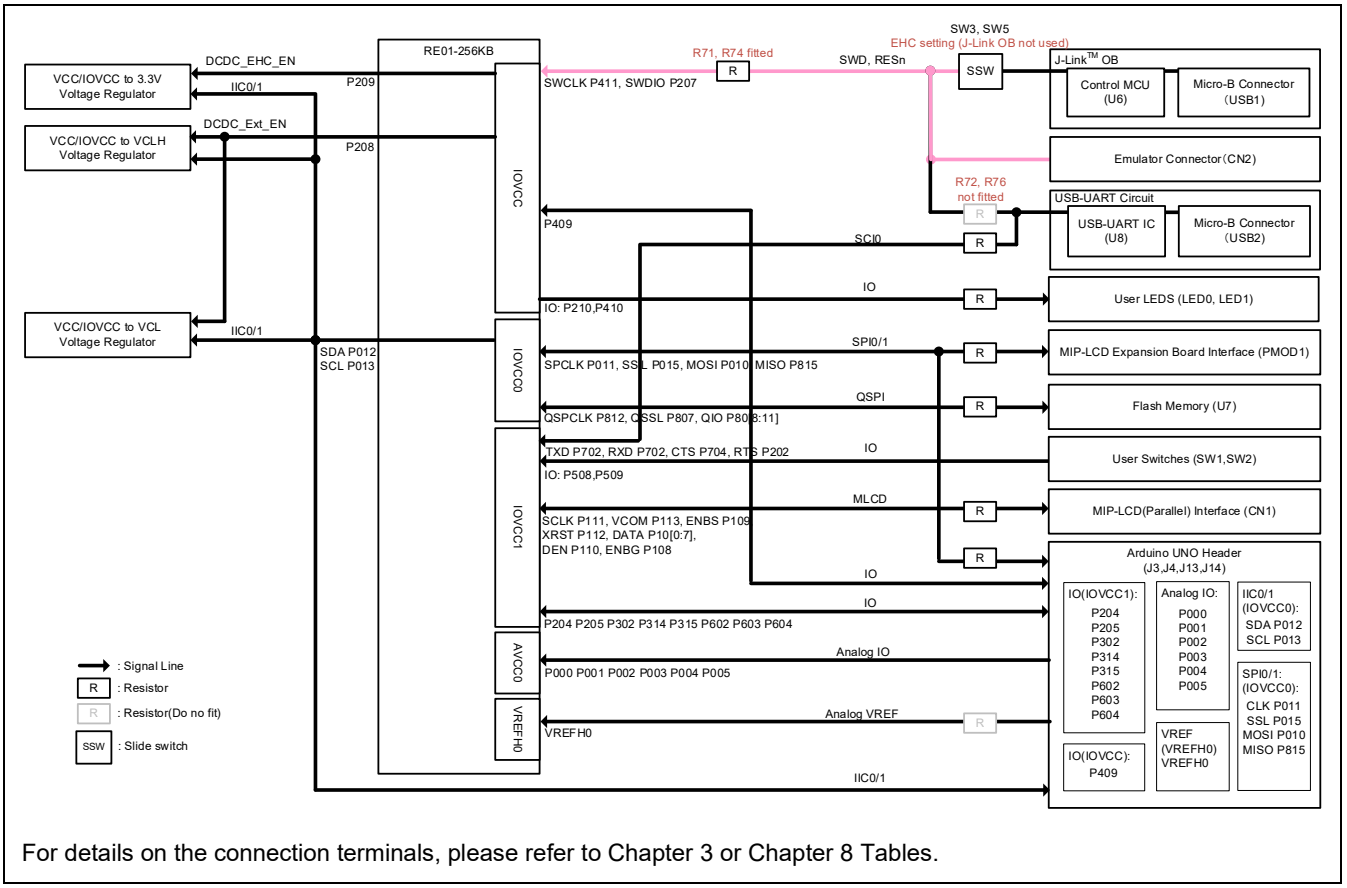

Other settings will be as per the default kit configuration, as supplied.

**Figure 6-12: Component Layout and Settings (RFP with E2)**

**Table 6-5: Configuration Details (RFP with E2)**

| Component | Setting | |
|---|---|---|
| SW3, SW5 | 2-3, 6-7 | EHC (J-Link OB not used) |
| SW9 | 2-3 | Boot |
| J8 | 1-2, 2-3 | open |
| J9 | - | short*1 |
| J10 | 1-2 | short*1 |
| R71, R74 | Fitted*1 | |
| R72, R76 | Removed*1 | |

*1: The settings are supported in default configuration, as supplied.




For details on the connection terminals, please refer to Chapter 3 or Chapter 8 Tables.

**Figure 6-13: Block diagram of Signal line (RFP with E2)**

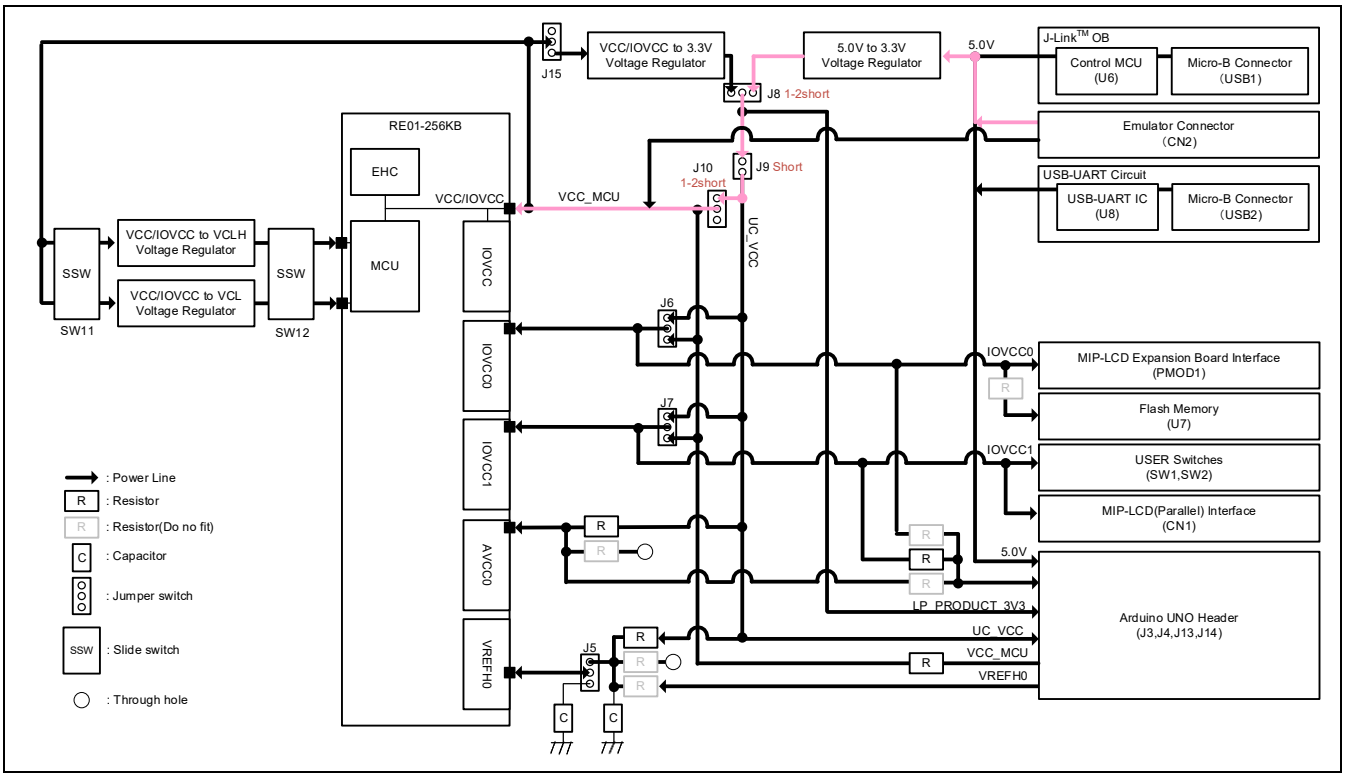
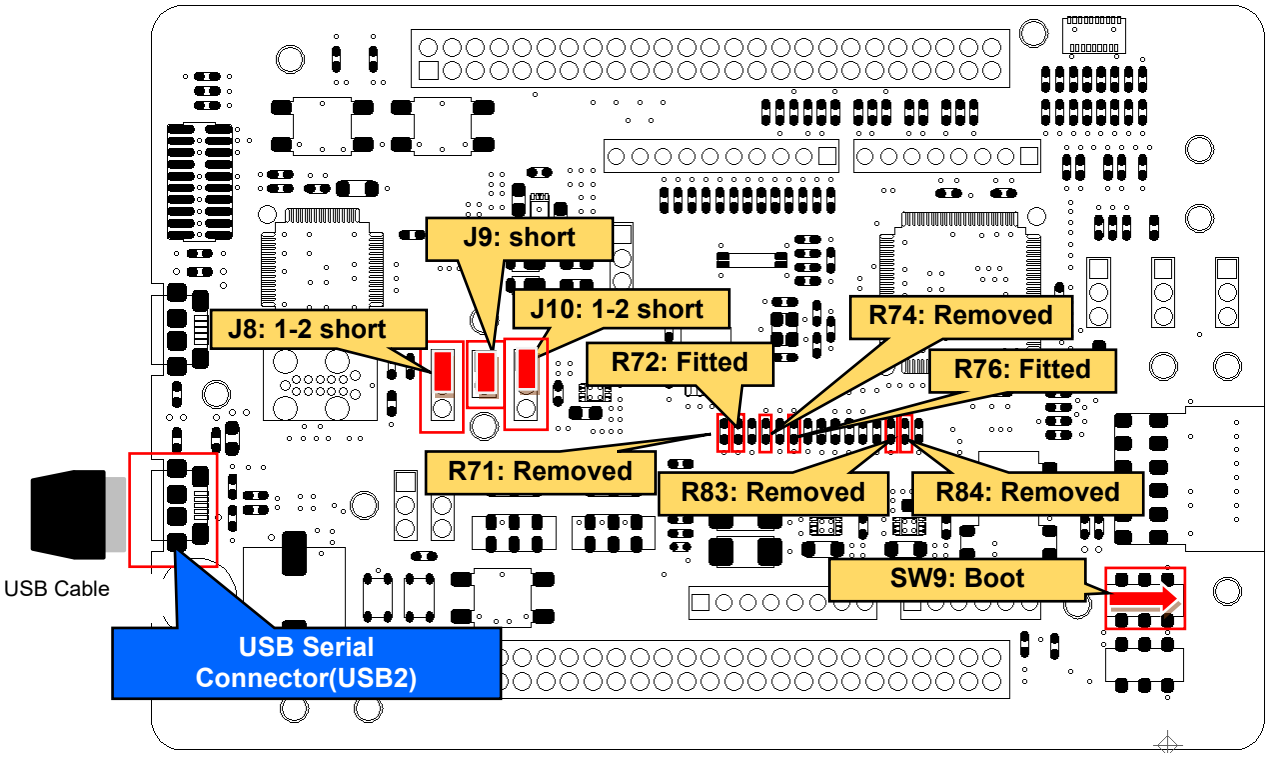



**Figure 6-14: Block diagram of Power line (RFP with E2)**

### 6.4.2 When using USB Cable (USB Serial)

A program can be written from host PC to RE01's internal flash memory by using an USB cable. To use RFP, specific switch and resistor settings must be set. Component layout and detailed settings are shown in **Figure 6-15** and **Table 6-6**. This function is not supported in the default configuration, as supplied.

**Figure 6-16** and **Figure 6-17** show the connection relationship between the power supply and signals in this setting change.



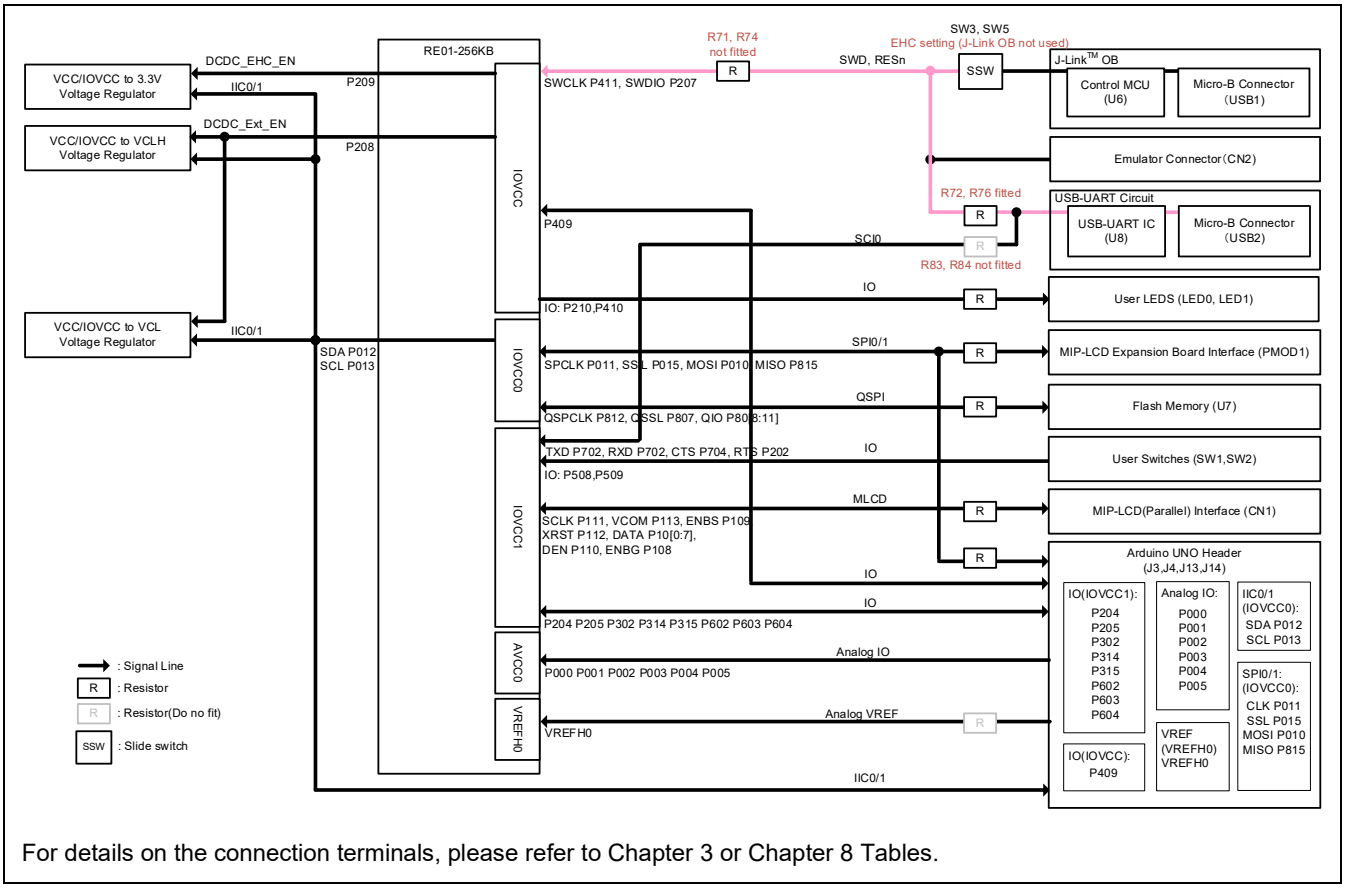

Other settings will be as per the default kit configuration, as supplied.

**Figure 6-15: Component Layout and Settings (RFP with USB-Serial )**

**Table 6-6: Configuration Details (RFP with USB-Serial )**

| Component | Setting | |
|---|---|---|
| SW9 | 2-3 | Boot |
| J8 | 1-2 | short*1 |
| J9 | - | short*1 |
| J10 | 1-2 | short*1 |
| R71, R74 | Removed | |
| R72, R76 | Fitted | |
| R83, R84 | Removed | |

*1: The settings are supported in default configuration, as supplied.




For details on the connection terminals, please refer to Chapter 3 or Chapter 8 Tables.

**Figure 6-16: Block diagram of Signal line (RFP with USB-Serial)**

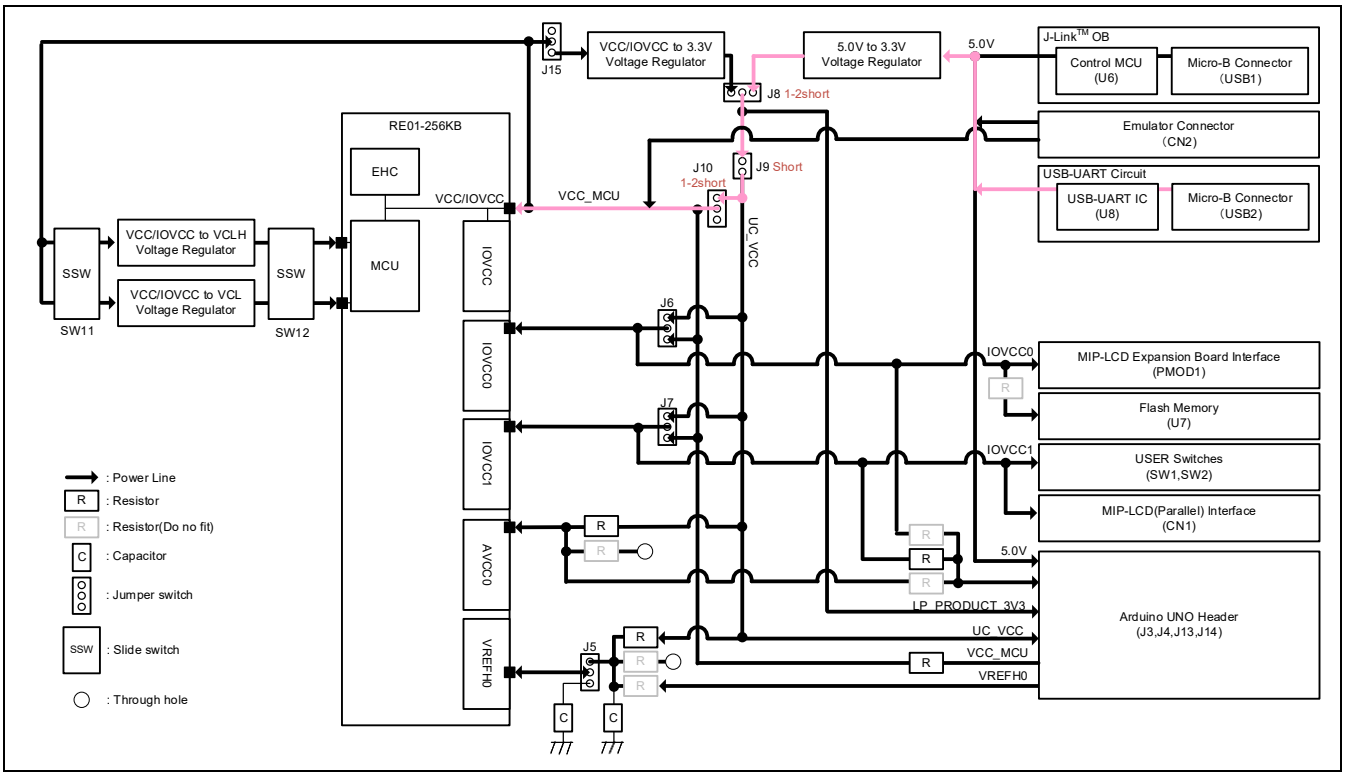



**Figure 6-17: Block diagram of Power line (RFP with USB-Serial)**

### 6.4.3 Debugger Connections

**Figure 6-18** shows the connection between the main board, emulator, and host PC. When using flash programmer, do not connect emulators for purposes other than flash programming.

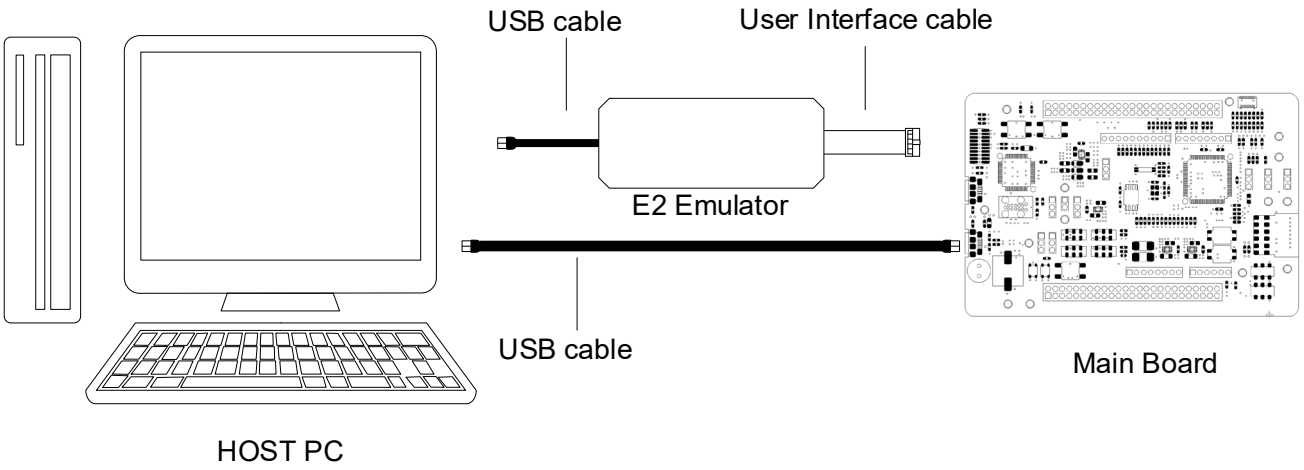



**Figure 6-18: Debugger Connection Diagram (RFP)**

### 6.4.4 How to Use

#### 6.4.4.1 When using E2 Emulator

Follow the procedures below to supply power from E2 emulator.

1. Set the switches and resistors on the main board as shown in **Table 6-5**.
2. Connect the emulator connector (CN2) to host PC via E2 emulator.
3. Start RFP on host PC.
4. On RFP, choose File->New Project.
   Insert new project name, and choose 3.3V under Power Supply in Tool Details.
5. Click the “Connect” button on the RFP.
6. When the connection is established, “Operation Completed” will be displayed on the screen.
7. Select the program to write.
8. Click the “Start” button on the RFP.
9. After writing is completed, “Operation Completed” will be displayed on the RFP.

#### 6.4.4.2 When using USB Cable (USB Serial)

Follow the procedures below to supply power from a USB cable (USB Serial).

1. Set the switches and resistors as shown in **Table 6-6**.
2. Connect the USB serial connector (USB2) to host PC via USB cable.
3. Start RFP on host PC.
4. On RFP, choose File->New Project.
   Insert new project name, and choose “USB Serial Port” in Tool Details.
5. Click the “Connect” button on the RFP.
6. When the connection is established, “Operation Completed” will be displayed on the screen.
7. Select the program to write.
8. Click the “Start” button on the RFP.
9. After writing is completed, “Operation Completed” will be displayed on the RFP.

## 6.5 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-Link™ OB or J-Link™ emulator.

### 6.5.1 Connection and Settings

When using J-Link™ OB, please refer to **section 6.1.1**.
When use J-Link™ emulator, please refer to **section 6.2.1**.

### 6.5.2 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.

## 6.6 Emulator connection in EHC mode

When the RE01 is connected to an emulator, the internal debugging circuitry runs which increases the power consumption of the RE01 . Therefore, when debugging in EHC mode, it is necessary to keep supplying enough power to run the device.

The following shows how to debug in EHC mode using a voltage source.

Note 1: This procedure assumes that a program to transition to the steady operation period in Chapter 13 EHC of the UM (the RE01 Group User's Manual: Hardware) has been constructed. Please write the program to transition to the steady operation in advance.

Note 2: The power supply from the emulator should be disabled.

### 6.6.1 Connection and Settings

After setting the board to EHC mode, connect the voltage source and the emulator as shown in **Figure 6-19**. For setting the EHC mode, refer to **Section 5.2 EHC Operation**.

**Figure 6-19** shows the case where the on-board super capacitor (BT2) is used as the secondary battery. If an external secondary battery or super capacitor is used (BT1), connect a voltage source to J12 1pin.

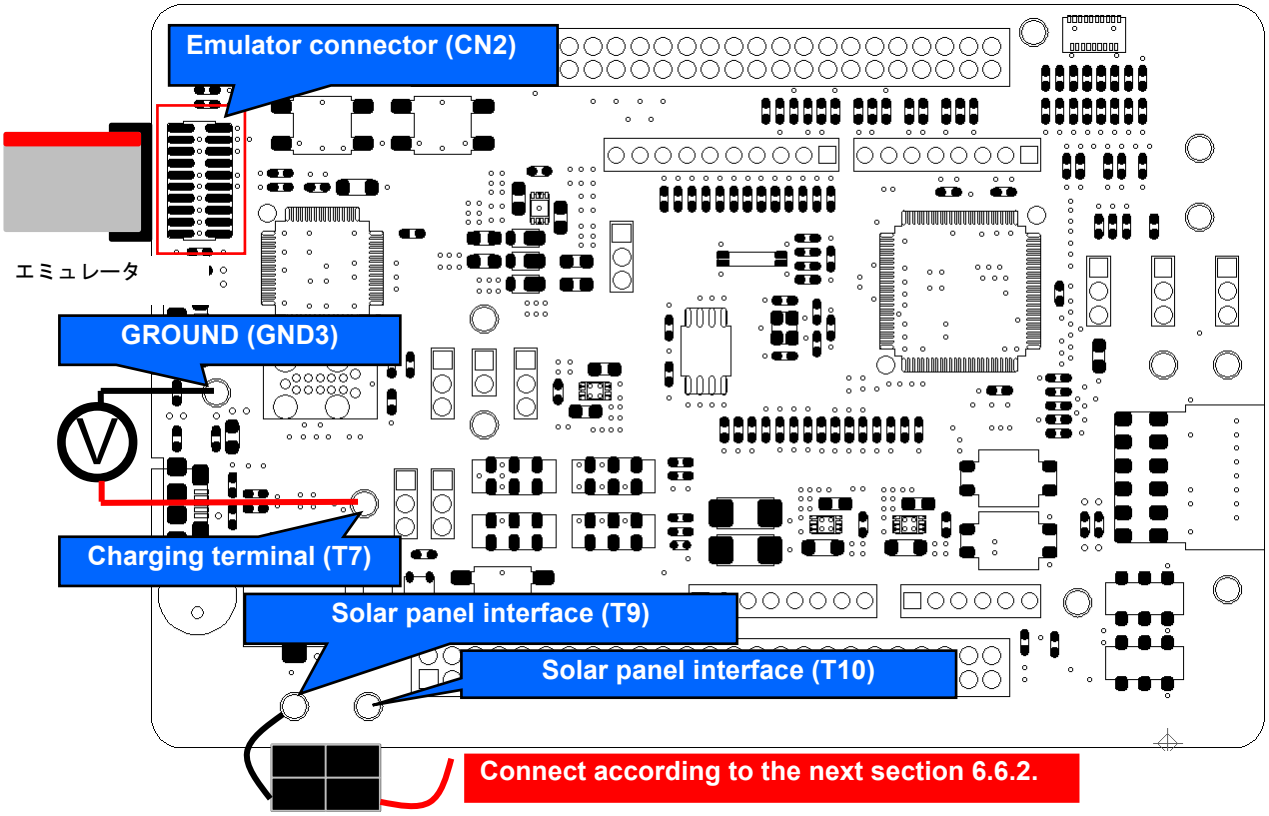



**Figure 6-19: Connection for connecting an emulator in EHC mode**

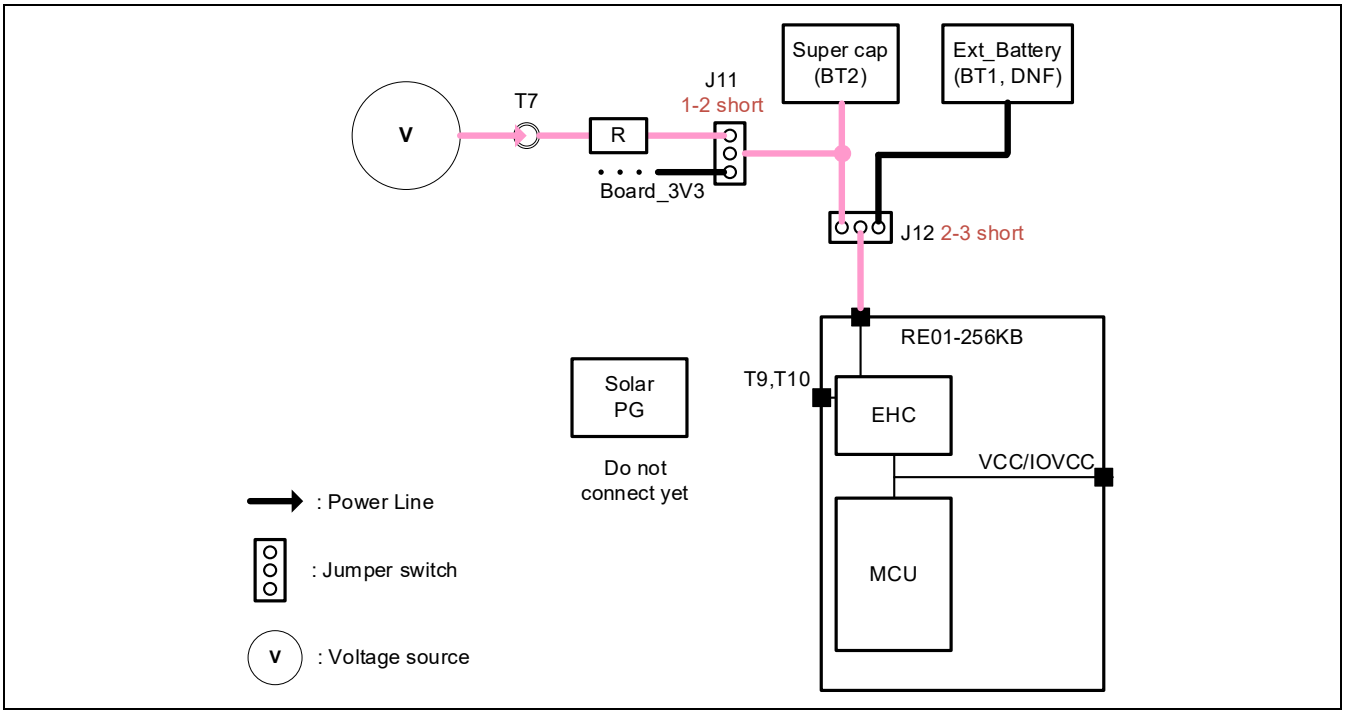



**Figure 6-20: Schematic diagram of the connection**

### 6.6.2 Debugging Procedure

Follow the steps below to debug.

1. Supply power from VSC_VCC (T10) to start RE01.
2. In order to transition from the secondary battery charging period to the steady operation period, apply a voltage higher than the software threshold voltage. (There is no problem if the voltage is applied before starting RE01.)
3. Operate the IDE to debug.

If the QUICKMODE bit of RE01 is changed from 1 to 0 after the transition to the steady state, the EHC circuit will be initialized and the power of RE01 will be turned off. If you wish to debug again, please follow the above procedure again.

# 7.Current Measurement Circuit

This main board allows the user to measure the current consumption of the RE01. **Figure 7-1** shows the current flow that can be measured with the default settings. Sample code is also available on Renesas website, entitled “RE01 256KB Group Low Power Mode Transition Example” (R01AN5337).

## 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**.

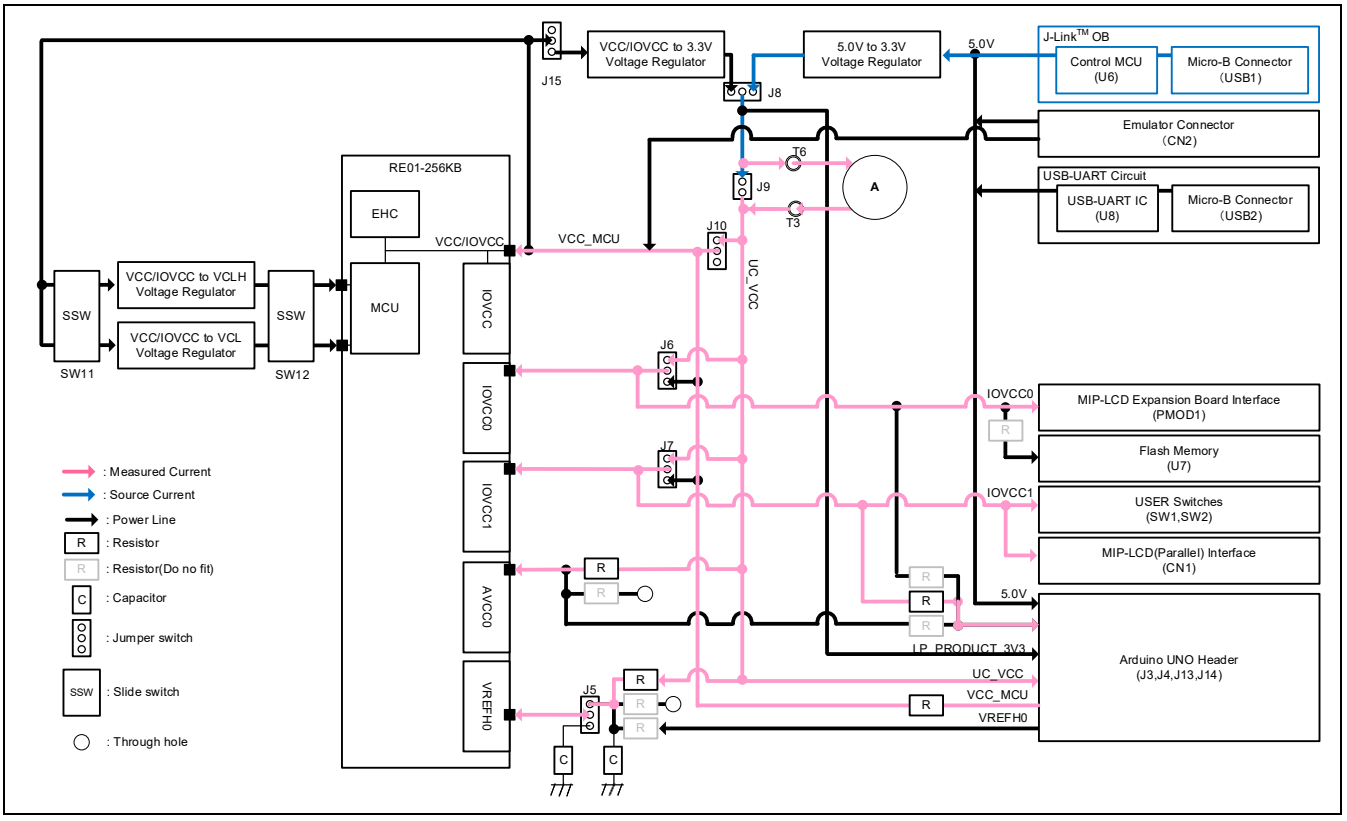
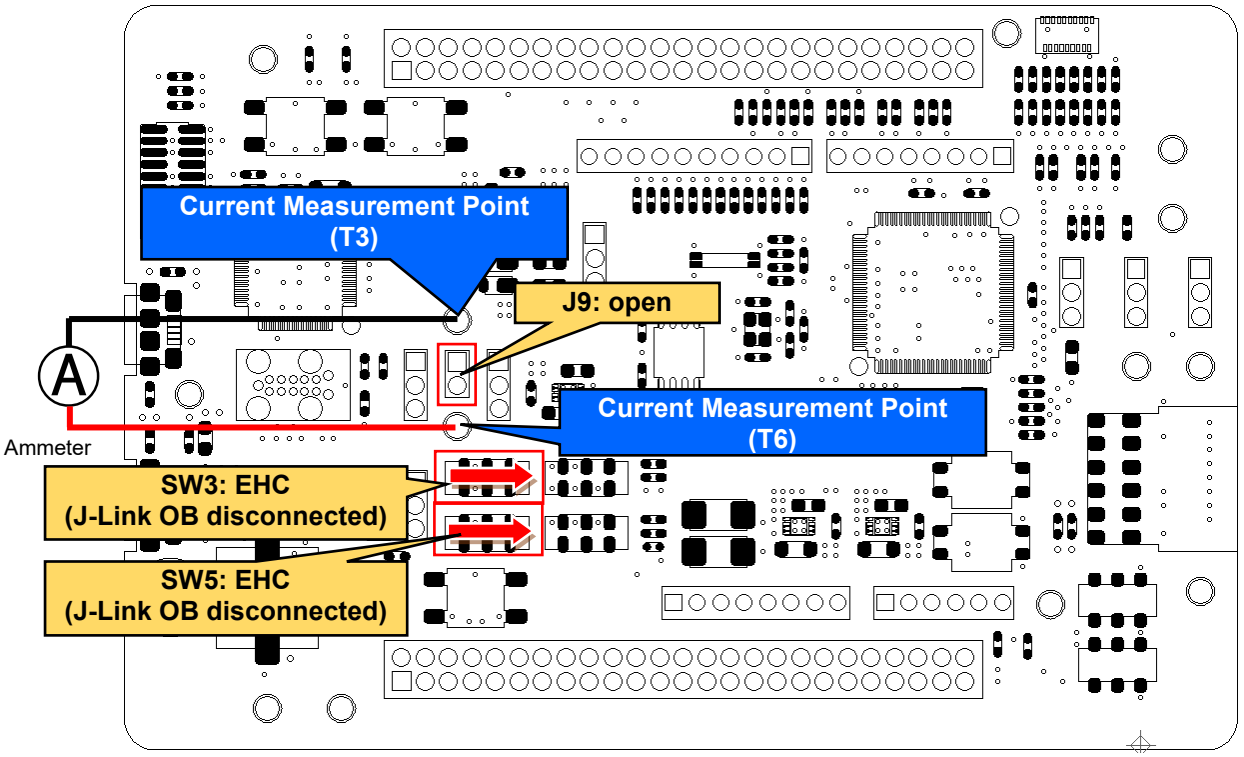



**Figure 7-1: Current flow when using on-board regulator 3.3V**

### 7.1.1 Settings for 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 and Setting**
**(Current Measurement, using on-board regulator 3.3V)**

**Table 7-1: Configuration Details (Current Measurement, using on-board regulator 3.3V)**

| Component | Setting | |
|---|---|---|
| J9 | - | open |
| SW3, SW5 | 2-3, 6-7 | EHC (J-Link OB not used) |

### 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 J9.
2. Connect an ammeter to current measurement points (T3 and T6).
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**.

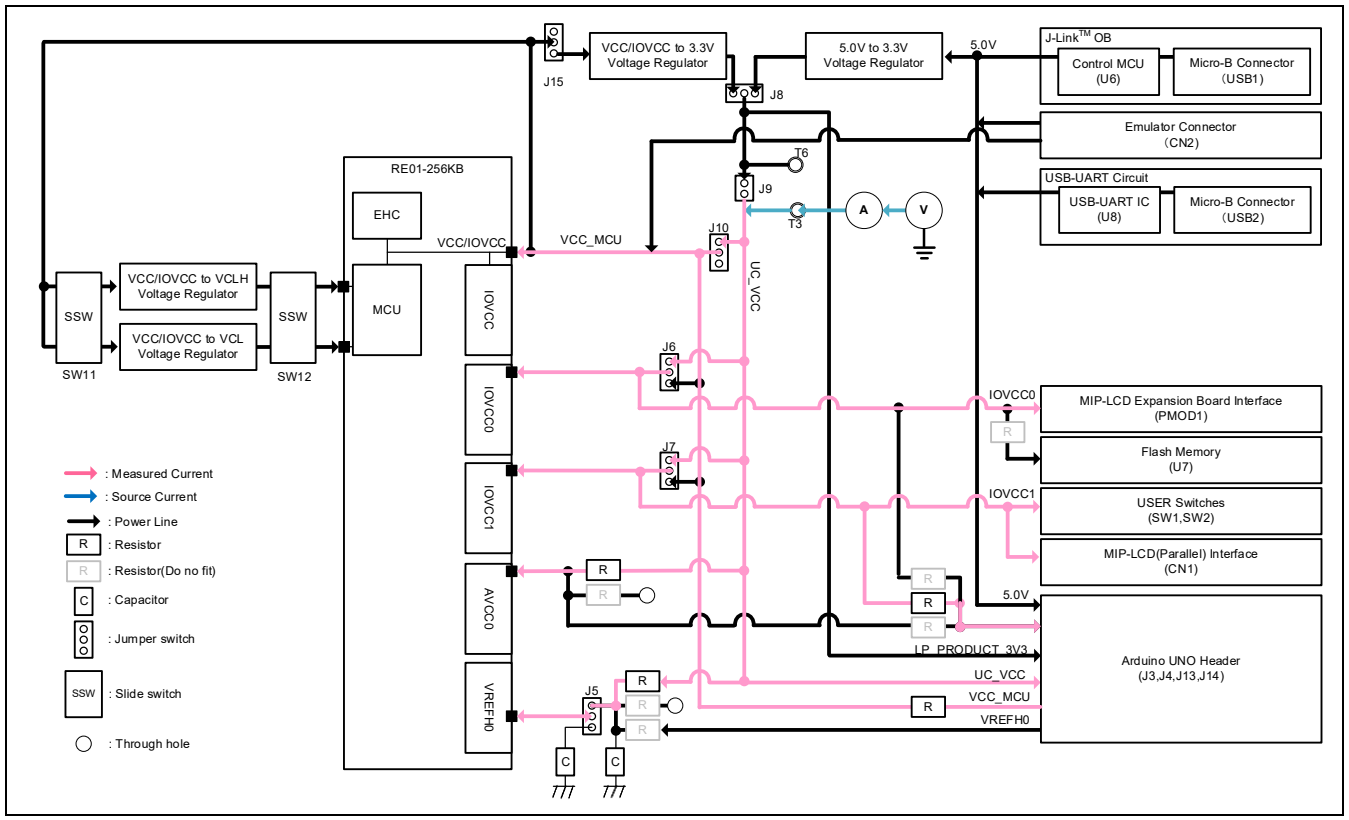
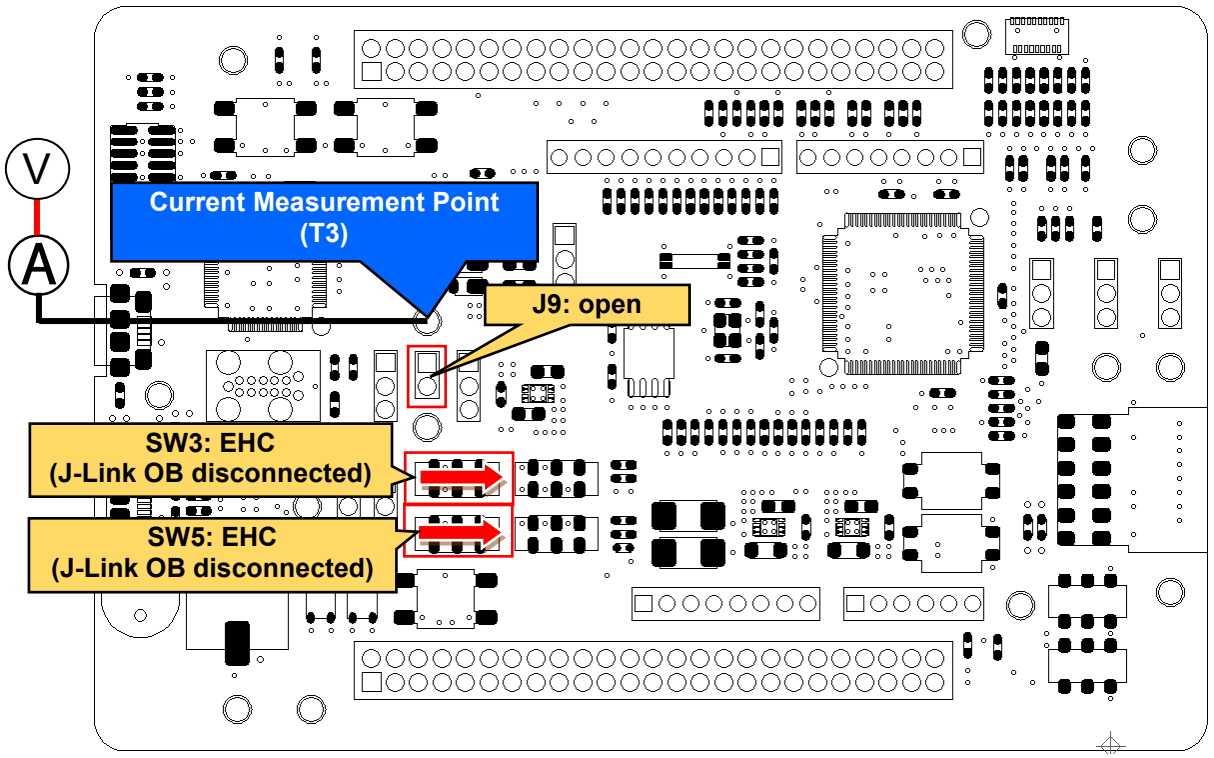



**Figure 7-3: Current flow when on-board regulator 3.3V is not used**

### 7.2.1 Settings for current measurement

Set up the board as shown in **Figure 7-4**, and connect the voltage source and the ammeter. If you want to supply voltage to the Arduino UNO interface, please supply voltage from T6 or J8 pin 2 separately.




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)**

**Table 7-2: Configuration Details (Current Measurement, on-board regulator 3.3V not used)**

| Component | Setting | |
|---|---|---|
| J9 | - | open |
| SW3, SW5 | 2-3, 6-7 | EHC (J-Link OB not used) |

### 7.2.2 How to use

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

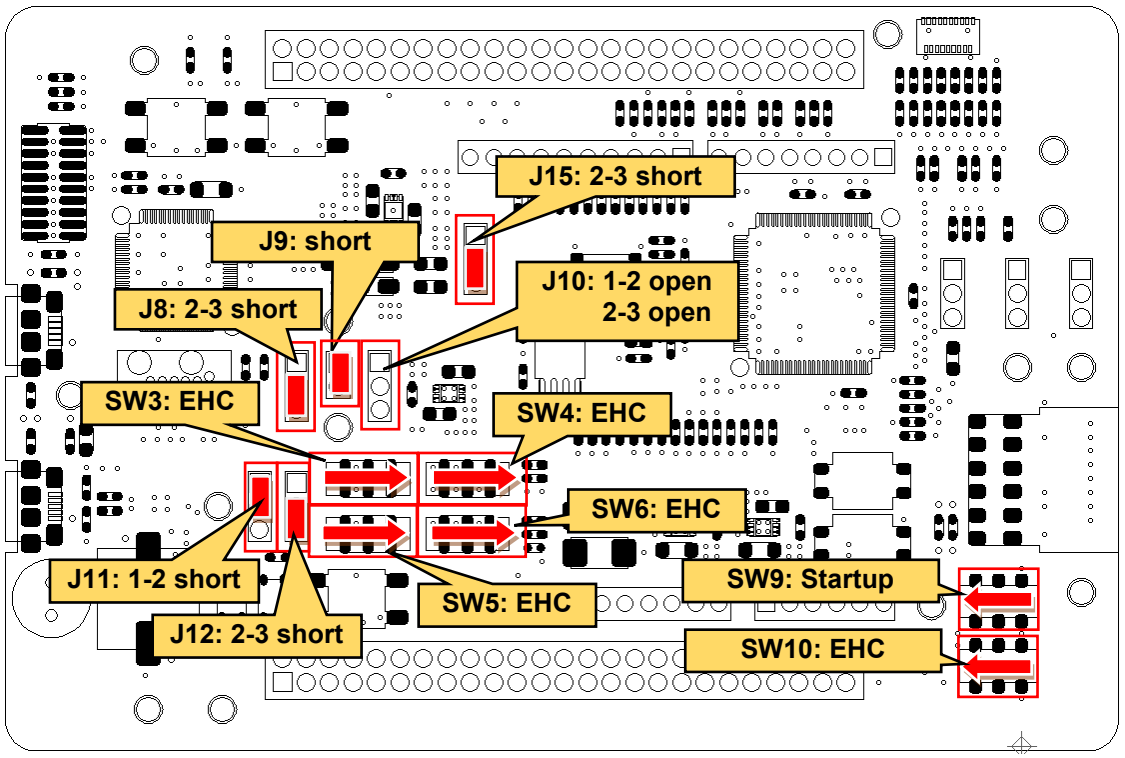
1. Open J9.
2. Connect an ammeter to current measurement points (T3 and T6).
3. Supply the board by using stand-alone power supply.

## 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)**

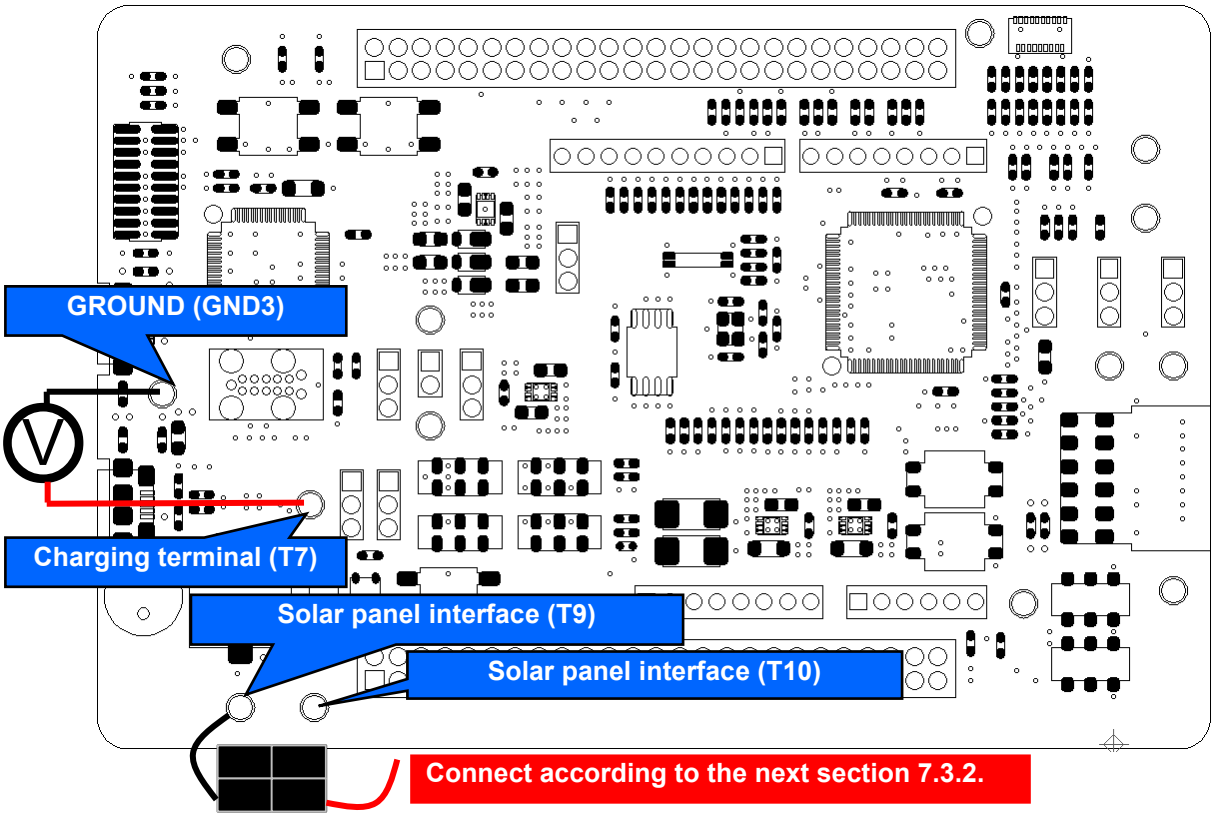



**Figure 7-6: Connection for current measurement in EHC mode**

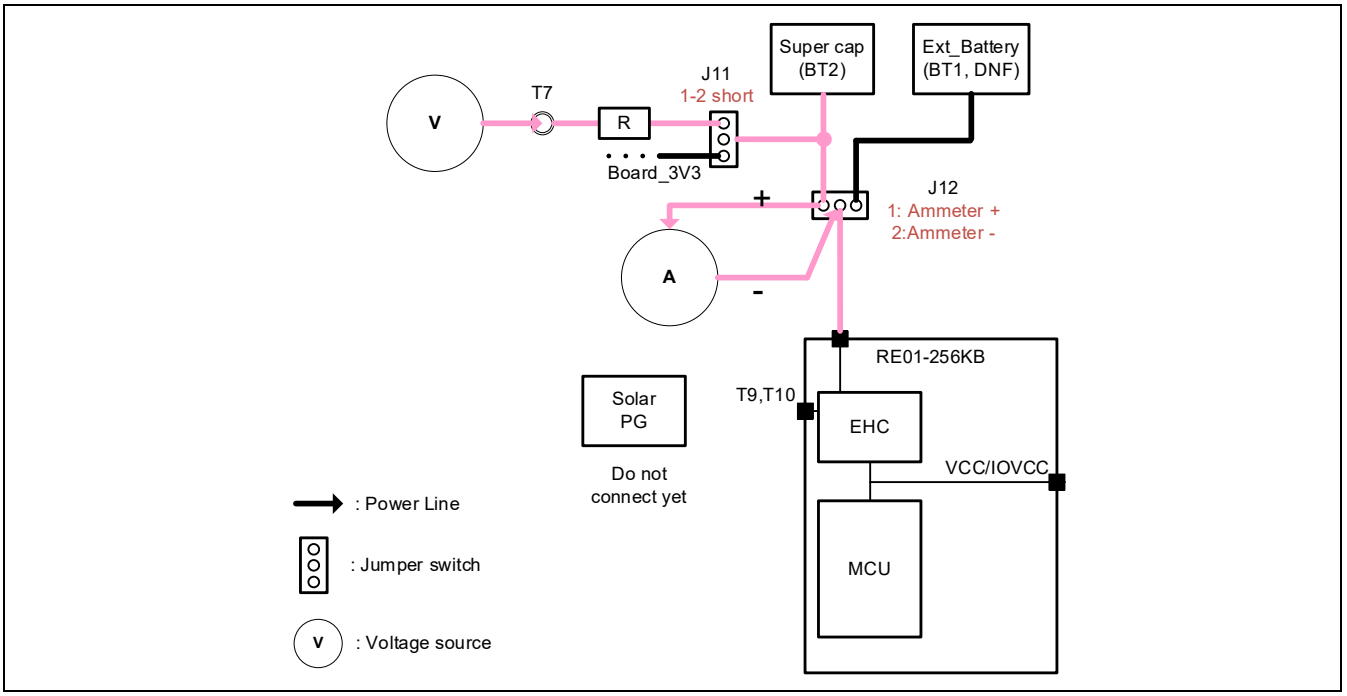



**Figure 7-7: Block diagram of the connection current measurement in EHC mode (when using the super capacitor mounted on the board)**

### 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 BT1, connect the voltage source to J12 pin 3 and the ammeter to J12 pin 2 ( - ) and pin 3 ( + ).

# 8. User Circuitry

## 8.1 Reset Circuit

This main board has built-in power-on reset circuit and a reset circuit that is triggered by a switch press. When power is supplied, RE01 is reset by the built-in power-on reset circuit. Pressing RES switch also resets RE01.

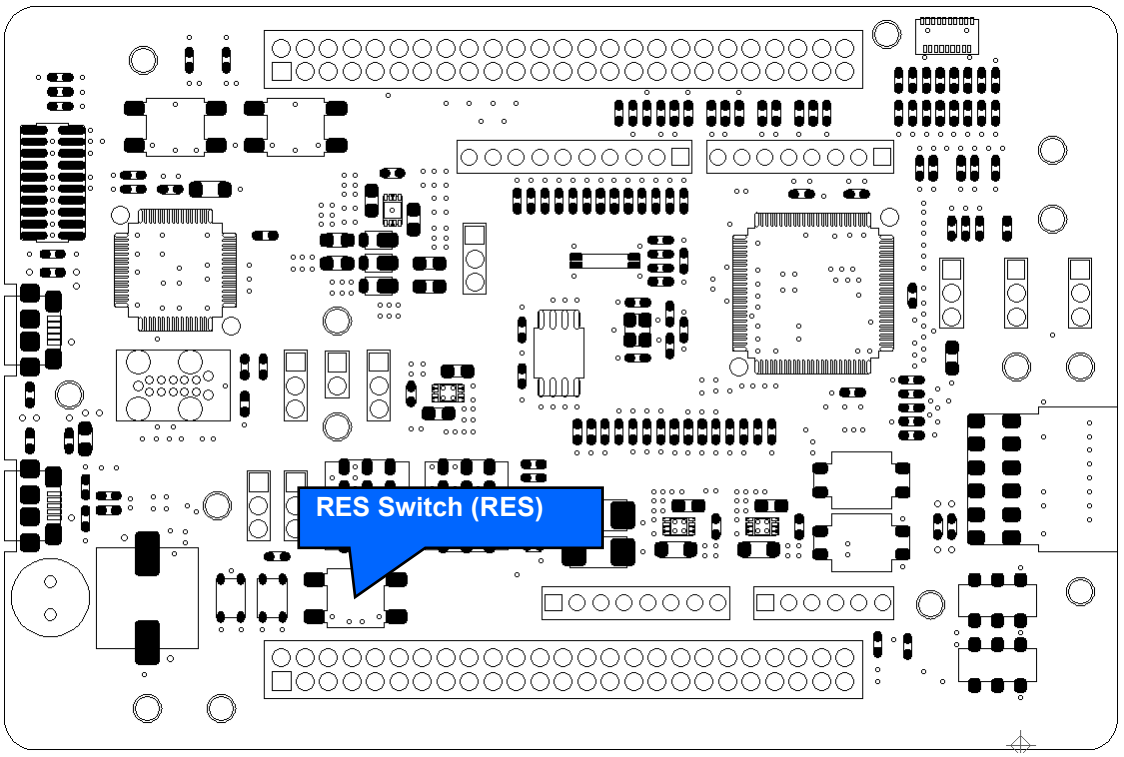



**Figure 8-1: Component Layout (Reset Circuit)**

## 8.2 Clock Circuit

The main board has clock circuit to supply clock to RE01. For details on the RE01 clock, refer to RE01 Group User's Manual Hardware. For details on the main board clock circuit, refer to the main board circuit diagram. **Figure 8-2** and **Table 8-1** shows the component layout and details.

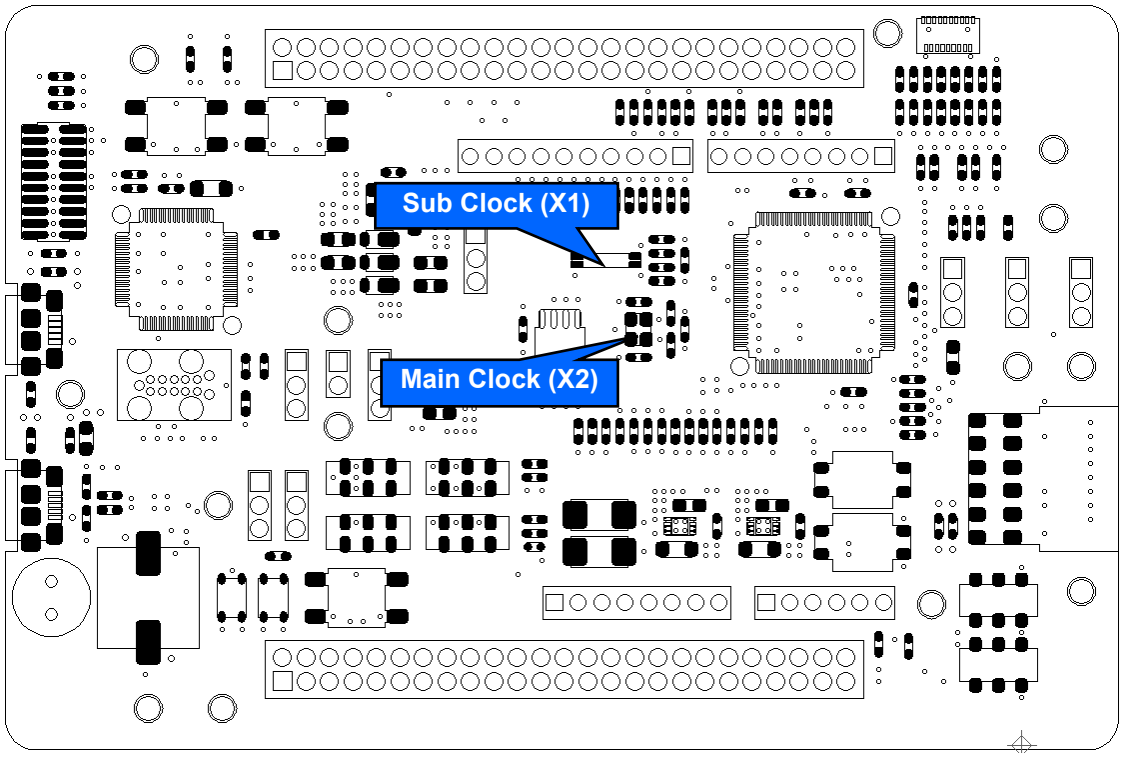



**Figure 8-2: Component Layout (Clock Circuit)**

**Table 8-1: Crystal**

| Crystal | Function | Default Setting | Frequency | Device Package |
|---|---|---|---|---|
| X1 | Sub Clock | Fitted | 32.768kHz | Encapsulated, SMT |
| X2 | Main Clock | Fitted | 32MHz | Encapsulated, SMT |

## 8.3 Switches

This main board has a total of 13 switches. **Figure 8-3** and **Table 8-2** show the layout and function of each switch.

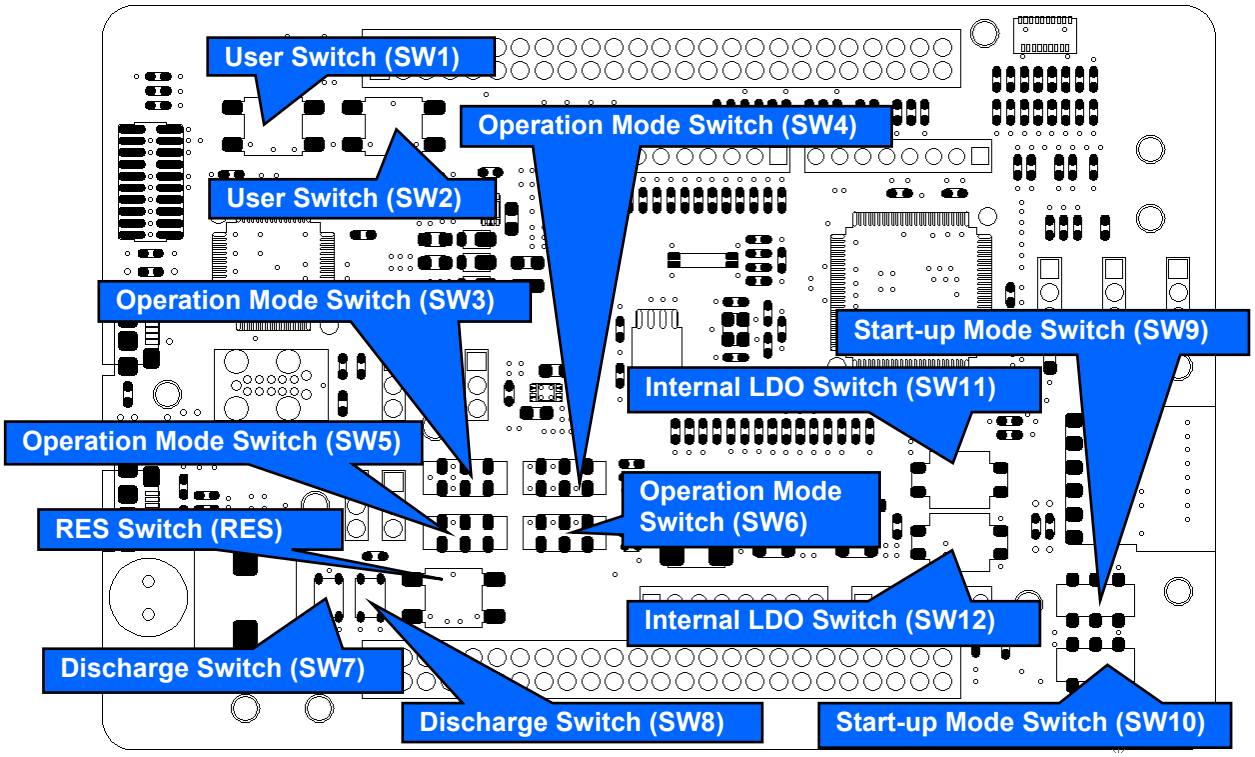



**Figure 8-3: Component Layout (Switches)**

**Table 8-2: Switches**

| Switch | Function | RE01 | |
|---|---|---|---|
| | | Port | Pin |
| RES | Resets the main board. | RES# | 23 |
| SW1 | Connects to KRM01_B for user controls. | P509 | 74 |
| SW2 | Connects to IRQ4_C for user controls. | P508 | 75 |
| SW3,5 | Selects normal mode or EHC mode.<br>Selects to use/not to use J-Link™ OB. | P411 (SWCLK) | 16 |
| | | P207 (SWDIO) | 22 |
| | | RES# | 23 |
| SW4,6 | Selects normal mode or EHC mode. | VCC_SU | 27 |
| | | VBAT_EHC | 28 |
| | | VSC_VCC | 29 |
| SW7 | Discharge C36 capacitor. | VCC/IOVCC | 14 |
| SW8 | Discharge VCC_SU storage capacitor (C25, C29, C30). | VCC_SU | 27 |
| SW9 | Selects RE01 start-up mode. | MD | 24 |
| SW10 | | EHMD | 19 |
| SW11 | Selects internal LDO or external DC/DC. | NC | NC |
| SW12 | | VCLH | 8 |
| | | VCL | 15 |

## 8.4 LED

There are 4 LEDs in this main board. **Figure 8-4** shows the component layout of the LEDs. **Table 8-3** shows the details of the LEDs.

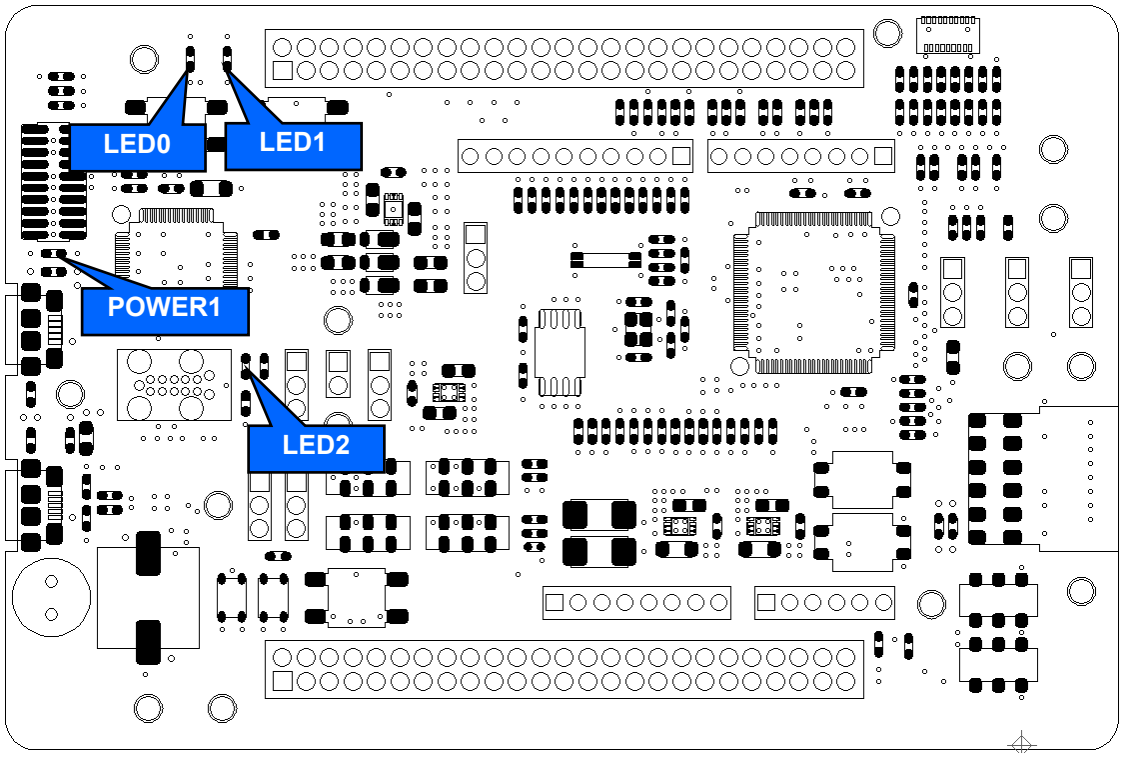



**Figure 8-4: Component Layout (LED)**

**Table 8-3: LED**

| LED | Color | Function | RE01 | |
|---|---|---|---|---|
| | | | Port | Pin |
| POWER1 | Green | Board_5V power line indicator | NC | NC |
| LED0 | Orange | User LED | P210 (IOVCC) | 32 |
| LED1 | Red | User LED | P410 (IOVCC) | 17 |
| LED2 | Green | J-Link™ OB Indicator | NC | NC |

## 8.5 Pmod™ Interface

This main board has the connector for Pmod™ interface. **Table 8-4** shows compatible connection boards and **Figure 8-5** shows the pin assignment.

**Table 8-4: Compatible Connection Boards**

| Compatible Boards | Reference Chapter |
|---|---|
| MIP-LCD Expansion Board | 7.5.1 |
| RL78/G1D BLE Module Expansion Board (RTKYRLG1D0B00000BJ) | 7.5.2 |
| Digilent Pmod™ Compatible Connector | 7.5.3 |

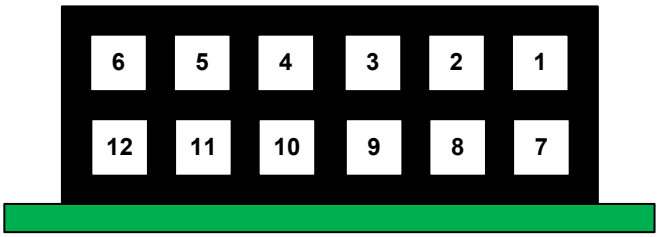



**Figure 8-5: Pin Assignment**

### 8.5.1 MIP-LCD Expansion Board

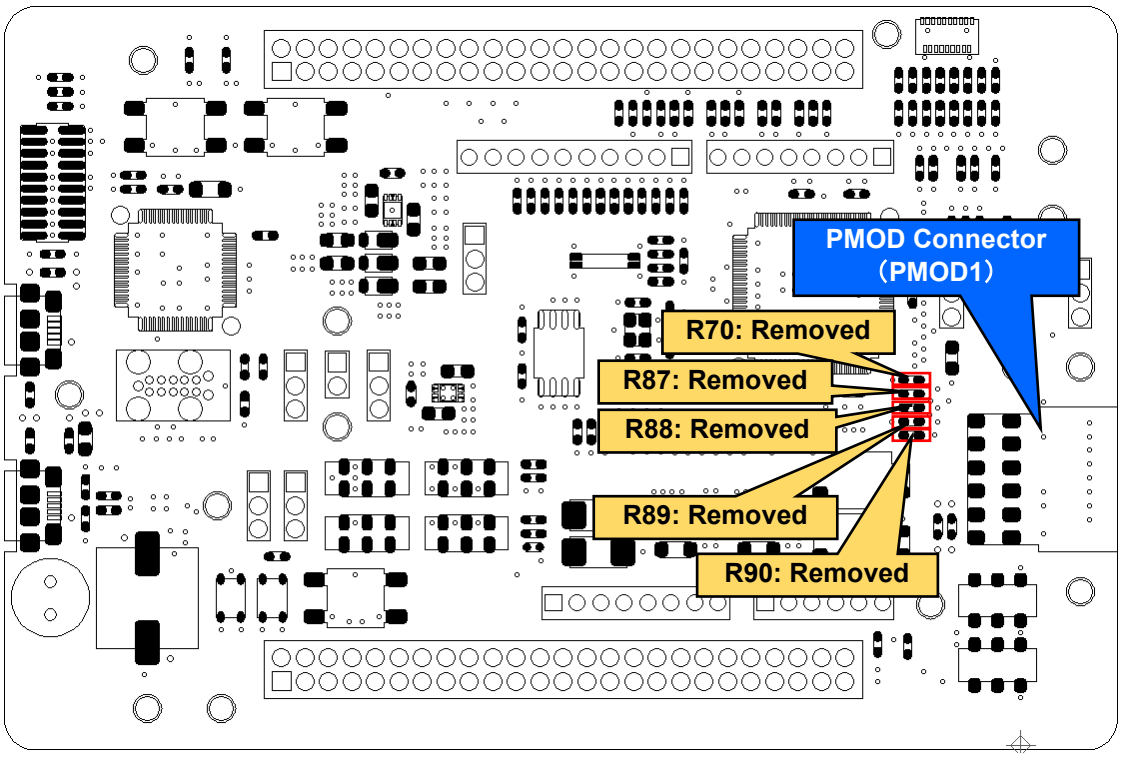
This main board has a connector for MIP-LCD expansion board interface. Connect the included MIP-LCD expansion board to the PMOD connector.

Connection with the MIP-LCD (TN0181ANVNANN-AN00 made by Kyocera[*1]) that is mounted on MIP-LCD expansion board are done via RE01 built-in serial peripheral interface (SPI). **Figure 8-6** and **Figure 8-7** shows the component layout, while **Table 8-6** shows the details of PMOD connector.

This function is supported in default configuration, as supplied. To return to this setting from other settings, set the resistors as shown in **Figure 8-6**, **Figure 8-7**, and **Table 8-5**.

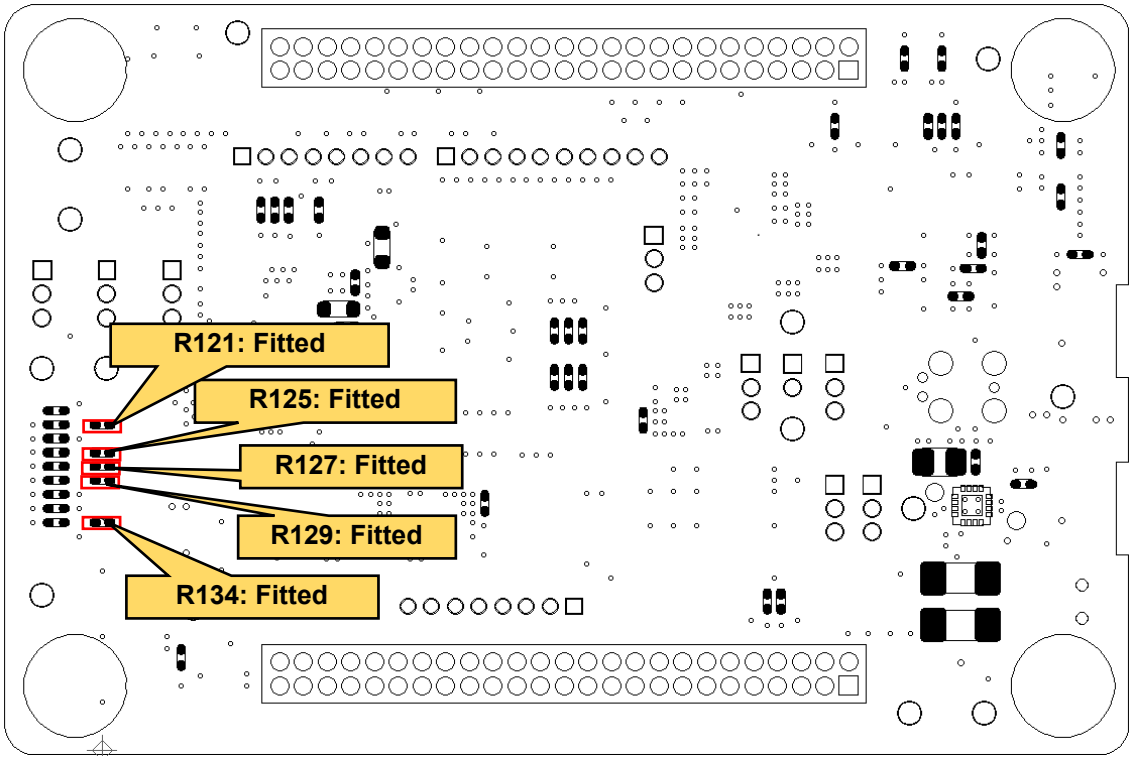
Sample code related to this expansion board is available on the Renesas website entitled “R_GDT Driver Sample Code (Using CMSIS Driver Package)” (R01AN4755).

[*1]: Please contact Kyocera.




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

**Figure 8-6: Component Layout and Settings (MIP-LCD Expansion Board (Top))**




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

**Figure 8-7: Component Layout and Settings (MIP-LCD Expansion Board (Bottom))**

**Table 8-5: Configuration Details (MIP-LCD Expansion Board)**

| Component | Setting |
|---|---|
| R70, R87-R90 | Removed |
| R121, R125, R127, R129, R134 | Fitted |

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

**Table 8-6: PMOD Connector (MIP-LCD Expansion Board)**

| PMOD Connector (PMOD1) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Signal Name | RE01 | | Pin | Signal Name | RE01 | |
| | | Port | Pin | | | Port | Pin |
| 1 | PMOD_SSLA1_B_P015 | P015 | 92 | 7 | PMOD_INT_AGTWOA1_B_ P814 | P814 | 99 |
| 2 | PMOD_MOSIA_B_P010 | P010 | 97 | 8 | PMOD_RESET_RXD4_C | P813 | 100 |
| 3 | PMOD_MISOA_B_CTS4_C | P815 | 98 | 9 | PMOD_IO0_P014 | P014 | 93 |
| 4 | PMOD_RSPCKA_B_P011 | P011 | 96 | 10 | PMOD_IO1 | P806 | 7 |
| 5 | GROUND | - | - | 11 | GROUND | - | - |
| 6 | IOVCC0 | - | - | 12 | IOVCC0 | - | - |

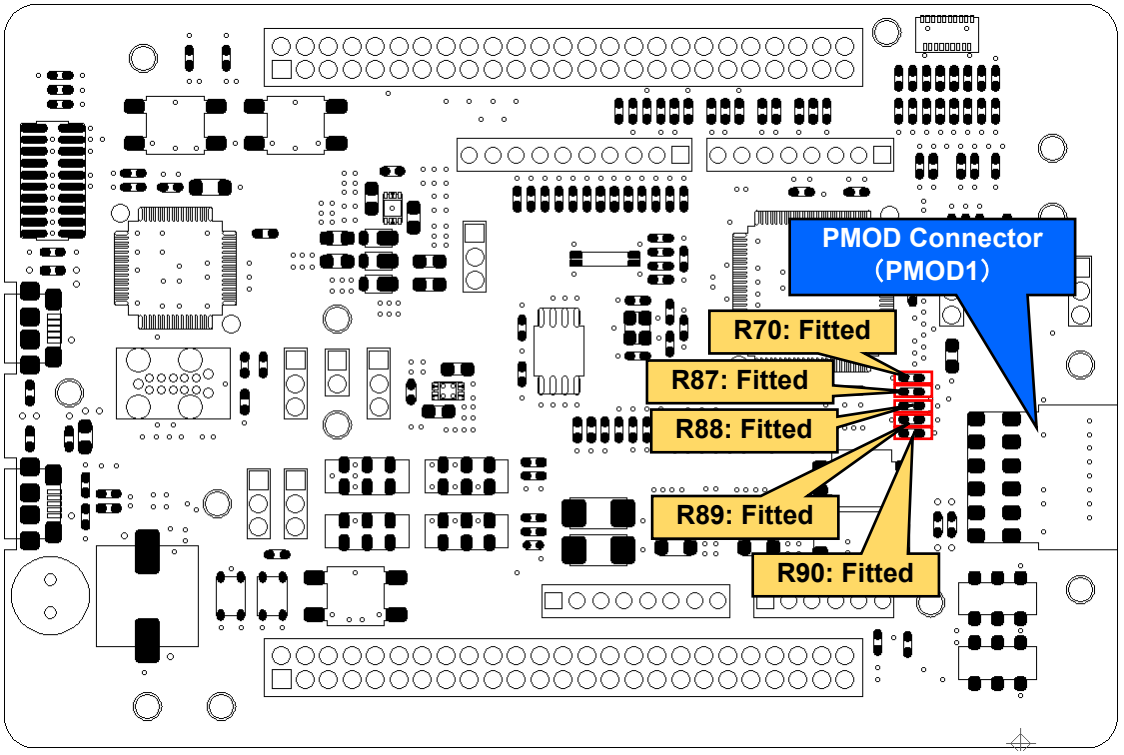
### 8.5.2 RL78/G1D BLE Module Expansion Board

This main board has a connector for the RL78/G1D BLE Module Expansion Board (BLE Evaluation Board). Connect the Renesas BLE Evaluation Board (sold separately) to the PMOD connector.

Connection with the RL78/G1D module that is mounted on BLE evaluation board are done via RE01 built-in serial communication interface (SCI). **Figure 8-8** and **Figure 8-9** show the component layout, while **Table 8-8** shows the details of PMOD connector.

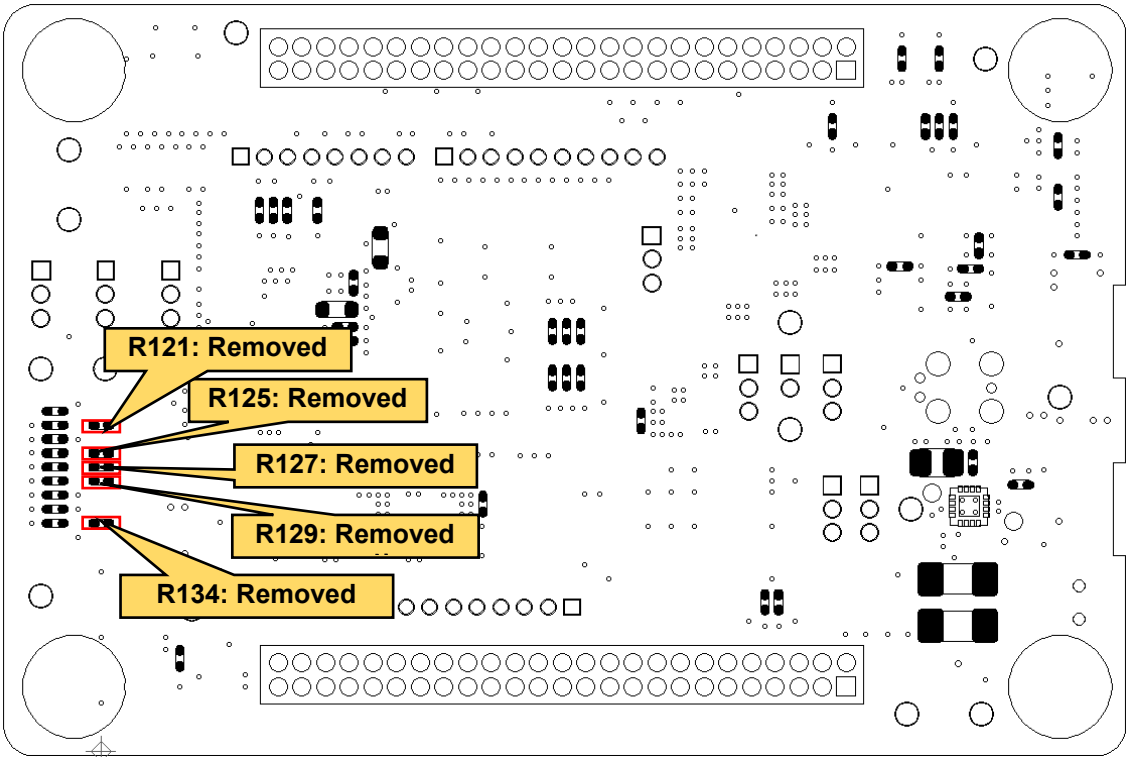
This function is not supported in default configuration, as supplied. Set the resistors as shown in **Figure 8-8**, **Figure 8-9**, and **Table 8-7**.

Sample code related to this expansion board is available on the Renesas website entitled “Bluetooth® Low Energy Protocol Stack Evaluation Kit RE01 256KB Host Sample” (R01AN5472).




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

**Figure 8-8: Component Layout and Settings (RL78/G1D BLE Module Expansion Board (Top))**




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

**Figure 8-9: Component Layout and Settings (RL78/G1D BLE Module Expansion Board (Bottom))**

**Table 8-7: Configuration Details (RL78/G1D BLE Module Expansion Board)**

| Component | Setting |
|---|---|
| R70, R87-R90 | Fitted |
| R121, R125, R127, R129, R134 | Removed |

**Table 8-8: PMOD Connector (RL78/G1D BLE Module Expansion Board)**

| PMOD Connector (PMOD1) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Signal Name | RE01 | | Pin | Signal Name | RE01 | |
| | | Port | Pin | | | Port | Pin |
| 1 | PMOD_MISOA_B_CTS4_C | P815 | 98 | 7 | PMOD_INT_AGTWOA1_B_ P814 | P814 | 99 |
| 2 | PMOD_TXD4_C | P812 | 1 | 8 | PMOD_MOSIA_B_P010 | P010 | 97 |
| 3 | PMOD_RESET_RXD4_C | P813 | 100 | 9 | PMOD_IO0_P014 | P014 | 93 |
| 4 | PMOD_RSPCKA_B_P011 | P011 | 96 | 10 | PMOD_SSLA1_B_P015 | P015 | 92 |
| 5 | GROUND | - | - | 11 | GROUND | - | - |
| 6 | IOVCC0 | - | - | 12 | IOVCC0 | - | - |

### 8.5.3 Pmod™

This main board has a connector for Digilent Pmod™ interface. Connect a commercially available Digilent Pmod™ module (or other compatible module) to PMOD connector. Connection with the Digilent Pmod™ module is done via RE01 built-in SPI interface (RSPI).

**Figure 8-6** and **Figure 8-7** shows component layout, while **Table 8-6** shows details of PMOD connector.

This function is not supported in default configuration, as supplied. To return to this setting from other settings, set the resistors as shown in **Figure 8-6**, **Figure 8-7**, and **Table 8-5**.

Not that Digilent Pmod™ pinouts are different from normal pinouts. Refer to the Digilent Pmod™ interface specifications for more details.

## 8.6 USB Serial Conversion

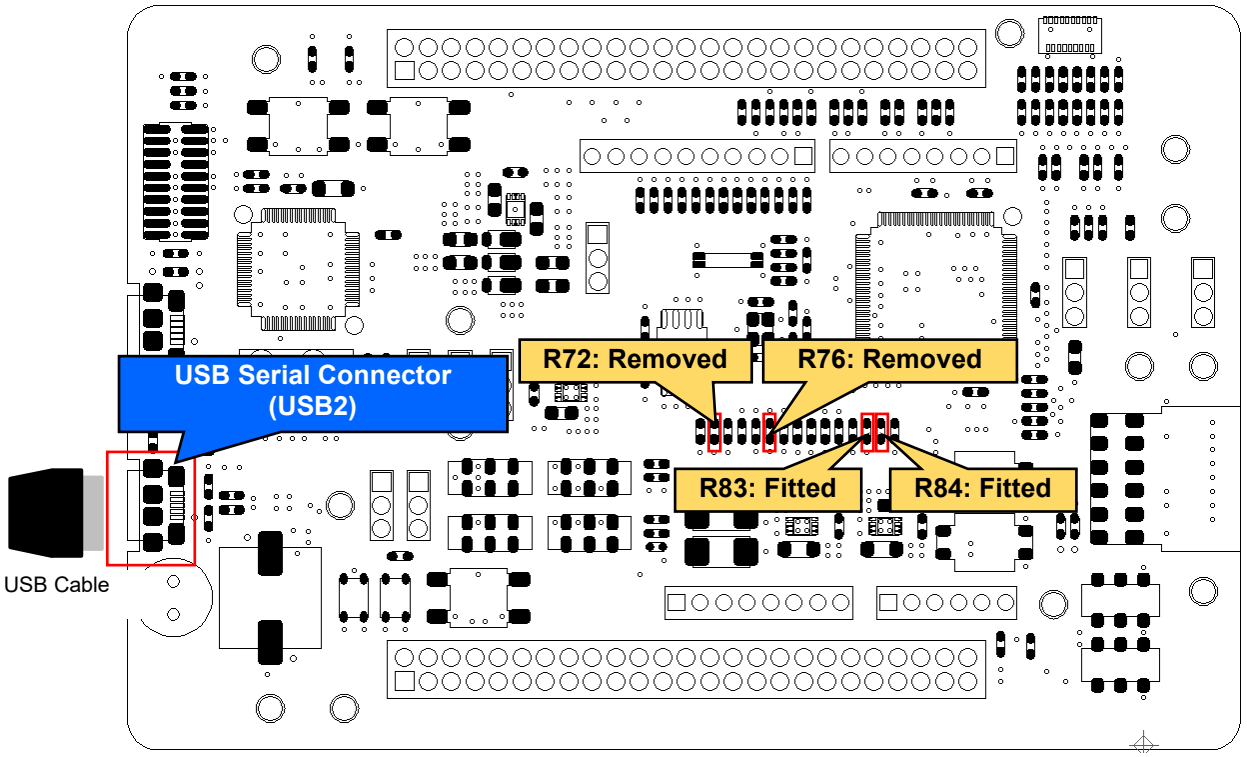
This main board has USB serial conversion circuit, which can be used as a virtual COM port by connecting to the host PC. Connect host PC to USB serial conversion connector (USB2) by using the included USB cable.

Connection with the host PC is done via RE01 built-in serial communication interface (SCI).

The component layout and details of USB serial connection are shown in **Figure 8-10** and **Table 8-10**.

This function is not supported in default configuration, as supplied. To return to this setting from other settings, set the resistors as shown in **Figure 8-10** and **Table 8-9**.

The related sample code is available on Renesas Website, entitled “USART Asynchronous Communication Sample Code (Using CMSIS Driver Package) ” (R01AN4699).




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

**Figure 8-10: Component Layout and Settings (USB Serial Conversion)**

**Table 8-9: Configuration Details (USB Serial Conversion)**

| Component | Setting |
|---|---|
| R72, R76 | Removed |
| R83, R84 | Fitted |

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

**Table 8-10: USB Serial**

| Signal Name | Function | RE01 | |
|---|---|---|---|
| | | Port | Pin |
| USB_SCI_TXD | SCI0 Transmit Signal | P703 | 40 |
| USB_SCI_RXD | SCI0 Receive Signal | P702 | 41 |
| USB_SCI_CTS | Input signal for controlling the start of transmission and reception | P704 | 39 |
| USB_SCI_RTS | Output signal for controlling the start of transmission and reception | P202 | 38 |

Prepare the driver provided by FTDI chip before using this function. The necessary driver is listed below.

- VIRTUAL CON PORT(VCP) Drivers

Please download the driver installer from the following URL.

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

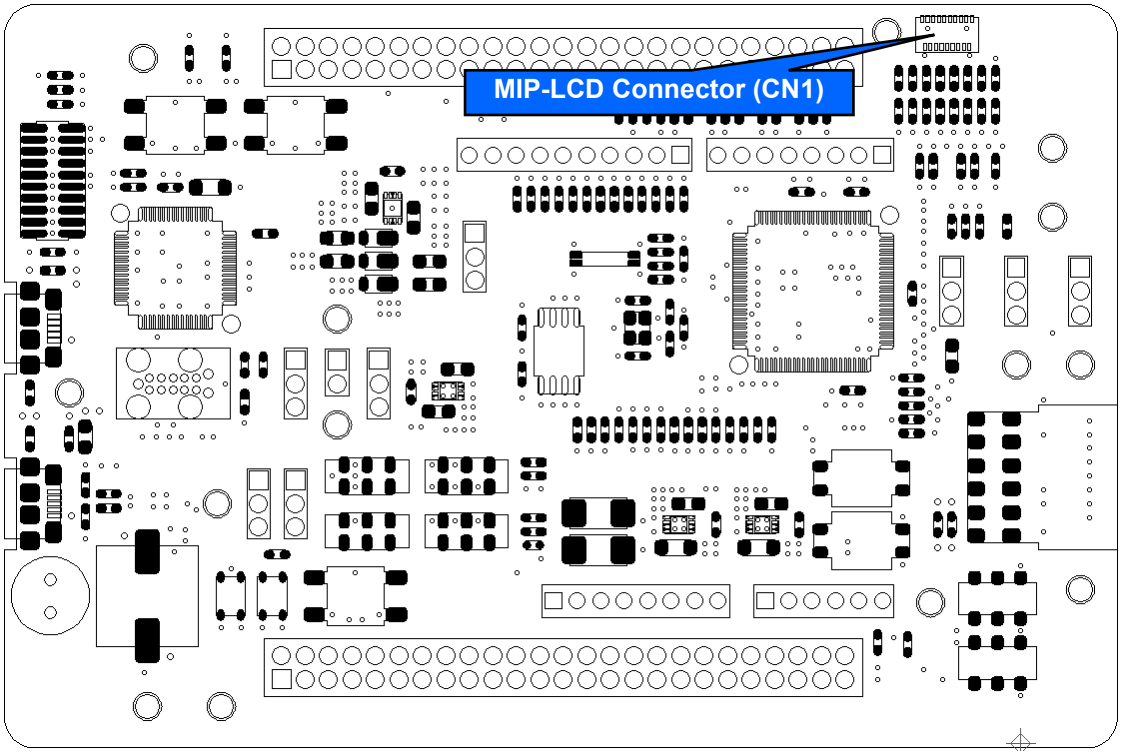
## 8.7 MLCD (Memory In Pixel Liquid Crystal Display) Interface

This main board has FPC connector (CN1), which can be connected to MIP-LCD (Kyocera TN0104ANVAANN-GN00[*1]). Connection to MIP-LCD is done through RE01 built-in MIP LCD Controller (MLCD).

Component layout is shown in **Figure 8-11**, while MIP-LCD connection details is shown in **Table 8-11**. This function is supported in default configuration, as supplied.

Related sample code is available in Renesas Website, entitled “MLCD Transfer Sample Code (Using CMSIS Driver Package)” (R01AN4883).

[*1]: Please contact Kyocera.




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

**Figure 8-11: Component Layout and Setting (MLCD)**

**Table 8-11: MIP-LCD Connector**

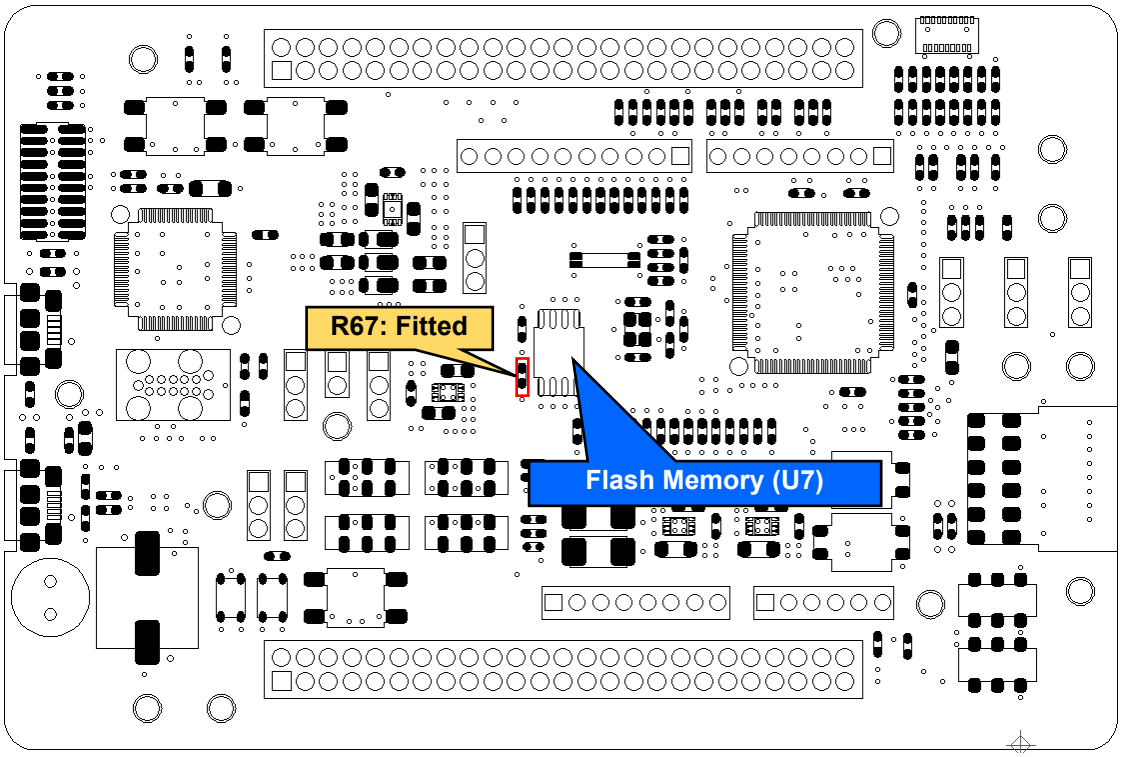
| MIP-LCD Connector (CN1) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Signal Name | RE01 | | Pin | Signal Name | RE01 | |
| | | Port | Pin | | | Port | Pin |
| 1 | MLCD_VCOM | P113 | 56 | 11 | MLCD_SI2 | P105 | 66 |
| 2 | IOVCC1 | - | - | 12 | MLCD_SI1 | P106 | 65 |
| 3 | GROUND | - | - | 13 | MLCD_SI0 | P107 | 64 |
| 4 | MLCD_ENBS | P109 | 60 | 14 | MLCD_DEN | P110 | 59 |
| 5 | MLCD_XRST | P112 | 57 | 15 | MLCD_SCLK | P111 | 58 |
| 6 | MLCD_SI7 | P100 | 71 | 16 | MLCD_ENBG | P108 | 61 |
| 7 | MLCD_SI6 | P101 | 70 | 17 | GROUND | - | - |
| 8 | MLCD_SI5 | P102 | 69 | 18 | IOVCC1 | - | - |
| 9 | MLCD_SI4 | P103 | 68 | 19 | MLCD_VCOM | P113 | 56 |
| 10 | MLCD_SI3 | P104 | 67 | - | - | - | - |

## 8.8 Flash Memory

This main board has a 64Mb flash memory made by Macronix (MX25R6435FM2IL0). Connection to the flash memory is done through RE01 built-in quad serial peripheral interface (QSPI).

Component layout is shown in **Figure 8-12**, while the details of flash memory connection is shown in **Table 8-13**.

This function is not supported in default configuration, as supplied. set the resistors as shown in **Figure 8-12** and **Table 8-12**.




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

**Figure 8-12: Component Layout and Setting (Flash Memory)**

**Table 8-12: Configuration Details (Flash Memory)**

| Component | Setting |
|---|---|
| R67 | Fitted |

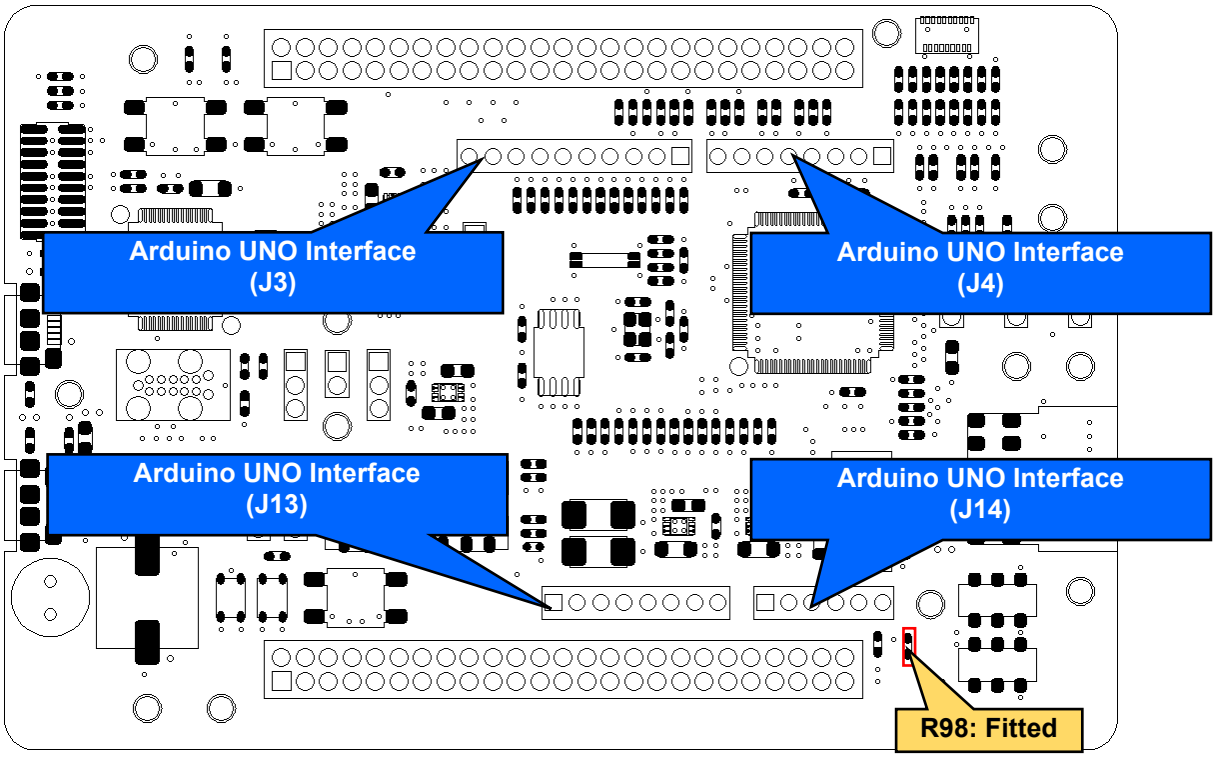
**Table 8-13: Flash Memory**

| Flash Memory (U7) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pin | Signal Name | RE01 | | Pin | Signal Name | RE01 | |
| | | Port | Pin | | | Port | Pin |
| 1 | QSPI_QSSL_A | P807 | 6 | 5 | QSPI_QIO0_A | P811 | 2 |
| 2 | QSPI_QIO1_A | P810 | 3 | 6 | QSPI_QSPCLK_A | P812 | 1 |
| 3 | QSPI_QIO2_A | P809 | 4 | 7 | QSPI_QIO3_A | P808 | 5 |
| 4 | GROUND | - | - | 8 | IOVCC0 | - | - |

## 8.9 Arduino UNO Interface

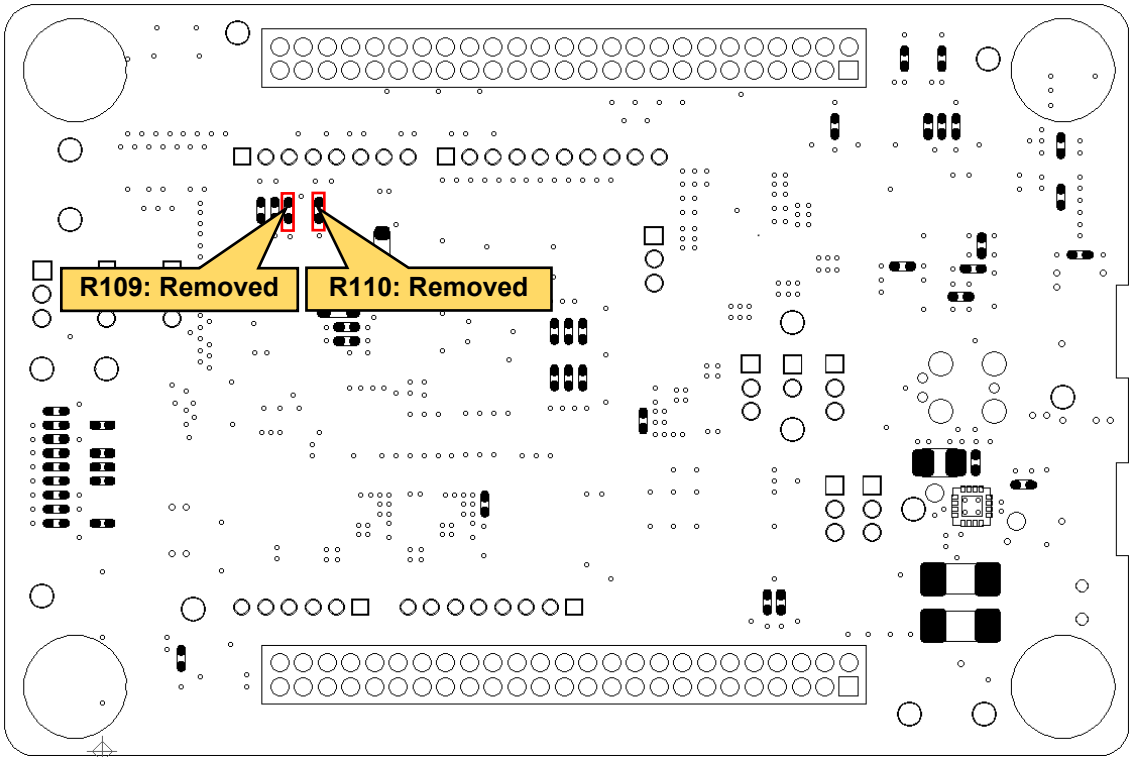
This main board has Arduino UNO interface and can be connected to various shields. Component layout and configuration details are shown in **Figure 8-13**, **Figure 8-14**, and **Table 8-14**. Details of Arduino UNO connections are shown in **Table 8-15**, **Table 8-16**, **Table 8-17**, and **Table 8-18**.

Voltage can be supplied to J13-1 pin from IOVCC0/IOVCC1/AVCC0. Select the power supply voltage by shorting any of R110, R98, or R109. To supply from IOVCC0, short only R110. To supply from IOVCC1, short only R98. To supply from AVCC0, short only R109. **Figure 8-13** and **Figure 8-14** shows the board's default resistor setting (supply from IOVCC1).




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

**Figure 8-13: Component Layout and Setting (Arduino UNO Interface (Top))**




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

**Figure 8-14: Component Layout and Settings (Arduino UNO Interface (Bottom))**

**Table 8-14: Configuration Details (Arduino UNO Interface)**

| **Component** | Setting |
|---|---|
| R98 | Fitted |
| R109, R110 | Removed |

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

**Table 8-15: Arduino UNO Interface (1)**

| **Arduino UNO Interface (J3)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **RE01** | | **Pin** | **Signal Name** | **RE01** | |
| | | **Port** | **Pin** | | | **Port** | **Pin** |
| 1 | ARDUINO_IO8 | P409 (IOVCC) | 18 | 6 | ARDUINO_RSPCKA_B | P011 (IOVCC0) | 96 |
| 2 | ARDUINO_IO9_GTIOC2A_B | P302 (IOVCC1) | 48 | 7 | GROUND | - | - |
| 3 | ARDUINO_SSLA1_B | P015 (IOVCC0) | 92 | 8 | ARDUINO_VREF | - | - |
| 4 | ARDUINO_MOSIA_B | P010 (IOVCC0) | 97 | 9 | ARDUINO_SDA0* | P012 (IOVCC0) | 95 |
| 5 | ARDUINO_MISOA_B | P815 (IOVCC0) | 98 | 10 | ARDUINO_SCL0* | P013 (IOVCC0) | 94 |

*: The default kit configuration uses a transfer rate of 50kbps or less. To increase the transfer rate, change the resistor values (R21, R22).

**Table 8-16: Arduino UNO Interface (2)**

| Arduino UNO Interface (J4) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **RE01** | | **Pin** | **Signal Name** | **RE01** | |
| | | **Port** | **Pin** | | | **Port** | **Pin** |
| 1 | ARDUINO_IO0_RXD5_B | P314 (IOVCC1) | 45 | 5 | ARDUINO_IO4 | P602 (IOVCC1) | 53 |
| 2 | ARDUINO_IO1_TXD5_B | P315 (IOVCC1) | 44 | 6 | ARDUINO_IO5_ GTIOC5A_B | P603 (IOVCC1) | 52 |
| 3 | ARDUINO_IO2_IRQ7_B | P204 (IOVCC1) | 36 | 7 | ARDUINO_IO6_ GTIOC5B_B | P604 (IOVCC1) | 51 |
| 4 | ARDUINO_IO3_IRQ8_C | P205 (IOVCC1) | 35 | 8 | ARDUINO_IO7 | P300 (IOVCC1) | 50 |

**Table 8-17: Arduino UNO Interface (3)**

| Arduino UNO Interface (J13) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **RE01** | | **Pin** | **Signal Name** | **RE01** | |
| | | **Port** | **Pin** | | | **Port** | **Pin** |
| 1 | IOVCC0*/IOVCC1/AVCC0* | - | - | 5 | Board_5V | - | - |
| 2 | LP_3V3 | - | - | 6 | GROUND | - | - |
| 3 | RESn | RES# (IOVCC) | 23 | 7 | GROUND | - | - |
| 4 | LP_3V3 | - | - | 8 | VCC_MCU | - | - |

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

**Table 8-18: Arduino UNO Interface (4)**

| Arduino UNO Interface (J14) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Pin** | **Signal Name** | **RE01** | | **Pin** | **Signal Name** | **RE01** | |
| | | **Port** | **Pin** | | | **Port** | **Pin** |
| 1 | ARDUINO_AN000 | P000 (AVCC0) | 89 | 4 | ARDUINO_AN003 | P003 (AVCC0) | 86 |
| 2 | ARDUINO_AN001 | P001 (AVCC0) | 88 | 5 | ARDUINO_AN004 | P004 (AVCC0) | 85 |
| 3 | ARDUINO_AN002 | P002 (AVCC0) | 87 | 6 | ARDUINO_AN005 | P005 (AVCC0) | 82 |

## 8.10 External DC/DC 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 DC/DC converter instead of the internal LDO. **Figure 8-15** shows an overview of operation when using a built-in regulator, and **Figure 8-16** 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.

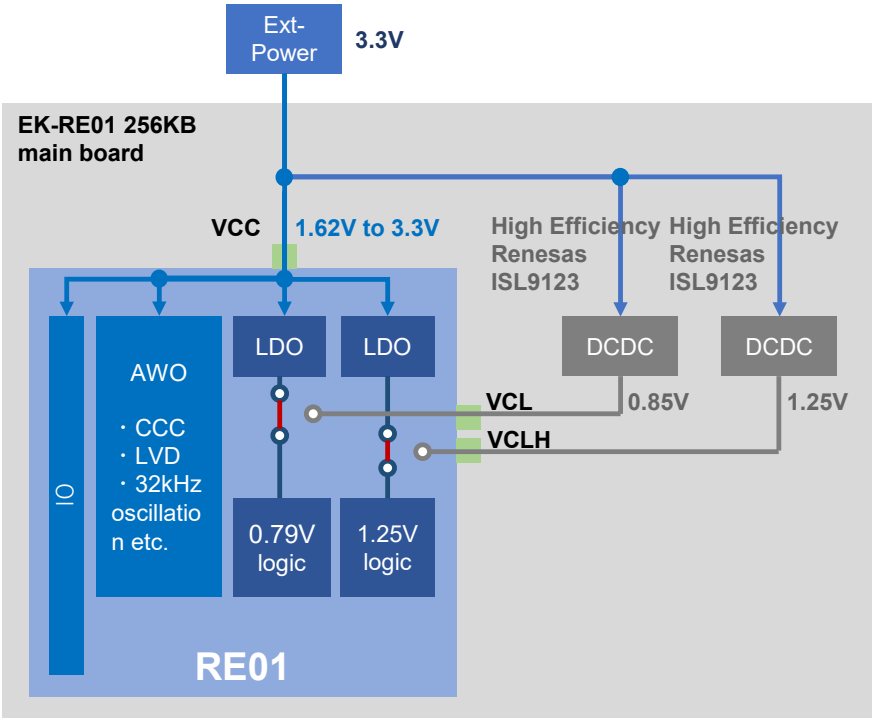



**Figure 8-15: overview of operation when using a built-in regulator**

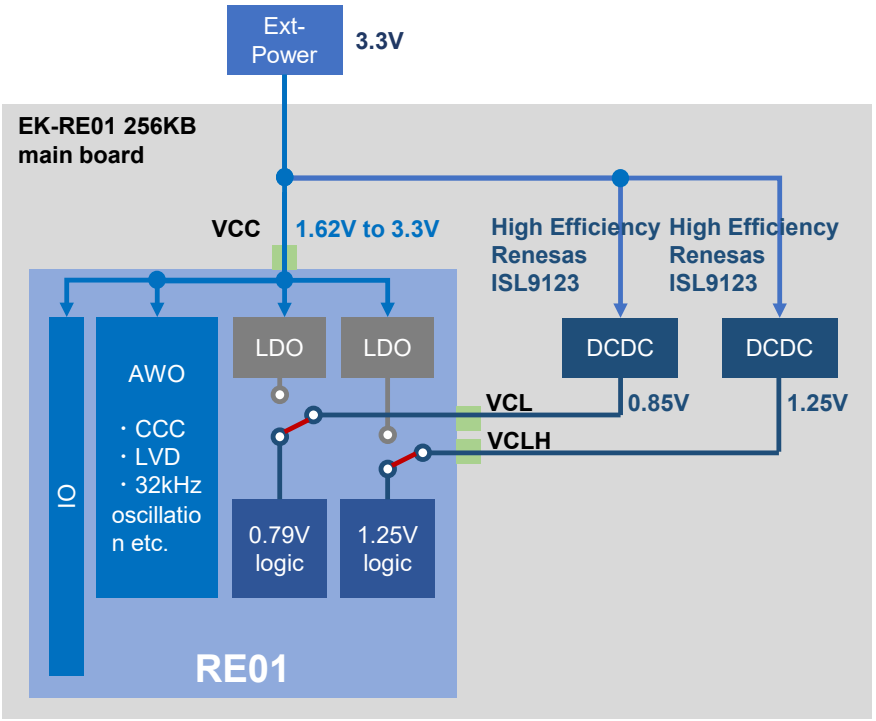



**Figure 8-16: overview of operation when using an external DC/DC converter**

Component layout is shown in **Figure 8-17**, while details are shown in **Figure 8-17** and **Table 8-19**.
For details on the usage and benefits of external DC / DC, refer to the application note " RE01 256KB Group How to reduce power consumption by using the external DC/DC converter " (R01AN5424).
The I²C bus interface is used to change the voltage of external DC/DC. The default kit configuration uses a transfer rate of 50kbps or less. To increase the transfer rate, change the resistor values (R21, R22).

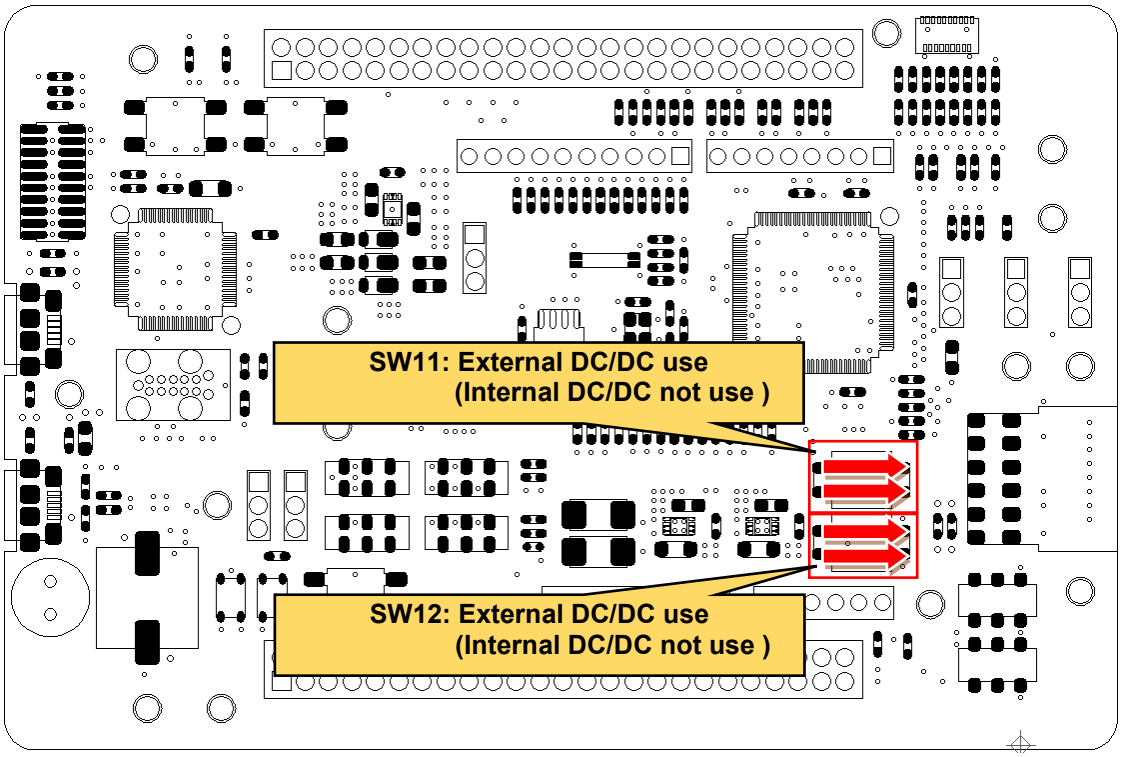



**Figure 8-17: Component Layout and Settings (External DC/DC Circuit)**

**Table 8-19: Configuration Details (External DC/DC Circuit)**

| Component | Setting | |
|---|---|---|
| SW11, SW12 | 1-4, 2-3 | External DC/DC use (Internal DC/DC not use) |

# 9. Headers

## 9.1 RE01 Headers

This main board has RE01 headers, which can be used to observe general I/O port. **Table 9-1** and **Table 9-2** shows the connections of RE01 header J1. **Table 9-3** and **Table 9-4** shows the connections of RE01 header J2.

**Table 9-1: RE01 Header J1 Connections (1)**

| RE01 Header J1 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** | **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** |
| 1 | P812<br>J1_P812 | 1 | 2 | P811<br>J1_P811 | 2 |
| 3 | P810<br>J1_P810 | 3 | 4 | P809<br>J1_P809 | 4 |
| 5 | P808<br>J1_P808 | 5 | 6 | P807<br>J1_P807 | 6 |
| 7 | P806<br>PMOD_IO1 | 7 | 8 | Reserve<br>NC | NC |
| 9 | Reserve<br>NC | NC | 10 | Reserve<br>NC | NC |
| 11 | GND<br>GROUND | - | 12 | Reserve<br>NC | NC |
| 13 | Reserve<br>NC | NC | 14 | VCC/IOVCC<br>VCC_MCU | 14 |
| 15 | Reserve<br>NC | NC | 16 | P411<br>J1_P411 | 16 |
| 17 | P410<br>LED1 | 17 | 18 | P409<br>ARDUINO_IO8 | 18 |
| 19 | EHMD<br>EHMD | 19 | 20 | Reserve<br>NC | NC |
| 21 | Reserve<br>NC | NC | 22 | P207<br>J1_P207 | 22 |
| 23 | RES#<br>RESn | 23 | 24 | MD<br>MD | 24 |

**Table 9-2: RE01 Header J1(2)**

| RE01 Header J1 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** | **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** |
| 25 | P200<br>J1_P200 | 25 | 26 | GND<br>GROUND | - |
| 27 | VCC_SU<br>VCC_SU | 27 | 28 | VBAT_EHC<br>VBAT_EHC | 28 |
| 29 | VSC_VCC<br>VSC_VCC | 29 | 30 | GND<br>GROUND | - |
| 31 | Reserve<br>NC | NC | 32 | P210<br>LED0 | 32 |
| 33 | P209<br>DCDC_EHC_EN | 33 | 34 | P208<br>DCDC_Ext_EN | 34 |
| 35 | P205<br>ARDUINO_IO3_IRQ8_C | 35 | 36 | P204<br>ARDUINO_IO2_IRQ7_B | 36 |
| 37 | P203<br>J1_P203 | 37 | 38 | P202<br>J1_P202 | 38 |
| 39 | P704<br>J1_P704 | 39 | 40 | P703<br>J1_P703 | 40 |
| 41 | P702<br>J1_P702 | 41 | 42 | P701<br>J1_P701 | 42 |
| 43 | P700<br>J1_P700 | 43 | 44 | P315<br>ARDUINO_IO1_TXD5_B | 44 |
| 45 | P314<br>ARDUINO_IO0_RXD5_B | 45 | 46 | IOVCC1<br>IOVCC1 | 46 |
| 47 | GND<br>GROUND | - | 48 | P302<br>ARDUINO_IO9_GTIOC2A_B | 48 |
| 49 | P301<br>J1_P301 | 49 | 50 | P300<br>ARDUINO_IO7 | 50 |

**Table 9-3: RE01 Header J2(1)**

| RE01 Header J2 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** | **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** |
| 1 | P604<br>ARDUINO_IO6_GTIOC5B_B | 51 | 2 | P603<br>ARDUINO_IO5_GTIOC5A_B | 52 |
| 3 | P602<br>ARDUINO_IO4 | 53 | 4 | P601<br>J2_P601 | 54 |
| 5 | P600<br>J2_P600 | 55 | 6 | P113<br>MLCD_VCOM | 56 |
| 7 | P112<br>MLCD_XRST | 57 | 8 | P111<br>MLCD_SCLK | 58 |
| 9 | P110<br>MLCD_DEN | 59 | 10 | P109<br>MLCD_ENBS | 60 |
| 11 | P108<br>MLCD_ENBG | 61 | 12 | IOVCC1<br>IOVCC1 | 62 |
| 13 | GND<br>GROUND | - | 14 | P107<br>MLCD_SI0 | 64 |
| 15 | P106<br>MLCD_SI1 | 65 | 16 | P105<br>MLCD_SI2 | 66 |
| 17 | P104<br>MLCD_SI3 | 67 | 18 | P103<br>MLCD_SI4 | 68 |
| 19 | P102<br>MLCD_SI5 | 69 | 20 | P101<br>MLCD_SI6 | 70 |
| 21 | P100<br>MLCD_SI7 | 71 | 22 | P511<br>J2_P511 | 72 |
| 23 | P510<br>J2_P510 | 73 | 24 | P509<br>SW1 | 74 |

**Table 9-4: RE01 Header J2(2)**

| RE01 Header J2 | | | | | |
|---|---|---|---|---|---|
| **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** | **Pin** | **Function (General IO Port/Power)**<br>**Circuit Net Name** | **RE01 Pin** |
| 25 | P508<br>SW2 | 75 | 26 | P501<br>J2_P501 | 76 |
| 27 | P500<br>J2_P500 | 77 | 28 | AVCC0<br>AVCC0 | 78 |
| 29 | GND<br>GROUND | - | 30 | P007<br>J2_P007 | 80 |
| 31 | P006<br>J2_P006 | 81 | 32 | P005<br>ARDUINO_AN005 | 82 |
| 33 | GND<br>GROUND | - | 34 | VREFH0<br>VREFH0 | 84 |
| 35 | P004<br>ARDUINO_AN004 | 85 | 36 | P003<br>ARDUINO_AN003 | 86 |
| 37 | P002<br>ARDUINO_AN002 | 87 | 38 | P001<br>ARDUINO_AN001 | 88 |
| 39 | P000<br>ARDUINO_AN000 | 89 | 40 | GND<br>GROUND | - |
| 41 | IOVCC0<br>IOVCC0 | 91 | 42 | P015<br>J2_P015 | 92 |
| 43 | P014<br>PMOD_IO0_P014 | 93 | 44 | P013<br>J2_P013 | 94 |
| 45 | P012<br>J2_P012 | 95 | 46 | P011<br>J2_P011 | 96 |
| 47 | P010<br>J2_P010 | 97 | 48 | P815<br>J2_P815 | 98 |
| 49 | P814<br>PMOD_INT_AGTWOA1_B_P814 | 99 | 50 | P813<br>PMOD_RESET_RXD4_C | 100 |

# 10. Code Development

## 10.1 Overview

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

- Connect Main Board to PC through IAR System® development tool I-jet™ emulator.
- Connect Main Board to PC through Segger development tool J-Link™ OB that is mounted 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.

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

## 10.2 Mode Support

This Evaluation Kit supports several operation modes and start-up modes. The settings related to modes change are described in Section 5. Operation/Start-up Mode. Refer to RE01 Group User's Manual: Hardware for detailed information about RE01 start-up mode 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. (R01UH0894)

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| Revision History | RE01Group<br>Evaluation Kit RE01 256KB User's Manual |
|---|---|

| Rev. | Date | Description | |
|---|---|---|---|
| | | Page | Summary |
| 1.00 | Jul 07, 2020 | — | First Edition issued. |
| 1.01 | Oct 02, 2020 | 8 | Add chapter 1.2 Kit Contents. |
| | | 9 | Change table 1-2. |
| | | 19 | Add figure 2-8. |
| | | 21 | Change figure 4-1. |
| | | 23 | Add chapter 4.3.1 All power pins. |
| | | 24-28 | Change figure titles. |
| | | | Add the voltage range that can be supplied. |
| | | 36 | Change the connector name. |
| | | 47 | Add figure 7-1. |
| | | | Change sentence. |
| | | 52 | Add power domains to table 8-3. |
| | | 63, 64 | Add power domains from table 8-15 to table 8-18. |
| 1.02 | Apr 16, 2021 | 21 | Update the connection relationship on the board in Figure 3-1 to show the connection terminals. |
| | | 24 | Correct numbering in the section 4.3.2. Add UC_VCC line to Figure 4-1 Power Supply System Diagram. |
| | | 26 | Add SW3 and SW5 to Figure 4-3 Setting. |
| | | 22, 23 | Add details of connection terminals in Table 3-1 and 3-2. |
| | | 34 | Add Figure 5-3, 5-4 the connection relationship between signal lines and power lines. |
| | | 43 – 50 | Add connection diagrams for signal lines and power lines for each setting. |
| | | 57 | Add the J-Flash Lite program writing method. |
| | | 58, 59 | Add Section 6.6 Emulator connection in EHC mode |
| | | 60 – 65 | Add the method of measuring the current when the on-board regulator 3.3V is not used and in EHC mode. |
| | | 82 | Add Figure 8-15 and Figure 8-16 External DCDC circuit schematic diagram and revise the text. |

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