

RX130 Group

RX Capacitive Touch Evaluation System CPU Board

User's Manual

Renesas 32-bit Microcontroller

RX Family/RX100 Series

Renesas Solution Starter Kit

RX Capacitance Touch Evaluation System

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(Rev.5.0-1 October 2020)

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

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

1. Precaution against Electrostatic Discharge (ESD)

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

2. Processing at power-on

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

3. Input of signal during power-off state

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

4. Handling of unused pins

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

5. Clock signals

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

6. Voltage application waveform at input pin

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

7. Prohibition of access to reserved addresses

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

8. Differences between products

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

How to Use This Manual

1. Purpose and Target Readers

This manual is designed to provide the user with a general understanding of the Capacitive Touch CPU Board and its electrical characteristics. It is intended for users designing sample code on the RSSK platform, using the many different incorporated peripheral devices.

The manual includes an overview of the Capacitive Touch CPU Board functions, but does not serve as a guide for embedded programming or hardware design. A basic knowledge of electric circuits, logical circuits, and MCUs is necessary in order to use this manual.

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 the RX130 Group, RX Capacitive Touch CPU Board included in the Renesas Capacitive Touch Evaluation System. 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 | Description of hardware (pin assignments, memory map, peripheral functions, electrical characteristics, timing) and operations. *Refer to corresponding application notes for descriptions on how to use peripheral functions. | RX130 Group RX Capacitive Touch Evaluation System CPU Board User's Manual | This User's Manual |
| Quick Start Guide | Quick and easy setup guide | RX Capacitive Touch Evaluation System Quick Start Guide | R12UZ0007EJ |

The following documents are also available for the RX130 Group. The latest versions of all documents are available for download from the Renesas Electronics website.

| Document Type | Description | Document Title | Document No. |
|--------------------------|---|--|--------------|
| Application Note | Peripheral function usage instructions, sample applications Reference programs Programming instructions for Assembler language and C language | Available on the Renesas Electronics website | |
| Renesas Technical Update | Updates concerning product specifications, documentation, etc. | | |

2. List of Abbreviations and Acronyms

| Abbreviation | Full Form |
|---------------------|---|
| ACIA | Asynchronous Communications Interface Adapter |
| bps | bits per second |
| CRC | Cyclic Redundancy Check |
| DMA | Direct Memory Access |
| DMAC | Direct Memory Access Controller |
| GSM | Global System for Mobile Communications |
| Hi-Z | High Impedance |
| IEBus | Inter Equipment Bus |
| I/O | Input/Output |
| IrDA | Infrared Data Association |
| LSB | Least Significant Bit |
| MSB | Most Significant Bit |
| NC | Non-Connect |
| PLL | Phase Locked Loop |
| PWM | Pulse Width Modulation |
| SFR | Special Function Register |
| SIM | Subscriber Identity Module |
| UART | Universal Asynchronous Receiver/Transmitter |
| VCO | Voltage Controlled Oscillator |

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Precautions

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. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

- Ensure attached cables do not lie across the equipment.
- Reorient the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Power down the equipment when not in use.
- Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10 m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

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

Safety Items

Definitions of Symbols

A variety of symbols are used in this document and on the product itself to prevent in advance danger to you the user or any third parties and to prevent in advance damage to any physical property.

This section, Safety Items, presents these symbols and their meanings. It also presents safety notes to assure that this produce is used safely and correctly.

This product should only be used after fully understanding the material presented in this section.



Warning

Warning items indicate things that, if not avoided, could lead to death or serious injury.



Caution

Caution items indicate both latent dangers that can lead to minor or moderately severe injury and latent dangers that can lead to property damage if not avoided.

In addition to the above two markings, the following are displayed at the same time if appropriate.

[Important] Indicates a point that can lead to equipment failure or malfunction if incorrectly set when setting up this product.

A triangular mark \triangle indicates a warning or caution.

Example:



Electrical Shock Hazard

The



mark indicates something that is forbidden.

Example: :



Do Not Disassemble

Warning



Warning

Handling related warnings:



Do not disassemble or modify this product. Renesas does not guarantee this product if it has been disassembled or modified.

The power supply for this product can be selected to be either the USB bus or a DC jack. A jumper is used to select the power supply.

If, during either use or storage of this product, any abnormality in the product itself (including abnormal odors, heating, color changes, or shape changes to the product itself) are observed, disconnect the USB cable and power supply cable immediately.

Installation:



Do not install this equipment in a location that has a high humidity or where water or other fluids could get on it. This equipment may be damaged if water or other fluids could get on it.

Ambient temperature:



The upper limit for the ambient temperature under which this product may be used is 35°C.

This maximum rated ambient temperature must not be exceeded.

Caution

Caution

Handling related cautions:

Use the antistatic band. Failure to do so could cause malfunction or unstable motion or be damaged Internal components.

This product must be handled carefully. Do not drop, knock over, or apply any strong mechanical shocks to this product.



When connecting or disconnecting cables from this product, hold the parts of the cable intended to be grasped (such as the plugs) and avoid putting stress on the cable. Do not pull on this product when it is connected to a communications cable or user system connection cable. Stress on the cable can result in internal disconnections in the cable. When connecting a cable to a connector, be careful not to insert the plug in the reverse orientation. Reverse insertion can result in damage to this product itself or to connected equipment.

The power supply for this product can be selected from two options (the DC jack or the USB cable). The jumper JP1 (on the top side of the circuit board) is used to select the power supply. Always check the jumper position before connecting a power source. An incorrect jumper position can result in damage to this product or the PC connected over the USB cable.

Do not handle this product with wet hands. This can lead to failure of the product.

Transport methods:



When transporting this product, use the product's packing box and cushioning materials and ship it with precision equipment handling. If the products packing is insufficient, it may be damaged during shipping.

If it must be transported by some other method, pack it carefully as precision equipment.

When packing this product, always use the antistatic pouch included with this product.

If some other pouch is used, damage to the product may be caused by electrostatic discharge.

Abnormal operation:



If operation of this product becomes abnormal due to interference from, for example, external noise, apply the following procedure.

1. Turn off the power.
2. Wait 10 seconds and then turn the power back on.

Disposal:



When disposing of this product, handle it as industrial waste according to all applicable laws.



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The WEEE (Waste Electrical and Electronic Equipment) regulations put responsibilities on producers for the collection and recycling or disposal of electrical and electronic waste. Return of WEEE under these regulations is applicable in the European Union only. This equipment (including all accessories) is not intended for household use. After use the equipment cannot be disposed of as household waste, and the WEEE must be treated, recycled and disposed of in an environmentally sound manner. Renesas Electronics Europe GmbH can take back end of life equipment, register for this service at "<http://www.renesas.eu/weee>".

Electromagnetic Environment

Electromagnetic Environment



- This product generates electromagnetic emissions in an industrial environment. Use in a residential environment may affect other equipment.
- This product requires special EMC precautions and should be used in accordance with the EMC information provided below.

EMI: Electro Magnetic Interference

| Standard | | Level | Guidance for EMC protection |
|--------------------|---------------|----------------|---|
| Test Item | EN 55011 | Group1 Class A | This product has no intentional external emissions, but internal RF emissions may affect nearby electromagnetically sensitive electronic equipment. |
| Radiated Emissions | :2009+A1:2010 | | |

EMS: Electro Magnetic Susceptibility

| Standard | | Level | Guidance for EMC protection |
|---------------------------------------|---------------------------------------|-----------------|---|
| Electrostatic Discharge | EN 61000-4-2:2009 | B ^{*1} | <p>This product is intended for use in electromagnetic environments in industrial settings. The user of the product should pay particular attention to the following electromagnetic immunity.</p> <ul style="list-style-type: none"> • Power supply quality • Protection against static electricity • Protection against external high-power radio waves • Protection against external magnetic fields |
| Radio Frequency Electromagnetic Field | EN 61000-4-3: 2006+A1:2008+A2:2010 | A ^{*2} | |

*1 Test Condition of Electrostatic Discharge

| Discharge Method | | Test Voltage | Result |
|--------------------|-------------------|--------------|--------|
| Indirect Discharge | VCP | ±4.0kV | Pass |
| | HCP | ±4.0kV | Pass |
| Direct Discharge | Contact Discharge | ±4.0kV | Pass |
| | Air Discharge | ±2.0kV | Pass |
| | | ±4.0kV | Pass |
| | | ±8.0kV | Pass |

*2 Test Condition of Radio Frequency Electromagnetic Field

| Test Level | Dwell Time | Modulation | Frequency Step | Antenna Polarization | Result |
|------------------------|------------|------------|----------------|----------------------|--------|
| 3V/m (80MHz - 1.0GHz) | 1.0sec | 1kHz | 1.0% | Horizontal | Pass |
| 3V/m (1.4GHz – 6.0GHz) | | AM 80% | | / Vertical | Pass |

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RX130 Group

RX Capacitive Touch Evaluation System CPU Board

1. Overview

1.1 Purpose

This CPU board is an evaluation tool for Renesas microcontrollers. This manual explains the technical components of the hardware in detail.

1.2 Features

This CPU board offers the following features:

- Renesas microcontroller programming
- User code debugging
- User circuits for switches, LEDs, etc.
- Sample application
- Capacitive Touch Sensing Control Unit (CTSU)
 - 36 channels available
- RX Capacitive Touch Evaluation System Application Board (option)

1.3 Board Specifications

The CPU board specifications are shown in Table 1.1.

Table 1.1 CPU Board Specifications

| Item | Specification |
|------------------------------------|---|
| Microcontroller | Part No: R5F5130ADFN |
| | Package: 80-pin LFQFP |
| | On-chip memory: ROM 128KB+8KB、RAM16KB |
| Input Clock | Main clock: 16MHz (option) |
| | Subclock: 32.768KHz (option) |
| Power Supply | DC power jack: 5.0 to 3.3V input |
| | USB bus-powered (VBUS): 5V |
| Debug Interface | E1 14-pin box header |
| DIP Switch | Mod configuration: 2-pole x 1 |
| Push Switch | Reset switch x 1 |
| | User switch x 3 |
| LED | Power indicator: red x 1 |
| | User: green x 1, orange x 1, red x 1 |
| USB to Serial Conversion Interface | Connector: USB-MiniB |
| | Driver: FT232R USB serial IC (manufactured by FTDI) |
| Application Board Interface (GPIO) | 2.54-mm pitch, 16-pin x 1 (CN1) |
| Application Board Interface(CTSU) | 2.54-mm pitch,40-pin x 1 (CN2) |
| Low-power Consumption Current | 500mA or less |
| Operating Temperature Range | When operating: 10 to 35°C, in storage: -10 to 50°C no condensation |
| Dimensions(L x W x H) | 89mm x 95mm x 18mm |

1.4 Regulatory Compliance Notices

1.4.1 European Union regulatory notices

This product complies with the following EU Directives. (These directives are only valid in the European Union.)

CE Certifications:

- Electromagnetic Compatibility (EMC) Directive 2014/30/EU
EN IEC61326-1: 2021 Group1 Class A

WARNING: This is a Class A product. This equipment can cause radio frequency noise when used in the residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures under his responsibility.

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 - Type name: RTK0EG0003S02001BJ

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2. Power Supply

2.1 Requirements

Although the CPU board does not come with an E1 debugger, the debugger can be used to power the board by connecting it to CN5. When not using an E1 debugger, the USB cable included with the CPU board can be connected to CN6 to supply power. Finally, by changing the board settings, it can be powered using a center positive 2.1-mm barrel power jack.

Details of the external power supply connection and settings are shown in Table 2.1. The default configuration and initial settings of the CPU board are shown in **bold, blue text**.

Table 2.1 Power Supply Requirements

| JP1 | Supply Source | Supply Source | Supply Voltage |
|------------------------|-------------------------------|-----------------|----------------|
| Pin 1-2 shorted | USB Cable (CN6) | USB VBUS | 5.0 VDC |
| Pin 2-3 shorted | Barrel Jack (CN3) | External Supply | 5.0 – 3.3VDC |
| | Battery (V1) ^{*1 *2} | Battery | 3.0 VDC |

Notes *1: Option

*2: When barrel power jack is not connected

2.2 Power-up Behavior

At the time of purchase, the microcontroller on the CPU board is pre-programmed with sample software. This software automatically recognizes what type of Renesas Capacitive Touch Evaluation System application board is connected to the CPU board and runs the corresponding demo program. Refer to the RX Capacitive Touch Evaluation System Quick Start Guide for more information.

3. Board Layout

3.1 Component Layout

Figure 3.1 shows the component layout of the RX130CPU board.

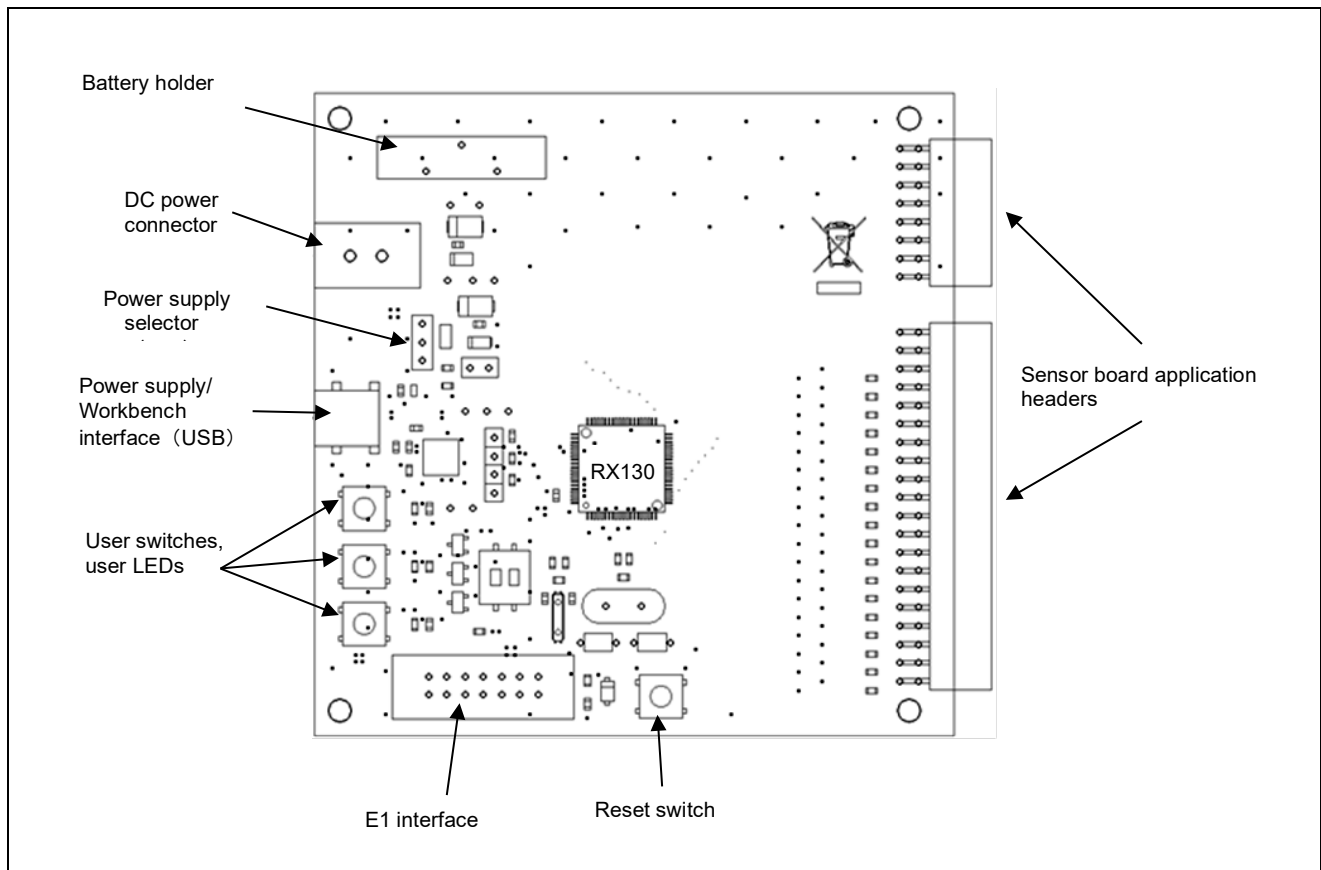


Figure 3.1 Component Layout

3.2 Component Placement

Figure 3.2 shows placement of individual components on the RX130 CPU board. Component numbers and values are also shown on the board schematics.

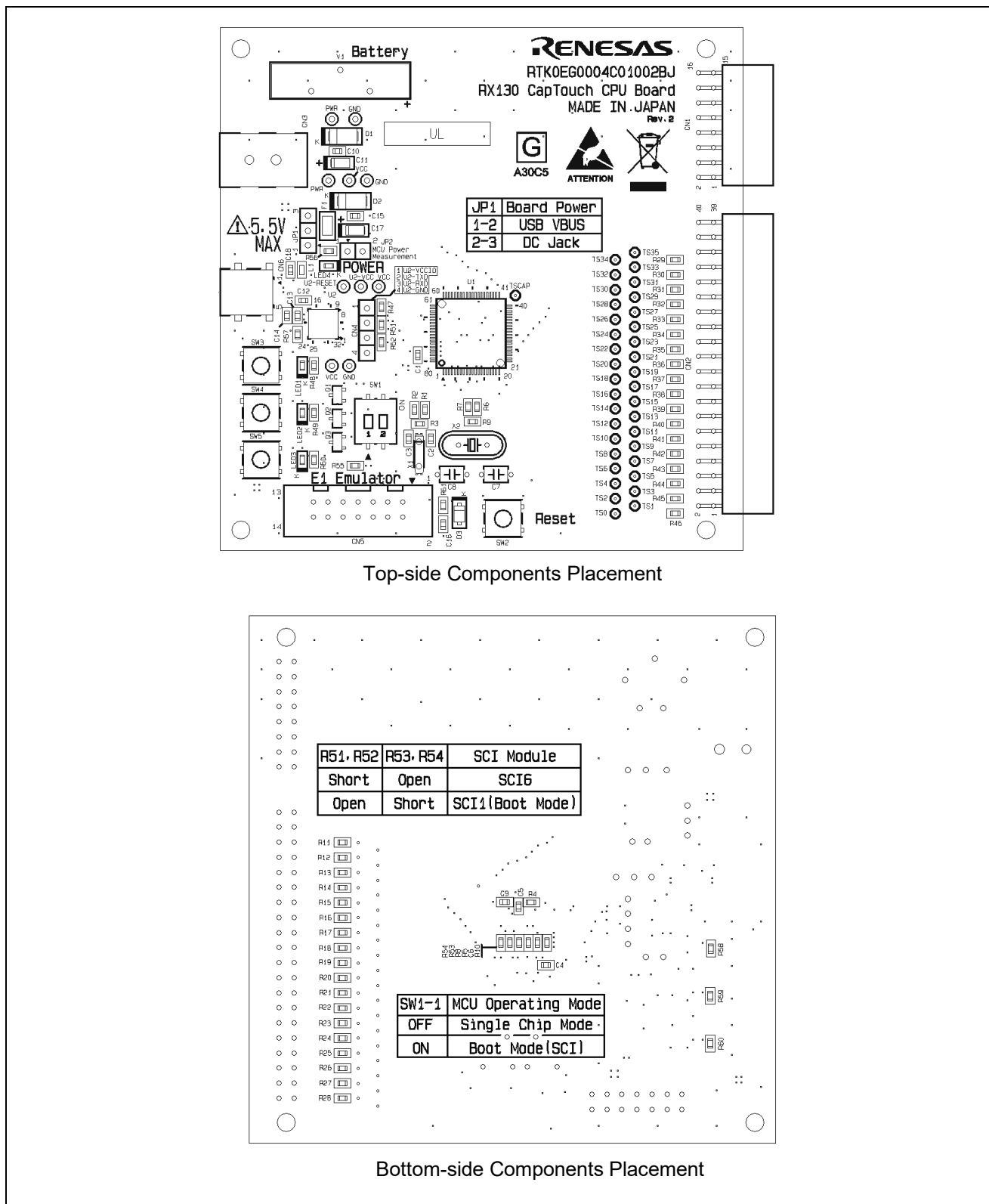


Figure 3.2 RX130CPU Board Component Placement Schematics

4. Connectivity

4.1 System Block Diagrams

Figure 4.1 provides a system block diagram for the CPU board.

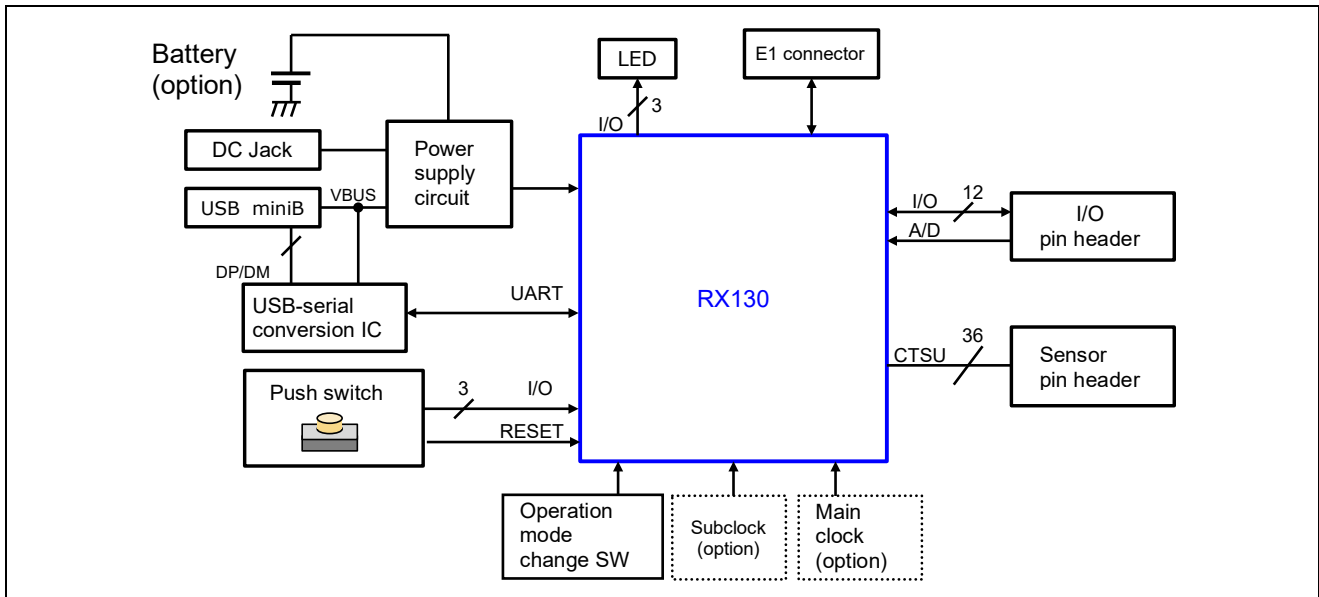


Figure 4.1 System Block Diagram

4.2 Debugger Connections

Figure 4.2 shows the connections between the CPU board, E1 emulator (option) and host machine.

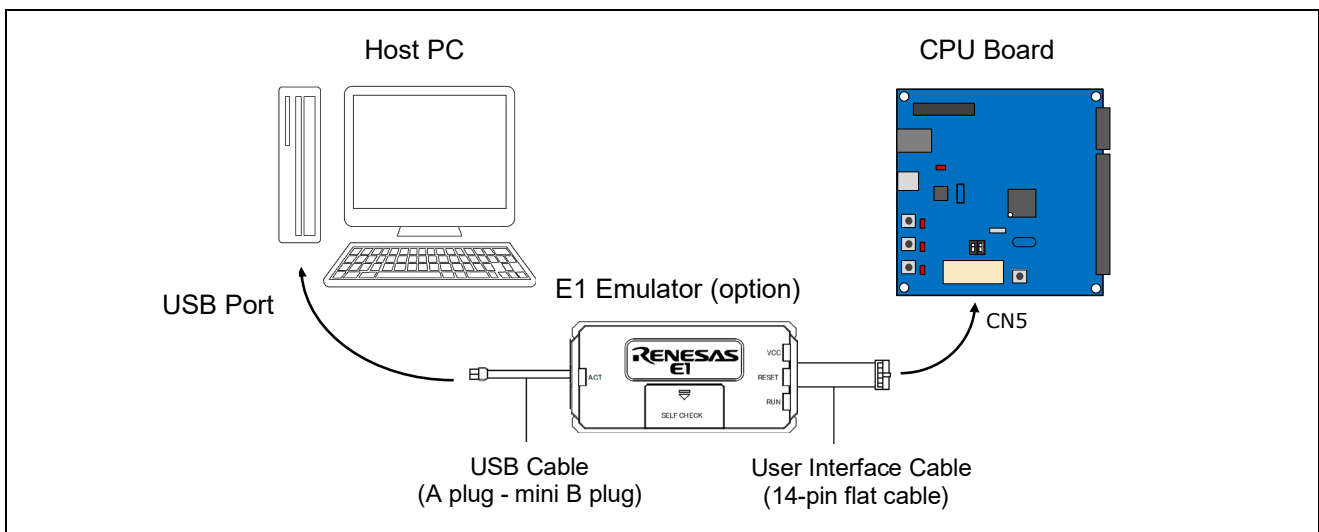


Figure 4.2 Debugger Connection Diagram

5. User Circuitry

5.1 Reset Circuit

The CPU board uses the MCU's built-in power-on reset circuit. In addition, a reset signal can be generated from the board's RES switch. Refer to the RX130 Group hardware manual for details regarding the microcontroller reset requirements and the CPU board circuit diagrams for information regarding the reset circuitry in use on the CPU board.

5.2 Clock Circuit

A clock circuit is fitted to the CPU board as the clock source for the MCU. Refer to the RX130 Group user's manual for details regarding the MCU clock specifications and the CPU board circuit diagram for information regarding the CPU board clock circuit. Details of the clocks fitted to the board are listed in Table 5.1.

Table 5.1 CPU Board Clocks

| Clock | Function | Default Placement | Frequency | Device Package |
|-------|------------|-------------------|-----------|-------------------|
| X1 | Main clock | Not fitted | - | HC49/US |
| X2 | Subclock | Not fitted | - | Encapsulated, SMT |

5.3 Switches

The CPU board is fitted with four push switches. Table 5.2 shows the function and connection of each switch.

Table 5.2 Switch Functions and Connections

| Switch | Function | Signal (Port) | MCU |
|-------------|---|---------------|-----|
| SW2 (Reset) | When pressed, the microcontroller is reset. | RES# | 9 |
| SW3 | Connects to an NMI input for user controls | NMI (P35) | 14 |
| SW4 | Connects to an IRQ input for user controls | IRQ2 (P12) | 28 |
| SW5 | Connects to an IRQ input for user controls | IRQ3 (P13) | 27 |

5.4 LEDs

The CPU board is fitted with four LEDs. Table 5.3 shows the function, color, and connection of each LED.

Table 5.3 LED Functions, Colors, and Connections

| LED | Color | Function | Port | MCU |
|--------------|--------|--|------|-----|
| LED4 (Power) | Red | Indicates the status of the Board_VCC power rail | - | - |
| LED1 | Green | User operated LED | P03 | 2 |
| LED2 | Orange | User operated LED | P04 | 3 |
| LED3 | Red | User operated LED | P06 | 1 |

5.5 USB Serial Conversion

For USB-serial conversion, USB serial IC FT232 (manufactured by FTDI) is mounted on the CPU board and connected to the RX130 Serial Communications Interface (SCI) module. Functions differ according to which SCI pin is connected to the board. Table 5.4 provides details of the USB serial IC and microcontroller connection.

Table 5.4 USB Serial Port Connections

| Signal Name | Function | MCU | |
|-------------|----------------------|------|-------------|
| | | Port | Signal Name |
| TXD6 | SCI6 transmit signal | PD0 | TXD6 |
| RXD6 | SCI6 receive signal | PD1 | RXD6 |
| TXD1 *1 | SCI1 transmit signal | P26 | TXD1 *1 |
| RXD1 *1 | SCI1 receive signal | P30 | RXD1 *1 |

Note *1 :Not connected as the default. To modify, refer to section 6.

6. Configuration

6.1 Modifying the CPU Board

This section lists the option links that are used to modify the way the CPU board operates in order to access different configurations. Configurations can be modified using option link resistors, jumpers or DIP switches. A link resistor is a 0Ω surface mount resistor, which is used to connect or isolate parts of a circuit. Option links are listed in the following subsections, detailing their function when fitted or removed. Connection details for ICs other than the MCU as well as headers is also provided. **Bold, blue text** indicates the default configuration that the CPU board is supplied with. Refer to the component placement diagram (Section 3) to locate the option links, jumpers and DIP switches.

6.2 MCU Settings

Table 6.1 details the option links associated with configuring the MCU operating modes.

Table 6.1 MCU Operating Mode Option Links

| Reference | Pin1 | Pin2 | Explanation | Related Ref. |
|-----------|------------|------|-------------------------|-------------------|
| SW1 | OFF | - | Single Chip Mode | - |
| | ON | | Boot Mode(SCI) | R53,R54, R44, R55 |

6.3 Power Supply Configuration

Table 6.2 lists the function of the option links associated with the power supply configuration.

Table 6.2 Power Supply Option Links

| Reference | Jumper Position | Explanation | Related Ref. |
|-----------|------------------------|--|--------------|
| JP1 | Shorted Pin 1-2 | Connects USB_VBUS to VCC. | U2 (VCCIO) |
| | Shorted Pin 2-3 | Connects PWR (CN3) to VCC. | U2 (VCCIO) |
| | | Connects V1 to VCC (when CN3 is not connected). | U2 (VCCIO) |
| | All open | Disconnects USB_VBUS and PWR from VCC rail. | - |
| JP2 | Shorted Pin 1-2 | Connects VCC to MCU_VCC. | U1(VCC) |
| | All open | Enables current probe for MCU current consumption (connect current meter between JP2 and MCU). | - |

6.4 Clock Configuration

Table 6.3 details the option link functions associated with the clock configuration.

Table 6.3 Clock Option Links

| Reference | Explanation | Fit | Not Fitted | Related Ref. |
|------------------------|--|--------|---------------|---------------------|
| P36/EXTAL, P37/XTAL | Connects crystal oscillator X1 to RX130. | R6,R7 | - | U1 (EXTAL, XTAL) |
| | Disconnects X1 from RX130. | - | R6,R7 | |
| XCOUT, XCIN | Connects 32.768kHz crystal(X2) to RX130. | R1, R2 | - | U1 (XCOUT, XCIN) |
| | Disconnects X2 from RX130. | - | R1, R2 | |

*Items shown in **bold** are the Fit / Not Fitted default configuration in which the CPU board is supplied.

6.5 Serial Configuration

Table 6.4 lists the option links associated to the serial configuration.

Table 6.4 Serial Option Links

| Signal Name | MCU | | Destination Selection | | |
|-------------|------|-----|-----------------------|---------------------|------------|
| | Port | Pin | Function | Fit | Not Fitted |
| PD1/RXD6 | PD1 | 65 | RXD6 | R51 | R53 |
| PD0/TXD6 | PD0 | 66 | TXD6 | R52 | R54 |
| TS2/RXD1 | P30 | 118 | RXD1 | R53 | R51, R44 |
| | | | TS2 | R44 (560Ohm) | R53 |
| TS4/TXD1 | P26 | 20 | TXD1 | R54 | R52, R45 |
| | | | TS4 | R45 (560Ohm) | R54 |

*Items shown in **bold** are the Fit / Not Fitted default configuration in which the CPU board is supplied.

7. Headers

7.1 Application Headers

Table 7.1 Application Headers (CN1) Connections

| Application Header CN1 | | MCU | | Application Header CN1 | | MCU | |
|---------------------------|-------------|------|-----|---------------------------|-------------|------|-----|
| Pin | Header Name | Port | Pin | Pin | Header Name | Port | Pin |
| 1 | PE1 | PE1 | 62 | 2 | PE0 | PE0 | 63 |
| 3 | PD2 | PD2 | 64 | 4 | P47 | P47 | 67 |
| 5 | P46 | P46 | 68 | 6 | P45 | P45 | 69 |
| 7 | P44 | P44 | 70 | 8 | P43 | P43 | 71 |
| 9 | P42 | P42 | 72 | 10 | P41 | P41 | 73 |
| 11 | P40 | P40 | 75 | 12 | PJ6 | PJ6 | 76 |
| 13 | NC | - | - | 14 | PE5/AN021 | PE5 | 58 |
| 15 | VCC | - | - | 16 | GND | - | - |

- : Non Connection

Table 7.2 Application Headers (CN2) Connections

| Application Header CN2 | | MCU | | Application Header CN2 | | MCU | |
|---------------------------|-------------|------|-----|---------------------------|-------------|------|-----|
| Pin | Header Name | Port | Pin | Pin | Header Name | Port | Pin |
| 1 | TS0 | P32 | 16 | 2 | TS1 | P31 | 17 |
| 3 | TS2 | P30 | 18 | 4 | TS3 | P27 | 19 |
| 5 | TS4 | P26 | 20 | 6 | TS5 | P15 | 25 |
| 7 | TS6 | P14 | 26 | 8 | TS7 | PH3 | 29 |
| 9 | TS8 | PH2 | 30 | 10 | TS9 | PH1 | 31 |
| 11 | TS10 | PH0 | 32 | 12 | TS11 | P55 | 33 |
| 13 | TS12 | P54 | 34 | 14 | TS13 | PC7 | 35 |
| 15 | TS14 | PC6 | 36 | 16 | TS15 | PC5 | 37 |
| 17 | TS16 | PC3 | 39 | 18 | TS17 | PC2 | 40 |
| 19 | TS18 | PB7 | 41 | 20 | TS19 | PB6 | 42 |
| 21 | TS20 | PB5 | 43 | 22 | TS21 | PB4 | 44 |
| 23 | TS22 | PB3 | 45 | 24 | TS23 | PB2 | 46 |
| 25 | TS24 | PB1 | 47 | 26 | TS25 | PB0 | 49 |
| 27 | TS26 | PA6 | 51 | 28 | TS27 | PA5 | 52 |
| 29 | TS28 | PA4 | 53 | 30 | TS29 | PA3 | 54 |
| 31 | TS30 | PA2 | 55 | 32 | TS31 | PA1 | 56 |
| 33 | TS32 | PA0 | 57 | 34 | TS33 | PE4 | 59 |
| 35 | TS34 | PE3 | 60 | 36 | TS35 | PE2 | 61 |
| 37 | NC | - | - | 38 | NC | - | - |
| 39 | NC | - | - | 40 | NC | - | - |

- : Non Connection

8. Circuit Diagram

The circuit diagram is shown on the Appendix 1.

9. PCB Layout Diagram

The PCB layout diagram is shown on the Appendix 2.

10. Parts List

The Parts list is shown on the Appendix 3.

11. Code Development

11.1 Overview

For all code debugging using Renesas software tools, the CPU board must be connected to a PC via an E1 emulator debugger. An E1 debugger is not supplied with this product and must be procured separately. For further information regarding the debugging capabilities of the E1 debugger, refer to RX Family E1/E20 Emulator User's Manual (R20UT0399EJ).

11.2 Software Project

Renesas offers a software project to be used with the Capacitive Touch Evaluation System application board. The project software can be downloaded from the product website.

11.3 Compiler Restrictions

The compiler supplied with this product is fully functional for a period of 60 days from installation and first use. After the first 60 days of use have expired, the compiler will default to a maximum of 128k code and data. To use the compiler with programs greater than this size you need to purchase the license for the full version from your distributor.

Note: The protection software for the compiler will detect changes to the system clock. Changes to the system clock back in time may cause the trial period to expire prematurely.

11.4 Mode Support

The MCU supports single chip and boot (SCI) modes, which are configured on the CPU board. Details of the modifications required can be found in section 6.2. All other MCU operating modes are configured within the MCU's registers, which are listed in the RX130 Group Hardware Manual.

To avoid damage to the MCU, modify the mode configuration after cutting power supply to the CPU board or when the MCU reset signal is low.

11.5 Debugging Support

The E1 emulator supports software break points, hardware event points and basic trace functionality. It is limited to a maximum of 8 on-chip event points, 256 software breaks and 256-trace functionality (branches/cycles). For further details, refer to the RX Family E1/E20 Emulator User's Manual (R20UT0398EJ).

11.6 Address Space

For the MCU address space details corresponding to each MCU operating mode, refer to the "Address Space" section of the RX130 Group Hardware Manual

12. Additional Information

Technical Support

For more information about how to use the Integrated Development Environment (IDE), refer to the IDE help menu.

For information about the RX130 Group microcontrollers, refer to the RX130 Group User's Hardware Manual.

For general information on Renesas microcontrollers, visit : <https://www.renesas.com/>

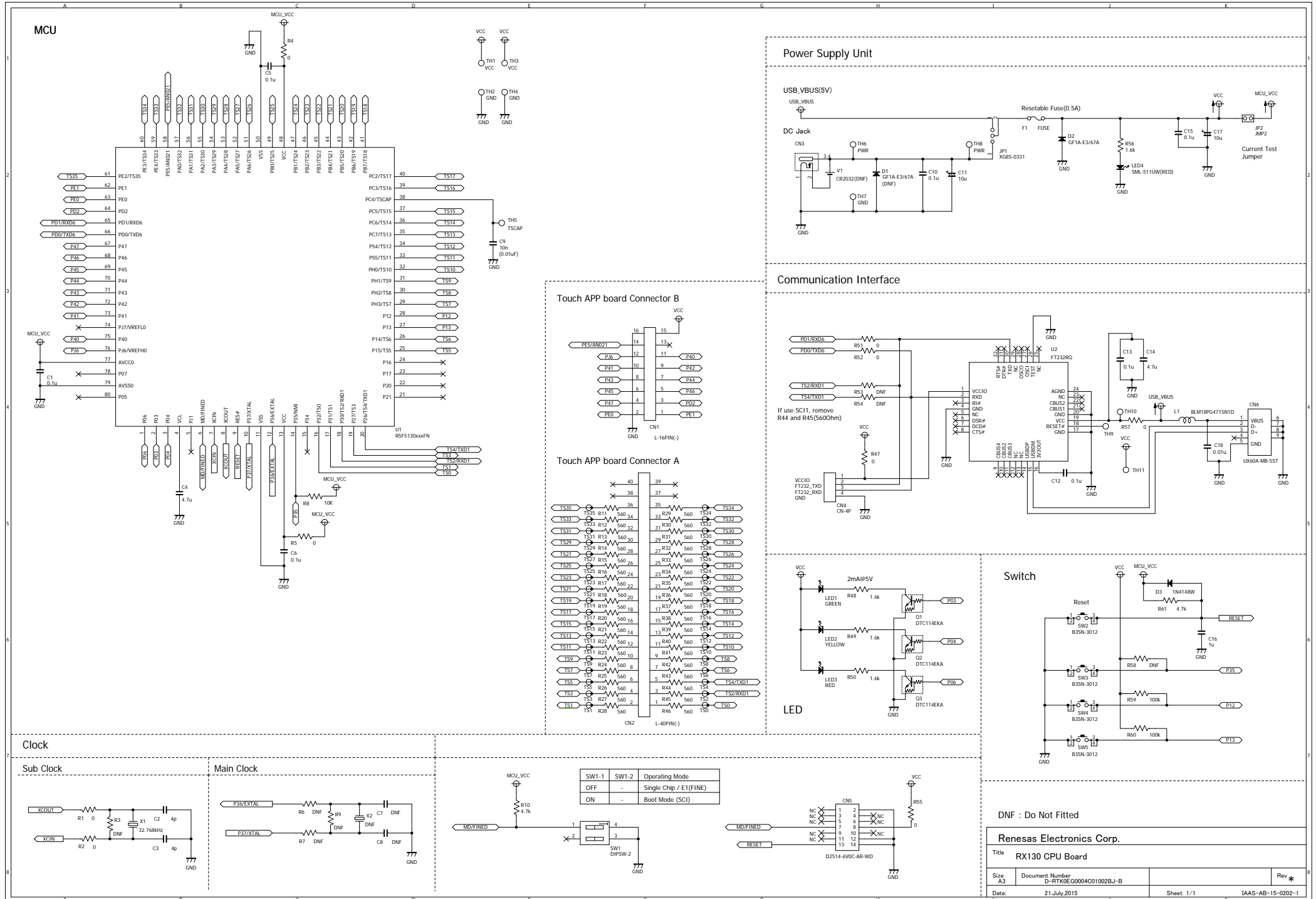
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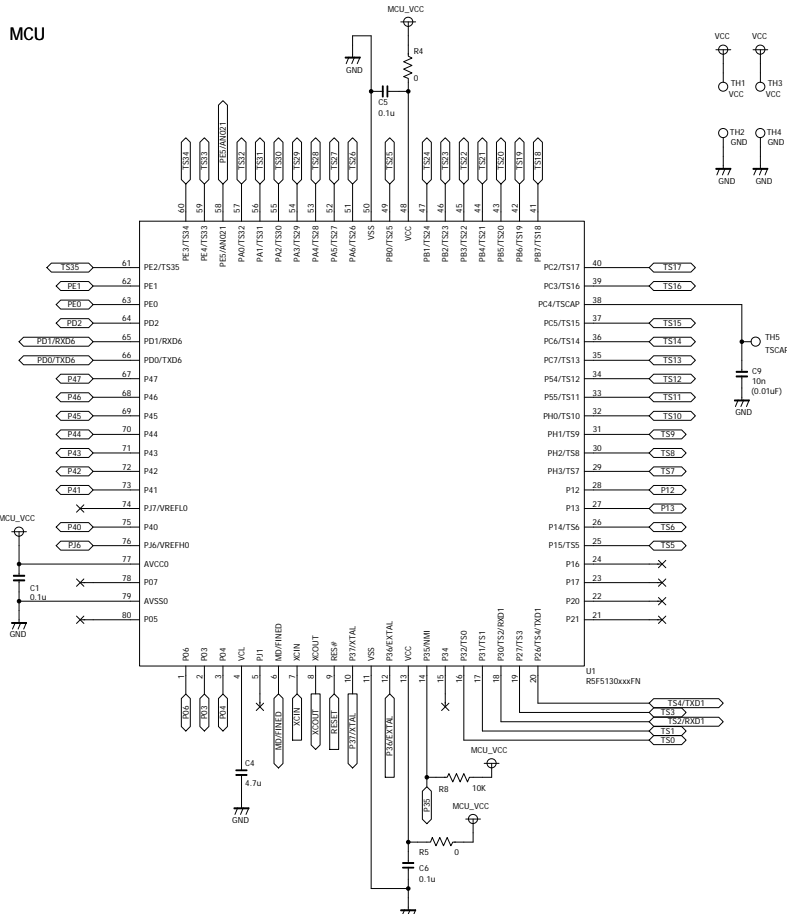
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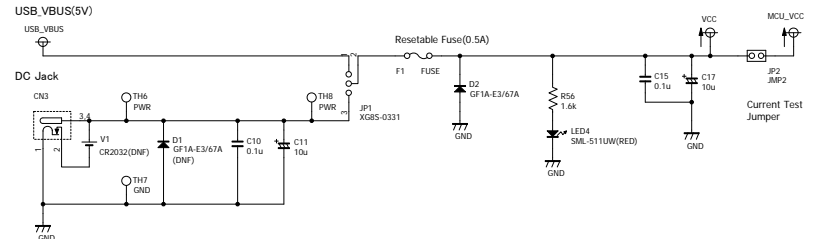
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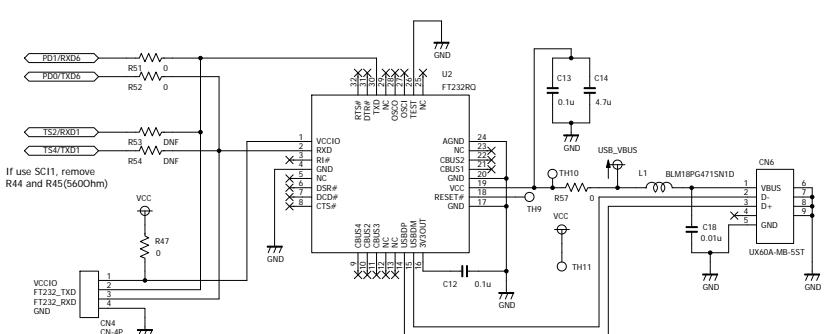
MCU



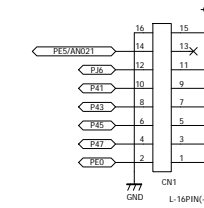
Power Supply Unit



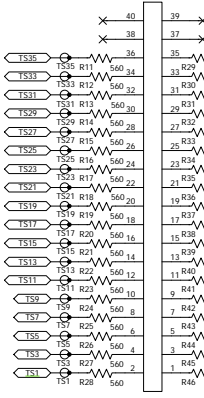
Communication Interface



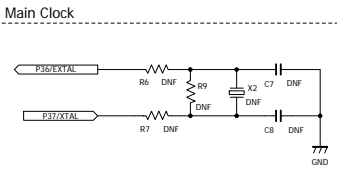
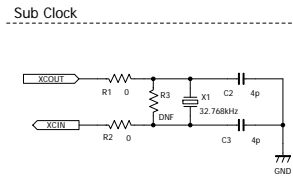
Touch APP board Connector B



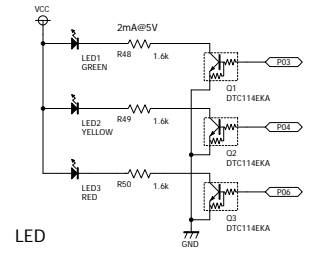
Touch APP board Connector A



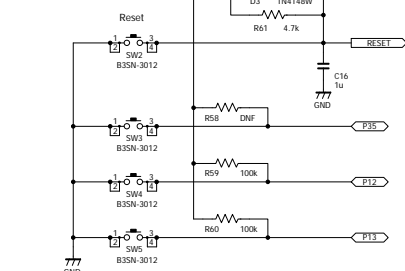
Clock



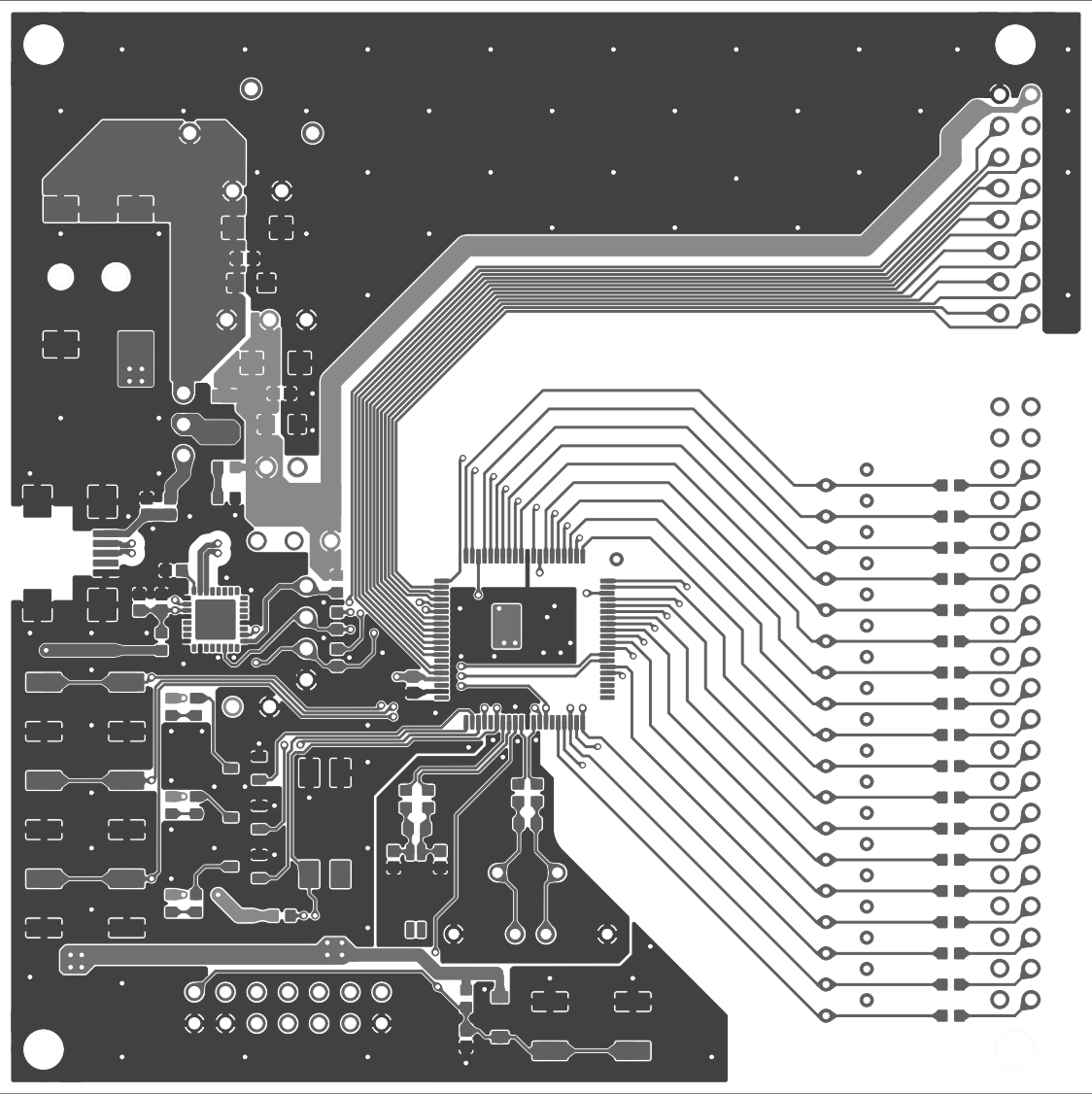
LED



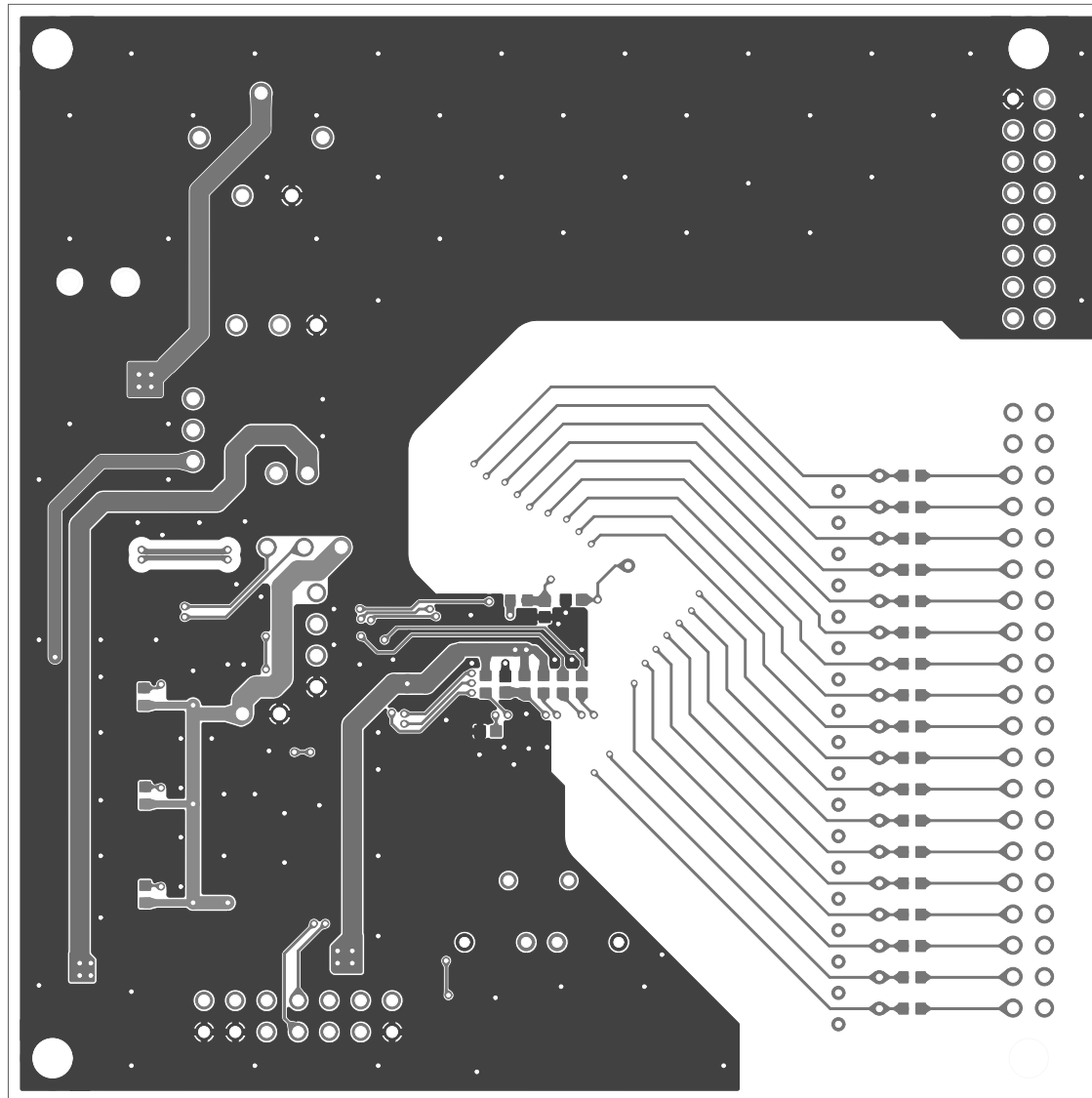
Switch



| SW1-1 | SW1-2 | Operating Mode |
|-------|-------|------------------------|
| OFF | - | Single Chip / E1(FINE) |
| ON | - | Boot Mode (SCI) |



PCB Top-side Layout



PCB Bottom-side Layout

Renesas Electronics Corp.

Appendix 3.

| PartNo | | RTK0EG0004C01002BJ | | Title RX Capacitive Touch Evaluation System RX130 CPU Board BOM | | | |
|--------|-------------------------|---|--------------------------------|---|---------------|---------|----------------------------|
| No | Component Name | | Component Specification | | | Qty/Set | Remarks |
| | Type | Reference | Product Number (Specification) | Manufacture | Mount/Unmount | | |
| 1 | Microcomputer | U1 | R5F51305ADFN | Renesas | Mount | 1 | |
| 2 | USB-Serial Converter IC | U2 | FT232RQ | FTDI | Mount | 1 | |
| 3 | Chip Capacitor | C9, C18 | GRM188B11H103KA01D | Murata | Mount | 2 | 0.01u(10n) |
| 4 | Chip Capacitor | C1, C5, C6, C10, C12, C13, C15 | GRM188B11E104KA01D | Murata | Mount | 7 | 0.1u |
| 5 | Chip Capacitor | C11, C17 | F931C106MAA | AVX | Mount | 2 | 10u |
| 6 | Chip Capacitor | C16 | GRM188B31E105KA75D | Murata | Mount | 1 | 1u |
| 7 | Chip Capacitor | C4, C14 | GRM188B31A475KE15D | Murata | Mount | 2 | 4.7u |
| 8 | Chip Capacitor | C2, C3 | GRM1885C1H4R0CA01D | Murata | Unmount | 0 | 4p |
| 9 | Ceramic Capacitor | C7, C8 | - | - | Unmount | 0 | |
| 10 | Right Angle Pin Socket | CN1 | FSR-42085-08 | Hirosugi-Keiki | Mount | 1 | 16-pin(2x8), 2.54mm-pitch |
| 11 | Right Angle Pin Socket | CN2 | FSR-42085-20 | Hirosugi-Keiki | Mount | 1 | 40-pin(2x20), 2.54mm-pitch |
| 12 | DC Jack | CN3 | PJ-002AH-SMT | CUI inc | Mount | 1 | |
| 13 | Pin Socket | CN4 | - | - | Unmount | 0 | 4-pin(1x4), 2.54mm-pitch |
| 14 | E1 Connector | CN5 | 7614-6002PL | 3M | Mount | 1 | |
| 15 | USB mini-B Receptacle | CN6 | UX60A-MB-5ST | HIROSE ELECTRIC | Mount | 1 | |
| 16 | Diode | D1 | GF1A-E3/67A | Vishay | Unmount | 0 | |
| 17 | Diode | D2 | GF1A-E3/67A | Vishay | Mount | 1 | |
| 18 | Diode | D3 | 1N4148W-E3-18 | Vishay | Mount | 1 | |
| 19 | リセッタブルヒューズ | F1 | OZCJ0050FF2G | Bel Fuse Inc | Mount | 1 | |
| 20 | Jumper | JP1 | XG8S-0331 | OMRON | Mount | 1 | 3-pin |
| 21 | Jumper | JP2 | XG8S-0231 | OMRON | Mount | 1 | 3-pin |
| 22 | Chip Ferrite Bead | L1 | BLM18PG471SN1D | Murata | Mount | 1 | |
| 23 | LED | LED1 | SML-512MWT86 | ROHM | Mount | 1 | Green |
| 24 | LED | LED2 | SML-511WWT86 | ROHM | Mount | 1 | Yellow |
| 25 | LED | LED3, LED4 | SML-511UWT86 | ROHM | Mount | 2 | Red |
| 26 | Transistor | Q1, Q2, Q3 | DTC114EKAT146 | ROHM | Mount | 3 | |
| 27 | Chip Resistor | R1, R2, R4, R5, R47, R51, R52, R55, R57 | MCR03EZPJ000 | ROHM | Mount | 9 | 0 |
| 28 | Chip Resistor | R11-R46 | MCR03ERTJ561 | ROHM | Mount | 36 | 560 |
| 29 | Chip Resistor | R48, R49, R50, R56 | MCR03ERTJ162 | ROHM | Mount | 4 | 1.6k |
| 30 | Chip Resistor | R59, R60 | MCR03ERTJ104 | ROHM | Mount | 2 | 100k |

Renesas Electronics Corp.

| No | Component Name | | Component Specification | | | Qty/Set | Remarks |
|----|-----------------------|---------------------------------|--------------------------------|----------------|---------------|---------|----------------------------|
| | Type | Reference | Product Number (Specification) | Manufacture | Mount/Unmount | | |
| 31 | Chip Resistor | R8 | MCR03ERTJ103 | ROHM | Mount | 1 | 10k |
| 32 | Chip Resistor | R10, R61 | MCR03ERTJ472 | ROHM | Mount | 2 | 4.7k |
| 33 | Chip Resistor | R3, R6, R7, R9, R53, R54 R58 | - | ROHM | Unmount | 0 | |
| 34 | DIP Switch | SW1 | SBS9102TK | KNITTER-SWITCH | Mount | 1 | 2-position |
| 35 | Tact Switch | SW2-5 | EVQQ2K02W | Panasonic | Mount | 4 | |
| 36 | CR2032 Battery Holder | V1 | BK-5058 | MPD | Unmount | 0 | |
| 37 | Crystal Oscillator | X1 | SSP-T7-FL | SSI | Unmount | 0 | 32.768kHz, CL=3.7pF, 20ppm |
| 38 | Crystal Unit | X2 | - | - | Unmount | 0 | HC-49 |
| 39 | Through Hole (Φ1mm) | TH1-4, TH6-TH11 | - | - | Mount | 10 | |
| 41 | Through Hole (Φ0.5mm) | TH5, TH12-47 | - | - | Mount | 37 | |
| 40 | PCB | | RTK0EG0004C01002BJ REV. A | | Mount | 1 | |

| | |
|------------------|--|
| Revision History | RX130 Group RX Capacitive Touch Evaluation System CPU Board User's Manual |
|------------------|--|

| Rev. | Date | Description | |
|------|--------------|-------------|---|
| | | Page | |
| 1.00 | Feb 17, 2016 | — | First Edition issued |
| 1.10 | Apr.26.24 | — | Update Notice and How to Use This Manual. |
| | | 2 | Added board dimensions to the Table 1.1 |
| | | 3 | Added regulatory compliance notices |
| | | 16 | Update Code development. |
| | | 17 | Update Additional Information. |

RX130 Group RX Capacitive Touch Evaluation System
CPU Board User's Manual

Publication Date: Rev.1.00 Feb 17, 2016
Rev.1.10 Apr 26, 2024

Published by:Renesas Electronics Corporation
3-2-24 Toyosu, Koto Ward, Tokyo, 135-0061, Japan

RX130 Group

RX Capacitive Touch Evaluation System CPU Board
User's Manual



Renesas Electronics Corporation

R01UH0001EJ0110