

# RX Capacitive Touch Evaluation System

## Self-Capacitance Touch Buttons/Wheels/Slider Board

### User's Manual

Renesas Solution Starter Kit

RX Capacitive Touch Evaluation System

Application Board

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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. 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 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. Unused pins should be handled as described under Handling of Unused Pins in the manual.

### 2. Processing at Power-on

The state of the product is undefined at the moment 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 moment 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 moment 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 moment when power is supplied until the power reaches the level at which resetting has been specified.

### 3. Prohibition of Access to Reserved Addresses

Access to reserved addresses is prohibited.

The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

### 4. Clock Signals

After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has 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.

Moreover, 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.

### 5. Differences between Products

Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

The characteristics of Microprocessing unit or Microcontroller unit products in the same group but having a different part number may differ in terms of the 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 Application 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 Application 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 Capacitive Touch Application 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 application board hardware specifications	RX Capacitive Touch Evaluation System: Self-Capacitance Buttons/Wheels/Slider Board User's Manual	This User's Manual

## 2. List of Abbreviations and Acronyms

<b>Abbreviation</b>	<b>Full Form</b>
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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### 1. Overview

#### 1.1 Purpose

This product was developed for use with a CPU board as an evaluation tool for the Renesas RX Capacitive Touch Evaluation System.

#### 1.2 Features

This application board offers the following features:

- Connectable to the CPU board included in the Renesas RX Capacitive Touch Evaluation System
- Same interface as the CPU board included in Renesas RX Capacitive Touch Evaluation System
- Button/wheel/slider board
  - 3 self-capacitance button electrodes
  - 2 types of wheel electrodes (8-electrode and 4-electrode)
  - 1 slider electrode (5 electrodes)
- 3-mm thick acrylic overlay (attached)



Figure 1.1 Application Board External Dimensions

## 2. Board Layout

### 2.1 Component Layout

Figure 2.1 shows the component layout of the application board.

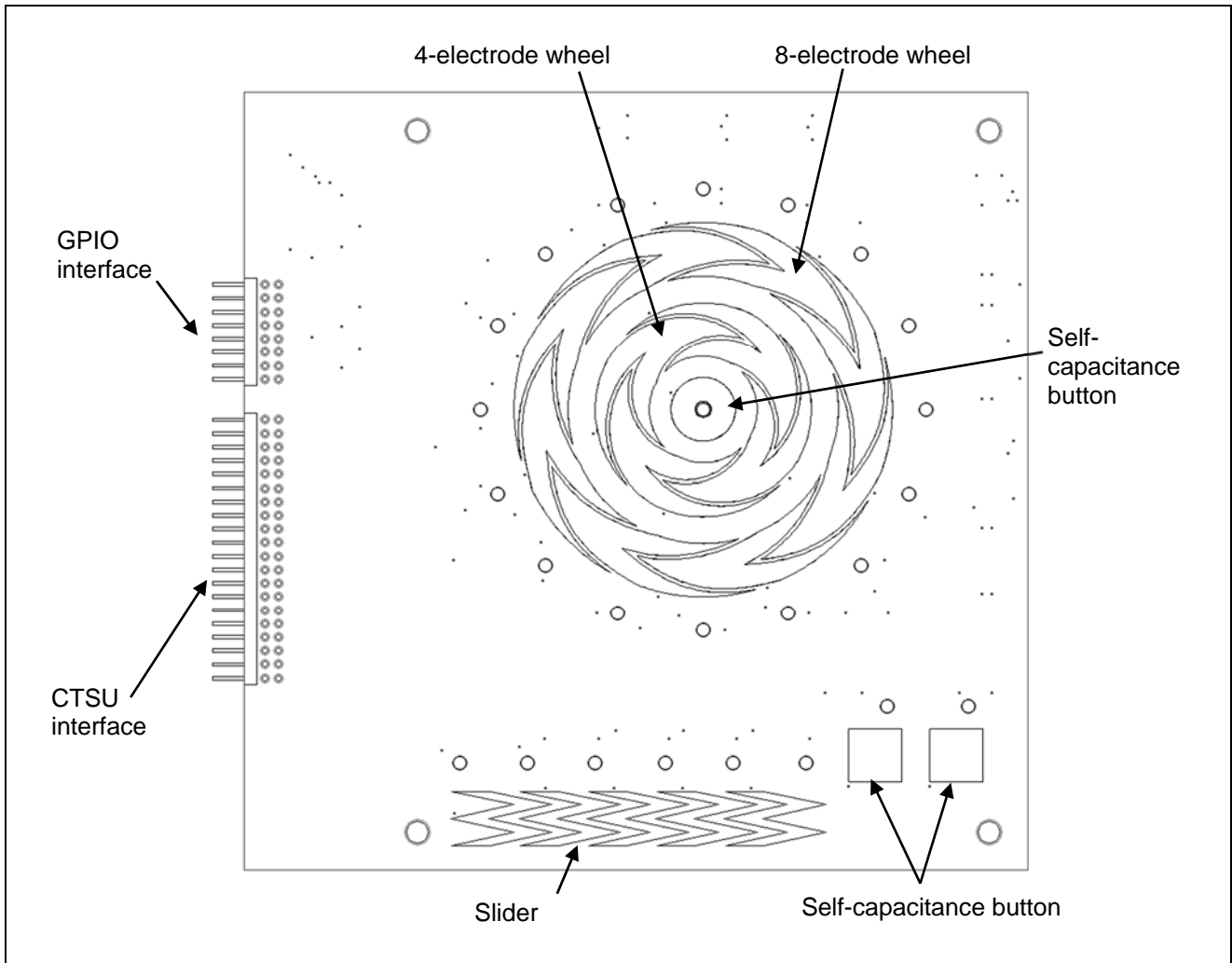


Figure 2.1 Component Layout



### 2.2 Overlay Dimensions

Figure 2.2 shows the dimensions of the overlay attached to the application board. Dimensions are shown in millimeters. Overlay thickness is 3.0 mm.

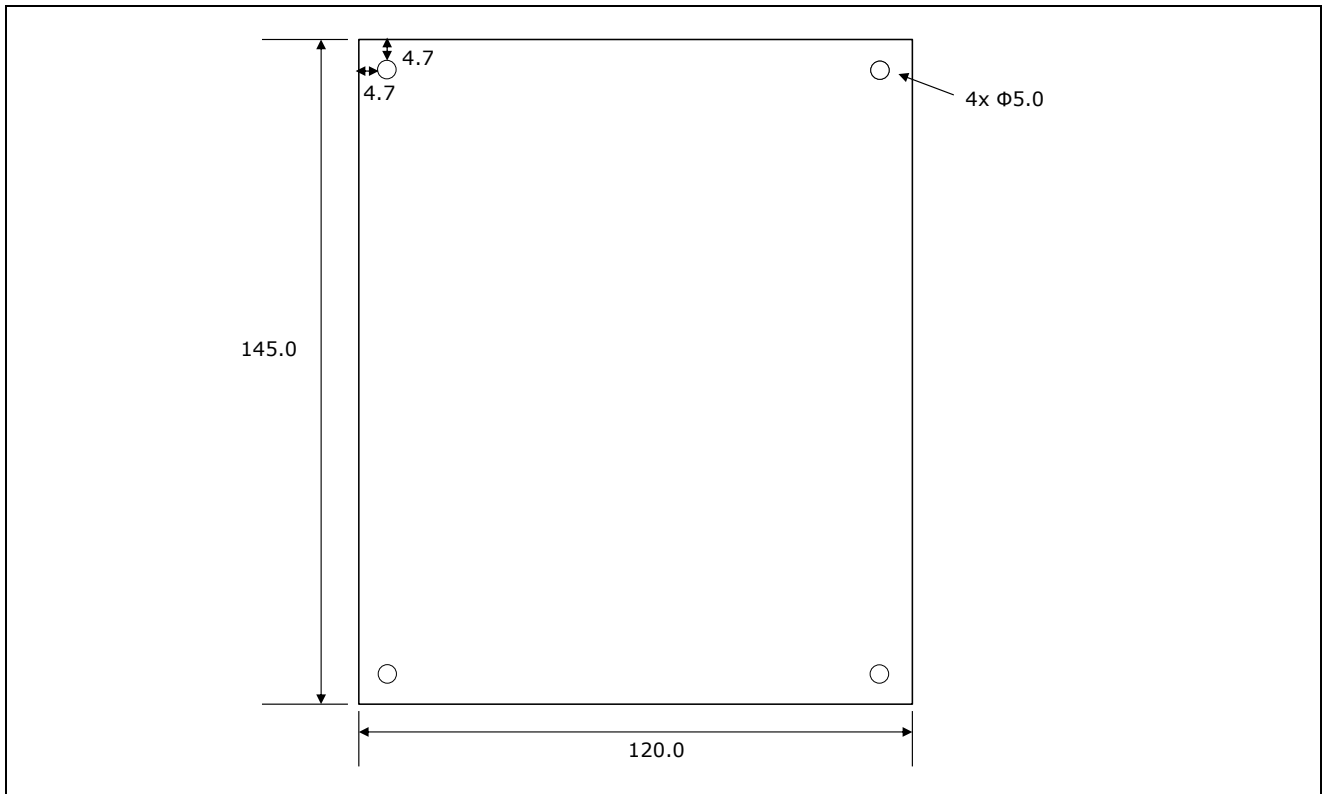


Figure 2.2 Overlay Dimensions

### 2.3 Component Placement

Figure 2.3 and Figure 2.4 show the placement of individual components on the application board.

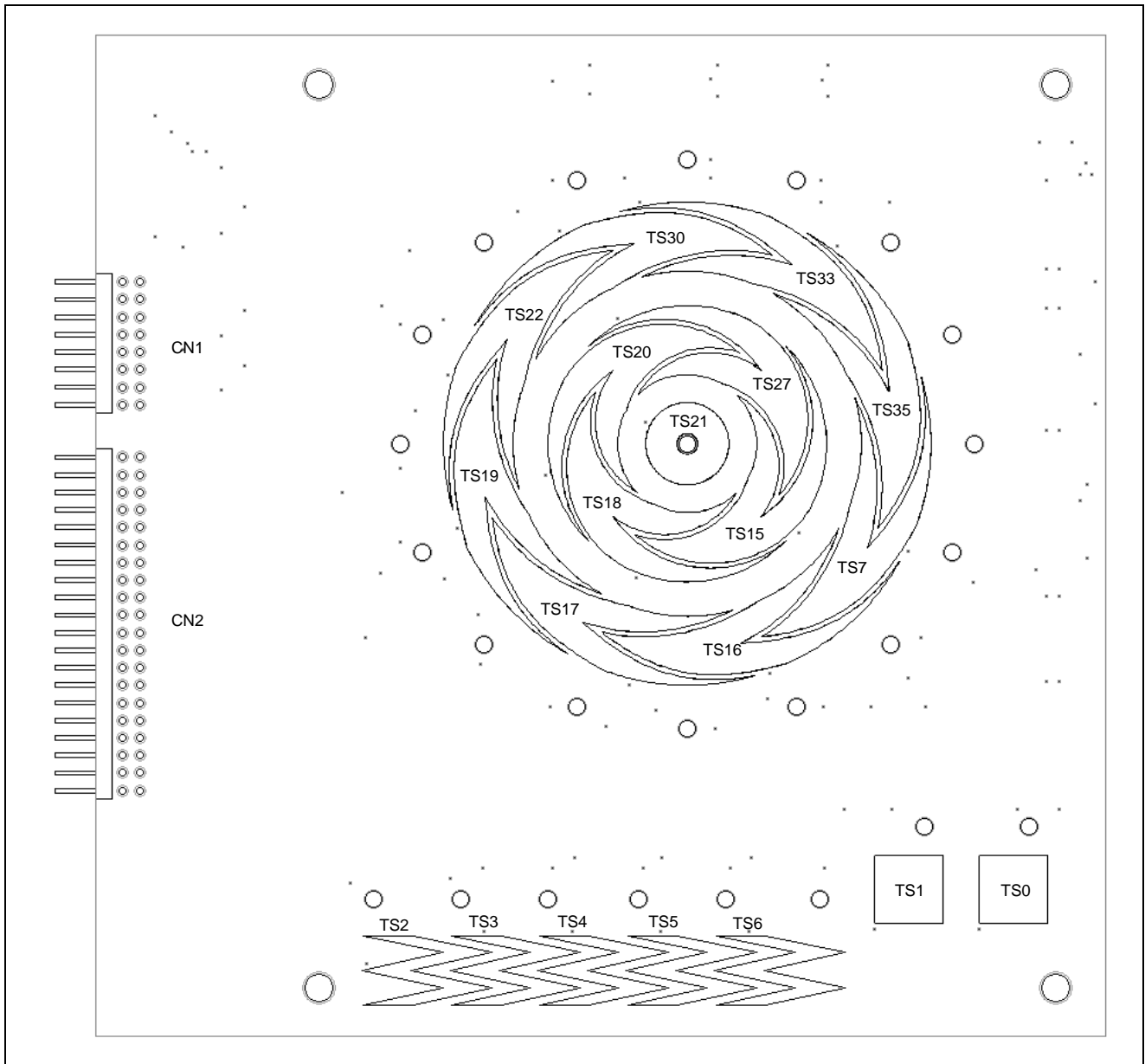


Figure 2.3 Application Board Component Placement (top/component side)

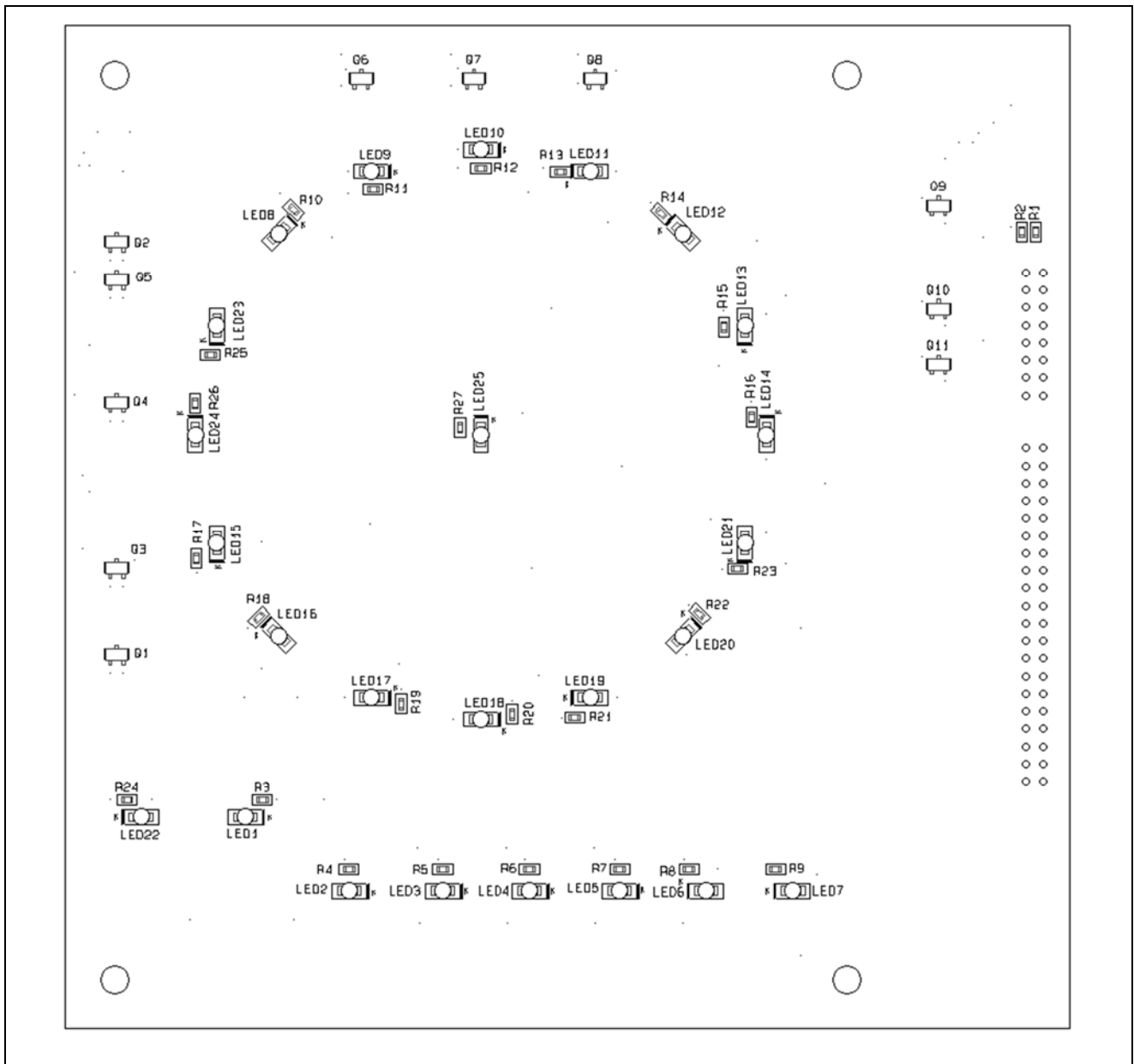


Figure 2.4 Application Board Component Placement (bottom/soldered side)

### 3. Board Attachment & Specifications

#### 3.1 Board Connection Configuration

Insert headers CN1 and CN2 on the application board into the corresponding CN1 and CN2 sockets on the CPU board. Make sure both headers are inserted to match the direction and number of pins on the corresponding connectors and that the pins are fully inserted into the sockets.

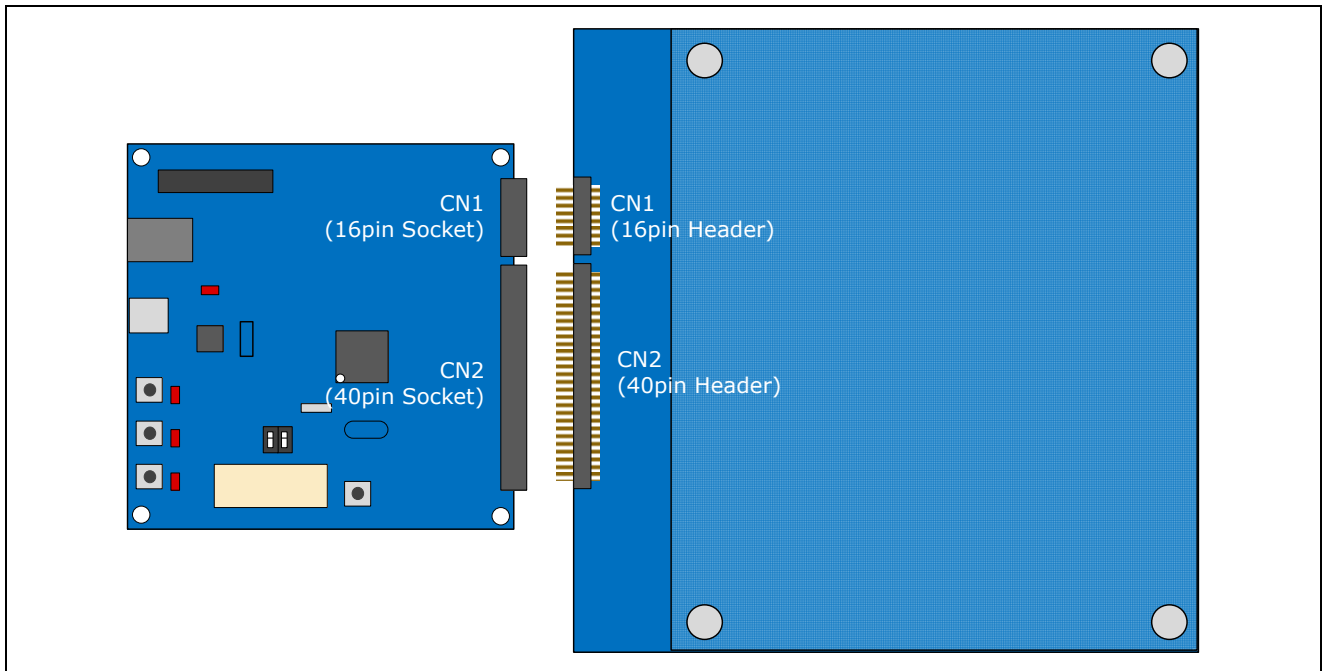


Figure 3.1 Board Connection Direction

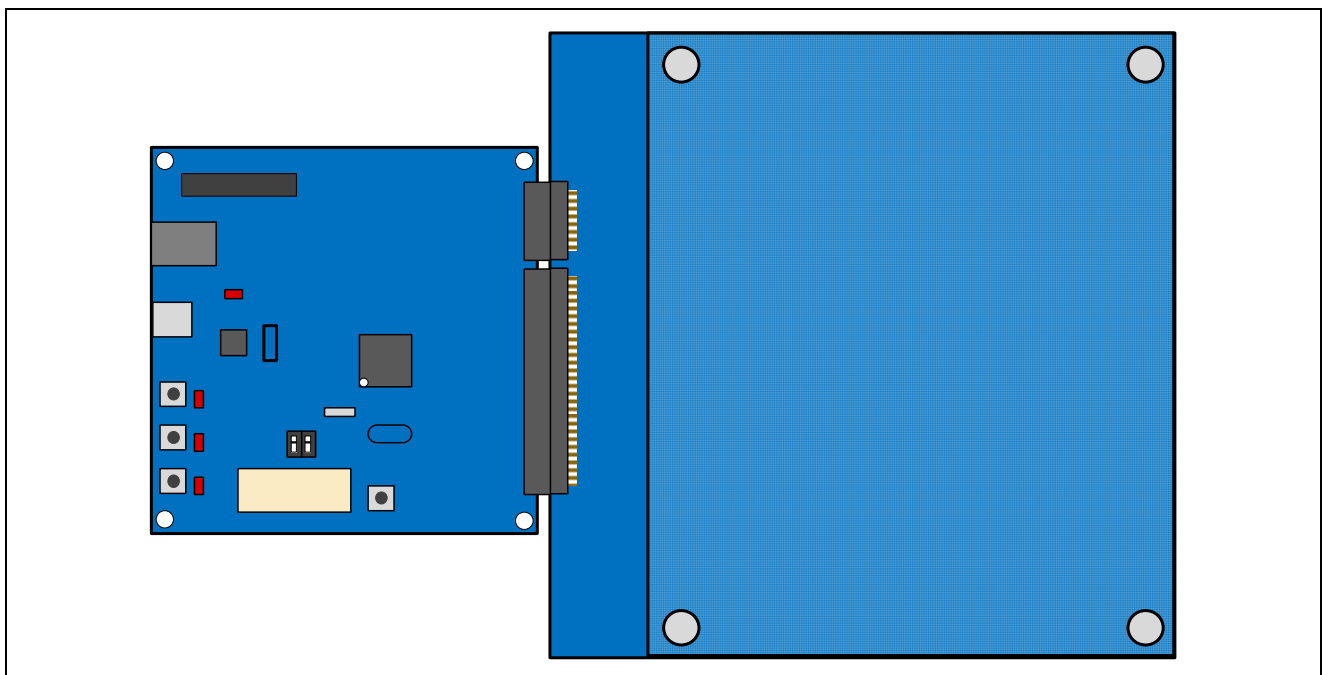


Figure 3.2 Connected Boards

## 4. Headers

Header names (circuit net names) differ for the application board and the CPU board. This section provides details on all headers; the following information can serve as verification tables when using the extension board function.

### 4.1 GPIO Interface

Table 4.1 Application Headers (CN1)

Pin	Header Name	Pin	Header Name
1	LED_LOW0	2	LED_LOW 1
3	LED_LOW 2	4	LED_LOW 3
5	LED_LOW 4	6	LED_LOW 5
7	LED_LOW 6	8	-
9	LED_COL1	10	LED_COL2
11	LED_COL3	12	LED_COL4
13	-	14	ADC
15	VCC_LED	16	VSS_GND

- : Non Connection

### 4.2 CTSU Interface

Table 4.2 Application Headers (CN2)

Pin	Header Name	Pin	Header Name
1	TS0	2	TS1
3	TS2	4	TS3
5	TS4	6	TS5
7	TS6	8	TS7
9	-	10	-
11	-	12	-
13	-	14	-
15	-	16	TS15
17	TS16	18	TS17
19	TS18	20	TS19
21	TS20	22	TS21
23	TS22	24	-
25	-	26	-
27	-	28	TS27
29	-	30	-
31	TS30	32	-
33	-	34	TS33
35	-	36	TS35
37	-	38	-
39	-	40	-

- : Non Connection

## 5. Circuit Diagram

The circuit diagram is shown on the Appendix 1.

## 6. PCB Layout Diagram

The PCB layout diagram is shown on the Appendix 2.

## 7. Parts List

The parts list is shown on the Appendix 3.



## 8. Additional Information

### Technical Support

For more information about how to use the application board, refer to the CD/DVD included with this product or to the Renesas website.

For information about the target microcontroller, refer to the corresponding User's Hardware Manual.

For information about Assembler language, refer to the RX Family User's Software Manual.

For information about Workbench6, refer to the Workbench6 Capacitance Touch Integrated Development Environment User's Manual.

Online tech support and other information is available at the following website:

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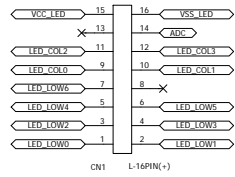
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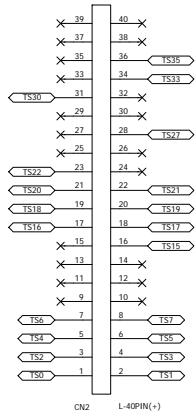
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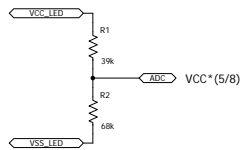
CPU Board Header B



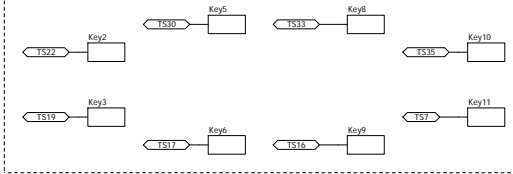
CPU Board Header B



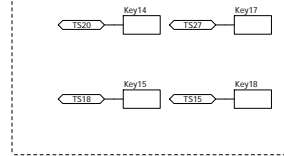
Board ID



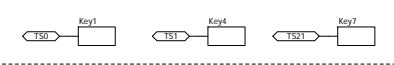
Wheel(8ch)



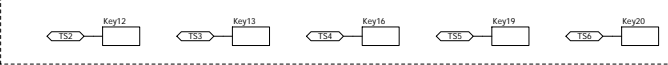
Wheel(4ch)



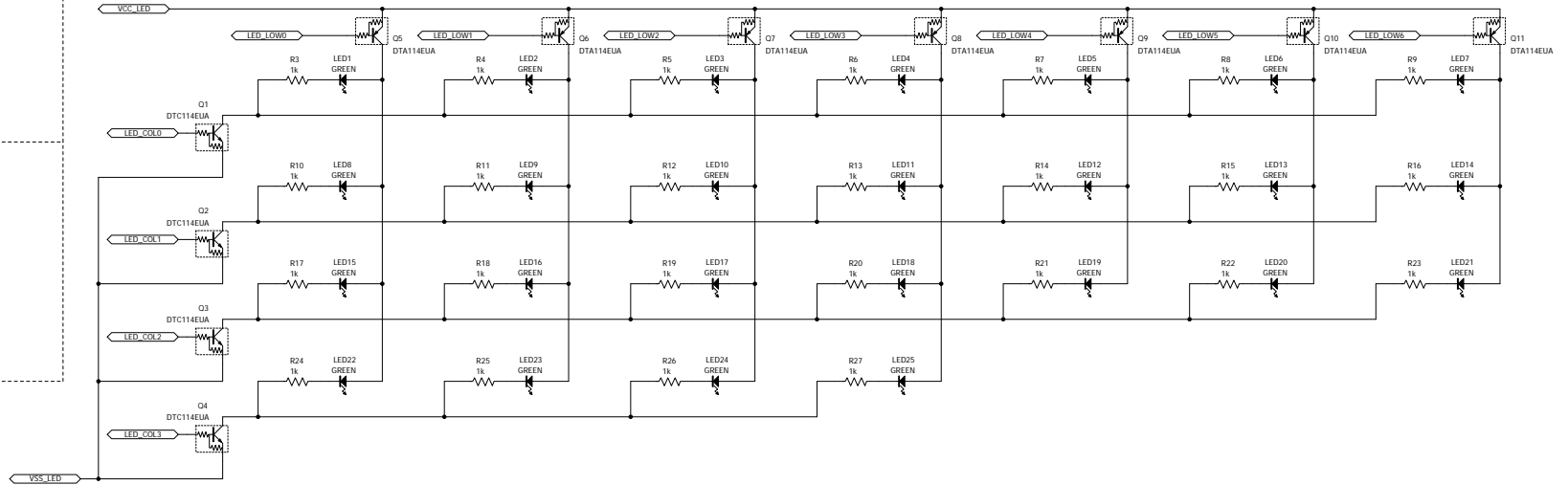
Buttons



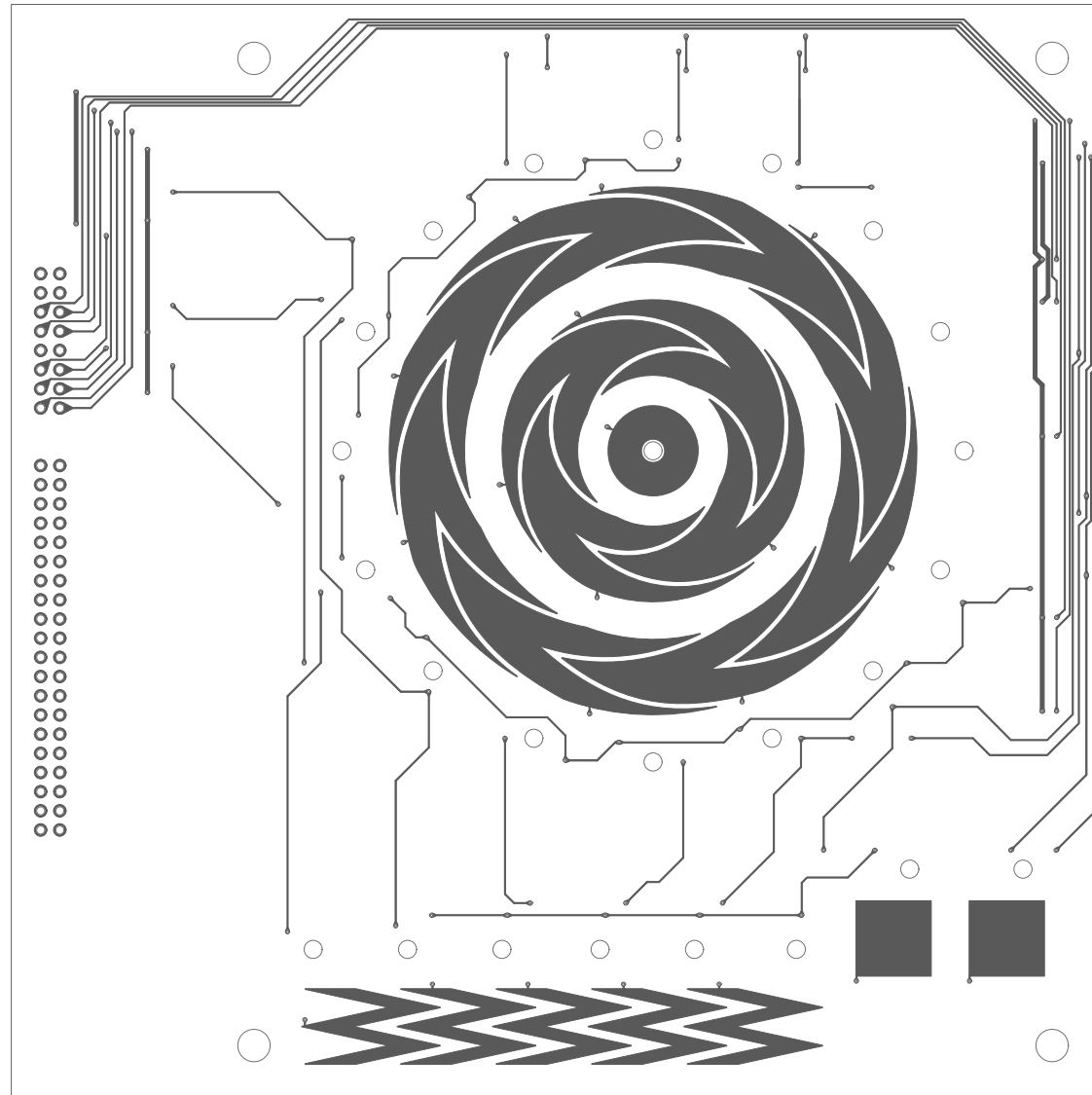
Slider(5ch)



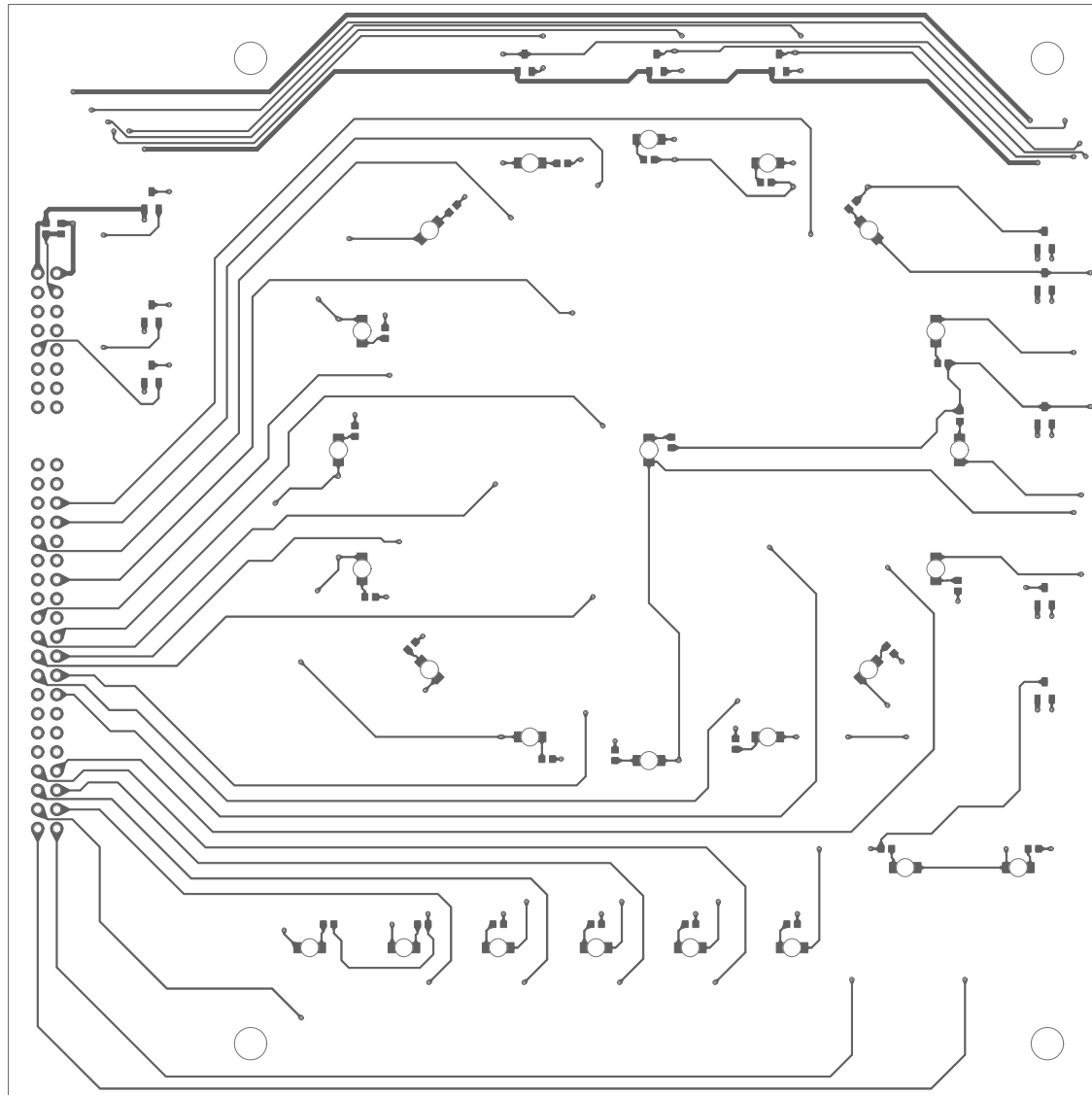
LEDs



Appendix 2.



PCB Top-side Layout



PCB Bottom-side Layout



Revision History	Self-Capacitance Touch Buttons/Wheels/Slider Board User's Manual
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Rev.	Date	Description	
		Page	
1.00	Feb 17, 2016	—	First Edition issued

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