User's Manual

RX Capacitative Touch Evaluation System

Mutual-Capacitance Matrix Key/Proximity Sensor Board

User's Manual

Renesas Solution Starter Kit
RX Capacitive Touch Evaluation System
Application Board

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

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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 latest versions of all documents are available for download from the Renesas Electronics website.

Document Type	Description	Document Title	Document No.
User's manual	Description of application board hardware specifications	RX Capacitive Touch Evaluation System: Mutual-Capacitance Button/Proximity Sensor Board User's Manual	This User's Manual

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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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
- Evaluation for two methods of touch detection:
  - Mutual-Capacitance method: 20 channels for touch buttons
  - Self-Capacitance method: 1 channel for proximity sensor (film type)
- 3-mm thick acrylic overlay (attached)

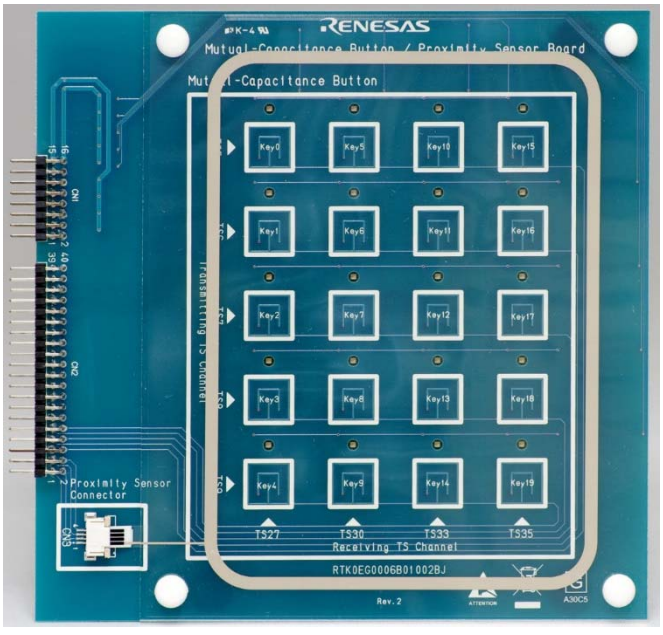

Figure 1.1 Application Board External Dimensions

2. Board Layout

2.1 Component Layout

Figure2.1 shows the component layout of the application board.

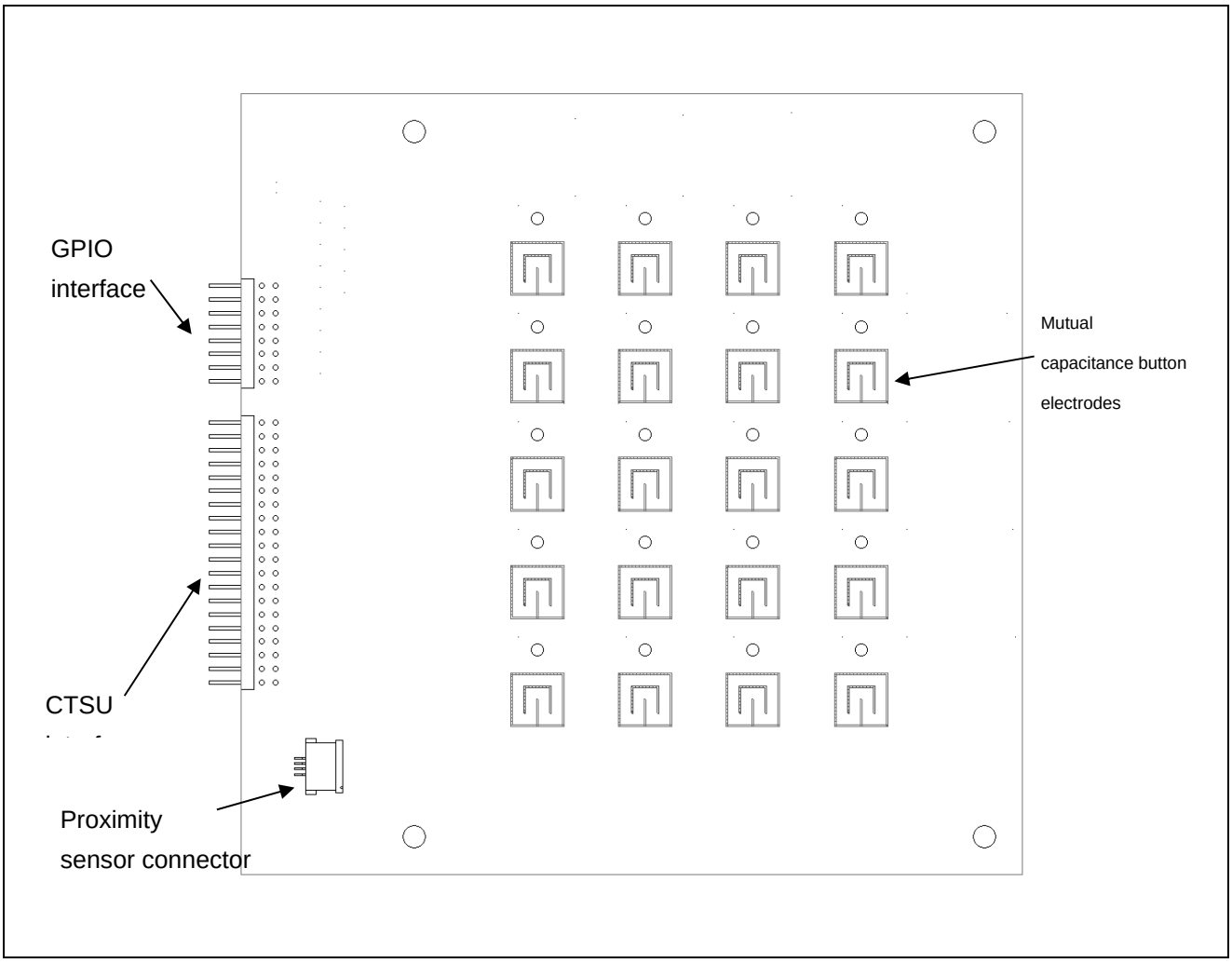

Figure2.1 Component Layout

2.2 Overlay Dimensions

Figure2.2 shows the dimensions of the overlay attached to the application board. Dimensions are shown in millimeters. Overlay thickness is 3.0 mm.

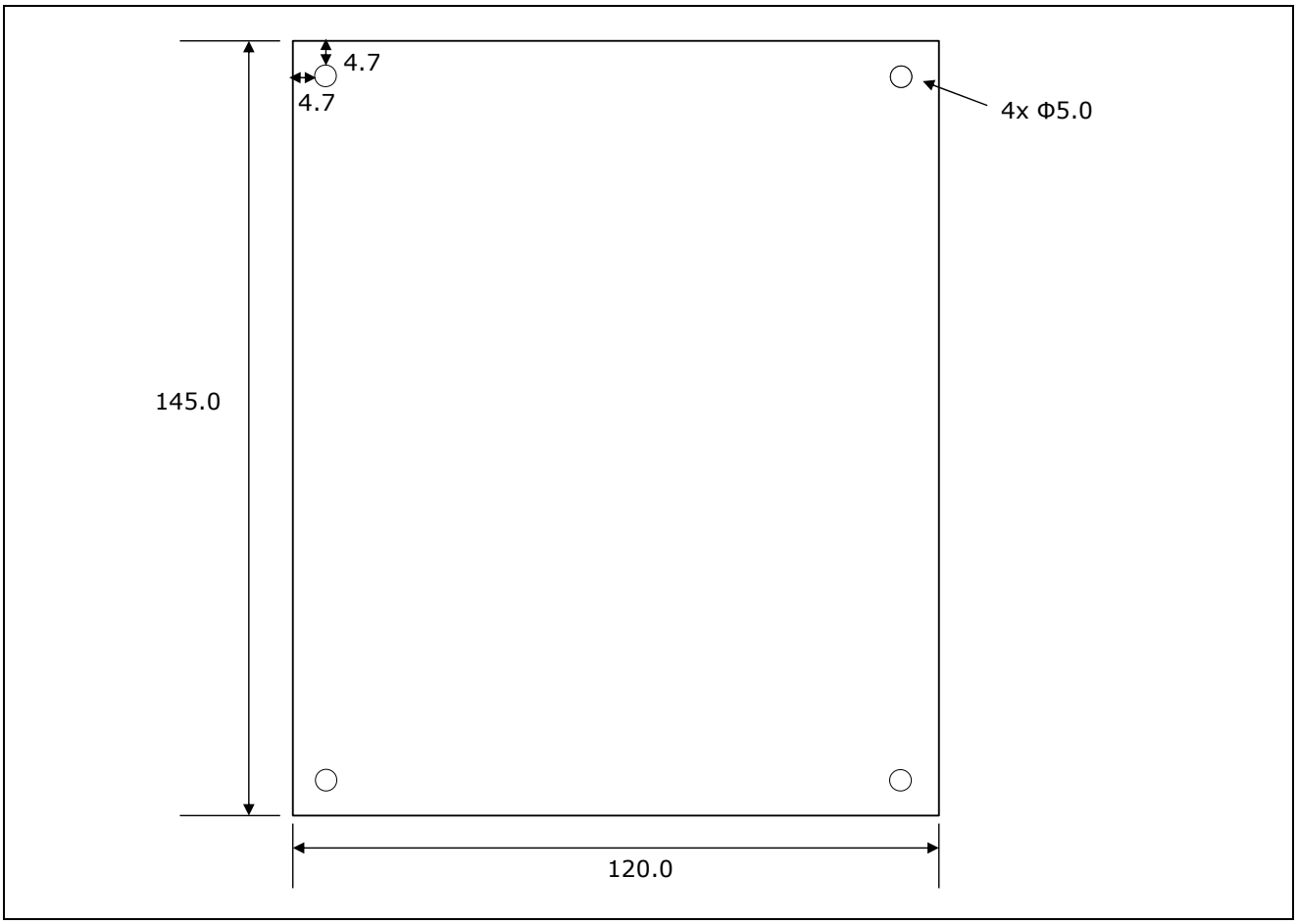

Figure2.2 Overlay Dimensions

2.3 Proximity Sensor Dimensions

Figure2.3 shows the film base dimensions of the proximity sensor and Figure2.4 shows the dimensions of the proximity sensor electrode area. Dimensions are shown in millimeters.

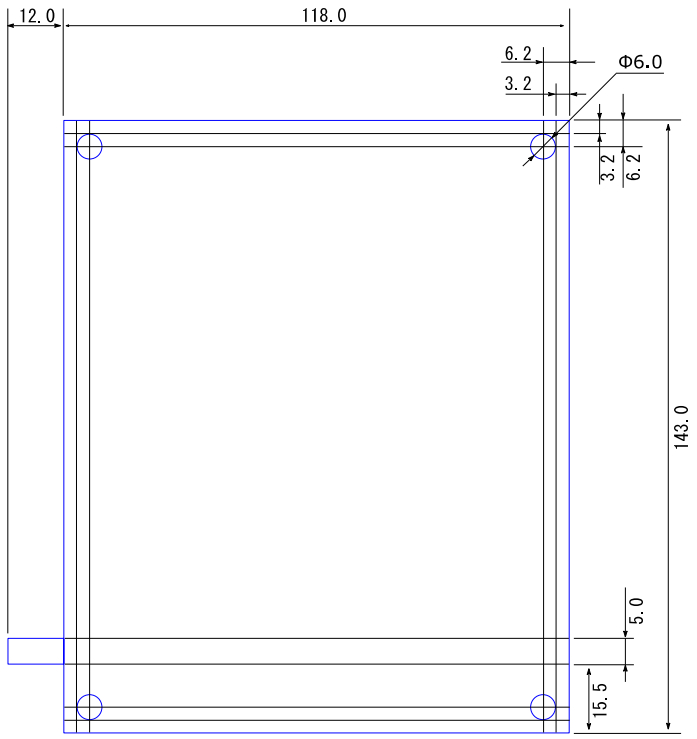

Figure2.3 Film Base Dimensions

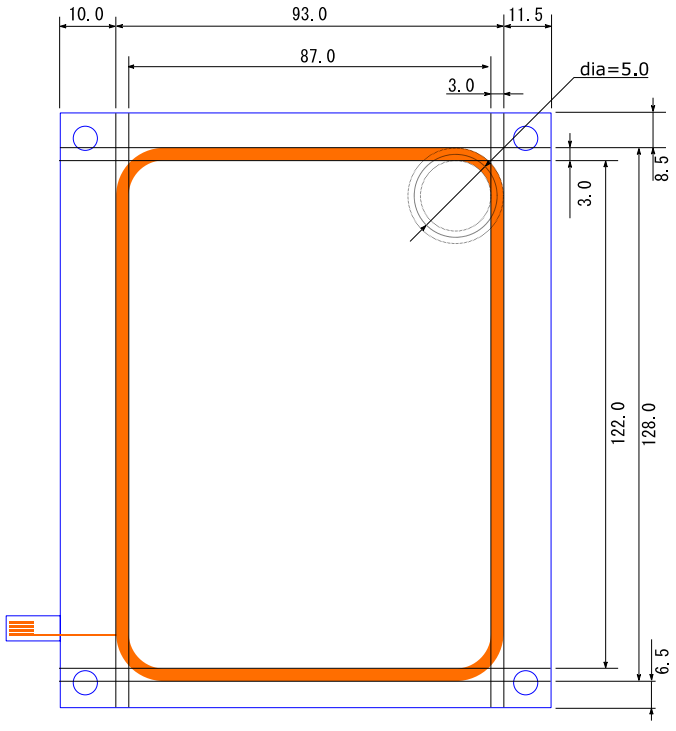

Figure2.4 Proximity Sensor Electrode Area Dimensions

2.4 Component Placement

Figure2.5 and Figure2.6 show the placement of individual components on the application board.

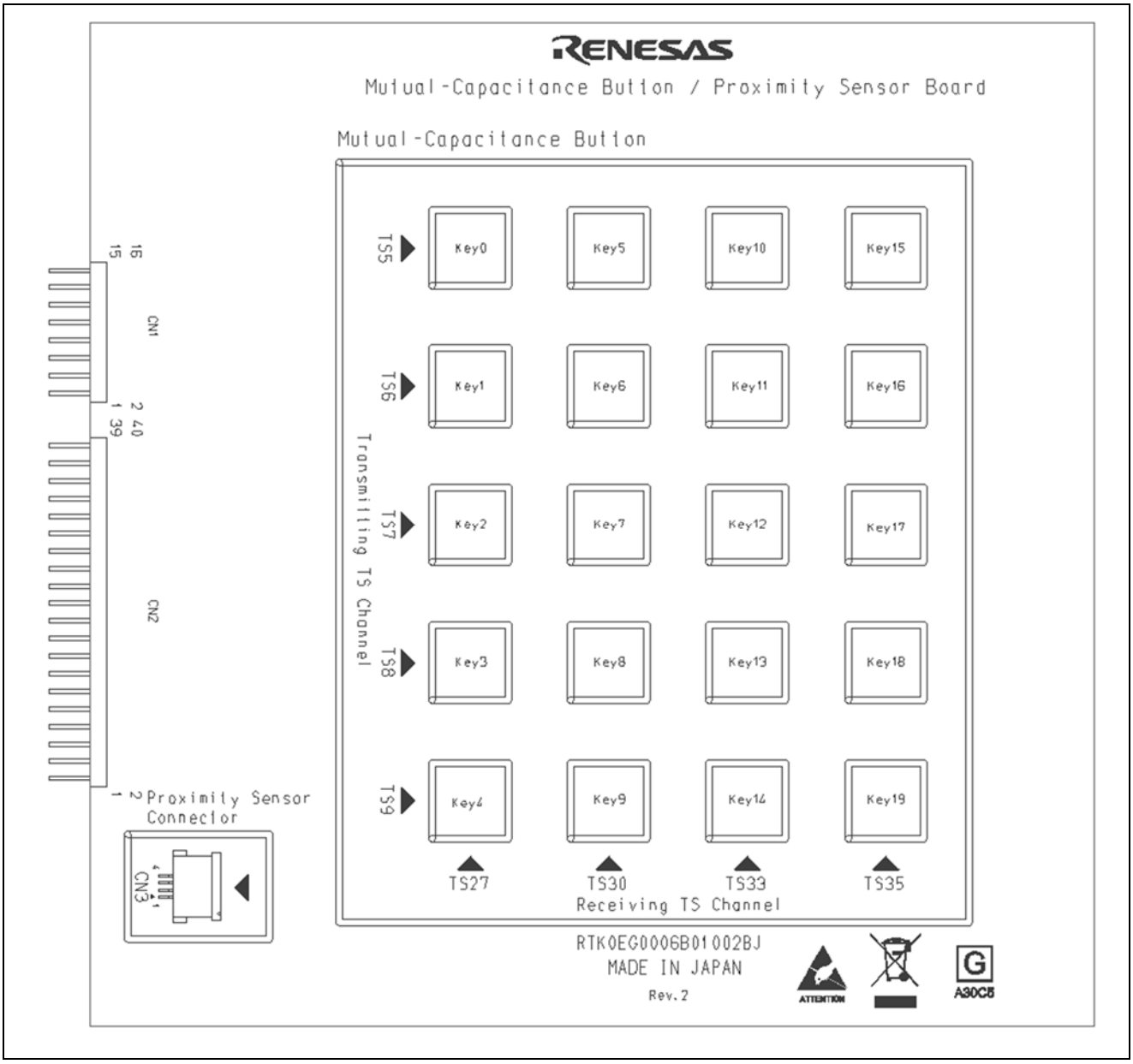

Figure2.5 Application Board Component Placement (top/component side)

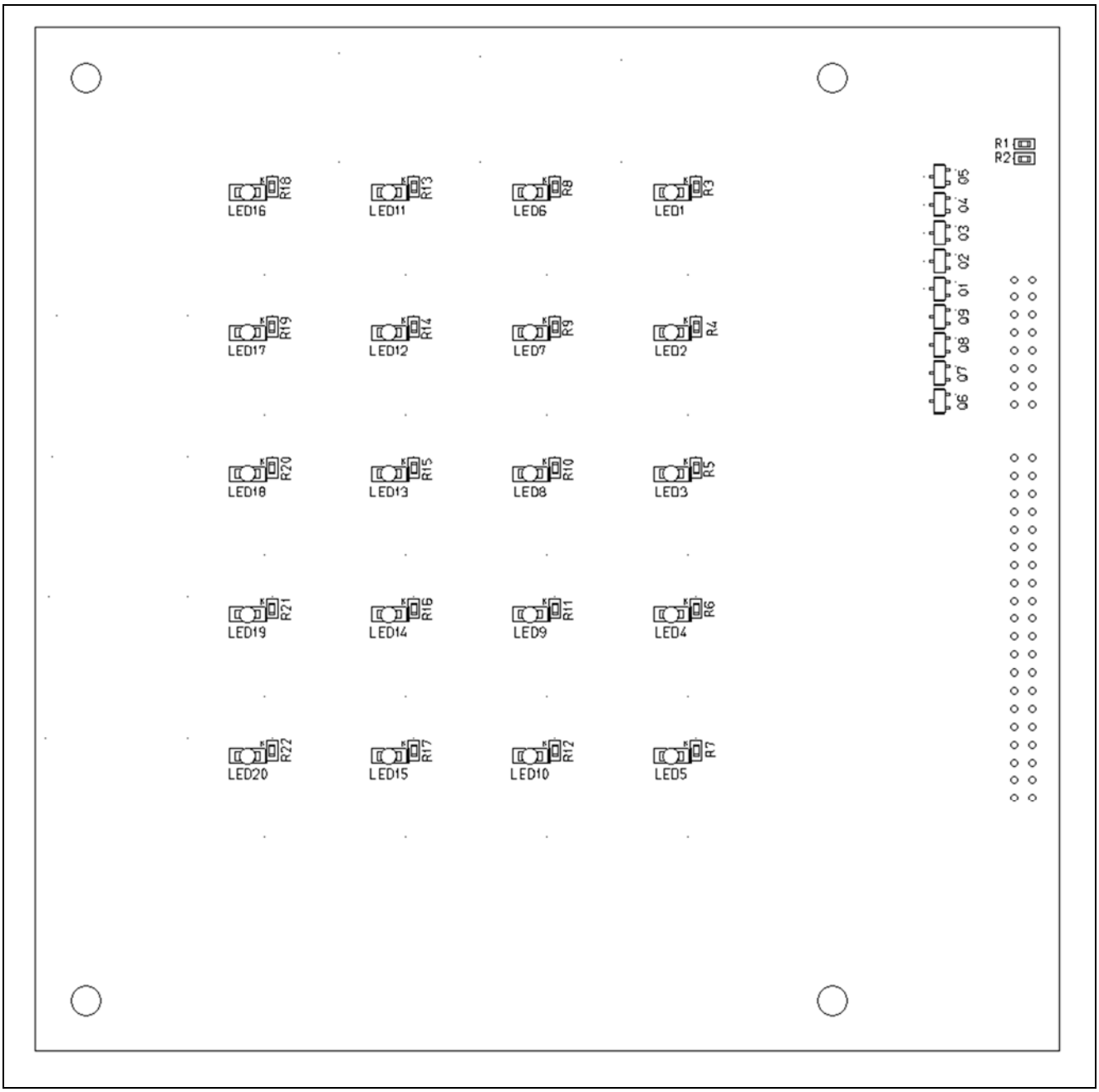

Figure2.6 Application Board Component Placement (bottom/soldered side)

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.

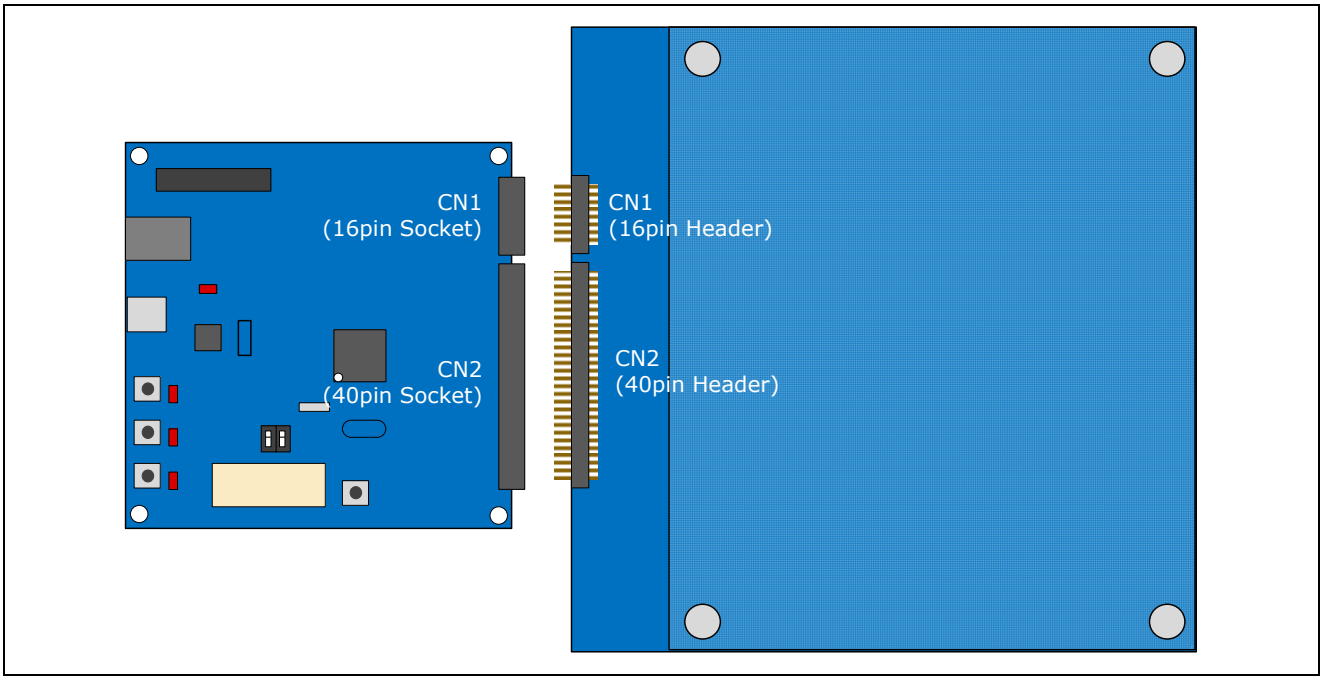

Figure3.1 Board Connection Direction

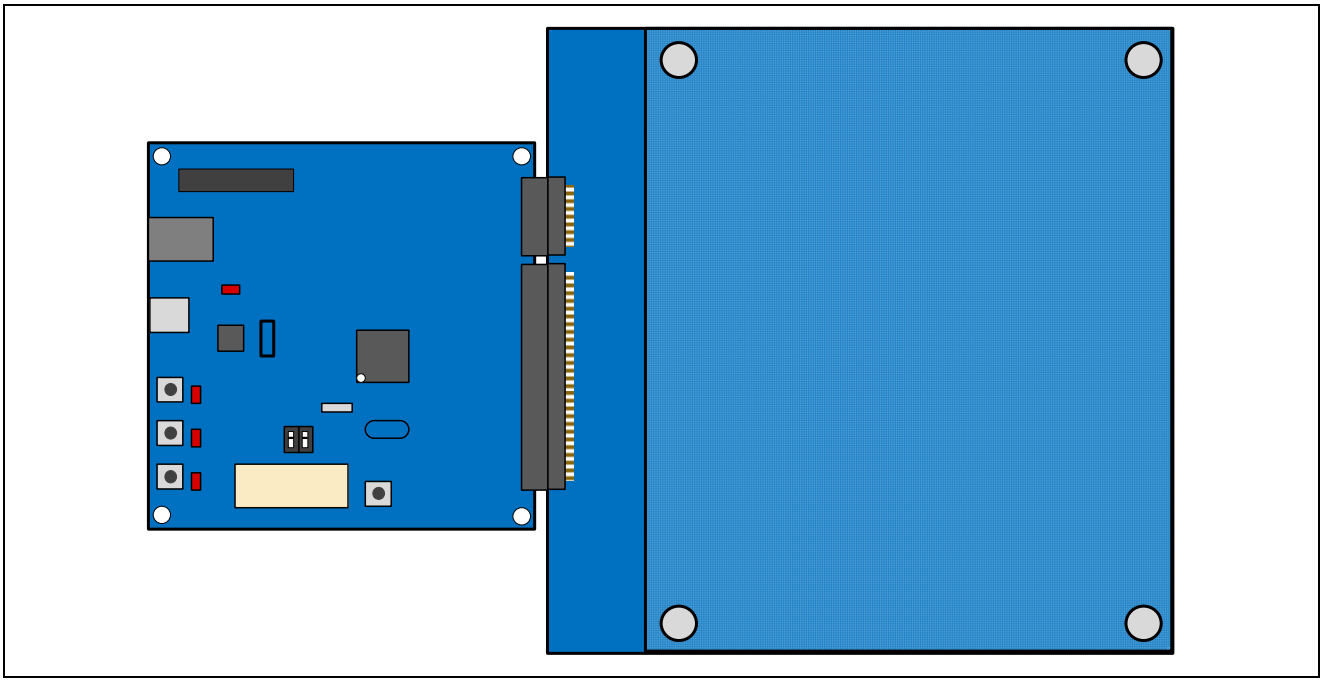

Figure3.2 Connected Boards

3.2 Mutual-Capacitance Button Specification

The user can configure up to 20 channels for mutual-capacitance buttons on the application board. To use the mutual-capacitance buttons, first set the capacitive touch sensor pins connected to electrodes to mutual-capacitance mode, and then set the transmit/receive pins. The mutual-capacitance electrodes are pre-determined for transmit or receive. Confirm the names of the application board circuit nets and the names of the MCU's connection pins, and set the appropriate pin functions by software. For details concerning how to set pins, please refer to the corresponding MCU user's manual. Table3.1 shows the application board circuit net names and transmit/receive pin assignments.

Table3.1 Application Board Circuit Net Names and Transmit/Receive Pin Assignments

Application Board Circuit Net Name	Capacitive Touch Sensor Pin Function	Application Board Circuit Net Name	Capacitive Touch Sensor Pin Function
TS5	Transmission	TS27	Reception
TS6		TS30	
TS7		TS33	
TS8		TS35	
TS9			

3.3 Proximity Sensor Connector

Table3.2 shows the specifications for the proximity sensor connection pins (CN3). To use the proximity sensor, set the capacitive touch sensor pins connected to electrodes to self-capacitance mode. Confirm the names of the application board circuit nets and the names of the MCU's connection pins, and set the appropriate pin functions by software.

Table3.2 Proximity Sensor Connection Pin (CN3) Specifications

CN3 Pin	Circuit Net Name	Proximity Sensor Pin Function
1	TS0	Connect to electrode
2	TS1	Not connected
3	TS2	Not connected
4	TS3	Not connected

3.4 LEDs

There are 20 LEDs on the application board, connected in a 4 x 5 matrix.

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

Table4.1 Application Headers (CN1)

Pin	Header Name	Pin	Header Name
1	LED0	2	LED1
3	LED2	4	LED3
5	-	6	-
7	LED6	8	LED7
9	LED8	10	LED9
11	LED10	12	-
13	-	14	ADC
15	VCC_LED	16	VSS_GND

- : Non Connection

4.2 CTSU Interface

Table4.2 Application Headers (CN2)

Pin	Header Name	Pin	Header Name
1	TS0	2	TS1
3	TS2	4	TS3
5	-	6	TS5
7	TS6	8	TS7
9	TS8	10	TS9
11	-	12	-
13	-	14	-
15	-	16	-
17	-	18	-
19	-	20	-
21	-	22	-
23	-	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 Renesas website.

For information about the target microcontroller, refer to the corresponding hardware manual.

For information about Assembler language, refer to the RX Family software manual.

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

Online tech support and other information is available at the following website:
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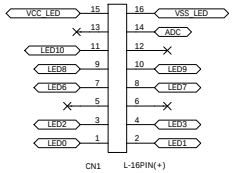
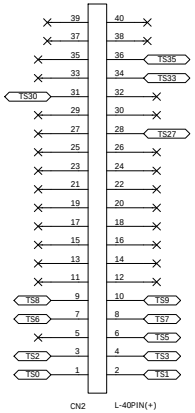
Appendix 1.

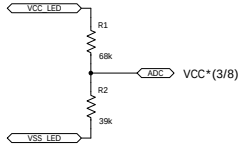
CPU Board Header B



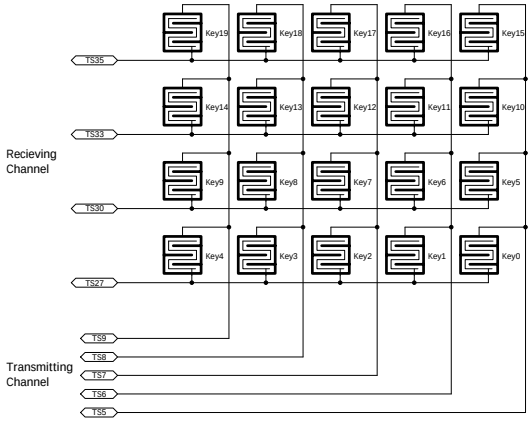
CPU Board Header B



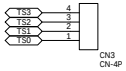
Board ID



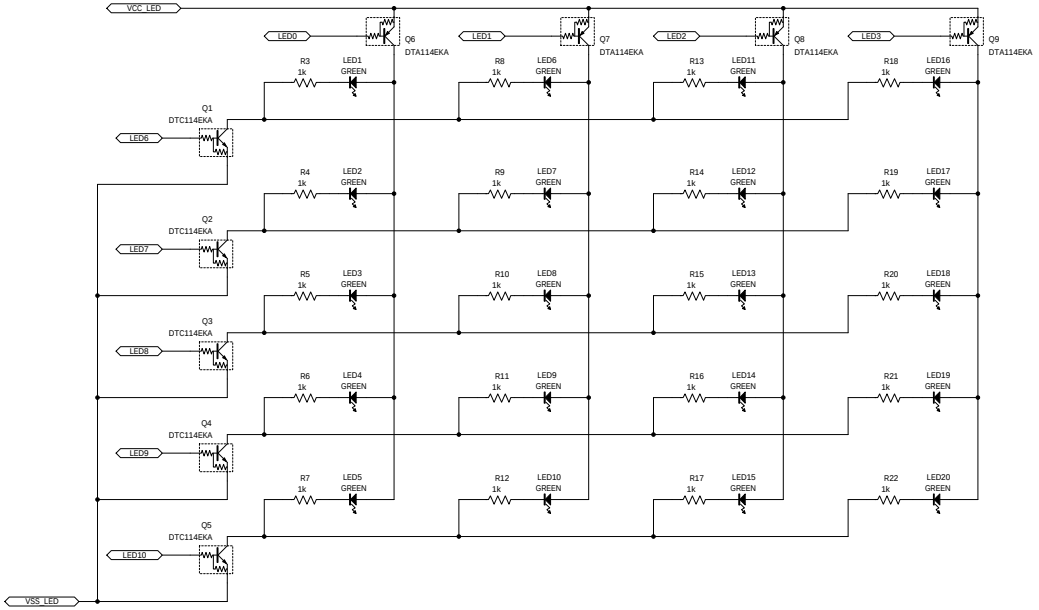
Mutual Capacitance Button



Proximity Sensor Connector



EDs



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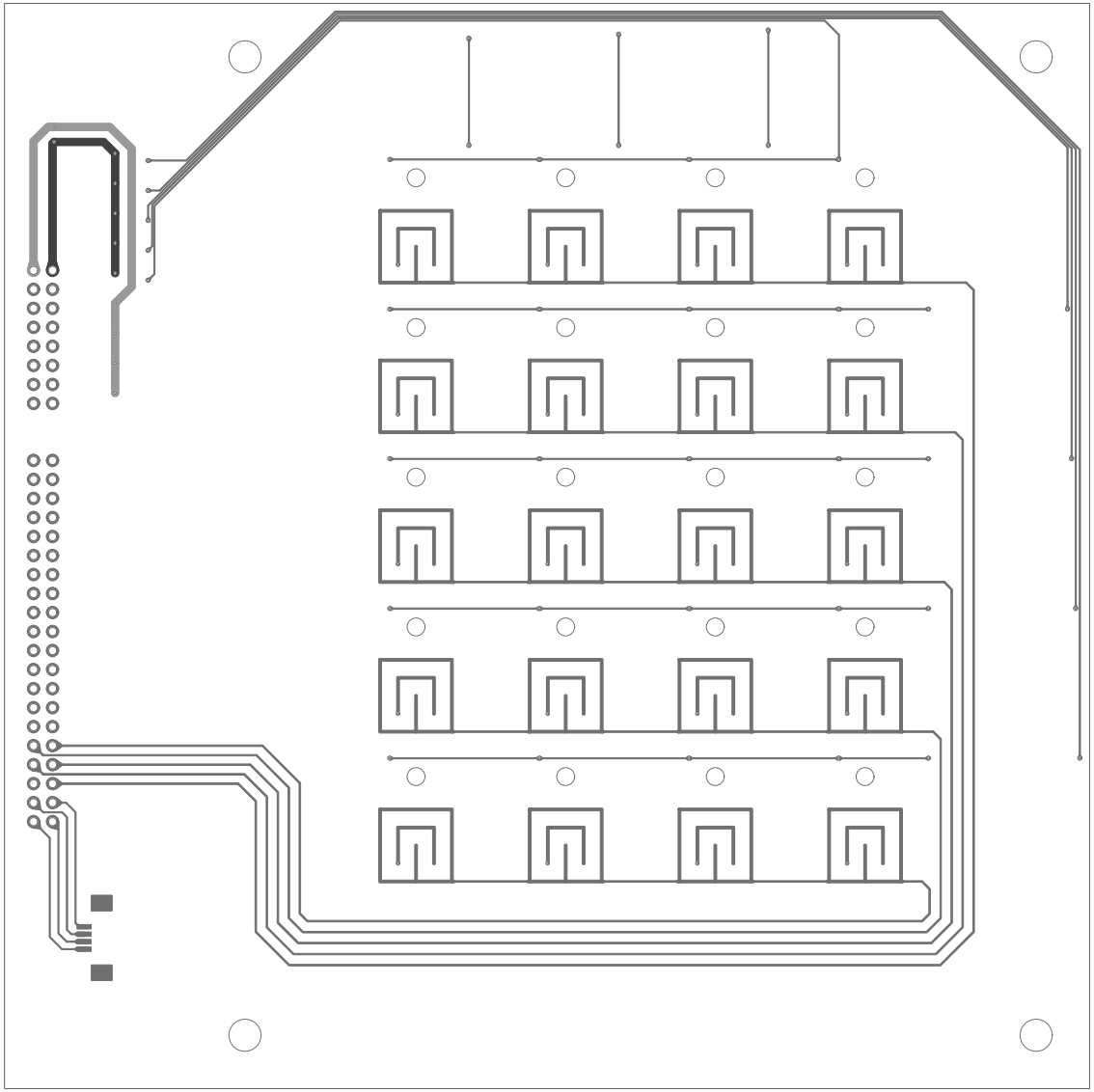
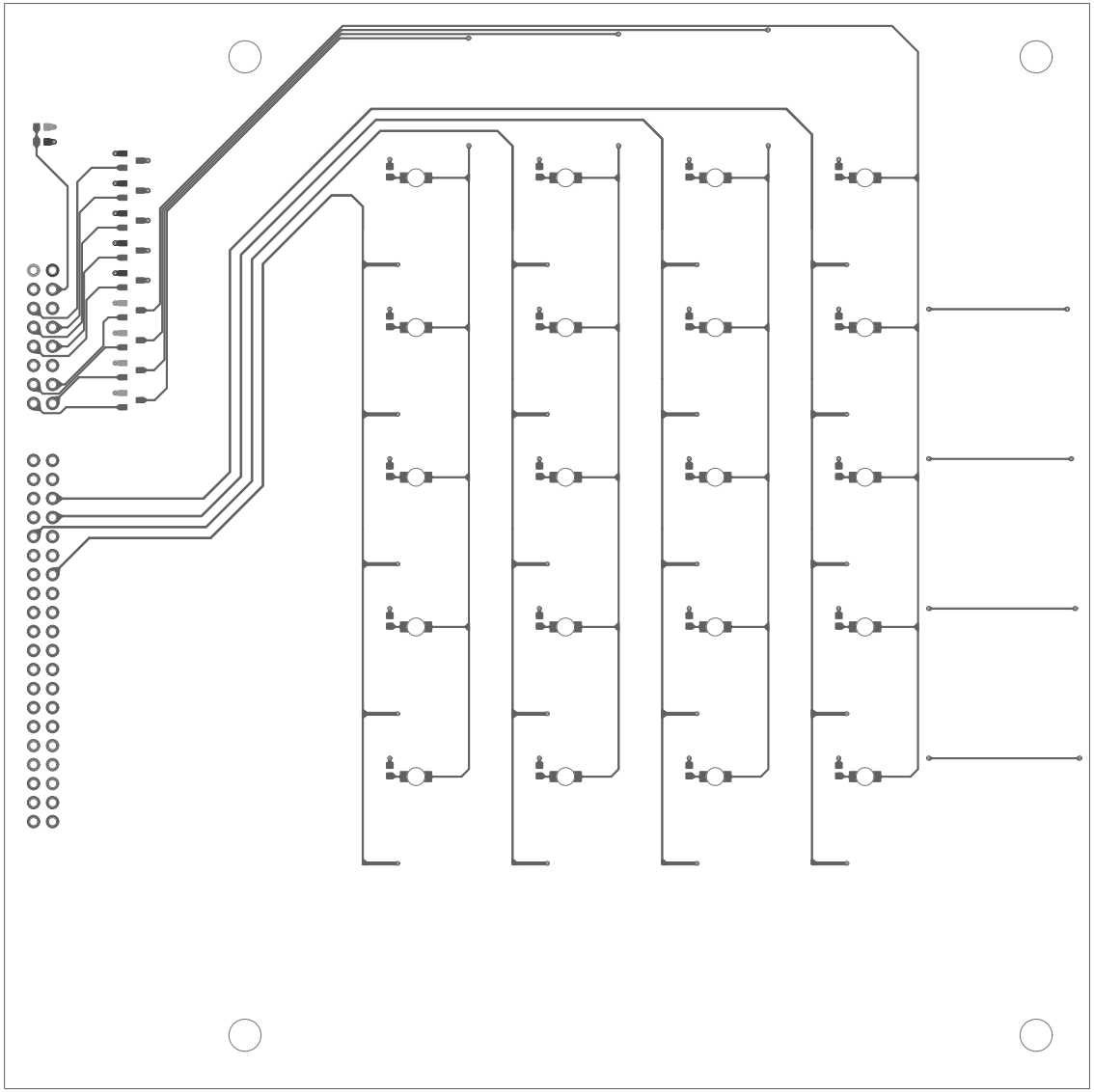
Appendix 2.



PCB Top-side Layout



PCB Bottom-side Layout

Appendix 3.

PartNo	RTK0EG0006B01002BJ	Title	Mutual-Capacitance Matrix Button/Proxmity Sensor Board BOM

No	Component Name		Component Specification			Qty/Set	Remarks
	Type	Reference	Product Number (Specfication)	Manufacture	Mount/Unmount		
1	Right Angle Pin Header	CN1	PSR-420256-08	Hirosugi-Keiki	Mount	1	16-pin(2x8), 2.54mm-pitch
2	Right Angle Pin Header	CN2	PSR-420256-20	Hirosugi-Keiki	Mount	1	40-pin(2x20), 2.54mm-pitch
3	FFC Connector	CN3	052207-0460	Molex	Mount	1	4-pole,1.00mm-pitch Top Contact Type
4	Chip Resistor	R1	MCR03ERTJ683	ROHM	Mount	1	68k
5	Chip Resistor	R2	MCR03ERTJ393	ROHM	Mount	1	39k
6	Chip Resistor	R3-22	MCR03ERTJ102	ROHM	Mount	20	1k
7	LED	LED1-LED20	SML-812MT	ROHM	Mount	20	Green, Reverse-mount available type
8	Transistor	Q1-Q5	DTC114EKA	ROHM	Mount	5	
9	Transistor	Q6-Q9	DTA114EKA	ROHM	Mount	4	
10	Touch Electrode	Key1-20	—	—	Mount	20	
11	PCB		RTK0EG0006B01002BJ REV.A		Mount	1	

Revision History	Mutual-Capacitance Button/Proximity Sensor Board User's Manual

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		Page	Summary
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Colophon 4.0

RX Capacitative Touch Evaluation System

Mutual-Capacitance Matrix Key/Proximity Sensor Board User's Manual

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