RA2L1 Group

CTSU 3D Gesture Electrode Board Sample Software

Introduction

RA2L1 Group is equipped with the hardware called “Capacitive Touch Sensing Unit2 (CTSU2)” that detects human touch by measuring capacitance generated between touch electrodes and the human hand.

This application note describes the software specification of the 3D Gesture Electrode Board (RTK0EG0023B01002BJ) as a sample application of mutual capacitance method used in CTSU2. This product is used in combination with the CPU board of the Capacitive Touch Evaluation System.

Target Device

RA2L1 Group

Related Documents

1. RA Family Using QE and FSP to Develop Capacitive Touch Applications (R01AN4934)
2. RA2L1 Group Renesas Solution Starter Kit Capacitive Touch Evaluation System User’s Manual (R12UZ0084)
3. RX130 Group CTSU Application Example: 3D Gesture Demo Set Small version (Hardware) (R01AN4320)
4. RX231 Group CTSU Application Example: 3D Gesture Demo Set (Hardware) (R01AN4219)
5. RX Family CTSU 3D Gesture Demo Set Sample Software (R01AN4101)
6. RX Family CTSU 3D Gesture Demo Set Evaluation Tool ‘3D Monitor’ (R20AN0501)
7. RA2L1 Group 3D Gesture Electrode Board (Hardware) (R01AN6126)

Contents

1. Overview

This application note describes the sample software that runs on the 3D Gesture Electrode Board (RTK0EG0023B01002BJ). For descriptions of the corresponding hardware, please refer to the related document “RA2L1 Group 3D Gesture Electrode Board (Hardware) (R01AN6126)”.

1.1 Software Structure

Figure 1-1 shows software structure.

Capacitive measurement with CTSU2 employs software generated by QE for Capacitive Touch, a development support tool for capacitive touch sensor application, and FSP configurator. The software is referred to as QE Touch module and QE CTSU module, respectively.

The gesture recognition library is used to analyze changes in the 3D position and determine gestures.

The application notifies the user of the 3D position calculation and gesture recognition results via USB communication with the user’s PC.

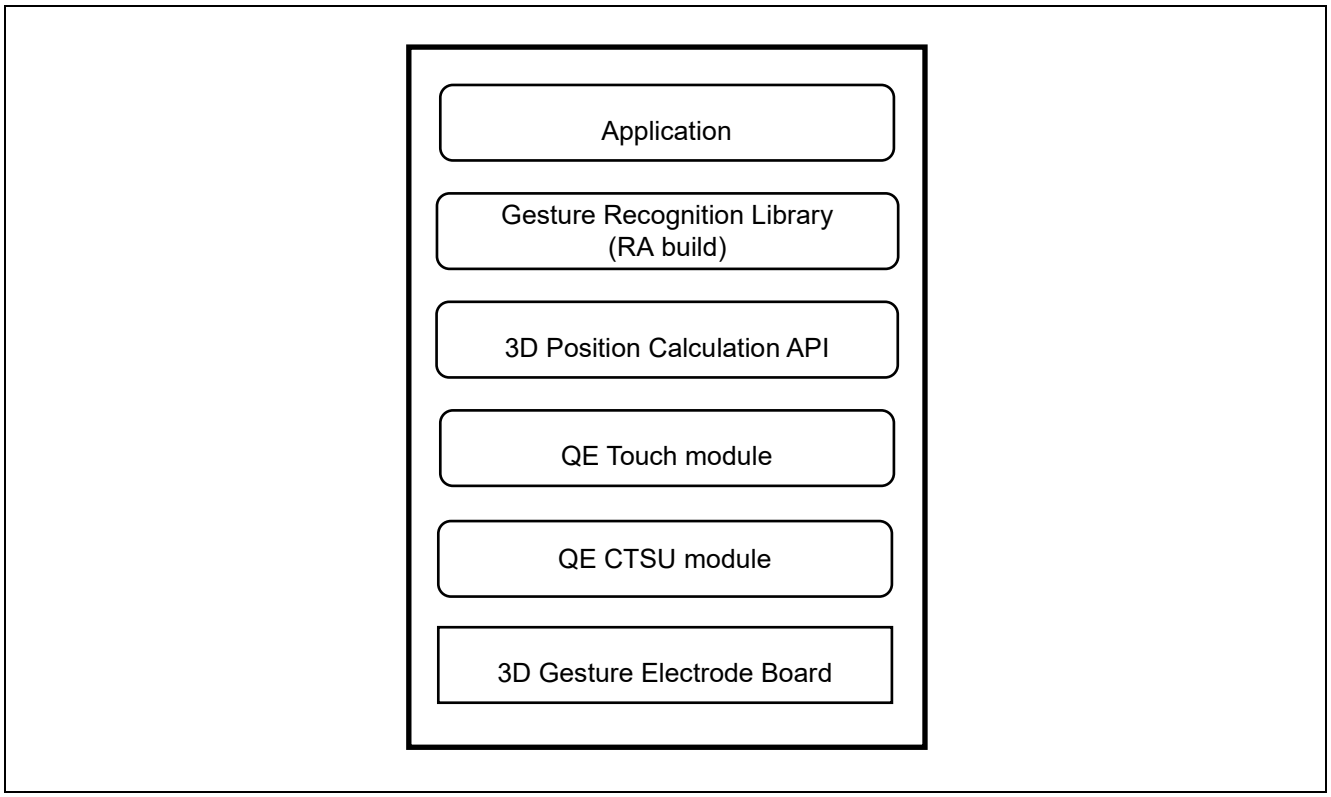

Figure 1-1 Software Structure

1.2 File Structure

Table 1-1 shows the application's file structure. Source files and header files generated by QE touch module and FSP configurator have been omitted for brevity.

Table 1-1 File Structure

Folder/File Name	Description
3d_gesture_electrode_sample_project_ra2l1	Project folder
.cproject	C project file
.project	Project file
3d_gesture_electrode_sample_project_ra2l1 Debug_Flat.launch	Debug configuration file
configuration.xml	FSP configurator configuration file
libGesture_Recognition_RA.a	Gesture recognition library
qe_gen	Source/header file storage folder
qe_touch_config.c	QE Touch configuration definition source file
qe_touch_config.h	QE Touch configuration definition header file
qe_touch_define.h	QE Touch configuration definition header file
qe_touch_sample.c	Application file
src	
r_cap_position.c	3D position calculation API source file
r_cap_position_config.h	3D position calculation API config file
r_cap_position_measure.h	3D position calculation API pre-measurement file
r_cap_position_if.h	3D position calculation API interface file
r_cap_position.h	3D position calculation API header file
r_cap_gesture_if.h	Gesture recognition interface file
QE-Touch	QE for Capacitive Touch generated folder
3d_gesture_electrode_sample_project_ra2l1.tifcfg	Touch I/F configuration file

2. Operation Confirmation Environment

Table 2-1 lists the operating conditions of the software.

Table 2-1 Operating Environment

Item	Description
Evaluation board	RTK0EG0018C01001BJ
MCU used	RA2L1 (R7FA2L1AB2DFP)
Operating frequency	48MHz
Operating voltage	5.0V
Integrated Development Environment	e^2 studio V2021-10
C compiler	GCC ARM Embedded 9.3.1.20200408
Capacitance touch IDE	QE for Capacitive Touch V2.0.0
Emulator	E2 Emulator Lite

Figure 2-1 shows the connection diagram for the 3D Gesture Electrode Board.

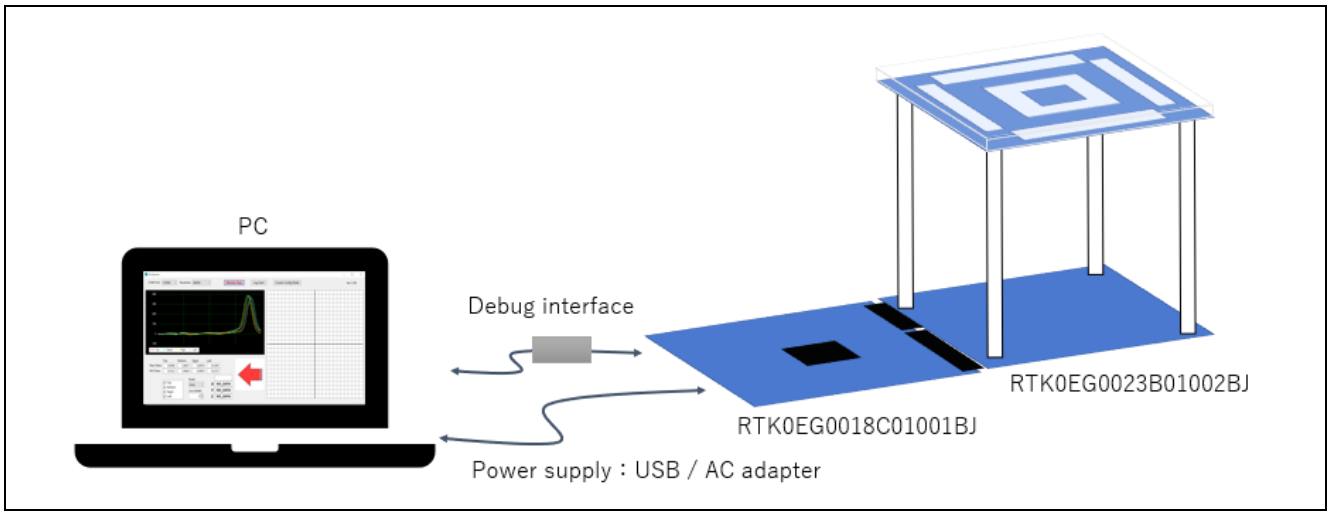

Figure 2-1 3D Gesture Electrode Board Connection Diagram

3. 3D Position Calculation

For 3D position calculation, please refer to the section 4 in “RX Family CTSU 3D Gesture Demo Set Sample Software (R01AN4101)”.

4. 3D Position Calculation Software Specification

4.1 File Configuration

Table 4.1 shows the source file used in this sample software.

Table 4-1 Source File

File Name	Description	Notes
r_cap_position.c	3D position calculation API source file	-

Table 4.2 shows the header files.

Table 4-2 Header Files

File Name	Description	Notes
r_cap_position_config.h	3D position calculation API config file	-
r_cap_position_measure.h	3D position calculation API pre-measurement file	-
r_cap_position_if.h	3D position calculation API interface file	-
r_cap_position.h	3D position calculation API header file	For use in 3D position calculation API

4.2 Constants

Table 4.3 shows the r_cap_positon_if.h constants.

Table 4-3 Constants（r_cap_position_if.h）

Constant Name	Setting Value	Description
CAPPOS_NODETECT	(0x3FFF)	Value displayed when no 3D position calculation results are detected
CAPPOS_SUCCESS	(0x00)	3D position calculation API completed normally
CAPPOS_ERROR	(0x01)	3D position calculation API error occurred
CAPPOS_NORMAL	(0x00)	Value displayed when result of noise environment is normal
CAPPOS_NOISY	(0x01)	Value displayed when result of noise environment is noise detection

Table 4.4 shows the r_cap_position_config.h constants.

The default setting value is the value for the 3D Gesture Electrode Board; change as necessary to fit the usage environment.

Table 4-4 Constants（r_cap_position_config.h）

Constant Name	Setting Value	Description
CAPPOS_CNF_MOVAVG_NUM	(15)	Moving average setting value
CAPPOS_CNF_DRIFT_NUM	(150)	Drift measurement number
CAPPOS_CNF_DRIFT_THR	(25)	Drift threshold
CAPPOS_CNF_RESUME_NUM	(25)	resume measurement number
CAPPOS_CNF_RESUME_THR	(20)	Resume threshold
CAPPOS_CNF_NOISE_THR_A	(150)	Noise threshold A (difference with reference value)
CAPPOS_CNF_NOISE_THR_B	(50)	Noise threshold B (difference with past value)
CAPPOS_CNF_MAX_X	(100)	X direction calculation range [mm]
CAPPOS_CNF_MAX_Y	(100)	Y direction calculation range [mm]

Table 4.5 shows the r_cap_position_measure.h constants.

The default setting value is the value for the 3D Gesture Electrode Board; change as necessary to fit the usage environment.

Table 4-5 Constants（r_cap_position_measure.h）

Constant Name	Setting Value	Description
CAPPOS_MEAS_Z0	(10)	Measured Z direction position [mm] Set to 1 or higher.
CAPPOS_MEAS_Z1	(20)	Measured Z direction position [mm] Set to a value higher than CAPPOS_MEAS_Z0
CAPPOS_MEAS_Z2	(30)	Measured Z direction position [mm] Set to a value higher than CAPPOS_MEAS_Z1
CAPPOS_MEAS_Z3	(40)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z2. If positions were measured in 3 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_3” constants.
CAPPOS_MEAS_Z4	(50)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z3. If positions were measured in 4 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_4” constants.
CAPPOS_MEAS_Z5	(60)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z4. If positions were measured in 5 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_5” constants.
CAPPOS_MEAS_Z6	(70)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z5. If positions were measured in 6 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_6” constants.
CAPPOS_MEAS_Z7	(80)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z6. If positions were measured in 7 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_7” constants.
CAPPOS_MEAS_Z8	(90)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z7. If positions were measured in 8 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_8” constants.
CAPPOS_MEAS_Z9	(100)	Measured Z direction position [mm]. Set to a value higher than CAPPOS_MEAS_Z8. If positions were measured in 9 locations, set to 0 for this constant and all “CAPPOS_MEAS_*_9” constants.
CAPPOS_MEAS_X	(60)	Measured X direction position [mm] If the X direction is not measured, set to 0 for this constant.
CAPPOS_MEAS_Y	(0)	Measured Y direction position [mm] If the Y direction is not measured, set to 0 for this constant.
CAPPOS_MEAS_TOP	(15284)	Top electrode count value when nothing is in vicinity of board
CAPPOS_MEAS_BTM	(14017)	Bottom electrode count value when nothing is in vicinity of board
CAPPOS_MEAS_RGT	(11991)	Right electrode count value when nothing is in vicinity of board
CAPPOS_MEAS_LFT	(11348)	Left electrode count value when nothing is in vicinity of board
CAPPOS_MEAS_TOP0	(13615)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_TOP1	(14451)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_TOP2	(14791)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z2)

CAPPOS_MEAS_TOP3	(14967)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_TOP4	(15060)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_TOP5	(15117)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_TOP6	(15165)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_TOP7	(15206)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_TOP8	(15215)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_TOP9	(15239)	Top electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_BTM0	(12637)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_BTM1	(13297)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_BTM2	(13565)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_BTM3	(13717)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_BTM4	(13801)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_BTM5	(13852)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_BTM6	(13894)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_BTM7	(13926)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_BTM8	(13950)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_BTM9	(13976)	Bottom electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_RGT0	(10725)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_RGT1	(11347)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_RGT2	(11597)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_RGT3	(11729)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_RGT4	(11805)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_RGT5	(11852)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_RGT6	(11890)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_RGT7	(11918)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_RGT8	(11930)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_RGT9	(11950)	Right electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_LFT0	(10229)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_LFT1	(10785)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_LFT2	(11009)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_LFT3	(11124)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_LFT4	(11192)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_LFT5	(11230)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_LFT6	(11261)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_LFT7	(11279)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_LFT8	(11297)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_LFT9	(11317)	Left electrode count value measured when coordinates are (0, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_X_RGT0	(10956)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_X_RGT1	(11417)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_X_RGT2	(11640)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_X_RGT3	(11760)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_X_RGT4	(11828)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_X_RGT5	(11869)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_X_RGT6	(11905)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_X_RGT7	(11924)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_X_RGT8	(11948)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_X_RGT9	(11956)	Right electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_X_LFT0	(11123)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_X_LFT1	(11198)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_X_LFT2	(11232)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_X_LFT3	(11257)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z3)

CAPPOS_MEAS_X_LFT4	(11278)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_X_LFT5	(11290)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_X_LFT6	(11307)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_X_LFT7	(11308)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_X_LFT8	(11327)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_X_LFT9	(11332)	Left electrode count value measured when coordinates are (CAPPOS_MEAS_X, 0, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_Y_TOP0	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_Y_TOP1	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_Y_TOP2	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_Y_TOP3	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_Y_TOP4	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_Y_TOP5	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_Y_TOP6	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_Y_TOP7	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_Y_TOP8	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_Y_TOP9	(0)	Top electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z9)
CAPPOS_MEAS_Y_BTM0	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z0)
CAPPOS_MEAS_Y_BTM1	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z1)
CAPPOS_MEAS_Y_BTM2	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z2)
CAPPOS_MEAS_Y_BTM3	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z3)
CAPPOS_MEAS_Y_BTM4	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z4)
CAPPOS_MEAS_Y_BTM5	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z5)
CAPPOS_MEAS_Y_BTM6	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z6)
CAPPOS_MEAS_Y_BTM7	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z7)
CAPPOS_MEAS_Y_BTM8	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z8)
CAPPOS_MEAS_Y_BTM9	(0)	Bottom electrode count value measured when coordinates are (0, CAPPOS_MEAS_Y, CAPPOS_MEAS_Z9)

4.3 Structures

Table 4.6 shows the st_position_result_t structures.

Table 4-6 st_cappos_result_t Structures

Type	Member	Description
int16_t	coord_x	x position calculation result [mm]
int16_t	coord_y	y position calculation result [mm]
int16_t	coord_z	z position calculation result [mm]
uint8_t	noise	Result of noise environment detection

Table 4.7 shows the st_captouch_data_t structures.

Table 4-7 st_captouch_data_t Structures

Type	Member	Description
uint16_t	top	Top electrode count value
uint16_t	btm	Bottom electrode count value
uint16_t	rgt	Right electrode count value
uint16_t	lft	Left electrode count value

4.4 API Function Specifications

For API function specification, please refer to “5.4 API Function Specification” in the related document “RX Family CTSU 3D Gesture Demo Set Sample Software (R01AN4101EJ)”.

5. Gesture Recognition Library Specification

5.1 File Configuration

Table 5.1 shows the library files.

Table 5-1 Library Files

File Name	Description
libGesture_Recognition_RA.a	Gesture recognition library file (RA build)

Table 5.2 shows the header file.

Table 5-2 Header File

File Name	Description
r_cap_gesture_if.h	Gesture recognition API interface file

5.2 Constants

Table 5.3 shows the constants. These are defined by enumerated type e_gesture_result_t.

Table 5-3 Constants

Constant Name	Setting Value	Description
GESTURE_RESULT_NONE	(0)	No recognition
GESTURE_RESULT_RIGHT_SWIPE	(1)	Right swipe
GESTURE_RESULT_LEFT_SWIPE	(2)	Left swipe
GESTURE_RESULT_FRONT_SWIPE	(3)	Front swipe
GESTURE_RESULT_BACK_SWIPE	(4)	Back swipe
GESTURE_RESULT_DOWN_SWIPE	(5)	Push
GESTURE_RESULT_CW_SLOW	(6)	Draw circle (Clockwise, Slow)
GESTURE_RESULT_CW_FAST	(7)	Draw circle (Clockwise, Fast)
GESTURE_RESULT_RESERVE	(8)	Reserved
GESTURE_RESULT_CCW_SLOW	(9)	Draw circle (Counter clockwise, Slow)
GESTURE_RESULT_CCW_FAST	(10)	Draw circle (Counter clockwise, Fast)
GESTURE_RESULT_RESERVE2	(11)	Reserved2

5.3 Structures

Table 5.4 shows the st_cappos_input_t structure.

Table 5-4 st_cappos_input_t Structures

Type	Member	Description
int16_t	coord_x	x position calculation result [mm]
int16_t	coord_y	y position calculation result [mm]
int16_t	coord_z	z position calculation result [mm]
uint8_t	noise	Result of noise environment detection

5.4 API Function Specifications

For API function specification, please refer to “6.4 API Function Specification” in the related document “RX Family CTSU 3D Gesture Demo Set Sample Software (R01AN4101)”.

6. Sample Application

This section describes the sample application. The 3D Gesture sample application has been added based on the QE Touch module application file qe_touch_sample.c.

- 3D Gesture Electrode Board initialization

  Initialization function SampleInitialize() has been added before the qe_touch_main function loop.

- Results notification

  Function SampleApplication() that notifies the user of the 3D position calculation and gesture recognition results has been added to the qe_touch_main function loop. Based on this, SampleApplication() is called for each touch measurement cycle.

  The 3D position calculation and gesture recognition results can be confirmed with the evaluation tool '3D Monitor'. For detail, please refer to the related document "RX Family CTSU 3D Gesture Demo Set Evaluation Tool '3D Monitor' (R20AN0501)".

  Function SampleAplReceive() is called at the completion of receiving SCI6 receive interrupt function user_uart_callback(). When receiving the "Monitor Start" command from the evaluation tool, the 3D position calculation and gesture recognition results are transmitted to the tool. When receiving the "Monitor Stop" command, transmission is stopped. For the format of communication with the evaluation tool, please refer to "7. Sample Application" in the related document "RX Family CTSU 3D Gesture Demo Set Sample Software (R01AN4101)".

  Table 6-1 shows UART settings.

Table 6-1 UART Settings

Setting	Value
Baud rate	38400bps
Data length	8bit
Parity	None
Stop bit	1bit
Flow control	None

6.1 Touch Interface Configuration

In this software, TS pins are configured as shown in Figure 6-1

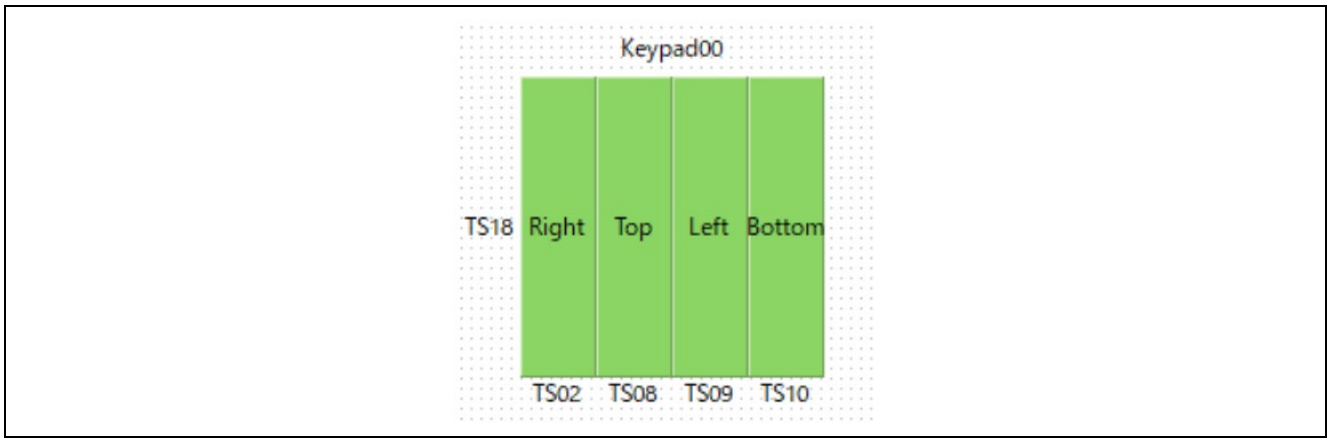

Figure 6-1 Touch Interface Configuration

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2021.12.6	-	First edition issued

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.

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