RX130 Group

Touchless Button Demo Solution Sample Software

Introduction

This application note describes touchless button demo solution (RTK0EG0036D01001BJ) Software specification using a sample application of self-capacitance method based on Capacitive Touch Sensor Unit (CTSU), the hardware that detects the contact or approach of human by measuring capacitance generated between touch electrodes and the human body.

Target Device

RX130 Group

Related Documents

1. RX Family Using QE and FIT to Develop Capacitive Touch Applications (R01AN4516EU0100)
2. RX130 Group RX Capacitive Touch Evaluation System CPU Board User's Manual (R12UZ0003EJ0100)
3. RA2L1 Group Touchless Button Demo Solution (Hardware) (R01AN5812EJ0101)

Contents

1. Overview

This application note describes the sample software that runs on the touchless button demo solution. Please refer to ‘Touchless Button Demo Solution (Hardware)' (R01AN5812JJ0101) for the description of the corresponding hardware.

1.1 Software Structure

Figure 1.1 shows software structure of this application.

Capacitive measurement with CTSU employs software generated by QE for Capacitive Touch, a development tool for capacitive touch sensor applications, and Smart Configurator. The software is referred to as QE Touch Module and QE CTUS Module, respectively.

The application notifies the user of the touch detection results via LED display and buzzer sound on the touchless button demo solution.

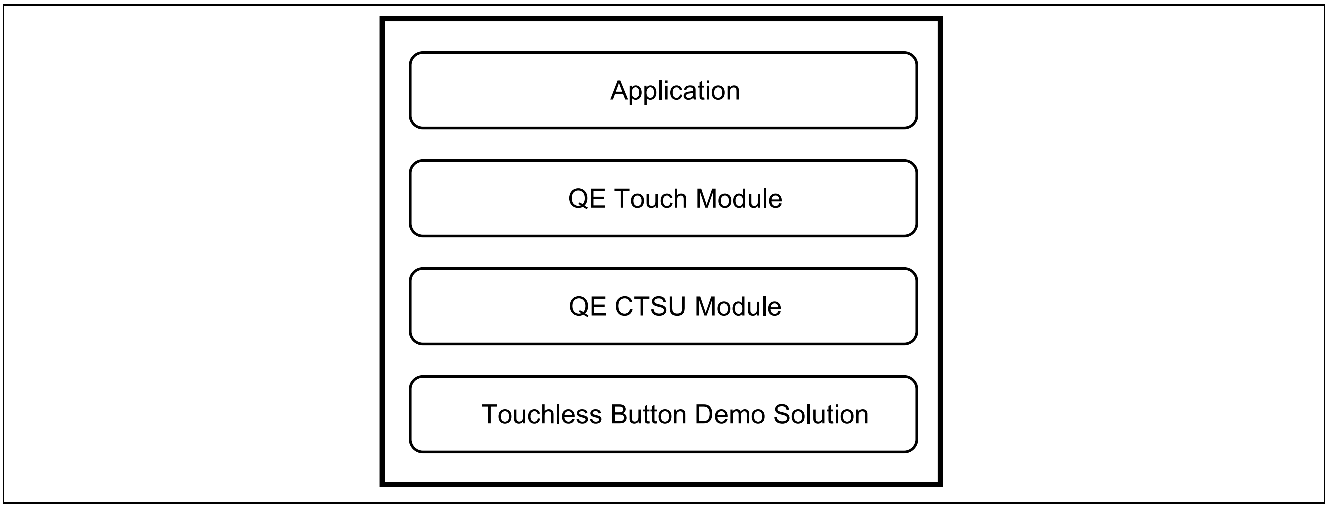

Figure 1.2 Software Structure Diagram

1.2 File Structure

Table 1.1 shows the file configuration used in this sample software. Source files and header files generated by the Smart Configurator, such as QE Touch Module, have been omitted for brevity.

Table 1.2 File Configuration

Folder/File Name	Description
touchless_sample_project_rx130	Project folder
.cproject	C project file
.project	Project file
touchless_sample_project_rx130 HardwareDebug.launch	Debug configuration file
touchless_sample_project_rx130.scfg	Smart configurator configuration file
src	Source/header file storage folder
qe_common.c	QE Touch common source file
qe_common.h	QE Touch common header file
qe_config01.c	QE Touch configuration definition source file
qe_config01.h	QE Touch configuration definition header file
touchless_sample_project_rx130.c	Application file
r_touchless_led.c	Touchless Button Demo Solution LED control source file
r_touchless_led.h	Touchless Button Demo Solution LED control header file
r_touchless_buzzer.c	Touchless Button Demo Solution buzzer control source file
r_touchless_buzzer.h	Touchless Button Demo Solution buzzer control header file
QE-Touch	QE for Capacitive Touch generated folder
touchless_sample_project_rx130.tifcfg	Touch I/F configuration file

2. Operating Environment

Table 2.1 lists the operating conditions of the software.

Table 2.2 Operating Environment

Item	Description
Evaluation board	RTK0EG0004C01002BJ
MCU used	RX130 (R5F5130ADFN)
Operating frequency	32MHz
Operating voltage	5.0V
Integrated Development Environment	e2 studio V2021-04
C compiler	CC-RX V3.03.00
CTSU development support tool	QE for Capacitive Touch V1.1.0
Emulator	E2 emulator Lite

Figure 2.1 shows the device connection diagram.

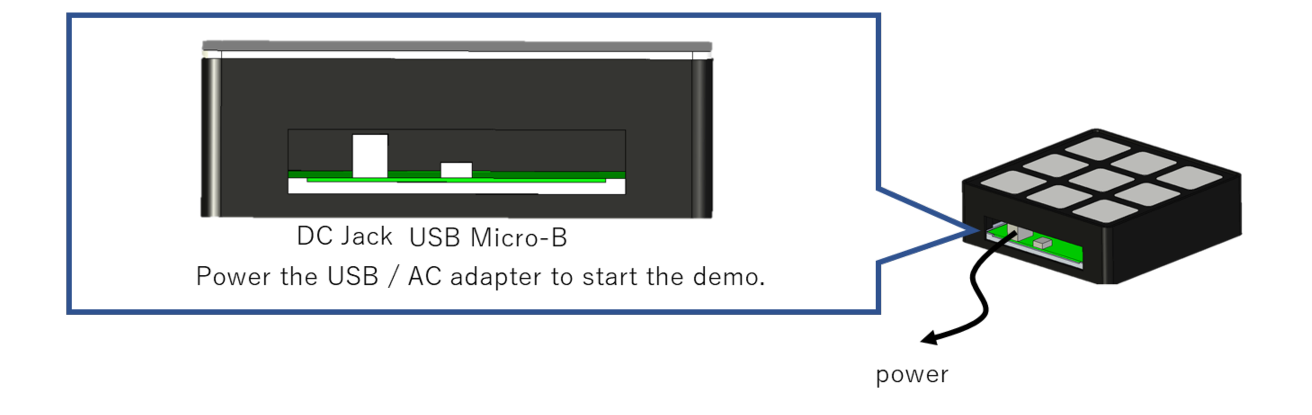

Figure 2.2 Device Connection Diagram

3. Sample Application

The following sample application using the Touchless button demo solution has been added to this sample software, based on QE Touch module application file touchless_sample_project_rx130.c.

3.1 Touchless button demo solution Initialization

The following initialization functions have been added before the main function loop.

- r_touchless_led_initialize () - LED control initialization
- r_touchless_buzzer_initialize () - Buzzer control initialization

3.2 Results Notification

To notify the user of proximity (including touch) detection results, function r_touchless_led_control (), r_touchless_buzzer_control () has been added after R_TOUCH_DataGet (), which is called in the main function loop.

This ensures that r_touchless_led_control (), r_touchless_buzzer_control () is called for each touch measurement cycle. Capacitance of 9 button electrodes is measured respectively. Proximity or touch is detected when the human body (fingers, hands, etc.) approaches and the measured value exceeds the threshold value, related LED is turned on and buzzer output is controlled.

3.3 Build Options

The sample application supports result notification by the following LEDs.

- Turns on the LED when the proximity (including touch) of 9 electrodes is detected
- Dim the LED according to the measured values of the 9 electrodes

The above result notification can be switched with the following build options.

Table 3.1 Build options（r_touchless_led.h）

Item	Description
ENABLE_LED_TOGGLE_LIGHT	With definition: enable LED lighting (default) No definition: enable LED dimming

It is possible to enable/disable buzzer.

The enable/disable of buzzer can be switched with following build options.

Table 3.2 Build options（r_touchless_buzzer.h）

Item	Description
ENABLE_RING_BUZZER	With definition: enable buzzer ringing (default) No definition: disable buzzer ringing

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http://japan.renesas.com/

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	2021.5.21	-	First edition release

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

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   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.
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   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.
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   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.).
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