Renesas Synergy™ Platform

Capacitive Touch Hardware Design and Layout Guidelines for Synergy, RX200, and RX100

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Introduction

The Capacitive Touch layout design guidelines details the operational design, PCB routing, and hardware component layout required to integrate the Renesas Synergy Capacitive Touch Solution into an application project.

Target Devices

Synergy, RX130, RX230, RX113, and RX231 with on-chip Capacitive Touch Sensing Unit (CTSU).

Related documents

- *Mutual-capacitance Touch Electrode Characteristics* (R01AN3192EJ)
- *Capacitive touch Wheel and Slider Design Guide* (R01AN3421EJ)
- *Workbench6 V1.06.00 User's Manual* (R20UT3986EJ)
- *CTSU Basis of Cap touch detection* (R30AN0218EJ)
- *CTSU Hardware Overview* (R01AN3824EU)
- *Capacitive Touch Workbench for Renesas Synergy User's Manual* (R20UT4061EU0110)
- *Synergy Capacitive Touch Tuning* (R20AN0448EU0100)
- *Self-capacitive touch software application design with Synergy MCUs* (R20AN0445EU0100)
- *Mutual-capacitive touch software application design with Synergy MCUs* (R20AN0446EU0100)

Contents

1. Overview

The Renesas Capacitive Touch Solution uses the human body's interactions with a MCU-generated electrostatic field to cost-effectively replace mechanical switches prone to failure. The touch solution has multiple facets to ensure proper operation. Each of these operational areas are covered, along with the essential rules at each stage, to help users develop a robust design with proper sensor function. With a wide variety of solutions available, the touch opportunities offered, while not exhaustive, provide a basis for design and development of touch solutions.

2. Operational design

The hardware side of the capacitive touch solution is presented in this operations design overview, including component selection, the types of capacitive touch buttons, and recommendations for grounding and integration into your layout and system.

2.1 General operation

Figure 1 shows the main areas of the capacitive touch solution.

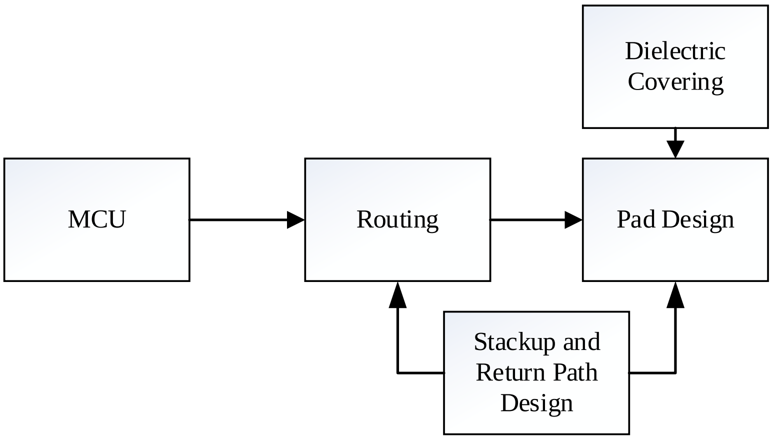

Figure 1 General design overview of the areas of concern in a capacitive touch layout

The functionality is made up of the MCU, which controls the generation of the field between the plates, as well as the measurement and the calibration to the physical part of the system. Care must be taken with the traces connecting the MCU to the pad in order to not affect the generation of the signal creating the field. For this reason, printed circuit board (PCB) design parameters such as the trace thickness, height and width are important factors in the design.

Lastly, once the field is generated at the pad, its performance can be effected by a variety of design factors which include the pad shape and covering.

2.2 Capacitive sensors

The electrostatic field that the MCU creates is represented as a capacitor that appears between the electrode or conductor, and any surrounding metal structure. The metal structure includes areas existing near the electrode, which are attached to the touch sensing (TS) port:

- Metal case
- Reference plane
- Other traces
- Another electrode

Since the coupling between the electrode and its environment does not change drastically over time, it is represented as a constant capacitance C_p¬(10 – 50 *pF*, as measured by the MCU). When a finger interacts with the electrode that stray capacitance results in a change in total capacitance; given by C_f (approximately 10 *pF*). With the addition of finger capacitance, the total capacitance in the system becomes (1). This formula forms the basis for self-capacitive touch.

$$C_{total} = C_{finger} + C_{parasitic} \quad (1)$$

2.3 Types of capacitive sensors

By measuring the increase in capacitance, the MCU is able to discern the status of the sensor. Figure 2 shows the self-capacitance method of detecting a touch. Self-capacitive touch measures the capacitance the human body adds to capacitance already formed between itself (the electrode), and its surroundings.

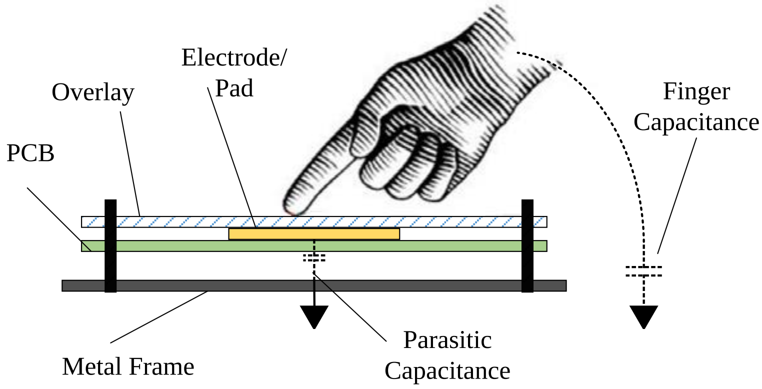

Figure 2 Typical self-capacitive touch design

The electrode shape is simple and relies on the system not having a lot of parasitic capacitance between the pad and its surroundings, in order to increase its sensitivity.

In contrast to the self-capacitance method, the CTSU drives a pair of touch sensing (TS) channels. These channels connect to corresponding electrodes to create an electric field. The electric field generates not only between the plates and the environment, but also between the two plates themselves. In mutual mode, CTSU functionality removes the parasitic capacitance from the measurement, while still measuring the interaction with a human finger. The result of a touch in this mode is a decrease in capacitance in the system. Since the CTSU is measuring the finger's interaction with the field between the two plates, this results a more complicated electrode shape. Figure 3 shows the interlocking pattern between a transmitting electrode and a receiving electrode.

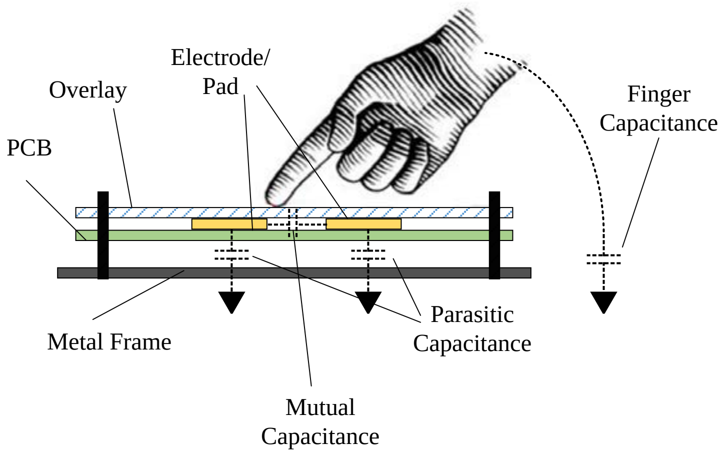

Figure 3 Typical mutual-capacitive touch design

Before describing how the CTSU measures the pad's interaction with the environment, it is important to understand how the system handles parasitic capacitance, which is common to both self and mutual methods of capacitive measurement.

2.3.1 Overview of parasitic capacitance

Parasitic or stray capacitance is something that hardware engineers account for in their design of a return path for currents that occurs between two conductive structures - generally current carrying traces and copper planes under areas of the printed circuit board. Many printed circuit boards maximize this type of stray capacitance in specific areas of the board such that currents have as short a return path as possible to their source creating short loop areas. However, in a capacitive touch system the same techniques could result in a desensitization due to the way the CTSU operates.

As demonstrated at the beginning of this section, via equation (1), the total capacitance of a pad that the CTSU measures is made up of both this parasitic capacitance and the capacitance that the human body forms between the finger and ground. The human body capacitance that it must measure, however, is usually a percentage of the parasitic capacitance that forms between conductors.

This leads to two important characteristics a design must account for:

- The higher the percentage that the body capacitance is the more sensitive to touch the system will be. This usually results in a decrease in parasitic capacitance by not having a solid copper ground behind the pads or the non-parallel running of traces.
- Too much capacitance in the system will hinder the ability for the CTSU from estimating the total capacitance in the system as the driver will not be able to charge the total system capacitance.

Since body capacitance is outside the control of the designer, reducing the parasitic capacitance between the pad/trace and surrounding objects is accomplished by techniques, such as not extending a solid plane under the pad, or by not running long parallel traces.

3. Component overview

3.1 External components

To ensure proper operation of the CTSU allowing the tuning process to succeed and the solution to be robust, external components must be added. These components must be paid attention to in order to ensure proper function:

- The overlay
- The TS capacitor
- Series resistance
- Voltage supply selection and decoupling

3.1.1 Overlay design and thickness

The inter-electrode distance depends on thickness of the material with which the surface of the touch key is covered as well as the dielectric material of the covering. The table list the relative permittivity of some common materials. Permittivity is different according to each material.

Dielectric material	***k***
Acrylic	2.4-4.5
Glass	4.5-7.5
Nylon Plastic	3.0-5.0
Flexible Vinyl Film	3.2
Air	1.0
Water	80

Glass has the best relative permittivity excluding water, but acrylic and plastic are also often used. It’s important if bonding multiple panel coverings together to keep the bond between them as uniform as possible for a constant dielectric, keeping bubbling and the amount of adhesive used to a minimum. Figure 4 shows other examples of manufacturing that use a flexible conductor to transfer the touch closer to the electrode.

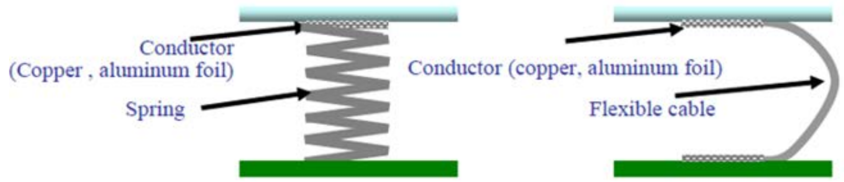

Figure 4 Examples of connecting the board and electrode in a wide gap situation

It is recommended to not make the cover too thick, as this increases the distance the field must travel to in order to interact with a finger, resulting in a desensitized system. For this reason, do not exceed thicknesses over 10mm for an overlay. However, for performance, in certain situations where thicker overlays are necessary performance of the system depends upon the type of detection method implemented:

In self-capacitance, the capacitance the electrode has is a function of distance, and exceeding the recommended thickness of the overlay will result in decreased sensitivity.

In the mutual-capacitance method, the electrodes are to be designed with a pattern with a larger amount of Tx/Rx facing distance. This projects the electrostatic field up, towards the fingers instead of keeping it tightly coupled between the electrodes (see Figure 5).

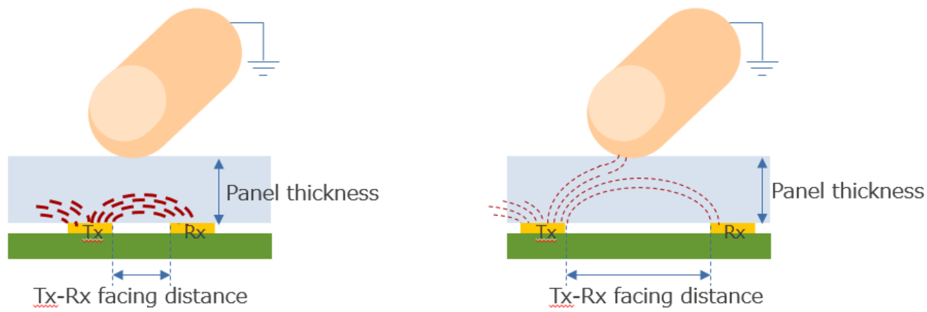

Figure 5 Field interacting with finger with a larger distance away from the electrode

Lastly, during manufacturing, in addition to uniform adhesion between the panel and electrodes, care should be taken not to generate the gap in the panel joint. Doing so could result in in a path that allows electrostatic discharge to propagate from the panel junction to the electrode providing a path for electrostatic discharge (ESD) to get to the MCU.

Figure 6 Example of ESD testing

In Figure 6, the red arrow shows a propagation path for the discharge around the panel to the electrode.

3.1.2 TS capacitor

To form a low pass filter for the internal current oscillator for the CTSU, it is necessary to insert capacitance between TSCAP port and ground (GND) to act as low pass filter with a value of 10 nF. In addition, placement of his capacitor should be as close to the TSCAP port as possible, to keep board level losses, associated with a long trace, from negatively affecting the performance of the filter.

3.1.3 Series resistance

It is recommended to insert a damping resistance between the electrode and each TS port. Resistance must be kept above a minimum 560 Ω, to prevent against surge breakdown and below a maximum 2k Ω, in order not to affect the CTSU pulse measurement. Mentioned again in Section 5, Routing and Stack up, as this series is in addition to the trace resistance.

3.1.4 Voltage supply

While not always possible, it is recommended to power your application via a properly decoupled, three pin linear power supply in order to reduce the possibility of coupled noise onto the touch sensing traces and sensors. Some common examples of noise on the voltage supply are conducted emissions or PWM/digital noise on the power plane for this reason, it is recommended to:

- Insert a ferrite core/bead along the powerline to suppress high frequency noise.
- Isolate any power sources that could cause switching transients to couple onto the MCU power and reference planes.

4. Self-capacitance

4.1 Introduction

A main advantage to construction of a self-capacitance solution is that it can be placed on either the top or bottom of the circuit board, allowing for the possibility of a low cost single sided solution. If placed on the bottom, the total overlay thickness is the thickness of the board in addition to the dielectric layer (see Figure 7).

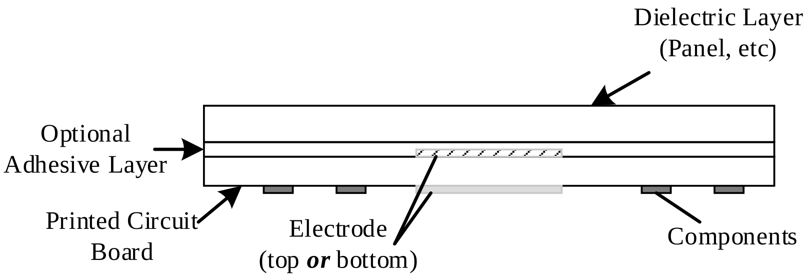

Figure 7 Stack-up example detailing the self-capacitance design

4.2 Electrode design overview

Self-capacitance buttons are patches of conductive material, usually made of solid copper, attached to a TS port. The sensors are able to form shapes that imitate buttons, sliders, and wheels. To form these shapes, solid copper traces should be used with the specifications (see Figure 8). To indicate to the user where to interact with the sensor, it is recommended to use a non-conductive graphic; the graphic does not need to be directly over the electrode.

4.2.1 Spacing requirements

Maintain a minimum of 5 mm distance between sensor electrodes and any communication, PWM or high amplitude periodic signal, communication lines, or GND plane (solid or hatched) that is on the same plane as the touch electrode trace.

4.2.2 Electrode shape

Figure 8 shows the recommended size of the electrode and possible patterns, with an area of 10mm×10mm to 13mm×13mm. A triangular or E-shape pattern is not recommended:

- In a self-capacitance method, there is no need for interleaving of the two plates. Designing in such a way could cause the fingers to turn into small tuned radiating structures either accepting or radiating energy.
- The triangle shape is not recommended because of the cross sectional area of the triangle limiting the effective region of the field to less than the shape of the electrode.

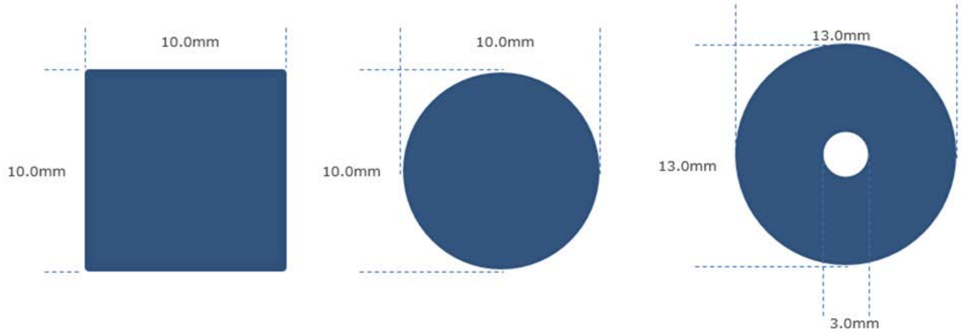

Figure 8 Example of design shapes for self-capacitance button

Lighting with LED lights from the back of the electrode is also effective when it is formed is in a donut-shape or mesh configuration. The preferable area of the electrode is equal or up to twice the size of area as the point of finger contact. Electrode sizes larger than twice the size of a finger can add parasitic capacitance that may lower the sensitivity.

4.2.3 Slider shape

A slider is constructed from the elements shown below. The “x” dimensions are all consistent with the dimensioning on the first element. The multiple elements are then stacked to create a slider with the desired number of elements

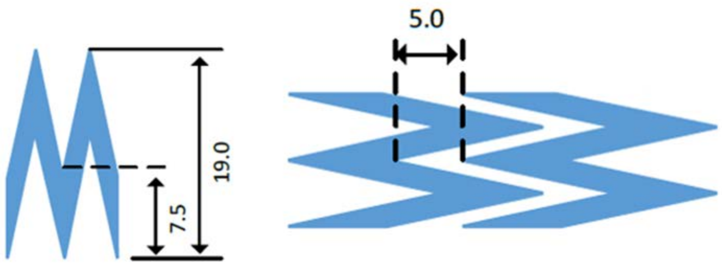

Figure 9 Recommended slider dimension/configuration (in millimeters)

4.2.4 Wheel shape

A wheel shape is similar in concept to the slider, but instead of a linear interpretation, the software assumes it as a circle with a layout between 0 and 360 degrees. An interlocking, chevron based design, such as the slider, is recommended as the best form of implementation as this allows the software to best interpolate and estimate the position of the finger along the wheel. The spacing and size requirements are similar to the slider design pattern. Finally, as a form of mechanical implementation, it is recommended to also put a tactical groove for the finger to trace as it moves along the wheel to guide the user through the recommended path.

5. Mutual capacitance

5.1 Introduction

The mutual capacitance method uses the field created between two electrodes, and measures the interaction the human body has with that field to determine touch. There are at least two TS channels, one for the transmit channel (Tx) and the other for the receive channel (Rx). This method allows the TS channels to be configured in a matrix format to produce sensors, as opposed to the self-capacitance method, which has a single sensor per channel. As an example, a nine-button matrix can be made with three transmit channels and three receive channels, as opposed to nine individual TS channels in the self-capacitance method. In addition, because of the nature of the field being contained between two electrodes, different shapes can be implemented that would project differently, depending on the geometry the two shapes share. While the mutual method can be implemented on a single layer board, it is more suited for a minimum of two layers and can be placed on either the top or bottom of the board. This section describes shape, spacing, and the field contained between the two plates.

5.2 Electrode shapes

Figure 10 shows the pattern recommended for a mutual button. The outside pattern is the transmitting electrode (Tx) and inside is the receiving electrode (Rx).

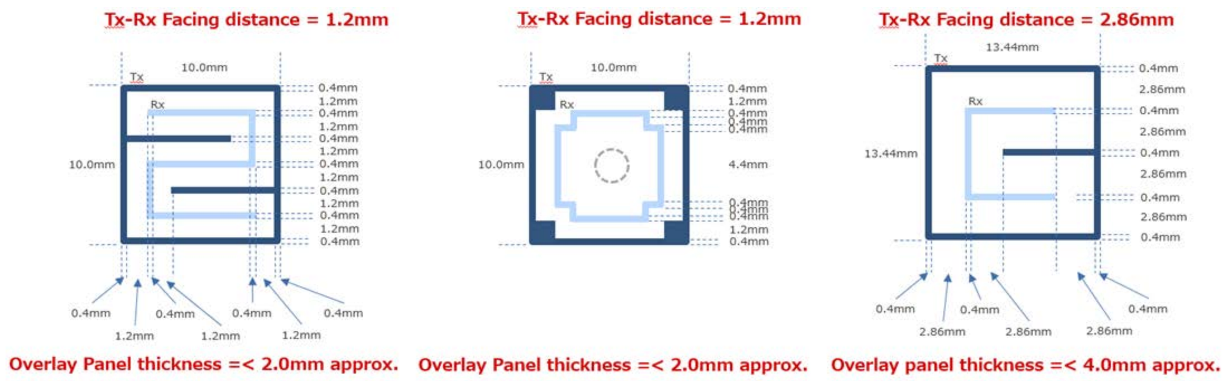

Figure 10 Example of a mutual pad design

To increase the capacitance, the opposing surface areas for transmit and surface should be kept large; these opposing surfaces form the plates of the coupling capacitance.

- The recommended area of the button is from 10x10 to 13.5x13.5 mm.
  The clearance distance between the Tx and Rx shapes are dependent upon the overlay panel thickness in order to project the electrostatic field towards the finger interacting with the panel. This results in:
- The distance between the Tx-Rx parts of the electrode being roughly 0.6 x (thickness) of the cover panel. Figure 10 shows the nominal widths of each of the Tx/Rx traces; however, the actual width used depends on the resistance of the pattern material. In exotic applications such as a plastic membrane, or where the material resistance is large (such as carbon film), increasing the width may be needed to keep the resistance small.

5.3 Mutual electrode field and overlay thickness

Figure 10 shows different shapes Renesas recommends for an application. Since mutual electrodes operate by the user interacting with the field contained between the two plates, there may be different shapes that fit different applications better; due to where the electrostatic field needs to be projected. Figure 11shows the case of the ‘2’ shape and the ‘C’ shape; where C shape projects the field higher, but results in lower sensor counts.

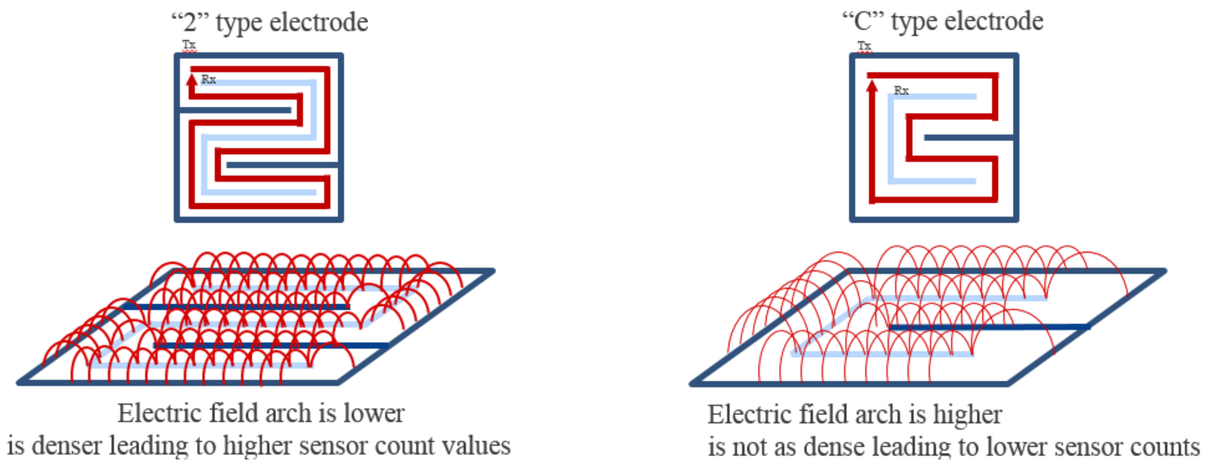

Figure 11 Field comparison between '2' type electrode and 'C' type electrode

Therefore, if a thicker overlay is needed, the application should investigate a pad shape with less Tx/Rx facing distance.

5.4 Spacing requirements

Maintain a minimum of 5mm distance between sensor electrodes (see Figure 12).

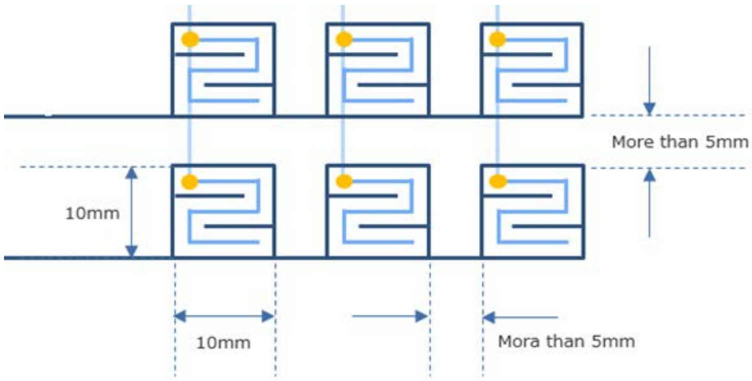

Figure 12 Spacing requirements

6. Routing and Stack up

The design of the traces that route pulses from the CTSU to the electrode, as well as the ground plane and stack-up behind those components, play an important role in ensuring that the pads are sensitive enough while being robust to ambient noise. Some areas of note to give attention to when routing the TS signals are:

- Crosstalk either from a noise source, or from one trace to another.
- The amount of parasitics contained in the traces carrying the pulses.

6.1 Routing

While there are particular routing recommendations pertaining to both self and mutual setups, there are some general routing rules which apply to both as the goal is to first reduce crosstalk between measurement traces, or between measurement traces and a noise source. The second goal is to reduce excessive capacitance associated with the pad and trace resulting in reduced sensitivity of the touch system.

When connecting touch electrode signals it is recommended to minimize, the amount of parallelism of the touch traces when exiting the MCU. Note the minimum distance that traces run parallel from the MCU before breaking into the minimum recommended trace spacing on the run to connecting to the touch electrode. It is recommended for the sensors to be as isolated from other parts of the circuit board as possible; these requirements (see Figure 13).

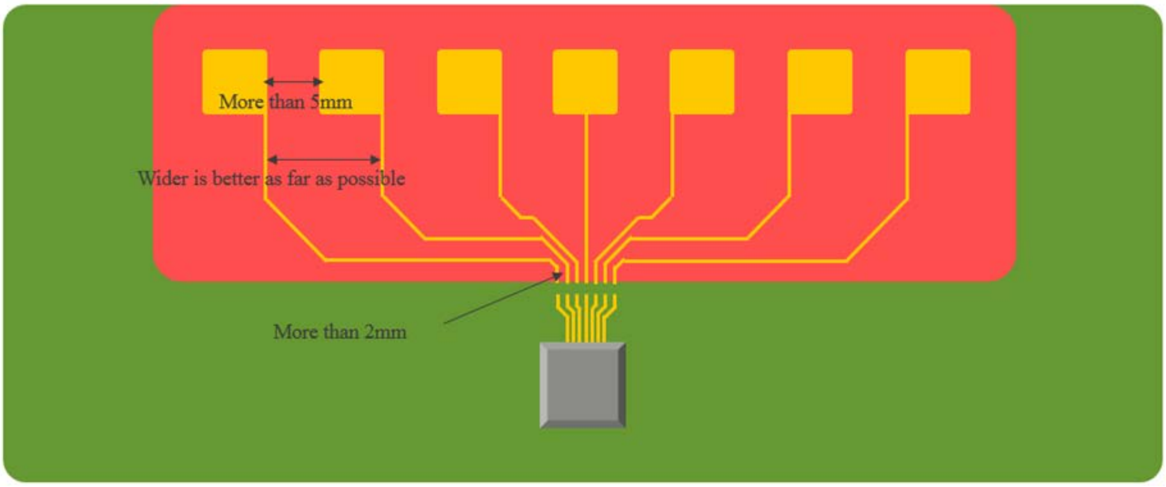

Figure 13 Recommended layout of TS traces in a self-capacitance setup

Specific trace width, spacing, length and sensor spacing design notes are found below.

- **Trace Width**: Keep the connecting trace between the MCU and the sensor pad as thin as the PCB technology allows. Doubling the trace width effectively doubles the coupling capacitance with other planes/traces, which will effect touch sensitivity.
- **Trace Spacing**: Reduce the crowding of traces near each other as soon as possible when routing them from the MCU. It is recommended to keep at least a minimum of 2mm when exiting the MCU.
- **Trace Length**: Ensure that the routing traces from the MCU to the sensor electrodes are less than 180mm (7in) for optimum performance and tuning capability. Longer traces can be supported, but will reduce the sensitivity and tuning capability of that particular sensor.
- **Sensor Spacing**: If possible achieve a minimum spacing of 1.5 to two times greater than the overlay panel thickness between the sensor electrodes, this is to prevent user error and isolate the effect one touch has on each of the other pads.

6.1.1 Self-capacitance method

The trace length of a self-capacitance pad and the pad itself form a ratio. While it is not recommended to exceed trace length of 7 inches, longer traces carry more parasitic capacitance. This causes sensors connected to shorter traces to have heightened sensitivity, since the resulting parasitic capacitance is small, and is referred to as ‘looking’ electrically large to a touch. Conversely, longer traces are associated with more parasitic capacitance, which causes associated sensors to ‘look’ electrically smaller to a touch. Figure 14 shows a situation where sensor A and B are closer to the MCU, appearing larger than sensor D, which is located farther away from the MCU.

Figure 14 How sensors 'look' to touch based on how close the sensors are to the MCU

If the sensor lines must cross other sensor lines, or other, ‘noisy’ signals, it is recommended to cross them on opposite sides of the board and they must cross at a right angle (see Figure 15).

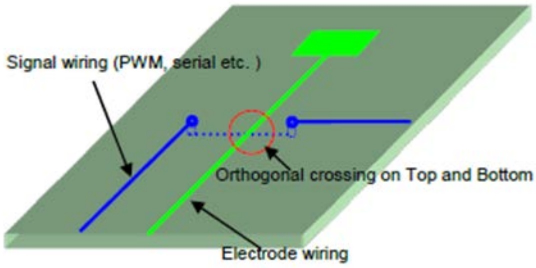

Figure 15 Wiring pattern of a noisy line and pad

Figure 16 shows the parasitic capacitance and the resistance on the cap touch key board. There is maximum self-parasitic capacitance the CTSU can support before becoming insensitive to touch, and as such, the board and system design should control the parasitic capacitance so the total of the parasitic is 50 pF or less.

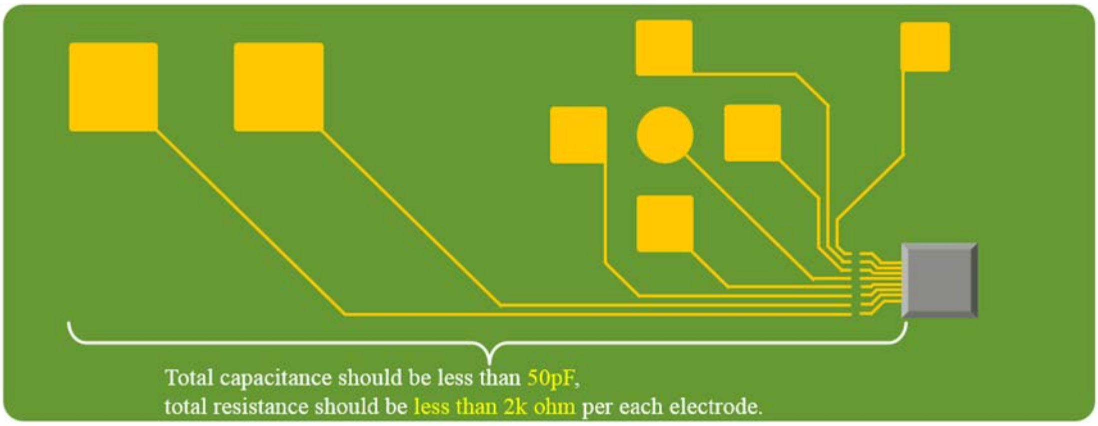

Figure 16 Board outline detailing total resistance and capacitance

Since the CTSU is estimating the capacitance, by driving a signal into the pads, it is necessary to insert a damping resistance between the electrode and TS port to protect from surge breakdown. For these reasons, a nominal resistance value of 560 Ω is recommended to prevent surging breakdown. An overall series resistance is limited to 2K Ω in total, to ensure operation of the CTSU.

6.1.2 Mutual capacitance method

To prevent capacitive crosstalk between the Rx and either Tx traces or other pulse carrying traces (such as the PWM, communication, and clock lines), care should be taken to route the Rx wiring as far from these traces as practical.

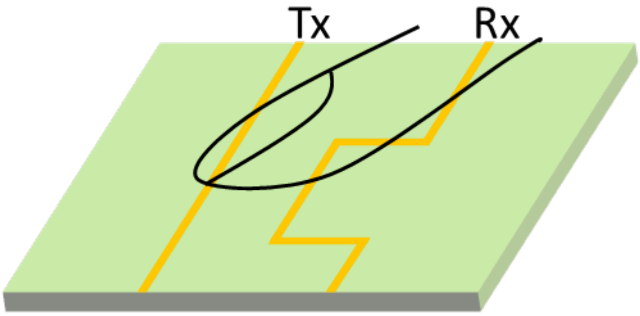

Figure 17 Unintended path for crosstalk between Rx/Tx traces via a user interaction example

The minimum keep out should be one finger distance between the two, as to not inadvertently allow a coupling path to occur during the interaction with the device. This rule is important to follow when traces come close to neighboring pads, as a clearance distance reduces the risk of improper detection due to a non-accurate touch, which may occur across traces instead of a pad. Recommended dimensions and layouts are demonstrate in Figure 18, which separates the Tx/Rx traces as to not allow any accidental interaction.

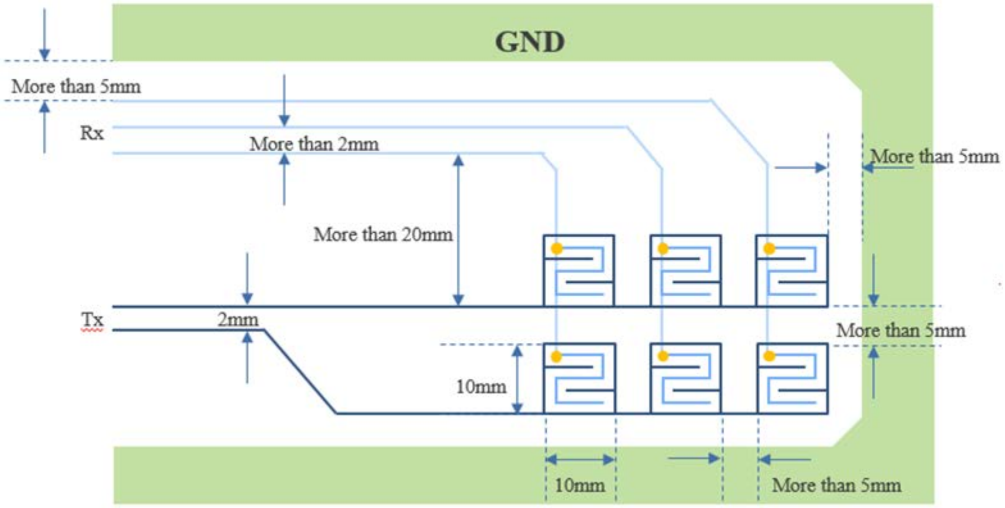

Figure 18 Recommended spacing between Tx/Rx traces and pads

If the Rx and Tx lines must cross due to board constraints avoid long parallel runs and if they need to cross should do so at 90 degrees in order to minimize the possibility of crosstalk between the two traces.

Other methods for avoiding false key detection in layout include:

- Protecting the two traces with a ground/guard trace to allow the noisy line to couple to.
- Route the Rx lines on the opposite side of the board separated between a reference trace.
- Route the Rx lines under a ground plane.

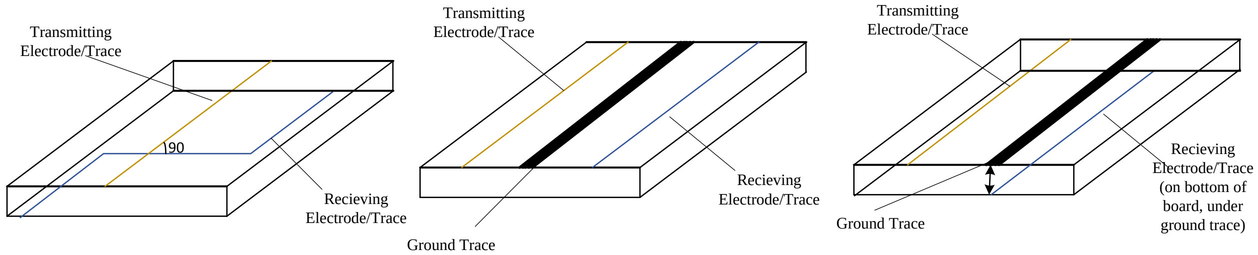

Figure 19 Recommended routings for traces

The figure shows: On the left, an example of routing RX/TX traces orthogonally; in the middle, an example using a ground strip to isolate the two traces; and on the right, an example of a routing the RX trace is under a ground trace.

As mentioned prior, trace capacitance and resistance similarly must be kept to maximum values and long traces in addition to traces tightly coupled to a ground plane are not recommended.

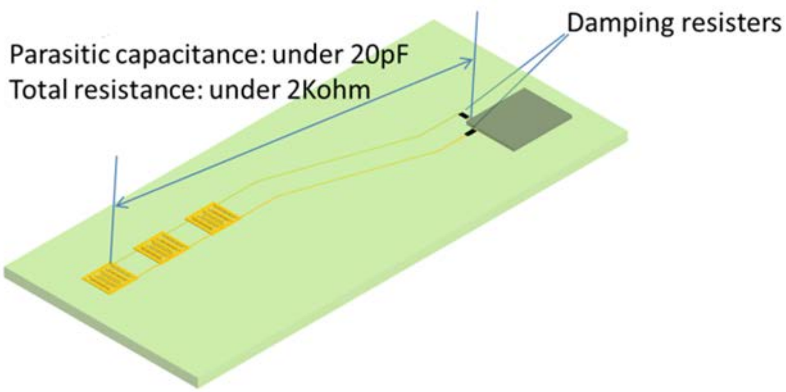

Figure 20 Max limits for parasitic capacitance and resistance of the measurement traces

6.2 Grounding

A ground plane is often introduced as a way to increase the external parasitic capacitance between the trace and the current return path, allowing the board to decouple higher frequencies naturally. However, because the touch solution relies on the MCU being able to register a difference in capacitance in order to discern between a touch vs. non-touch a solid copper backing may not be the best option. The design choices vary depending upon the type of capacitive touch mechanism being implemented.

6.2.1 Self-capacitance method

In general, this type of sensor is sensitive to any ground plane laid near it as it increases the parasitic capacitance of that sensor pad. If there is, too much capacitance the CTSU may not be able to accurately detect the changes in overall capacitance due to a touch. For this reason, it is recommended to not include a solid ground plane behind the pads, and adhere to the spacing requirements when near the pads to increase sensitivity. However, on multilayer applications, a mesh ground plane behind the pads at no more than 30-40% fill is recommended on multilayer boards to aid in the rejection of conducted noise issues. The tradeoff between the slight reduction in sensitivity and increase in electrical noise immunity make this a useful design choice if required. The ground should be tied directly to the MCU ground (V_ss) to ensure a low impedance return path an example of these guidelines are shown in Figure 21, and the traces should be placed perpendicular to the mesh lines.

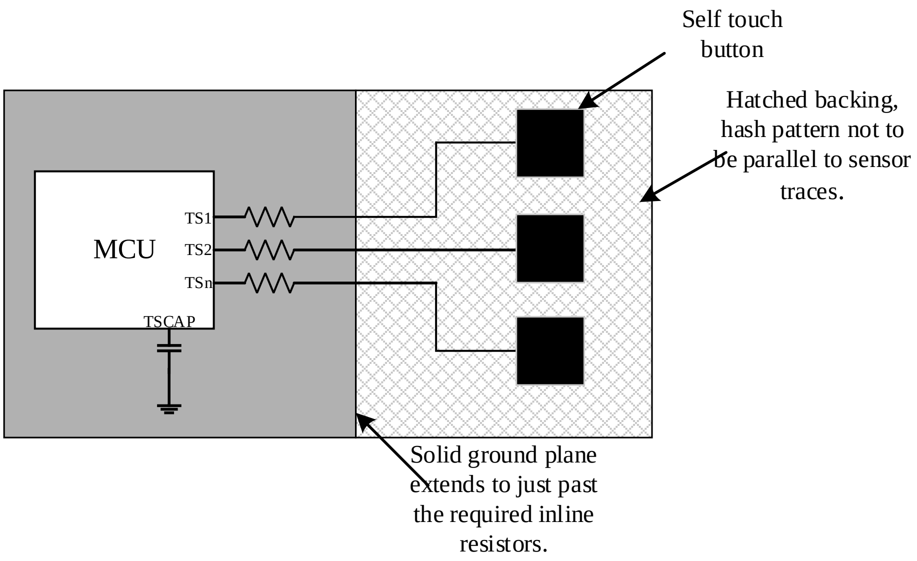

Figure 21 Example of a grounding scheme for a self-touch solution

A usual stack up for a multilayer touch board includes four layers, the ground plane is recommended to be at least one or two of the planes in the stack up depending upon the design being implemented. Do not extend any solid ground plane on any layer under the sensors, as that will increase the parasitic capacitance resulting in a decrease in sensitivity. See Section 4.2.1 and 5.4 for spacing requirements from the edge of the sensor to the plane.

Figure 22 Example of multi-layer stack up in a self-capacitance board

6.2.2 Mutual-capacitance method

While the mutual method is more robust to parasitic capacitances, due to the measurement method, many of the same methods that exist for improving the performance of a self-system work similar for a mutual system. Therefore, if using a solid ground plain in order to reduce parasitics it is important to route the Rx traces farthest away from a ground plane to avoid a loss in sensitivity (Figure 23).

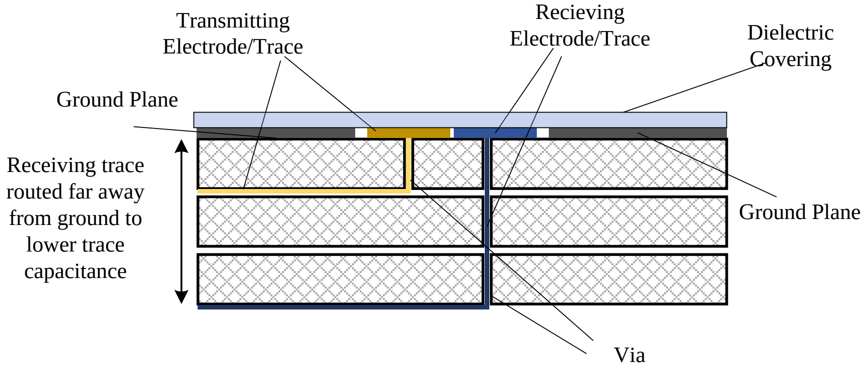

Figure 23 Rx trace routing example when presented with a ground plane

7. External noise sources

Capacitive touch systems designed to replace their mechanical counterparts are prone to noise from a wide variety of different sources. For example buttons attached to GPIO ports, with relatively little software debouncing are inherently robust to a wide variety of sources such as PWM sources, relays and poorly decoupled power supplies. To properly characterize any sort of noise issues, the EMC model of source/path/receiver can be used to properly break down the system into their parts.

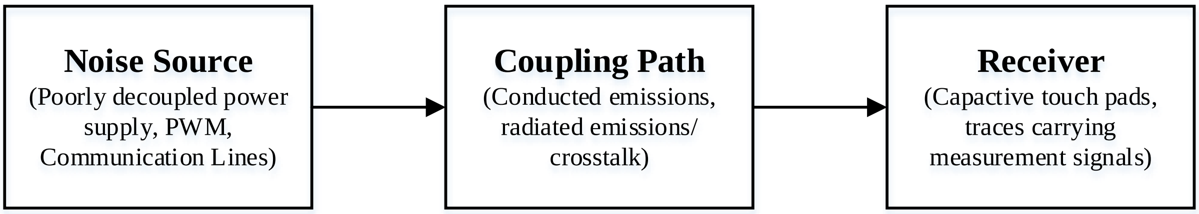

Figure 24 The Noise-path-receiver model for noise in a capacitive touch system

The majority of the noise sources come from either the higher harmonics of a PWM, a 60 Hz harmonic from a poorly decoupled power supply, or communication/timing lines. These sources along with their coupling channel can be broken down into the following, each being able to affect the end measurement:

- Conducted — A conducted noise channel is one that forms a galvanic connection to the system, and example of noise sources are 50/60Hz low frequency AC noise from a power supply, or switched mode power supply harmonics.
- Radiated — A radiated noise channel is one that couples wirelessly due to nearby traces via capacitive/magnetic fields with the trace or pad. Examples of sources that travel this type of noise channel are the drivers of a LED or LCD interface, and communication interfaces (such as WIFI or Bluetooth).
- Environmental — This type of noise, not typically considered an EMC problem occurs over time as the environment changes the properties of the parasitic capacitance being measure, such as humidity, temperature, or manufacturing variability. In addition, an environmental factor would also be either customer interaction with the touch system, as this could lead to an unintended coupling path not previously seen, or unforeseen interaction during the excitation of HMI (such as lighting, screen turning on, and so on).

  As these sources and noise channels become more pronounced, they can greatly affect the touch measurement, causing errors that eclipse touch and non-touched thresholds leading to errors

8. Design guideline summary

The guidelines covered in this document are summarized in Table 1. While exceeding these recommendations could still result in a functioning system, it is recommended to try to incorporate as many of these requirements into your system as the application allows.

Table 1 Design guideline summary

Topic	Guideline	Reference
Component Overview	Overlay thickness: Nominal is between 2-10 mm, but is dependent upon the dielectric constant of the overlay.	Section 3.1.1
	TS-Capacitor Value: 10 nF	Section 3.1.2
	Series resistance value: 560 Ω-2 kΩ	Section 3.1.3
Self-capacitance pad design	Button design dependent upon application; see guidelines in the section referenced.	Section 4.2.2
	Slider design dependent upon application; see guidelines in section referenced.	Section 4.2.3
	Wheel design dependent upon application; see guidelines in section referenced.	Section 4.2.4
Mutual-capacitance pad design	Renesas supported button shapes; nominal recommended size is 10x10 mm.	Figure 10
Sensor spacing requirements	A nominal minimum of 5 mm between electrode(s) and other objects; spacing is dependent upon the overlay thickness.	Section 5.4 and 4.2.1
TS Traces	Mutual-capacitance distance between Tx and Rx traces should be large enough to prevent unintended crossing where the user may touch (recommended 10-15+ mm of distance).	Section 6.1.2
	Mutual-capacitance distance between Tx/Tx and Rx/Rx traces distance is recommended minimum of 2 mm.	Section 6.1.2
	Self-capacitance TS traces to be kept to a recommended minimum of 2 mm away from other objects.	Section 6.1.1
	TS Trace Routing: Cross other traces at 90° to reduce parallel runs; route Tx/Rx on opposite sides of board, if possible.	Section 6.1.1 and 6.1.2.
	TS Trace width: Smallest possible, dependent upon material of the trace.	Section 6.1
	TS Trace length: Do not exceed 178 mm (7 inches)	Section 6.1
Grounding	Do not extend solid grounds underneath the touch pads. If noise robustness is needed, recommend not to exceed 30-40 % meshed/hashed beneath pads on multilayer boards. Ensure the mesh lines do not run parallel to the TS lines.	Section 6.2

Website and Support

Support: https://synergygallery.renesas.com/support

Technical Contact Details:

- America: https://renesas.zendesk.com/anonymous_requests/new
- Europe: https://www.renesas.com/en-eu/support/contact.html
- Japan: https://www.renesas.com/ja-jp/support/contact.html

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	May 1, 2017	-	Initial version
1.01	Jun 14, 2017	-	Document updated for using RX100 and RX200 as well as Synergy.

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