Designing a TrackPad with MSP430 CapTIvate™ Touch technology

Section – Electrode Geometry

Electrode Geometry

- Pattern
- Pitch
- Diamond Spacing
- Trace Width

In this section we review critical electrode geometries, such as pitch and spacing. The recommended dimensions are summarized here.

Recommended pattern - diamond

Diamond Spacing - 0.3mm typical

Electrode Pitch – 5 to 7mm

Trace width – as small as possible

Pattern

The diamond pattern is a proven topology that is easy to implement on a PCB or ITO substrate. There are alternative patterns that may offer improved characteristics, but it is beyond the scope of this document and left to the reader to perform their own investigation or evaluation.

Spacing

Spacing between the diamonds determines the quality of the coupling between an RX and TX diamond and can impact the distance a finger can be detected as well as the noise susceptibility. The smaller the spacing, the more dense or tightly coupled the e-fields are between the diamonds.

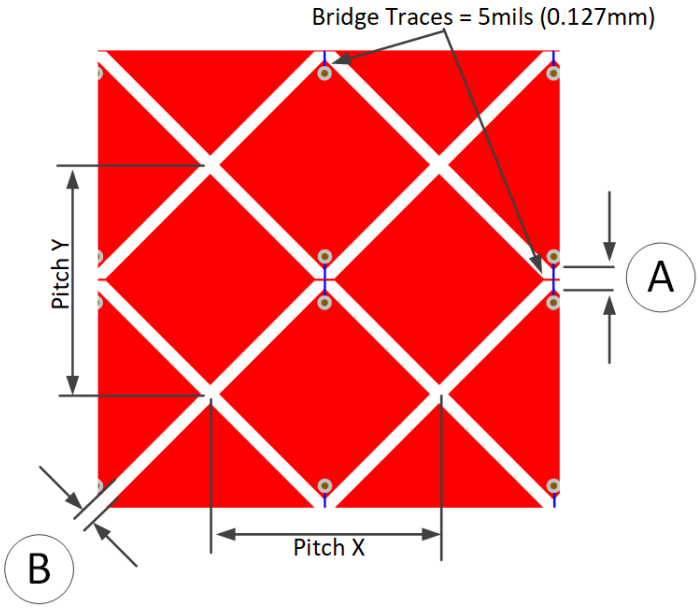
[mutual_spacing.gif]

The recommended spacing between diamonds ranges from 0.3mm (typical) to 0.5mm. The larger the spacing, the further the e-field will extend out into space. So for overlays that are 1-2mm thick, a gap of 0.3mm is suggested. If overlay is thicker, using a 0.4mm or larger is recommended.

A Tip-Tip Spacing Example:
Using PCB manufacturer specs
- Trace width (min) = 5mils
- Clearance (min) = 5mils

Therefore, Tip-Tip spacing
= trace width + (2x) clearance
= (5+5+5)mils or (0.381mm).

B Diamond-Diamond Spacing Example:
= 0.707 x Tip-Tip spacing
= 10.6mils (0.269mm)
But, round up to 0.3mm to be safe



[electrode_pitch_spacing.gif]

Electrode Bridge Trace Width

The rows and columns of diamonds are connected with a bridge trace on both layers and should be as narrow as possible as allowed by the PCB manufacturer, typically 5mils (0.127mm) or 6mils (0.152mm).

Tip-Tip Spacing (A)

Additional consideration must be given to the Tip-Tip spacing, which is controlled by the trace width and minimum PCB manufacturing clearances. As shown in the illustration above, a board manufacturer has a minimum 5mil (0.127mm) trace width and a minimum 5mil clearance spacing (minimum space between copper). Therfore, the Tip-Tip spacing must be (5mil + 5mil + 5mil) = 15mil (0.381mm), or greater.

Diamond-Diamond Spacing (B)

Knowing what the Tip-Tip spacing is, the diamond to diamond spacing can be calculated as 0.707 x tip-tip spacing. In this example that is 0.707 x 0.381mm = 0.269mm. As a rule of thumb it's always good to add a little mechanical margin for PCB layouts so in this case the diamond spacing is suggested to be 0.3mm.

Recommended spacing is 0.3mm (typical), up to 0.5mm (max) with thicker overlays.

Pitch

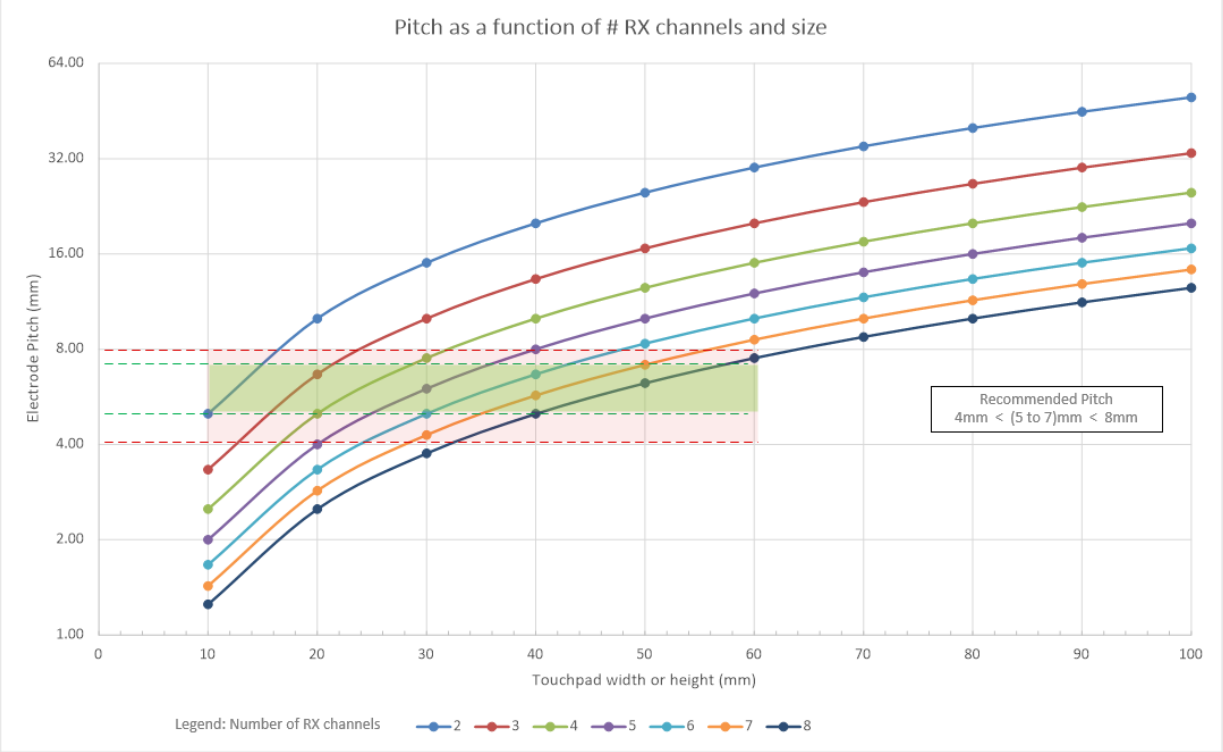
A sensor's pitch is the distance from the center of one RX diamond to the center of a neighboring RX diamond, or center of a TX diamond to center of TX diamond as shown in the previous illustration. The pitch along any axis is calculated by dividing that Touchpad's axis length by the number of RX or TX

channels assigned to that axis. For example, a 40mm Touchpad has 6 RX diamonds along its X axis so the X axis pitch is 40mm/6 = 6.6mm.

Why is pitch important? The pitch helps determine the resolution of the Touchpad as well as its linearity. To help select the appropriate pitch, first consider the type of Touchpad, standard or basic? Based on an average finger pad size of 10-14mm, the pitch should be approximately ½ the diameter of the finger size. This means for standard Touchpads that support up to 2 finger touch, the recommended pitch is 5 to 7mm as shown in the green region of the graph below.

The graph below shows a wide range of Touchpad sizes and a plot of recommended diamond pitch as a function of the sensor configuration (number of RX and TX channels). The green region on the graph shows the range of 5 to 7mm and the intersection of various sensor configurations.

For example, if designing a 40mm standard Touchpad, the number of RX channels can range from 6 to 8 (6x6, 7x7 and 8x8).



A pitch > 8mm is generally not recommended for 2-finger Touchpad applications, however for 1-finger touchpads, this is fine. In fact, using pitches > 8mm work for basic touchpads, where resolution and linearity are not important.

Pitch <4mm is not recommended because it won't provide significant improvement in resolution and requires the use of more RX and TX channels.

The recommendation for electrode pitch ranges from 4mm (min) to 5-7mm (typical) and 8-10mm (max). See chart above for application specific recommendations.