

## 4.8 The Capacitive PCB - Part 2

The Capacitive PCB (aka Sensing PCB or Large PCB), has been discussed prior already at 2.10.4. In this section we are looking into some of the variants of the PCB, the PIN-Out, and circuitry of it.

### 4.8.1 Sensing PCB Circuitry

The following two pictures in figure D91 show a rendering of both sides of a Sensing PCB.

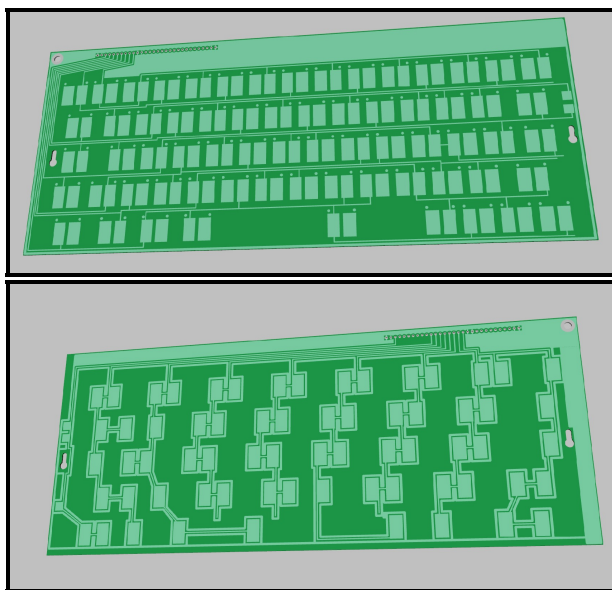


Figure D91: Top and Bottom Layer of PCB

The sensing PCB contains a pair of pads that aren't connected to each other. One side of the pair is connected to a signal generator and the other to a sensing mechanism. The columns are connected to the generator and the rows to the sensing mechanism (comparator). In a  $16 \times 8$  matrix, as it is used for the Model F keyboards, the signal is sent through each column one after the other, more than 50 times a second. During each individual current flow from the column the 8 rows will be measured.

The flipper contains electrically conducting material. When it closes in towards the pair of pads on the PCB, the capacitance will change. Due to the layout in a matrix the exact pad with a change in capacitance can be measured and in return which key was pressed.

The following figures will illustrated this in a simplified format by only using a  $2 \times 2$  matrix. The first figure indicates with the black tracks and pads the active current flow. It is sent through the column 1 first and then moves to column 2 (and starts again from the beginning).

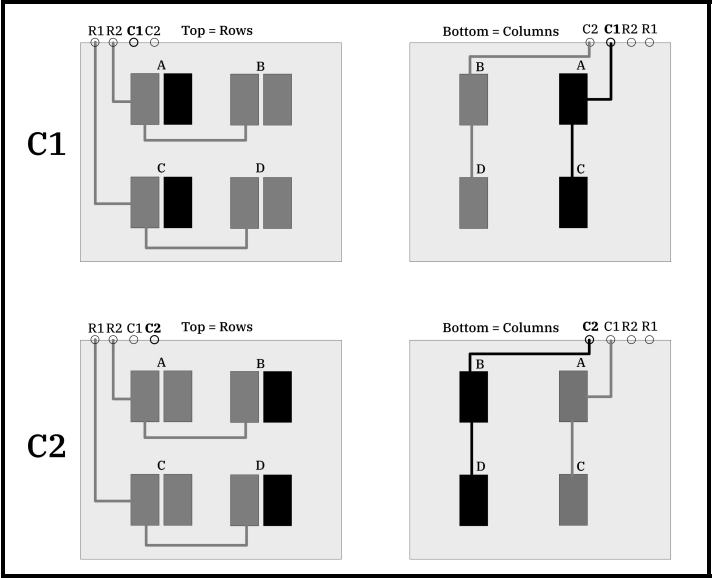


Figure D92: Sensing Pad Illustration - no key pressed

In figure D93 the key A is pressed down, illustrated by the red square. If a current is sent through C1, the capacitance change can be measured on R2. When the current flows next through C2, no change is registered in any row. The controller uses the change that happened during *C1R2* and returns a value unique to the specific pad.

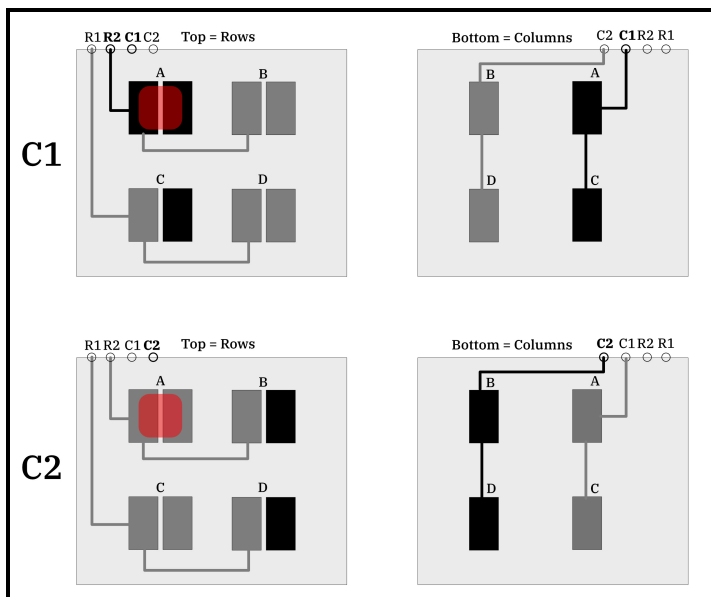


Figure D93: Sensing Pad Illustration - A pressed

If multiple keys are pressed at the same time, let's say A / B / D, like shown in figure D94, the sensing works in the same way. A current is sent through column 1. Row 2 gets a signal difference (C1R2 is recorded by the controller). The controller now sends current through column 2 and in both rows R1 and R2 a signal difference gets detected (C2R1 and C2R2 is recorded). The controller can return a value for all three detected key presses (*C1R2, C2R1, C2R2*).

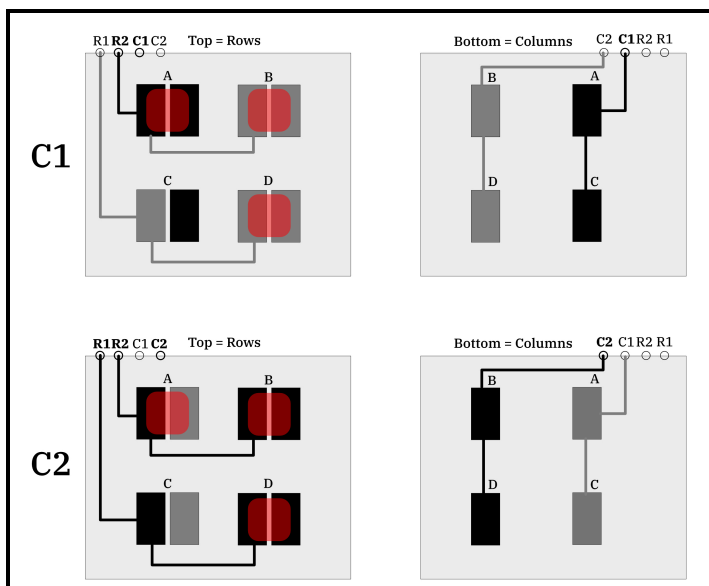


Figure D94: Sensing Pad Illustration - A / B / D pressed

The detection follows a simple matrix process but in reality it is more complex. Some of it is well documented by Tom Wong-Cornall<sup>8</sup>.