Capacitive Keyboard
Touch Keyboard

As a part of technology advancement everything is going to be comfortable and easier. Keyboard technology too is part of this advancement. Now key became the touch key. So keyboard became the Touch keyboard. Touch keyboards differ from conventional keyboards like tactile, non-tactile in which mechanical contact is to be made. Here a simple touch to the button /key is required. There is no pressure required to activate the key, hence the effort to apply pressure not needed. Key size and shape and keyboard size is highly adjustable to meet the requirement and the output from the keyboard can be taken exactly same as per the existing normal keyboard. Along with this there are several advantages and features.

- Any mechanical button / key, switch, slider and proximity detector can be replaced with touch solution.
- Ease to operate.
- Simplified mechanical design and assembly process
- Operate on most of the dielectric materials.
- An unlimited contact possible as simply touch is required.
- Flexibility in design, key size, and shape.
- Very less chances of physical degradation.
- Improves System reliability and product appearance.
- Rigid and immune to the environmental effects, wear and tear.
- Can be designed in applications that are exposed to rain or water.
- Supports almost all customised technical requirement.
- Resistant to oxidation.
- More durable.
- Key sensitivity is highly adjustable.
- Backlighting to the key and entire keyboard also possible.
- Can be operated in slider form.

There are several technologies on which touch keyboards works. Of that the core sensing is based on resistive, inductive and capacitive sensing. Some of the chip level solution providers are Microchip Technologies, Cypress Semiconductor Corporation and Q-Touch Technology. Each technology is having its own characteristics and application domain.
Among these, a capacitive sensing technology works well and best suits to the touch keyboards. Because it provides various options in design such as key sensitivity adjustment, overlay thickness adjustments, various overlay material selection such as glass, acrylic, wood, polycarbonate, PET film etc. Meet EMI, RFI and ESD Protection can be provided and the design can be made water proof.

We use Cypress semiconductors 'Cap sense' technology and Microchip technologies 'M-Touch'; which provides range of microcontrollers for the development. Depending upon the application area particular technology is to be used.

Touch key is the capacitor formed by the conductive electrode (copper, tin) on the PCB or PCF and the human finger. PCB or PCF electrode area is generally surrounded by the ground fill. Grounds fill in the hashed net conductive area. In the absence of the touch to the key there is particular capacitance associated with the key called parasitic capacitance. And when key is touched then the capacitance increases and that change in capacitance is sensed by the controller unit and decision is taken as key touch.

Key touch is to convert the change in capacitance into the digital code. This enables the implementation of the switched capacitor circuitry, an analog multiplexer and digital counting function. The hardware configuration works in conjunction with firmware in the dedicated controllers.

Signal processing in the decision logic is robust and reliable. False triggering due to electrostatic spikes and momentary unintentional touch or proximity is eliminated.

Practically any number of touch keys can be implemented. When multiple keys are used, each key can be set for the individual sensitivity level, keys of different shape and size can be used to meet both the functional and aesthetic requirements.

This technology can be deployed in various ways to meet the technical requirement. It's having high immunity to the AC mains noise, EMC noise, and power supply voltage changes. keys/ buttons and sliders not only implemented separately but also in combination. Meets all the requirements of the products of rain or water exposed area. Design offers use of different user module as CSA (Capacitive Successive Approximation), CSD (capacitive Sigma Delta Modulation) with or without prescalar as per the design need.
The international devices feature automatic drift compensation to account for slow changes due to ageing or changing environmental conditions. They have a dynamic range of several decades and do not require coils, oscillators, RF components, special cable, RC networks, or a lot of discrete parts. And as the part of development they dissipate very less power and can also be suitable in the battery power operated devices.

Keyboard design and development is fully customised. Design goes based on the 100% customer's requirement. Such as key sizes, total keyboard size, upper graphic design, required output (Such as in terms of scan and return lines, or any communication protocol) and base required either PCB (Printed Circuit Board) or Printed Circuit Flexible (PCF).

Various features can be implemented such as key illumination (key backlight), sound or keyboard vibration on key touch.

**Applications:**

- Any kind of Industrial Machines Keyboard such as CNC machine, ASM Machines, Moulding Machines, etc.
- ATM Machine.
- Mobile Keypads, Notebooks, PCs, Printers.
- Digital Cameras.
- Keyboards in Vehicles.
- Industrial Ovens.
- Home Automation and Interior Design.
- Keyboards in Crane Machines, Coal and Mining applications.
- Switches in Elevators.
- Bathrooms and Swimming pool appliances.
- Automotive appliances.
- Outdoor Equipments.
- Public access systems.
- Speed and voltage regulators.
- Petrol and Oil Dispensary Machines.
- Biomedical Equipments.
- Anywhere we find a mechanical switch and keyboard.
Technical Support:

Free support is available at research@keetronics.com. Resources include general and technical discussion, keyboard design such as selection of proper dimensions, graphic design and implementation of output features in the keyboard; and assistance in interfacing driver development.

As keyboard can be interfaced in various ways to the main application, based on the output format taken in design. So assistance in available in terms of the driver flowcharts, firmware development in implementation of the keyboard driver in the main application.

Technical Data:

- **Regulated Input Voltage**: 2.4V to 5.25V (DC) (Selective by keyboard design requirement)
- **Output Voltage**: 2.4V to 5.25V (DC)
- **Supply Current**: 7mA (Vin = 5V, and with no optional feature implemented)
- **Over Voltage and Over Current Protection**: Regulates output voltage to 5.25 V for input voltage upto 20 V DC and current upto 1.3 A. After that tripping takes place. Automatic recovery on power off and reset.
- **Operating Temperature**: - 40°C to + 85°C
- **Overlay Materials Supported**: Polyester, Glass, Acrylic, Wood, Polycarbonate and PET Film.
- **Overlay Thickness**: 0.5mm To 15mm
- **Keyboard Base**: 1. PCB  2. PCF
- **Output Format From Keyboard**:
  1. Matrix output in terms of scan and return lines:
     1. Active low
     2. Active high
  2. Dedicated output for each key/button:
     1. Active low
     2. Active high
  3. **Note: In this case No. of output lines is equal to the no. of keys.**
  4. In terms of communication protocol:
     1. UART
     2. I2C
     3. SPI
- **25 mA Sink and 10 mA drive on all keyboard output lines.**
Design Guide

**Important considerations for Keyboard design:**

- Sensitivity depends on size, large key area will have better sensitivity.
- Larger the gap between the key footprint and ground fill, larger the sensitivity.
- Overlay thickness and key sensitivity are inversely proportional.
- For better results, overlay with 5 mm thickness is recommended. As the thickness of overlay increases the sensitivity decreases.
- Shapes of the buttons (footprint) is recommended as round or square, other shapes should be avoided.
- Minimum Button diameter should be at least 5mm.
- LED backlighting is possible by removing the conductive part in the center from the sensor pad.
- Sensing pads the controller should be nearer to each other.
- Trace length: Trace length or the distance between the controller and the sensor pad is max. 230mm (23cm) for sliders and 300mm(30cm) for the button. These extreme conditions requires large sensing pad.
- Good recommended trace / track width is 0.17mm to 0.20mm.
- Board Thickness: FR4 based designs are found to perform well with standard board thickness ranging from 0.5mm to 1.6mm.
- Ground Fill : Ground fills or conductive net connected to ground are recommended to be added on both side of the PCB. Typical hatching for the ground fill on the top layer is 15% (7mils line and 45mils spacing), and 10% on the bottom layer (7mils line 70 mils spacing).
- In case of sliders min. 5 slider segments are recommended to use.