4-bit Microcontroller

ESD Prevention Mechanism
for PCB & Layout

Application Note

**Tenx reserves the right to change or
discontinue this product without notice.**

tenx technology inc.

tenx technology, inc.
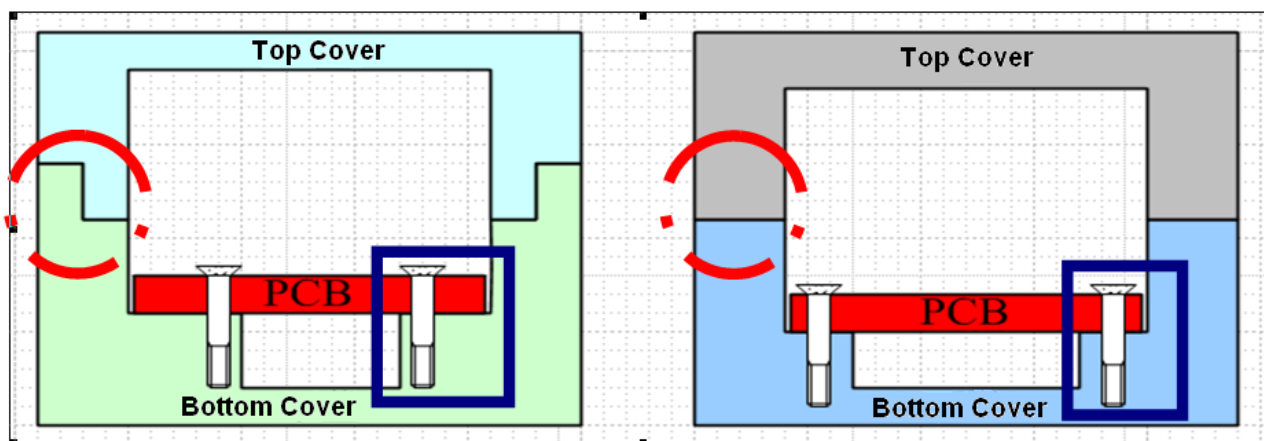
INDEX

PRODUCT NAME

4 Bit Microcontroller

TITLE
ESD Prevention Mechanism for PCB & Layout

APPLICATION NOTE
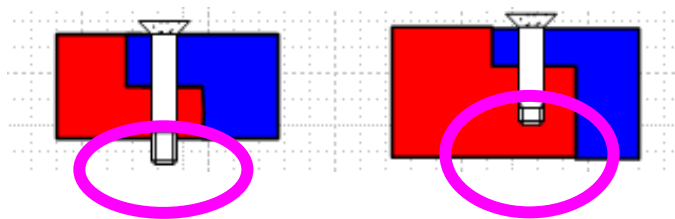
1. Design Suggestion for ESD Prevention Mechanism

(A)   When designing the plastic housing, it is recommended to utilize hand-shaking connection method for any two connection areas, such as top and bottom covers as well as battery lid, etc. (as the red circle in **Fig. A**)；and the planar type of connection method should be avoided (As the red circle in **Fig. B**). As the static electricity is a type of linear penetration conduction, thus a gap shown at connection section in Fig. B may cause ESD transient impact on the internal circuitry directly; yet the internal circuitry is relatively difficult to be affected by ESD transient as shown in Fig**. A**.

(B)   Since the fittings among the PCB and the housings are mostly of conductive screws, the mounting position for these screws or any conductive material fixed on the PCB should be arranged carefully to keep away from the ESD conduction path. (as the blue frames in **Figure. A** and **B**) so as to decrease the ESD interference.
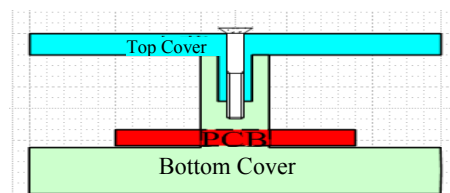

(Fig. A)   (Fig.B)

(C)   Avoid any object (e.g. screw) penetrating through the housing directly. If the penetrating object is conductive, then the ESD transient will be conducted into the internal circuitry (as shown in **Fig C**) through such conductor or via the gap between such penetrating object and the housing so that affect the normal operation of the circuitry. If it is impossible to prevent such objects from penetrating, please use the non-conducting materials or wrap these screws up (as shown in **Fig. E**)

tenx technology, inc.

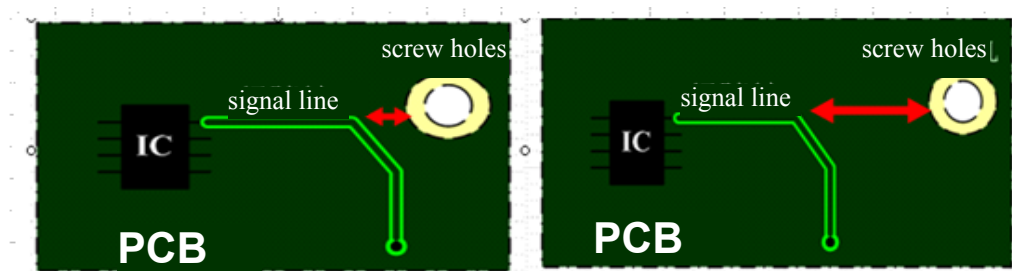| **(Fig. C)** | **(Fig. D)** | **(Fig. E)** |
| Penetrating the housing | Non-penetrating the housing | |

(C)   Generally, a function-selecting plastic button will be installed on the housing. It is suggested widening the bottom area of plastic button (as shown in Fig. F) which should be made of non-conducting materials. In this way, it will minimize the possibility of conducting ESD transient into the internal circuitry from the gap between the button and the housing that may cause malfunctioning.

(Fig. F)

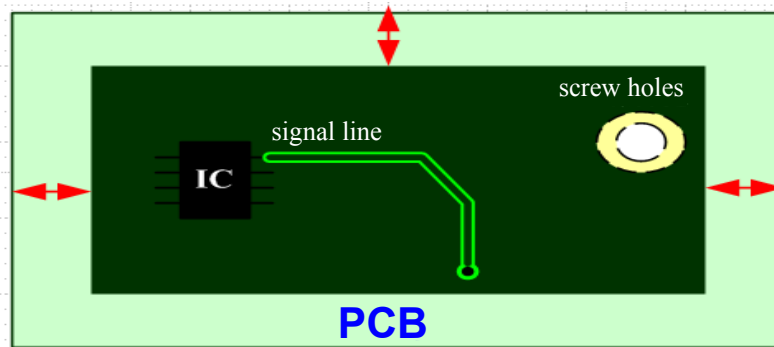## 2. Design Suggestion for ESD Prevention in the PCB Layout

(A)   Generally, the screw holes are reserved on the PCB for securing the housing. However, it will make the ESD transient easily to be conducted to the signal line through the screw, and then result in malfunctioning. Thus, if feasible, keep the signal line away from the screw hole (as shown in **Fig. G**). The actual spacing is not fixed, it should be determined by the various factors such as the housing type, the position for device placement, the application environment and the intensity of ESD…,etc. It is certain that if the ESD transient is conducted from the screw, the situation can be improved by keeping the signal line away from the screw hole.
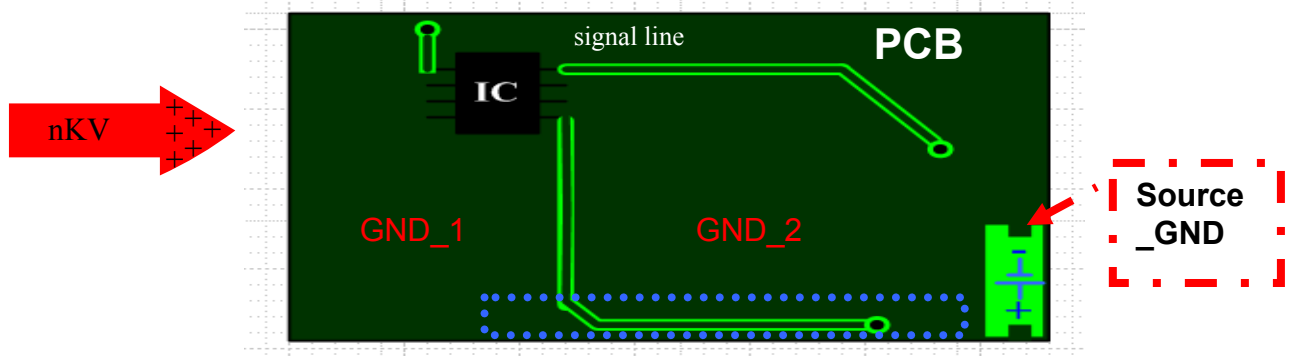

(Fig. G)

tenx technology, inc.

(B)   If possible, reserve some small area along the four sides of PCB wherein without plated copper and any signal line paving (as light-green block in **Fig. H**).

Because malfunctioning is probably resulted from the ESD transient conduction due to the vertical coupling, horizontal coupling, or the conduction from the board edge of the PCB. So try to reserve the said area size as large as possible. Such design can make an improvement when the ESD transient is conducted from the board edge.
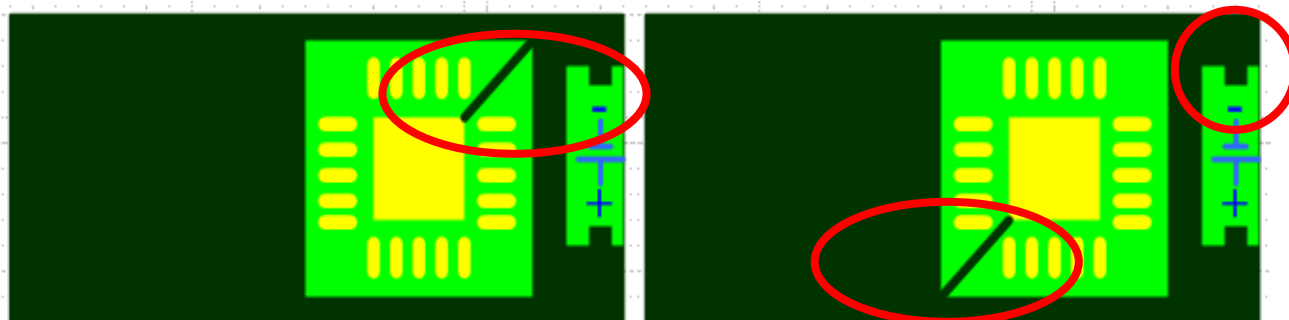

(Fig. H)

(C)   When drawing PCB Layout, avoid separating the GND Layer into a too small connected segment by reason of routing for the signal line, where is connected between the GND of a certain block and that of power source or that of other blocks. (As shown in **Fig I** below).

(D)   For example, if the large ESD noise is conducted from the left-side, the connected area where can connect the GND_1 Block with the right-side GND_2 is quite small as a zone to endure the ESD transient discharge current. This will cause the ESD noise being conducted to the nearby signal lines due to the ESD noise bouncing widely on the circuitry, and then the malfunctioning occurs.
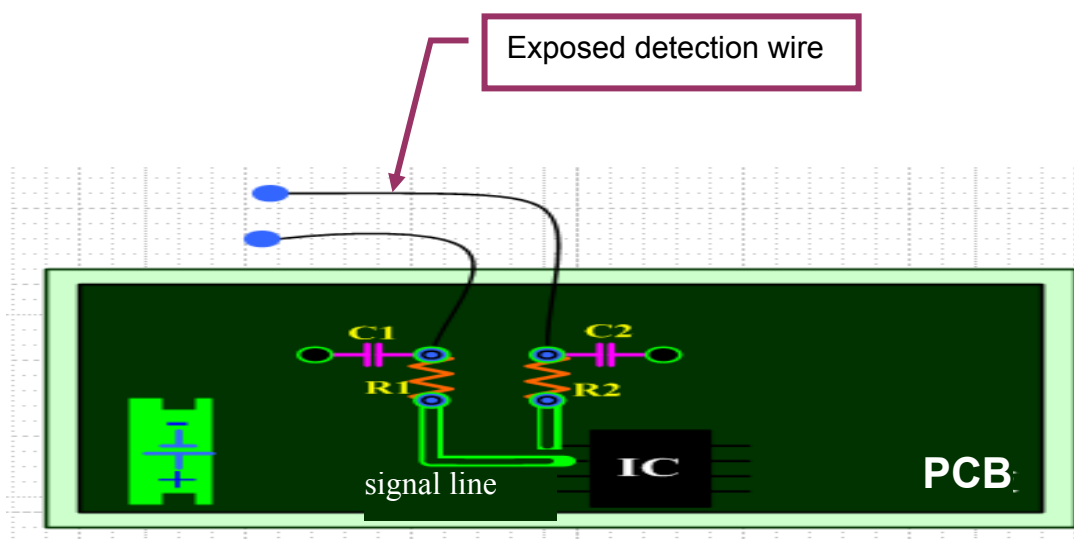

(Fig. I)

(D)   Don't neglect to connect the IC Substrate to GND. If possible, please connect the GND near the power input as it is helpful for discharging the ESD charge to GND on the IC chip. On the other hand, the electrical potential of GND will be more close to the zero potential of such PCB if the GND is near the power source more. In this way, the possibility of malfunctioning on IC chip would be minimized (shown in **Fig. J**).

tenx technology, inc.

(Fig. J)

(E)   When connecting the external detection wire of product (e.g. speedometer), if the detecting point of said exposed detection wire is made of bare metal without any protection object, please add a grounding capacitor at the connecting end of each detection wire and of PCB. In addition, add a resistor with serial connection between the detection wire and the signal line as well to prevent the noise from such conduction path into the circuitry on the PC board where malfunctioning may occur. Notice that it must be considered the effect of the additional resistor and capacitor on the testing environment in order to improve the detection accuracy.

(Fig. K)

(F)   Regardless of being used or not, please reserve a Reset_PIN on PCB and bound this pin to the Reset PAD of the chip. In this way, even though the IC chip is interfered seriously, it can still be reset by the Reset_PIN. Without the Reset_PIN function, there would be no chance to reset the IC at all, and then the IC function will fail and not work.

tenx technology, inc.