

Application for Using Center-off Switch with Spring Action

Description: When using the center-off switch with spring action as the trigger, please follow the solutions to avoid or reduce unexpected negative voltage noise on IC pins, causing functional abnormalities.

Reason: The input voltage withstands specifications of ICs are different based on the part number, processes, and designs. Take the NY5Q series as an example (Table 1) if VSS is 0V, the maximum input negative voltage is -0.3V, it might cause IC functional abnormalities as the input voltage exceeds the specification voltage.

Because of the feature of the center-off switch with spring action, when the shrapnel is pushed (shown as Figure 2), it easily caused negative voltage noise on the connected I/O pins (shown as Figure 3). In the normal situation, the noise can easily exceed the IC's tolerance specifications, but due to its short duration and low power, it usually does not cause abnormal IC function.

If the switch needs to be connected with a capacitor for application, the capacitor will amplify the noise's energy, generating long-term negative voltage noise (Figure 4) that exceeds the tolerance of the IC specification and causes IC function abnormalities.

Symbol	Parameter	Rated Value	Unit
Vdd - Vss	Supply voltage	-0.5 ~ +6.0	V
Vin	Input voltage	Vss-0.3V ~ Vdd+0.3	V
Top	Operating Temperature	-20 ~ +70 (*)	°C
Tst	Storage Temperature	-40 ~ +125 (**)	°C

Figure 1: The voltage specification of NY5Q series

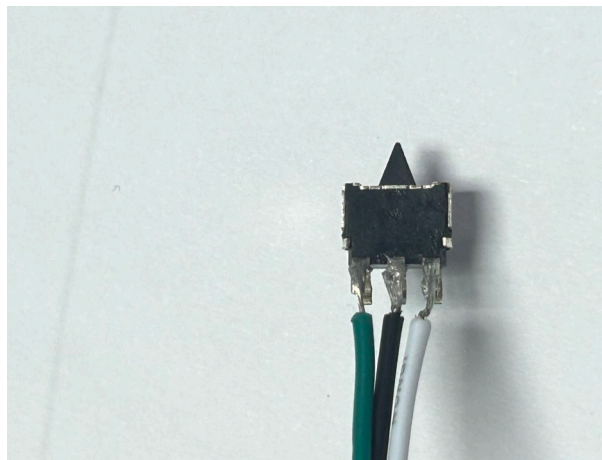


Figure 2: The common center-off switch with spring action.

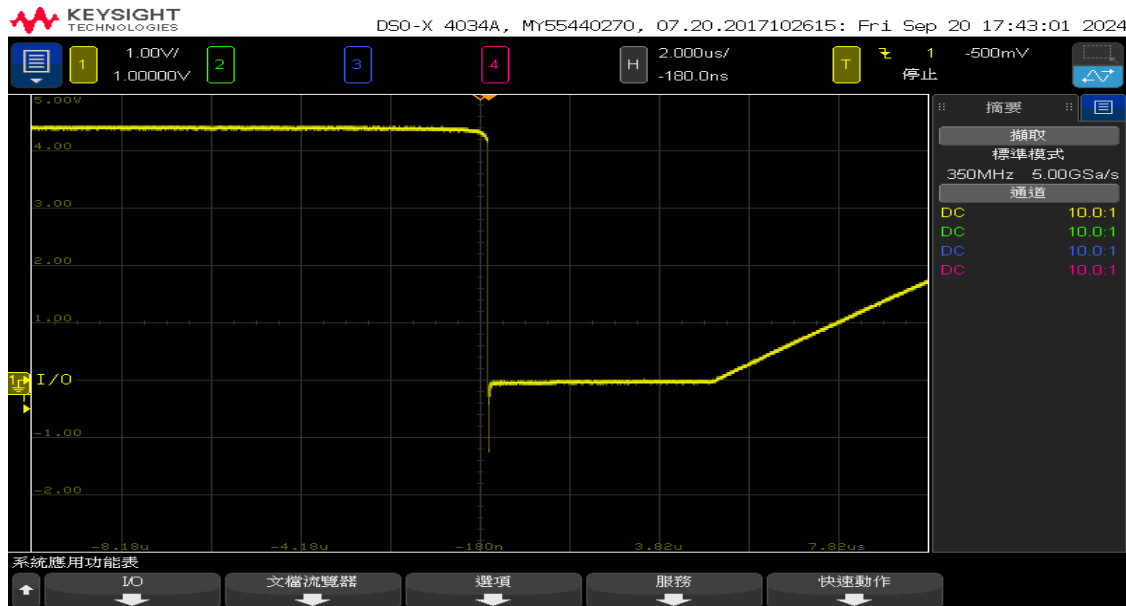


Figure 3: The negative voltage noise generated by the pushed spring (without capacitance)

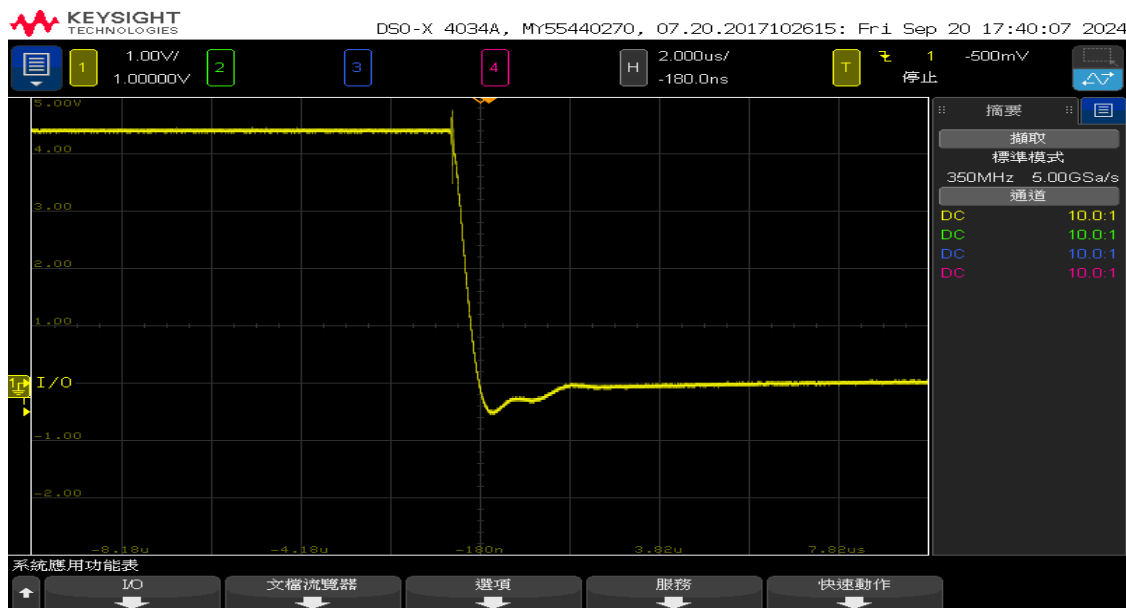


Figure 4: The negative voltage noise generated by the pushed spring (connected with 0.1uF capacitance)

Solution: Nyquest provides the following solutions to reduce the noise strength and avoid the exceeded negative voltage causing IC abnormal function.

1. Remove the capacitor from the switch to avoid amplifying the noise strength.
2. If the switch must be connected with a capacitor for the application, user can effectively reduce noise strength by decreasing the capacitor value. The capacitor value is decided through the wire length and the quality of the switch.
3. Shorten the length of connecting wire to reduce its energy.
4. The resistor series connection between the switch and the capacitor (Figure 5), the higher resistor

value, the better effect. This solution will cause partial voltage because of the resistor and the pull-up resistor of the pin which leads to the pin voltage cannot reach the threshold status. Please adjust the resistor value by the actual conditions.

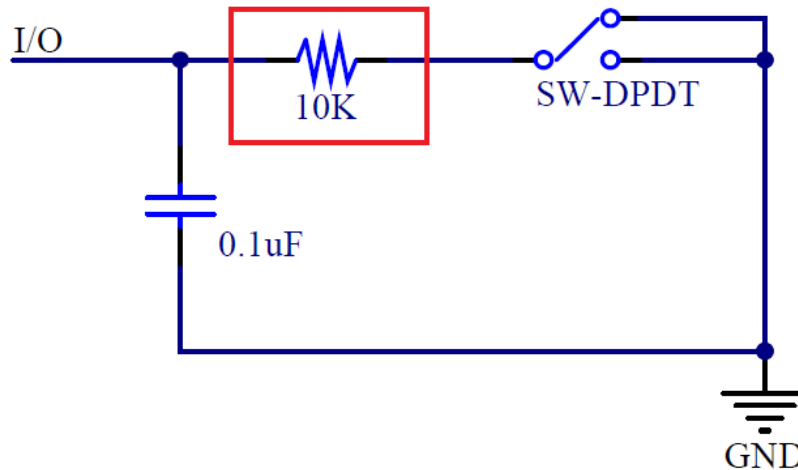


Figure 5: I/O and the resistor series connection diagram

Notice:

1. There are some slightly different input voltage withstand specifications for ICs based on the part number, processes, designs, and production batch. Please follow the input voltage specifications to make sure ICs function well.
2. The center-off switch with spring action is only a common example. Other switches with similar features may also produce noise that exceeds the specifications. Attention should be paid when using the application