

I/O Setting @ Mode Switch

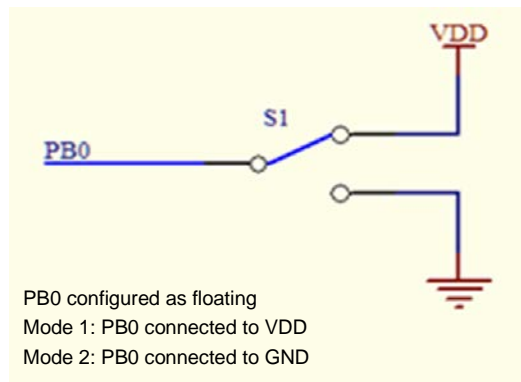
Higher standby current (I_{sb}) at sleep mode is often encountered, when I/O pins are used for bonding option, or as a slide switch to choose different operating modes. This is because of the internal pull-up resistor being connected to GND, so that leakage current flows from VDD via the pull-up resistor to GND. Therefore, we suggest users to switch I/O pins to Output state via programming to avoid such I_{sb} leakage problem. Take Q-Code programming with the following two examples for reference.

Please be noted that the bonding option, slide switch and corresponding I/O pins used in the examples are not necessarily the same as used actual products. Engineers should make necessary modifications per application needs. Moreover, the following examples read only once of the I/O status for condition judgement. For actual applications, please consider to increase the READ times of I/O status, and then execute subsequent program flow only after multiple readings yield the same result.

Example 1: Use PB0 as bonding option or slide switch. Read PB0 status after power up to choose or switch to required operating mode. Suggest realizing it via the following two approaches.

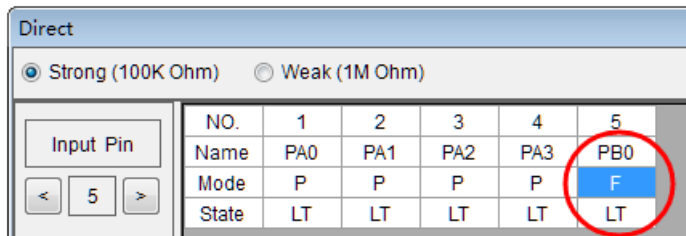
Approach 1: Set PB0 as Input Floating. Operate in Mode1 if PB0 connected to VDD; otherwise, operate in Mode2 if PB0 is connected to GND.

Reference Circuit:



Program Setting:

Step1: Set PB0 as Input Floating.



Step2: Read once of PB0 status after power up, choose or switch to the operating mode accordingly.

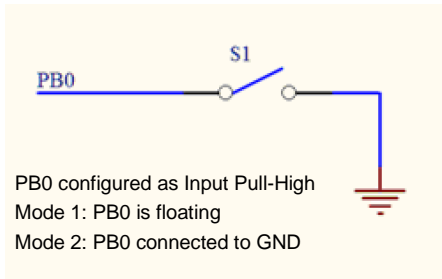
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PowerOn:
    Delay(10ms),
    PB.0 = 1?L_Mode_1, ;Read PB0 for operating mode
    L_Mode_2
L_Mode_1:
    .
    .
    .
L_Mode_2:
    .
    .
    .
    
```

Note: Since PB0 is configured as Input Floating, PB0 must be bonded to either VDD or GND to avoid abnormal operation of IC.

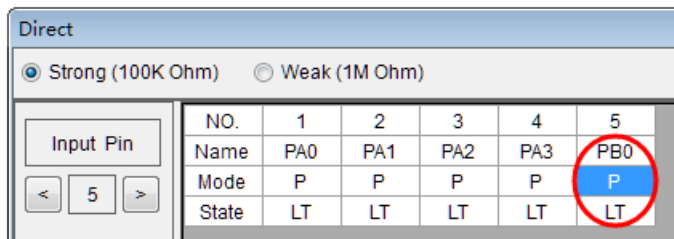
Approach 2: Configure PB0 as Input Pull-High. Operate in Mode1 when PB0 is kept floating at outside (no need to bond this wire if product is to operate in this mode). If PB0 is connected to GND, then operate in Mode2.

Reference Circuit:



Program Setting:

Step1: Configure PB0 as Input Pull-High.



Step2: Read once of PB0 status after power up, choose or switch to the operating mode accordingly then switch PB0 to Output. (PB0 is switched to output High when it is floating; while PB0 is switched to output Low when PB0 is connected to GND.)

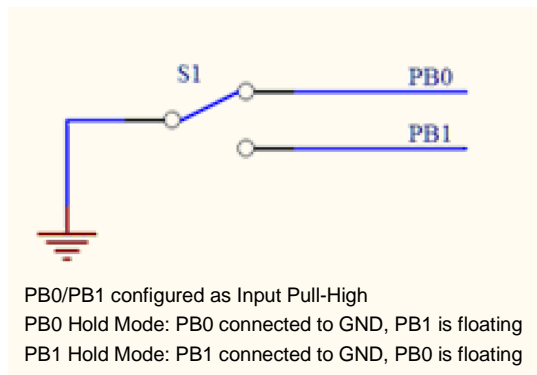
```

PowerOn:
    Delay(10ms),
    PB.0 = 1?L_Mode_1, ;Read PB0 for operating mode
    L_Mode_2
L_Mode_1:
    PB.0 = 1, ; PB0 floating, PB0 output High
    PBM.0 = 0, ; Set PB0 to Output mode
    .
    .
    .
L_Mode_2:
    PB.0 = 0, ; Bonding to GND, PB0 output Low
    PBM.0 = 0, ; Set PB0 to Output mode
    .
    .
    .
    
```

Note: Since PB0 has been set as Input Pull-High, it must be switched to Output Low before IC enters sleep mode if PB0 is connected to GND. Otherwise, it would cause current leakage via internal pull-high resistor.

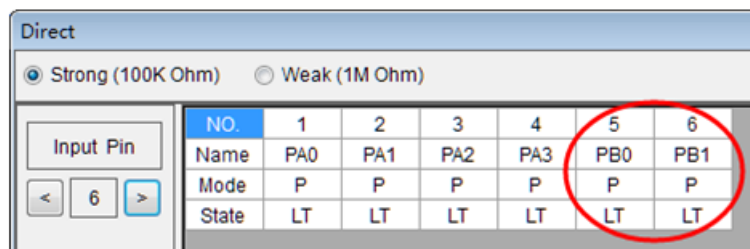
Example 2: PB0/PB1 is connected to a slide switch with common node to GND. Read PB0 / PB1 status per application after power up to choose or switch to the required operating mode.

Reference Circuit:



Program Setting:

Step1: Configure PB0/PB1 as input Pull-High.



Step2: Write the program code per application need regarding slide switch functions. (Read the operating mode in the program, or use Input State of Q-Code program to set the key input mode and execute corresponding key path when slide switch changes.)

Step3: Before IC enters sleep mode, switch the I/O pins of slide switch that are connected to GND into Output Low; while keeping the other floating I/O pin as Input Pull-High. In this way, the Isb leakage current could be avoided, while normal slide switch operation (wake-up IC when slide switch changed, or corresponding features of the basic slide switch) is not affected.

```

Sleep:
    Switch(PB[x x d d]) = [ x,L_PB1_Hold,L_PB0_Hold,x ]
                        ; Read PB0/PB1 level

L_PB1_Hold:
    PB.1 = 0,           ; PB1 output Low
    PBM.1 = 0          ; Set PB1 to Output mode

L_PB0_Hold:
    PB.0 = 0,           ; PB0 output Low
    PBM.0 = 0          ; Set PB0 to Output mode
    
```

Step4: Switch PB0/PB1 to Input Pull-High immediately when IC is waken-up.

```

WakeUp:
    PBM.0 = 1,         ; Set PB0 to Input mode
    PBM.1 = 1         ; Set PB1 to Input mode
    
```

Note: Since PB0 has been set as Input Pull-High, those I/O pins that are connected to GND via slide switch must be changed to Output Low before IC enters sleep mode. Otherwise, it would cause current leakage via internal pull-high resistor. The other floating I/O pin should remain as Input Pull-High, and PB0/PB1 must be switched to Input Pull-High right after IC is waken up. Otherwise, you will not be able to choose / switch to required operating mode.