



SIMPLE RESET CIRCUITS FOR THE ST6

by Microcontroller Application Team

1 INTRODUCTION

When powering up any microcontroller, before the power supply voltage reaches its final state, it goes through voltage ranges, where the device is not guaranteed to operate. Since some device's cells will start operating at voltage levels lower than others, the device may power-up in an unknown state. To guarantee that the device starts up in a known state, it is necessary to control the reset phase. This can be achieved using either external reset circuitry or in ST6 revision C devices, using the internal Low Voltage Detector (LVD) and with the reset pin left unconnected.

The first part of this application note describes low-cost reset circuits for ST6 microcontrollers. These circuits range from a very simple solution, which is only effective during power-up, to a circuit providing power-up and power-down monitoring with a delay at power-on. When used with the watchdog timer and by implementing some software, an efficient and reliable reset of the ST6 can be implemented.

The second part of this note presents a program which makes use of the ST6 microcontroller watchdog to prevent malfunctioning that could be caused by a bad or noisy reset input signal.

2 HARDWARE IMPLEMENTATIONS

2.1 EXTERNAL POWER-ON RESET

The Figures 1 & 2 present simple circuits which only provide power-on reset. They use an external RC to generate the reset pulse. The time constant of the RC should be long enough to guarantee that the reset pulse is still present until V_{DD} reaches $V_{DD\ min}$.

These two circuits however, do not protect against brown-out situations where power does not drop to zero, but merely dips below $V_{DD\ min}$. In such situations, voltage at **RESET** pin will not go low enough to guarantee a reset pulse.

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Figure 1. Simple power-on reset circuit

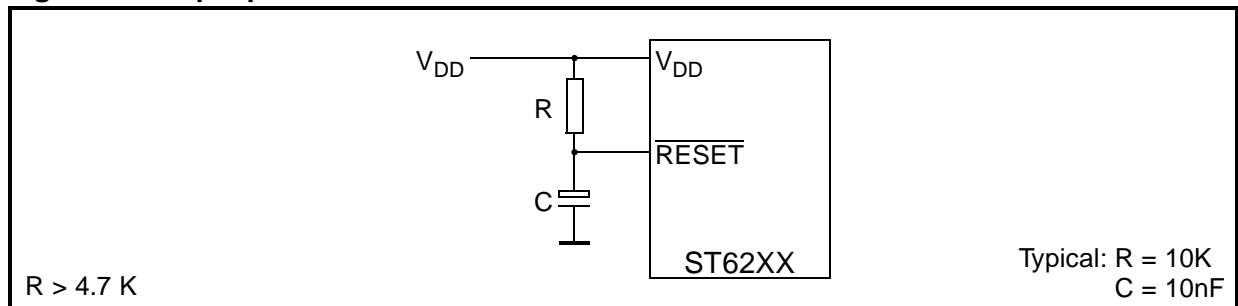
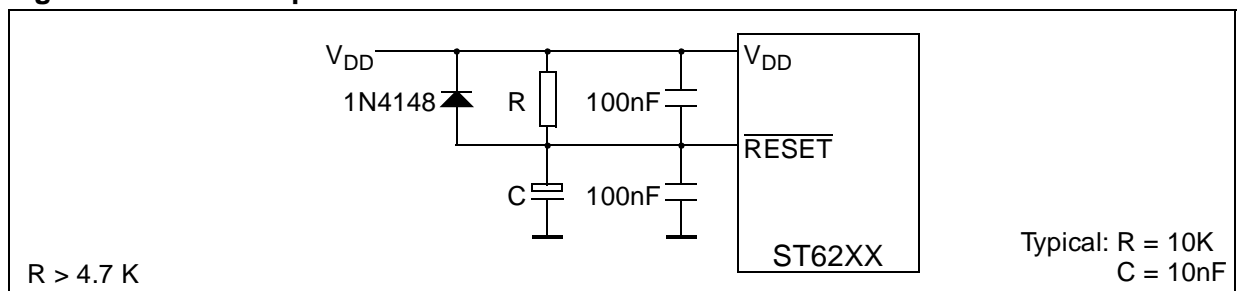


Figure 2 presents an advanced power-on reset. The 1N4148 diode is used to rapidly discharge the C capacitor on power-down. This is very important as a power-up reset pulse is needed after a short power-down (less than the time constant of RC) or after a power spike. Due to the internal structure of the ST6 I/O port, the external 1N4148 diode is not mandatory. The two 100nF capacitors allow the reset pin level to follow voltage variations that appear on either V_{DD} or ground.

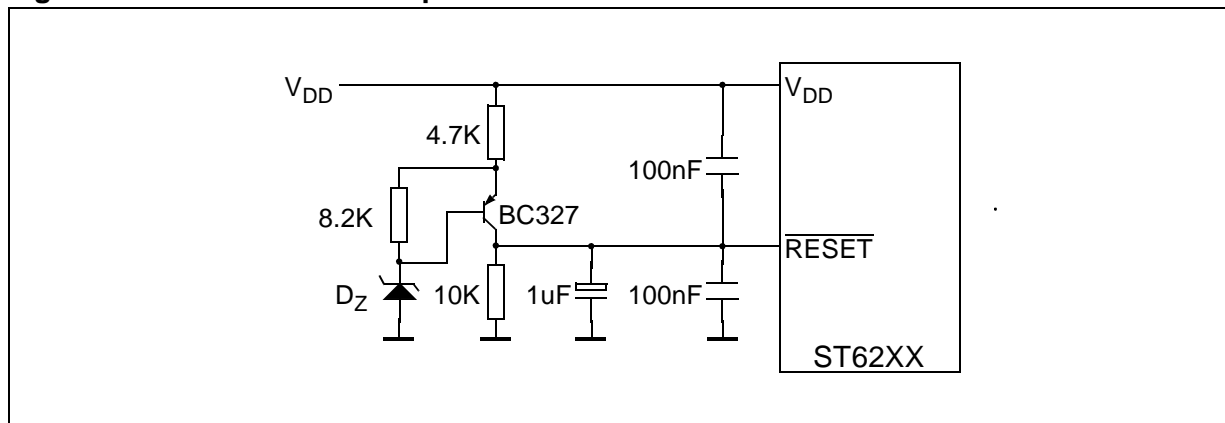
Figure 2. Advanced power-on reset circuit



2.2 BROWN-OUT PROTECTION

In many applications, it is necessary to guarantee a reset pulse whenever V_{DD} is less than $V_{DD\ min}$. This can be achieved using a brown-out protection circuit such as the one described in Figure 3. This simple circuit causes a reset whenever V_{DD} drops below the zener diode voltage plus the V_{BE} .

Figure 3. External brown-out protection circuit



3 SOFTWARE IMPLEMENTATION

To prevent a loss of functionality caused by a bad or noisy reset input, a software loop lasting approximately 20ms can be implemented immediately after the reset. In this loop, within the first few instructions, the Watchdog Timer is activated with a short time-out delay.

If, during this loop, the ST6 program hangs up due to an incorrect reset, the watchdog will time-out and generate a new reset signal. This will continue until the program correctly exits the delay loop.

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Reset routine example:

```
<Software>
start      ldi    wdt, 10000011b      ; start watchdog for 384uS
           ldi    count, 0

n1         ldi    wdt, 10000011b
           ldi    a, 0

n2         inc    a                    ; 19 x 16.25uS = 338uS
           cpi    a, 19
           jrc    n2

           inc    count
           ld     a, count
           cpi    a, 59                ; 59 x 338us = 19.9mS
           jrc    n1

; program starts here
; CAUTION, watchdog is now activated forever

           ldi    wdt, 11111111b      ; reload the watchdog counter
           ...
           ...
           ...
           ldi    wdt, 11111111b      ; reload the watchdog counter
           ...
           ...
           ...
           ldi    wdt, 11111111b      ; reload the watchdog counter
           ...
           ...
           ...
```

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