AN258

EP93xx Power-up and Reset Lockup Workaround

1. Introduction

Under certain circumstances, the EP93xx may enter into a “locked” condition on power up, when a software reset is issued, or when an internal watchdog reset is issued. This application note provides a low-cost workaround which will provide reliable power up and reset operation by adding a few readily-available components. A fix of this issue is planned in a future revision of the silicon.

When new silicon becomes available, applications that employ this workaround should not have to be re-designed. Customers could use the same board design and simply not populate the additional components except a single zero-ohm resistor.

2. Workaround

The workaround circuits take advantage of the one thing that locked conditions have in common: the red LED stays illuminated. The basic idea of the circuits is to detect the red LED staying on for a period of time and then to issue a manual reset to the voltage monitor IC that drives POR after an appropriate amount of time has elapsed.

These hardware workarounds will detect this locked condition and restart the EP93xx device. It requires a few passive devices and either a Schmitt-trigger inverter or a good-quality 2-input NAND with Schmitt trigger. A simplified schematic of each of the proposed circuits is shown in Figure 1 and Figure 2.

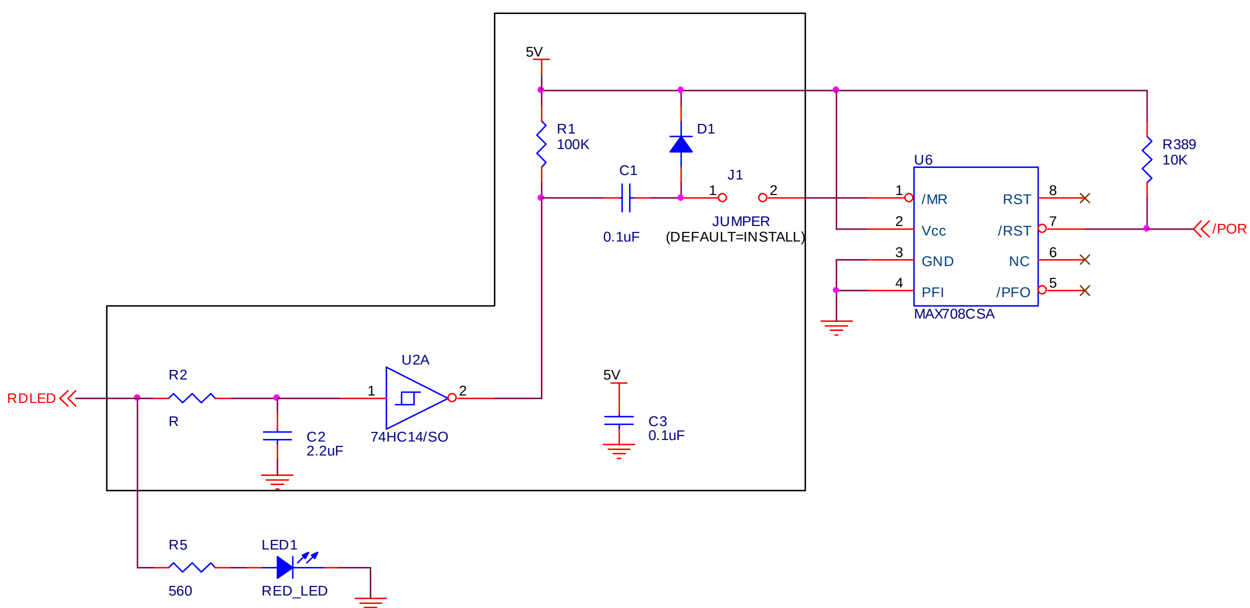

Figure 1. Proposed Reset Circuit 1

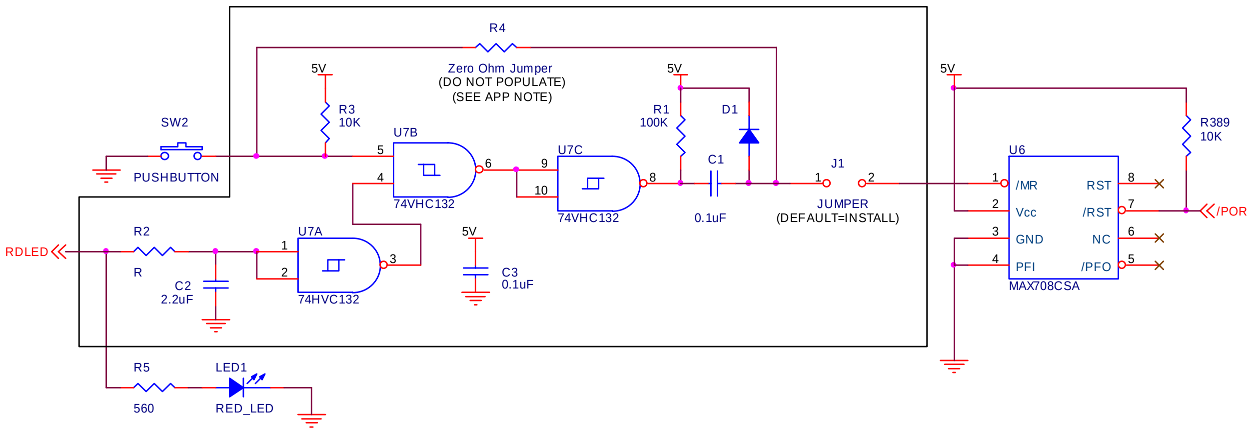

Figure 2. Proposed Reset Circuit 2

3. Reset Circuit Overview

The circuits shown in Figure 1 and Figure 2 are proposed circuits to keep the EP93xx device from being held in the locked state on power up or when a software reset or watchdog reset is issued. There may be other circuits that can achieve the same function. Readers are encouraged to read the *Reset Circuit Operation* section.

Each of these circuits closely resemble the reset circuit already on the Cirrus Logic development boards. The components inside the L-shaped box augment the existing reset circuit to restart the board if a locked condition is detected. The devices outside the dashed box are components that already exist on the Cirrus Logic development boards. The use of the Max708 is not mandatory as other voltage monitor ICs may perform just as well.

The main difference between the two proposed circuits is that Circuit 2 incorporates the use of a pushbutton but Circuit 1 does not. A push button is not always needed and in those cases, Circuit 1 may be preferred.

4. Reset Circuit Operation

The workaround circuits take advantage of the one thing that locked conditions have in common: the red LED stays illuminated. The basic idea of the circuits is to detect the red LED staying on for a period of time and then issue a manual reset to the voltage monitor IC that drives POR after an appropriate amount of time period has elapsed.

IMPORTANT

These circuits put a restriction on the use of the red LED. If the customer application uses this LED for indication then the proposed circuit will issue a reset once the timeout period is reached, otherwise this workaround has no impact on the application. The red LED may still be used in customer applications, but it must not be left on continuously. It may be blinked quickly with sufficiently long periods of off time to discharge the circuit.

There are two basic parts to each of the circuits:

- An RC circuit driven by the red LED pin from the EP93xx device and a Schmitt-trigger inverter or the NAND package mentioned earlier.
- An RC circuit on the manual RESET pin on the voltage monitor IC that drives POR. An over-voltage diode may be necessary if the voltage monitor IC does not have internal protection.

The first part of the circuit is quite simple. A typical value for R2 would be 120 kΩ to 180 kΩ. This value will produce a timeout value of approximately 1 to 1.5 seconds. Meaning, if the red LED stays lit for 1 to 1.5 seconds then the circuit will issue a manual reset. This causes the voltage monitor IC to issue a POR and reboot the EP93xx device.

The value for R2 may be adjusted per the customer's application. Refer to Figure 3 for an oscilloscope view of the red LED RC circuit charging up and the output of the Schmitt-trigger inverter in Circuit 1. Channel 1 is the RC and channel 2 is the output of the Schmitt-trigger inverter. Figure 3 shows that the Schmitt-trigger inverter goes low once the RC reaches approximately 3V. The RC circuit will continue to charge after the POR reset is issued and the EP93xx boots correctly the next time. The red LED is turned off by the Boot ROM code if doing an internal boot. If an external boot is performed, it is up to the customer's software to turn off the red LED.

Depending on the voltage monitor IC used, diode D1 may or may not be required. The problem is that the voltage on C1 nearest the manual reset pin can reach up to 2*Vcc. If the voltage monitor IC does not have an internal protection device, then an external diode is needed to protect the manual reset pin input.

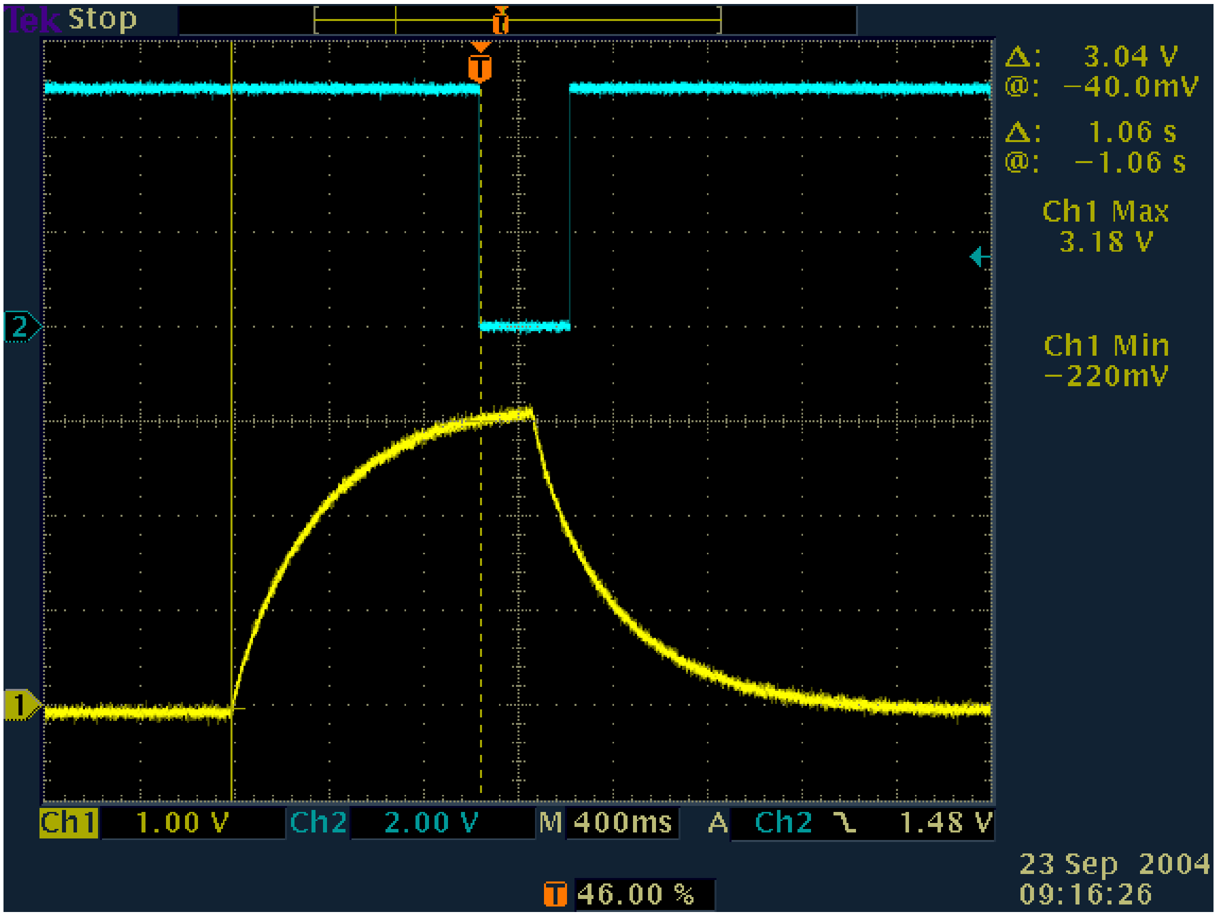

Figure 3. Oscilloscope View of the Red LED RC Circuit, R2 = 120 kΩ

The second part of the circuit causes a simulated manual reset button press to occur. The RC on the $\overline{MR}$ pin of the voltage monitor IC generates a pulse from the logic-zero level output of the Schmitt-trigger inverter. The generation of this pulse is very important. If the pulse is not present, the voltage monitor will continuously drive the POR signal and keep the EP93xx in reset, which keeps the first RC circuit charging and the red LED illuminated.

The operation of second part of the circuit relies on the fact that there is a pull-up resistor on the $\overline{MR}$ pin inside the voltage monitor IC. Refer to Figure 4 for an oscilloscope view of the RC circuit at the $\overline{MR}$ pin.

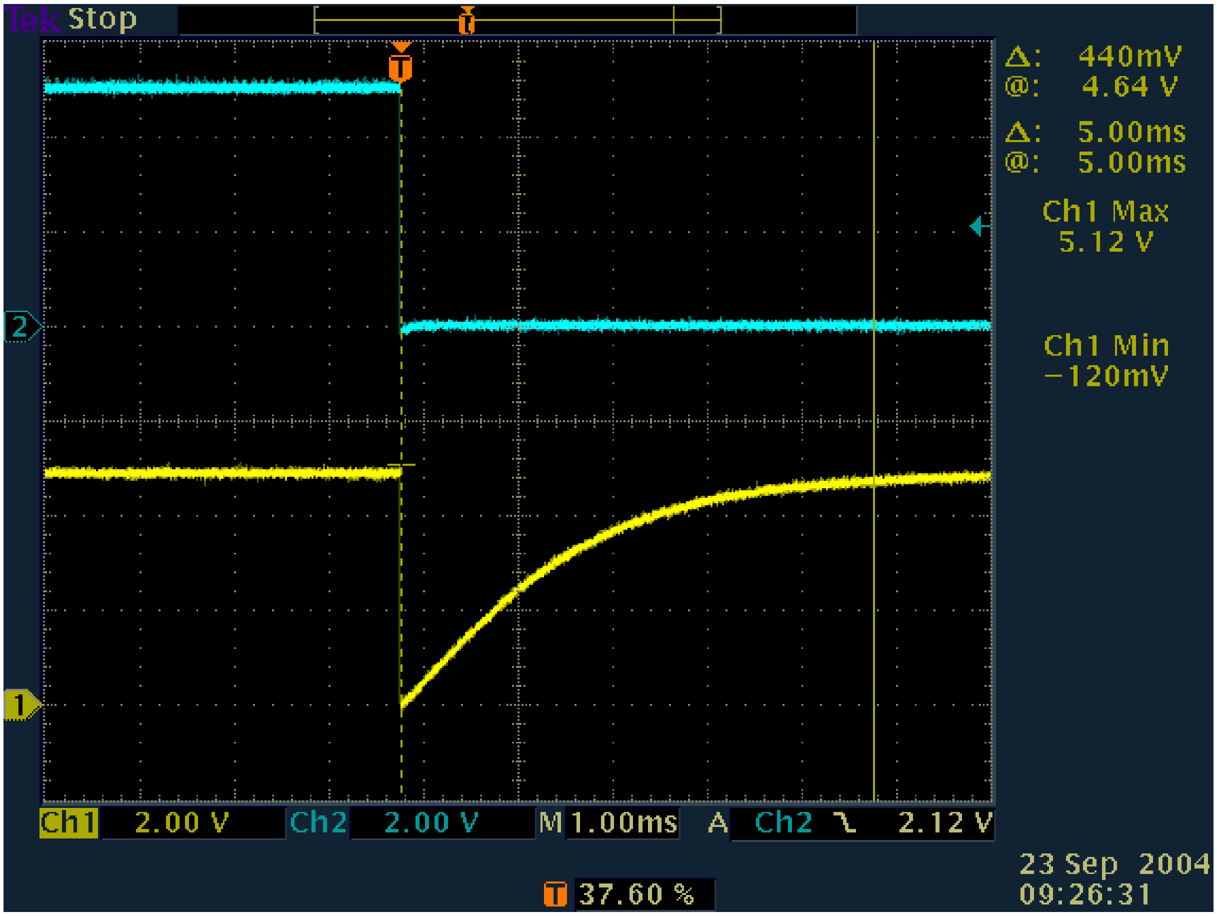

Figure 4. Oscilloscope View of the RC Circuit at the $\overline{MR}$ Pin

This figure shows channel 1, the output of the Schmitt-trigger inverter in Circuit 1, going low and staying low. Channel 2 shows the voltage at the $\overline{MR}$ pin of the voltage monitor IC. Initially, C1 is charged by R1 but once the Schmitt-trigger inverter goes low, it causes a logic zero on the $\overline{MR}$ pin. C1 then starts charging through the pull-up resistor inside the voltage monitor IC. This causes the critical pulse on the $\overline{MR}$ pin and keeps the voltage monitor IC from continually asserting a POR. The values for C1 and R1 and the pull up inside the voltage monitor IC are not critical but must form a long enough period to satisfy the minimum input duration on the $\overline{MR}$ pin. In the case of the MAX708, this value is 125 ns. Figure 4 indicates that this condition is easily satisfied.

In ciruit 2, resistor R4 should not be populated for normal operation. If circuit 2 is removed, location R4 must be populated with a zero-ohm resistor or solder short. R4 will connect the push button directly to the $\overline{MR}$ pin.

Jumper J1 is installed by default. If using a debugger, it may be desired to prevent the restart circuit from resetting the board. In that case, remove J1 for debugging.

Revision	Date	Changes
1	27 Sep 2004	Initial Release
2	30 Sep 2004	Added alternate circuit (Circuit 2).

Contacting Cirrus Logic Support

For all product questions and inquiries contact a Cirrus Logic Sales Representative.
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