AN1790
APPLICATION NOTE

How to Connect ST Reset Circuits to a Microprocessor

CONTENTS

This Application Note describes how to connect the STM809, STM810, STM811 and STM812 Reset Circuits to Microprocessor Systems.

Further information on Reset Circuits can be found in the STM809, STM810, STM811, STM812 datasheet on *www.st.com*.

INTRODUCTION

All digital systems require the power supply to be controlled during power-up and normal operations. Noise resulting from ground loops or switching many signals at once, can create glitches in the power supply which can cause the system to malfunction.

For this reason ST has developed a new type of low-power supervisory device, called Reset Circuits, specifically to monitor power supplies. The Reset Circuits, STM809, STM810, STM811, STM812, assert a reset signal whenever the power supply drops below a preset threshold value, and keep it asserted until the voltage rises above that threshold for a minimum period of time. The STM811 and STM812 also provide a push-button reset input signal ($\overline{MR}$).

RESET THRESHOLDS

The STM8xx Reset Circuit devices have different reset threshold levels. Table 1, lists the thresholds, V_{RST}, for each device and each temperature range.

When considering the threshold level required for an application, it is also necessary to consider the maximum transient duration, not causing a reset pulse, with respect to voltage threshold overdrive. A large transient voltage overdrive needs less time to generate the Reset pulse, than a small transient voltage overdrive, which needs much longer. Refer to the characterization graph shown in Figure 1.

Table 1. Reset Thresholds

Part	Temperature Range (°C)	V_{RST} (V)		
		Min	**Typ**	**Max**
STM8xxL	25	4.54	4.63	4.72
	-40 to 80	4.50		4.75
STM8xxM	25	4.30	4.38	4.46
	-40 to 80	4.25		4.50
STM8xxT	25	3.03	3.08	3.14
	-40 to 80	3.00		3.15
STM8xxS	25	2.88	2.93	2.98
	-40 to 80	2.85		3.00
STM8xxR	25	2.58	2.63	2.68
	-40 to 80	2.55		2.70

Figure 1. Max Transient Duration NOT Causing Reset Pulse vs. Reset Comparator Overdrive
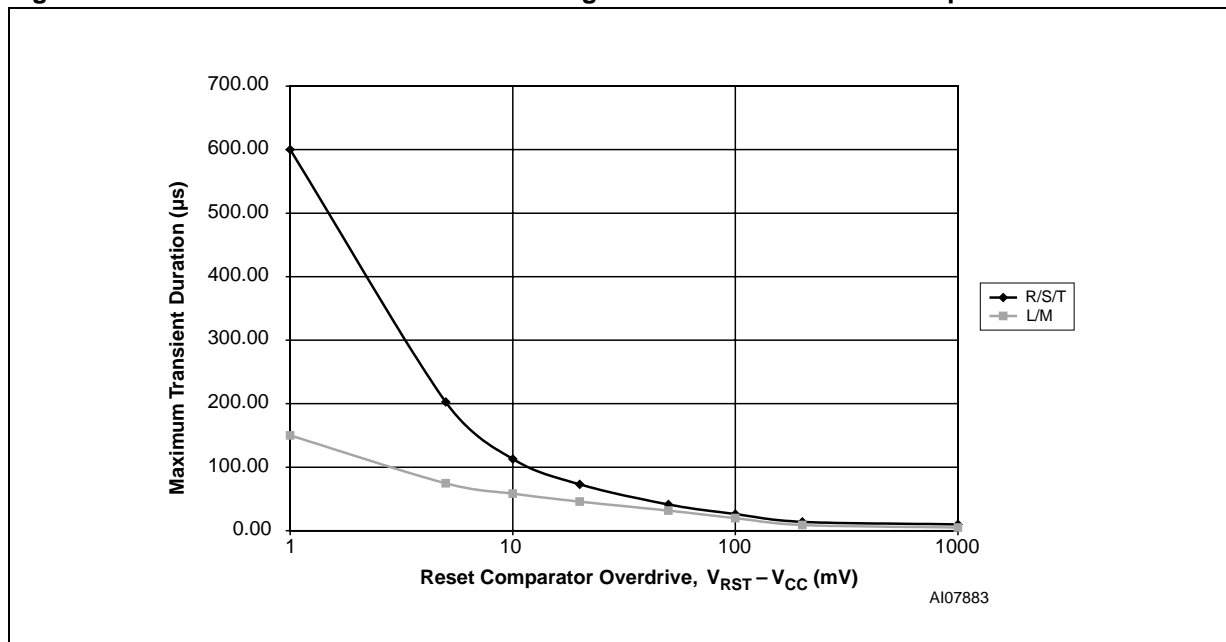
RESET OUTPUT

ST Reset Circuits feature a push-pull Reset output with the option of an active High (RST) or active Low (RST) output (see Figure 2 and Table 2). The push-pull output minimizes the external connections between the Reset Circuit and the microprocessor or other logic devices. It offers high speed, almost rail-to-rail response, and the capability to source or sink current.
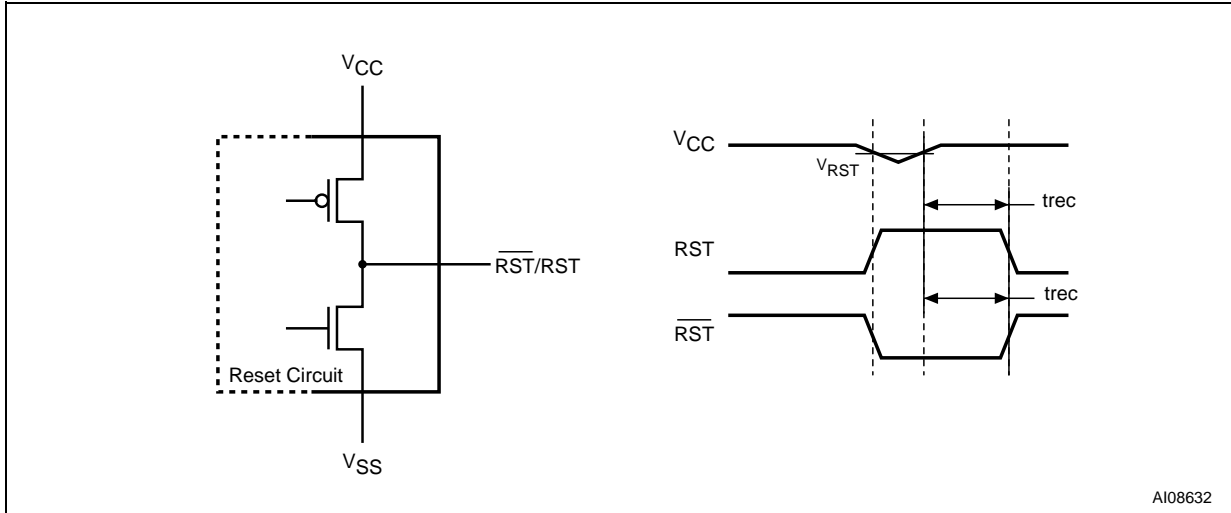
Figure 2. Reset Output

AI08632

Table 2. Device Options

| Part	Reset Output active	Manual Reset (MR)
STM809	Low	No
STM810	High	No
STM811	Low	Yes
STM812	High	Yes

MANUAL RESET INPUT

The STM811 and SMT812 devices feature a Manual Reset ($\overline{MR}$) input, which activates the Reset output for a predefined time, t_{rec}. The simplest way to use this feature is to connect a push-button between the $\overline{MR}$ and V_{SS} (ground), as shown in Figure 3.

The Manual Reset has an internal 20 kΩ pull-up resistor and a debounce circuit, which solves the problem of any noise generated by switching the push-button.

The timing diagram represented in Figure 4 shows how the Manual Reset input functions. When $\overline{MR}$ is driven Low, the Reset (RST or $\overline{RST}$) output becomes active after a delay of t_{MLRL}, and remains active during the time that $\overline{MR}$ is Low. When the switch is released, $\overline{MR}$ goes High (thanks to the internal pull-up resistor), but the Reset output remains active for a time of t_{rec}.
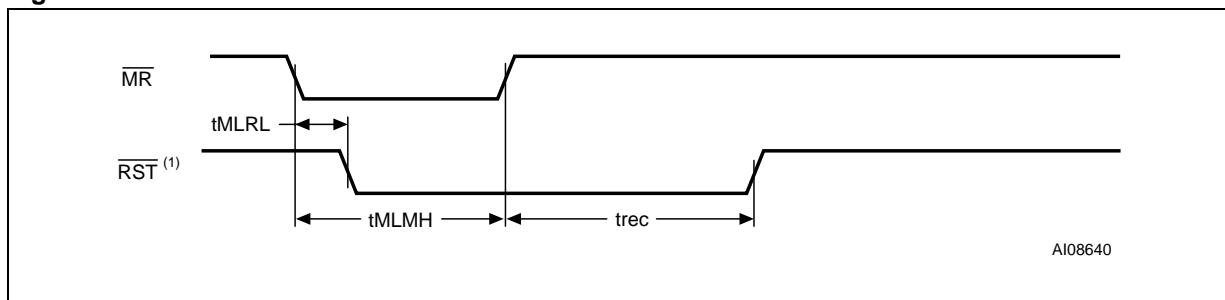
The minimum pulse width of the $\overline{MR}$ signal ($t_{MLMH(min)}$ = 10µs) must be taken into account in a design. If the $\overline{MR}$ pulse width is shorter than $t_{MLMH(min)}$, the RST/$\overline{RST}$ pulse generated is equal to the pulse width of $\overline{MR}$, which can lead to the system not functioning correctly.

Figure 3. Manual Reset Connection
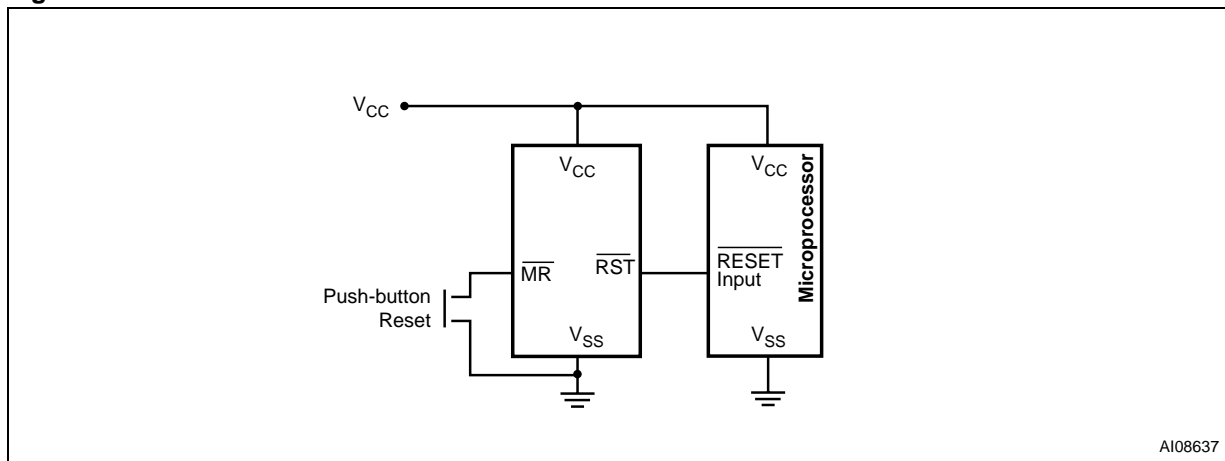
AI08637

Figure 4. Manual Reset Waveform

AI08640

Note: 1. RST for STM810/812
2. Refer to STM8xx datasheet for the timing values.

CONNECTING THE RESET CIRCUITS IN AN APPLICATION

The standard connection of the Reset devices is very simple, as normally no other circuits are required. The standard connections for the STM809, STM810, STM811 and STM812 are shown in Figure 5.

Figure 5. Standard Reset Device Connections
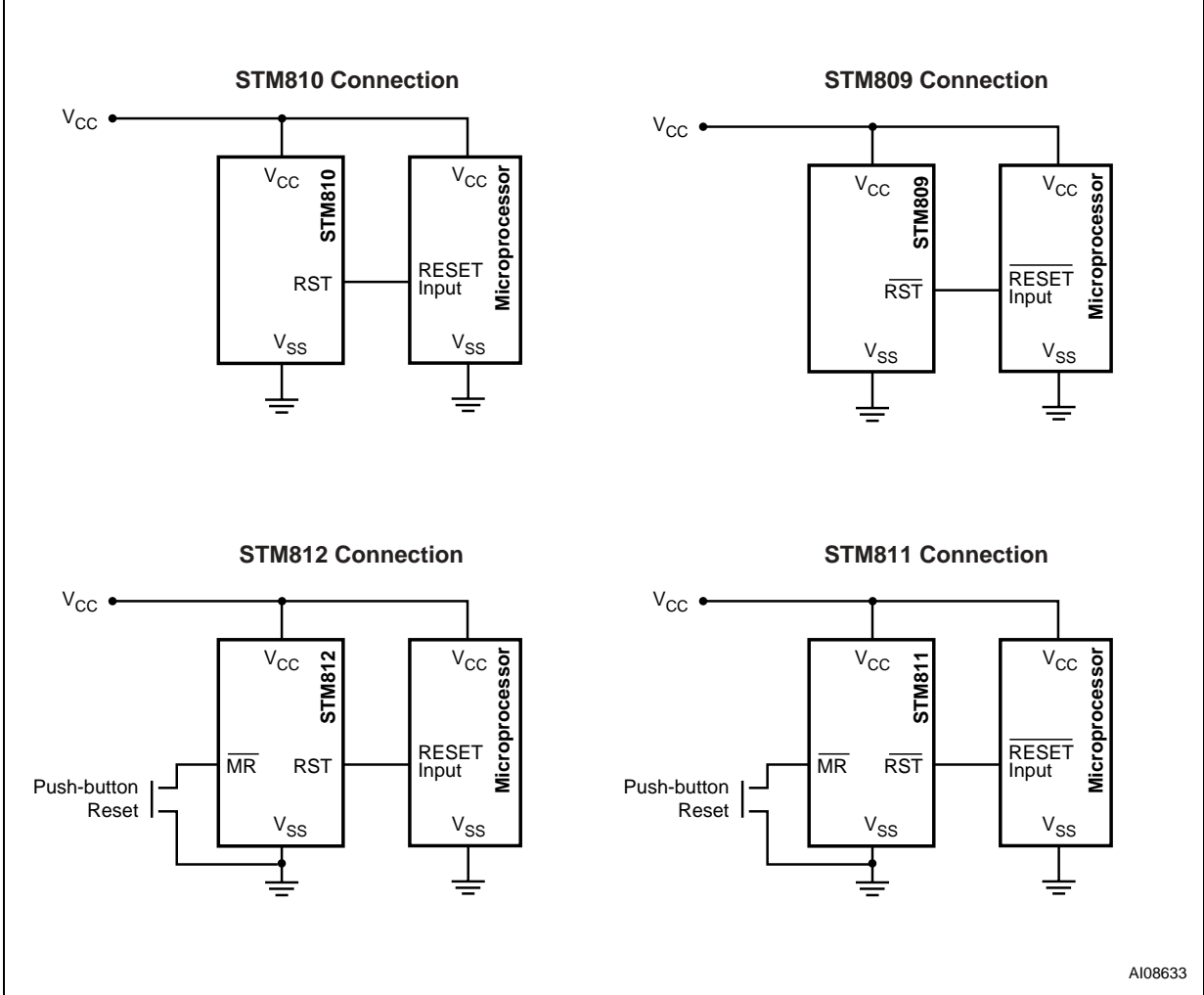
Connection in a Noisy Environment

The internal debounce circuit in the ST Reset devices is especially designed to remove any noise generated by switching the push-button at the Manual Reset input. However the internal debounce circuit may not be sufficient to filter external noise in extremely noisy environments, for example, long wires in a noisy environment or high speed buses near the Manual Reset input. In such cases, an external capacitor can be added to solve the problem (see Figure 6). The recommended value of the capacitor is 0.1µF.

**Figure 6. Reset Device Connection in a Noisy Environment**
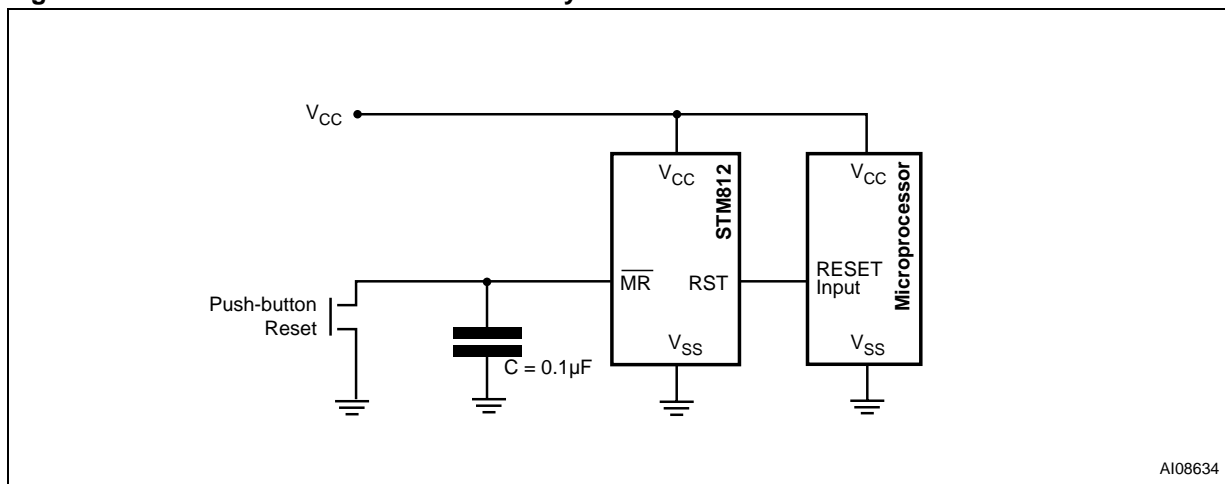
Connection to a Bi-directional Microprocessor Reset

Sometimes designers need to connect a Reset Circuit device to a microprocessor's bi-directional Reset input. In this case a resistor should be connected between the $\overline{RST}$ output and the microprocessor's $\overline{RESET}$ input. The value of the resistor should be high enough to limit the current when the microprocessor pulls down the $\overline{RESET}$ input and low enough to respond when $\overline{RST}$ goes low. The recommended value of the resistor is 4.7kΩ (see Figure 7).

**Figure 7. Reset Device Connection to a Bi-directional Microprocessor Reset**
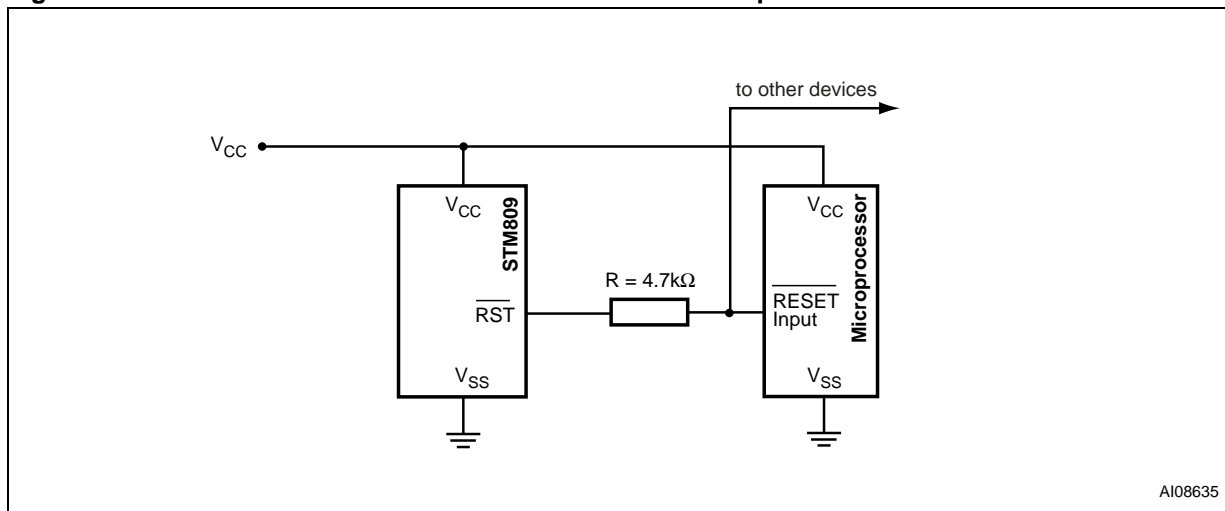
Connection With Reset Output Valid Down to V$_{CC}$ = 0V

When V$_{CC}$ falls below 1V, the $\overline{RST}$ (STM809/811) output no longer sinks current, but becomes an open circuit. In most applications this is not a problem, as most microprocessors do not operate below 1V. However, in applications where $\overline{RST}$ must be valid down to 0V, a pull-down resistor should be added to hold the $\overline{RST}$ output Low. The value of the resistor must be large enough not to load the $\overline{RST}$ output, and still be small enough to pull the output to ground. The recommended value of the resistor is 100kΩ (see Figure 8).

Figure 8. Reset Device Connection With $\overline{RST}$ Valid Down to V$_{CC}$ = 0V

AI08636
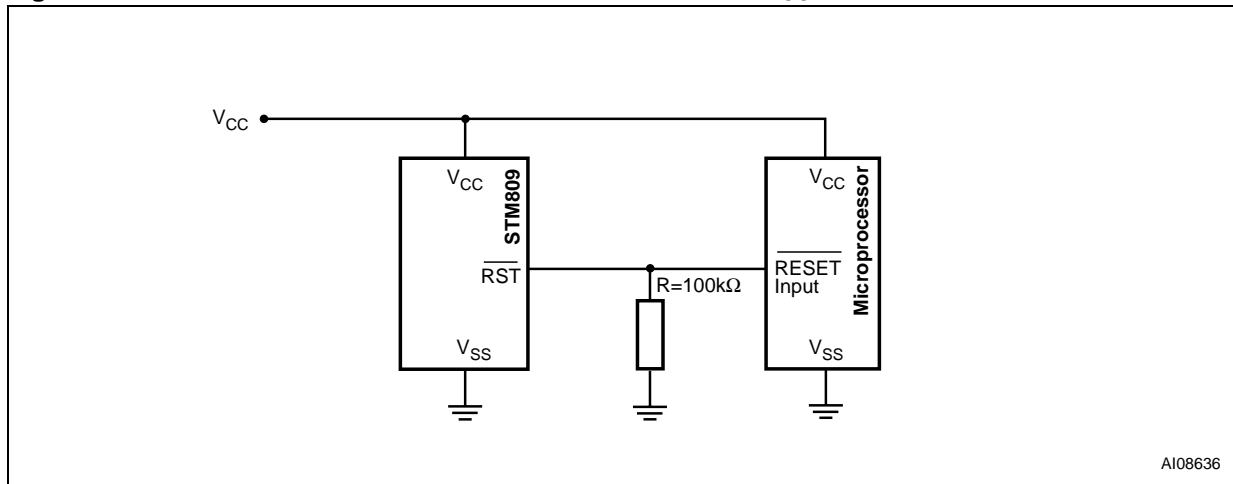
CONCLUSION

ST Reset Circuits are low-power supervisory devices, that have been specifically designed to monitor power supplies in microprocessor systems.

In standard applications, they can be directly connected to the microprocessor, as no other external circuits are required. However, they can also be used in specific application environments, with the simple addition of a resistor or capacitor.

They are available in small SOT23 and SOT143 packages; they require only a low supply current, typically in the 5-10 µA range and offer a wide range of voltage thresholds.

REFERENCES

■ STM809, STM810, STM811, STM812 datasheet

REVISION HISTORY

Table 3. Document Revision History

Date	Version	Revision Details
04-Dec-2003	1.0	First Issue.

If you have any questions or suggestion concerning the matters raised in this document please send them to the following electronic mail address:

ask.memory@st.com (for general enquiries)

Please remember to include your name, company, location, telephone number and fax number.