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APPLICATION NOTE 5040

Voltage Monitoring in Complex Systems

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Abstract: One 5V rail is not enough anymore. Modern designs require several power supply voltages to support new microprocessors, DSPs, and FPGAs. Each of these power supply voltages requires monitoring to maximize system reliability. This article discusses innovative supervisory solutions that can monitor multiple power supply rails, in order to meet today's complex power-sequencing requirements.

Introduction

The [MAX803/MAX809/MAX810](#) microprocessor (μ P) supervisory circuits are a classic Maxim innovation—although we did not invent the supervisor circuit, we were the first to put it in a 3-pin package. This family of ICs works very well for monitoring a single power supply rail, but modern systems use more than just one rail. Customers often use multiple 3-pin supervisors to monitor each power supply rail, but there is a better design approach: Maxim offers a wide selection of supervisors that can monitor more than one power supply rail, sequence power supplies, and integrate a variety of different functions, including watchdog timers and extra comparators.

Monitoring Two Power Supply Rails

Many digital-signal-processor (DSP) and microprocessor-based systems only require an I/O voltage and a core voltage. Maxim has a large number of 2-rail monitoring solutions that integrate extra functions. For example, the [MAX6732A](#) monitors the I/O voltage and core voltage, and provides a watchdog timer function, all in a small 6-pin SOT23 package. Figure 1 shows an example circuit using this device. The active-low watchdog output (WDO) is connected to the μ P's nonmaskable interrupt input (NMI).

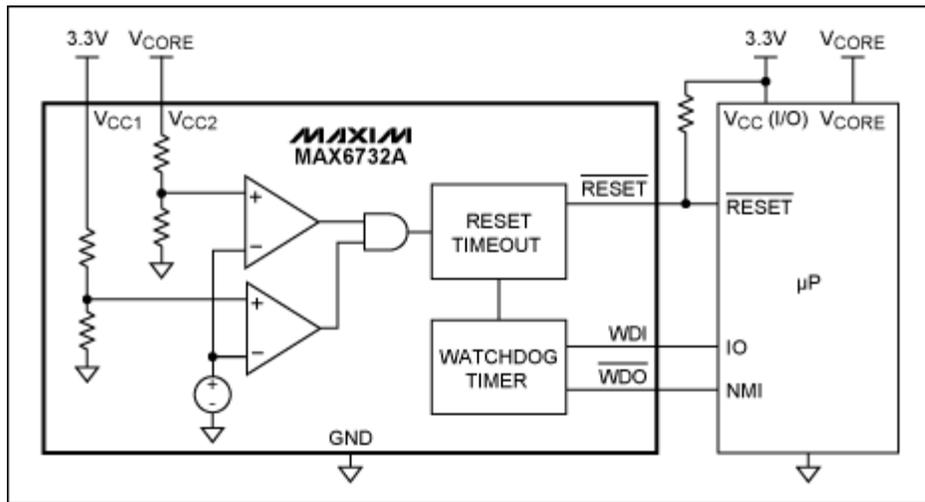


Figure 1. Monitoring microprocessor core and I/O voltages.

Monitoring Three or More Power Supply Rails

A more complex system that uses an FPGA might incorporate a 3.3V I/O rail, a 2.5V auxiliary/phase-locked loop (PLL) voltage, a 1.8V I/O rail for DDR2 memory, and a 1.2V core voltage. Instead of using four devices to monitor each voltage, you can save cost and board space by monitoring all the voltages with a single IC. Figure 2 shows how to monitor these four power supply rails using the [MAX6710E](#), which comes in a tiny 6-pin SOT23 package.



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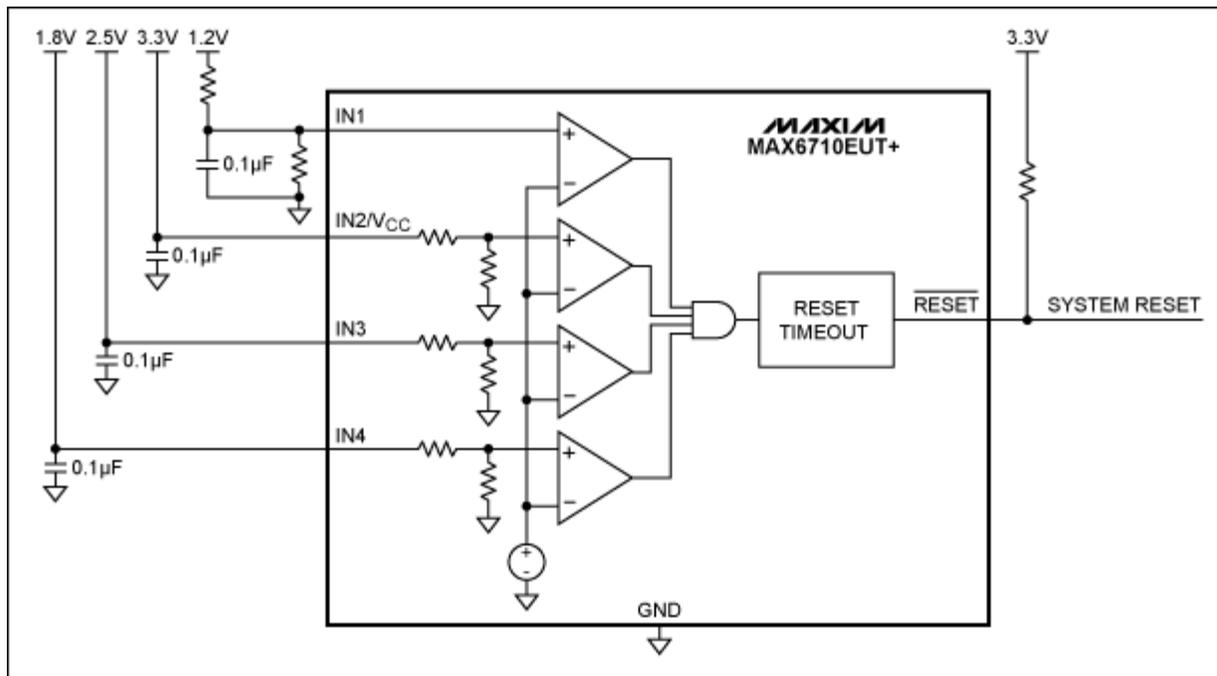


Figure 2. Monitoring a typical FPGA-based system.

Some systems require power sequencing in addition to basic monitoring. A very simple way to implement this is illustrated in Figure 3. The MAX16029 monitors the power supply voltage for each rail. When the 3.3V rail goes above the undervoltage threshold, the associated comparator output goes high after a delay set by the capacitor that is connected to CDLY1. This comparator output is connected to the enable pin for the 2.5V power supply. Sequencing proceeds, using this approach, until all the power supply rails are up. After a final capacitor-set time delay, the reset output goes high and the system completes power-up. Figure 4 shows the resulting power-up sequence.

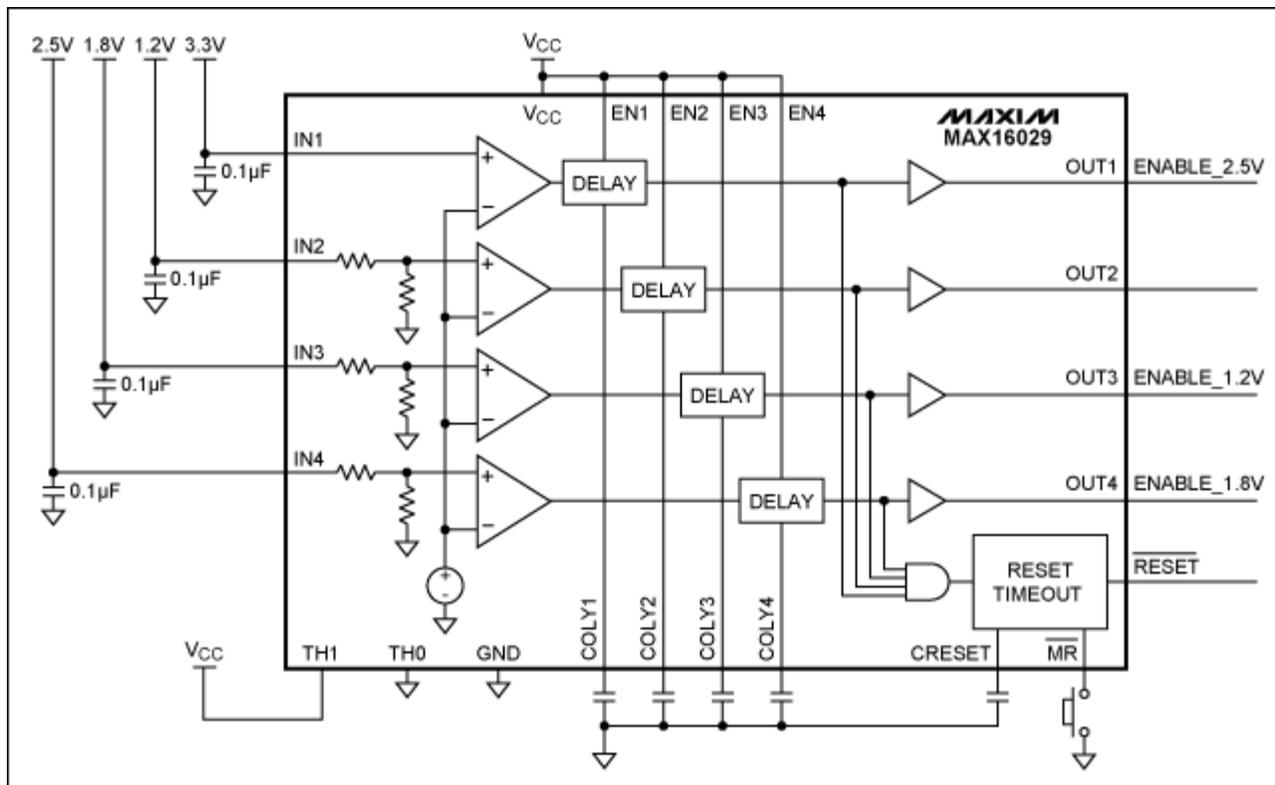


Figure 3. The MAX16029 monitors and sequences a four-voltage system.

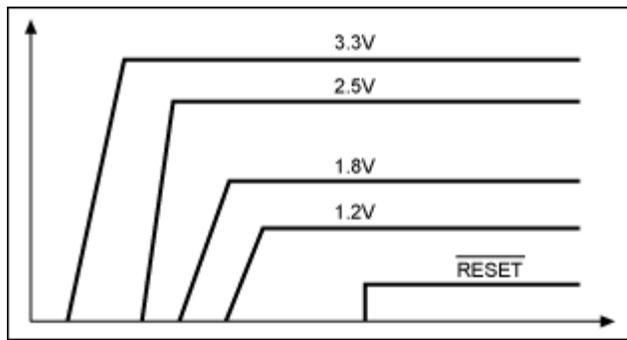


Figure 4. Sequencing waveforms.

For systems that require even more voltages, the circuit in Figure 5 shows how to monitor six power supply rails with the [MAX16005](#). This IC includes a built-in watchdog timer, which further improves system reliability. The watchdog, besides asserting a pulse on an active-low RESET during a timeout, also asserts and latches the active-low WDO.

A margin input allows the power supplies to be margined below the undervoltage thresholds without causing a reset. This input can be pulled low during manufacturing testing.

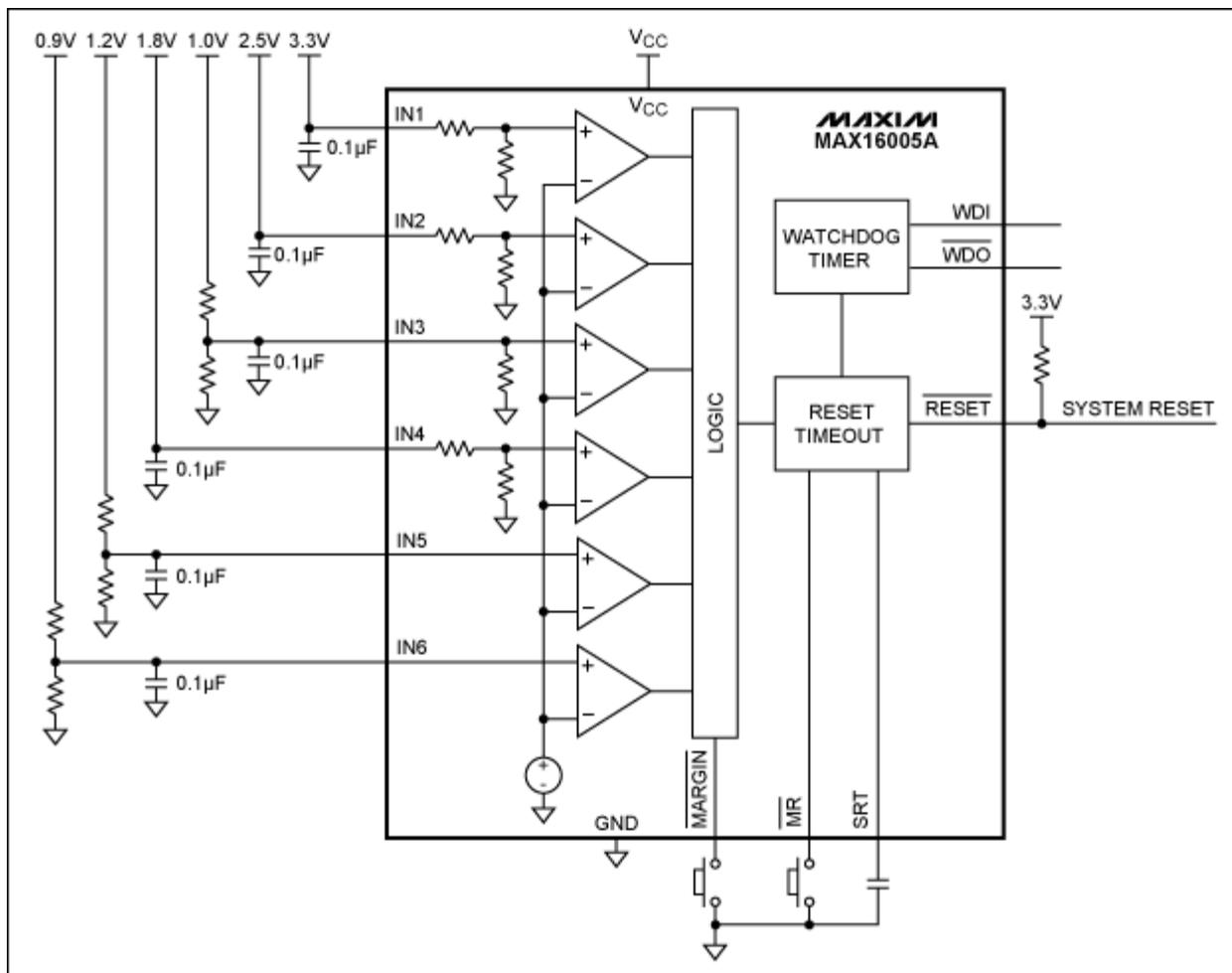


Figure 5. The MAX16005A monitors six voltage rails and features a watchdog timer.

A simplified version of the MAX16005, the [MAX16005](#), offers the same number of voltage monitoring inputs but lacks the margin input, adjustable timeout, and watchdog timer (Figure 6).

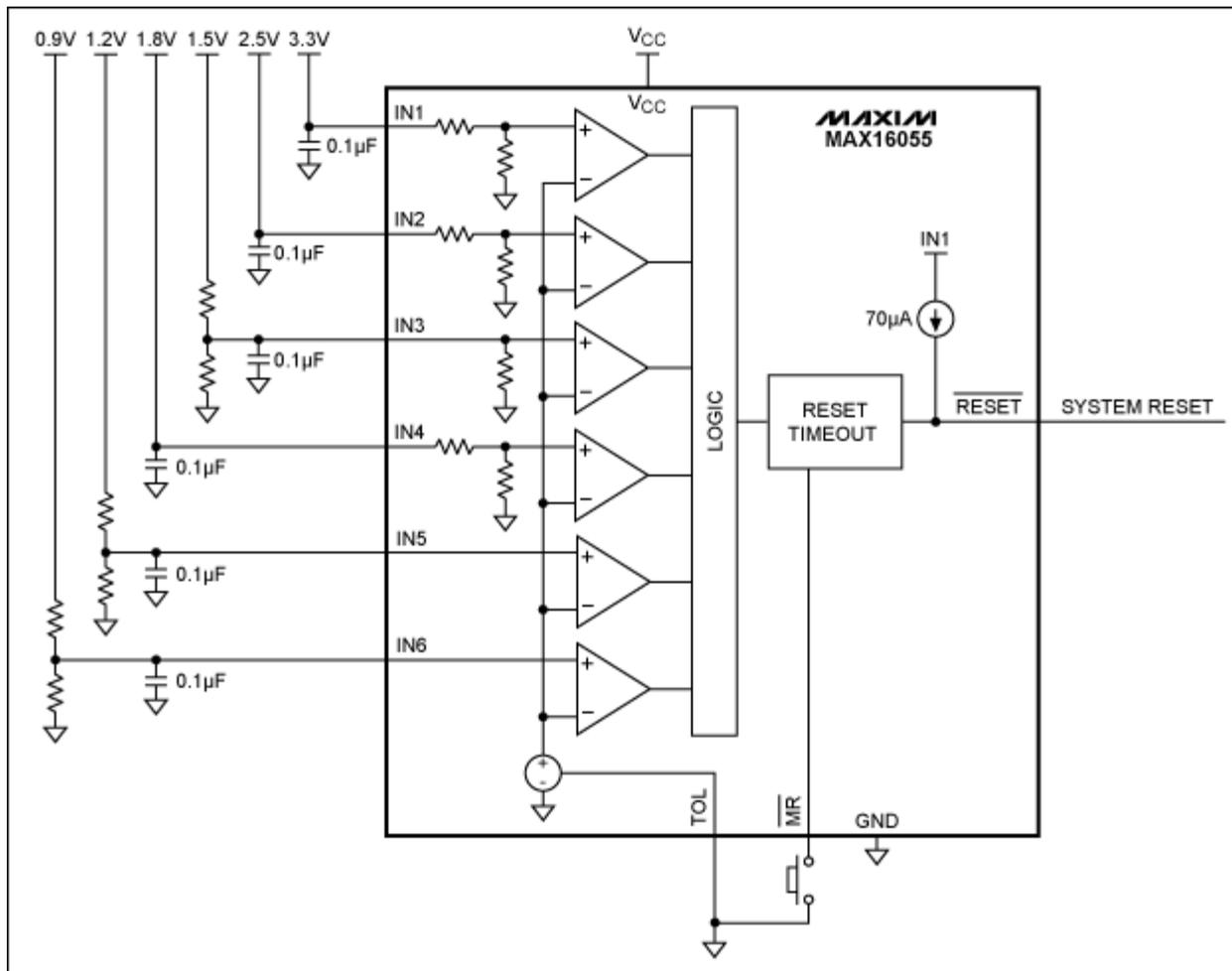


Figure 6. The MAX16055 monitors six voltage rails (with no watchdog timer).

More Information

Maxim offers a wide array of products for monitoring voltages in a complex system. Click a link below to see the full list of products for a particular number of voltage rails.

[2 Voltages](#)

[3 Voltages](#)

[4 Voltages](#)

[5 Voltages](#)

Related Parts

MAX16005	Low-Voltage, Quad-/Hex-/Octal-Voltage μ P Supervisors in TQFN	-- Free Samples
MAX16029	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	-- Free Samples
MAX16055	Ultra-Small, Hex Voltage, Microprocessor Supervisor	-- Free Samples
MAX6710	Low-Voltage, High-Accuracy, Triple/Quad Voltage μ P Supervisory Circuits in SOT Package	-- Free Samples
MAX6732A	Single-/Dual-/Triple-Voltage μ P Supervisory Circuits with Independent Watchdog Output	
MAX803	3-Pin Microprocessor Reset Circuits	-- Free Samples
MAX809	3-Pin Microprocessor Reset Circuits	-- Free Samples
MAX810	3-Pin Microprocessor Reset Circuits	-- Free Samples

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