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APPLICATION NOTE 4109

Low-Cost Power-Supply Sequencer

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Abstract: This article presents a circuit that shows how a MAX16029 sequences, and then reverse sequences, for high reliability without the use of costly programmable parts.

This article was also featured in Maxim's Engineering Journal, vol. 61 (PDF, 440kB).

A similar article appeared in the January 18, 2007 issue of *EDN*.

Most point-of-load DC-DC converters can be powered up sequentially by wiring the power-good output of one converter to the enable input of the next. That approach works well for simple designs, but it does not satisfy a requirement of many modern microprocessors and DSPs—that the power-supply rails be sequenced in reverse order during power-down. Various vendors provide programmable-sequencing ICs for that purpose, but these parts are usually too expensive for cost-sensitive applications.

An alternative to programmable-sequencing ICs, the circuit of **Figure 1** can sequence and monitor four power-supply rails economically and effectively. Four DC-DC power supplies individually provide the application circuit with 3.3V, 2.5V, 1.8V, and 1.2V, respectively. A quad supervisor circuit (U1) monitors each rail and generates the master power-OK (POK) signal. Also during power-up, U1 ensures that the next supply in the sequence does not turn on until the preceding supply voltage is valid. A second quad supervisor (U2) creates the power-up and power-down sequences using an RC circuit consisting of R1, R2, R3, and C1. External resistive dividers are not necessary, because each supervisor has internally set thresholds.

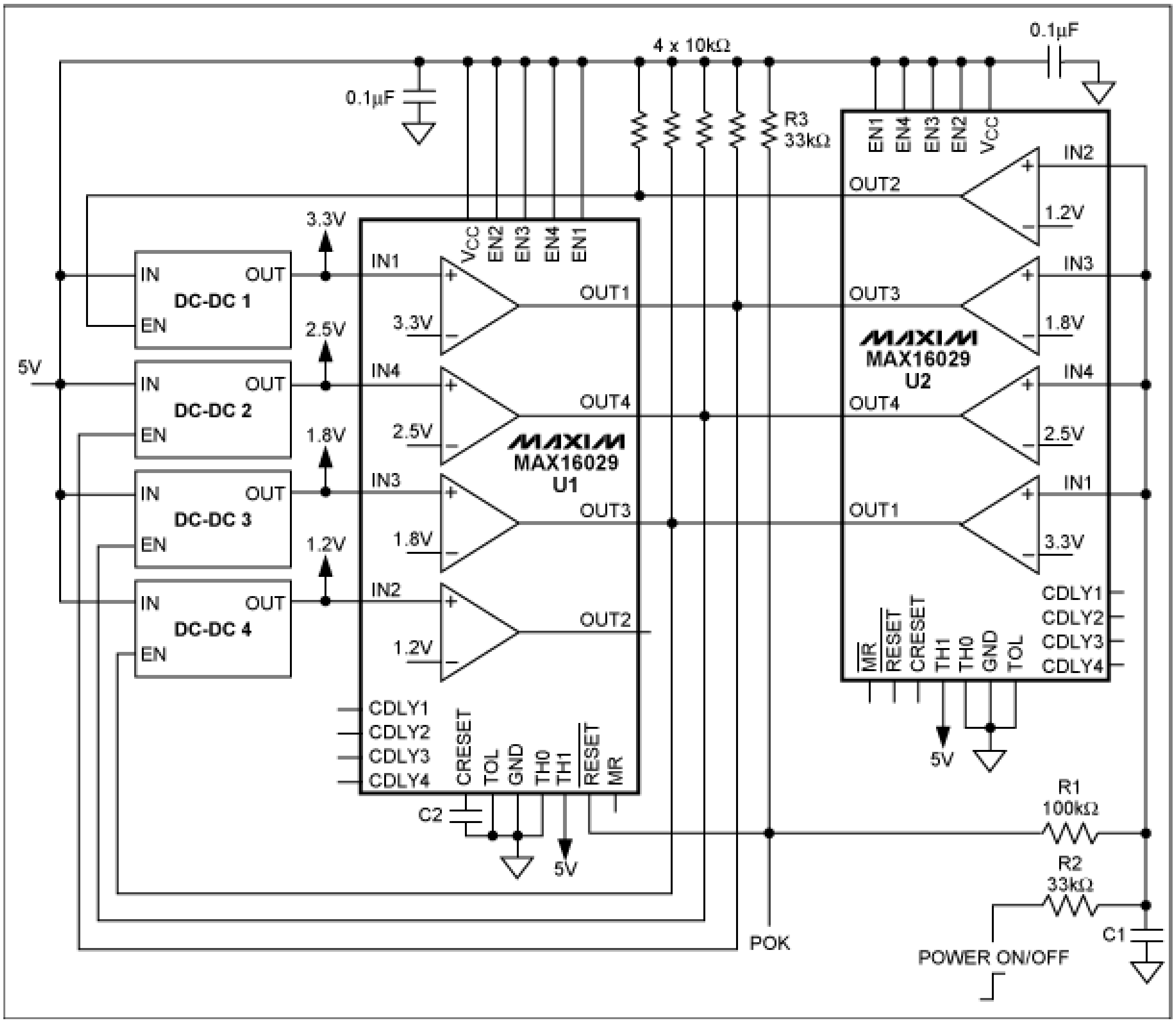

Figure 1. Using inexpensive ICs, this circuit first applies the four supply voltages in a specified order at power-up, then applies them in reverse order at power-down.

A power-up sequence is initiated by connecting the power on/off signal to the 5V input, which causes C1 to charge through R2. As the capacitor voltage slowly exceeds 1.2V, then 1.8V, 2.5V, and 3.3V, each corresponding U2 output floats, thereby allowing the power supplies to turn on in a prescribed sequence. After all four supplies are on, the POK signal asserts following a timing delay set by C2.

To monitor the supply rails, allow the power on/off signal to float high. The POK signal then maintains the C1 voltage through R1 and R3, and keeps the power supplies on. In response to a fault, POK de-asserts rapidly, which discharges C1 through R1 and shuts off all the supplies. To power down, connect the power on/off signal to ground. C1 discharges through R2 and R1 when POK de-asserts, turning off each power supply in reverse order (**Figure 2**).

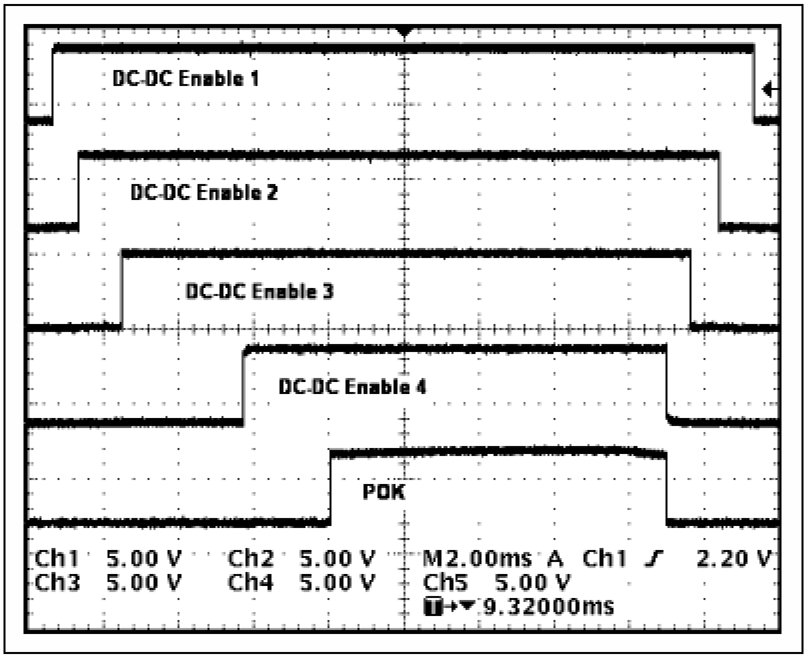

Figure 2. Beginning with DC-DC converter 1, the circuit of Figure 1 switches on three additional converters in sequence and generates a POK signal. Pulling the circuit's on/off input low removes the POK signal and switches off all four converters in reverse order.

Related Parts		
MAX16025	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	Free Samples
MAX16026	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	Free Samples
MAX16027	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	Free Samples
MAX16028	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	Free Samples
MAX16029	Dual-/Triple-/Quad-Voltage, Capacitor-Adjustable, Sequencing/Supervisory Circuits	Free Samples

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