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Transistor quickly wakes sleeping LDO

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Portable systems, such as telephone handsets, make extensive use of low-dropout (LDO) regulators. These components provide noise-sensitive parts with a stable power-supply line. When a telephone enters standby mode, most of the circuits go to sleep by disabling the LDO's outputs. Operating current thus drops to a minimal level. When a user starts to dial a number, the LDO receives an enable signal and immediately delivers the nominal operating voltage. Unfortunately, most low-noise LDOs use a bypass capacitor that briefly loads the internal reference voltage upon wake-up. In fact, the output exhibits a latency period before reaching its steady-state level. With a 10-nF bypass capacitor, this period typically lasts 1 msec and correspondingly degrades the overall response time. The ultra-low-noise MC33263 from Motorola (www.motorola.com) also uses a 10-nF bypass capacitor. However, the EZCap architecture of the IC allows the use of an inexpensive decoupling capacitor (ESR from 10 mV to 3V) and allows the designer to speed the wake-up time (**Figure 1**).

The base of a low-cost pnp transistor connects to an RC network. At power-up, C_4 discharges. When the control logic sends its high-going wake-up signal, the transistor's base is momentarily tied to ground. The transistor turns on and immediately charges bypass capacitor C_1 toward its nominal operating voltage. After a few microseconds, the pnp turns off and becomes transparent to the regulator. This circuit dramatically improves the response time of the regulator from 1 msec to 30 msec (**Figure 2**). You need only adjust the RC time constant to avoid any bypass-capacitor overload during the wake-up transient. Such an overload would generate an unacceptable output overshoot. Because the transistor connects to the bypass pin, it does not degrade the noise performance of the LDO. (DI #2241)

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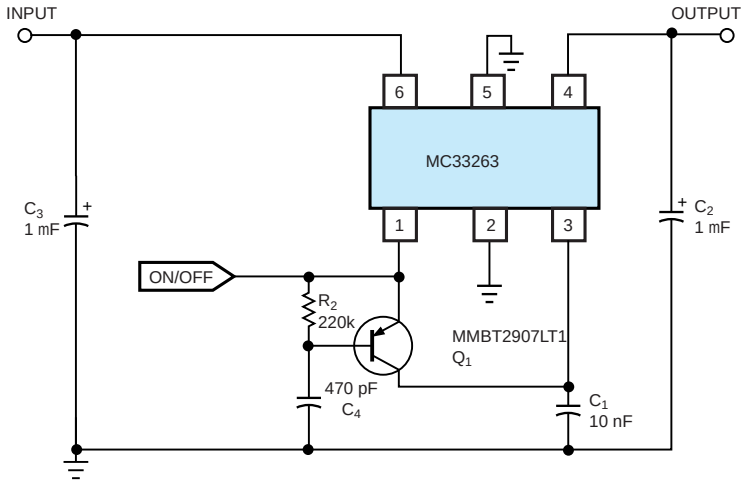
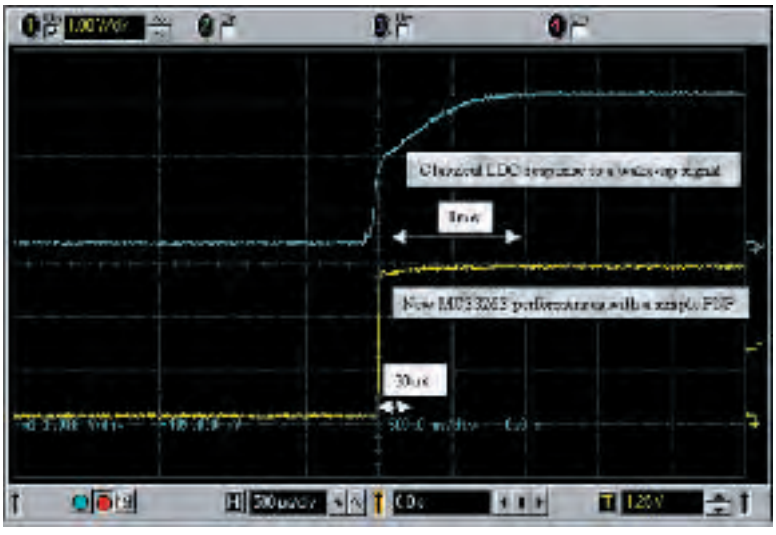
FIGURE 1



An inexpensive transistor and two passive components drastically improve the wake-up-response time of a linear regulator

FIGURE 2



The simple circuit in Figure 1 improves the wake-up-response time of the LDO from 1 msec (upper trace) to 30 msec (lower trace).