An Easy Way to Add Auxiliary Control Functions to Hot Swap Cards – Design Note 421

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Introduction

A Hot Swap™ controller is essential to any system in which boards are inserted into a live backplane. The controller must gently ramp up the supply voltage and current into the card's bypass capacitors, thus minimizing disturbances on the backplane and to other cards. Likewise, it must disconnect a faulty card from the backplane if it draws too much current. The controller also monitors undervoltage and overvoltage conditions on the backplane supply, ensuring reliable operation of the card's circuitry. The LTC4215-1 takes the obvious next step and integrates three general purpose I/O (GPIO) lines and an accurate ADC into the Hot Swap controller to provide quantitative information on board voltage and current. Upgrading to the LTC4215-1 is analogous to replacing a car's venerable "Check Engine" light with a modern dashboard information display.

Additional Control

There are many functions on a card that are considered part of the "power gateway," apart from the actual function of the board (telecommunications, data acquisition, etc.) These include sequencing power supplies, providing supply status information, monitoring pushbuttons, etc. The LTC4215-1 GPIO pins are well suited to these functions. Tying the ON pin high turns on the pass FET after a 100ms power-on delay. Grounding the ON pin enables software control of the FET. The state of the GPIO pins can be set before enabling the FET, ensuring a known state when downstream power is enabled. GPIO1 defaults high on power up, and can sink 5mA. GPIO2 defaults high and can sink 3mA. GPIO3 defaults low and can sink 100µA.
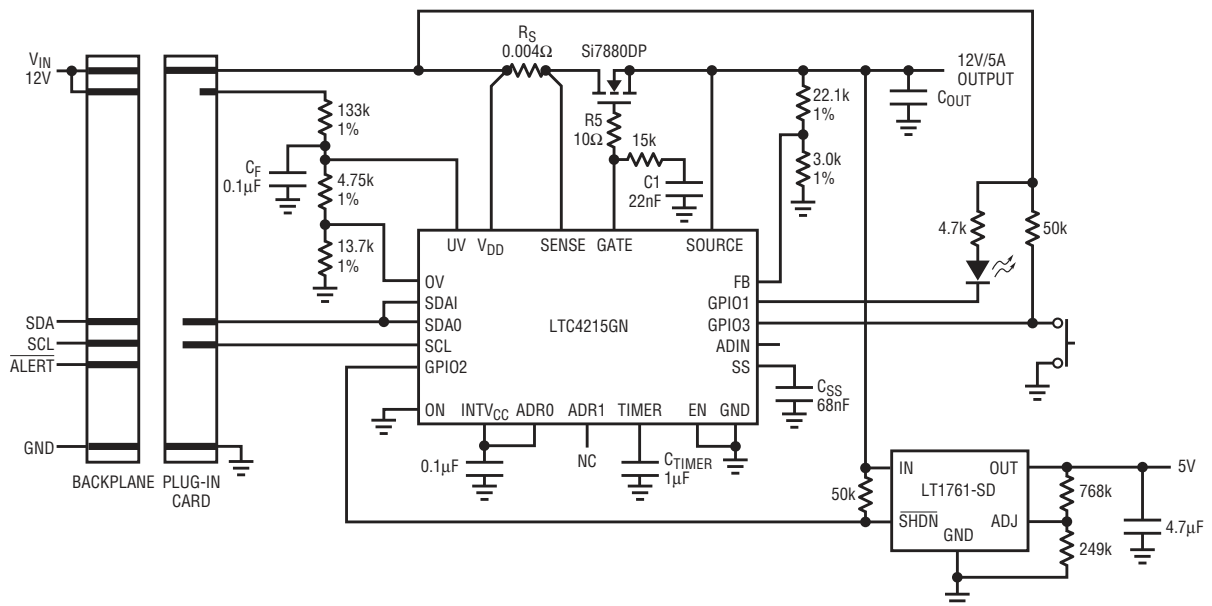
Figure 1. The LTC4215-1 in a Typical Card Resident Application

For instance, Figure 1 shows an application that monitors a "request to remove card" pushbutton and lights an "okay to remove" LED when the card is ready for removal. This permits graceful shutdown of the card. For example, it can transfer collected data before shutting down so that it is not lost. GPIO1, which defaults high, controls the LED. GPIO3 is reprogrammed as an input that monitors the state of the pushbutton. The GPIO2 pin controls the operation of an onboard regulator. This is important in mixed signal circuits, where analog circuitry may need to be powered up before digital signals are enabled.

Figure 2 uses a GPIO pin to control an LTC4210-1 Hot Swap controller, which in turn controls a 3.3V rail. Once again, this is useful for sequencing supplies and may eliminate the need for additional sequencing circuits.

Figure 3 uses all three GPIO pins to light one of eight LEDs using a 74HC138 decoder. These can indicate system status or power consumption. Other possible functions include issuing a microprocessor reset, adding additional channels to the ADC using the GPIO pins to control a multiplexer, or interfacing with an advanced power supply sequencer such as the LTC2928.

Conclusion

The LTC4215-1 is a smart power gateway for Hot Swap circuits. It provides fault isolation, closely monitors the health of the power path, and provides an unprecedented level of control over the inrush current profile. The three general purpose I/O pins and a spare ADC channel allow further control of power path and system initialization/shutdown related functions.
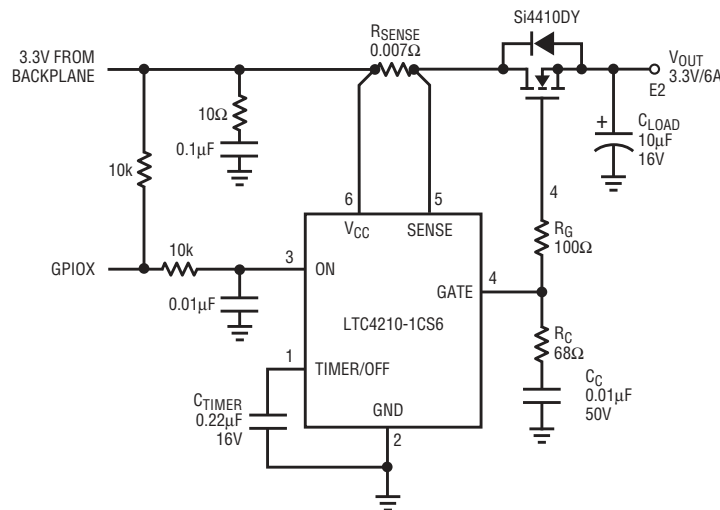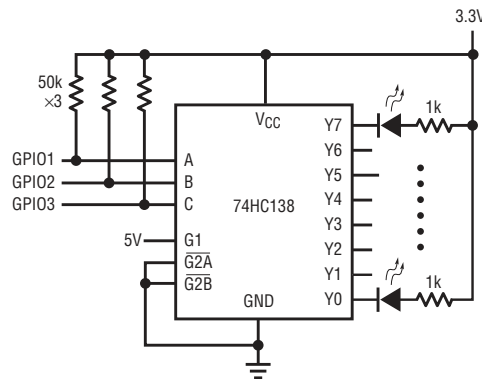

Figure 2. Controlling an LTC4210-1

Figure 3. Controlling Eight Status LEDs

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