How to Save Register Content During Power-down

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Activating power-down in a SpartanXL device reduces the supply current to less than 100 µa, de-activates all inputs and outputs, and resets all internal flip-flops. The configuration data is retained, but all user data is lost. Here is a way to save your data.

The SpartanXL look-up tables can be used as RAM, and they are not affected by power-down. Therefore, you can save all essential data by loading it into the look-up table space before entering power-down. This method will cost you just two device pins (input A and output B), one external 10K resistor, and an internal state-machine.

Here's How it Works:

1. Connect input pin A to the external power-down signal.
2. Connect output pin B to the dedicated "Powerdown" pin of the device.
3. Connect the resistor between input pin A and the Powerdown pin.
4. Connect output pin B directly to the Powerdown pin.
5. Program the device to drive output pin B High during normal operation.

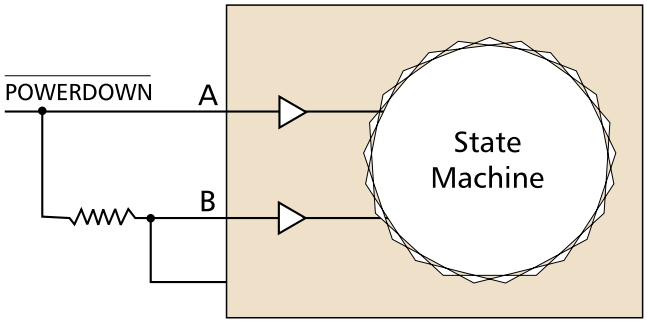

Figure 1

During normal device operation, hold input pin A High (with an external control signal). To initiate power-down, pull pin A Low with an external signal. Program the internal state machine to samples the A input whenever it might be appropriate to enter the power-down state. Sampling A=Low initiates a state-machine sequence that:

1. Stops normal operation.
2. Transfers all vital data into RAM.
3. Pulls output pin B Low.
4. Because pin B is connected to the Powerdown pin, the device immediately goes into power-down mode.

During power-down, the device ignores all inputs by considering them Low, turns off all internal pull-ups, and places all outputs into a 3-state condition. The dedicated Powerdown pin, however, is now held Low by the resistor connecting it to the A input (which is held low by the external power-down signal).

To revert to normal operation, pull pin A (and thus Powerdown) High, causing the chip inputs and outputs to become active again. When the internal state machine samples A=High, it restores data from the look-up tables back to the original flip-flop locations, and then lets your logic restart.

Eliminating SPROM Stand-By Current

The SpartanXL serial-configuration PROM is active only during the milliseconds of configuration time. However, it has a continuous 50 µa of stand-by or idle current that can be completely eliminated by doing the following:

1. Connect the SPROM Ground pin to LDC
2. Program LDC and Din to be in a 3-state condition during user operation.

Some designers have expressed concern that this reduces the SPROM supply voltage by the amount of Vol on the LDC pin. But all CMOS outputs are really resistive, and their voltage drop is proportional to the sink or source current. At 5 mA, Vol is less than 125 mV, as shown in the IBIS files. The Vcc characteristics of the SPROM have sufficient margin to make this operation reliable, as long as Vcc never drops below 3.0 V.