Designing With XC9500 CPLD Family User-Programmable Grounds

XC9500 CPLDs have a unique feature that helps you create rock-solid designs. User-Programmable Grounds (UPGs) are a very easy way to provide additional noise immunity if you have very large numbers of simultaneously switching outputs (SSOs). UPGs can also deliver a correct (non-floating) CMOS voltage level to a floating output pin. This is done with a special programming cell that connects the output pin to an external ground or internally forces the output driver low, while retaining the macrocell logic capability behind the pin, as illustrated in **Figure 1**.

Using UPGs

When macrocell outputs change state, they may produce current transitions for a few nanoseconds, causing the internal device ground voltage to rise. If you have a very large number of SSOs, this ground rise could possibly cause unwanted state transitions. By providing additional grounds, near the SSOs, this unwanted ground rise can be kept well within safe limits by providing a low impedance path to dissipate the voltage spikes.

If you have more than 20 SSOs, with a load capacitance of 50 pF or more, UPGs can be very useful, giving you extra noise margin.

It takes approximately three UPGs to deliver the same grounding capability as a dedicated ground pin. If you have large numbers of unloaded SSOs (a total of well over 100 is acceptable) or less than 20 loaded SSOs, no UPGs are needed.

Software Support

Using the Design Manager in the Xilinx Alliance Series and Foundation Series software, you can easily specify that all unconnected output pins must become connected to a UPG. If you are unsure about what may be connected to these unused pins, it is best to avoid this UPG setting, because you could accidentally ground any attached external signals. However, if you have completed your design and wish to tie-off unused macrocell outputs or introduce extra grounding benefit, set "UPG ON." It can be reset in the future if needed, by taking advantage of the XC9500 family's in-system programability.

In general, UPGs are convenient for terminating unused output signals. On the rare occasion where additional grounding may be beneficial, UPGs become an even more valuable asset. ◆
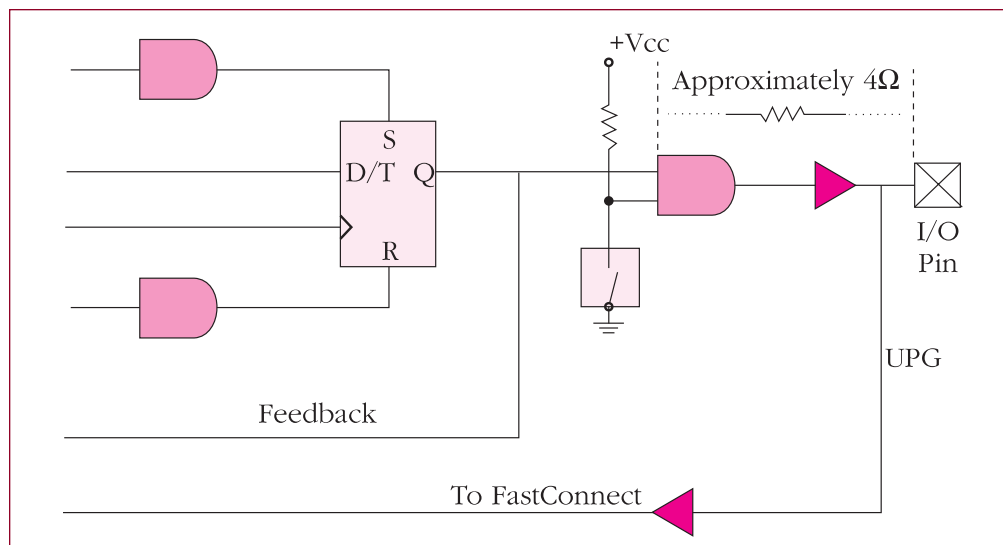
Figure 1 - *UPG for XC9500 devices*