TND302

Hot–Swapping Boards Facilitated by Low Cost Analog Switches

Prepared by: Fred Zlotnick
ON Semiconductor

ON Semiconductor™

http://onsemi.com

TECHNICAL NOTE

Many devices need to be capable of “hot–swapping”. Telecomm and networking designers often need for their boards to be inserted or removed from an active operating system. When hot–swapping, often times it is one or two I/O lines that are causing a problem, or as many as 32 or more lines.

Many devices have stringent requirements on current usage, sequencing of power supplies, test program modes, etc. One issue arises from the ESD protection that most CMOS families employ. Most CMOS devices have a protection diode that goes from its input or output to supply voltage. An example might be the use of an FPGA that is tied to a standard “HC04” gate, and the gate is on a card to be hot–swapped. Figure 1 shows the input configuration of many CMOS devices. When inserting a board, normally ground (GND) and V_{CC} are established first. As the board is plugged in, V_{CC} is momentarily at ground potential. Since there is almost assuredly a capacitor across the V_{CC} terminal to GND, there will be a delay until the capacitor reaches close to V_{CC}. When the board is inserted, the input is now shorted to GND via its ESD diode, causing either a glitch on the line, or possible latch–up of the driver.

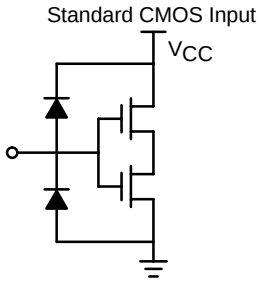

Figure 1. Input Configuration for a CMOS Device

There are many solutions to this problem, however one of the simplest and most elegant solutions provides a great deal of flexibility and control in the circuit. The ON Semiconductor **MC74VHC1G66DFT2** takes up only 4.5 mm^2 of board space, consumes very nearly zero power, and inserts almost zero delay into the path. It provides a low cost addition to the circuit, and protects the devices from seeing glitches. The device is available in a single form as the MC74VHC1G66DFT2, and a quad version as the **MC74LVX4066DT**. Both devices insert only a few Ohms of series resistance (<20) and provide a delay of <1 ns, when enabled. The solution enables hot–swapping where the designer can choose a delay time. The device is bilateral so the signal can flow in either direction, just like the wire that connects it. Other than the small voltage drop and slight delay previously mentioned, the device is transparent, except at the time of start up.

Example: an FPGA or DSP or MCU needs to be connected to a module and one line needs to function as a hot swap. Inserting a single 5–pin part, with its control gate connected to a V_{CC} pin that represents known Power Up, or is simply a pass through to the module supply voltage. The

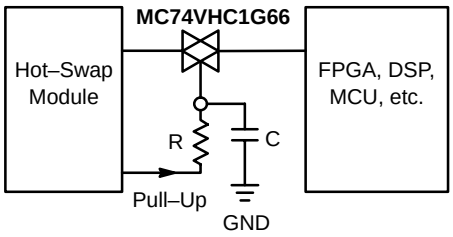

Figure 2. Connection to an FPGA, DSP or MCU

R/C time constant creates a delay, from a few ms, to perhaps 500 ms. When the control pin reaches threshold, the device turns on and becomes a transparent low resistance, near zero delay connection to the sensitive device. If the user has need for more than 1 line of isolation, 2 devices may be used, hooking all the control pins in parallel. A quad device with similar characteristics, is available as an MC74LVX4066 and multiple quad devices may be used for 8– or 16–pins of isolation. The V_{CC} pin should be connected to the same power supply as the device it is protecting. This solution is simple, low cost and allows for almost any contingency in the future.

Notes

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

N. American Technical Support: 800–282–9855 Toll Free USA/Canada

JAPAN: ON Semiconductor, Japan Customer Focus Center
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan 141–0031
Phone: 81–3–5740–2700
Email: r14525@onsemi.com

ON Semiconductor Website: http://onsemi.com

For additional information, please contact your local
Sales Representative.