A PCB Design Guideline to Prevent DVI Signaling Power-Reverting in the CH7009 Family Chips Applications

1. Introduction

This application note focuses on a special PCB design care for the CH7009 family (CH7009/CH7010/CH7301) DVI applications. When using the CH7009 family devices for DVI applications, system shut-down problems have been reported by customers in some PC motherboards. Typically, the PC would shut down properly if the DVI monitor is powered down first. However, if the DVI monitor remains powered on, occasionally, Windows may not shut down properly. This problem only occurs in some motherboard designs. Intel's ADD cards and nVidia's PDD cards have not shown this behavior. It is suggested that the motherboard designer follow this guideline to prevent the motherboard from having this system power-down sequence disorder.

2. Explanation to the Problem

Referring to **Figures 1**, when the DVI monitor is powered on, AVCC is 3.3V. When the PC is powered down, TVDD power of CH7009 device is turned off and would normally go to GND. However, power is fed back from the receiver's AVCC to CH7009's TVDD through the 50 Ohm termination resistor and the ESD protection diode, in the CH7009. Typically, TVDD is kept at around 2.5V to 2.7V under this condition. In some motherboard designs, CH7009 and other circuits on the motherboard are powered by the same voltage regulators. The power-down disorder occurs when other circuits on the motherboard are powered on by CH7009's TVDD power and the PC power supply, therefore, does not power down properly.

Figures 1 shows the simplified schematic for CH7009 DVI Output.

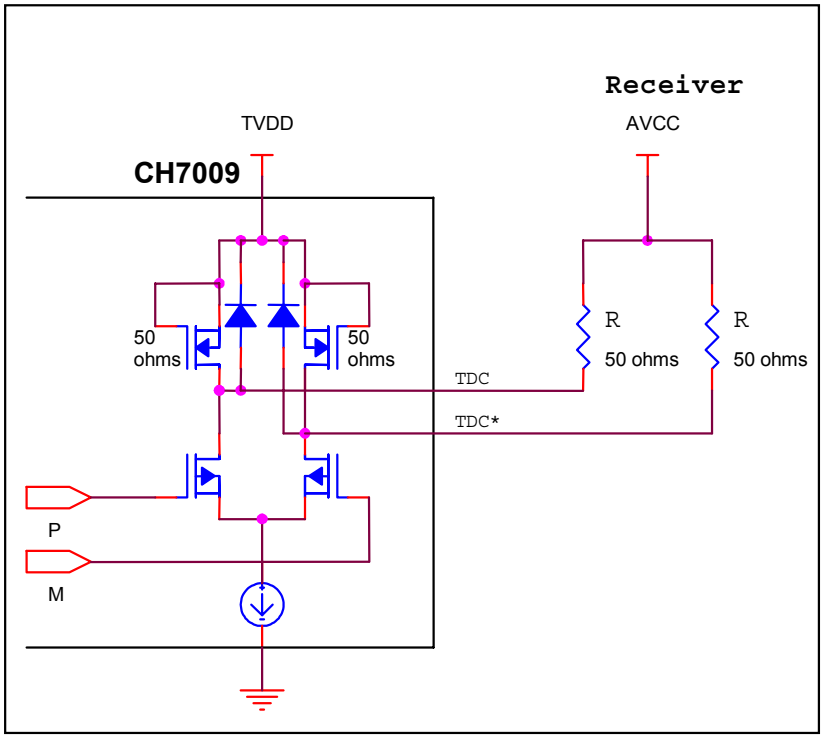

Figure 1: The simplified schematic of CH7009 DVI Output

3. Solutions to the Problem

The way to prevent the above problem is to isolate the CH7009 device's TVDD power supply from sharing with other devices on the motherboard. A simple solution is using a low forward-voltage diode or a dedicated voltage regulator. These two solutions are shown in **Figures 2** and **Figures 4**, respectively. A dedicated voltage regulator for TVDD is preferred over the diode solution because TVDD can be maintained at 3.3V. **Figures 3** shows the diode forward voltage vs. current of the recommended diode 1N5817. A 0.15V - 0.3V drop across the diode is expected during the normal operation.

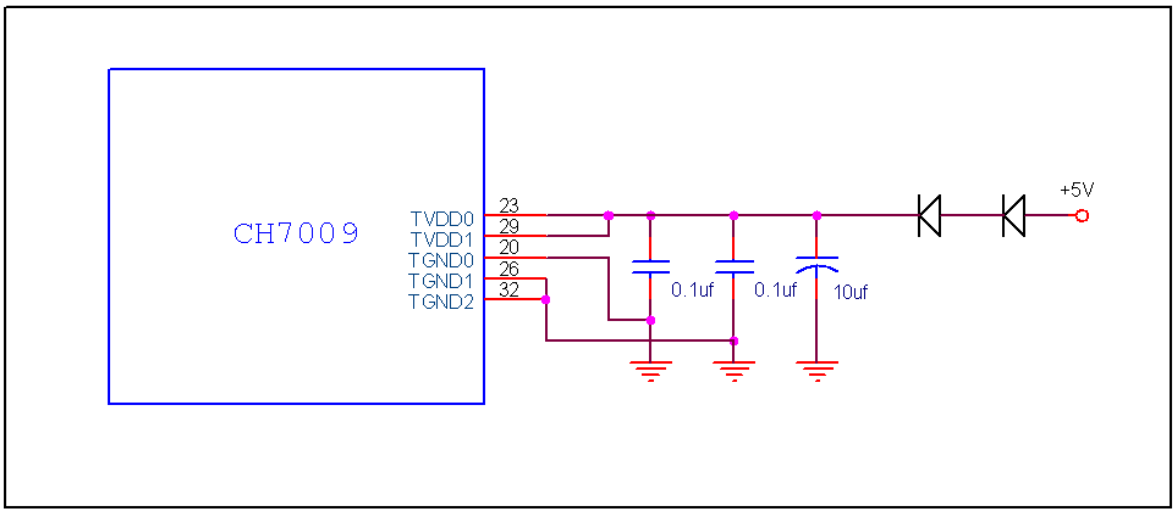

Figure 2: Isolate the CH7009 family TVDD power with a low forward-voltage diode (such as 1N5817)

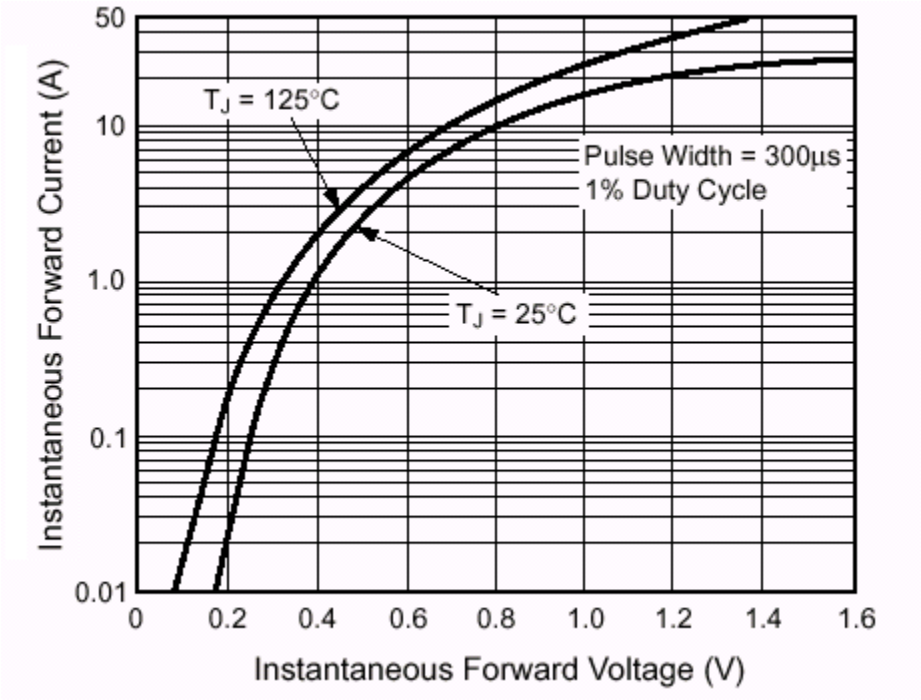

Figure 3: The forward-voltage characteristics of diode 1N5817

The circuit shown on **Figures 4** isolates the CH7009 family TVDD power with a 5.0V - 3.3V voltage regulator (such as LT1587-3.3).

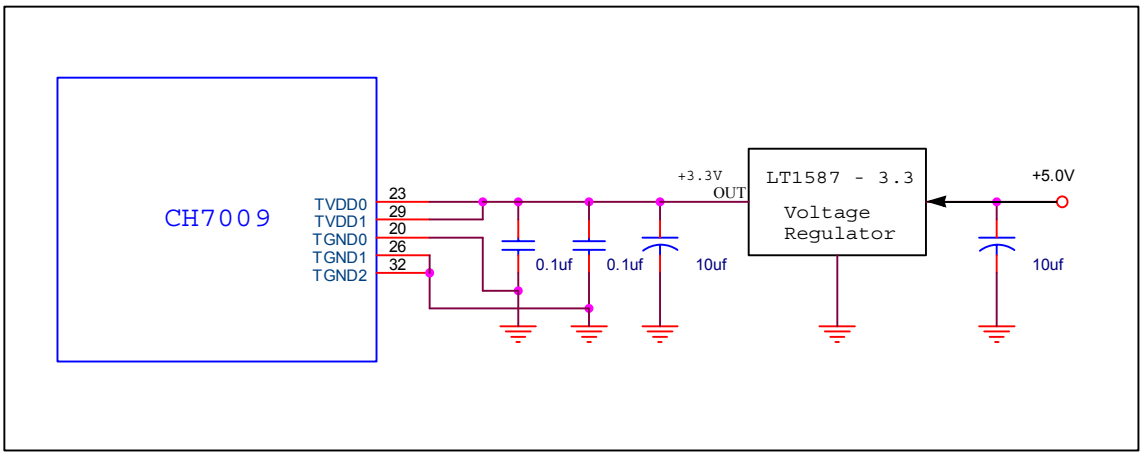

Figure 4: The circuit isolates the CH7009 TVDD power with a 5.0V - 3.3V voltage regulator

4. Conclusion

Experimentally, either solution works well to solve the above problem. Chrontel recommends the use of a dedicated voltage regulator for CH7009. However, the motherboard designers can choose the less expensive low forward-voltage diode solution if the power VDD is well regulated to at least 3.3V. Please note that when diode solution is used, the diode voltage drop should be as small as possible so that the TVDD voltage remains above 3.0V.

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