Introduction

Recently, there are a number of devices that can use different voltage sources for operation. For example, tablets can work from an internal Li-chemistry battery and an external 5V power supply during battery charging. In such devices it is very important to switch between two power rails without output voltage drop and at the same time prevent reverse current flowing from the higher voltage rail to the lower voltage rail. Silego’s new dual-channel SLG59M1639V is an excellent choice for these types of applications.

Multiplexing Two Power Rails Circuit Design and Analysis

Figure 1 is circuit example of multiplexing 2 power rails to 1 common output. SLG59M1639V is a dual-channel, 45 mΩ PMOS power switch designed to switch 1.5V to 5V power rails up to 2A in each channel. It has a true reverse current blocking feature and fast reverse-current detection response time. Thus, if VOUT>VIN by 50mV, the switch will be automatically turned off. Since the RDS(ON) of the load switch is very small, to detect VOUT-VIN ≥ 50mV difference it is necessary to create at least 1A - 1.1A on the VIN of lower power rail (in our case it is VIN2).

Figure 1. Multiplexing Two Power Rails using the SLG59M1639V
Sometimes in real applications there are a number of components on VIN2 where the total current consumption will be approximate to or higher than 1A. In this case, it may not be necessary to set the R2 resistor. In a case where VIN1 (higher power rail) is already turned ON and it needs to switch to VIN2 (lower power rail), and besides setting ON2 to High, it is obligatory to set ON1 to Low, otherwise VOUT will still be close to the VIN1 rail. An example of such operation is illustrated in waveform 5. To minimize 5V - 3.3V - 5V switchover distortion, ON1 can be toggled Low or High while ON2 is always high. Examples of such operations are illustrated in waveforms 3 and 4. To reduce voltage drop during a 5V to 3.3V switchover, it is possible to use a larger CLOAD (C3) or a larger RLOAD (R3). An example of such improvement is illustrated in waveform 7.

**Operation waveforms**

- **Figure 2. Waveform 1: 3.3V Power-up Operation**
- **Figure 3. Waveform 2: 5V Power-up Operation**
- **Figure 4. Waveform 3: 3.3V to 5V VOUT Switchover Transient Behavior**
- **Figure 5. Waveform 4: 5V to 3.3V VOUT Switchover Transient Behavior**
Conclusion

Using Silego’s SLG59M1639V device makes it easy to multiplex two power rails to one common output. This application is very often used for switching between external and internal power sources in tablets, smartphones, and other similar products. Also, it is possible to implement a similar solution using Silego’s SLG59M1641V with active LOW ON-OFF control and faster turn on/off times.

Figure 6. Waveform 5: Not switching to VIN2 if VIN1 turned on

Figure 7. Waveform 6: 5V VOUT Power-down Behavior

Figure 8. Waveform 7: 5V to 3.3V VOUT Switchover Transient Behavior with C3 = 100µF, R3 = 150Ω
About the Author

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Background: Petro Zeykan received his Master’s degree in “Cable Television and Information Systems” in 2008 from Lviv Polytechnic National University. Since 2010 he has worked as a Fiber Optic Engineer and, in 2011 began to work as an application engineer for power products at Silego Technology Inc. Currently he is a Sr. Application Engineering Manager for power products providing applications support, and designs automated systems for load switch characterization.

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