1. Introduction

In the integrated circuit (IC) industry, emerging technologies enable the manufacture of smaller and smaller devices. Increasingly common are complex devices with multiple power supplies of different voltages. Galileo Technology manufactures a number of such devices.

The use of multiple power supplies of different voltages in a single device influences the device's power up and power down sequence. This Application Note provides the power up and power down requirements for a system using a Galileo Technology device with multiple power supplies of different voltages.

In the example in Section 2., three different voltages (3.3V, 2.5V and 1.8V) are supplied to the device. The same guidelines apply to all Galileo Technology devices with two or more power supplies of different voltages.

2. Internal Structure

The different power supplies entering the device are connected to power rails which cover the entire die. There are diode clamps between the power rails, as shown in Figure 1.

Figure 1: Protection Diodes Between Power Rails

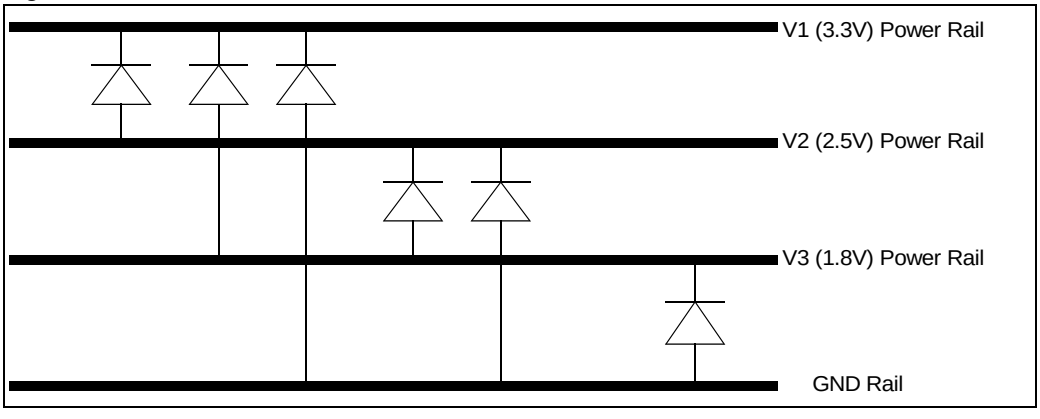
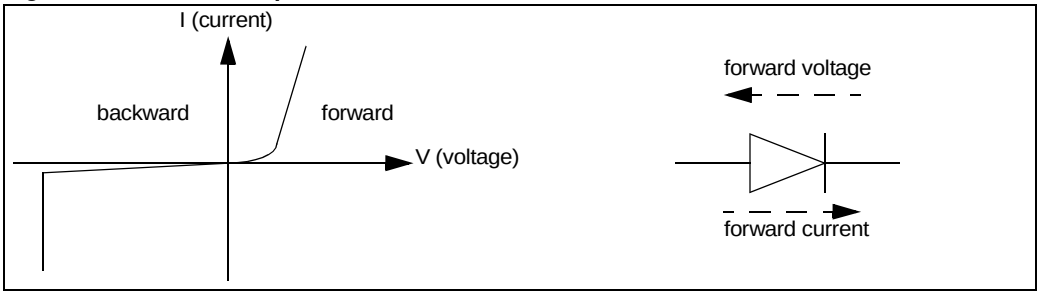


Figure 2 illustrates basic diode operation.

Figure 2: Basic Diode Operation



To prevent high currents from flowing between the power rails, the diodes must not have a forward bias. For this reason a specific power up/power down sequence must be followed. This sequence is described in Section 3.1.

3. Power Up/ Power Down

3.1 Sequential Power Up/Power Down

Because there are diodes between the power rails, the power supplies must be turned on and off in a specific order. The maximum time period between adjacent voltages reaching 90% of their value must be kept as low as possible and must never exceed 20 ms (see Figure 3).

Power Up Sequence

Turn the power supplies ON in the following order:

1. V1 (the highest voltage)
2. V2 (the second highest voltage)
3. V3 (the lowest voltage)

Power Down Sequence

Turn the power supplies OFF in the following order:

1. V3 (the lowest voltage)
2. V2 (the second lowest voltage)
3. V1 (the highest voltage)

Figure 3 and Figure 4 illustrate the sequential power up and power down timing restrictions.

Figure 3: Sequential Power Up Timing Restrictions

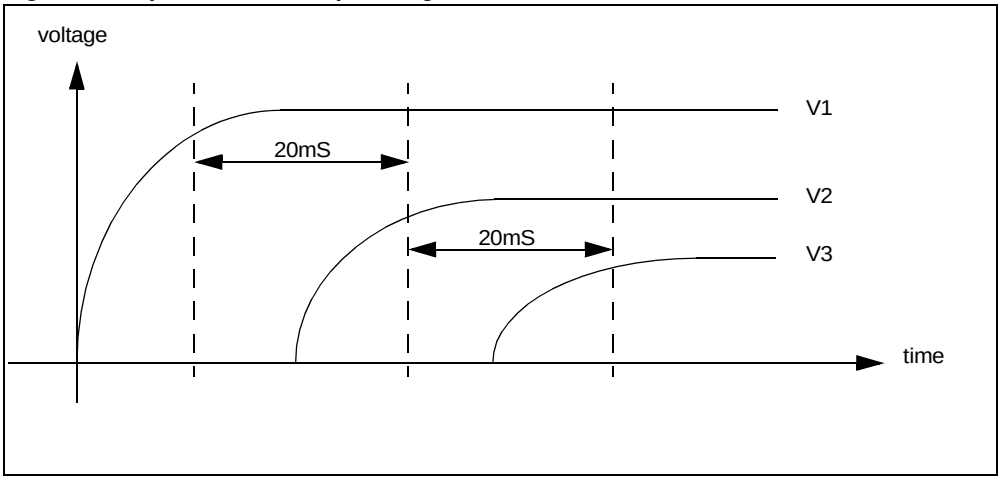
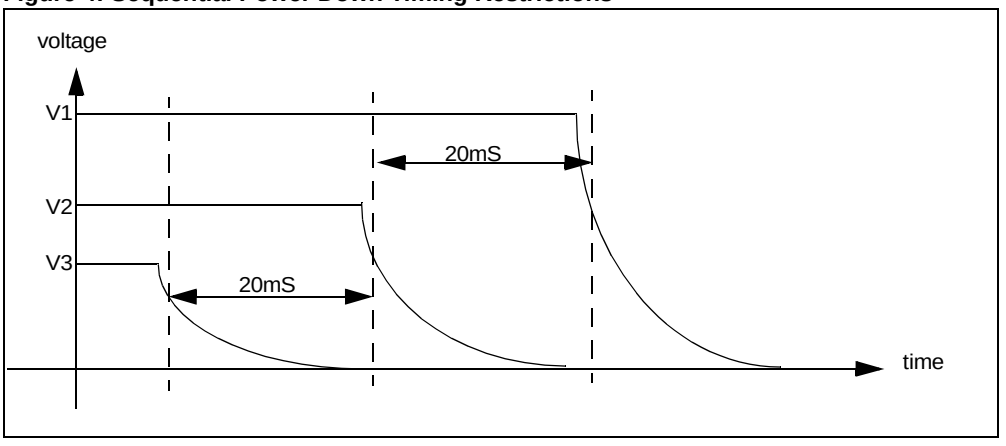


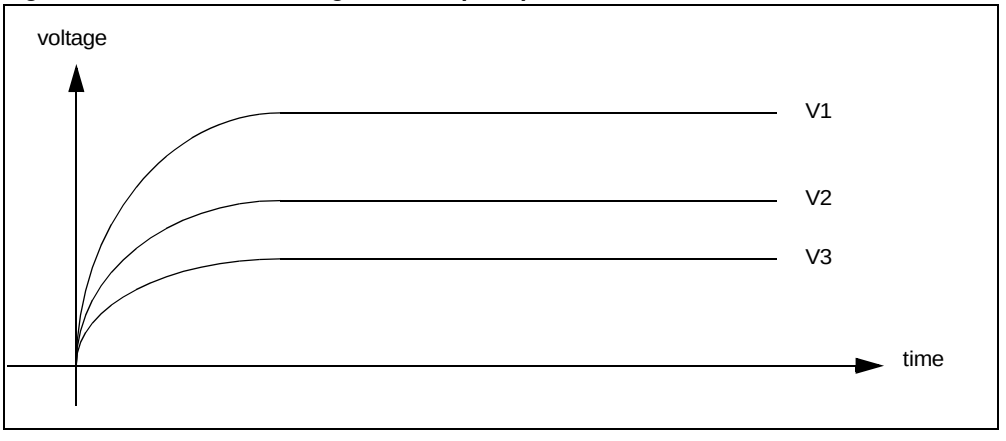
Figure 4: Sequential Power Down Timing Restrictions



3.2 Simultaneous Power Up/Power Down

The power supplies can also be turned on at the same time. Figure 5 shows the recommended relationship between the voltages as a function of time, when the power supplies are turned on simultaneously. A higher voltage power supply should always have a higher voltage than the adjacent lower voltage power supply.

Figure 5: Simultaneous Voltage Power Up Sequence



4. Power Up Sequence and Device Initialization

Correct power up sequence alone does not ensure correct device initialization. In general, the reset signal (RST_) *must* be active (low) until all power supplies have reached their recommended values. If the device datasheet states that reset should be active for at least x clock cycles, the counting of x cycles starts only after all power supplies have reached their recommended values. See the device datasheet for the recommended device initialization process.

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