TSW2200EVM: Multi-Output Power Supply Evaluation Module

The TSW2200EVM evaluation module (EVM) provides a multiple output power supply solution for powering other EVMs. This EVM provides fixed and adjustable supplies that can be used as simple on or off supplies or sequenced supplies for power critical EVM setups. This user's guide discusses options available when using the EVM.

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1 Hardware Configuration

The TSW2200EVM (Figure 1) provides users with a multiple-output power supply board using a switching regulator and low-dropout (LDO) regulators. With an onboard TUSB3210 integrated circuit (IC) and UCD90120A sequencer, users can configure the EVM to operate in either manual or sequencer mode. Manual operation allows each output to be turned on or off with a jumper setting, whereas the sequencer operation allows precise configurability of turnon time using the Fusion GUI software.

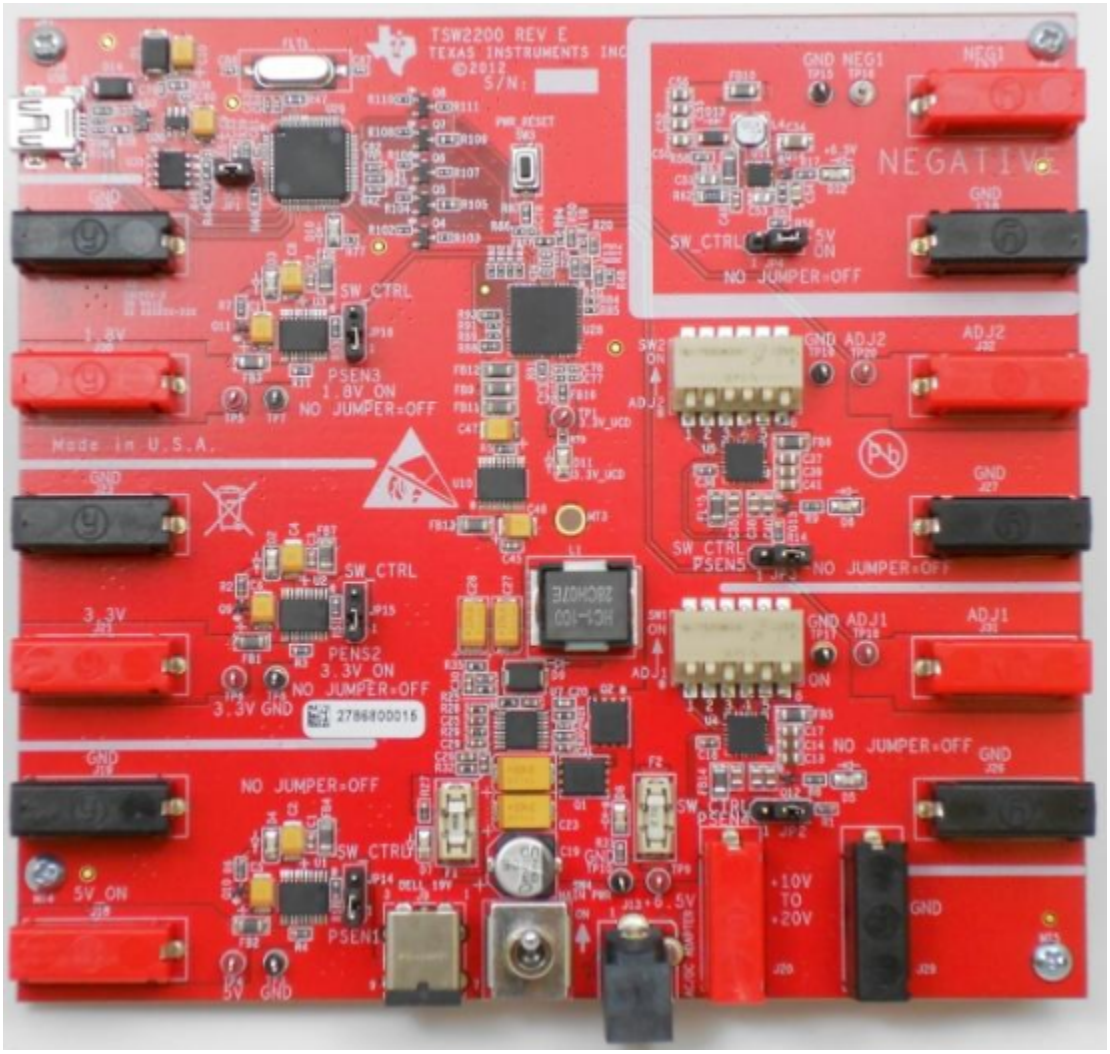

Figure 1. TSW2200EVM Evaluation Module

1.1 Input Power Source

The input supply for the TSW2200 can be a voltage of 10 V to 20 V using banana jacks, a 19-V Dell™ laptop charger, or a 12 V @ 2 A (AC-to-DC) power module. These input voltages are stepped down to 6.5 V using a switching regulator.

1.2 Output Power Regulators

The available power rails are four fixed supplies at 5 V, 3.3 V, 1.8 V and a negative rail of –5 V. Two positive adjustable output regulators are also present supplying voltages from 1.4 V to 6.4 V. All output supplies except for the –5 V output have a rated output current of 1 A. The –5 V output regulator is rated for 0.36 A.

1.3 Switches, Jumpers, and LEDs

SW4 controls the main power switch supplying input power to the EVM. After SW4 is enabled, each separate output supply is turned on and off using individual jumpers. Table 1 shows the jumper configurations for each supply. Manually enable or disable the supply, depending on the jumper location. Another option programs the supply with the UCD90120A sequencer. In this mode the UCD90120A is programmed with the Fusion GUI software. This software controls the turnon times of each supply as well as monitoring overvoltage and undervoltage conditions.

Table 1. Jumper Settings For Power Output Rails

Output Supplies	Jumper Setting: Manual ON	Jumper Setting: Manual OFF	Jumper Setting: Sequencer Control
5 V	1-2	Remove jumper	2-3
3.3 V	1-2	Remove jumper	2-3
1.8 V	1-2	Remove jumper	2-3
from 1.4 V to 6.4 V	2-3	Remove jumper	1-2
from 1.4 V to 6.4 V	2-3	Remove jumper	1-2
–5 V	2-3	Remove jumper	1-2

The LED indication displays which input and output power is enabled or disabled. Table 2 shows which LEDs correspond to specific supplies onboard.

Table 2. LED Indication For Power

Supply	LED
5-V output	D4
3.3-V output	D2
1.8-V output	D3
from 1.4 V to 6.4 V	D5
from 1.4 V to 6.4 V	D6
–5V output	D12
Input power	D7 and D8
UCD90120A input	D11
TUSB3210 input	D10

2 Software Configuration

The Fusion Digital Power Designer software controls the turnon and turnoff of the TSW2200 in sequencer mode. Download the Fusion software from the Digital Power Software page on the TI Web site. This software allows configuration of enable control for turning on and turning off the output supplies at specific time delays. Also available with the Fusion GUI is voltage monitoring of the output. Voltage monitoring reads out conditions of overvoltage, undervoltage, current, and temperature. The following steps demonstrate the set up of the Fusion GUI software.

2.1 Preprogrammed Configurations

Sequencing is provided by the UCD90120A, included on the EVM. Observe the sequencing capabilities of the board by setting the supplies to SW_CTRL (settings in Sequencer control column of Table 1), a preloaded delay for each supply occurs when the board is powered on. This delay is seen when powering on by the sequence of LEDs turning on for their respective supplies. The button highlighted in Figure 2 preprograms this delay into the UCD90120A's flash memory, loading a configuration after the board is shut off.

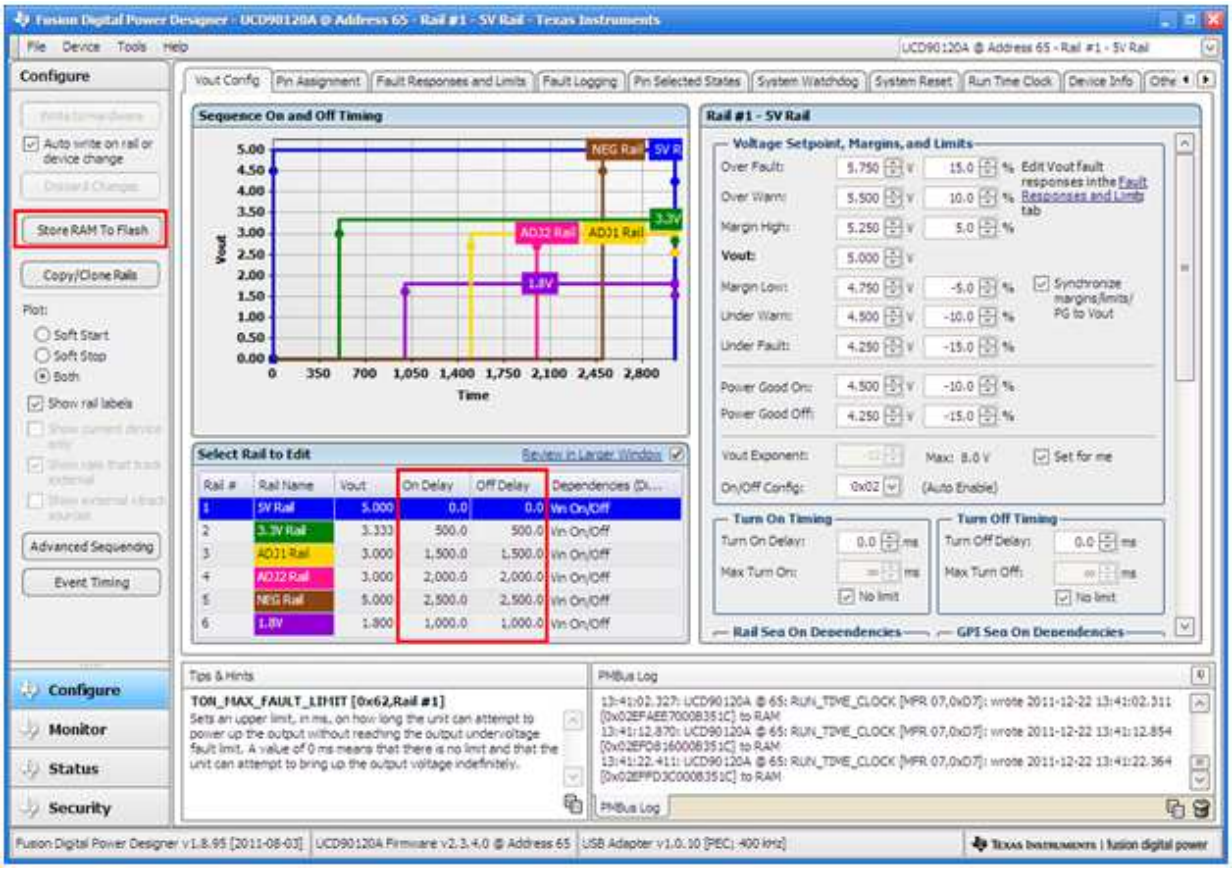

Figure 2. Preprogrammed Delays in Flash Memory

2.2 Delay Settings

Figure 2 highlights the location where the turnon and turnoff delay for each supply is set. Edit the supply value in the *Select Rail to Edit* area for configuration of each rail's delays independently.

2.3 Pin Assignment Settings

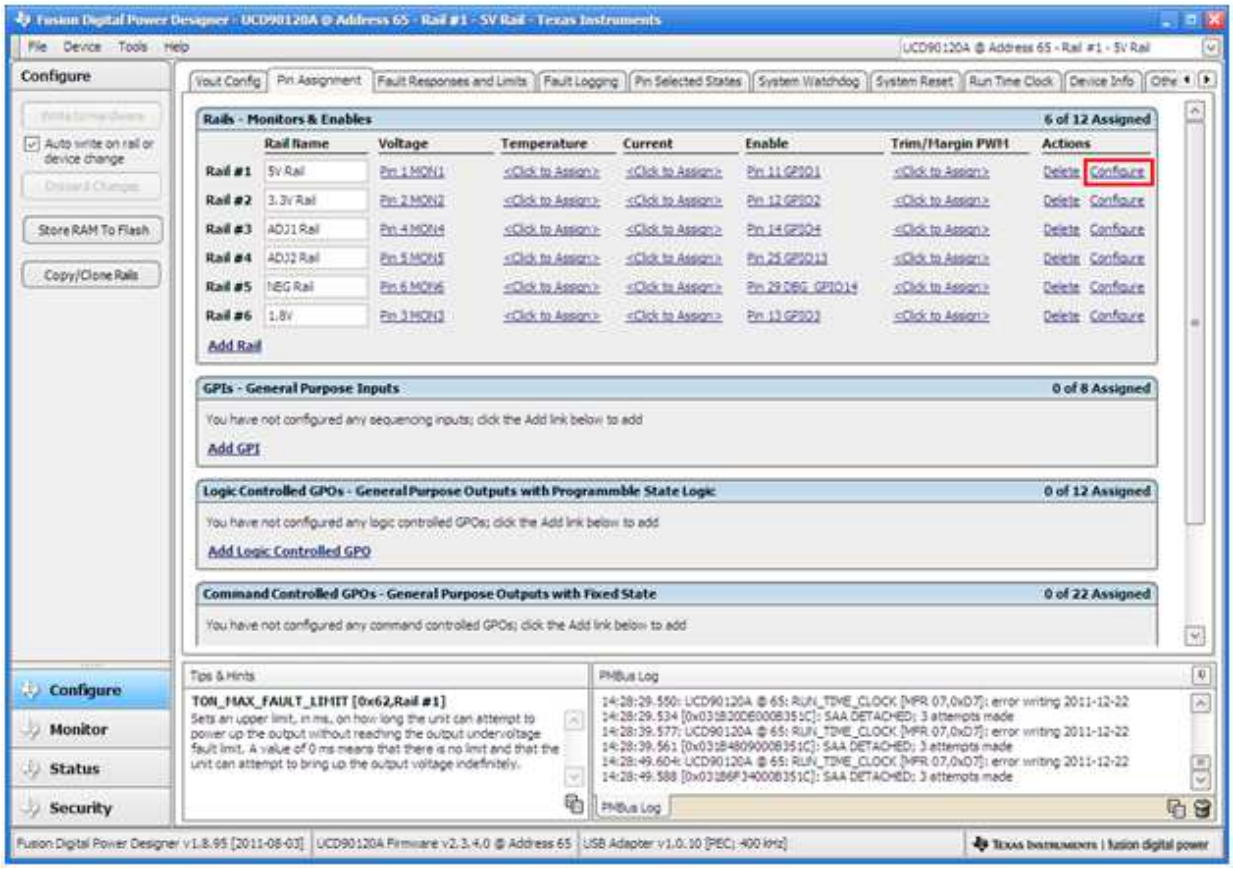

Figure 3. Pin Assignments For Supplies, Enables, and Monitoring

Different configurations are possible with the TSW2200, notably changing the enable settings so the EVM powers up with all supplies off or all supplies on. Configuration of active-low or active-high enable settings for each supply as well as the pin assignments for monitoring and enabling are shown in the pin assignment screen, Figure 3.

Pin assignments are made for the rail name using the pin monitors, as seen in the Voltage column in Figure 3 . These are preset and must not be changed as this is a permanent pin configuration in the hardware. Because the negative regulator's output is –5 V, the monitor pins of the UCD90120A cannot support a voltage outside the range of 0 V to 2.5 V. In order to eliminate an extra inverter for purposes of converting the –5 V to the required monitor voltage range, no monitoring is provided for the –5V supply.

The enables are also preset in the hardware and must not be changed from the settings shown in Figure 3. All supplies have an enable pin connected and used so that all the supplies can be sequenced. The last customizable pin assignment configuration is under the Configure link highlighted in Figure 3. When selecting *Configure*, the screen shown in Figure 4 appears and allows options for an active-low or active-high enable polarity as well as two types of output mode configurations. The output mode configuration is always actively driven.

Users can set the enable polarity, however, in two configurations, depending on the desired result for the supplies during board power up. Table 3 shows the two configurations available for each supply setting. Mode 1 sets all enable polarities to their appropriate state for turnon. This means that when set in Mode 1, all supplies begin to turn on in the configured sequence as soon as the board is powered up. When *Store RAM to flash* is also pushed when setting in mode 1, the board does not need the USB cable connected or have the Fusion GUI software running, the sequencing simply occurs when the board is powered up or when the PWR_RESET SW3 is pushed. Note that when sequencing the supplies, do not turn the board on using the main switch to sequence because transient voltage spikes result from the main supply turning on everything for a short time before the UCD90120A takes control. Sequencing from mode 1, the board powers up in a sequence, then the user can press and hold the SW3 button while all connections are made to the output, and when the button is released, the power comes on in sequence.

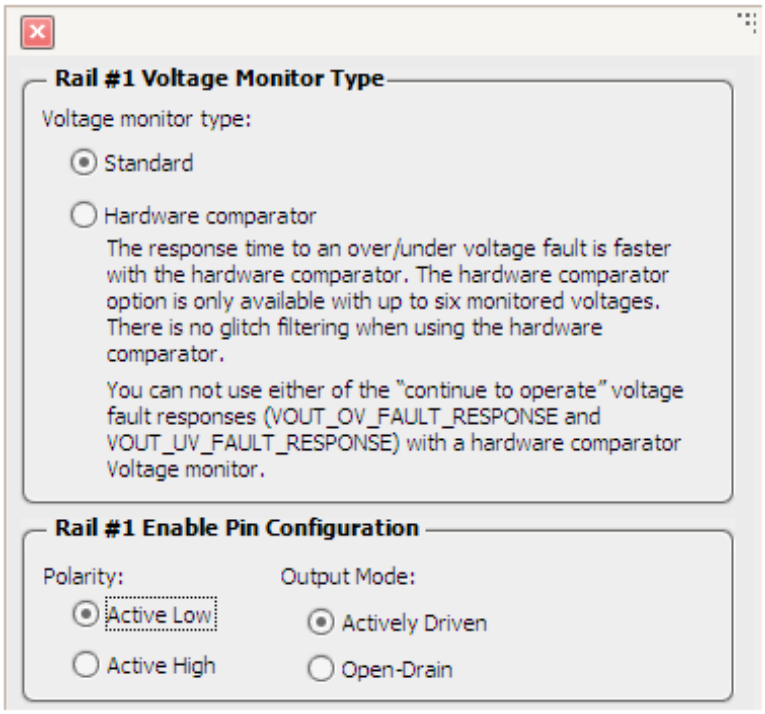

Figure 4. Enable Polarity and Output Mode Type

Table 3. Enable Polarity Modes For Desired Turnon or Turnoff Conditions

Output Supplies	Mode 1 – Enable Polarities	Mode 2 – Enable Polarities
5 V	Active low	Active high
3.3 V	Active low	Active high
1.8 V	Active low	Active high
ADJ1	Active high	Active low
ADJ2	Active high	Active low
NEG	Active high	Active low

Table 3 shows the second mode possible for each supply. Mode 2 sets the supplies to the enable polarity keeping supplies off when the board powers on. In this mode, the Fusion GUI software and a USB cable connected to the board are required. When operating in this mode and once all the desired delay settings are set, a write to the hardware is possible. This write to hardware is in real time and sets all supplies to the appropriate delays. Once the configuration for turnon is set, then all enable polarities for each supply

under Configure in Figure 3 are changed to Mode 1 settings. Another write to hardware is done, and then all supplies are sequenced without turning the board off and on. When all boards need to be sequenced off by a specified delay setting, then all enable polarities can be reset to Mode 2 and a write to the hardware can be repeated. This then sequences all supplies off, based on the specified time for each supply.

2.4 Voltage Monitoring

The last Fusion GUI readout beneficial for maintaining correct output voltage levels is the voltage monitoring function. This portion of the software allows real-time voltage monitoring of each output voltage rail. In Figure 5, the output voltage readings appear in the top left. Each voltage reads out the correct output voltage of each supply. The monitoring is preprogrammed based on the hardware and software specifications. The voltage reading for Vout #6 – NEG Rail is not valid because the monitor pin was not connected for this rail. This is because the output of the negative regulator is -5 V and cannot be divided appropriately to a voltage within the 0V to 2.5V requirement.

When monitoring voltage it is important whether the voltage exhibits undervoltage or overvoltage conditions. Measure this data within the Status Registers/Lines box or the graphical readout for the respective output voltage to the right of the Readings box. These two boxes indicate if the output voltage is OK, as well as what condition the voltage is in with respect to the overvoltage and undervoltage limit conditions. This data ensures the power supply board is operating correctly.

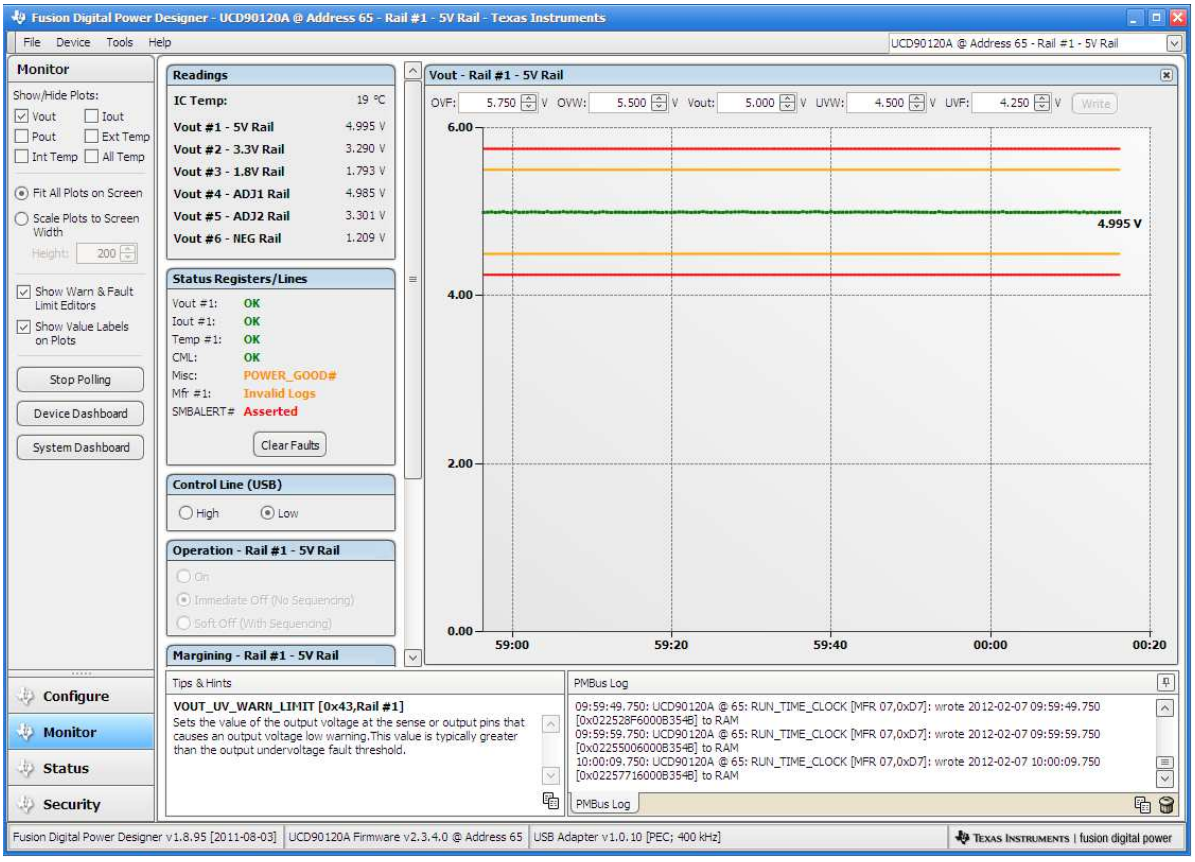

Figure 5. Voltage Monitoring Readouts For Each Output Voltage Rail

3 Turnon Sequencing Example

To verify the sequencing of two of the supplies turning on, perform the following steps for setting up the TSW2200 and the Fusion GUI software. For this setup, the 5V rail does not have a turn on delay, whereas the 3.3V rail has a 20ms delay.

3.1 Hardware Setup

Prepare the TSW2200 for software programming with the following steps:

1. Plug in the input power as described in Section 1.1.
2. Connect the TSW2200 to the computer with a USB cable.
3. Turn on the EVM with SW4. Do not connect the output voltages to the loads.

3.2 Software Setup

Configure the sequencer delay settings with the following steps:

1. Start the Fusion GUI software.
2. Configure the delay settings for the 5V and 3.3V rails as shown in Figure 6.
3. Set the enable polarities as listed in Mode 2 from Table 3 (accessible in Configure menu as shown in Figure 3).
4. Click *Write to Hardware* (all rails must be turned off; verify by appropriate LEDs in Table 2 being off).
5. Change jumpers for all other rails, besides 5 V and 3.3 V, to the settings in Table 1 under Manual OFF.
6. Connect a scope probe to the 5V rail and another to the 3.3V rail.
7. Change the enable polarities to the settings listed for Mode 1 from Table 3.
8. Click *Write to Hardware* (5V and 3.3V rails turn on; verify by LEDs).
9. Figure 7 shows the oscilloscope capture of the 5V and 3.3V rails sequencing with a delay of 10 ms.

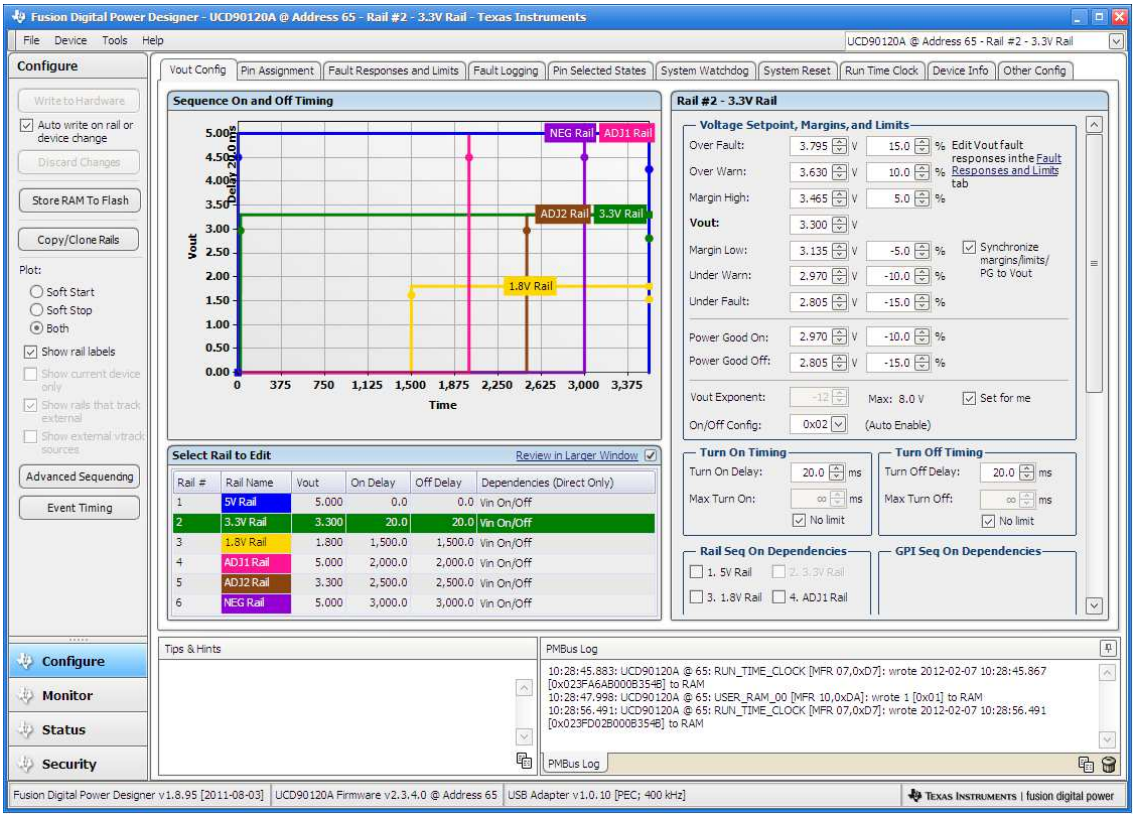

Figure 6. 5V and 3.3V Rails With 20ms Delay

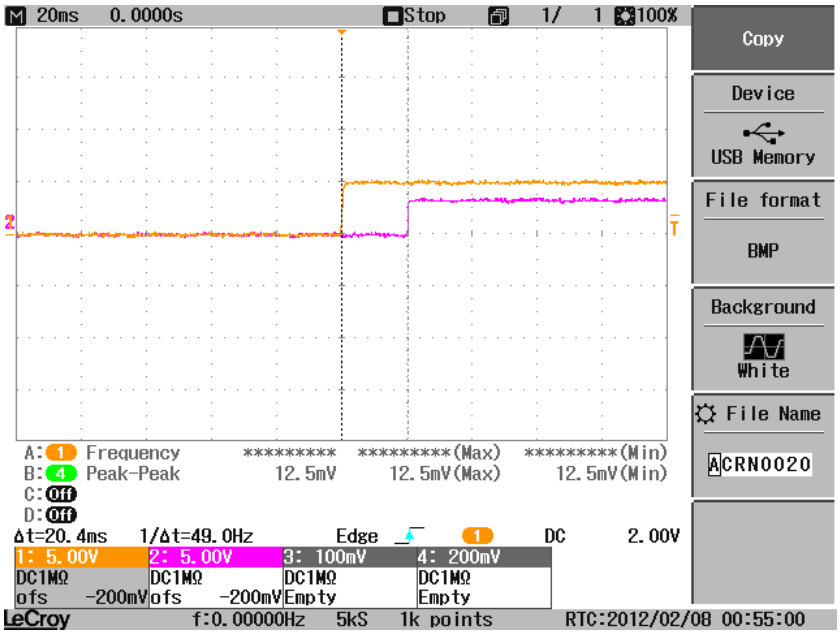

Figure 7. 5V and 3.3V Rails With 20ms Delay Capture

4 Reference

For more information on Fusion GUI software functionality, refer to the supplementary Fusion Tools Documentation.

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- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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