Application Note

UCD91xxx Frequently Asked Questions

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ABSTRACT

The UCD91xxx family devices are flexible and powerful to meet sequencing and monitoring requirements.

This application report addresses frequently asked questions to give users a jump start.

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Trademarks

1 Introduction

The UCD91xxx family of digital power supply sequencers are designed to meet sequencing, monitoring, and margining needs. The entire family is scalable so designers can migrate to other variants without extensive rework. This document addresses some frequently asked questions.

2 Frequently Asked Questions

2.1 Sequencer Studio GUI FAQs

2.1.1 Can the Sequencer Studio generate a data flash image file (.hex) while working without a device connected?

In the previous generation of UCD90xxx devices, the PARM_VALUE and PARM_INFO commands supported writing the configuration image directly to non-volatile memory in the device. As a security measure, the UCD91xx devices do not support directly writing configuration images into flash. Therefore, the GUI cannot provide a .hex file that can be flashed to a device, but there are some alternatives:

1. A SYSCFG file can be saved, and then loaded into another GUI session for additional modifications
2. A CSV output file containing a list of PMBus commands that configure the device can be generated. This enables an external controller to configure the device without interfacing with the GUI. The configuration is saved to nonvoltatile memory by issuing a STORE_DEFAULT_ALL command

2.1.2 How Do I Configure Margining in Sequencer Studio?

There is a margining tab within Sequencer Studio that allows the user to add rails, and configure the properties for each one.

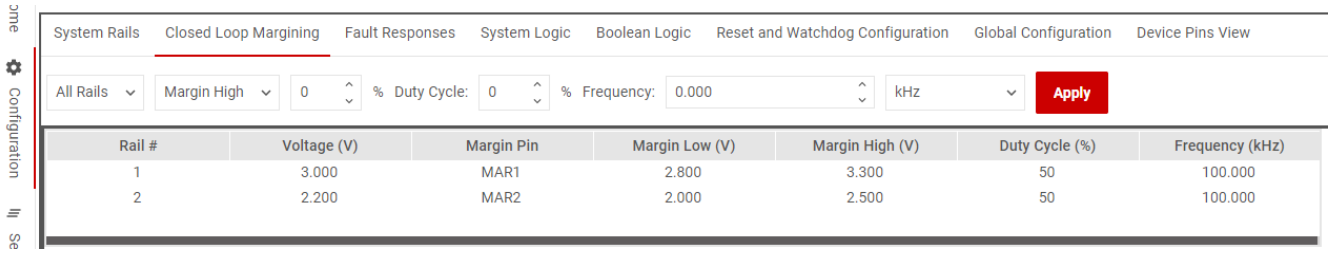

Figure 2-1. Margining Tab of Sequencer Studio

2.1.3 How Do I use Voltage Trimming?

There is a setting in the GUI that configures the device to use the margining circuitry to trim the output voltage of the regulator to the nominal voltage.

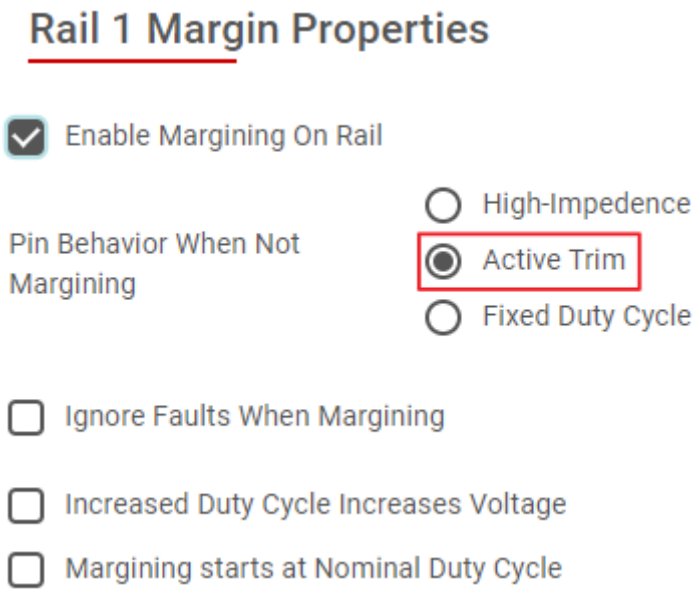

Figure 2-2. Margining Properties Example

2.1.4 How Do I Set ADC Voltage Divider Settings?

There is a field within the rail configuration tab that allows the user to select the division factor

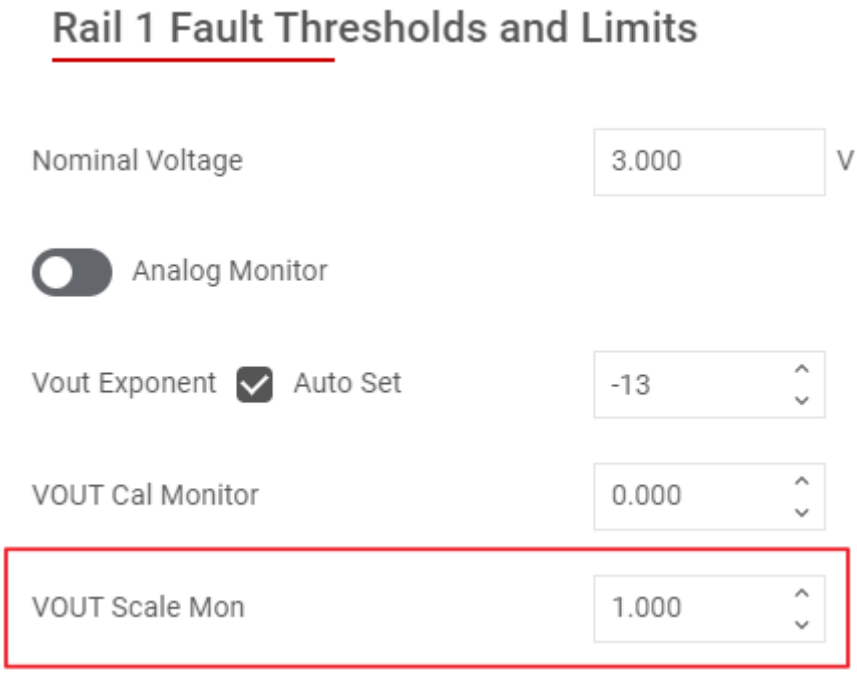

Figure 2-3. Voltage Scaling

2.1.5 How Do I Configure the Black Box Fault Log?

The black box fault logs in the UCD91xxx devices are designed to preserve the first and last faults that occur in the device. The first fault is written to the device non-volatile memory as soon as possible after it occurs, and the last fault is written when the device crosses the BOR voltage threshold. No additional configuration is required to enable the black box.

2.1.6 How Can I Read the Device Firmware Image?

It is not possible to read the image of the firmware; however, it is possible to read the rail configuration profile, and load it in to Sequencer Studio.

2.2 Hardware FAQs

2.2.1 Are Pulldown Resistors Required on EN Pins?

Pulldown resistors on EN pins are needed in some situations. When the UCD91xxx device is in reset or in initialization, the GPIO pins are in high-impedance state, so pulldown resistors are required to keep EN pins low. Excluding these pull-down resistors can result in unpredictable behavior on the ENx pin.

2.2.2 Are the Decoupling Capacitors Required on MON Pins?

Decoupling capacitors on MON pins are recommended. MON pins are ADC channels. There is no internal filtering to average the ADC samples. Therefore, decoupling capacitors are used to remove rail ripple voltage. If resistor dividers are used to scale down the voltages, adding decoupling capacitors can reduce input impedance and improve ADC sample accuracy.

2.2.3 What is The Value of the Tank Capacitor?

The size of the tank capacitor is largely dependent on how long you want the device to continue running after a power loss. If functional black box fault logging is desired, the tank capacitor must be large enough to keep the supply voltage above 1.62V for at least 825us to allow the last black box fault log to finish writing off.

2.2.4 Can Less than Three GPIs Be Used for PIN SELECTED RAIL STATE (PSRS)?

Yes. PSRS supports up to three GPIs. Enable each state manually for this to be accessible from the GPIs.

2.2.5 Can the Logical General Purpose Output (LGPO) Be Used as an Enable?

Yes, but TI does not recommend doing so. A rail ENx pin has many features that LGPO pins do not such as enable and disable with dependencies, delays, fault responses, re-sequences, and fault logging. Furthermore, fault shutdown with an ENx is also faster than using an LGPO.

2.2.6 How Should Users Implement a Power-Down Sequence When the Rails ON_OFF_CONFIG are Set to Always On?

The UCD91xxx has a mode called *Always On* where the rails power up as soon as the device powers on. In this case, only a fault triggers a power-down sequence.

2.2.7 Can the RESET Pin be Used to Sequence Off Rails?

TI does not recommend this because the device reset interrupts monitoring. The control pin must be used in this situation.

2.2.8 Is an RC Filter Needed for External VREF?

TI recommends a capacitor only if an external VREF is being used. TI recommends using the external VREF to improve ADC performance. Even routing VDD to the VREF pins improve the performance.

2.2.9 What is the CONTROL Pin Used For?

The control pin can be used to activate the power sequence. Inverting the state of the pin causes a de-sequence. The control pin is only a dependency if the user selects that option. The ON_OFF_CONFIG setting determines if the PMBus CONTROL pin affects the rail states or not.

2.2.10 What Are the States of IO Pins When The Pin is Under Reset?

High impedance

2.2.11 Are These Devices Tested for Radiation?

No

2.2.12 What Are the Options to Configure Devices?

Sequencer Studio GUI or PMBus through an external host.

2.3 Software FAQs

2.3.1 How Can Users Re-sequence All Rails After They are Off due to Fault Response When the Rails are ON_OFF_CONFIG are set to AUTO Mode?

The resequencing option allows the device to attempt a re-sequence after a fault occurs.

2.3.2 How do Users Know that the Sequencing Dependencies are Met?

The user can configure the device to use a GPIO to toggle when the desired rails have crossed the POWER_GOOD_ON thresholds. The power good status can also be read over PMBus.

2.3.3 Is Clock Stretching Required by the PMBus Master?

Yes. UCD91xxx devices can hold clock low while processing the PMBus inquiry. According to PMBus specifications, a host must support clock stretching for up to 35ms. TI recommends leaving a 1-ms interval between two PMBus inquiries; otherwise, the UCD91xxx can occasionally hold clock low for 35ms and then timeout (hardware release clock line).

2.3.4 What are Restart (Retry) and Re-sequence?

Retries refer to a fault on a single rail. Re-sequences apply to all of the fault-slaves. Once a rail exhausts its retries, then this trigger a re-sequence.

2.3.5 What are the Fault Shutdown Slaves?

A fault slave is a rail that executes the same fault response as the master. If the master goes down, then each fault slave also goes down.

2.3.6 What Happens when the Fault Log is Full?

If the fault log is in FIFO mode, then this removes the oldest fault. Otherwise, the log stops logging.

2.3.7 How Can Users Re-sequence All Rail After They are off due to Fault Response When the Rails are ON_OFF_CONFIG are Set to AUTO Mode?

The resequencing option allows the device to attempt a re-sequence after a fault occurs.

2.3.8 When Importing a Project File into a Device, Why Do Some GPIO Pins Unexpectedly Turn On and Off?

The device is still monitoring while a program is being loaded, so the device is continually evaluating dependencies. You may see behavior where rails and GPIOs are toggling while the configuration loads. This is normal, and simply means that the device is evaluating the new conditions, and applying the changes accordingly.

2.3.9 When is the Re-sequencing Count Reset?

The re-sequencing count is reset when all re-sequencing rails stay above the POWER_GOOD threshold for more than one second. Once the re-sequencing count is exhausted, the device does not perform any resequencing until a reset or power cycle is triggered.

2.3.10 When is the Retry Count Reset?

The retry count is reset whenever the rail stays above the POWER_GOOD threshold for a TON_MAX_FAULT_LIMIT amount of without having a glitch. If TON_MAX_FAULT_LIMIT is set to 0, four seconds are used for the time.

2.3.11 Why are the Fault Shutdown Slave Rails Not Off Immediately?

The shutdown behavior is configurable. There are options for immediate shutdown as well as soft off (sequenced down)

2.3.12 Why Are The Rails Off Immediately Instead of Following the Sequencing Settings (Dependencies, TOFF Delay) when Toggling the CONTROL?

The CONTROL shutdown behavior is configurable. There are options for immediate shutdown as well as soft off (sequenced down)

2.3.13 Why are the settings not saved after device reset?

Explicitly tell the program to write the configuration to flash using the STORE_DEFAULT_ALL command, or click *Store Flash* in Sequencer Studio.

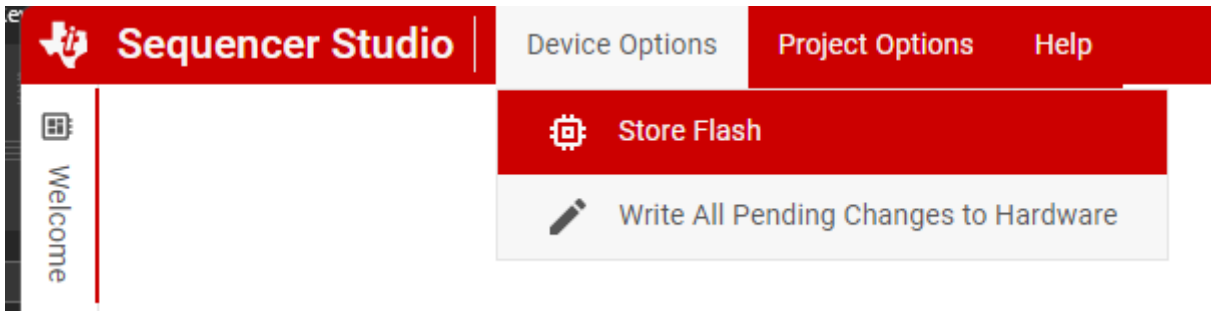

Figure 2-4. Save Configuration to Flash

2.3.14 Why Are There No Undervoltage Faults? For Some Reason, the Rails Do Not Start

UCD91xxx monitors undervoltage only after reaching power good for the first time.

2.3.15 Why Do Rails not Re-sequence After Restart is Exhausted?

Resequencing only works when all re-sequencing rails are below the power good off threshold. All the rails have to be off before trying to re-sequence.

2.3.16 Why Do the Rails Not Start or Stop?

There are many reasons the device behavior is unexpected. There are a few common issues that should be evaluated:

1. Power good on/off thresholds are configured incorrectly
2. ON_OFF_CONFIG is set incorrectly
3. Hardware issues (ENx pin not connected, MONx pin not connected, etc.)

2.3.17 Why Does the Time Interval Between Two Re-sequences Longer than the Value Set in Time Between Re-sequences?

The timer starts when all rails are below the power good off thresholds, so the activation of this timer is dependent on voltage decay times.

2.3.18 Why Does the Turn-on and Turn-off Sequence or Re-sequence Hang, or Take Very Long to Complete?

Check to see if there are any dependencies that can be causing the device to wait.

2.3.19 Why is a Fault Logged even if the Fault is Ignored by a Glitch Filter?

A glitch filter only applies to the fault response, but the fault itself is still logged.

2.3.20 When is POWER_GOOD Fault Flag Set?

When at least one rail has not reached the power good threshold.

2.3.21 What is the Difference Between Resequencing and Retries?

Retries refer to a fault on a single rail. A rail exhausts the retries before triggering a re-sequence off all of the rails.

2.3.22 How Quickly Can UCD Detect and Respond to a Fault?

UCD91xxx can detect and respond to a fault within 400us.

2.3.23 Why Does the GPI Not Turn Off the Rails when it is De-asserted if the GPI is Configured as a Rail Sequence-Off Dependency?

Dependencies are evaluated when the rail changes state, so simply changing the GPI dependency does not immediately change the state.

2.4 PMBus FAQs

2.4.1 Is Packet Error Code Required by the PMBus Master?

This is optional. UCD91xxx devices send a receive pack error codes if the PMBus host supports it. No special configuration is needed.

2.4.2 Is the PMBus Connector for the Sequencer Studio GUI Still Required if a PMBus Host is Already Available?

The connector for the USB-to-GPIO connector is only used when the UCD91xxx must communicate with Sequencer Studio. Any controller with PMBus capability must be able to communicate and configure the UCD91xxx device without the GUI.

2.4.3 What is an ALERT Signal?

The PMBUS Alert Pin notifies the host controller if a status set to generate an alert has set. The statuses that cause an alert can be selected using the SMBALERT_MASK command.

2.4.4 Can The GPI Status of a UCD91xxx Be Read Over The PMBus?

Yes; there is more information about this is PMBus user guide

2.5 Margining FAQs

2.5.1 Are There any Application Notes for Margining Function?

TBA

2.5.2 Does the UCD91xxx Family Support Voltage Margining?

The UCD91100, UCD91160, and UCD91320 devices support PWM margining.

2.5.3 When does the UCD91xxx start rail margining?

The UCD91xxx begins margining immediately when the rail powers up in margining mode. The device has a nominal duty cycle mode where the PWM signal will be started at the nominal rail voltage, so there are no spikes on the rail when it starts.

3 Summary

The UCD91xxx family devices are designed to allow users to quickly setup a sequencing configuration. This application report addressed frequently asked questions to accelerate development time.

4 References

Texas Instruments, *UCD91320 32-Rail PMBus Power Sequencer and System Manager*, data sheet.

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