POWERNAVIGATOR 5.4

DIGITAL MULTIPHASE USER GUIDE

MARCH 2018

BIG IDEAS
FOR EVERY SPACE

RENESAS

OVERVIEW

- **This guide walks a user through the steps to setup and configure the ISL691xx and ISL681xx Digital Multiphase products using the PowerNavigator GUI. For all other Renesas Digital Power devices, please see the Digital Point of Load user guide.**

- **This guide is intended for use with PowerNavigator Revision 5.4.62**

- **This presentation contains the following sections that can be referred to depending on the stage of the design:**

  - PowerNavigator Introduction
  - Running PowerNavigator
  - Creating a new project in offline mode
  - Connecting to Hardware and loading Project files
  - Creating HEX files for production programming

 BIG IDEAS FOR EVERY SPACE

INSTALLING POWERNAVIGATOR

BIG IDEAS FOR EVERY SPACE

RENESAS

Installing PowerNavigator

- Download the latest version of PowerNavigator from:
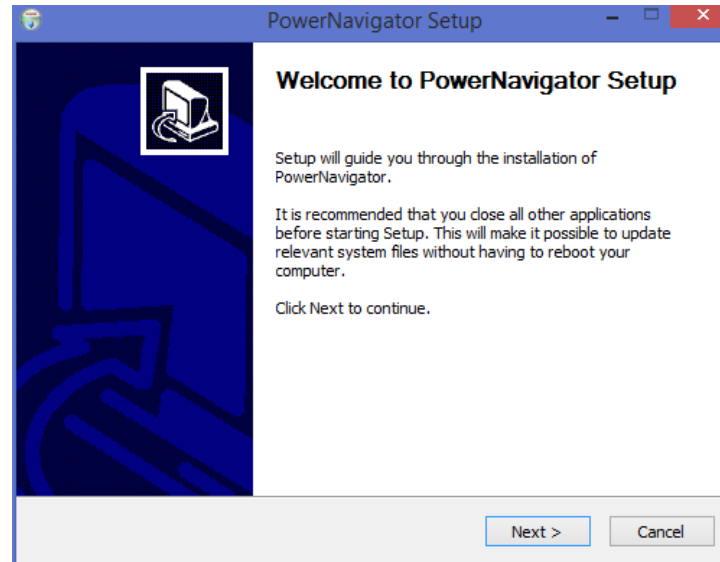

    www.intersil.com/powernavigator

- PowerNavigator Requires a Windows PC with Windows Vista or greater

- A driver is NOT required for the USB to PMBus adapter – it uses the built-in Windows HID driver.

BIG IDEAS FOR EVERY SPACE

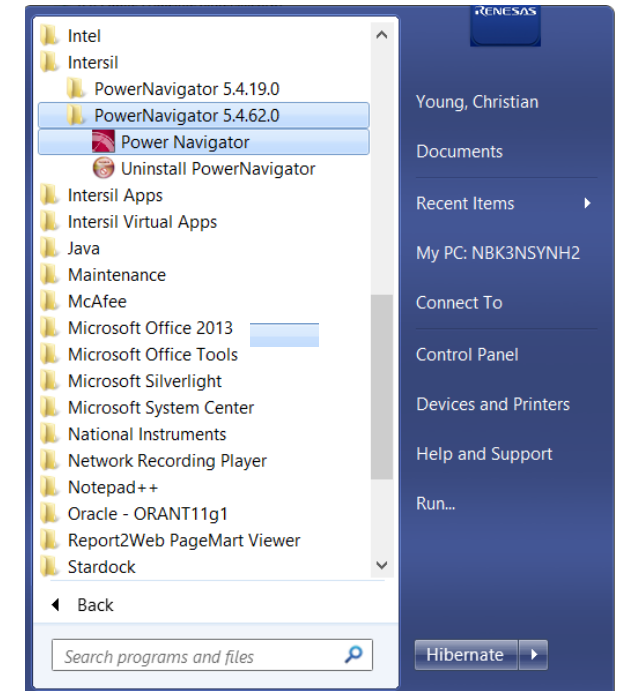RENESAS

Installing PowerNavigator

1 Double Click installer to begin install process.
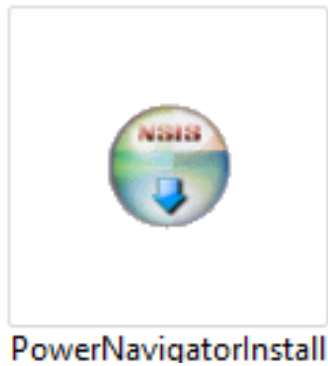
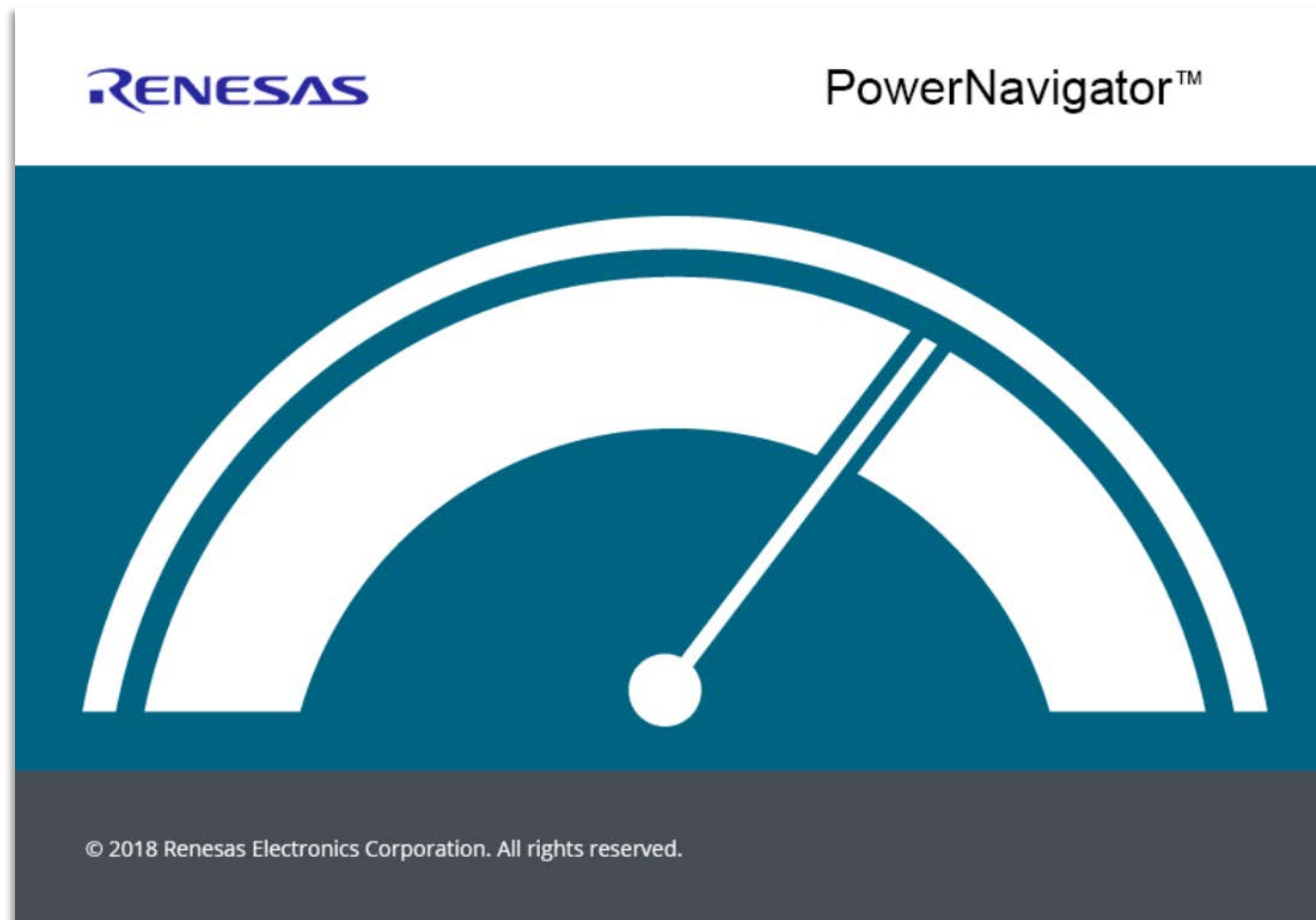**2** Click through PowerNavigator Setup Wizard to install.

3 After installation is complete, PowerNavigator will be visible in Start Menu under "Intersil"

PowerNavigatorInstall

PowerNavigator Setup

Welcome to PowerNavigator Setup

Setup will guide you through the installation of PowerNavigator.

It is recommended that you close all other applications before starting Setup. This will make it possible to update relevant system files without having to reboot your computer.

Click Next to continue.

Next >   Cancel

Intel
Intersil
    PowerNavigator 5.4.19.0
    PowerNavigator 5.4.62.0
        Power Navigator
        Uninstall PowerNavigator
Intersil Apps
Intersil Virtual Apps
Java
Maintenance
McAfee
Microsoft Office 2013
Microsoft Office Tools
Microsoft Silverlight
Microsoft System Center
National Instruments
Network Recording Player
Notepad++
Oracle - ORANT11g1
Report2Web PageMart Viewer
Stardock
◄ Back

Search programs and files

Young, Christian
Documents
Recent Items ►
My PC: NBK3NSYNH2
Connect To
Control Panel
Devices and Printers
Help and Support
Run...

Hibernate ►

BIG IDEAS FOR EVERY SPACE

RENESAS

LAUNCHING POWERNAVIGATOR

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

RENESAS

PowerNavigator Launch Screen

PowerNavigator Launch Screen
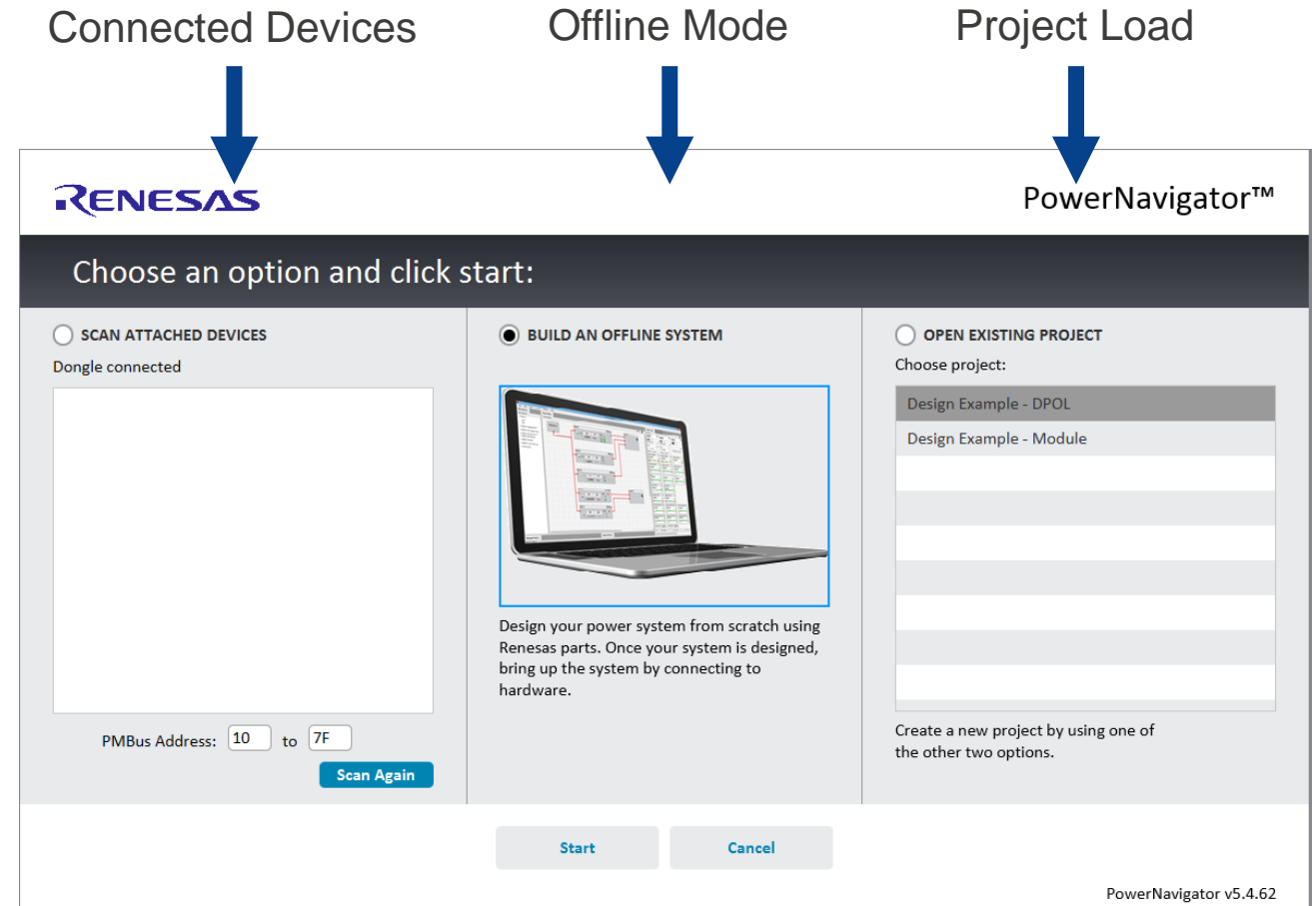
Connected Devices:

- Used for telemetry monitoring only. Device configuration changes cannot be made in this mode.

Offline Mode:

- Used to create new projects

Project Load:

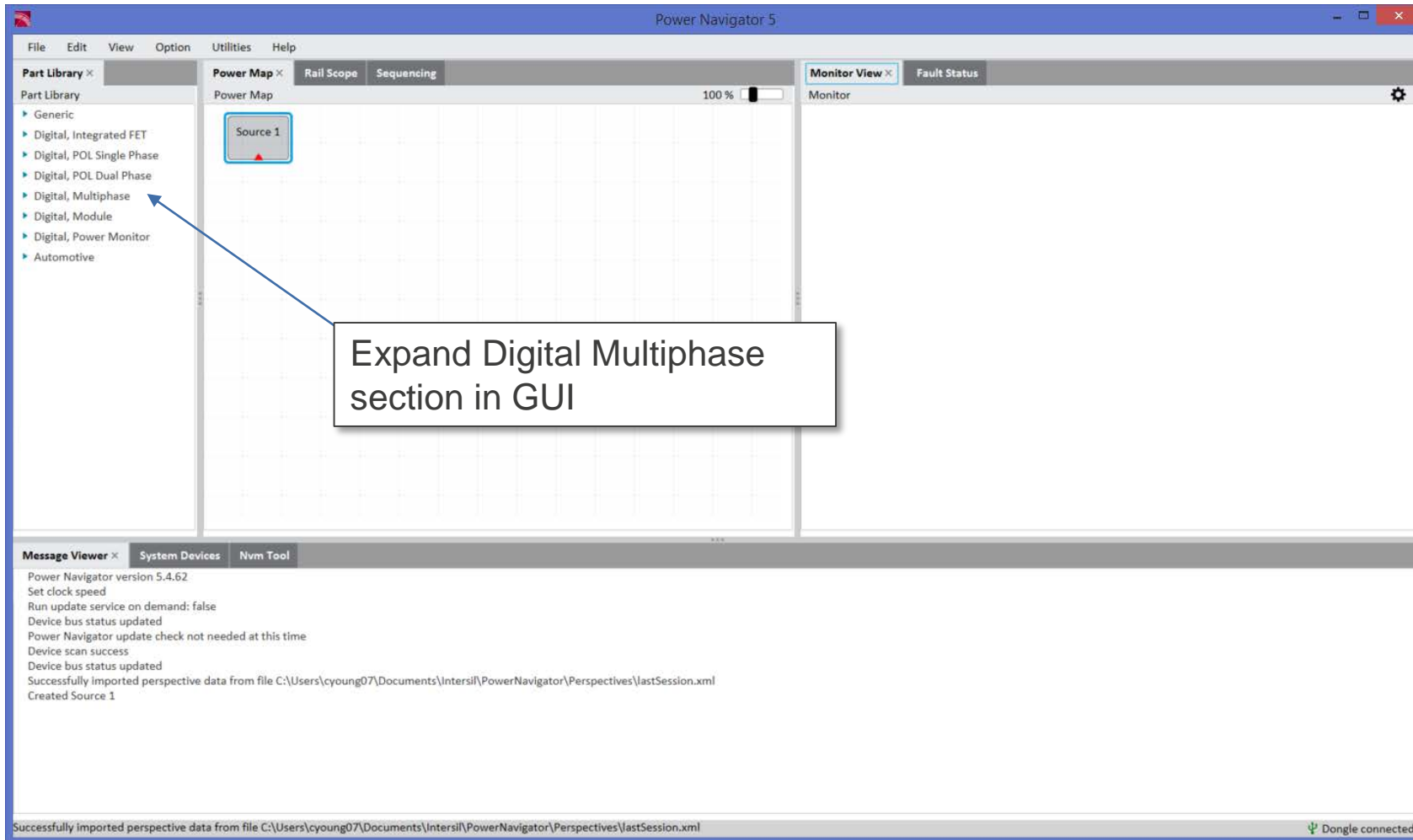- Used to load an existing project or connect to existing hardware. Allows device configuration changes to be made.
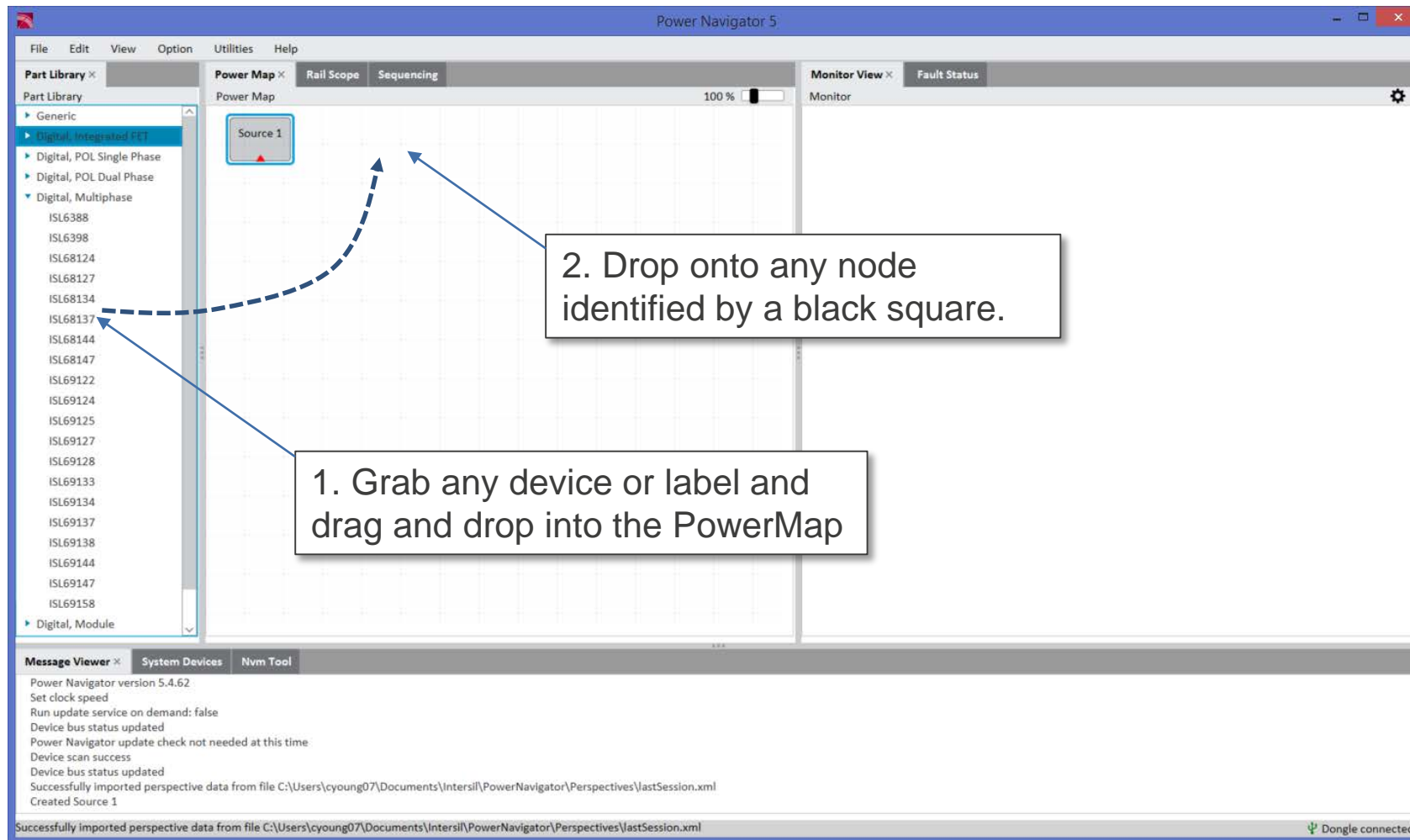
Connected Devices

Offline Mode

Project Load

RENESAS

PowerNavigator™

Choose an option and click start:

○ SCAN ATTACHED DEVICES
Dongle connected

○ BUILD AN OFFLINE SYSTEM

○ OPEN EXISTING PROJECT
Choose project:

Design Example - DPOL
Design Example - Module

Design your power system from scratch using Renesas parts. Once your system is designed, bring up the system by connecting to hardware.

Create a new project by using one of the other two options.

PMBus Address: 10 to 7F

Scan Again

Start   Cancel

PowerNavigator v5.4.62

BIG IDEAS FOR EVERY SPACE

RENESAS

Project Files

- Digital multiphase devices rely on **Project Files** for loading and editing configuration settings. ***It is not possible to read back the stored configuration settings from a multiphase controller***, so proper use and maintenance of project files is critical.

- **Definitions:**
  - **Project File**: System level file that contains all project information, including individual configuration files.
  - **Config File**: Unique file contained within the project file with the setup information for a single controller configuration

- **The project files can be found on your PC:**
  - C:\USERS***User Name***\Documents\Intersil\PowerNavigator\Projects
  - Project files for all Digital Multiphase demo boards are available from Renesas upon request

BIG IDEAS FOR EVERY SPACE

CREATING PROJECTS IN OFFLINE MODE

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Launch Screen

Connected Devices

Offline Mode

Project Load

Click on "Build New System" and then "Start"

Digital Multiphase – Main Screen

Expand Digital Multiphase section in GUI

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Main Screen

2. Drop onto any node identified by a black square.

1. Grab any device or label and drag and drop into the PowerMap

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – PowerNavigator PowerMap

Each box or "Rail Block" on the PowerMap represents one of the device outputs

Double Click on the Rail Block to bring up the device's design tool.

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – PowerNavigator PowerMap

Example ISL68137 RailBlock (6-PH operation):

Address and Page info

Rail Name (customizable)

Vout/Iout Telemetry

Online (hardware connected) or Offline indicator

PMBus Enable/ Disable

PGOOD Status

Controller Type

Number of phases assigned. 6PH in this example – each "dot" represents a phase.

BIG IDEAS FOR EVERY SPACE

RENESAS
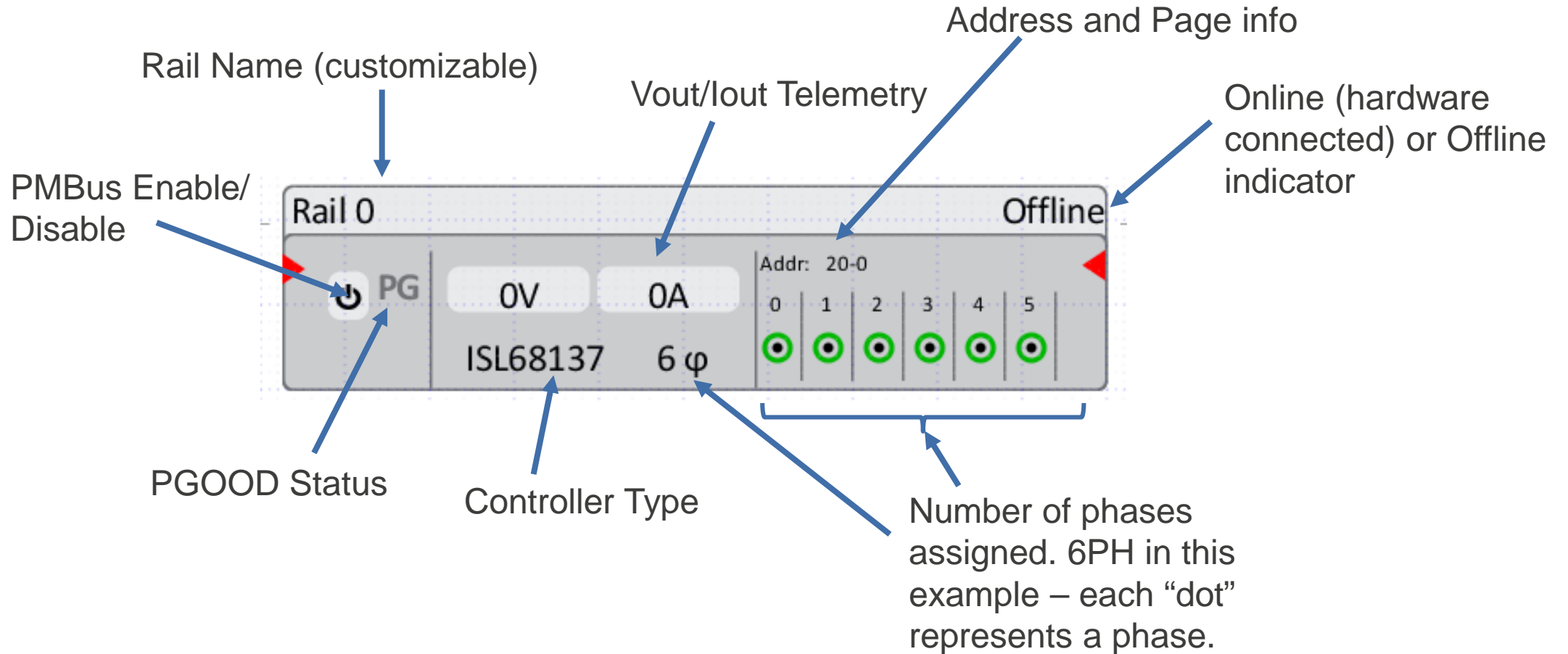
Digital Multiphase – PowerMap and Rail Inspector

Double click PowerMap rail block to bring-up Rail Inspector

TIP: Make sure to configure **both outputs**! If an output is not used (no phases assigned) be sure to disable SVID on that output.

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Rail Inspector

Rail Inspector Navigation panel

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
- Telemetry
  - Monitor
  - Fault
  - Phase Scope
- Command Tools
  - New

Rail Information

Rail Name: Rail 1

Devices	Address	Page
ISL68137	0x20	1

Rail Status
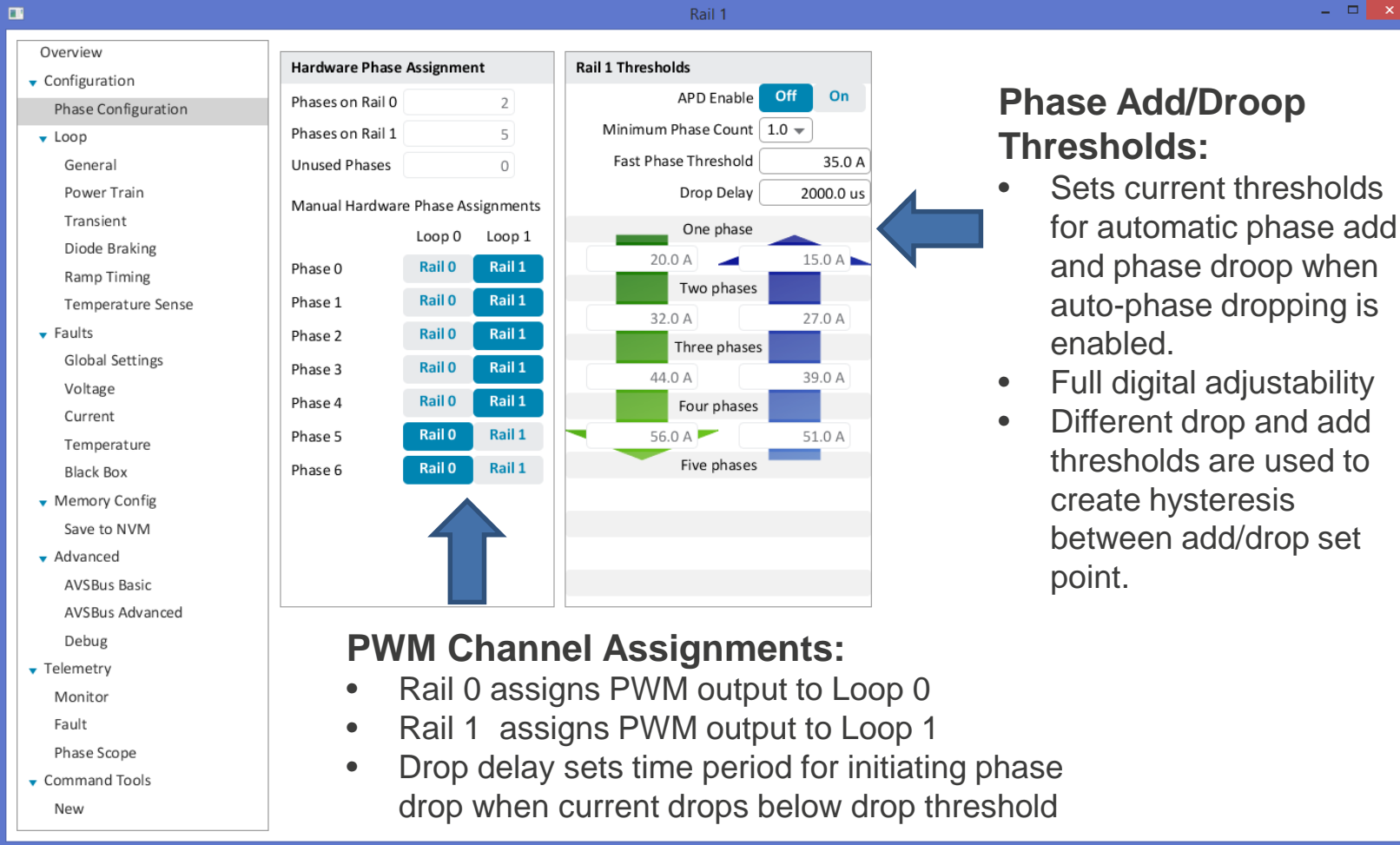
Vout Status: Disabled

PMBus Status: Offline

User Revision Register

User Revision From Hardware: 0

User Settable Revision Value
Integer Value from 0 to 255

0

Revision Register – user settable configuration revision to assist with revision tracking

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Phase Configuration

Phase Add/Droop Thresholds:

- Sets current thresholds for automatic phase add and phase droop when auto-phase dropping is enabled.
- Full digital adjustability
- Different drop and add thresholds are used to create hysteresis between add/drop set point.

PWM Channel Assignments:

- Rail 0 assigns PWM output to Loop 0
- Rail 1 assigns PWM output to Loop 1
- Drop delay sets time period for initiating phase drop when current drops below drop threshold

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Device Setup

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - Command Tools
    - New

General Configuration

Vout Max	2.3 V	
Vout OV Fault Limit	1.125 V	25.0 %
Vout Margin High	0.945 V	5.0 %
Vout	0.9 V	
Vout Margin Low	0.855 V	-5.0 %
Vout UV Fault Limit	0.585 V	-35.0 %
Vout Min	0.0 V	
☐ Track PMBus Vout		
Bootcap Recharge Frequency	10.0 kHz	
Minimum PWM Low Time	150.0 ns	
Switching Frequency	500 kHz	

VOUT_MAX sets upper line of output voltage. Any VOUT_COMMAND above VOUT_MAX will be ignored.

Vout and Vout OV/UV fault limits thresholds

Check "track PMBus Vout" to have fault levels track the Vout command based on percentage

Per phase switching frequency

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Power Train Configuration

Selects current sense scheme – Inductor DCR or SPS.

Default IMON output for ISL99226/7 SPS. Adjust as needed to dial in load line accuracy

Displays max current measurement per phase before Isense ADC clips

Bulk Capacitance or ceramic capacitance by output inductors

Ceramic Capacitance used at load

Power stage UFET and LFET Rds(on). Use typical values from datasheet.

Approx. resistance of PCB planes between output inductors and Load.

Output inductance and DCR (per phase). Use typical values from inductor datasheet. This information is REQUIRED for proper operation.

Digital Multiphase – Control Loop Configuration
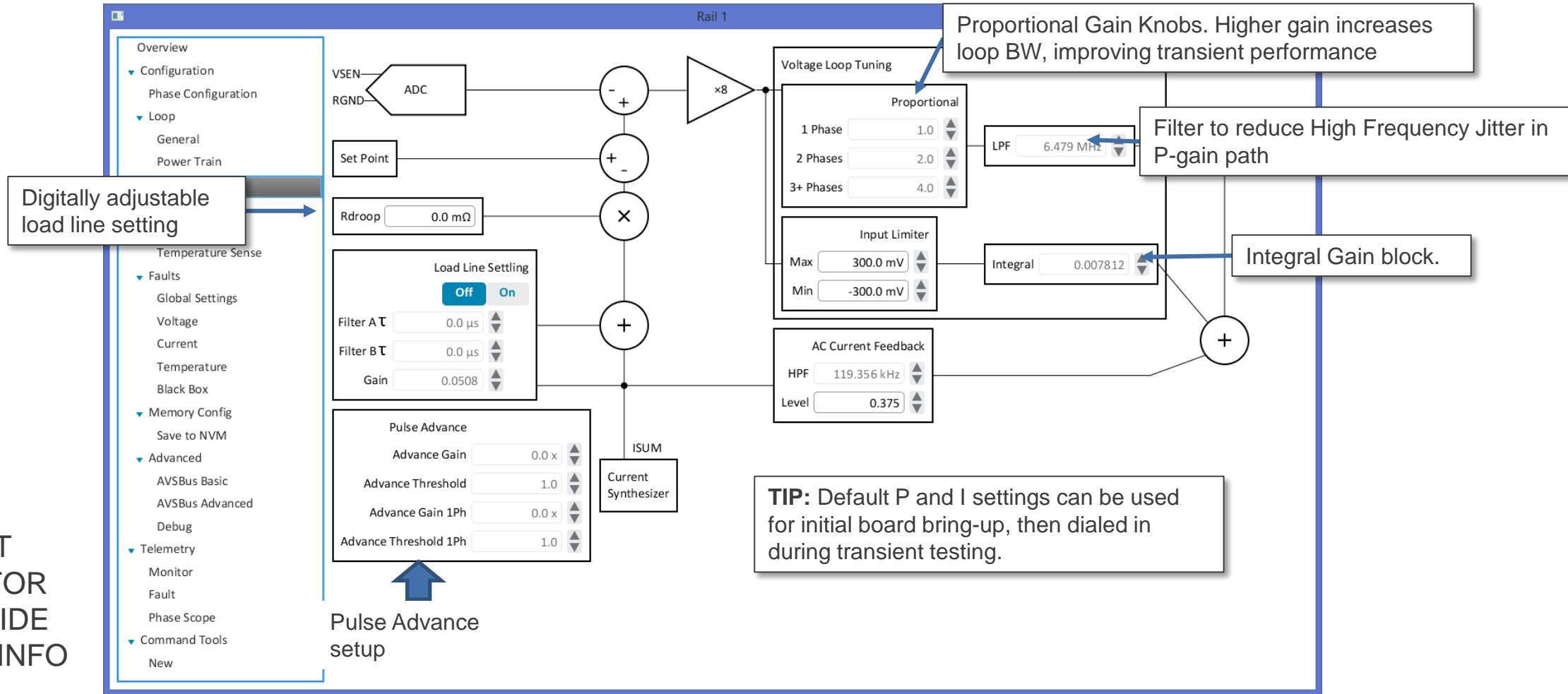
CONTACT RENESAS FOR TUNING GUIDE WITH MORE INFO

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Diode braking

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
- Telemetry
  - Monitor
  - Fault
  - Phase Scope
- Command Tools
  - New

Diode Braking

Overshoot Suppression [Disabled] [Enabled] → Enabled/Disabled Diode Braking

Trigger Holdoff

Stop braking each phase when its current <	0.0 A
Forced delay between events	8000.0 ns
Holdoff if HPF ISUM >	15.0 A
Reset HPF ISUM Holdoff after	1250.0 ns

→ Settings to determine when to apply diode breaking to prevent LFET overheating. Default values are a good starting point. See tuning guide for more info.

Trigger Conditions

Start if ΔV rise >	50.0 mV
Stop when ΔV fall <	50.0 mV

→ Vout excursion during load release required before diode breaking is engaged. Lower values result in more aggressive braking.

Diode Foward Drop

Diode Forward Drop	0.7 V

→ Used by current estimator to mode diode breaking behavior. Typical range: 0.3V to 0.7V.

- **Start if ΔV rise > Threshold**
  - VOUT is monitored for fast rising conditions and suppression will be initiated if the fast rising magnitude exceeds this threshold.
- **Stop if ΔV fall < Threshold**
  - Vout is monitored for falling condition and suppression will be halted if the falling magnitude exceeds this threshold. It must be smaller than the rise threshold.

TIP: Diode braking should only be enabled after other loop settings have been optimized.

RENESAS

Digital Multiphase – Dynamic Voltage Change Tuning

Sets TON_DELAY (delay from enable to Vout ramp), TON_RISE (Vout soft-start ramp time), TOFF_DELAY (delay from enable low to disable) and TOFF_FALL (Vout soft-stop time, if used)

Dynamic voltage change performance optimization. Two Gain Settings:

Transition Up Gain to improve dynamic performance form a lower to higher Vout.

Transition Down Gain to improve dynamic performance from a higher to lower Vout.

Follow graphic to adjust gain settings.

TIP: Dynamic Voltage Gain performance should be dialed in after optimizing control loop performance.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Temp Sense Setup

Used to select temperature sense scheme. Use "SPS" setup when using smart power stage – TMON output from SPS is directly connected to TEMP monitoring pin. Temp compensation is not required when using SPS.

Example diode temp sense scheme. Use diode sense when using inductor DCR for current sense. Temperature compensation must be enabled for DCR temp co. compensation.

Primary/Aux Diode Enable: diode temp sense allows the use of two sensing diodes per TEMP pin. Use these settings to enable/disable Aux or Primary diode.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Global Fault Setup

Rail 1

- Overview
- ▼ Configuration
  - Phase Configuration
  - ▼ Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - ▼ Faults
    - **Global Settings**
    - Voltage
    - Current
    - Temperature
    - Black Box
  - ▼ Memory Config
    - Save to NVM
  - ▼ Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - ▼ Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - ▼ Command Tools
    - New

De-assert PowerGood

- ☐ Fast Over-Current Fault
- ☐ Slow Over-Current Fault
- ☐ Over-Voltage Fault
- ☐ Under-Voltage Fault

The controls above configure Power Good to be de-asserted even if a fault is not enabled on the individual fault setup screens. If a fault is enabled, Power Good is automatically de-asserted if the fault occurs and there is no need to select a control above.

Hiccup Retry

- ☐ Input Under Voltage
- ☐ Input Over Voltage
- ☐ Input Over Current
- ☐ Temperature
- ☐ Output Under Voltage
- ☐ Output Over Voltage
- ☐ Output Over Current

Check to enable hiccup retry for each fault type. If left unchecked, controller will use latch off fault response.

De-assert PowerGood: If a fault is set to ignore, these configure the device to still pull PGOOD low.

For example, if Vout Under-Voltage fault is set to ignore, but the De-assert PowerGood box is checked, when a UV fault occurs, the controller will continue to regulate, but PGOOD will be pulled low.

If the controller is set to act on a FAULT, PGOOD will always be pulled low and the controller will latch off when the fault occurs.

RENESAS

Digital Multiphase – Vout Fault Configuration

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - Command Tools
    - New

Vin Faults

Vin Undervoltage Fault Limit	8.0 V
Shutdown on Fault	☑
Vin Overvoltage Fault Limit	14.0 V
Shutdown & Protect on Fault	☑

Vout Faults

Vout Undervoltage Fault Limit	0.585 V
Shutdown on Fault	☑
Vout Overvoltage Fault Limit, device enabled	1.125 V
Shutdown & Protect on Fault	☑
Protect OV Fault when Disabled (Fixed ~3.2V)	☐

Sets VOUT Under Voltage fault limit, relative to VID setting. If box is unchecked, fault will be ignored and controller will continue to attempt to regulate.

Sets VOUT Over Voltage fault limit, relative to VID setting. If box is unchecked, fault will be ignored and controller will continue to attempt to regulate (Not Recommended).

Protect OV Fault when Disabled: If Vout exceeds 3.2V when output is disabled, controller will clamp output voltage to protect load if this box is checked.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Current Fault Configuration

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - Command Tools
    - New

Iin OC Fault (Per Loop)
Limit — 50.0 A
Shutdown on Fault ☐

Iout Peak Current (Per Phase)
Min Peak Current — -60.0 A — Count 6
Max Peak Current — 60.0 A — Count 6

Iout Fast Sum OC (Per Loop)
Limit — 250.0 A
Delay — 59.4 μs
Filter — 5.338 us
Shutdown on Fault ☑

Iout Slow Sum OC (Per Loop)
Limit — 250.0 A
Delay — 992.1 μs
Filter — 85.402 us
Shutdown on Fault ☑

SPS Fault Flag Detect
Enable ☑
Disabling SPS Flag Dectect requires SPS Fault# connection to Controller enable pin for multiphase rails.

Input current OC protection limit. Iin is calculated using current estimator hardware.

Sets Peak Over and Under current per phase (includes inductor ripple current). Peak settings should not be set above max measured current from Power Train page. Count = number of consecutive switching cycles with a peak trips before a fault is declared. Peak per phase current will be limited to this value.

Fast Sum OC: Average OC protection of the summed phase current

Slow Sum OC: Slow average OC protection of the summed phase current

Disables output if SPS internal OC trips or per phase current sense ADC clips. Recommend to leave this enabled.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Temp Fault Configuration

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - Command Tools
    - New

Internal Temperature Fault

Controller Over Temp Fault Limit	125.0 C
	☑ Shutdown on Fault

External Temperature Faults

SPS Under Temp Fault Limit	-100.0 C
SPS Over Temp Fault Limit	125.0 C
	☑ Shutdown on Fault
SPS Over Temp Warn Limit	2000.0 C

Internal Temp Sensor OT limit fault limit. When box is checked (recommended), controller will latch off if OT limit is exceeded.

External Smart Power Stage OT/UT fault limit. When box is checked (recommended), controller will latch off if OT or UT limit is exceeded.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Black Box Setup

Enable Black Box: Enables/ Disables Black Box function

Write Black Box Data to OTP: If enabled, when a Black Box event is triggered, Black Box information is written to OTP. There are 10 OTP saves – when OTP is full, no more Black Box events can be stored in OTP. If disabled, Black Box events are only stored in RAM, and will be lost if controller 3V3 input is cycled.

Single NVM Write per POR: When enabled, only a single Black Box event will be stored between device power cycles (POR). This prevents multiple Black Box event triggers from the same fault.

Black Box Slot: Selects where to read Black Box Data from. Two options: RAM or one of 10 Black Box OTP slots.

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Device PMBus Address Select

TIP: If project device address is not set to hardware device address, PowerNavigator will not be able to download settings to hardware – make sure the address is correct!

After configuring both outputs with Rail Inspector, set PMBus address to match intended PMBus address in actual design

BIG IDEAS FOR EVERY SPACE

Offline Project Is Now Complete!

After reaching the NVM configuration screen on BOTH outputs, your offline project is now complete! Return to PowerNavigator main screen and save.

BIG IDEAS FOR EVERY SPACE

CONNECTING TO HARDWARE

BIG IDEAS FOR EVERY SPACE

RENESAS

Connecting to Hardware

- Once the project file is complete, Renesas's USB to PMBus adapter (ZLUSBEVAL3Z) can be used to connect to hardware.

- To connect to the controller's PMBus interface, only SCL, SDA and GND connections from the adapter to the board are required.
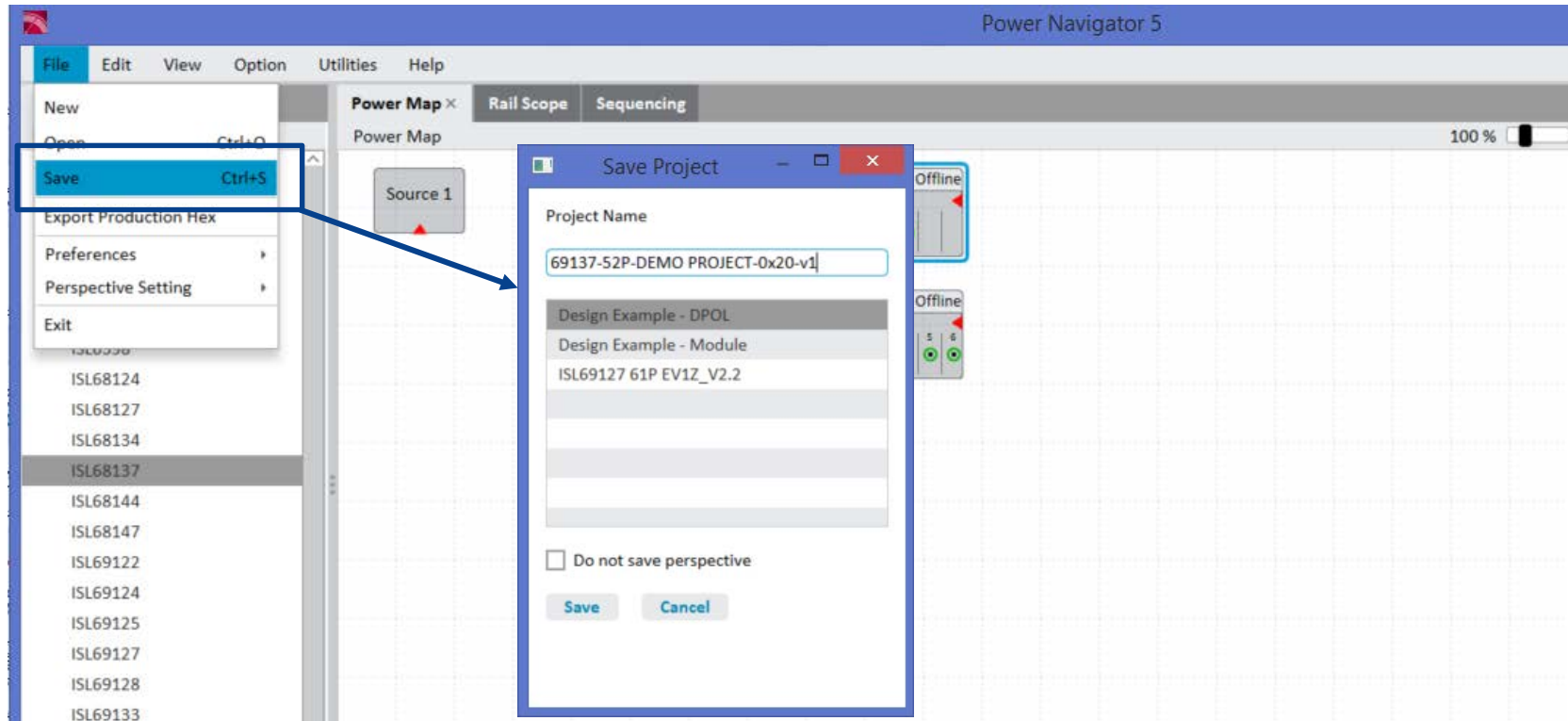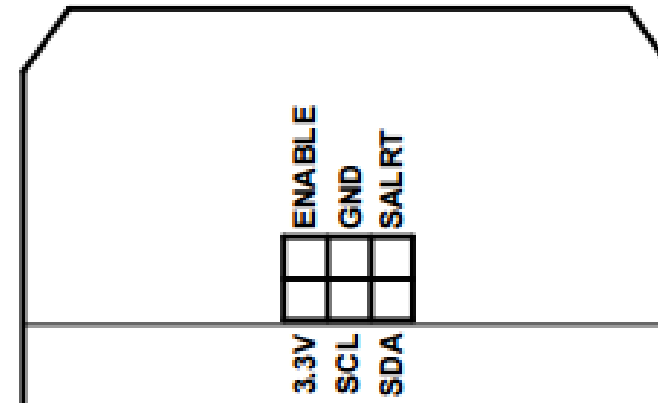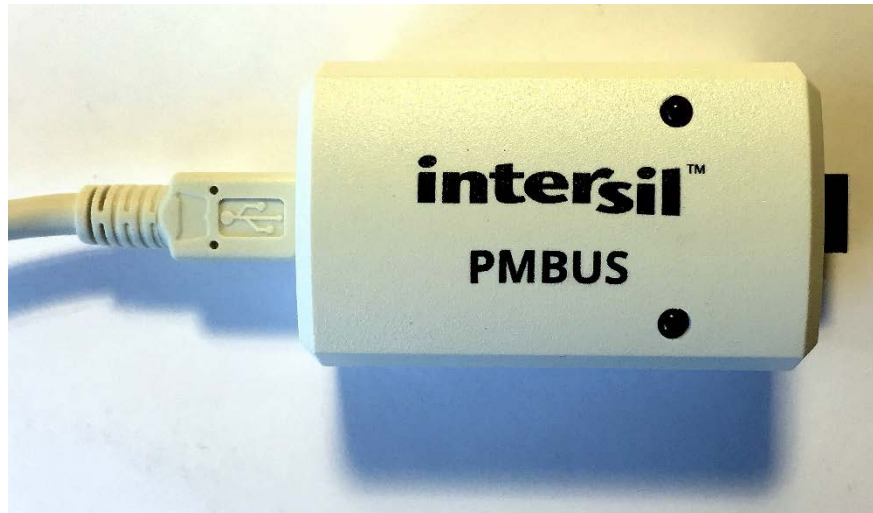
Digital Multiphase – Connecting to Hardware

Connected Devices   Offline Mode   Project Load

RENESAS   PowerNavigator™

Choose an option and click start:

○ SCAN ATTACHED DEVICES
Dongle connected

ISL69127 @ 0x60

PMBus Address: 10 to 7F

Scan Again

○ BUILD AN OFFLINE SYSTEM

● OPEN EXISTING PROJECT
Choose project:

Design Example - DPOL
Design Example - Module
ISL69127 61P EV1Z_V2.2

Create a new project by using one of the other two options.

Start   Cancel

PowerNavigator v5.4.62

Connected devices show up in Device Scan.

Click on saved project in "Open Existing Project" window, then click "Start"

BIG IDEAS FOR EVERY SPACE   **RENESAS**

Digital Multiphase – Connected PowerMap

Digital Multiphase – Monitor View Screen
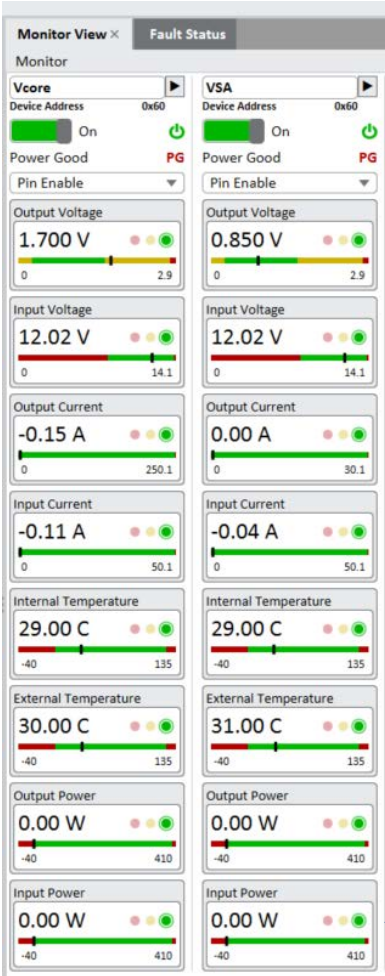
Rail Name(s)

Pin or PMBus Enable Selector
Vout Telemetry

Vin Telemetry

Iout Telemetry

Iin Telemetry

Internal Temp Telemetry

External Temp Telemetry

Pout Telemetry

Pin Telemetry

Using the Monitor View screen, all device telemetry is automatically read back and displayed in real time.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Railscope

RailScope Displays Telemetry information from **multiple rails** at the same time

Double click slots to add rails to RailScope

Select up to 4 telemetry parameters per device

RailScope controls

Enable/disable logging

Adjust Plot size

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – PhaseScope

PhaseScope Displays Detailed Telemetry information from **one rail** (ex – per phase current)

Select what phases to display telemetry for

Per-phase current information displayed

PhaseScope controls

Enable/disable logging

Adjust Plot size

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Monitor/Current Balance

Quick view of device telemetry and status

View of per phase current. Individual phase offsets can be used to manually adjust current balance among phases.

Total Iout offset adjustment for each output. Can be used to manually calibrate offsets at no load.

Iin tuning for each channel. Can be used to adjust input current offset errors.

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Fault Reporting

PMBus Fault reporting. Triggered faults will be displayed here.

TIP: If a rail is having start-up issues, or shutting down during board bring-up, check fault bits *first* to help debug issue.

BIG IDEAS FOR EVERY SPACE

ADVANCED FEATURE SET: AVSBUS

BIG IDEAS FOR EVERY SPACE

RENESAS

AVSBus Overview

- AVSBus is an interface designed to facilitate and expedite point-to-point communication between an ASIC , FPGA, or other logic, memory, or processor devices and a POL control device on a system for the purpose of adaptive voltage scaling.

- This bus provides a focused set of functionality for the purpose of high speed rail control. All other configurations and settings must be done through the GUI or through PMBus.

- The AVSBus commands can always be read, but they cannot be written unless the device is configured to operate via AVSBUS in the PMBus command OPERATION.

- 2 New Panels are visible using the PowerNavigator GUI to facilitate AVSBus testing
  - AVSBUS Basic
  - AVSBUS Advanced

- Require dedicated Renesas-developed AVSBus dongle to support device testing. Refer to the EVK users guide for details on dedicated hardware developed.

*Available only on ISL68137, ISL68134 devices

** Compliant to latest AVSBUS 1.3x04 Spec defined by System Management Interface Forum (PMBUS part III)

Digital Multiphase – AVSBus

Rail 1

Overview
- Configuration
  - Phase Configuration
  - Loop
    - General
    - Power Train
    - Transient
    - Diode Braking
    - Ramp Timing
    - Temperature Sense
  - Faults
    - Global Settings
    - Voltage
    - Current
    - Temperature
    - Black Box
  - Memory Config
    - Save to NVM
  - Advanced
    - AVSBus Basic
    - AVSBus Advanced
    - Debug
  - Telemetry
    - Monitor
    - Fault
    - Phase Scope
  - Command Tools
    - New

AVSBus Host Interface Configuration

Vout Mode	PMBus Nominal
VDDIO Voltage	3.3 V
Bus Speed	5 MHz

AVSBus Commands

VOUT	0.0V	Read	Send
Transition Rate Rising	0.0mV/µs	Read	Send
Transition Rate Falling	0.0mV/µs		
Reset VOUT			Send
IOUT	0.0A	Read	
Temperature	0.0°C	Read	
Version	0	Read	
Status		Read	Clear
Vdone ●		OT Fault ●	

VDDIO – adjust I/O voltage on AVSBus adapter

Bus Speed – Adjust AVSBus speed on AVSBus adapter. Max 50MHz

AVSBus Commands – read/write single AVSBus commands to device.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – AVSBus

Drag and drop AVSBus commands to "queue" up a sequence of AVSBus commands to AVSBus dongle buffer. Up to 100 commands can be queued at a time.

Delays can be added to the sequence, allowing the AVSBus commands to be precisely sequenced.

Once queued up, the command loop can be run and the AVSBus commands will be executed.

Checking the Loop button allows the command sequence to be repeated.

BIG IDEAS FOR EVERY SPACE

RENESAS

AVSBus – Example Vout Set Point Change
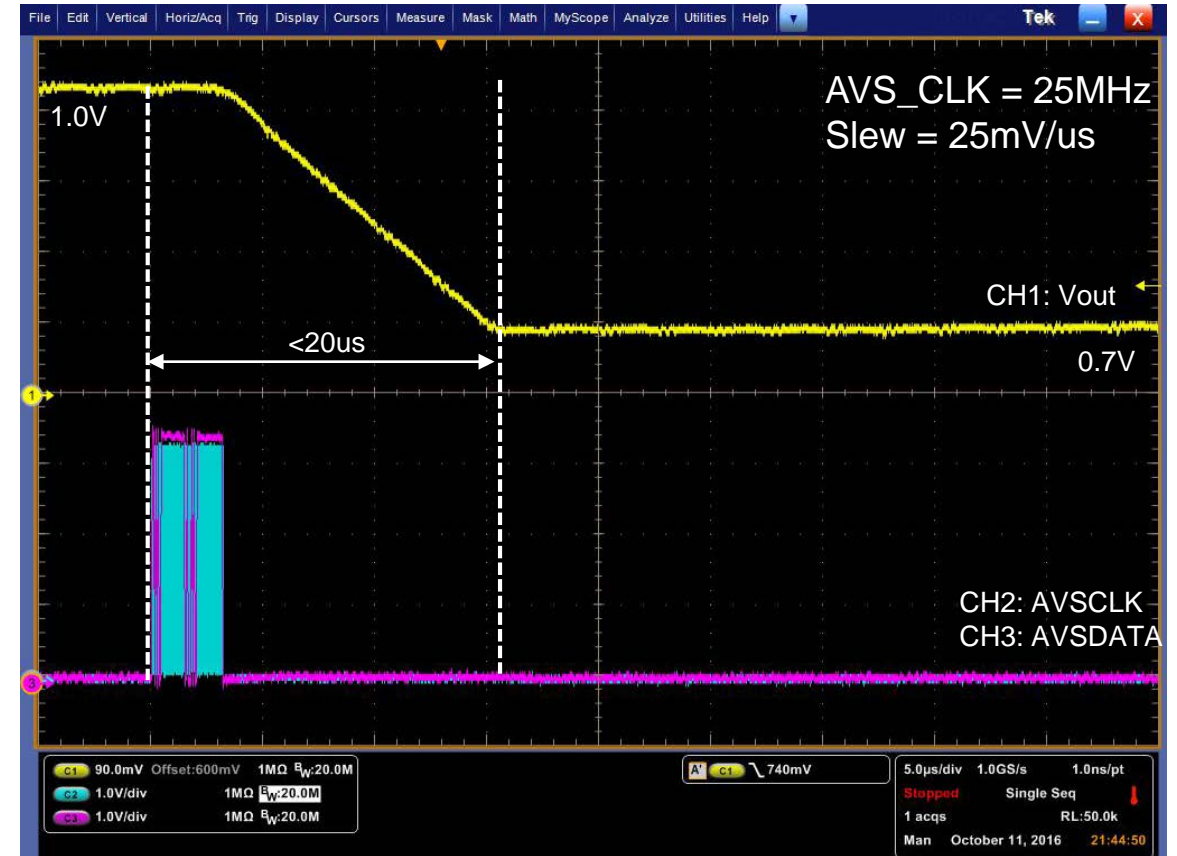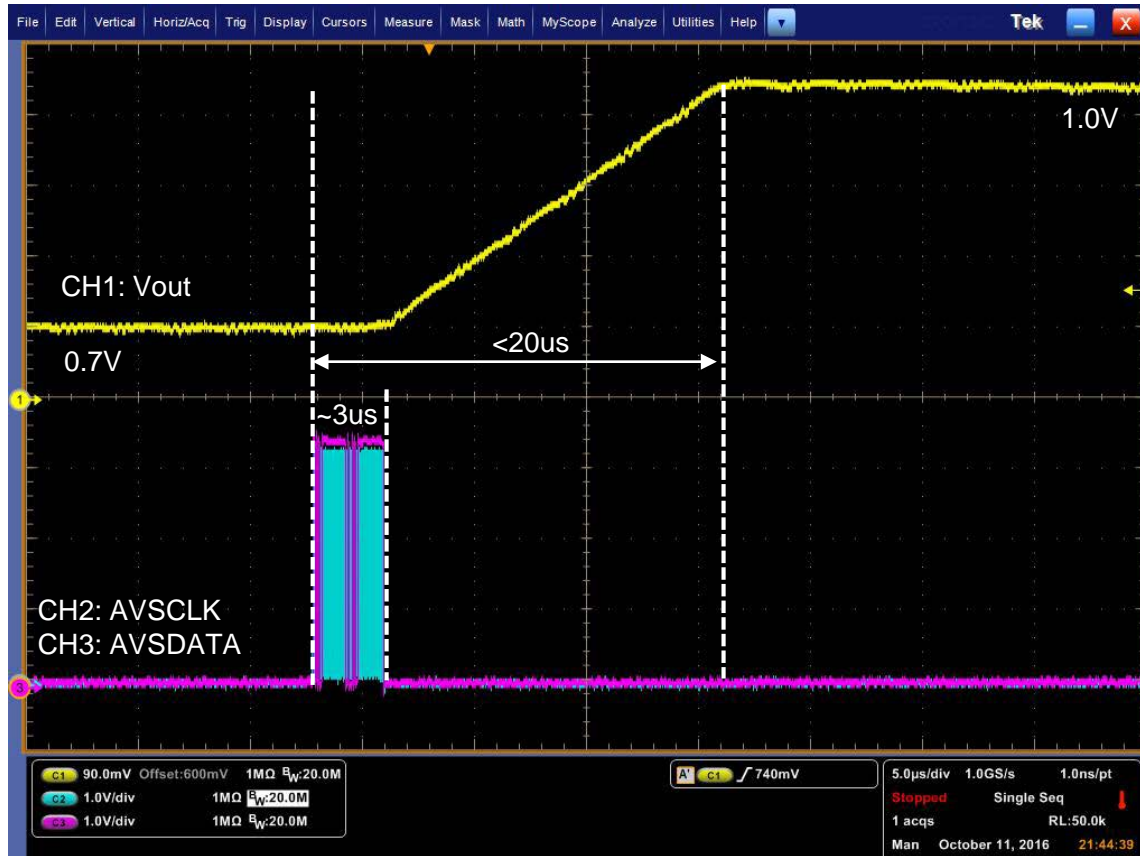
Using the AVSBus interface, 300mV change in Vout takes <20us, enabling rapid changes in CPU power states

SAVING SETTINGS TO NVM

Digital Multiphase NVM Stores

- Renesas Digital Multiphase controllers contain OTP (one time programmable) NVM memory for storing device configuration settings.

- Up to 8 different configurations (Configuration ID's) can be stored in the device, using 1 of 8 available NVM "slots"
  - Once a NVM slot is used, it cannot be erased or reprogrammed.
  - Multiple versions of the same Configuration ID can be stored in NVM – the controller will always use the most recent version.

- At start-up, an external pin-strap resistor tells the controller which of the stored *Configuration ID's* to use
  - The resistor does not point to a NVM slot, but rather to a *CONFIGURATION_ID*

BIG IDEAS FOR EVERY SPACE

RENESAS

Example Configuration Stores

Example: Storing Configs

- A 4+0 design configuration is first stored as Config ID 1

- The 4+0 design is then updated due to design change (ex. Vboot change), resulting in a new Config ID 1 store.

- A 3+1 design configuration is stored as Config ID 4
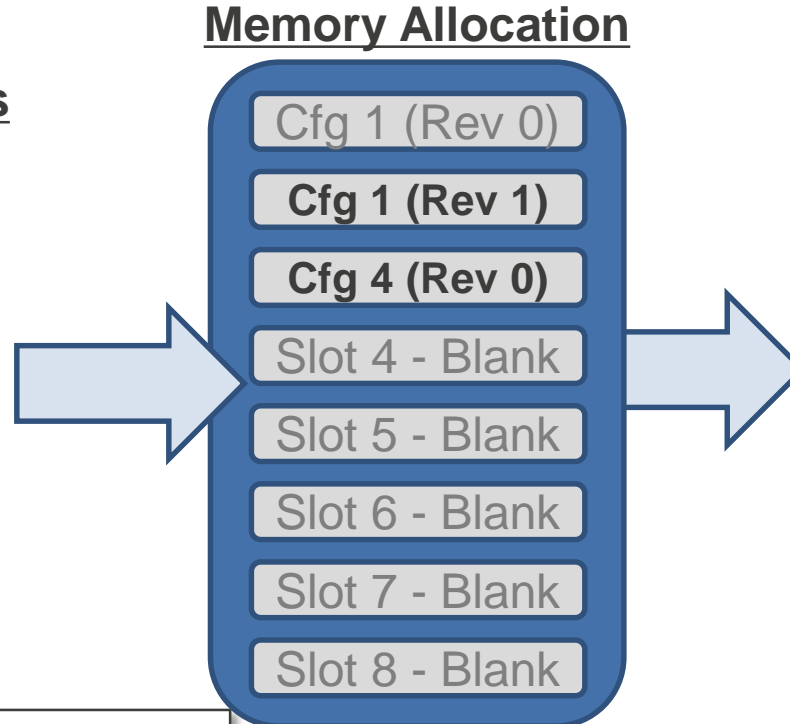
In this example:
- **2** CONFIG IDs are stored in OTP
- **3** OTP slots are used, however. CFG1 (Rev 0) uses a slot, but is not accessible since it has been replaced by CFG1 (Rev 1)

Memory Allocation

Cfg 1 (Rev 0)
Cfg 1 (Rev 1)
Cfg 4 (Rev 0)
Slot 4 - Blank
Slot 5 - Blank
Slot 6 - Blank
Slot 7 - Blank
Slot 8 - Blank

Upon Power Up

- A 1800 Ohm Rconfig will result in Cfg1 (Rev 1) to be used. Only the latest revision will ever be loaded

- A 3300 Ohm Rconfig will result in Cfg4 (Rev0) to be used

R CONFIG (Ω)	CONFIG ID
6800	0
1800	1
2200	2
2700	3
3300	4
3900	5
4700	6
5600	7

BIG IDEAS FOR EVERY SPACE   RENESAS

Saving Settings to NVM

To save the current config to the on-board memory in the device that is connected.

First click on the "Save to NVM" in the Rail Inspector

If the project has not been saved since the most recent changes, the "Refresh" button will be enabled and the "Save" buttons for the configuration IDs will be disabled.

BIG IDEAS FOR EVERY SPACE

RENESAS

Saving Settings to NVM

After project has been saved, "Refresh" will gray out, indicating the latest settings have been saved. "Save Project" is enabled if the project has unsaved changes.

"Save" options will now be active, allowing the project to be saved to 1 of 8 available CFG ID's

BIG IDEAS FOR EVERY SPACE

RENESAS

Saving Settings to NVM

Once the configuration has been saved, input power to the part should be cycled.

Re-loading the NVM screen will show that there are now 7 saves remaining. In addition, the NVM contents will show a match to the project in your directory.

Clicking on the "Match Found" button will show information for the matching project.

BIG IDEAS FOR EVERY SPACE

RENESAS

HEX FILE EXPORT

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase HEX File Export

- To support production programming, Digital Multiphase controllers support a HEX export utility.

  - Once a design has been finalized, the exported HEX file is used to program devices on high speed production programmers.

- The HEX export utility is available under the "Utilities" menu on the main PowerNavigator screen.

- Using this utility, multiple projects can be combined into a single HEX file

  - Each project is assigned one of 8 available CONFIG_IDs
  - An external resistor is then used to select the proper CONFIG_ID

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Saving A Project

Select "Save" from File Menu. Be sure to save revision information in project name

Digital Multiphase – Exporting HEX File

After saving, select "Multiphase Hex Exporter" from Utilities Menu.

BIG IDEAS FOR EVERY SPACE

Digital Multiphase – Exporting HEX File

In Multiphase Hex Exporter, select controller part number from drop down box
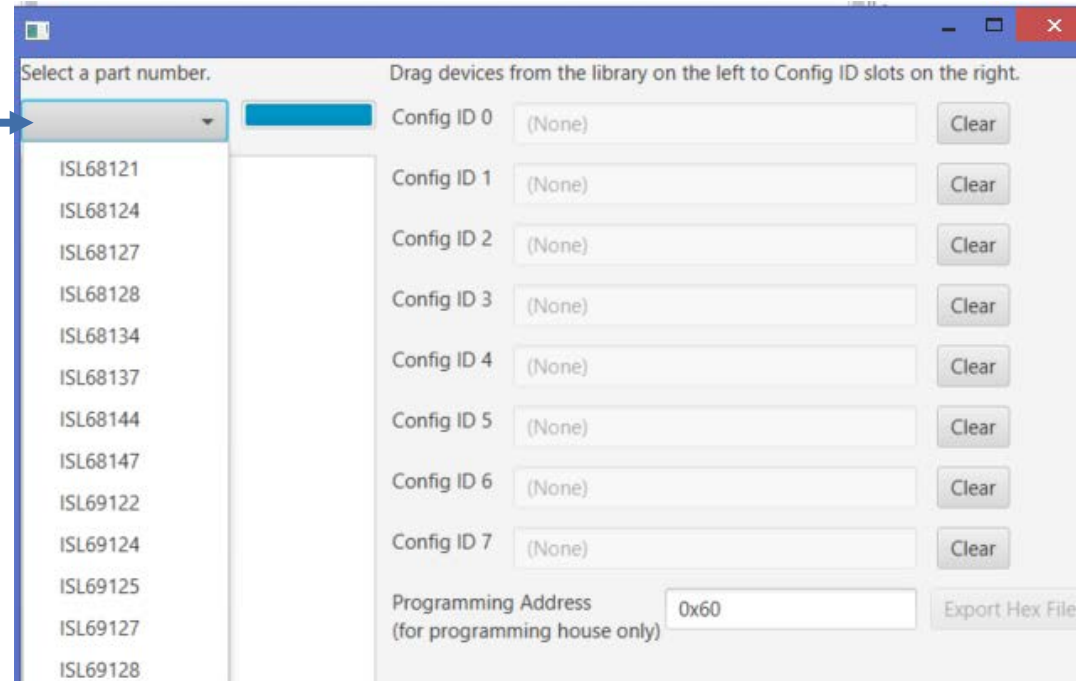
Digital Multiphase – Exporting HEX File

After part number is selected, the Hex Exporter tool will scan the PowerNavigator Projects folder for all project IDs with that part number.

After scanning is complete, all projects using that part number will be displayed

Select project, then Click and drag project into desired Config ID.
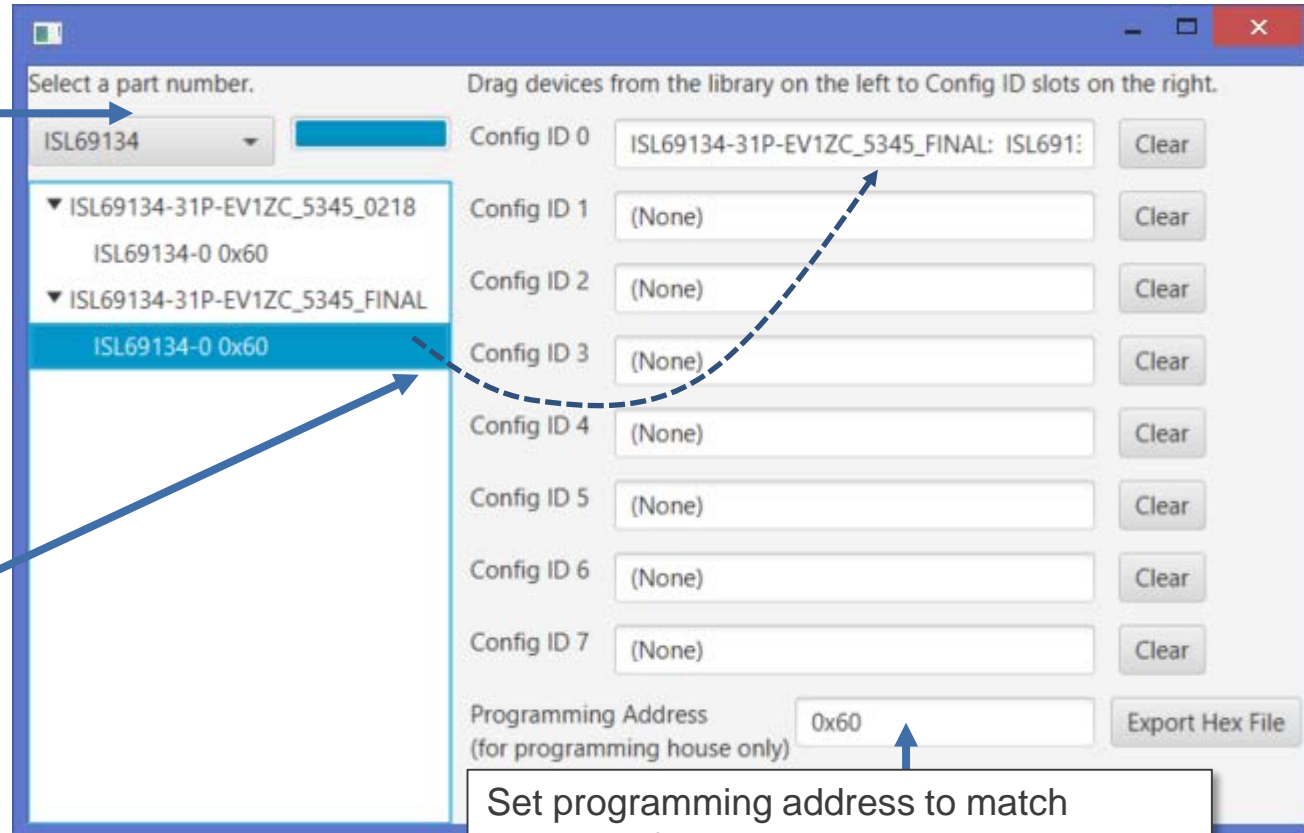
Set programming address to match address of controller in programming environment.

Screenshot contents:

Select a part number.

ISL69134

Drag devices from the library on the left to Config ID slots on the right.

- ▼ ISL69134-31P-EV1ZC_5345_0218
  - ISL69134-0 0x60
- ▼ ISL69134-31P-EV1ZC_5345_FINAL
  - ISL69134-0 0x60

Config ID 0 — ISL69134-31P-EV1ZC_5345_FINAL: ISL691: [Clear]
Config ID 1 — (None) [Clear]
Config ID 2 — (None) [Clear]
Config ID 3 — (None) [Clear]
Config ID 4 — (None) [Clear]
Config ID 5 — (None) [Clear]
Config ID 6 — (None) [Clear]
Config ID 7 — (None) [Clear]

Programming Address (for programming house only) — 0x60 [Export Hex File]

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Exporting HEX File

After all projects have been loaded, click "Export Hex File"

In resulting pop-up window, select save location and file name for Hex file. To ease Hex file management, be sure to include version numbering in Hex file.

Digital Multiphase – Configuration Vs. HEX File

Hex File

Configuration File


```
ISL69134-0 0x60.txt

 1  # ISL69134-0 0x60
 2  # connected: true
 3  # IC_DEVICE_ID            0x002DD249
 4  # IC_DEVICE_REV           0x00040000
 5  # 5.3.24
 6  # 2016/06/10 11:54:48
 7
 8  PAGE                 0x00            # 0x0
 9  SFVRATETODAC         0x00004444      # 0xE451
10  SFTELTEMPRANGE       0x0000020D      # 0xE452
11  SFTELVINRANGEMV      0x000051D1      # 0xE453
12  SFTELVOUTRANGEMV     0x0000104C      # 0xE454
13  SFPINRANGEBY8        0x00001062      # 0xE455
14  SFLPVOUTRANGEMV      0x00001000      # 0xE456
15  SFLPIINRANGEBY64     0x00000400      # 0xE457
16  SCALEDROOP           0x031B031B      # 0xE458
17  TEMPCO0              0x00000000      # 0xE459
18  TEMPCO1              0x00000000      # 0xE45A
19  SCALEIOUT            0x136D136D      # 0xE45B
20  SCALEPOWER           0x09F209F2      # 0xE45C
21  TCTELCFG1            0x41841C11      # 0xE45D
22  TCTELCFG2            0x00000000      # 0xE45E
23  TCTELCFG3            0x00000001      # 0xE45F
24  RAMUSR_TMONCALOFFSET 0x00000000      # 0x1090
25  RAMUSR_FILTERWAIT    0x00000010      # 0x1091
26  RAMUSR_CH0UTLIMITS   0xFFCEFFCE      # 0x1092
27  RAMUSR_CH1UTLIMITS   0xFFCEFFCE      # 0x1093
28  RAMUSR_OTLIMITS      0x107D7D7D      # 0x1094
29  RAMUSR_TEMPCONFIG    0x25E2828C      # 0x1095
30  RAMUSR_PH01DCRFILTRES 0x000001EC     # 0x1096
31  RAMUSR_PH23DCRFILTRES 0x00000000     # 0x1097
32  RAMUSR_PH45DCRFILTRES 0x01EC01EC     # 0x1098
33  RAMUSR_PH6DCRFILTRES  0x800001EC     # 0x1099
34  RAMUSR_PH01ISENGAIN  0x80008000      # 0x109A
35  RAMUSR_PH23ISENGAIN  0x80008000      # 0x109B
36  RAMUSR_PH45ISENGAIN  0x80008000      # 0x109C
37  RAMUSR_PH6ISENGAIN   0x80008000      # 0x109D
38  RAMUSR_PH01ISENOFFSET 0x003A0000     # 0x109E
39  RAMUSR_PH23ISENOFFSET 0x00000000     # 0x109F
```
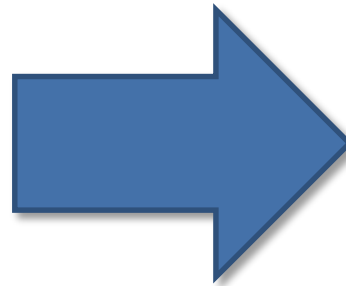
```
ISL69134-10 0x60.hex RevE.hex

 1  4907C0AD49D22D001E
 2  4907C0AE000005007A
 3  4907C000050400007F
 4  4909C001352E332E323401
 5  490BC002000001553B4928BDA5
 6  0005C0E601000C
 7  0005C0F70001D7
 8  0007C0F6B3040000D1
 9  0007C0F600000000D8
10  0007C0F600000000D8
11  0007C0F600000000D8
12  0007C0F600000000D8
13  0007C0F600000000D8
14  0007C0F600000000D8
15  0007C0F600000000D8
16  0007C0F600000000D8
17  0007C0F600000000D8
18  0007C0F600000000D8
19  0007C0F600000000D8
20  0007C0F600000000D8
21  0007C0F600000000D8
22  0007C0F600000000D8
23  0007C0F600000000D8
24  0007C0F600000000D8
25  0007C0F601000000CE
26  0007C0F600000000D8
27  0007C0F6B3040000D1
28  0007C0F603B4014849
29  0007C0F6019001BD48
30  0007C0F60D27002093
31  0007C0F603B4014849
32  0007C0F6019001BD48
33  0007C0F62503002005
34  0007C0F670B5054654
35  0007C0F6002004461A
36  0007C0F62968FFF738
37  0007C0F6EDFFA10064
38  0007C0F64919496884
```
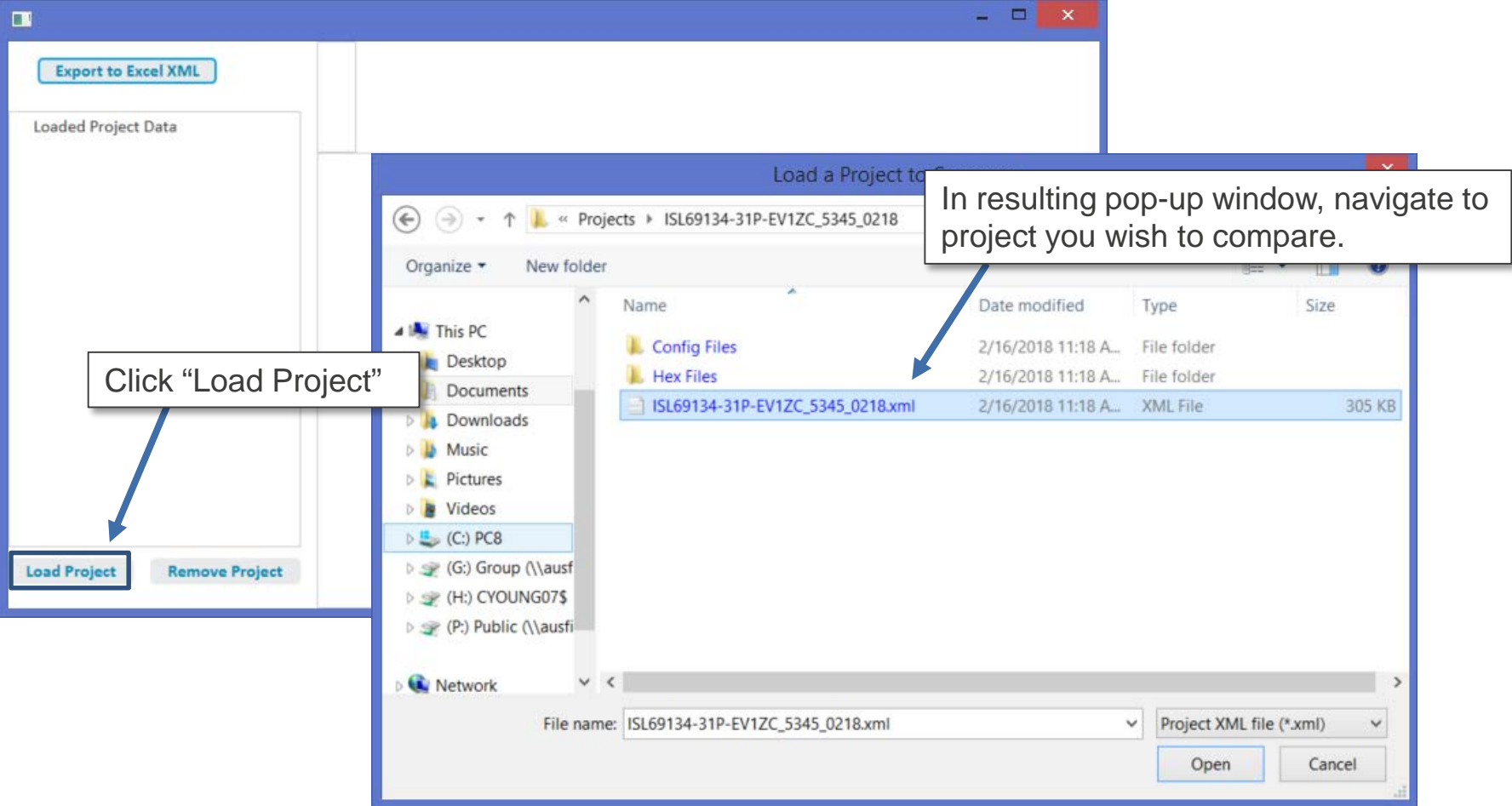
BIG IDEAS FOR EVERY SPACE

RENESAS

PROJECT COMPARE

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Project Compare
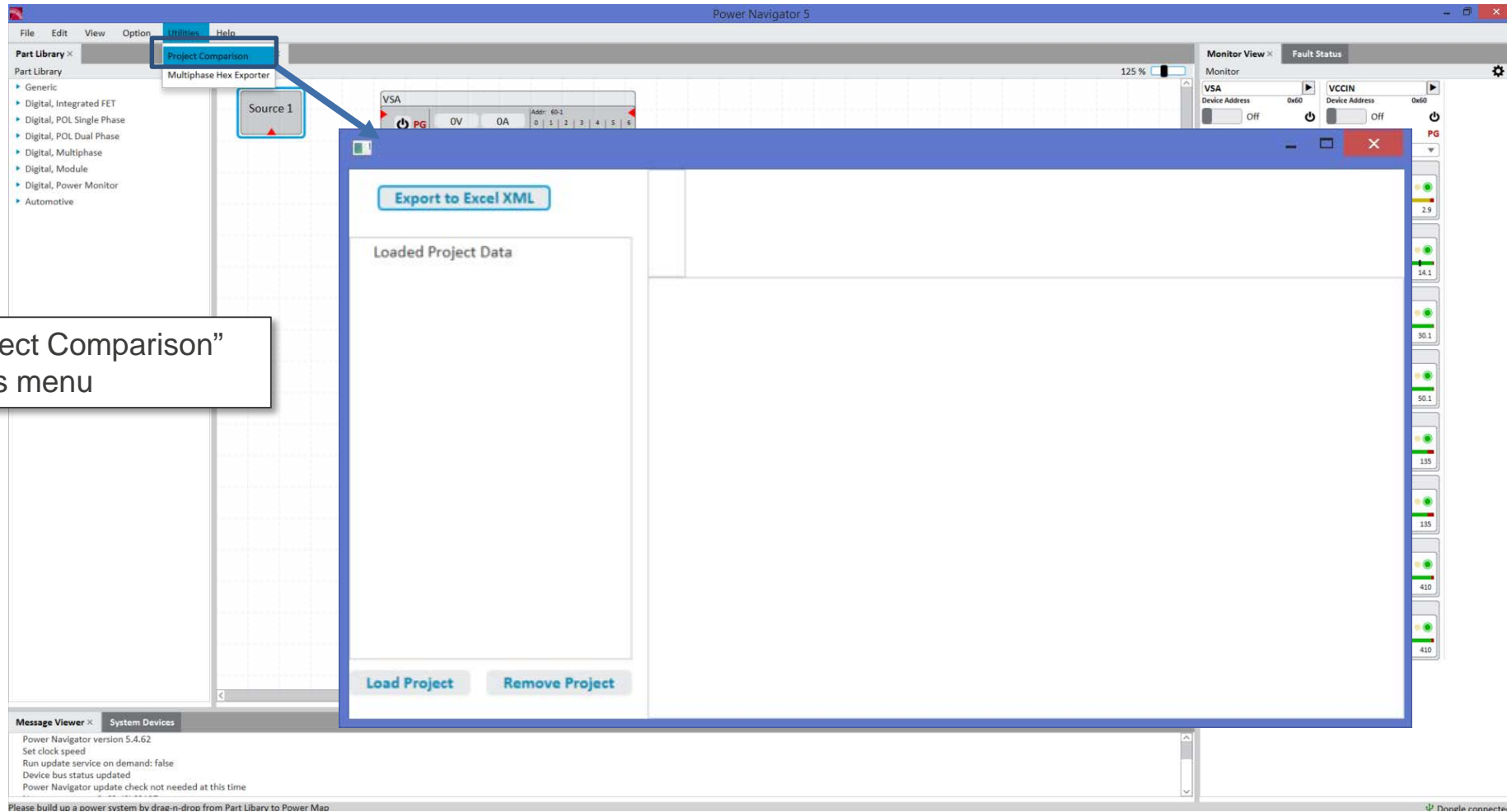
Select "Project Comparison" from Utilities menu

Digital Multiphase – Connecting to Hardware

Click "Load Project"

In resulting pop-up window, navigate to project you wish to compare.

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Connecting to Hardware

After projects have been loaded, expand to show individual rails

Drag and drop rails into compare window

RENESAS CONFIDENTIAL

BIG IDEAS FOR EVERY SPACE

RENESAS

Digital Multiphase – Connecting to Hardware

Scan List for differences, OR click "Export to Excel XML"

Digital Multiphase – Connecting to Hardware

After clicking "Export to Excel XML", name comparison and select save location

Digital Multiphase – Connecting to Hardware

Differences will be automatically highlighted in RED

BIG IDEAS FOR EVERY SPACE

Renesas.com

RENESAS CONFIDENTIAL

RENESAS