Isolated GUI Tools User Guide

1 Revision History

Version	Date	Comment
Fusion GUI 1.8.130	October 27, 2011	Draft

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4 About This User's Guide

4.1 Documented Program Version

This user guide describes Fusion Digital Power Designer and some of the tools that come packaged with it in the Installer. The installer has components that are related to non-isolated and isolated users. This guide is written specifically with isolated users in mind, with emphasis on the UCD31XX.

4.2 Conventions

Any hexadecimal number will be prefixed by 0x. For example, 0xFF. Any other number should be assumed to be decimal.

4.3 User Interface Terminology & Tips

Checkbox

User can select any number of boxes.

Radio Button

User can only select one of the circles at a time. For example, clicking "High" will deselect "None."

Spin Edit

Used for numeric entry. User can type in a number directly or click the up and down arrows to increment or decrement the number. The up/down usually changes the last decimal place (adding or subtracting 0.001 in this example).

Widget

A generic term used to describe a user interface component such as a button or checkbox.

Disabled (Grayed Out)

User cannot edit the widget. This is usually because the GUI has determined that a particular item is a "don't care" or does not make sense given the setting of some other widget or PMBus command.

4.4 Terminology

Designer GUI or GUI – refers to Fusion Digital Power Designer GUI (main tool)

Device GUI or Engineering GUI - refers to UCD3xxx Device GUI

4.5 Providing Feedback on this User's Guide

Please contact your Texas Instruments representative to give feedback on this document.

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	💿 None i Du	ow 🔘 High	
	0.880 💭		
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5 Getting Started

5.1 PC Requirements

The GUI requires the following:

- A PC running Windows XP/Windows 7
- Microsoft.NET Framework version 2.0

Microsoft.NET is the runtime application framework that the GUI uses. The GUI's installer will ensure version 2.0 of .NET is installed, and install if necessary.

5.2 USB Adapter

The EVM is attached to the PC through a Texas Instruments serial bus adapter, part number <u>HPA172</u>ⁱ. The user should have received this adapter with an EVM. The serial adapter must be running firmware v. 1.0.5 or higher. If the adapter's firmware does not meet this requirement, a warning message will appear when the GUI first starts.

The GUI can be run in "Offline mode" without the serial bus adapter, which allows the user to edit an existing device configuration or experiment with a default "virtual device."

5.3 Download & Installation

The latest public production versions can be found at <u>http://www.ti.com/fusiongui</u>. In addition to what is found at that address, your TI representative may provide you with more recent releases that are not available from the website mentioned.

If you would like to be added to our release mailing list for Isolated GUI builds send an email to: <u>iso-fusion-gui-releases.owner@list.ti.com</u>.

Download the ZIP file to your hard drive. You do not need to unzip the ZIP: you can launch the installer from within WinZip or similar ZIP utility.

The following figure displays some extra tools you can create shortcuts for in addition to the main Fusion Digital Power Designer GUI.

👸 Setup - Texas Instruments Fusion Digital Power Designer	• X
Select Additional Tasks Which additional tasks should be performed?	
Select the additional tasks you would like Setup to perform while installing Texas Instruments Fusion Digital Power Designer, then click Next.	;
Create a desktop icon	A
✓ Create a Quick Launch icon	
Other desktop shortcuts	
V Fusion Design Offline	
SMBus SAA Debug Tool	=
UCD3xxx Device GUI	
Additional Tasks:	
Add application directory to your system PATH	
	Ŧ
< Back Next >	Cancel



5.4 Upgrading the GUI

When upgrading to a new release of the GUI, there is no need to un-install the current installed version first. In fact, doing so will remove your program preferences, and is not recommended. The GUI installer will take care of updating all necessary files. The program preferences will not be modified by the installer.

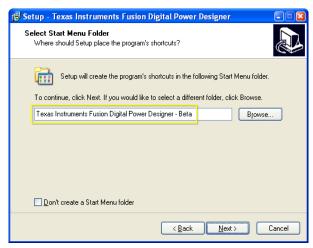
5.5 Multiple Installations of the GUI

You *can* install different versions of the GUI on same the PC. Because the preferences are stored within the program folder as described in Section 6.1.1.1, each version of the GUI installed on your PC will have its own set of preferences.

When you install a second copy of the GUI, you need to ensure the name of the folder for the additional copy is named different from the default folder name, "Texas Instruments Fusion Digital Power Designer." The easiest way to do this is to append something descriptive to the folder name. For example, in the following example " – Beta" was appended to the installation folder pathname:



You will also need to rename the Start Menu folder that gets created. Again, " – Beta" has been appended to the default:

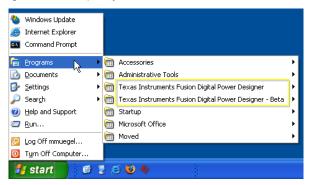




Finally, you'll need to decide whether you want to install desktop or quick launch shortcuts for this version of the GUI. These shortcuts will overwrite any existing shortcuts. In the "beta" example used here, it is probably best to skip the creation of shortcuts:

😰 Setup - Texas Instruments Fusion Digital Power Designer	
Select Additional Tasks Which additional tasks should be performed?	
Select the additional tasks you would like Setup to perform while installing Texas Instruments Fusion Digital Power Designer, then click Next. Additional icons: Create a gesktop icon Create a Quick Launch icon	
< <u>B</u> ack Next>	Cancel

Using this technique, you'll be able to launch either version of GUI from the Start Menu:



5.6 Overview

The Fusion Digital Power Designer or Designer GUI is the main tool of the package. In addition to the Designer GUI there are a number of tools that are very helpful. Depending on what stage of development, one tool may be more advantageous than another. This user guide aims to cover the most important tools included in the installer.

6 Fusion Digital Power Designer (Designer GUI)

6.1 Starting the GUI

The previous form in the installer controls whether GUI "shortcuts" are added to the desktop and quick launch area. The quick launch area is the area next to the Start menu which contains shortcuts to commonly used applications.



📔 🧰 Startup	•		
💼 Texas Instruments Fusion Digital Power Designer	►	🛅 Device GUIs	۲
💼 Texas Instruments Fusion Digital Power Manufacturing Tool	•	🛅 Special	×
TI-COMM for Windows	•	🛅 Tools	×
🛅 TN3270 Web	•	Ocumentation & Help Center	
💼 WebEx	•	🍓 Fusion Digital Power Designer	
i WinZip	•	🌵 Fusion Digital Power Designer Offline Mode	
😕 Adobe Reader 9		License Agreement	
🏉 Internet Explorer		📷 Texas Instruments Home Page	
🗐 Outlook Express		🚯 Uninstall	
ReverDVD DX			

Figure 1 - Accessing Designer GUI from Start Menu

When you launch the GUI, it attempts to find a supported device attached to the PMBus. The following sequence is followed:

1. The GUI looks for an attached USB serial bus adapter. If it is not found you will see the following figure.

Texas Instruments			
Fusion Digital Power Designer Version 1.0.0.27650 [2011-10-27]			
No USB Adapter Found! A Texas Instruments USB serial bus adapter does not appear to be connected to your PC. Please check your connection. You should see a green light on the adapter when it is attached to the PC.			
Retry Adapter Mode Offline Mode Exit Program			

- 2. The GUI sends SMBus commands to the "broadcast" address 11 telling any devices that are in ROM mode to execute their program (go to flash mode). While this is not necessary for production devices such, it may be necessary for in-development products that are set to boot to ROM mode.
- 3. The GUI scans addresses 1 through 127 for an attached device. It does this by reading a special manufacturer command, DEVICE_ID, on each address. This parameter contains information about the device, including part number and firmware version. Address 12 is skipped because this is reserved for use in the SMBus Alert Response Protocol. After this command has been read then the SETUP_ID is analysed. If the SETUP_ID is not recognized, due to being part of new firmware, for example, then there are some steps that can be taken to still allow for communication with the GUI. See "Section 6.1.1.1 SETUP_ID in firmware is not recognized by the GUI".

4. While the scanning process occurs, you will see a dialog box:

attached to your device and power is supplied to your device. Scanning Mode: DEVICE_ID and DEVICE_CODE scan

Packet Error Checking:

USB Adapter Firmware Version: 1.0.10

Enabled

Disabled

Change Device Scanning Options

Bus Speed:

100 kHz

④ 400 kHz



No compatible PMBus devices were found. Please check that the serial cable end of your USB adapter is

Retry

Double check your USB adapter connection and power to your device and click "Retry" if you would like to retry the scan.

Adapter Mode ...

ALERT Pullup: 2.2 kΩ

CLOCK Pullup: 2.2 kΩ

DATA Pullup: 2.2 kΩ

 \sim

 \sim

 $[\lor]$

Exit Program

Offline Mode

If the GUI is still unable to detect the device see the following troubleshooting tips in "Section 6.1.1 Connection Troubleshooting Tips."

If you expect the device not to be detected and are interested in working with the offline features for your device, simply click "Offline Mode". This allows you to use most of the GUI's features while not electrically connected to a device. Offline Mode is described in more detail in Section 6.8.

6.1.1 Connection Troubleshooting Tips

Problem	Resolution		
The scan never occurs. The GUI immediately comes up with the error form. When retry is clicked, the error form reappears immediately.	This usually indicates the USB serial adapter is not attached to the PC or is malfunctioning. Verify that the green LED on the serial adapter is ON. If it is not, unplug the adapter, power off your device, reconnect the adapter, and then power on your device.		
The GUI scans each address, but can not find the device	Verify that power is on to the device. Try re-applying power to the EVM. Also, try resetting the USB adapter as described above.		

6.1.1.1 SETUP_ID in firmware is not recognized by the GUI

Generally in order for the GUI to recognize your firmware it needs to recognize the manufacturer commands Device_ID and SETUP_ID. However in the case where you are developing a new firmware and the SETUP_ID is not supported by the GUI you can change your scan preferences to ignore your SETUP_ID and continue to try to communicate with your device through the GUI. If communication can be established, then you will have the ability to interact with the PMBus commands that you have implemented in your firmware. You will not be able to access the Design features of model compensation and the stage of your topology since this requires knowledge of your SETUP_ID which indicates to the GUI the device's topology.

You can skip the SETUP_ID recognition scan by doing the following.

6.1.1.1.1 Change the Device Scanning Options

Texas Instruments						
Fusion Digital Power Designer Version 1.0.0.27650 [2011-10-27]						
No Devices Found! No compatible PMBus devices were found. Please check that the serial cable end of your USB adapter is attached to your device and power is supplied to your device. Scanning Mode: DEVICE ID and DEVICE CODE scan						
USB Adapter I	Firmware Version: 1.0.10					
Bus Speed:	Packet Error Checking:		ALERT Pullup:	2.2 kΩ 🗸		
◯ 100 kHz						
● 400 kHz O Disabled O Parallel DATA Pullup: 2.2 kΩ V						
Change Device Scanning Options Retry Adapter Mode Offline Mode Exit Program						

Figure 2 - Select Change Device Scanning Options

The following dialog allows you tell the scanner what type of device is to be expected at each address. Click the button "UCD3XXX Isolated" at the top right. Click "OK" and then "Retry" the scan.

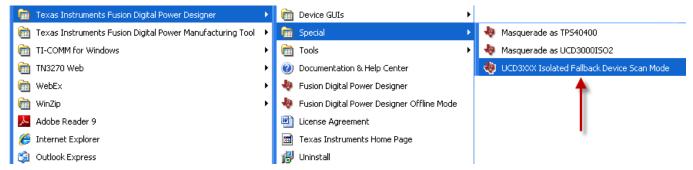


🌵 Device Scan Editor				_ 0 🗙
Set All Addresses To: Skip	DEVICE_ID DEVICE_CODE	DEVICE_ID & DEVICE_COD		
1d 0x01 UCD3XXX 🗸	19d 0x13 UCD3XXX 🗸	36d 0x24 UCD3XXX 🖂	53d 0x35 UCD3XXX 🗸	70d 0x46 UCD3XXX 🗸
2d 0x02 UCD3XXX 🖂	20d 0x14 UCD3XXX 🖂	37d 0x25 UCD3XXX 🖂	54d 0x36 UCD3XXX 🖂	71d 0x47 UCD3XXX
3d 0x03 UCD3XXX 🗹	21d 0x15 UCD3XXX 🖂	38d 0x26 UCD3XXX 🖂	55d 0x37 UCD3XXX 🖂	72d 0x48 UCD3XXX
4d 0x04 UCD3XXX 🗸	22d 0x16 UCD3XXX 🖂	39d 0x27 UCD3XXX 🖂	56d 0x38 UCD3XXX 🖂	73d 0x49 UCD3XXX 🗹
5d 0x05 UCD3XXX 🗸	23d 0x17 UCD3XXX 🖂	40d 0x28 UCD3XXX 🖂	57d 0x39 UCD3XXX 🗹	74d 0x4A UCD3X0X
6d 0x06 UCD3XXX 🗸	24d 0x18 UCD3XXX 🗸	41d 0x29 UCD3XXX 🗸	58d 0x3A UCD3XXX V	75d 0x48 UCD3X0X
7d 0x07 UCD3XXX 🖂	25d 0x19 UCD3XXX 🖂	42d 0x2A UCD3XXX 🗸	59d 0x38 UCD3XXX 🗹	76d 0x4C UCD3X0X
8d 0x08 UCD3XXX 🖂	26d 0x1A UCD3XXX 🖂	43d 0x2B UCD3XXX 🖂	60d 0x3C UCD3XXX M	
9d 0x09 UCD3XXX 🖂	27d 0x1B UCD3XXX 🖂	44d 0x2C UCD3XXX ✓	61d 0x3D UCD3XXX 🖂	
10d 0x0A UCD3XXX 🗸	28d 0x1C UCD3XXX 🖂	45d 0x2D UCD3XXX 🖂	62d 0x3E UCD3XXX 🖂	
11d 0x0B UCD3XXX V	29d 0x1D UCD3XXX 🖂	46d 0x2E UCD3XXX ✓	63d 0x3F UCD3XXX 🖂	
13d 0x0D UCD3XXX V	30d 0x1E UCD3X0X ✓	47d 0x2F UCD3XXX ⊻	64d 0x40 UCD3XXX 🖂	
14d 0x0E UCD3XXX 🗸	31d 0x1F UCD3XXX V	48d 0x30 UCD3XXX 🗸	65d 0x41 UCD3XXX 🖂	
15d 0x0F UCD3XXX ✓	32d 0x20 UCD3X0X ✓	49d 0x31 UCD3XXX ✓	66d 0x42 UCD3XXX 🛩	
16d 0x10 UCD3XXX 🗸	33d 0x21 UCD3X0X ✓	50d 0x32 UCD3XXX 🗸	67d 0x43 UCD3XXX 🗸	
17d 0x11 UCD3XXX ✓	34d 0x22 UCD3XXX ✓	51d 0x33 UCD3XXX 🗸	68d 0x44 UCD3XXX 🗸	85d 0x55 UCD3XXX 🗸
<	11			>
		ок		🕢 Help

Figure 3 - Click UCD3XXX Isolated at top

6.1.1.1.2 Click Fallback Mode from Start Menu

An alternative way to change the scanning options is to select this scan mode from the Start Menu as shown below.





6.2 Enable GUI Protected Features

Figure 5 shows how to access the configuration screen to enable the GUI protected features. Figure 6 shows the screen. Make sure the selections are checked as shown and in the password box type the word "**forestin**." Click OK and then many features will be available.

👆 Fu	sion Digital Power	Designer	r - DC-DC LLC @ Address 88	- Page
File	Device Tools	Debug	Help	
	Import Project		gs - Page 0x0	
S	Save Project As		45.375 V	
Į	E-Mail Project		5.156 V	
l	Import		8.34 A	
	Export		139 ℃	
	Preferences	-	2: 29 ℃	
0	USB Adapter Settir	ngs		
4	Exit		Registers/Lines	
	-http:// 200 (^)		ОК	
Hel	ght: 200 ≑	Iout:	ок	
		Temp:	ок	
	ow Warn & Fault hit Editors	Input:	OK	

Figure 5: GUI Preferences

😻 Fusion Digital Power Designer Preferences 🔹
Preferences
Move device dashboard window when main window is moved or resized
Use PAGE_PLUS_READ and PAGE_PLUS_WRITE to read/write PAGEd commands on PMBus 1.2 capable devices
Show advanced editors and features that are normally hidden (e.g. "Advanced Config" on UCD92xx and "All Config" on UCD90xxx)
Enable GUI protected features (e.g. pflash export):
Password: •••••• Valid
Enable GUI customer-specific features
Configure Device Scan Mode and Addresses
Enable all Standard Warnings/Confirmations
Delete All Application Preferences
Cancel OK

Figure 6: GUI Protected Features



6.3 Monitor

After a device is found, the first screen that appears is the Monitor Screen. Depending on which commands are implemented the corresponding monitor graphs will be available. In the figure below the commands for reading Vin, Vout, Iout, Pout, Temp 1, Temp 2, Frequency were all implemented so the graphs are available. The Monitor tab gives you a live view of the active power supply. In addition to plotting the values it also shows the latest values in the "Readings" group. It also shows a snapshot of the "Status Registers/Lines". The word "Fault" appears in red when a register is at fault, otherwise a green "OK" is visible. The polling of the parameters being read can also be halted by clicking "Stop Polling" on the left side.

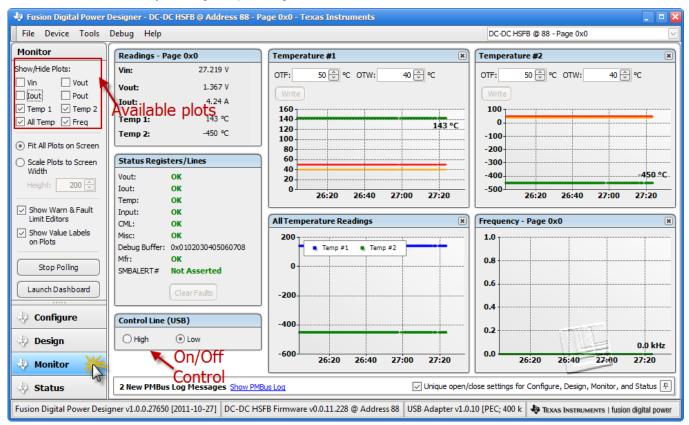


Figure 7 - Monitor mode displays some of the live parameters being read from the device.

6.4 Configure

As can be seen from the above figure there are a four clickable categories on the bottom left. To get to the Configure mode the user selects "Configure". The following figure displays some of the features of the Configure mode.

🜵 Fusion Digital Power Designer - DC-DC HSFB @ Address 88 - Page 0x0 - Texas Instruments File Device Tools Debug Help DC-DC HSEB @ 88 - Page 0x0 Configure Configuration Click here to write edits to RAM of device ^ Write to Hardware Command Hex/Edit Code Value/Edit Auto write on rail or CMD5_DCDC_NONPAGED [MFR 21] 0xE5 0x10006... 🗸 0x10... 🗸 device change CMD5_DCDC_PAGED [MFR 20] 0xE4 0x00000... 🗸 0x00... 🗸 Discard Changes 0x01680... 🗸 CPCC [MFR 36] 0xF4 Clicking the combo box Store RAM To Flash DEADBAND_CONFIG [MFR 26] 0×EA 0x01900... 🗸 causes this dialog to 360.0 🕀 W PMAX: appear. Making the Restore Flash to RAM DEVICE_ID [MFR 45] UCD3100ISO1 0xFD IMAX: 40.0 🕀 A command editable. IC DEVICE ID UCD3138RGC 0xAD TON: 100.0 🕀 msec IC DEVICE REV 0 0xAF Show: **IDEAL DIODE EMUL CONFIG** OFF 🔽 0×FE Enabled 🗸 Enable: Global Device Parameters 39.00 🕀 IIN OC FAULT LIMIT 0x5B OFF 🗸 Timer: Parameters for IIN_OC_WARN_LIMIT 0x5D 35.00 🕀 this Rail All Parameters IOUT_OC_FAULT_LIMIT 0x46 40.00 🕀 IOUT OC WARN LIMIT 0x4A 30.00 🕀 A 0x001E Sort Parameters By: Ocommand Name LIGHT_LOAD_CONFIG [MFR 02] 0xD2 0x0007... 0x00 Parameter has been O Command Code MFR_DATE 0x9D YYMMDD 0x59... 🗸 edited MFR_ID 0x99 Group by Category Click to Undo edit 0x54... 🗸 MFR LOCATION 0x9C Dallas, TX 0x44... 🗸 MFR MODEL UCD3138HSFBI 0x55... 🗸 0x9A MFR REVISION 0×9B 0x45... MFR SERIAL 0×9E XXXXX 0x58... 🗸 \sim - (2) **₽** PMBus Log Tips & Hints 🌵 Configure CPCC [MFR 36.0xF4] 19:23:36.832; USB-SAA #1; CONTROL1 now Low 19:23:38.361: DC-DC HSFB @ 88: USER_RAM_00 [MFR 10,0xDA]: wrote 1 Configure Constant Power Constant Current 🧄 Design [0x01] to RAM Description of command being edited Monitor G-Fa 😭 Status PMBus Loa Fusion Digital Power Designer v1.0.0.27650 [2011-10-27] DC-DC HSFB Firmware v0.0.11.228 @ Address 88 USB Adapter v1.0.10 [PEC; 400 k 😽 TEXAS INSTRUMENTS | fusion digital power

6.4.1 PMBus commands, Edits, and Writing to Hardware

When the Configure mode appears all of the implemented PMBus Commands are visible. A discussion of the relationship between what is visible and what is implemented in the firmware will be discussed in "Section 6.4.2 How do Implemented Commands on the Firmware Appear in the GUI?." A read was done on all the PMBus Commands and their values are immediately visible.

On the left there are some controls to decide how they can be ordered to help view them. They may be listed by category, or sorted by name, or by hex code.

Some values are read-only (uneditable) and some are writable. In the above figure the parameter

LIGHT_LOAD_CONFIG was edited by changing the value. When a command is edited a uppears beside it. This indicates that the value can be undone, or reverted back to the device value stored in RAM. As a command is edited the value is not automatically written to the device. To write all edits to the device the user needs to click "Write to Hardware." Then if the user would like to store those to flash then "Store RAM To Flash" would need to be clicked. "Section 6.4.3 Saving PMBus command values to local file" discusses saving the current state of all commands to a local file that can be used to write to another device.



Another feature that is highlighted in this figure is the dialog box that appears to edit the Constant Power Constant Current "CPCC" command. Not all commands are direct value edits like "IIN_OC_WARN_LIMIT" that is set for "35 A" rather some of them are more complex and require unique dialogs to edit them. CCPC is just one example from many.

6.4.2 How do Implemented Commands on the Firmware Appear in the GUI?

The Designer GUI is dynamic. It automatically lays out the PMBus commands that are implemented in the firmware. The firmware developer can make a change and then relaunch the GUI noticing the change immediately without a new Designer GUI installation. How does the GUI know which commands are implemented? The answer is there are certain Manufacturer commands that indicate which commands are implemented. The command "CMDS_DCDC_NONPAGED[MFR 21] 0xE5" is one such important command that helps the GUI to configure itself. It contains a bitmask. That bitmask is determined in firmware. Each bit in the bitmask indicates whether a command is implemented or not. Each bit refers to a specific command according to the PMBus 1.2 spec. When the GUI reads this bitmask it looks for all the "1"s and then displays those commands in the GUI. "Section 7.4 Isolated Bitmask Tool" discusses a valuable tool to help firmware developers set this important bitmask. The figure below displays the read-only command "CMDS_DCDC_NONPAGED[MFR 21] 0xE5"

Command	Code	Value/Edit	Hex/Edit		Firmwa
CMD5_DCDC_NONPAGED [MFR 21]	0×E5	0x10006 🖂 🗲	UX 10 🗸		bitma
CMDIS_DEDE_PHEED [MER 20]	0.61	Oxi	-		indicat
CPCC [MPR 36]	0.64	0x 0x	_	-AULT_ALL DEFAULT_ALL	suppor
DEADBAND_CONTIG [MER 26]	DIER	0x1	-		comma
DEWICE_ID (MER. 45)	0.60	0x1 0x1	-	IMAND NSITION_RATE	
RC_DRWSCE_3D	DuAD		-	-	
IC_DRWICE_REW	DuRE	0x:	-	FAULT_LIMIT	
IDEAL DODDE EMIL CONFIG	DIFE			WARN_LIMIT WARN_LIMIT	
EN_SK_FAULT_LIMET	0,58			FAULT_LIMIT	
EPI_CK_WINKIN_LIMET	0.60			FAULT_LIMIT WARN_LIMIT	
KOUT_OC_FAULT_LIPHET	0:45			-	
KONT_OK_WARK_LEMET	D:98				
LIGHT_LOND_COMPIG[MER.02] 🔱	0.02	0x			
MER_DATE	0:90	0x: 0x:		-	
MER_ID	0,99	0x			
MPR_LOCATION	0,90	0x			
MER_MODEL	0.56	BI Ox	5F POWER_GO		
MERL, REVESSON	0,98	0xi	_	ΤE	
MER_SERGAL	0/9E		79 STATUS_W		
	- ·	(A)	38 READ_VIN		

Figure 8 - Displays the list of commands the firmware supports

6.4.3 Saving PMBus command values to local file

6.5 Design – Model Stage and Compensator

To get to the Design mode click the "Design" button on the bottom left. The following figure should appear. The number of loops to configure and parameters in the power stage may differ depending on your topology.

🚸 Fusion Digital Power De	esigner - DC-DC HSFB @ Address 88 - Page 0x0 - Texas Instruments	💶 🗖 🔤
File Device Tools D	Debug Help	DC-DC HSFB @ 88 - Page 0x0
Design	Voltage Loop (CLA #0) Current Loop (CLA #1) Feed Forward Loop (CLA #2)	1
Calculate		
	Power Stage - Rail #1 Power Stage Parameters	Frequency Response
Auto Calculate	Vbus: 48.000 + V Vout: 12.000 + V	Metrics: O Loop Stage Loop: Crossover: 13 40 kHz Stage:
View Coeff "C" Code		Crossover: 13.40 kHz Scage: 4 Phase Margin: 17.92° Comp: 4
		Crossover: 13.40 kHz Stage: Phase Margin: 17.92° Comp: Gain Margin: 10.57 dB
Upload Compensation	Rds-on-Q1: 10.000 ↔ mΩ RpT: 4.000 ↔ mΩ	
Write Loop Coefficients	Rds-on-Q2: 10.000 💬 mΩ RsT: 1.000 🖓 mΩ	Gain - Magnitude
	Rds-on-Q3: 10.000 (mΩ np: 5.000 (m) turns	55
Store RAM to Flash	Rds-on-Q4: 10.000 ↔ mΩ ns: 2.000 ↔ turns	
Errors	Rds-on-Q5: 5.000 ∲ mΩ R1: 16.20 √ kΩ	- a ³⁵
	Rds-on-Q6: 5.000 💬 mΩ R2: 1.74 💬 kΩ	(dp) 15
	<u>TDelay:</u> 1↓0000 ↔ % Cp: 3,500.0 ↔ pF	₩ -5
	RL1: 1.000 ↔ mΩ L1: 2.200 ↔ μH	ي 25
	R3: 1.00 ψ kΩ R4: 75.00 ψ kΩ	-23
	R5: 0.10 Φ kΩ R6: 3.09 Φ kΩ	-45
		0 00 I
	Rs: 1.000 (mΩ Cp1: 1.0 (pF	
	Schematic View	Gain - Phase
	Capacitor Legs	5
	C (μF) ESR (mΩ) ESL (nH) # Legs	-15
	▶ 47.000 22.000 4.000 2	9 -35
	100.000 130.000 15.000 1	-75
	Add NewLeg Delete Selected Leg	-95 -115
		-55 -55 -75 -95 -95 -115 -115 -155
🚸 Configure	Coefficient Cot & Alpha Configuration	-175
Conngure	Coefficient Set & Alpha Configuration	-195
🚸 Design 🌟	Coefficient Set Configuration	10 100 1,000 10,00 100,0 0 00
🖑 Monitor	Coef: Set A 🔍 (info)	v <u> </u>
🔅 Status	2 PMBus Log Messages Show PMBus Log	pen/dose settings for Configure, Design, Monitor, and Status 📳
Fusion Digital Power Desigr	ner v1.0.0.27650 [2011-10-27] DC-DC HSFB Firmware v0.0.11.228 @ Addre	255 88 USB Adapt 🛛 🕸 Texas Instruments fusion digital power

Figure 9 - Design mode selected

6.5.1 Power Stage

Depending on which topology is being modeled, the relevant parameters for the stage will be displayed. In the example shown above for HSFB the following parameters for the stage were shown:

Power Stage	- Rail #1				
- Power Sta	age Paramete	rs			
Vbus:	48.000 🔶) v	Vout:	12.000 🐳	v
Fs:	200.000 🔶	kHz	Iout:	5.00 💭	A
Rds-on-Q1:	10.000 🔶	mΩ	RpT:	4.000 🐳	mΩ
Rds-on-Q2:	10.000 🔶	mΩ	RsT:	1.000 💭	mΩ
Rds-on-Q3:	10.000 🔶	mΩ	np:	5.000 💭	turns
Rds-on-Q4:	10.000 🔶	mΩ	ns:	2.000 💭	turns
Rds-on-Q5:	5.000 🔶	mΩ	R1:	16.20 💭	kΩ
Rds-on-Q6:	5.000 🔶	mΩ	R2:	1.74 📩	kΩ
TDelay:	1,0000 🔶	%	Cp:	3,500.0 🐳	pF
RL1:	1.000 🔶	mΩ	L1:	2.200 ≑	μH
R3:	1.00 荣	kΩ	R4:	75.00 💭	kΩ
R5:	0.10 荣	kΩ	R6:	3.09 荣	kΩ
Rs:	1.000 👻	mΩ	Cp1:	1.0 🐳	pF
	So	hematic	View		
— Capacitor Legs					
	C (μF) ESR (mΩ) ESL (nH) # Legs				
	47.000	22.000	4.000		2
10	00.000	130.000		15.000	1
	Add NewLeg		Delete	Selected Leg	

Figure 10 - Stage parameters for HSFB for Voltage Loop (CLA #0)

To model the power stage for the topology, certain parameters need to be specified. Based on the values set, the Bode plot for the power stage is calculated and displayed on the right. The power stage equation differs from loop to loop. The figure above is part of the voltage loop as shown in Figure 9.

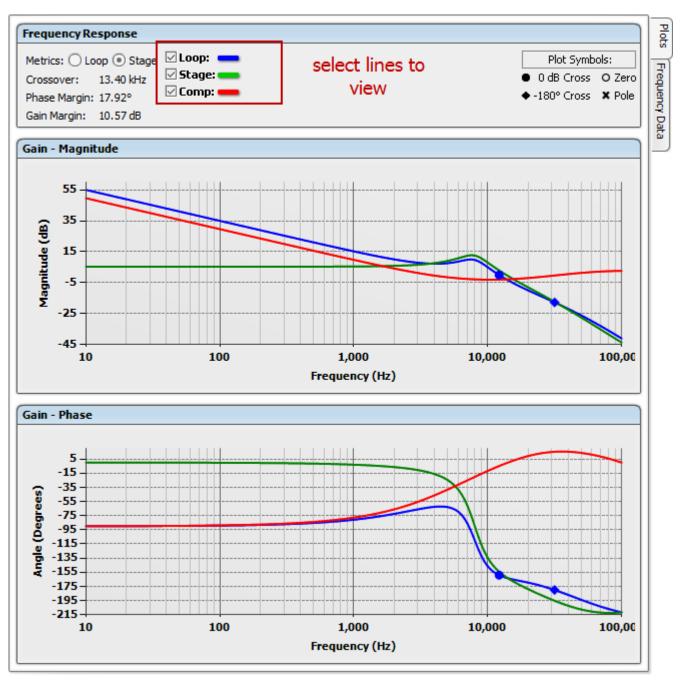


Figure 11 - Bode plots

There are three lines. The green line indicates the power stage. The other two lines are the Compensator and the Loop. Lines can be deselected as shown in the figure above. The Compensator will be discussed in "Section 6.5.2 Compensator."

Clicking "Schematic View" in Figure 10 will open a dialog with a picture of the schematic. See below.

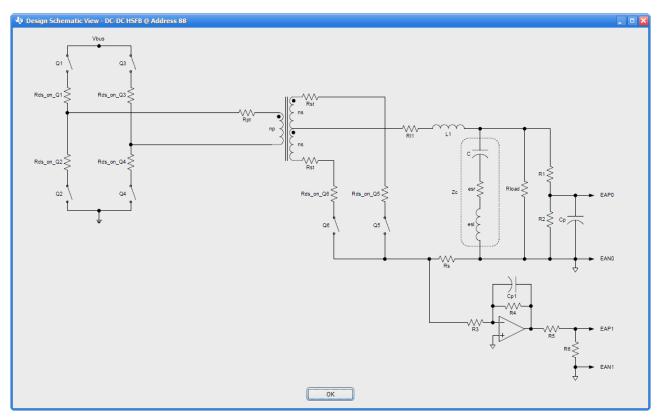


Figure 12 - HSFB schematic being modelled

The Bode plots are updated automatically as you set the values.

6.5.2 Compensator

To model the compensator there are a number of values to configure. The values to configure for the compensator are the Coefficient Sets (A to G), Alphas (0 and 1), Bins (0 to 6) and Threshold Limits (0 to 5). This needs to be done for each loop. The compensator area is just below the Power Stage Parameters. Simply scroll down to bring the controls into view.

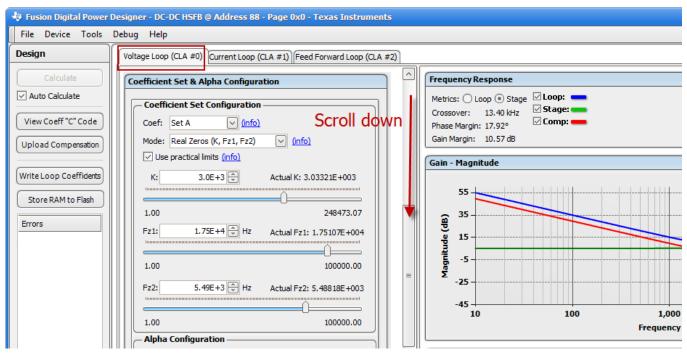


Figure 13 - Scroll down the stage parameters to see the compensator

The GUI comes equipped with 3 different ways to program the UCD3138 digital compensator. The figure below lists these options. The compensator hardware is described by the forth equation (Device PID). In this context; Kp, Ki, Kd and α are the raw register values used to configure the positions of the poles and zeros of the compensator. SC is a gain scaling term. Although it is normally set to zero, it provides additional gain for situations where the power stage gain may be low. PRD is used to configure the minimum operating period and KCOMP is used to configure the maximum operating period. In the context of the compensator they are simply gain terms that modify the overall transfer function by a fixed value. It is important to be aware that the proper way to configure PRD and KCOMP varies based on the control topology implemented. Please consult the relevant user guide and training materials for details.

\$ystem Name	Transfer Function
Complex Zeros	$2 \square K = \frac{s^2}{4} \square \frac{s}{12} \square $
K, fz, Qz, fp	
Real Zeros	$2 \square K _ \frac{s}{2} \square 1 _ \frac{s}{2} \square 1 _$
K , fz1, fz2, fp	$s = \frac{s}{2 \Box fp} \Box l$
Device PID	1000 Kp \square Ki $\frac{1}{1}$ \square Kd $\frac{1}{1}$ \square Kd $\frac{1}{2}$ \square \square KCOMP 2 \square $\frac{1}{2^4}$ PRD \square
Kp, Ki, Kd, □	$1 \square \square$

Figure 14 - Three ways to program compensator

6.5.2.1 Coefficient sets and Alpha

Coefficient Set & Alpha Configuration	1
Coefficient Set Configuration	Select Coefficient set to configure from Set A, B, C,
Coef: Set A	D, E, F, G.
Mode: Real Zeros (K, Fz1, Fz2) V (info)	Three modes to program the compensator. 1: Kp, Ki, Kd.
Use practicer limits unfo K:	 2. Real Zeros (K, Fz1, Fz2) 3. Complex Zeros (K, Q, Fz) Values can be set by editting the value directly or by dragging the track bar.
Fz1: 1.75E+4 → Hz Actual Fz1: 1.75107E+004	Since the values written to the device are integers (Kp, Ki, Kd) there will be some rounding. The effect of the rounding shows up in the "Actual"s
1.00 100000.00 Fz2: 5.49E+3 → Hz Actual Fz2: 5.48818E+003 1.00 100000.00 Alpha Configuration	
Alpha: 0 🗸	Select from Alpha 0 or Alpha 1
 ● Fp: 4.29E+4 → Hz ○ Alpha: 50 → ○ Fp = infinite, Alpha = 0 (Simple Integrator) Actual Alpha: 50 124.58 63661.98 	Three ways to edit Alpha. Set Fp, set Alpha directly, or set it to Simple Integrator. While setting Fp the "Actual" Alpha is shown below
Other Front End Resolution: 1 mV V Oversample: 1x V	 Has an effect on what threshold limits can be selected.
Save Plot Settings to Favorites Design Favorites Compensator line in the Bode plot	Save Set Kp, Ki, Kd and Alpha combination to Favorites so they can be used for other sets or simply for record keeping. It is based on which Set and Alpha are selected.

Figure 15 - Coefficient Set and Alpha Configuration

6.5.2.2 Bode Plot

The Bode plot located on the right of Figure 13 is based on the selected Set and Alpha.

6.5.2.3 Saving Favorites

Sometimes the user would like to keep copies of their Sets and Alphas so they may use them later or apply them to another Set and Alpha. This is possible by clicking the "Save Plot Settings to Favorites" button in Figure 15.

Users can also access the "Favorites" tab directly to view all their Alpha-Set combinations. They can also copy favorites and add descriptions. See Figure 16.

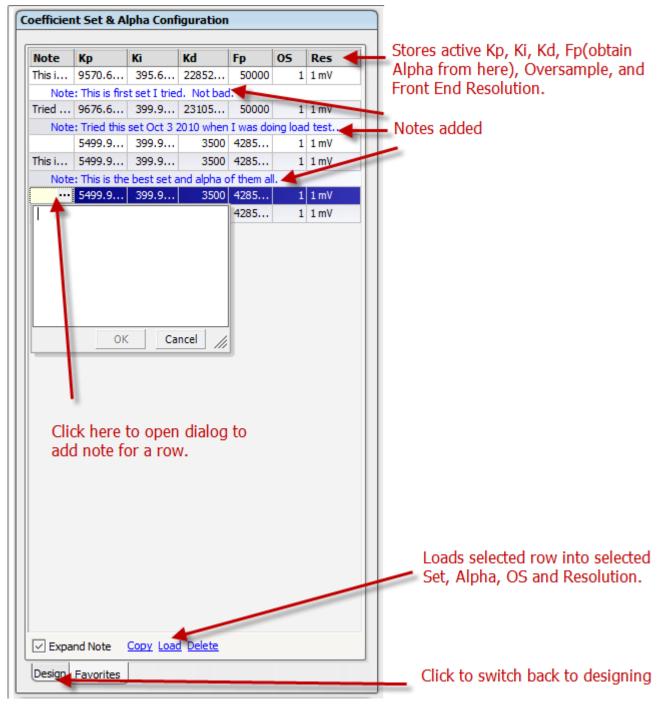


Figure 16 - Favorites

6.5.2.4 Coefficient Set and Alpha Summary

Immediately below the Set configuration is the "Coefficient Set and Alpha Summary." This section displays all the alphas and coefficient sets.

GUI(Fp) - refers to what the current value in the GUI	Coefficient Set & Alpha Su	mmary	
is set to. New Alpha - Indicates what the GUI(Fp) would convert	Alpha# 0 Edit Discard	•	Discard
to for Alpha.	GUI(FP) 5.000E+004		286E+004
	New Alpha 31	New Alpha	50
Last Alpha - Indicates the last Alpha value read on the device.	Last Alpha 50	Last Alpha	50
The New Alpha value becomes highlighted when the	Set GUI Actual	Device PID Pending	Last Written
last Alpha differs from the New Alpha.	K: 3033.21 3033.21	Kp: 9677	5500
last Alpha differs from the New Alpha.	Fz1: 5000.00 4997.03	Ki: 400	400
	Fz2: 5000.00 4997.03	Kd: 23106	3500
Columns in the Sets mean:	<u>GUI edit</u>	Discard GUI edit	
GUI - Displays the GUI edited coefficients in the Mode	Set B GUI Actual	Device PID Pending	Last Written
currently selected(in this case Real Zeros) in the Set	K: 3033.21	Kp: 5500	5500
configuration area.	Fz1: 17510.74 4997.03	Ki: 400	400
comguration area.	Ez: 5488.18 4997.03	Kd: 3500	3500
Actual - Displays what the GUI values would be	<u>GUI edit</u>	Discard GUI edit	
converted to Device Kp, Ki, Kd and back to the	Set C GUI Actual	Device PID Pending	Last Written
	K: 3033.21 3033.21	Kp: 5500	5500
currently selected mode for the GUI values.(There	Fz1: 17510.74 4997.03	Ki: 400	400
would be loss since the rounding). This is an accurate	Fz2: 5488.18 4997.03	Kd: 3500	3500
representation of what would be on the device.	GUI edit	Discard GUI edit	
Device DID Device - Displayer whet the Articles - U.S.	Set D GUI Actual	Device PID Pending	Last Written
Device PID Pending - Displays what the Actual would be	K: 3033.21 3033.21	Kp: 5500	
in Device Kp, Ki, Kd.	Fz1: 17510.74 4997.03	400	400
	Fz2: 5488.18 4997.03	Kd: 3500	
Last Written - Displays the last values written to the	GULedit	Discard GUI edit	
hardware, in other words what is on the hardware.	<u>oon an</u>	Distanti GOT Curt	
	Clicking "Discard" wo	uld update the GU	I, Actual and
If Last Written differs from Device PID Pending then it	Device PID Pending c		
is highlighted.	_		acio on che
	device for that particu	ilar sey Alpria.	

Figure 17 - Coefficient Set & Alpha Summary

Another way to discard all GUI edits globally is to click "Upload Compensation" as described in Section 6.5.2.5

6.5.2.5 Bin Assignment & Non-Linear Table Configuration

To configure the non-linear table the user specifies which sets and alphas are to be used within the configurable limits. One of the rules of the limits is that Lim 0 should be less than Lim 1 and Lim 1 should be less than Lim 2 etc... Lim (n) < Lim (n+1). If the limits are not configured validly then the "Write Loop Coefficients" button will be disabled.

6.5.2.5.1 Make Non-Linear table Linear – Apply Bin 0 to all.

If the user wishes to simply use the same Set and Alpha for all the limits, making it essentially Linear, then the user can select the convenience option "Apply Bin 0 configuration to all bins". All the errors will be removed in this case even though all the Limits are the same. See figure below where all the bins are configured for Set C and Alpha 1.

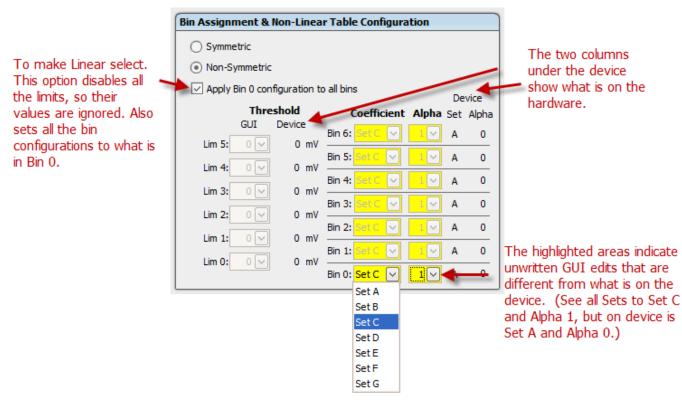


Figure 18 - Apply Bin 0 to all bins (Linear)

6.5.2.5.2 Non-Symmetric and Symmetric

There is an option to make the Limits Symmetric or Non-Symmetric. For Non-Symmetric the limits can be positive or negative. For Symmetric the limits specified must be positive since the symmetric part is automatic and negates all the positive limits. See figure below.

Bin Assignment & Non-Linea	r Table Configuration		Bin Assignment & Non-Linear Table Configuration	
O Symmetric			© Symmetric	
Non-Symmetric	>		O Non-Symmetric	
Apply Bin 0 configuration t	o all bins	Device	Apply Bin 0 configuration to all bins	Device
Threshold	Coefficient Alpha S	et Alpha	Threshold Coefficient Alpha s	et Alpha
GUI Device Lim 5: 5 🗸 5 mV	Bin 6: Set G 🖂 1 🗸	G 1	GUI Device Lim 5: 5 ∨ Bin 6: Set G ∨	G 1
Lim 4: 4 √ 4 mV		F 1	Lim 4: 4 V 4 mV	F 1
Lim 3: 3 🗸 3 mV		E 0	Lim 3: 3 V 3 mV	E 0
Lim 2: 2 🗸 2 mV		D 1 C 0	Lim 2: 2 V 2 mV Bin 2: Set C V 0 V	
Lim 1: 1 🗸 1 mV		B 1	Lim 1: 1 V 1 mV Bin 1: Set B V 1 V	B 1
Lim 0: 0 ✓ 0 mV	Bin 0: Set A ∨ 1∨	A 1	Lim 0: 0 \vee 0 mV -Lim 0: 0 0 0 mV Bin 0: Set A \vee 1 \vee	A 1
			-Lim 1: 1 1 mV	в 1
tive values ⁰			Bin 2: Set C 0	C 0
-2 -3 =	End Resolution: 1 mV	Must be p	oositive_im 3: 3 3 mVBin 3: Set D 1	D 1
-4	Save Plot Sett		-Lim 4: 4 4 mV	E 0
	have made		-Lim 5: 5 5 mV	F 1
-7			Bin 6: Set G 1	G 1

Figure 19 - Symmetric and Non-Symmetric

6.5.2.6 Writing Loop Coefficients, C code, Upload Compensation

After the user is satisfied with their configuration they can then proceed to writing it to the hardware. This does not happen automatically but requires the user to "Write Loop Coefficients." If there are errors they need to be corrected before the writing can proceed. What will be written? All the highlighted values are an indication of what is different from what is on the device so those values will be written. If the user wishes to discard all their GUI edits, or the highlighted values they can do a global discard by simply clicking "Upload Compensation." These buttons mentioned are located on the left side. The user can also view the C code that represents the coefficients in firmware by clicking "View Coeff 'C' Code". See figure below.

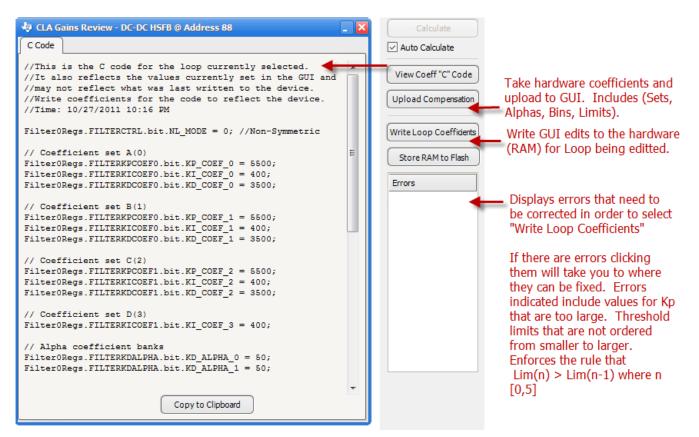


Figure 20 - Writing Loop Coefficients, and global reset of GUI edits to hardware coefficients

6.6 Status

The final mode is the status tab. It provides additional details on the type of fault or warning. Figure 21 - Status Mode shows a screen shot of this tab.

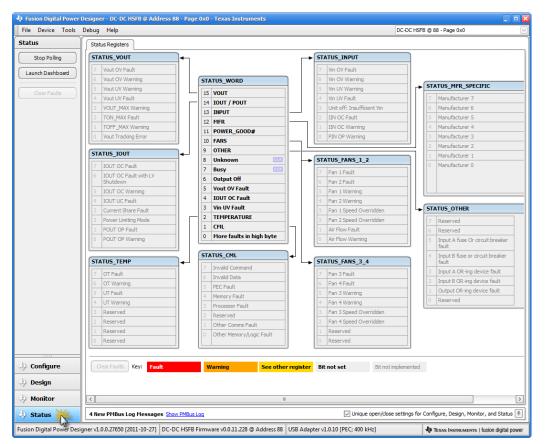


Figure 21 - Status Mode

6.7 Capture the State of the Device - Saving Project File

After editing PMBus commands in Configuration Mode or editing the Compensation, users can simply click the "Write …" button on the left to commit those changes to the hardware's RAM. They can then follow that with a "Store RAM to Flash" to commit the hardware changes to Flash so that they would remain after the device undergoes a reset. If the changes on the hardware are not flashed then a reset would simply restore what is in Flash and overwrite what was previously written to RAM.

However, the above only covers writing device-related parameters. What about the parameters set in the Power Stage in Design mode? These are not stored on the device. The only way these can be stored is by saving a "Project File". The Project File is an .XML file stored on the PC. Not only does it contain design parameters, but it also stores the current state of all pmbus commands. So it is a snapshot of the device and more.

To save a "Project File" simply click File> Save Project As ...

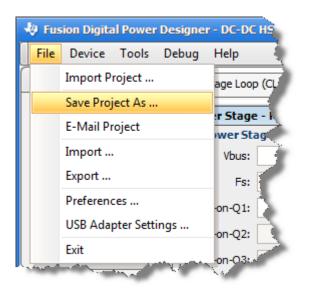


Figure 22 - Save Project File

What can be done with a project file? If a new device was hooked up to the PC the user can simply import the project file and write that to the device. The project file can also be used in Offline mode and act as a virtual device.

6.8 Offline Mode

So far all the discussion has been related to communicating with a device that is connected and online. There is also a concept of working with the device in offline mode. This is done by working with a previously saved Project File as discussed in the last section or by working with Sample Project Files that are already embedded in the GUI. In offline mode the user can write pmbus commands to a "virtual device" and they can also do modelling in Design mode. When the user gets a device they can simply import this project file that they've worked offline with and sync the device to that.

6.8.1 Starting in Offline mode

To start offline you can click the other shortcut that came when the GUI was installed. See following figure.

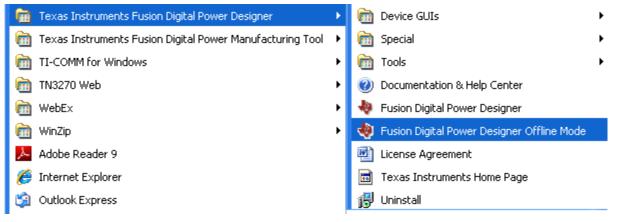


Figure 23 - Starting in offline mode

Another way to start in offline mode is to unplug any connected devices and start the GUI normally with the other shortcut. This will cause the GUI to scan for devices and then upon the fail will prompt the user to Retry, or work in offline mode.

6.8.2 Open Existing Project File

In offline mode the user selects from three options. The first option is to open an existing project file that has been previously saved.

🜵 Fusion Digital Power Designer Offline Wizard	• 🗙
Open Existing Project, Open Sample, or Create New Project?	
You are in offline mode and not connected to any device. Offline mode supports viewing and editing a device's configuration. Design and configuration information is saved to an XML formatted file, which is called a project file. Project files can be imported and written to a device when you have physically connected to the device.	
Please select your activity and click Next:	
Open Existing Project You have previously created a project file or were sent a project file. Project files have a .xml extension.	
O Open Sample Project	
Sample and reference designs are bundled with Fusion Digital Power Designer. You can use these as a basis for a design or to learn more about the capabilities of devices the GUI supports.	
O Create New Design/Project	
You will be able to select from a list of supported devices and create a new project file. You can then refine your design and configuration offline.	
Next > Cancel	

Figure 24 - Offline options

6.8.3 Open Sample Project

The user can also open a sample project file and work with that. They can then save that afterwards as a project file to their PC and use it later to import to a device. The following Sample projects are available at this time. Isolated UCD31XX users should click "UCD31xx Isolated Digital Power Controllers" See figure below.

🖞 Fusion Digital Power Designer Offline Wizard 📃 🛛 🗙
Select Device Category
UCD92xx Fusion Digital Power Controllers A family of fully configurable multi-output and multi-phase DC/DC Point of Load controllers. Devices available for 1 to 4 rails and from 2 to 8 phases.
UCD30xx Isolated Digital Power Controllers The UCD30xx family of digital power controllers is a family of IC's provided by Texas Instruments to support customers developing Isolated Power Supplies. The UCD30xx family of ICs supports a wide range of isolated topologies with a high level of integration, including up to eight high-resolution Digital Pulse Width Modulated (UPWM) outputs, Power Management, and Protection Features. Applications include Isolated AC/DC (including PFC) and Isolated DC/DC power supplies.
UCD31xx Isolated Digital Power Controllers The UCD31xx family of digital power controllers is a family of IC's provided by Texas Instruments to support customers developing Isolated Power Supplies. The UCD31xx family of ICs supports a wide range of isolated topologies with a high level of integration, including up to eight high-resolution Digital Pulse Width Modulated (DPWM) outputs, Power Management, and Protection Features. Applications include Isolated AC/DC (including PFC) and Isolated DC/DC power supplies.
O UCD91xx Fusion Digital Power Controllers Single and dual-phase synchronous buck digital PWM controller designed for point of load power applications.
O TPS40xxx Analog Power Controllers and TPS539xx Analog Power Converters User friendly analog control power ICs with a PMBus compliant interface.
UCD90xx Sequencers and System Health Controllers A family of power supply managers that monitor and sequence up to 13 independent voltage rails. Devices integrate a 12-bit ADC with a 2.5V internal reference for monitoring of up to 13 power supply voltage, current, temperature inputs, or fan tachometers. Up to 26 GPIO pins can be used for power supply enables, voltage margining, power-on reset signals, external interrupts, cascading multiple UCD90124 devices, or other system functions.
Need help deciding what product is right for you? Visit the <u>Texas Instruments Power Management website</u> to learn more about TI's full range of Power Management IC solutions.
If you can't find your device family listed here, it may be a device supported by <u>Switcher Pro</u> ™, TI's interactive tool to design power supplies with TPS40K™ controllers, TPS60xxx low-power DC/DC converters, and SWIFT™ (TPS54xxx) point-of-load step-down DC/DC products.
< Prev Next > Cancel

After clicking "Next" the sample projects will appear. This list will increase as new topologies are supported.

elect a sample project file b	pelow. Click a row in the grid and then click the Next button.
Device	Description
ISFB Center-Tap	UCD31XX HSFB Center Tap with Feed Forward
LC	UCD31XX LLC Half Bridge
PFC Bridgeless	UCD31XX PFC Bridgeless
PFC Interleave	UCD31XX PFC Interleave
PFC Single phase	UCD31XX PFC Single Phase
SFB Peak Current Mode	UCD31XX PSFB Center Tap - Peak Current Mode
SFB Voltage Mode	UCD31XX PSFB Center Tap - Voltage Mode

7 Device GUI (Engineering GUI)

In the previous section the Fusion Designer GUI was described. In this section the Device GUI will be described. The device GUI provides an entry point to a number of important tools. Users will also find out that a number of these tools are also available in the Designer GUI under the Tools menu. Users may use whichever entry point they wish to launch these tools. The following figure shows the entry point to some of the tools that will be described now from the Designer GUI previously discussed. Note you will need to enable the "Protected Features" with the password "forestln" in the Designer GUI to see this. See Section 6.2 Enable GUI Protected Features. This password should also be used for the Device GUI if prompted for password.

🤣 Fusion Digita	l Powe	r Designer - DC-DC HSFB @ Address 88 - Pa	ge 0x0 - Texas 1
File Device	Tools	debug Help	_
Monitor	(Device/Project Configuration Compare	Temperature +
Show/Hide Plots:	١	/oltage Switching Tool	OTF: 50
Vin Vi	[Debug Console	160
∐Iout ∐F	F	PMBus Logging	
✓ Temp I ✓ I	1	Memory Debugger ┥	140
	١	Memory Peek/Poke/Dump	120
Fit All Plots on	9	SMBus & SAA Tool	120
 Scale Plots to Width 	1	Numeric Encode/Decode Tester	100
Height: 2	(Device Read/Write Stress Tester	80
Show Warn &		Group Command Protocol Tester	
└─│ Show Warn & Limit Editors		Configuration Import Tester	60
Show Value La	4	ASCII Tool	40
onriota	E	EPROM File Tool	
Stop Pollin	E	EPROM File Compare Tool	20
Launch Dashb	I	solated GUI Bit Mask Generator 🗲	
	[Decimal & Mantissa Exponent Tool 🗲	29:00
	F	PEC & SMBus -> I2C Translation Tool	All Temperature
	C	Clear Configuration	200
	(Download Firmware	
	[Download USB Adapter Firmware	
			0
		<i>∎</i>	

Figure 25 - Designer GUI Tools menu

7.1 Launching Device GUI

During the installation users had the option to create a shortcut for the UCD3xxx Device GUI. If that option was not selected the UCD3xxx Device GUI can also be accessed from the Start Menu.

🛅 Texas Instruments Fusion Digital Power Designer	×	💼 Device GUIs 🔹 🕨	L 🕸	UCD3xxx Device GUI
💼 Texas Instruments Fusion Digital Power Manufacturing Tool	×	💼 Special	49	ULocation: C:\Program File
🛅 TI-COMM for Windows	•	🛅 Tools 🛛 🔸	-49	U Power Designer\bin
🛅 TN3270 Web	•	Ocumentation & Help Center	-19	UCD7242 Device GUI
🛅 WebEx	•	🚸 Fusion Digital Power Designer	-49	UCD7410x Device GUI
🛅 WinZip	•	🚸 🛛 Fusion Digital Power Designer Offline Mode		
😕 Adobe Reader 9		🖭 License Agreement		
🏉 Internet Explorer		🐻 Texas Instruments Home Page		
🗐 Outlook Express		😼 Uninstall		

Figure 26 - Opening UCD3xxx Device GUI

The Device GUI looks as follows,

🚸 UCD3XXX Device GUI	
Status	Tools
Attached: Unknown	Scan Device in ROM Mode
Last ROM Found: IC Info: ROM Info: Package ID:	Scan for Device in Program Mode: <u>DEVICE ID PMBUS REVISION</u> When a device is found, dump additional PMBus commands Command ROM to execute its program (SendByte 0xF0 to Address 11) Command Program to jump to ROM (SendByte 0xD9)
Last Program Found: Address: DEVICE_ID: MFR_MODEL: MFR_REVISION:	ROM API SMBus Debug USB Adapter (SAA) Settings Memory Debugger Memory Peek/Poke Firmware Download Erase/Set DFlash: 0xFF 0xAA Peek/Poke IC Registers and Firmware Variables Report trim status Dump Info Block Erase/Set PFlash: 0xFF 0xAA Program Flash Checksum: Dump Calculate Recreate Validate Clear Export Flash Compare Flash Files Dump Flash File Flash Test Tool Full Export Tool X0 to Hex Tool Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool
Log	
Timestamp Message	
09:35:30.625 Click one of the scan but	tons to find a device in ROM or program mode
Copy Log Clear Log	Display all SMBus/I2C activity
Fusion Digital Power Designer v1.0.0.1545	58 [2011-10-28] USB Adapter v1.0.10 [PEC; 400 kHz]

Figure 27 - UCD3xxx Device GUI

After the Device GUI starts up there are a number of links that are enabled and some disabled. Which links are clickable depends on whether the GUI is in ROM mode or Program mode. To start off the user should click "Scan

Device in Rom Mode" if the device is in ROM mode. If the user clicks this and the device isn't in ROM mode a message will be logged that No ROM detected. If the device is in Program mode then the user should select "Device ID" or "PMBus REVISION".

tatus		Tools ROM scan	
Attached: UCD	3100ISO1 @ Address 88	Scan Device in ROM Mode Program scan	
Last ROM Foun IC Info: ROM Info: Package ID:	d: 	Scan for Device in Program Mode DEVICE ID PMBUS REVISION When a device is found, dump additional PMBus commands Command ROM to execute its program (SendByte 0xF0 to Address 11) Command Program to jump to ROM (SendByte 0xD9 to Address 88)	
Last Program Fo Address: DEVICE_ID: MFR_MODEL: MFR_REVISIC	88d 0x58 UCD3100IS UCD3138HS	ROM API SMBus Debug USB Adapter (SAA) Settings Memory Debugger Memory Peek/Poke Firmware Download Erase/Set DFlash: 0xFF 0xAA Peek/Poke IC Register Report trim status Dump Info Block Erase/Set PFlash: 0xFF 0xAA Program Flash Checksum: Dump Calculate Recreate Validate Clear	
		Export Flash Compare Flash Files Dump Flash File Flash Test Tool Full Export Tool X0 to Hex Tool Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool	<u>ol</u>
	Message	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool	
Log Timestamp 09:47:54.654	Scanning addresses 1-1	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool 1,13-127 for program mode devices	
Log Timestamp 09:47:54.654 09:47:55.049	Scanning addresses 1-11 Found UCD3100ISO1 @	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool 1, 13-127 for program mode devices Address 88d	
Log Timestamp 09:47:54.654 09:47:55.049 09:47:55.050	Scanning addresses 1-1: Found UCD3100ISO1 @ Address:	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool 1, 13-127 for program mode devices Address 88d 88d 0x58	
Log Timestamp 09:47:54.654 09:47:55.049	Scanning addresses 1-1: Found UCD3100ISO1 @ Address: DEVICE_ID:	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool 1, 13-127 for program mode devices Address 88d	
Log Timestamp 09:47:54.654 09:47:55.049 09:47:55.050	Scanning addresses 1-1: Found UCD3100ISO1 @ Address: DEVICE_ID: 0x554344333130304	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool I, 13-127 for program mode devices Address 88d 88d 0x58 UCD3100IS01 0.0.11.0228 111026	
Log Timestamp 09:47:54.654 09:47:55.049 09:47:55.050 09:47:55.058	Scanning addresses 1-1: Found UCD3100ISO1 @ Address: DEVICE_ID: 0x554344333130304 SETUP_ID:	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool 1,13-127 for program mode devices	
Log Timestamp 09:47:54.654 09:47:55.050 09:47:55.058 09:47:55.078	Scanning addresses 1-1: Found UCD3100ISO1 @ Address: DEVICE_ID: 0x554344333130304 SETUP_ID:	Device Debug Tool Mantissa/Exponent Tool Iso Bitmask Tool In 13-127 for program mode devices In 13-127 for program mode devices In 13-127 for program mode devices Address 88d In 13-127 for program mode devices In 13-127 for program mode devices Address 88d In 13-127 for program mode devices In 13-127 for program mode devices Address 88d In 13-127 for program mode devices In 13-127 for program mode devices VED3100ISO1 0.0.11.0228 111026 In 13-123 for 13-130323600 In 14-14-14-14-14-14-14-14-14-14-14-14-14-1	

7.2 Moving between ROM and Program mode

To move between ROM mode and Program mode the user can select the following links respectively.

Scan Device in ROM Mode Scan for Device in Program Mode: <u>DEVICE ID</u> <u>PMBUS REVISION</u> When a device is found, dump additional PMBus commands				
Command ROM to execute it			_	
Command Program to jump t	O ROM (SendByte UxL		_	
ROM API	SMBus Debug	USB Adapter (SAA) Settings	Memory Debugger	
Memory Peek/Poke	Firmware Download	Erase/Set DFlash: <u>0xFF</u> <u>0xAA</u>	Peek/Poke IC Registers and Firmware Variables	
Report trim status	Dump Info Block	Erase/Set PFlash: 0xFF 0xAA		
Program Flash Checksum:	Dump Calculate	<u>Recreate</u> <u>Validate</u> <u>Clear</u>		
Export Flash Compare Flas	sh Files Dump Flash	File Flash Test Tool Full Expo	ort Tool X0 to Hex Tool	
Device Debug Tool	Mantissa/Ex	ponent Tool Iso Bitma	ask Tool	

Figure 28 - Moving from ROM mode to Program mode

7.3 Firmware Download Tool

To open the Firmware Download tool click "Firmware Download"

Scan Device in ROM Mode Scan for Device in Program Mode: <u>DEVICE ID</u> <u>PMBUS REVISION</u> When a device is found, dump additional PMBus commands						
	Command ROM to execute its program (SendByte 0xF0 to Address 11) Command Program to jump to ROM (SendByte 0xD9 to Address 88)					
ROM API Memory Peek/Poke Report trim status	SMBus Debuq Firmware Download Dump Info Block	USB Adapter (SAA) Settings Erase/Set DFlash: <u>0xFF</u> 0xAA Erase/Set PFlash: <u>0xFF</u> 0xAA	Memory Debugger Peek/Poke IC Registers and Firmware Variables			
Program Flash Checksum: Export Flash Compare Fla Device Debug Tool		Recreate Validate Clear File Flash Test Tool Full Expo ponent Tool Iso Bitma				

The tool launched should look as follows:

Figure 29 - Scanning for device in ROM or Program mode

Note: Use the Fusion GUT's built-in firmware download tool if you need to download/reset data flash but want to keep your current PMBus configuration. Unlike the Fusion GUT, this tool does not require that the device have firmware loaded or be able to execute its program. Firmware File: C: projects/hpa/TechnicalInfo/Cyclone/new cyclone/UCD3138HSFBEVM_029_0_0_11_0227_111019.x0 Select File Program flash mode: Data flash mode: Program flash checksum write mode (Device power up mode): Download @ Download program flash Download ta flash (mose serase first) Download ta flash (mose serase first) Download ta flash Select His option for experimental firmware or if you need to be able to perform low-level debugging via the ROM. When the UCD3000 is powered on, it will stay in ROM mode. Skip program flash Skip data flash Write pattern: DAS THRU whatever program checksum is present in the firmware image file This option can be used to test a firmware image produced by the Fusion GUT File->Export* tool PHash +DPlash output or the UCD3000 Device GUT's Export Flash* output. © Execute program when download is complete (boot device, one time only) Detailed logging Scan for device after program is executed (What's this?) A bort firmware download if device has not been factory timmed (What's this?) Immestamp Message Message Message 09:531:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) Message Message <t< th=""><th>🚸 Fusion Digital Power Firmware Download Tool</th><th>N 🗆 🗖</th></t<>	🚸 Fusion Digital Power Firmware Download Tool	N 🗆 🗖					
Program flash mode: Data flash mode: Program flash mode: Download program flash (mass erases first) (mass erases first) Program flash (mass erases first) (mass erases first) Download data flash (mass erase first) Download data flash							
Ownload program flash (mass erases first) O NOT write program checksum (Stay in ROM) Skip program flash Erase data flash (mass erases first) O D NOT write program checksum (Stay in ROM) Skip program flash Erase data flash (mass erases first) Write pattern: (DXAA) WRITE program checksum (Automatically execute program) Skip program flash Skip data flash (mass erases first) PASS THRU whatever program checksum (stay in ROM) Skip program flash Skip data flash (mass erases first) PASS THRU whatever program checksum (stay in ROM) Write pattern: DXAA PASS THRU whatever program checksum is present in the firmware image file This option can be used to test a firmware image produced by the Fusion GUI THE->Export* tool PFlash+DFlash output or the UCD3000 Device GUI's "Export Flash* output. Scan for device after program is executed (what's this?) Abort firmware download if device has not been factory trimmed (what's this?) Timestamp Message Message 09:53:57.985 USB Adapter v1.0. 10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.985 09:53:58.105 Looking for device in ROM mode 09:53:58.105 09:53:58.105 Looking for device in program mode 09:53:58.107 09:53:58.107 Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode <t< td=""><td>Firmware File: C:\projects\hpa\TechnicalInfo\Cyclone\new</td><td colspan="6">nware File: C:\projects\hpa\TechnicalInfo\Cyclone\new cyclone\UCD3138HSFBEVM_029_0_0_11_0227_111019.x0 Select File</td></t<>	Firmware File: C:\projects\hpa\TechnicalInfo\Cyclone\new	nware File: C:\projects\hpa\TechnicalInfo\Cyclone\new cyclone\UCD3138HSFBEVM_029_0_0_11_0227_111019.x0 Select File					
 Download program flash (mass erases first) Erase program flash (mass erases first) Erase data flash (mass erases first) Erase data flash Skip program flash Skip data flash (Write pattern: DXAA Write pattern: DXAA PASS THRU whatever program checksum (Automatically execute program) Select this option for export on evices. When the device is powered on, it will exect its program flash. Write pattern: DXAA PASS THRU whatever program checksum is present in the firmware image file This option can be used to test a firmware image produced by the Fusion GUI "File->Export" tool PFlash+tDFlash output or the UCD3000 Device GUI's "Export Flash" output. Sacan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Message Dis 35:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) D9:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands D9:53:58.103 No devices in ROM mode D9:53:58.103 Copy Log Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close 	Program flash mode: Data flash mode:	Program flash checksum write mode (Device power up mode):					
Erase program flash Erase data flash debugging via the ROM. When the UCD3000 is powered on, it will stay in ROM mode. Skip program flash Skip program flash Write pattern: DXAA PASS THRU whatever program checksum is present in the firmware image file This option can be used to test a firmware image produced by the Fusion GUI "File->Export" tool PFlash +DFlash output or the UCD3000 Device GUI's "Export Flash" output.	Download program flash O Download data flash						
Erase program flash Erase data flash Skip program flash Skip data flash WRTE program checksum (Automatically execute program) Skip program flash Skip data flash Write pattern: PASS THRU whatever program checksum is present in the firmware image produced by the Fusion GUI. "File->Export" tool PFlash+DFlash output or the UCD3000 Device GUI's "Export Flash" output. Execute program when download is complete (boot device, one time only) Detailed logging Scan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Timestamp Message 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.805 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program Mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Close	(mass erases first) (mass erases first)						
Skip program flash Skip data flash Select this option for production devices. When the device is powered on, it will exectite its program flash. Write pattern: PASS THRU whatever program checksum is present in the firmware image file DXAA This option can be used to test a firmware image produced by the Fusion GUI "File->Export" tool PFlash+DFlash output or the UCD3000 Device GUI's "Export Flash" output. Execute program when download is complete (boot device, one time only) Detailed logging Scan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Timestamp Message 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.103 No device in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in ROM Mode Close	○ Erase program flash ○ Erase data flash						
OxAA OxAA OxAA OxAA OxAA OxAA Dis option can be used to test a firmware image produced by the Fusion GUI "File->Export" tool PFlash+DFlash output or the UCD3000 Device GUI's "Export Flash" output. Image: Discrete program when download is complete (boot device, one time only) Detailed logging Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Image: Discrete program is executed (What's this?) Image: Discrete program tool is complete program mode Discrete program t	◯ Skip program flash ◯ Skip data flash	Select this option for production devices. When the device is powered on, it will execite its					
tool PFlash +DFlash output or the UCD3000 Device GUI's "Export Flash" output. Execute program when download is complete (boot device, one time only) Detailed logging Scan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Timestamp Message 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.105 Looking for device in program mode 09:53:58.855 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode	 Write pattern: 	O PASS THRU whatever program checksum is present in the firmware image file					
 Execute program when download is complete (boot device, one time only) Detailed logging Scan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) <u>Timestamp Message</u> 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.855 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close 	0xAA						
Scan for device after program is executed (What's this?) Abort firmware download if device has not been factory trimmed (What's this?) Timestamp Message 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.865 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Clear Log Other Scan for Devices in Program Mode	_	tool PHash +DHash output or the UCD3000 Device GUI's Export Hash "output.					
Timestamp Message 09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.865 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in ROM Mode Close	=						
09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.805 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.807 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Copy Log Other Scan for Devices in ROM Mode	✓ Scan for device after program is executed (What's this	<u>s?</u>) [] Abort firmware download if device has not been factory trimmed (<u>What's this?</u>)					
09:53:57.985 USB Adapter v1.0.10 [PEC; 400 kHz] Found (Adapter #1) 09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.805 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.807 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Copy Log Other Scan for Devices in ROM Mode							
09:53:57.986 Looking for device in ROM mode 09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.805 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode							
09:53:58.103 No devices responded to UCD3000 or UCD9110 IC version ROM commands 09:53:58.105 Looking for device in program mode 09:53:58.865 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode		nd (Adapter #1)					
09:53:58.105 Looking for device in program mode 09:53:58.805 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close	-						
09:53:58.865 Found DC-DC HSFB Firmware v0.0.11.228 @ Address 88 in program mode 09:53:58.871 Ready to download firmware Copy Log Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close		19110 IC version ROM commands					
09:53:58.871 Ready to download firmware Copy Log Clear Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close							
Copy Log Other Scan for Devices in Program Mode Scan for Devices in ROM Mode Close		@ Address 88 in program mode					
	09:53:58.871 Ready to download firmware						
Fusion Digital Power Designer v1.0.0.15458 [2011-10-28] DC-DC HSFB Firmware v0.0.11.228 @ Address 🖑 Texas Instruments fusion digital power	Copy Log Clear Log Other	Scan for Devices in Program Mode Scan for Devices in ROM Mode Close					
	Fusion Digital Power Designer v1.0.0.15458 [2011-10-28]] DC-DC HSFB Firmware v0.0.11.228 @ Address 🏘 Texas Instruments fusion digital power					

The user can choose what they would like to download with regards to the Program Flash, and Data Flash. Regarding the Program flash checksum (last column of options) it is important to note that if the program checksum is written then on a device reset, the Program mode will always be executed. This is a potential problem for firmware that hasn't reached production level and the commands to jump back to ROM have not been fully implemented. The problem that can occur is for the device to get locked in program mode. So it is preferred not to write the program checksum for firmware in initial stages.

The user picks the firmware file to download and clicks download. Sometimes this tool may be launched when the device is running in program mode. In that case they can use the button "Other …" at the bottom to put the device in ROM mode so that they can proceed with the download.

7.4 Isolated Bitmask Tool

The Isolated Bitmask Tool provides firmware developers with a tool to help them set the bitmask for the commands that inform the GUI of what PMBus commands are supported. See "Section 6.4.2 How do Implemented Commands on the Firmware Appear in the GUI?"

Scan Device in ROM Mode Scan for Device in Program Mode: DEVICE ID PMBUS REVISION When a device is found, dump additional PMBus commands Command ROM to execute its program (SendByte 0xF0 to Address 11) Command Program to jump to ROM (SendByte 0xD9 to Address 88) ROM API SMBus Debug USB Adapter (SAA) Settings Memory Debugger Peek oke IC Registers Memory Peek/Poke Firmware Download Erase/Set DFlash: 0xFF_0xAA and Firmware Variables Report trim status Dump Info Block Erase/Set PFlash: 0xFF 0xAA Dump Calculate Recreate Validate Clear Program Flash Checksum: Export Flash Compare Flash Files Dump Flash File Flash Test Tool Full Exp Tool X0 to Hex Tool Iso Bitmask Tool Device Debug Tool Mantissa/Exponent Tool GUI when first opened 🜵 Isolated Bitmask Generator Tool _ 🗆 🔀 1. Select PMBus Revision 1.2 🗸 2. Select PMBus commands to generate bitmask. 3. Or paste the Hex Code bitmask to see which commands are being used. Select PMBus Commands Hex Code Entry Bitmask Generated PMBUS_CMD_PAGE (0x00) ^ //***PMBus commands selected*** PMBUS_CMD_OPERATION (0x01) PMBUS_CMD_ON_OFF_CONFIG (0x02) // 0 0000000 0000000 PMBUS_CMD_CLEAR_FAULTS (0x03) // 1 0000000 0000000 PMBUS_CMD_PHASE (0x04) // 2 0000000 0000000 PMBUS_CMD_PAGE_PLUS_WRITE (0x05) // 3 0000000 0000000

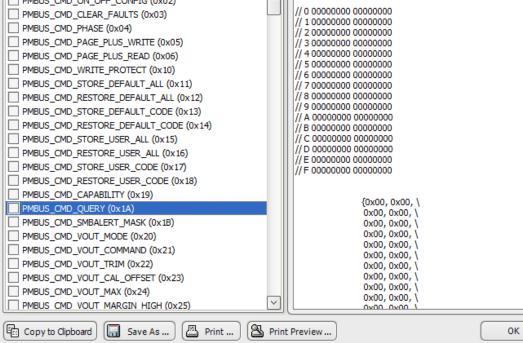
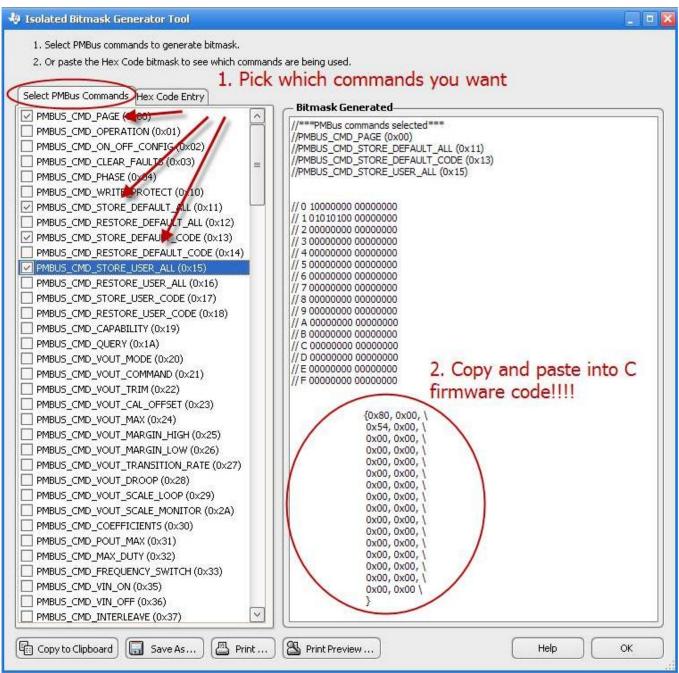


Figure 30 - Bitmask tool

2. Select commands desired in the bitmask and the bitmask code on the right will automatically be generated.



3. The user can also work in reverse by pasting a known bitmask in C code and then see what commands those bitmasks were indicating. They can also go back to the Select PMBus commands tab and all the indicated ones will be checked.



🏘 Isolated Bitmask Generator Tool 1. Select PMBus commands to generate bitmask. 2. Or paste the Hex Code bitmask to see which commands are being used. Select PMBus Commands Hex Code Entry **Bitmask Generated** {0x80, 0x00, \ PMBUS_CMD_PAGE 0x54, 0x00, \ PMBUS_CMD_STORE_DEFAULT_ALL PMBUS_CMD_STORE_DEFAULT_CODE 0x00, 0x00, \ 0x00, 0x00, \ PMBUS_CMD_STORE_USER_ALL 0x00, 0x00, \ 0x00, 0x00, \ // 0 1000000 00000000 0x00, 0x00, \ // 1 0 10 10 100 00000000 0x00, 0x00, \ // 2 0000000 00000000 0x00, 0x00, \ // 3 0000000 00000000 0x00, 0x00, \ // 4 0000000 00000000 0x00, 0x00, \ 2. We work backwards // 5 0000000 0000000 0x00, 0x00, \ // 6 0000000 00000000 0x00, 0x00, \ and figure out which // 7 0000000 00000000 0x00, 0x00, \ // 8 0000000 00000000 0x00, 0x00, \ commands created // 9 0000000 00000000 0x00, 0x00 \ // A 0000000 00000000 that bitmask. // B 0000000 00000000 // C 0000000 0000000 1. Paste your C code bit // D 0000000 0000000 // E 0000000 0000000 mask into here. // F 0000000 0000000 3. Also, you can continue editting that bit mask by switching to "Select PMBus Commands" and continue working from there. 🔠 Print Preview ... Print ... Copy to Clipboard Save As... Help OK

7.5 Firmware Memory Debugger

Included with the Fusion Digital Power Design software suite a powerful low level GUI is available for debug using the PMBus.

Scan Device in ROM Mode						
Scan for Device in Program Mode: DEVICE ID PMBUS REVISION						
\bigtriangledown When a device is found,	dump additional PMBus	s commands				
<u>Command ROM to execute it</u> Command Program to jump t						
ROM API	SMBus Debug	USB Adapter (SAA) Set	tings Memory Debugger			
Memory Peek/Poke	Firmware Download	Erase/Set DFlash: 0xF	E OXAA Peek/Poke IC Registers			
Report trim status	Dump Info Block	Erase/Set PFlash: <u>0xF</u>				
Program Flash Checksum:	Dump Calculate	Recreate Validate	Clear			
Export Flash Compare Flas	sh Files Dump Flash	File Flash Test Tool	Full Export Tool X0 to Hex Tool			
Device Debug Tool	<u>Mantissa/Ex</u>	ponent Tool	Iso Bitmask Tool			

Figure 31 - Memory Debugger

File	2											_
All	😽 Wate	th List										
Register/	Variable Nar	ne:	~	Substring Match	- Fil	ter Clea	r Filter She	ow: 💿 All	O Registers (Flash OPF	las
election:	< (3 IA :	pmbus_checksum 🕻										
Name			Description	Туре	Value	Hex	Address	Size	Category	1		^
- pa	arm_index			UInt8			0x0001901F	1 byte	RAM			1
⇒ pa	arm_mem_le	ength		Array unsig			0x00004FBC	38 bytes	PFlash			
÷ pi	arm_mem_s	tart		Array unsig			0x00004F70	76 bytes	PFlash			
- pa	arm_offset			Int16			0x00019020	2 bytes	RAM			
- pa	arm_size			UInt8			0x00019023	1 byte	RAM			
- pe	eriod			UInt16	0	0x0000	0x000193F2	2 bytes	RAM			
- pt	fc_command	d	for APEC demo	UInt8			0x000193E9	1 byte	RAM			
- pt	fc_os_enab	le	for APEC demo	UInt8			0x000193EC	1 byte	RAM			
+ pt	fc_out_stru	ct		Struct PFC			0x000193C8	27 bytes	RAM			
- pt	fc_phase_2	_enable	for APEC demo	UInt8			0x000193EA	1 byte	RAM			
- pt	fc_zvs_ena	ble	for APEC demo	UInt8			0x000193EB	1 byte	RAM			
) pr	mbus_buffe	r		Array unsig			0x00019024	40 bytes	RAM			
- pr	mbus_buffe	r_position		UInt8			0x0001904E	1 byte	RAM			
- pr	mbus_check	sum		UInt32	2,271,5	0x87654	0x00018910	4 bytes	DFlash	REFRESH		
- pr	mbus_check	(sum_b	For Portability, It Is	UInt32			0x00018A30	4 bytes	DFlash			=
e pr	mbus_dcdc	_cal		Array PMBU			0x00019108	12 bytes	RAM			
D pr	mbus_dcdc	_cal_constants		Array PMBU			0x00018880	12 bytes	DFlash			
÷ pr	mbus_dcdc	_cal_constants_b		Array PMBU			0x000189A0	12 bytes	DFlash			
e pr	mbus_dcdc	_cal_nonpaged	second rail default v	Struct PMBU			0x00019174	4 bytes	RAM			
🕂 pr	mbus_dcdc	_cal_nonpaged_constants	second rail default v	Struct PMBU			0x0001888C	4 bytes	DFlash			
D pr	mbus_dcdc	_cal_nonpaged_consta	second rail default v	Struct PMBU			0x000189AC	4 bytes	DFlash			
e pr	mbus_dcdc	_config		Array PMBU			0x00019068	76 bytes	RAM			
-		_config_constants		Array PMBU			0x00018890	76 bytes	DFlash			~
÷ ~	mhun dede	confin constants h		Areso DADI I			0-00010000	76 hutas	nElsah			Ľ
Expa	and All	Collapse Al	Refresh All	Write Changes	Ir	nport	Export Sele	ected	Export All	ClearW	atch List	
Timestam	np Mes	sage								Copy Loc	Clear Log	
12:35:25.	.616 0x00	0018910: read 4 byte(s) (x87654321									

Figure 32: GUI Debugger

To also access the GUI through the Design GUI click the "Memory Debugger" item under tools, shown in Figure 33.

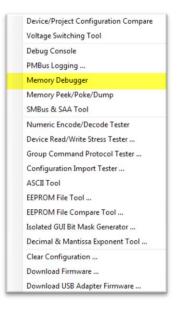


Figure 33: Fusion Designer GUI Debugger Tool

By default the tool comes up displaying all of the hardware based device registers.

Name	e	Description	Туре	Value	Hex	Address	Size	Category			
÷-	AdcRegs	IRQ Index Offset Ve	Struct ADC			0x00040000	152 bytes	Register	REFRESH	WRITE	Ē
ė.	CimRegs	Memory Fine Base A	Struct CIM		-	0xFFFFFF20	24 bytes	Register			
•	DecRegs	DPWM Individual Reg	Struct DEC			0xFFFFFE00	156 bytes	Register			
÷.	Dpwm0Regs		Struct DPWM			0x000D0000	140 bytes	Register			
•	Dpwm1Regs		Struct DPWM			0x000A0000	140 bytes	Register			C
÷	Dpwm2Regs		Struct DPWM			0x00070000	140 bytes	Register			
•	Dpwm3Regs	Analog Comparator	Struct DPWM			0x00050000	140 bytes	Register			
÷.	FaultMuxRegs	Ramp Control Register	Struct FAULT			0x00030000	128 bytes	Register			
<u>ل</u>	FeCtriORegs		Struct FE_CT			0x000E0000	68 bytes	Register			
•	FeCtrl 1Regs		Struct FE_CT			0x00080000	68 bytes	Register			
<u>ل</u>	FeCtrl2Regs	Filter Status Register	Struct FE_CT			0x00080000	68 bytes	Register			
÷.	FilterORegs		Struct FILTE			0x000C0000	100 bytes	Register			
<u>ل</u>	Filter 1Regs		Struct FILTE			0x00090000	100 bytes	Register			
•	Filter 2Regs	Fault Port I/O Directi	Struct FILTE			0x00060000	100 bytes	Register			
•	GioRegs	Front End Control 0	Struct GIO			0xFFF7FA00	64 bytes	Register			
÷.	LoopMuxRegs	Clock Trim Register	Struct LOOP			0x00020000	120 bytes	Register			
÷	MiscAnalogRegs	Static Memory Contr	Struct MISC			0xFFF7F000	72 bytes	Register			
÷	MmcRegs	PMBus Control Regist	Struct MMC			0xFFFFFD00	60 bytes	Register			
•	PMBusRegs	Clock Control Registe	Struct PMBU			0xFFF7F600	36 bytes	Register			
Ð	SysRegs	T24 Counter Data Re	Struct SYS_R			0xFFFFFFD0	48 bytes	Register			
	TimerRegs	UART Control Regist	Struct TIMER			0xFFF7FD00	156 bytes	Register			C
<u>ن</u>	Uart0Regs		Struct UART			0xFFF7EC00	56 bytes	Register			
÷-	Uart1Regs	: allow reading const	Struct UART			0xFFF7ED00	56 bytes	Register			

Figure 34: GUI UCD3138 Debugger – Defaults

If you expand any item on this list you will have access to every bit field inside the UCD3138 device. This access extends to both reading and writing to these registers.

Name			Description	Туре	Value	Hex	Address	Size	Category		
÷.	FeCtr	1Regs		Struct FE_C			0x000B0000	68 bytes	Register		
÷	FeCtr	2Regs	Filter Status Register	Struct FE_C			0x00080000	68 bytes	Register		
÷.	Filter	Regs		Struct FILTE			0x000C0000	100 bytes	Register		
ŧ	FI	LTERSTATUS	Filter Status Register	Union FILTE			0x000C0000	4 bytes	Register		
ŧ	FI	LTERCTRL	Filter Control Register	Union FILTE			0x000C0004	4 bytes	Register		
Ð	CF	PUXN	CPU XN Register	Union CPUX			0x000C0008	4 bytes	Register		
(t	FI	LTERXNREAD	Filter XN Read Register	Union FILTE			0x000C000C	4 bytes	Register		
Œ	FI	LTERKIYNREAD	Filter KI YN Read Re	Union FILTE			0x000C0010	4 bytes	Register		
Œ	FI	LTERKDYNREAD	Filter KD YN Read R	Union FILTE			0x000C0014	4 bytes	Register		
Œ	FI	LTERYNREAD	Filter YN Read Register	Union FILTE			0x000C0018	4 bytes	Register		
Ð	- co	DEFCONFIG	Coefficient Configur	Union COEF			0x000C001C	4 bytes	Register		
Ē	FI	LTERKPCOEF0	Filter KP Coefficient	Union FILTE		0x00007	0x000C0020	4 bytes	Register		
		all		UInt32	29,033	0x00007	0x000C0020	4 bytes	Register		
	ė.	bit		Struct FILTE		0x00007	0x000C0020	4 bytes	Register		
	Ė	Bit Fields		Bit Fields		0x00007	0x000C0020	4 bytes	Register		
			KP Coefficient 1	S Bit Field: 16	0	0x0000	0x000C0020	16 bits	Register		
		KP_COEF_0 [15:0]	KP Coefficient 0	S Bit Field: 16	29,033	0x7169	0x000C0022	16 bits	Register R	EFRESH	WRITE

Figure 35: Device Debugger Bit Field Selector

Figure 35 displays one register set fully expanded in the debugger. Clicking the "REFRESH" button on the right will force the debugger to read the corresponding register from the device. Entering a new value in the "Value" or "Hex" fields and then clicking "WRITE" will write the new values to the device. *Keep in mind that reading and writing to any register in the device is very powerful and also dangerous. Some registers should not be changed and others are cleared on read so care should be used when selecting which registers you want to access. Please see the appropriate programmer's manual for further details.*

Since there are so many different fields inside of the UCD3xxx devices a "Watch List" is available to create a convenient place to both read and write to the addresses of interest. If you click one of the stars next to a variable name it will turn gold indicating that it has been added to the watch list. To remove an item from the watch list, simply click the star again. If you click the "Watch List" tab at the top of the window you will now see the items you selected.

jir bit		5
🖮 🤺 Bit Fields		E
	KP Coefficient 1	5
	KP Coefficient 0	5
	Filme IVD Conference	1

Figure 36: Watch List Selection Star

The debugger also has the ability to read and write to any global firmware variable. This can be done by providing the GUI with the path to find the ".map" and ".pp" files from the firmware build. Click the item shown in Figure 37.

Change Map
Close

Figure 37: Map File Selection

After clicking this item, a window will pop up providing detailed instruction on what to do. For an example, see Figure 38.

		The second Alar
- About Map/PP Files -		
	located, non-local glol	ault, if you tell the debugger where certain Code bal (extern) variables can be debugged. The
address in memor • *.pp - Contains d	y they have been loca eclarations from your s	variables in your "C" source code and at what ted. There is only one map file. source code, after they have been run through pp file for each source code file.
Add the -m xxxxx.map lin pre-processor options to o		map file during compilation. Add the -ppa -ppo e per source file.
Note that IC register defin definitions bundled with th		your .map and .pp files, overriding the default
- Select Files & Option		
and UCD9222, the debug	ger will automatically u	So for example, if you switch between UCD9244 use the apprpriate files.
	Register Only - M 31xx 1,00	Ianually Select Map
	31xx 100	Select ZIP File Containing Map/PP Files
UCD	ining Map/PP Files	· · · · · · · · · · · · · · · · · · ·
Select Folder Conta Show Registers Only Collapse unions in far Because the debugg lower level bit fields, bitfield complicate de showing bit field stru Check this if the -sm	B1xxx and ining Map/PP Files /- Auto Select Map /or of bit fields er allows you to edit bi you may find that alte bugging. Checking this cts when other membe lenums mode was use all enums mode was use all enums mode was use	Select ZIP File Containing Map/PP Files Show Registers Only - Manually Select Map t field structures full "hex" values in addition to the mative byte and word representations of a struct box simplifies the variable node tree by only rs of a union are only simple types.
Select Folder Conta Show Registers Only Collapse unions in fav Because the debugg lower level bit fields, bitfield complicate de showing bit field stru Code Composer smal Check this if thesm compiled. Small enum	B1xxx and ining Map/PP Files /- Auto Select Map /or of bit fields er allows you to edit bi you may find that alte bugging. Checking this cts when other membe lenums mode was use all enums mode was use all enums mode was use	Select ZIP File Containing Map/PP Files Show Registers Only - Manually Select Map t field structures full "hex" values in addition to the mative byte and word representations of a struct box simplifies the variable node tree by only rs of a union are only simple types. d sed in Code Composer when the target firmware w

Figure 38: Debugger Customization Tool

The generation of the ".pp" files can be configured by modifying the Code Composer build options as shown in Figure 39.

Build Options for U	ICD3138LLCEVM_028.pjt (Debug)
General Compiler	Linker Link Order
-g -k -ppa -ppc -al	Preprocessor Include Search Path (i):/header files Pre-Define Symbol (·d):DEBUG Undefine Symbol (·u): Preprocessing: With Comments (ppc) ▼
	OK Cancel Help

Figure 39: ".pp" Generation Parameters

The "*.map" file name and location can be specified in the code compose build options as shown in Figure 40.



Build Options f	or UCD3138LLCEVM_028.pjt (Debug)					
General Com	General Compiler Linker Link Order					
-c -heap10 -m	n".\cyclone.map" -o".\Debug\cyclone.out" -stack200 -w -x					
Category: Basic Libraries Advanced	Basic ABI (abi=): None, default to ARM9 Suppress Banner (-q) Output Module: Output Filename (-o): .\Debug\cyclone.out Map Filename (-m): .\cyclone.map					
	Autoinit Model: Run-Time Autoinitialization (-c) Heap Size (-her p). 10 Stack Size (-kack): 200 Fill Value (-): Code Extry Point (-e):					
	OK Cancel Help					

Figure 40: Map Filename



After selecting the location of the ".map" and ".pp" files the debugger will extract the information it needs to allow read/write access to all global firmware variables. Depending on the speed of the system this can take a few moments. The GUI will create a local cache of the data it extracts. So as long as the files do not change subsequent launches of the debugger will be much faster.

You now can interact with RAM, DFLASH or PFLASH variables in the same way described above for device registers. Figure 41 shows an example where variables from RAM and DFLASH have been added to the watch list. "vout_cmd" is the mantissa of a linear16 variable and "supply_state" is a variable indicating the state of the IRQ state machine. Notice that the debugger picks up comments as well as the details of enumerated data types. These variables can be read or written to just like any other variable in the system.

File									
All 😾 Watch List									
egister/Variable Name:		ubstring Match 🕟	Filter Clea		L Channe		Registers OR		
					iter Show:		Registers () R		
election: <u>Watch List</u> (2) > supply_state (2)	(Supply state enum for s	tate machine)							
Name	Description	Туре	Value		Address	Size	Category		
🗐 🤺 Dpwm0Regs	DPWM Module Regist	Struct DPWM			0x000D0000	140 bytes	Register		
E 👷 DPWMEV1		Union DPWM			0x000D0010	4 bytes	Register		
🖻 🤺 bit	DPWM Event 1 Regis	Struct DPWM			0x000D0010	4 bytes	Register		
🖻 👷 Bit Fields		Bit Fields			0x000D0010	4 bytes	Register		
EVENT1 [17:4]	Event 1 configuration	U Bit Field: 14	44		0x000D0011	14 bits	Register		
🕬 🛨 FeCtrl0Regs	Front End Control Mo	Struct FE_CT			0x000E0000	68 bytes	Register		
E 🛧 RAMPCTRL	Ramp Control Register	Union RAMP			0x000E0000	4 bytes	Register		
🖻 📩 bit	Ramp Control Register	Struct RAMP			0x000E0000	4 bytes	Register		
🖻 🤺 Bit Fields		Bit Fields			0x000E0000	4 bytes	Register		
	Analog Peak Current	U Bit Field: 1	0		0x000E0002	1 bit	Register		
MASTER_SEL [6:5]	Master Ramp I/F Select	U Bit Field:2	0		0x000E0003	2 bits	Register		
🛛 🛧 Filter0Regs	Filter Module Registe	Struct FILTE			0x000C0000	100 bytes	Register		
E + FILTERKPCOEF0	Filter KP Coefficient	Union FILTE			0x000C0020	4 bytes	Register		
😑 🥋 bit	Filter KP Coefficient	Struct FILTE			0x000C0020	4 bytes	Register		
😑 🤺 Bit Fields		Bit Fields			0x000C0020	4 bytes	Register		
KP_COEF_0 [15:0]	KP Coefficient 0	S Bit Field: 16	29,033		0x000C0022	16 bits	Register		
mbus_dcdc_config_constants		Array PMBUS			0x00018890	76 bytes	DFlash		
= transformed provided and the second	must be even numbe	Struct PMBU			0x00018890	76 bytes	DFlash		
vout cmd		UInt16	6,144		0x00018890	2 bytes	DFlash		
with supply state	Supply state enum fo	Enum SUPPL	0 - STATE IDLE		0x0001936C	4 bytes	RAM	REFRESH	WRITE
			0 - STATE IDLE	-					
			1 - STATE_RAMP_UP						
			2 - STATE_RAMP_DOV	ΝN					
			3 - STATE_REGULATE						
Expand All Collapse All	Refresh Watch List	Write Changes	4 - STATE_LIGHT_LO	٩D	t Selecte	d) 🕞	coort All	Clear Wat	ch List
			5 - STATE_CPCC						
			6 - STATE_FAULT 7 - STATE_VOUT_TRANSITION						
mestamp Message			- STATE_VOUT_TRA	1691	TON			Copy Log	Clear Log
:51:48.488 0x000E0000: read 4 byte(s)	0x00000001								

Figure 41: Watch List with Firmware Variables

For the editable values there are up and down arrows.

0. 😂

The increment is normally 1. However, the firmware developer has the ability to specify how large the increments are and what the max and min of the variable is. They do this by specifying it in the comments. See highlights in comments below,

extern Uint16 my_uint16; // test root node [min=5, max=200, step=5]

typedef struct

{		
Uint8	a; // [step=10]	
Uint8	b; // <mark>[min=0, max=100, res=5]</mark>	
Uint8	c; // <mark>[min=100, res=5]</mark>	
float	d; // <mark>[min=-1e-3, max=1e3] ste</mark> p/res do not make s	sense with floats
Int8	e; // [min=-100, max=100]	
} struct1;		

Order within the brackets does not matter. White space does not matter.

Note there are two different ways to change how the up/down arrows work in the decimal editor:

- step: simple increment/decrement. If current value is 2 and step is 5 and you click up, it will go to 7
- res: modulo oriented resolution. If current value is 2 and res is 5 and you click up, it will go to 5.

7.6 SMBus Debug

Scan Device in ROM Mode							
Scan for Device in Program Mode: DEVICE ID PMBUS REVISION							
When a device is found, dump additional PMBus commands							
Command ROM to execute i	ts program (SendByte (0xF0 to Address 11					
Command Program to jump t	to ROM (SendByte 0xD	9)					
ROM API	SMBus Debug	USB Adapter (SAA) Settings	Memory Debugger				
Memory Peek/Poke	Firmware Download	Erase/Set DFlash: <u>0xFF</u> <u>0xAA</u>	Peek/Poke IC Registers and Firmware Variables				
Report trim status	Dump Info Block	Erase/Set PFlash: <u>0xFF</u> <u>0xAA</u>					
Program Flash Checksum:	Dump Calculate	<u>Recreate</u> <u>Validate</u> <u>Clear</u>					
Export Flash Compare Fla	sh Files Dump Flash I	File Flash Test Tool Full Expo	ort Tool X0 to Hex Tool				
Device Debug Tool	Mantissa/Ex	ponent Tool Iso Bitma	Iso Bitmask Tool				

The tool looks as follows when launched,

🜵 SMBus & SAA Tool									_ 🛛
— Target / Miscellaneous—		 Specify a 	address			(]
Device Address: 88	58 h (All Values Below Are Hex)					l	Group Pro	tocol	SAA Settings
- Read Data			— Write Data—						
	Data	Status		Cmd	Data				Status
		n/a	Send Byte	00					n/a
O Read Byte 00 -		n/a	🔘 Write Byte	00	00				n/a
Read Word O O		n/a	O Write Word	00	0000				n/a
Read Block E1 2	2233445566778899AABBCCDDEEFF01	ACK	O Write Block	00	00				n/a
Read Block O O O O O O O		n/a							
Send			Send			ot include o		oyte; it is aut rocess call be	
- Process Calls			- Signals						
	Cmd Data	Status	SMBALERT#:	High	Refresh				
Process Call	00 0000	n/a	Control Lines:	#1	#2	#3	#4	#5	
(Word write, word read)			(dicking sets)	High	High	High	High	High	Refresh All
 Block Process Call (Block write, block read) 	00 00	n/a		Low	Low	Low	Low	• Low	KerrealitAli
Write Length: 1			GPIO Peek/P	oke					
Read Length:	Read:		b7		b5 b4		b2 b1	ьо	
Send			Read:						Read/Write
			Write:						
Log 10:26:05.772: SAA #1: PollPmbusSignalLines: ACK signal 5 is High 10:26:05.773: SMBALERT # now High 10:26:59.905: SAA #1: BlockRead (Address 11d, Cmd 0xE1): NACK 10:27:05.118: SAA #1: BlockRead (Address 88d, Cmd 0xE1): ACK 0x2233445566778899AABBCCDDEEFF01									
Copy Log Clear Log		Adapter	r Overview						Close

Figure 42 - SMBus Debug

In order to use this tool the user needs to specify the device address. This tool can be used to intereact with PMBus commands. It can be used to Read commands by specifying the hex command and it can be used to write to commands specifying the command and the data.

8 API – Application Programming Interface

There is a reusable API behind most of the functionality covered. It can be used via .NET: VB or C#. This can be used to automate tests or even create new custom GUIs. TI will provide binary libraries, source code for examples, and documentation. See your TI representative for more information regarding this.

9 Manufacturing Tool

www.ti.com/fusion-mfr-gui

When it is time for production there is another tool that has been used to speed up the process of configuring devices. It is called the Manufacturing GUI. This graphical tool can be used to run scripts on the devices and provide a pass/fail result. Some of the functions included are importing a project file on to a device, write serial numbers and MFR date, calibrate devices using instrumentation (GPIB, SCPI, and USB) or manual measurements, test the device's output and various other functions. Users can also develop their own functions to include in the manufacturing scripts. See your TI representative for more information regarding this tool.

10 Documentation and References

10.1 References

[1] PMBusTM specification <u>http://PMBus.org/specs.html</u>.

ⁱ <u>USB Interface Adapter EVM</u> (HPA172)