

MCP19110/11/18/19 – Buck Power Supply Graphical User Interface User's Guide

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Object of Declaration: MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In

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Manufacturer: Microchip Technology Inc. 2355 W. Chandler Blvd. Chandler, Arizona, 85224-6199 USA

This declaration of conformity is issued by the manufacturer.

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Carlom

Derek Carlson VP Development Tools

12- Sep-14

NOTES:



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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXA", where "XXXXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB[®] IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- Chapter 1. "Product Overview" Important information about the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In.
- Chapter 2. "Installation and Operation" Includes instructions on how to get started with the MCP19110/11/18/19 Buck Power Supply Graphical User Interface Plug-In and a description of the user's guide.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	MPLAB [®] IDE User's Guide
	Emphasized text	is the only compiler
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u>File>Save</u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit	
Text in angle brackets < >	A key on the keyboard	Press <enter>, <f1></f1></enter>
Courier New font:		•
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-0pa+, -0pa-
	Bit values	0, 1
	Constants	0xFF, `A'
Italic Courier New	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] file [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses	Replaces repeated text	<pre>var_name [, var_name]</pre>
	Represents code supplied by user	<pre>void main (void) { }</pre>

RECOMMENDED READING

This user's guide describes how to use the DSTEMP. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- MCP19110/11 Data Sheet "Digitally Enhanced Power Analog Controller with Integrated Synchronous Driver" (DS20002331)
- MCP19118/19 Data Sheet "Digitally Enhanced Power Analog Controller with Integrated Synchronous Driver" (DS20005350)
- MCP87018 Data Sheet "High-Speed N-Channel Power MOSFET" (DS20002329)
- MCP87050 Data Sheet "High-Speed N-Channel Power MOSFET" (DS20002308)
- MCP19111 User's Guide "MCP19111 Evaluation Board User's Guide" (DS50002109)
- MCP19110/11 Programming Specification "MCP19110/11 Flash Memory Programming Specification" (DS20002336)
- MCP19118/19 Programming Specification "MCP19118/19 Flash Memory Programming Specification" (DS20005321)

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- General Technical Support Frequently Asked Questions (FAQs), technical support requests, online discussion groups, and Microchip consultant program member listing
- Business of Microchip Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER SUPPORT

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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://www.microchip.com/support.

DOCUMENT REVISION HISTORY

Revision B (December 2014)

- Added MCP19118/19 documentation to "Recommended Reading".
- Added Section 2.3 "Plug-In Features".
- Updated Section 2.4 "GUI Tab Descriptions".

Revision A (March 2013)

• Initial Release of this Document.



MCP19110/11/18/19 – BUCK POWER SUPPLY GRAPHICAL USER INTERFACE USER'S GUIDE

Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In is a stand-alone, hybrid (analog + digital), synchronous buck Pulse-Width Modulation (PWM) controller for point-of-load (POL) applications. It offers the ability to adjust many key attributes of the analog PWM controller's operation. While at first it may seem that adjusting and configuring the product performance and feature set may be a challenge, it was with this in mind that the MCP19110/11/18/19 MPLAB X Plug-In was developed. This graphical user interface (GUI) simplifies the configuration of the controller and power conversion system and enables users to get to solutions faster.

The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface User's Guide explains how to install and use the plug-in.



FIGURE 1-1: General System Diagram.

To summarize, the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In is used within the MPLAB[®] X Integrated Development Environment (IDE). No knowledge of the MPLAB X IDE is required but, as the user becomes more familiar with Microchip's software tools and device performance, the MPLAB X IDE offers a path to support more advanced control algorithms and configurations.

1.2 THE DEVELOPMENT SYSTEM'S COMPONENTS

- 1. **MCP19110/11/18/19 MPLAB[®] X IDE Graphical User Interface Plug-In:** This graphical user interface simplifies the configuration of the MCP19110/11/18/19. It is user-installed and resides within the MPLAB X IDE. This user's guide describes the plug-in installation procedure, as well as how to use it.
- 2. **MPLAB[®] X Integrated Development Environment (IDE):** This is a complete software development environment that links the software and hardware development. This is a free tool, available from Microchip, that supports device configuration, advanced programming, as well as debug support. The GUI resides inside the MPLAB X IDE.
- 3. MCP1911X Power Supply Firmware: This firmware is provided by the plug-in. See Section 2.3.1 "MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In Description". This is standard firmware that has been configured to work with this graphical user interface once it is opened as a project within MPLAB X IDE.
- MPLAB[®] XC8 Compiler: The firmware described above is coded in C and thus requires a C-compiler. C-compilers are available for free from Microchip's website.
- 5. **MCP19111 Power Supply Evaluation Board**: This board is available from Microchip and provides a method to evaluate the performance of the MCP19111 in the target end application.
- 6. **PICkit 3 In-Circuit Debugger/Programmer, etc.:** A programming tool is required to configure the evaluation board. We recommend the PICkit 3 or ICD3, which is available from microchipDIRECT.

In practice, the user modifies the GUI parameters to provide the features and performance needed in the end applications. The GUI modifies the firmware, compiles it with the XC8 C-compiler and then loads it, through the PICkit 3, to the MCP19111 Evaluation Board. The MCP19111 Evaluation Board will then perform as configured.

1.3 ROLE OF FIRMWARE

This section gives a brief overview of different tasks that may be accomplished by a MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In firmware.

1.3.1 Initialize the Internal Peripherals

At start-up, the firmware initializes the internal operating points of the device. These include, but are not limited to:

- switching frequency, phase shift, maximum duty cycle
- output voltage set point
- compensation parameters
- protection peripherals (overvoltage, undervoltage etc.)

This action is accomplished by writing specific values into the corresponding registers.

1.3.2 Handle Protection Events

Most integrated analog protection functions can interrupt the main program execution. This ensures that the product, and more specifically the firmware, can react to external events as fast as possible.

1.3.3 Soft-Start Ramp

When the output turns on, the device uses a voltage ramp in order to reach the output voltage target. This ramp is managed by the firmware by increasing the internal reference (OVCCON) step by step.

1.3.4 Environment Monitoring

The device can continually check its environment by using the internal analog-to-digital converter (ADC). It can then use this result to make any operating point adjustments. The firmware also handles the GPIO pins' states.

1.4 GRAPHICAL USER INTERFACE (GUI) ENVIRONMENT

The screen shot below provides a picture of MPLAB X IDE with the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In installed (bottom left) and the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In project opened (top left). More information is available in **Chapter 2.** "Installation and Operation".

Projects Wind	ow Editor	Pane
MPLAB X IDE v2.20 - MCP1911X : MCP19111		
Elle Edit View Navigate Source Refactor Bun Debug Team Iools Window Help		
🕐 🎦 🔐 😓 🥬 🥐 🍋 🗠 💽 👔 - 🎉 - 🔽	• 💁 • 🎧 📆 • PC: 0x0 z dc c : W:0x0 : bank 0	Q. Search (Ctrl+I)
Projects 4 × Files Classes Services	V_MCP1911X.h × 4 main.c ×	
© 💭 MCP1911X	[····································	
Empirical State E	33	
Brary Files	34 35 - //***	
Object Files	36 // Dynamic #define definition (modified by the GUI)	
ali source Hes adc.monitor.c	37 //***********************************	
fash_rw.c	39 - //SF part register	
- Intparts	40 #define V_T2CON 0X04	
and a manual of the second sec	41 #define V PR2 0X19	11
🕀 🎯 Libraries	43 #define V PWNPHL 0X00	
🛞 🗁 Loadables	44 //OV register	
Navioator MCP1911X - Dashboard MCP1911X Puo-in 4 X	45 #define V_OVECON 0X91	
MCP19110/11/18/19 Development Tool - Digitally-Enhanced Power Analog	47 #define V_OUVCON 0X13	
· · · · · · · · · · · · · · · · · · ·	48 #define V_OOVCON 0X86	
MCP1911X project rev: 1.04 Create New Project	49 #define V_ABECON 0X0F	
Evaluation Board - ADM00397 💌 🕢 😥 🛃 🖉 🖬 🛍 🔝 🕼 🕄	51 #define V_VINLVL 0X9A	
Parameter Components [Efficiency Protection Compensation]	52	
A	53 //multi phase config 54 #define V RUFFCON 0X03	
Component and Compensation Calculator	55 //Dead time	
Load Eval Board Components and Load Recommended Components and Compensation Compensation	56 #define V_PE1 0X00	
	57 #define V_DEADCON 0X13 58 //Compensation	
Output Voltage Input Voltage	59 #define V_CMPZCON 0X0D	
Set Coarse Value 1785.4 mV Input Voltage 12 V	60 #define V_SLPCRCON 0X32	
Set Fine Value 1799 v mV Input Voltage Ripple 100 mV	61 //Current sense gain 62 #define V CSGSCON 0X05	
	63 //Current sense DC gain	
Output Current Estimation	64 #define V_CSDGCON 0X00	-
Couple comment 30 = A Cor Step Load	631 //over current	2
High Output Ourgent I	Configuration Loading Error × MCP1911X (Clean, Build,) ×	
	V. CLEAN SUCCESSFUL (total time; 74ms)	<u>ام</u>
	make -f nbproject/Makefile-MCD19111.mk SUBDROJECTS= .build-conf	
Output Votage Overshoot 100 100	<pre>make(1): Entering directory 'C:/Users/m91395/HPLABKProjects/test2/HCP1911X' make -f nbproject/Makefile-MCP19111.mk dist/MCP19111/production/MCP1911X.production.hem</pre>	_
Hulti-Phase Configuration	<pre>make(2): Entering directory 'C:/Users/m91395/M9LABXProjects/test2/MCP1911X' </pre>	
Device Configuration stand alone unit 💌	"C:\Program Files\Microchip\xc0\v1.33\bin\xc0.exe"pass1chip+MCP19111 -Q -Gdouble=24 "C:\Program Files\Microchip\xc0\v1.33\bin\xc0.exe"pass1chip+MCP19111 -Q -Gdouble=24	float=24rom=default,-fd0-fffopt=default,+asm,-asmfile,- float=24rom=default,-fd0-fffopt=default,+asm,-asmfile,-
SM Error Signal Input Gain 3.3 V dB	"C:\Program Files\Microchip\xc0\v1.33\bin\xc0.exe"pass1chip-MCP19111 -Q -Gdouble=24	float=24rom-default,-fd0-fffopt-default,+asm,-asmfile,-
	"C:\Program Files\Microchip\xc8\v1.33\bin\xc8.exe"pass1chip+MCP19111 -Q -Gdouble=24	float#24rom#default, fd0-fffopt#default, tasm, -asmfile, -
Switching Frequency Dead Time Delay	"C:\Program Files\Microchip\mc3\v1.33\bin\mc9.eme"chip=MCP19111 -G -mdist/MCP19111/products Microchin MPLAS XCS C Commiler (SSO Mode) V1.33	ion/MCD1911X.production.mapdouble=24float=24rom=defaul
Generated Prequency. 300 V High Side 15 ns	Part Support Version: 1.33 (A)	لتح
		25 44 265
Plug-In view		

FIGURE 1-2:

MCP19110/11/18/19 MPLAB X Plug-In User Interface Overview.

Note: The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In is preset to be used with the MCP19111 Evaluation Board (ADM00397). However, it is possible to use the plug-in with another board.



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Chapter 2. Installation and Operation

2.1 GETTING STARTED

2.1.1 Required Software

- MPLAB X IDE v2.20 or later
- MCP19110/11/18/19 Buck Power Supply Graphical User Interface Plug-In archive. See the MCP19110/11 or MCP19118/19 devices web pages for details. The archive contains the MCP19110/11/18/19 plug-in file (com-microchip-mplab-mcp1911X-buckpowersupply.nbm)
- MPLAB XC8 C Compiler (v1.33 or later)

2.1.2 Required Hardware

- Microchip PIC programmer/debugger (for example, PICkit 3 or ICD3)
- MCP19111 Evaluation Board (ADM00397) or another board containing an MCP19110/11/18/19 and a programming connector

Note: If you are not using the standard MCP19111 Evaluation Board (ADM00397), then some of the predefined features may not be compatible with your configuration. The schematic of the MCP19111 Evaluation Board, as well as "*MCP19111 Evaluation Board User's Guide*" (DS52109), are available on the Microchip website. From the Microchip website, please search for the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In product page and review the software tools.

2.1.3 Software Installation

The following steps describe how to install the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In.

- 1. If MPLAB X IDE is already installed, go to Step 2. If not, download MPLAB X IDE (free) from www.microchip.com/mplabx and follow the MPLAB X IDE installation instructions.
- If an XC8-compatible C-compiler is already installed in MPLAB X IDE, go to Step 3. If not, you can download a free version of Microchip's XC8 from www.microchip.com/mplabxc. The XC8 user's guide, installation instructions and download links are available on this page.
- Download the MCP19110/11/18/19 Buck Power Supply Graphical User Interface Plug-In Archive (*.zip) from www.microchip.com/mcp19111 under "Documentation & Software".
- 4. Unzip the MCP19110/11/18/19 Buck Power Supply Graphical User Interface Plug-In archive, which contains the com-microchip-mplab-mcp1911X-buckpowersupply.nbm plug-in file.

5. The plug-in file must be installed in MPLAB X IDE. To install it, open MPLAB X IDE. From the menu bar, select Tools > Plugins.

💥 MPLAB 🕽	K IDE \	/2.20									
File Edit	View	Navigate	Source	Refactor	Run	Debug	Team	Tools	Window	Help	
🛍 🖆		ł	56					Lice Ade	enses d to Favori	tes	•
] Projects				¶ X]Fi	les			Ter DTI	nplates Os and XMI	L Schemas	5
								Plu	gins		
								Ор	tions		



Starting the Plug-In Installation.

6. This opens a new Plugins window. Select the **Downloaded** tab and click on the **Add Plugins** button.

🔀 Plug	ins						[Ш
Upda	tes Available	Plugins (18) Downlo	aded Installed (26)	Settings				
	dd Plugins					<u>S</u> earch:		
	Install		Name					
Ī	nstall							
							<u>C</u> lose <u>H</u> elp	İ

FIGURE 2-2: The Plugins Window.

.

7. Locate the com-microchip-mplab-mcp1911X-buckpowersupply.nbm file that was downloaded in the archive and click on **Open**. Then click on the **Install** button on the bottom left side of the window.

💥 Add Plugins		×
Look in:	Downloads 💌 🗈 📸 🕶	
Recent Items	com-microchip-mplab-mcp1911X-buckpowersupply.nbm	
Desktop		
My Documents		
Computer		
	File name: com-microchip-mplab-mcp1911X-buckpowersupply.nbm Qpen	
Network	Files of type: Plugin distribution files (*.nbm)	

FIGURE 2-3:

Opening and Launching the Plug-In Installation File.

8. This opens the "Plugin Installer" window. Click on Next to continue.

Plugin Installer
Welcome to the Plugin Installer The installer will download, verify and then install the selected plugins.
The following plugins will be installed:
MCP19110/11/18/19 Plugin [1.0.4.71]
< <u>B</u> ack Next > Cancel Help



The Plugin Installer Window.

9. Review and accept the License Agreement by checking the **I accept the terms** in all of the license agreements check box, then click on Install.

Plugin Installer
License Agreement Please read all of the following license agreements carefully.
In order to continue with the installation, you need to agree with all of the license agreements associated with the particular plugins.
MCP19110/11/18/19 Plugin License Agreement Digitally-Enhanced Power Analog - MCP19110/11/18/19 User Development Tool Software License Agreement: The software supplied herewith by Microchip Technology Incorporated (the "Company") for its PICmicro Microcontroller is intended and supplied to you, the Company's customer, for use solely and exclusively on Microchip PICmicro Microcontroller products. The software is owned by the Company and/or its supplier, and is protected under applicable copyright laws. All rights are reserved. Any use in violation of the foregoing restrictions may subject the user to criminal sanctions under applicable laws, as well as to civil liability for the breach of the terms and conditions of this license.
<u>< B</u> ack <u>I</u> nstall <u>Cancel</u> <u>H</u> elp

FIGURE 2-5:

Plug-In License Agreement.

10. If a window opens indicating that the MCP19110/11/18/19 plug-in is not signed, click on **Continue**.

Validation Warning	
The following plugins are not signed:	
MCP19110/11/18/19 Plugin	
Warning: Installing untrusted plugins is potentially insecure. Use unsigned or untrusted plugins at your own risk.	
Cancel	

FIGURE 2-6: Validation Warning Message.

 Once the installation completes, select **Finish** to close the Plugin Installer window. The installation requires the MPLAB X IDE to be restarted. Choose the option that best fits your needs. When done, the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In should be visible as displayed in Figure 2-8.

	Plugin Installer	
	Restart application to complete installation Restart application to finish plugin installation.	
	The Plugin Installer has successfully installed the following plugins: MCP 19110/11/18/19 Plugin © Restart Now © Restart Later	
	Einish Cancel Help	
FIGURE 2-7:	Plug-In Installation Complete.	

Note: The MPLAB X IDE allows the windows to be configured in different ways. To adjust placement or orientation, use your mouse to click and hold the tabs you want to move, then drag them to the location you want.

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	~
MCP19110/11/18/19 Development Tool - Digitally-Enhanced Power Analog	MPLAB IDE v8 Users - IMPORTANT
No MCP1911X project selected 💭 Create New Project	Take a Tour
	Download Compilers and Assemblers
Parameter Components Efficiency Protection Compensation	
Component and Compensation Calculator	MPLAB Harmony
Load Eval Board Components and Compensation	Users Guide, Release Notes and Support Docs.
Output Voltage Input Voltage	Dive In
Set Coarse Value 0 w Input Voltage 40 V Set Fine Value 0 w mV Input Voltage Ripple 1000 mV	Open Sample Project
	Create New Project
Output Current Estimation Output current Output current Output Current Output Current Step Load	Import MPLAB Legacy Project
High Output Current I _{OH} 30 a A	Import Hex (Prebuilt) Project
Low Output Current I OL 30 🛖 A loL] Output
Output Voltage Overshoot 30 m Time	
Multi-Phase Configuration	
Device Configuration stand alone unit	
SM Error Signal Input Gain 3.3 v dB	
Switching Frequency Dead Time Delay	
Generated Frequency 1600 V kHz High Side 11 V ns	
Phase Delay (U us) U V Low Side 4 V ns	

FIGURE 2-8: MCP19110/11/18/19 MPLAB X Plug-In Tab After Installation.

The plug-in needs an MCP1911X project to work on in order to be enabled. Figure 2-8 shows the MCP19110/11/18/19 Plug-In GUI when no project is currently opened. If there are no MCP1911X projects, the plug-in can create a new MCP1911X project using the **Create New Project** button. This button will open a window that allows choosing the new project folder location. The MCP1911X project folder can be placed in any location. Once the project is created, it will be automatically opened by MPLAB X IDE.

To update an existing project, go to <u>*File>Open Project*</u>. In the Open Project window that opens, browse to the location of your project and click on the **Open Project** button, as shown in Figure 2-9.

Note: The plug-in will be enabled if the project is compatible with the opened plug-in.

🛒 Open Project	X
Look in: 🚺 MPLABXProjects	· 🖻 💣
	Project Name:
	MCP1911X
	✓ Open as Main Project
	Open <u>R</u> equired Projects:
File name: C:\Users\MPI ABXProjects\MCP 1911X	Open Project
Project Polder	Cancer



- **Note 1:** If multiple projects are opened on MPLAB X IDE, the plug-in will work on the project selected as "Main Project". The main project can be changed by right clicking on the desired project, then choosing "Set as Main Project" from the Projects view.
 - **2:** If the plug-in is not visible in MPLAB X IDE, it can be displayed using the MPLAB X IDE menu, as shown in Figure 2-10.



FIGURE 2-10: Displaying the Plug-In.

2.2 PROJECT CONFIGURATION

To display the project properties, right click on the project name inside the Projects view and select **Properties**, as shown in Figure 2-11. While the provided project should already be correctly configured to ensure proper hardware and software configuration, please ensure that the correct hardware tool (PICkit 3 or ICD3) and C-compiler (XC8) are highlighted in the Hardware Tool and Compiler Toolchain windows, respectively. Figure 2-13 shows an example of how to select these tools. This section describes a list of settings that must be checked before beginning to use the tools.

	2 20 - MCD1011V • MCD1011				
File Edit View	Navigate Source Refactor I	Run Debua T	eam Tools Wi	ndow Help	
P P 📮	■ ■ @ MCP1911	1	T B	- 🎲 - 🔍	
	T X J Files	Ulasses	J Servi	ces	
⊕ (a) Heade	New	•			
Eibrary	Add Existing Items from Fold	ers			
E Gojeci	New Logical Folder				
🔤 🖳 ad	Locate Headers				
🖭 fla	Add Item to Important Files.				
🖭 ini	Export nex				
ma Barra	Build				
tibrarie	Clean and Build				
E Loadal	Clean				
	Set Configuration				
MCP1911X [Main]	out comgaradon		J MCP1911X Plu	g-In ¶ ×	
MCP19110/1	Run		r-Enhanced Powe	er Analog 🚿	
MCD1011V project	Debug				
INCPISITX project	Step into				
Evaluation Board	Make and Program Device] 🕙 🜄 🗔	81 📿 📀	
Parameter Com	Set as Main Project				
	Open Required Projects			A	
Component a	Close				
Load Eval Bo	Rename		ed Components a	and	
Compensatio	Move				
Output Voltar	Copy				
	Delete	Delete		1	
Set Coarse Va	Code Assistance	•			
Set Fine Value	Find			1 mv	
	Share on Team Server				
Output Curre	Versioning	•			
Output currer	Local History	•	p Load		
Step Load F	Properties				
Hinh Output C	urrent I 7.5 A		-		

FIGURE 2-11:

Selecting Properties in the Projects View.



FIGURE 2-12: PICkit 3.

K Project Properties - MCP1911X		×
Categories:	Configuration	
Project Properties - MCP1911X Categories: Categories: O PICkit 3 O Lobraries O Lubraries O Lubraries O XC8 global options O XC8 compiler O XC8 linker O Conf: MCP19110 O VICkit 3 O Loading O Lubraries O Ruiding O XC8 compiler O XC8 linker O Conf: MCP19119 O VICkit 3 O Loading O Lubraries O Ruiding O XC8 compiler O XC8 linker O Conf: MCP1919 O VICkit 3 O Loading O VICkit 3 O V	Configuration Family: Device: All Families UDEVICE Bug Header: Supported Debug Header: None Hardware Tool: Hardware Tools Omplet Toolchains HI-TECH PICC (None found) Ompasm Official Omplet Toolchains Ompasm (v5.58) [C: \Program Files \Microchip \MPL Complete Tools Omplete Tools Other Tools Other Tools Other Tools Omplete Tools Omplete Tools Other Tools Omplete Tools Omplete Tools Other Tools Omplete Tools Omplete Tools Other Tools Omplete Tools Other Tools Omplete Tools Other	X
	*Tip: double dick on serial number (SN) to use a friendly name (FN) instead.	
Manage Configurations		
	ОК Cancel Apply Unlock <u>H</u> elp	



Project Properties View.

There are additional important properties of the MCP1911X project shown in the following screen shots. Please note that each device's version has its own set of properties. Please ensure to set the properties for the correct targeted device. For instance, to set the properties of an MCP19110 device, follow the "Conf:[MCP19110]" branch on the tree view from the project properties window (Figure 2-13).

• The "Freeze Peripherals" option must be disabled to use the debug mode (to disable it, deselect the check box).

鱰 Project Properties - MCP1911X		
Categories:	Option categories: Freeze Peripherals	-
PICkit 3	Freeze Peripherals	

FIGURE 2-14:

Project Properties – Freeze Peripherals.

 The programmer should not power the device. Therefore, please ensure the "Power target circuits from PICkit3" option under the Power option category is not enabled. The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In shall be powered by VIN.

Rroject Properties - MCP1911X		
Categories:	Option categories: Power	•
····· • PICkit 3 ····· • Loading	Power target circuit from PICkit3	
• Libraries	Voltage Level	12.0

FIGURE 2-15: Project Properties – Power Configuration.

• To use the debug mode, the "Calibrate oscillator" peripheral option under the Runtime option category must be disabled.

Project Properties - MCP1911X	
Categories:	
Conf: [MCP19111]	Options for xc8
PICkit 3	Option categories: Runtime
···· Loading	
···· Libraries	Do not link startup module in
••• O Building	Calibrate oscillator
XC8 global options XC8 compiler	Alternate oscillator calibration value
XC8 linker	Backup reset condition flags

FIGURE 2-16: Project Properties – Calibrate Oscillator.

2.3 PLUG-IN FEATURES

At this point, you should be able to set your desired parameters through the GUI (see **Section 2.4** "GUI Tab Descriptions"). This section describes the actions provided by the plug-in and the basic MPLAB X IDE options that allow programming or debugging the part.

2.3.1 MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In Description

Figure 2-17 shows the actions provided by the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In.



FIGURE 2-17: MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In Actions.

The plug-in status label describes if the plug-in has detected an MCP1911X project to work on. It also displays the project firmware version. If no projects are detected, the plug-in will not be enabled.

The **Create New Project** button allows creating a new MCP1911X project. Once pressed, a window will allow selecting the project folder location. The plug-in will automatically open the project and set it as the main project. This button is available at any time.

The **Profile Selection** drop-down menu is used to select the desired profile to act on as described below. A profile is a set of firmware parameters that contains the whole MCP19110/11/18/19 settings (output voltage, switching frequency, etc.). The user can load, create, save, delete, import and export a firmware profile for the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In.

The **Load Profile** button () will restore all values from the selected profile into the GUI. This action will override the user's current changes if they were not saved. A message box will appear to remind this to the user before the current values are replaced.

The **Create Profile** button ()) will ask the user for a profile name. When set, the plug-in will create the new profile with the current settings from the GUI.

The **Save Profile** button (I) is used to store the current data from the GUI into the selected profile.

Note: The user cannot modify the default evaluation board profile because it is protected.

The **Delete Profile** button () will delete the selected profile. The evaluation board profile cannot be removed because it is used as a working starting point profile.

The **Import Profile** button ($_{\otimes}$) allows reading a profile file (.cfg). The plug-in will read all the values in the file and will update the values on the GUI.

The **Export Profile** button (a) is used to create a file from a profile. This file can be imported by another MCP19110/11/18/19 Plug-In installation.

The **Open Firmware Folder** button (\mathbb{R}) opens the folder containing the compiled firmware (commonly called .hex file). This compiled firmware can be used directly to program the part.

Note: Before taking the compiled firmware file, make sure it is up-to-date. Use the MPLAB X IDE Clean and Build button (see Section 2.3.2 "MPLAB X IDE Actions") to generate a new firmware based on the current GUI settings.

The **Expert Mode** button (
) allows switching the GUI in Expert mode, which enables the features described in **Section 2.5** "Advanced Mode".

The **Help** button (2) will open a web browser to the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In official page. This page contains all the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In user's guides and application notes.

The tab selection area contains several tabs displaying the MCP1911X project settings. These tabs are described in **Section 2.4** "**GUI Tab Descriptions**".

2.3.2 MPLAB X IDE Actions

MPLAB X IDE provides standard commands to compile, program or debug the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In. This section describes the most common commands.

M	IPLAB	X IDE v	v2.20 - M	CP1911X	: MCP191	11									
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>N</u> avigate	Source	Ref <u>a</u> ctor	<u>R</u> un	<u>D</u> ebug	Tea <u>m</u>	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp				
] P	1		5	9 (MCP 19	111			T	8 • 1	•	<u>.</u>	- 🚡	,• 🖓	3

FIGURE 2-18: MPLAB X IDE Actions.

The **Clean and Build** button (2011) allows compiling the MCP1911X project. This may be useful to verify that the code syntax is still correct after a source code change or to verify the memory usage of a firmware. This option is available without a PICkit or ICD programmer.

The **Program Part and Run** button () compiles the project source code, programs the part and executes the code. Before programming, ensure that the programmer is correctly installed and connected. In addition, the evaluation board must be powered with at least 6V input. If this is the first time the programmer has been used, the environment may prompt on which programmer you want to use.

The **Program Part and Debug** button () does the same thing as the Program Part and Run but you can additionally control the firmware. If the part is programmed in Debug mode, it will not restart automatically after a power-off.

The **Device Selection** drop-down menu allows selecting the targeted device: MCP19110, MCP19111, MCP19118 or MCP19119. When the MCP19110/18 is selected, the Enable pin can move to another available pin because not all MCP19111/19 pins are available on the MCP19110/18 and device. This selection actually selects a project properties set. The project contains a set of properties for each device version, but only one is used depending on the device selection. After a device selection, please make sure that the selected project properties are correctly set according to **Section 2.2 "Project Configuration**".

MPLAB X IDE v2.20 - MCP1911X : M	ICP19111
File Edit View Navigate Source Re	factor Run Debug Team Tools
1 🔁 🔛 🔛 🤍	MCP19111 (active)
	MCP19111 (active)
Projects	MCP19110
MCP1911X	MCP19119
🕂 💼 Header Files	MCP19118
Important Files	Customize

FIGURE 2-19: Drop-Down Menu Example

The figure below shows a second method which allows selecting the device version by right clicking on the project from the Projects view.



FIGURE 2-20:

Changing Targeted Device Using Right-Click on Project Example.

2.4 GUI TAB DESCRIPTIONS

This section shows the GUI tabs provided by the MCP19110/11/18/19 MPLAB X Plug-In. These tabs are used to modify the firmware of the MCP1911X project. As soon as a new option has been set from the GUI, the firmware will be updated and can be directly programmed. Please also refer to the MCP19110/11 or MCP19118/19 data sheet for more information on the product configuration.

Placing the cursor over settings controls or labels will give a brief description of what these particular settings do. See the example in Figure 2-21.

Output Voltage	Input Voltage		
Set Coarse Value 1785.4 🗸 mV	Input Voltage	12 🜩 V	
⁵⁴ Will set the register OVCCON: Output Vo	tage Set Point Coar:	se Configuration bits. OVC<7:0>	= (VOUT/15.8 mV)+15.8 mV.

FIGURE 2-21: Tooltip Text Example.

2.4.1 Parameter Tab

The **Parameter** tab is used to set the main features of the part, as shown in Figure 2-22.

				-			
Compon	ent and Com	pensation	Calculato				
Load E Compe	val Board Comp nsation	onents and	L	oad Recommen Compensation	ded Compo	onents and	
Output V	/oltage		I	nput Voltage			
Set Coa	rse Value 178	5.4 🖌 mV		Input Voltage		12 🗘 V	
Set Fine	Value 179	9 🗸 mV		Input Voltage	Ripple	100 🌩 mV	
Output C	urrent Estim	ation					
Output	current		30 ≑ A	lour St	en Load		
Step L	oad Paramet	ers:		ын	op Loau	_	
High Ou	tput Current I	он	7.5 🖨 A	.01			
Low Out	tput Current I,-	N	2.5 🜩 A	I _{OL}			
Output	Voltage Oversh	noot	100 m		т	ime	
output	voltage oversi		100 - 111				
Multi-Ph	ase Configura	ation					
Device (Configuration	star	nd alone uni	t 🗸			
SM Erro	r Signal Input G	Sain -3.3	3	√ dB			
Switchin	g Frequency			ead Time De	lay		
Generat	ted Frequency.	308 💊	/ kHz	High Side	15 🗸 ns	5	
Phase D	elay (0 us)	0	, •	Low Side	16 y ns	3	
Max Du	ty-Cycle	76	/ %				
Startup	Behavior						
Soft Sta	rt Duration	15	ms (1500	ms max, 0 ms :	= max slope	e: 1 V/ms)	
✓ Use	Enable Pin	Use pip G	PB7				
		and build					

FIGURE 2-22: The Parameter Tab.

2.4.1.1 OUTPUT VOLTAGE

The output voltage of the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In device is user-programmable over the range of 0.5V to 3.6V. The value set for "Set Coarse Value" is translated for the OVCCON register, while the value set for "Set Fine Value" is translated for the OVFCON register. The OVCCON DAC is an 8-bit DAC that coarsely adjusts the output voltage set point. The OVFCON DAC is a 5-bit DAC that finely adjusts the output voltage set point. Refer to the Electrical Characteristics table in the MCP19110/11 or MCP19118/19 data sheet for more information.

2.4.1.2 INPUT VOLTAGE

The "Input Voltage Ripple" section defines the input capacitance and its equivalent series resistance (ESR) necessary to meet the specified input ripple requirement.

2.4.1.3 OUTPUT CURRENT ESTIMATION

The parameters under "Step Load Parameters" are used to define the dynamic performance of the system and indicate the amount of output capacitance needed to achieve the desired transient response. The MCP19110/11/18/19 control system uses an analog peak current mode control. The load step is defined as the load current step from high output current to low output current.

The next step requires entering the size of the overshoot desired for this load step. Larger load current steps and smaller output voltage overshoot result in larger output capacitance and lower ESR to minimize the overshoot leading to a higher system cost.

2.4.1.4 MULTI-PHASE CONFIGURATION

The "Multi-Phase Configuration" section changes the value loaded into the BUFFCON register. The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In has the ability to operate as shown in Table 2-1.

TABLE 2-1:OPERATION MODES FOR THE MCP19110/11/18/19 – BUCK POWER SUPPLY
GRAPHICAL USER INTERFACE PLUG-IN

Operation Mode	Description
Stand-alone unit	The device is configured to run as a stand-alone converter. No external clock or error signals are necessary. This is the option that should be used for a single evaluation board.
Multiple output master unit	This option is used when the user desires multiple output voltages. In order to do this, the system must have multiple MCP19110/11/18/19 devices. When selected, the device is configured as the MASTER and its CLOCK is the output on the CLKPIN. The devices configured as slaves use this signal for synchronization. All other peripherals remain the same as those for the stand-alone unit.
Multiple output slave unit	For this option, the CLKPIN is configured as an input and should be connected to the CLKPIN of the multiple output master. All other peripherals remain the same as those for the stand-alone unit.
Multi-phase master unit	This option should be used when the user desires multiple power trains to share the load current. In this case, the output of each power train is connected to the same output rail. Like the multiple output master, its CLOCK is the output on the CLKPIN. The devices configured as multi-phase slaves use this signal for synchronization. The EAPIN is also configured as an output which feeds the output of the error amplifier to the multi-phase slave unit for regulation. All other peripherals remain the same as those for the stand-alone unit.
Multi-phase slave unit	For this option, the CLKPIN is configured as an input pin and should be connected to the CLKPIN of the multi-phase master. The EAPIN is configured to be an input pin and should be connected to the output of the multi-phase master's amplifier. Since the master and slave error amplifier offsets are slightly different from part to part, the error input signal gain of the multi-phase slave can be dynamically changed so that the multiple power trains will share the load current equally. The error input signal gain of the multi-phase slave will load the values into the SLVGNCON register and add gain to the error amplifier signal provided by the multi-phase master. The available gain range is from -3.2 dB to 3.0 dB. All other peripherals remain the same as those for the stand-alone unit.

2.4.1.5 SWITCHING FREQUENCY

The switching frequency of the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In is generated by using a single edge of the 8 MHz internal clock. The MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In switching frequency is set by configuring the PR2 register. The programmable range of the switching frequency is from 100 kHz to 1.6 MHz. The maximum allowable HDRV duty cycle is adjustable and is controlled by the PWMRL register. The available switching frequencies below 1.6 MHz are defined as Fsw = 8 MHz/N, where N is an integer number between 5 and 80.

The phase of the MCP19110/11/18/19 slave devices may be shifted from the MASTER clock through the PWMPHL register. The GUI can be used to configure this delay for a slave device.

The switching frequency of the converter determines the efficiency, the transient response, the size and the cost of the design. The switching frequency should be carefully evaluated to optimize the design to the performance goals.

2.4.1.6 DEAD TIME DELAY

In the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In, the dead time is adjustable from 4 ns to 64 ns for the low side and from 11 ns to 71 ns for the high side, in 4 ns steps. The values for tDEAD-1 and tDEAD-2 do not need to be the same. The desired drive signal dead time is configured through the GUI by configuring the DEADCON register, as shown in Figure 2-23.



FIGURE 2-23: Dead Time Description.

2.4.1.7 START-UP BEHAVIOR

The Soft Start duration control on TMR1L and TMR1H registers to achieve the soft start ramp time. Each time the TMR1 timer overflows, the OVCCON will increase its value, so the output voltage set point will be increased in 15.8 mV steps. Soft Stop is implemented the same way.

If a start-up pin is used, the selected pin will be set by using the $V_NUM_EN_PIN$ from the $V_MCP1911x$. h definition. When a start-up pin is defined and enabled, the selected pin will automatically be configured as an input and the internal pull-up will be enabled. By default, the start-up pin is connected to the BT1 button of the MCP19111 Evaluation Board (ADM00397). If the start-up pin is enabled, the part will start switching only after pressing the BT1 button. Pressing the button while the part is switching will stop it.

2.4.2 Components Tab

The **Components** tab is used to set the component of a system in order to compute the best compensation setting and the efficiency of the system. This tab contains a button allowing to load the value of the MCP19111 Evaluation Board (ADM00397) components. A second button allows loading the best component value depending on the parameters set in the **Parameter** tab. They represent component values that meet the design goals. These recommended values are displayed on the right of the current values. See Figure 2-24 below.

Microchip's MCP87050 and MCP87018 MOSFETs were used for the high-side and low-side switches. The MOSFET's ON resistance (RDSON) and gate charge are both critical parameters for design analysis. The low-side MOSFET body diode characteristics are also a key parameter for estimating the efficiency of the converter. Refer to the MOSFETs' data sheets for more information.

The diode conduction time is the estimated amount of time when the current is flowing through the low-side switch body diode. This time can be adjusted by using the MCP19110/11/18/19 dead time adjust setting. The inductor DC resistance and the ESR of the input and output capacitors are also used for efficiency and control system calculations. Refer to the component data sheets for more information on these values.



2.4.3 Efficiency Tab

The **Efficiency** tab represents the calculated efficiency using the component parameters. A good idea is to vary the critical values to see the effect on the system efficiency. For example, increasing the switching frequency results in lower efficiency. Optimizing the high-side MOSFET results in higher efficiency for specific operating conditions. Lower-resistance high-side MOSFETs do not always result in the highest efficiency. If the switching losses are much larger than the conduction losses for the high-side MOSFET, a MOSFET with higher RDSON and lower gate charge or capacitance may be a better choice for the operating conditions of interest. See Figure 2-25.



2.4.4 Protection Tab

The **Protection** tab is used to set the protections features, as shown in Figure 2-26.

Set 10% of VOUT 🗸 Appl	У
Enable Output Under Voltag	e 1058.6
Output Under Voltage Response	Delay, then Restart 🗸 🗸
Enable Output Over Voltage	e 2117.2
Output Over Voltage Response	Delay, then Restart 🗸 🗸
Set Value 50 V A	High side MOSFET on Components tab first.
Set Value 50 A Note: Please check R _{DS(ON)} value of The Over Current Protection values of Changing it will reset the Over Curren	High side MOSFET on Components tab first. are computed from R _{DS(ON)} , nt Protection selected value
Set Value 50 A Note: Please check R _{astony} value of The Over Current Protection values of Changing it will reset the Over Curren Leading Edge Blanking Time	High side MOSFET on Components tab first, are computed from R _{os(ony} , ant Protection selected value 780 ns
Set Value 50 A Note: Please check R _{DS(ON)} value of The Over Current Protection values of Changing it will reset the Over Current Leading Edge Blanking Time Output Over Current Response	High side MOSFET on Components tab first, are computed from R _{DSFOWY} int Protection selected value 780 ns v Shutdown v
Set Value 50 A Note: Please check R _{DS(ON)} value of The Over Current Protection values of Changing it will reset the Over Curre Leading Edge Blanking Time Output Over Current Response nput Under Voltage Lockout	High side MOSFET on Components tab first. are computed from R _{DS(ON)} , int Protection selected value 780 ns v Shutdown v

FIGURE 2-26: The Protection Tab.

2.4.4.1 OUTPUT UNDERVOLTAGE AND OVERVOLTAGE

The "Output Voltage Protection" value acts on the OUVCON and OOVCON registers for the desired threshold. These registers hold the digital values that set the DAC voltage levels at which the output undervoltage and overvoltage are detected. The ABECON register is used to activate or deactivate the protection. The available range for these settings is from 0.0V to 3.84V. When an output overvoltage or output undervoltage occurs, an interrupt flag is set, allowing virtually any action to be taken through the firmware. The GUI does provide the option to disable the output if either an undervoltage or overvoltage event occurs.

2.4.4.2 OUTPUT OVERCURRENT

The GUI acts on the OCCON register. This register contains the digital value (OOC<4:0>) that sets the DAC voltage level, at which the output overcurrent state is detected. The voltage drop across the high-side power MOSFET is measured and compared to the OOC<4:0> value. Leading edge blanking is applied to this current measurement. The amount of leading edge blanking time is controlled by the OCLEB<1:0> bits in the OCCON register. The overcurrent Enable bit is also contained in the OCCON register. The available range for this setting will depend on the high-side RDSON value but the GUI will automatically scale the settings based on the RDSON value. When an overcurrent event is detected, the high-side drive will immediately turn off and skip the next clock cycle. An internal flag will also be set, so other desired actions may be taken through the firmware.

2.4.4.3 INPUT UNDERVOLTAGE LOCKOUT

The GUI is used to configure the VINLVL register for input undervoltage lockout (UVLO) protection. This register sets the DAC voltage level, which sets the input undervoltage lockout threshold. When the input voltage is above this value, the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In is allowed to turn on. The UVLO Enable bit is also contained in this register. The available range for this setting is 4V to 32V.

2.4.5 Compensation Tab

The **Compensation** tab is used to set the compensation parameters. This tab shows the tools/elements that are used to design the system's analog control loop. The Gain and Zero Frequency drop-down menus from the "Compensation" section set the position of the zero used to compensate the control system. Changes in the system dynamic performance result from changing the location of the system zero and gain. The next rows show the slope compensation needed for peak current mode control. Increasing the level of slope compensation reduces the influence of the current feedback relative to the influence of the voltage feedback. Over-compensation can introduce instability; under-compensation can introduce voltage ripple. The "Current sense gain" and "Current sense DC gain" cells are used to set the gain of the current sense signal. The calculated system crossover frequency and phase margin are also displayed. The higher the crossover frequency, the faster the system responds to transients. Higher switching frequency and lower inductance enable a higher crossover frequency while sacrificing efficiency. Phase margin greater than 45 degrees is recommended. See Figure 2-27.



FIGURE 2-27:

The Compensation Tab.

2.4.5.1 COMPENSATION

The "Compensation" values set the CMPZCON register. This register contains the bits that set the compensation gain (CMPZG<3:0>) and the zero frequency (CMPZF<3:0>). The available range of values for the zero frequency is from 1500 Hz to 35300 Hz, while the gain is adjustable from 36.15 dB to 0 dB.

The SLPCRCON register controls the slope compensation ramp that is subtracted from the error amplifier output. The four SLPS <3:0> bits control the slew rate of the ramp. The four SLPG<3:0> bits control the amplitude of the ramp signal. The available amplitude range is from 0.017 VPK-PK to 1.250 VPK-PK, as measured for a 50% duty cycle waveform.

The current is measured across the inductor by using a resistor-capacitor (RC) in parallel and extracting the inductor current information from the voltage across the capacitor. This very small voltage, plus the ripple, is amplified by the current gain amplifier. The amount of gain is controlled by the CSGSCON register. The range of the gain that can be set is from 0 dB to 22.5 dB and has a step size of 1.5 dB.

2.4.5.2 COMPUTED RECOMMENDED VALUES

There are two automated features to complete the Compensation tab values. The **Load Eval Board Components and Compensation** feature sets this tab to the default values that are standard on the MCP19111 Evaluation Board (ADM00397). This feature is used as a reset to restore the analyzer back to the original evaluation board component values. The **Load Recommended Components and Compensation** feature automatically fills in the tab with the calculated values. This feature is used to evaluate changes in key parameters quickly (such as switching frequency, inductance, output capacitance and ESR, MOSFET parameters, etc.).

2.4.5.3 BODE PLOT OF COMPENSATED SYSTEM

A bode plot displays the system gain and phase curve over frequency. Crossover, phase margin and gain margin are also displayed. The curves and the data are updated automatically.

The **Keep Data** button allows keeping the current curves and data. This allows changing any parameter and comparing the different performance to the kept curves and data.

The **Restore Data** button will restore the kept data in place of the current GUI value.

The **Clear Data** button will remove the displayed kept curves and data. After pressing this button, there is no more kept data to restore.

Note: The Restore Data and Clear Data buttons are enabled only after the Keep Data button has been used.

2.5 ADVANCED MODE

The Advanced mode can be activated using the Export Mode button (2) on the plug-in. When this mode is enabled, the following changes appear:

- Apart from the common tabs, the MCP19110/11/18/19 Buck Power Supply Graphical User Interface Plug-In GUI has a new **Bench Test** tab allowing certain peripherals to be disabled or output internal signals using the test multiplexer of the IC.
- Two new toolbar buttons will be displayed.

2.5.1 New MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In Actions for Advanced Mode

Evaluation B	loard - ADM003	97	v 🔊 🔁	2 🎽 🖕 🛓		X	0	
Parameter	Components	Efficiency	Protection	Compensation	Bench Test			
Others							^	
VZCCON	4	2 mV	*					
BUFFCC)N - ASEL<3:0>	Band gap	reference			~		
Main Peripherals Activation								
✓ Enab	ole Output Volta	ige		✓ Enable S	witching Freq	luency		

FIGURE 2-28: Actions for Advanced Mode.

The **Refresh GUI** button () is used to refresh the GUI values from the project sources. This can be used if the project source files are modified externally to the GUI.

The **Update Values in Debug Mode** button (a) allows the part to be updated with the latest GUI values while it is still running. This option is only available when the part is running in Debug mode. For some values, such as the output voltage, this function does not directly write into the corresponding register but rather to an intermediate variable. This variable is then used by the main program to change the output voltage using a specified ramp. Another important point is that this feature only acts on the values specified in the **Parameter**, **Protection**, **Compensation** and **Bench test** (in Advanced mode) tabs.

Parameter	Components	Efficiency	Protection	Compensation	Bench Test		
Others							
VZCCON 2 mV			IV 🗸				
BUFFCC	0N - ASEL<3:02	Band gap reference				~	
Main Per	ipherals Acti	vation					
✓ Enable Output Voltage				 Enable Switching Frequency 			
Enable Compensation				Enable High Side Dead Time			
✓ Enable Slope Compensation				Enable Low Side Dead Time			
✓ Enable Over Current							
Peripher	als Activatio	n					
ATSTCO	ATSTCON PE1		ABE	ABECON			
	IS [DECON	v	CRTMEN			
	DIS [DRVSTR	VSTR VSTR				
BNC	CHEN [PDEN	✓	✓ RECIREN			
	/DIS	PUEN					
	[UVTEE					
	[OVTEE					
							v

2.5.2 Bench Test Tab

FIGURE 2-29: The Bench Test Tab.

The Advanced mode displays a new tab on the MCP19110/11/18/19 – Buck Power Supply Graphical User Interface Plug-In, the **Bench Test** tab, shown in Figure 2-29.

The parameters under the "Others" section control the VZCCON register and the BUFFCON - ASEL register. The ASEL bits are used to select a desired internal signal and connect it to the GPA0 pin as an analog output. It also requires that the BNCHEN check box under the "Peripherals Activation" section is enabled.

The check boxes under the "Peripherals Activation" section are used to enable or disable the peripherals that cannot be controlled directly from the other tabs.

2.6 HOW CAN THE CODE BE MODIFIED?

Before editing the code, it is useful to understand how the plug-in interacts with the project source to avoid conflicts.

The GUI plug-in writes to the $v_{MCP1911X.h}$ file. This file contains definitions where the name starts with a "V_" and defines a byte value.

Example: #define V_TMR1 0x99

In order to maintain the functionality of the firmware, these types of definitions cannot be modified and they must keep their original name. The settings displayed by the GUI are saved/read directly to/from the project sources after any changes in the GUI parameters.

This file also generates some conditional definitions in order to activate/deactivate several firmware features. Example: in V_MCP1911X.h:

```
#if (V_NUM_EN_PIN < PIN_DISABLED)
#define EN_PIN_EN 0X01</pre>
```

If $V_NUM_EN_PIN \ge PIN_DISABLED$, the EN_PIN_EN will not be defined.

Then in main.c:

```
#ifdef EN_PIN_EN
EN_PIN_WPU = 1; //weak pull-up enable
EN_PIN_IO = 1; //input state
EN_PIN = 0;
EN_PIN_INT_EN = 1; //interrupt enable
```

#endif

If the user inserts code between the <code>#ifdef EN_PIN_EN</code> and <code>#endif</code>, the code may not be included at the compilation. Below is a summary of the project modification permissions to keep the plug-in working with the project.

- New source files can be added.
- Existing source files can be removed or modified, except for V_MCP1911X.h, which cannot be removed. If some code is removed from the existing file, some features provided by the GUI may not respond correctly.
- The project name can be modified.
- The project folder name can be modified.

NOTES:



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