

Evaluation Kit User's Manual

Digital Step Attenuator PE4312



9380 Carroll Park Drive • San Diego, CA 92121 USA • Phone 858-731-9400 • Fax: 858-731-9499



Table of Contents

Introduction	3
Applications Support	3
Evaluation Kit Contents and Requirements	3
Kit Contents	
Software Requirements	3
Hardware Requirements	3
PE4312 DSA Evaluation Board Assembly	4
Overview	4
USB Interface Board	
USB Interface Board Overview	5
Connection of the USB Interface Board to the Evaluation Board	5
USB Driver Installation	5
EVK Software Installation	6
Using the Application Software Graphical User Interface	9
Evaluation Board Overview	12
Hardware Operation	14
Technical Resources	15



Introduction

The PE4312 is a 50Ω, HaRP[™] technology-enhanced 6-bit RF Digital Step Attenuator (DSA) designed for use in 3G/4G wireless infrastructure and other high performance RF applications. An integrated digital control interface supports both serial and parallel programming of the attenuation, including the capability to program an initial attenuation state at power-up. Covering a 31.5 dB attenuation range in 0.5 dB steps, it maintains high linearity and low power consumption from 1 MHz through 4 GHz. PE4312 also features an external negative supply option, and is offered in a 20-lead 4x4 mm QFN package. In addition, no external blocking capacitors are required if 0V DC is present on the RF ports.

The PE4312 Evaluation Kit (EVK) includes the application software and hardware required to control and evaluate the functionality of the DSA using a PC running the Windows operating system to control the USB interface board.

Applications Support

For any technical inquiries regarding the evaluation kit or software, please visit applications support at <u>www.psemi.com</u> (fastest response) or call **(858) 731-9400**.

Evaluation Kit Contents and Requirements

Kit Contents

The PE4312 Evaluation Kit (EVK) includes all of the specific software and hardware required to evaluate the DSA. Included in the EVK are:

Quantity	Description
1	PE4312 DSA Evaluation Board Assembly (PRT-10505)
1	Peregrine USB Interface Board Assembly (PRT-50446)
1	USB 2.0 Type A to Type B Mini Cable

Software Requirements

The application software will need to be installed on a computer with the following minimum requirements:

- PC compatible with Windows™ XP, Vista, 7, or 8
- Mouse
- USB port
- HTML browser with internet access
- Administrative privileges

Hardware Requirements

In order to evaluate the step attenuation performance of the evaluation board, the following equipment is required:

- DC power supplies and DC cables
- Vector network analyzer

CAUTION: The PE4312 DSA EVK contains components that might be damaged by exposure to voltages in excess of the specified voltage, including voltages produced by electrostatic discharges. Handle the board in accordance with procedures for handling static-sensitive components. Avoid applying excessive voltages to the power supply terminals or signal inputs or outputs.



PE4312 DSA Evaluation Board Assembly

Overview

The Evaluation Board is assembled with a PE4312 DSA, SP2T mechanical switch (\overline{P} /S), SP3T mechanical switches (D1~D6,LE), several headers, and SMA connectors. The \overline{P} /S switch is used for Parallel or Serial mode selection. The D1~D6,LE switches are used for setting the control bits in Direct Parallel programming mode.



Figure 1. PE4312 Evaluation Board Assembly



USB Interface Board

USB Interface Board Overview

A USB interface board (*Figure 2*) is included in the Evaluation Kit. This board allows the user to send SPI commands to the device under test by using a PC running the Windows[™] operating system. To install the software, extract the zip file to a temporary directory and follow the installation procedure included.

Figure 2. DSA USB Interface Board



Connection of the USB Interface Board to the Evaluation Board

The Evaluation Board and the USB interface board contain a keyed 16 pin header. This feature allows the USB interface board (socket) to connect directly to the Evaluation Board (pin) on the front-side as shown in *Figure 3*.





USB Driver Installation

The latest USB interface board drivers are available via Microsoft Windows update. Internet connectivity is required to download the drivers. Connect the USB interface board to the PC and select the Windows Update option to obtain and install the drivers.

If the USB board drivers are not installed, it will not be possible to run the program correctly. A USB interface board (*Figure 2*) is included in the Evaluation Kit.

Figure 4. USB Driver Installation





EVK Software Installation

In order to evaluate the PE4312 performance, the Application Software has to be installed on your computer. The USB interface and DSA application software is compatible with computers running Windows™ XP, Vista, 7, or 8. This software is available directly from Peregrine's website at <u>www.psemi.com</u>.

To install the DSA evaluation software, unzip the archive and execute the "setup.exe."

Figures 5(a-c). Application Software Installation Procedure

BDSA Evaluation Software Installer.msi setup.exe

After the setup.exe file has been executed, a		
welcome screen will appear. It is strongly		
recommended that all programs be closed prior to running the install program. Click the "Next>" button to proceed.		

DSA Evaluation Software Welcome to the DSA Evaluation Software Setup 👝 🖕 • Wizard 0. 0 0. • The installer will guide you through the steps required to install DSA Evaluation Software on your computer. WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law. Cancel < Back Next>

Take a moment to read the license agreement, then click "I Agree" and "Next>."

BSA Evaluation Software				
License Agreement				
· · · · · · · ·				
Please take a moment to read the license agreement now. If you accept the terms below, click "I Agree", then "Next". Otherwise click "Cancel".				
BY CLICKING ON THE "I Agree" BUTTON, "YOU" (MEANING YOU PERSONALLY OR THE COMPANY YOU				
REPRESENT AND ON WHOSE BEHALF YOU ARE FULLY AUTHORIZED TO ENTER THIS AGREEMENT) ARE				
CONSENTING TO BE BOUND BY AND ARE BECOMING A				
PARTY TO THIS LICENSE AGREEMENT ("AGREEMENT"). IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THIS				
AGREEMENT, CLICK THE "CANCEL" BUTTON AND THE -				
○ I Do Not Agree ○ I Agree				
Cancel Cancel Next >				



For most users the default install location for the program files is sufficient. If a different location is desired, the install program can be directed to place the program files in an alternate location. The software is installed for "Everyone" by default. Once the desired location is selected click "Next >."

The Confirm Installation is ready to install the DSA evaluation software on your computer, then click "Next>" to proceed with the software installation.

Figures 5(d-f). Application Software Installation Procedure

DSA Evaluation Software				
Select Installation Folder	0			
0.0.	• • •			
The installer will install DSA Evaluation Software to the following folder.				
To install in this folder, click "Next". To install to a different folder, enter it be	low of click "Browse"			
	ion of click promise .			
<u>F</u> older:				
C:\Program Files (x86)\Peregrine Semiconductor Corp\DSA Evaluatio	Browse			
	Disk Cost			
Install DSA Evaluation Software for yourself, or for anyone who uses this o	computer:			
	somputer.			
⊘ Just <u>m</u> e				
Cancel < Back	Next >			
BSA Evaluation Software				
Confirm Installation	••••			
· · ·	• •• •			
The installer is ready to install DSA Evaluation Software on your computer. Click "Next" to start the installation.				
Cancel < Back	Next>			
B DSA Evaluation Software				
Installing DSA Evaluation Software				
DSA Evaluation Software is being installed.				
Please wait				
i idase Walt				

As the software files are installed, a progress indicator will be displayed. On slower computers, installation of the software may proceed for a few moments.

For applications support, please visit www.psemi.com

Document No. DOC-59828-1 | UltraCMOS® RFIC Solutions

< <u>B</u>ack

Next)

Cancel

©2014 Peregrine Semiconductor Corp. All rights reserved.



Once the evaluation software is installed, click "Close" to exit.

A new Start Menu item under Peregrine Semiconductor will appear in the start menu of your computer. Select "DSA Evaluation Software" to launch the GUI.

Peregrine Semiconductor
Ø DSA Evaluation Software

Figure 5(g). Application Software Installation Procedure

BSA Evaluation Software				
Installation Complete	···			
	••••			
DSA Evaluation Software has been successfully installed.				
Click "Close" to exit.				
Please use Windows Update to check for any critical updates to the .NET Framework.				
Cancel < Back	Close			
Cancel < <u>B</u> ack				



Using the Application Software Graphical User Interface

Figure 6 displays the DSA application software graphical user interface (GUI), which has the USB interface board plugged into the computer. If the USB interface board is not connected when the application software is launched, the message "**No interface board connected! Please connect USB-SPI Interface #101-0695.**" will appear at the bottom of the screen.

In the upper left corner, under the Peregrine Logo there is a drop down menu item to select the part for evaluation and the part description is right below the part number box.

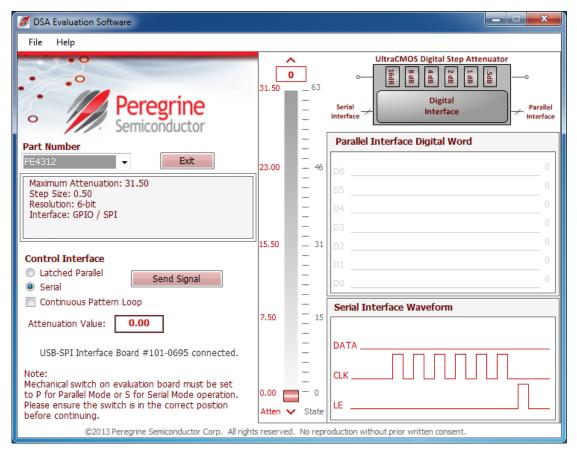


Figure 6. DSA Application Software Graphical User Interface (GUI)



The DSA application software GUI supports Latched Parallel and Serial modes, and shows the control bit waveform at the right side of the GUI when the mode is selected.

The Send button changes functionality based on the control interface mode. Send Latch in Latched Parallel mode and Send Signal in Serial mode is provided to resend the programming bits to the device at the same attenuation state.

Control Interface ■ Latched Parallel ■ Serial 	Control Interface Latched Parallel Serial
Parallel Interface Digital Word	Parallel Interface Digital Word
D60	D60
D5 0	D50
D40	D40
D30	D3 0
D20	D2 0
D10	D1 0
D0 0	D0 0
Serial Interface Waveform	Serial Interface Waveform
DATA	DATA

Figure 7. Latched Parallel or Serial Mode

Continuous Pattern Loop can be selected to automatically step through each of the attenuation states.

Continuous Pattern Loop

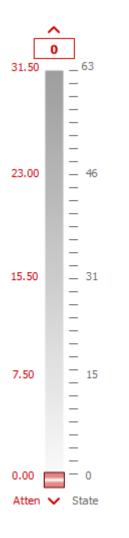
The Attenuation Value box displays the attenuation value the DSA is currently programmed. The user can enter the desired attenuation value followed by the "Enter" key to program the DSA.

Attenuation Value:

0.00



The center of the GUI is the attenuation slide bar that allows the user to quickly select the desired attenuation. The arrows at the top and bottom can be clicked to increase or decrease attenuation state at the minimum step size.

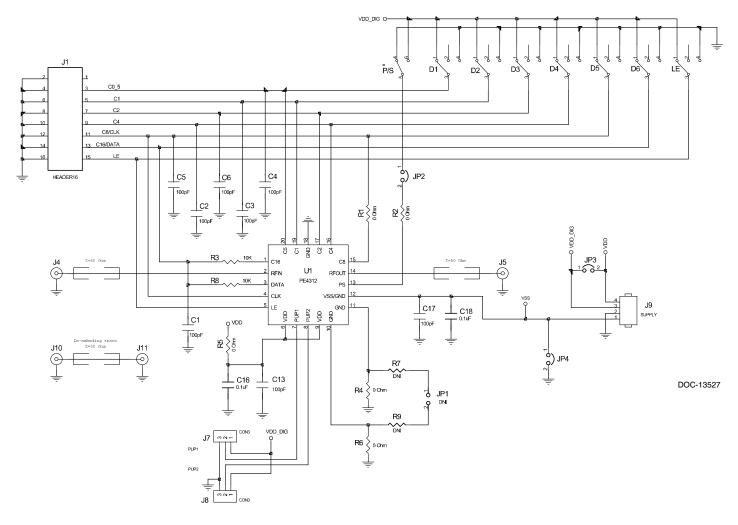


Document No. DOC-59828-1 | UltraCMOS® RFIC Solutions



Evaluation Board Overview

Figure 8. PE4312 Evaluation Board Schematic



Notes: 1. CAUTION: Contains parts and assemblies susceptible to damage by electrostatic discharge (ESD) 2. Install shunt connector on JP2, JP3, and JP4



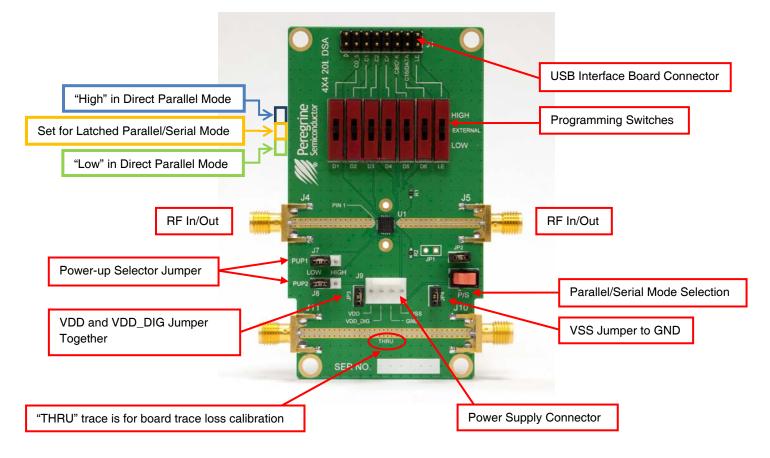


Figure 10. PE4312 Evaluation Board Outline Showing Functional Overview

For applications support, please visit www.psemi.com

Document No. DOC-59828-1 | UltraCMOS® RFIC Solutions



Hardware Operation

- 1. Verify that all DC power supplies are turned off before proceeding
- 2. Connect the jumper on JP2
- 3. Position the \overline{P}/S switch to Parallel or Serial mode
- 4. Set jumpers of PUP1 (J7) and PUP2 (J8) to be "HIGH" at RIGHT position and "LOW" at LEFT position
- 5. Set the D1~D6 and LE mechanical programming switches on board to support Direct Parallel, Latched Parallel, or Serial mode
 - a. Place D1~D6 and LE at the middle position to support Latched Parallel and Serial modes with GUI application software and proper position of \overline{P}/S switch
 - b. In Direct Parallel mode, D1~D6 can be set to "HIGH" or "LOW" to manually program the attenuation state while LE is connected to "HIGH" without using the USB interface board and GUI application software
- 6. Provide external power supply to the J9 connector (refer to the Operating Ranges table in the datasheet for the voltage range)
 - a. VDD is the positive power supply with 3.3V typical
 - b. VDD_DIG is the positive power supply for control signals with 1.8V typical, and it can be connected to VDD with jumper on JP3 to simplify the test set-up
 - c. VSS is the external negative power supply with –3.3V typical. To simplify the test set-up, it can also be shorted to GND with jumper on JP4 to enable using the internal negative voltage generator
- 7. Calibrate board trace loss with "THRU" trace between J10 and J11



Technical Resources

Additional technical resources are available for download in the Products section at <u>www.psemi.com</u>. These include the Product Specification datasheet, S-Parameters zip file, Evaluation Kit schematic and Bill of Materials, Material Declaration form, and PC-compatible software file.

Trademarks are subject to trademark claims.

For applications support, please visit www.psemi.com

Document No. DOC-59828-1 | UltraCMOS® RFIC Solutions