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# Evaluation Kit User's Manual

## Digital Step Attenuator PE4312



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## 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 [www.psemi.com](http://www.psemi.com) (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

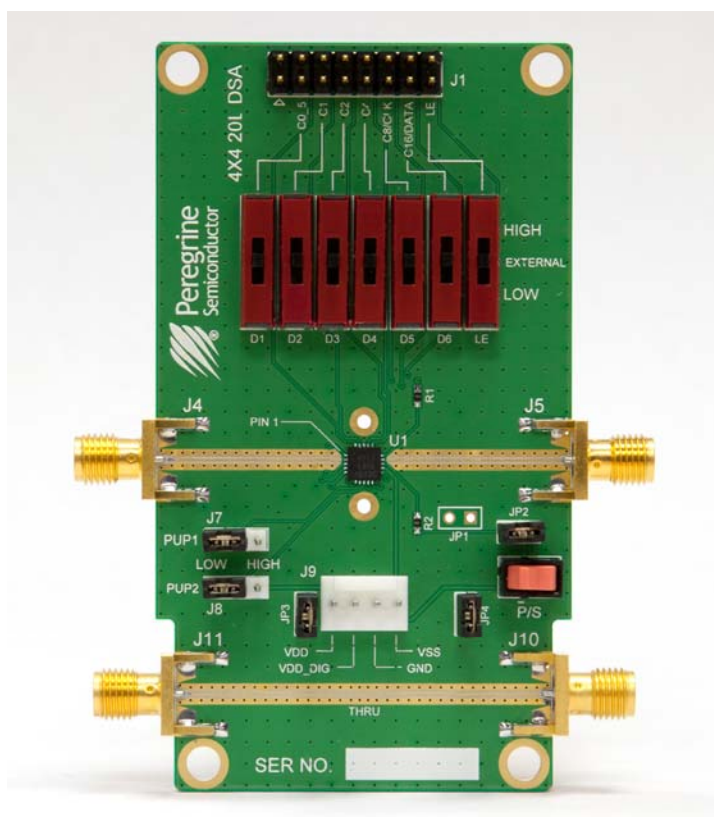
*CAUTION: The PE4312 DSA EVK contains components that might be damaged by exposure to voltages in excess of the specified voltage, including voltages produced by electrostatic discharges. Handle the board in accordance with procedures for handling static-sensitive components. Avoid applying excessive 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 ( $\bar{P}/S$ ), SP3T mechanical switches (D1~D6,LE), several headers, and SMA connectors. The  $\bar{P}/S$  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.

### 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 2. DSA USB Interface Board



Figure 3. DSA USB Interface Board Connected to the PE4312 Evaluation Board for Latched Parallel and Serial Programming

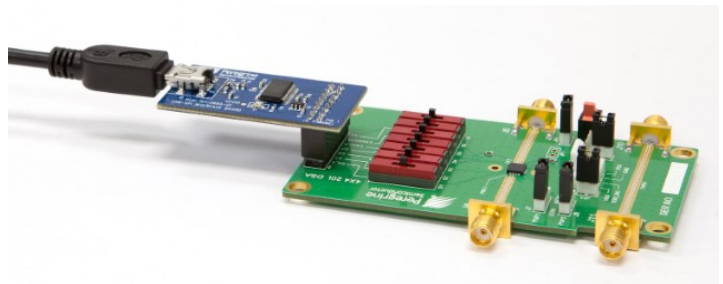
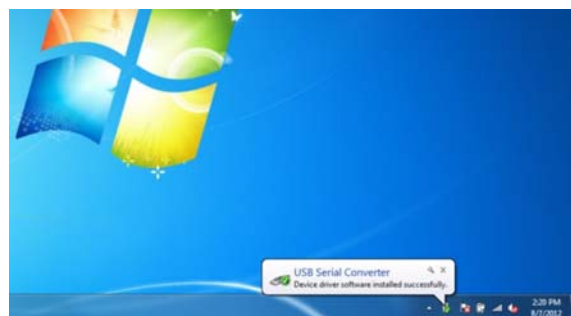


Figure 4. USB Driver Installation



## EVK Software Installation

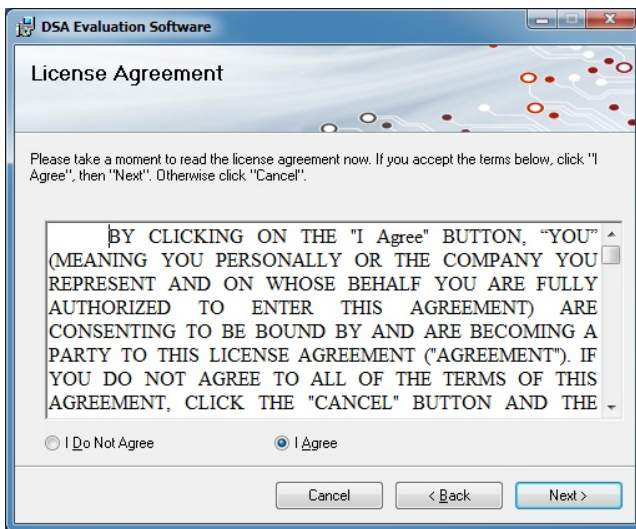
In order to evaluate the PE4312 performance, the Application Software has to be installed on your computer. The USB interface and DSA application software is compatible with computers running Windows™ XP, Vista, 7, or 8. This software is available directly from Peregrine’s website at [www.psemi.com](http://www.psemi.com).

To install the DSA evaluation software, unzip the archive and execute the “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.

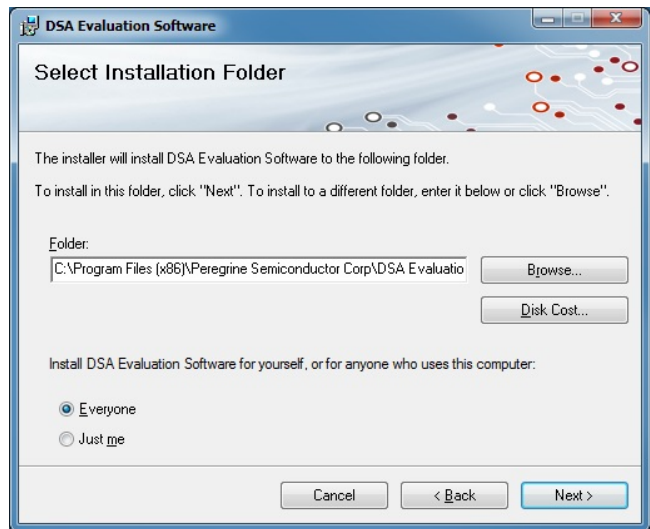
Take a moment to read the license agreement, then click “I Agree” and “Next>.”

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

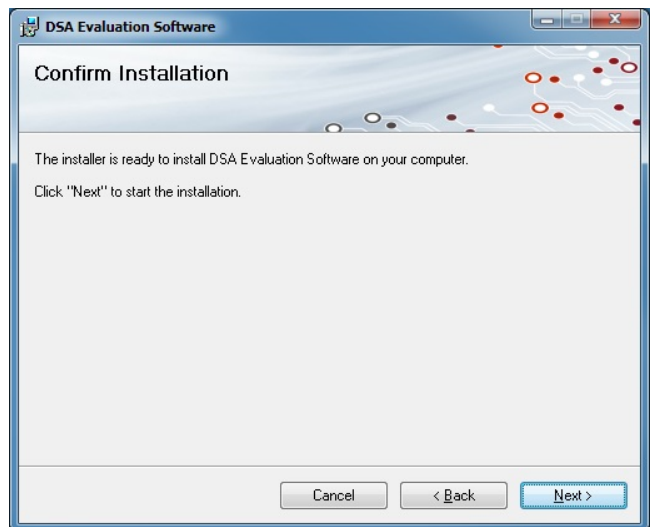


For most users the default install location for the program files is sufficient. If a different location is desired, the install program can be directed to place the program files in an alternate location. The software is installed for “Everyone” by default. Once the desired location is selected click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

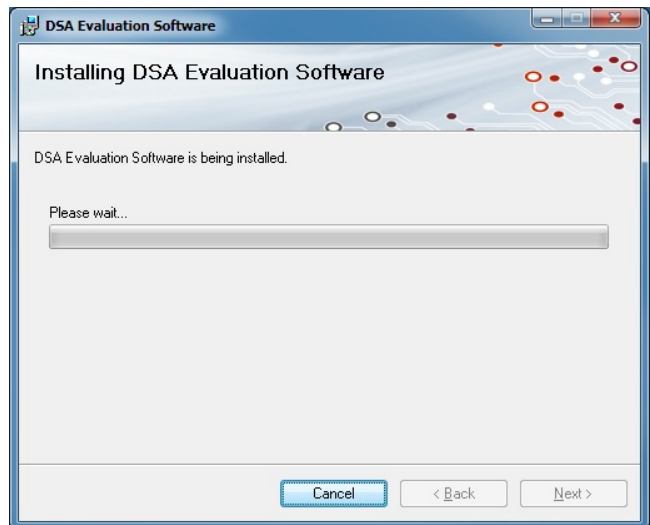
### Figures 5(d-f). Application Software Installation Procedure



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



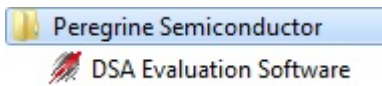
As the software files are installed, a progress indicator will be displayed. On slower computers, installation of the software may proceed for a few moments.



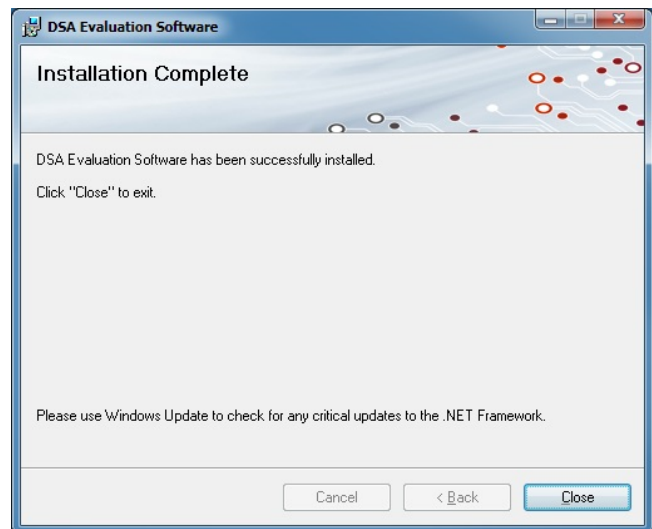


Once the evaluation software is installed, click “Close” to exit.

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.



**Figure 5(g). Application Software Installation Procedure**

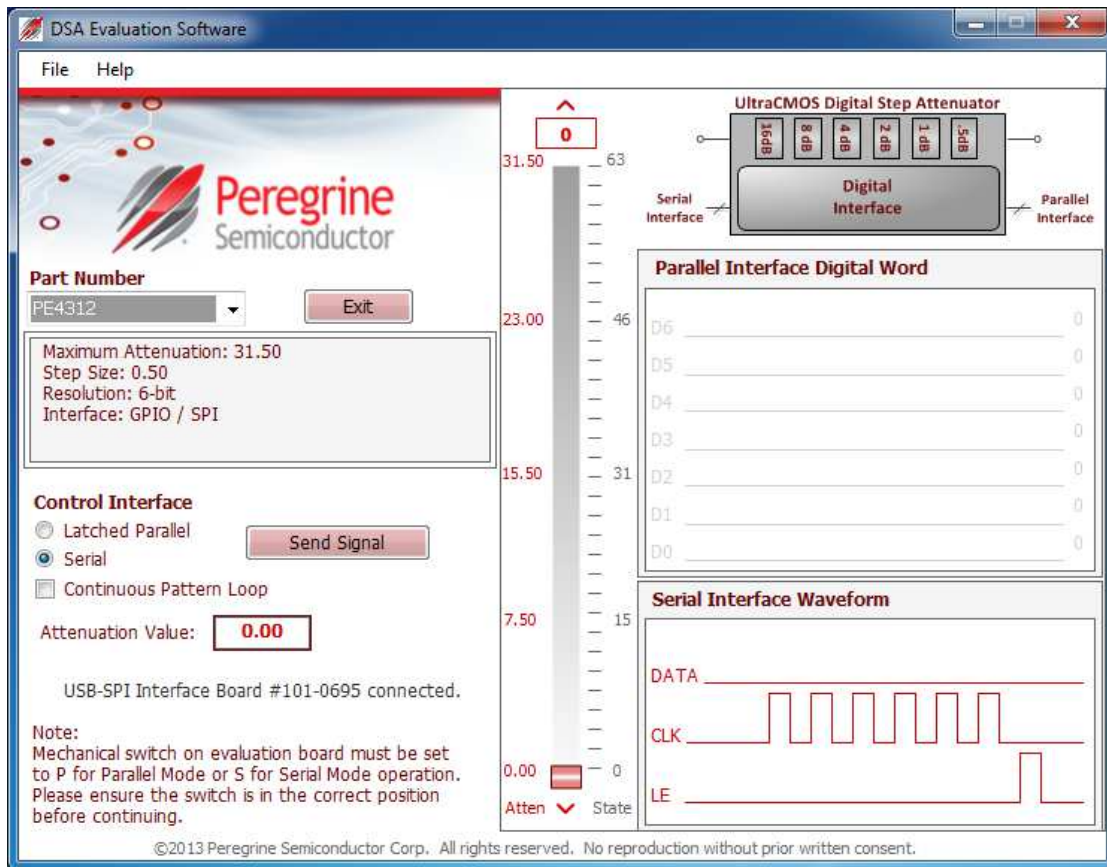


## Using the Application Software Graphical User Interface

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.

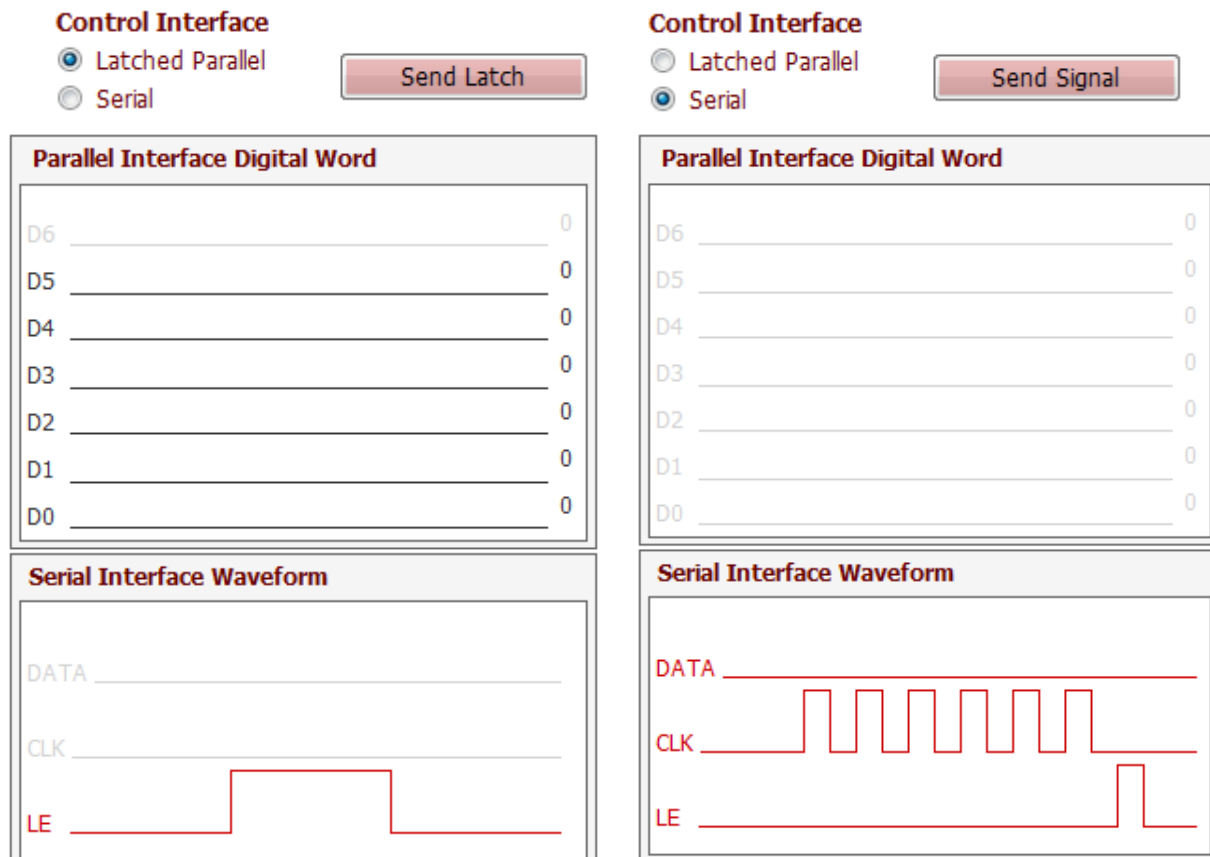
Figure 6. DSA Application Software Graphical User Interface (GUI)



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.

**Figure 7. Latched Parallel or Serial Mode**



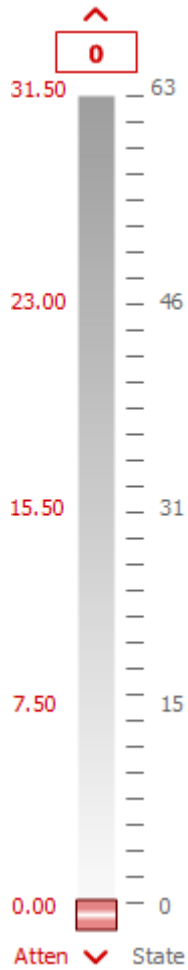
Continuous Pattern Loop can be selected to automatically step through each of the attenuation states.

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.

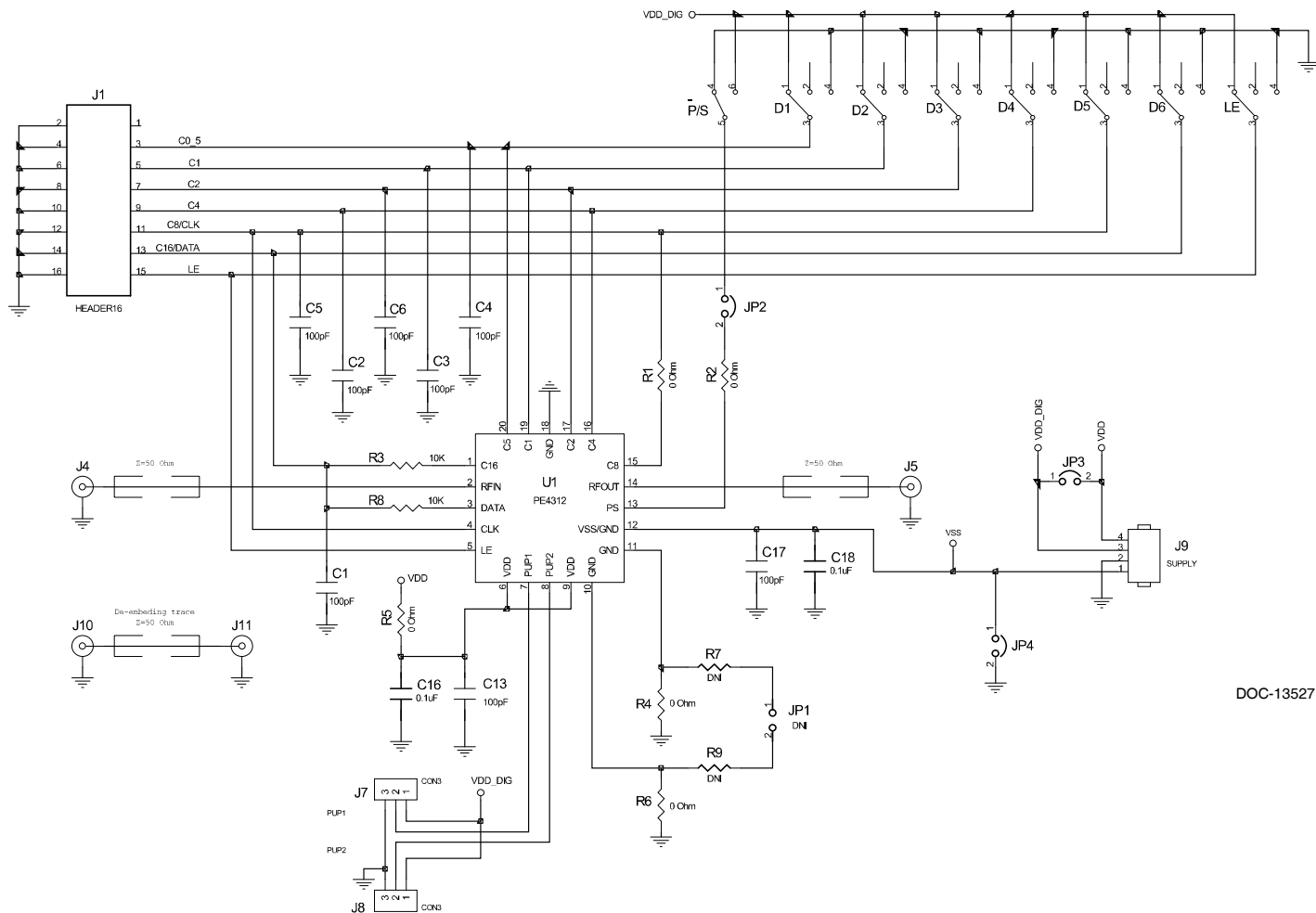
Attenuation Value:

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.



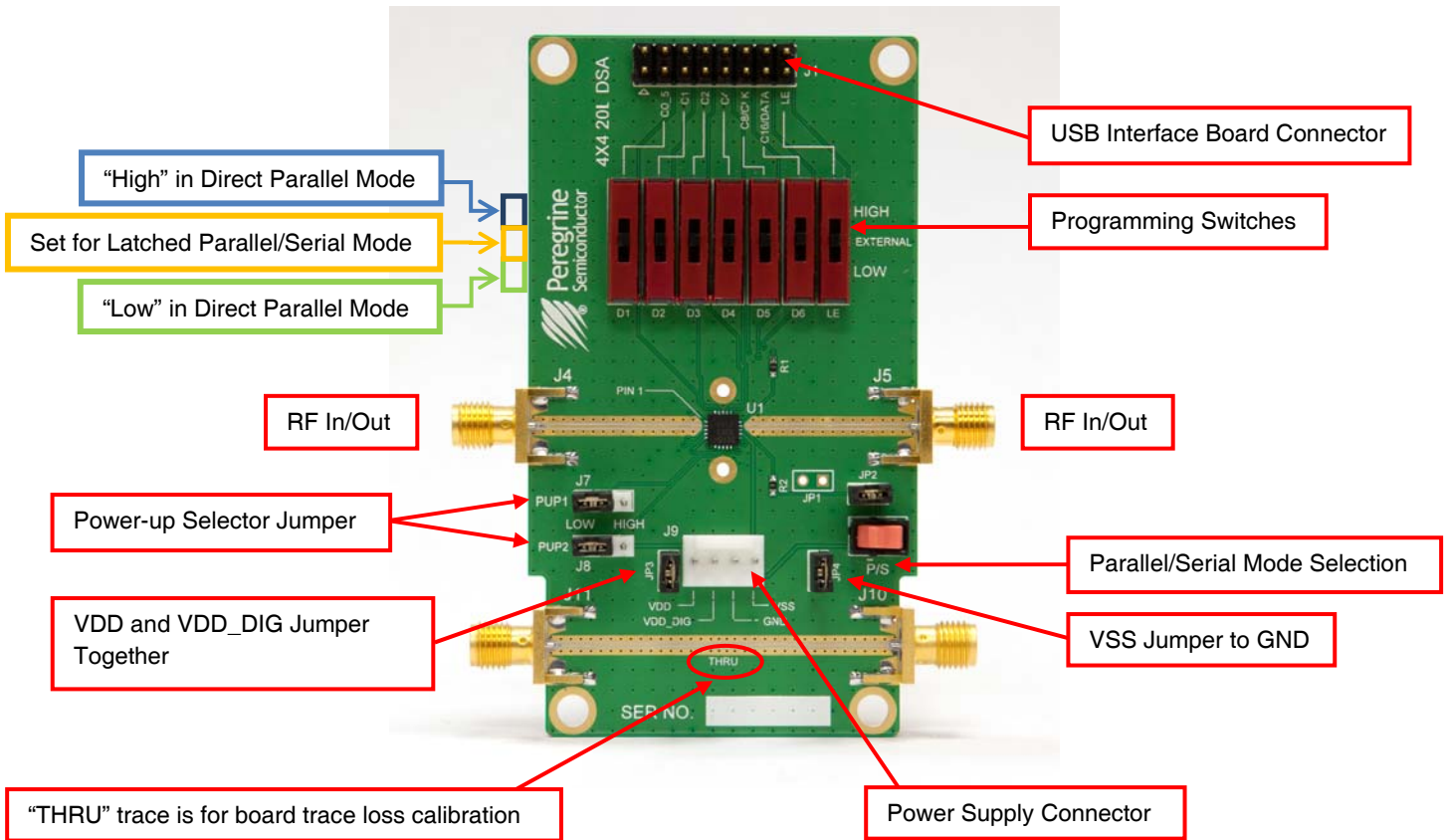
# Evaluation Board Overview

**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



## Hardware Operation

1. Verify that all DC power supplies are turned off before proceeding
2. Connect the jumper on JP2
3. Position the  $\bar{P}/S$  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  $\bar{P}/S$  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 [www.psemi.com](http://www.psemi.com). 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.

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