pSemi
A Murata Company

PE43508 Evaluation Kit (EVK) User's Manual

EVK User's Manual, 9 KHz–55 GHz

PE43508
Evaluation Kit

Copyright and Trademarks

Disclaimers

Patent Statement

pSemi products are protected under one or more of the following U.S. patents: patents.psemi.com

Sales Contact

For additional information, contact Sales at sales@psemi.com.

Corporate Headquarters

9369 Carroll Park Drive, San Diego, CA, 92121

858-731-9400

Table of Contents

Technical Resources - 17

Introduction

<div style="text-align:right">1</div>

The PE43508 is a 50Ω, HaRP™ technology-enhanced, 6-bit RF digital step attenuator (DSA) that supports a wide frequency range from 9k to 55 GHz. The PE43508 features glitch-safe attenuation state transitions, supports 1.8V control voltage and optional V_{SS_EXT} bypass mode to improve spurious performance, making this device ideal for test and measurement, point-to-point communication systems, and very small aperture terminals (VSAT).

The PE43508 provides an integrated digital control interface that supports both serial addressable and parallel programming of the attenuation. The PE43508 covers a 31.5 dB attenuation range in 0.5 dB and 1 dB steps. It is capable of maintaining 0.5 dB and 1 dB monotonicity through 55 GHz. In addition, no external blocking capacitors are required if 0 VDC is present on the RF ports.

The PE43508 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.

Application Support

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

Evaluation Kit Contents and Requirements

Kit Contents

The PE43508 DSA EVK includes the following hardware required to evaluate the device:

Table 1 ▪ PE43508 Evaluation Kit Contents

Quantity	Part Number	Description
1	PRT-69885	PE43508 DSA Evaluation Board Assembly
1	PRT-69137	Kit, USB Interface Board (Blue), 8 bit, 2.5V IO, with 3-foot cable

PC Requirements

The PE43508 DSA Evaluation Software requires a computer with the following minimum requirements:

- PC with Windows XP, Vista, 7, 8 or 10
- Mouse or other pointing device
- USB port
- Web browser with Internet access (for downloading software)
- User account with administrator privileges (for installing software)

Instrumentation Requirements

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

- Power supply
  - 3.3 VDC with 0.5A minimum
  - DC cables (banana to Mini-Grabber suggested)
- Vector network analyzer
  - 2.92 mm, 3.5 mm, or SMA (frequency-dependent) RF cables

Caution: The PE43508 DSA EVK contains components that may be damaged by exposure to voltages in excess of the specified voltage, including voltages produced by electrostatic discharges. Use care when handling the board. Always handle in accordance with procedures for handling static-sensitive components. Avoid applying excess voltages to or touching the power supply terminals, RF ports, digital inputs.

Evaluation Board Assembly

2

Evaluation Board Assembly Overview

The evaluation board is assembled with a PE43508 DSA, several headers, and 2.92 mm (K) RF connectors. To demonstrate the most optimal performance at mmWave frequencies, a two-layer RF core-only (8 mils thick) PCB is used. Special care is required in handling the evaluation board due to the thinness of the PCB.

Figure 1 ▪ PE43508 Evaluation Board Assembly
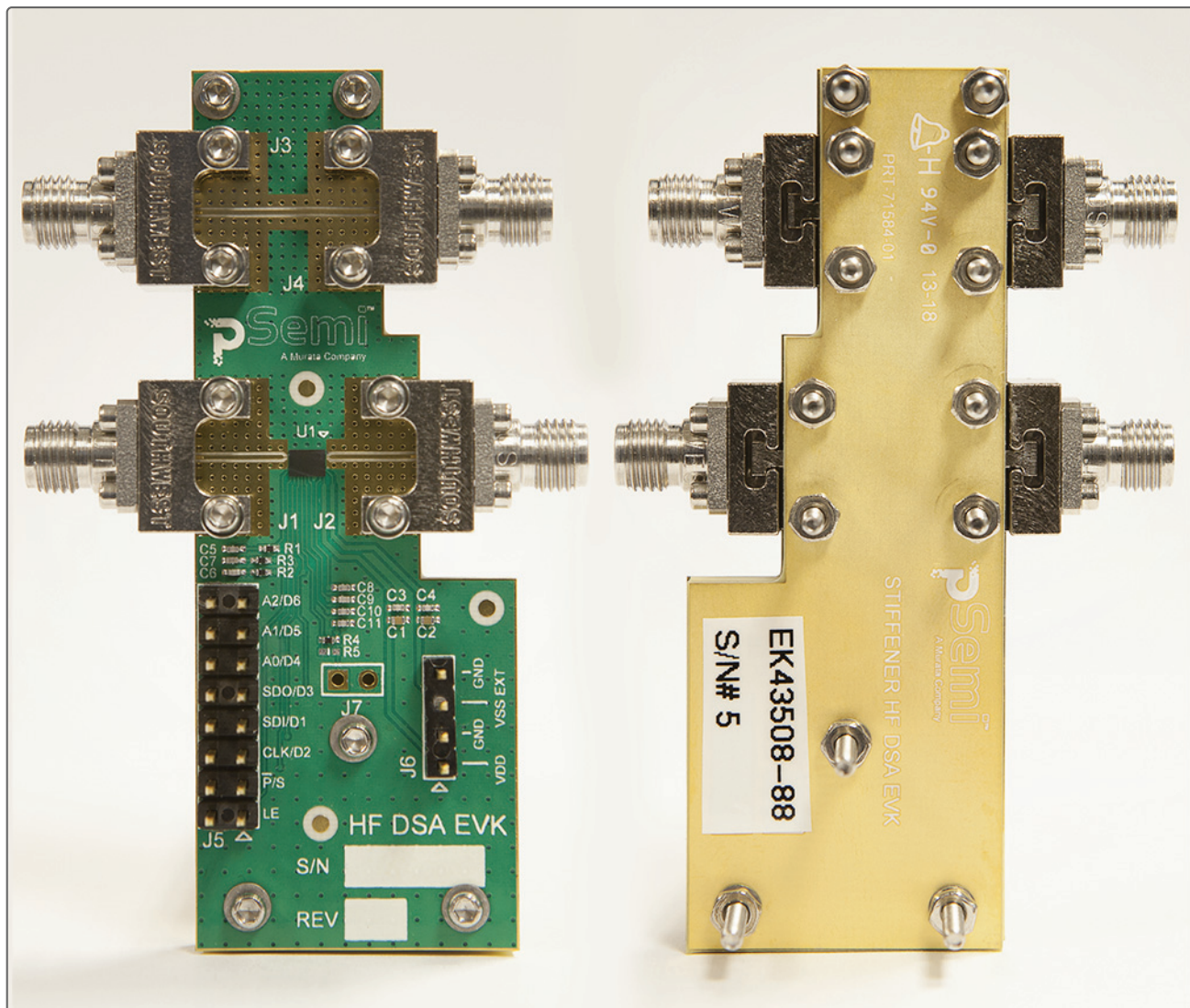
Peregrine USB Interface Board

The USB interface board (**Figure 2**) is included in the evaluation kit. This board allows the user to control the digital input signals at the PE43508 device by using pSemi software running the Windows operating system. To install the driver software, see "**Software Installation**" on page 5.

Figure 2 ▪ *Peregrine USB Interface Board*

pSemi™
A Murata Company

Quick Start Guide

3
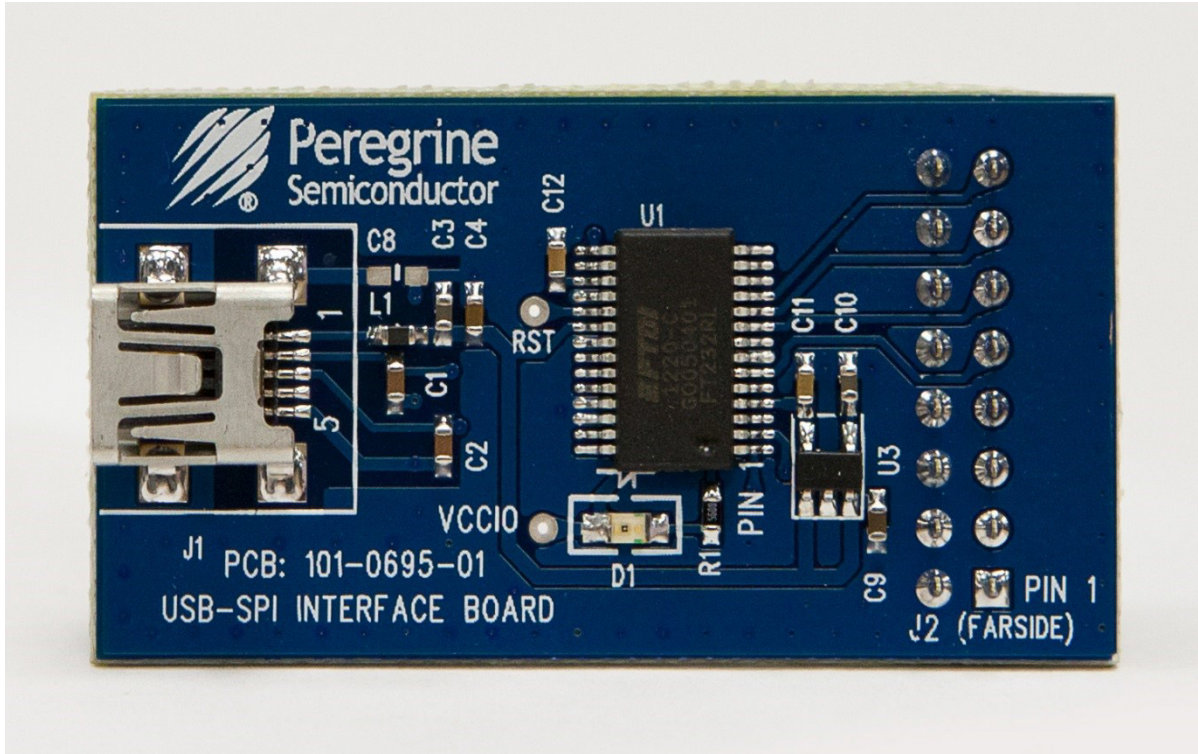
Quick Start Overview

The EVB assembly was designed to ease customer evaluation of the PE43508 digital step attenuator. This section will guide the user through the software installation, the hardware configuration, and the features of the graphical user interface (GUI).

Software Installation

USB Interface Driver

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 (**Figure 3**).

In the case where Windows Update is not available; the USB interface board driver may be downloaded directly from the manufacturer at the following URL:

www.ftdichip.com/Drivers/D2XX.htm

Select the link for the appropriate Windows operating system driver. It is recommended to select the "Setup Executable" option when choosing the driver to download.

A USB interface board (**Figure 2**) is included with the evaluation kit, and driver installation completed prior to attempting communicating with the PE43508 DSA evaluation board.

*Figure 3 ▪ USB Driver Installation (Detecting)*
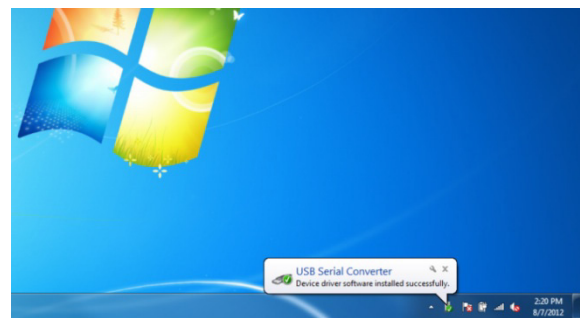
EVK Software

To evaluate the PE43508 EVK performance, the application software must be installed on your computer. The USB interface and PE43508 DSA Evaluation software is compatible with computers running Windows XP, Windows Vista, Windows 7, Windows 8, or Windows 10 in 32- or 64-bit configurations. This software is available for download as a .zip file directly from the pSemi Corporation website at the following URL:

http://www.psemi.com/products/digital-step-attenuators-dsa

To install the PE43508 DSA Evaluation Software, unzip the archive to a named folder of your choice and execute the installer application "setup.exe" (**Figure 4**).

*Figure 4 ▪ DSA Evaluation Software Setup.exe File*
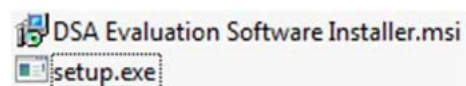
After the setup.exe file has been executed, a welcome screen appears. It is strongly recommended that all programs be closed prior to continuing. Click the "Next" button to proceed (**Figure 5**).

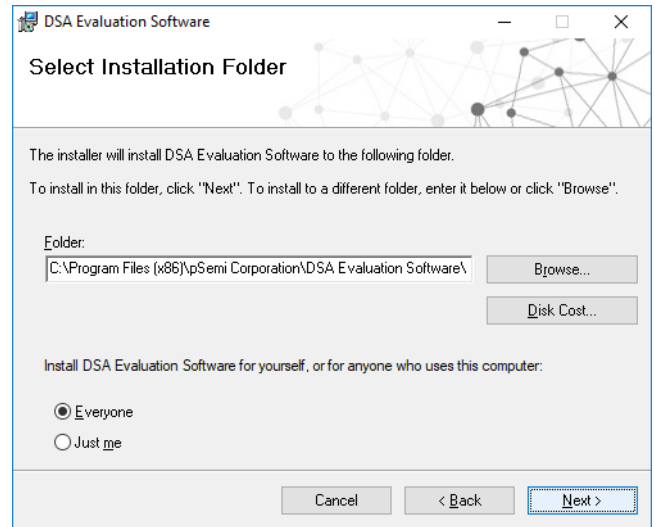*Figure 5 ▪ DSA Evaluation Software Setup*
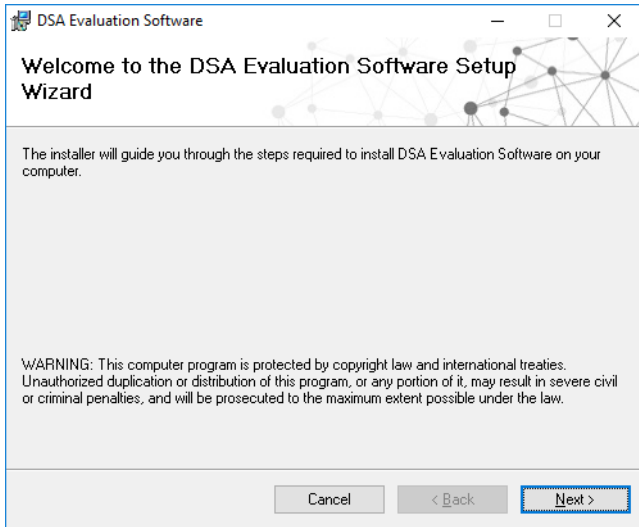
Review the license agreement, select "I agree," and then click "Next." (**Figure 6**).

Figure 6 ▪ License Agreement
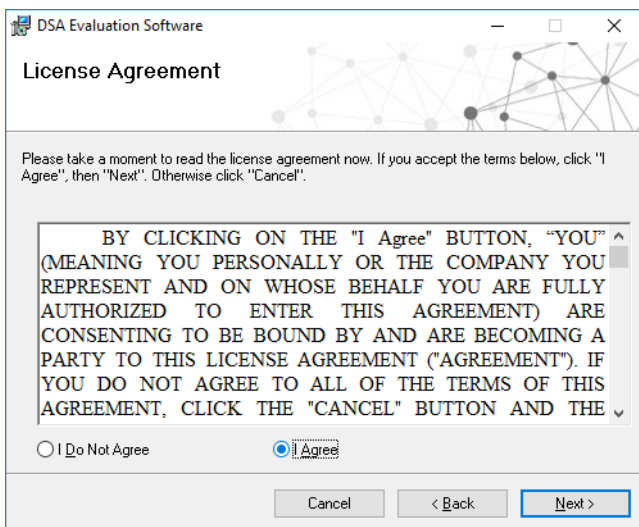
Select the desired location for the installation directory. It is recommended to accept the default location.

Figure 7 ▪ Default Installation Location

The next window allows the user to confirm the installation choices before beginning the installation process. Click "Next" to proceed with the software installation (**Figure 8**). Please note that the installation of software requires Administrator privileges under the Windows operating system.
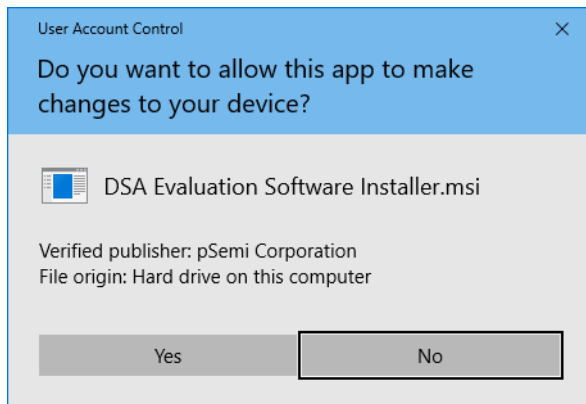
Figure 8 ▪ Confirm Installation

www.psemi.com
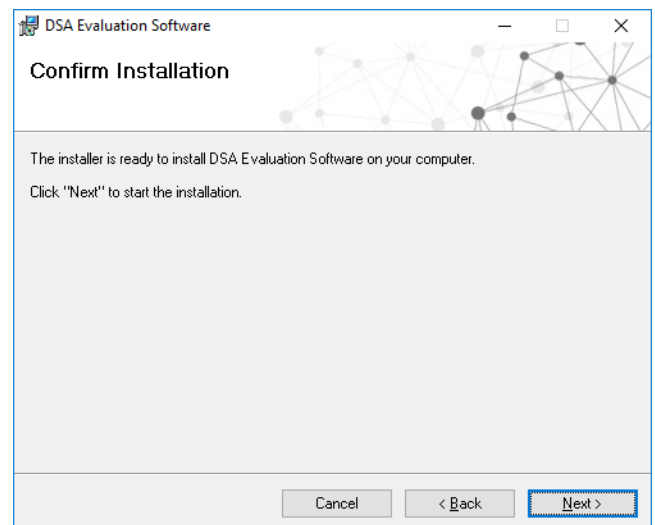
As the software files are installed, an indicator displays the progress. On slower computers, installation of the software may take a few minutes (**Figure 9**).

*Figure 9 ▪ Installation Progress Display*
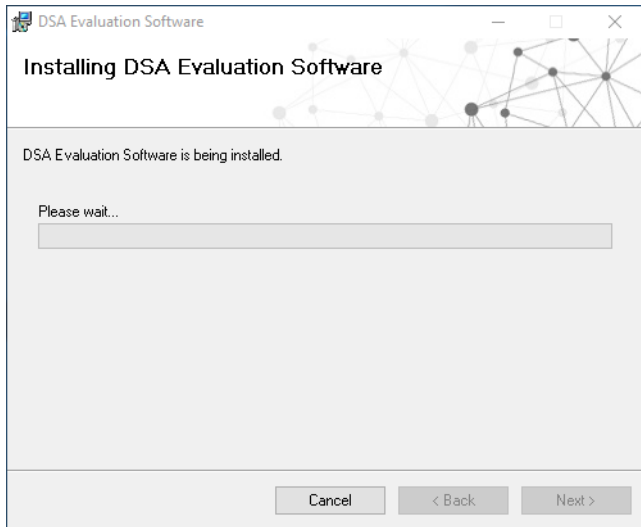
You may be prompted to confirm the installation of the application. Confirm that the "Verified publisher" is "Peregrine Semiconductor Corporation" before proceeding (**Figure 10**).

Figure 10 ▪ User Access Control Confirmation Dialog
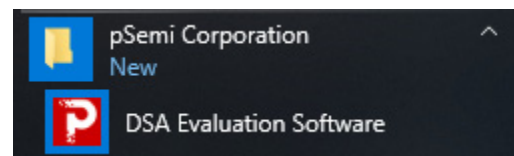

Upon successful installation, a confirmation message is displayed. Click "Finish" to exit (**Figure 11**).

Figure 11 ▪ Installation Complete
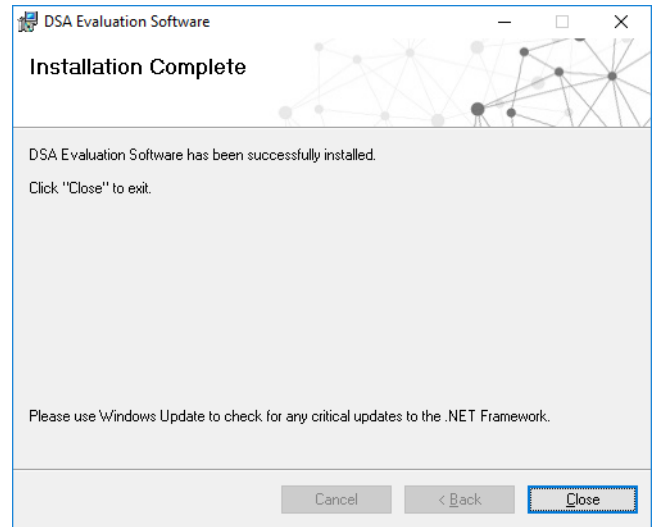
A new folder named "Peregrine Semiconductor" appears in the start menu of your computer. Select "DSA Evaluation Software" to launch the evaluation software (**Figure 12**).

Figure 12 ▪ DSA Evaluation Software Start Menu Item

Evaluation Solution Assembly

Connection of the USB Interface Board to the Evaluation Board

The evaluation board and the USB interface board contain a 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 13**. Use caution when connecting the USB Interface board to ensure that the two rows of pins are connected without shifting in any direction.

Figure 13 ▪ PE43508 USB Interface Board Connected to the Evaluation Board for Latched Parallel and Serial Programming—Front View
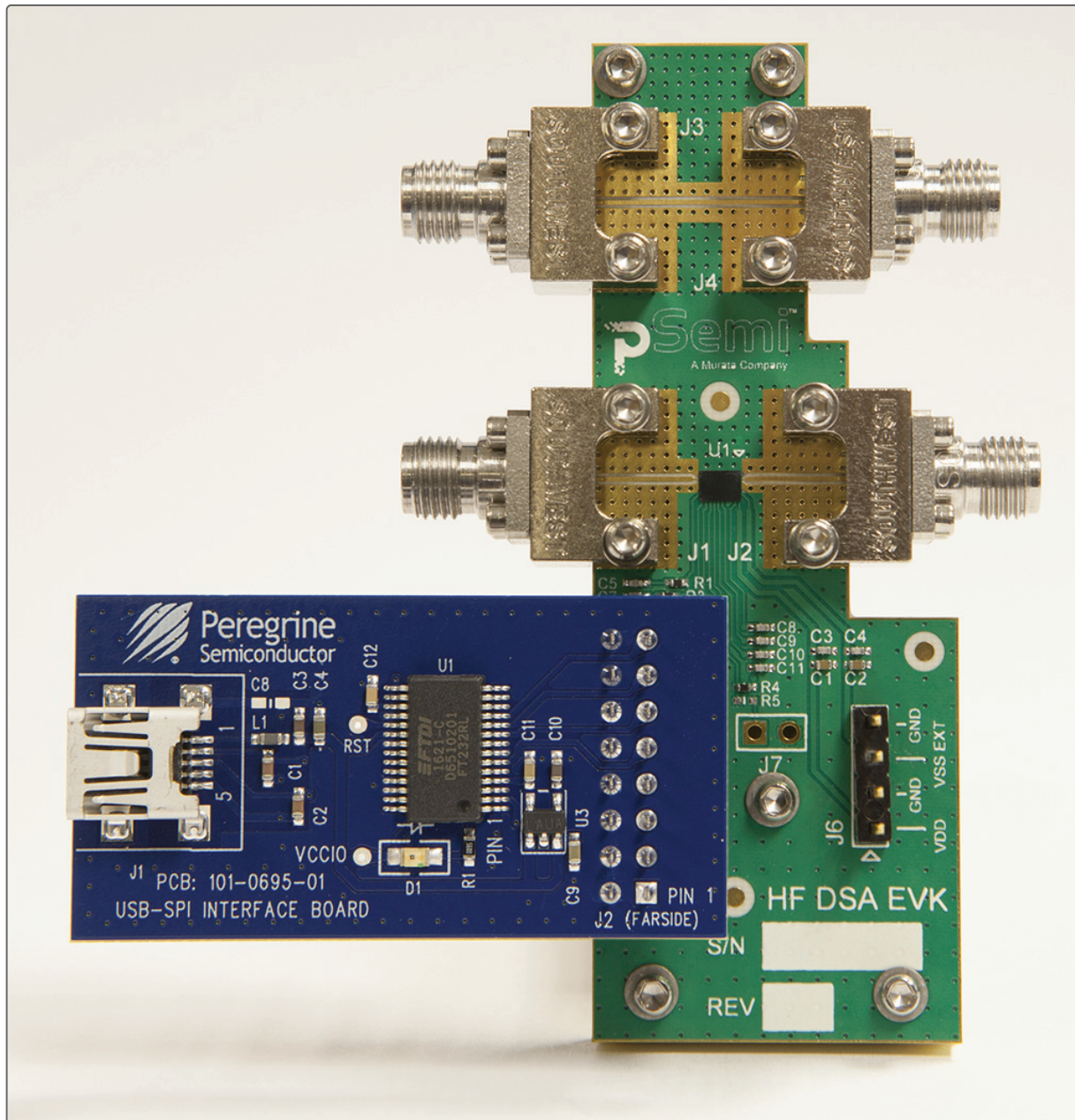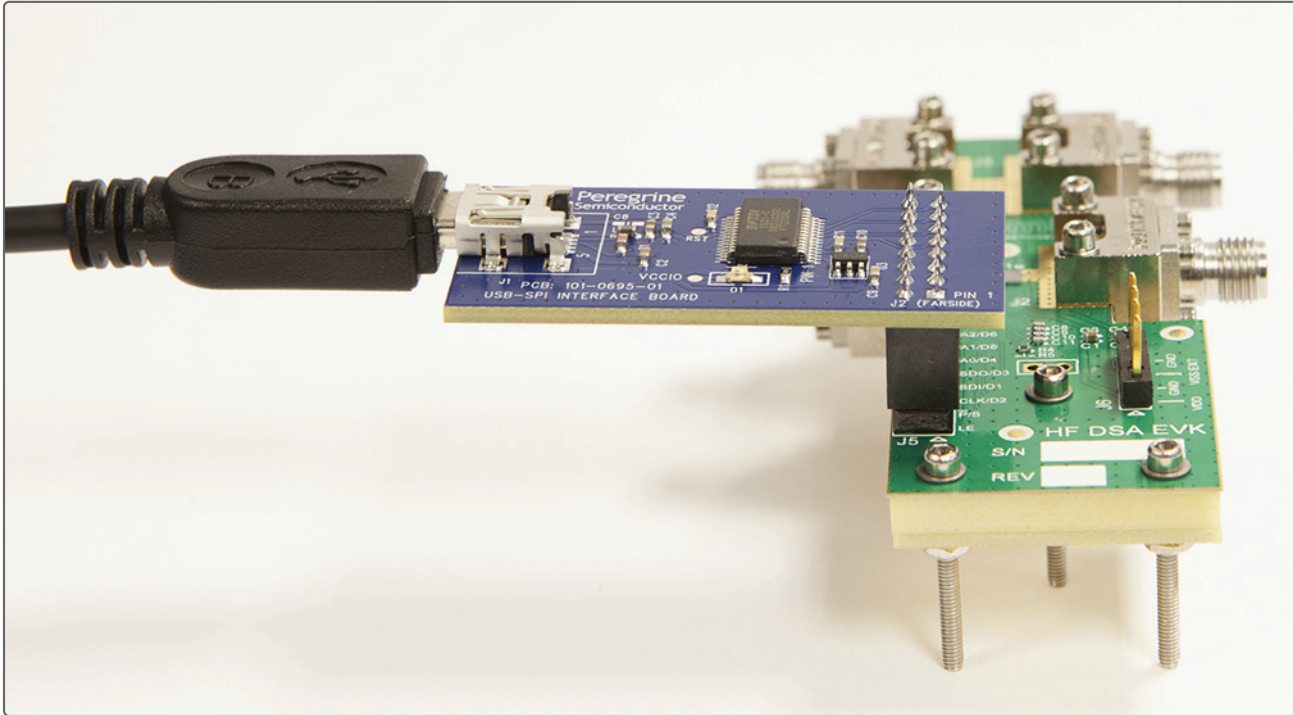
Figure 14 ▪ PE43508 USB Interface Board Connected to the Evaluation Board for Latched Parallel and Serial Programming—Side View

Hardware Configuration

The evaluation board is designed to ease customer evaluation of pSemi's products. The board contains:

1) Digital signal connectors that are connected for power supply, digital control signals and USB interface board.

2) 2.92 mm (K) connectors that are connected for RF performance verification and THRU trace to calibrate board trace loss.

Evaluation Board Schematic

The schematic of the evaluation board is provided in the following section:

Figure 15 ▪ PE43508 DSA Evaluation Board Schematic
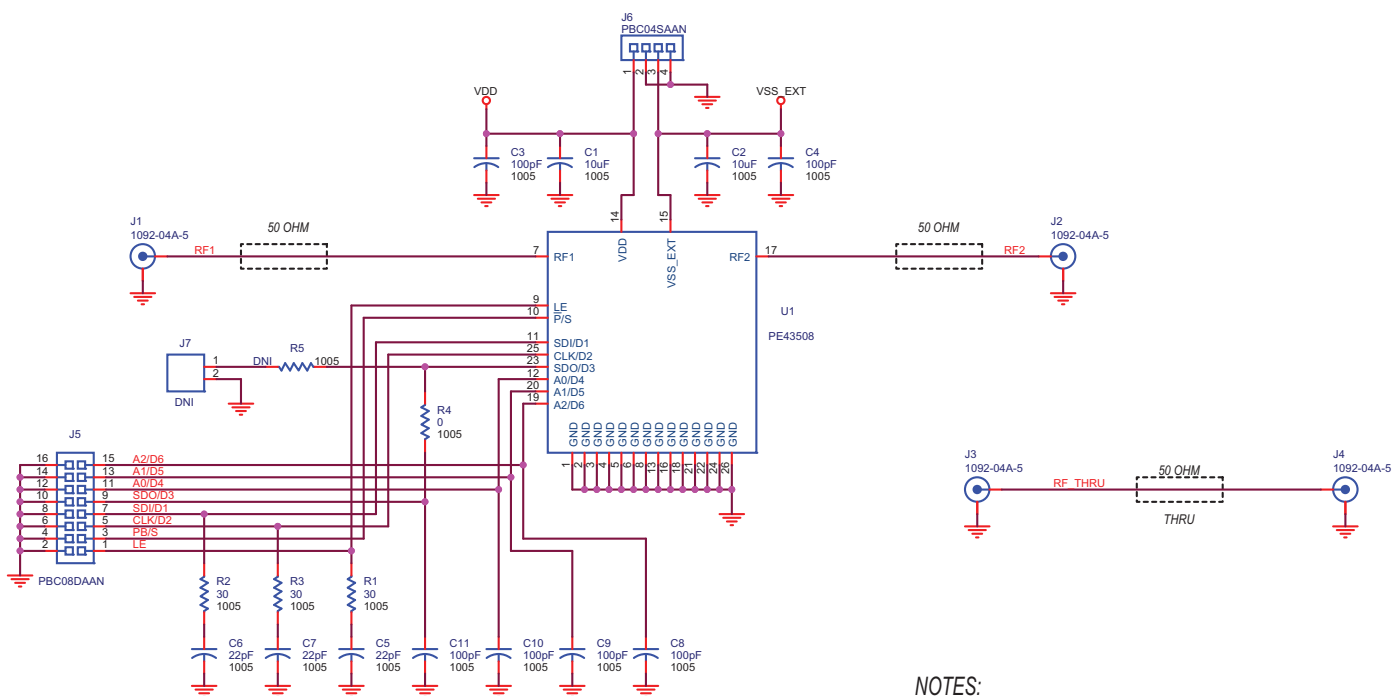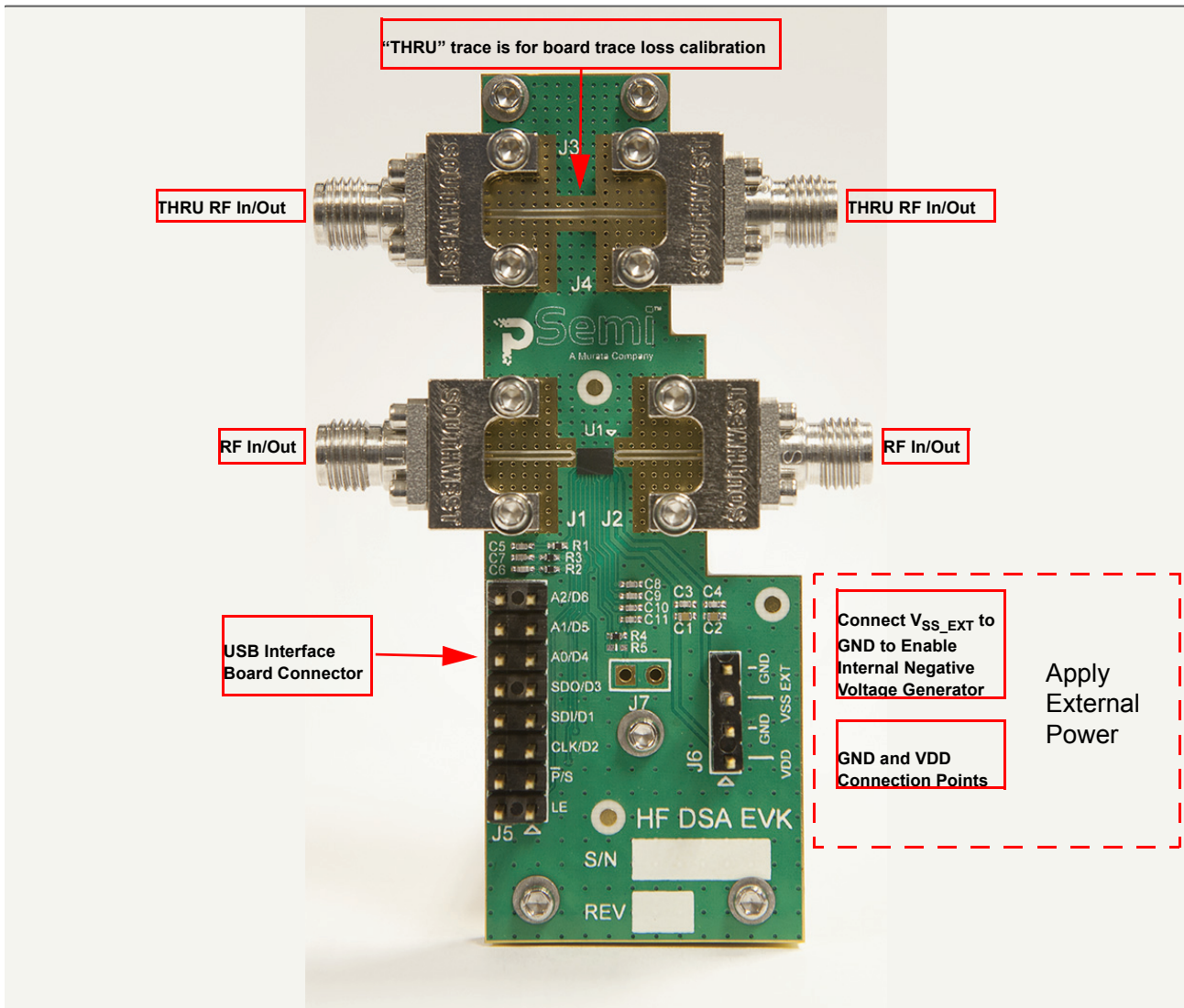

NOTES:

1. CONTAINS PARTS AND ASSEMBLIES SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGE (ESD)

Functional Overview

Evaluation Board

Figure 16 illustrates the connections on the RF evaluation board used in evaluating the PE43508 DSA.

Figure 16 ▪ PE43508 DSA Evaluation Board Functional Overview

Hardware Operation

The following steps prepare the evaluation solution for power up and making measurements. Please follow the guidelines and verify the connections with the supplied schematic before applying power.

1) Verify all DC power supplies are turned off before proceeding.

2) Calibrate board trace loss with THRU trace test coupon between J3 and J4. THRU calibration is sufficient for initial measurements. Use one-half the loss of the measured trace, as this will de-embed one connector and half the trace. If more accurate results are desired, a full vector de-embedding can be done with the THRU trace that matches your de-embedding technique.

3) Provide external power supply for V_{DD} on J6. V_{DD} on pin 1, GND on pin 2. (For more information, see the Recommended Operating Conditions table in the PE43508 datasheet.)

4) Set the external power supply current limit to 600 μA or higher to allow for inrush current requirement.

5) External VSS may be omitted by using the internal negative voltage generator to simplify the test setup for PE43508. Enable the internal negative voltage generator by shorting to GND (J6 pin 3 to J6 pin 4).

Alternatively, provide external power supply for V_{SS_EXT} on pin 3 and GND on pin 4 on J6 header. (For more information, see the Recommended Operating Conditions table in the PE43508 datasheet.)
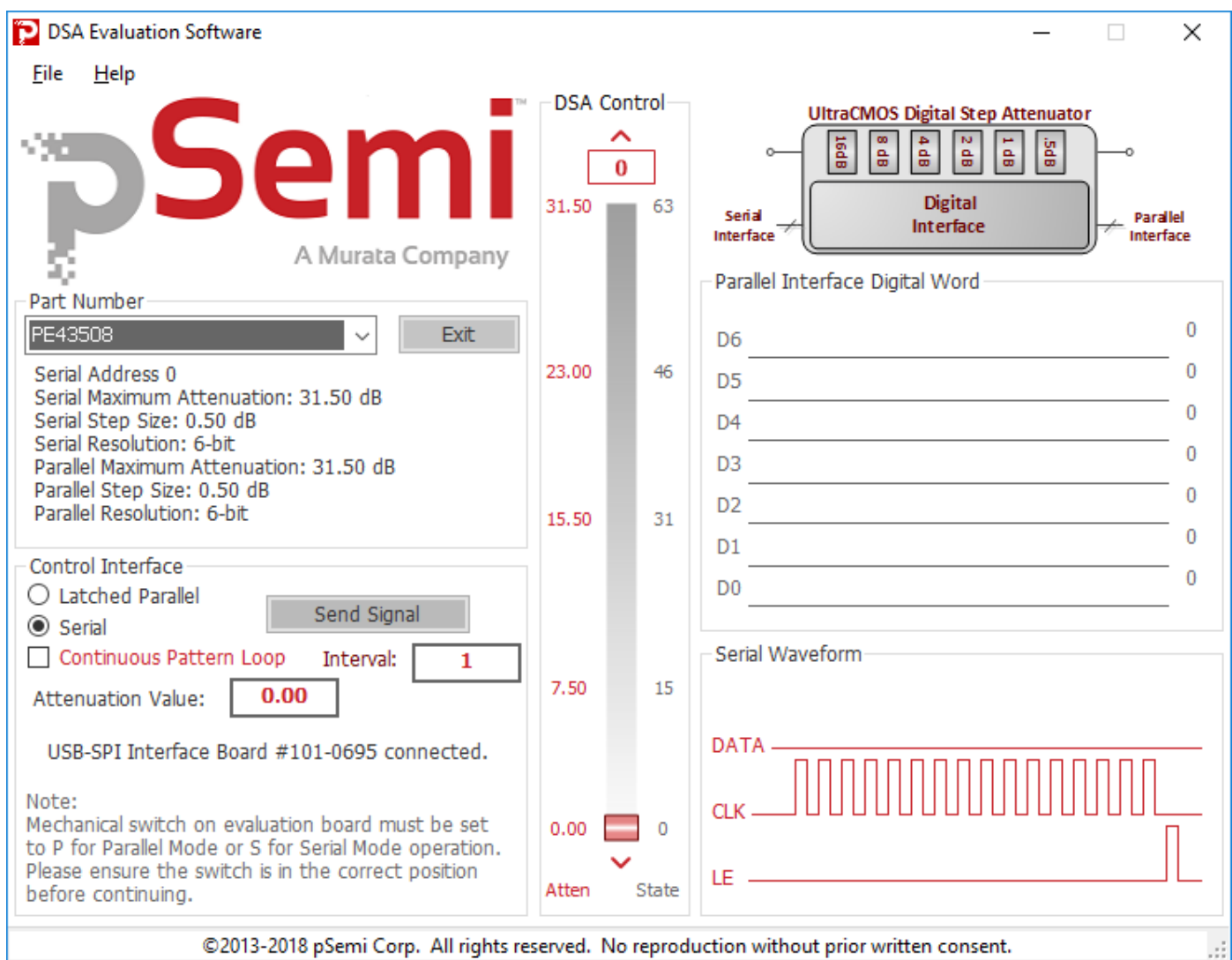
Graphical User Interface

Figure 17 displays the DSA application software graphical user interface (GUI), which has the USB interface board plugged into the computer. see **"Hardware Operation"** on page 12 for the EVK hardware configuration to enable use with the GUI control software.

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" appears at the bottom of the screen. The message "USB-SPI Interface Board 101-0695 connected" is displayed when the USB adapter is connected and recognized.

In the upper left corner, under the Peregrine logo, use the drop down menu to select the part for evaluation. The part description appears in the box below the part number.

Figure 17 ▪ PE43508 DSA Evaluation Board Functional Overview

Graphical User Interface Controls

Part Number Selection

The drop down control (**Figure 17**) allows the user to select the type of attenuator to control. To evaluate the PE43508, ensure PE43508 is selected. The device information section is updated when the selected device is changed.

Figure 18 ▪ Graphical User Interface Part Number Selection

Device Information

The device information area displays some basic information about the device that has been selected. Information consists of serial address, maximum attenuation, number of digital bits, and attenuation step size.

*Figure 19 ▪ Graphical User Interface Device Information*

Latched Parallel and Serial Mode

The DSA application software supports both serial and latched parallel device modes. Select the desired mode by choosing either "Latched Parallel" or "Serial" on the left side of the application. This radio button will set the P/S input level to the device when the radio button is clicked.

The Send button changes functionality based on the control interface mode. Send Latch in Latched Parallel mode and Send Signal in Serial mode are provided to resend the programming bits to the device at the same attenuation state.
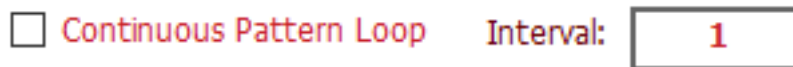
Figure 20 ▪ Latched Parallel and Serial Mode GUI Features
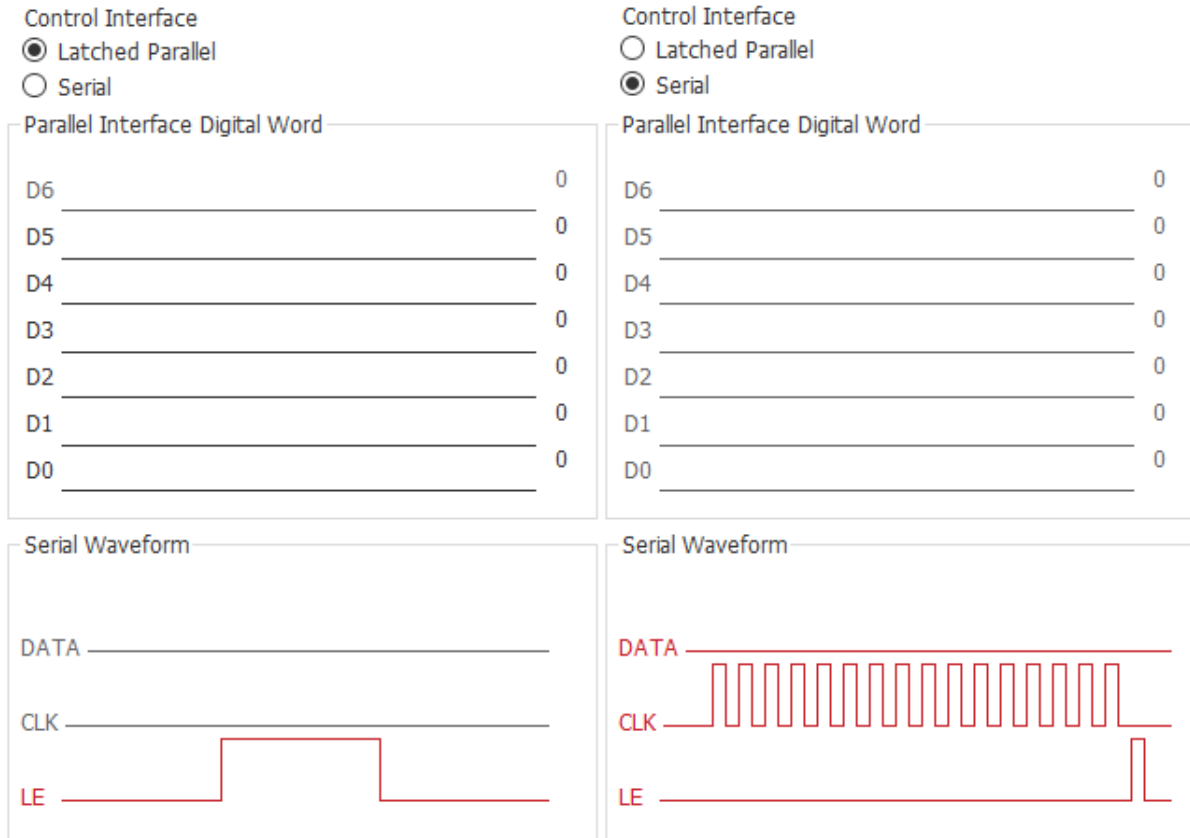
Continuous Pattern Loop

Click the Continuous Pattern Loop check box to step through each of the attenuation states. The pause interval can be specified in seconds to adjust the time in between sending each pattern.
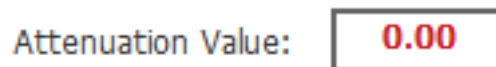
Figure 21 ▪ Continuous Pattern Loop Settings

Attenuation Value

The Attenuation Value box displays the attenuation value the DSA is currently programmed to. Type the desired attenuation value and then click "Enter" key to program the DSA.

Figure 22 ▪ Attenuation Value

Attenuation Slide Bar

The attenuation slide bar in the center of the GUI allows the user to quickly select the desired attenuation. Use the mouse to drag the red rectangle to the desired setting. The red arrows at the top and bottom can be clicked to increase or decrease attenuation state at the minimum step size.

Figure 23 ▪ Attenuation Slide Bar

Technical Resources

4
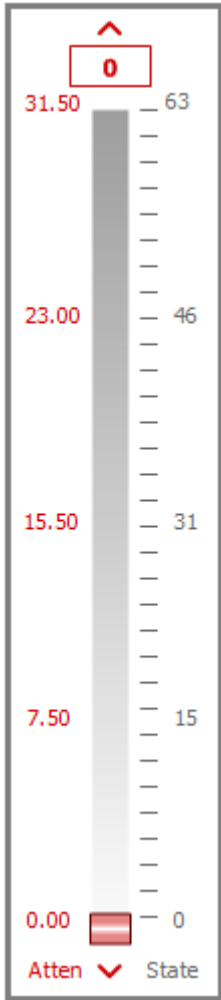
Technical Resources

Additional technical resources are available for download in the Products section at 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.

Trademarks are subject to trademark claims.

This page intentionally left blank.