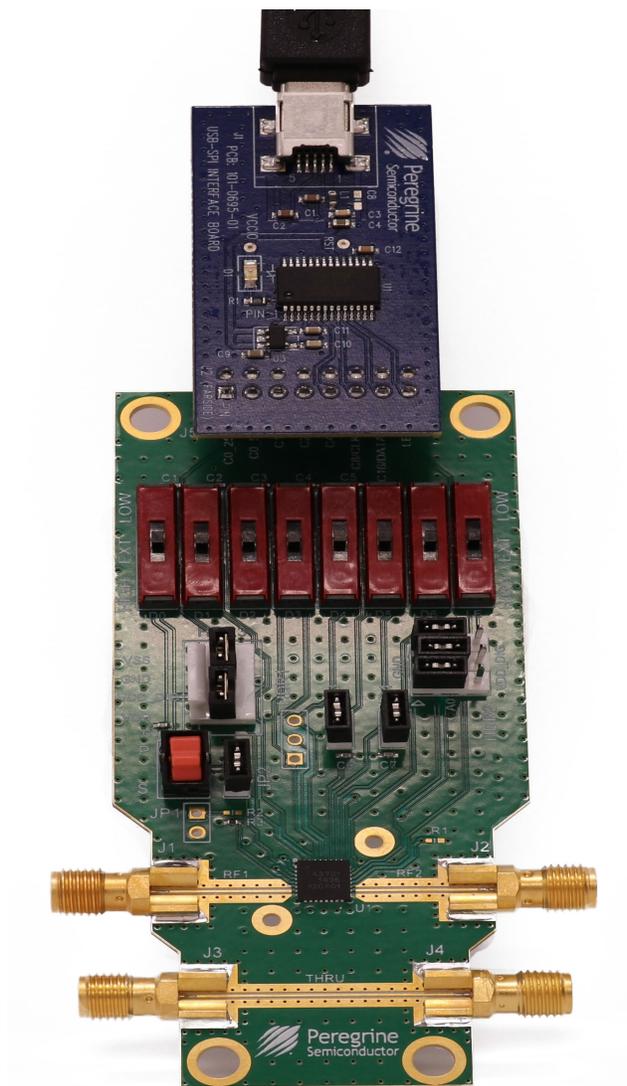


# PE43670 Evaluation Kit (EVK) User's Manual

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*Evaluation Kit (EVK) User's Manual, 7-bit, 31.75 dB, 9 KHz–4 GHz*



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# Introduction



The PE43670 is a 50Ω, high-linearity, 7-bit RF digital step attenuator (DSA) that supports a frequency range from 9 kHz to 4 GHz. The PE43670 provides an integrated digital control interface that supports both serial addressable and parallel programming of the attenuation.

The PE43670 covers a 31.75 dB attenuation range in 0.25 dB steps. In addition, no external blocking capacitors are required if 0 VDC is present on the RF ports.

The PE43670 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](http://www.psemi.com) (fastest response) or call (858) 731-9400.

## Evaluation Kit Contents and Requirements

### *Kit Contents*

The PE43670 DSA EVK includes the following hardware required to evaluate the device:

**Table 1** ■ PE43670 Evaluation Kit Contents

Quantity	Part Number	Description
1	PRT-72712	PE43670 DSA Evaluation Board Assembly
1	PRT-69137	Kit, USB Interface Board (Blue), 8 bit, 2.5V IO, with 3-foot cable

### *PC Requirements*

The PE43670 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
  - SMA RF cables

**Caution:** The PE43670 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, or digital inputs.

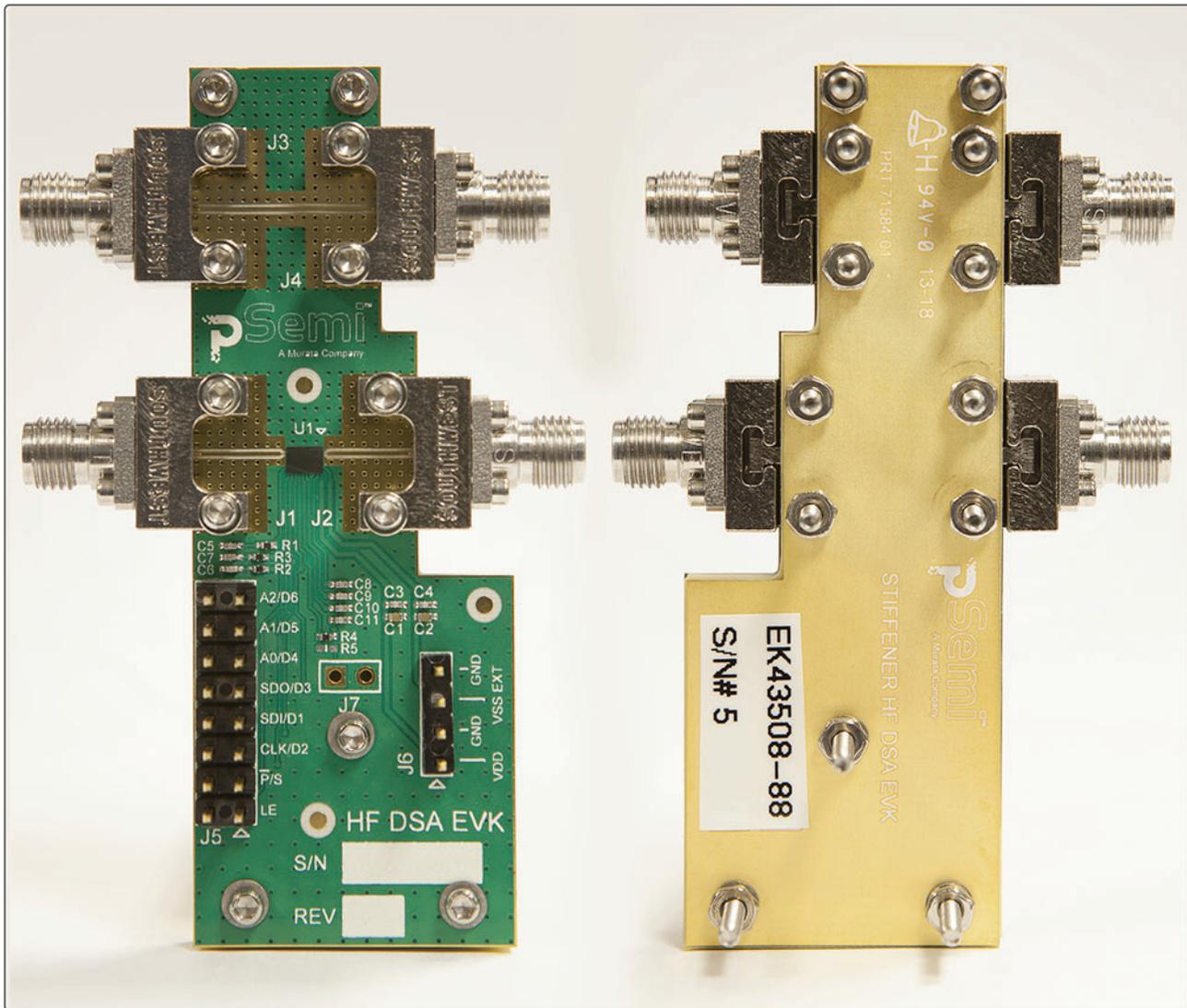
# Evaluation Board Assembly

2

## Evaluation Board Assembly Overview

The evaluation board is assembled with a PE43670 DSA, several headers, and SMA RF connectors.

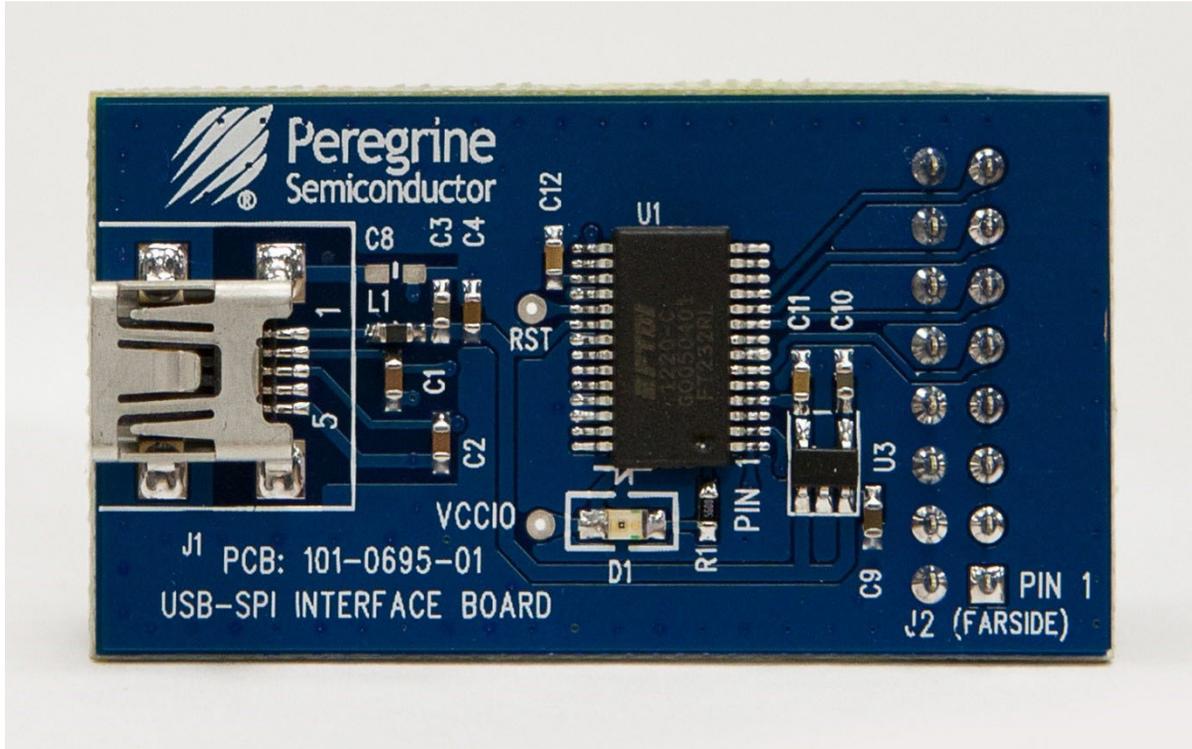
Figure 1 ■ PE43670 Evaluation Board Assembly



## 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 PE43670 device by using Peregrine software running the Windows operating system. To install the driver software, see “Software Installation” on page 5.

Figure 2 ▪ Peregrine USB Interface Board



# Quick Start Guide



## Quick Start Overview

The EVB assembly was designed to ease customer evaluation of the PE43670 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).

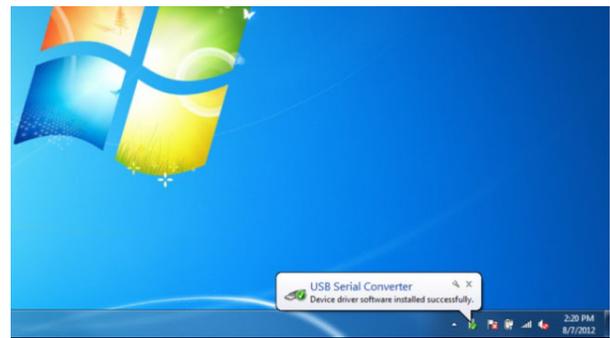
In the case where Windows Update is not available; the USB interface board driver may be downloaded directly from the manufacturer at the following URL:

[www.ftdichip.com/Drivers/D2XX.htm](http://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 PE43670 DSA evaluation board.

Figure 3 ■ USB Driver Installation (Detecting)



### EVK Software

To evaluate the PE43670 EVK performance, the application software must be installed on your computer. The USB interface and PE43670 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 website at the following URL:

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

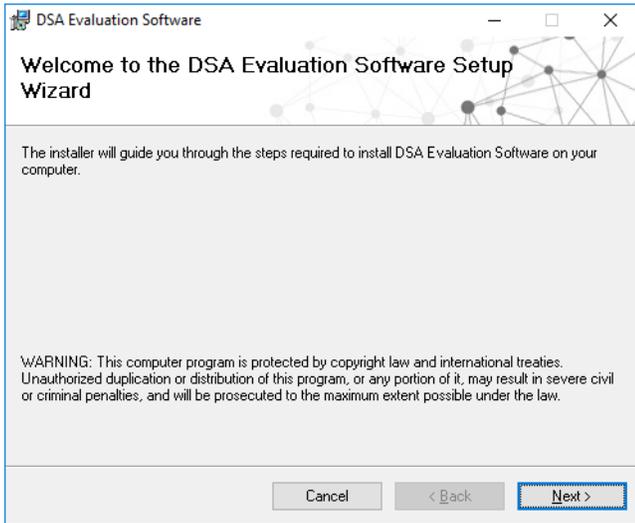
To install the PE43670 DSA Evaluation Software, unzip the archive to a named folder of your choice and execute the installer application “setup.exe” (Figure 4).

Figure 4 ■ DSA Evaluation Software Setup.exe File



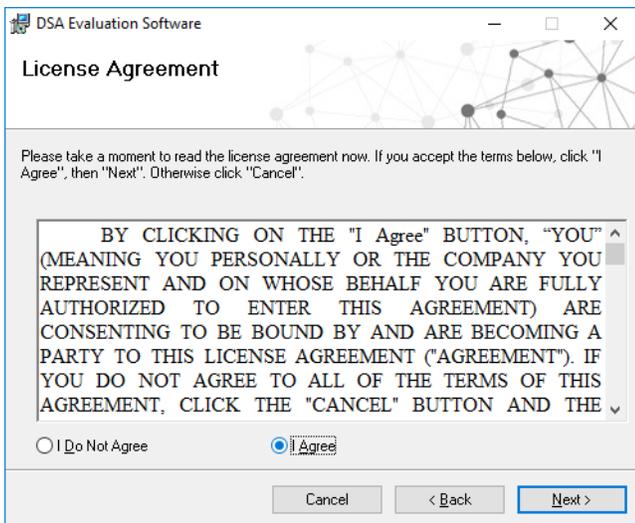
After the setup.exe file has been executed, a welcome screen appears. It is strongly recommended that all programs be closed prior to continuing. Click the “Next” button to proceed (Figure 5).

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

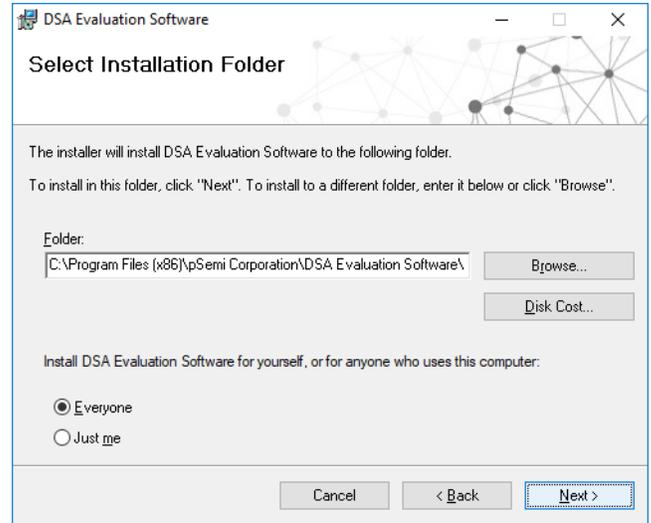
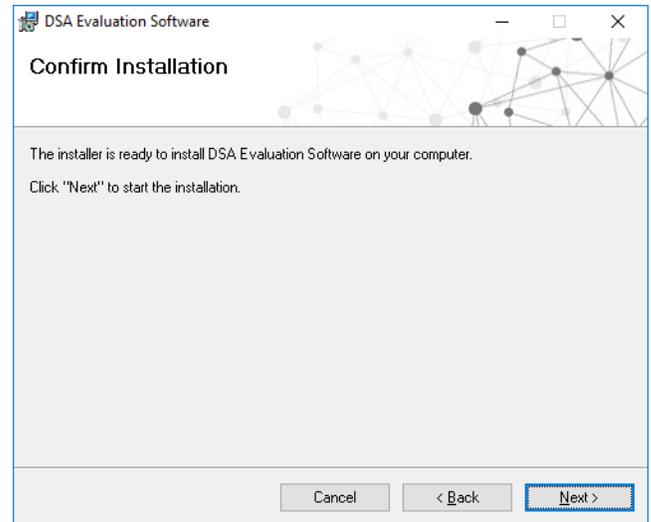
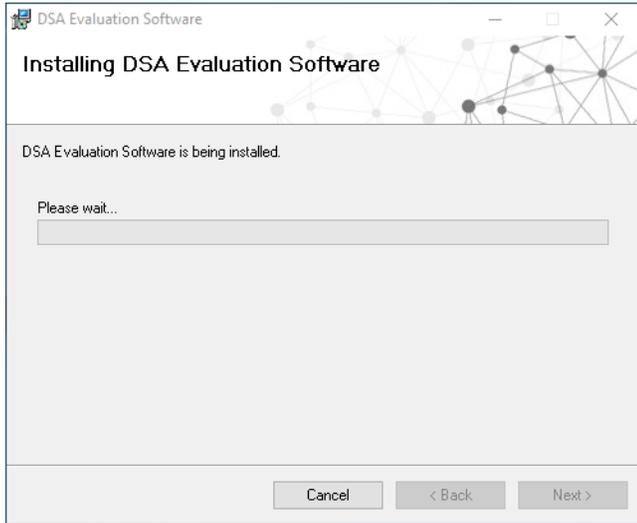


Figure 8 ■ Confirm Installation



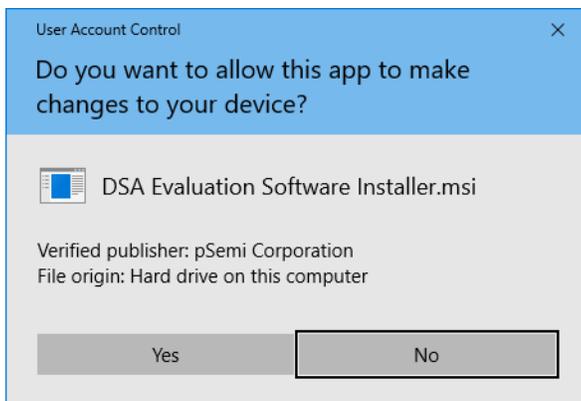
As the software files are installed, an indicator displays the progress. On slower computers, installation of the software may take a few minutes (Figure 9).

**Figure 9 ■ Installation Progress Display**



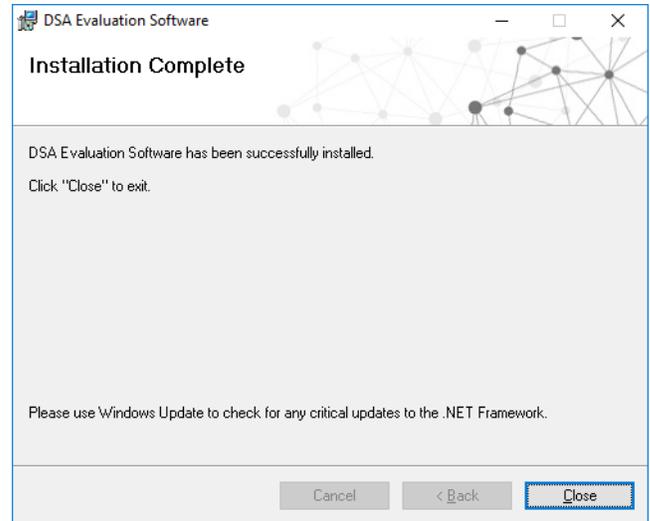
You may be prompted to confirm the installation of the application. Confirm that the “Verified publisher” is “pSemi Corporation” before proceeding (Figure 10).

**Figure 10 ■ User Access Control Confirmation Dialog**



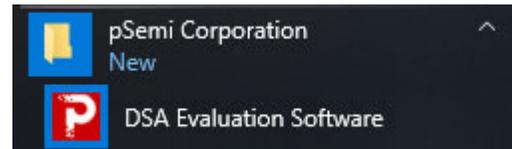
Upon successful installation, a confirmation message is displayed. Click “Close” to exit (Figure 11).

**Figure 11 ■ Installation Complete**



A new folder named “pSemi Corporation” 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**

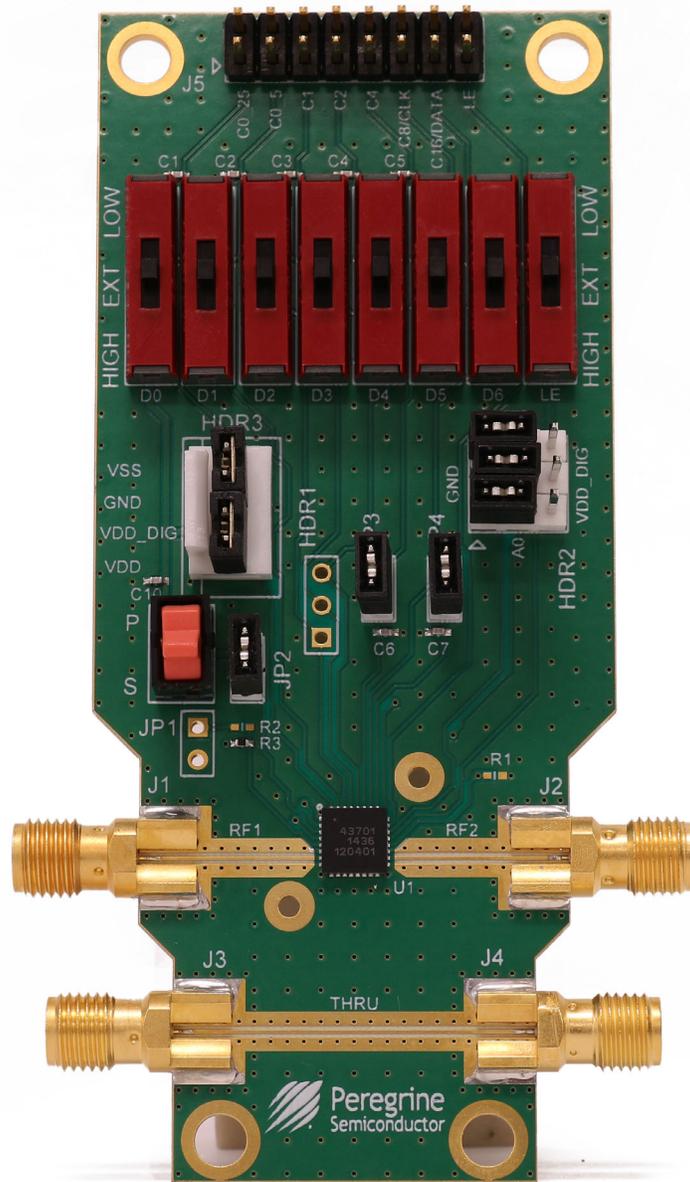


## Evaluation Solution Assembly

### Connection of the USB Interface Board to the Evaluation Board

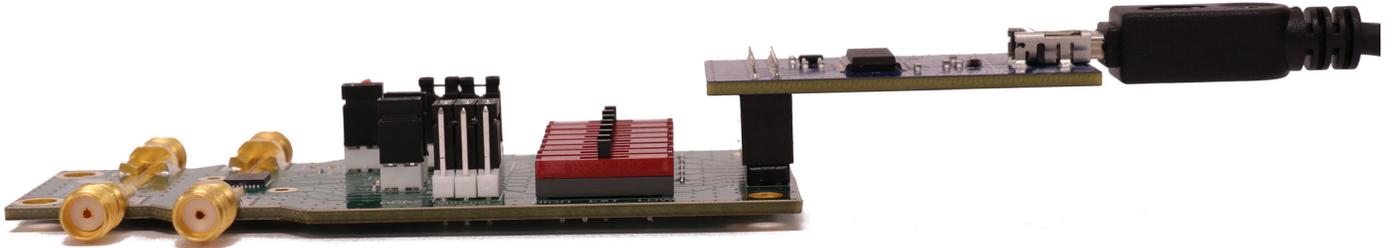
The evaluation board and the USB interface board contain a 16-pin header. This feature allows the USB interface board (socket) to connect directly to the evaluation board (pin) on the front-side as shown in **Figure 13**. Use caution when connecting the USB Interface board to ensure that the two rows of pins are connected without shifting in any direction.

*Figure 13 ■ PE43670 USB Interface Board Connected to the Evaluation Board for Latched Parallel and Serial Programming—Front View*



*Figure 14 ■ PE43670 USB Interface Board Connected to the Evaluation Board for Latched Parallel and Serial Programming—Side View*

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## Hardware Configuration

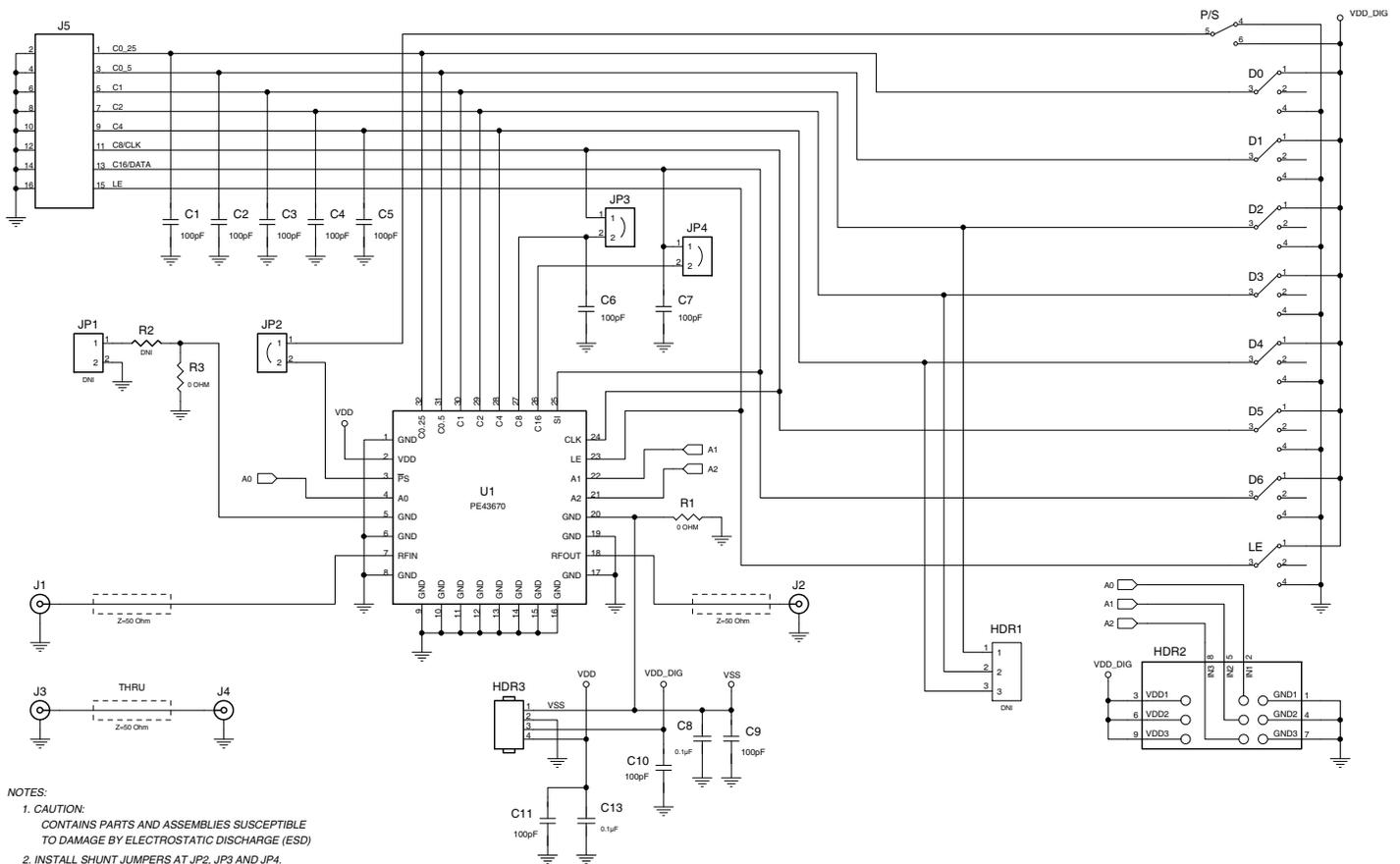
The evaluation board is designed to ease customer evaluation of pSemi's products. The board contains:

- 1) Digital signal connectors that are connected for power supply, digital control signals and USB interface board.
- 2) SMA connectors that are provided 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 ■ PE43670 DSA Evaluation Board Schematic

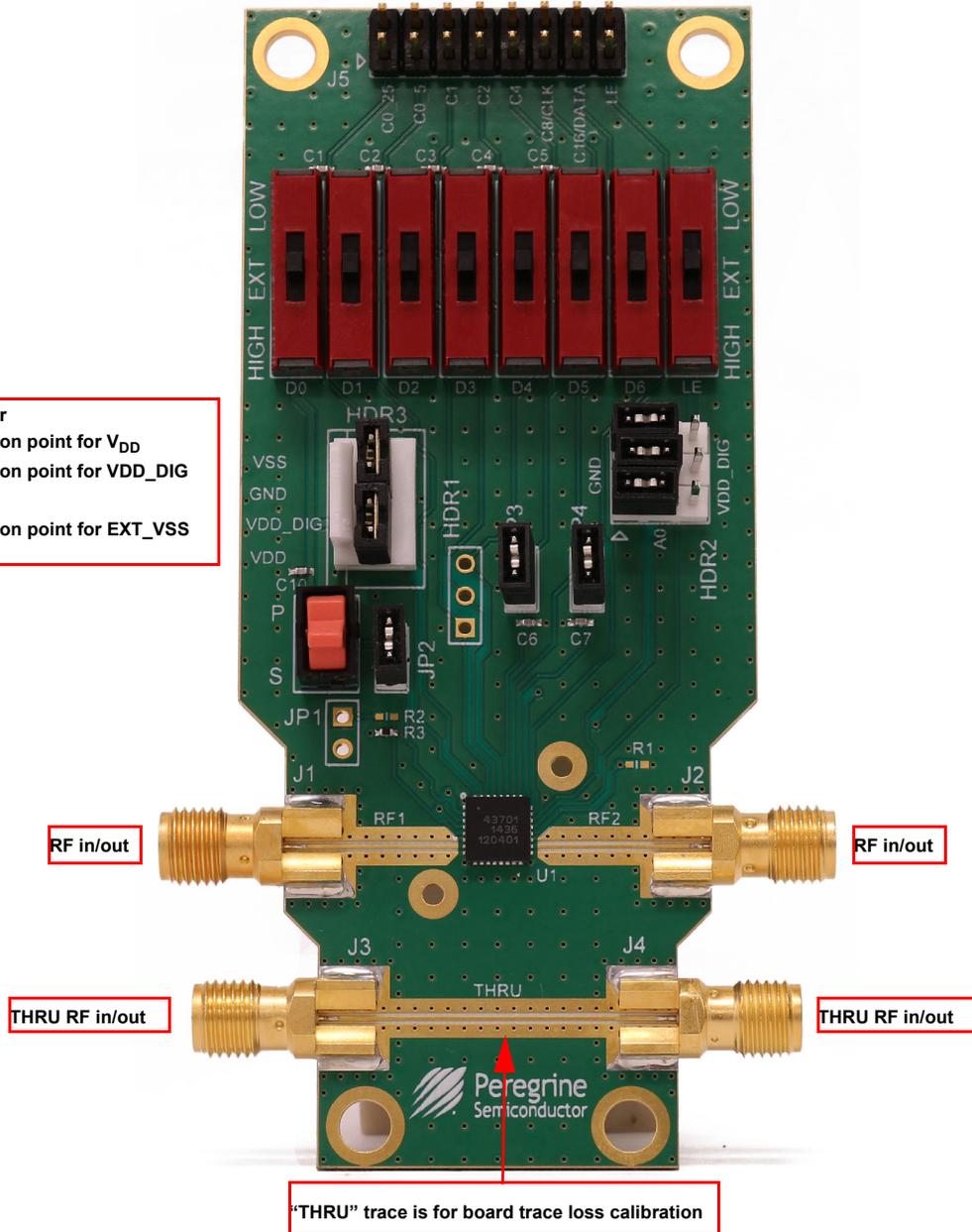


## Functional Overview

### Evaluation Board

Figure 16 illustrates the connections on the RF evaluation board used in evaluating the PE43670 DSA.

Figure 16 ■ PE43670 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 J4 and J5. THRU calibration is sufficient for initial measurements. Use one-half the loss of the measured trace for each port, 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 HDR3 pin 4,  $V_{DD}$  DIG on HDR3 pin 3, GND on HDR3 pin 2 (**Table 2**).

**Table 2** ▪ Recommended Operating Condition for the PE43670

Parameter	Min	Typ	Max	Unit
Positive supply voltage, $V_{DD}$	3.0	3.3	5.5	V
Positive supply current, $I_{DD}$		70	200	$\mu$ A
Digital input high <sup>(1)</sup>	2.6		3.60	V
Digital input low	0		1	V
Digital input leakage current			15	$\mu$ A

**Notes:**

- 1) This voltage is named VDD DIG on EVKHDR3 pin 3 and is used to manually set a logic "1" when using D0–D6 and LE to force the logic levels.

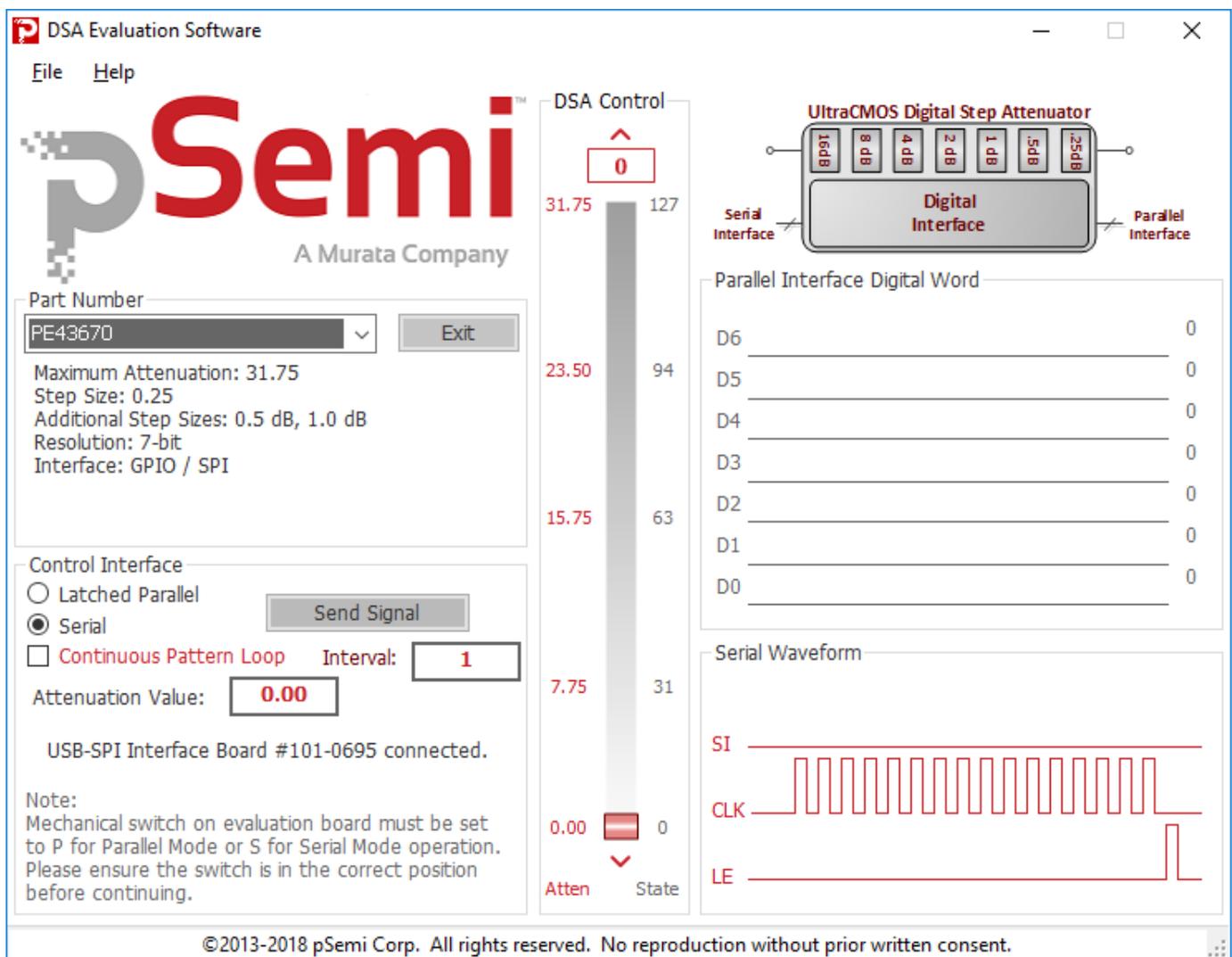
## Graphical User Interface

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 pSemi 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 • PE43670 DSA Evaluation Software Graphical User Interface



## Graphical User Interface Controls

### Part Number Selection

The drop down control (**Figure 18**) allows the user to select the type of attenuator to control. To evaluate the PE43670, ensure PE43670 is selected. The device information section is updated when the selected device is changed.

*Figure 18 ■ Graphical User Interface Part Number Selection*

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A screenshot of a graphical user interface element. It features a label 'Part Number' in blue text above a dark grey dropdown menu. The menu is currently open, showing the text 'PE43670' in white on a dark background. A small white downward-pointing arrow is visible on the right side of the menu box.

### Device Information

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

*Figure 19 ■ Graphical User Interface Device Information*

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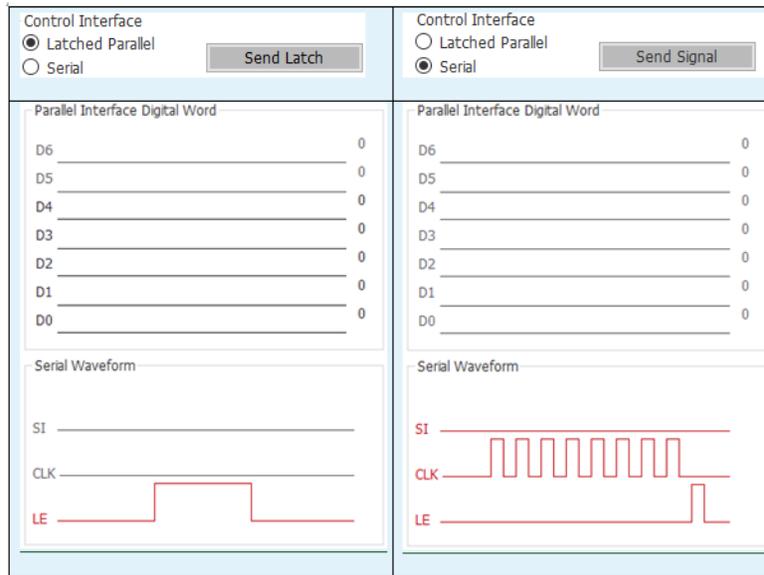
Maximum Attenuation: 31.75  
Step Size: 0.25  
Additional Step Sizes: 0.5 dB, 1.0 dB  
Resolution: 7-bit  
Interface: GPIO / SPI

### 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.

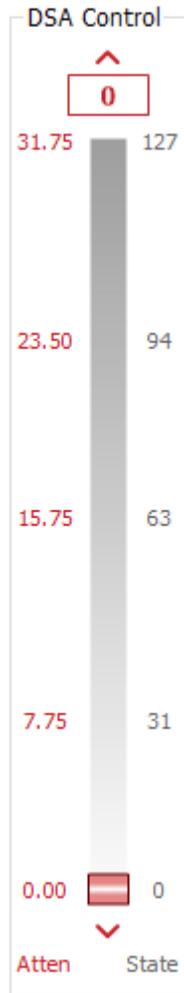
**Figure 22** ▪ Attenuation Value



### 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



### 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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