Evaluation Board for Zero-Drift, Digitally Programmable Sensor Signal Amplifier

AD8555AR-EVAL

FEATURES

Single- or dual-supply operation
AC and DC signal evaluation
Built-in, 100 Ω bridge with unbalancing capability
Provision to create low-pass filter
Readback feature of programmed values
External clamp voltage setting
Interface for PC parallel port
Microsoft® Windows®-compatible software
SOIC socket for easy part replacement

GENERAL DESCRIPTION

This document describes the evaluation board hardware and software used to evaluate the AD8555 and its derivatives in a SOIC package. The evaluation board allows the speedy demonstration and evaluation of the AD8555 zero-drift, digitally programmable sensor signal amplifier.

The AD8555 is an auto-zero instrumentation amplifier with programmable gain and output offset adjustment features. The evaluation board enables a personal computer (PC) to communicate with the AD8555. Users can send commands to the evaluation board and read back the programmed values for the device that is being evaluated.

The information in this document is meant to supplement the information in the AD8555 data sheet. To evaluate the device thoroughly, users are encouraged to read this document and the AD8555 data sheet.

FUNCTIONAL BLOCK DIAGRAM

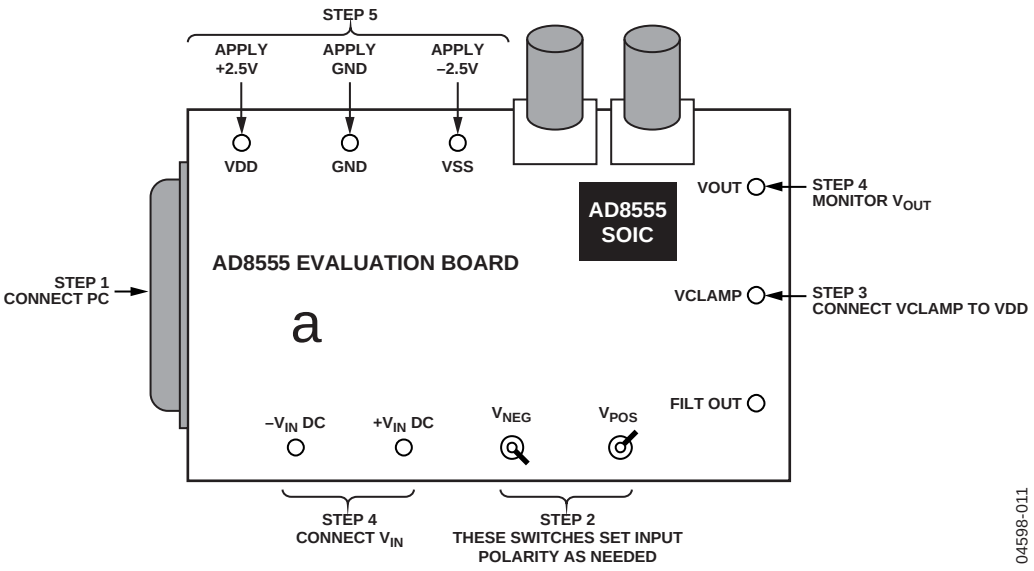

Figure 1.

Rev. A

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REVISION HISTORY

12/05—Rev. 0 to Rev. A
Changes to Figure 14 12

4/05—Revision 0: Initial Version

HARDWARE DESCRIPTION

The AD8555 evaluation board is designed for maximum configuration flexibility. An ac signal can be applied to $+V_{IN}$ ac, and the output can be monitored from V_{OUT} ac. DC signals can be differentially applied between $+V_{IN}$ dc and $-V_{IN}$ dc, and the results can be monitored using a voltmeter at V_{OUT}. Users can view the filter output signal at the FILT/DIGOUT pin. The board also allows swapping of the polarity of the inputs using switches V_{NEG} P1 and V_{POS} P1.

Four resistors (R1A, R1B, R2A, R2B) simulate a 100 Ω bridge configuration. The bridge can be unbalanced using the provided trim potentiometers (P1 and P2). The top and bottom of the bridge are connected to VDD and VSS, respectively.

Pulse shaping is performed on this board before applying the data to the AD8555 data input pin. The pulse widths are set for 5 µs, representing the low level (0 V); and 80 µs, representing the high level (>2.4 V). This adjustment is made using Resistor RT0 and Resistor RT1. The trim potentiometers are glued to their fixed positions.

Supply current can be monitored by using a resistor in place of R7. Clamp voltage can be applied externally to a level or can be set easily to V_{DD} by placing a jumper from VCLAMP to VDD. The SOIC socket is soldered for easy programming and removal of the part. Pin 1 is the pin located in the upper left-hand corner of the socket close to R7. Please make sure that the part is placed in the socket properly. See Figure 14 for the evaluation board schematic.

SYSTEM REQUIREMENTS

The evaluation kit has the following system requirements:

- PC with Pentium® 90 or greater and bidirectional printer port
- Microsoft® Windows® operating system
- Standard Centronics® printer cable

COMMUNICATING WITH THE EVALUATION BOARD

The evaluation board has a high speed interface that uses the PC's printer port. Because the port is used for both sending and receiving data, it must have bidirectional capability.

HARDWARE REQUIREMENTS

- Power supplies
- Voltage source
- Voltmeter
- BNCs and power cables
- PC and parallel cable

ADJUSTING FOR 0 V DIFFERENTIAL INPUT

Prior to initial hardware setup and output verification, complete the following to adjust for differential input offset:

1. Connect +input (high) of a voltmeter to $-V_{IN}$ dc.
2. Connect −input (low) of the voltmeter to GND of the power supply.
3. Monitor the output (V_{OUT} dc) voltmeter.
4. Adjust trim Potentiometer P1 to get close to 0 V (−0.1 mV).
5. Connect +input (high) of a voltmeter to $+V_{IN}$ dc.
6. Connect −input (low) of the voltmeter to GND of the power supply.
7. Monitor the output (V_{OUT} dc) voltmeter.
8. Adjust trim Potentiometer P2 to get close to 0 V (0.1 mV).

QUICK INITIAL HARDWARE SETUP AND OUTPUT VERIFICATION

For an initial hardware setup and output verification, follow these steps:

1. Connect the AD8555 evaluation board to the parallel port of your PC system using a standard 25-pin (male-to-female) printer cable.
2. Position manual switches to V_{POS} P2 and V_{NEG} P1.
3. Jumper the VCLAMP connector pin to the VDD connector pin.
4. Apply 1 mV dc signal between the +VIN dc and −VIN dc connectors, and monitor the VOUT dc output using a voltmeter.
5. Place an AD8555 part in the SOIC socket, connect the VCLAMP pin to the VDD pin, and apply dc power to the board using an external power supply (±2.5 V).

When you complete this procedure, the output should be 70 mV, with the board in this configuration consuming roughly 4 mA.

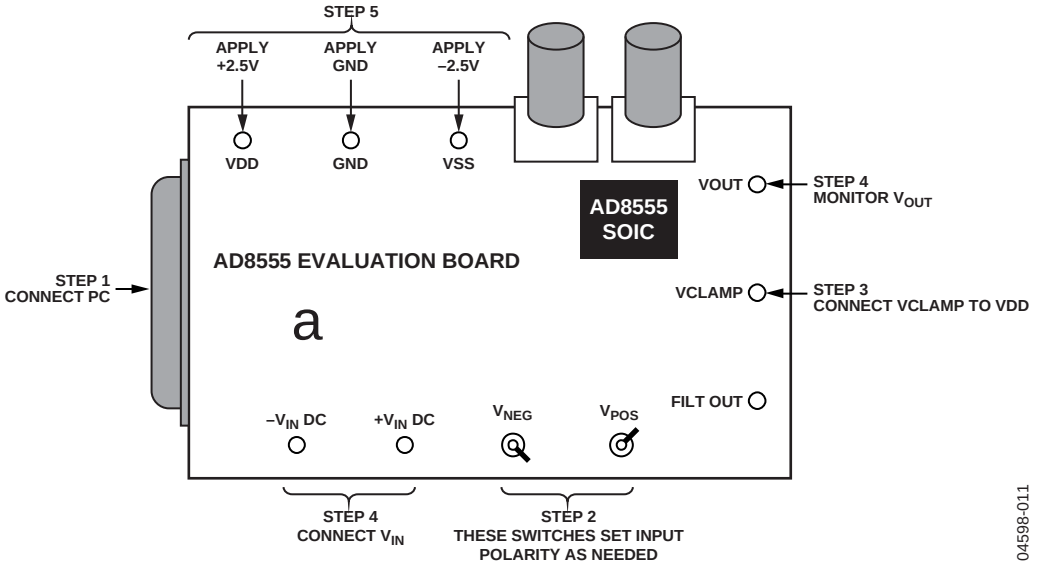

Figure 2.

SOFTWARE

INSTALLATION

To install the evaluation software on the PC

1. Insert the CD-ROM into the CD drive on your computer. After a few moments, a message for the installation appears.
2. Double-click **AD8555_setup.exe**.
3. Follow the instructions until the software installation is complete.

The AD8555 evaluation software was developed in the Microsoft Visual Studio® .NET environment. This environment requires installation of dotnetfx.exe, which takes several minutes and needs 38 MB of hard disk drive memory.

The software installation places the executable program in the user-selected directory and copies the parallel port drivers to the system directory. If the data sheet box is checked, the latest copy of the data sheet is copied into the directory specified by the user. A handshake icon is placed on the desktop symbolizing the start of a new partnership. Under default conditions, the program is installed in the following directory:

C:\Program Files\Analog Devices\AD8555

For future reference or for the most current data sheet, visit www.analog.com/AD8555.

REMOVING THE EVALUATION SOFTWARE

To remove the AD8555 evaluation software modules

1. Click **Start > Settings > Control Panel**.
2. Double-click **Add/Remove Programs** and select **Microsoft .Net Framework**.

The components that dotnetfx.exe and the AD8555 program placed on your system are removed.

RUNNING THE SOFTWARE

To run the AD8555 software application

1. Double-click the **AD8555** icon. The program starts in no programming mode.
2. Set the appropriate gain and offset values and click **Simulate.**
3. Program the gain between 70 and 1280 and the offset between 0 V and 5 V. This is done by selecting the right mode and sending the appropriate digital codes.
4. Click **Run**.

The output is input × gain and responds to the specified configuration.

SOFTWARE MODES

The evaluation software can be run in the following four modes for different levels of expertise:

- No programming
- Easy programming
- Bit pushing
- All

To select a mode, click the corresponding button in the **Starting Window** at the bottom of the AD8555 software dialog box. Based on the mode selected, a portion of the AD8555 software dialog box appears.

Click **All** to display the entire dialog box and activate all functions.

No Programming Mode

1. To select no programming mode, click **No Programming** in the **Starting Window** at the bottom of the AD8555 software dialog box. The dialog box shown in Figure 3 appears.
2. Type the desired gain or offset in the appropriate box and press **ENTER**.
3. Click **Run** to configure the pattern for this gain or offset.

The program picks the best gain combination for first and second stage gains and configures the part accordingly. The best gain combination might not give an exact gain, but it is the best and closest possible due to the limited number of gain settings available for the first and second stages.

You can specify output offset adjustment as either a percentage of the power supplies or a fixed value. Click **Run** to place the part in simulation mode. Fuses are not blown permanently.

The **Free** check box is for demonstration purposes and does not have any significance during evaluation. Select the **Free** check box and click **Run** if you want to step through the second stage gain. The demonstration stops at the last gain.

In no programming mode, do not use the buttons at the bottom of the **No Programming** box. These buttons are used in other modes of the software as described in the Bit Pushing Mode and Easy Programming Mode sections. Select only the desired gain and offset, and then click **Run**.

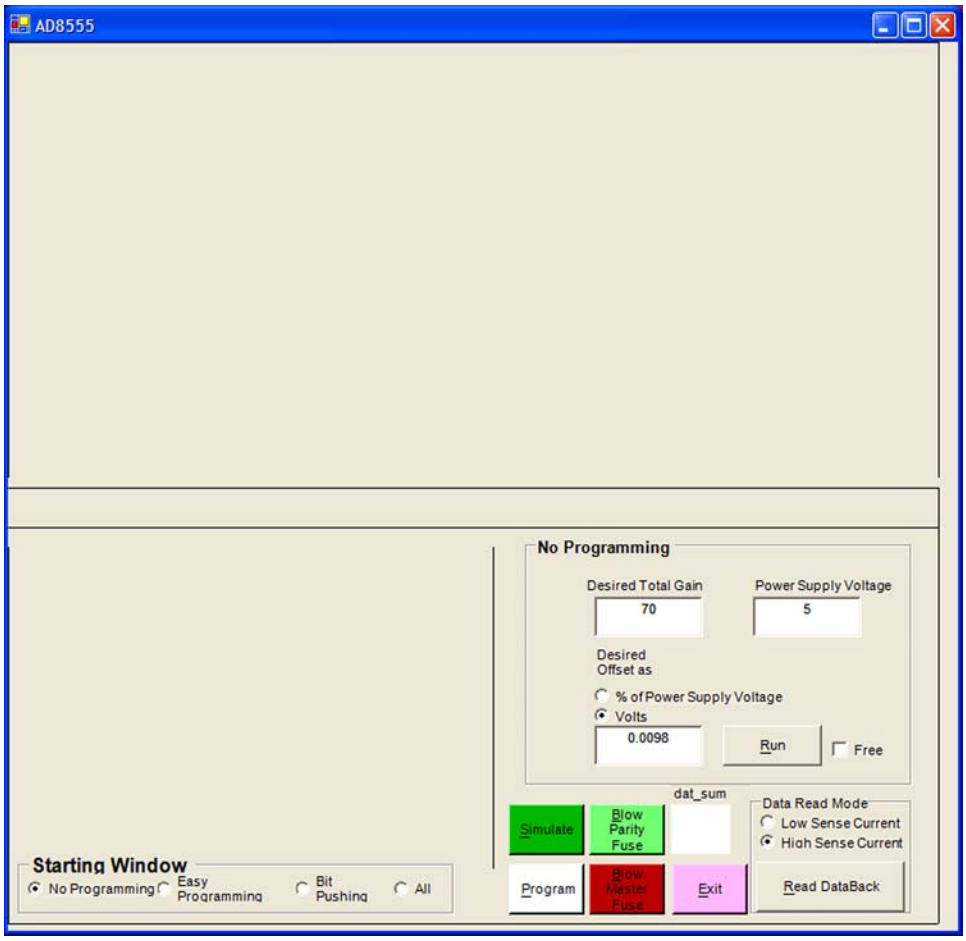

Figure 3. No Programming Dialog Box

Easy Programming Mode

This mode is for users who are familiar with the internal architecture and operation of the part and how it is put together (first stage, second stage, and offset adjust block).

1. To select the easy programming mode, click **Easy Programming** in the **Starting Window** at the bottom of the AD8555 software dialog box. The dialog box shown in Figure 4 appears.
2. Type the gain and offset settings in the appropriate boxes and click **Simulate**. The result of that action can be seen by the change in the output value.

For example, to set the first stage gain to 4.025, type **4.025** in the **Desired First Stage Gain Value** box and click **Simulate**.

To set the second stage gain to 25, type **25** in the **Desired Second Stage Gain Value** box and click **Simulate**.

If, at any time, the entered value falls outside the allowed range, an error message appears. If a value within the range is entered, the closest value and its code appear in the boxes. The first stage gain range is 4 to 6.4, the second stage gain range is 17.5 to 200, and the offset voltage range is −2.5 V to +2.5 V.

The static boxes to the right of the entered values show the appropriate code for the value. The **Field_1 Code** box shows the last action taken. All buttons to the right of this window are active and exercisable. You can simulate, program, or read back the programmed value. When you click the **Read DataBack** button, the **Data ReadBack** box displays the last value of the readback function.

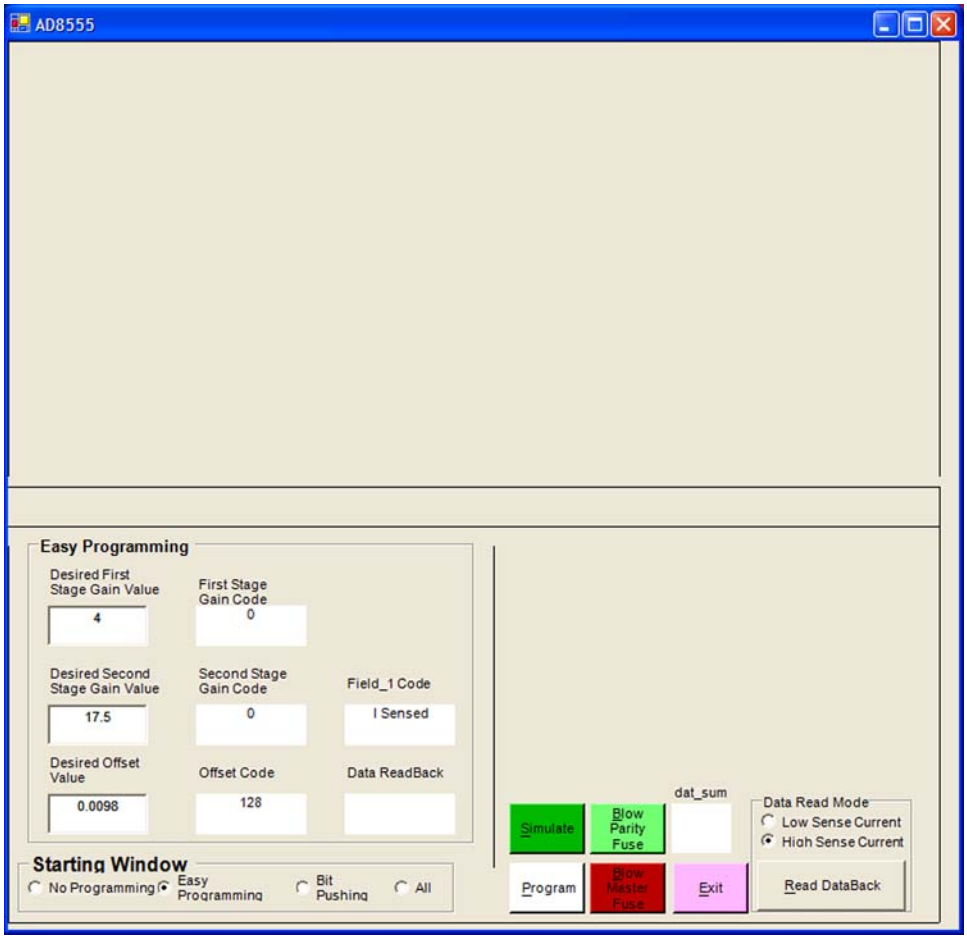

Figure 4. Easy Programming Dialog Box

Bit Pushing Mode

This mode is recommended if you are familiar with how data patterns are structured and want to send an exact bit pattern to the AD8555. Not all fields of this 38-bit pattern are available for programming. For definitions of the fields, see the AD8555 data sheet.

1. To select the bit pushing mode, click **Bit Pushing** in the **Starting Window** at the bottom of the AD8555 software dialog box. The dialog box shown in Figure 5 appears.
2. To generate and program a code, click an option in the **Select Operation** box.
3. Set the pattern in **Field 4**.
4. Click **Simulate**.

Depending on the function, different numbers of bits in Field 4 are active for programming. Selecting the **Offset Adjust** check-box in the **Select Operation** box activates eight bits in Field 4 for the data pattern, selecting **First Gain Stage** activates seven bits, and selecting **Second Gain Stage** activates only three bits.

For example, to offset the output by 2.5 V

1. Click **Offset Adjust**.
2. Set the bit pattern in **Field 4** to **10000000**.
3. Click **Simulate**.

The static boxes below the bit pattern display the code and value of the bit pattern.

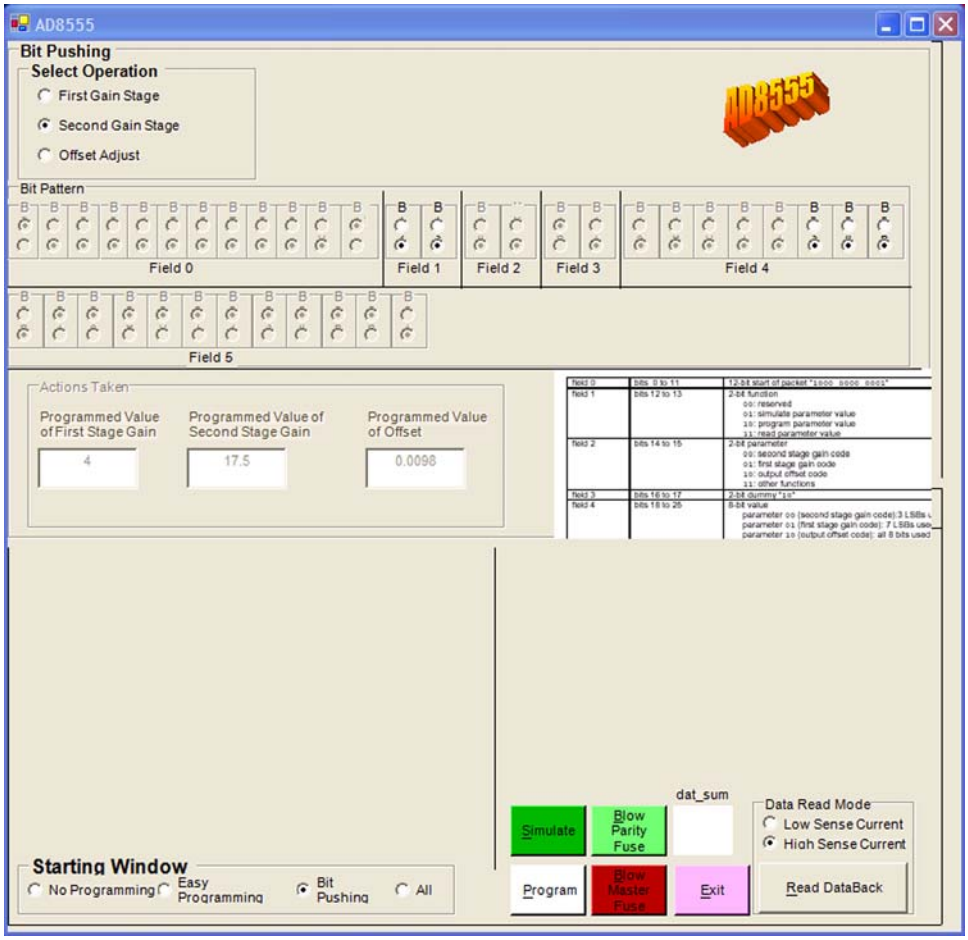

Figure 5. Bit Pushing Mode

All Modes

To display all programming windows, click **All** in the **Starting Window** at the bottom of the AD8555 software dialog box. The dialog box shown in Figure 6 appears. In this mode, you can enter data into any of the fields and obtain appropriate results based on the selected function. All buttons are active. For descriptions of the button functions, see Table 1.

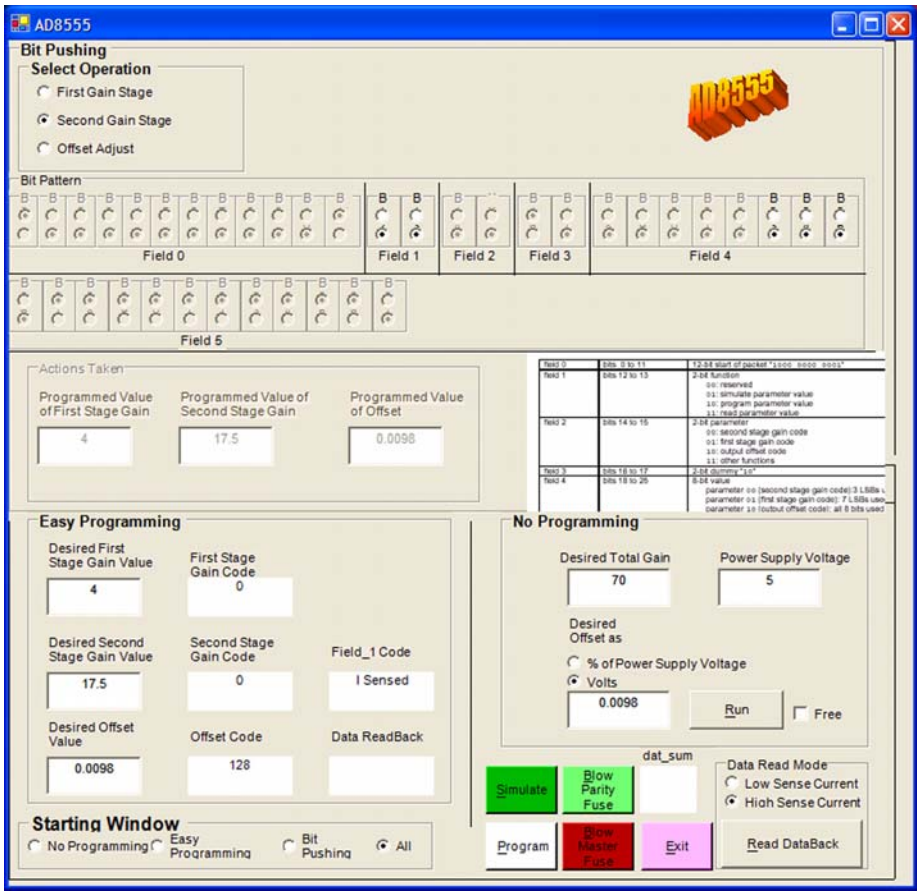

Figure 6. AD8555 Dialog Box with All Modes Displayed

Table 1. AD8555 Dialog Box Button Functions

Button	Function
Simulate	Configures the part according to the specified pattern. This button does not blow any fuses.
Program	Blows fuses according to the specified pattern. Blown fuses cannot be reprogrammed.
Blow Parity Fuse	Blows the parity fuse. The parity fuse keeps track of the state of the blown fuses. If, for any reason, the state of this fuse is changed either intentionally or unintentionally, the parity flag is set and the alarm is set.
Blow Master Fuse	Permanently sets the part to the programmed gain and offset and prevents future programming. Click this button only after selecting and programming the gain and the offset. Prior to blowing the master fuse, make sure that, if prompted, you first blow the parity fuse.
dat_sum	Keeps track of the fuses blown. Depending on the value in this static field, you can either blow the master fuse or, if prompted, you can blow the parity fuse first and then blow the master fuse.
Exit	Closes the AD8555 software evaluation program.
Read DataBack	Reads back the state of the programmed fuses after they have been blown. The options are:
	Low Sense Current option, when dropped across a blown fuse (high impedance), creates a voltage that can trigger an internal comparator and provide the right level in the output.
	High Sense Current option reads back the fuse states to make sure that the fuses are blown. A code for blown fuses appears in a pop-up box.

Refer to the AD8555 data sheet for more information on its theory of operation, simulation/programming/read modes, and parity error detection. The AD8555 data sheet also contains more information on programming procedures for the part.

TYPICAL AC SETUP AND RESPONSE

AC Input Example

Setup requirements are as follows:

- Power supplies
- Function generator
- Scope
- BNCs and cables
- PC and parallel cable

Results

When the part is powered with ±2.5 V, and 50 mV of input is applied, the default conditions are

V_{CC} = 2.5 V
V_{SS} = −2.5 V
Gain 1 = 4
Gain 2 = 17.5
Offset = V_{SS}

The overall gain is 70.

When you place the switches in V_{NEG} P1 and V_{POS} P2, there is one set of outputs. When you change to V_{NEG} P2 and V_{POS} P1, you get the exact voltage, but with the opposite polarity.

When both switches are on one side (for example, V_{NEG} P1 and V_{POS} P1), the inputs are shorted together.

RT0 and RT1 are the trim potentiometers used for pulse width shaping. Do not change their settings. RT0 is adjusted to create a 5 µs pulse; RT1 is adjusted to create an 80 µs pulse. Figure 7 shows the output on Channel 2 under these conditions and configuration.

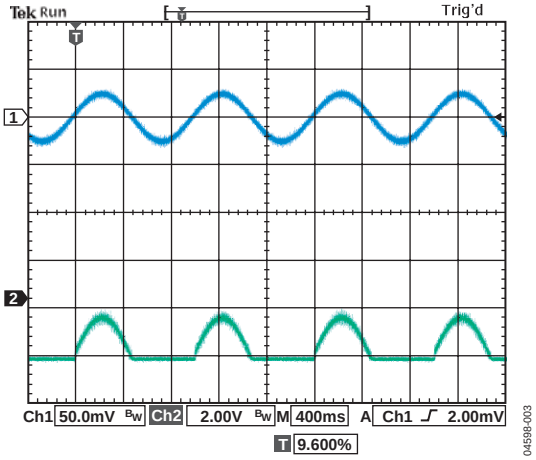

Figure 7.

Figure 8 shows the results of the previous conditions with V_{OFF} = 2.5 V or Code 128.

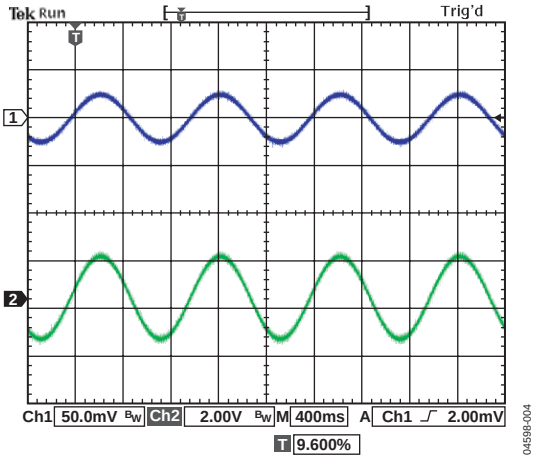

Figure 8.

In Figure 9, overall gain = 100 (G1 = default = 4, G2 = Code 1 = 25, offset = 2.5 V or Code 128).

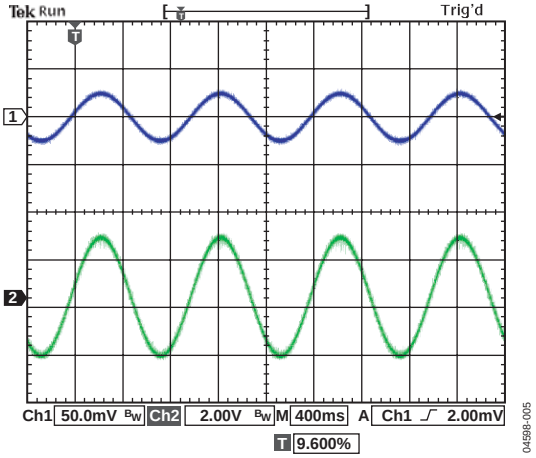

Figure 9.

In Figure 10, V_{IN} = 2 mV p-p and G1 = 6.4, G2 = 35, offset = 2.5 V or Code 128.

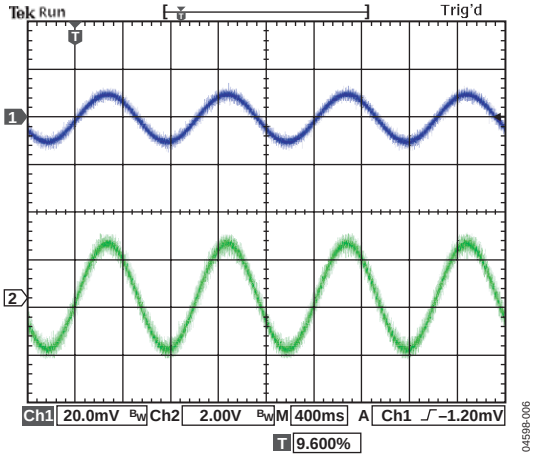

Figure 10.

OUTPUT CLAMP FEATURE

The output of the part can be clamped to the desired level. The output clamp feature is provided to protect the circuitry that follows the AD8555, in case the input to AD8555 is accidentally larger than anticipated.

In normal situations ($V_{SUPPLIES}$ = ±2.5 V, Gain = 70, V_{OFFSET} = 2.5 V, Input = 40 mV p-p), the response to an input is as shown in Figure 11.

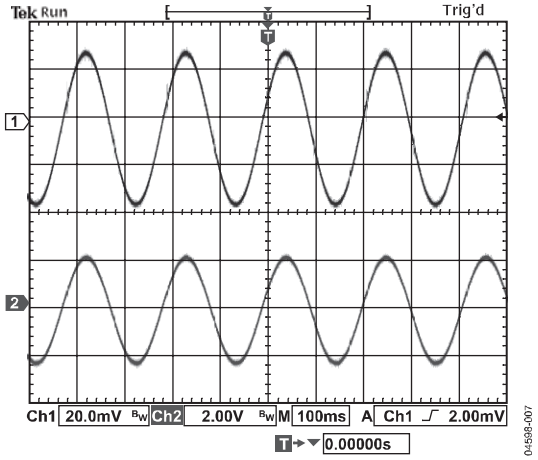

Figure 11. Normal Response

Figure 12 shows the output after V_{CLAMP} is set to 0.8 V.

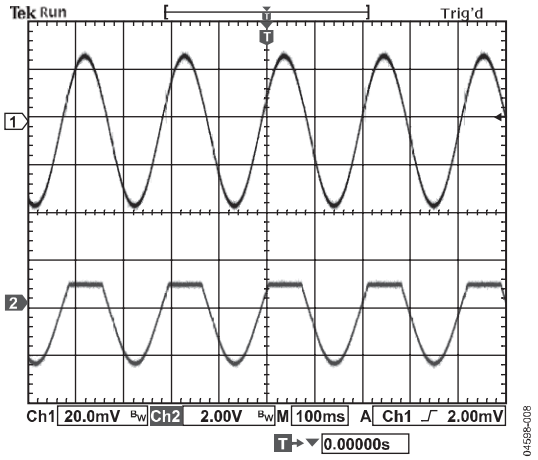

Figure 12. Response with V_{CLAMP} Set

Applying a large gain to an input yields saturation, as shown in Figure 13. The conditions are V_{IN} = 20 mV p-p, G1 = 6.4, G2 = 200, Offset = 2.5 V.

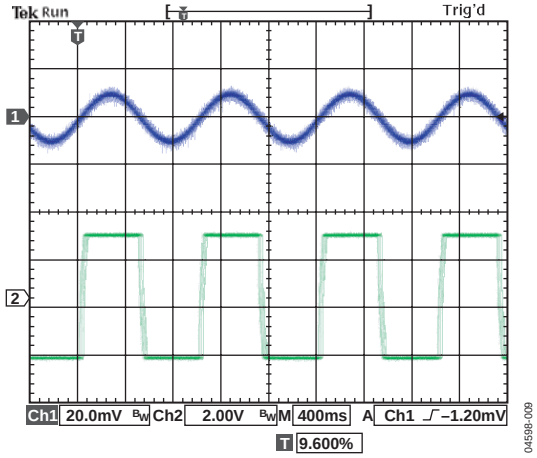

Figure 13. Results with Saturation

Note that Resistor RT1 and Resistor RT2 are used for pulse stretching; do not adjust them. They are factory-adjusted for optimal results.

EVALUATION BOARD SCHEMATIC

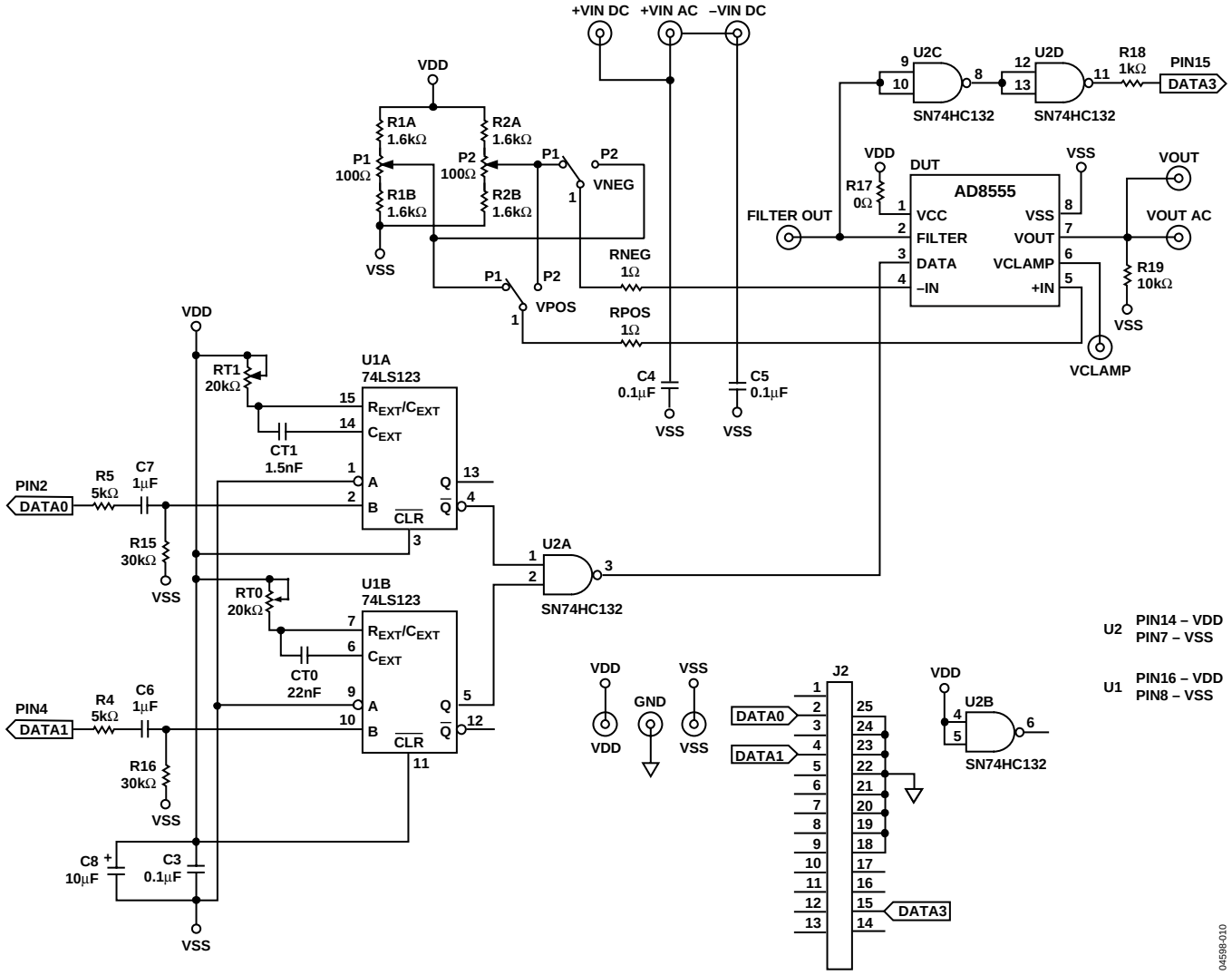

Figure 14. Evaluation Board Schematic

ORDERING GUIDE

Model	Description
AD8555AR-EVAL	Evaluation Board