

FEATURES

- COMPLETE EVALUATION MODULE FOR THE PGA2310 STEREO AUDIO VOLUME CONTROL
- RCA JACKS FOR ANALOG INPUTS AND OUTPUTS
- DB-25 CONNECTOR FOR INTERFACING WITH A PC PARALLEL (PRINTER) PORT

- 14-PIN HEADERS FOR DATA INPUT AND OUTPUT
- INCLUDES SOFTWARE AND PARALLEL PORT CABLE FOR USE WITH COMPUTERS RUNNING MICROSOFT WINDOWS® 95/98

Windows is a registered trademark of Microsoft.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

HARDWARE SETUP

This section provides an overview of the evaluation module hardware for setup purposes. Complete schematics at the end of the data sheet are provided.

POWER SUPPLIES

The PGA2310-EVM includes a power-supply connector, labeled PS on the circuit board. Four locking terminals are provided for the analog power supplies (VA+ and VA-), a digital power supply (VD+), and a common ground (GND). There are two configuration modes for the power supplies: Three-Supply operation and Two-Supply operation.

In the case of Three-Supply operation, jumper J₁ is installed, while jumper J₂ is open circuit. Separate supplies are required for VD+, VA+, and VA-. The supplies share a common ground connection at the GND terminal. Table I shows the supply configuration details.

Supply Designator	Typical Supply Voltage	Supply Voltage Range
VD+	+5V	+4.5V to +5.5V
VA+	+15V	+4.5V to +16V
VA-	-15V	-4.5V to -16V

NOTE: Install jumper at J₁. Remove jumper from J₂ (open circuit).

TABLE I. Requirements for Three-Supply Operation.

In the case of Two-Supply operation, jumpers J₁ and J₂ are installed. The J₂ jumper connects the VA+ terminal to the VD+ terminal, with VA+ providing both the positive analog and digital supplies. Separate supplies are required for VA+ and VA-. The supplies share a common ground connection at the GND terminal. Table II shows the supply configuration details.

Supply Designator	Typical Supply Voltage	Supply Voltage Range
VA+	+5V	+4.5V to +5.5V
VA-	-5V	-4.5V to -5.5V

NOTE: Install jumpers at J₁ and J₂.

TABLE II. Requirements for Two-Supply Operation.

PC PARALLEL PORT INTERFACE

The evaluation module includes a DB-25 connector, labeled LPT, which is used to interface the PGA2310-EVM with a PC parallel (or printer) port. The parallel port is used by the evaluation module software to communicate with the PGA2310's serial interface. An interface cable is supplied as part of the evaluation module package.

DATA IN AND DATA OUT HEADERS

Two 14-pin headers are included on the evaluation module. They are labeled DATA IN and DATA OUT. The DATA IN header provides an alternative connection for host communications with the PGA2310's serial interface. It also provides a means for interfacing to another PGA2310-EVM when using a daisy-chain configuration.

The DATA OUT header is used to connect to the DATA IN header of another PGA2310-EVM when using a daisy-chain configuration. Daisy-chain operation is discussed in more detail under "Dual DUT (or Daisy-Chain) Operation".

ANALOG INPUT AND OUTPUT CONNECTORS

The evaluation module includes RCA jacks for connection to waveform generators, signal analyzers, and commercial audio equipment. The input jacks are labeled AINL and AINR, while the output jacks are labeled AOUTL and AOUTR. The 'L' and 'R' at the end of the reference designators refer to the left and right audio channels, respectively.

The analog inputs and outputs are unbalanced (referenced to ground). The analog input or output swing must not exceed 27Vp-p with ±15V analog power supplies, or 7Vp-p with ±5V analog supplies.

REGISTER LOOPBACK JUMPER

The evaluation module contains a loop-back jumper, labeled SDO R. The purpose of this jumper is to allow read back of the previously programmed gain register values for one or more devices. This is helpful when diagnosing problems with the PC parallel port or host controller communications.

The serial interface is basically a 16-bit serial in, serial out shift register. The SDI pin is the input, while SDO is the output. As 16-bits of new data is shifted into the PGA2310, the previously programmed 16-bits are being shifted out. This allows the user to read back the values to determine if the device is being programmed correctly. It also allows multiple PGA2310 devices to be cascaded, or daisy-chained, to form a 16 x N-bit long shift register, where N is the number of devices included in the chain. This arrangement allows a 3-wire interface to program multiple PGA2310 devices connected in a daisy-chain fashion. Daisy-chain operation is discussed in more detail in "Dual DUT (or Daisy-Chain) Operation".

SOFTWARE INSTALLATION

SYSTEM REQUIREMENTS

The supplied software will run on personal computers designed for use with Windows 95[®] and 98.

A CD-ROM drive is required for installation of program files and access to support documents. Approximately 4MB of hard disk space is required for installation.

INSTALLATION PROCEDURE

The following procedure assumes familiarity with navigating the Windows desktop to find folders and files located on mounted volumes. Should you need assistance with this, please consult the Windows Help system.

Step 1: Insert the accompanying CD into your CD-ROM drive.

Step 2: Locate the PGA2310-EVM folder on the CD, using either My Computer or Windows Explorer.

Step 3: Double-click the PGA2310-EVM folder icon, and then locate the Package folder. Double-click on the Package folder icon to open the folder. Locate the file named Setup.exe. Double-click the Setup.exe icon to start the installation process. Follow the on-screen instructions to complete the installation procedure.

STARTING UP THE SOFTWARE: THE MAIN PANEL

The setup program installs a Texas Instruments folder in the Programs folder of the Start menu. Within the Texas Instruments folder is the PGA2310-EVM program. Selecting this program will startup the applications software.

Once the program is started, the Main panel will be displayed, as shown in Figure 1. The Main panel allows the user to select the parallel (or printer) port address, and either Single or Dual DUT operation. The 'Reset All' button will revert all settings to their startup defaults. Pressing the 'DUT1 Panel' button will open a panel containing the PGA2310 control objects, as shown in Figure 2.

DETERMINING AND SETTING THE PRINTER PORT ADDRESS

The parallel port address for your PC can be found by going to the Start menu and selecting the Control Panel item in the Settings menu. When the Control Panels window opens, find the System icon and double click it. From the System window, select the Device Manager tab by clicking on it once. Scroll down the list of devices until you see the Ports entry. Double click on the Ports entry to list the PC ports. One of the

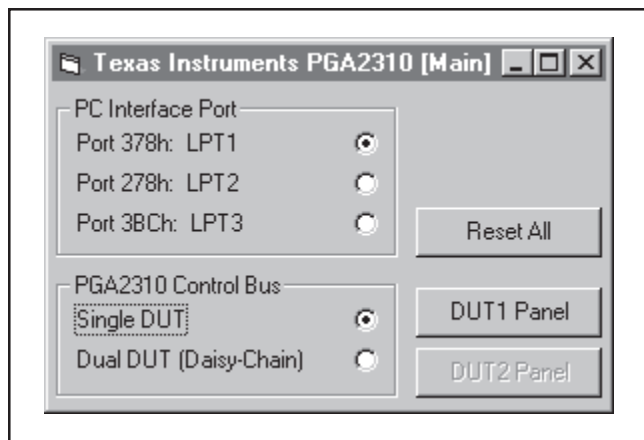


FIGURE 1. The Main Panel.

ports should be a Printer Port. Double click on the Printer Port entry to open the Printer Port window. From the Printer Port window, select the Resources tab by clicking on it once. The Input/Output Range is displayed (ex/ 0378 –037F). Write down the starting number in the range (ex/ 0378), and go to the Main panel of the evaluation module program and select the port address that matches this number.

SINGLE OR DUAL DUT?

Most users will select Single DUT, since they will have only one evaluation module. This will enable the DUT1 control panel, as shown in Figure 2. If you have two demo boards and are connecting them in a daisy-chain fashion, select Dual DUT (Daisy-Chain). "Dual DUT (or Daisy-Chain) Operation", provides more details regarding daisy-chain operation.

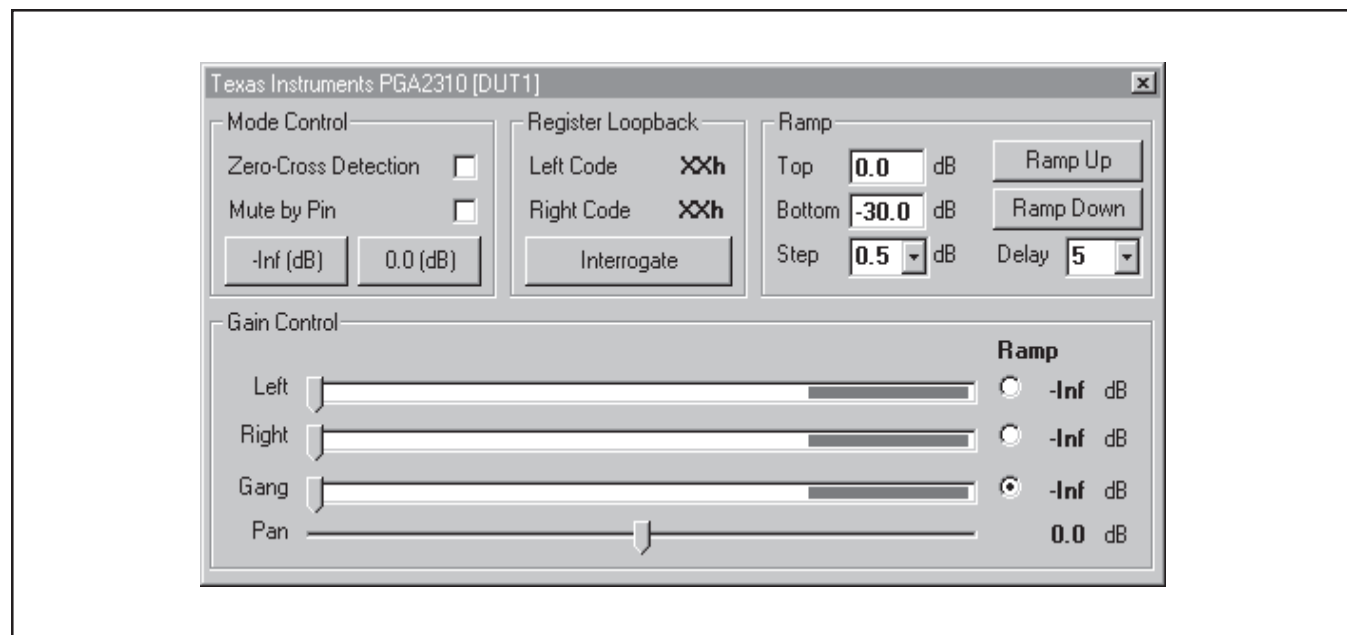


FIGURE 2. The DUT1 Panel.

PROGRAMMING THE PGA2310

THE DUT PANEL

All controls for the PGA2310 are contained within the DUT panel (see Figure 2). This section describes the functions contained within this panel.

GAIN CONTROLS

The Gain Controls occupy the bottom half of the DUT panel. There are three gain sliders for the PGA2310, one each for left and right channel, and a Gang slider for controlling both left and right channels simultaneously. When the PGA2310 first powers up, it will reset to maximum attenuation (or mute). The software also defaults to maximum attenuation (shown as $-\infty$ to the right of the sliders). A display to the right of each slider displays the currently selected gain setting.

The Ramp radio buttons to the right of each slider are used to select the gain slider to be automated when using the Ramp controls in the upper right-hand corner of the DUT panel.

The Pan slider functions as a Balance control, simultaneously gaining one channel while attenuating the other. It behaves just like the balance control on your home or car stereo system.

MODE CONTROLS

The Mode control section resides in the upper left-hand corner of the DUT panel. Several functions are accessible from this section.

The Zero-Cross Detection checkbox is used to enable and disable the zero crossing detector circuit inside the PGA2310 device. The default setting is zero crossing detection disabled.

The Mute by Pin checkbox is used to enable or disable the MUTE pin function of the PGA2310. When MUTE is LOW, the PGA2310 sets both left and right channel attenuation to maximum (or mute). The default setting is mute disabled.

Two buttons allow the user to quickly set the gain of both left and right channels to either 0dB or $-\infty$ dB (or mute). The $-\infty$ dB button differs from the Mute by Pin checkbox in that it programs maximum attenuation for both left and right channels using the PGA2310's gain control registers, as opposed to using the MUTE pin.

REGISTER LOOPBACK CONTROLS

With the SDO R jumper installed, the user can test the function of the PGA2310 serial interface by using the Register Loopback control. Simply press the Interrogate button to read back the value being programmed. This function is included primarily for diagnostics, to ensure that the PC parallel port and PGA2310 are communicating properly.

When using the Dual DUT setup, the SDO R jumper should be installed on the second evaluation module, and left open circuit on the first evaluation module to ensure proper loopback functionality.

RAMP CONTROLS

The Ramp controls allow automation of the gain settings for one or both channels. The user enters the top and bottom points for the ramp, along with the desired step size and delay between steps. The ramp may be generated from bottom to top (Ramp Up) or from top to bottom (Ramp Down) for the given range.

The ramp step size may be set from 0.5dB to 3.0dB in 0.5dB increments. The ramp step delay may be set using relative delay settings of 0, 1, 2, 5, 10, 20, or 50.

The channel selection for the automated ramp is selected using the radio buttons located to the right of the gain sliders in the Gain Control section of the DUT panel.

DUAL DUT (OR DAISY-CHAIN) OPERATION

As mentioned previously in this document, the PGA2310 serial interface allows multiple devices to be cascaded, or daisy-chained, which allows a three-wire control interface to write the gain settings for all of the devices connected to the control port. Figure 3 illustrates the daisy-chain connection of multiple PGA2310 devices.

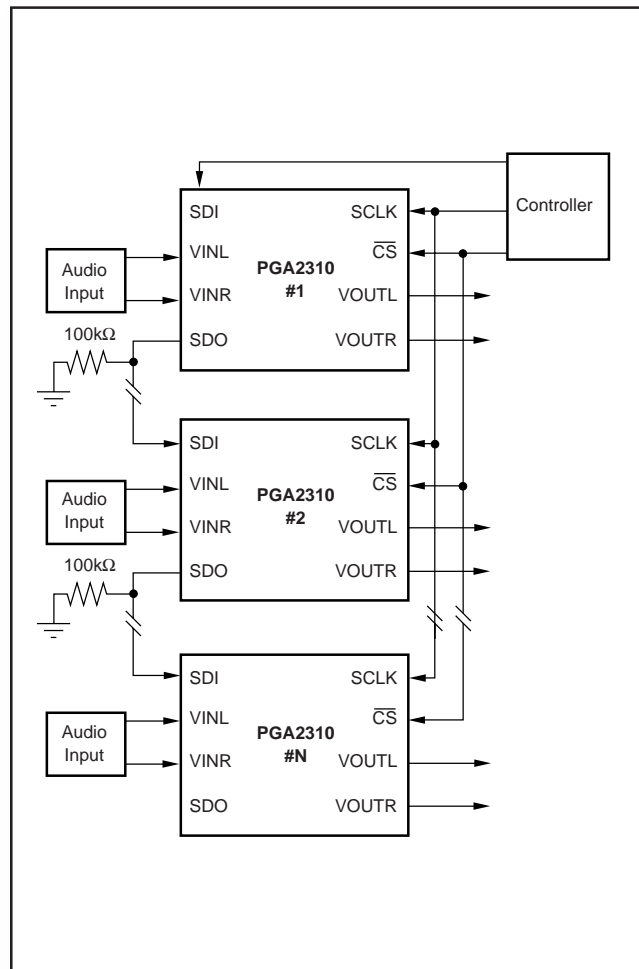


FIGURE 3. Daisy-Chain Connection of Multiple PGA2310 Devices.

Using the supplied software, two PGA2310-EVM modules may be connected together using the Dual DUT option in the Main panel, as shown in Figure 4. Selecting the Dual DUT radio button will enable the DUT1 and DUT2 control panels. The DUT1 panel was shown previously in Figure 2, while the DUT2 panel is shown in Figure 5. Simply set the controls as previously discussed in the section, “Programming the PGA2310: The DUT Panel” for each device using the appropriate panel.

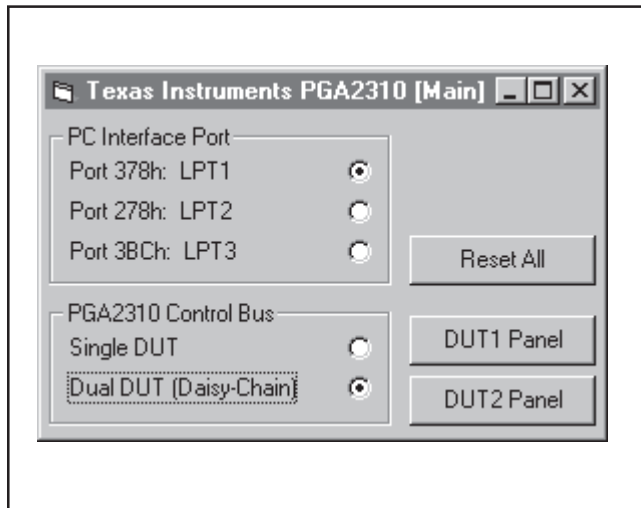


FIGURE 4. Dual DUT Configuration.

CONNECTING TWO PGA2310-EVM BOARDS IN DUAL DUT MODE

As shown in Figure 6, connecting two evaluation modules is accomplished using the DATA OUT and DATA IN connectors on the corresponding EVM boards. The DATA OUT connector of EVM-1 is connected to the DATA IN connector of EVM-2 using a straight through, flat ribbon cable. The SDO_R jumper on EVM-1 is open circuit (no jumper), while a jumper is installed on SDO R for EVM-2. This allows the Register Loopback function in the DUT1 and DUT2 panels to interrogate the gain setting values for both PGA2310's.

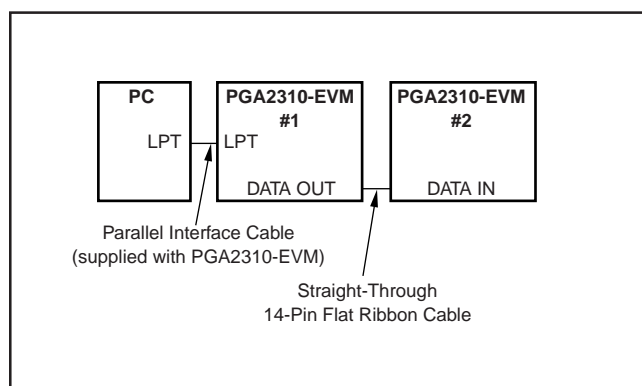


FIGURE 6. Connecting Two PGA2310-EVM Boards for Dual DUT Operation.

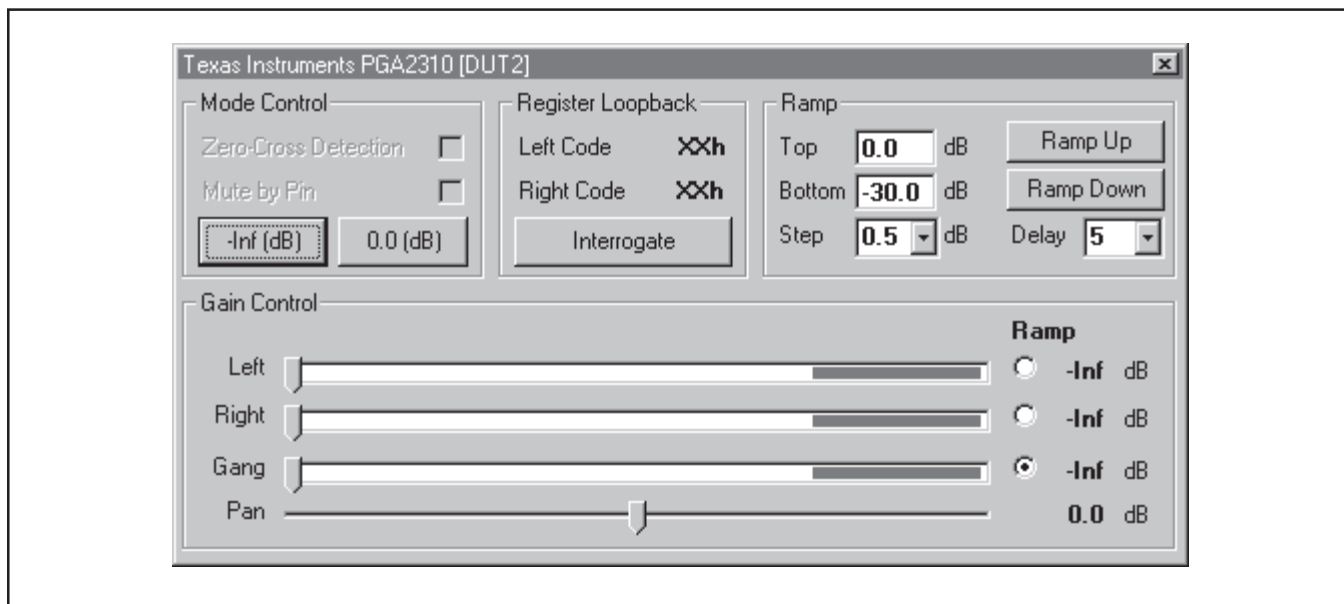


FIGURE 5. The DUT2 Panel.

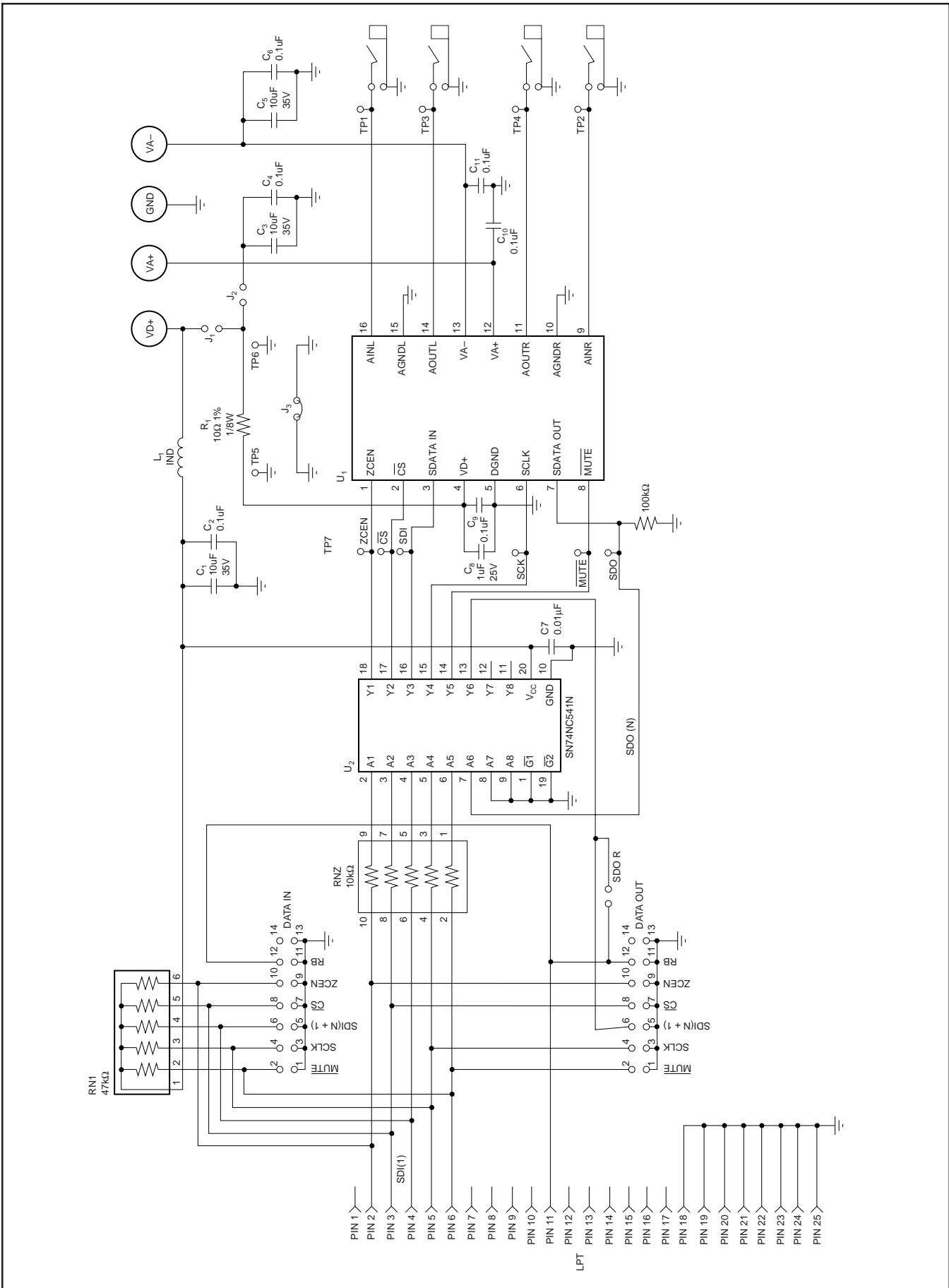


FIGURE 7. Schematic Drawing.

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

EVM IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation kit being sold by TI is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not considered by TI to be fit for commercial use. As such, the goods being provided may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety measures typically found in the end product incorporating the goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may not meet the technical requirements of the directive.

Should this evaluation kit not meet the specifications indicated in the EVM User's Guide, the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Please be aware that the products received may not be regulatory compliant or agency certified (FCC, UL, CE, etc.). Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive.**

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.**

Please read the EVM User's Guide and, specifically, the EVM Warnings and Restrictions notice in the EVM User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact the TI application engineer.

Persons handling the product must have electronics training and observe good laboratory practice standards.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Copyright • 2001, Texas Instruments Incorporated

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the absolute maximum supply voltage of $\pm 16\text{V}$ and the corresponding input/output voltage range of 29.0Vp-p . The device is industrial grade, so it can be operated over the -40°C to $+85^{\circ}\text{C}$ temperature range.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than $+60^{\circ}\text{C}$. The EVM is designed to operate properly with certain components above $+60^{\circ}\text{C}$ as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265

Copyright • 2001, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Telephony	www.ti.com/telephony
Low Power Wireless	www.ti.com/lpw	Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated