Application Note 2268
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LMH6882 Evaluation Board

SUMMARY

The LMH6882EVAL evaluation board is designed to aid in the characterization of Texas Instruments High Speed LMH6882 Differential Amplifier.

In order to use the full bandwidth of the LMH6882 the LMH6882EVAL board has been built with a high performance dielectric on the top layer (ROGERS RO4350B). This high-performance dielectric provides well matched impedance and low loss to frequencies beyond 1GHz. All signal paths are routed on the top layer. The remainder of the board is conventional FR4.

http://www.rogerscorp.com/documents/726/acm/RO4000-Laminates---Data-sheet.aspx

Use the evaluation board as a guide for high frequency layout and as a tool to aid in device testing and characterization.

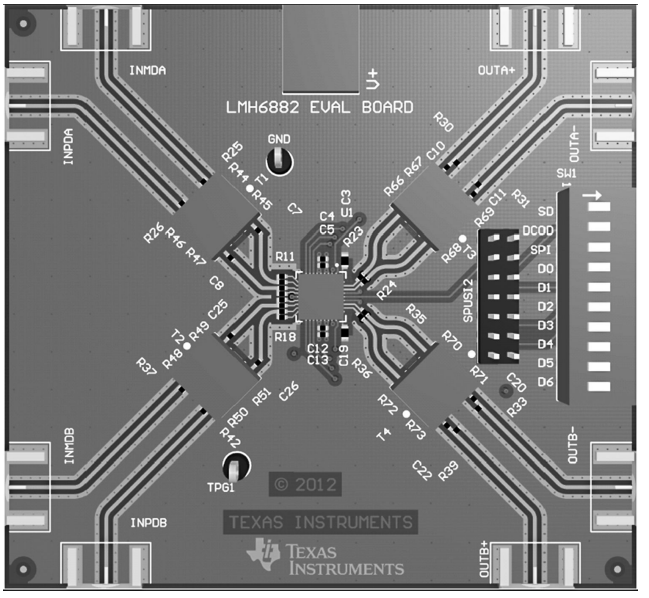

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FIGURE 1. LMH6882EVAL

General Description

The LMH6882 DVGA has differential inputs and differential outputs. To aid evaluation with 50Ω single ended test equipment the LMH6882EVAL evaluation board is shipped with input and output transformers installed. The signal path uses the INPD and OUT+ marked connectors. The INMD and OUT− signal paths are grounded. The evaluation board uses edge mounted SMA connectors. When using the differential inputs a termination resistor can be placed on the pads used by the transformer primary coils. For DC-coupled operation the appropriate capacitors can be replaced by 0Ω resistors. If DC-coupled operation is desired it is important to provide for proper bias voltages on the input and output pins (see the LMH6882 datasheet for more details). The LMH6882EVAL evaluation board is designed to be used with transformers or baluns. There are DC-blocking capacitors on both the input and output signal traces. The input pins of the LMH6882 will self-bias to approximately mid supply (2.5V). Capacitors between the amplifier and the output transformer will prevent undesirable currents from flowing through the transformer primary coil. Many transformers will show increased distortion products when there is a DC current flowing through the primary coil. Transformers T1 through T4 can provide both impedance matching as well as single ended to differential conversion. The board is shipped with 2:1 impedance ratio transformers that will match 50Ω equipment with the 100Ω input impedance of the LMH6882 DVGA . Do not connect the transformer secondary winding directly to ground. The LMH6882 has a self-biased input common mode voltage of approximately 2.5V.

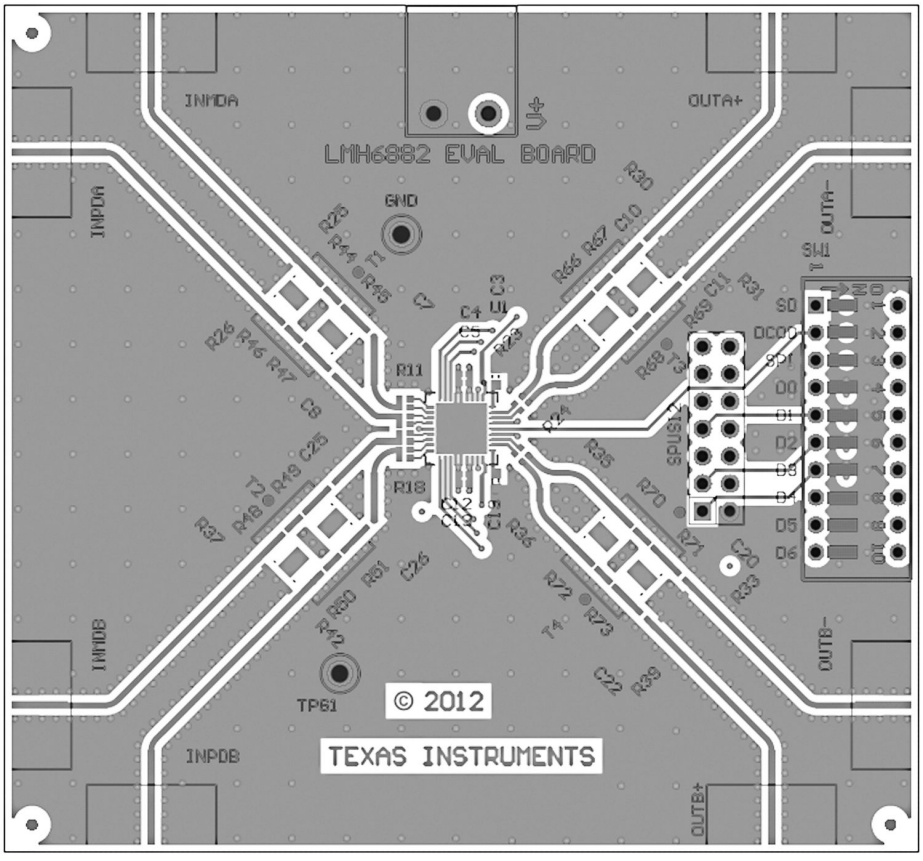

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FIGURE 2. Top Layer Metal

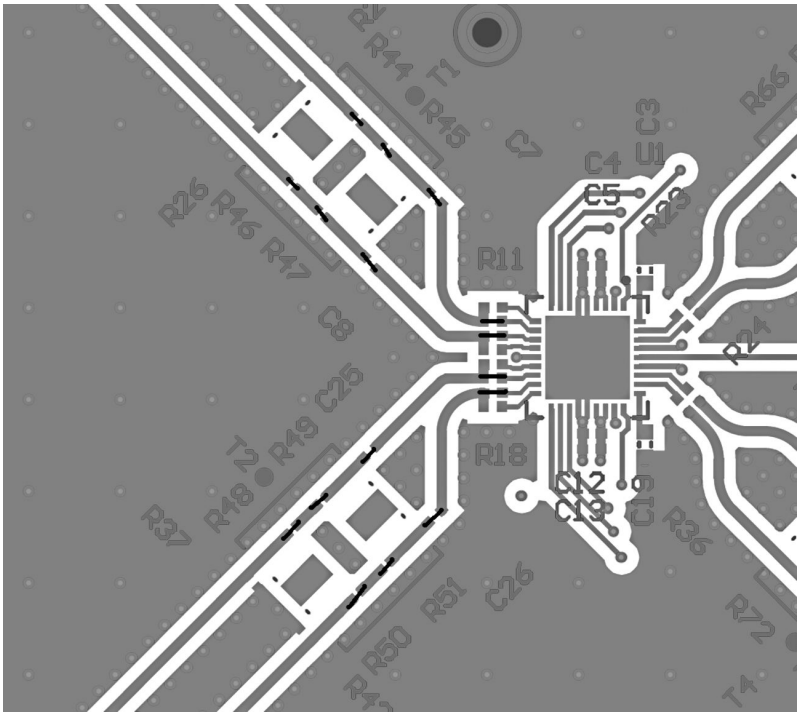

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FIGURE 3. Input Configuration for Differential Signals

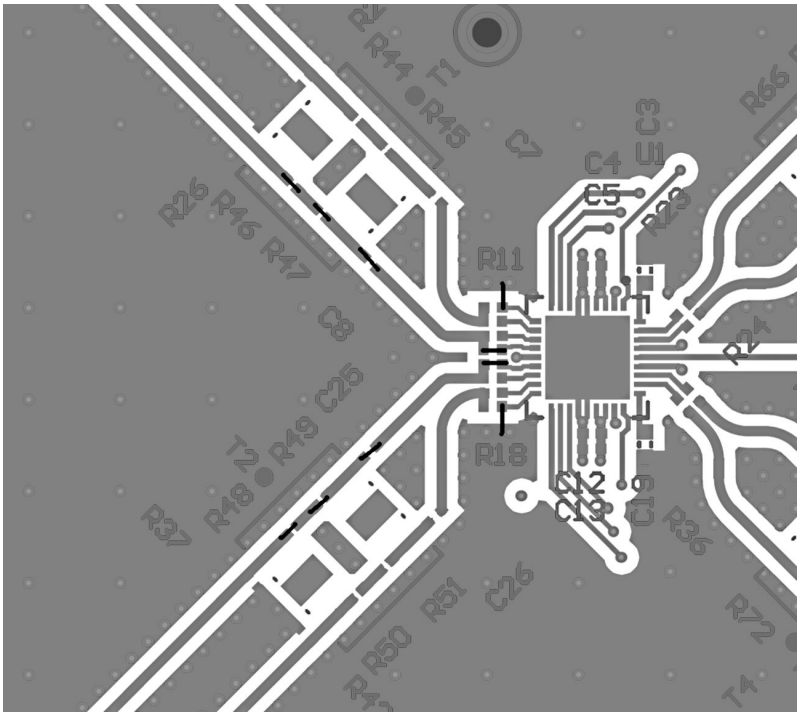

FIGURE 4. Input Configuration for Single Ended Signal. R11 and R18 should be 50Ω to ground. The other additional components are small wires or 0Ω resistors. If AC coupling is desired C8 and C25 can be loaded with 0.1 µF ceramic capacitors.

Gain Control

For ease of use, a bank of DIP switches is installed on the board to control gain settings in parallel mode. The DIP switches short the corresponding pins to ground. For example, to use the LMH6882 in parallel mode the SPI switch must be in the ON position which shorts the SPI pin to a logic low state. The table below lists the different switch positions and their functions. The Parallel functions are listed first when the pins have dual function. Shutdown pins have no effect in serial mode. To reiterate, the switches when On (or closed) short the indicated pin to ground through a 50Ω resistor. So the switch has the opposite polarity of the corresponding pin when considered from the pin logic state. For example on the SPI pin the switch in the On state will short the SPI pin to ground for a logic 0 condition on the SPI pin.

Switch Functions

Switch	Function
1	Shutdown (Active ON)
2	Not Used
3	SPI/Parallel (Parallel when switch ON/Closed)
4	D0/ SDO
5	D1/ SDI
6	D2/ CLK
7	D3/ CS
8	D4
9	D5
10	D6

Please note that the dip switches settings will impact the on-board impedance for the SPI header pins. With the dip switches are set to the OPEN position the header pins are un-terminated. When the dip switches are closed the header pins are terminated with 49.9Ω resistors. The USB to SPI interface boards cannot drive 49.9Ω loads, so the switches on the SPI control lines need to be in the OPEN position for SPI control.

Pins D0, D1, D2, and D3 are internally biased to the logic low (0) state. The evaluation board has resistors that pull Pins D1, D2 and D3 to V+. The DIP switch then connects these pins to ground for gain control. Because the D0 pin needs to be biased low for

serial data communication it has a 300Ω resistor to ground and will not change state with the DIP switch. If it is desired to use the pin D0 for parallel control, and SPI communication is not important, resistor R65 can be removed, and resistor R64 can be loaded with a 1.5kΩ resistor. This will restore operation of the D0 pin in parallel mode, but no data will clock out of the LMH6882 during SPI mode.

Pins D4, D5 and D6 are internally biased to a logic high state (2.5V). These pins are not shared during SPI mode. During SPI mode they can be shorted to ground with the DIP switch or left floating.

The SD and SPI pins are internally biased to the logic low state. Specifically, the SD pin is biased to the device enabled state, and the SPI pin is biased to the parallel mode state.

SPISPI™ Compatible Gain Control Using USB2ANY and LabView Control Software

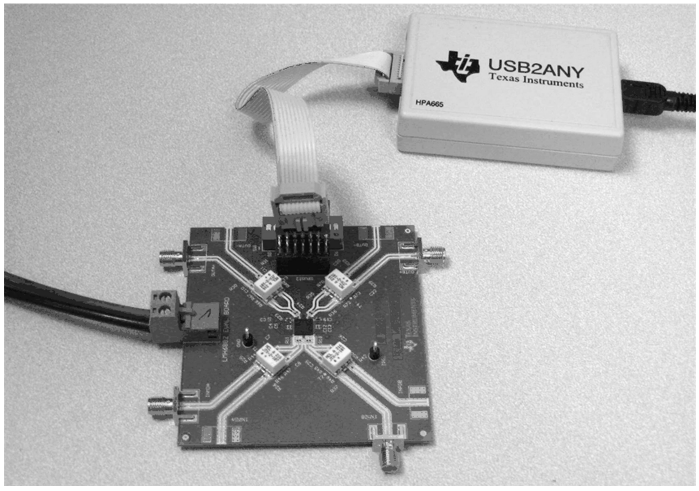

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FIGURE 5. LMH6882 Eval Board Connected to USB2ANY

The LMH6882EVAL board can easily be controlled in the serial mode using Texas Instruments USB2ANY to USB to SPI controller board. This board and the required software are included with the LMH6882EVAL board.

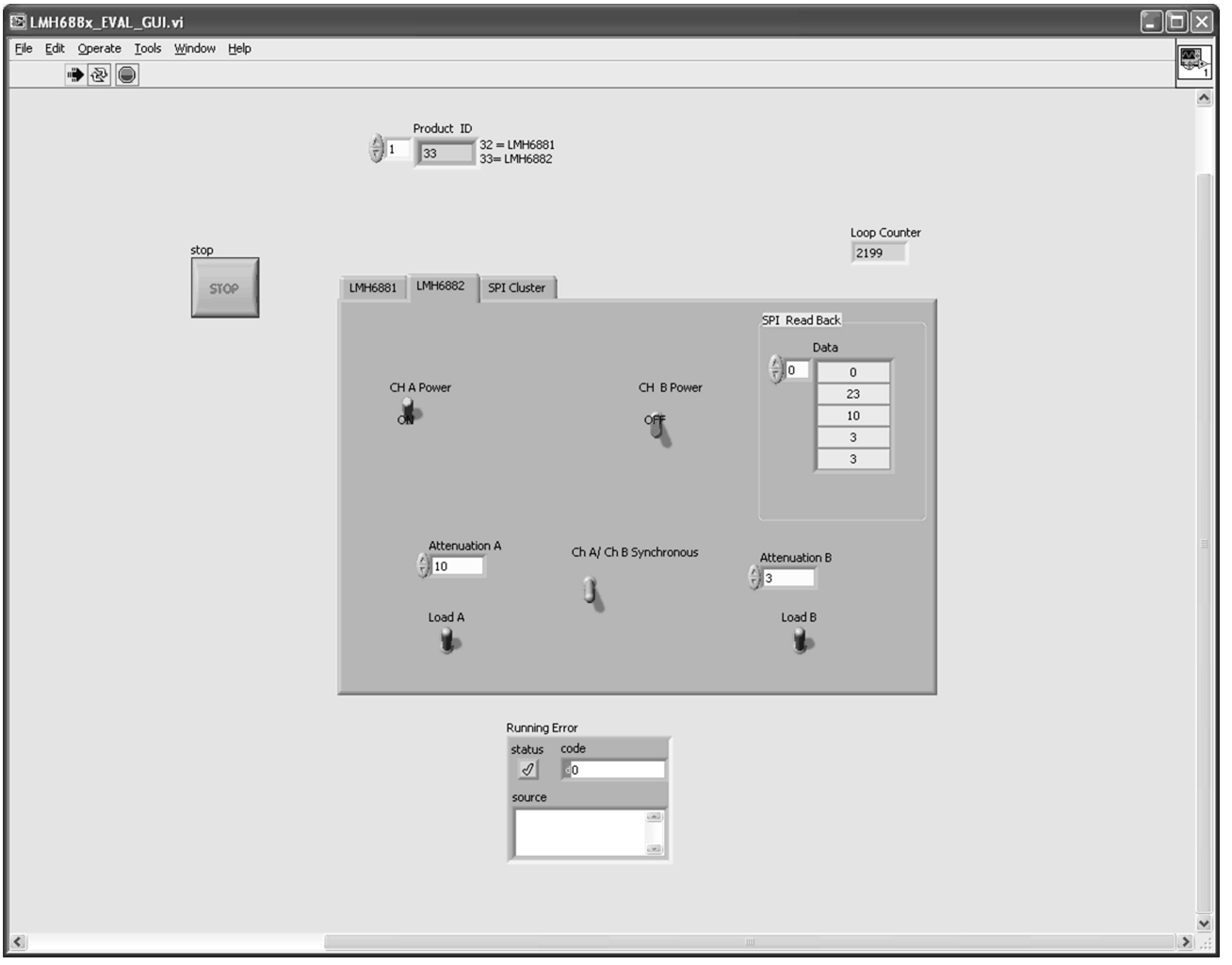

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FIGURE 6. LMH688x GUI Screen Capture

To use the LMH688x GUI software, extract the files from the ZIP file into a directory. Double click the exe file and the GUI will launch as shown in *Figure 6*. The Product ID should indicate 33 for the LMH6882. If it does not show any ID there is a problem with the controller board or the evaluation board, recheck all connections and start the exe file again. To use the LMH6882 board click on the LMH6882 tab as shown. The CHA and CHB power switches turn the A and B channels on and off. The Attenuation windows set the attenuation in 1/4 dB steps. The Maximum attenuation is 80 steps or 20dB. Zero attenuation is equal to 26dB of gain and 80dB attenuation is equal to 6dB of gain. The attenuation selected will not become effective if the Load A or Load B switch is in the OFF position. The screen shot shows the switches in the ON position, so the attenuation settings will be effective immediately. The CHA/B synchronous switch will force channel A and channel B to have the same value of attenuation if set to the ON position, it is shown in the OFF position in the screen shot so that both channels can have separate gains. The SPI Read Back window shows the contents of registers 2,3,4,5. Register 2 is the control register. Register 3 and 4 are the A and B attenuation registers. Register 5 is the gain set control register.

Observant users may notice that the GUI has set bits 0 and 1 of register #2 to a value of 1. This is to maintain compatibility with previous (unreleased) versions of the LMH6882. In the production version of the LMH6882 those two bits have no function and can be set to any desired value.

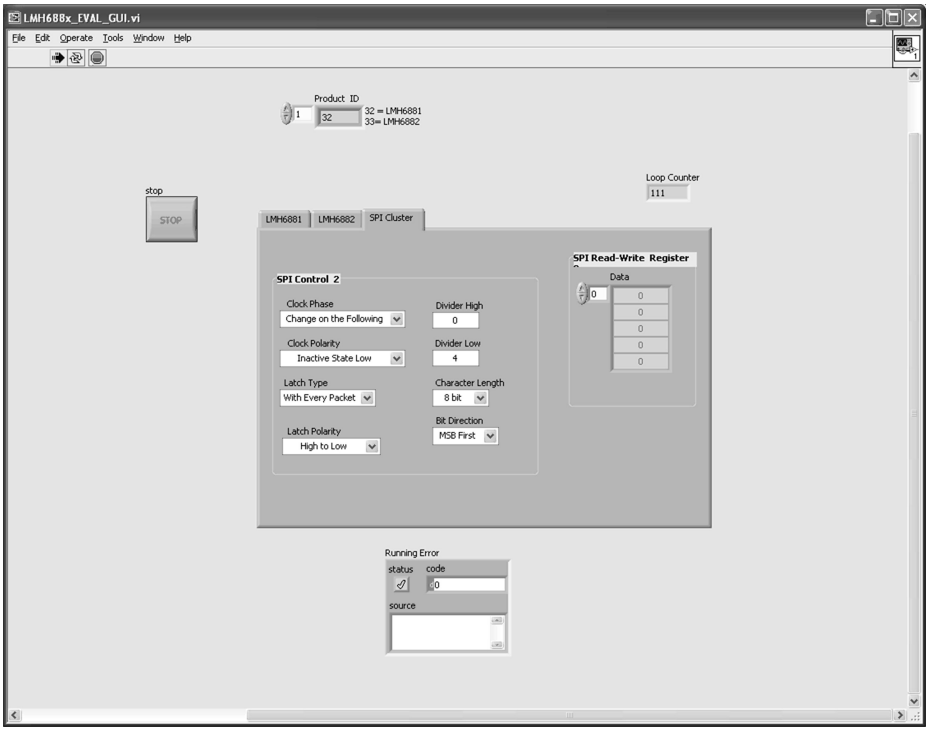

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FIGURE 7. Default SPI Settings

The default SPI settings for the LMH688x control software are shown in *Figure 7* . These settings should be left unchanged. If there is a problem with the SPI connection the first thing to check is the position of the DIP switches. The switch settings should be all in the OFF position (switch sliders moved towards the DUT side of the board) this is the most common problem when communicating with the evaluation board. If the switches are correct and there is power to the evaluation board it may be useful to try setting the “Divider Low” box to 8 or higher. This will slow the SPI clock speed. Sometimes merely selecting the SPI cluster tab will be sufficient to restore communication with the evaluation board. If board communication is successful the board “Product ID” field will show the proper device ID (33 for LMH6882).

SPI-Compatible Gain Control using the SPISU2 Card

NOTE. The SPISU2 board is being phased out. The following documentation is for legacy use only. New boards will have only the USB2ANY board.

The LMH6882EVAL board can easily be controlled in the serial mode using Texas Instruments SPISU2 USB to SPI controller card. This card and the required software are available on the Texas Instruments website. Directions for installing the USB control software and evaluation board drivers are in the user's guide available on the Texas Instruments website. To use the SPI card, the LMH6882 DVGA must be put into serial mode. This is done by setting switch #3 on the DIP switch block in the OFF position. Switches 4, 5, 6, and 7 also need to be in the OFF position. If the switches are in the ON position the digital lines will be grounded and the SPISU2 card will not be able to communicate with the DVGA. Once the SPUSI2 board drivers and TinyI2CSPI software are installed, connect the SPUSI2 board directly onto the LMH6882_EVAL double-row header (J1) by aligning pin 1 as shown in *Figure 4*. Plug the USB cable into the SPISU2 card and the host PC. Start the Tiny I2CSPI software and load the LMH6882 profile as shown in *Figure 8*. Additional commands can be generated by changing the data in the MOSI column. Check the LMH6882 datasheet for details on the data to be sent to the DVGA registers. The example SPI commands are a good starting point for generating the desired commands.

SPISU2 Header Pins

Pins	Serial Function
1	Chip Select
2	Ground
3	Clock
4	N/A
5	Serial Data Out (MISO)
6	N/A

Pins	Serial Function
7	Serial Data IN (MOSI)
8 - 14	N/A

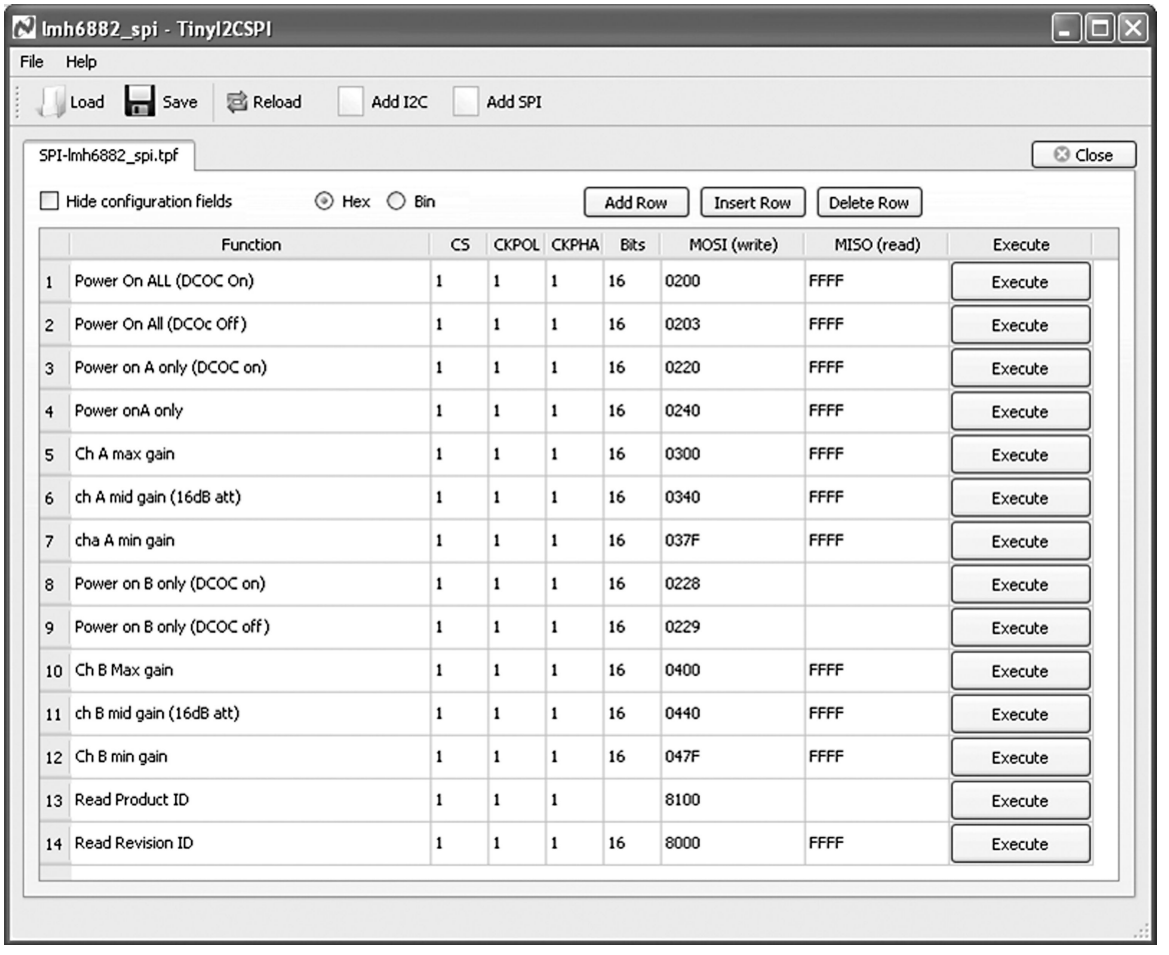

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FIGURE 8. Tiny Personality File

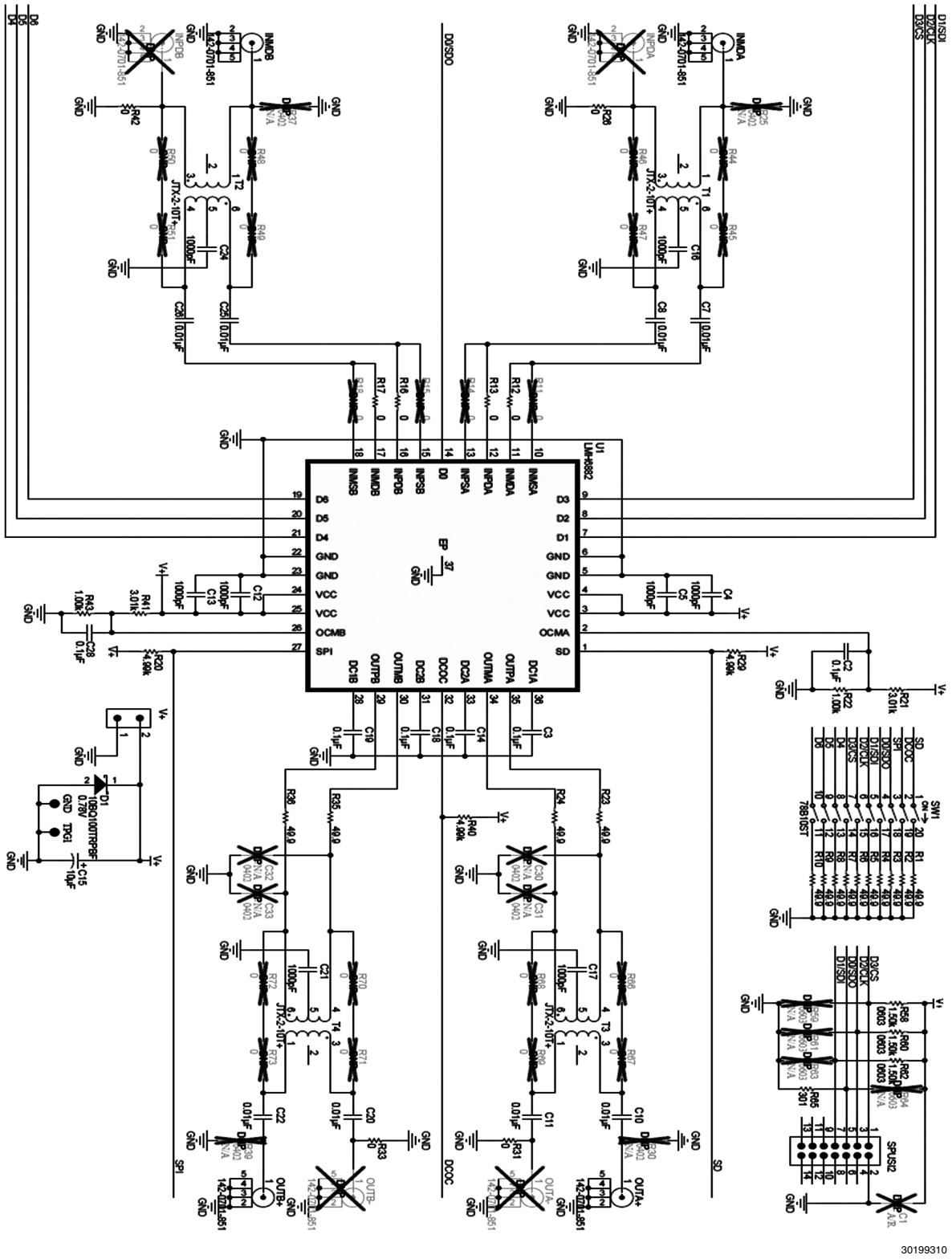

FIGURE 9. Schematic

Notes

Notes

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