LMP90100 Evaluation Board with Sensor AFE Software User's Guide

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1.0. Introduction

The LMP90100 Evaluation Board Design Kit (consisting of the LMP90100 Evaluation Board, the SPIO-4 Digital Controller Board, the Sensor AFE software, and this user's guide) is designed to ease evaluation and design-in of National Semiconductor's LMP90100 24-bit Fully Programmable Low Power ΣΔ ADC with True Continuous Background Calibration.

Data capturing and static evaluations are simplified by connecting the SPIO-4 Digital Controller Board to a PC via USB and running the Sensor AFE software. The data capture board will generate the SPI signals to communicate to and capture data from the LMP90100. The user will also have the option to evaluate the LMP90100 without using the SPIO-4 board or the Sensor AFE software.

The LMP90100 will digitize the analog input, and the software will display these results in time domain and histogram. The software also allows customers to write to and read from registers, to calibrate the device or the system's gain, offset, and scale settings, and most importantly, to configure and learn about the LMP90100.

This document describes the connection between the boards and PC, provide a quick start for a normal DC, 3-wire RTD, and thermocouple/temperature sensor applications, describe how to evaluate the board with and without the SPIO-4 board, and provides the schematic and BOM.

2.0. Equipment

2.1. Equipments

1. LMP90100 evaluation board
2. SPIO-4 digital controller board
3. Power supplies (optional) to source VA, or VIO, or VREFP.
4. Multimeter
5. PC with Sensor AFE software

2.2. Connection Diagram

Figure 1 shows the connection between the LMP90100 Evaluation Board, SPIO-4 Digital Controller Board, and a personal computer with Sensor AFE software. LMP90100 can be powered using external power supplies or from the SPIO-4 board.

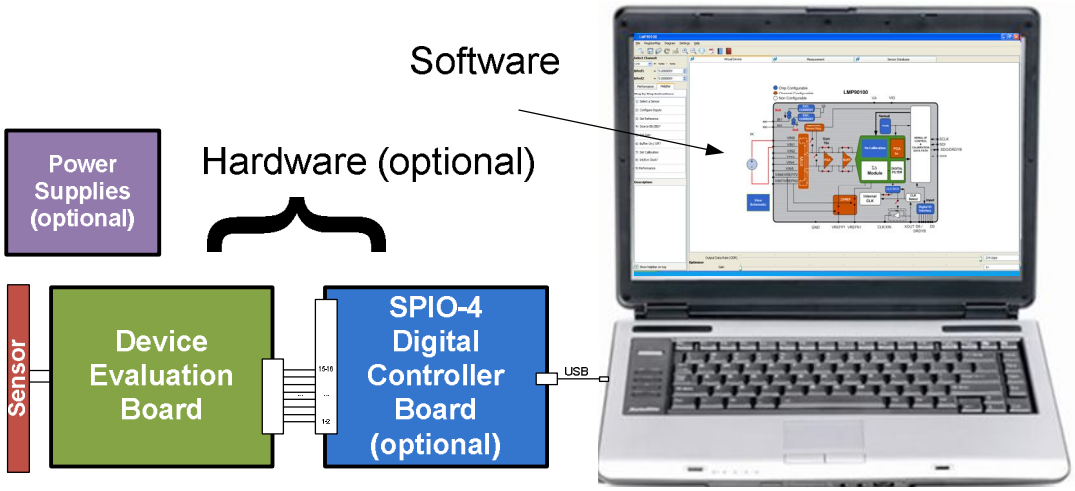


Figure 1 – Connection Diagram

2.3. Board Assembly

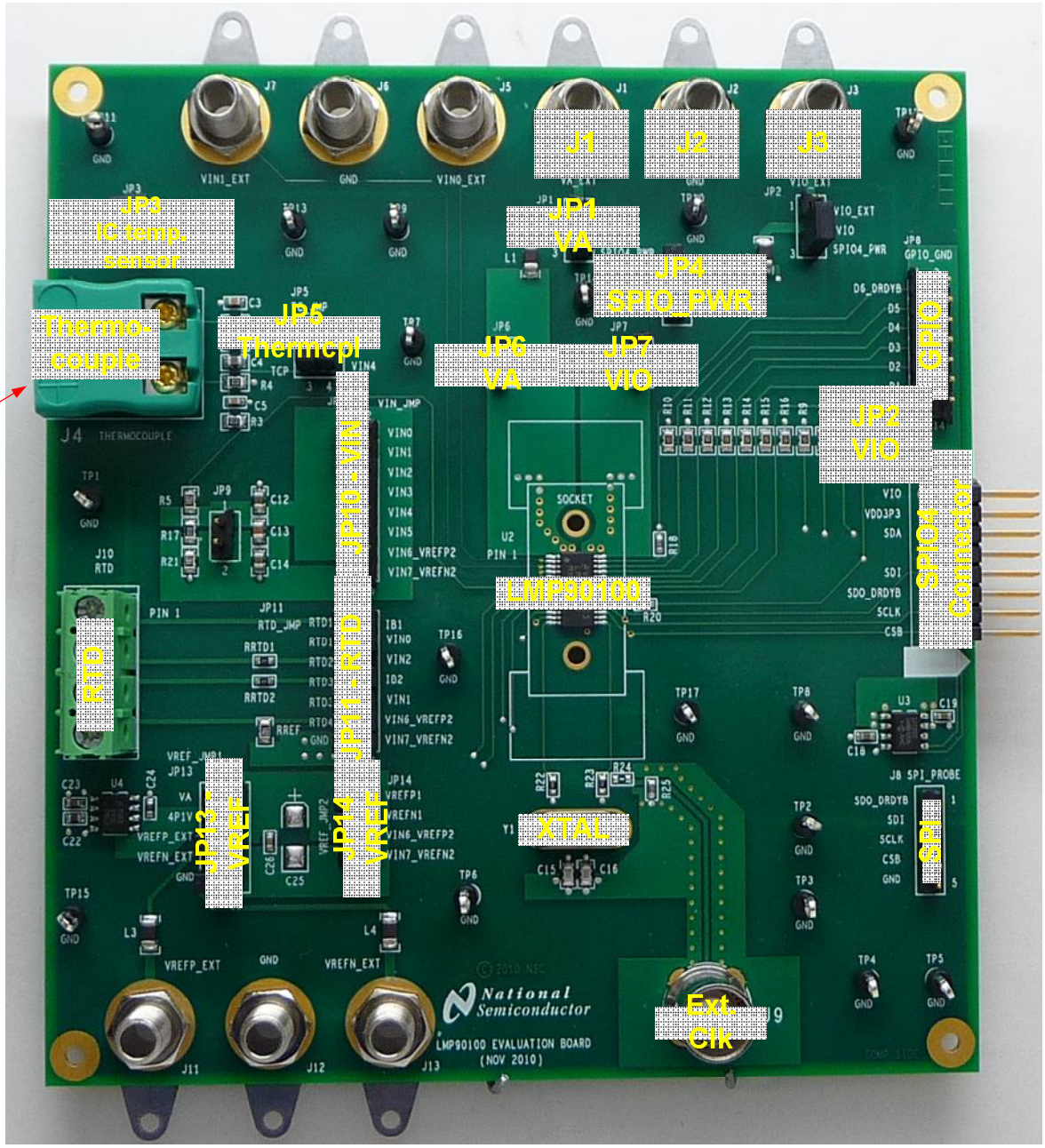


Figure 2 – LMP90100 Evaluation Board Assembly

3.0. Example #1: Quick Start – DC Reading

The following procedures show a quick method to assemble the LMP90100EB and perform a quick DC voltage reading.

B. LMP90100 EB Jumper Connections

1. Figure 20 shows the schematic.
2. The jumpers not mentioned in this table have to be left unconnected for this exercise.
3. SPIO-4 board is properly setup out of the box (no assembly required).

Jumper	Jumper Connections	Purpose
JP1	Pins 1 & 2	Source VA with an external power supply
JP2	Pins 1 & 2	Source VIO with an external power supply
JP6	Pins 1 & 2	Connect VA to LMP90100
JP7	Pins 1 & 2	Connect VIO to LMP90100
JP13	Pins 3 & 4	VREFP1 = 4.1V from LM4140
JP13	Pins 9 & 10	VREFN1 = Ground
JP14	Pins 1 & 2	Connect VREFP1 to LMP90100
JP14	Pins 3 & 4	Connect VREFN1 to LMP90100
JP10	Pins 1 & 2	VIN0 = 3/4 (VREF1)
JP10	Pins 3 & 4	VIN1 = 1/2 (VREF1)

Table 1 – Jumpers Connection

C. Opening the Software - follow section "9.0. Installing the Software" to install the Sensor AFE software.

D. Connecting and Powering the Boards – these steps have to be done in this order.

1. Connect a 5.0V power supply to **J1** (VA_EXT) and GND (J2).
2. Connect a 5.0V power supply to **J3** (VIO_EXT) and GND (J2).
3. **Turn on** the power supplies that are sourcing VA (J1) and VIO (J3).
4. Connect the LMP90100EB's **JP12** to SPIO-4 Board's **J6** (pins 1-16). See Figure 3.

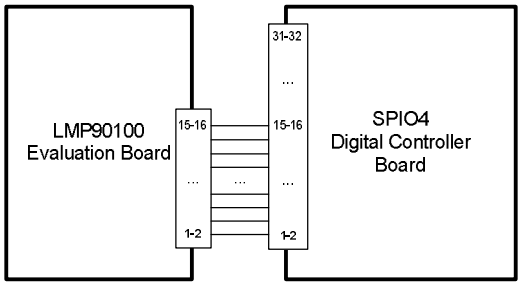


Figure 3 – LMP90100EB-to-SPIO-4 Board Connection

5. Connect SPIO-4 Board to a PC via **USB.**
6. Use a multimeter to measure LMP90100EB's JP6, JP7; they should all be approximately 5V. If they are not, check your power supplies and jumpers. Measure JP14.P2; it should be approximately 4.1V. If it's not, check your jumpers and U4.

E. Configuring the Device Using the Sensor AFE Software

1. Follow the step-by-step instructions under the **"HelpBar"** mini-tab (left hand side of the GUI) to configure the device. The recommended configuration is shown in Figure 4.

   a. Step 1: Select a Sensor - select **"DC"** → **"DC"** since the input source is not a sensor.

   b. Step 2: Configure Inputs – click on the **"INPUT MUX"** block to set "**VINP = 000: VIN0"** and "**VINN = 001: VIN1".** Since VIN0 = (3/4) VREF1 and VIN1 = (1/4) VREF1, the measurement across this channel will be (1/2) VREF1.

   c. Step 3: Select Reference – click on the "**VREF MUX"** block to choose **"VREF_SEL = 0: VREF1".** Make sure the VREF1 value is 4.1V.

   d. Step 4: Source IB1/IB2? – *this step can be ignored because neither IB1 nor IB2 is connected to the inputs.*

   e. Step 5: Set Gain – since VIN = (1/2) VREF1, the maximum gain that can be set is 2. Click on the **"FGA"** block**, "PGA"** block**,** or the "**Gain"** slider to select the gain.

   f. Step 6: Set Buffer – click on the **"BUFF"** block to include or exclude the buffer from the signal path.

   g. Step 7: Set Calibration - click on the **"No Calibration"** block to enable or disable calibration. Refer to the LMP90100 datasheet to more information on the LMP90100's background calibration types and modes.

   h. Step 8: Int/Ext CLK? – click on the **"CLK MUX"** block and make sure the internal clock is selected.

   i. Step 9: Performance - click on the **"Performance"** mini-tab. This tab displays the Estimated Device Performance base on the block diagram that you've configured, as well as the Measured System Performance if you've connected a board and ran the LMP90100.

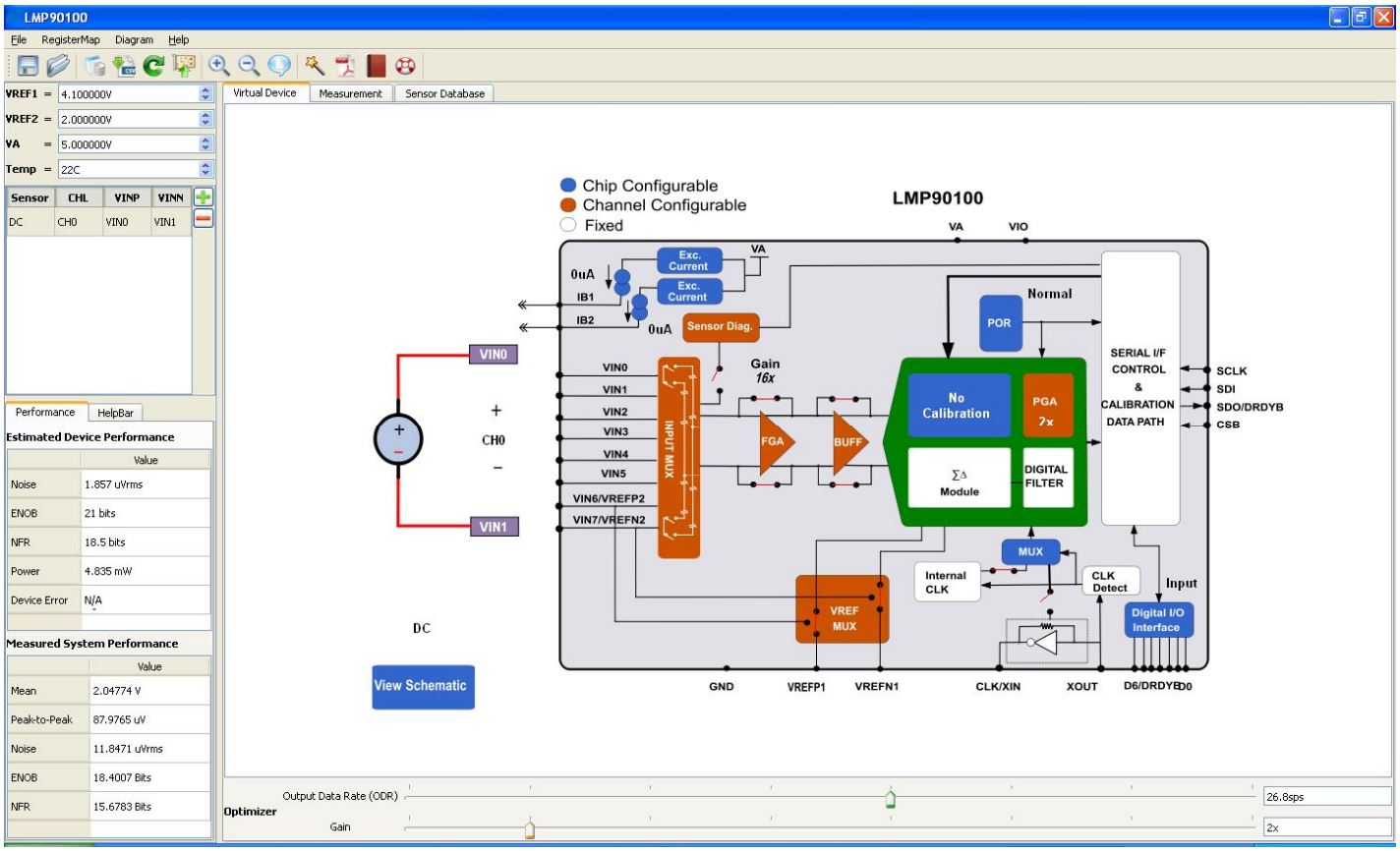


Figure 4 - Recommended LMP90100 Configuration for a DC Reading

2. Click on the **"Measurement"** tab and set the **"Scan Mode"** as follows:

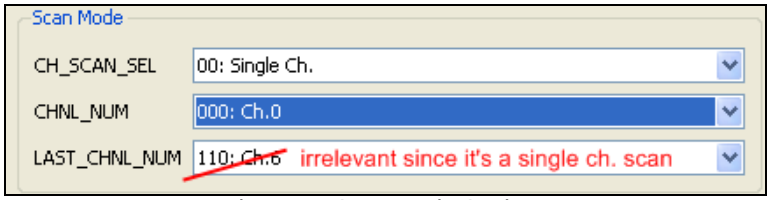


Figure 5 - Scan Mode Settings

a. Under the **"Output Format"** field, select Display "**Output Voltage (V)"**
b. Under the **"Stop Condition"** field, select Run **"1000"** samples.
c. Click on the **"Run"** button to view the output voltage results. A reading of approximately ½(VREF1) should be plotted as seen in Figure **6**.

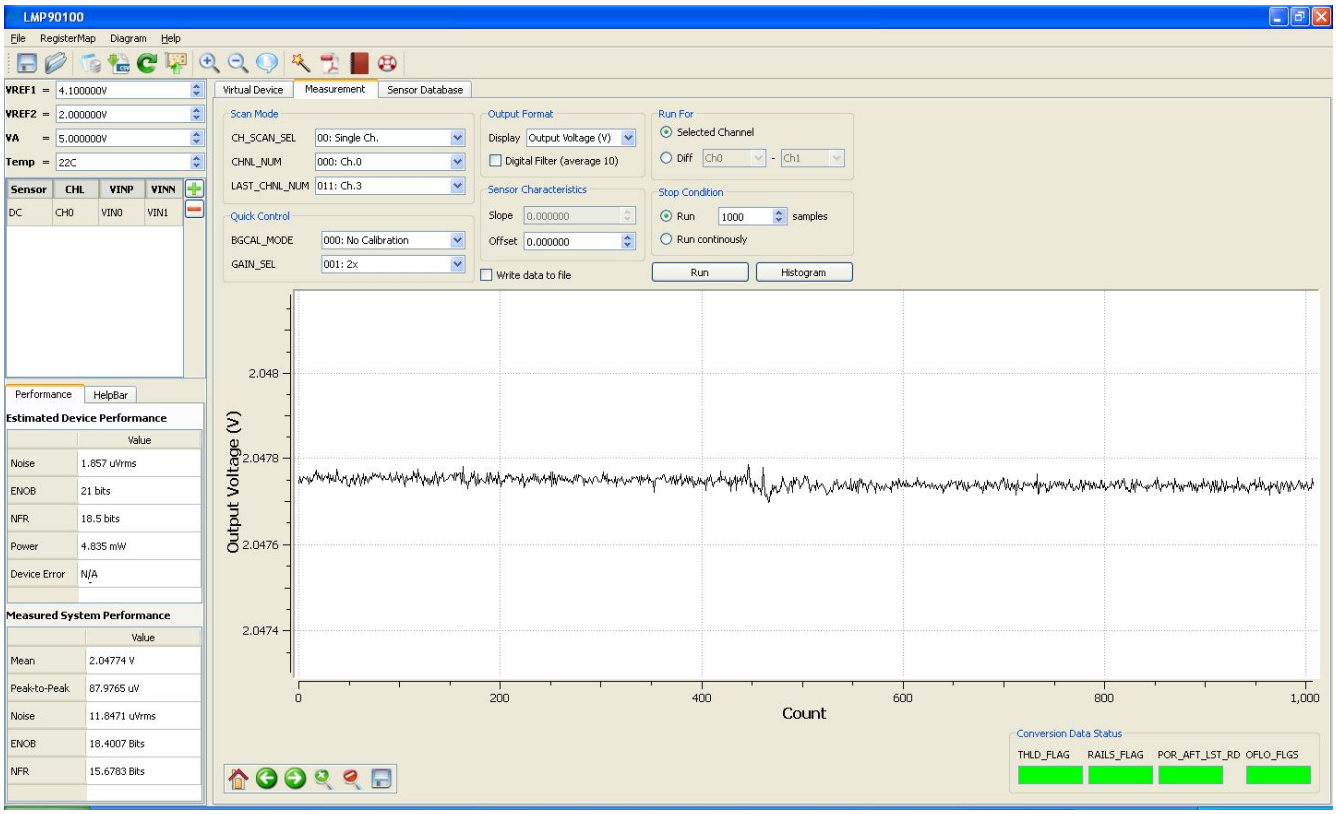


Figure 6 - Results for Example #1 - DC Reading

4.0. Example #2: Shorted Input and Calibration Test

This demonstration will showcase LMP90100's ability to calibrate for offset error.

F. LMP90100 EB Jumper Connections

1. The LMP90100EB schematic can be seen in Figure 20.
2. The jumpers not mentioned in this table have to be left unconnected for this exercise.
3. SPIO-4 board is properly setup out of the box (no assembly required).

Jumper	Jumper Connections	Purpose
JP1	Pins 2 & 3	VA = SPIO4_PWR
JP2	Pins 2 & 3	VIO = SPIO4_PWR
JP4	Pins 2 & 3	SPIO_PWR = 5.0V
JP6	Pins 1 & 2	Connect VA to LMP90100
JP7	Pins 1 & 2	Connect VIO to LMP90100
JP13	Pins 1 & 2	VREFP1 = VA
JP13	Pins 9 & 10	VREFN1 = Ground
JP14	Pins 1 & 2	Connect VREFP1 to LMP90100
JP14	Pins 3 & 4	Connect VREFN1 to LMP90100
JP10	Pins 1 & 2	VIN0 = ½ (VREF1)
JP9	Pins 1 & 2	

Table 2 – Jumpers Connection

G. Opening the Software - follow section "9.0. Installing the Software" to install the Sensor AFE software.

H. Connecting and Powering the Boards

1. Connect the LMP90100EB's **JP12** to SPIO-4 Board's **J6** (pins 1-16) as seen in Figure 3.
2. Connect SPIO-4 Board to a PC via **USB.**
3. Use a multimeter to measure LMP90100EB's JP6, JP7, and JP14.P2; they should all be approximately 5V. If they are not, check your power supplies and jumpers.

I. Configuring the Device Using the Sensor AFE Software

1. Follow the step-by-step instructions under the **"HelpBar"** mini-tab to configure the device. The recommended configuration can be seen in Figure 7.

   a. Step 1: Select a Sensor - select **"DC"** → **"DC"** since the input source is a DC voltage

   b. Step 2: Configure Inputs – click on the **"INPUT MUX"** block to set "**VINP = 000: VIN0"** and "**VINN = 000: VIN0".** Since VINP = VINN, a reading of approximately 0V should be read.

   c. Step 3: Select Reference – click on the "**VREF MUX"** block to choose **"VREF_SEL = 0: VREF1".** On the left hand side of the GUI, change the VREF1 value to 5.0V as seen below.

   d. Step 4: Source IB1/IB2? – *this step can be ignored because neither IB1 nor IB2 is connected to the inputs.*

   e. Step 5: Set Gain – since VIN = 0V, the maximum gain that can be set is 128x. Click on the **"FGA"** block**, "PGA"** block**,** or the "**Gain"** slider to select the gain.

   f. Step 6: Set Buffer – click on the **"BUFF"** block to include or exclude the buffer from the signal path.

   g. Step 7: Set Calibration - the purpose of this example is to show how the LMP90100 removes the offset error using background calibration. Initially, disable the calibration by selecting "**000: No Calibration"** under the **"No Calibration"** block.

      Refer to the LMP90100 datasheet to more information on the LMP90100's background calibration types and modes.

   h. Step 8: Int/Ext CLK? – click on the **"CLK MUX"** block and make sure the internal clock is selected.

   i. Step 9: Performance - click on the **"Performance"** mini-tab. This tab displays the Estimated Device Performance base on the block diagram that you've configured, as well as the Measured System Performance if you've connected a board and ran the LMP90100.

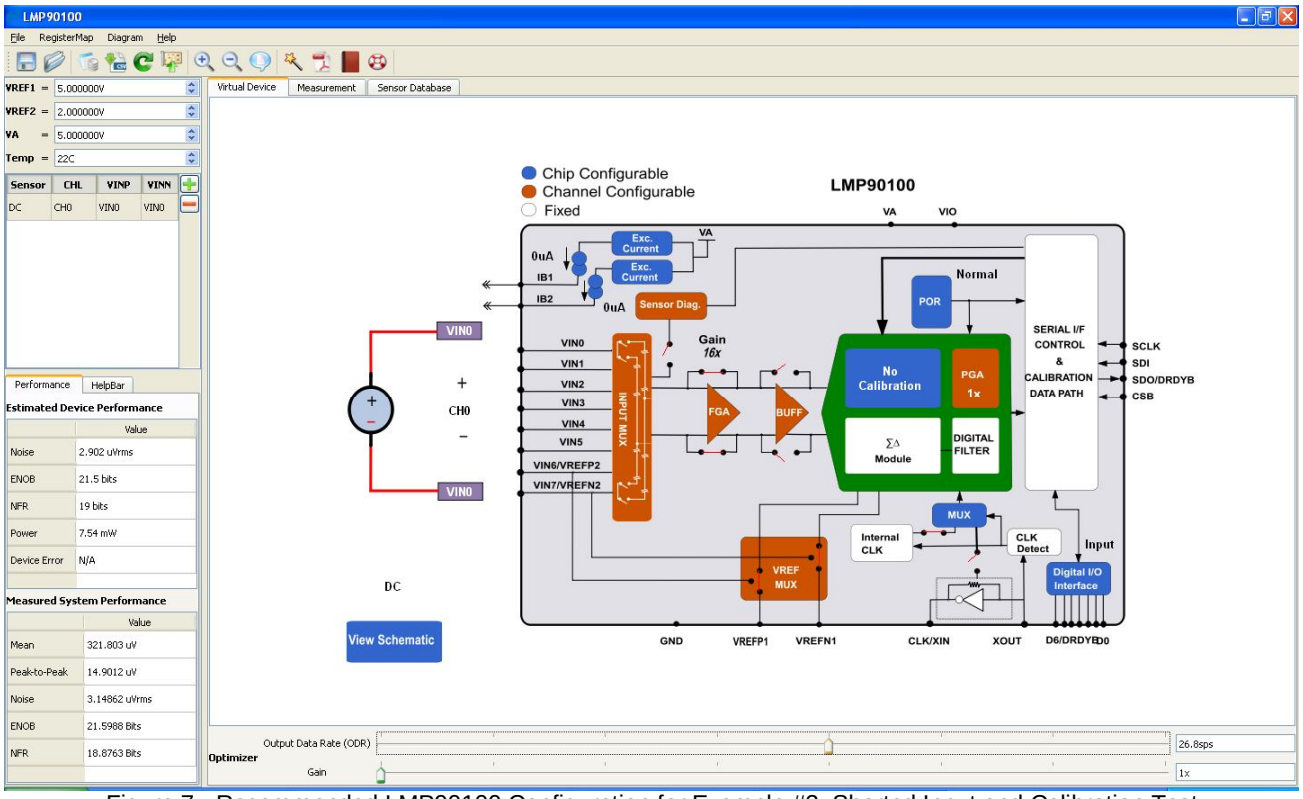


Figure 7 - Recommended LMP90100 Configuration for Example #2: Shorted Input and Calibration Test

2. **Capturing Data without Calibration:**
   a. Click on the **"Measurement"** tab and set the **"Scan Mode"** as follows:

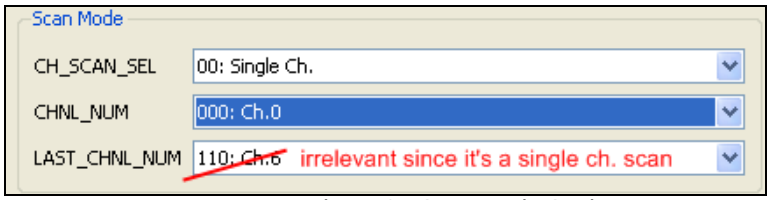


Figure 8 - Scan Mode Settings

   b. Under the **"Output Format"** field, select Display "**Output Voltage (V)"**
   c. Under the **"Stop Condition"** field, select Run **"500"** samples.
   d. Click on the **"Run"** button to view the output voltage results. A reading in the hundreds of uV should be plotted similar to Figure 9.

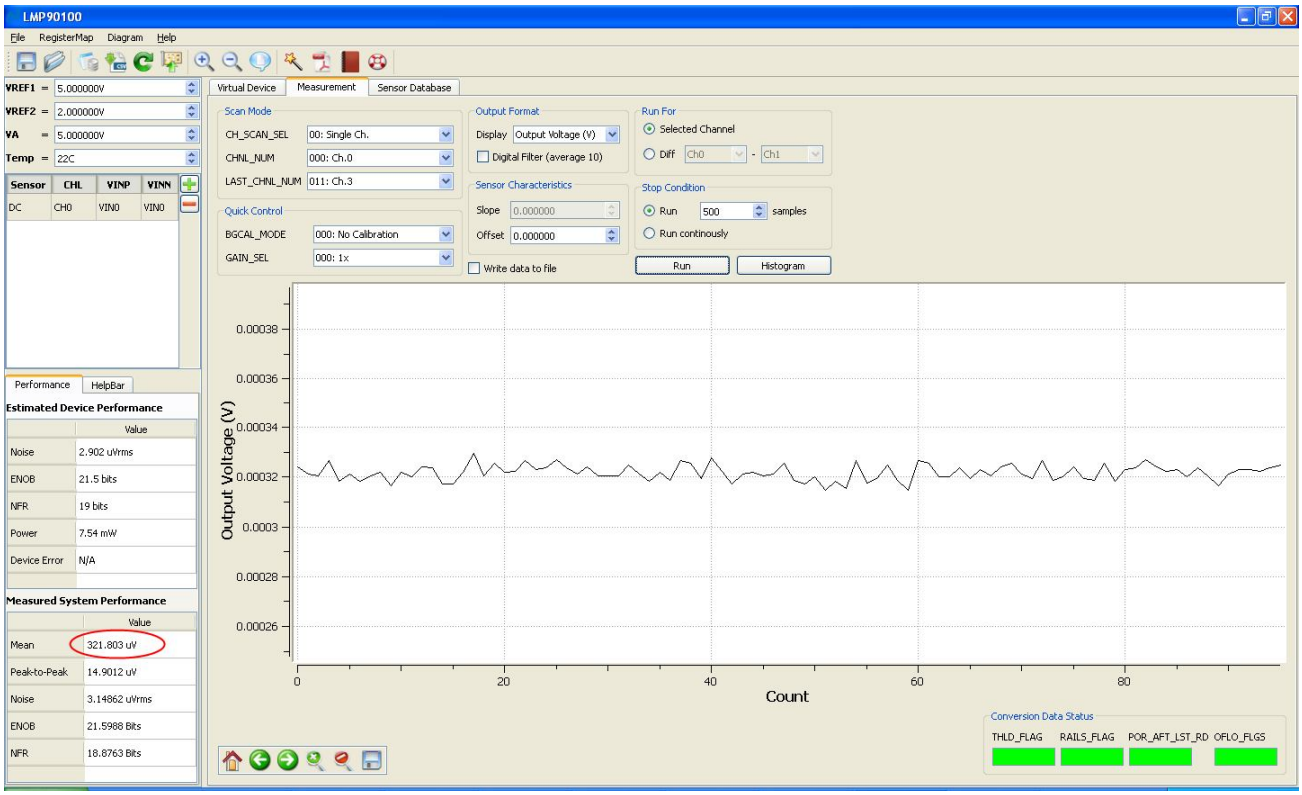


Figure 9 - Results for Shorted Input Test without Calibration

3. **Capturing Data with Calibration:**
   a. In the **"Measurement"** tab, go to "**Quick Control → BGCAL_MODE"** and change the background calibration to **"001: Offset Cor / Gain Est".**
   b. Click on the **"Run"** button again to view the output voltage results. A mean output reading closer to 0V should be plotted similar to Figure 10. This decrease in the mean output reading demonstrates the LMP90100 offset calibration feature.

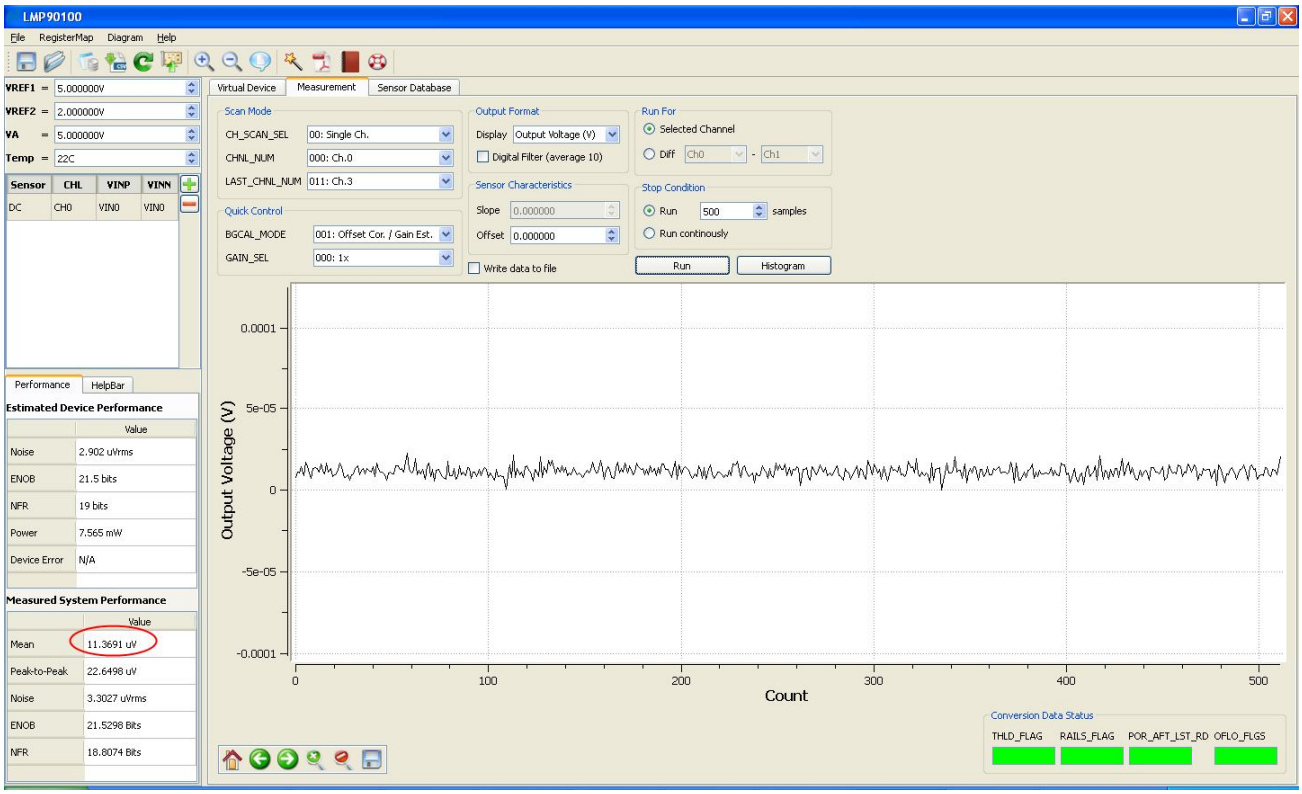


Figure 10 - Results for Shorted Input Test with Calibration

5.0. Example #3 - 3-wire RTD Application

A 3-wire RTD has a typical configuration shown in Figure 11. This section will explain how to configure the LMP90100EB and software tool to evaluate a 3-wire RTD.

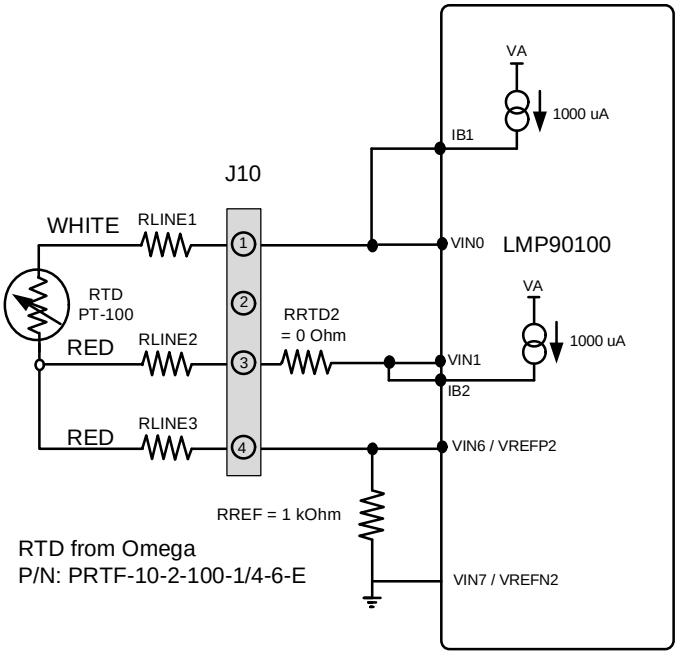


Figure 11 - 3-Wire RTD Configuration

A. LMP90100EB Jumper Connections

1. Figure 20 shows the schematic.
2. The jumpers not mentioned in this table have to be left unconnected for this exercise.
3. SPIO-4 board is properly setup out of the box (no assembly required).

Jumper	Jumper Connections	Purpose
JP1	Pins 2 & 3	VA = SPIO4_PWR
JP2	Pins 2 & 3	VIO = SPIO4_PWR
JP4	Pins 1 & 2	SPIO4_PWR = 3.3V
JP6	Pins 1 & 2	Connect VA to LMP90100
JP7	Pins 1 & 2	Connect VIO to LMP90100
JP11	Pins 1 & 2	Connect IB1 to VIN0

Jumper	Jumper Connections	Purpose
JP11	Pins 3 & 4	Connect VIN0 to RTD.P1
JP11	Pins 7 & 8	Connect IB2 to VIN1
JP11	Pins 9 & 10	Connect VIN1 to RTD.P3
JP11	Pins 11 & 12	Connect VIN6_VREFP2 to RTD.P4
JP11	Pins 13 & 14	Connect VIN7_VREFN2 to ground

Table 3 – Jumpers Connection

B. Opening the Software – follow section "9.0. Installing the Software" to install the Sensor AFE software.

C. Connecting and Powering the Boards

1. Connect the LMP90100EB's **JP12** to SPIO-4 Board's **J6** (pins 1-16). See Figure 3.
2. Connect SPIO-4 Board to a PC via **USB.**
3. Use a multimeter to measure LMP90100EB's JP6 and JP7; they should all be approximately 3.3V. If they are not, check your power supplies and jumpers.

D. Connecting the Sensor to the LMP90100EB

1. Connect a 3-wire RTD to J10 (see Figure 11). The white wire should be at J10.P1, and the red wires should be at J10.P3 and J10.P4.

E. Configuring the Device

1. Follow the step-by-step instructions under the **"HelpBar"** mini-tab to configure the device. The recommended configuration can be seen in Figure 12.

   a. Step 1: Select a Sensor - select **"RTD" → "PRTF-10-2-100-1/4-6-E"**.

   b. Step 2: Configure Inputs – click on the **"INPUT MUX"** block to set "**VINP = 000: VIN0"** and "**VINN = 001: VIN1".** Click on the **"View Schematic"** button located next to the block diagram. This should open up a PDF of the schematic and calculation for this 3-wire RTD example.

   c. Step 3: Select Reference – click on the "**VREF MUX"** block to choose **"VREF_SEL = 1: VREF2".** Make sure the value for VREF2 is 2.0V [RREF * (IB1+IB2)].

   d. Step 4: Source IB1/IB2? – click on the **"EXC. Current"** block to set **"RTD_CUR_SEL = 1010: 1000 uA"**.

   e. Step 5: Set Gain – since VIN = 0.109 V at room temperature for IB1 = IB2 = 1000 uA, the maximum gain can be 16x. Click on the **"FGA"** block**, "PGA"** block**,** or the "**Gain"** slider to select the gain.

f. Step 6: Set Buffer – click on the **"BUFF"** block to include or exclude the buffer from the signal path.

g. Step 7: Set Calibration - click on the **"No Calibration"** block to enable or disable calibration. Refer to the LMP90100 datasheet to more information on the LMP90100's background calibration types and modes.

h. Step 8: Int/Ext CLK? – click on the **"CLK MUX"** block and make sure the internal clock is selected.

i. Step 9: Performance - click on the **"Performance"** mini-tab. This tab displays the Estimated Device Performance base on the block diagram that you've configured, as well as the Measured System Performance if you've connected a board and ran the LMP90100.

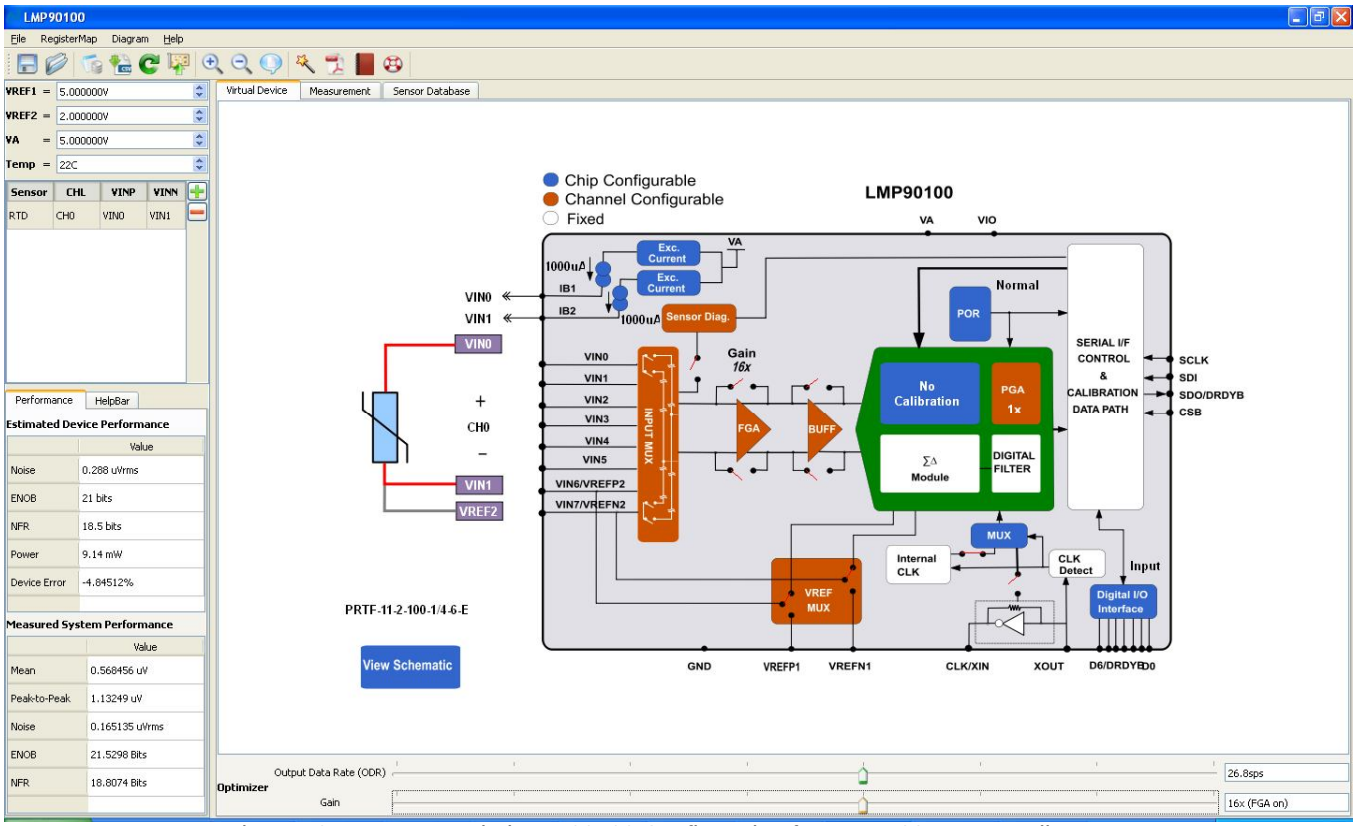


Figure 12 - Recommended LMP90100 Configuration for a PT-100 RTD Reading

2. Click on the **"Measurement"** tab and set the **"Scan Mode"** as follows:

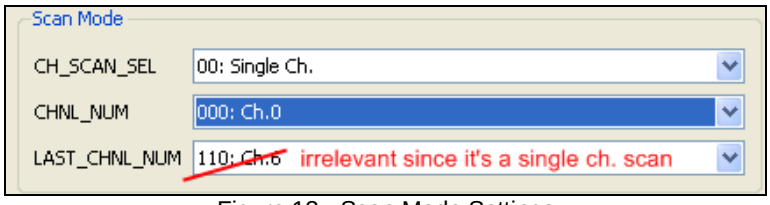
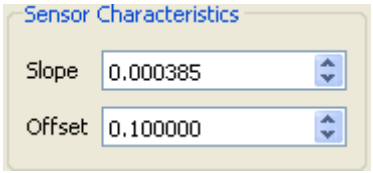


Figure 13 - Scan Mode Settings

a. Under the **"Output Format"** field, select Display "**Temperature (°C)"**
b. Make sure the **"Sensor Characteristics"** is set as:



c. Under the **"Stop Condition"** field, select **"Run Continuously"**.
d. Click on the **"Run"** button to view the output temperature reading. A reading of approximately 23°C (room temperature) should be plotted.

6.0. Example #4: Thermocouple and LM94022 Application

The thermocouple and temperature sensor schematic of the LMP90100 Evaluation Board are shown in Figure 14. The temperature sensor is a LM94022 and is located under the thermocouple connector (J4) to provide cold junction compensation. The thermocouple connector (J4) is made for use with a type K thermocouple. This section will explain how to configure the LMP90100EB for the thermocouple and IC temperature sensor applications.

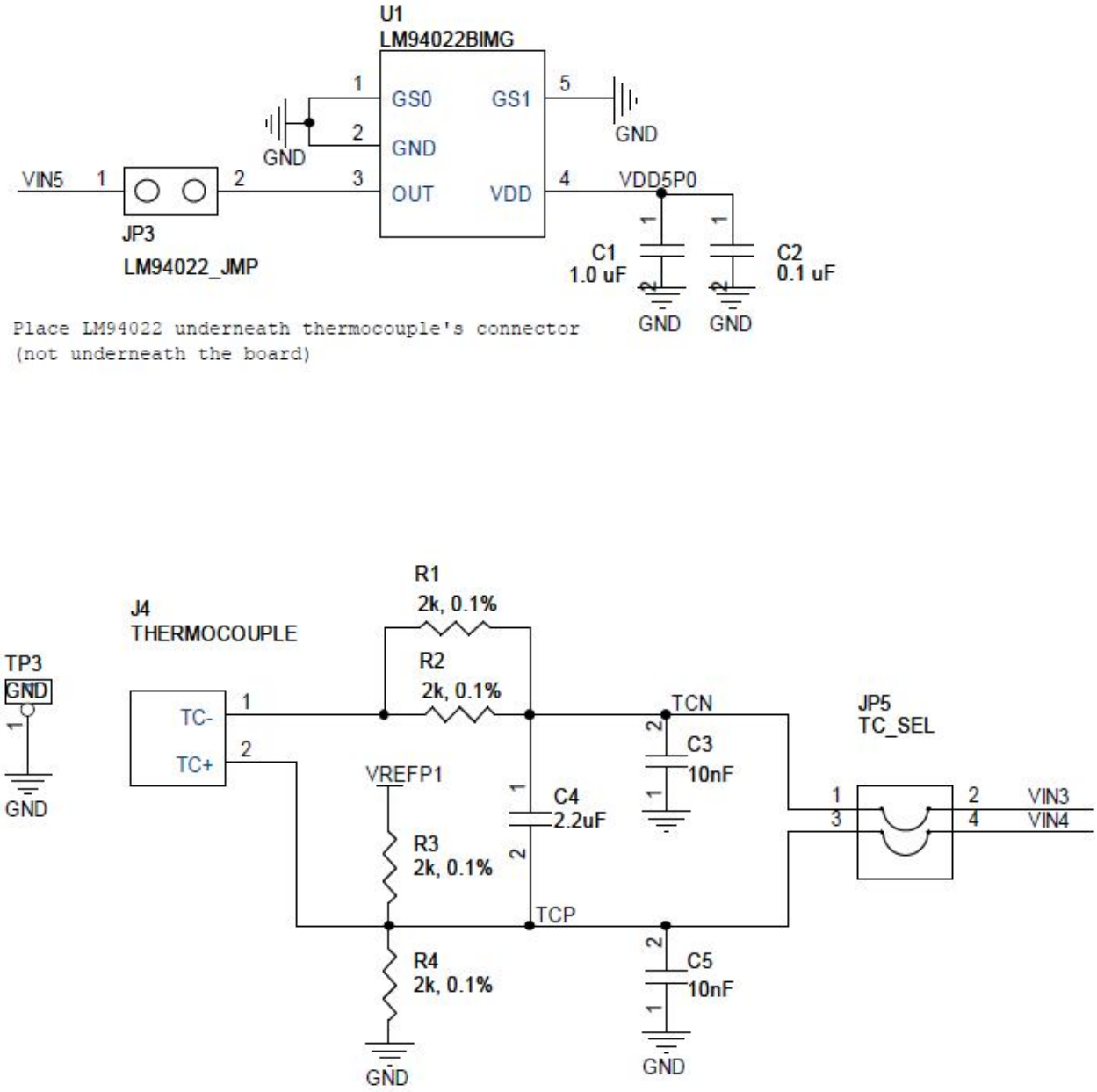


Figure 14 – Thermocouple and Temperature Sensor Schematic

A. LMP90100EB Jumper Connections:

a. Figure 20 shows the schematic.
b. The jumpers not mentioned in this table have to be left unconnected for this exercise.
c. SPIO-4 board is properly setup out of the box (no assembly required).

Jumper	Jumper Connections	Purpose
JP1	Pins 2 & 3	VA = SPIO_PWR
JP2	Pins 2 & 3	VIO = SPIO_PWR
JP3	Pins 1 & 2	Connect LM94022 Output to LMP90100' VIN5
JP4	Pins 2 & 3	SPIO_PWR = 5.0V
JP5	Pins 1 & 2	Connect thermocouple to LMP90100 VIN3
JP5	Pins 3 & 4	Connect thermocouple to LMP90100 VIN4
JP6	Pins 1 & 2	Connect VA to LMP90100
JP7	Pins 1 & 2	Connect VIO to LMP90100
JP11	Pins 13 & 14	Connect VIN7 to ground
JP13	Pins 1 & 2	VREFP1 = VA
JP13	Pins 9 & 10	VREFN1 = Ground
JP14	Pins 1 & 2	VREFP1 = VA
JP14	Pins 3 & 4	VREFN1 = Ground

Table 4 - Jumpers Connection for 3-wire RTD Application

B. Opening the Software – follow section "9.0. Installing the Software" to install the Sensor AFE software.

C. Connect a K type thermocouple to J4. Note that the thermocouple's positive input (TCP) = VIN4 and TCN = VIN3.

D. Configuring the Device Using Sensor AFE Software

1. **Setting Up the Thermocouple -** follow the step-by-step instructions under the **"HelpBar"** mini-tab to configure the device. The recommended configuration can be seen in Figure 15.

   a. Step 1: Select a Sensor - select **"Thermocouple" → "PT8A3KD12B1A0"**.

b. Step 2: Configure Inputs – click on the **"INPUT MUX"** block to set "**VINP = 100: VIN4"** and "**VINN = 011: VIN3".** Click on the **"View Schematic"** button located next to the block diagram. This should open up a PDF of the schematic for a thermocouple.

c. Step 3: Select Reference – click on the "**VREF MUX"** block to choose **"VREF_SEL = 0: VREF1".** Make sure the value for VREF1 = 5.0V.

d. Step 4: Source IB1/IB2? – *this step can be ignored because neither IB1 nor IB2 is connected to the inputs.*

e. Step 5: Set Gain – since the differential junction across a thermocouple is low, the maximum gain can be 128x. Click on the **"FGA"** block**, "PGA"** block**,** or the "**Gain"** slider to select the gain.

f. Step 6: Set Buffer – click on the **"BUFF"** block to include or exclude the buffer from the signal path.

g. Step 7: Set Calibration - click on the **"No Calibration"** block to enable or disable calibration. Refer to the LMP90100 datasheet to more information on the LMP90100's background calibration types and modes.

h. Step 8: Int/Ext CLK? – click on the **"CLK MUX"** block and make sure the internal clock is selected.

i. Step 9: Performance - click on the **"Performance"** mini-tab. This tab displays the Estimated Device Performance base on the block diagram that you've configured, as well as the Measured System Performance if you've connected a board and ran the LMP90100.

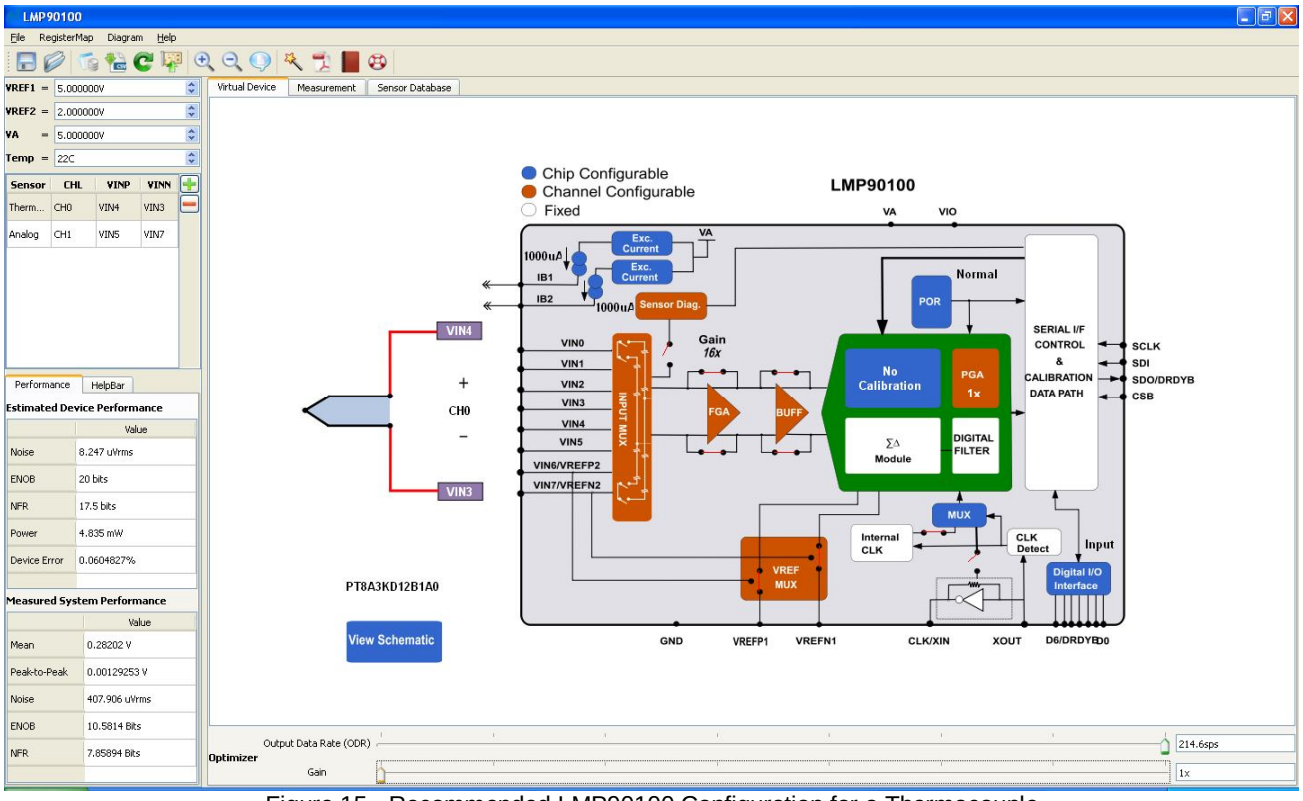


Figure 15 - Recommended LMP90100 Configuration for a Thermocouple

2. **Setting Up the LM94022 Temperature Sensor -** follow the step-by-step instructions under the **"HelpBar"** mini-tab to configure the device for an LM94022 sensor application. The recommended configuration can be seen in Figure 17.

   a. Step 1: Select a Sensor – click on the **"+"** button to enter the "**Sensor Database"** tab. Select **"Analog"** → **"LM94022"**.

   b. Now that the LM94022 is added, the sensor window should look like Figure 16.

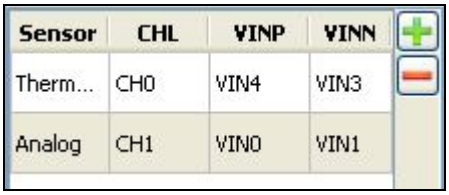


Figure 16 – Sensor Window

   c. Step 2: Configure Inputs – click on the **"INPUT MUX"** block to set "**VINP = 101: VIN5"** and "**VINN = 111: VIN7".** Click on the **"View Schematic"** button located next to the block diagram. This should open up a PDF of the schematic for a thermocouple.

   d. Step 3: Select Reference – click on the "**VREF MUX"** block to choose **"VREF_SEL = 0: VREF1".** Make sure the value for VREF1 = 5.0V.

   e. Step 4: Source IB1/IB2? – *this step can be ignored because neither IB1 nor IB2 is connected to the inputs.*

   f. Step 5: Set Gain – click on the **"FGA"** block**, "PGA"** block**,** or the "**Gain"** slider to select the gain.

   g. Step 6: Set Buffer – click on the **"BUFF"** block to include or exclude the buffer from the signal path.

   h. Step 7: Set Calibration - click on the **"No Calibration"** block to enable or disable calibration. Refer to the LMP90100 datasheet to more information on the LMP90100's background calibration types and modes.

   i. Step 8: Int/Ext CLK? – click on the **"CLK MUX"** block and make sure the internal clock is selected.

   j. Step 9: Performance - click on the **"Performance"** mini-tab. This tab displays the Estimated Device Performance base on the block diagram that you've configured, as well as the Measured System Performance if you've connected a board and ran the LMP90100.

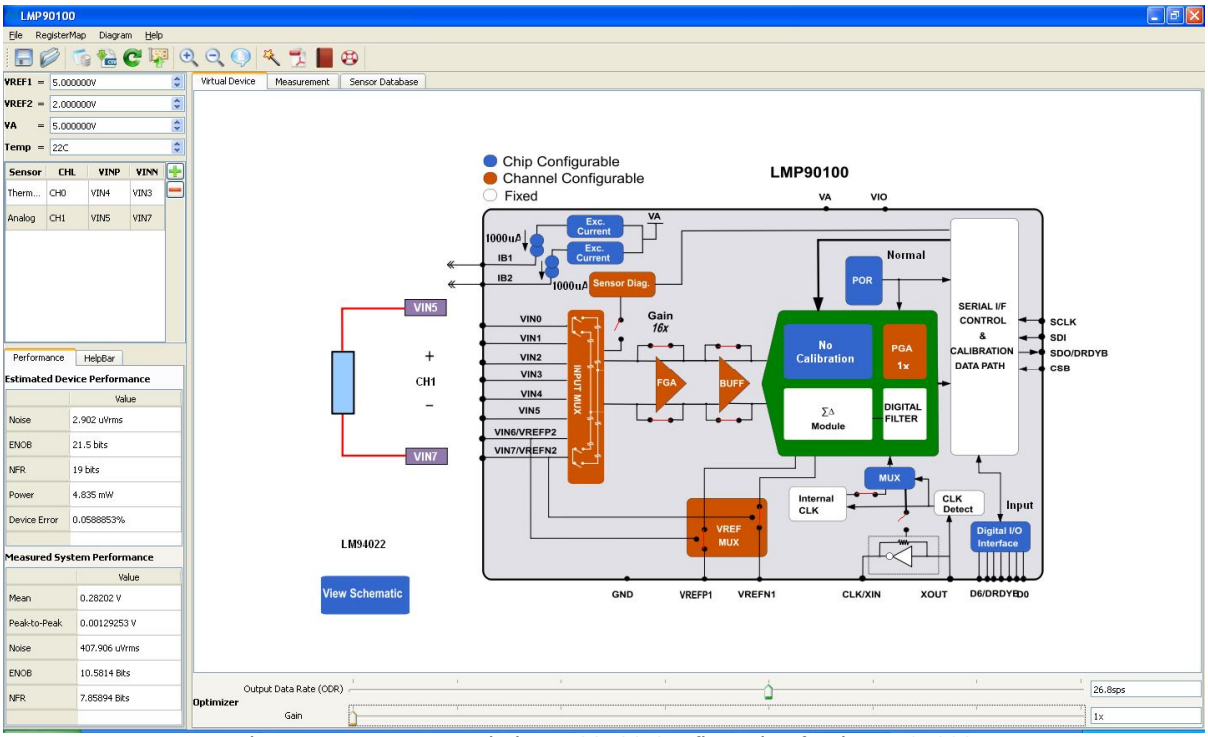


Figure 17 - Recommended LMP90100 Configuration for the LM94022

3. **Reading the Output**
   a. Click on the **"Measurement"** tab and set the **"Scan Mode"** as follows:

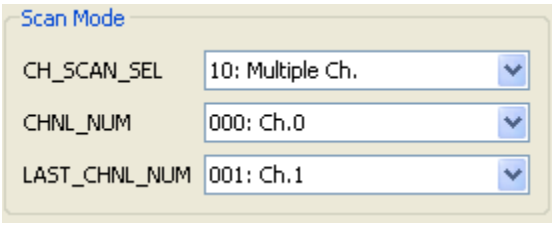
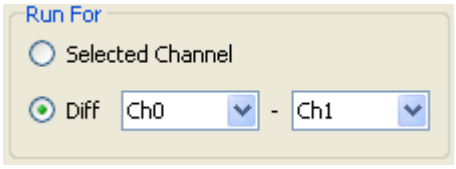


Figure 18 - Scan Mode Settings

   b. Under the **"Output Format"** field, select Display "**Voltage (V)**"
   c. Under the **"Run For"** field, plot the difference of CH0 and CH1.



   d. Under the **"Stop Condition"** field, select Run **"1000 Samples".**
   e. Click on the **"Run"** button to capture data.
   f. See the LM94022 Transfer Table starting on page 9 of its datasheet to determine the temperature of the temperature sensor. In this application, the LM94022 is set up with GS = 00.
   g. Consult a K type thermocouple chart to determine the temperature between the thermocouple connector and the end of the thermocouple.

7.0. Powering the LMP90100EB

There are two ways in which VA and VIO can be sourced: external supplies or SPIO-4 power.

If using external power supplies to source VA and VIO, then do the following:
1. Connect an external power supply to J1 for VA. Jumper pins 1 and 2 of JP1 to select this option.
2. Connect an external power supply to J2 for VIO. Jumper pins 1 and 2 of JP2 to select this option.
3. Jumper JP6 to connect the external power to VA.
4. Jumper JP7 to connect the external power to VIO.

If using the SPIO-4 power to source VA and VIO, then do the following:
1. Jumper pins 1 and 2 of JP4 to select 3.3V for VA and VIO, or jumper pins 2 and 3 of JP4 to select 5.0V for VA and VIO.
2. Jumper pins 2 and 3 of JP1 to select the SPIO-4 power for VA.
3. Jumper pins 2 and 3 of JP2 to select the SPIO-4 power for VIO.
4. Jumper JP6 to connect the SPIO-4 power to VA.
5. Jumper JP7 to connect the SPIO-4 power to VIO.

The schematic for the LMP90100EB can be seen in Figure 20.

8.0. Evaluating the LMP90100 without SPIO-4 Board.

The SPIO-4 digital controller board is used to generate the SPI signals to communicate to the LMP90100. Without the SPIO-4 board, the Sensor AFE software for the LMP90100 cannot be used to capture and analyze data from the LMP90100EB.

If the SPIO-4 board is not available but LMP90100 evaluation is desirable, then connect your own SPI signals to J8 of the LMP90100EB as seen in Figure 19.

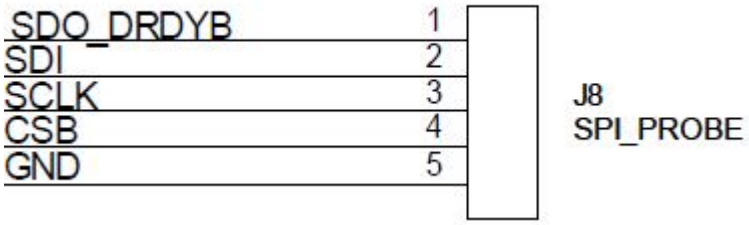


Figure 19 - LMP90100EB's J8 for SPI Signals

Refer to the LMP90100 datasheet for more information on the LMP90100's SPI protocol.

9.0. Installing the Software

Each Sensor AFE product will have its own software. To access the Sensor AFE software for LMP90100, click on http://share/sites/psp/precsys/psd/wikis/SensorAFE.aspx.

10.0. Schematic

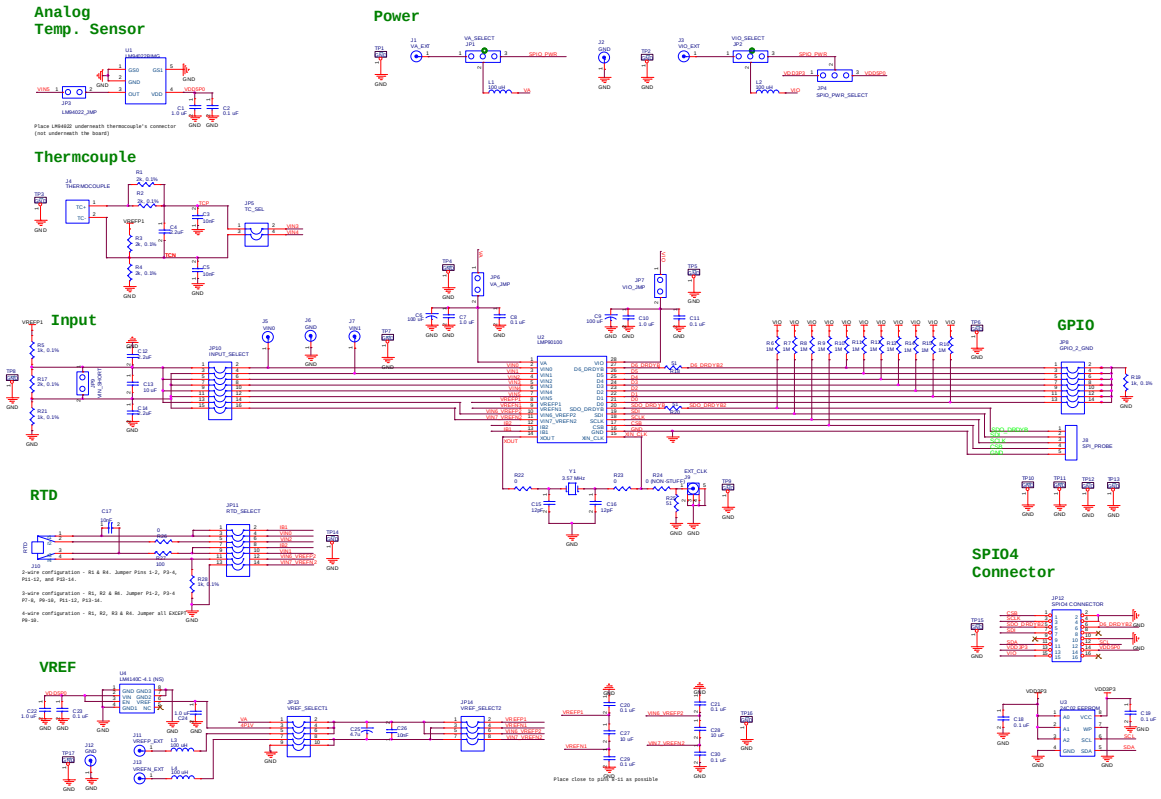


Figure 20 - LMP90100EB Schematic

11.0. Layout

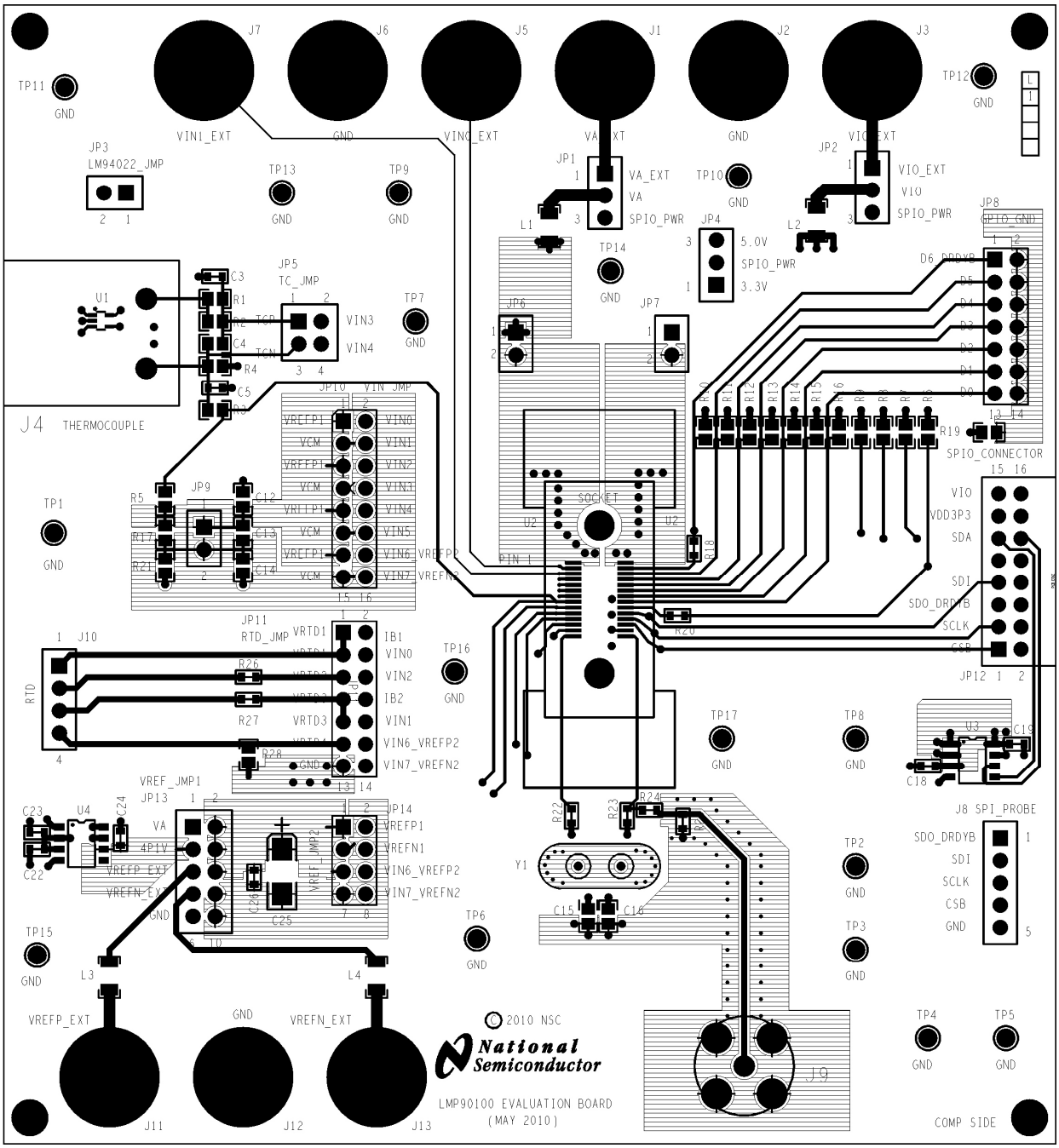


Figure 21 - Layout – Top Layer

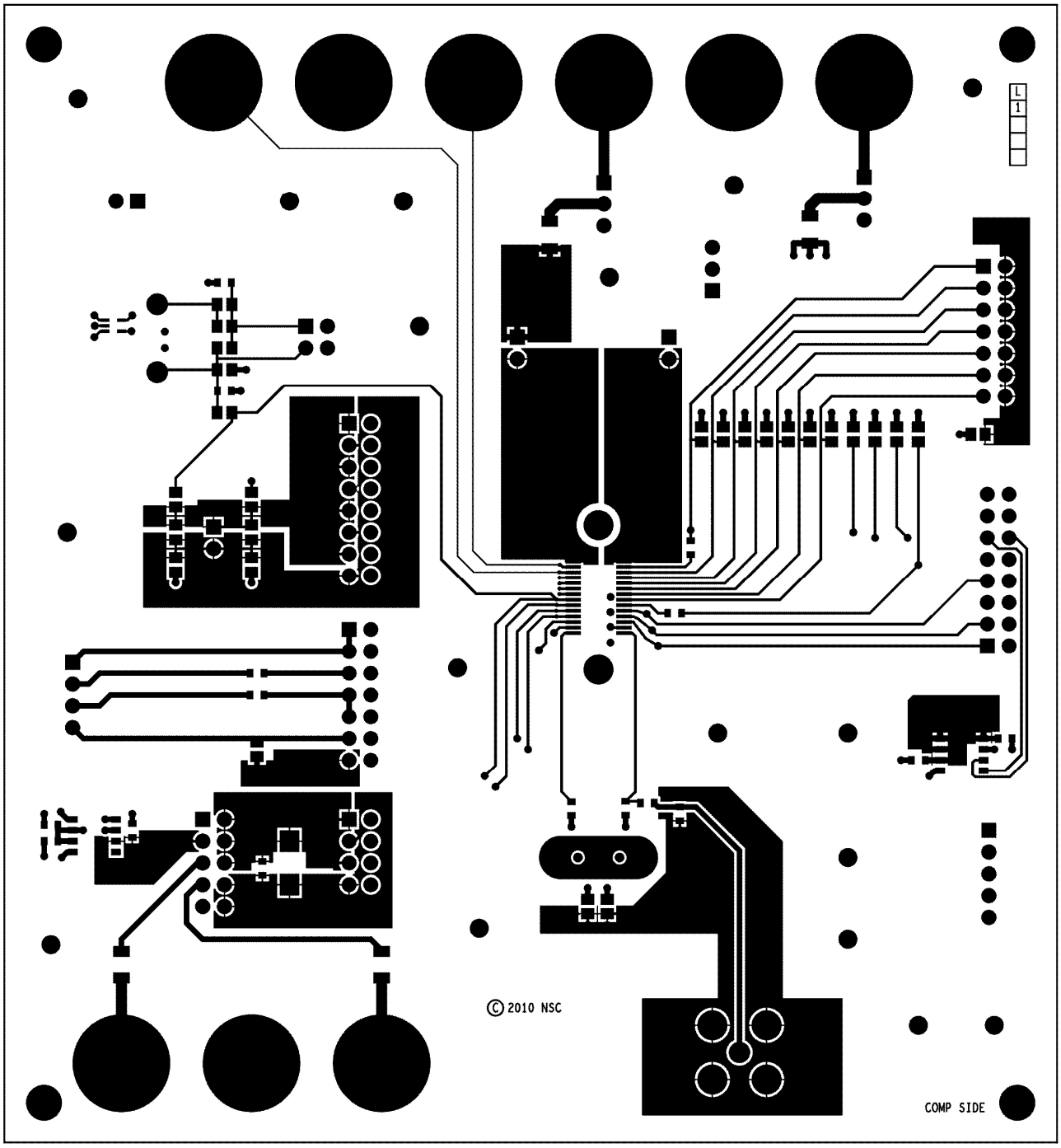


Figure 22 - Layout 3rd Layer

12.0. BOM

Item	Quantity	Reference	Value	Description	Source	Source Part #
1	5	C1,C7,C10,C22,C24	1.0 uF	CAP CER 1.0UF 10V Y5V 0603	Digikey	490-1585-1-ND
2	10	C2,C8,C11,C18,C19,C20,	0.1 uF	CAP CER .1UF 0603	Digikey	490-4779-1-ND
		C21,C23,C29,C30				
3	4	C3,C5,C17,C26	10nF	CAP CER 10000PF 50V 10% X7R 0603	Digikey	490-1512-1-ND
4	3	C4,C12,C14	2.2uF	CAP CER 2.2UF 10V Y5V 0805	Digikey	490-1743-1-ND
6	3	C13,C27,C28	10 uF	CAP CER 10UF 10V Y5V 0805	Digikey	445-1371-1-ND
7	2	C15,C16	12pF	CAP 12PF 50V CERM CHIP 0805 SMD	Digikey	PCC120CNCT-N
9	1	JP1	VA_SELECT	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
10	1	JP2	VIO_SELECT	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
11	1	JP3	LM94022_JMP	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
12	1	JP4	SPIO4_PWR_SELECT	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
13	1	JP5	TC_SEL	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
14	1	JP6	VA_JMP	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
15	1	JP7	VIO_JMP	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
16	1	JP8	GPIO_2_GND	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
17	1	JP9	VIN_SHORT	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
18	1	JP10	INPUT_SELECT	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
19	1	JP11	RTD_SELECT	CONN HEADER .100 SINGL STR 36POS	Sullins Connector	S1011E-36-ND
20	1	JP12	SPIO4 CONNECTOR	CONN HEADR BRKWAY .100 80POS	Digikey	A34278-40-ND

				R/A		
21	1	JP13	VREF_SELECT1	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
22	1	JP14	VREF_SELECT2	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
23	1	J1	VA_EXT	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
24	3	J2,J6,J12	GND	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
25	1	J3	VIO_EXT	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
26	1	J4	THERMOCOUPLE	THERMOCOUPLE CLASS K SOCKET	RS Mobile	381-7564
27	1	J5	VIN0	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
28	1	J7	VIN1	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
29	1	J8	SPI_PROBE	CONN HEADER .100 SINGL STR 36POS	Digikey	S1011E-36-ND
30	1	J9	EXT_CLK	CONN BNC FEM JACK PC MNT STRGHT	Digikey	ACX1051-ND
31	1	J10	RTD	TERM BLOCK PCB 4POS 5.0MM GREEN	Digikey	277-1579-ND
32	1	J11	VREFP_EXT	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
33	1	J13	VREFN_EXT	CONN JACK BANANA UNINS PANEL MOU	Digikey	J147-ND
34	4	L1,L2,L3,L4	100 uH	INDUCTOR 100UH 140MA 10% SMD	Digikey	587-2038-1-ND
35	4	R5,R19,R21,RREF	1k, 0.1%	RES 1.0K OHM 1/8W .1% 0805 SMD	Digikey	RG20P1.0KBCT-ND
36	4	RRTD1,RRTD2,R22,R23	0	RES 0.0 OHM 1/10W 0603 SMD	Digikey	RMCF1/160RCT ND
37	5	R1,R2,R3,R4,R17	2k, 0.1%	RES 2.0K OHM 1/8W .1% 0805 SMD	Digikey	P2.0KDACT-ND
38	11	R6,R7,R8,R9,R10,R11,R12,	1M	RES 1.0M OHM 1/8W 5% 0805 SMD	Digikey	RHM1.0MARCT-ND

		R13,R14,R15,R16				
39	3	R18,R20,R25	51	RES 51 OHM 1/10W 5% 0603 SMD	Digikey	P51GCT-ND
41	17	TP1,TP2,TP3,TP4,TP5,TP6,	GND	TEST POINT PC MULTI PURPOSE BLK	Digikey	5011K-ND
		TP7,TP8,TP9,TP10,TP11,				
		TP12,TP13,TP14,TP15,TP16,				
		TP17				
42	1	U1	LM94022BIMG	ANALOG TEMPERATURE SENSOR	NSC	LM94022BIMG
43	1	U2	LMP90100	LMP90100	NSC	LMP90100
44	1	U3	24C02 EEPROM	EEPROM 256x8	Mouser	579-24C02CSN
45	1	U4	LM4140C-4.1	4.1 V Voltage Reference	NSC	LM4140C-4.1
46	1	Y1	3.57 MHz	CRYSTAL 3.579545 MHZ 18PF 49US	Digikey	XC1707-ND
47	4	N/A	N/A	BUMPON HEMISPHERE .44X.20 BLACK	Digikey	SJ5003-0-ND

Table 5 - BOM

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