

LMP91000EVM User's Guide

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1. Introduction

The Texas Instruments LMP91000EVM evaluation module (EVM) helps designers evaluate the operation and performance of the LMP91000 Sensor Analog Front End for Electrochemical sensor. The LMP91000EVM is part of the Sensor AFE eval platform

The EVM contains one LMP91000, (See Table 1).

Table 1: Device and Package Configurations

DEVICE	IC	PACKAGE
U1	LMP91000SD	LLP-14

The LMP91000EVM is provided with a 16 bit ADC (ADC161S626) in order to capture the output of the LMP91000. **The LMP91000EVM is not provided with any gas sensor. It supports 3-lead electrochemical cells and 2-lead galvanic cell in potentiostat configuration.**

2. Setup

This section describes the jumpers and connectors on the EVM as well and how to properly connect, set up and use the LMP91000EVM in the Sensor AFE eval platform.

2.1. Gas Sensor Connection

Both 3-lead and 2-lead gas sensor need to be placed in the Gas Sensor Footprint

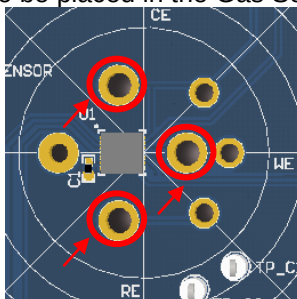


Figure 1: Gas sensor's footprint

2.1.1. Not Biased Gas sensor

Even if the LMP91000 is provided with an internal switch to short the RE and WE pin that can be enabled when the device is in Deep sleep mode, it is possible to add an external JFET which makes the same feature when the gas sensor is left connected to the board and the LMP91000 is turned off.

The JFET (Q1) should be a p-type FET. Recommended FETs are listed in the table below.
The gate resistance R12 can be populated with a 1kohm resistor.

Table 2: Recommended p-FETs for short circuiting RE and WE when LMP91000 is OFF

DEVICE	IC	DESCRIPTION	MANUFACTURER	PACKAGE
Q1	PMBFJ177	P-channel Silicon Junction Field-effect Transistor	NXP SEMICONDUCTOR	SOT23
	SST177		VISHAY SILICONIX	
	MMBF177		Fairchild	

2.2. Jumpers Configuration

2-WIRE is the jumper which shorts CE and RE pin when a 2-lead gas sensor is connected to the LMP91000.

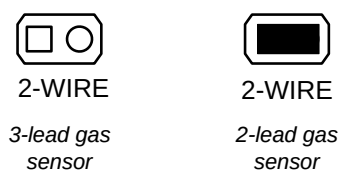


Figure 2: 2-WIRE Jumper Settings

J_MENB configures the Module Enable of the LMP91000 either manual or controlled by external microcontroller. In manual mode, the Module Enable of the LMP91000 is tied to GND. When the LMP91000EVM is connected to the SPIO4 board pin 1-2 need to be shorted.

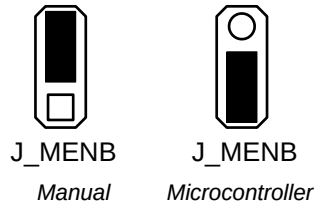


Figure 3: J_MENB Jumper Settings

2.3. Connection of the LMP91000EVM to SPIO4 Board

The SPIO4 board is a data capture board required when the LMP91000 is used in the Sensor AFE eval platform. The LMP91000EVM is connected to the SPIO4 board through the SPIO-GPSI16 connector. The white arrows present on both LMP91000EVM and SPIO4 board need to be aligned in order to guaranty the right connection.



Figure 4: Connection of the LMP91000EVM to SPIO4 board

2.4. LMP91000EVM as part of Sensor AFE eval platform

When the LMP91000EVM is part of the Sensor AFE eval platform it doesn't require any external power supply to properly work.

Before using the Sensor AFE eval platform make sure the following steps have been accomplished:

1. Install the Graphical User Interface of the LMP91000EVM
2. Connect the LMP91000EVM to the SPIO4 board
3. Connect the USB cable to SPIO-4 board
4. Connect the other end of the USB cable to an available USB port on the computer
5. Run the Graphical User Interface

The voltage at VDD pin of the LMP91000 (VDD test point) is 3.3V, the voltage at VREF pin of the LMP91000 (VREF test point) is 2.5V. The LMP91000EVM is ready to work.

2.5. LMP91000EVM In Standalone Operation (without ADC)

The LMP91000EVM can be used as a standalone board. In this case it requires the following voltages

2.5.1. Jumper/s setting

J_MENB - pin 2 and 3 shorted (manual mode), if on the I2C bus already exist a device with the same address of the LMP91000, leave pin1 and 2 shorted.

2.5.2. Power supply

1. Remove R7 resistor
2. Connect a supply voltage (2.7V to 5.25V) between VDD test point and GND test point.

2.5.3. Voltage reference

If the on board 2.5V voltage reference fits the requirements of the application, do not accomplish the following steps.

1. Remove R6 resistor
2. Connect a reference voltage (1.5V to VDD) between VREF test point and GND test point.

2.5.4. I2C bus

The I2C bus requires two 10kohm pull-up resistors (R1, R2); the external microcontroller can be connected to the SPIO-GPSI16 connector according to the following pin out:

SCL	pin 12 of SPIO-GPSI16
SDA	pin 11 of SPIO-GPSI16
GND	pin 2 of SPIO-GPSI16

Refer to LMP91000's datasheet for further details on I2C commands and registers.

The footprints of the pull-up resistors (R1, R2) are on the bottom side of the eval board.

2.5.5. Other

Remove the resistor R8 in order to disconnect the ADC's input from LMP91000's output.

3. Board Layout

Figure 5, Figure 6 and Figure 7 show the board layout for the LMP91000EVM.

The EVM offers footprint for

- External JFET (Q1) to short RE and WE pin,
- Resistor (R3) and capacitor (C2) to apply external RTIA gain and filter

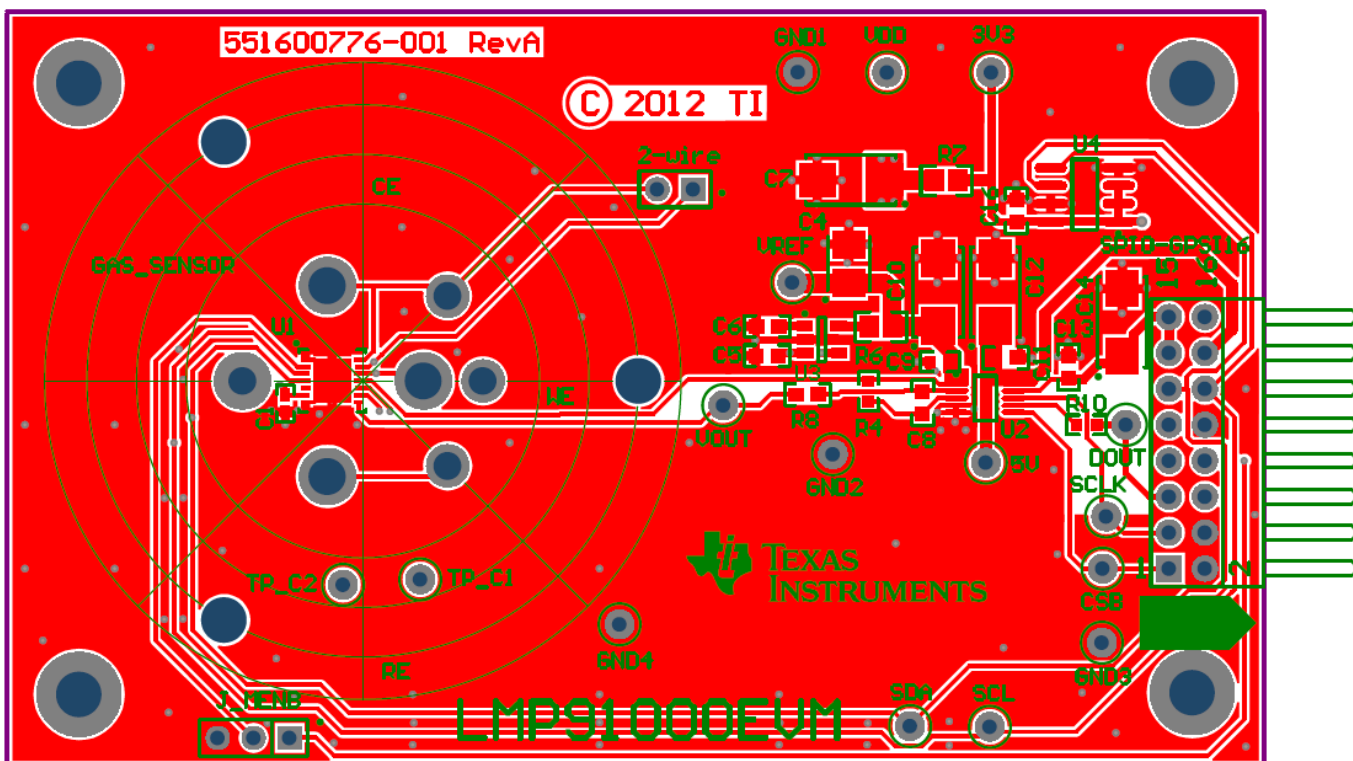


Figure 5: Top Layer Routing

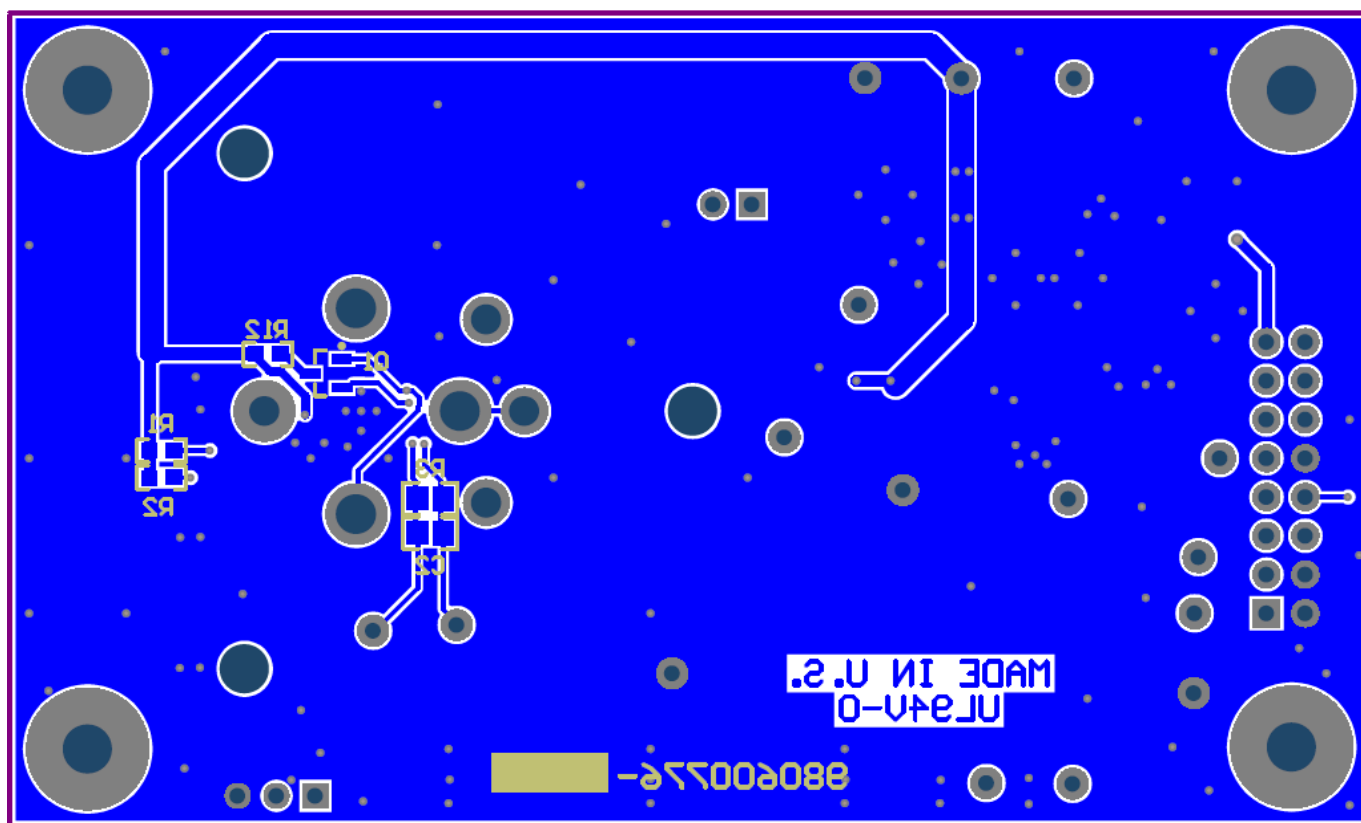


Figure 6: Bottom Layer Routing

4. Schematic

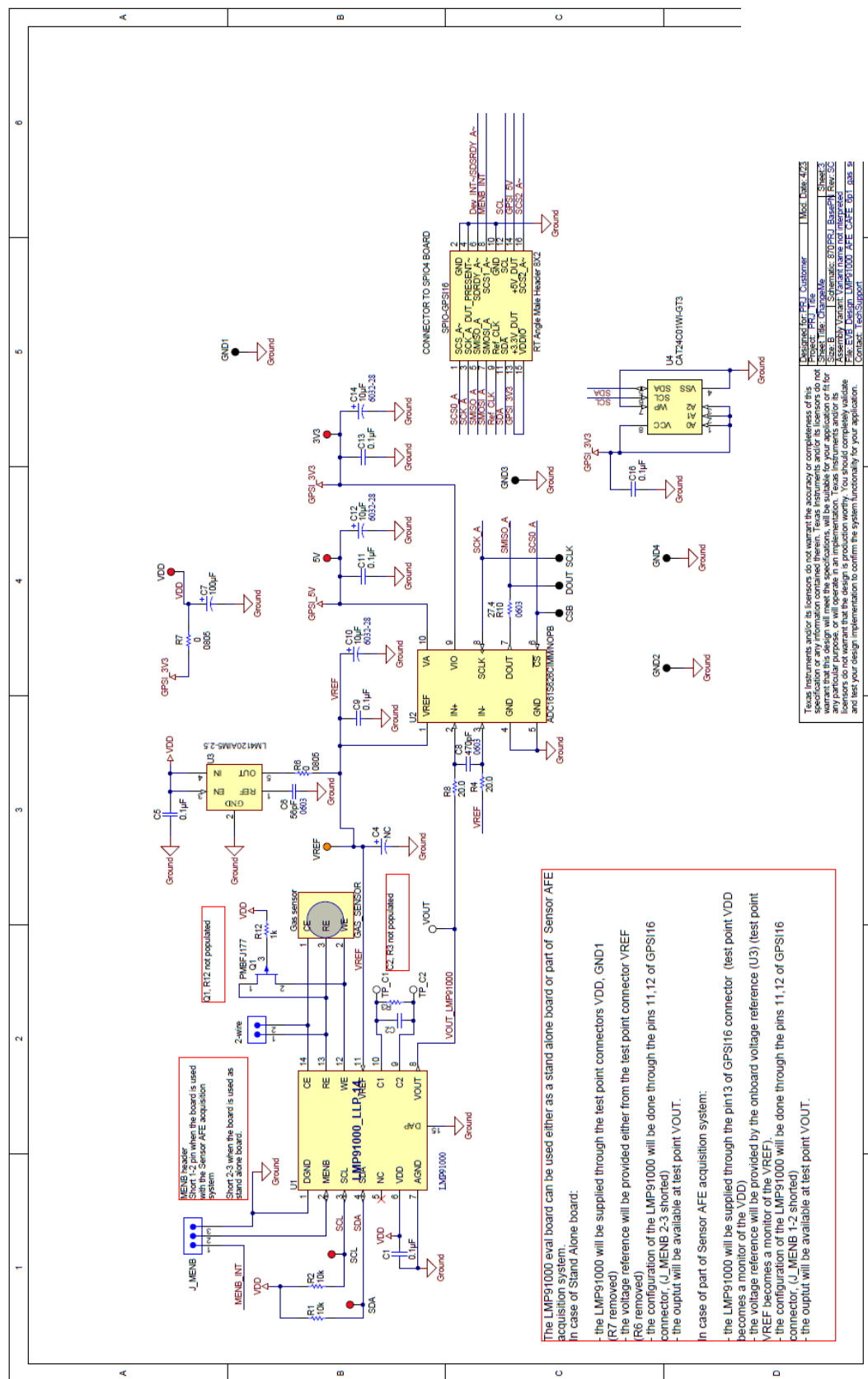


Figure 7: LMP91000EVM Schematic

Table 3: LMP91000EVM Bill of Materials

COUNT	REF DES	DESCRIPTION	SIZE	MFR	PART NUMBER
1	2-wire	Header, TH, 100mil, 1x2, Gold plated, 230 mil above insulator	0.100 x 2	Samtec Inc.	TSW-102-07-G-S
12	3V3, 5V, SCL, SDA, VDD, TP_C1, TP_C2, VOUT, CSB, DOUT, SCLK, VREF	Test Point, TH, Miniature, Red	40 mil	Keystone Electronics	5000
1	C1	CAP, CERM, 0.1uF, 10V, +/-10%, X5R	402	MuRata	GRM155R61A104KA01D
5	C5, C9, C11, C13, C16	CAP, CERM, 0.1uF, 16V, +/-5%, X7R	603	AVX	0603YC104JAT2A
1	C6	CAP, CERM, 56pF, 50V, +/-5%, C0G/NP0	603	AVX	06035A560JAT2A
1	C7	CAP, TANT, 100uF, 10V, +/-10%, 0.1 ohm	6032-28	AVX	TPSC107K010R0100
1	C8	CAP, CERM, 470pF, 50V, +/-5%, C0G/NP0	603	AVX	06035A471JAT2A
3	C10, C12, C14	CAP, TANT, 10uF, 16V, +/-10%, 0.45 ohm	6032-28	Vishay-Sprague	593D106X9016C2TE3
4	GND1, GND2, GND3, GND4,	Test Point, TH, Miniature, Black	40 mil	Keystone Electronics	5001
3	GAS_SENSOR	Gas sensor Hood	100mil	Cambion	450-3326-01-03-00
4	H1, H2, H3, H4	BUMPON HEMISPHERE .44X.20 BLACK		3M	SJ-5003 (BLACK)
1	J_MENB	Header, TH, 100mil, 1x3, Gold plated, 230 mil above insulator	0.100 x 3	Samtec Inc.	TSW-103-07-G-S
2	R4, R8	RES, 20.0 ohm, 1%, 0.1W	603	Yageo America	RC0603FR-0720RL
2	R6, R7	RES, 0 ohm, 5%, 0.125W	805	Vishay-Dale	CRCW08050000Z0EA
1	R10	RES, 27.4 ohm, 1%, 0.1W	603	Vishay-Dale	CRCW060327R4FKEA
1	SPIO-GPSI16	SPIO-GPSI16 Header, 8-Pin, Dual row, Right Angle	0.100 x 8 dual row	Sullins Connector Solutions	PBC36DGAN
1	U1	LMP91000	LLP-14	Texas Instruments	LMP91000SD
1	U2	IC ADC 16BIT 50-250KSPS	MSOP-10	Texas Instruments	ADC161S626CIMM/NOPB
1	U3	Precision Micropower Low Dropout Voltage Reference	SOT-23	Texas Instruments	LM4120AIM5-2.5
1	U4	IC EEPROM 2KBIT 400KHZ	TSSOP-8	ON Semiconductor	CAT24C01WI-GT3

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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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~

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