National Semiconductor

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LMP91000 Evaluation Board User Guide (551600558-001 REV A)

The LMP91000 evalboard (LMP91000SDEVAL) can be used as stand-alone or as part of SensorAFE eval platform (refer to SensorAFE platform http://www.national.com/sensorAFE for software and required hardware). It allows configuring the LMP91000 through the I^2C interface and testing the device with real gas sensors (3-lead amperometric cells and 2-lead galvanic cells).

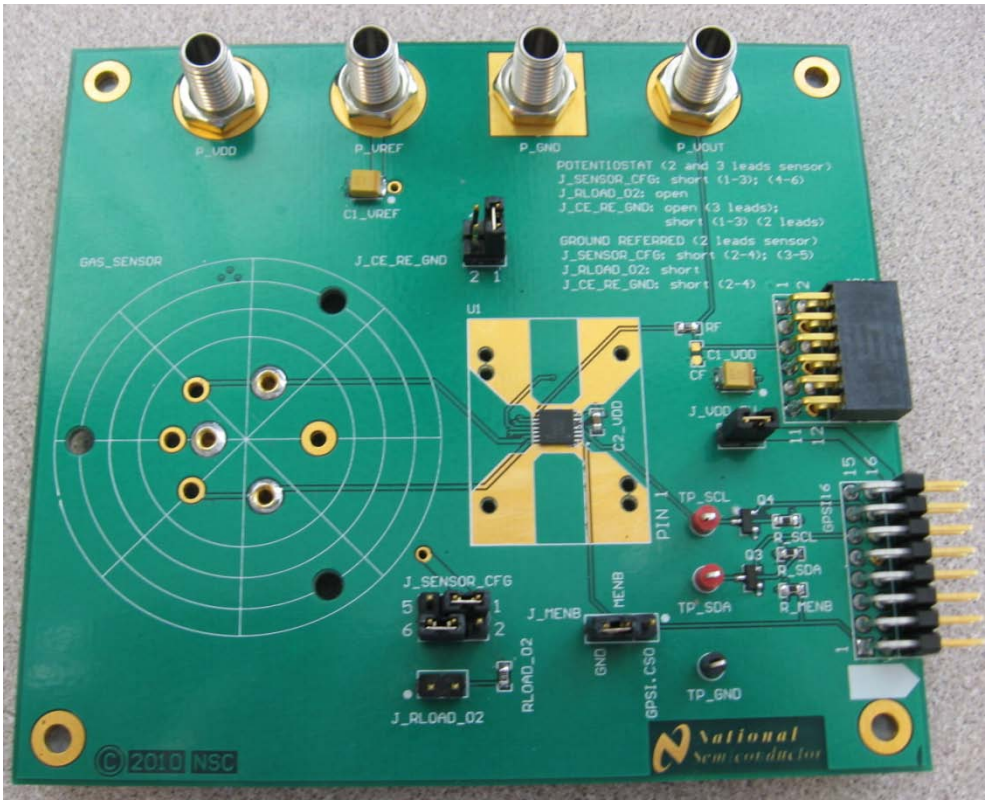


Figure 1 LMP91000SDEVAL

1. Gas sensor connection

The LMP91000 evalboard is not provided with any gas sensor. It supports 3-lead electrochemical cells and 2-lead galvanic cell. Before connecting the gas sensor configure the jumpers according to the tables below.

3-lead amperometric cell (Toxic gas sensor)

Jumper name	Configuration
J_SENSOR_CFG	4-6 shorted; 1-3 shorted
J_RLOAD_O2	open
J_CE_RE_GND	open

2-lead galvanic cell ground referred (O2 gas sensor)

Do not connect any supply voltage at P_VREF plug.

Jumper name	Configuration
J_SENSOR_CFG	2-4 shorted; 3-5 shorted
J_RLOAD_O2	1-2 shorted
J_CE_RE_GND	2-4 shorted

2-lead galvanic cell in potentiostat configuration (O2 gas sensor)

Jumper name	Configuration
J_SENSOR_CFG	4-6 shorted; 1-3 shorted
J_RLOAD_O2	open
J_CE_RE_GND	1-3 shorted

2. Stand alone usage

2.1 JUMPERS

In order to use the LMP91000SDEVAL in standalone mode, the following jumpers need to be configured as follow:

Jumper name	Configuration
J_VDD	open
J_MENB	GND – MENB shorted

The I2C bus is already provided with 10kohm pull-up resistors and level shift circuit which allows supplying the LMP91000 at a voltage higher or equal to the I2C's external microcontroller (***refers to Schematic***).Connect the external microcontroller to GPSI16 as the pin out below.

SCL	Pin12
SDA	Pin 11
V_pull-up	Pin 13 (Max 5.25V)
GND	Pin 2

2.2 POWER SUPPLY

Connect a supply voltage (2.7V to 5.25V) between P_VDD and GND banana plugs.

2.3 VOLTAGE REFERENCE

If the LMP91000 is configured in order to receive an external voltage reference, connect a supply voltage or reference source (1.5V ≤VREF≤ Supply Voltage) between P_VREF and GND banana plugs.

2.4 CONFIGURATION OF THE LMP91000

Before configuring the LMP91000, be sure that the jumpers have been configured according the previous tables, the gas sensor is connected to the board, the power supplies are connected to the board and they are powered on, the microcontroller for I2C is connected to the board. The registers in the LMP91000 are configured thorough the I^2C interface, refers to the Datasheet of the LMP91000 for timing information and registers' address.

3. Using as part of Sensor AFE evaluation platform

3.1 EVALBOARDS CONNECTION

In this case the LMP91000SDEVAL is part of the evaluation platform (LMP91000SDEVAL + ADC161S626BEB + SPIO4 board), the 3 boards need to be connected as follow:

- LMP91000SDEVAL to ADC161S626BEB through the AB12 and GPSI16 connectors (note the white arrow on the boards to align the boards);
- ADC161S626BEB to SPIO4 though the SPIO-GPSI16 connector (note the white arrow on the boards to align the boards);

Then the SPIO4 needs to be connected to a PC via USB cable

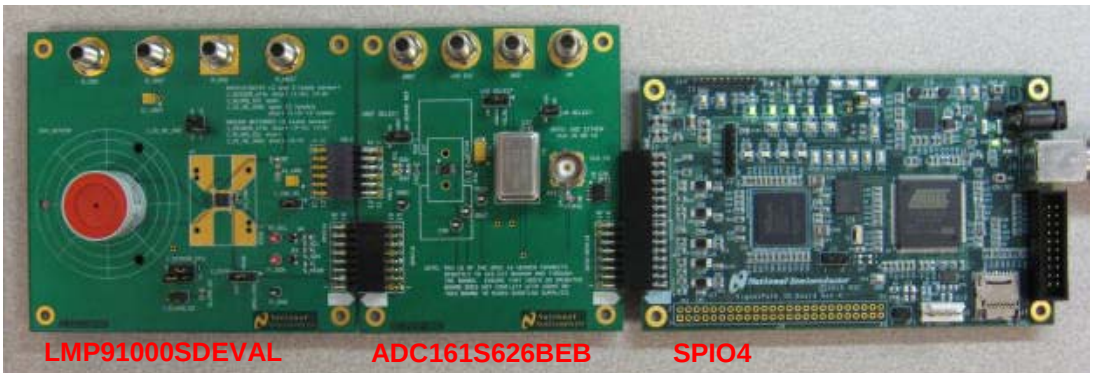


Figure 2 Sensor AFE evaluation platform

3.2 JUMPERS

In order to use the LMP91000SDEVAL in the evaluation platform the following jumpers need to be configured as follow:

Jumper name	Configuration
J_VDD	P_VDD - GPSI_5V shorted
J_MENB	MENB - GPSI.CS0 shorted

On the ADC161S626BEB make sure to configure the jumpers as follow

Jumper name	Configuration
VREF_SELECT	VREF - ON BOARD REF shorted
VIO_SELECT	VDDIO - VA shorted
VA_SELECT	+5V - VA shorted

3.3 POWER SUPPLY

All the required power supplies are provided by the SPIO4 board once connected to a PC via USB cable.
Do not connect any supply voltage to the P_VDD banana connector. This connector can be used as a monitor of the Voltage reference.

3.4 VOLTAGE REFERENCE

If the LMP91000 is configured in order to receive an external voltage reference:

- Connect a supply voltage or reference source (1.5V ≤VREF≤ Supply Voltage) between P_VREF and GND banana plugs.
- Or alternatively is possible to use the voltage reference (4.096V) provided by the ADC161S626BEB. ***Do not connect any supply voltage to the P_VREF banana connector. This connector can be used as a monitor of the Voltage reference.***

3.5 CONFIGURATION OF THE LMP91000

Refer to LMP91000 Sensor AFE User Guide for further information.

4. Connectors, Jumpers, Test Point

4.1 POWER SUPPLY

P_VDD	banana plug for the positive power supply of the LMP91000 and pull-up resistor of I^2C.
P_GND	banana plug for ground connection.

4.2 SIGNAL CONNECTORS

Reference Signals

P_VREF	banana plug for internal zero voltage generation, only when the LMP91000 is configured to receive an external reference

Output signals

P_OUT	Banana plug for the ground referred output of the LMP91000.

4.3 JUMPERS

The evalboard has 5 jumpers

J_CE_RE_GND	It is a 4pin header which allows either shorting CE (Counter Electrode) with RE (Reference Electrode) or CE with GND.
J_SENSOR_CFG	It is a 6pin header which multiplexes the gas sensor leads to the LMP91000 input pins according to the connected sensor and circuit topology.
J_RLOAD_O2	It is a simple jumper which connects the load resistor to a galvanic cell (like O2 gas sensor)
J_MENB	It is a 3 pin header which configures the Module Enable of the LMP91000 either manual or controlled by external microcontroller.
J_VDD	It is a 3 pin header which selects the supply voltage when the evalboard is connected to the USI2 or SPIO4 boards.

4.4 TEST POINTS

The test points are connected as follows.

TP_SCL	CLOCK of I^2C
TP_SDA	DATA of I^2C
TP_GND	Ground

4.5 SPECIAL CONNECTORS

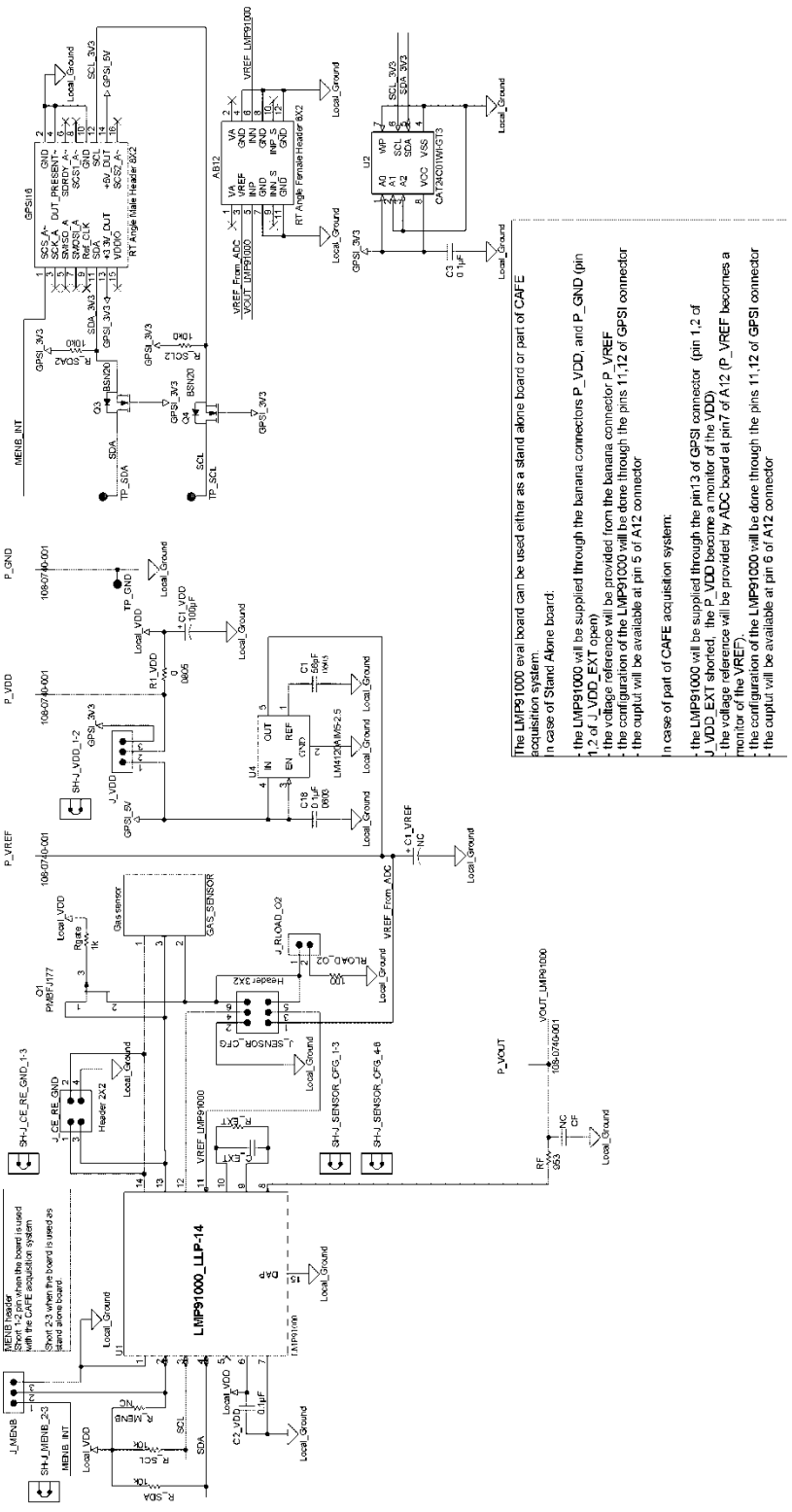
For NSC's data capture boards

AB12	12 pin female for SPIO4 and ADC1x1S626 boards interface
GPSI16	16 pin header for USI2, SPIO4 and ADC1x1S626 boards interface

4.6 OTHER COMPONENTS

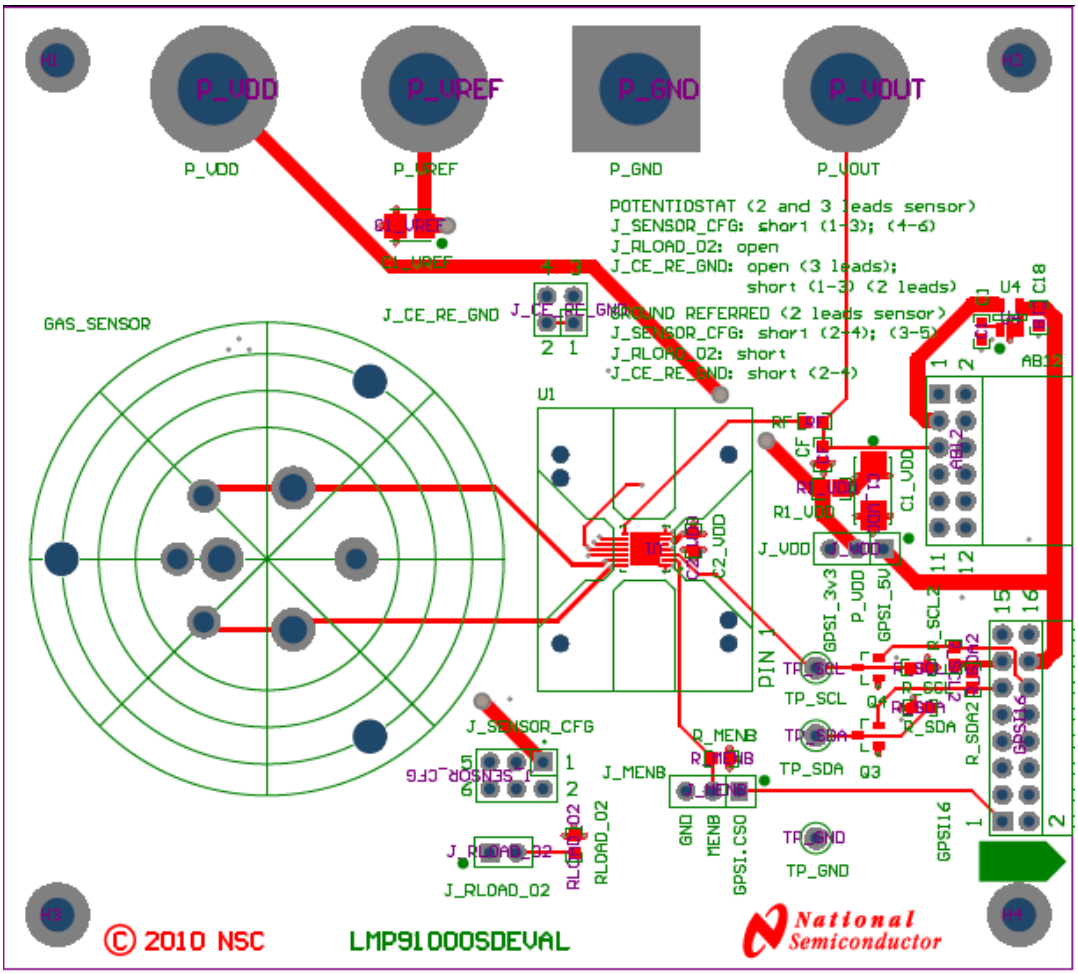
The evalboard is already populated with a JFET (Q1) which shorts the RE and WE pin of the Gas sensor when the supply voltage is removed from the board. It allows leaving connected not biased gas sensor to the evalboard also when the board is not powered.
Moreover if an external filter (capacitance) or external gain at the TIA stage is needed, the board is provided with two footprints to solder 0805 SMT capacitance and resistor.

5. Schematic

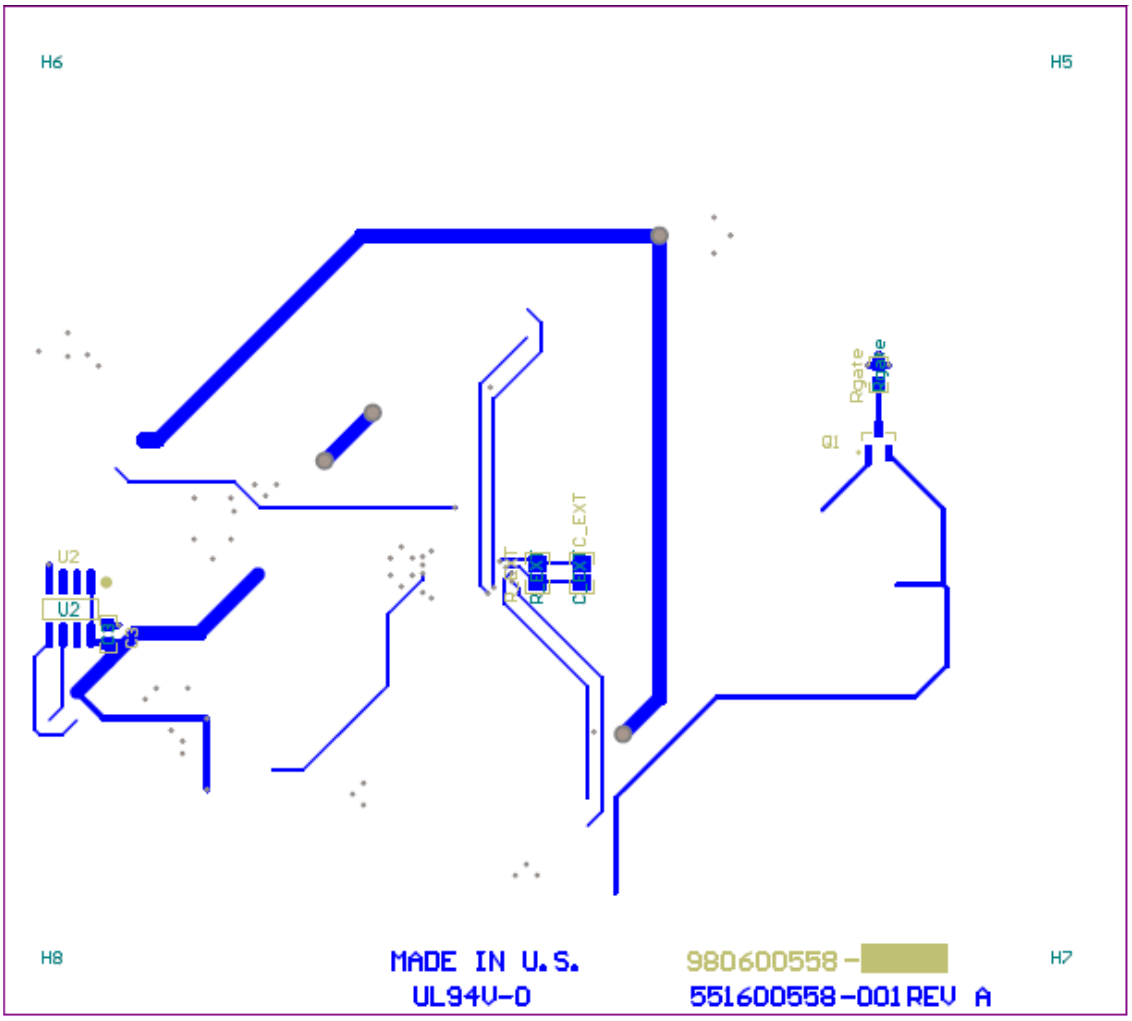

LMP91000_LLP-14
The LMP91000 eval board can be used either as a stand alone board or part of CAFE acquisition system:
In case of Stand Alone board:
- the LMP91000 will be supplied through the banana connectors P_VDD, and P_GND (pin 1,2 of J_VDD_EXT open)
- the voltage reference will be provided from the banana connector P_VREF
- the configuration of the LMP91000 will be done through the pins 11,12 of GPSI connector
- the output will be available at pin 5 of A12 connector
In case of part of CAFE acquisition system:
- the LMP91000 will be supplied through the pin13 of GPSI connector (pin 1,2 of J_VDD_EXT shorted, the P_VDD become a monitor of the VDD)
- the voltage reference will be provided by ADC board at pin7 of A12 (P_VREF becomes a monitor of the VREF).
- the configuration of the LMP91000 will be done through the pins 11,12 of GPSI connector
- the output will be available at pin 6 of A12 connector

6. Board Layout

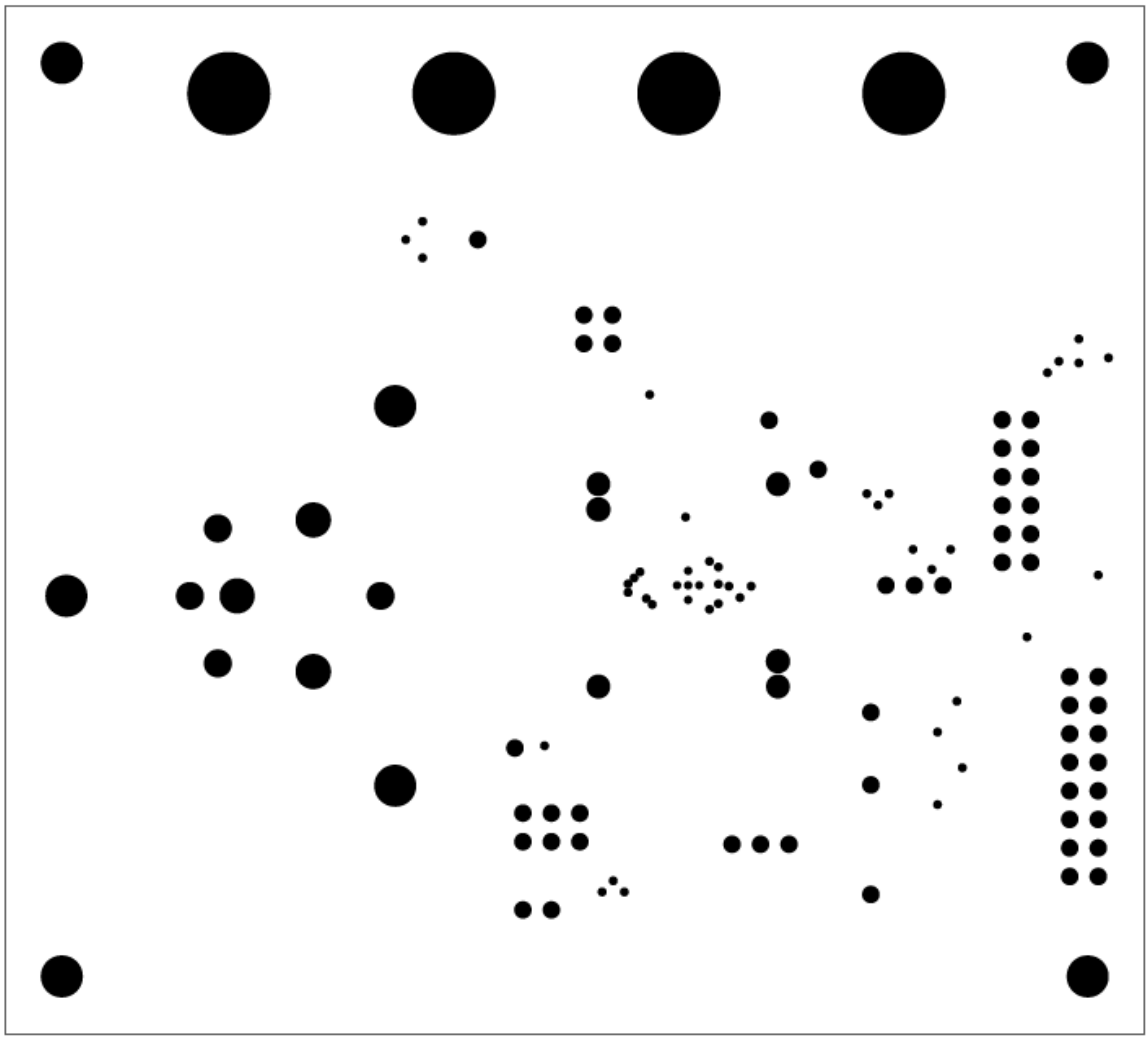
6.1 Top Layer



6.2 Bottom Layer



6.3 Supply plane



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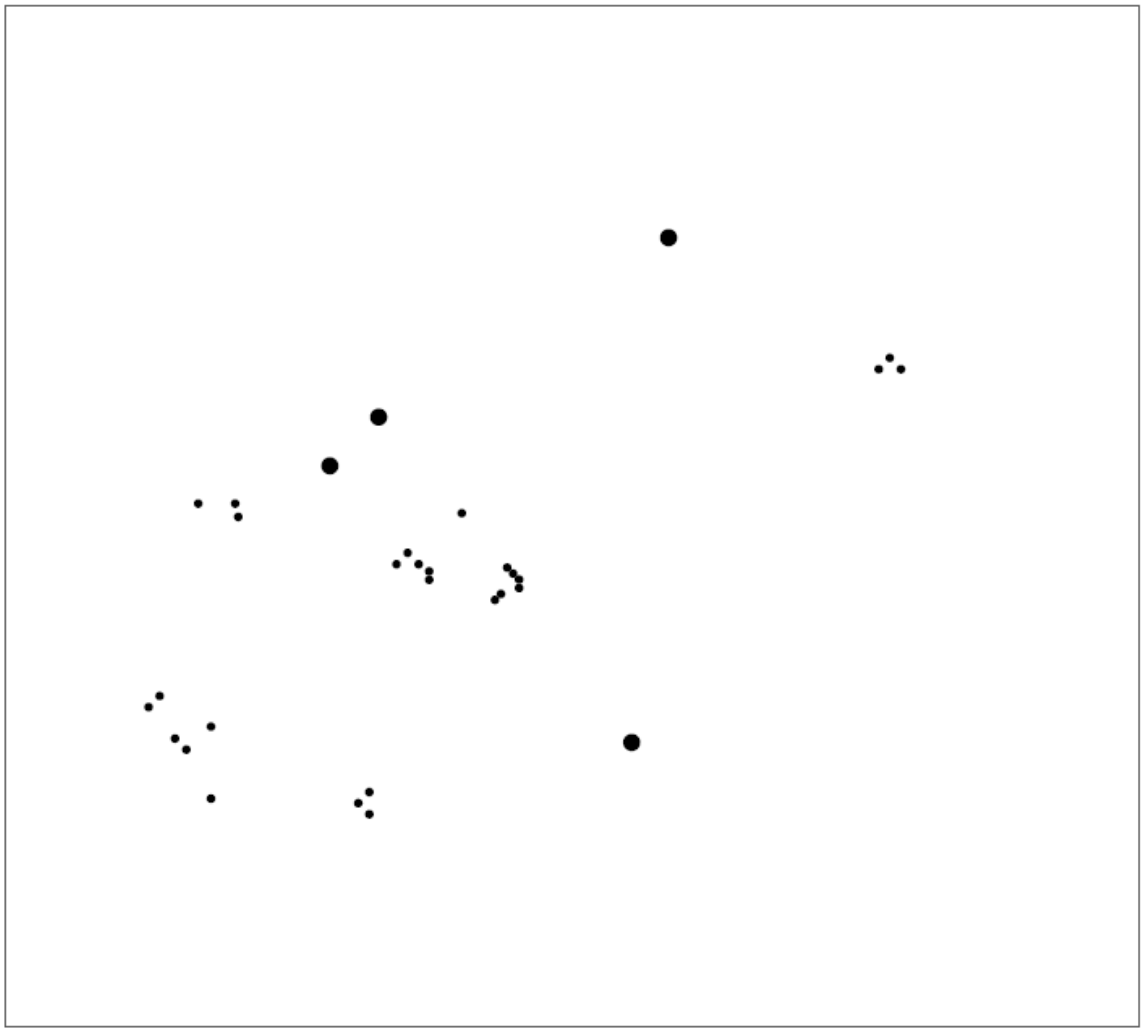
6.3 Ground plane



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7. BOM

Item	Designator	Description	Manufacturer	Part Number	Quantity
1	AB12	RT Angle Female Header 6X2 TIN	Sullins Connector Solutions	PPTC062LJBN-RC	1
2	Board Foot1, Board Foot2, Board Foot3, Board Foot4	BUMPON HEMISPHERE .44X.20 BLACK	3M	SJ-5003 (BLACK)	4
3	C1_VDD	CAP, TANT, 100uF, 10V, +/- 10%, 0.1 ohm, 6032-28 SMD	AVX	TPSC107K010R0100	1
4	C2_VDD, C3	CAP, CERM, 0.1uF, 16V, +/- 5%, X7R, 0603	AVX	0603YC104JAT2A	2
5	GPSI16	SPIO-GPSI16 Header, 8-Pin, Dual row, Right Angle	Tyco Electronics	9-146309-0	1
6	J_CE_RE_GND	Header, TH, 100mil, 2x2, Gold plated, 230 mil above insulator	Samtec Inc.	TSW-102-07-G-D	1
7	J_MENB, J_VDD	Header, TH, 100mil, 1x3, Gold plated, 230 mil above insulator	Samtec Inc.	TSW-103-07-G-S	2
8	J_RLOAD_O2	Header, TH, 100mil, 1x2, Gold plated, 230 mil above insulator	Samtec Inc.	TSW-102-07-G-S	1
9	J_SENSOR_CFG	Header, TH, 100mil, 3x2, Gold plated, 230 mil above insulator	Samtec Inc.	TSW-103-07-G-D	1
10	P_GND, P_VDD, P_VOUT, P_VREF	Standard Banana Jack, Uninsulated, 15A	Johnson Components	108-0740-001	4
11	Q1	P-channel Silicon Junction Field-effect Transistor	NXP Semi.	PMBFJ177,215	1
12	Q3, Q4	N-channel Enhancement Mode FET	NXP Semi.	BSN20,215	2
13	R1_VDD	RES, 0 ohm, 5%, 0.125W, 0805	Vishay-Dale	CRCW08050000Z0EA	1
14	RF	RES, 953 ohm, 0.5%, 0.1W, 0603	Yageo America	RT0603DRE07953RL	1
15	Rgate	RES, 1.00k ohm, 1%, 0.1W, 0603	Vishay-Dale	CRCW06031K00FKEA	1
16	RLOAD_O2	RES, 100 ohm, 0.5%, 0.1W, 0603	Yageo America	RT0603DRE07100RL	1
17	R_SCL, R_SCL2, R_SDA, R_SDA2	RES, 10k ohm, 5%, 0.1W, 0603	Vishay-Dale	CRCW060310K0JNEA	4
18	lead gas sensor holder	Solder mount socket, for .059 (1,52) to .062 (1,57) diameter pins	WEARNES CAMBION	450-3326-01-03-00	3
19	U1	LMP91000	NSC	LMP91000SD	1
20	U2	IC EEPROM 2KBIT 400KHZ 8TSSOP	ON Semi..	CAT24C01WI-GT3	1
21	U4	Precision Micropower Low Dropout Voltage Reference	NSC	LM4120AIM5-2.5	NP
22	C1				NP
23	C18				NP
24	C_EXT, CF, R_EXT				NP
25	R_MENB				NP
26	C1_VREF				NP

Notes

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