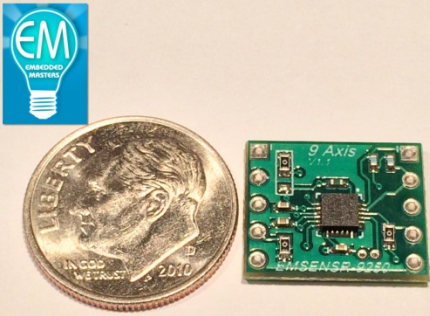# Embedded Masters

EMSENSR-MPU9250 0.59"x0.5" 9-Axis Motion Sensor

Description:

The 9DOF MPU-9250 is the world's smallest 9-axis MotionTracking MEMS device designed for the low power, low cost, and high performance requirements of consumer electronics equipment including smartphones, tablets and wearable sensors. And guess what? You get to play with it. The EMSENSR-MPU9250 makes it easy to prototype with the InvenSense MPU-9250 by having all the pins mapped to 2.54mm/0.1" headers. The board also provides I2C pull-up resistors, zero ohm jumpers to switch the I2C address of the device, switchable between I2C and SPI mode, and enable/disable Frame Synch.

The MPU-9250 is a System in Package (SiP) that combines two chips: the MPU-6500, which contains a 3-axis gyroscope, and 3-axis accelerometer. The second die houses the AK8963 3 axis magnetometer from Asahi Kasei Microdevices Corporation. The part is offered in a 3x3x1mm LGA package and is upgrade-compatible with the MPU-6500 integrated 6-axis MotionTracking device, providing a simple upgrade path and making it easy to fit on space constrained boards.

The EMSENSR-MPU9250 pins are all mapped to standard 2.54mm/0.1" headers. The distance between the headers is 500mil.

<u>V1.1 NOTE:</u> There most current EMSENSR-MPU9250 is V1.1 and is Notated on the Silkscreen. It is electrically equivalent to the Original EMSENSR-MPU9250 it just has a slightly different Pinout to accommodate the standardized EMSENSR pinouts for the EMRF-Wireless Platform and is also smaller than the original version. Both schematics are shown in this Datasheet.

Need help with Sensor Fusion Libraries or Custom Embedded PCB/Software, Wireless/Mobile Applications, and general design services can be provided by Embedded Masters for your own application.
Contact <u>sales@embeddedmasters.com</u>

Want a breakout board that Embedded Masters doesn't currently offer please let us know!!

MPU-9250 Full Datasheet link:

http://www.cdiweb.com/datasheets/invensense/MPU9250REV1.0.pdf
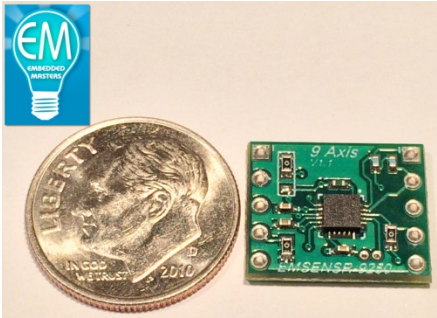
BUY IT NOW!!

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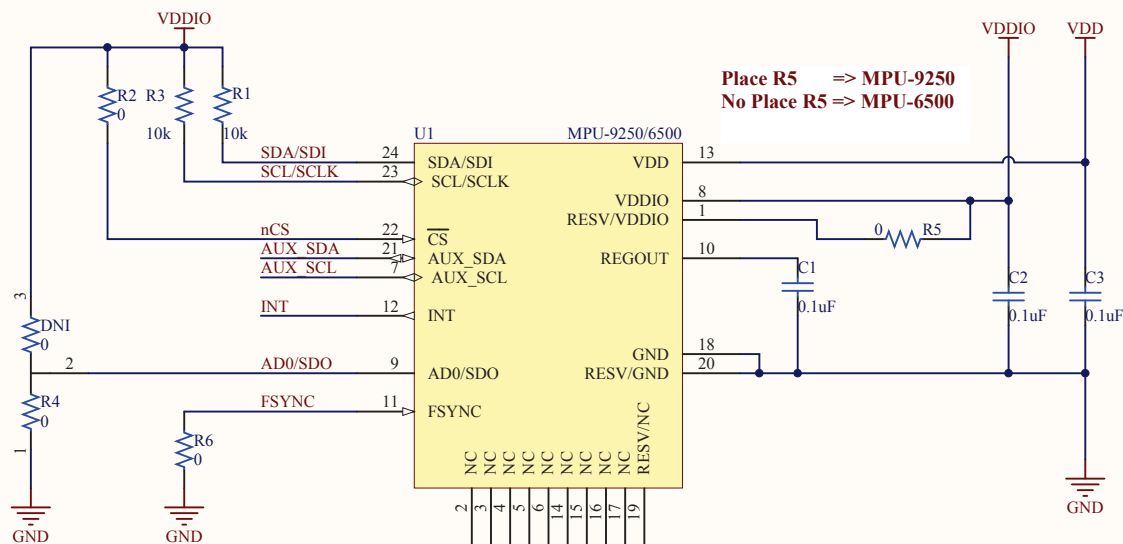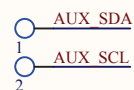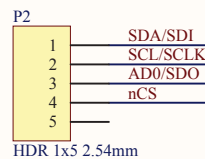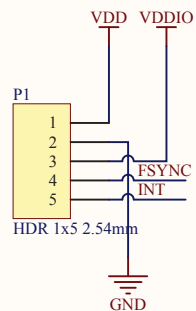
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Features:

- Ultra-small 0.59"x0.5" Breakout board with .1"/2.54mm header spacing that can be directly soldered into a prototype or used with breadboard.
- 500mil header-header spacing.
- VDD Supply voltage range of 2.4V–3.46V; VLOGIC of 1.8V±5% or VDD
- Tri-Axis angular rate sensor (gyro) with a sensitivity up to 131 LSBs/dps and a full-scale range of ±250, ±500, ±1000, and ±2000dps
- Tri-Axis accelerometer with a programmable full scale range of ±2g, ±4g, ±8g and ±16g
- Tri-axis compass with a full scale range of ±4800μT
- Reduced settling effects and sensor drift by elimination of board-level cross-axis alignment errors between accelerometer, gyroscope, and compass
- Gyro operating current: 3.2mA (full power, gyro at all rates)
- Gyro + Accel operating current: 3.208mA (full power, gyro at all rates, accel at 1kHz sample rate)
- Gyro + Accel + Compass + DMP operating current: 3.5mA (full power, gyro at all rates, accel at 1kHz sample rate, compass at 8Hz rate)
- Accel low power mode operating current: 8.4uA at 1Hz, 19.8uA at 31.25Hz
- Full Chip Idle Mode Supply Current: 8μA
- 400kHz Fast Mode I^{2}C or 20MHz SPI with 512 byte FIFO
- On-chip timing generator with ±1% frequency variation over full temperature range
- On board Temperature Sensor
- 10,000g shock tolerant
- I2C Pullup Resistors populated on board.
- BOB configured for I2C Default can be converted to SPI mode
- Zero Ohm Resistor Jumper for Switching LSB of I2C Address, Switch between I2C/SPI mode, enable/disable Frame Synch.

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VDD VDDIO

P1
1
2
3
4 FSYNC
5 INT
HDR 1x5 2.54mm

GND

P2
1 SDA/SDI
2 SCL/SCLK
3 AD0/SDO
4 nCS
5
HDR 1x5 2.54mm

AUX_SDA
1
AUX_SCL
2

VDDIO

R2 R3   R1
0
    10k   10k

3
DNI
0

2
R4
0

1

GND

R6
0

GND

SDA/SDI   24
SCL/SCLK   23

nCS   22
AUX_SDA   21
AUX_SCL   7

INT   12

AD0/SDO   9

FSYNC   11

U1   MPU-9250/6500

SDA/SDI   VDD   13
SCL/SCLK
                    VDDIO   8
                  RESV/VDDIO 1
CS
AUX_SDA   REGOUT   10
AUX_SCL

INT

                      GND   18
AD0/SDO   RESV/GND   20

FSYNC

NC NC NC NC NC NC NC NC RESV/NC
2 3 4 5 14 15 16 17 19

Place R5   => MPU-9250
No Place R5 => MPU-6500

VDDIO   VDD

0 R5

C1   C2   C3
0.1uF   0.1uF   0.1uF

GND

Zero Ohm Jumpers:
R2 = nCS   I2C=VDD   SPI = Remove R2

R4 = AD0/SDO   LSB of I2C Address   SPI = Remove R4

R6 = FSYNC   If not used connect to GND

Title *EMSENSR-MPU9250,6500 V1.1*

Size: Letter   Number: Revision: 1.0

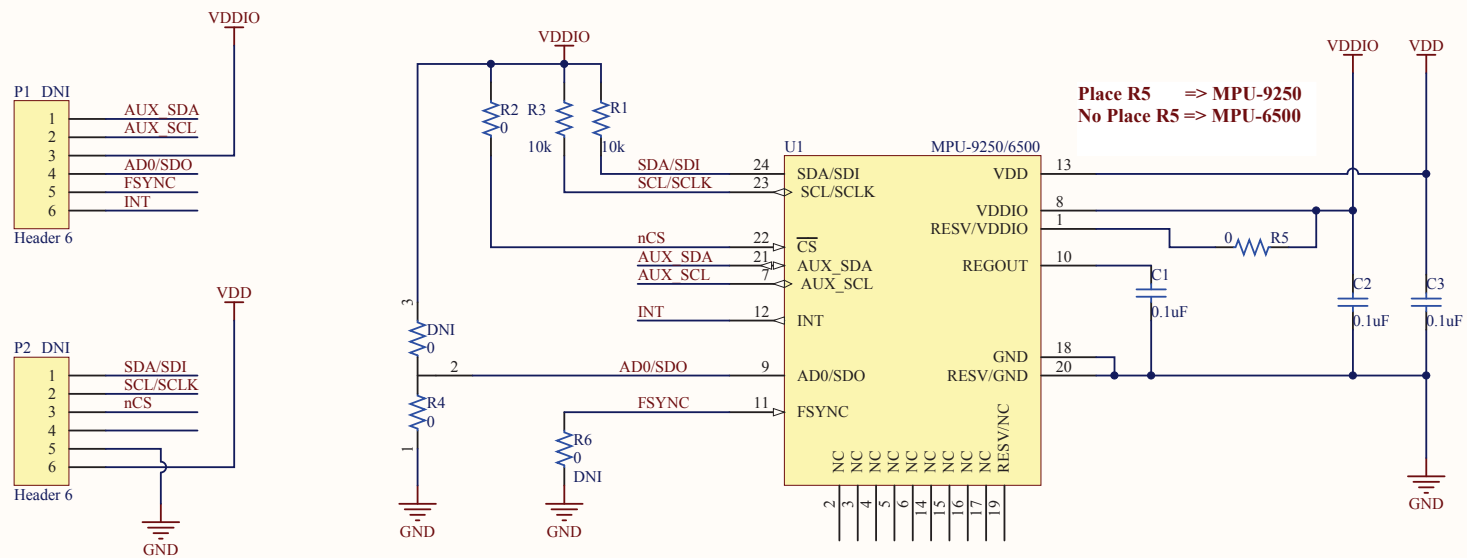Date: 12/4/2014   Time: 5:00:34 PM   Sheet 1 of 1
File: EMSENSR-9250,6500, V1.1.SchDoc

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VDDIO

P1 DNI

AUX_SDA
AUX_SCL

AD0/SDO
FSYNC
INT

1
2
3
4
5
6

Header 6

VDD

P2 DNI

SDA/SDI
SCL/SCLK
nCS

1
2
3
4
5
6

Header 6

GND

VDDIO

R2 R3   R1

0   10k   10k

3

DNI
0

2

R4
0

1

GND

R6
0
DNI

GND

SDA/SDI   24
SCL/SCLK   23

nCS   22
AUX_SDA   21
AUX_SCL   7

INT   12

AD0/SDO   9

FSYNC   11

U1   MPU-9250/6500

SDA/SDI
SCL/SCLK

$\overline{CS}$
AUX_SDA
AUX_SCL

INT

AD0/SDO

FSYNC

VDD   13

VDDIO   8
RESV/VDDIO   1

REGOUT   10

GND   18
RESV/GND   20

NC NC NC NC NC NC NC NC NC RESV/NC

2   3   4   5   6   14 15 16 17 19

Place R5   => MPU-9250
No Place R5 => MPU-6500

VDDIO   VDD

0   R5

C1
0.1uF

C2
0.1uF

C3
0.1uF

GND

Zero Ohm Jumpers:
R2 = nCS   I2C=VDD   SPI = Remove R2

R4 = AD0/SDO   LSB of I2C Address   SPI = Remove R4
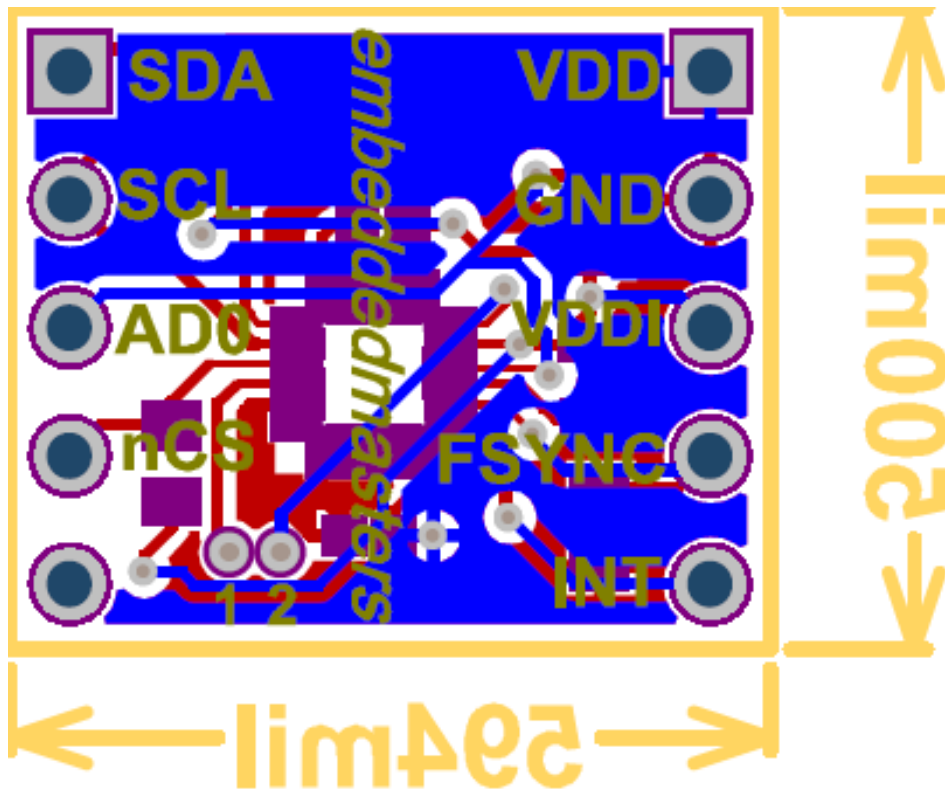
R6 = FSYNC   If not used connect to GND

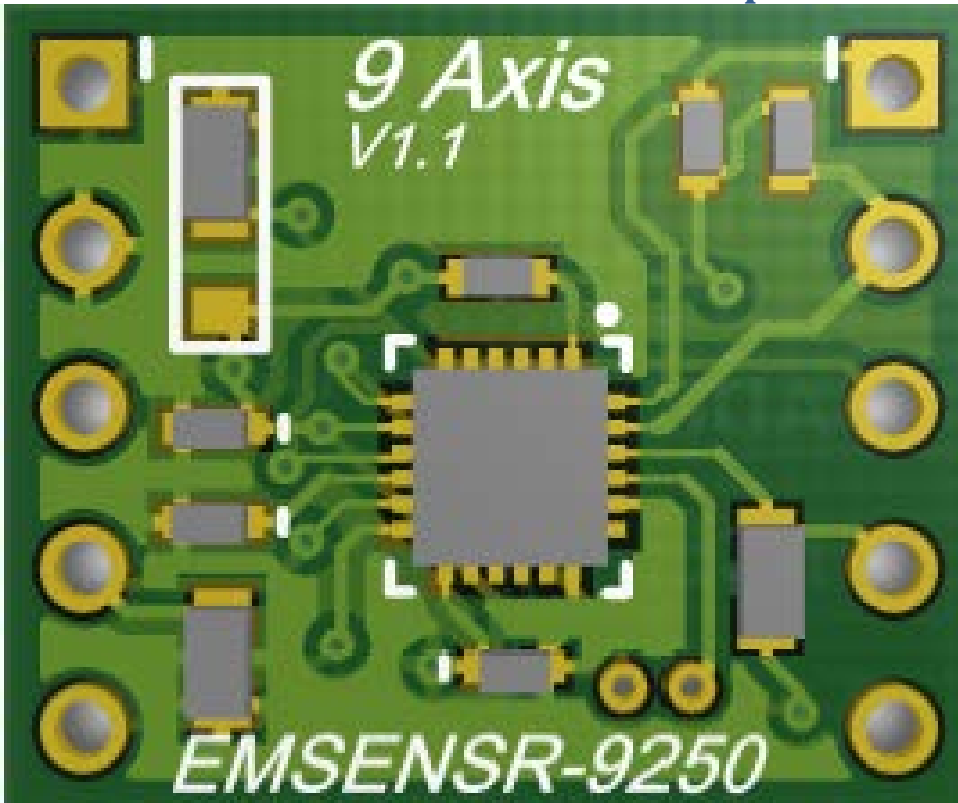# Embedded Masters

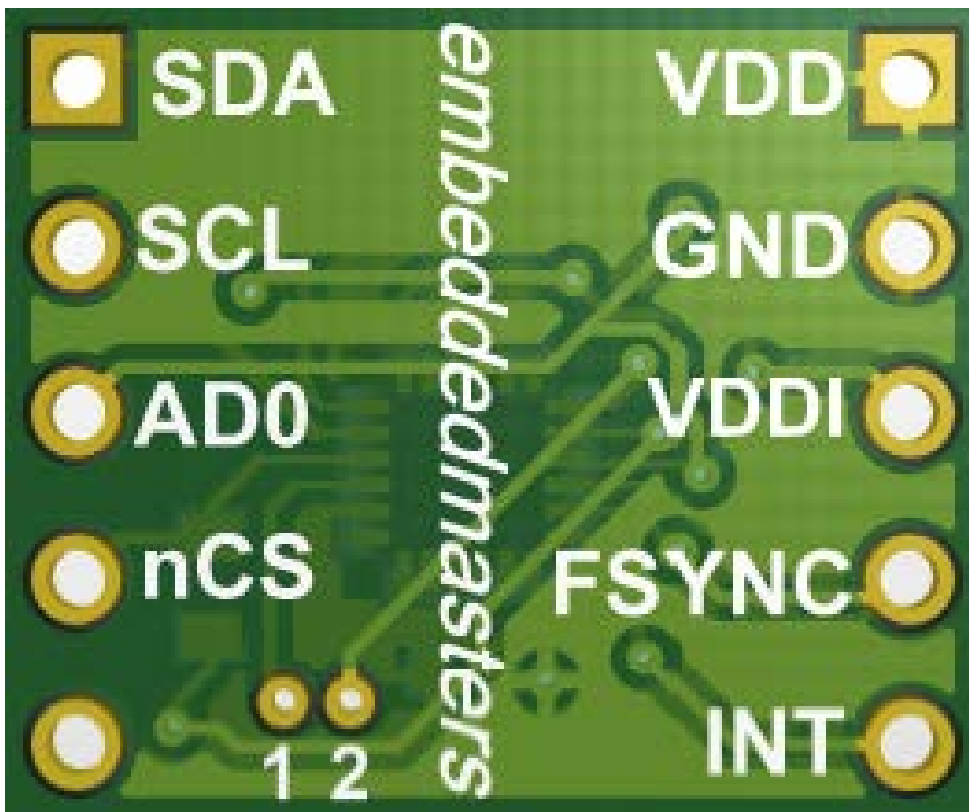## EMSENSR-MPU9250 V1.1 PCB – Top
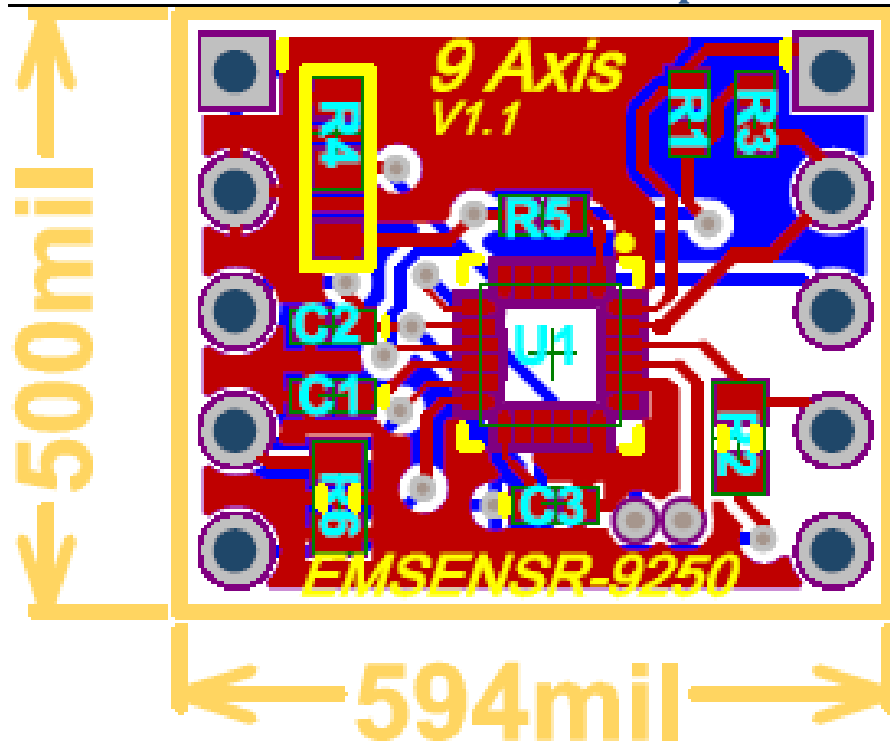
EMSENSR- MPU9250 V1.1 PCB – Bottom
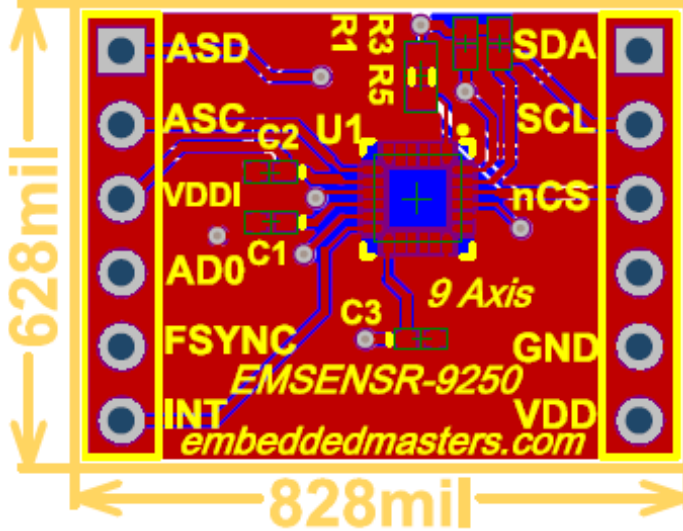
EMSENSR- MPU9250 V1.1 3D PCB – Top

EMSENSR- MPU9250 V1.1 3D PCB - Bottom

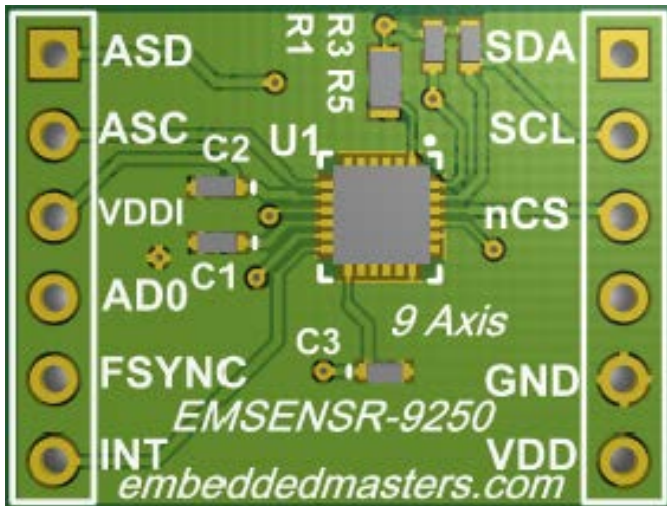## EMSENSR-MPU9250 V1.0 PCB – Top

EMSENSR-MPU9250 V1.0 3D PCB – Top

EMSENSR-MPU9250 V1.0 3D PCB – Bottom