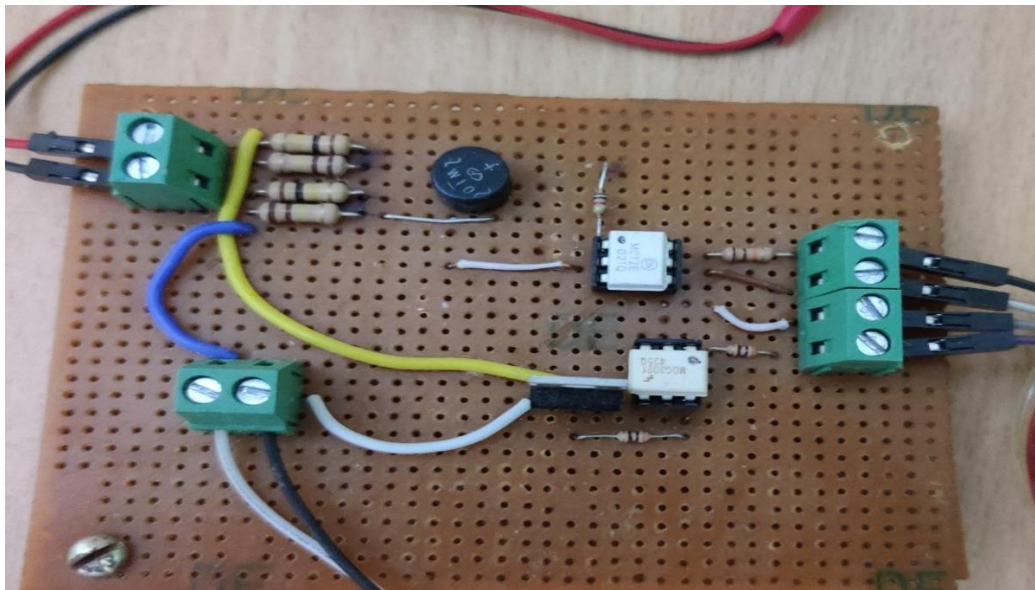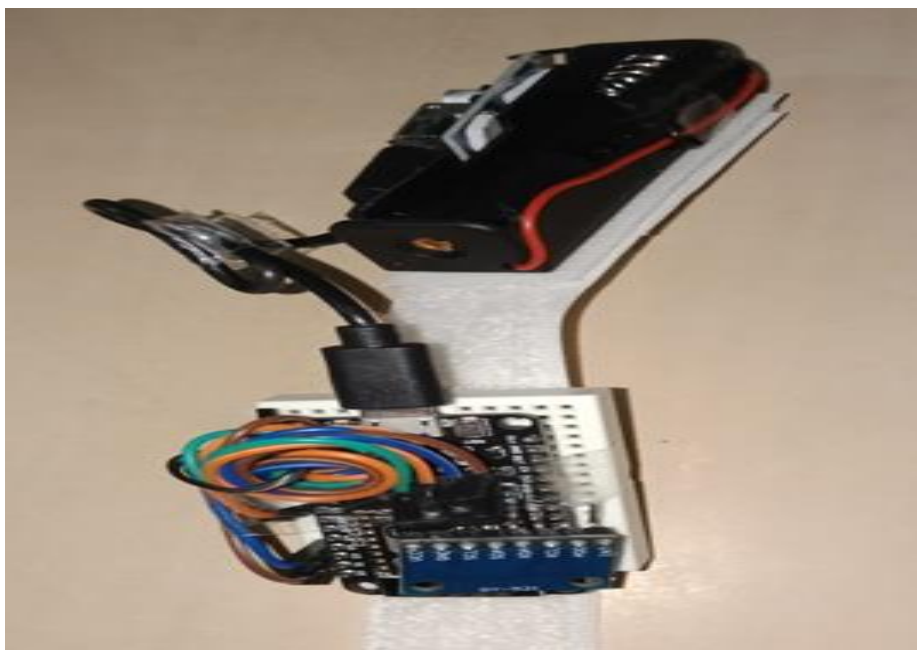# Appendix A

A1. Component Layout

Subscriber Circuit

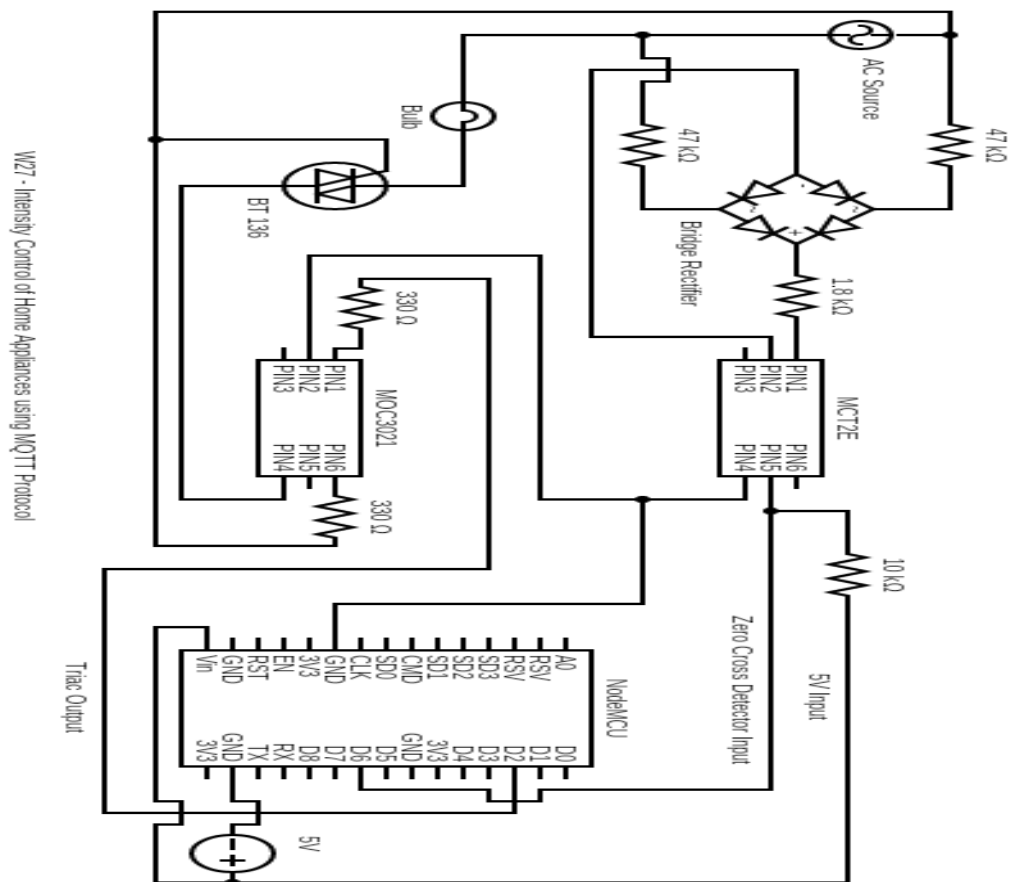

Publisher Circuit

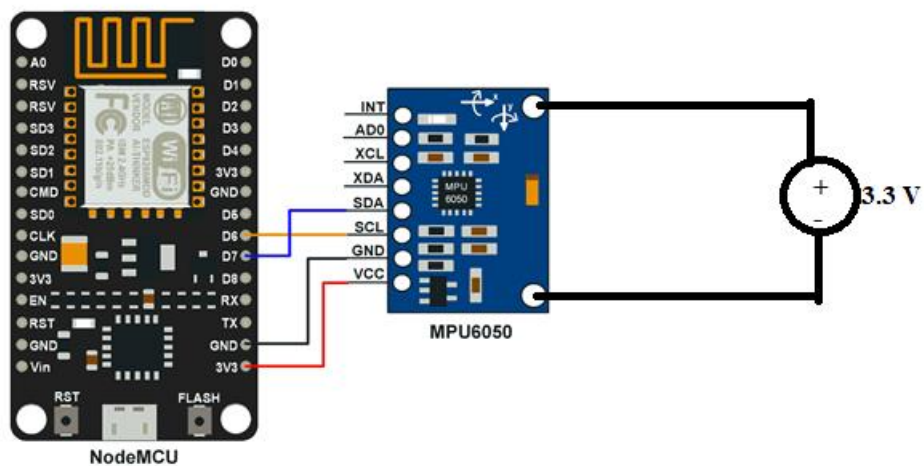# A2. Circuit Diagram

Subscriber Circuit

Publisher Circuit

A3. Component List

Sl no.	Name of the component	Quantity
1.	Node MCU [ESP8266]	2
2.	Accelerometer	1
3.	Battery 3.3V	1
4.	MOC3021 Octocoupler	1
5.	MCT 2E Octocoupler	1
6.	BT 136 Triac	1
7.	Bridge Rectifier	1
8.	Resistor - 47K ohm	2
9.	Resistor -1.8K ohm	1
10.	Resistor - 330 ohm	2
11.	Resistor - 10K ohm	1
12.	Bulb	1
13.	Fan	1
14.	Connecting Wires	Few

A4. Main Components Data Sheets

A4.1 Node MCU

ESP8266 Pin Configuration
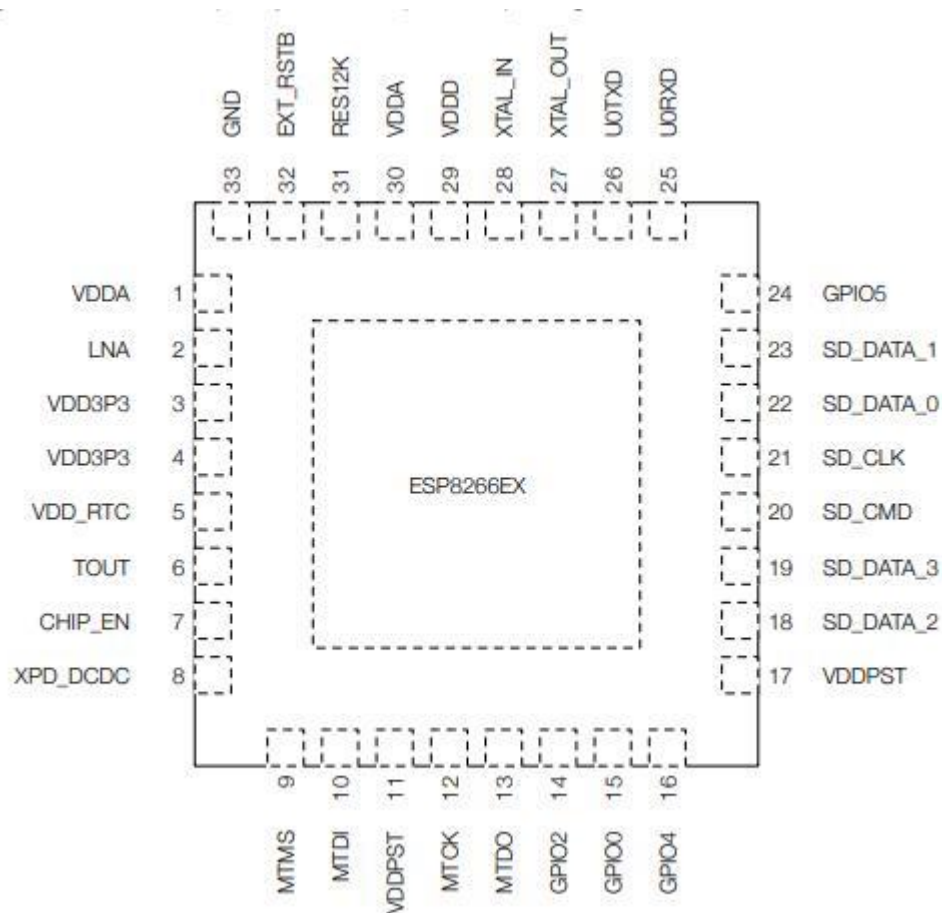
Pin Functions

| Pin	Name	Type	Function
1	VDDA	P	Analog Power 2.5 V ~ 3.6 V
2	LNA	I/O	RF antenna interface Chip output impedance = 39 + j6 Ω. It is suggested to retain the π-type matching network to match the antenna.
3	VDD3P3	P	Amplifier Power 2.5 V ~ 3.6 V

4	VDD3P3	P	Amplifier Power 2.5 V ~ 3.6 V
5	VDD_RTC	P	NC (1.1 V)
6	TOUT	I	ADC pin. It can be used to test the power-supply voltage of VDD3P3 (Pin3 and Pin4) and the input power voltage of TOUT (Pin 6). However, these two functions cannot be used simultaneously.
7	CHIP_EN	I	Chip Enable High: On, chip works properly Low: Off, small current consumed
8	XPD_DCDC	I/O	Deep-sleep wakeup (need to be connected to EXT_RSTB); GPIO16
9	MTMS	I/O	GPIO 14; HSPI_CLK
10	MTDI	I/O	GPIO 12; HSPI_MISO
11	VDDPST	P	Digital/IO Power Supply (1.8 V ~ 3.6 V)
12	MTCK	I/O	GPIO 13; HSPI_MOSI; UART0_CTS
13	MTDO	I/O	GPIO 15; HSPI_CS; UART0_RTS
14	GPIO2	I/O	UART TX during flash programming; GPIO2
15	GPIO0	I/O	GPIO0; SPI_CS2
16	GPIO4	I/O	GPIO4
17	VDDPST	P	Digital/IO Power Supply (1.8 V ~ 3.6 V)
18	SDIO_DATA_2	I/O	Connect to SD_D2 (Series R: 20 Ω); SPIHD; HSPIHD; GPIO9
19	SDIO_DATA_3	I/O	Connect to SD_D3 (Series R: 200 Ω); SPIWP; HSPIWP; GPIO10
20	SDIO_CMD	I/O	Connect to SD_CMD (Series R: 200 Ω); SPI_CS0; GPIO11
21	SDIO_CLK	I/O	Connect to SD_CLK (Series R: 200 Ω); SPI_CLK; GPIO6
22	SDIO_DATA_0	I/O	Connect to SD_D0 (Series R: 200 Ω); SPI_MISO; GPIO7
23	SDIO_DATA_1	I/O	Connect to SD_D1 (Series R: 200 Ω); SPI_MOSI; GPIO8
24	GPIO5	I/O	GPIO5
25	U0RXD	I/O	UART Rx during flash programming; GPIO3
26	U0TXD	I/O	UART TX during flash programming; GPIO1; SPI_CS1
27	XTAL_OUT	I/O	Connect to crystal oscillator output, can be used to provide BT clock input
28	XTAL_IN	I/O	Connect to crystal oscillator input
29	VDDD	P	Analog Power 2.5 V ~ 3.6 V
30	VDDA	P	Analog Power 2.5 V ~ 3.6 V
31	RES12K	I	Serial connection with a 12 kΩ resistor and connect to the ground
32	EXT_RSTB	I	External reset signal (Low voltage level: active)

Functional Block Diagram
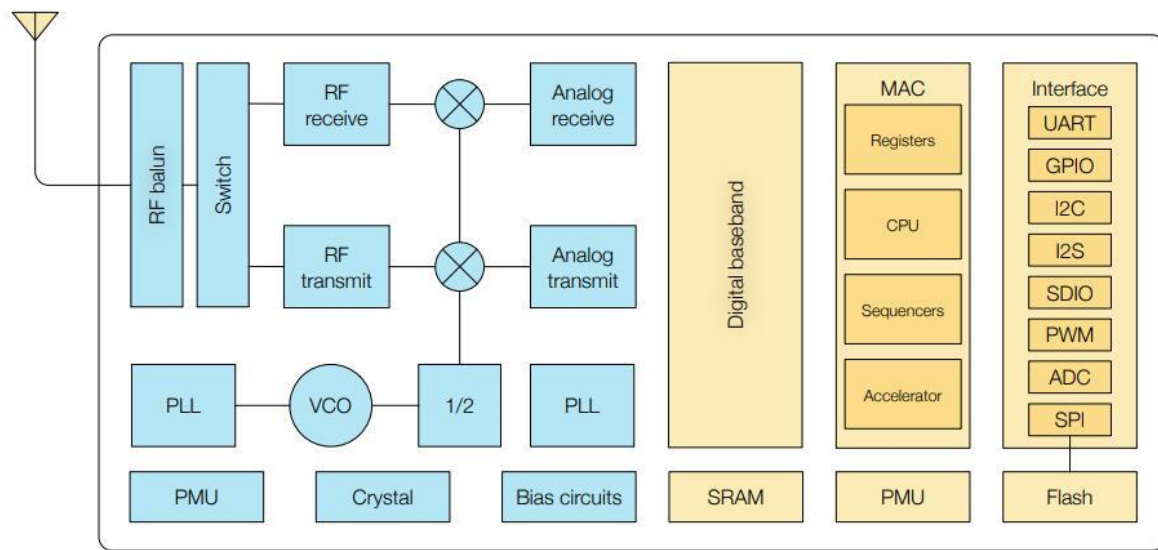
ESP8266 Functional Block Diagram

Features

- 802.11 b/g/n support

- 802.11 n support (2.4 GHz), up to 72.2 Mbps

- Defragmentation

- 2 x virtual Wi-Fi interface

- Automatic beacon monitoring (hardware TSF)

- Support Infrastructure BSS Station mode/SoftAP mode/Promiscuous mode

Specifications

Categories	Items	Parameters
Wi-Fi	Certification	Wi-Fi Alliance
	Protocols	802.11 b/g/n (HT20)
	Frequency Range	2.4 GHz ~ 2.5 GHz (2400 MHz ~ 2483.5 MHz)
	TX Power	802.11 b: +20 dBm
		802.11 g: +17 dBm
		802.11 n: +14 dBm
	Rx Sensitivity	802.11 b: −91 dbm (11 Mbps)
		802.11 g: −75 dbm (54 Mbps)
		802.11 n: −72 dbm (MCS7)
	Antenna	PCB Trace, External, IPEX Connector, Ceramic Chip
Hardware	CPU	Tensilica L106 32-bit processor
	Peripheral Interface	UART/SDIO/SPI/I2C/I2S/IR Remote Control
		GPIO/ADC/PWM/LED Light & Button
	Operating Voltage	2.5 V ~ 3.6 V
	Operating Current	Average value: 80 mA
	Operating Temperature Range	−40 °C ~ 125 °C
	Package Size	QFN32-pin (5 mm x 5 mm)
	External Interface	-
Software	Wi-Fi Mode	Station/SoftAP/SoftAP+Station
	Security	WPA/WPA2
	Encryption	WEP/TKIP/AES
	Firmware Upgrade	UART Download / OTA (via network)
	Software Development	Supports Cloud Server Development / Firmware and SDK for fast on-chip programming
	Network Protocols	IPv4, TCP/UDP/HTTP
	User Configuration	AT Instruction Set, Cloud Server, Android/iOS App

A4.2 Accelerometer

Pin Configuration
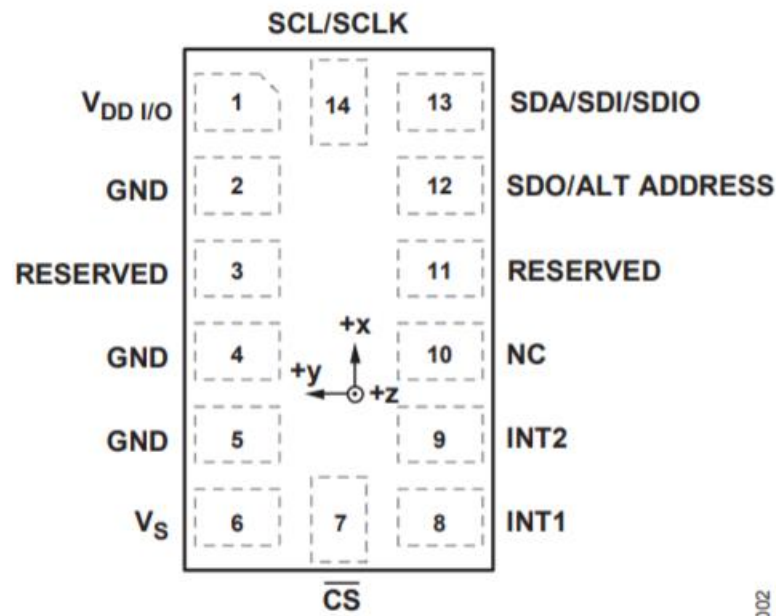
Pin Functions

Pin No.	Mnemonic	Description
1	$V_{DD\,I/O}$	Digital Interface Supply Voltage.
2	GND	This pin must be connected to ground.
3	RESERVED	Reserved. This pin must be connected to V_S or left open.
4	GND	This pin must be connected to ground.
5	GND	This pin must be connected to ground.
6	V_S	Supply Voltage.
7	$\overline{CS}$	Chip Select.
8	INT1	Interrupt 1 Output.
9	INT2	Interrupt 2 Output.
10	NC	Not Internally Connected.
11	RESERVED	Reserved. This pin must be connected to ground or left open.
12	SDO/ALT ADDRESS	Serial Data Output (SPI 4-Wire)/Alternate I²C Address Select (I²C).
13	SDA/SDI/SDIO	Serial Data (I²C)/Serial Data Input (SPI 4-Wire)/Serial Data Input and Output (SPI 3-Wire).
14	SCL/SCLK	Serial Communications Clock. SCL is the clock for I²C, and SCLK is the clock for SPI.

Functional Block Diagram
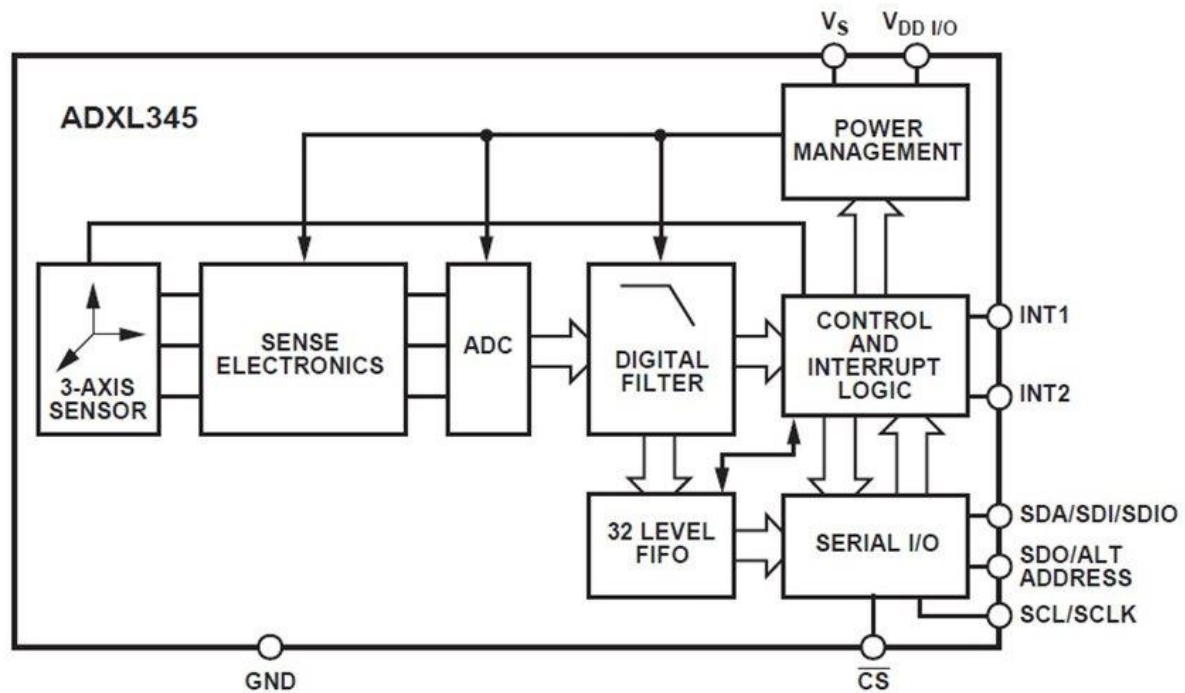
Features

1. Small, thin, ultralow power

2. 3-axis accelerometer with high resolution (13-bit) measurement at up to ±16 g.

3. Digital output data is formatted as 16-bit twos complement and is acces- sible through either a SPI (3- or 4-wire) or I2C digital interface.

Specifications

Parameter	Conditions	Min	Typ	Max	Unit
SENSOR INPUT	Each axis				
Measurement Range	User Selectable		±2, 4, 8, 16		g
Nonlinearity	Percentage of full scale		±0.5		%
Inter-Axis Alignment Error			±0.1		Degrees
Cross-Axis Sensitivity[2]			±1		%
OUTPUT RESOLUTION	Each axis				
All g-ranges	10-bit mode		10		Bits
±2 g range	Full-Resolution		10		Bits
±4 g range	Full-Resolution		11		Bits
±8 g range	Full-Resolution		12		Bits
±16 g range	Full-Resolution		13		Bits
SENSITIVITY	Each axis				
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±2 g 10-bit or Full-Resolution	232	256	286	LSB/g
Scale Factor at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±2 g 10-bit or Full-Resolution	3.5	3.9	4.3	mg/LSB
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±4 g 10-bit mode	116	128	143	LSB/g
Scale Factor at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±4 g 10-bit mode	7.0	7.8	8.6	mg/LSB
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±8 g 10-bit mode	58	64	71	LSB/g
Scale Factor at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±8 g 10-bit mode	14.0	15.6	17.2	mg/LSB
Sensitivity at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±16 g 10-bit mode	29	32	36	LSB/g
Scale Factor at X_{OUT}, Y_{OUT}, Z_{OUT}	V_S = 2.5 V, ±16 g 10-bit mode	28.1	31.2	34.3	mg/LSB
Sensitivity Change due to Temperature			±0.02		%/°C
0 g BIAS LEVEL	Each axis				
0 g Output (X_{OUT}, Y_{OUT}, Z_{OUT})	V_S = 2.5 V, T_A = 25°C	-150	0	+150	mg
0 g Offset vs. Temperature			<±1		mg/°C
NOISE PERFORMANCE					
Noise (x-, y-axes)	Data Rate = 100 Hz, ±2 g 10-bit or Full-Res.		<1		LSB RMS
Noise (z-axis)	Data Rate = 100 Hz, ±2 g 10-bit or Full-Res.		<1.5		LSB RMS
OUTPUT DATA RATE / BANDWIDTH	User Selectable				
Measurement Rate[3]		0.1		3200	Hz
SELF TEST					
Output Change X		+0.31		+1.02	g
Output Change Y		-0.31		-1.02	g
Output Change Z		+0.46		+1.64	g
POWER SUPPLY					
Operating Voltage Range (V_S)		2.0	2.5	3.6	V
Interface Voltage Range ($V_{DDI/O}$)		1.7	1.8	V_S	V
Supply Current	Data Rate > 100 Hz		130	150	µA
Supply Current	Data Rate < 10 Hz		25		µA
Standby Mode Leakage Current			0.1	2	µA
Turn-On Time[4]	Data Rate = 3200 Hz		1.4		ms
TEMPERATURE					
Operating Temperature Range		−40		85	°C
WEIGHT					
Device Weight			20		mgrams