“microSP” Wireless Sensor

SPS207G-D2

433,92 MHz

Accelerometer , Magnetometer , Temperature

The SPS207xx is a wireless "IoT" sensor based on the STE proprietary and patented "microSP" Technology (Patent WO20090119121A). **"microSP"** is a special and sophisticated PPM (Pulse Position Modulation) transmission in which the data message is converted to the time position of short (2µs) RF pulses. The pulse peak power is very high (+ 14 dBm - 25 mW) while the pulse flow has a very low duty cycle. Consequently, during the transmission, the average current consumption is very low and very low is also the transmitted average RF power (RF power density).
The three sensors inside the SPS207 are a 3-axis, 12-bit digital accelerometer, a 12-bit 3D digital magnetometer, and a high-precision digital temperature sensor. A sophisticated and fast sampling system, controlled by the micropower MCU (MSP430G2453), allows measurements to be made in a few microseconds while maintaining a very low total operating current (see Table 1).

RF performance data

Tx frequency	433,92 MHz
RF peak power	25 mW
ERP (peak)	2mW
ERP power density (10 kHz)	<-13dBm
Emission BW	>500kHz
Pulse width	2 µs

Measurements performances

3 Axis Magnetometer (MAG3110)	
Resolution	12 bit
Full scale range	±1000 µT
Sensitivity	0,10 µT
3 Axis Accelerometer (MMA8452Q)	
Resolution	12 bit
Full scale range	2 G
Temperature (TMP112)	
Resolution	10 bit
Temp. Range	-40 +85°C
Accuracy	± 0,5°C (0°C to 65°C)
	±1°C (-40°C to +85°C)

General

Supply voltage	nom.=3VDC (min. 2,4V – max. 3,6V)
Current (depending upon the TX and sensors sample timing)	6 - 10 - 24 µA
Operating temperature	-40 +85°C
PCB dimensions	60X34 mm

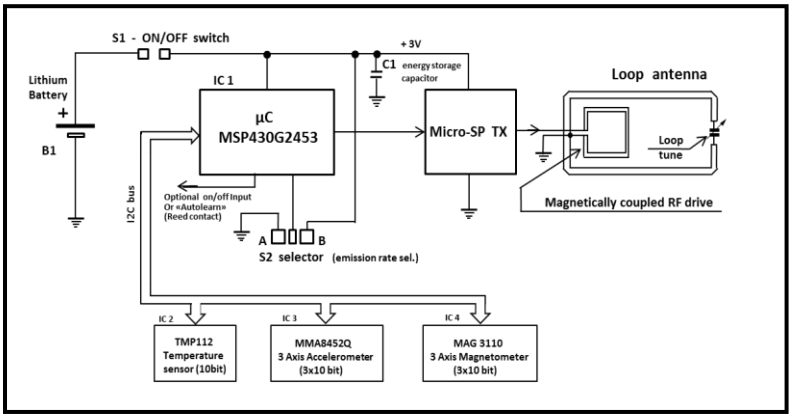

Fig. 1 – SPS207xx Block Diagram

Table 1 - Tx transmission time (heartbeat) and sensor measurements sampling rate.

S2 Jumper	Sensor sample (2)	Tx time(3)	Current
S2 = A	2 s	2 s	24µA
-	4 s	30 s	10 µA
S2 = B	10 s	60 s	6 µA

Note 1 : *Transmission mode with S2 jumper in “A” position is intended mainly and exclusively for test and system set-up purpose . Limitations are posed by the Normative on the band occupancy time, but also important and relevant anti-collision criteria must be accurately considered.*
Note 2 *: Sample time for the Accelerometer and Magnetometer sensors. Temperature is sampled every 30 seconds.*
Note 3 *: After sampling a sensor, if a significant change in the measurement is detected, a Tx session is immediately performed (consult the Factory for the definition of the threshold level of the measure).*

Tx "Heartbeat" and sensor sampling time

Periodic emissions at predetermined regular intervals ("Heartbeat" i.e. "Tx time" in Table 1) must be used as a check on the integrity of the wireless network and each message is complete with sensor measurements plus battery status. However, at the time of the sensor sample, if a datum is different from the previous measure, an update transmission is immediately performed.

The trigger threshold level for an immediate transmission and the sensor "sample time" can be adapted to different cases or alarm situations (consult the Factory). As an example a measurement sampling time of 2 seconds is to be considered necessary in alarm systems (i.e. in systems where a sudden change in measurement must be considered as an "alarm" and immediately transmitted). Several non-critical applications may require a longer sampling time and this may be convenient to reduce the battery total absorbed current.

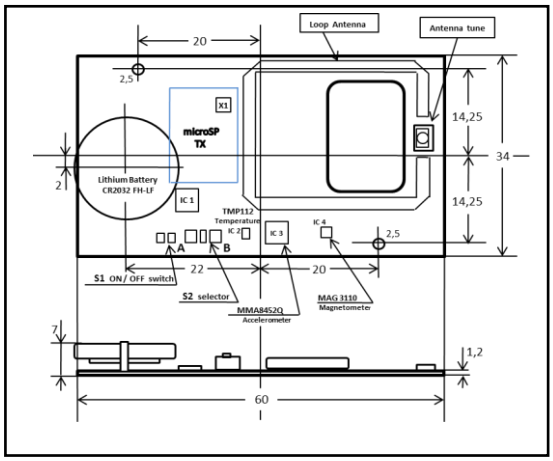

Fig.2 - SPS207S Mechanical dimensions

Transmission protocol and data frame structure (128-bit message)

The 128 bit data message is pulse modulated in a 10 ms transmission time. The message starts with the emission of two "Preamble" pulses followed by a 2 bit "Header", a 4 bit Device/Manufacturer "Code" and a 22 bit unique "ID". Two bit (four voltage levels) are used for the battery "charge" status.

*The **SPS207S** module is part of the "SPnet" wireless remote ultra-low power Tag, Sensors, Alarm and RF Beacon data communication network. The "SPnet" is an RF Spread Spectrum "PPM" modulated data transmission protocol optimized to decode and manage data collected from a "cloud" of remote "micro.SP" technology transmitters. Primary goal is a wireless network of compact, cheap , ultra-low current consumption transmitter modules powered by a small button lithium battery or energy harvester and capable to operate continuously and autonomously for 10/20 years.*

The receiver module SPR27S3-D2

The SPR27S3 module, "D2"software programmed, receives and decodes the 128 bit string and, after check-sum control, transmits the string from the UART serial port (38400,n,8,1) in two formats :

A) - an "Hex-ASCII" string as shown below (SPR27S3 Receiver S1 selector in "A" position – pin n°16 "high")

B) - a "Clear" format - ASCII characters (SPR27S3 Receiver S1 selector in "B" position - pin n°16 "Low")

SPS207 Wireless Sensor - Hex-ASCII Format string - (SPR27S3 Receiver S1 selector in "A" position) .

"STX"	II	H	M	CCCCCC	XXX	YYY	ZZZ	xxx	yyy	zzz	TTT	B	NNN	SSS	"ETX"

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"STX" = 0x02
II  = Message Type (03) - 8 bit
H   = Header (0) - 2 bit
M   = Device "ID" (1) - 4 bit
CCCCCC = Unique "ID" code  - 22 bit
XXX = Magnetometer  X Axis - 12 bit
YYY = Magnetometer  Y Axis - 12 bit
ZZZ = Magnetometer  Z Axis - 12 bit
xxx = Accelerometer X Axis - 12 bit
yyy = Accelerometer Y Axis - 12 bit
zzz = Accelerometer Z Axis - 12 bit
TTT = Temperature   - 10 bit
B   = Battery level -  2 bit
NNN = RSSI Noise    - 10 bit
SSS = RSSI Frame    - 10 bit
"ETX" = 0x03
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Batt. level
0 = ≤ 2 V
1 = ≤ 2,5 V
2 = ≤ 2,9 V
3 = ≥ 3 V

Clear Format ("ASCII" characters)
S1 Selector in "B" position
Hyperterminal or Teraterm Terminal Emulator

Header	**= 0**
Device ID	**= 1**
ID Code	**= 123416**
Mag.-X- uT	**= -129.60**
Mag.-Y- uT	**= 163.20**
Mag.-Z- uT	**= 20.80**
Acc.-X- mG	**= 19**
Acc.-Y- mG	**= 66**
Acc.-Z- mG	**= 1017**
Temperature	**= 26.75**
Battery	**>= 3,0V**
RSSI Noise mV	**= 148**
RSSI Frame mV	**= 1362**