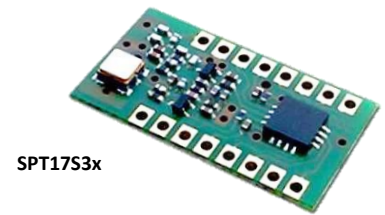


SPT17S3xx

"microSP" Transmitter

434,350 MHz



Description

The SPT17S3xx series modules are RF data transmitters 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 into the time position of short (2 μ s) RF pulses. The pulse peak power is very high (+ 14dBm - 25mW) while the impulse stream 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 SPT17S3 transmitter module is perfect for designing wireless sensors, wireless alarms and actuators or tags. These wireless devices, "microSP" equipped, can continuously transmit the life state (Heartbeat) and measurements or commands at regular intervals or according to appropriate modalities. Powered by a small lithium battery, they can easily guarantee a life span of over 25 years.



For further explanations, with theoretical and practical insights on the "microSP" Technology, refer to the AN-901 Application Note in which, in addition to the "microSP" patent with description of the generation of the RF pulses, the concept of low "Duty cycle" PPM modulated transmission is explained and also its practical use in data transmission .

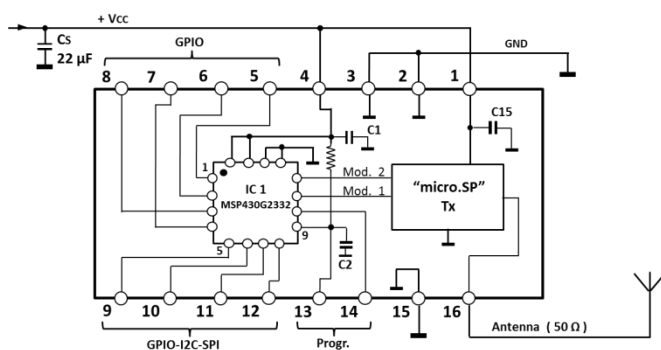


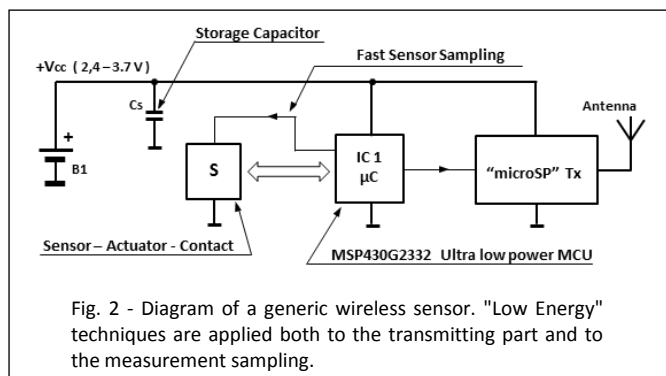
Fig. 1 - SPT17S3xx Block diagram .

The SPT17S3 module includes a "microSP" transmitter circuit and an ultra-low power microcontroller MSP430G2332 (IC1). The μ C implements pulse generation and the entire data string while generic input-output pins (GPIO) are available outside the module (refer to Fig.1 and Table 2) .

A suitable "SW" will be responsible for carrying out sensor measurements and for generic control and generation of alarms or commands.

Figure 2 shows the basic scheme of a typical wireless sensor device. Wireless sensors or alarms must take into account a "Low Energy" design with appropriate timing and measurement sampling. Refer to the application note AN-901 for further details on the "Low energy" design techniques.

Application in a wireless sensor or alarm



The SPT17S3 module can be interfaced directly with a sensor or with digital or analog inputs. To maintain a very low consumption, the measurements are appropriately sampled in a very short time (normally less than 100 μ s). By accurately managing these sampling times and the repetition time of the "Life state" transmission (Hearthbeat), the total average current consumption can be reduced to less than 1-2 μ A.

The sampled measurements and transmission current peaks are absorbed by the storage capacitor Cs (Fig. 2) and the battery has an excellent efficiency of use of its total mA/h capacity.

Moreover, in the presence of such a low average current, the battery does not show a voltage drop with related reduction in its efficiency even at very low temperatures (-25 / -40 ° C).

When a wireless sensor is designed as described above, the microcontroller is used to generate PPM modulation and also to manage sensors or alarm inputs. This is the preferred solution both in terms of cost and energy optimization. In the vast majority of "IoT" applications of sensors or one-way wireless alarms, the need for a second μ C is eliminated.

Table 1 - RF Performance Data

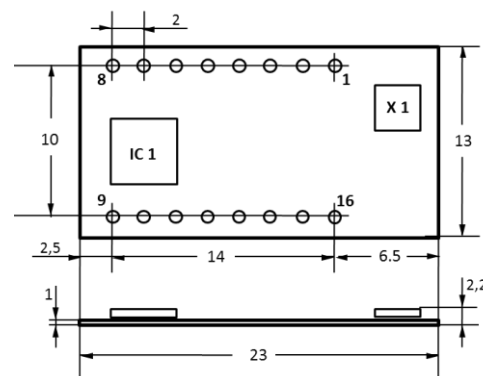
Frequency	434.35 MHz
RF Output Power	+14 dBm (25 mW) (Peak – conducted) (1) -20dBm/10kHz (typ. ERP Power Density)
Modulation	PPM (Pulse Position Modulation)
Emission BW (- 3 dB)	300 kHz
Supply Voltage	3 Vdc (2,4 -3,7 Vdc)
Current	1 – 2 μ A (2)
RF output impedance	50 Ω
Operating Temp.	-40 + 85 °C
Dimensions	13 x 23 mm
IC1 μ Controller	MSP430G2332

Note (1) : "ERP" radiated power depends on the antenna efficiency.

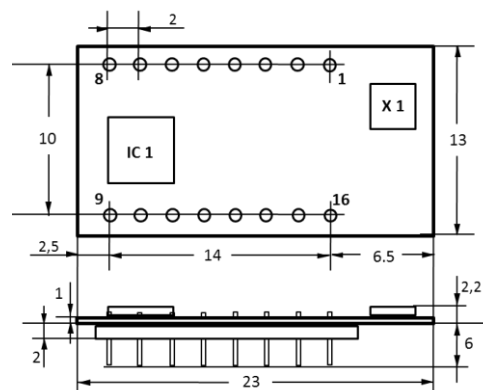
Note (2) : 1–2 μ A is the typical average current absorption of a "microSP" sensor made with the SPT17S3 Tx module.

Table2– Terminal Functions – SPT17S3-x

N°	Description	N°	Description
1	+ Vcc TX	9	μ C pin 5 (P1.4)
2	GND	10	μ C pin 6 (P1.5)
3	GND	11	μ C pin 7 (P1.6/SCL)
4	+ Vdd (μ C)	12	μ C pin 8 (P1.7/SDA)
5	μ C pin 1 (P1.0)	13	μ C pin 9 (RST-SBWDIO)
6	μ C pin 2 (P1.1)	14	μ C pin 10 (SBWTCK)
7	μ C pin 4 (P1.3)	15	GND
8	μ C pin 3 (P1.2)	16	Antenna (Z=50 Ω)



SPT17S3-xx



SPT17S3P-xx

Fig. 3 - Mechanical dimensions

Typical implementation of a wireless "microSP" Sensor

Temperature and Humidity (10 bit measurement)

Figure 4 shows the diagram of a "microSP" wireless Sensor using the Silicon Labs Si7020 Precision Relative Humidity and High Accuracy Temperature Sensor.

For a detailed description, refer to the AR-S105 Application Report. This transmitter module has the code number SPT17S3-TH001 (firmware SW-3147TH001).

The TH001 version provides for the activation of a "Test mode" to facilitate installation and allow complete control of the RF transmission and the level and reliability of the received signal. It is also possible to select up to four operating modes with different sampling and transmission times.

For schematics on other types of wireless sensor or alarm, refer to the "AR-S1xx Application Reports" and consult the Factory.

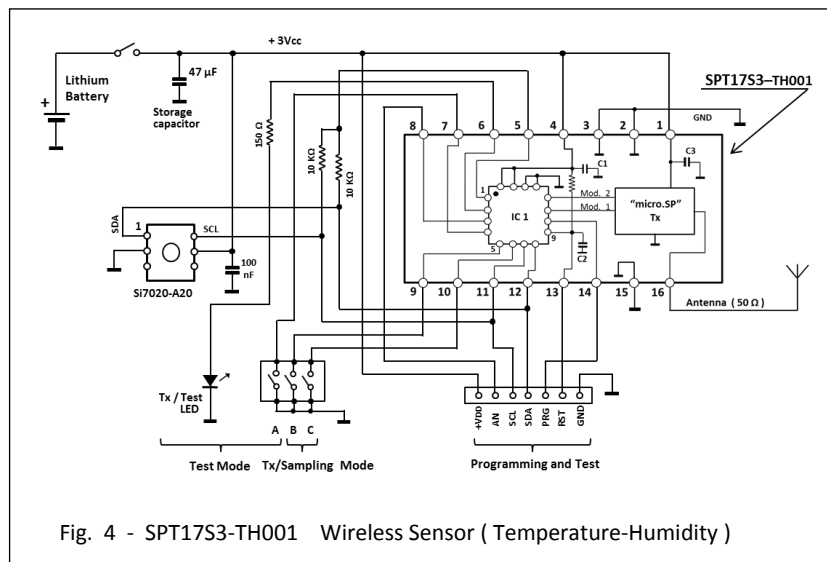


Fig. 4 - SPT17S3-TH001 Wireless Sensor (Temperature-Humidity)

The SPT17S3P-D2

A "Demo" unit to be used to test and evaluate the "microSP" Technology

The SPT17S3P-D2 is the "Demo" version of the "microSP" SPT17xx transmitter module line. The module is programmed with the "D2" software and has three On/Off inputs plus an analog input 0-1.5 VDC (10-bit resolution). It also measures the temperature using the sensor inside the MSP430G2332 microcontroller and the battery voltage. Two GPIO pins of the microcontroller are used to select up to four different operating modes.

In Fig.6 the schematic of the SPT17S3-D2 with the analog and the On/Off inputs and with the S1 and S2 selectors that allow choosing the "Heartbeat" transmission time and the measurements sampling time lapse.

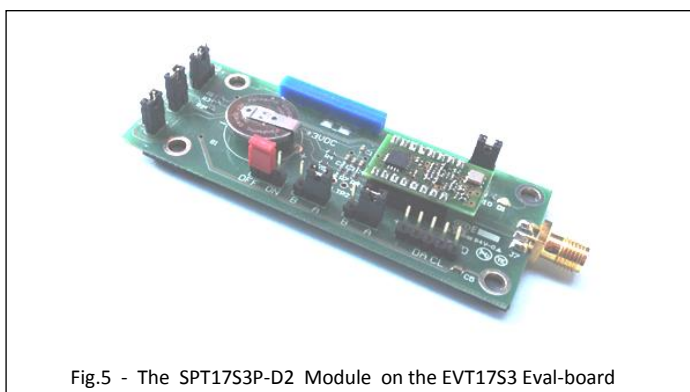
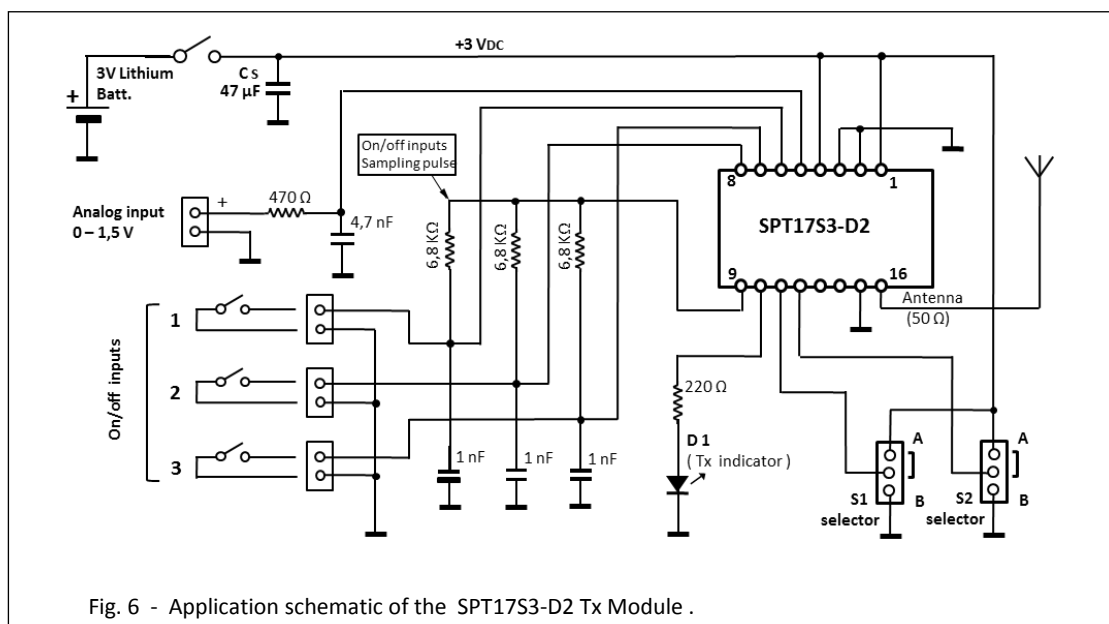


Fig.5 - The SPT17S3P-D2 Module on the EVT17S3 Eval-board

Further information on the SPT17S3P-D2 module is available on the EVT17S3 Eval-board data sheet.

Although designed for "Demo" purposes and in particular for use in combination with the Evaluation Board, the module can be used in many practical cases as it is. As an example, to transmit the status of up to three microswitches or when it is necessary to measure a voltage remotely using the AD converter of the MSP430G2332 microcontroller.



Note 1 - In the SPT17xx series transmitter modules, the Cs "Energy Storage" capacitor is not provided on board and must be mounted externally. Depending on the applications and especially on the current absorbed by the sensor system, the Cs capacitor can be in the range between 22 µF and 100 µF.

Note 2 - The SPT17S3-D2 module measures the temperature using the sensor inside the MSP microcontroller and the measurement is not calibrated. The calibration process can be performed during the programming phase: refer to the MSP430 documentation or ask the factory.

The "Pulse" and related RF Emission Spectrum .

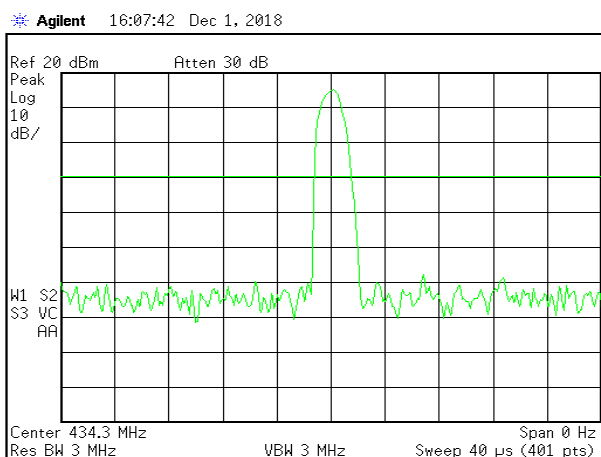


Fig.7 - The RF pulse as generated by a "microSP" Tx .

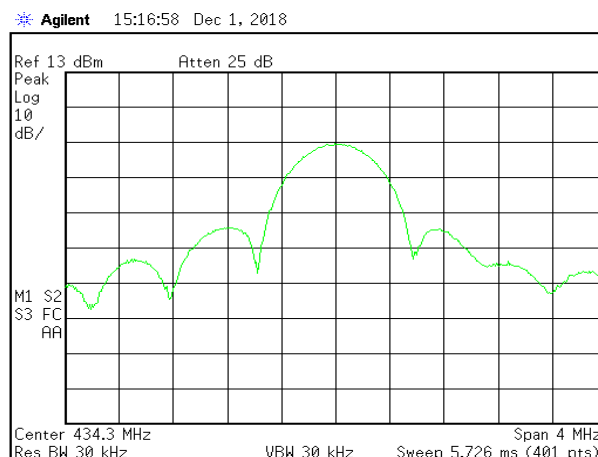


Fig.8 - The RF spectrum of a 96 bit message transmission .

In Fig.8 the RF spectrum of a 96-bit message transmission with 2 µs RF pulses and "PPM" modulation. The "Gaussian" shape of the pulses (Fig.7) is necessary to limit the "Occupied Bandwidth" as required by the International Normative (FCC - Part 15 and ETSI - EN 300 220). Apart from the Normative, the reduced bandwidth allows employing a narrower selectivity on the receiver side increasing the signal to noise (S/N) ratio and reducing the interferences from other electronics or RF devices emissions .