

# *SNP705X DATASHEET*

Version 2.3

## Description

The SNP705X is a sensor for air pressure measurements designed for TPMS (Tire Pressure Monitoring System) applications.

## Features

- Calibrated pressure sensor for absolute pressure measurement
- Temperature and supply voltage sensor
- 8051 based microcontroller
- Standby current 0.25uA
- RF Transmitter 433MHz/315MHz integrated
- External accelerometer
- Support LF programming
- Absolute Pressure range: 450kPa/900kPa/1500kPa

| RF                              |  |              | Comment                                    |
|---------------------------------|--|--------------|--|
| Frequency                       |  | 315 / 433.92 | MHz – programmable about centre freq       |
| PA                              |  | On chip      | 3.5 ~10 dBm output power                   |
| Modulation                      |  | ASK / FSK    |  |
| FSK deviation                   |  | 90           | kHz – programmable                         |
| Format                          |  | Manchester   | Mark/space also supported                  |
| <b>LF (Wakeup, Programming)</b> |  |              |  |
| Format                          |  | Manchester   | OOK & PWM also supported                   |
| Format speed                    |  | 3.9/6.5      | Kbps                                       |
| <b>Pressure</b>                 |  |              |  |
| Sensor resistance               |  | 20 to 3.3    | kOhm                                       |
| Main measure                    |  | ADC          | 12 bit                                     |
| <b>Temperature</b>              |  |              |  |
| Main measure                    |  | ADC          | 12 bit                                     |
| <b>On chip oscillator</b>       |  |              |  |
| frequency                       |  | 8/39/2000    | KHz  |
| <b>Micro</b>                    |  |              |  |
| LF decoder                      |  | Fuzzy        | Improves noise and distortion performance. |
| Flash                           |  | 16           | Kbytes                                     |
| RAM                             |  | 384          | Bytes                                      |
| GPIO                            |  | 3            |  |
| <b>Other</b>                    |  |              |  |
| Package                         |  | LGA 24Pin    | SIP (System In Package)                    |
| Battery Supply                  |  | 2.1~3.6      | Volts                                      |

## Applications

- Tire Pressure Monitoring System
- MEMs sensor

## Functional Description

SNP705X consists of 16k Flash memory, interrupt bus, configuration registers and control bus which operate the analogue circuitry all of which are controlled via a 8-bit integrated microcontroller. The micro is clocked by a tunable oscillator with a selectable center frequency. The motion detection is achieved via external accelerometer.

Measurements of pressure, temperature, and battery voltage are performed under software control, and the data can be formatted and prepared for RF transmission by the microcontroller. A software defined wakeup mechanism is developed for minimizing power consumption. An Interval timer controls the timing of measurements and transmissions. The circuitry can be programmed to wake up at regular intervals or it can be woken up by the integrated LF Receiver, which furthermore enables the sensor to receive data.

The LF receiver supports wireless Flash programming to the chip with no need of I2C communication which demonstrates high efficiency in customer firmware development phase.

The integrated microcontroller is instruction set compatible to the standard 8051 processor. It is equipped with hardware Manchester, bi-phase encoder/decoder and CRC generator and checker, which enable easy implementations of customer specific applications.

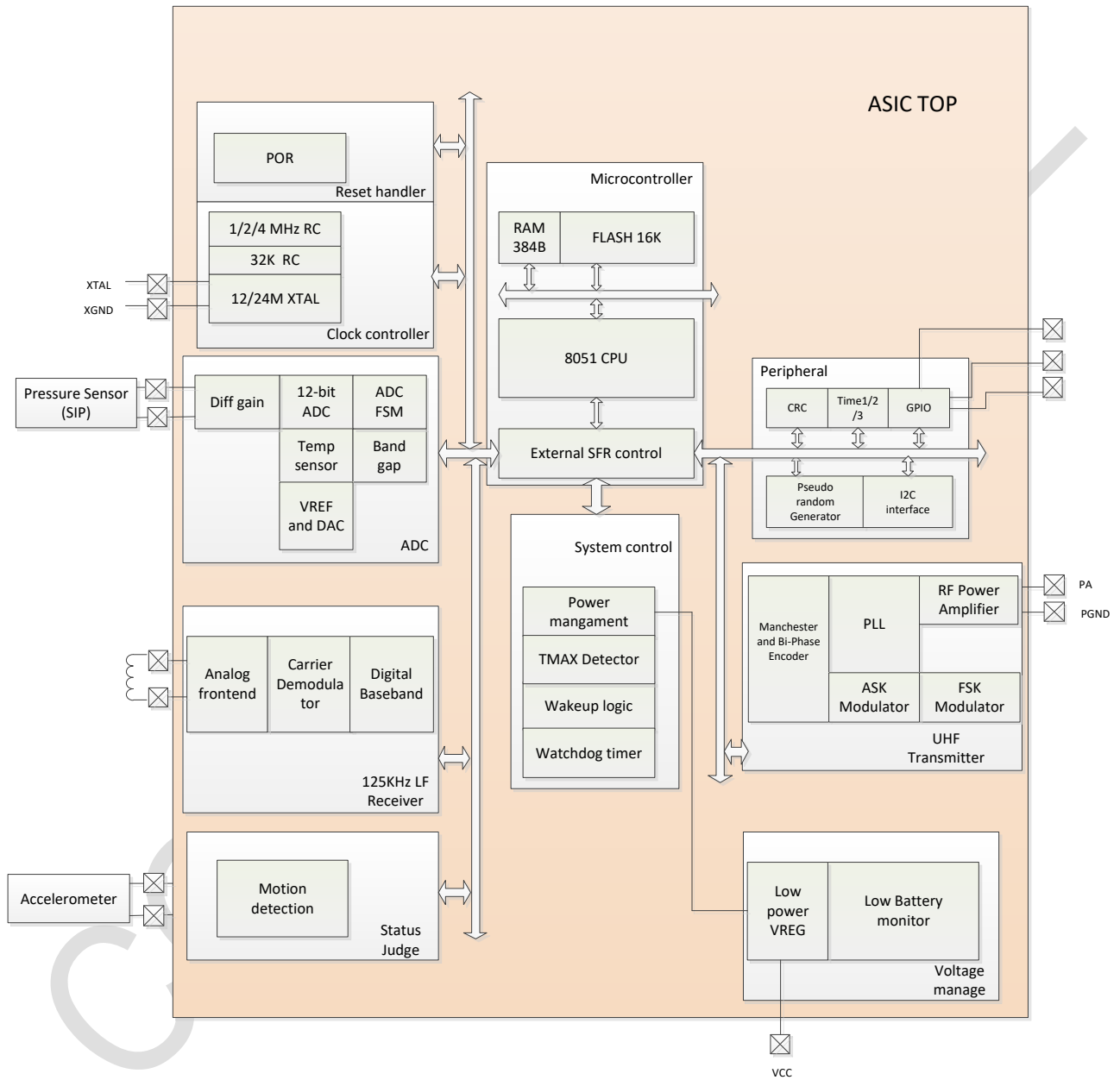
The low-power RF Transmitter for 315 and 434 MHz contains a fully integrated PLL synthesizer, an ASK/FSK modulator and an efficient power amplifier.

The accelerometer interface can support external dual-axis accelerometer to detect tire roll status.

On-chip Flash memory is integrated to store the customer specific application program code, the unique ID-number of the sensor and the calibration data for the sensor. Additionally flash embedded library functions developed by SENASIC cover standard tasks used by the application.

| SNP705X ORDERING INFORMATION |                         |
|------------------------------|-------------------------|
| Part number                  | Absolute Pressure range |
| SNP705G                      | 450kPa                  |
| SNP705H                      | 900kPa                  |
| SNP705N                      | 1500kPa                 |

## Block Diagram



SNP705X Function Diagram for ASIC

## Electrical Characteristics

Table 1 Absolute Maximum Ratings

| Parameter                                  | Symbol        | Values   |      |               | Unit | Note/Test Condition               | Num.                   |
|--|---------------|----------|------|---------------|------|-----------------------------------|------------------------|
|  |               | Min.     | Typ. | Max.          |      |                                   |                        |
| Supply Voltage                             | $V_{bat}$     | -0.3     | —    | +3.8          | V    |                                   | 1.1                    |
| Operating Temperature                      | $T_j$         | -40      | —    | +125          | °C   | Normal mode                       | 1.2                    |
|  |               | -40      | —    | +150          | °C   | Idle mode                         | 1.3                    |
| Storage Temperature                        | $T_{storage}$ | -40      | —    | +150          | °C   | Device not powered                | 1.5                    |
| ESD HBM                                    | $V_{ESD,HBM}$ | -2000    | —    | +2000         | V    | All pins according to JS-001-2014 | 1.6                    |
|  |               | -4000    | —    | +4000         | V    | RF pin according to JS-001-2014   | 1.7                    |
| ESD CDM                                    | $V_{ESD,CDM}$ | -500     | —    | +500          | V    | All pins according to JS-002-2014 | 1.8                    |
| Latch up                                   | $I_{LU}$      | -100     | —    | +100          | mA   | All pins according to JEDEC 78D   | 1.9                    |
| Input Voltage                              | $V_{in}$      | -0.3     | —    | $V_{bat}+0.3$ | V    | GPIO0, GPIO1, GPIO2               | 1.10                   |
|  |               | -0.3     | —    | $V_{bat}+0.3$ | V    | XTAL, PSA, PSB                    | 1.11                   |
|  |               | -0.3     | —    | $V_{bat}+0.3$ | V    | LFA, LFB                          | 1.12                   |
|  |               | -0.3     | —    | +0.3          | V    | SA, SB                            | 1.13                   |
| Input and Output Current (digital IO pins) | $I_{io,dig}$  | -10      | —    | +10           | mA   | GPIO0, GPIO1, GPIO2               | 1.14                   |
|  |               | $I_{in}$ | -10  | —             | +10  | mA                                | LFA, LFB, XTAL, SA, SB |

Table 2 Operating Range

| Parameter           | Symbol          | Values |      |      | Unit | Note/Test Condition  | Num. |
|---------------------|-----------------|--------|------|------|------|--|------|
|                     |                 | Min.   | Typ. | Max. |      |  |      |
| Supply Voltage      | $V_{bat1}$      | 2.1    | 3.0  | 3.6  | V    | Measurement of pressure, acceleration, temperature and battery | 2.1  |
|                     | $V_{bat2}$      | 2.1    | 3.0  | 3.6  | V    | Operation of LF receiver                                       | 2.2  |
|                     | $V_{bat3}$      | 2.1    | 3.0  | 3.6  | V    | RF transmission  | 2.3  |
|                     | $V_{bat4}$      | 2.1    | 3.0  | 3.6  | V    | MCU, FLASH reading/programming/erasing                         | 2.4  |
| Ambient Temperature | $T_{operating}$ | -40    | —    | 125  | °C   | Normal operation   | 2.6  |
|                     | $T_{Flash}$     | -20    | —    | 90   | °C   | Flash programming/erasing                                      | 2.7  |

Table 3 Pressure Sensor

| Parameter                            | Symbol                | Values |      |      | Unit | Note/Test Condition                           | Num. |
|--------------------------------------|-----------------------|--------|------|------|------|---|------|
|                                      |                       | Min.   | Typ. | Max. |      |   |      |
| Measurement Error                    | P <sub>Error</sub>    | -7     | —    | +7   | KPa  | T = 0...70°C, V <sub>bat</sub> =2.1...3.6V    | 3.2  |
|                                      |                       | -15    | —    | +15  | KPa  | T = -40...125°C, V <sub>bat</sub> =2.1...3.6V | 3.5  |
| RAW LSB resolution                   | P <sub>LSB, RAW</sub> |        | —    | 2.1  | KPa  | T = -40°C, V <sub>bat</sub> =2.1...3.6V       | 3.6  |
|                                      |                       |        | —    | 2.3  | KPa  | T = 25°C, V <sub>bat</sub> =2.1...3.6V        | 3.7  |
|                                      |                       |        | —    | 2.5  | KPa  | T = 125°C, V <sub>bat</sub> =2.1...3.6V       | 3.8  |
| Pressure Measurement Stability Range | P <sub>sta</sub>      | -2.75  |      | 2.75 | KPa  | Minimum 95% of the measurement                | 3.9  |

- 1) Above pressure error result was tested based on SNP705H, SNP705N has a larger pressure error due to large pressure range ;about more information of SNP705N ,please contact with SENASIC FAE
- 2) SNP705H (900Kpa)detail pressure error is as below :

| Temperature condition  | 0°C~70°C |         | -40~0°C; 70~125°C |         |
|------------------------|----------|---------|-------------------|---------|
| Absolute Pressure(kPa) | 100~500  | 500~900 | 100~500           | 500~900 |
| Measurement Error(kPa) | ±5       | ±7      | ±10               | ±15     |

- 3) SNP705N (1500Kpa)detail pressure error is as below :

| Temperature condition  | 0°C~70°C |         |          | -40~0°C; 70~125°C |         |          |
|------------------------|----------|---------|----------|-------------------|---------|----------|
| Absolute Pressure(kPa) | 100~500  | 500~900 | 900~1500 | 100~500           | 500~900 | 900~1500 |
| Measurement Error(kPa) | ±7       | ±12     | ±20      | ±15               | ±25     | ±40      |

Table 4 Temperature Sensor

| Parameter                        | Symbol             | Values |      |      | Unit | Note/Test Condition                           | Num. |
|----------------------------------|--------------------|--------|------|------|------|---|------|
|                                  |                    | Min.   | Typ. | Max. |      |   |      |
| Measurement Error                | T <sub>Error</sub> | -2     | —    | +2   | °C   | T = -20...70°C, V <sub>bat</sub> =2.1...3.6V  | 6.1  |
|                                  |                    | -3     | —    | +3   | °C   | T = -40...125°C, V <sub>bat</sub> =2.1...3.6V | 6.2  |
| Temp Measurement Stability Range | T <sub>stab</sub>  | -1     | —    | +1   | °C   | Minimum 95% of the measurement                | 6.3  |

Table 5 Battery Sensor

| Parameter         | Symbol             | Values |      |      | Unit | Note/Test Condition             | Num. |
|-------------------|--------------------|--------|------|------|------|---------------------------------|------|
|                   |                    | Min.   | Typ. | Max. |      |                                 |      |
| Measurement Error | V <sub>Error</sub> | -3     | —    | +3   | %    | Percentage of measurement value | 7.1  |

Table 6 Supply Currents

| Parameter  | Symbol                   | Values |      |      | Unit | Note/Test Condition  | Num. |
|--|--------------------------|--------|------|------|------|--|------|
|  |                          | Min.   | Typ. | Max. |      |  |      |
| Supply current at RF transmission (FSK, 433.92MHz) | I <sub>RF433_L2_3V</sub> |        | 9.67 |      | mA   | V <sub>bat</sub> =3V, T=-40°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 8dBm  | 8.8  |
|  |                          |        | 9.38 |      | mA   | V <sub>bat</sub> =3V, T=25°C, Z <sub>load</sub> =X ohm, RFout matched P <sub>out</sub> ~ 8dBm    | 8.9  |
|  |                          |        | 8.89 |      | mA   | V <sub>bat</sub> =3V, T=125°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 8dBm  | 8.10 |
| Supply current at RF transmission (FSK, 433.92MHz) | I <sub>RF433_L1_3V</sub> |        | 6.1  |      | mA   | V <sub>bat</sub> =3V, T=-40°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 5dBm  | 8.3  |
|  |                          |        | 5.9  |      | mA   | V <sub>bat</sub> =3V, T=25°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 5dBm   | 8.4  |
|  |                          |        | 5.6  |      | mA   | V <sub>bat</sub> =3V, T=125°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 5dBm  | 8.5  |
| Supply current at RF transmission (FSK, 433.92MHz) | I <sub>RF433_L3_3V</sub> |        | 12.5 |      | mA   | V <sub>bat</sub> =3V, T=-40°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 10dBm | --   |
|  |                          |        | 11.8 |      | mA   | V <sub>bat</sub> =3V, T=25°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 10dBm  | --   |
|  |                          |        | 11.3 |      | mA   | V <sub>bat</sub> =3V, T=125°C, Z <sub>load</sub> = X ohm, RFout matched P <sub>out</sub> ~ 10dBm | --   |

Table 6.1 Supply Currents(cont'd)

| Parameter   | Symbol                  | Values |      |      | Unit | Note/Test Condition   | Num. |
|---|-------------------------|--------|------|------|------|---|------|
|   |                         | Min.   | Typ. | Max. |      |   |      |
| Supply current in power down state                                    | I <sub>PWD_3V</sub>     |        | -    | 0.3  | uA   | V <sub>bat</sub> =3V, T=25°C  | 8.13 |
|   |                         |        | -    | 0.9  | uA   | V <sub>bat</sub> =3V, T=90°C  | 8.14 |
|   |                         |        | 1.6  | 3.5  | uA   | V <sub>bat</sub> =3V, T=125°C   | 8.15 |
|   |                         |        |      | 0.2  | uA   | V <sub>bat</sub> =3V, T=-40°C   |      |
| Supply current in idle state  | I <sub>IDLE_3V</sub>    |        | -    | 59   | uA   | V <sub>bat</sub> =3V, T=25°C  | 8.21 |
|   |                         |        | -    | 77   | uA   | V <sub>bat</sub> =3V, T=90°C  |      |
|   |                         |        | 88   | 152  | uA   | V <sub>bat</sub> =3V, T=125°C   | 8.22 |
|   |                         |        | -    | 64   | uA   | V <sub>bat</sub> =3V, T=-40°C   |      |
| Supply current in run state (Peripheral units in active state, 32KHz) | I <sub>RUN_3V</sub>     |        | -    | 618  | uA   | V <sub>bat</sub> =3V, T=25°C  | 8.23 |
|   |                         |        | -    | 566  | uA   | V <sub>bat</sub> =3V, T=90°C  |      |
|   |                         |        | -    | 576  | uA   | V <sub>bat</sub> =3V, T=125°C   | 8.24 |
|   |                         |        | -    | 695  | uA   | V <sub>bat</sub> =3V, T=-40°C   |      |
| Supply current in run state (PLL enabled)                             | I <sub>RUN_3V,PLL</sub> |        | 2.6  |      | mA   | V <sub>bat</sub> =3V, T=25°C, P <sub>out</sub> ~ 8dBm, Power Level 2  | 8.25 |
|   |                         |        |      |      | mA   | V <sub>bat</sub> =3V, T=90°C, P <sub>out</sub> ~ 8dBm, Power Level 2  |      |
|   |                         |        | 2.4  |      | mA   | V <sub>bat</sub> =3V, T=125°C, P <sub>out</sub> ~ 8dBm, Power Level 2 | 8.26 |
|   |                         |        | 2.2  |      | mA   | V <sub>bat</sub> =3V, T=-40°C, P <sub>out</sub> ~ 8dBm, Power Level 2 |      |
| Supply current in thermal shutdown                                    | I <sub>TSHD_3V</sub>    |        | 2.8  | 4.6  | uA   | V <sub>bat</sub> =3V, T=125°C   | 8.19 |
| LF Receiver current   | I <sub>LF_3V</sub>      |        |      | 9    | uA   | V <sub>bat</sub> =3V, T=25°C  | 8.27 |
|   |                         |        |      | 11   | uA   | V <sub>bat</sub> =3V, T=90°C  |      |
|   |                         |        |      | 12   | uA   | V <sub>bat</sub> =3V, T=125°C   |      |
|   |                         |        |      | 8    | uA   | V <sub>bat</sub> =3V, T=-40°C   |      |



Table 7 RF Transmitter

| Parameter                            | Symbol               | Values |        |      | Unit   | Note/Test Condition   | Num. |
|--------------------------------------|----------------------|--------|--------|------|--------|---|------|
|                                      |                      | Min.   | Typ.   | Max. |        |   |      |
| Transmit Frequency                   | $f_{TX,433.92MHz}$   | 432    | 433.92 | 444  | MHz    |   | 9.2  |
| Output Power transformed into 50 Ohm | $P_{O,L1,433.92MHz}$ |        | 5.6    |      | dBm    | $V_{bat}=3.0V, T=25^{\circ}C$<br>$Z_{load}=50\text{ ohm RF matched}$<br>Power Level=1 | 9.5  |
| Output Power transformed into 50 Ohm | $P_{O,L2,433.92MHz}$ |        | 7.7    |      | dBm    | $V_{bat}=3.0V, T=25^{\circ}C$<br>$Z_{load}=50\text{ ohm RF matched}$<br>Power Level=2 | 9.6  |
| Output Power transformed into 50 Ohm | $P_{O,L3,433.92MHz}$ |        | 9.8    |      | dBm    | $V_{bat}=3.0V, T=25^{\circ}C$<br>$Z_{load}=50\text{ ohm RF matched}$<br>Power Level=3 |      |
| Output Power change over temp.       | $dP_{-40^{\circ}C}$  |        | 0.6    |      | dB     | $V_{bat}=3.0V, T=-40^{\circ}C$  | 9.13 |
| Output Power change over temp.       | $dP_{125^{\circ}C}$  |        | -1.1   |      | dB     | $V_{bat}=3.0V, T=125^{\circ}C$  | 9.14 |
| Output Power change over supply      | $dP_{1.9V}$          | -10.1  | -7.1   |      | dB     | $V_{bat}=1.9V, T=25^{\circ}C$   | 9.15 |
| Output Power change over supply      | $dP_{2.1V}$          | -5.5   | -4.8   |      | dB     | $V_{bat}=2.1V, T=25^{\circ}C$   | 9.17 |
| Output Power change over supply      | $dP_{3.6V}$          | 1.6    | 1.9    |      | dB     | $V_{bat}=3.6V, T=25^{\circ}C$   | 9.18 |
| Datarate                             | $DR_{RF}$            |        |        | 19.6 | Kbit/s | Manchester coded  | 9.19 |
| Datarate accuracy                    | $dDR_{RF}$           | -1     |        | +1   | %      |   | 9.20 |
| Reference Spur                       | $P_{spur,433.92MHz}$ |        |        | -50  | dBc    |   | 9.22 |
| Carrier Harmonics                    | $P_{h2,433.92MHz}$   | -33    |        | -28  | dBc    | 2 <sup>nd</sup> harmonics   | 9.21 |
| Phase Noise                          | $P_{PN,10KHz}$       |        |        | -80  | dBc/Hz |   | 9.25 |
|                                      | $P_{PN,100KHz}$      |        |        | -80  | dBc/Hz |   | 9.26 |
|                                      | $P_{PN,1MHz}$        |        |        | -90  | dBc/Hz |   | 9.27 |
|                                      | $P_{PN,10MHz}$       |        |        | -120 | dBc/Hz |   | 9.28 |
| FSK frequency shift                  |                      | 0      | +/-45  |      | KHz    | Programmable  |      |
| RF Data Duty Cycle                   | $DC_{RF,ASK}$        | 45     | 50     | 55   | %      | Valid only for ASK <sup>1)</sup>  |      |
| ASK Mod depth                        | $MD_{RF,ASK}$        | 90     |        |      | %      |   |      |

1) ASK duty cycle is defined at -3dB of the max. RF power during ASK is on

Table 8 LF Receiver Characteristics

| Parameter                                | Symbol        | Values |      |      | Unit   | Note/Test Condition                                     | Num.   |
|--|---------------|--------|------|------|--------|---|--|
|  |               | Min.   | Typ. | Max. |        |   |  |
| LF Carrier Frequency                     | $f_{LF}$      | -5%    | 125  | +5%  | KHz    |   |  |
| LF Data Rate                             | $DR_{LF}$     | -3%    | 3.9  | +5%  | Kbit/s |   | 10.6   |
| LF input differential capacitance        | $C_{LF,diff}$ | 2      | 3.9  | 10   | pF     | At 125KHz   |  |
| LF input differential resistance         | $R_{LF,diff}$ | 1      |      |      | Mohm   | At 125KHz, -40°C to 90°C                                |  |
| LF Receiver settling time after power on | $t_{ON\_set}$ |        |      | 15   | ms     | After LF receiver power-on till passing MLF preamble    |  |
| LF Detection Sensitivity                 | $S_{nodet}$   | 0.1    |      |      | mVpp   | $DR_{LF}=3.9KHz$ , 100% modulation depth                | 10.12  |
|  | $S_{det}$     |        |      |      | mVpp   | $DR_{LF}=3.9KHz$ , 100% modulation depth, -20°C to 90°C |  |
|  |               |        |      | 2    |        | mVpp  | $DR_{LF}=3.9KHz$ , 100% modulation depth, -40°C to 125°C |

Table 9 Crystal Oscillator

| Parameter                       | Symbol            | Values |      |      | Unit | Note/Test Condition | Num. |
|---------------------------------|-------------------|--------|------|------|------|---------------------|------|
|                                 |                   | Min.   | Typ. | Max. |      |                     |      |
| Crystal frequency range         | $f_{XTAL}$        |        | 24   |      | MHz  | 12MHz optional      | 12.0 |
| Crystal tolerance               |                   | -50    |      | +50  | ppm  |                     |      |
| Crystal load capacitance        |                   |        | 6    |      | pF   |                     | 12.2 |
| Crystal Oscillator startup time | $t_{XTAL\_start}$ |        |      | 2    | ms   |                     | 12.1 |

Table 10 Power On Reset

| Parameter                    | Symbol    | Values |      |      | Unit | Note/Test Condition       | Num. |
|------------------------------|-----------|--------|------|------|------|---------------------------|------|
|                              |           | Min.   | Typ. | Max. |      |                           |      |
| Power on reset level         | $V_{POR}$ | 1.0    |      | 1.65 | V    | Measured at Pin $V_{bat}$ | 16.1 |
| Power on reset release level | $V_{THR}$ | 1.1    |      | 1.7  | V    | Measured at Pin $V_{bat}$ | 16.3 |
| Power on reset time          | $t_{POR}$ |        |      | 0.5  | ms   |                           | 16.4 |

Table 11 Voltage Regulator

| Parameter                        | Symbol            | Values |      |      | Unit | Note/Test Condition           | Num. |
|----------------------------------|-------------------|--------|------|------|------|-------------------------------|------|
|                                  |                   | Min.   | Typ. | Max. |      |                               |      |
| Regulated output voltage         | V <sub>REG</sub>  |        | 1.8  |      | V    | V <sub>bat</sub> =2.1V – 3.6V | 17.1 |
| External Capacitance at Vreg Pin | C <sub>VREG</sub> |        | 1    |      | uF   |                               | 17.6 |

Table 12 Battery Monitor

| Parameter                           | Symbol             | Values |      |      | Unit | Note/Test Condition                | Num. |
|-------------------------------------|--------------------|--------|------|------|------|------------------------------------|------|
|                                     |                    | Min.   | Typ. | Max. |      |                                    |      |
| Low battery threshold warning level | TH <sub>LBAT</sub> | 2.2    | 2.3  | 2.4  | V    | Used by ROM Library functions only | 18.1 |

Table 13 FLASH Memory

| Parameter                        | Symbol                  | Values |      |      | Unit    | Note/Test Condition  | Num. |
|----------------------------------|-------------------------|--------|------|------|---------|--|------|
|                                  |                         | Min.   | Typ. | Max. |         |  |      |
| Erase/Program temperature        | T <sub>FL</sub>         | -20    |      | 90   | °C      |  | 19.1 |
| Erase/Program supply voltage     | V <sub>bat</sub>        | 2.1    | 3.0  | 3.6  | V       |  | 19.2 |
| Flash memory data retention time | t <sub>RetFlash</sub>   | 10     |      |      | y       | Defect rate < 1ppm over lifetime for typical mission temperature profile |      |
| Flash write cycles (Endurance)   | N <sub>write</sub>      | 1K     |      |      | cycle s | Programming/erase cycles per wordline                                    | 19.3 |
| Flash line write time            | t <sub>write_line</sub> |        |      | 7.8  | ms      |  | 19.5 |

Table 14 Thermal Shutdown

| Parameter                         | Symbol              | Values |      |      | Unit | Note/Test Condition               | Num. |
|-----------------------------------|---------------------|--------|------|------|------|-----------------------------------|------|
|                                   |                     | Min.   | Typ. | Max. |      |                                   |      |
| Thermal shutdown<br>HOT threshold | T <sub>HOT,TH</sub> |        |      | 125  | °C   | Used by Library functions<br>only | 20.2 |
| Thermal shutdown<br>HOT release   | T <sub>HOT,RE</sub> | 95     |      |      | °C   |                                   | 20.1 |

Table 15 Digital I/O pins

| Parameter                        | Symbol              | Values              |      |                     | Unit | Note/Test Condition           | Num. |
|----------------------------------|---------------------|---------------------|------|---------------------|------|-------------------------------|------|
|                                  |                     | Min.                | Typ. | Max.                |      |                               |      |
| Input Low voltage                | V <sub>IL</sub>     |                     |      | 0.2V <sub>bat</sub> | V    |                               | 22.1 |
| Input High voltage               | V <sub>IH</sub>     | 0.8V <sub>bat</sub> |      |                     | V    |                               | 22.2 |
| Output Low voltage               | V <sub>OL</sub>     |                     |      | 0.2V <sub>bat</sub> | V    | I <sub>OL</sub> =4mA/6mA      | 22.3 |
| Output High voltage              | V <sub>OH</sub>     | 0.8V <sub>bat</sub> |      |                     | V    | I <sub>OL</sub> =4mA/6mA      | 22.4 |
| Digital Pin Output<br>Current    | I <sub>in,DIG</sub> | -4                  |      | 4                   | mA   | Programmable,<br>6mA optional |      |
| Digital Pin Input<br>Capacitance | C <sub>in,DIG</sub> |                     |      | 10                  | pF   |                               | 22.6 |

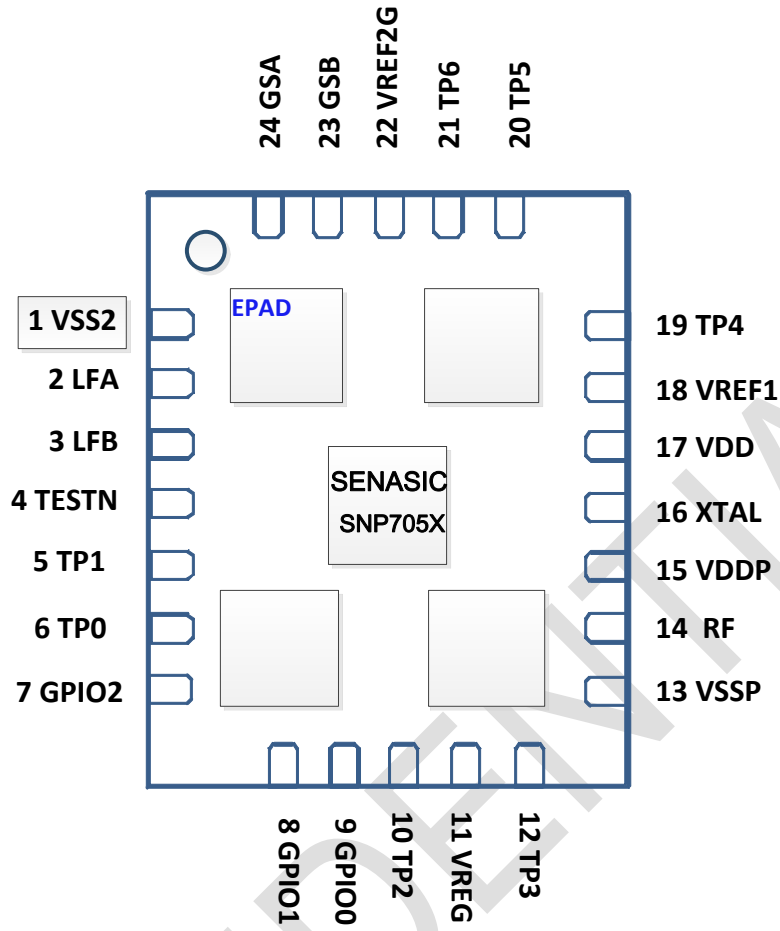
Table 16 I<sup>2</sup>C Interface

| Parameter                | Symbol            | Values |      |      | Unit | Note/Test Condition | Num. |
|--------------------------|-------------------|--------|------|------|------|---------------------|------|
|                          |                   | Min.   | Typ. | Max. |      |                     |      |
| I <sup>2</sup> C bitrate | DR <sub>I2C</sub> |        |      | 400  | Kb/s |                     | 23.1 |

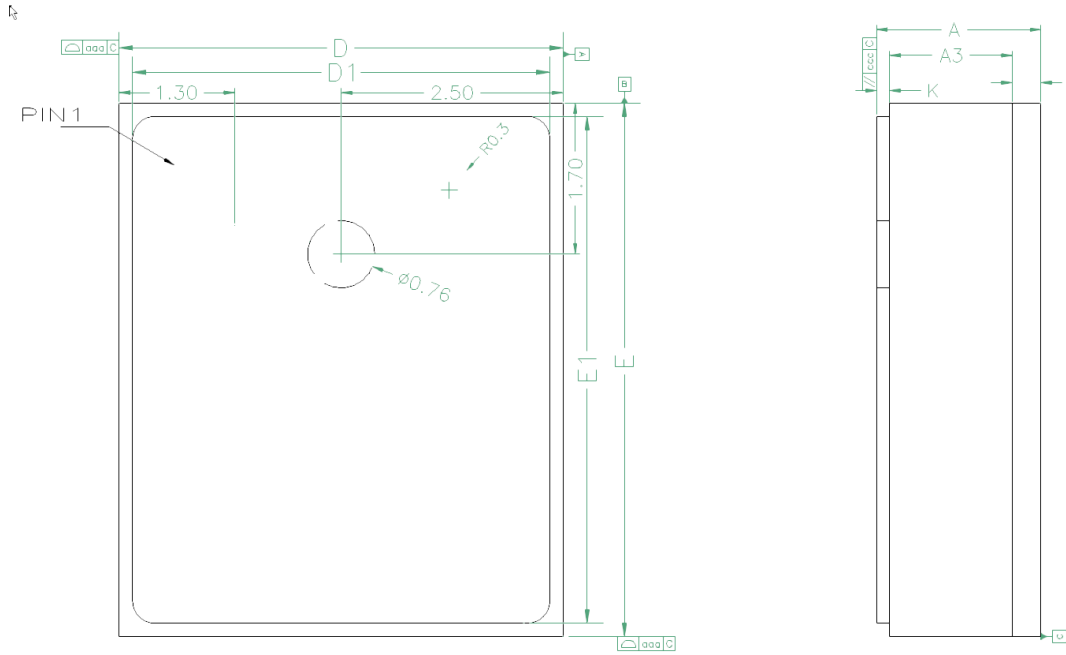
## Pin Assignment Table

| Pin   | Name   | Type       | Function   |
|-------|--------|------------|--|
| 1     | VSS2   | Supply     | Ground   |
| 2     | LFA    | Analog IO  | LF channel coil connection                         |
| 3     | LFB    | Analog IO  | LF channel coil connection                         |
| 4     | TESTN  | Digital In | Active high, test mode entry. Pull down by default |
| 5     | TP1    |            | N.C., just place a test point on board             |
| 6     | TP0    |            | N.C., just place a test point on board             |
| 7     | GPIO2  | Digital IO | GPIO / Test mode output                            |
| 8     | GPIO1  | Digital IO | GPIO / I2C data                                    |
| 9     | GPIO0  | Digital IO | GPIO / I2C Clock                                   |
| 10    | TP2    |            | N.C., just place a test point on board             |
| 11    | VREG   | Supply     | Supply 1.8V from internal regulator                |
| 12    | TP3    |            | N.C., just place a test point on board             |
| 13    | VSSP   | Supply     | Ground   |
| 14    | RF     | Analog IO  | RF output  |
| 15    | VDDP   | Supply     | Battery supply 3V                                  |
| 16    | XTAL   | Analog IO  | XTAL pin(12/24MHz)                                 |
| 17    | VDD    | Supply     | Battery supply 3V                                  |
| 18    | VREF1  | Analog IO  | 100nF to ground                                    |
| 19    | TP4    |            | N.C., just place a test point on board             |
| 20    | TP5    |            | N.C., just place a test point on board             |
| 21    | TP6    |            | N.C., just place a test point on board             |
| 22    | VREF2G | Analog IO  | Accelerometer common end                           |
| 23    | GSB    | Analog IO  | Differential input from accelerometer              |
| 24    | GSA    | Analog IO  | Differential input from accelerometer              |
| 25~29 | EPAD   | Supply     | Ground   |

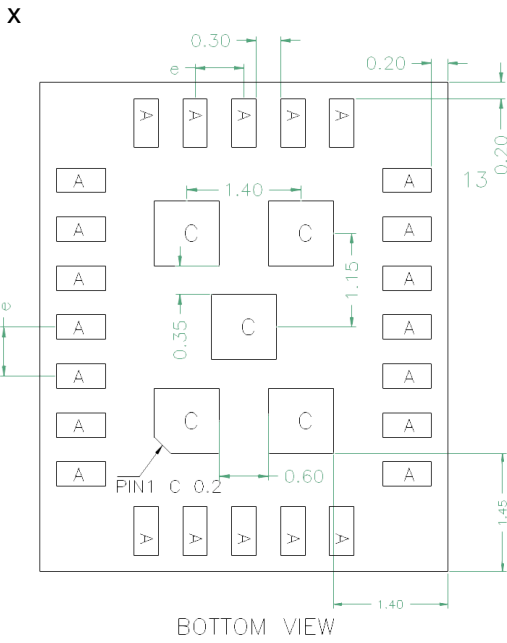
### Package Dimensions



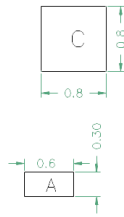
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SIDE VIEW

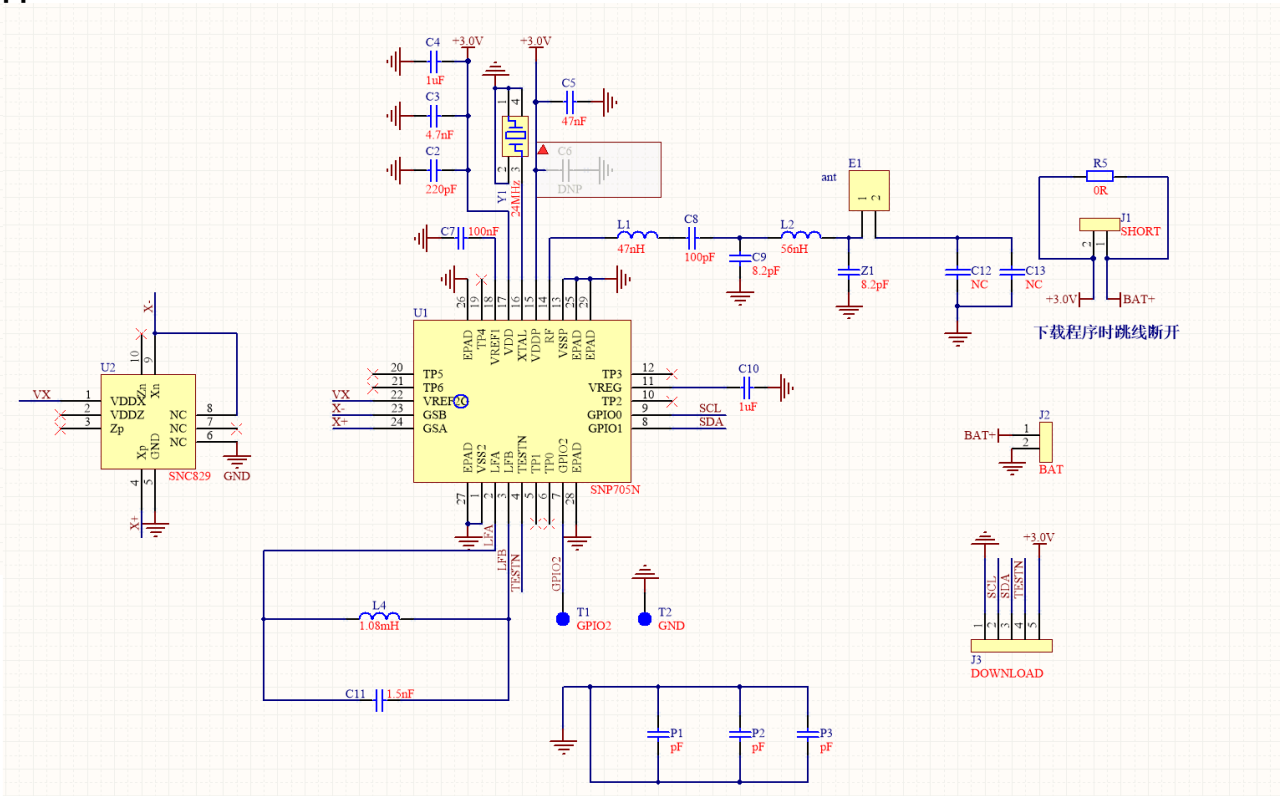


BOTTOM VIEW



| MILLIMETER |         |      |      |
|------------|---------|------|------|
| SYMBOL     | MIN     | NOR  | MAX  |
| A          | 1.75    | 1.85 | 1.95 |
| A2         | 0.27    | 0.32 | 0.37 |
| A3         | 1.33    | 1.38 | 1.43 |
| K          | ---     | 0.15 | ---  |
| D          | 4.90    | 5.00 | 5.10 |
| D1         | 4.65    | 4.70 | 4.75 |
| E          | 5.90    | 6.00 | 6.10 |
| E1         | 5.65    | 5.70 | 5.75 |
| e          | BSC 0.6 |      |      |
| aaa        | 0.10    |      |      |
| ccc        | 0.05    |      |      |

## Application Circuit



Note: 1 L1/L2/C8/C9 value might be changed according to different antenna , P1/P2/P3 is for loop antenna design.

2 SNC829 is a dual axis accelerometer that designed by SENASIC ,it is specialized designed for TPMS application



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