SNP830

Battery Pressure Measurement Sensor

SNP830 Datasheet

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Consultation Information

For further information on technical support, delivery and prices, please call the national consultation hotline: *021-5061-0206*, or you can obtain relevant support by email *info@senasic.com*.

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1 Introduction

1.1 Product Overview

SNP830 is a battery pack pressure monitoring sensor, which is mainly applied to the safety monitoring of battery packs in new energy vehicles. By monitoring the pressure changes in the battery packs, it senses the possible safety hazards in the battery packs in advance. The chip consists of 8-bit MCU, 24-bit ADC, temperature sensor MEMS, pressure sensor MEMS. Through the built-in firmware function, the chip monitors changes in environmental pressure in real time and provides alarm signals to the host system according to the user-configured alarm strategy.

1.2 Features

- Built-in 24-bit ADC
- Supply voltage: 3.3V/5V
- Temperature range: -40~125°C
- Pressure range : 40kPa~260kPa
- Pressure accuracy: ±1.2kPa@25°C
- Integrated temperature sensor, air pressure sensor, supply voltage monitoring unit
- Support for external host access to internal registers via SPI
- Average operating current:can be as low as 10μA
- Supports three alarm strategies: fixed threshold alarm, relative threshold alarm, and slope threshold alarm
- Flexible and configurable sampling period
- Package: LGA24 (6.0 mmx5.0mmx1.9mm)
- AEC-Q100 specification

1.3 Applications

- Battery pack pressure monitoring for new energy vehicles
- MEMS sensor

1.4 Order Information

Table 1 Order Information

Model	Ordering Number	Mylar	Package	Packing Option
SNP830	SNP830CNCLE	N	LGA24	Reel
SNP830	SNP830CMCLE	Y	LGA24	Reel

2 Block Diagram

The following figure shows the block diagram of the internal structure of the sensor chip, which integrates 24-bit high-precision ADC, temperature and pressure sensors, and supports the external host to communicate with the chip through the SPI interface.

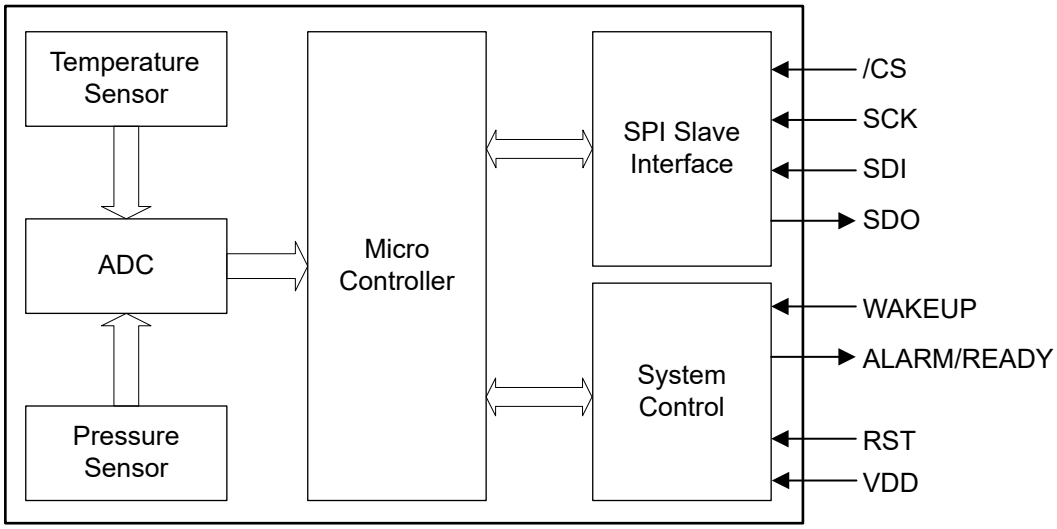


Figure 1 Block Diagram

3 Pin Description

3.1 Pin Configuration

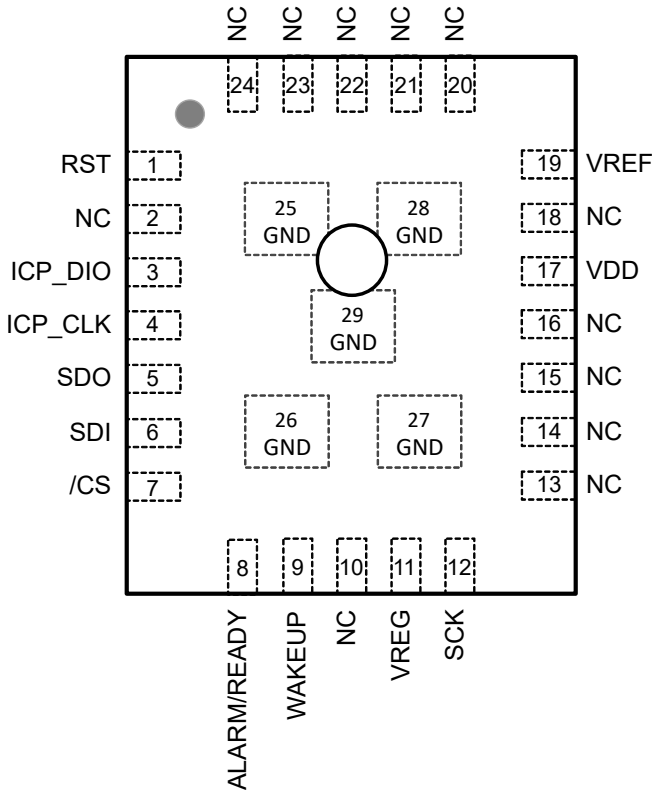


Figure 2 Pin Configuration

3.2 Pin Description

Table 2 Pin Description

Pin No.	Name	Pin Type	Function
1	RST	Input	Reset pin, active high
2	NC		N.C., just place a test point on board
3	ICP_DIO		N.C., just place a test point on board
4	ICP_CLK		N.C., just place a test point on board
5	SDO	Output	SPI data transmit port
6	SDI	Input	SPI data receive port
7	/CS	Input	SPI selection signal, active low
8	ALARM/READY	Output	Alarm output /communication response signal
9	WAKEUP	Input	wakeup input, active high
11	VREG	Power	Internal regulator, external 100nF capacitor ground
12	SCK	Input	SPI CLK
10,13~16	NC		N.C., just place a test point on board

Pin No.	Name	Pin Type	Function
17	VDD	Supply	Power supply 3.3V~5V
19	VREF	Power	Internal regulator, external 100nF capacitor ground
18,20~24	NC		N.C., just place a test point on board
25~29	EPAD	Ground	Ground

3.3 Reference Design

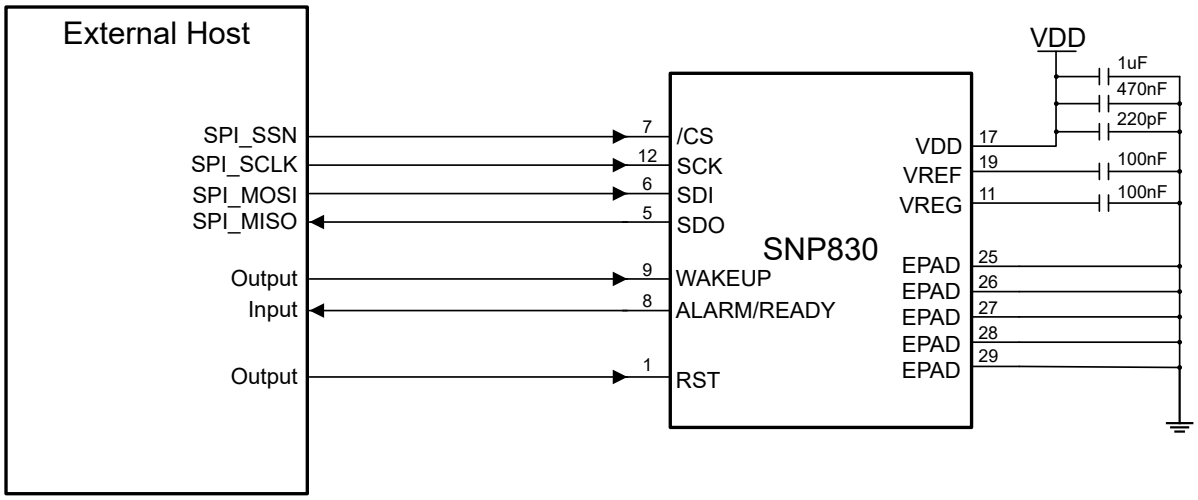


Figure 3 Reference Design

4 Specification

4.1 Absolute Maximum Ratings

Table 3 Absolute Maximum Ratings

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	-0.3		+5.5	V	
Operating Temperature	T_j	-40		+125	°C	
Storage Temperature	$T_{storage}$	-50		+150	°C	No power on
ESD HBM	$V_{ESD,HBM}$	-2000		+2000	V	All pins according to JS-001-2014
ESD CDM	$V_{ESD,CDM}$	-500		+500	V	All pins according to JS-002-2014
Latch up	I_{LU}	-100		+100	mA	All pins according to JEDEC 78D
Input Voltage	V_{in}	-0.3		V_{DD}+0.3	V	All I/O pins
Digital Pin Input Current	$I_{io,dig1}$	-10		+10	mA	All I/O pins

4.2 Recommended Operating Conditions

Table 4 Recommended Operating Conditions

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Supply Voltage	V_{DD}	3.1		5.5	V	Measurement of pressure, temperature and supply voltage
Ambient Temperature	$T_{operating}$	-40		+125	°C	Normal operation

4.3 Temperature Measurement

Table 5 Temperature Measurement

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Measurement range	T_{range}	-40		+125	°C	
Measurement resolution	T_{ratio}		1		°C	
Measurement Error	T_{error}	-3		+3	°C	V_{DD}=5V

4.4 Pressure Measurement

Table 6 Pressure Measurement

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Measurement range	P_{range}	40		260	kPa	
Measurement resolution	P_{ratio}		0.1		kPa	
Measurement Error	P_{Error}	-1.2		+1.2	kPa	T=0~85°C V_{DD}=5V
		-2.5		+2.5	kPa	T=-40~125°C V_{DD}=5V

4.5 Supply Voltage Measurement

Table 7 Supply Voltage Measurement

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Measurement range	V_{range}	3		5.5	V	
Measurement resolution	V_{ratio}		10		mV	
Measurement Error	V_{error}	-150		+150	mV	

4.6 Supply Current

Table 8 Supply Current

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Supply Current	I_{avg}		30	35	μA	T=25°C, V_{DD}=5V Sampling period 1s
			12	15	μA	T=25°C, V_{DD}=5V Sampling period 5s
			250	300	μA	T=25°C, V_{DD}=5V Sampling period 100ms
Sampling current	I_{max}		4	4.5	mA	T=25°C, V_{DD}=5V Sampling current
Supply Current in Sleep Mode	I_{sleep}		8	12	μA	T=25°C, V_{DD}=5V Sampling supply current in sleep mode

4.7 Digital I/O Pins

Table 9 Digital I/O Pins

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
Input Low Voltage	V_{IL}			$0.2V_{DD}$	V	
Input High Voltage	V_{IH}	$0.8V_{DD}$			V	
Output Low Voltage	V_{OL}			$0.2V_{DD}$	V	I_{OL}=4mA
Output High Voltage	V_{OH}	$0.8V_{DD}$			V	I_{OH}=4mA
Digital pin output current	$I_{out,DIG}$	-4		4	mA	
Digital pin input capacitance	$C_{in,DIG}$			10	pF	

4.8 SPI

Table 10 SPI

Parameter	Symbol	Values			Unit	Note/Test Condition
		Min.	Typ.	Max.		
SPI communication rate	f_{SCK}			1	MHz	
SPI command interval	f_{SSH}	50			us	

5 Functional Description

5.1 Interface Description

5.1.1 Application connection

The following figure depicts a schematic diagram of the external host and sensor signal connection.

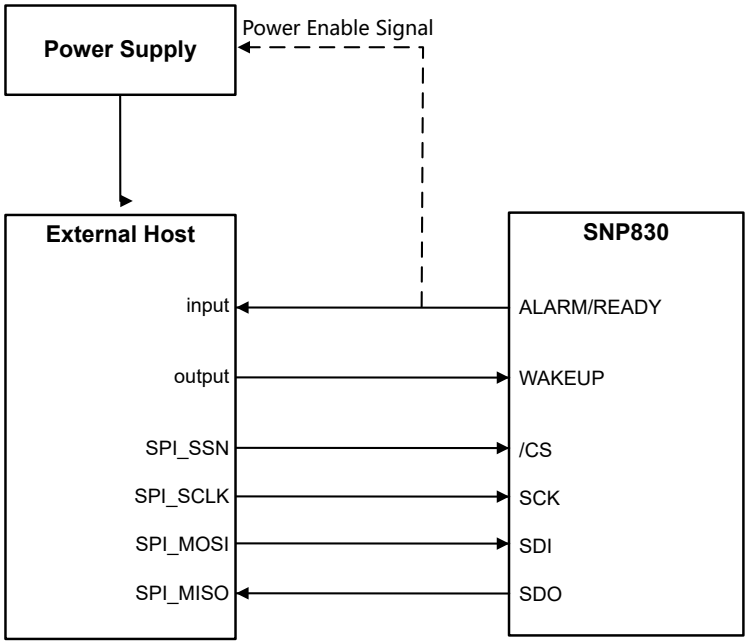


Figure 4 The external host and sensor signal connection

- The ALARM signal can be used as one of the host power enable signals when the external host is in the power-down state under low power consumption.
- When the sensor monitors an abnormality and alarms, the ALARM output goes high to enable the power supply of the host computer.
- After the host is powered on, the ALARM signal status is detected to determine if the sensor is in alarm and handle it accordingly.

Note: The ALARM level will only go high when an alarm is detected and cannot be used as the only enable signal for the host power supply.

5.1.2 RST

RST is the hardware reset signal of SNP830, when the chip is abnormal, the chip can be reset by the high level signal (at least 200μs high level pulse) of RST pin, after the reset, all the operation status and parameters are reset.

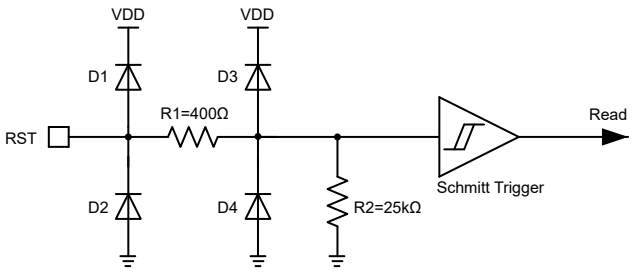


Figure 5 RST Interface

5.1.3 WAKEUP

WAKEUP pin is the communication request signal of SNP830, normally the external host should keep this signal low. When the external host wants to request communication, it should pull wakeup high first, and wait for the READY pin to respond high before communication can take place.

Note: Avoid keeping the wakeup level high, as this will cause the sensor not to sample.

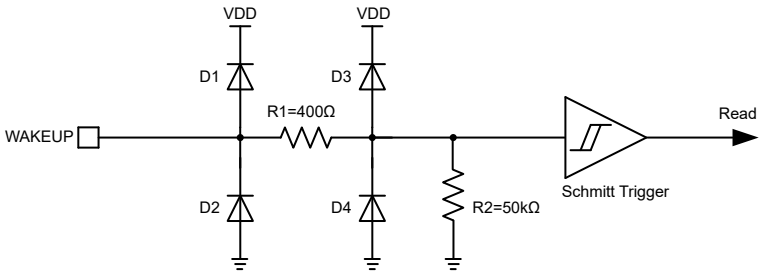


Figure 6 WAKE Interface

5.1.4 ALARM/READY

ALARM/READY has two uses, can be used for both alarm output and communication response, normally outputs low.

- Alarm Output: The ALARM signal outputs a high level when the sensor monitors a pressure abnormality.
- Communication response: When the external host pulls up WAKEUP to request communication, the READY signal will output high when the communication interface is ready.

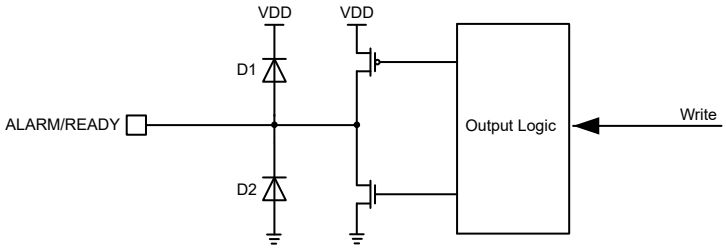


Figure 7 ALARM Interface

5.2 SPI

5.2.1 SPI Timing

When the SNP830 is in communication, an external host can access the sensor operating registers via SPI. The SPI interface supports a maximum rate of 1Mbps, CPOL=0, CPHA=1 . An SPI data frame starts at the falling edge of CS and ends at the rising edge of CS, with a fixed 16bits data length.

Note: The SNP830 is used as an SPI slave only.

The SPI access timing needs to satisfy the following constraints.

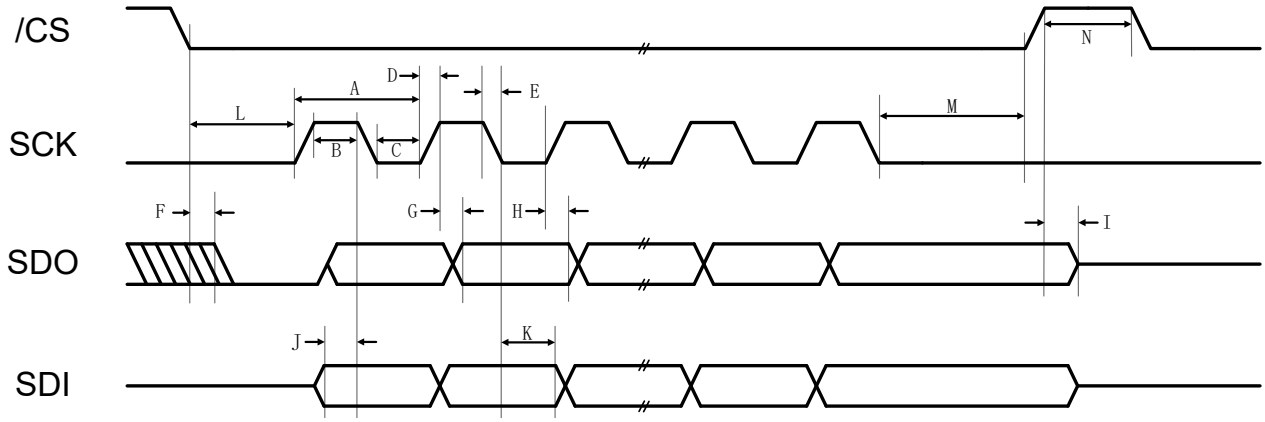


Figure 8 SPI Timing

Table 11 SPI Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit
A	t_{SCK}	1000			ns
B	t_{SCKH}	0.4		0.6	t_{SCK}
C	t_{SCKL}	0.4		0.6	t_{SCK}
D	t_{SCKR}			50	ns
E	t_{SCKF}			50	ns
F	t_{ACCESS}			500	ns
G	t_{VALID}			300	ns
H	t_{HOLD_OUT}			300	ns

Parameter	Symbol	Min.	Typ.	Max.	Unit
I	$t_{DISABLE}$			600	ns
J	t_{SETUP}	200			ns
K	t_{HOLD_IN}	200			ns
L	t_{LEAD}	500			ns
M	t_{LAG}	500			ns
N (frames to frames interval)	t_{SSN}	50			us

5.2.2 Communications protocol

SNP830 supports data interaction in the form of command and response through the SPI interface, as shown in the figure below, T1,T2,T3 corresponds to the command request from the master, and R1,R2,R3 corresponds to the response from the slave. R1 responds to T1 requests, R2 responds to T2 requests, and so on.

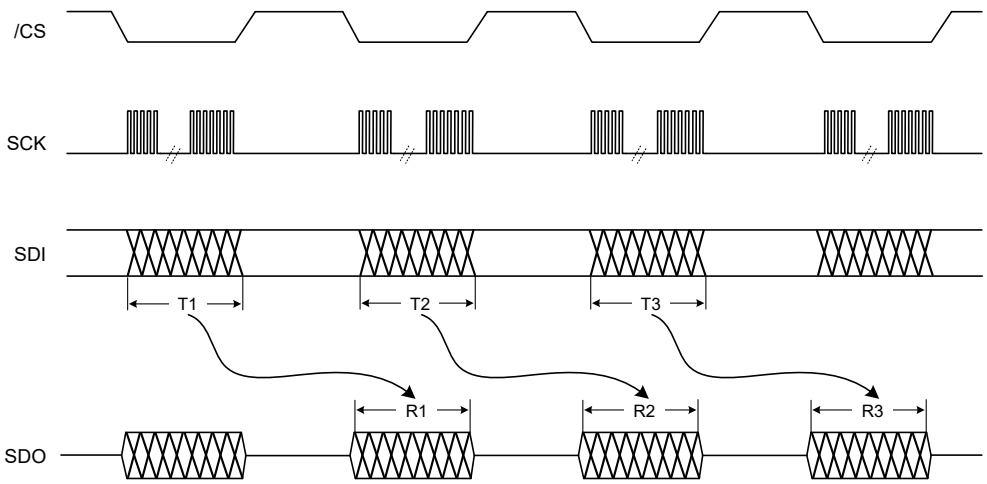


Figure 9 Communications protocol

Table 12 SPI Communication Frame Definition

Bit		b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Read registers	T1	0	0	0	0	0	0	a7	a6	a5	a4	a3	a2	a1	a0	p1	p0
	R0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	p1	p0
	T2	t	t	t	t	t	t	t	t	t	t	t	t	t	t	p1	p0
	R1	0	s4	s3	s2	s1	s0	d7	d6	d5	d4	d3	d2	d1	d0	p1	p0
Write register	T1	1	0	0	0	0	0	a7	a6	a5	a4	a3	a2	a1	a0	p1	p0
	R0	r	r	r	r	r	r	r	r	r	r	r	r	r	r	p1	p0
	T2	1	1	0	0	0	0	d7	d6	d5	d4	d3	d2	d1	d0	p1	p0
	R1	1	s4	s3	s2	s1	s0	a7	a6	a5	a4	a3	a2	a1	a0	p1	p0
	T3	t	t	t	t	t	t	t	t	t	t	t	t	t	t	p1	p0
	R2	1	s4	s3	s2	s1	s0	d7	d6	d5	d4	d3	d2	d1	d0	p1	p0

- b15:0=16-bit data for SPI frame
  - b15=0 means read register

  - b15=1 for write register
- a7:0=Register address for read or write
- p1:0=Checksum bit
  - p1=Odd parity bit of b15:9
  - p0=Odd parity bits of b8:2
- t=next frame host request content
- r=Previous slave response
- s4:0=Response status
  - 0 0 0 0 0=Correct response
  - x x x 1=Checksum error
  - x x x x 1 x=Invalid response data, usually first frame reply data after wakeup
  - x x 1 x x=Access error, write address and write data must be adjacent, write address first then write data
  - x 1 x x=write register error, register not writable
- d7:0 = register data read or written

5.3 Working Status

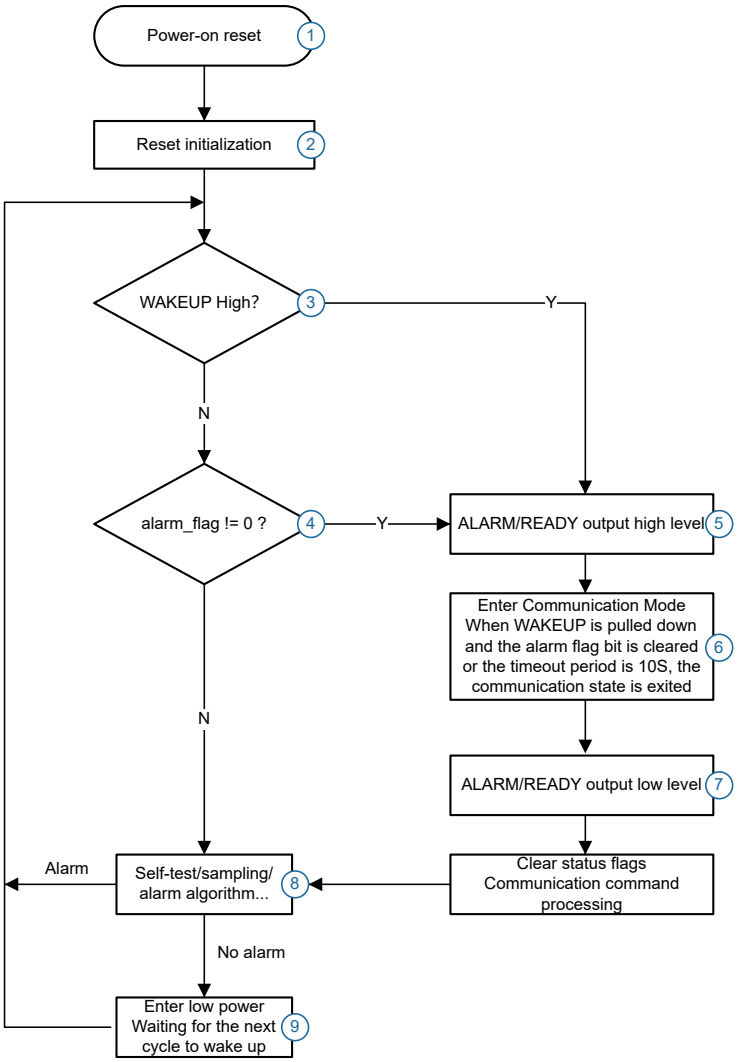


Figure 10 Workflow

- After the chip is powered up or hardware reset①, the system will run initialization②, and all the operation status and parameters are reset. After the initialization is completed, the system enters the cycle sampling monitoring state.

> **Note:** Configuration parameters will be reloaded as default or last stored values.

- Each cycle always judges the WAKEUP level③ and the alarm flag bit④, when the chip is woken up by an external WAKEUP high level or the chip monitors the occurrence of an alarm abnormality, the chip will switch to the communication state, and at the same time, the ALARM/READY⑤ output will be held high, and then the external host computer can access the working register of the sensor through the communication interface to read the status flag bit, the measured pressure value and so on. At this time, the external host can access the working register of the sensor through the communication interface to read the status flag bit, measured pressure value, etc., and then exit the communication state⑥.
- When the sensor exits the communication state, ALARM/READY⑦ outputs a low level and immediately performs a pressure measurement (8).

- After the end of each cycle of sampling, if no abnormality occurs, the sensor will enter a low-power operation until the next cycle arrives or external WAKEUP high level wake-up, otherwise ALARM immediately output a high level alarm signal and switch to the communication state, waiting for the host to respond.

5.3.1 Periodic sampling

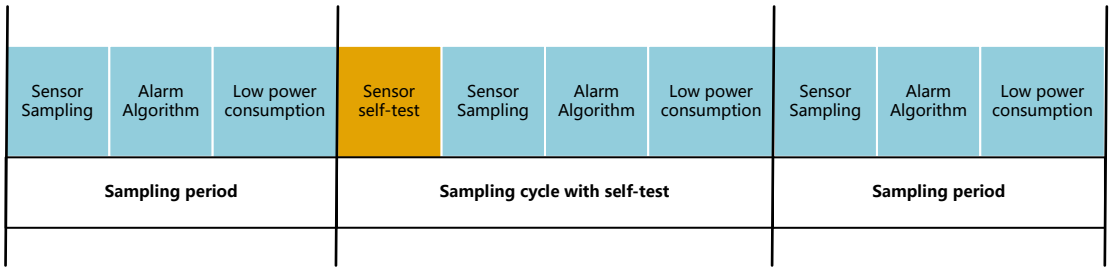


Figure 11 Periodic Sampling Monitoring State

The SNP830 usually works in a periodic sampling monitoring state with a configurable sampling period of 10ms - 12.8s. The sensor periodically performs self-tests, sampling, alarm algorithms, etc., and at the same time, the sensor saves nearly 12 cycles of pressure measurements.

5.3.2 Request for communication

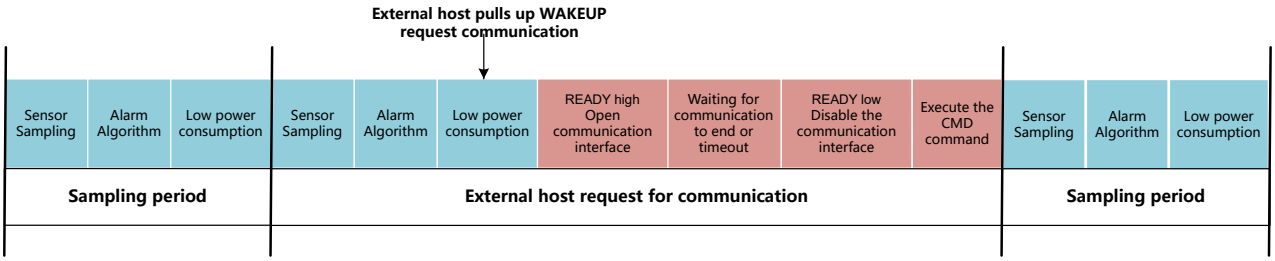


Figure 12 External host request for communication

The process of an external host requesting communication is as follows:

1. When the external host needs to communicate with the sensor, pull WAKEUP up.
2. The sensor will enter the communication state immediately after detecting WAKEUP high, and at the same time READY outputs high.
3. The external host can read and write the sensor working registers through the communication interface after detecting READY high.
4. After the communication is finished, the external host immediately pulls WAKEUP low, causing the sensor to exit the communication state.

Note:

- Avoid having the WAKEUP level pulled high all the time, which will cause the sensor to stay in the communication state.
- Try to read and write the required registers in the same communication cycle to avoid frequent communication requests.

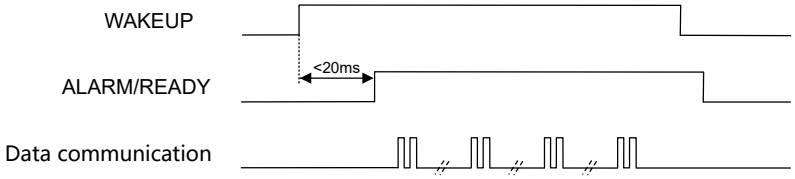


Figure 13 Request communication timing

5.3.3 reverse wake-up

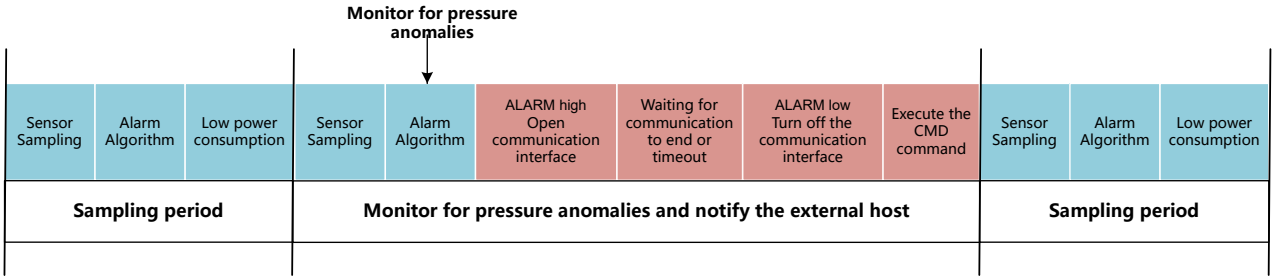


Figure 14 Monitor pressure anomalies

During cycle sampling, the alarm algorithm monitors when an abnormal pressure triggers an alarm:

- Sensor alarm flag position bit, the sensor ALARM immediately outputs a high level and enters the communication state.
- When the external host is woken up, it immediately pulls WAKEUP high and obtains all status information, temperature value, pressure value, etc. through the communication interface.
- After obtaining the full state, write the CMD state reset command (CLRFLAG=1 and CLRFIFO=1) and switch WAKEUP to low to allow the sensor to exit the communication state and reset.

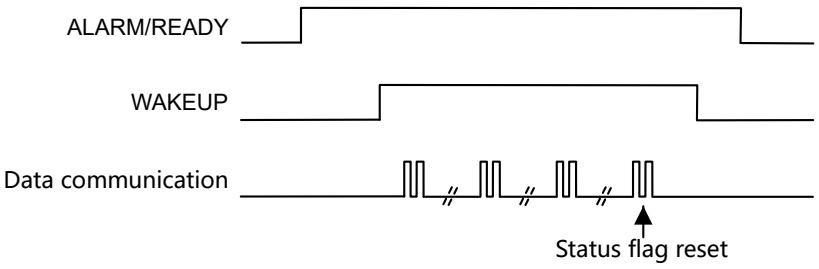


Figure 15 Reverse Wake-Up Timing

5.4 Alarm Strategy

5.4.1 Fixed Threshold Alarm

SNP830 periodically measures the pressure value and triggers a fixed threshold alarm when the current pressure value > fixed alarm threshold (default 150kPa, configurable 40kPa~250kPa) is monitored.

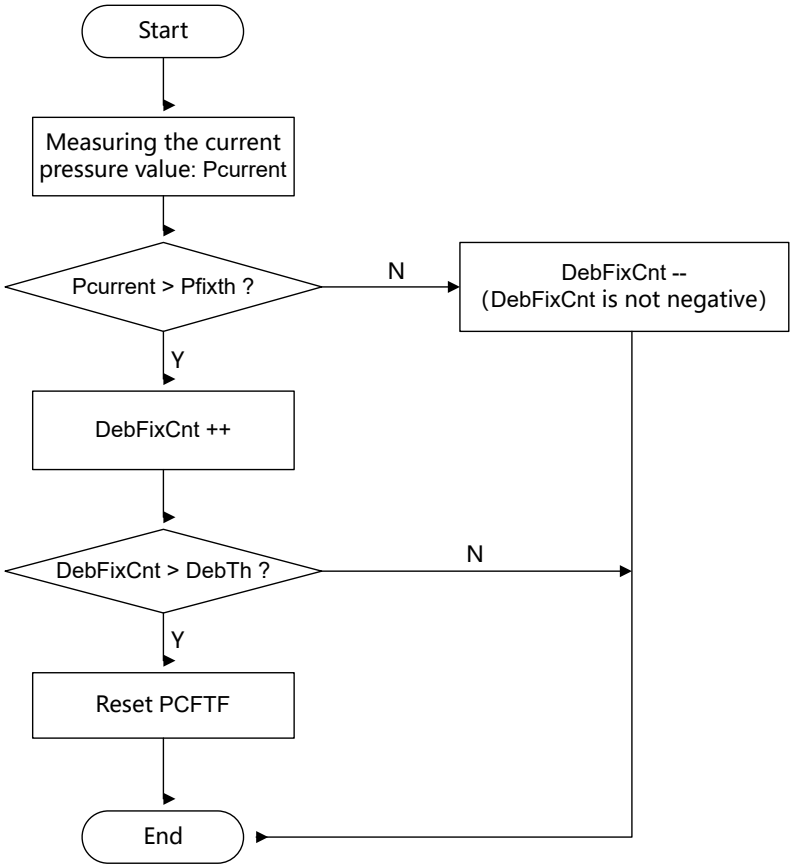


Figure 16 Fixed Threshold Alarm

- Pcurrent: current measured pressure value
- Pfixth: Fixed alarm threshold (default 150kPa, configurable 40~250kPa)
- DebFixCnt: Debounce counter
- DebTh: Debounce threshold (default 1, configurable 0~15)

5.4.2 Relative Threshold Alarm

SNP830 periodically measures the pressure value and triggers a relative threshold alarm when it monitors the current pressure value > the pressure value before the relative time (default 2min, configurable 1~8min) + the relative alarm threshold (default 3kPa, configurable 1~32kPa).

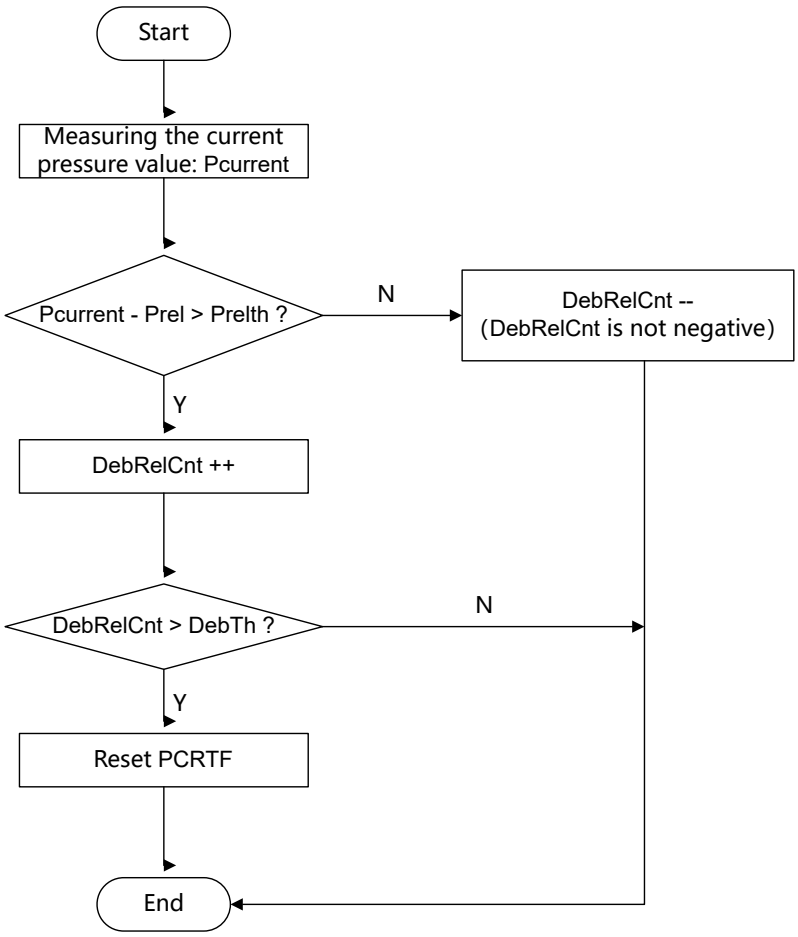


Figure 17 Relative Threshold Alarm

- Pcurrent: current measured pressure value
- Prel: Relative pressure value before relative time (default 2min, configurable 1~8min) Prelth: Relative alarm threshold (default 3kPa, configurable 1~32kPa)
- DebRelCnt: Dithering Counter
- DebTh: Debounce threshold (default 1, configurable 0~15)

5.4.3 Slope Threshold Alarm

SNP830 Cyclic Pressure Value, triggers the Slope Threshold Alarm when the current pressure change rate is monitored > Slope Alarm Threshold (default 0.5kPa/s, configurable 0.5~10kPa/s).

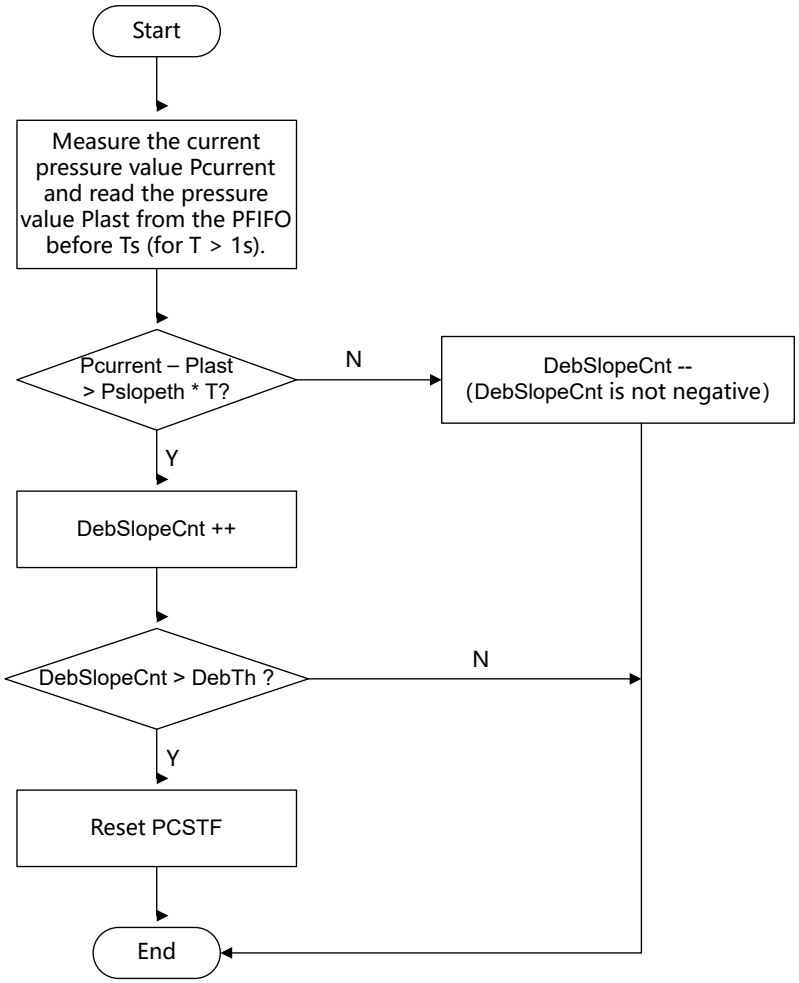


Figure 18 Slope Threshold Alarm

- Pcurrent: current measured pressure value
- Plast: previous recorded pressure value
- T: Time difference between the current moment and the previous recorded pressure value (take T ≥ 1s)
- Psolpeth: slope alarm threshold (default 0.5kPa/s, configurable 0.5~10kPa/s)
- DebSlopeCnt: Dithering Counter
- DebTh: Dithering threshold (default 1, configurable 0~15)

5.5 Sensor self-test

5.5.1 ADC self-test

SNP830 has a built-in 24-bit high-precision ADC module and integrated self-diagnostic function, which allows you to determine whether the ADC module is abnormal through the ADC self-test. The ADC self-test can be used to determine whether the ADC module is abnormal.

- When the ADC self-test is abnormal, the ADC self-test error flag bit ADCERRF will be set, and if the self-test error alarm enable bit STERR=1, the chip will trigger the ALARM alarm signal.
- When the ADC self-test error occurs, the sensor maintains the last normal measured pressure value.

This flag bit needs to be cleared manually after it is set.

5.5.2 MEMS self-test

SNP830 integrates a Wheatstone full-bridge pressure MEMS consisting of high-precision force-sensitive resistors into the ADC differential measurement channel. The MEMS interface integrates a self-diagnostic function, which can diagnose whether the MEMS interface is short-circuited, disconnected, or other abnormalities.

- When the MEMS self-test is abnormal, the MEMS self-test error flag bit MEMSERRF will be set, if the self-test error alarm enable bit STERR=1, the chip will trigger the ALARM alarm signal.
- When a MEMS self-test error occurs, the sensor maintains the last normal measured pressure value.

This flag bit needs to be cleared manually after it is set.

5.5.3 Over-undervoltage self-test

SNP830 measures the supply voltage before each sample, when the supply voltage is out of the normal operating range (3.1 ~ 5.5V), the corresponding over-voltage or under-voltage flag will be set, then the sensor will keep the last normal measured pressure value.

5.5.4 Temperature Self-Test

SNP830 will measure the current ambient temperature before each sample, when the ambient temperature is out of the normal working range (-40~125℃), the corresponding over-temperature or under-temperature flag will be set, this flag will not affect the chip pressure measurement and thermal runaway monitoring function.

5.5.5 Pressure self-test

When the actual pressure value is out of the normal working range (40~260kPa), the corresponding high pressure or low pressure flag will be set, and the sensor pressure measurement value will be the upper or lower limit of the range.

5.5.6 Configuration parameter storage self-test Configuration parameter storage self-test

SNP830 sets the configuration parameter storage error flag bit if a configuration parameter storage command fails.

This flag needs to be cleared manually after it is set.

5.5.7 Sensor initialization self-test Sensor initialization self-test

SNP830 performs system initialization immediately after power-up (or hardware reset), and the Sensor Initialization Not Completed flag is set, which is cleared automatically after the chip measures a valid pressure value for the first time. This flag is cleared when the chip measures a valid pressure value for the first time. This flag remains in place when a sensor hardware failure prevents a pressure measurement after power-up.

5.6 Register

5.6.1 Register Mapping and Reset Values

Table 13 Register Mapping and Reset Values

Address	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
$50	CMD	RESET	STORE	CLRFLAG	CLRFIFO	Reserved	Reserved	MEMSST	ADCST
	Reset Value	0	0	0	0	0	0	0	0
$51	PSPCFG	X10	PSP						
	Reset Value	0	9						
$52	STPCFG	STP							
	Reset Value	0							
$53	ALARMCFG	STERR	Reserved				PCSTEN	PCRTEN	PCFTEN
	Reset Value	0	0				1	1	0
$54	CONFIG0	AUTOCLR	Reserved						
	Reset Value	0	0						
$55	CONFIG1	Reserved							
	Reset Value	0							
$56	PCDEBTH	Reserved				DEBTH			
	Reset Value	0				1			
$57	PCFIXTH	FIXTH							
	Reset Value	150							
$58	PCRELTH	RELWIN			RELTH				
	Reset Value	1			2				
$59	PCSLOPETH	SLOPETH							
	Reset Value	5							
$6A	STATUS	ADCERRF	MEMSERRF	Reserved	OTPERRF	Reserved	PCSTF	PCRTF	PCFTF
	Reset Value	0	0	0	0	0	0	0	0
$6B	SENSTATUS	NOTINIT	Reserved	POVER	PUNDER	TOVER	TUNDER	VOVER	VUNDER
	Reset Value	0	0	0	0	0	0	0	0
$6C	TCODE	TCODE							
	Reset Value	X							
$6D	VCODE	VCODE							
	Reset Value	X							
$6E	PCURRH	PCURR [15:8]							
	Reset Value	X							
$6F	PCURRL	PCURR [7:0]							

Address	Register Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	Reset Value	X							
$70~$87	PFIFOHx~PFIFOLx	PFIFO1~PFIFO12							
	Reset Value	X							

5.6.2 Register Introduction

5.6.2.1 instruction register (CMD)

Table 14 CMD Register Definition

CMD	addr: $50, reset value 00H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7]	RESET	1b'0	W	All registers (including configuration registers) reset
[6]	STORE	1b'0	W	Store current configuration parameters to NVM
[5]	CLRFLAG	1b'0	W	Status flag reset
[4]	CLRFIFO	1b'0	W	Pressure FIFO reset, alarm policy reset
[3]	Reserved	1b'0	W	Reserved
[2]	Reserved	1b'0	W	Reserved
[1]	MEMSST	1b'0	W	MEMS self-check
[0]	ADCST	1b'0	W	ADC self-check

5.6.2.2 Sampling period configuration register (PSPCFG)

Table 15 PSPCFG Register Definition

PSPCFG	addr: $51, reset value 09H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7]	X10	1b'0	R/W	Enable Fast Sampling Mode When X10=1, Fast Sampling Mode is enabled, the sampling rate is increased by 10 times, and the sampling filter is also turned on.
[6:0]	PSP	7b'0001001	R/W	PSP is configurable from 0 to 127 When X10=0, sampling period T = (PSP + 1) * 100ms When X10=1, sampling period T = (PSP + 1) * 10ms

5.6.2.3 Self check cycle configuration register (STPCFG)

Table 16 STPCFG Register Definition

STPCFG	addr: $52, reset value 00H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7:0]	STP	8b'00000000	R/W	Self-test cycle counting to configure ADC and MEMS self-test cycles STP = 0: disable cycle self-test function STP = 1~255: self-test every STP sample period

5.6.2.4 Alarm enable configuration register (ALARMCFG)

Table 17 ALARMCFG Register Definition

ALARMCFG	addr: $53, reset value 06H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7]	STERR	1b'0	R/W	Self-test Abnormal Alarm Enable

ALARMCFG	addr: $53, reset value 06H			
Bit	Field	Reset Value	Type	Description
				0: disable 1: enable
[6:3]	Reserved	4b'0000	R/W	Reserved
[2]	PCSTEN	1b'1	R/W	Slope Threshold Alarm Enable 0: disable 1: enable
[1]	PCRTEN	1b'1	R/W	Relative threshold alarm enable 0: disable 1: enable
[0]	PCFTEN	1b'0	R/W	Fixed Threshold Alarm Enable 0: disable (default) 1: enable

5.6.2.5 Special function configuration register (CONFIG0)

Table 18 CONFIG0 Register Definition

CONFIG0	addr: $54, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7]	AUTOCLR	1b'0	R/W	Automatically reset FIFO after alarm wakeup enable 0: disable 1: enable
[6:0]	Reserved	7b'0000000	R/W	Reserved

Table 19 CONFIG1 Register Definition

CONFIG1	addr: $55, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	Reserved	8b'00000000	R/W	Reserved

5.6.2.6 Alarm filtering configuration register (PCDEBTH)

Table 20 PCDEBTH Register Definition

PCDEBTH	addr: $56, reset value 01H			
Bit	Field	Reset Value	Type	Description
[7:4]	Reserved	4b'0000	R/W	Reserved
[3:0]	DEBTH	4b'0001	R/W	Debounce Threshold Used for debounce in alarm policy, trigger alarm when the number of consecutive abnormalities is greater than DEBTH, valid value range 0~15

5.6.2.7 Fixed threshold configuration register (PCFIXTH)

Table 21 PCFIXTH Register Definition

PCFIXTH	addr: $57, reset value 96H			
Bit	Field	Reset Value	Type	Description
[7:0]	FIXTH	8b'10010110	R/W	Fixed Threshold Valid value range 40~250, unit kPa - Defaults to 40kPa when the value < 40 is written. - Default is 250kPa when the written value is > 250.

5.6.2.8 Relative threshold configuration register (PCRELTH)

Table 22 PCRELTH Register Definition

PCRELTH	addr: $58, reset value 22H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7:5]	RELWIN	3b'001	R/W	Relative Window 0: Relative Window 1min 1: Relative Window 2min 2: Relative Window 3min 3: Relative Window 4min 4: Relative Window 5min 5: Relative Window 6min 6: Relative Window 7min 7: Relative Window 8min
[4:0]	RELTH	5b'00010	R/W	Relative Threshold Valid value range 0~31, unit kPa, corresponding to 1~32kPa

5.6.2.9 Slope threshold configuration register (PCSLOPETH)

Table 23 PCSLOPETH Register Definition

PCSLOPETH	addr: $59, reset value 05H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7:0]	SLOPETH	8b'00000101	R/W	Slope Threshold Valid value range 5~100, unit 0.1kPa/s, corresponds to 0.5~10kPa/s. - Defaults to 0.5kPa when the written value is <5. - When writing value <5, default is 0.5kPa When writing value >100, default is 10kPa

5.6.2.10 Alarm status register (STATUS)

Table 24 STATUS Register Definition

STATUS	addr: $6A, reset value 00H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7]	ADCERRF	1b'0	R	ADC Self-test error flag
[6]	MEMSERRF	1b'0	R	MEMS Self-test error flag
[5]	Reserved	1b'0	R	Reserved
[4]	OTPERRF	1b'0	R	Configuration parameter storage error flag
[3]	Reserved	1b'0	R	Reserved
[2]	PCSTF	1b'0	R	Slope threshold alarm flag
[1]	PCRTF	1b'0	R	Relative threshold alarm flag
[0]	PCFTF	1b'0	R	Fixed Threshold Alarm Flag

5.6.2.11 Sensor Status Register (SENSTATUS)

Table 25 SENSTATUS Register Definition

SENSTATUS	addr: $6B, reset value 00H			
Bit	**Field**	**Reset Value**	**Type**	**Description**
[7]	NOTINIT	1b'0	R	Sensor initialization not completed flag
[6]	Reserved	1b'0	R	Reserved
[5]	POVER	1b'0	R	Pressure over range limit sign
[4]	PUNDER	1b'0	R	Pressure over range lower limit sign
[3]	TOVER	1b'0	R	Temperature over range limit flag

SENSTATUS	addr: $6B, reset value 00H			
Bit	Field	Reset Value	Type	Description
[2]	TUNDER	1b'0	R	Temperature over range lower limit flag
[1]	VOVER	1b'0	R	Voltage over range limit flag
[0]	VUNDER	1b'0	R	Voltage over range lower limit flag

5.6.2.12 Temperature measurement value register (TCODE)

This register stores the last measured temperature value. Conversion formula for the actual temperature value: (TCODE - 55) °C

Table 26 TCODE Register Definition

TCODE	addr: $6C, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	TCODE	8b'00000000	R	Temperature reference value

5.6.2.13 Voltage measurement value register (VCODE)

This register stores the voltage value of the most recent measurement. Conversion formula for actual pressure value: ((VCODE + 300) * 10) mV

Table 27 VCODE Register Definition

VCODE	addr: $6D, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	VCODE	8b'00000000	R	voltage reference value

5.6.2.14 Pressure measurement value register (PCURR)

This register stores the last measured pressure value with an accuracy of 0.1 kPa. Actual pressure value conversion formula: (PCURR * 0.1) kPa

Table 28 PCURRH Register Definition

PCURRH	addr: $6E, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	PCURR[15:8]	8b'00000000	R	Current pressure value 8 digits higher

Table 29 PCURRL Register Definition

PCURRL	addr: $6F, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	PCURR[7:0]	8b'00000000	R	Current pressure value 8 digits lower

5.6.2.15 Pressure value FIFO register (PFIFO)

The sensor has a built-in pressure value cache FIFO with a depth of 12, storing the pressure values of the last 12 cycles sampled in the monitoring mode, the time is stored in PFIFO1 ~ PFIFO12 from near to far, and the accuracy of storage is 0.1 kPa. The conversion formula of the actual pressure value is (PFIFOx * 0.1) kPa. When a pressure alarm occurs, the external host can read the cached pressure value to get more information about the alarm.

Table 30 PFIFOHx Register Definition

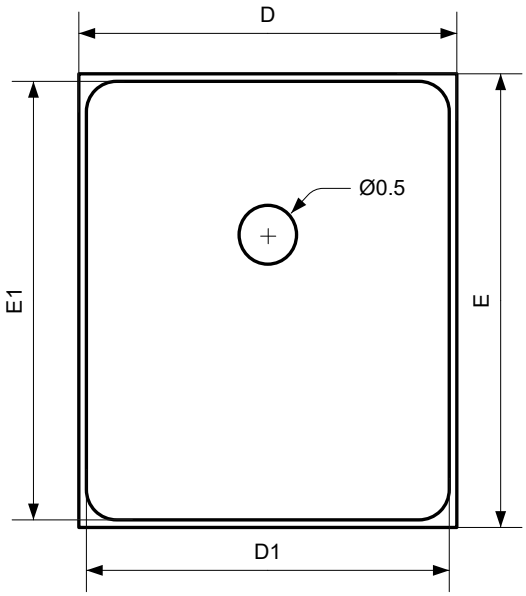
PFIFOHx	addr: $70~$86, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	PFIFOx[15:8]	8b'00000000	R	Current pressure value 8 digits higher

Table 31 PFIFOLx Register Definition

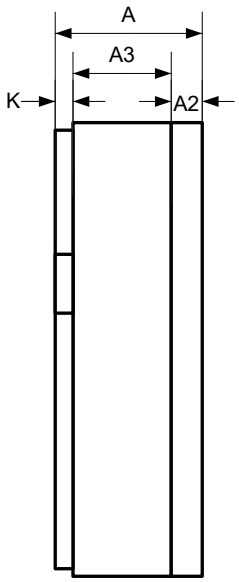
PFIFOLx	addr: $71~$87, reset value 00H			
Bit	Field	Reset Value	Type	Description
[7:0]	PFIFOx[7:0]	8b'00000000	R	Current pressure value 8 digits lower

6 Package Information

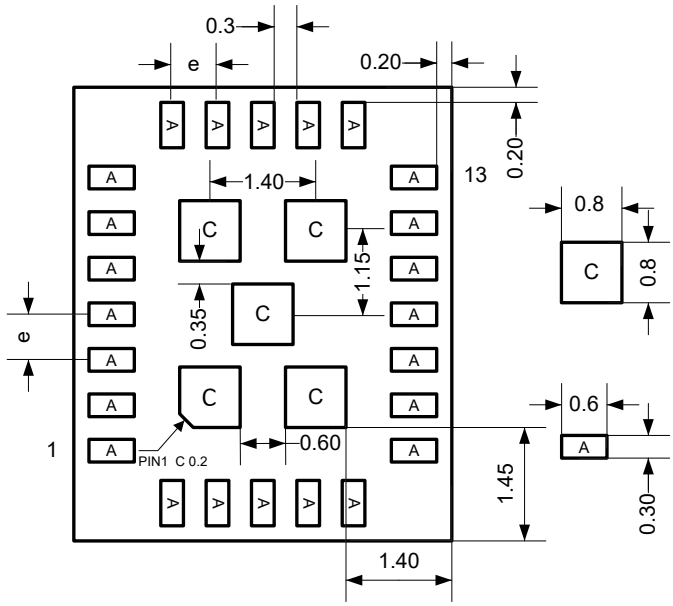
6.1 Package Dimension (mm)



TOP VIEW



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	0.12	0.15	0.18
D	4.90	5.00	5.10
D1	4.67	4.70	4.73
E	5.90	6.00	6.10
E1	5.67	5.70	5.73
e	BSC 0.6		

Figure 19 Package Dimension

6.2 Package Reference

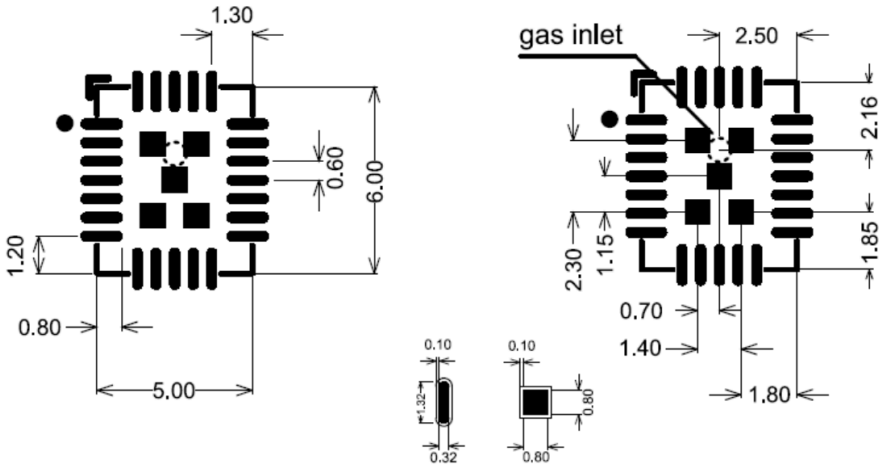
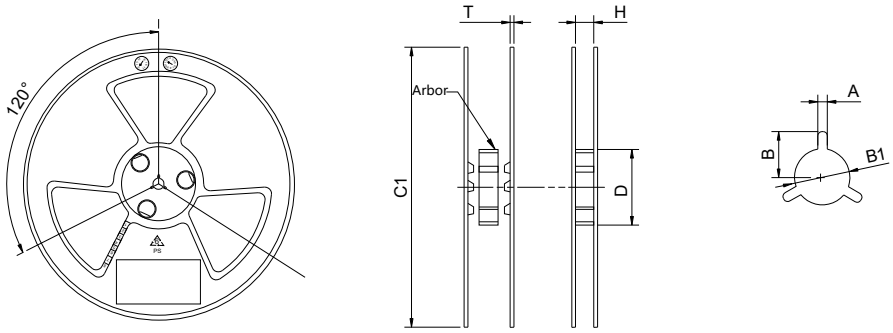


Figure 20 Package Reference

7 Taping Information



SPEC	12	16	24	32	44	56	72	88
C1±3	330	330	330	330	330	330	330	330
H±0.5	12.5	16.5	24.5	32.5	44.5	56.5	72.5	88.5
A±0.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
B±0.3	10.75	10.75	10.75	10.75	10.75	10.75	10.75	10.75
B1 $^{+0.5}_{-0.2}$	Ø13.0	Ø13.0	Ø13.0	Ø13.0	Ø13.0	Ø13.0	Ø13.0	Ø13.0
T±0.2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
D±1	Ø100	Ø100	Ø100	Ø100	Ø100	Ø100	Ø100	Ø100

Figure 21 Reel Size

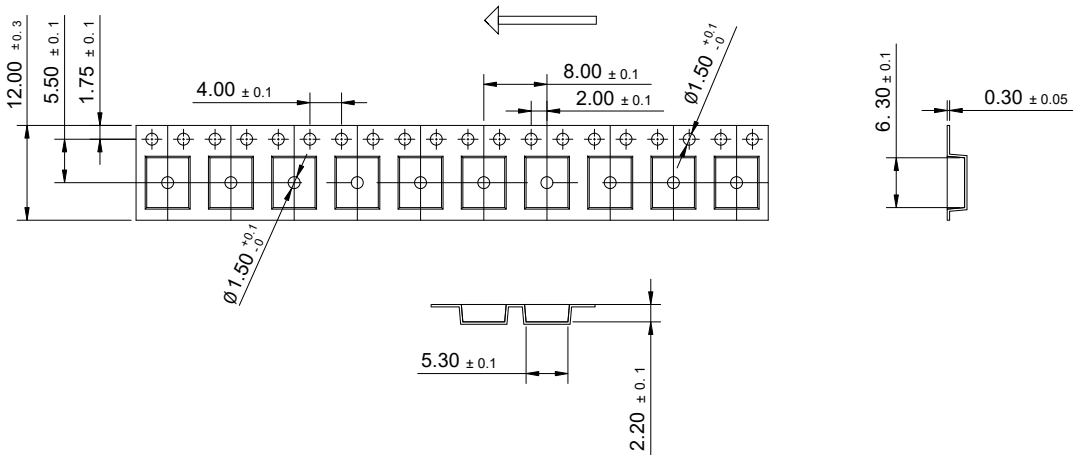


Figure 22 Carrier tape size

Note:

- The cumulative error for any 10 holes in the chain gear does not exceed ±0.20mm.
- The material thickness is measured at the edge of the carrier tape.
- Non-parallelism shall not exceed 1mm at a distance of 250mm along the length of the carrier tape.
- Unannotated tolerance: ±0.1mm.
- All dimensions comply with EIA-481-D version.

8 Revision History

Table 32 Revision History

Version	Date	Note
V1.0	2025.07.22	Initial version.