



WF280A

Digital Pressure Sensor

Data Sheet

WF280A

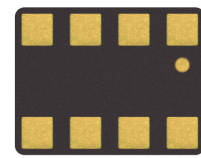
Digital Pressure Sensor

Key parameters

- Pressure range: 300 ... 2000hPa
- Package: 8-pin LGA metal-lid
Footprint: $2.0 \times 2.5\text{mm}^2$, height: 1.0mm
- Relative accuracy: 0.12 hPa, equiv. to $\pm 1.0\text{ m}$ (950 ... 1050hPa@25°C)
- Absolute accuracy: typ. $\pm 1\text{ hPa}$ (950 ... 1050hPa, 0...+40°C)
- Temperature coefficient offset: 1.5 Pa/K, equiv. to 12.6 cm/K (25...+40°C @ 900hPa)
- Digital interface: I²C
- Current consumption: 5.4 μA @1Hz sampling rate
- Temperature range: -40...+85°C
- RoHs compliant, halogen-free

Typical applications

- Indoor navigation (floor detection, elevator detection)
- Outdoor navigation, leisure and sports applications
- Enhancement of GPS navigation
- Weather forecast
- Health care applications (e.g. spirometry)
- Vertical velocity indication (e.g. rise/sink speed)



Target devices

- Handsets such as mobile phones, tablet PCs, GPS devices
- Navigation systems
- Portable health care devices
- Home weather stations
- Flying toys
- Sport watches

Brief Description

WF280 is a high precision barometer and altimeter especially designed for consumer applications. It measures the pressure based on piezo-resistive MEMS pressure sensor.

The ultra-low power, low voltage electronics of the WF280A is optimized for use in mobile phones, smart watches, PDAs, GPS navigation devices and outdoor equipment. The sensor module is housed in a compact 8-pin metal-lid LGA package with a footprint of only $2.0 \times 2.5\text{mm}^2$ and 1.0 mm package height. Its small dimensions and its low power consumption allow the implementation in battery driven devices. With a low altitude noise of merely 0.1m and very low offset temperature coefficient (TCO), the WF280A offers superior performance and are perfectly suitable for applications like floor detection, health care as well as GPS refinement. The I²C interface allows for easy system integration with a microcontroller.



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1 Specification

VDD = 3.3V, T=25°C, unless otherwise noted.

Table 1 Parameter specification

Parameter	Symbol	Condition	Min	Typ	Max	Units
Operating temperature range	T _A	operational	-40	25	+85	°C
		full accuracy	0		65	
Operating pressure range	P	full accuracy	300		2000	hPa
Sensor supply voltage	V _{DD}		1.8		3.6	V
Supply current	I _{DD, LP}	1Hz, lowest osr_p and osr_t		5.4		μA
Peak current	I _{peak}	during pressure measurement		760		μA
Current at temperature measurement	I _{DDT}			541		μA
Sleep current	I _{DDSL}	25°C		0.1	0.3	μA
Relative accuracy	A _{rel}	700...900hPa		±0.12		hPa
		25...40°C		±1.0		m
Offset temperature coefficient	TCO	900hPa		±1.5		Pa/K
		25...40°C		±12.6		cm/K
Absolute accuracy pressure	A _{ext} ^P	300...1100hPa -20...0°C		±1.7		hPa
	A _{full} ^P	300...1100hPa 0...65°C		±1.0		hPa
Resolution of output data in O4 ultra high resolution mode	R ^P	Pressure		0.095		Pa
	R ^T	Temperature		0.01		°C
Noise in pressure	V _{P,full}	Full bandwidth, O4 ultra high resolution		2.0		Pa
				16.6		cm
	V _{P,filtered}	Lowest bandwidth, O4 ultra high resolution		0.2		Pa
				1.7		cm
Absolute accuracy temperature	A ^T	@25°C		±1.0		°C
		0...+65°C		±2.0		°C
PSRR (DC)	PSSR	Full V _{DD} range			±0.005	Pa/mV
Long term stability	ΔPstab	12 months		±TBD		hPa
Solder drifts			-0.5		+2	hPa
Possible sampling	f _{sample}		157	182	TBD	Hz



2 Absolute maximum ratings

Table 2 Absolute maximum ratings

Parameter	Symbol	Condition	Min	Max	Units
Supply voltage	V _{DD}		-0.3	+3.6	V
Voltage at all IO Pins	V _{DDIO}	all pins	-0.3	V _{DD} +0.3	V
Overpressure	P		0	10,000	hPa
Storage temperature	T _{STOR}		-45	+85	°C
ESD rating	ESD	HBM		±2	kV



3 Operation

3.1 Brief description

The WF280A is designed to be connected directly to an external microcontroller of a mobile device via the I²C bus. The pressure and temperature data has to be compensated by the calibration data of the on-chip Non-Volatile Memory (NVM) which is individually factory calibrated for each device.

3.2 Function description

The WF280A consists of a piezo-resistive micro-machined pressure sensor, an analog to digital converter and a control unit with Non-Volatile Memory (NVM) and a serial I²C interface. The WF280A delivers the compensated values of the pressure and the temperature.

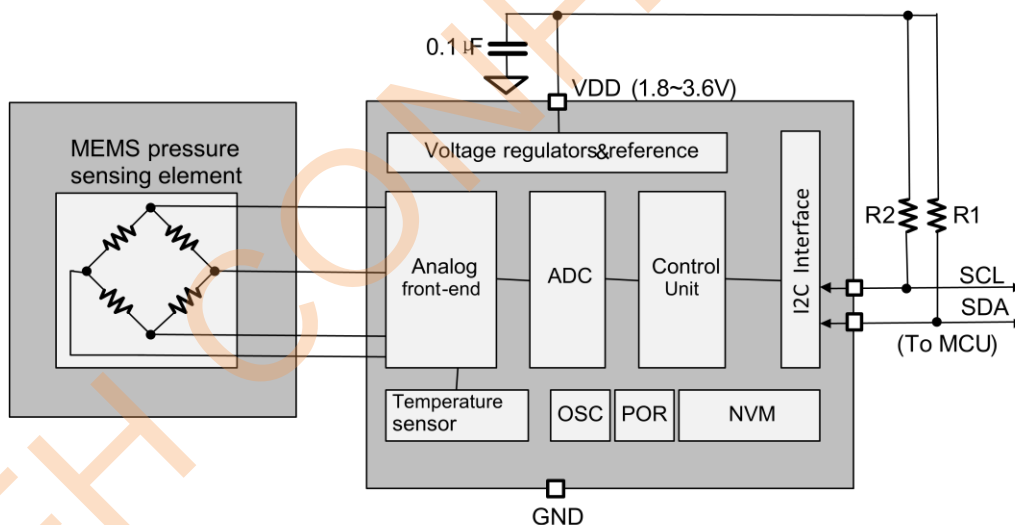


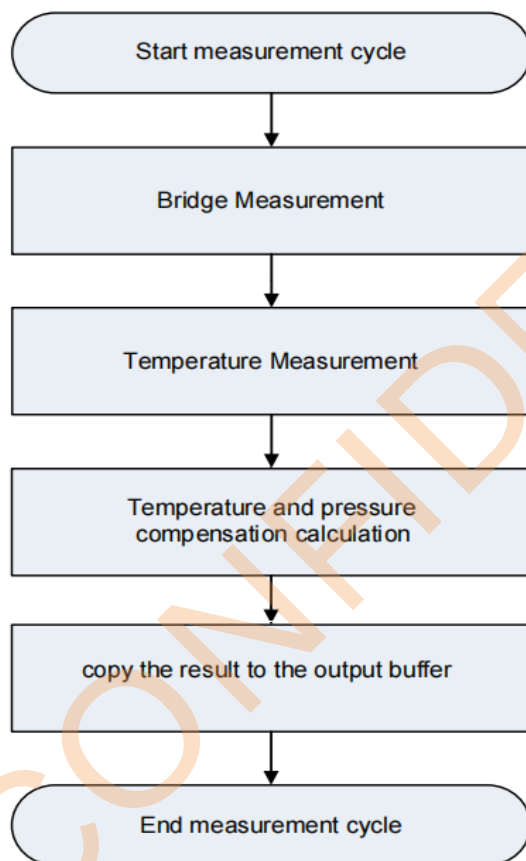
Figure 1 Block diagram of WF280A



3.3 Measurement of pressure and temperature

The WF280A must actively send a control command to trigger a measurement process by external controller(MCU),otherwise the chip remains in sleep state.

Each measurement process of the bridge sensor and the temperature sensor may include the following processes:



3.4 Measurement Time&Noise

ADC OSR setting

OSR (BIN)	OSR_P / OSR_T	Measurement Time [ms]	3-sigma Noise for 20-bit bridge data [counts]*
000b	oversampling × 128	69.6	10.2
001b	oversampling × 64	35.6	11.4
010b	oversampling × 32	18.8	17.7
011b	oversampling × 16	10.4	22.8
100b	oversampling × 8	6.2	30.3
101b	oversampling × 4	4.0	44.7
110b	oversampling × 2	3.0	58.5
111b	oversampling × 1	2.4	76.5

* Test conditions: bridge resistance 1.1kΩ, Gain=51x, ADC_Offset=-8/16~8/16, VDD=3.3V, NOR mode, 256 sampling times, interval 400ms, IIR filter disabled



4 I²C Interface

4.1 I²C Operation

From master to slave

From slave to master

S Start

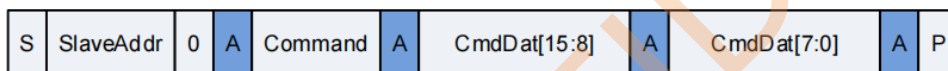
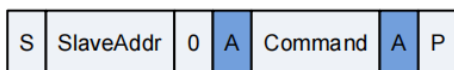
P Stop

A Acknowledge

N Not Acknowledge

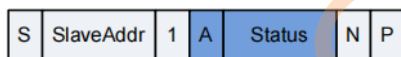
The default 7-bit I²C device address of WF280A is binary 0111000.

4.2 I²C Write

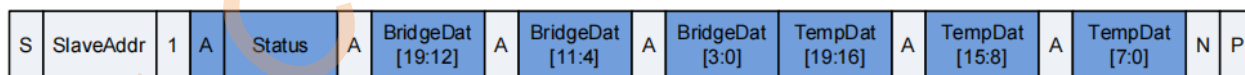


4.3 I²C Read

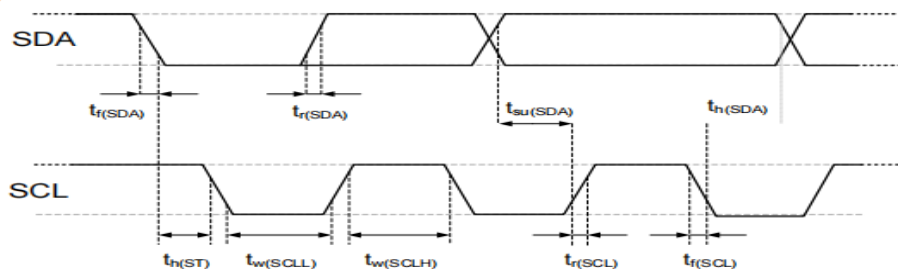
Readout status byte at any time



Readout 20-bit bridge measurement and 20-bit temperature measurement when the FIFO is disabled



4.4 I²C Timing





Symbol	Parameter	Conditions			Units
			Min.	Max	
f _{SCL}	SCL clock frequency		0	100	kHz
t _{HD;STA}	Hold time (repeated) START condition	After this period, the first clock pulse is generated	4.0	-	μs
t _{LOW}	LOW period of the SCL clock		4.7	-	μs
t _{HIGH}	HIGH period of the SCL clock		4.0	-	μs
t _{SU;STA}	Set-up time for a repeated START condition		4.7	-	μs
t _{HD;DAT}	Data hold time		0.09	3.45	μs
t _{SU;DAT}	Data setup time		250	-	ns
t _r	Rise time of SDA, SCL		-	1000	ns
t _f	Fall time of SDA, SCL		-	300	ns
t _{SU;STO}	Set-up time for STOP condition		4.0	-	μs
t _{BUF}	Bus free time between STOP and START condition		4.7	-	
C _b	Capacitive load for each bus line		-	400	pF
t _{VD;DAT}	Data valid time		-	3.45	μs
t _{VD;ACK}	Data valid acknowledge time		-	3.45	Ms
V _{nL}	Noise margin at the LOW level		0.1VDD	-	V
V _{nH}	Noise margin at the HIGH level		0.2VDD	-	V

Notice: The SCL and SDA IO of Master(MCU) must be open drain output but not Push pull output.



5 Command list

1) PT_MEAS: Measure bridge sensor and temperature

Command Byte	Data Byte 0								Data Byte 1							
--	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
0xAC	0	OSR_T				0	OSR_P				0x00					

This control command is used to start a temperature and bridge sensor measurement with specified over sampling rate (OSR).

When this command is executed, both the 20-bit bridge data and the 20-bit temperature data can be read in the next read operation, in the format shown below:

Return Status Byte								Return Data Byte 0								Return Data Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Status [7:0]								Bridge data [19:12]								Bridge data [11:4]							

Return Data Byte 2								Return Data Byte 3								Return Data Byte 4							
7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Pressure data [3:0]				Temp. data [19:16]				Temperature data [15:8]								Temperature data [7:0]							

2) Readout status byte at any time

Return Status Byte							
7	6	5	4	3	2	1	0
Status [7:0]							

Status byte bits definition

Bit	Function	Description
Bit[7]	Busy indication	1 – the chip is busy 0 – the chip is sleeping
Bit [6:5]	Mode Status	00 NOR mode
Bit [4]	For test only	0
Bit [3]	Calibration Enable	0 – Calibration disabled; raw data is output 1 – Calibration enabled; compensated data is output
Bit [2]	For test only	0
Bit [1]	For test only	0
Bit [0]	For test only	1



6 Pin-out and connection diagram

6.1 Pin-out

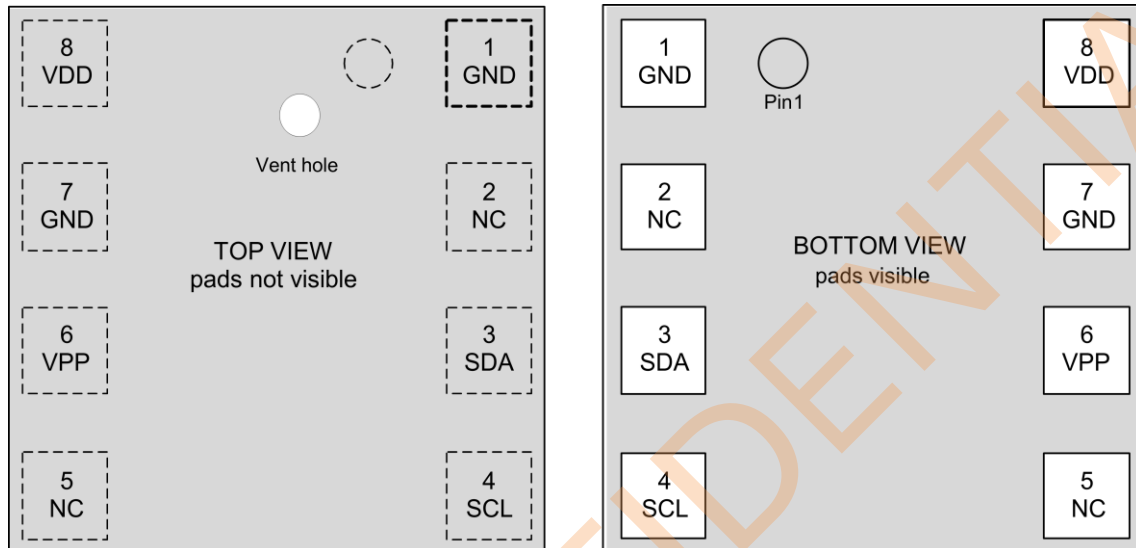


Figure 11 Pin-out top and bottom view

Table 15 Pin description

Pin	Name	I/O Type	Description	Connect to
1	GND	Supply	Ground	GND
2	NC	--	Not Connected	Not connected
3	SDA	In/Out	Serial data input and output	I ² C SDA
4	SCL	In	Serial clock input	I ² C SCL
5	NC	--	Not Connected	Not connected
6	VPP	Supply	NVM programming supply	Not connected
7	GND	Supply	Ground	GND
8	VDD	Supply	Power supply	VDD



6.2 Connection diagram

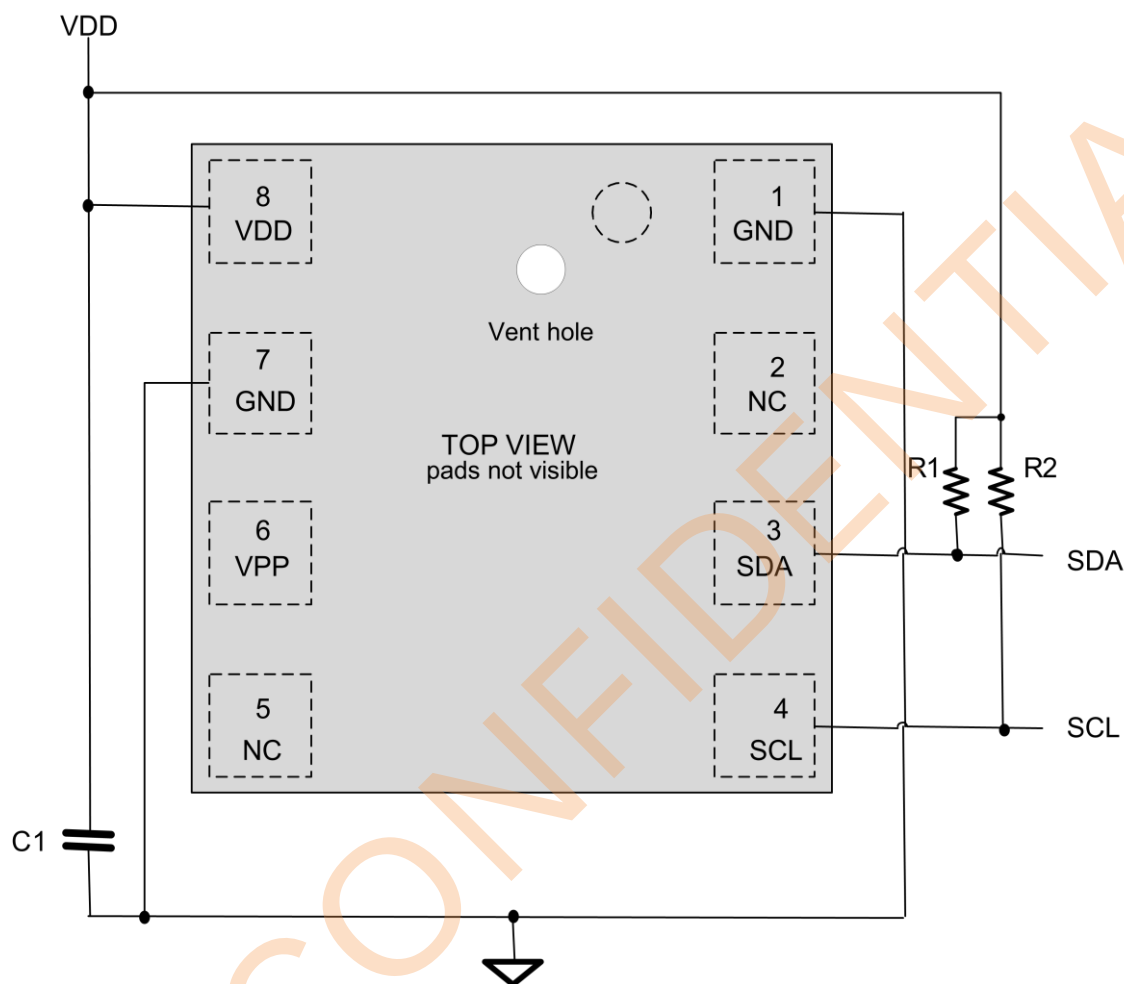


Figure 12 Connection diagram

Notes:

- The recommended value for C1 is 100nF
- The value for the pull-up resistors R1, R2 should be based on the interface timing and the bus load; the typical value is 4.7 k Ω for both resistors.



7 Package, reel and environment

7.1 Outline dimensions

The sensor housing is an 8-pin metal-lid LGA 2.0 × 2.5 × 1.0mm³ package. Its dimensions are depicted in Figure 13.

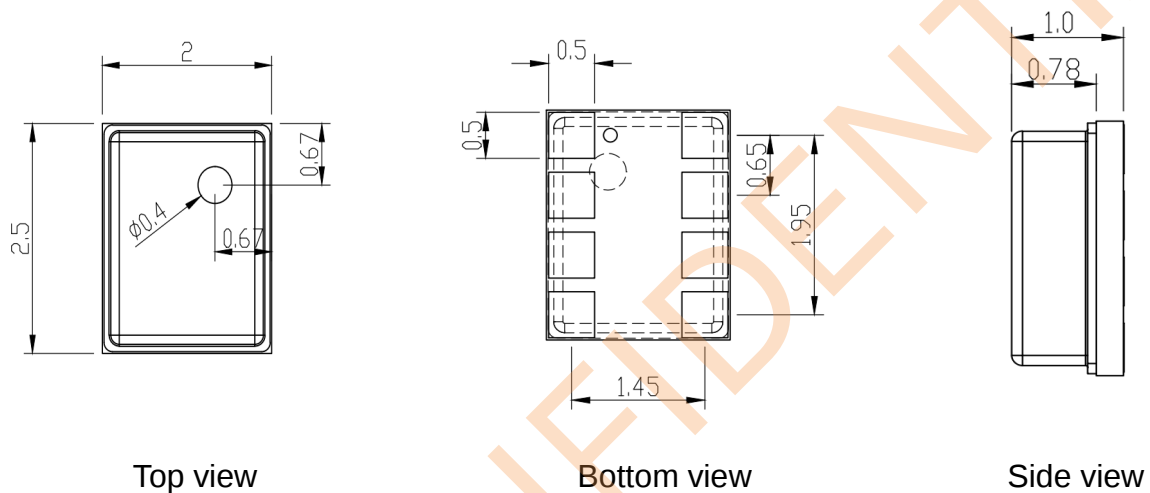


Figure 13 Package outline dimensions for top, bottom and side view



8 Document history and modification

Version	Description	Date
1.0	Initial release	Mar. 20, 2023
1.1	Add I2C IO output setting	Jun. 05, 2024