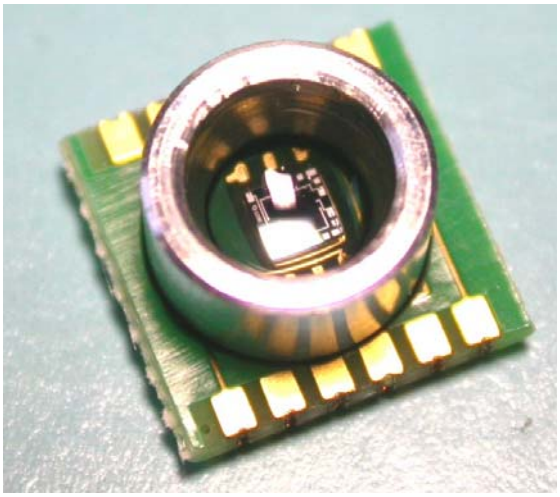
MIS-7000 series (Preliminary)

Intelligent Pressure Sensor

■ Features

- □ Supply Voltage 2.7 to 5.5V
- □ 300 to 1100 mbar pressure range
- □ Wide operating temperature range:- 20 to +85°C
- □ High accuracy（±0.1%FS @ -25 to 85℃）
- □ Factory calibrated and temperature compensated
- □ Digital signal output、rail to rail ratiometric analog output or 0 to 1V analog output

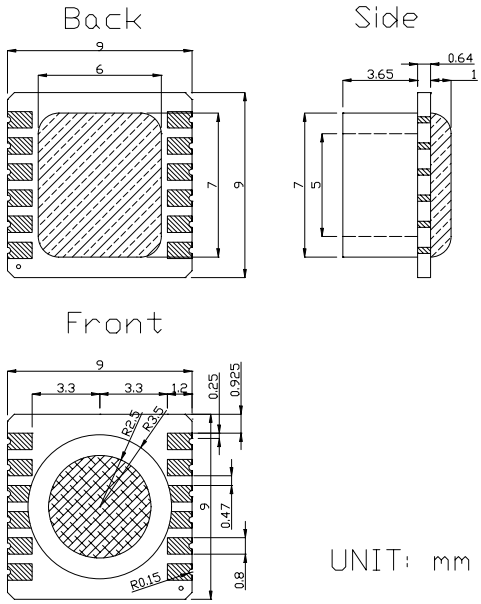


■ Applications

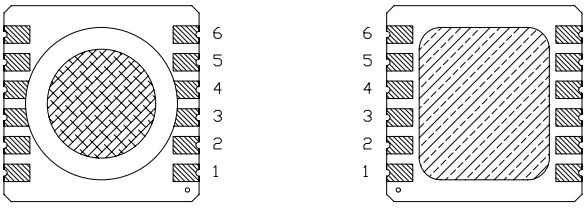
- □ Digital altitude meter
- □ Weather forecast station
- □ Digital barometer
- □ Sport watch
- □ GPS receivers

The MIS-7000 is a intelligent pressure sensor which consist of a MEMS piezoresistive pressure sensor and a CMOS sensor interface IC. The interface IC enables easy and precise calibration of resistive bridge sensors via EEPROM. It correct digitally offset、gain and both temperature coefficients. All devices were factory calibrated and temperature compensated. Using MIS-7000 series is easy to get rid of bothersome calibrations and temperature compensations. The MIS-7000 can provide selectable 0 to 1V, rail-to-rail ratiometric analog output, or digital serial output for various applications.

■ Outline Dimensions



■ Pin Configurations



Pin Name	Pin	Function
VDD	1	Supply voltage (2.7 to 5.5V)
SIG	2	Analog output, digital output
N/C	3	No connection
N/C	4	No connection
N/C	5	No connection
GND	6	Ground supply

■ Specifications

Parameter	Min	Typ	Max	Units	Notes
Absolute Maximum Ratings					
Supply Voltage	-0.3		6.0	V	
Storage Temperature Range	-25		85	°C	-13°F～+185°F
Maximum Overpressure			2X		Rated pressure
Recommended Operating Conditions					
Pressure Range	300		1100	mbar	
Supply Voltage	2.7	5	5.5	V	
External Capacitance between Vdd and Gnd	100	220	470	nF	
Output load Capacitance		10	15	nF	
Power ON Rise Time			100	ms	
Operating Temperature Range	-25		85	°C	-13°F～+185°F
Operating humidity	15		85	% RH	No condensation
Media Compatibility	Clean, dry air & non-corrosive gases				
Electrical characteristic(1)					
Supply Voltage	2.7	5	5.5	V	
Supply Current（varies with update rate）	0.25		1	mA	2
Temperature Coefficient – PTAT Source		20	100	ppm/K	3
Power Supply Rejection Ratio	60			dB	
Analog to Digital Converter					
Resolution		14		Bit	
Integral Nonlinearity	-4		+4	LSB	
Differential Nonlinearity	-1		+1	LSB	
Response Time		1		ms	
Pressure Output Characteristics					
Resolution		0.2		mbar	
Absolute Pressure Accuracy	-0.8		+0.8	mbar	4
Relative Pressure Accuracy	-0.8		+0.8	mbar	5
Max. Error over Temperature	-1.2		+1.2	mbar	6
Temperature Output Characteristics					
Resolution		0.8		℃	

Notes：

1. Unless otherwise specified, measurements were taken with a supply voltage of 5 Vdc at a temperature of 25±3℃ and humidity ranging from 25% ～85% .
2. The update rate is selectable including 8, 40, 200, and 1kHz.
3. PTAP, Proportional to absolute temperature. The Bandgap/PTAT provides the PTAT signal for internal temperature compensation.
4. Maximum error of pressure reading over the pressure range.
5. Maximum error of pressure reading over the pressure range after offset adjustment at one pressure point.
6. With the second-order temperature compensation over -25 to 85℃.

Metrodyne Microsystem Corp. reserves the right to make changes to the product specification in this publication.

■ Ordering information

MIS-7 0 0 0-015 A D

C
A
B

A	Pressure type	B	Pressure range	C	Output type
A	Absolute	006	5.8 PSI	D	digital one-wire-interface
		015	15 PSI	E	absolute analog voltage (0 to 1V)
		100	100 PSI	F	rail-to-rail ratiometric analog output

1. ZACwire™ Communication Interface

1.1 Properties and Parameters

Parameter	Symbol	Min	Typ	Max	Units	Notes
Pull-up resistor (on-chip)	$R_{ZAC,pu}$		30		kΩ	On-chip pull-up resistor switched on during Digital Output Mode and during CM mode (first 6ms power up)
ZACwire™ rise time	$t_{ZAC,rise}$			9	µs	Any user RC network included in Sig™ path must met this rise time
ZACwire™ load capacitance	$C_{ZAC,load}$	0	1	15	nF	
Voltage level - low	$V_{ZAC,low}$		0	0.2	V_{DD}	Rail-to-rail CMOS driver
Voltage level - high	$V_{ZAC,high}$	0.8	1		V_{DD}	Rail-to-rail CMOS driver

1.2 Bit Encoding

Start bit => 50% duty cycle used to set up strobe time

Logic 1 => 75% duty cycle

Logic 0 => 25% duty cycle

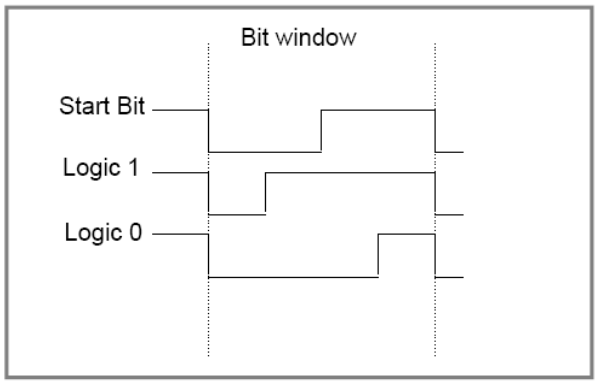


Figure 1. Duty Cycle Manchester

1.3 MIS-7000 Read Operations

The MIS-7000 transmits 10-bit bytes (1 start bit, 8 data, 1 parity). During Normal Operation Mode, it transmits 3 data bytes packet (First two bytes for pressure data, the third for temperature data). It first transmits the first byte of pressure data followed by the second byte and the third byte is temperature data. The pressure data is 14-bits in resolution, so the upper two bits of the first byte are always zero padded. The temperature byte represents an 8-bit temperature quantity spanning from –50°C to 150°C. There is a half stop bit time between bytes in a packet. That means for the time of a half a bit width, the signal level is high.

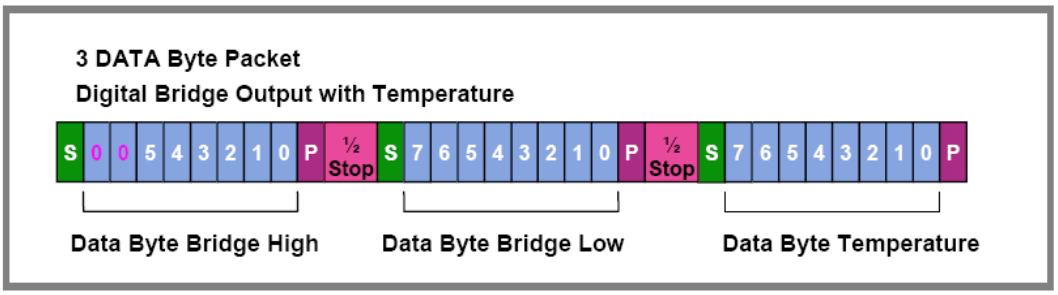


Figure 2. Digital Output Pressure Readings with Temperature

There is a variable idle time between packets. This idle time varies with the update rate setting in

EEPROM. The table below shows the idle time between packets versus update rate. This idle time can vary by nominal +/-15% between parts and over a temperature range of –50°C to 150°C. **The typical update rate setting is 40Hz**. Other update rates are available in 8, 200,and 1000Hz. Please contact factory for more information.

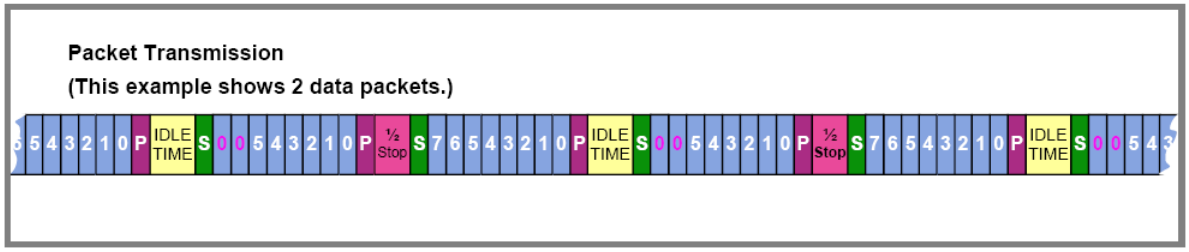


Figure 3. Transmission of a Number of Data Packets

Transmissions from the IC occur at one of two speeds depending on the update rate programmed in EEPROM. If the user chooses one of the two fastest update rates (1ms or 5ms) then the baud rate of digital transmission will be 32kHz. If however, the user chooses one of the two slower update rates (25ms or 125ms), then the baud rate of digital transmission will be 8kHz.

Update Rate setting	Idle Time between Packets	Baud rate of digital transmission
1kHz (1ms)	1ms	32kHz
200Hz (5ms)	4.85ms	32kHz
40Hz (25ms)	**22.5ms**	**8kHz**
8Hz (125ms)	118ms	8kHz

2. Pressure and Temperature Calculations

For pressure measurement：

14bit pressure quantity spanning from 100mbar to 1100mbar

$$\text{Pressure} = \text{AD(P)} \times \left(\frac{1000}{16384}\right) + 100 \quad \text{(Unit：mbar)}$$

＊AD(P)：Pressure reading

For temperature measurement：

8-bit temperature quantity spanning from –50°C to 150°C

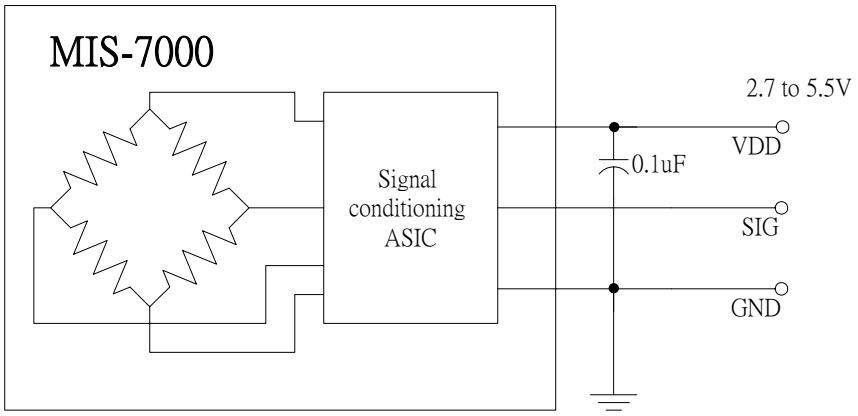
$$\text{Temp.} = \text{AD(T)} \times \left(\frac{200}{256}\right) - 50 \quad \text{(Unit：°C)}$$

＊AD(T)：Temperature reading

3. Application Circuit Examples

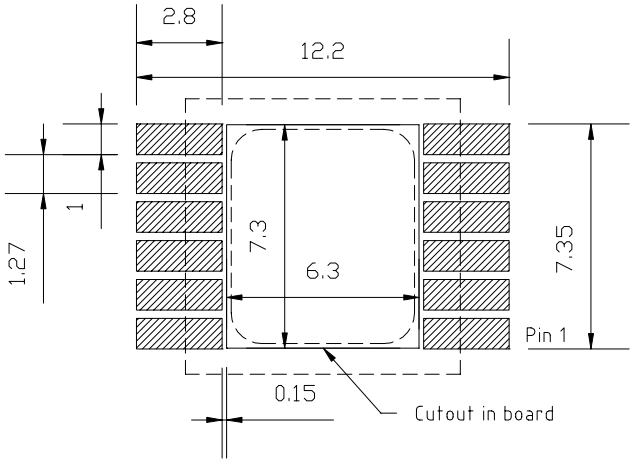
For the digital output no load resistor or load capacity are necessary. No pull down resistor is allowed. If a line resistor or pull up resistor is used, the requirement for the rise time must be met ($\phi 9\ \mu s$). The IC output includes a pull up resistor of about 100kΩ. The digital output can easily be read by firmware from a

microcontroller. .



4. Recommended Pad Layout

4.1 Pad layout for backside of MIS-7000 soldered onto PCB



All dim. in mm

4.2 Pad layout for front side of MIS-7000 soldered onto PCB