



AT2310 Pressure Sensor

External Specification

Specification Part Number 850063

Revision C1

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GENERAL DESCRIPTION

The Atmodule AT2310 precision digital-output pressure sensor uses smart sensor techniques to correct pressure readings for temperature and linearity, achieving a total error band of under 0.2% FS over the -40 C to +85 C temperature range. The typical error band is 0.08% FS over the -40 C to +85 C temperature range. Static accuracy is better than 0.05% FS. The module contains a silicon pressure sensor, sensor interface electronics, a 21-bit A/D converter, EEPROM calibration memory, and a sensor signal processor. Operating from a regulated 3.3 volt power supply, the module is designed for board mounting.

FEATURES

- Media isolation
- 0.20% FS total error over temperature all effects.
- Very low long term drift
- Four-wire serial interface bi-directional
- Pressure measurement range 1 to 16 PSIA
- Digital temperature compensation and calibration
- 110 mS conversion time
- 1.0 mS data access time
- 0.05% (0.008 PSI) static accuracy

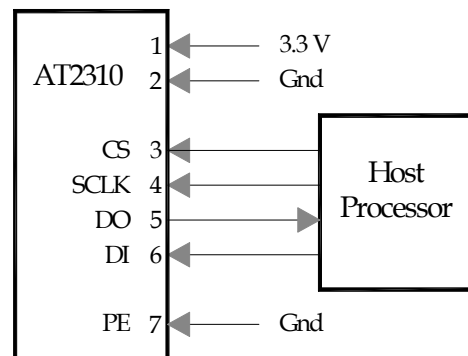
APPLICATIONS

- Barometers and altimeters
- Smart radios and GPS receivers

AT2310 Module Outline



Module Connection To Host



1 Scope

This specification describes the operating characteristics of the AT2310 pressure module.

2 Performance

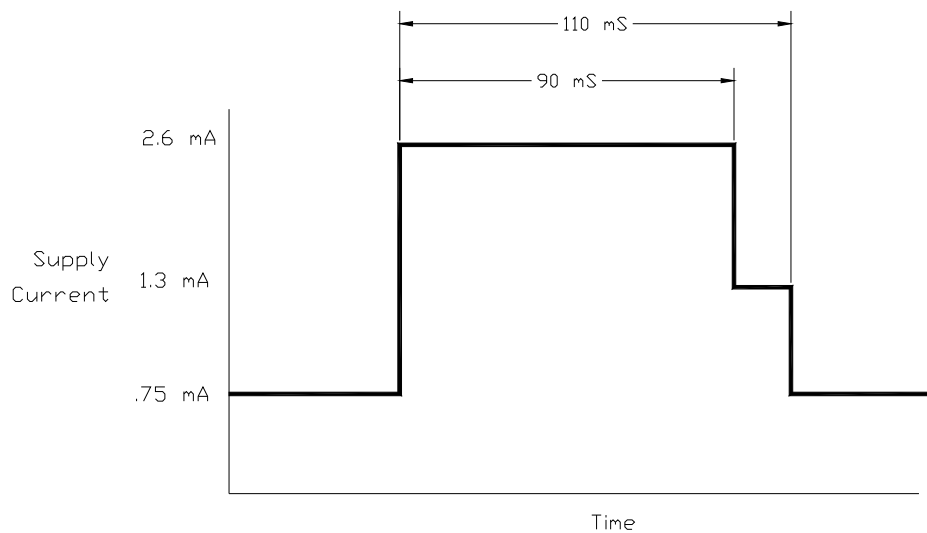
Parameter	Minimum	Typical	Maximum	Units
Pressure measurement range	1.0		16	PSIA
Pressure altitude measurement range	60,000		-2500	Feet
Maximum applied pressure without damage	0		25	PSIA
Output resolution		0.001		PSIA
Total accuracy (All effects over temperature)	-0.045	0.010	+0.045	PSIA
Static accuracy (Offset plus linearity error at 68 F)		0.008		PSIA
Stability		0.008	PSIA/Year	
Output noise pk-pk includes output resolution		0.001		PSIA
Output scaling (Output Counts/PSIA)		1000		Counts
Digital-output word range	-32,767		32,767	Counts
Digital output value for zero pressure		00000		Counts
Digital output value for full-scale pressure (16.000 PSIA)		16,000		Counts
Pressure measurement time (CS high to data ready)		110	150	mS
Power on time. Time from Vdd valid until data is ready.		200		mS
Power on to data-out line (DO) valid		80		mS

3 Electrical Parameters

Parameter	Description	Minimum	Typical	Maximum
Vsupply	Operating	2.9	3.3	3.6
	Max limits	-3		5.5 V
	Turn on rate	0.05 V/mS		
Isupply	Supply current at Vdd= 3.3 volts			
	Peak current during conversion		2.6 mA	
	Average current continuous sample		2.5 mA	
	End of conversion waiting for command		0.75 mA	
Vih	Input high voltage CS, SCLK, DI	$0.25 \times V_{dd} + 0.8$		Vdd
Vil	Input low voltage CS, SCLK, DI	Vss		$0.20 \times V_{dd}$
Iil	Input leakage current CS, SCLK, DI	- 1 μ A		+1 μ A
Iipe	Input current PE pin Vpe =Vdd=3.3 volts		165 μ A	
Voh	Output low voltage DO (Iol = 6 mA)			0.6 Volts
Voh	Output high voltage DO (Ioh = -3.0 mA)	Vdd - 0.7		
Rpepd	Program enable internal pull down to Vss		20 K Ohm	
Csupply	Capacitance Vdd - Vss		0.11uF	

4 Supply Current Profile

With the data-out line high at the end of conversion the module supply current is 0.75 mA. When the pressure conversion command is issued the supply current increases to 2.6 mA for 90 mS, drops to 1.3 mA for 20 mS, and then returns to 0.75mA when the pressure value is ready.



5 Power Supply Rejection Ratio

The AT2310 has a typical power supply rejection ratio of +0.001 PSIA per +0.1 volt change in the nominal 3.3 volt supply. The AT2310 is calibrated at 3.3 volts.

6 Pressure Measurement Range

The AT2310 is calibrated over the 1 to 16 PSIA pressure range. The device will function beyond the calibrated pressure range. At approximately 17.5 PSIA the output will saturate. This value is temperature dependant. The device will function down to zero applied pressure.

7 Light Sensitivity

The pressure sensing element in the AT2310 is a piezoresistive silicon pressure sensor. The sensor die is located inside the round metal ring and is protected with a silicone gel and metal cap. The pressure output value will change slightly with ambient light reaching the pressure die. Normal room lighting conditions will have an affect of +/-0.001 PSIA or less on the pressure output. Direct sunlight should be avoided. The AT2310 is calibrated with no light reaching the sensor element.

8 Assembly Method

The AT2310 should be hand soldered using a no-clean solder. If the unit is put through a surface mount process the hole in the sensor cap should be taped before cleaning. The surface mount process may cause a shift in module calibration.

9 Handling

The AT2310 should be handled by the edges. Avoid conductive contaminants such as solder flux.

10 Power Up Sequence

After power is applied there is an 80 mS power on self test sequence. During this time the Data-Out line is configured as an input and the DO value is not valid. At the end of the power on self test the Data-Out line becomes an output, is set low and a pressure conversion performed. The Data-Out line will go high at the end of the first pressure conversion indicating that the module is ready to accept commands. The time from power on to Data-Out high is 200 mS.

11 Digital Interface

11.1 General Description

The AT2310 four-wire serial interface is a synchronous serial interface. The input data word is 16 bits long. The output data word is 17 bits long including the end-of-conversion bit that is always a one. To select the module the chip-select line is set low. The command in progress is finished and the end of conversion bit (D16) is output. The module is now ready to receive and transmit data. The 16-bit input word is clocked in while the 16 bit output word is read out. The output data word is the result of the **previous** command. **The data-in line is read on the rising edge of the serial clock (SCLK) line. The data-out line changes state just after the rising edge of the serial clock line.** The input command is executed when the chip-select line is brought high after all 16 bits have been clocked in. Clocks beyond the 16th are ignored. If the CS line is brought high (deselected) before all 16 bits have been transferred then the data I/O is aborted and a pressure conversion started.

If the CS line is high (module deselected) when a command completes, the command result is discarded and a pressure conversion is started. The module will **free run** and convert pressure continuously when the CS line is high (module deselected).

11.2 Output Data Format

The output data word is 17 bits long. The data is clocked out of the module from most significant to least significant bit. Data bit D16, the most significant bit, is the end-of-conversion bit and is always a one.

Data bit D15 is the sign bit for the output magnitude.

0 = positive 1 = negative

Data bits D14 through D0 contain the magnitude.

Magnitude = 0 to 32,767

```
(D16                                     D0)
(1 x x x x x x x x x x x x x x x x)
(E S |----- Magnitude -----|)
E = End of conversion bit = 1
S = Sign bit        1 = negative
```

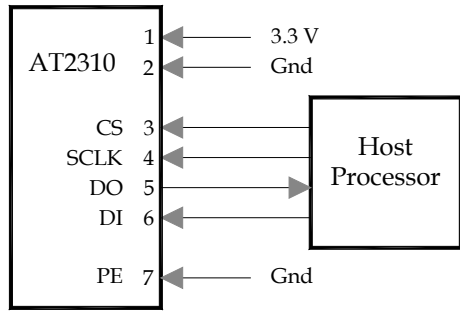
11.3 Input Data Format

The input data word is 16 bits long. Data is clocked into the module most significant to least significant bit.

Data bits D15 through D8 contain the command. Data bits D7 through D0 contain the command option.

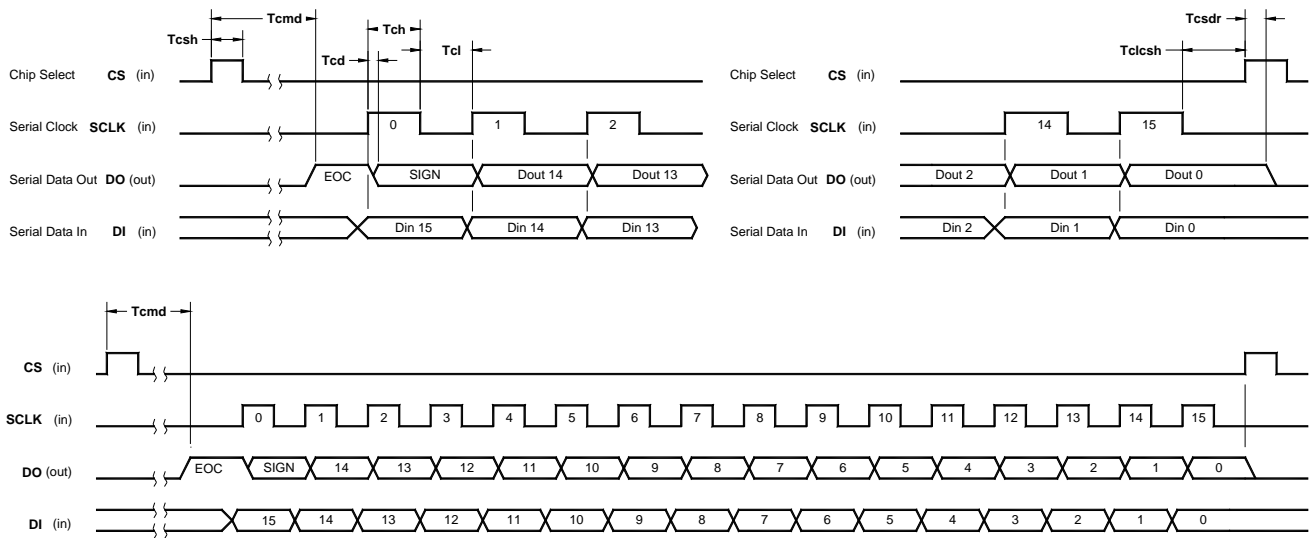
```
(D15          D8) (D7          D0)
(x x x x x x x x) (x x x x x x x)
|---Command---| |----Option-----|
```

11.4 4-Wire Connection Diagram



Note: The PE line has a 20 K Ohm internal pull down. Connection of the PE line to Gnd is optional.

11.5 AT2310 4-Wire Serial Interface Timing Diagram



I/O TIMING

Parameter	Description	Minimum	Typical	Maximum
T_{pon}	Power on time to module ready		200 mS	
T_{cmd}	Pressure conversion time		110 mS	150 mS
T_{cmd}	Read module serial number	1.0 mS	2.5 mS	6.0 mS
T_{csh}	Chip select high time. Note: CS must be brought low before the command completes.	50 μ S		T_{cmd}
T_{ch}	SCLK high time	28 μ S		
T_{cl}	SCLK low time	28 μ S		
T_{csdr}	CS high (deselected) to DO set low		22 μ S	28 μ S
T_{cd}	SCLK high to DO valid time	3 μ S	6 μ S	20 μ S
T_{clcsh}	SCLK 15 falling edge to CS high	0 μ S		
T_{dis}	DI set up and hold time (DI valid to SCLK)	0 μ S		

11.6 AT2310 Pressure Module Commands

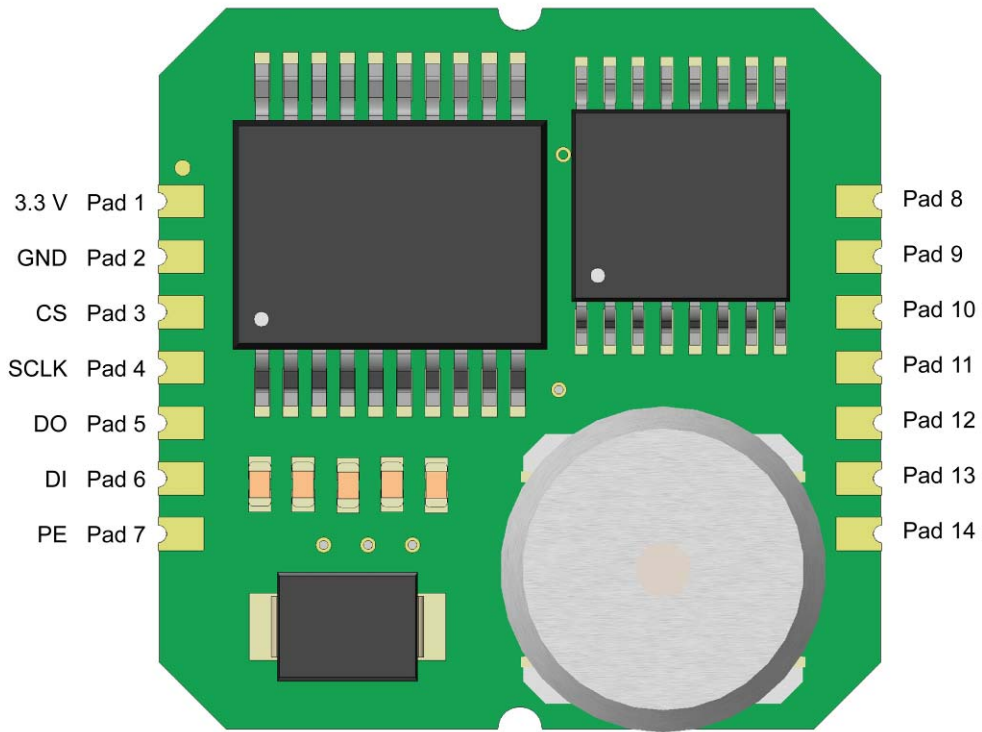
	Command	Command Data	Binary Command Word
Measure the applied pressure and return the pressure value	0	0	(00000000)(00000000)
Return the least significant 16 bits of the serial number	6	0	(00000110)(00000000)
Return the most significant 8 bits of the serial number	6	1	(00000110)(00000001
Reserved commands	1 to 5 7 to 18	0 to 255	(0000xxxx)(xxxxxxxxxx)

The module accepts commands 0 through 18. The reserved commands are used for factory access to internal diagnostic and calibration registers. Issuing a reserved command may affect the calibration of the unit. Atmos recommends that the customer use the zero command to access the module pressure. In applications that only require the pressure output the data-in line can be tied low.

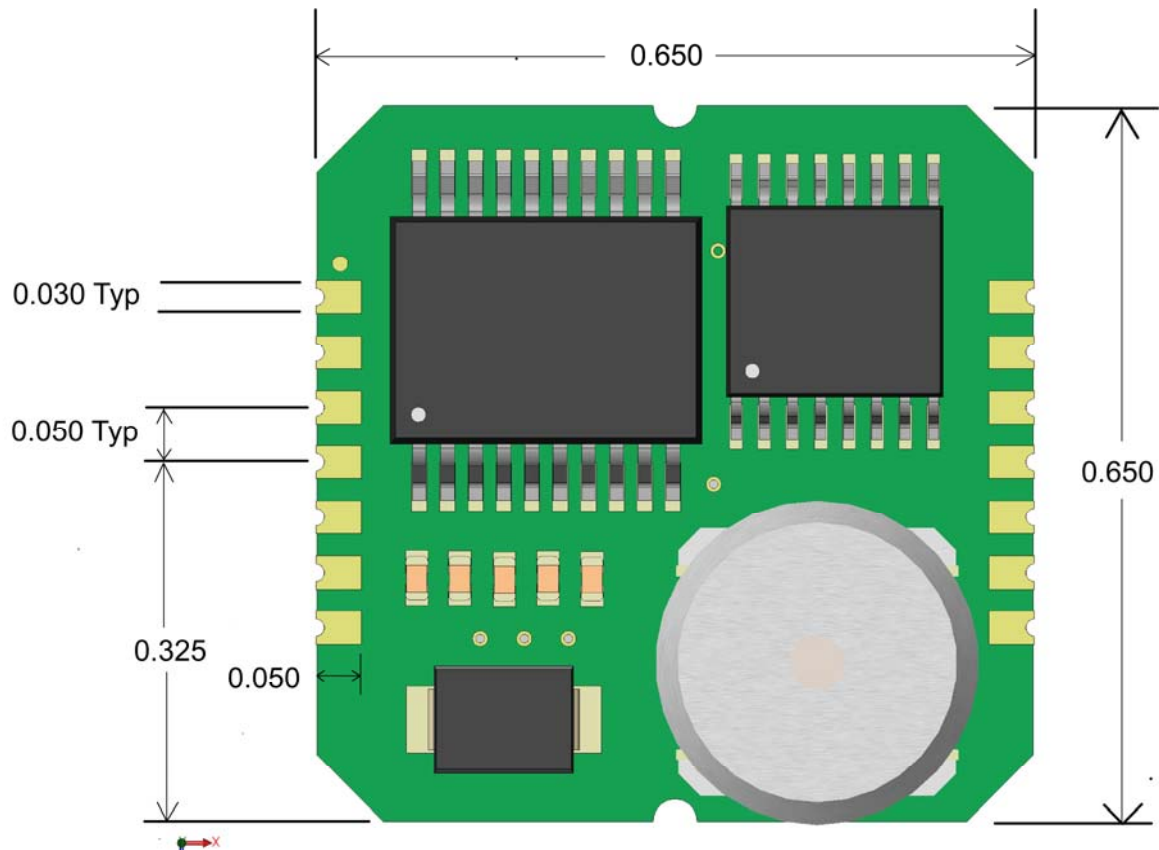
12 AT2310 Pin Assignment

Pin Number	Signal Name	Type	Description
1	3.3 V DC	Power pin	3.3 supply
2	GND	Power pin	Ground
3	CS (Active Low)	Input	Chip Select Active low
4	SCLK	Input	Serial Clock
5	DO	Output	Data Output
6	DI	Input	Data Input
7	PE	Input with 20 K pull down	Flash program enable
8-14	These pads are for mechanical connection. They are not connected electrically.		

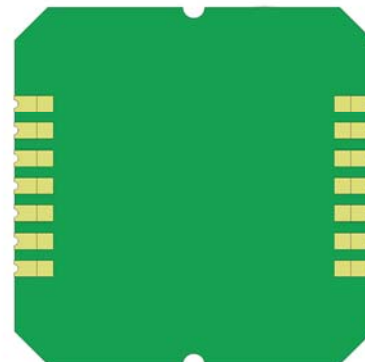
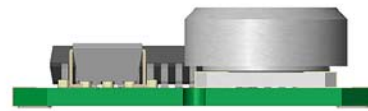
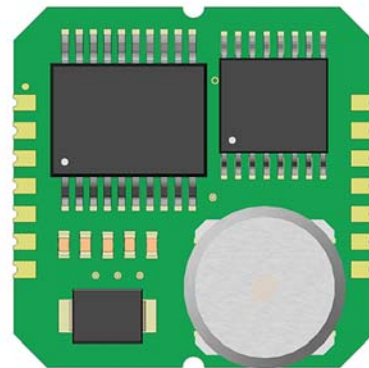
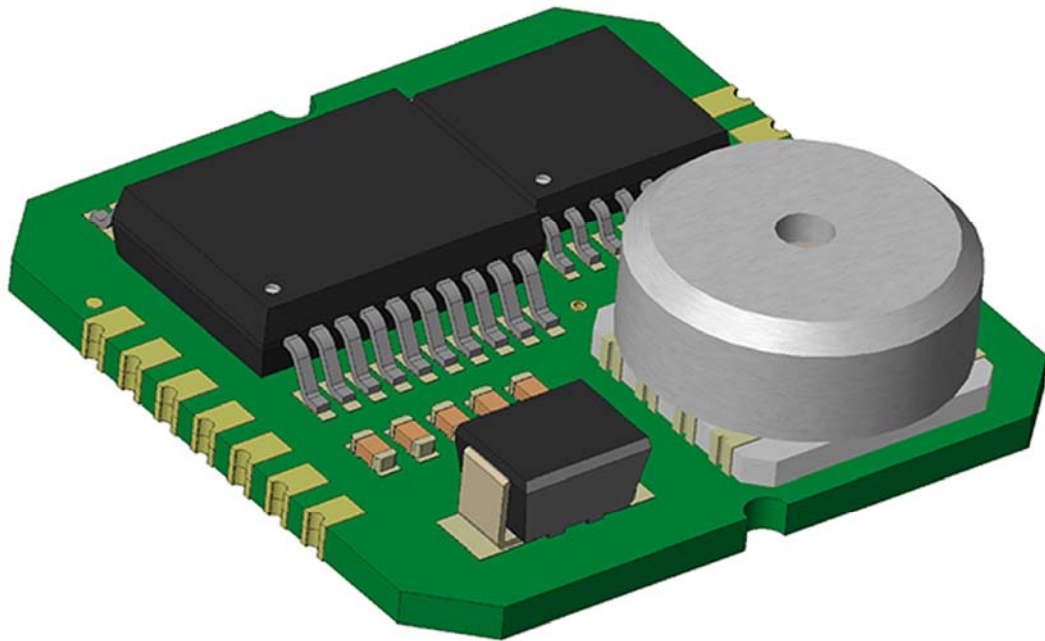
13 Module Dimensions and Pad Size



Dimensions Are In Inches



14 Module Views



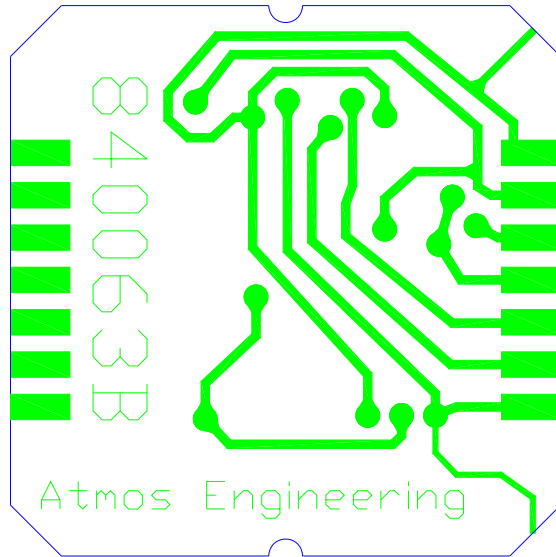
15 Part Marking

The AT2310 is marked on the bottom of the printed circuit board.

AT2310 Marking Type 1

Bottom view of the printed circuit board

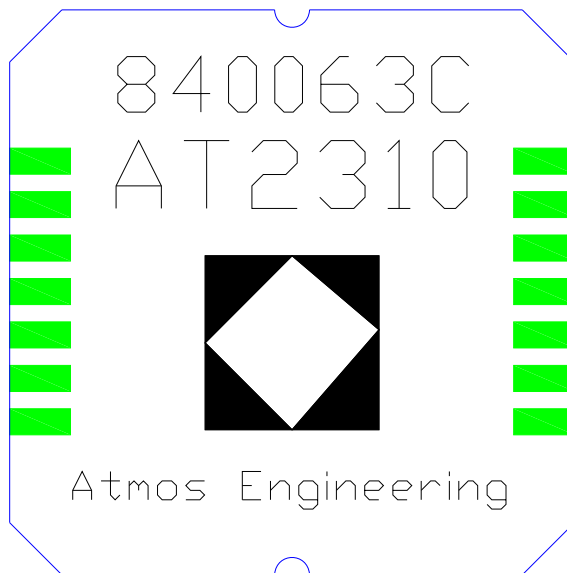
Module serial number 1 to 999



AT2310 Marking Type 2

Bottom view of the printed circuit board

Module serial numbers 1000 and above



16 Revision Log

9/13/2006 Revision C

5/4/2009 Revision C1

Added the module height of 0.185 inch maximum to section 14. This is a form fit and function interchangeable change. All revision C modules produced to date have conformed to this dimension.