Digital Temperature 316 SS Probe

ATS80

- -40°C - 150°C Operating Temperature
- ± 0.5°C Typical Accuracy
- 0.03125°C Temperature Resolution
- Wide Supply Range: +2.7V - +5.25V
- 316 Stainless Steel Housing
- 3 Wire, SPI Interface (Half Duplex)
- Media – Liquid, Air, & Gas

DESCRIPTION

The ATS80 sensor is digital temperature sensor with a 3 wire SPI output. The probe body is 316 stainless steel and is designed to be inserted into the media to be measured.

The 28 AWG, PTFE wires are potted with a high temperature epoxy into the housing. The terminations can be tinned or a connector can be specified.

APPLICATIONS

- Industrial Automation
- HVAC
- Semiconductor
- Liquid /Gas Chromatography
- Commercial Ovens

Maximum Environmental Ratings

Operating Temperature ……..... -40°C to 150°C

Storage Temperature Range ……. -65°C to 160°C

Operational Characteristics

V_+ = 5V, V_- = 0V, Temperature = 25°C

PARAMETER	SYMBOL	Min	Typ.	Max	UNITS
Supply Voltage	V_{DD}	2.7	5	5.5	V
Operating Temperature	T_S	-40		150	°C
Supply Current	I_{DD}		1.6		mA
Temperature Error	te	-0.5		0.5	°C
Response Time	t_R	1	2	20	ms
Update Rate	t_U		1.2		ms
Temperature Resolution			0.03125		°C
SPI Interface					
Input Low Level	V_{in_low}	0		.8	Vdd
Input High Level	V_{in_high}	2.5		1	Vdd
Input Capacitance	C			10	pF
Output Low Level	V_{o_low}			.4	Vdd
Output Capacitance	C			50	pF

Wire Diagram

Black	-V
Red	+V
White	INT
Green	SDAT
Yellow	SCLK

Temperature Sensor Digital Interface – SPI

Figure 1 shows the timing diagram for a serial read from the temperature probe. The CS line enables the SCLK input. Thirteen bits of data plus a sign bit are transferred during a read operation. Read operations occur during streams of 16 clock pulses. The first 2 bits out are leading zeros and the next 14 bits contain the temperature data. If CS remains low and 16 more SCLK cycles are applied, the temp probe loops around and outputs the two leading zeros plus the 14 bits of data that are in the temperature value register. When CS returns high, the DOUT line goes into three-state. Data is clocked out onto the DOUT line on the falling edge of SCLK.

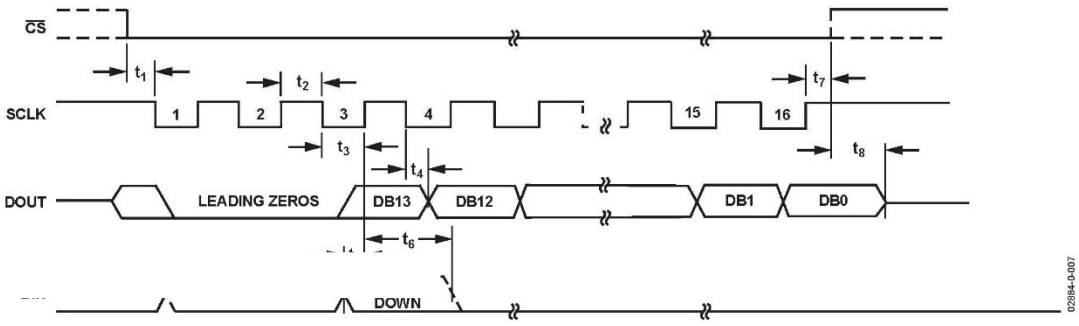

Figure 1

Parameter[1]	Limit	Unit	Comments
t_1	5	ns min	$\overline{CS}$ to SCLK setup time
t_2	25	ns min	SCLK high pulse width
t_3	25	ns min	SCLK low pulse width
t_4[2]	35	ns max	Data access time after SCLK falling edge
t_5	20	ns min	Data setup time prior to SCLK rising edge
t_6	5	ns min	Data hold time after SCLK rising edge
t_7	5	ns min	$\overline{CS}$ to SCLK hold time
t_8[2]	40	ns max	$\overline{CS}$ to DOUT high Impedance

Table 1

Temperature Sensor Digital Interface – SPI

Temperature Conversion Equations

$$Positive\ Temperature = ADC\ Code(d)/32$$

$$Negative\ Temperature = (ADC\ Code(d)^{1} - 16384)/32$$

$$Negative\ Temperature = (ADC\ Code(d)^{2} - 8192)/32$$

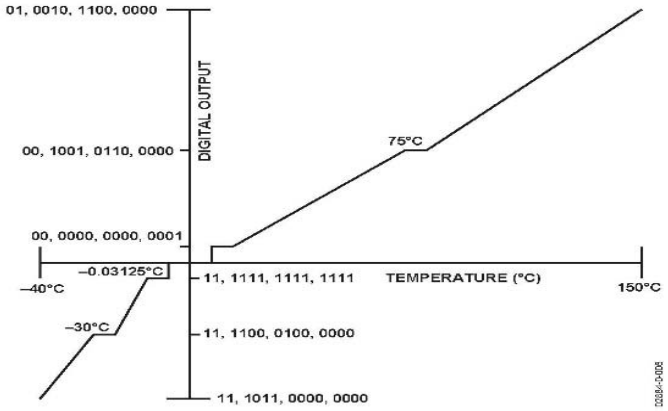

Figure 13. Temperature-to-Digital Transfer Function

[1] ADC code uses all 14 bits of the data byte, including the sign bit.
[2] DB13 (the sign bit) is removed from the ADC code.

Figure 2

Temperature	Digital Output DB13 … DB0
–40°C	11, 1011 0000 0000
–30°C	11, 1100 0100 0000
–25°C	11, 1100 1110 0000
–10°C	11, 1110 1100 0000
–0.03125°C	11, 1111 1111 1111
0°C	00, 0000 0000 0000
+0.03125°C	00, 0000 0000 0001
+10°C	00, 0001 0100 0000
+25°C	00, 0011 0010 0000
+50°C	00, 0110 0100 0000
+75°C	00, 1001 0110 0000
+100°C	00, 1100 1000 0000
+125°C	00, 1111 1010 0000
+150°C	01, 0010 1100 0000

Table 2

Mechanical Dimensions (inches)

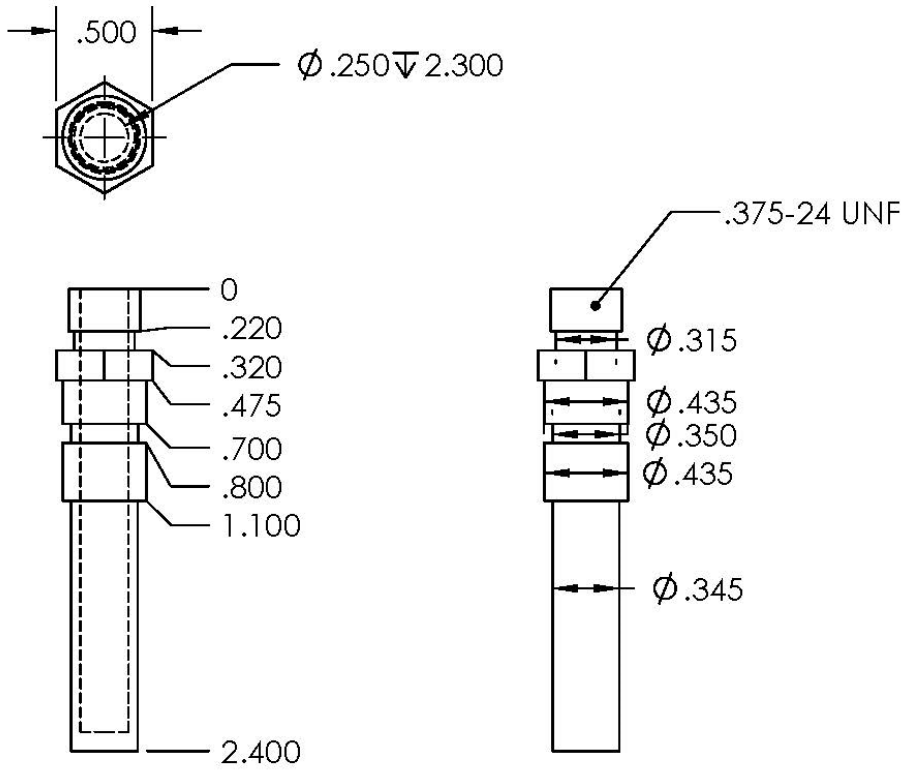

Figure 3

Part Number Configuration

ATS80-0-0

Model

(0= flying leads, 1= Molex connector) Connection

Cable Length (0=3Ft, 1= 6ft, 2=9ft, 3= Custom)

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