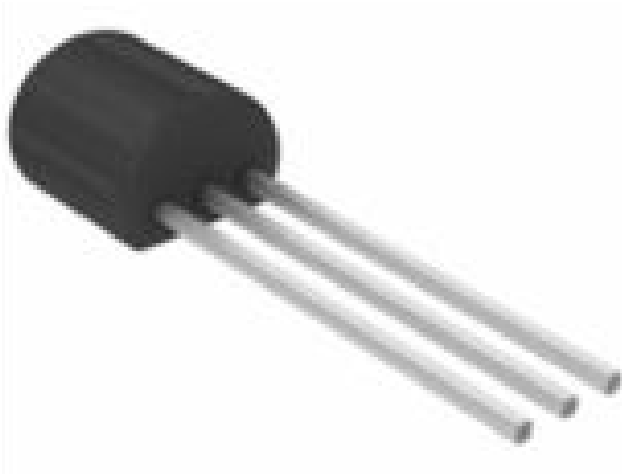
Bandgap Temperature Sensor



Source: (ECE-Depot) 100-3000
http://www.digikey.com/product-search/en?KeyWords=TMP36GT9Z-ND

This device measures the ambient temperature. The output is a voltage from 0.1V to 2.0V (nominally 0.75V @ 25C) and has a temp coefficient of 10mV/C (12.4 ADC counts per C). It requires a resistor on the output, ~100kOhms is recommended.

Wiring Diagram

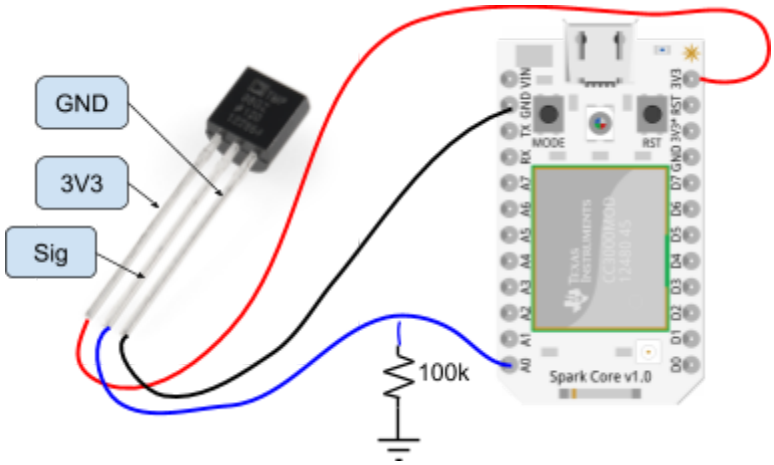


Figure 1: Test Circuit Connection Diagram

Test Data

Temp Source	Output Reading (V)	Output Reading (DAC)
Ambient Room Temp	0.73V	900
Firmly Placed Finger	0.77V	950
Heat Gun at 4”		1500

Converting from ADC reading to Temperature

The technical datasheet for the TMP36 part lists the following important specifications.

TMP36 Output Voltage	$T_A = 25°C$	750	mV
Scale Factor, TMP36	$-40°C \le T_A \le +125°C$	10	mV/°C

These two specifications basically state that at 25℃ the sensor will output 750mV, at 24℃ output 740mV, etc.

Our Photon converts analog measurements into a digital value between 0 and 4095, corresponding to 0 to 3.3V on the output pin. Thus 23℃ should yield 0.73V and return a DAC value of 906. Or put into an equation:

$$Temp\ ℃ = \frac{(ADC - 620)}{12.4}$$

Keep in mind nothing in engineering is ever exact. There are many sources of error when making temperature measurements:

- Temperatures sensors will vary from part to part (± 3℃)
- “Ground” voltage for the sensor and ADC could be slightly different
- Noise can impact a measurement
- The temperature at the sensor may not be the same as the air temp

Example Code

```
int data;

void setup()
{
  Serial.begin(9600);
  pinMode(D7, OUTPUT);
  pinMode(A1, INPUT);
}

void loop()
{
  digitalWrite(D7, HIGH);
  delay(10);
  data = analogRead(A1);
  digitalWrite(D7, LOW);
  Serial.print(data);
  Serial.print(",");
  Serial.print((data-620)/12.4);
  Serial.println(";");
  delay(490);
}
```

Technical Datasheet

http://www.analog.com/media/en/technical-documentation/data-sheets/TMP35_36_37.pdf