

1 Features

- Scale factor: **10 mV/°C**
- Operation range: **-40°C ~ +125°C**, up to +150°C
- Temperature accuracy: **± 2°C (typical)**
- Temperature linearity: **± 0.5°C (typical)**
- Package: **5-Pin SOT-23 (1.60 mm × 3.00 mm)**
8-Pin VSSOP (3.90 mm × 4.90 mm)
- Supply range: **2.7V ~ 5.5V**
- Low quiescent current:
 - Normal operation: **less than 50µA**
 - Shutdown mode: **less than 0.5µA**
- Stable with large capacitive loads
- Digital output: **analog**

The TMP36 is available in low-cost 5-lead SOT-23 surface-mount, 3-lead TO-92 and 8-lead SOIC packages.

2 Applications

- Power system monitors
- Temperature control

3 Description

The TMP36 is a low voltage, precision centigrade temperature sensors, which provides an analog voltage output that is linearly proportional to the Celsius (Centigrade) temperature. Every GX36 chip is factory calibrated, so no external calibration is required, and the typical accuracy is ±1°C at +25°C and ±2°C over the -40°C to +125°C temperature range.

The low output impedance of the TMP36 and its linear output and precise calibration simplify interfacing to temperature control circuitry and ADC. The sensing devices can be powered from a single-supply of 2.7 V to 5.5 V. The supply current is less than 50µA, providing very low self-heating effect, less than 0.1°C in still air. In addition, a shutdown function is provided to reduce supply current to less than 0.5 µA.

The TMP36 is specified from -40°C to +125°C, provides a 750 mV output at 25°C, and operates up to 125°C from a single 2.7 V supply. The output scale factor of the TMP36 is 10 mV/°C.

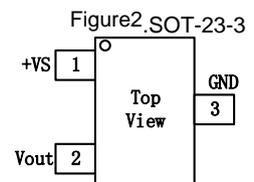
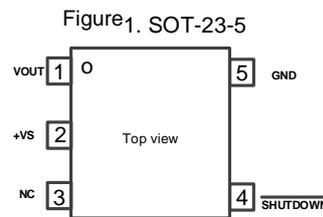


Figure3. TO92

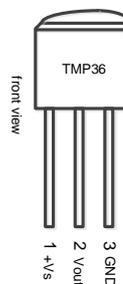
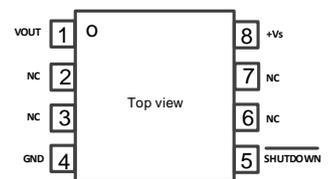


Figure4. SOIC



4 Pin Configuration and Functions

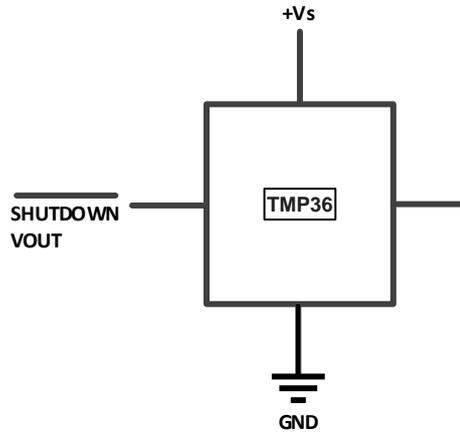


Figure 4. Pin Functions

Table 1. Device Pin Configuration and Functions

| NAME | PIN | | | DESCRIPTION |
|-----------|--------|------|------|-----------------------|
| | SOT-23 | TO92 | SOIC | |
| Vout | 1 | 2 | 1 | Analog voltage output |
| +Vs | 2 | 1 | 8 | Device supply pin |
| /SHUTDOWN | 4 | / | 5 | Device enable pin |
| GND | 5 | 3 | 4 | Ground |

5 Specifications

5.1 Absolute Maximum Ratings

| | MIN | MAX | UNIT |
|----------------------|------|------------------------|------|
| Power supply, +Vs | | 6 | V |
| /SHUTDOWN pin | GND | +Vs | V |
| ALERT pin voltage | -0.5 | (+Vs +0.3) and ≤5.5 | V |
| Operating range | -40 | 150 | °C |
| Junction temperature | | 160 | °C |
| Storage temperature | -60 | 160 | °C |
| | | | |

Unless otherwise stated, over operating free-air temperature range. Stress above these ratings may cause permanent damage to the device.

5.2 ESD Ratings

| | | Value | UNIT |
|---|---|-------|------|
| Electrostatic discharge, V _{ESD} | Human Body Mode (HBM), per ANSI/ESDA/JEDEC JS-001 | ±2000 | V |
| | Machine Mode (MM), per JEDEC-STD Classification | 200 | V |

5.3 Recommended Operating Conditions

| | MIN | NOM | MAX | UNIT |
|---|------|-----|-----|------|
| Supply voltage V+ | 2.7 | 3.3 | 5.5 | V |
| Operating temperature range T _A | - 40 | | 125 | °C |

Unless otherwise stated, over operating free-air temperature range.

5.4 Electrical Characteristics

At $T_A = 25^\circ\text{C}$ and $V_+ = 2.7\text{V} \sim 5.5\text{V}$, unless otherwise noted. (Typically, $T_A = 25^\circ\text{C}$, $V_+ = 3.3\text{V}$)

| PARAMETER | CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------------------|---|------|---------|---------|--------------------------------------|
| Supply voltage range | | 2.7 | | 5.5 | V |
| Supply current | Normal operation | | | 40 | μA |
| | Shutdown mode | | | 0.5 | μA |
| Temperature range | | -40 | | 125 | $^\circ\text{C}$ |
| Accuracy (Temperature error) | $+25^\circ\text{C}$, $+V_S = 3.3\text{V}$ | | ± 1 | ± 2 | $^\circ\text{C}$ |
| | 0°C to $+70^\circ\text{C}$, $+V_S = 1.8\text{V}$ | | ± 1 | ± 3 | $^\circ\text{C}$ |
| | -40°C to $+125^\circ\text{C}$ | | ± 2 | ± 3 | $^\circ\text{C}$ |
| Supply voltage sensitivity | $T_A = 25^\circ\text{C}$, $3.0\text{V} < +V_S < 5.5\text{V}$ | | 20 | 100 | $\text{m}^\circ\text{C}/\text{V}$ |
| Scale factor | $-40^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ | | 10 | | $\text{mV}/^\circ\text{C}$ |
| Load Regulation | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$ | | 8 | 30 | $\text{m}^\circ\text{C}/\mu\text{A}$ |
| | $105^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ | | 3.0 | 70 | $\text{m}^\circ\text{C}/\mu\text{A}$ |
| Linearity | | | 0.5 | | $^\circ\text{C}$ |
| Long-term stability | | | 0.4 | | $^\circ\text{C}$ |
| GX36 output voltage | $A = 25^\circ\text{C}$ | | 750 | | mV |
| Output load current | | 0 | | 50 | μA |
| Short-circuit current | | | | 550u | μA |
| Capacitive load driving | | 1000 | 10000 | | pF |
| Device turn-on time | Output within $\pm 1^\circ\text{C}$, $100\text{ k}\Omega 100\text{ pF}$ load ² | | 0.5 | 1 | ms |

6 Typical Performance Characteristics

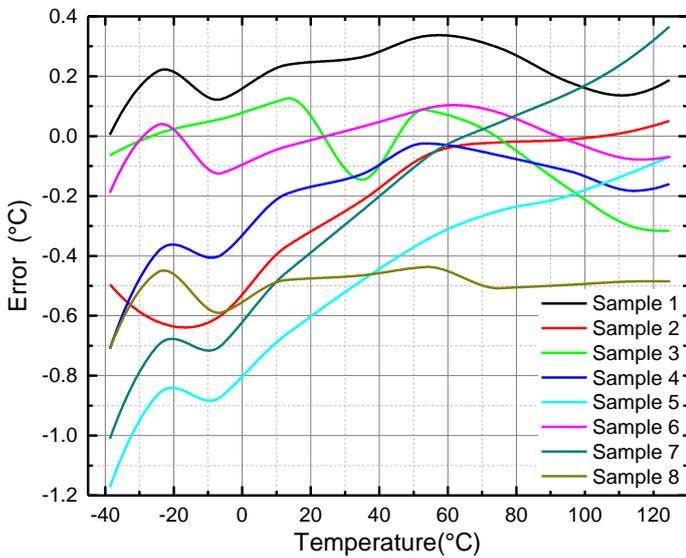


Figure 4. Temperature Error

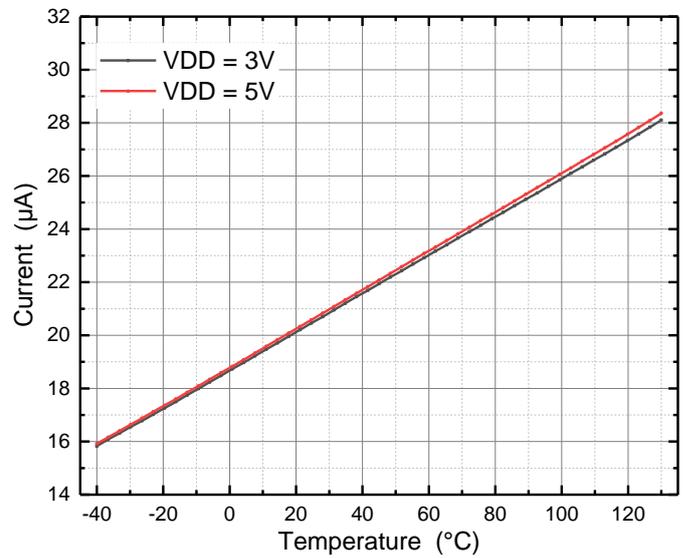


Figure 5. Supply Current versus Temperature

Table 2. Output Voltage versus Temperature

| TEMPERATURE (°C) | V _{OUT} (mV) | TEMPERATURE (°C) | V _{OUT} (mV) |
|------------------|-----------------------|------------------|-----------------------|
| -40 | 100 | 50 | 1000 |
| -30 | 200 | 60 | 1100 |
| -20 | 300 | 70 | 1200 |
| -10 | 400 | 80 | 1300 |
| 0 | 500 | 90 | 1400 |
| 10 | 600 | 100 | 1500 |
| 20 | 700 | 110 | 1600 |
| 30 | 800 | 120 | 1700 |
| 40 | 900 | 125 | 1750 |

7 Typical Applications

Figure 6 shows the basic temperature sensor connections for the TMP36 temperature sensor. Table 1 shows the corresponding pin descriptions for the three package types of temperature sensors. For the SOT-23, Pin 3 is labeled as “NC” as are Pins 2, 3, 6, and 7 on the SOIC package. It is recommended that no electrical connections be made to these pins. If the shutdown feature is not needed on the SOT-23 or the SOIC package, the / SHUTDOWN pin should be connected to +V_S. Note the 0.1μF bypass capacitor on the input side of the power supply. This capacitor should be a ceramic type, and be located as close a physical proximity to the temperature sensor supply pin as practical to reach better filter effect. Minimizing the radio frequency interference (RFI) is especially important for these devices because the temperature sensor operates at very low current and can be exposed to extremely hostile electrical environments. When the sensor operates in an environment with high frequency radiation or high conducted noise, connecting a 0.1 μF ceramic capacitor in parallel with a large value tantalum capacitor (2.2 μF) can provide better noise reduction capability.

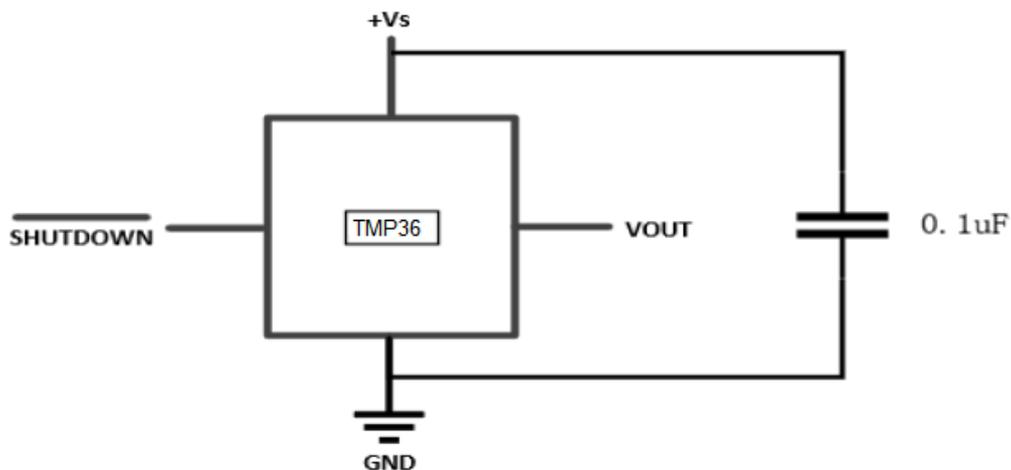
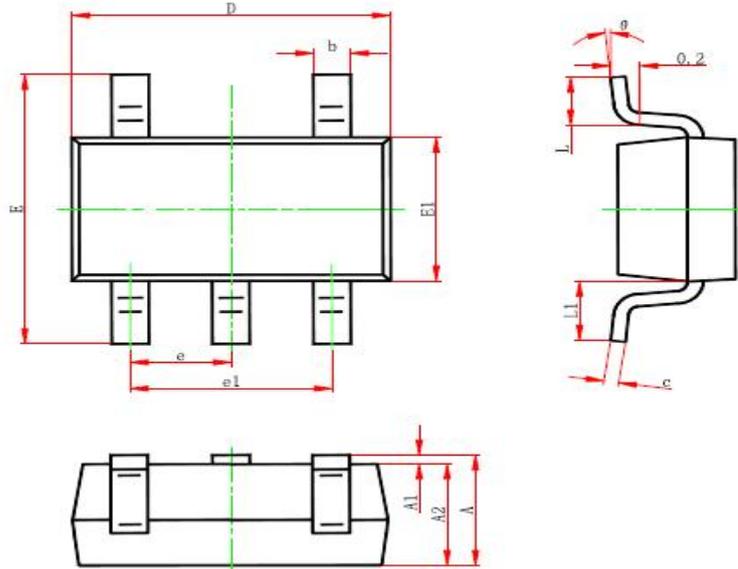


Figure 6. Basic Temperature Sensor Connections

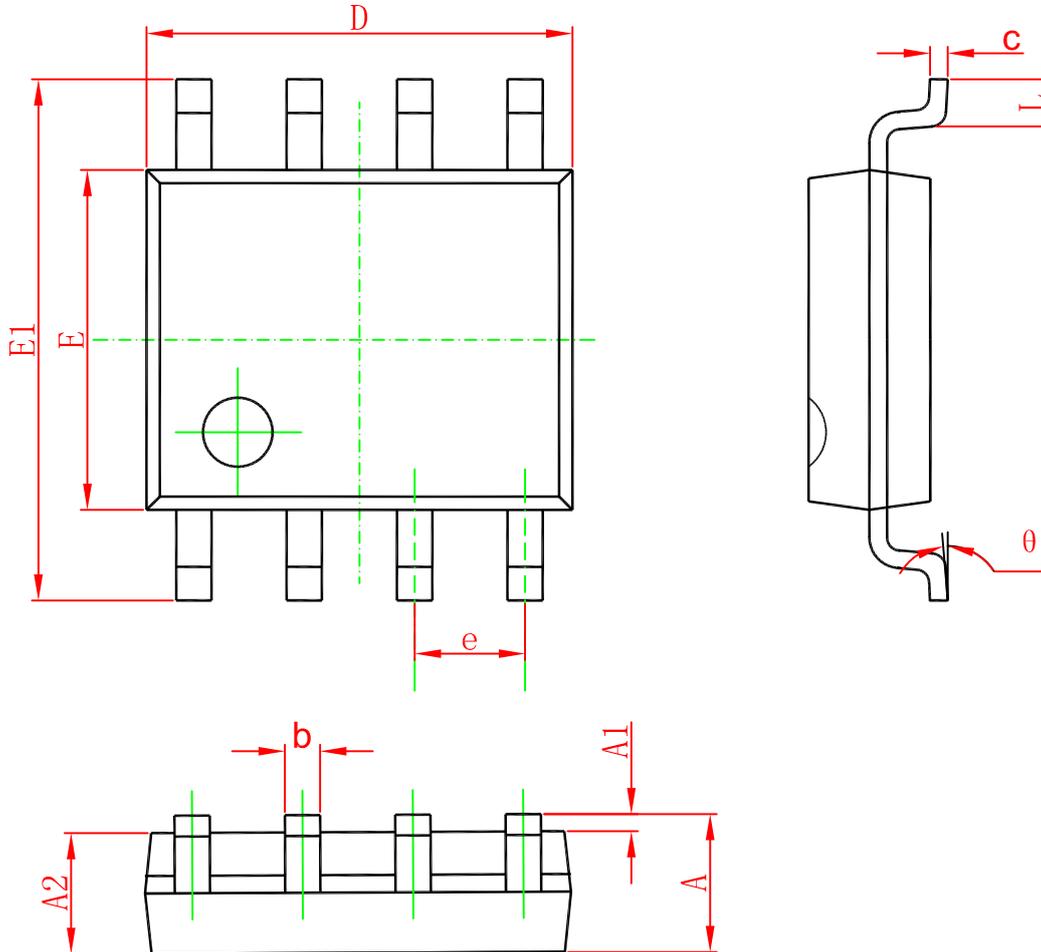
8 Package Information

SOT23-5



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E1 | 1.500 | 1.700 | 0.059 | 0.067 |
| E | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| L1 | 0.600REF. | | 0.024REF. | |
| θ | 0° | 8° | 0° | 8° |

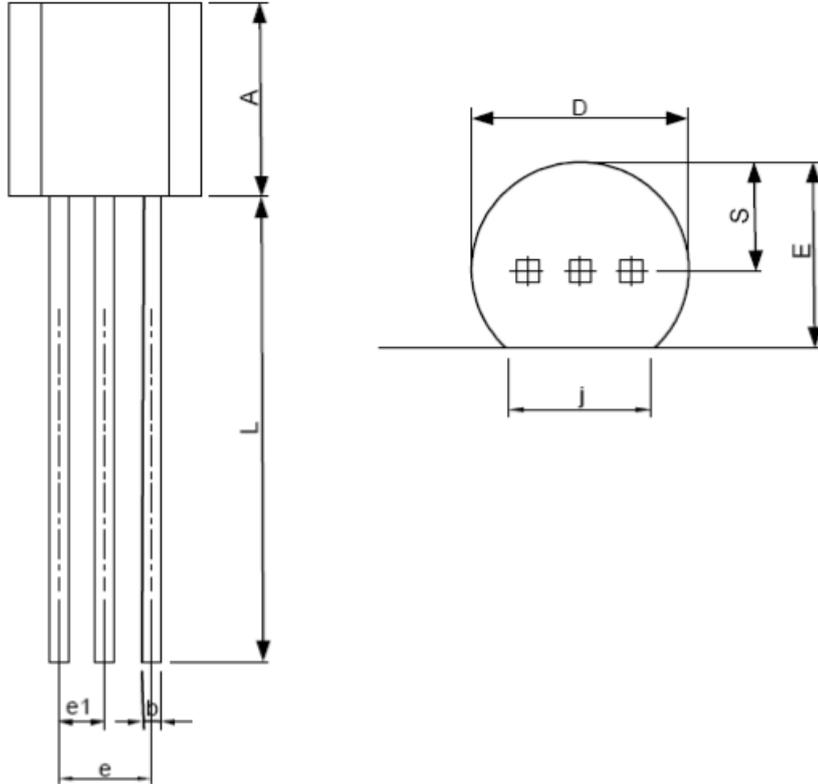
SOP-8



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min | Max | Min | Max |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| θ | 0° | 8° | 0° | 8° |

Package Information

TO-92



| SYMBOL | TO-92 | | | |
|--------|-------------|-------|--------|-------|
| | MILLIMETERS | | INCHES | |
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.32 | 5.33 | 0.170 | 0.210 |
| b | 0.41 | 0.53 | 0.016 | 0.021 |
| D | 4.45 | 5.20 | 0.175 | 0.205 |
| E | 3.18 | 4.19 | 0.125 | 0.165 |
| e | 2.42 | 2.66 | 0.095 | 0.105 |
| e1 | 1.15 | 1.39 | 0.045 | 0.055 |
| j | 3.43 | 4.00 | 0.135 | 0.157 |
| L | 12.70 | 15.00 | 0.500 | 0.591 |
| S | 2.03 | 2.66 | 0.080 | 0.105 |

9 Ordering information

| Order code | Package | Baseqty | Deliverymode |
|---------------|---------|---------|---------------|
| UMW TMP36GT9Z | TO-92 | 1000 | Bulk Bag |
| UMW TMP36GRTZ | SOT23-5 | 3000 | Tape and reel |
| UMW TMP36FSZ | SOP-8 | 2500 | Tape and reel |