

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 TMP36 chip is factory calibrated, so no external calibration is required, and the typical accuracy is $\pm 1^{\circ}\text{C}$ at $+25^{\circ}\text{C}$ and $\pm 2^{\circ}\text{C}$ over the -40°C to $+125^{\circ}\text{C}$ 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 $50\mu\text{A}$, 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 $0.5\mu\text{A}$.

The TMP36 is specified from -40°C to $+125^{\circ}\text{C}$, 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 $10\text{ mV}/^{\circ}\text{C}$.

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

Features

Scale factor: $10\text{ mV}/^{\circ}\text{C}$

- Operation range: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$, up to $+150^{\circ}\text{C}$
- Temperature accuracy: $\pm 2^{\circ}\text{C}$ (typical)
- Temperature linearity: $\pm 0.5^{\circ}\text{C}$ (typical)
- Package: 5-Pin SOT-23 (1.60 mm \times 3.00 mm)
8-Pin VSSOP (3.90 mm \times 4.90 mm)
- Supply range: 2.7V \sim 5.5V
- Low quiescent current:
 - Normal operation: less than $50\mu\text{A}$ -
 - Shutdown mode: less than $0.5\mu\text{A}$
- Stable with large capacitive loads
- Digital output: analog

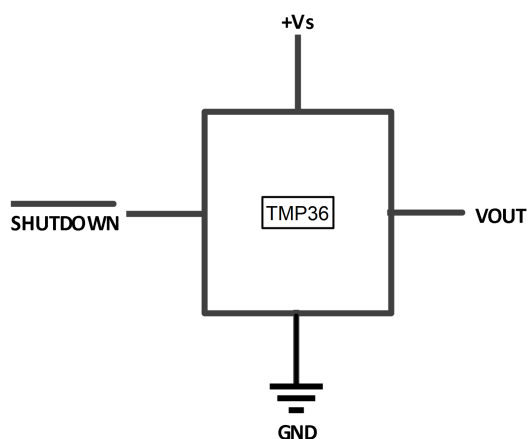


Figure 4. Pin Functions

Table 1. Device Pin Configuration and Functions

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

Specifications

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.

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

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.

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	$\text{m}^\circ\text{C}/\mu\text{A}$
	$105^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$		30	70	$\text{m}^\circ\text{C}/\mu\text{A}$
Linearity			0.5		$^\circ\text{C}$
Long-term stability			0.4		$^\circ\text{C}$
TMP36 output voltage	$A = 25^\circ\text{C}$		750		mV
Output load current		0		50	μA
Short-circuit current				550 μ	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

Typical Performance Characteristics

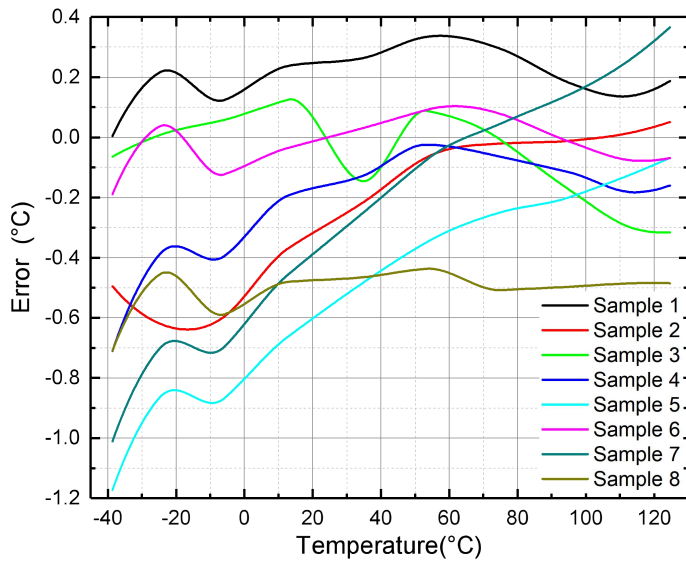


Figure 4. Temperature Error

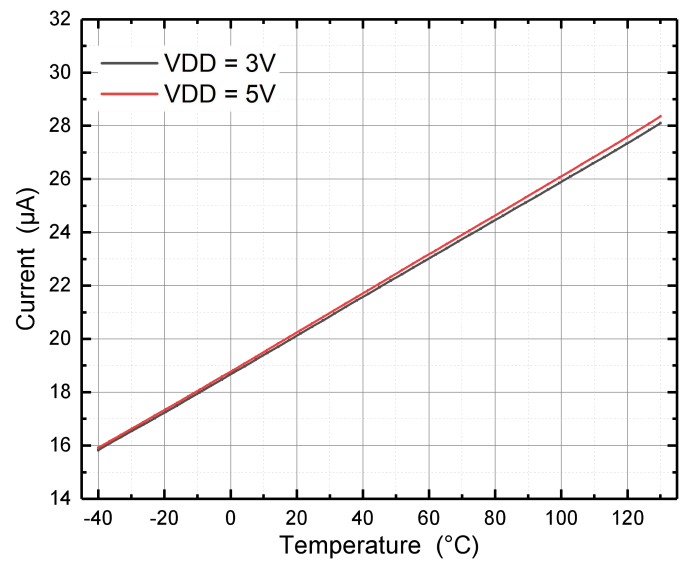


Figure 5. Supply Current versus Temperature

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

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.

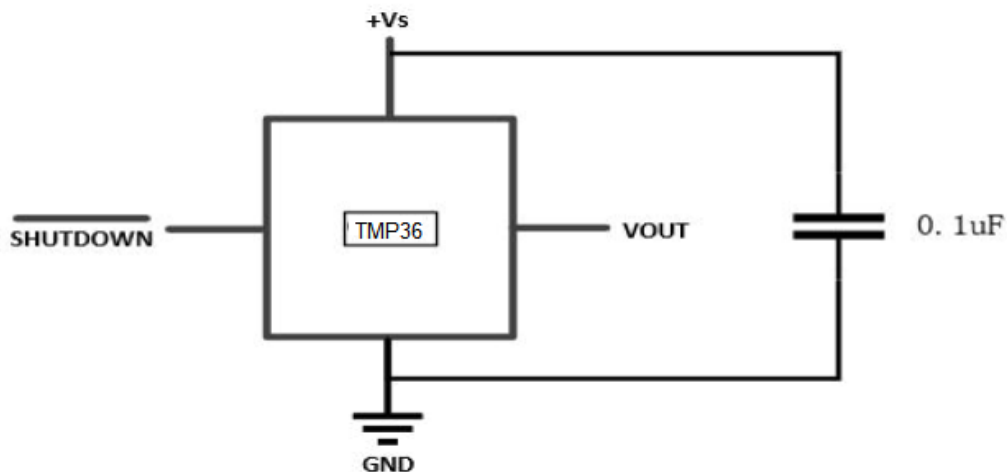
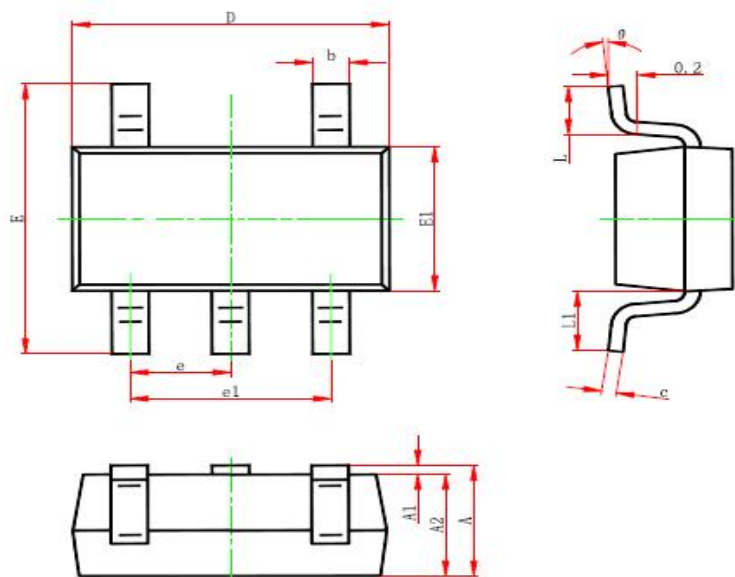


Figure 6. Basic Temperature Sensor Connections

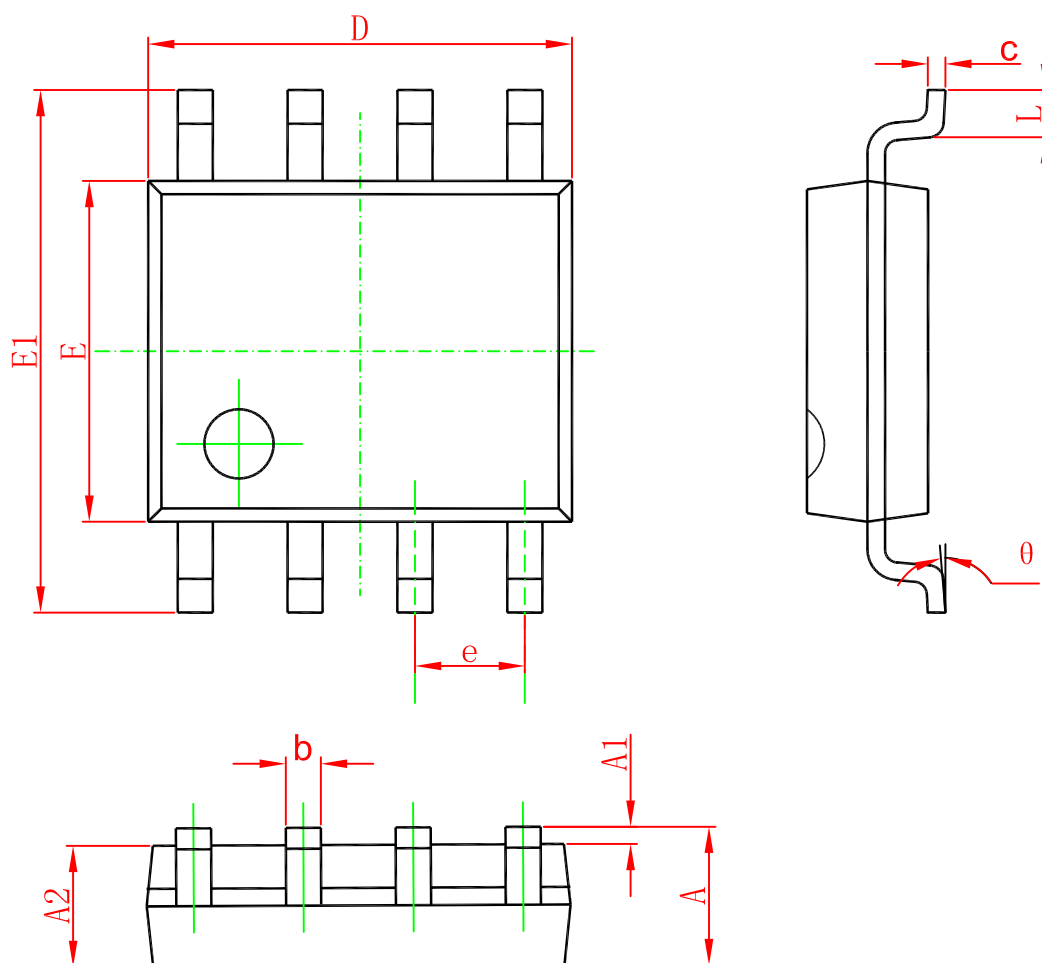
Package Information

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°

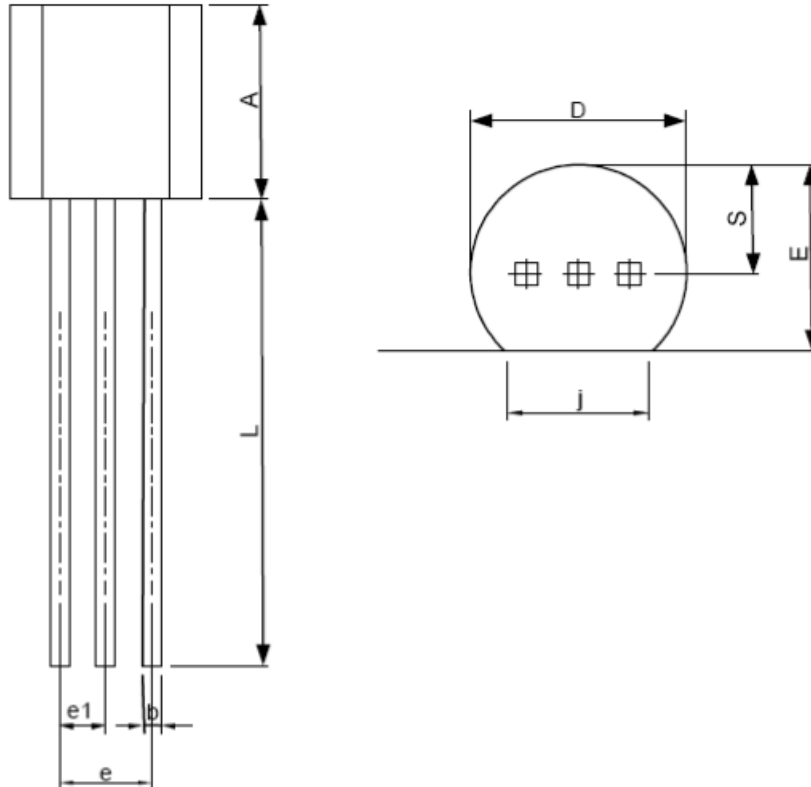
SOP-8



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

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