



2.4V, 10uA ANALOG TEMPERATURE SENSOR

DESCRIPTION

The UTC **TS20** is a low-power analog precision output temperature sensor that operates over a supply voltage range from 2.4V to 5.5V, with a current consumption of only 10µA (max).

This device is particularly well suited for portable applications because minimizing battery cost and maximizing useful battery life are crucial.

The UTC **TS20** provides an analog voltage output proportional to temperature. Accuracy is ±1.5°C (max) at an ambient temperature of +30°C. The temperature error increases linearly and reaches a maximum of ±2.5°C at the temperature range extremes. Self-heating effects are negligible (less than 0.02°C in still air) due to the low current consumption.

The operating temperature range varies with the voltage supply. The UTC **TS20** can be used over a range of -55°C to +130°C with a supply voltage of 2.7V to 5.5V. For applications with a supply voltage of 2.4V, the UTC **TS20** can be used over a temperature range of -30°C to +130°C.

FEATURES

- * Power Supply Voltage: 2.4V ~ 5.5V
- * 2.5°C Accuracy
- * 10uA MAX. Current Consumption
- * Temperature Range -55°C to +130°C
- * Predictable Curvature Error
- * Suitable for Remote Applications

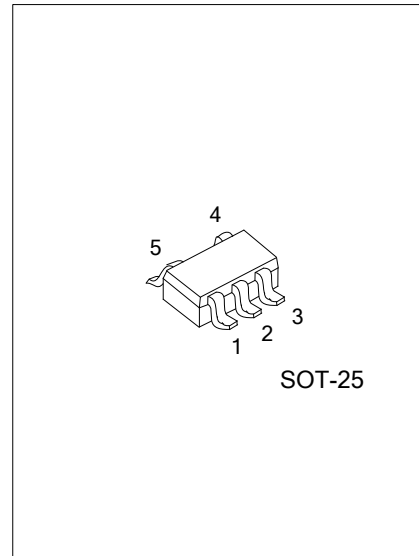
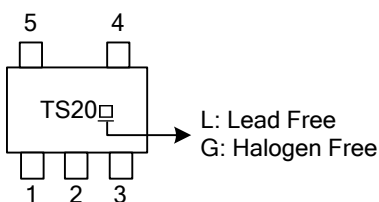
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment					Packing
Lead Free	Halogen Free		1	2	3	4	5	
TS20L-AF5-R	TS20G-AF5-R	SOT-25	N	G	O	V _{CC}	G	Tape Reel

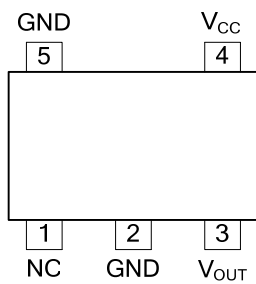
Note: Pin assignment: I:V_{IN} O:V_{OUT} G:GND N: No Connection

<p>TS20L-AF5-R</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel (2) AF5: SOT-25 (3) G: Halogen Free, L: Lead Free</p>
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MARKING



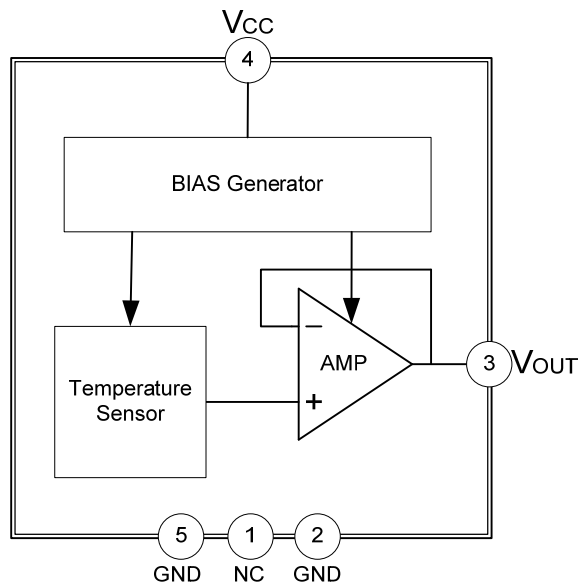
■ PIN CONFIGURATIONS



■ PIN DESCRIPTION

PIN	NAME	TYPE	PIN DESCRIPTION
1	NC	—	No Connection. (Must be connected to ground or left floating)
2	GND	I/O	Ground. (Should be connected to pin 5. May be left floating, if desired)
3	V _{OUT}	O	Voltage Output.
4	V _{CC}	I	Supply Voltage. (Bypass to GND with a 0.1uF capacitor)
5	GND	I/O	Ground.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING (unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply Voltage	V _{CC}	-0.2 ~ +6.5	V
Output Voltage	V _{OUT}	-0.6 ~ (V _{CC} +0.6)	V
Output Current	I _{OUT}	10	mA
Input Current at any pin	I _{IN}	5	mA
Junction Temperature	T _J	+150	°C
Operating Temperature	T _{OPR}	-55 ~ +130	°C
Storage Temperature	T _{STG}	-65 ~ +150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.
 Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ _{JA}	415	°C/W

■ RECOMMENDED OPERATING CONDITIONS (unless otherwise specified)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT
Power Supply Voltage	V _{CC}	2.4		5.5	V

■ ELECTRICAL CHARACTERISTICS (unless otherwise specified)

(V_{CC}=+2.7V, T_A = -55°C to +130°C. Typical values are at T_A = +25°C)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Temperature-to-Voltage Error (Notes1,2)		T _A =+25°C~ +30°C	-1.5		+1.5	°C	
		T _A =+130°C	-2.5		+2.5	°C	
		T _A =+125°C	-2.5		+2.5	°C	
		T _A =+100°C	-2.2		+2.2	°C	
		T _A =+85°C	-2.1		+2.1	°C	
		T _A =+80°C	-2.0		+2.0	°C	
		T _A =0°C	-1.9		+1.9	°C	
		T _A =-30°C	-2.2		+2.2	°C	
		T _A =-40°C	-2.3		+2.3	°C	
		T _A =-55°C	-2.5		+2.5	°C	
Output Voltage	V _{OUT}	T _A = 0°C		1.8639		V	
Nonlinearity (Note3)		T _A = -20°C ~ +100°C		±0.4		%	
Variance from Curve				±1.0		°C	
Sensor Gain (Temperature Sensitivity or Average Slope) (Note4)		T _A = -30°C ~+100°C	-11.4	-11.77	-12.2	mV/°C	
Output Impedance	R _{OUT}	I _L =0uA ~ +16uA			160	Ω	
Load Regulation (Note5)	REG _{LOAD}	I _L =0uA ~ +16uA			-2.5	mV	
Line Regulation (Note6)	REG _{LINE}	V _{CC} =+2.4V ~ +5.0V			+3.3	mV/V	
		V _{CC} =+5.0V ~ +5.5V			+8.8	mV	
Quiescent Current	No Load	I _Q	V _{CC} =+2.4V ~ +5.5V		4.5	7	uA
			V _{CC} =+2.4V ~ +5.0V		4.5	10	uA
			V _{CC} =+2.4V ~ +5.5V		+0.7		uA
Change							
Temperature Coefficient of Quiescent Current	TC _{IQ}			-11		nA/°C	
Power-Down Supply Current	I _{SD}	V _{CC} ≤+0.8V		0.02		uA	

■ ELECTRICAL CHARACTERISTICS (Cont.)

Note1: $V_{OUT} = (-3.88 \times 10^{-6} \times T^2) + (-1.15 \times 10^{-2} \times T) + 1.8639V$ (T = temperature in degrees Celsius)

Note2: Accuracy is defined as the error between the measured and calculated output voltage at the specified conditions of voltage, current, and temperature (expressed in °C).

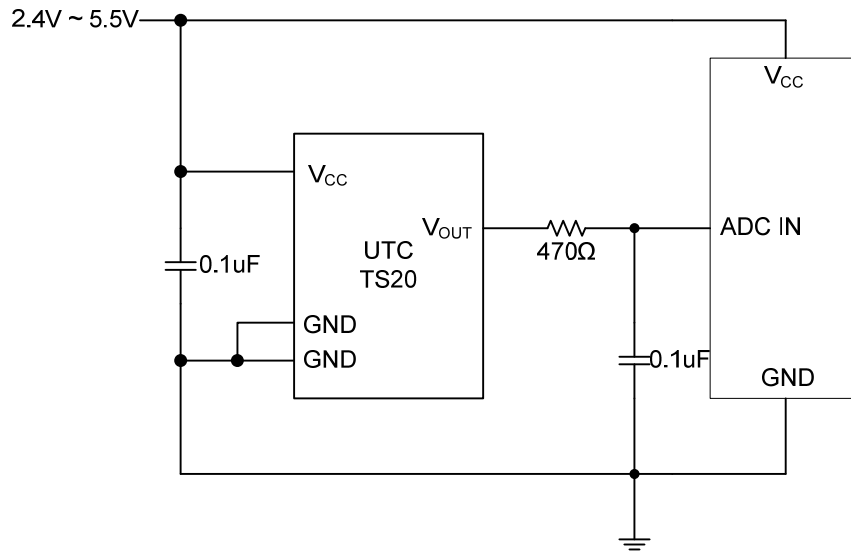
Note3: Nonlinearity is defined as the deviation of the calculated output-voltage-versus-temperature curve from the best-fit straight line, over the temperature range specified.

Note4: Linear Equation: $V_{OUT} = -11.77 \text{ mV/}^\circ\text{C} \times T + 1.860V$

Note5: Load regulation or output impedance specifications apply over the supply voltage range of +2.4V to +5.5V.

Note6: Line regulation is calculated by subtracting the output voltage at the highest supply input voltage from the output voltage at the lowest supply input voltage.

■ TYPICAL APPLICATIONS CIRCUITS



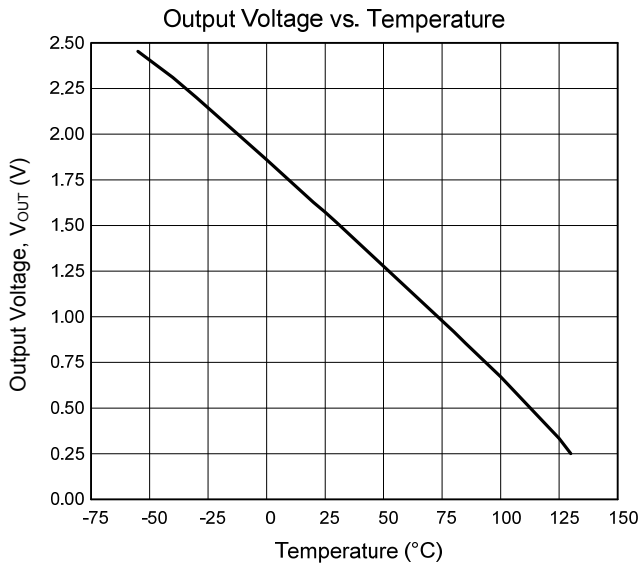
Note: $V_{OUT} = (-3.88 \cdot 10^{-6} \cdot T^2) + (-1.15 \cdot 10^{-2} \cdot T) + 1.8639$ (T=temperature in degrees Celsius)

$$\text{or } T = -1481.96 + \sqrt{2.1962 \cdot 10^6 + \frac{(1.8639 - V_{OUT})}{3.88 \cdot 10^6}}$$

Temperature(T)	Typical V_{OUT}
+130°C	303mV
+100°C	675mV
+80°C	919mV
+30°C	1515mV
+25°C	1574mV

Temperature(T)	Typical V_{OUT}
0°C	1863.9mV
-30°C	2205mV
-40°C	2318mV
-55°C	2485mV

■ TYPICAL CHARACTERISTICS($V_{CC}=+2.7V$, $T_A=25^{\circ}C$, unless otherwise specified)



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