FM50

Low Voltage SOT-23 Temperature Sensor

Features

- Precision Calibrated to ±1°C (Typical)
- Temperature Range: -40°C to 125°C
- Extremely Linear Output Ramp (10mV/°C)
- Output Ramp is Calibrated in Degrees Celsius
- Low Operating Current <130µA (no load)
- Low Self Heating (0.2°C Max in Still Air)
- Operating Voltage Range: +2.7V to 6.0V
- Uses a Single Positive Supply
- Non-linearity ≤ 0.8°C

Applications

- Mobile Phones
- Mobile Communications Terminals
- Computers
- Battery Management
- FAX Machines/Printers/Copiers
- Portable Medical Instruments
- HVAC
- Power Supply Modules
- Disk Drives
- Automotive Control Circuits

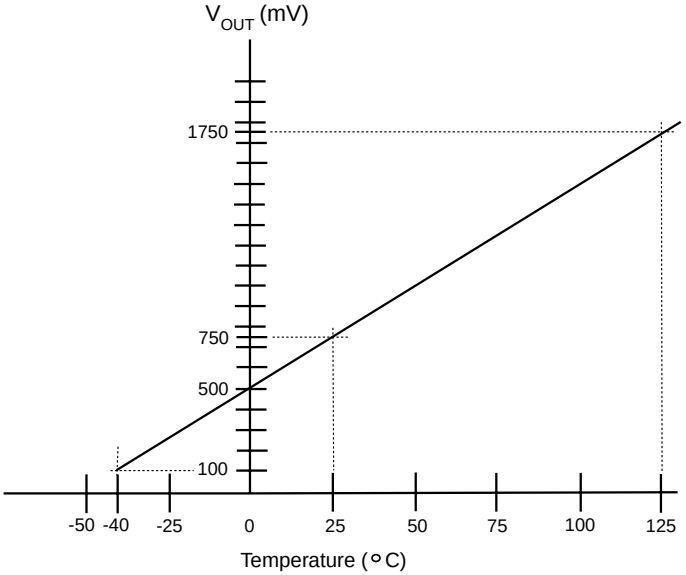
Description

As a high-precision CMOS temperature sensor, the FM50 is a cost-effective solution for high-accuracy low-power temperature monitoring applications. Output voltage versus temperature is extremely linear, with a slope of 10mV/°C. Typically accuracy is ±1°C over a -40°C to 125°C temperature range and ±0.5°C at room temperature.

No calibration is required. All ports are calibrated during assembly and test.

Package is a 3-pin surface mount SOT-23.

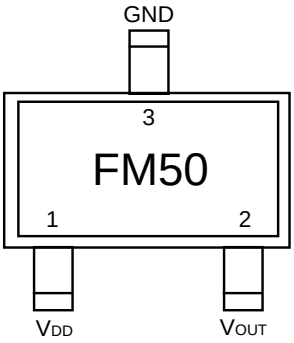
Thermal Response



$$\text{Temperature (°C)} = \frac{V_{OUT} - 500\ \text{mV}}{10\ \text{mV/°C}}$$

FM50 Output Voltage vs. Temperature

Pin Assignments



Pin Descriptions

Pin Name	Pin No.	Type	Function
V_{OUT}	2	Analog Output	**Temperature Sense.** Analog output voltage indicating temperature. V_{OUT} = 500+10T(°C) mV
V_{DD}	1	Power	**Supply Voltage.** 2.4 to 6.0V
GND	3	Power	**Ground.**

Absolute Maximum Ratings[1]

Parameter	Min.	Typ.	Max.	Units
Supply Voltage			+7	V
Output Voltage			V_{DD} + 0.5	V
Output Current			10	µA
Operating Temperature Range[2]	-50		+150	°C
Storage Temperature Range	-60		+150	°C
Lead Soldering Temperature			220	°C
ESD[2] Human Body Model Machine Model			 2000 250	 V V

Notes:

1. Absolute maximum ratings are limits beyond which operation may cause permanent damage to the device. These are stress ratings only; functional operation at or above these limits is not implied.
2. Operating ratings are conditions for which the device is intended to be functional without specific guaranteed performance limits. For guaranteed specifications and test conditions refer to Electrical Characteristics.
3. Human Body Model: 100pF capacitor discharged through a 1.5kOhm resistor into each pin. Machine Model: 200pF capacitor discharged directly into each pin.

Electrical Characteristics[4]

Limits apply for -40°C ≤ T_A ≤ +125°C and V_{DD} = +5.0V unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Accuracy[5]		T_A = +25°C T_A = -40°C (T_{MIN}) T_A = +125°C (T_{MAX})	-1 -3 -3	±0.5 ±1 ±1	+1 +3 +3	°C °C °C
Non-Linearity[6]			-0.8		+0.8	°C
Supply Voltage	V_{DD}		+2.7		+6.0	V
Supply Current	I_S	Output floating; T_A = +25°C			130	µA
Output Sink Capability	I_{OL}	+2.7V < V_{DD} < +6.0V		50		µA
Output Source Capability	I_{OH}	+2.7V < V_{DD} < +6.0V		25		µA
Average Output Slope (Sensor Gain)	A_{OUT}		9.8	10	10.2	mV/°C
Room Temperature Output	V_{OUT25}	T_A = +25°C	740		760	mv

Notes:

4. These specifications are guaranteed only for the test conditions listed.
5. Accuracy (expressed in °C) = Difference between calculated output voltage and measured output voltage. Calculated output voltage = 10mV/°C multiplied by the device's case temperature at specified conditions of temperature, voltage and power supply, added to 500mV.
6. Non-linearity is defined as the deviation of the output-voltage-versus-temperature curve from the best-fit straight line, over the device's rated temperature range.

Typical Performance Characteristics

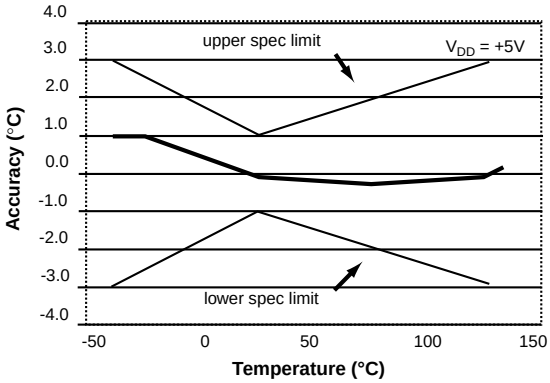


Figure 1. Accuracy vs. Temperature

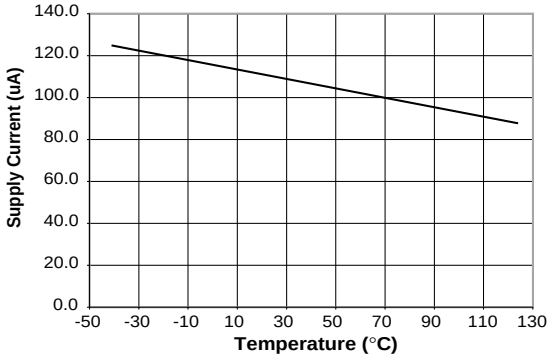


Figure 2. Typical IDD versus Temperature

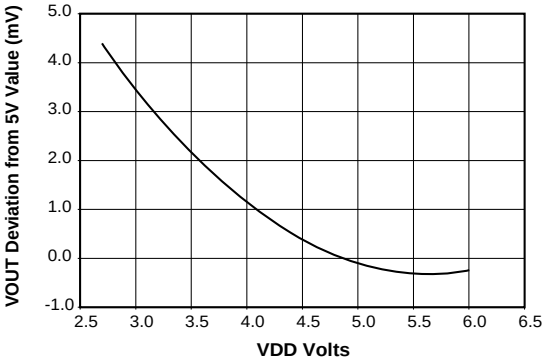
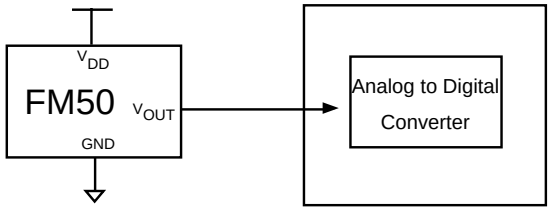


Figure 3. Typical Sensitivity to Supply Voltage

Applications Information

Application Diagram



Mounting

The FM50 can be easily mounted by gluing or cementing it to a surface. In this case, its temperature will be within about 0.2°C of the temperature of the surface it is attached to if the ambient air temperature is almost the same as the surface temperature. If the air temperature is much higher or lower than the surface temperature, the actual temperature of the FM50 die will be at an intermediate temperature between the surface temperature and the air temperature.

To ensure good thermal conductivity, the backside of the FM50 die is directly attached to the GND pin. The lands and traces to the FM50 will, of course, be part of the printed circuit board, which is the object whose temperature is being measured. These printed circuit board lands and traces will not cause the FM50's temperature to deviate from the desired temperature.

Alternatively, the FM50 can be mounted inside a sealed-end metal tube, and can then be dipped into a bath or screwed into a threaded hole in a tank. As with any IC, the FM50 and accompanying wiring and circuits must be kept insulated and dry to avoid leakage and corrosion. This is especially true if the circuit may operate at cold temperatures where condensation can occur. Printed-circuit coatings and varnishes such as Humiseal and epoxy paint or dips can be used to ensure that moisture cannot corrode the FM50 or its connections.

Typical Applications Circuits

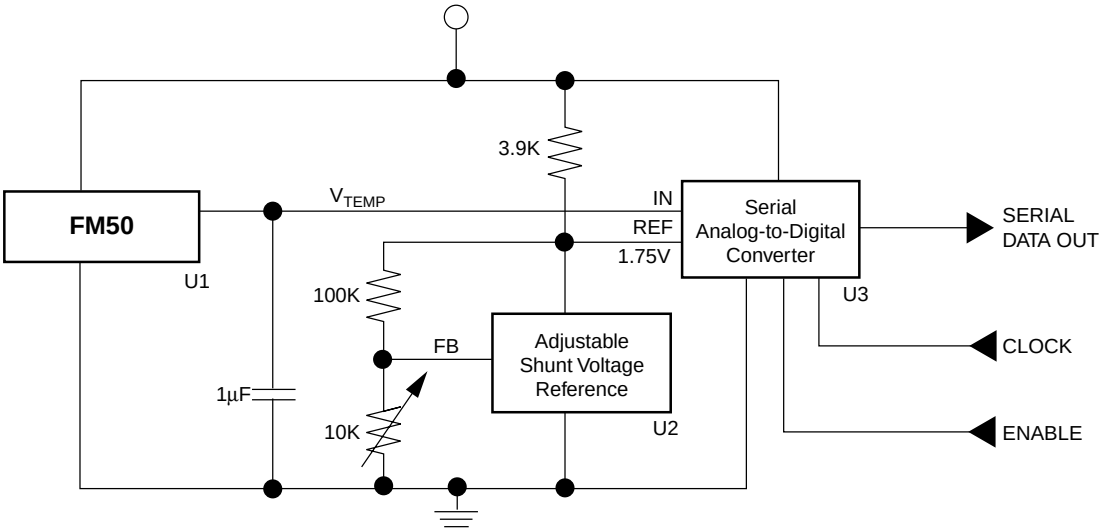


Figure 4. Serial Output Temperature to Digital Converter (Full Scale = +125°C)

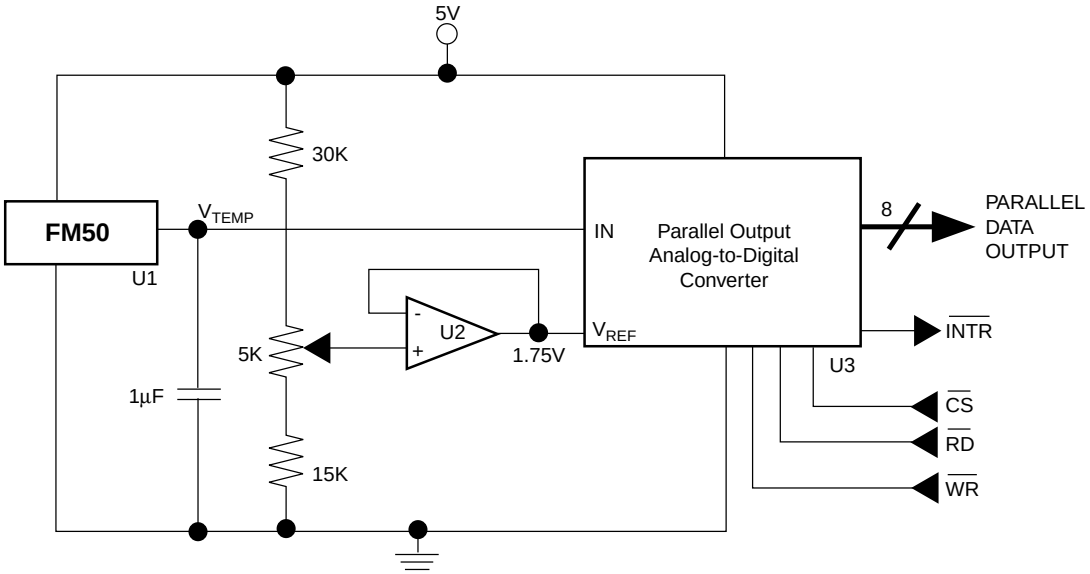


Figure 5. Parallel Output Temperature to Digital Converter (Full Scale = +125°C)

Typical Applications (continued)

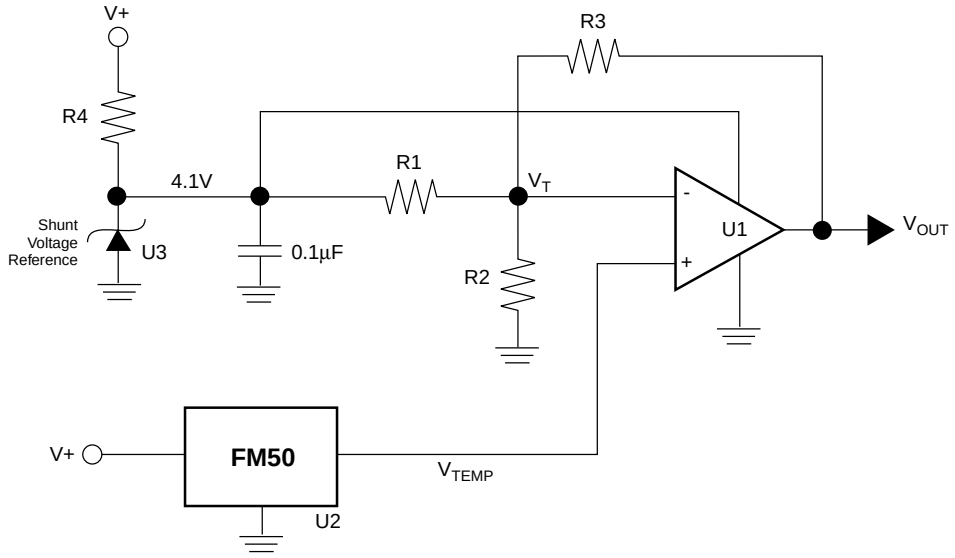
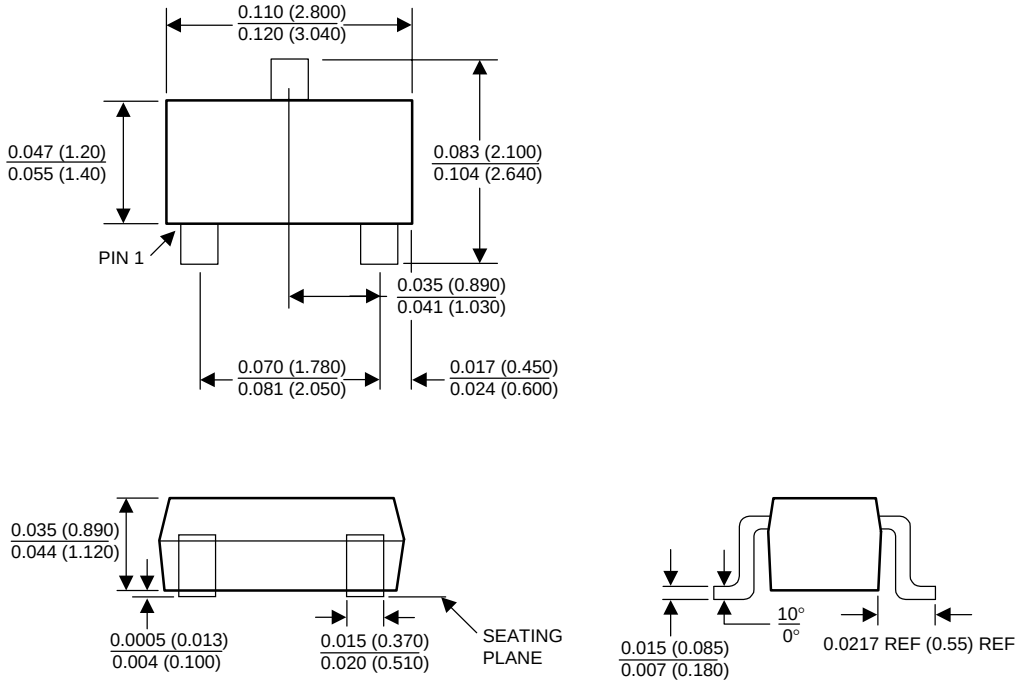


Figure 6. Thermostat/Fan Controller

Mechanical Dimensions inches (millimeters) unless otherwise noted

SOT-23 FS Package Code AU



Ordering Information

Part Number	Package	Temperature Range	Shipping
FM50S3X	3-Pin SOT-23	-40°C to +125°C	Tape and Reel, 3000 units/reel