ANDIGILOG

New Release Specification

Product Specification

General Description

The aSM121 is a high-precision, 3-lead CMOS silicon thermistor in an ultra-small leadless package that provides a cost-effective solution for applications requiring high-accuracy low-power temperature monitoring. The aSM121 functions in a way that is similar to a PTC thermistor. However, it is linear-calibrated, enabling application developers to directly interpret output voltage as temperature without complex compensation for non-linearity.

The aSM121 output voltage ramp has a positive slope of 10mV/°C that is independent of supply voltage. The aSM121 has a guaranteed room temperature (25°C) accuracy of ±1°C. The aSM121 does not require external calibration - each device is calibrated at the factory.

Features

- Precision Calibrated to ±1°C at 25°C
- Temperature Range: -30°C to 125°C
- Extremely Linear Output Ramp: 10mV/°C
- 0°C Output: 0.50V
- Output Ramp is Calibrated to Degrees Celsius
- Low Operating Current: 14μA
- Operating Voltage Range: +2.7 V to +3.6V
- Non-linearity: ≤ 0.8°C
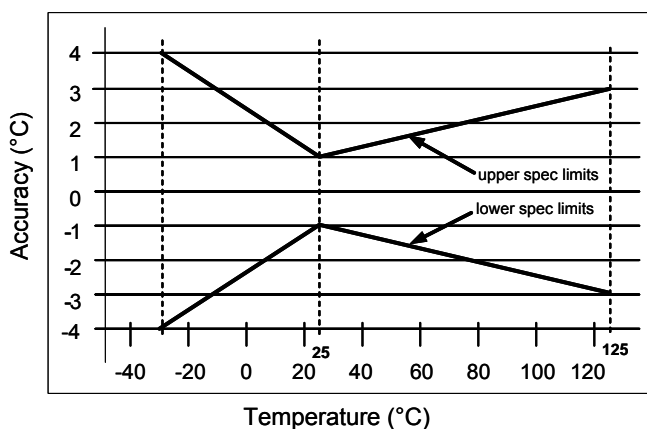- 1.2mm x 1.5mm QFN Package

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

Pin Configuration
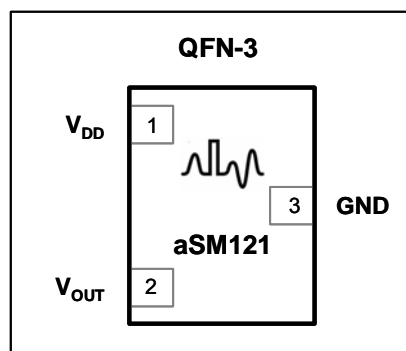
Top view, contacts underneath, actual part marking below

Accuracy vs Temperature

Ordering Information

Part Number	Package	Temperature Range	Part Marking	How Supplied
aSM121Q3	3-Lead QFN	-30˚C to +125˚C	Jm	3000 units on T&R

m – month / year code

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Absolute Maximum Ratings[1]

Parameter		Rating
Supply Voltage		+7V
Output Voltage		V_{DD} + 0.5V
Continuous Current, any terminal		10mA
Storage Temperature Range		-60°C to +150°C
ESD[2]	Human Body Model	4000V
	Machine Model	400V
Thermal Resistance - Θ_{JA}	QFN-3	TBD
Lead Temp		260°C

Notes:
1. Absolute maximum ratings are limits beyond which operation may cause permanent damage to the device. These are stress ratings only; functional operations at or above these limits is not implied.
2. Human Body Model: 100pF capacitor discharged through a 1.5kΩ resistor into each pin. Machine Model: 200pF capacitor discharged directly into each pin.
3. These specifications are guaranteed only for the test conditions listed.

Recommended Operating Ratings

Symbol	Parameter	Min	Max	Units
V_{DD}	Supply Voltage	+2.7	+3.6	V
V_{OUT}	Output Voltage	0	1.8	V
T_A	Operating Temperature Range	-30	+125	°C

Electrical Characteristics[3]

Limits apply for $-40°C \leq T_A \leq +125°C$ and $V_{DD} = +3.0V$ unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Accuracy[4]		T_A=+25°C	-1	±0.5	+1	°C
		T_A=-30°C (T_{MIN})	-4	±1	+4	°C
		T_A=+125°C (T_{MAX})	-3	±1	+3	°C
Non-linearity[5]				±0.8		°C
Supply Current - Output floating	I_{DD}	T_A=+25°C		14		
		$-30°C \leq T_A \leq +125°C$			15	μA
Output Sink Capability[6]	I_{OL}	+2.7V < V_{DD} < +3.6V	—	25		μA
Output Source Capability[6]	I_{OH}	+2.7V < V_{DD} < +3.6V		200		μA
Average Output Slope (Sensor Gain)	A_{OUT}			10		mV/°C
Zero-Degree Output Voltage	V_{OUT0}	T_A=+0°C		500		mV
Room Temp Output Voltage	V_{OUT25}	T_A=+25°C		750		mV
Self Heating[7]		QFN-3		0.025		°C

Notes:
4. Accuracy (expressed in °C) = Difference between calculated output voltage and measured output voltage. Calculated output voltage = 10mV/°C multiplied by device's case temperature at specified conditions of temperature, voltage and power supply with an offset of 500mV (see Fig. 1).
5. 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.
6. Lowest output current should be targeted; higher currents result in more self-heating of the device.
7. Max Self Heating = Θ_{JA} x (V_{DD} x I_{DD}). Assumes a capacitive load.
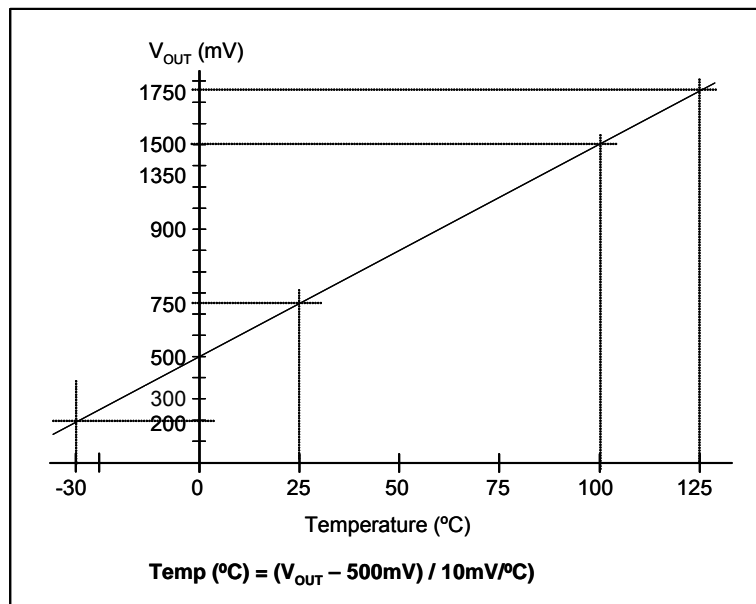
Figure 1. aSM121 Output Voltage vs. Temperature

Mounting

The aSM121 package provides good thermal conductivity to the surface to which it is soldered. It's low mass allows it to respond quickly to changes in board temperature. In this case, its temperature will be within about 0.02°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 aSM121 die will be at an intermediate temperature between the surface temperature and the air temperature.

To ensure good thermal conductivity, the backside of the aSM121 die is directly attached to the GND pin. The lands and traces to the aSM121 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 aSM121's temperature to deviate from the desired temperature.

Alternatively, the aSM121 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 aSM121 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 aSM121 or its connections.

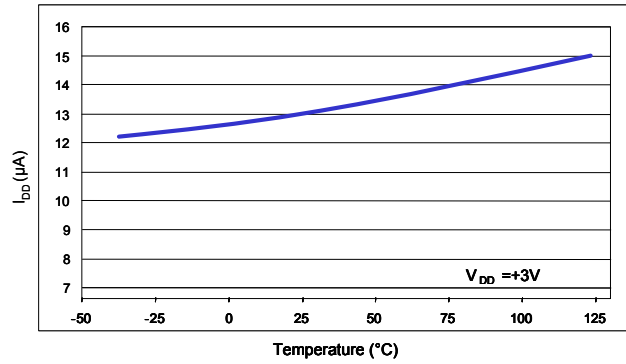July 2005 - 70A04006

Typical Performance Characteristics

Figure 2. aSM121 Current vs Temperature

Typical Applications
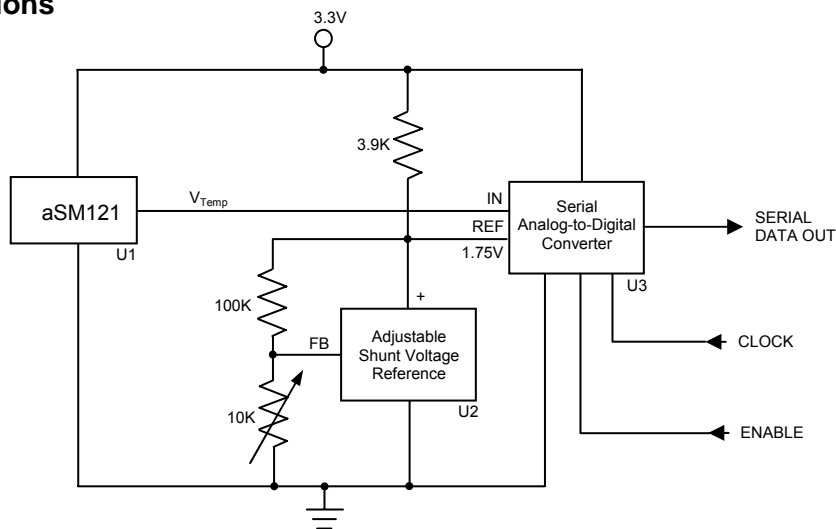
Figure 3. Serial Output Temperature to Digital Converter (Full Scale = +125°C)

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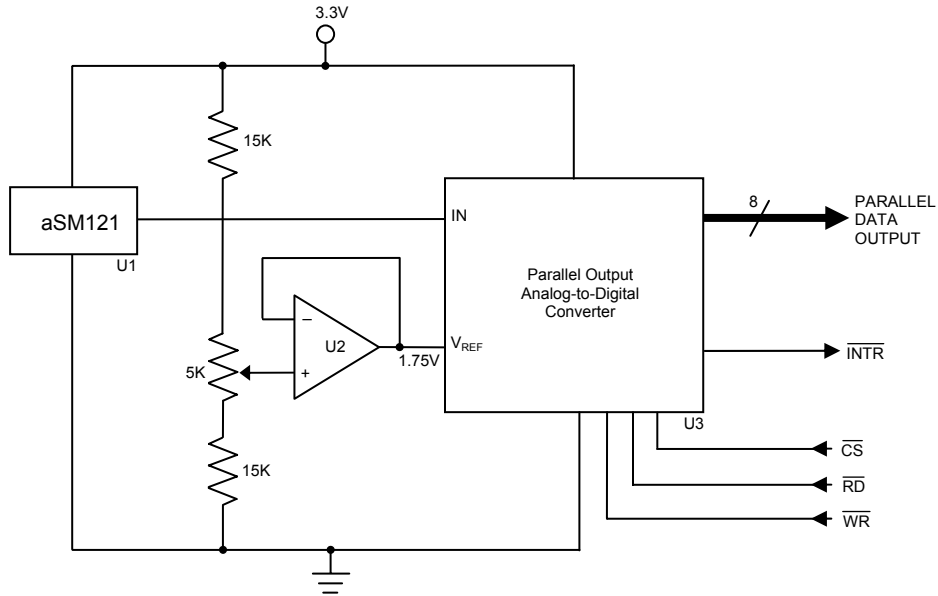## Typical Applications (cont.)

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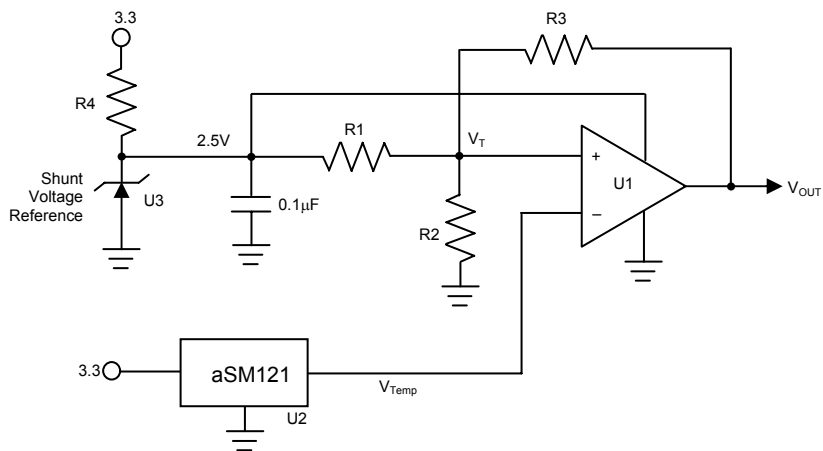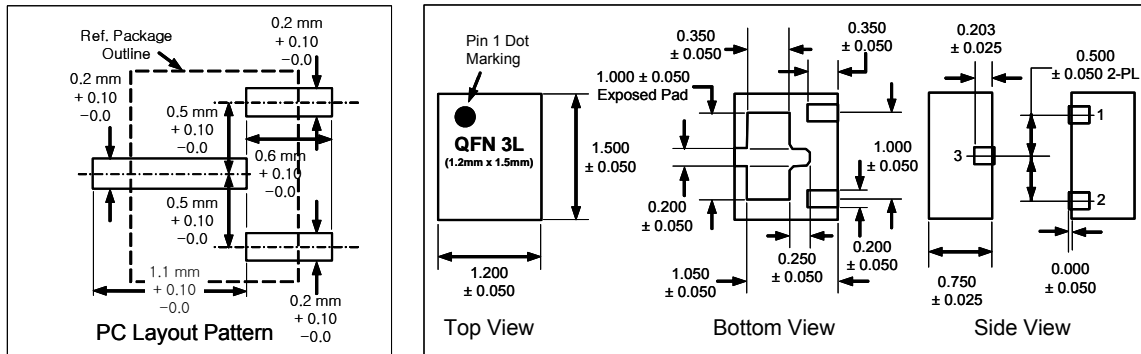

Figure 5. Thermostat / Fan Controller

QFN-3 Package Dimensions and PC Layout Pattern

Note: Solder mask is recommended to be 0.07mm larger than PC lands.
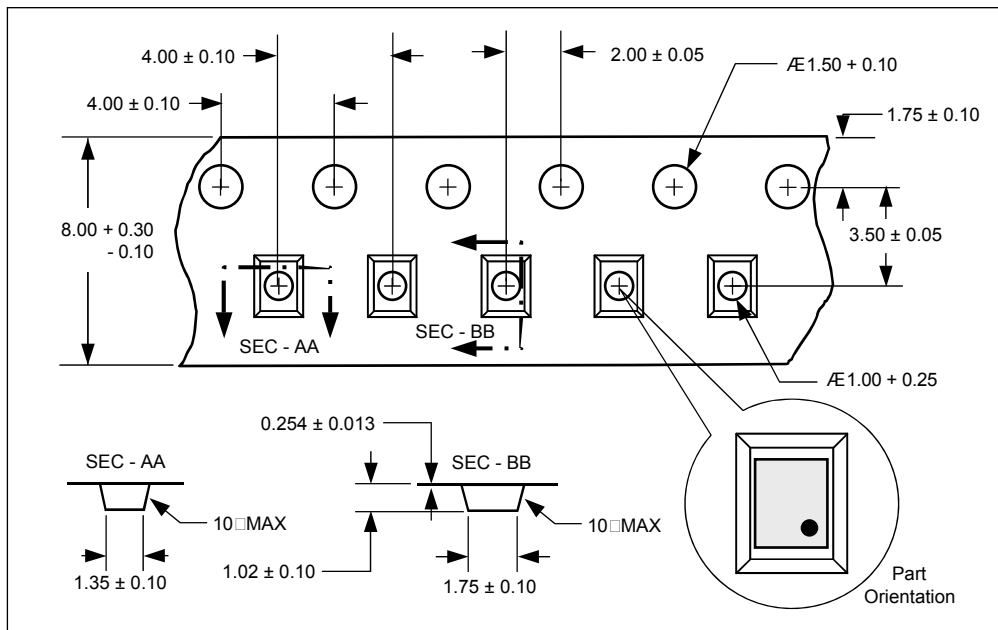
Figure 6. Package Outline

Tape and Reel Data

Figure 7. Tape Dimensions and Part Orientation

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Data Sheet Classifications

Preliminary Specification

This classification is shown on the heading of each page of a specification for products that are either under development(design and qualification), or in the formative planning stages. Andigilog reserves the right to change or discontinue these products without notice.

New Release Specification

This classification is shown on the heading of the first page only of a specification for products that are either under the later stages of development(characterization and qualification), or in the early weeks of release to production. Andigilog reserves the right to change the specification and information for these products without notice.

Fully Released Specification

Fully released datasheets do not contain any classification in the first page header. These documents contain specification on products that are in full production. Andigilog will not change any guaranteed limits without written notice to the customers. Obsolete datasheets that were written prior to January 1, 2001 without any header classification information should be considered as obsolete and non-active specifications, or in the best case as Preliminary Specifications.

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Notes:

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