

# 8-Bit CMOS Digital Temperature Sensor with ADC Output

## FEATURES

**8-Bit ADC with 1ms Conversion Times**  
**On-Chip Temperature Sensor:  $-20^{\circ}\text{C}$  to  $+108^{\circ}\text{C}$**   
**Over-temperature Indicator**  
**Automatic Power-Down at the End of a Conversion**  
**Wide Operating Supply Range: 2.7 V to 5.5 V**  
**Parallel or Serial Digital Output for SoC Integration**

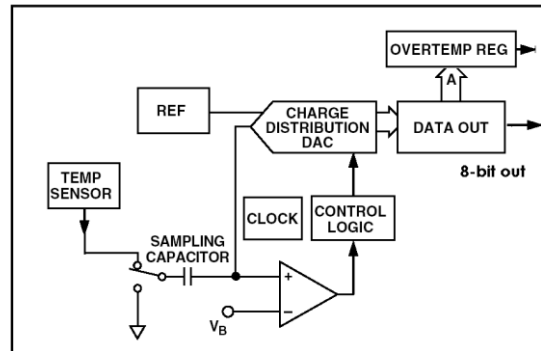
## APPLICATIONS

**Personal Computers**  
**Ambient Temperature Monitoring**  
**Battery-Charging Applications**  
**Industrial Process Control**  
**Automotive**

## GENERAL DESCRIPTION

This analog block has an 8-bit single channel ADC with an on-chip temperature sensor that can operate from a single 2.7 V to 5.5 V power supply. The ADC is a 1ms successive approximation converter. Within the block, a temperature sensor, a clock oscillator and a sample-and-hold are present. When a conversion is initiated, the resulting ADC code at the end of the conversion gives a measurement of the chip or ambient temperature ( $\pm 3^{\circ}\text{C}$  @  $25^{\circ}\text{C}$  un-calibrated or  $\pm 1^{\circ}\text{C}$  calibrated). On-chip register can be programmed to provide an over-temperature indicator, which becomes active when a programmed limit is exceeded.

## FUNCTIONAL BLOCK DIAGRAM

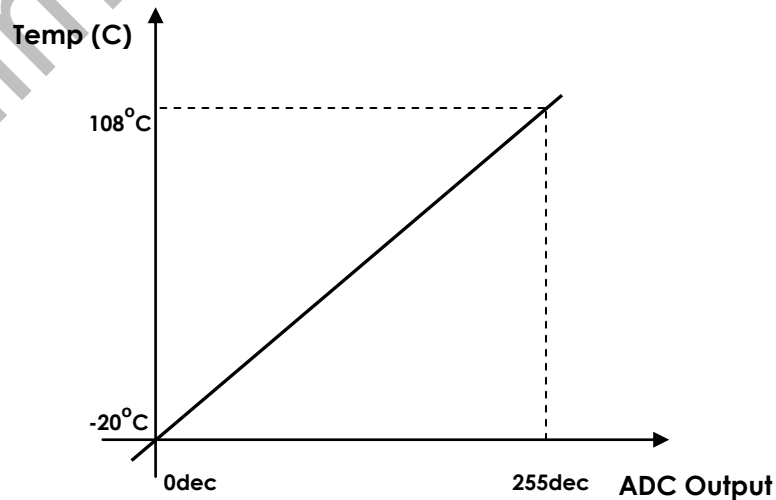


**SPECIFICATIONS (VDD = 2.8 V to 5.5 V, GND = 0 V, unless otherwise noted.)**

Parameter	Value	Unit
<b>DC ACCURACY</b>		
Resolution	8	Bits
Differential Nonlinearity	±1	LSB (typical)
Relative Accuracy	±1	LSB (typical)
Gain Error	±5	LSB (typical)
Offset Error	±5	LSB (typical)
<b>TEMPERATURE SENSOR</b>		
Error @ 25C	±3 or ±1 (calibrated)	°C (typical)
Temperature Resolution	0.5	°C/LSB (typical)
<b>CONVERSION RATE</b>		
Conversion Time	1	ms (typical)
<b>DIGITAL OUTPUTS</b>		
Output Low Voltage, VOL	GND ± 0.1	V
Output High Voltage, VOH	VDD ± 0.1	V
<b>POWER REQUIREMENTS</b>		
VDD	2.8 - 5.5	V
IDD	300	uA (typical)
IDD power down	<1	uA

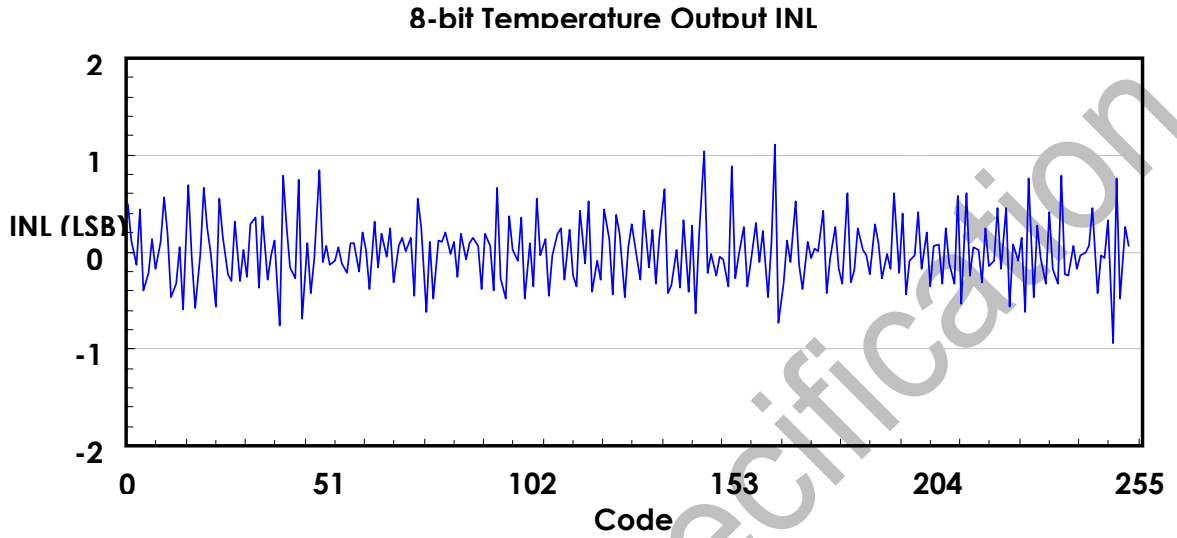
**TEMPERATURE MEASUREMENT**

The typical transfer characteristic of the temperature sensor is shown below. The results of the 8-bit conversion can be converted to degree Celsius by using 0.5°C/LSB and offset with -20°C. Ideal temperature versus ADC output characteristics:



## TYPICAL MEASURED ERROR

Below is a typical measured silicon INL error of the ADC and temperature measurement:



## TIMING DIAGRAM OF THE DIGITAL OUTPUT

