21.7 ADC Conversion Result

After the conversion is complete (ADIF is high), the conversion result can be found in the ADC Result Registers (ADCL, ADCH).

For single ended conversion, the result is

$$ADC = \frac{V_{IN} \cdot 1024}{V_{REF}}$$

where V_{IN} is the voltage on the selected input pin and V_{REF} the selected voltage reference (see Table 21-3 on page 262 and Table 21-4 on page 263). 0x000 represents analog ground, and 0x3FF represents the selected reference voltage minus one LSB.

21.8 Temperature Measurement

The temperature measurement is based on an on-chip temperature sensor that is coupled to a single ended ADC8 channel. Selecting the ADC8 channel by writing the MUX3..0 bits in ADMUX register to "1000" enables the temperature sensor. The internal 1.1V voltage reference must also be selected for the ADC voltage reference source in the temperature sensor measurement. When the temperature sensor is enabled, the ADC converter can be used in single conversion mode to measure the voltage over the temperature sensor.

The measured voltage has a linear relationship to the temperature as described in Table 21-2. The voltage sensitivity is approximately 1 mV/°C and the accuracy of the temperature measurement is +/- 10°C.

Table 21-2. Temperature vs. Sensor Output Voltage (Typical Case)

Temperature / °C	**-45°C**	**+25°C**	**+85°C**
Voltage / mV	242 mV	314 mV	380 mV

The values described in Table 21-2 are typical values. However, due to the process variation the temperature sensor output voltage varies from one chip to another. To be capable of achieving more accurate results the temperature measurement can be calibrated in the application software. The software calibration requires that a calibration value is measured and stored in a register or EEPROM for each chip, as a part of the production test. The software calibration can be done utilizing the formula:

$$T = \{ [(ADCH << 8) \mid ADCL] - T_{OS} \} / k$$

where ADCn are the ADC data registers, k is a fixed coefficient and T_{OS} is the temperature sensor offset value determined and stored into EEPROM as a part of the production test.