

INTERNAL TEMPERATURE SENSING



In SCA61T-, SCA100T-, SCA103T-, SCA1000-, and SCA1020-Series products

OBJECTIVE

To explain how to use VTI's products with internal temperature compensation.

DESCRIPTION OF APPLICATION EXAMPLES

Due to cross dependency of various physical phenomena, the perfect sensor is more or less impossible to design and manufacture. In MEMS sensors, temperature dependency is the main factory which also relates to VTI's products, even though the sensing elements are designed to minimise this problem (see Figure 1.).

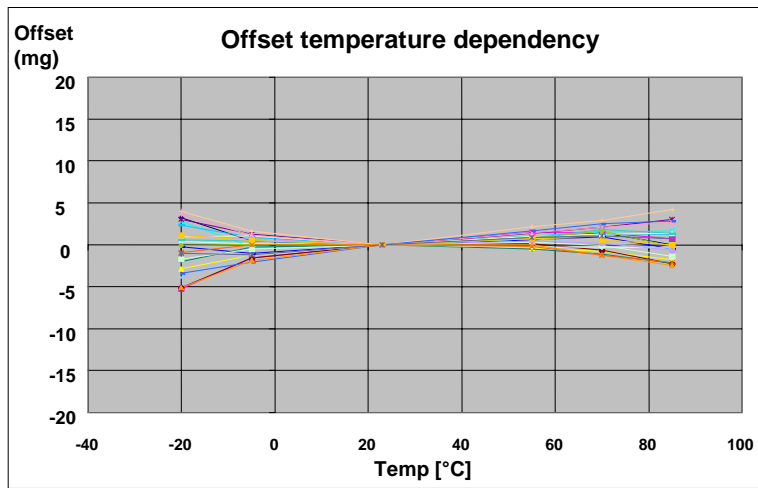


Figure 1. The nominal offset temperature dependency of SCA61T and SCA100T

SOLUTION

Some of VTI's sensors (SCA61T-, SCA100T-, SCA103T-, SCA1000-, and SCA1020- Series) have an internal temperature sensor, which is used for internal offset compensation. The signal is also available for additional external compensation. The temperature sensor can be accessed via the SPI interface and the temperature reading is an 8-bit word (0...255). The transfer function is expressed with the following formula:

$$T_{real} = \frac{Counts - 197}{-1.083} \tag{1}$$

where *Counts* is the measured data and *T_{real}* is the actual temperature in [°C].

The transfer function is very linear and the sensitivity accuracy is better than $-1.082 \text{ counts/}^\circ\text{C} \pm 10\%$, while absolute accuracy is in range of $\pm 15 \text{ }^\circ\text{C}$. See table 1.

SPI COMMAND

To read temperature information from the sensor's ASIC, use the following command:

Command	Command format	Description:
RWTR	00001000	Read temperature data register

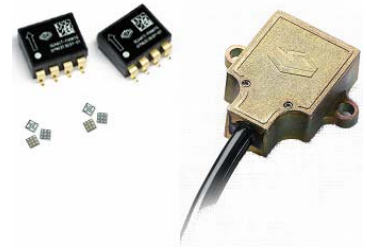
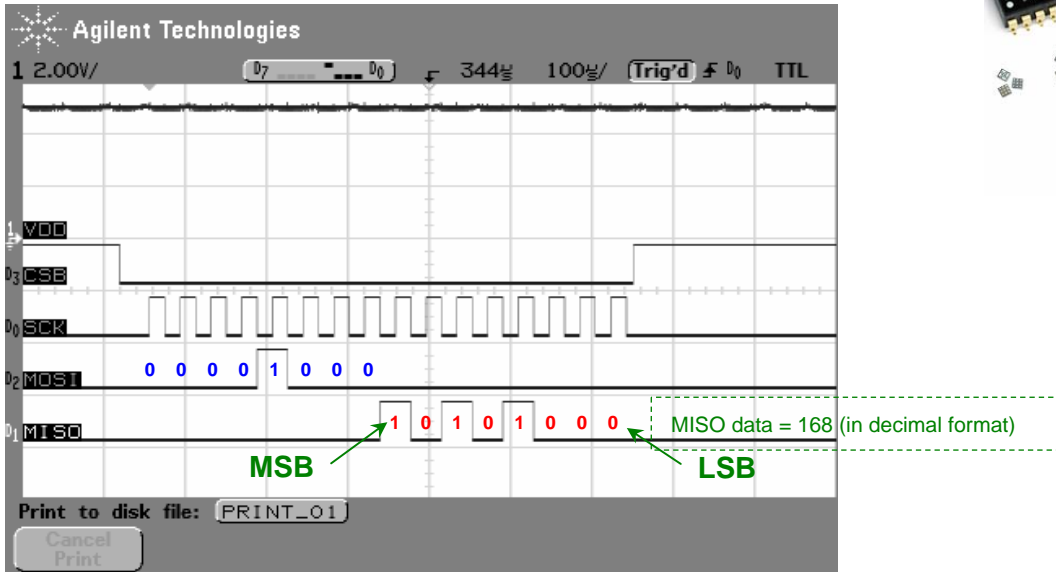


Figure 2. Command and data transmission over the SPI

ACCURACY CONSIDERATIONS

Table 1. Temperature sensor measurement

Temp	Digital output @ Temp [Counts]							Slope [Count/°C]
	-40	-25	-5	23	70	85	125	
Min	231	218	198	167	116	97	53	-1.128
Max	249	235	213	183	133	115	71	-1.038
Mean	238.92	225.47	204.05	173.34	124.16	105.24	60.97	-1.083
Stdev	2.70	2.70	2.79	2.99	3.53	3.37	3.64	0.019
+4 Sigma	249.73	236.28	215.21	185.31	138.28	118.71	75.55	-1.008
- 4 Sigma	228.11	214.66	192.88	161.36	110.03	91.78	46.39	-1.157

By using the temperature information for 2nd order compensation it is possible to achieve less than 0,1° offset error over – 5 °C ... +70 °C with SCA61T-, SCA100T- and SCA103T-series. The 2nd order temperature compensation requires offset temperature dependency data over compensated temperature range. Customers can measure the offset temperature dependency themselves, or the data can be purchased from VTI.

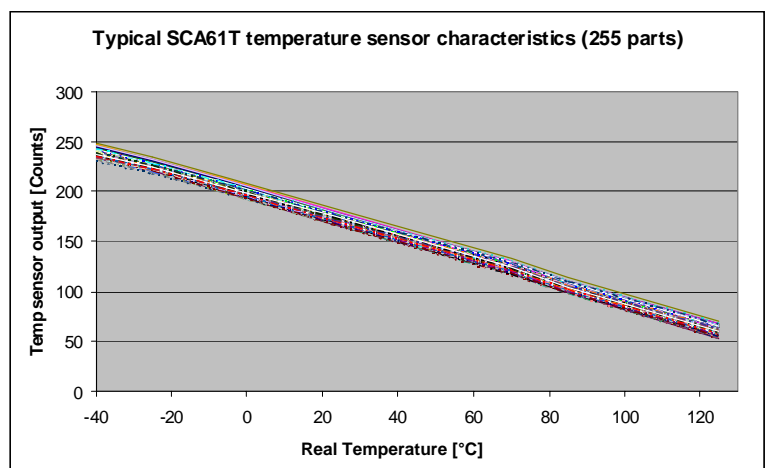


Figure 3. SCA61T temperature sensor characteristics

4 Oct 2005 VTI Technologies reserves all rights to modify this document without prior notice.

VTI Technologies Oy
 Myllynkivenkuja 6
 P.O.Box 27
 FIN-01621 Vantaa
 Finland
 Tel. +358 9 8791 81
 Fax. +358 9 8791 8791
 sales@vti.fi

VTI Technologies Oy
 Frankfurt Branch
 Rennbahnstr. 72-74
 D-60528 Frankfurt am Main
 Germany
 Tel. +49 69 6786 880
 Fax +49 69 6786 8829
 sales.de@vti.fi

VTI Technologies, Inc.
 One Park Lane Blvd.
 Suite 804 - East Tower
 Dearborn, MI 48126
 USA
 Tel. (313) 425 0850
 Fax (313) 425 0860
 sales@vfittechnologies.com

