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Application Note – AC10-003
Zero Stability of AC3050

This Application Note presents information on the zero stability of the AC3050 series die. While specific to the AC3050 die, the results are extendable to the AC3030 die series as well. This document should only be used as a design guide. Performance in high vibration environments should be verified.

The Acuity low pressure die is specifically designed to eliminate zero drift and zero “flyers”. A flyer is an atypical part with high drift that initially passes tests but subsequently continues to drift. The design steps include a series of fully dry silicon etch (plasma and DRIE) processes, elimination of Pyrex glass constraints, and additional structures and thin-films in the device.

Zero Warm-up Effect Warm-up

One of the key issues with a pressure die is its stability after turn-on. The effect may be due to the device, the electronics to which it is attached, the pressure environment in which it is operating as well as sensor or electronic warm-up. All of these are combined in the error tested here to produce a worse case.

Several different types of tests can be performed from just monitoring the output at room temperature to monitoring the parts when operated at an elevated temperature to observing changes in offset before and after a temperature stress.

Three separate tests are reported here:

- Offset over 0.8 hours at room temperature
- Offset change over 19 hours at 85 C
- Offset change between initial tests at Room Temperature and Final Tests after 120 hours at 85 C

Offset over 0.8 hours at room temperature:

Figure 1 shows the output change for 20 modules of 10 mBar parts over a 2900 second (0.8 hour) run at room temperature.

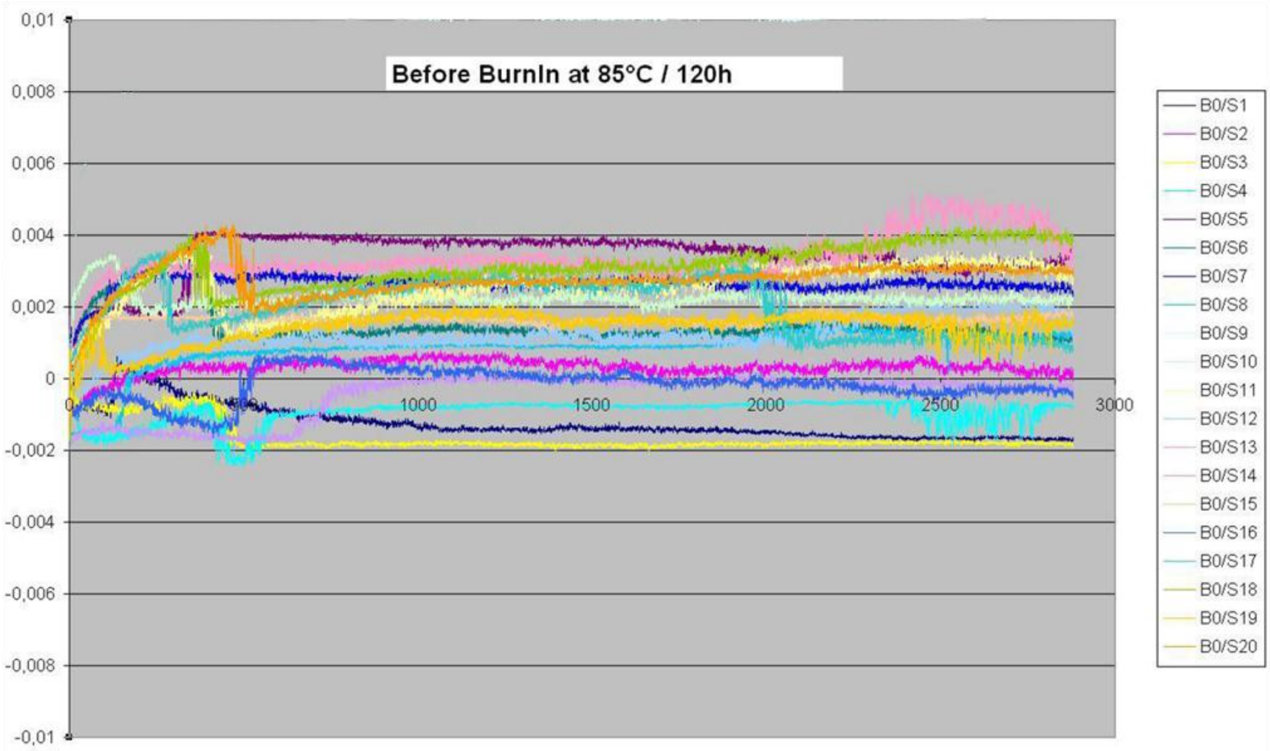

FIGURE 1- OUTPUT CHANGES OVER 2900 SECONDS AT ROOM TEMPERATURE AFTER TURN-ON.

All parts were measured in module with the sensor calibrated to give a nominal 0.500 volt output. Full-scale output is 4.000 Volts. Thus 0.004 volt change shown in the output from the initial value represents less than 0.1%. One part had a 0.25% change. However, the rest are within a +0.1% FS to -0.05% FS change.

These results were based on the first module builds. Additional tests, in progress, indicate that the results on subsequent lots are as good or better.

Effect of Elevated temperature on Zero Stability

A classic stress test for sensors is to power the sensor while elevating the temperature for an extended period of time. Piezoresistive sensors that are going to drift will start to exhibit issues in the first few hours. Typical automotive acceptance tests on a new product design involve powered testing at 125 C for 168 hours. A less than a 100 microvolt change for a nominal full-scale output of 60 mV would indicate passing 1000 hour testing. While the 168 hours testing is needed to assure passing the 1000 hour test, testing of the part for typically 18 to 24 hours usually gave an indication on if there was an issue and is a good indication of subsequent stability.

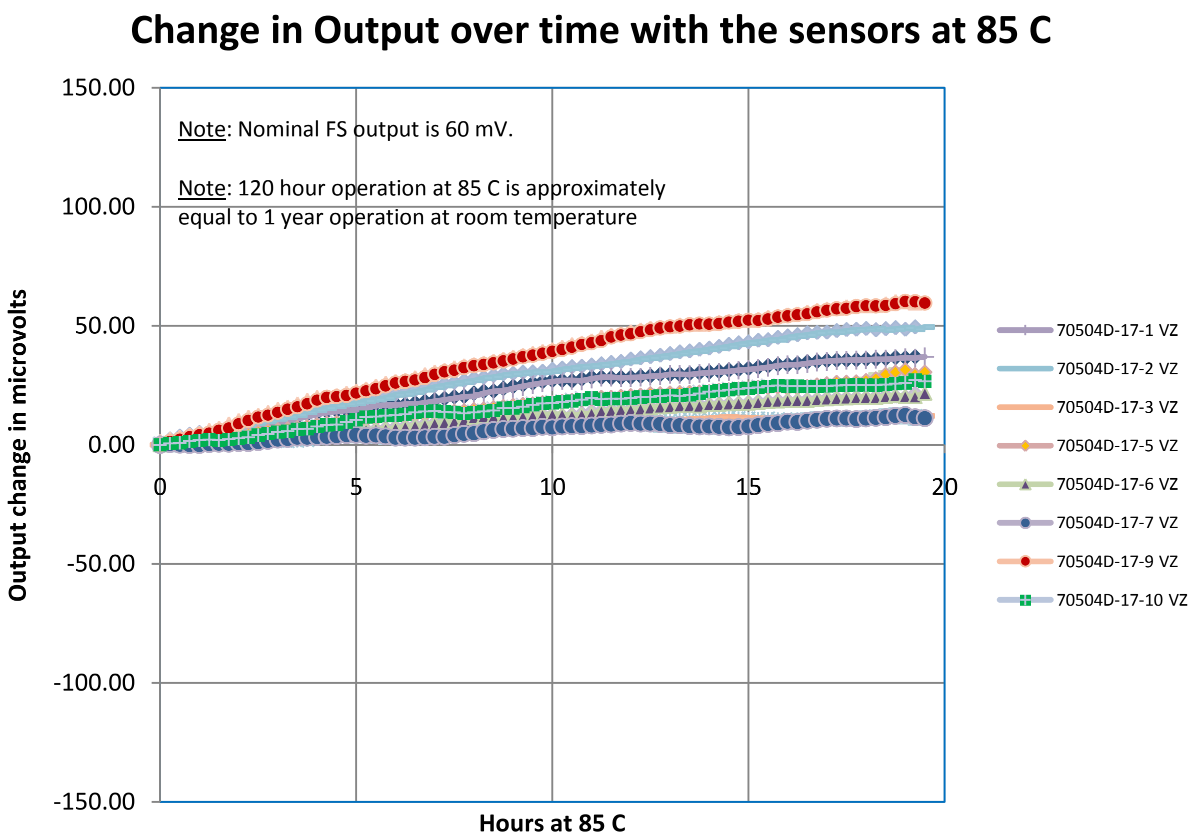

Figure 2 – Offset change over time as the sensors are operated at 85 C.

As can be seen in Figure 2, the parts show acceptable drift generally reaching a plateau in the 15 to 18 hour range. Note that at 60 microvolt drift for a 60 mV FS part, this represents about a 0.1% change in offset.

Effect of Elevated temperature storage on Zero - Room Temperature Zero Change after 120 hours at 85C

The third test performed was also on 10 mBar full-scale amplified products. In this test, parts were measured before 120 hours of powered operation at 85 C and then measured again at the end of that stress test. The 120 hour operation can be estimated to be roughly equivalent to accelerated aging of the part for 1 year at room temperature. The offsets were compared and the differences plotted in Figure 3.

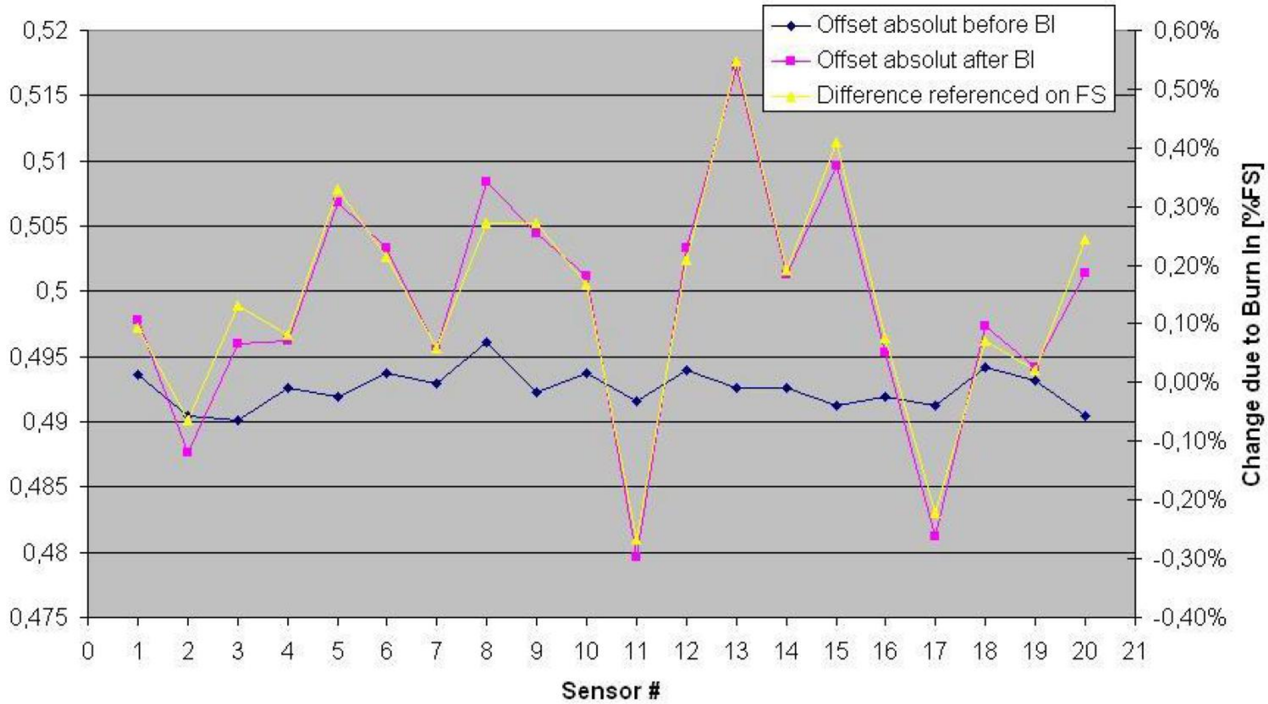

Figure 3 – Offset Change as a result of 120 hour burn-in at 85 C

The blue line in Figure 3 is the nominal offset before the 120 hour stress. The Red line is the offset after the stress. The yellow line is the effective percent full-scale change due to the stress. As can be seen, the high is about 0.5% and the low is -0.3%. The typical change is about 0.25% of full-scale.

Conclusion

Initial zero stability tests show that the AC3050 Die is stable in the range of 0.1% and below, both for orientation related zero changes as well as warm-up and drift at hot storage. Zero change after 120 hours burn-in at 85 C showed a worst-case drift, within 20 parts of 0.5% FS with a typical change of about 0.25% Full-scale. The 120 hour hot storage at 85 C is roughly equivalent to accelerated aging of the part for over a year at Room Temperature.

For further information

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