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Application Note – AC10-002
Position (g) Sensitivity of AC3050

This Application Note presents information on the position sensitivity 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.

Sensor Design and Orientation effect on the zero output AC3050

One of the challenges of precision calibration of pressure sensors is that the diaphragm has some mass to it. Thus, it has some acceleration sensitivity. In some cases, this is a sizeable error while, in others, it is quite small. Error in the Acuity design is extremely small. The Acuity design uses advanced Deep Reactive Ion Etching to form the active diaphragm area and to form a minimum-thickness secondary region referred to as a boss to stiffen the diaphragm in the center of the diaphragm. This boss reduces second-order bending of the diaphragm for improved pressure linearity, while providing mechanical amplification of the extremely low applied pressure.

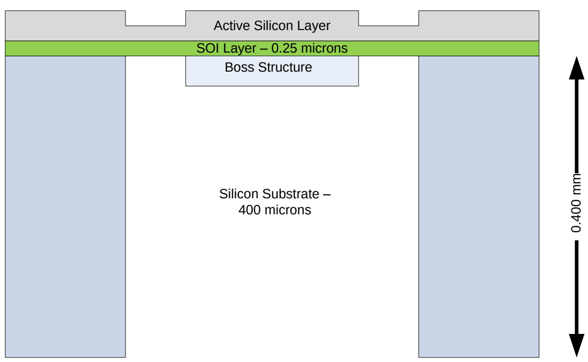

Figure 1 - AC3050 Cross-section

Measured Orientation effect on the zero output AC3050

If the part is calibrated in one orientation and then mounted in another, it is important that the change in orientation or any vibration does not impact the zero output. The Orientation sensitivity is also, obviously, a measure of a part's sensitivity to acceleration.

Twenty parts were tested. Each part was measured 3 times. The first was with the die facing down. The second was with the die rotated exactly 180 so that it was facing up. Because of the Earth Gravitational forces, this is equivalent to the part seeing a 2-g change in the loading. A third test was to measure the output when the part was rotated only 90 from the first position where the g-force pulling down on the sensor is parallel to the diaphragm and is essentially zero.

These parts were tested in an amplified configuration where the sensor was calibrated to produce 4 Volts full-scale output for 10 mBar. Thus the changes in output are all based on calibrated sensors.

The results are summarized in Table 1. The fourth data column in the table is the difference between the first two columns divided by the full-scale span (4 volts), divided by 2 because of the difference between +1g and effectively -1g.

The results show that, on average, the parts exhibit less than a 0.038% Full-Scale change per g in output. For these 10 mBar parts, this is equivalent to less than a 0.0038 mBar change per g. Based on the average and standard deviation, then the expected upper and lower control limits should be in the range of +0.067 % Full-Scale per g (UCL) and -0.143% Full-Scale per g (LCL).

Table 1 – Change in Zero due to changes in Orientation

Vs:5V	Offset [V]			Delta
SN#	Die-Down	Die-Up	Die sideways	[%FS/g]
1	0.5105	0.5155	0.5145	-0.063
2	0.5053	0.5099	0.5084	-0.058
3	0.5063	0.5096	0.5074	-0.041
4	0.5076	0.5120	0.5088	-0.055
5	0.5098	0.5118	0.5103	-0.025
6	0.5085	0.5107	0.5092	-0.028
7	0.5060	0.5070	0.5059	-0.013
8	0.5100	0.5124	0.5110	-0.030
9	0.5036	0.5133	0.5039	-0.121
10	0.5094	0.5112	0.5103	-0.023
11	0.5067	0.5081	0.5081	-0.017
12	0.5083	0.5124	0.5114	-0.051
13	0.5077	0.5133	0.5084	-0.070
14	0.5093	0.5143	0.5108	-0.063
15	0.5055	0.5091	0.5075	-0.045
16	0.5070	0.5098	0.5078	-0.035
17	0.5060	0.5085	0.5073	-0.031
18	0.5072	0.5121	0.5110	-0.061
19	0.5160	0.5123	0.5107	0.046
20	0.5094	0.5076	0.5067	0.022
			Average	**-0.038**
			Std Dev	0.035
			Ave + 3 Std Dev (UCL)	0.067
			Ave - 3 Std Dev (LCL)	-0.143

Conclusions

In a sample build, AC3050 has been shown to exhibit an average position sensitivity on zero output of <0.04% Full-Scale/g with a standard deviation of 0.035% Full-Scale/g. Assuming a Gaussian Distribution, 99.7% of the devices should have less than a 0.15% Full-Scale Zero change per g, based on this sample build.

For further information

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