Sensor Airbag Accelerometer 6x6 QFN X and XY axis devices - Shake Removal during Final test at -40C/105C

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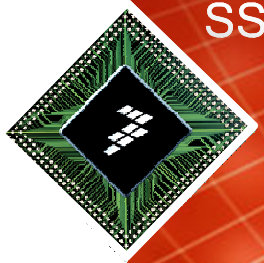
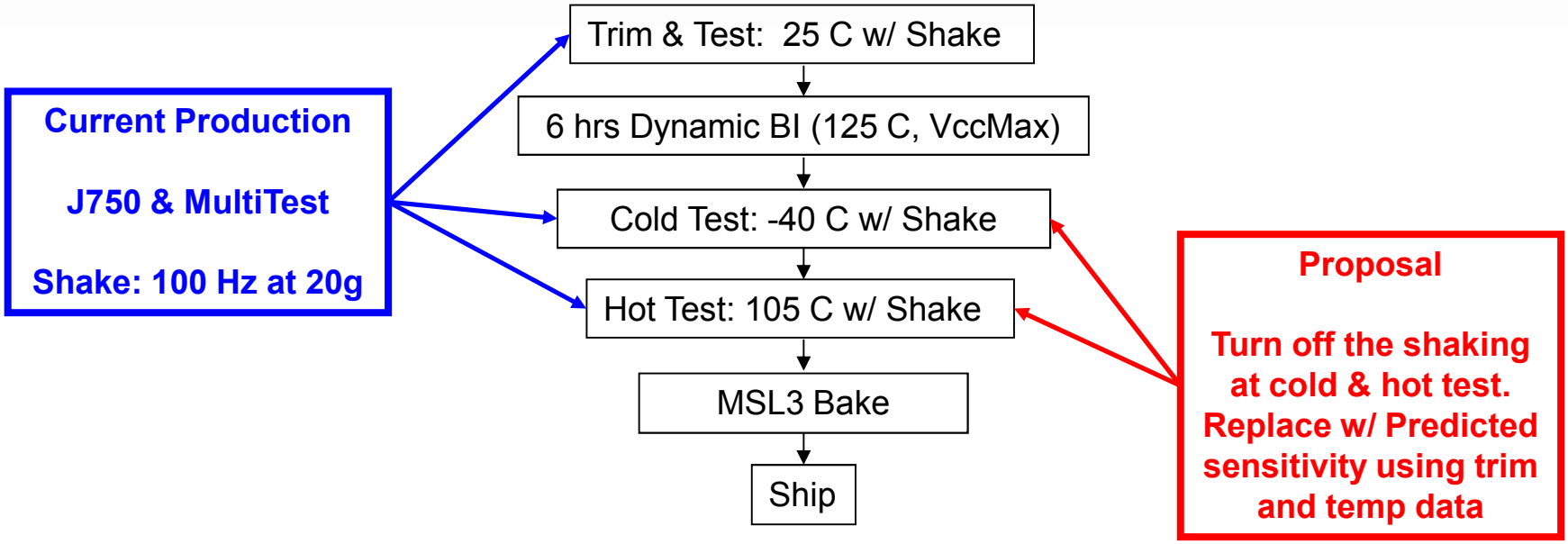


July 14, 2014

Description of Change

- Device information.
  - QFN6x6 Auto X and XY axis Accelerometers
- Current Practice.
  - Shake for sensitivity test at the cold and hot insertions (-40 C and 105 C)
- Proposed Practice.
  - Removal of the sensitivity test (removal of shaking) and the addition of the predicted sensitivity calculation

Final Test Flow



Predicted Sensitivity Calculations

- STg = Self Test Trim / Sensitivity Trim
- Predicted Sensitivity Cold (PredSens) = Self Test Cold / STg
- Predicted Sensitivity Hot (PredSens) = Self Test Hot / STg
- STg was added to the trim flow
- Predicted Sensitivity was added to the cold and hot test flows before shake (sensitivity). There were no failure flags added to the predicted sensitivity in order to collect all of the sensitivity (shake) data for all parts.

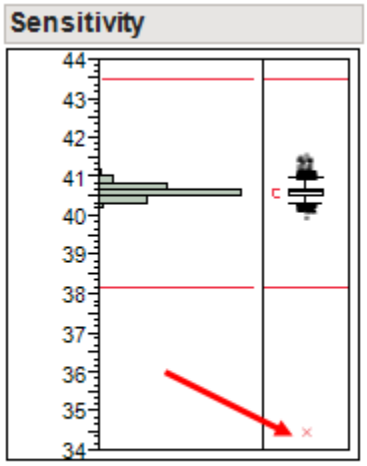
Shake Removal Evaluation Criteria

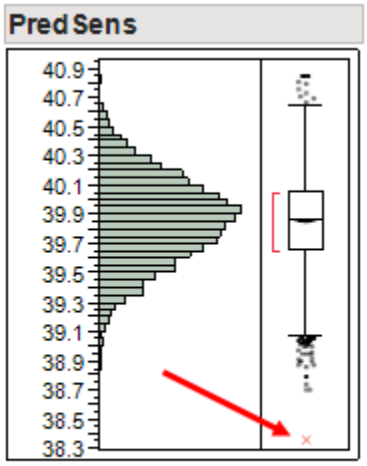
- All real sensitivity (shake) failures at the cold and hot insertions (-40 & 105 C) must be captured and screened with the predicted sensitivity calculation.

Evaluation Results

- After retesting the initial sensitivity failures, there were 5 X-axis parts (out of 376 k parts) and 8 XY-axis parts (out of 443 k parts) that showed to be real sensitivity failures. The bulk of the initial failures were due to site related noise (high harmonic distortion).
- In production, sensitivity (shake) failures are not retested. For this evaluation, it was necessary to retest all sensitivity failures to verify what was a false failure and what was a real failure.
- All of the real sensitivity failures standout in the predicted sensitivity distribution for the lot.
- The addition of DPAT to the predicted sensitivity would screen these parts at final test. In addition, there are other parts that did not fail sensitivity (shake) that standout from the distribution of the lot for predicted sensitivity. Which means that additional parts with deflection behavior that is different from the rest of the lot would also be screened.

Sensitivity Failure Example #1
X - 100 g - Cold - KMXDTJ402000





Quantiles

100.0%	maximum	41.536
99.5%		41.0834
97.5%		40.921
90.0%		40.786
75.0%	quartile	40.69
50.0%	median	40.603
25.0%	quartile	40.5233
10.0%		40.452
2.5%		40.353
0.5%		40.2326
0.0%	minimum	34.471

Summary Statistics

Mean	40.611816
Std Dev	0.1588568
Std Err Mean	0.0018174
Upper 95% Mean	40.615379
Lower 95% Mean	40.608254

Quantiles

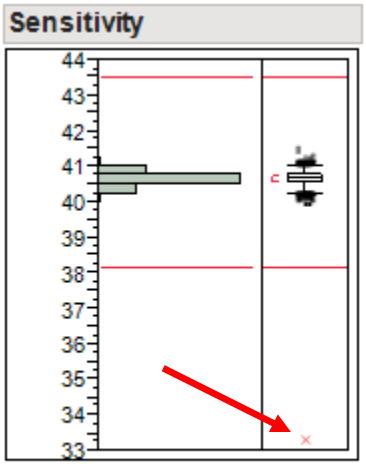
100.0%	maximum	40.848
99.5%		40.574
97.5%		40.415
90.0%		40.229
75.0%	quartile	40.058
50.0%	median	39.867
25.0%	quartile	39.662
10.0%		39.476
2.5%		39.284
0.5%		39.0726
0.0%	minimum	38.369

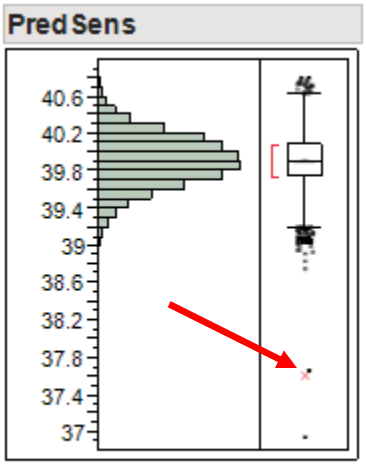
Summary Statistics

Mean	39.858599
Std Dev	0.2927037
Std Err Mean	0.0033487
Upper 95% Mean	39.865163
Lower 95% Mean	39.852035

Example of a real sensitivity failure (left) and how this part stands out in the predicted sensitivity distribution.

Sensitivity Failure Example #2
X - 100 g - Cold - KMXDTJ402100





Quantiles

100.0%	maximum	41.515
99.5%		41.0491
97.5%		40.928
90.0%		40.815
75.0%	quartile	40.7338
50.0%	median	40.634
25.0%	quartile	40.538
10.0%		40.452
2.5%		40.332
0.5%		40.1899
0.0%	minimum	33.303

Summary Statistics

Mean	40.633353
Std Dev	0.1734232
Std Err Mean	0.0020455
Upper 95% Mean	40.637363
Lower 95% Mean	40.629343

Quantiles

100.0%	maximum	40.795
99.5%		40.6073
97.5%		40.4253
90.0%		40.244
75.0%	quartile	40.094
50.0%	median	39.911
25.0%	quartile	39.737
10.0%		39.5669
2.5%		39.3487
0.5%		39.1289
0.0%	minimum	36.952

Summary Statistics

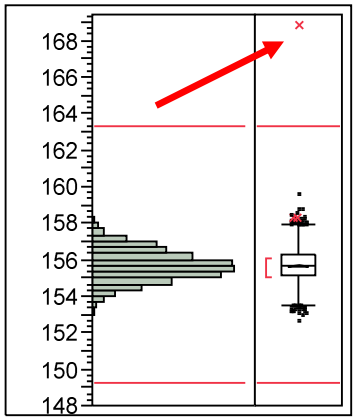
Mean	39.907134
Std Dev	0.2746663
Std Err Mean	0.0032397
Upper 95% Mean	39.913485
Lower 95% Mean	39.900783

Example of a real sensitivity failure (left) and how this part stands out in the predicted sensitivity distribution.

Sensitivity Failure Example #3
XY - 50/50 g - Cold - KMXDTJ844100

Distributions LotID=KMXDTJ844100, TestStep=Cold

XSensitivity



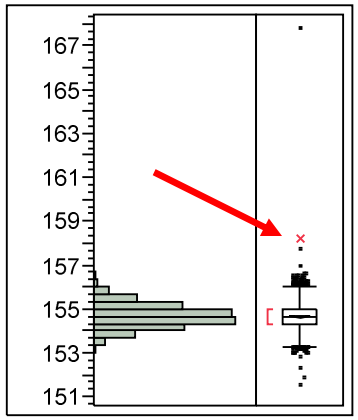
Quantiles

100.0%	maximum	168.83
99.5%		157.841
97.5%		157.3
90.0%		156.81
75.0%	quartile	156.24
50.0%	median	155.66
25.0%	quartile	155.13
10.0%		154.66
2.5%		154.12
0.5%		153.57
0.0%	minimum	152.7

Summary Statistics

Mean	155.69199
Std Dev	0.8407435
Std Err Mean	0.0097834
Upper 95% Mean	155.71117
Lower 95% Mean	155.67282

XPredSens



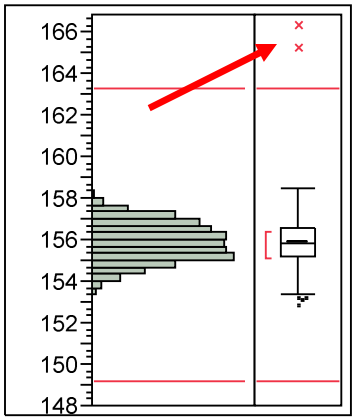
Quantiles

100.0%	maximum	167.81
99.5%		156.191
97.5%		155.75
90.0%		155.37
75.0%	quartile	155.02
50.0%	median	154.67
25.0%	quartile	154.33
10.0%		154.01
2.5%		153.66
0.5%		153.299
0.0%	minimum	151.55

Summary Statistics

Mean	154.68216
Std Dev	0.557477
Std Err Mean	0.0064871
Upper 95% Mean	154.69487
Lower 95% Mean	154.66944

YSensitivity



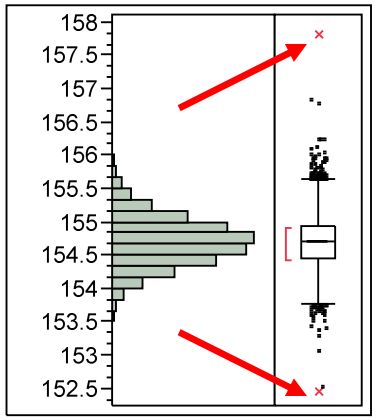
Quantiles

100.0%	maximum	166.35
99.5%		157.89
97.5%		157.5
90.0%		157.08
75.0%	quartile	156.58
50.0%	median	155.87
25.0%	quartile	155.23
10.0%		154.73
2.5%		154.197
0.5%		153.709
0.0%	minimum	152.84

Summary Statistics

Mean	155.89449
Std Dev	0.9080898
Std Err Mean	0.010567
Upper 95% Mean	155.91521
Lower 95% Mean	155.87378

YPredSens



Quantiles

100.0%	maximum	157.82
99.5%		155.72
97.5%		155.44
90.0%		155.16
75.0%	quartile	154.93
50.0%	median	154.7
25.0%	quartile	154.46
10.0%		154.25
2.5%		154
0.5%		153.759
0.0%	minimum	152.46

Summary Statistics

Mean	154.70331
Std Dev	0.367367
Std Err Mean	0.0042749
Upper 95% Mean	154.71169
Lower 95% Mean	154.69493

Restatement Of Criteria & Summary

- All real sensitivity (shake) failures at the cold and hot insertions (-40 & 105 C) must be captured and screened with the predicted sensitivity calculation.
  - Evaluation meets this criteria

- The evaluation meets the success criteria. A conversion from shaking at the cold and hot test insertions (-40 and 105 C) to the predicted sensitivity calculation can be performed with customer approval.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