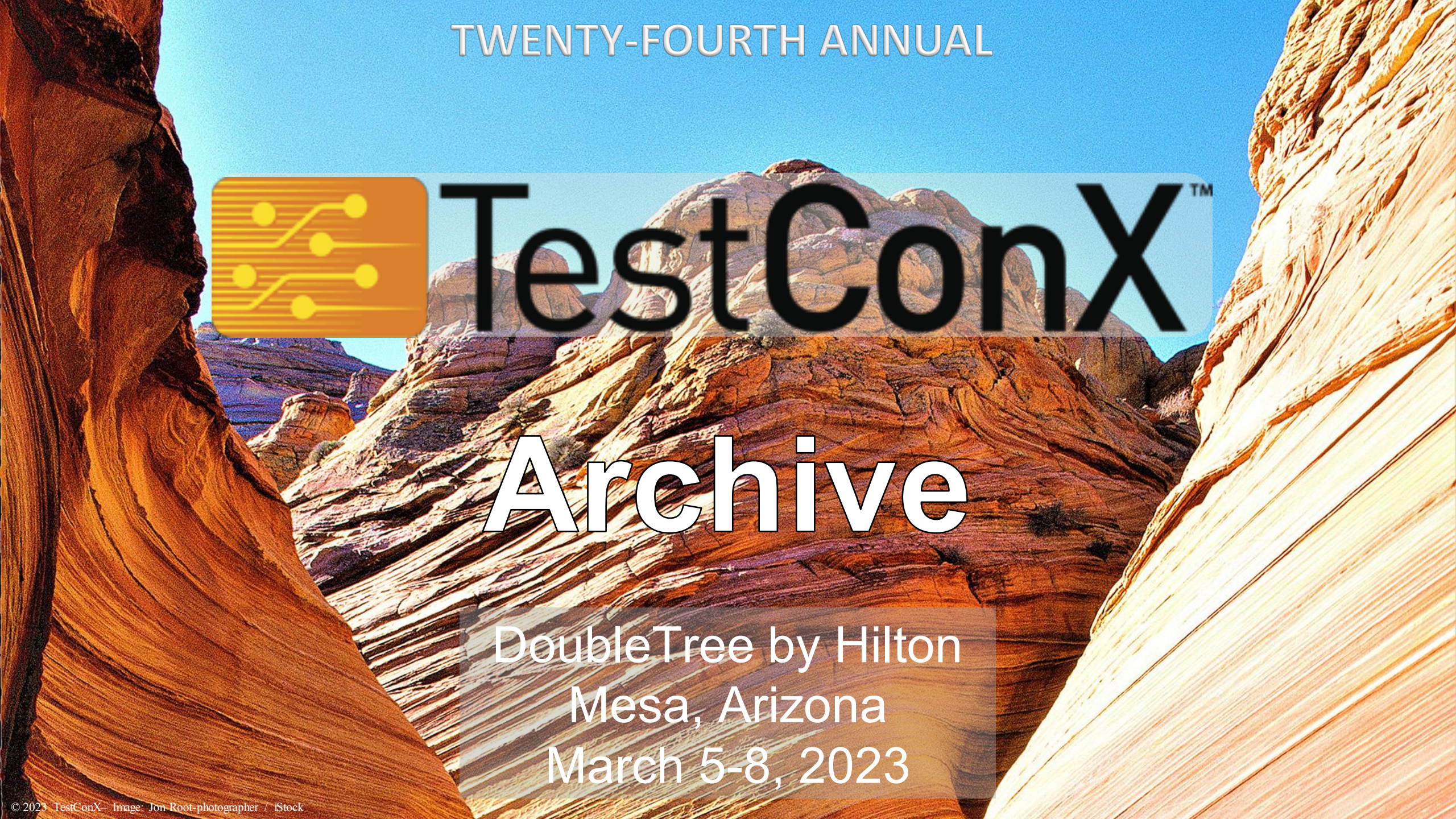

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A Statistical Approach To Grouping Pins During Testing To Achieve Optimized Test Limits

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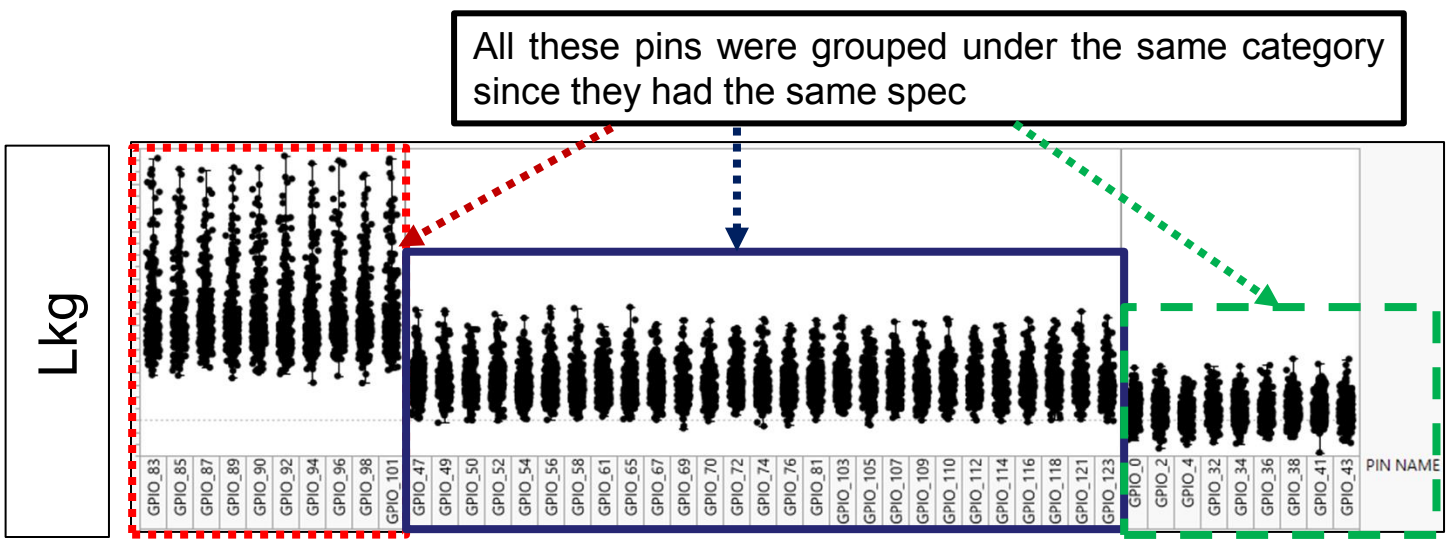
Introduction

•Test programs for System On Chips (SOC) utilize pin grouping techniques, where a few global variables are defined with certain values for upper and lower limits for pins that could behave similarly.

•Pin grouping achieves high levels of parallelism, there by lowering the test time, but affects our ability to optimize the limits for each pin group.

Problem statement

• Need a method to reliably group the pins together, to develop optimized test limits for the pins



Step 1: Means Analysis Test

•Tukey- Kramer Test, a multiple comparison means analysis method was utilized, that yields a “Connecting Letters Report” to rank the degree of differences between the means of each pin

Connecting Letters	
Level	
GPIO_96	A
GPIO_87	A B
GPIO_98	A B
GPIO_90	A B
GPIO_85	A B
GPIO_101	A B
GPIO_89	A B
GPIO_94	A B
GPIO_92	A B
GPIO_83	B

GPIO_52	C	GPIO_105	C D E
GPIO_72	C D	GPIO_121	C D E
GPIO_47	C D	GPIO_114	C D E
GPIO_56	C D	GPIO_112	C D E
GPIO_67	C D E	GPIO_74	C D E
GPIO_50	C D E	GPIO_69	C D E
GPIO_109	C D E	GPIO_110	C D E
GPIO_103	C D E	GPIO_58	C D E
GPIO_116	C D E	GPIO_76	C D E
GPIO_107	C D E	GPIO_54	C D E
GPIO_118	C D E	GPIO_65	C D E
GPIO_49	C D E	GPIO_70	D E
GPIO_81	C D E	GPIO_123	E
GPIO_61	C D E		

GPIO_38	F
GPIO_41	F
GPIO_0	F
GPIO_2	F
GPIO_32	F
GPIO_34	F
GPIO_43	F
GPIO_36	F
GPIO_4	F

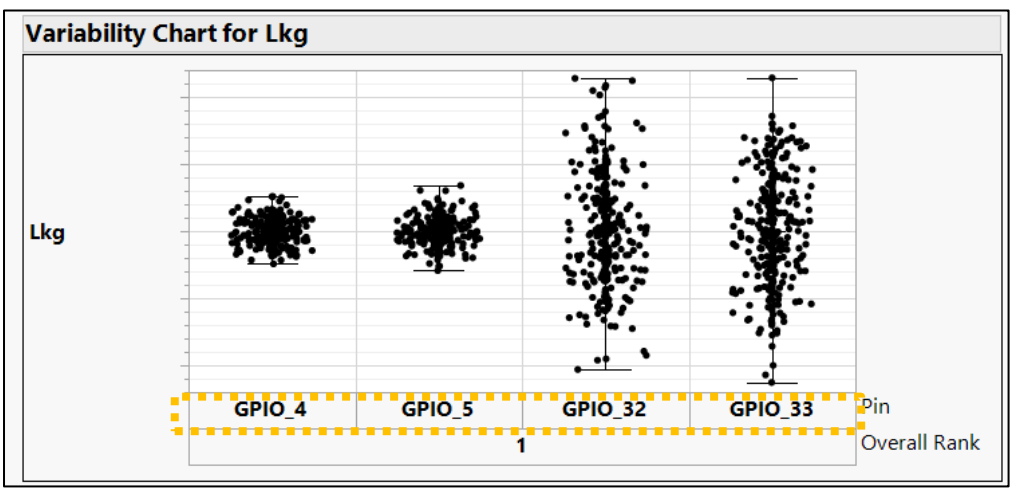
Step 2: Standard Deviations Test

•Means test, as the name suggests accounts only the means, so pins that have similar means, but different spreads or Standard deviation (SD) are grouped together.

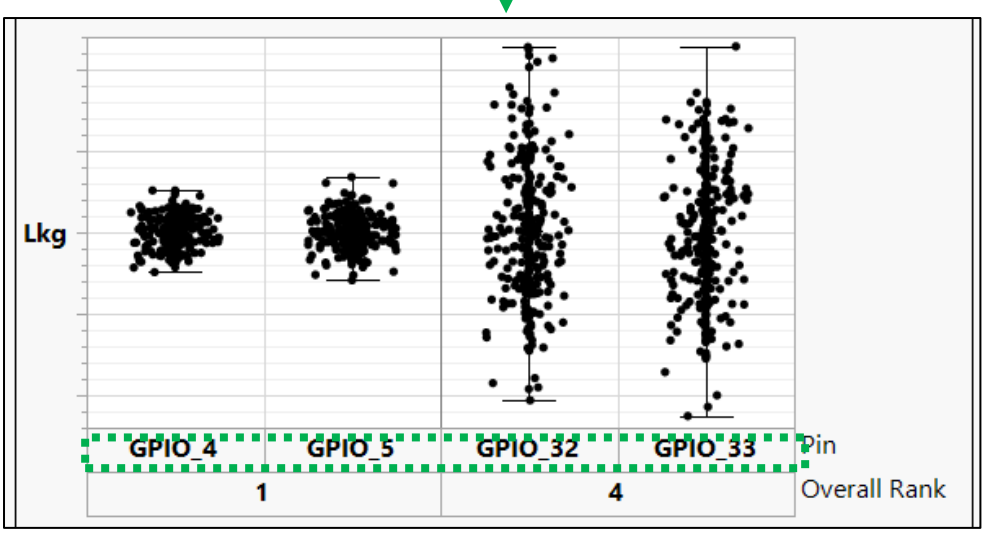
• SD test finds Median Standard Deviation within each letter mean group and compares other pins within group

•If any pin within the letter group differs from the median standard deviation by 15% or more, it's split into a different pin group

Step 1 grouped these pins together to Rank 1

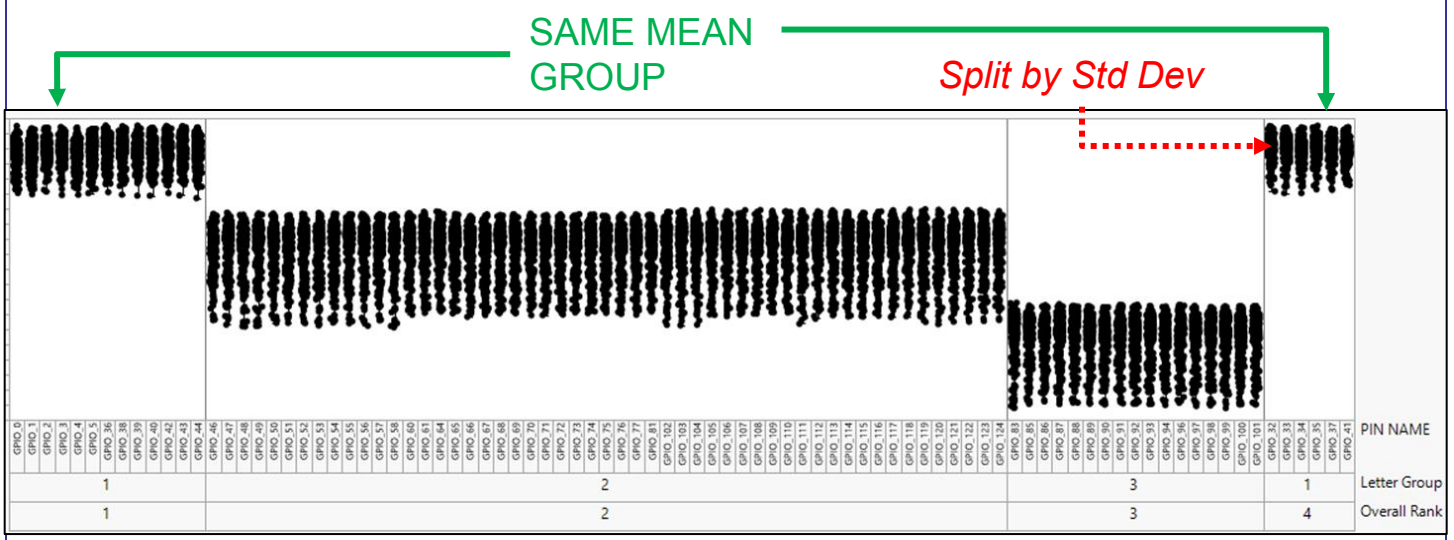


Step 2 helps split them further into different ranks



Results

•The overall Rank groups the pins more accurately



•The process was automated and repeated with few other parameters that yielded similar results

Proposed future actions

•The overall process is a reactionary statistical approach that helped us identify how the pin groups behave differently for different parts.

•The physics behind the behavior needs to be understood, so that the information can be fed back to the design, integration or teams can start grouping them proactively, instead of waiting for the feedback.

Summary

•A statistically superior methodology was developed by utilizing already existing methods.

•Using this approach, we can now establish better test limits that help us achieve the Zero-Defect requirement

References

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