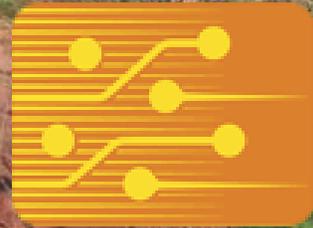


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Archive

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Contacto Evaluation Cycle Time Reduction

Thiha Shwe
Texas Instruments Incorporated



Overview

- Background
- Current Evaluation Process
- Step 4: Qualification Summary Data
- Road To METS Test
- Challenges of Current Evaluation Process
- New process
 - Automatic Test Equipment (ATE) Setup to Evaluate Contactor
 - Test Flow
 - Correlation Data
- Summary
- Acknowledgements



Contacter Evaluation Cycle Time Reduction

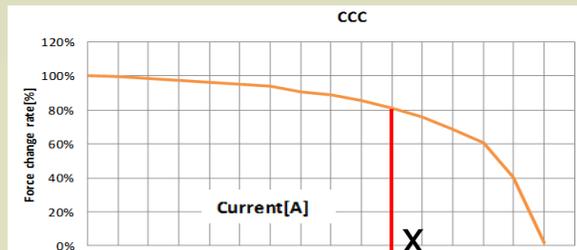
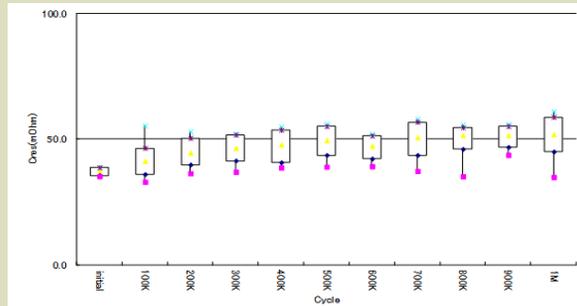
2



Background

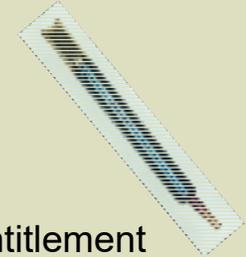
Vendor Data

- 1M insertions mechanical stress
- ISMI Current Carrying Capability (CCC)



Test Floor

- Run at 90% of pin CCC
- Pin life: fail at 2% or less entitlement



Gaps	Vendor Data	ATE
Test Temperature	Room	Tri-Temp
Contact material	Au Plate	NiPdAu, Matte Tin, ...
Setup	Disconnect bet. Mechanical & Electrical Cycles	Both Mechanical & Electrical Cycles
Environment	Clean	Debris
Compressed Pin Height (CPH)	Control	Vary± Total stack up tolerances
Speed	Slow & steady	Fast & wobble



<https://whesjournalism.com/3234/sports/why-soccer-is-better-than-american-football/>

Contactor Evaluation Cycle Time Reduction



Current Evaluation Process

Qualification Criteria
QUALITY
PRICE
SUPPORT
DELIVERY

Created 5 Steps Evaluations Process

Step 4: TI ATE Evaluation

- Check boundaries
 - ✓ Temperature
 - ✓ Pitch
 - ✓ Test current
 - ✓ Ω Trend (RDSON/Cres)
 - ✓ Test frequency / bandwidth
 - ✓ High Current
 - ✓ Pin Life

Contactor Evaluation Process Flow		
Step 1	Benchmarking	Compare Paper Spec.
		Step 1 Gate (Pass/Fail)
Step 2	Supplier Factory Evaluation	Supplier factory Evaluation
		1. Pin Spec. Validation
		2. Durability Cycle Test (@ Tri-Temp)
		Step 2 Gate (Pass/Fail)
Step 3	TI Engineering Evaluation	Sample check out
		Step 3 Gate (Pass/Fail)
Step 4	TI ATE Evaluation	Phase I, Life
		Phase II, Temperature
		Phase III, Test Sensitivity
		Step 4 Gate (Pass/Fail)
Step 5	Released to Roadmap	Qualification Data Review
		Step 5 Gate (Qualify or Fail)

James Tong presented in 2016 BiTS



Contactor Evaluation Cycle Time Reduction

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Step 4: Qualification Summary Data

Setup	Device 1		Device 2		Device 3		Device 4		Device 5	
Eval. Contactor Base Line Contactor	Vendor A	Baseline	Vendor A	Baseline	Vendor A	Baseline	Vendor A	Baseline	Vendor A	Baseline
Test Sensitivies	High Current		Life, Cres		High Temp		Cold Temp		Pad Pitch	
First Pass Yield%	+8.33%	Reference	+4.19%	Reference	+2.29%	Reference	+0.38%	Reference	+2.45%	Reference
Final Yield%	+4.31%		+3.85%		+1.03%		+0.49%		+0.84%	
First Pass Cont%	-1.42%		-0.31%		-0.44%		-0.21%		-1.18%	
Final Cont%	-0.30%		-0.18%		-0.09%		0.03%		-0.32%	
Re-Screen%	-10.73%		-1.27%		-3.37%		-0.22%		-2.46%	
Pin Life	x6	x2	x1.5	x1.9	x2					
Eval. Status	Complete		Complete		Complete		Complete		Complete	



<https://www.business2community.com/marketing/7-steps-defining-marketing-qualified-lead-mql-0892360>

- Multiple devices selected as test vehicles to cover all required specifications
- Working & good, but take too much time to complete

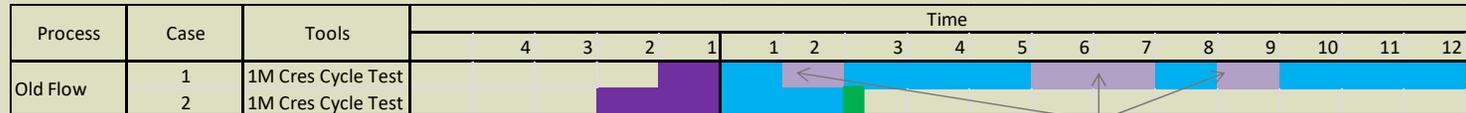


Contacter Evaluation Cycle Time Reduction

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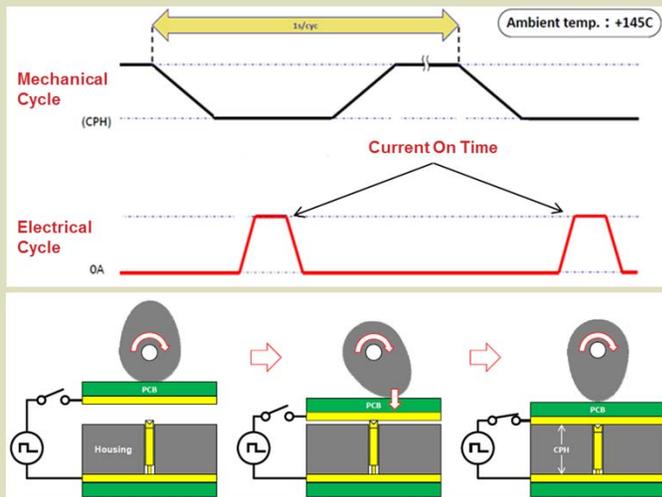
Road To METS Test



Step 2

Step 1	Benchmarking
Step 2	Supplier Factory Evaluation
Step 3	TI Engineering Evaluation
Step 4	TI ATE Evaluation
Step 5	Released to Roadmap

- Developed METS (Mechanical, Electrical, and Temperature stress) test.



Characterize Pin using various:

- Current pulse
- Duty Cycle
- Contact material
- Temperature
- CPH
- Cleaning

Vendor in-house METS Test Data Comparison

Vendor	Base Line	A	B	C	D
METS (Room)	x	10x	20.3x	6.1x	1.1x
METS (High Temp)	x	2x	4.1x	1.7x	1.1x

METS result is use to rule out under perform pin design

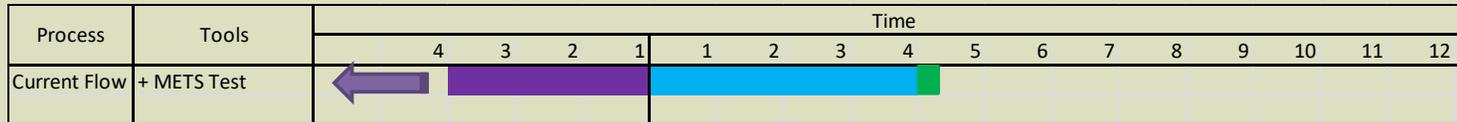


Contacter Evaluation Cycle Time Reduction

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Challenges of Current Evaluation Process



- Long Qual. cycle time
- Discrepancy of METS test
 - Between suppliers (different equipment)
 - Suppliers vs. ATE

Step 1	Benchmarking
Step 2	Supplier Factory Evaluation
Step 3	TI Engineering Evaluation
Step 4	TI ATE Evaluation
Step 5	Released to Roadmap

Pin Life	Base Line	Vendor A	Vendor B
METS	X	10X	20.3X
ATE	Y	2Y	1.5Y



<https://www.vectorstock.com/royalty-free-vector/confused-emoji-vector-661227>

Contactors Evaluation Cycle Time Reduction



<https://www.wisbar.org/NewsPublications/WisconsinLawyer/Pages/Article.aspx?Volume=86&Issue=5&ArticleID=10839>



ATE to Evaluate Contactor

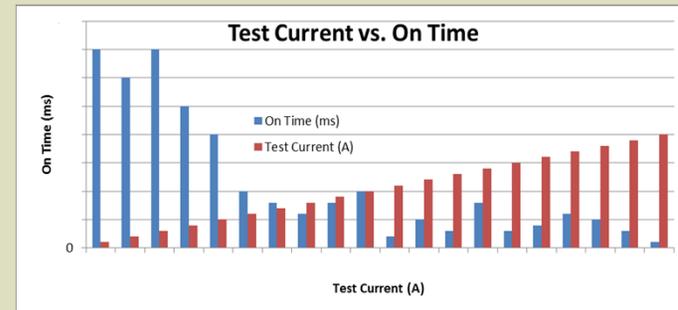
Goals:

- To test contactor Cres with a test cell
- To shorten the contactor evaluation process cycle time

Method:

- Test and stress High Current, Cres, Life, pitch and temperature using generic hardware
 1. Capability to debug the whole test cell infrastructure/setup
 2. Using rejected device
 3. Common hardware for all sites
 - ✓ Flexibility to location of evaluation site
 4. Dynamic per pin CCC test

Ability to emulate ATE test conditions



Contacter Evaluation Cycle Time Reduction

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Test Flow

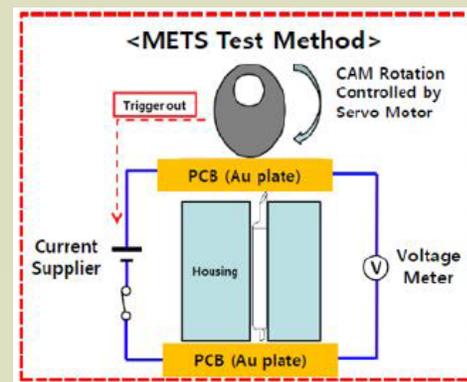
- Adopt METS test into ATE

- ✓ Keep all variables

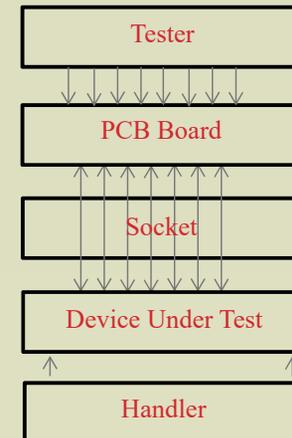
- Test Flow:

- ✓ Continuity open
 - ✓ Continuity short
 - ✓ High Current Test
 - ✓ Cres Calculation

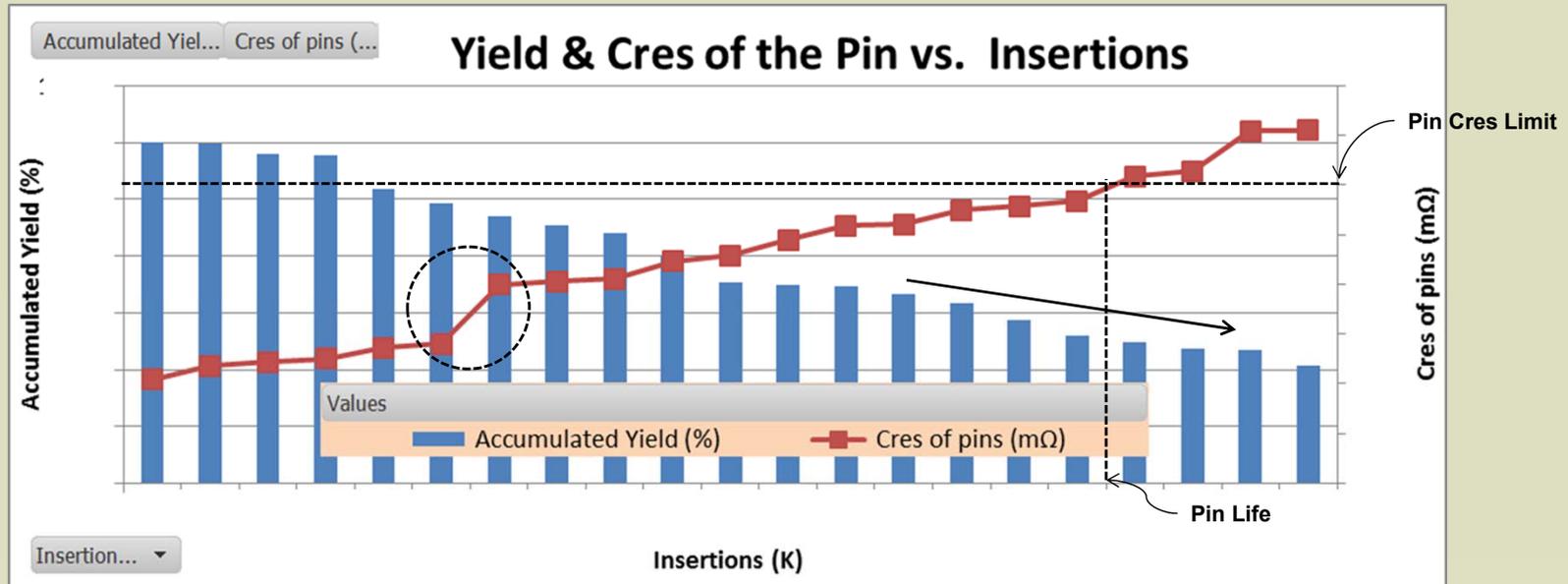
Vendor METS Test Setup



Test Cell

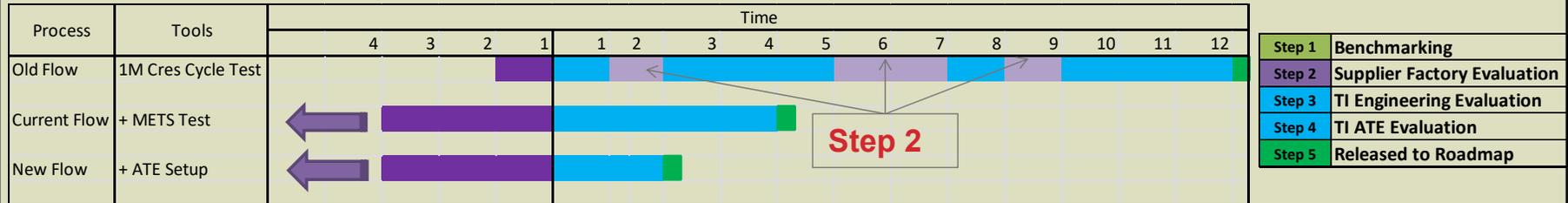


Correlation Data



- Step function of Cres increased → Failure Analysis of the pin for further improvement
- Determines pin life by Cres → Yield degradation

Summary



- Old flow: Good Cres at tri-temp for lifetime insertions fails to emulate actual use conditions in test floor → Churning between step 2 to step 4
- Current flow: METS test matched use conditions in supplier lab to avoid churning during Qual. cycle.
- New Flow: Minimize Qual. duration by emulating actual ATE setup.

Acknowledgements

TI around the world

We have manufacturing, design or sales offices in more than 35 countries, serving more than 100K customers worldwide



TI Test Application Group & TICL

2019 TestConX Committee and Attendees



Contactor Evaluation Cycle Time Reduction

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