SW Test Workshop
Semiconductor Wafer Test Workshop

A new approach to low pin count products test found Vertical Probes for to be superior to Cantilever

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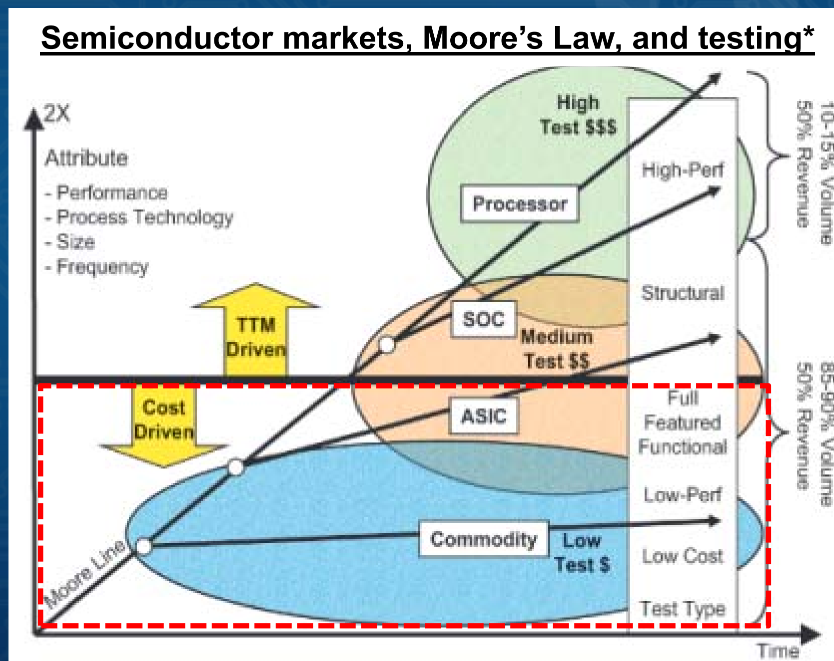
Overview

- Introduction
- Methods and Materials
- Results / Fields of comparison
- Summary / Conclusion

Introduction

- Texas Instruments
- FTest = Freising Test (Freising, Germany)



Product portfolio:

- High performance analog
- Linear & Logic
- Power management
- ...

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FTest products

Methods and Materials

- **Introduction**
- **Methods and Materials**
  - Test candidates
  - Probe solution
  - Technoprobe T1 needle
  - Technoprobe XLT option
  - ROI estimation
- **Results**
- **Summary / Conclusion**

Methods and Materials

- **Test candidates**

	Single site	Quad site	16 site
Product	Op-Amp	Mobile Application	Little logic
Needles	61	96	80
Tester	ETS-364 (Eagle / Teradyne)	VLCT (Texas Instruments)	ETS-88 (Eagle / Teradyne)
Max. Curr.	50mA	10mA	50mA
Max. Frequ.	n.a.	3MHz	1GHz
Max. test temperature	125C	25C	85C

Methods and Materials

- Cantilever probe
  Tungsten Rhenium
- FR4 probe card
- Stiffener
  (as requ. by vendor)
- Allied Diamond Lapping
  (50-30145 3um, PinkPad)

- Technoprobe T1
  with XLT option
- FR4 probe card
- Stiffener
  (as requ. by vendor)
- MIPOX WA6000 SWE

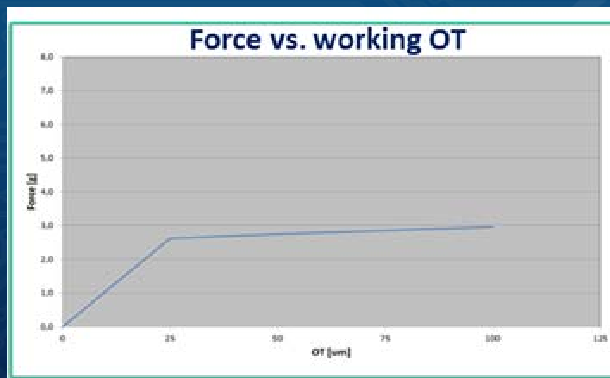
Method and Materials

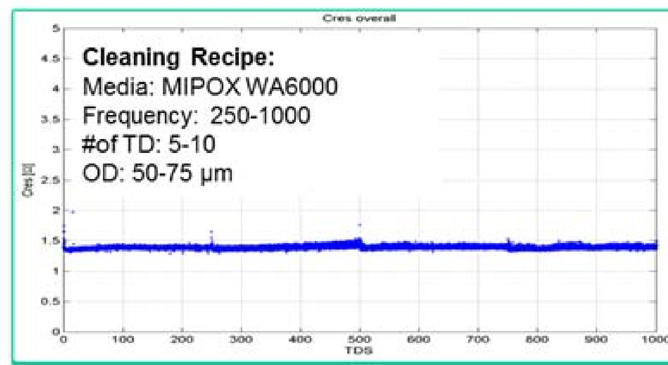
- **Technoprobe TPEG™ MEMS T1 needle technology:**
  - Fine pitch down to 55um
  - Low force for Al Pad probing and PoAA
  - Main characteristics:

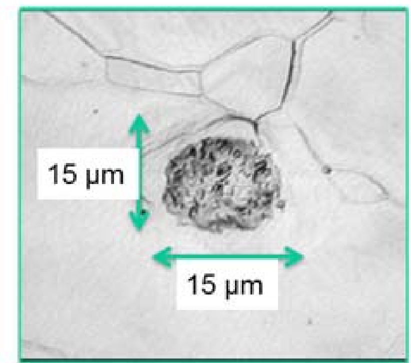
PARAMETER	TPEG™ MEMS T1
Needle diameter	Less than 1,5 mils equivalent
Max pin count	> 20.000 pins
X, Y alignment accuracy and Z planarity	X,Y: ± 8 µm; Z plan: Δ 20 µm
Min pitch and configuration	55 µm linear configuration
Pin Current (CCC)	410 mA
Force (at 3 mils OT)	2 g or 3 g

Method and Materials

- **Technoprobe XLT option**
  - Patented solution by Technoprobe
  - XLT option offers a longer usable tip while maintaining the advantages of the already proven TPEG™ MEMS T1 characteristics
    - Low and constant force
    - Effective cleaning recipe for stable CRES
    - No scrub probe marks







ROI estimation (4M+ TD)

- **Cantilever**
  - Initial cost X$
  - Renew Y$
  - Online cleaning Z$
  - Offline maintenance 1.5h

➔ **Running cost K$**

- **TPEG™ MEMS T1 XLT**
  - Initial cost 8*X$
  - Renew Y$*2
  - Online cleaning 0.67*Z$
  - Offline maintenance 0.3h

➔ **Running Cost ~0,1*K$**

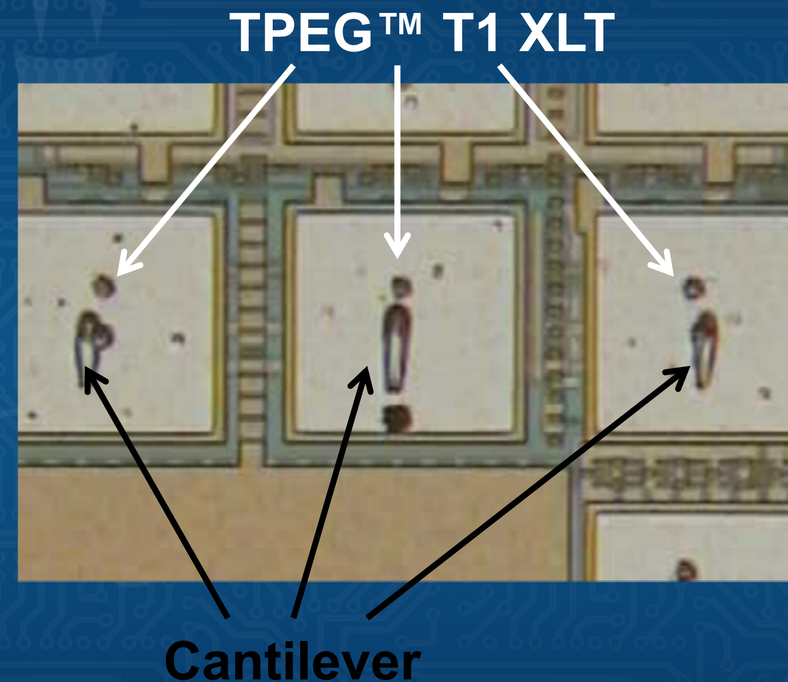
- **TPEG™ MEMS T1 XLT Probe Card breakeaven cost vs cantilever at 2.000.000 touchdowns**

Results

- **Introduction**
- **Methods and Materials**
- **Results / Fields of comparison:**
  - Probe marks
  - Contact resistance
  - Operating performance
  - Throughput
  - Cost of ownership
- **Summary / Conclusion**

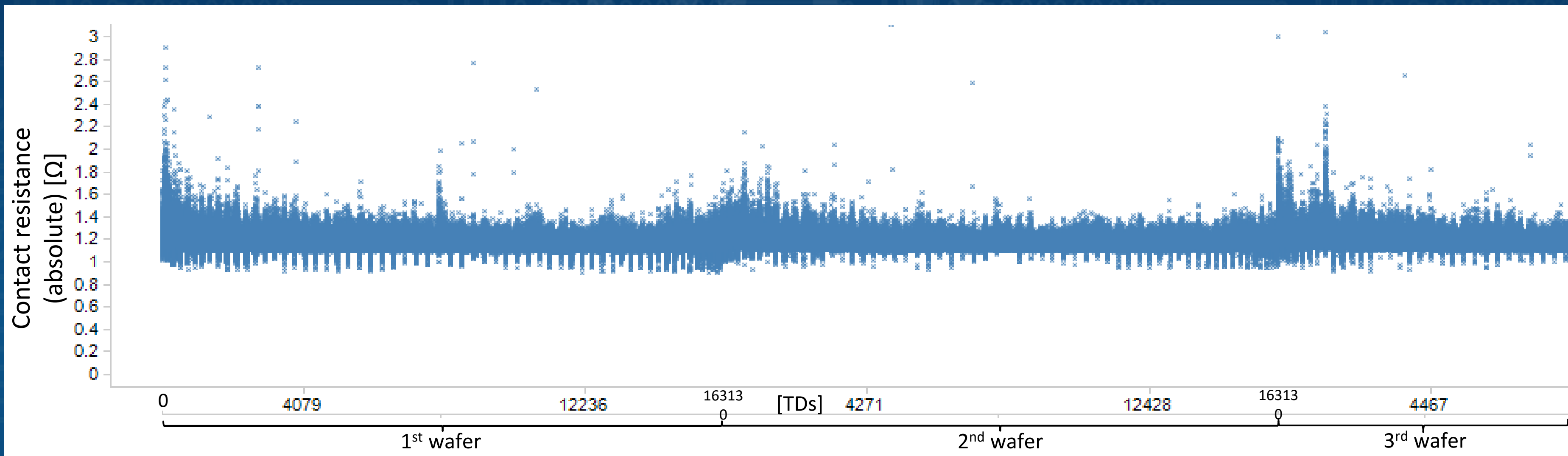
Results

- **Probe Marks Analysis**
  - TPEG™ MEMS T1 XLT technology outperforms cantilever in respect of probe marks and pad damage:
    - No punch through and no cracks below bond pad found.
    - 15 test runs on all test canditates



Results

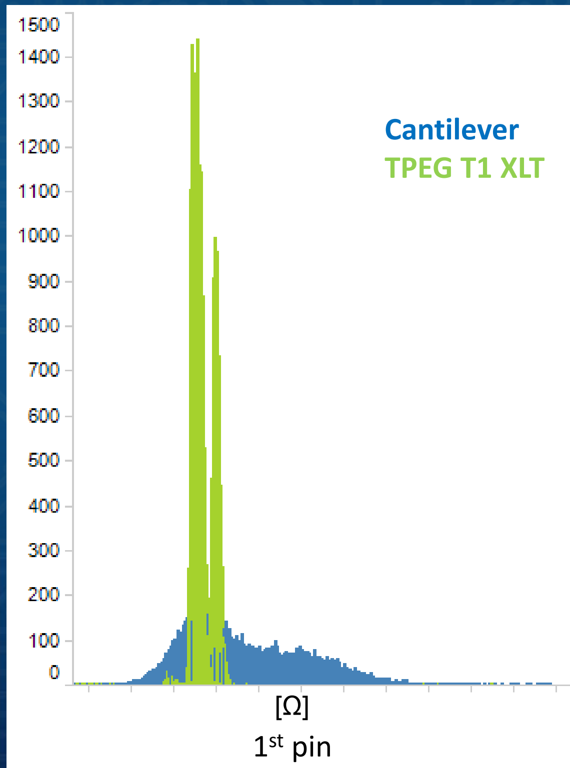
- **Contact resistance (vertical only)**

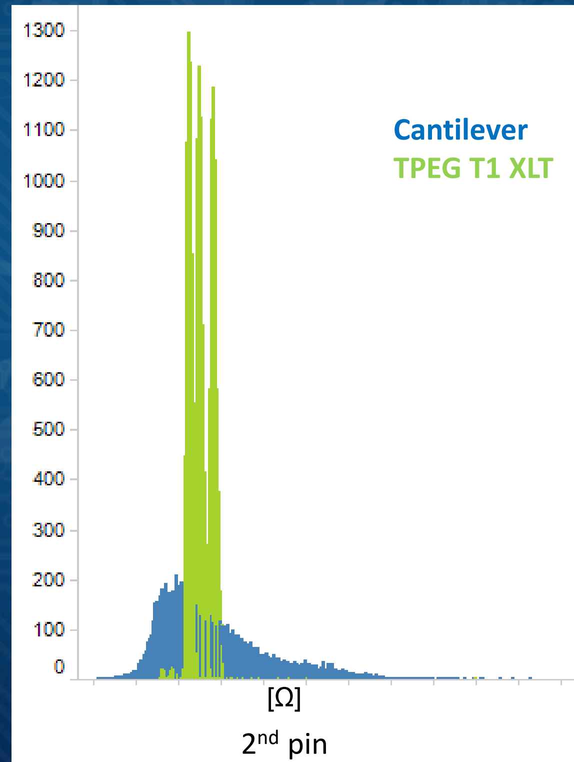


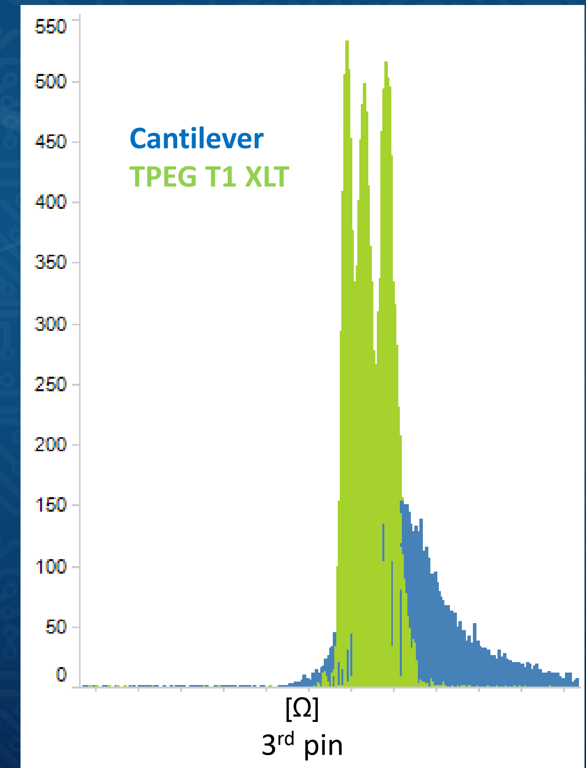
- **Cleaning recipe**
  - Over travel (test): 80 um (first touch)
  - Online cleaning media: MIPOX WA6000 SWE
  - Cleaning freq.: 35 touchdowns
  - Strokes: 1 @RT, 2@ HT
  - Over travel (clean): 85 um
- **Offline Mantenance**
  - Every 500.000 Touchdowns
    - Visual inspection (incl. free length measurement)
    - Particle removal (pressurized air, IPA, brush) if required.
- **➔ Contact resistance: Average 1.2 Ω , std. dev. 0.06 Ω (over 250k TDs)**

Results

- **Contact resistance distributions**
  - TPEG™ T1 XLT has much narrower distribution vs Cantilever enabling better control over time.

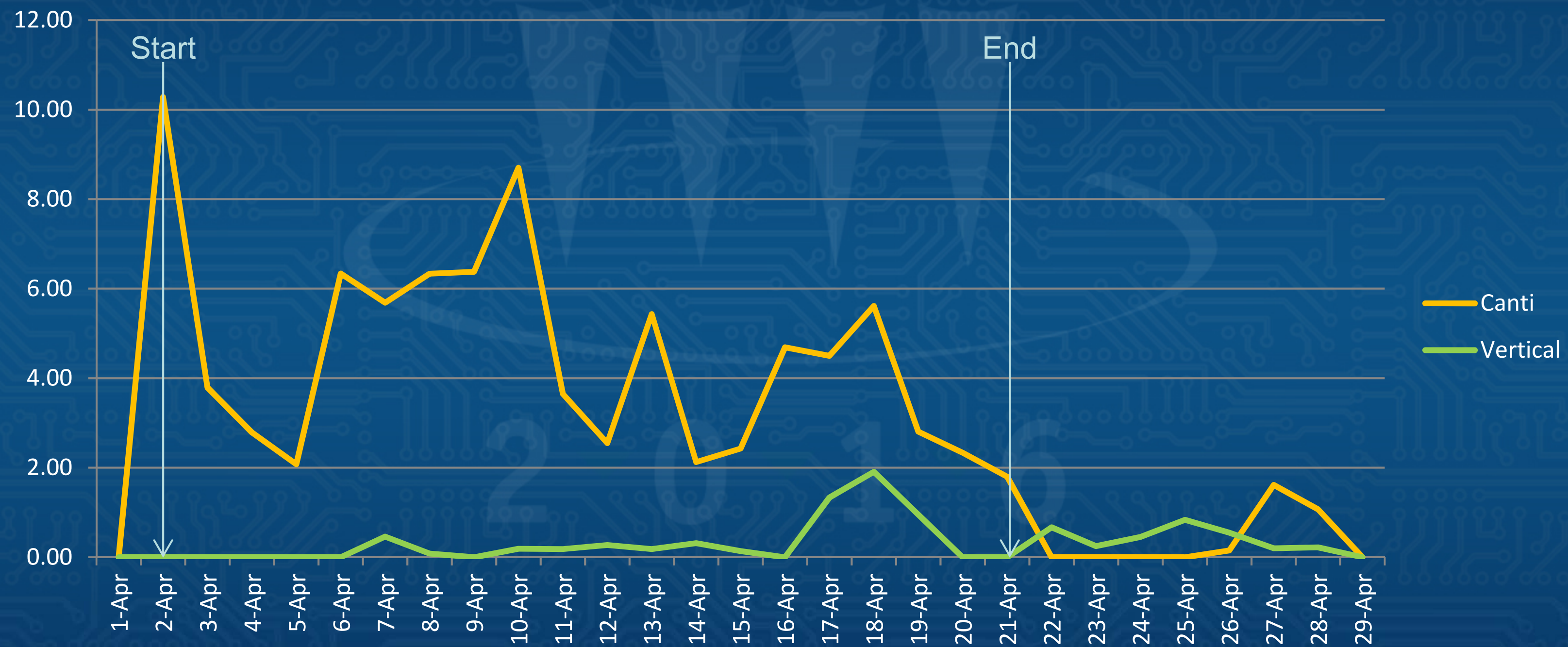






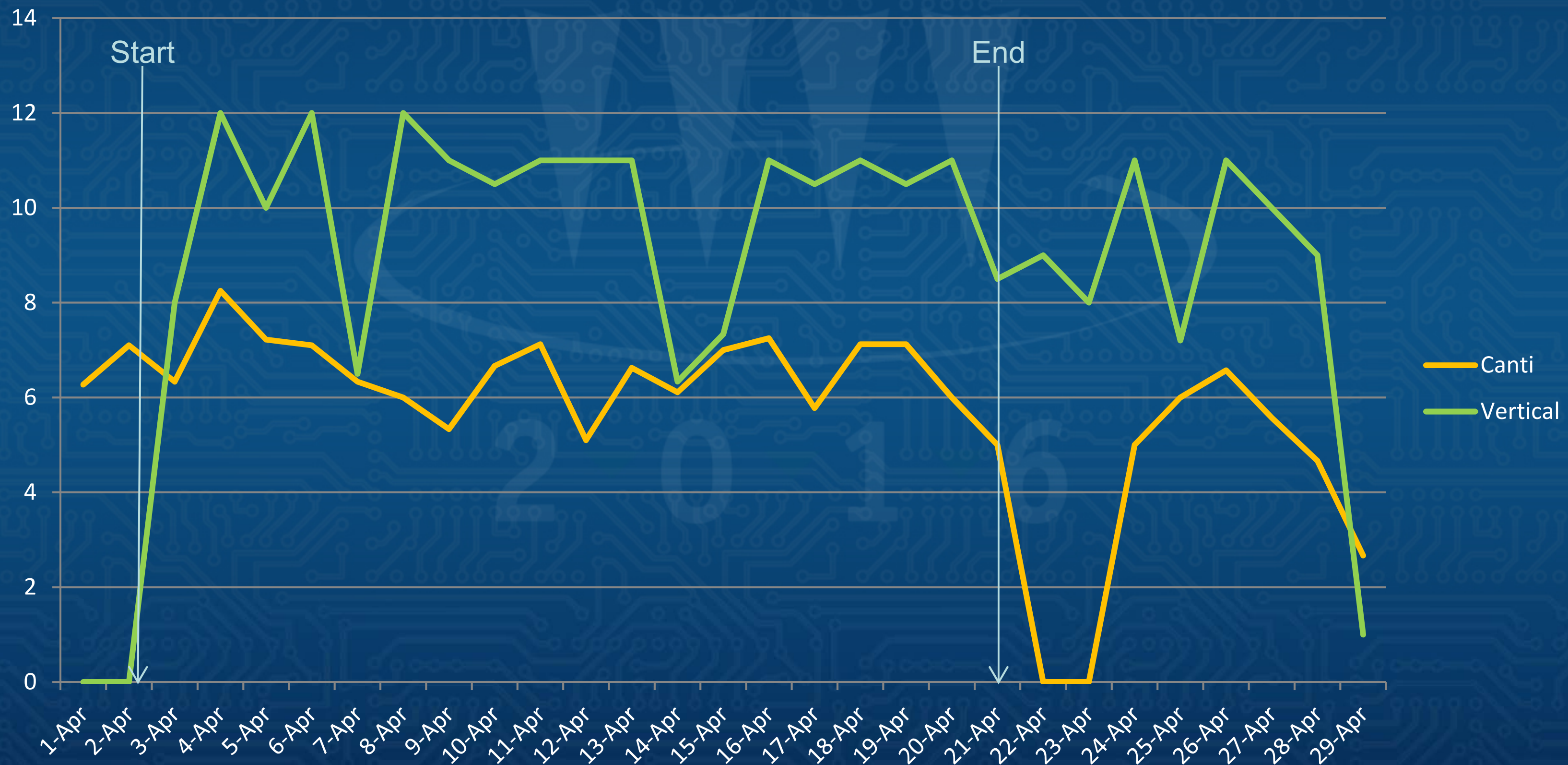
Results

- **Operating performance**



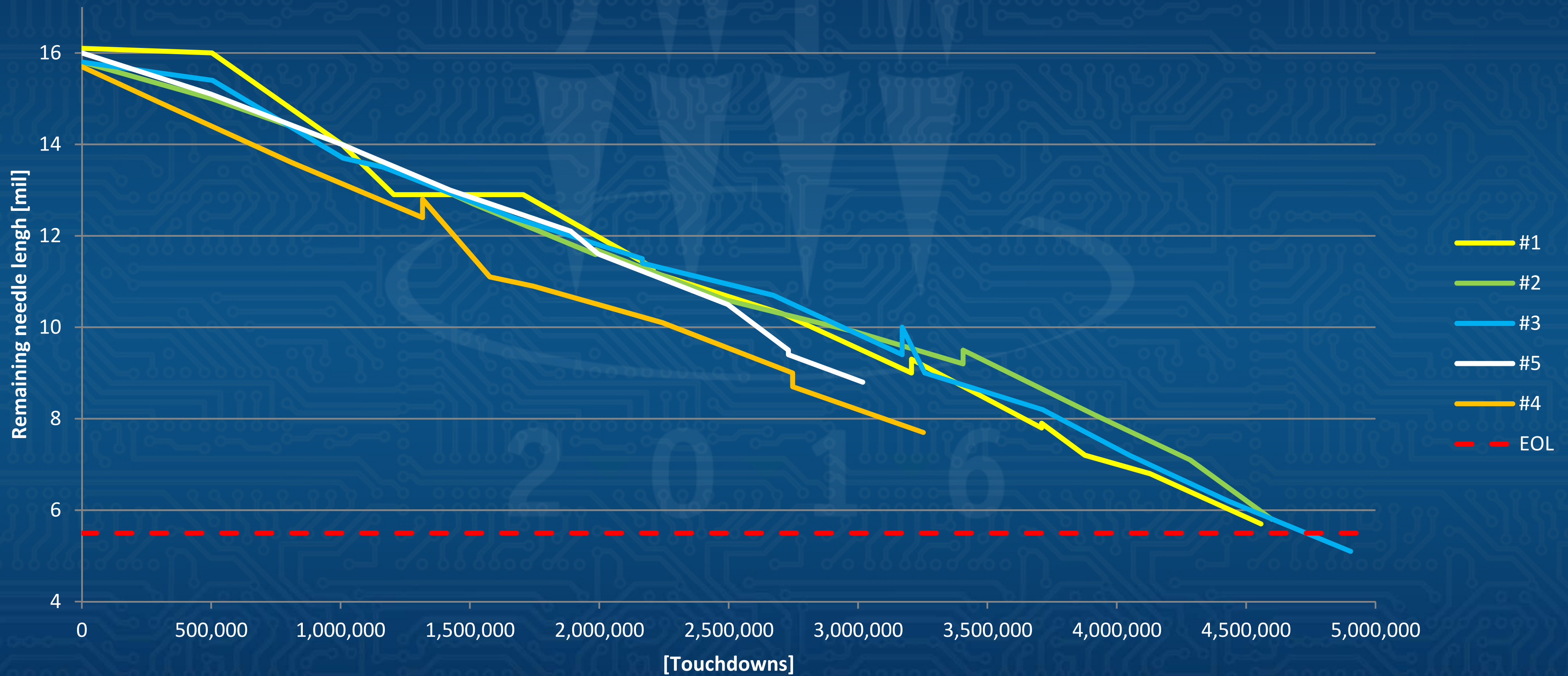
Results

- **Impact on throughput**



Results

- **Lifetime**



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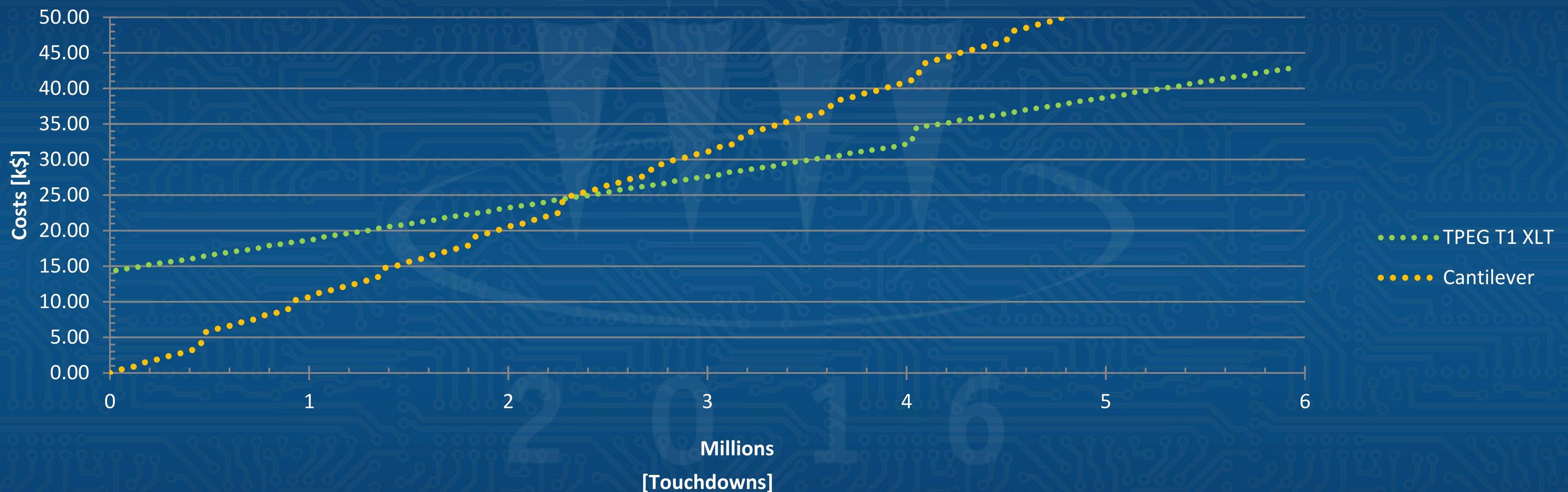
Results

- **Financial Impact**



Conditions for calculation

- Cantilever cards already in house (no new acquisition, only rebuilt / refurbish at EOL)
- PCB is re-used for vertical

Summary

Conclusion:

- **High performance probe solutions are cost effective also for low pin count probe card applications**
- **This study has demonstrated the advantage of using vertical technology (Technoprobe T1 XLT) also for low pin count probe cards:**
  - No pad damage
  - Stable contact resistance with better distribution
  - Higher life time with less maintenance effort
  - Higher initial cost but overall lower cost over lifetime → Better ROI

Acknowledgement

- **Texas Instruments**
  - Dirk Jasmer, Maciej Miler (Product responsible)
  - Al Wegleitner (& PTS team)
  - Werner Huber (& FTest management team)
- **Technoprobe**
  - Detlev Koch (Teltec)
  - Alessandro Antonioli
  - Raffaele Vallauri

Thank you for your attention

Backup