AEHR TEST SYSTEMS

Setting the Test Standard for Tomorrow

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Nasdaq: AEHR

Test Industry – The Tough Questions

- Are we really providing enough test coverage
- What failure rate is good enough
- How long do semiconductors, sensors, and devices need to be reliable for?
- How critical is the impact of failures based on the market:
  - Automotive
  - Mobile
  - Security
  - Health Monitoring

Advanced Driver Assistance Systems & Autonomous Driving

Biometric Sensing based Security

Biometric Sensing based Health Monitoring

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Test Industry – The Tough Questions

Safety

Advanced Driver Assistance Systems & Autonomous Driving

Security

Biometric Sensing based Security

Certainty

Biometric Sensing based Health Monitoring

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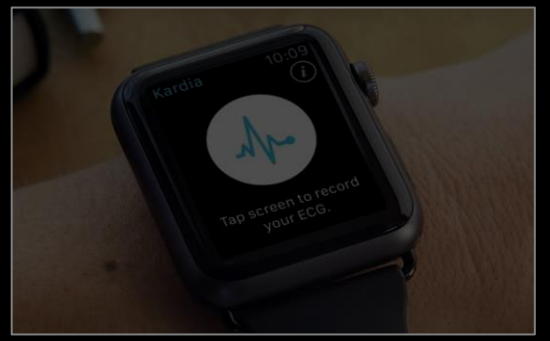

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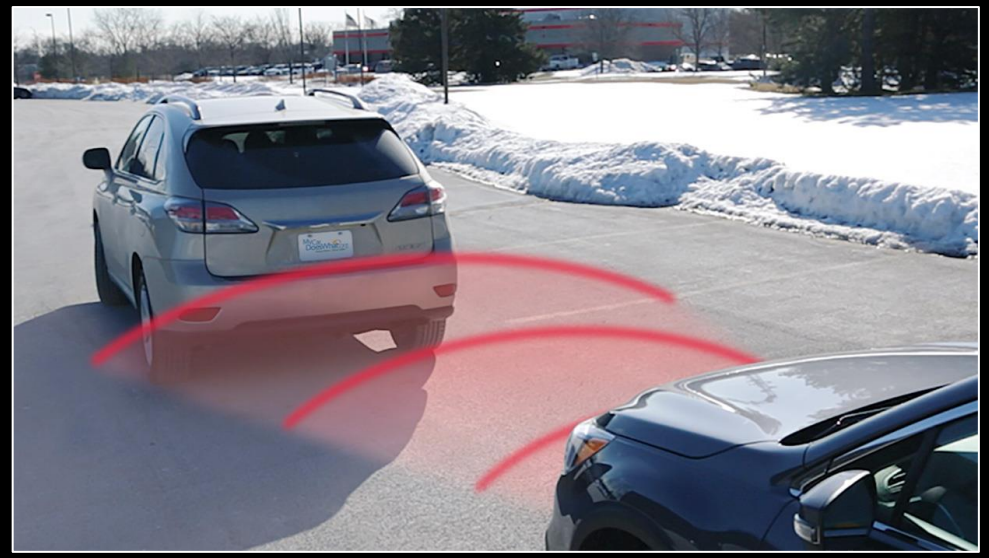
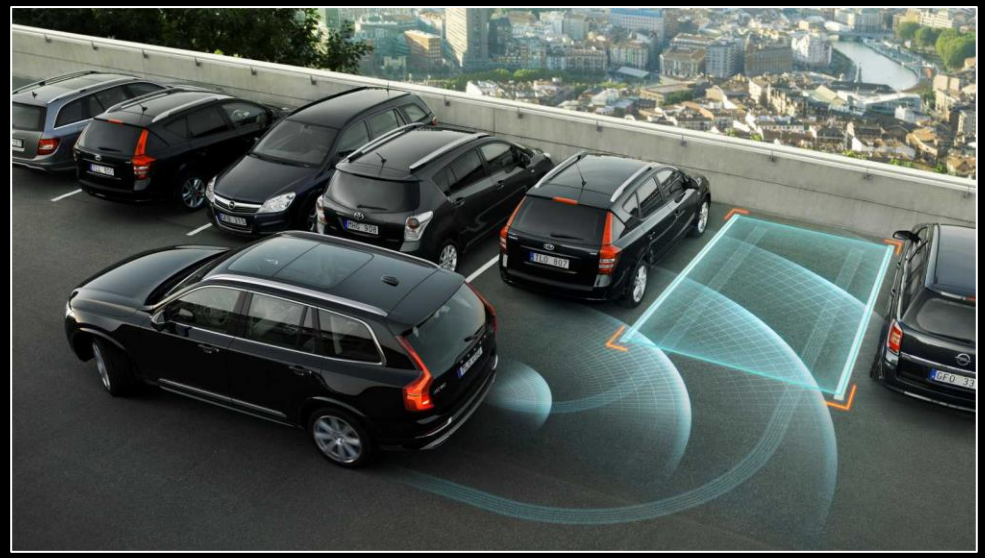
Advanced Driver Assistance in Automobiles

Automotive IC growth in sensors, control, information, and entertainment has substantially higher requirements for initial quality and long term reliability





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Semi- and Fully-Autonomous Cars

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Autonomous Personal Vehicles

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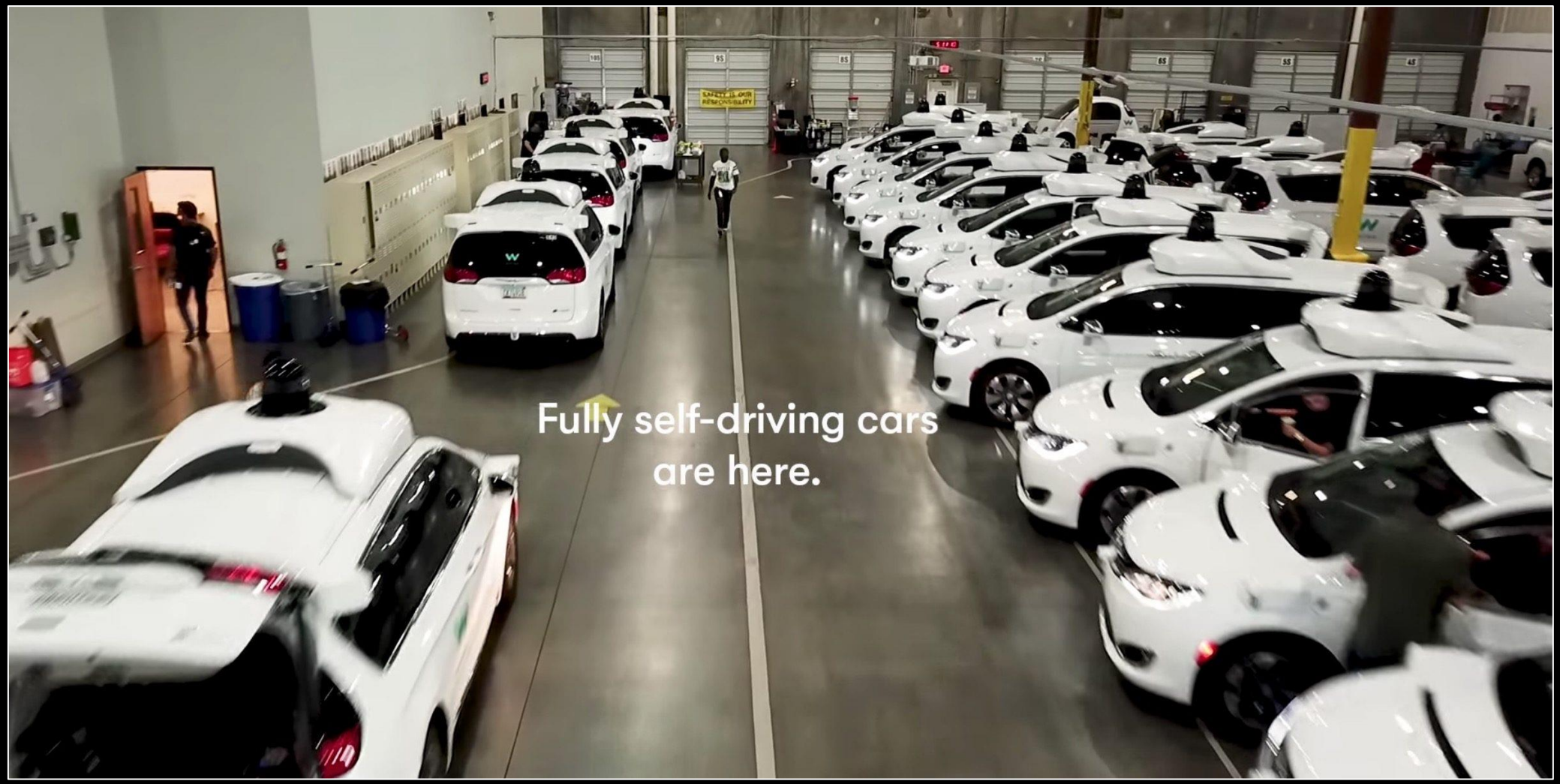
Autonomous Ride Share / Taxis



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Autonomous Transport Vehicles

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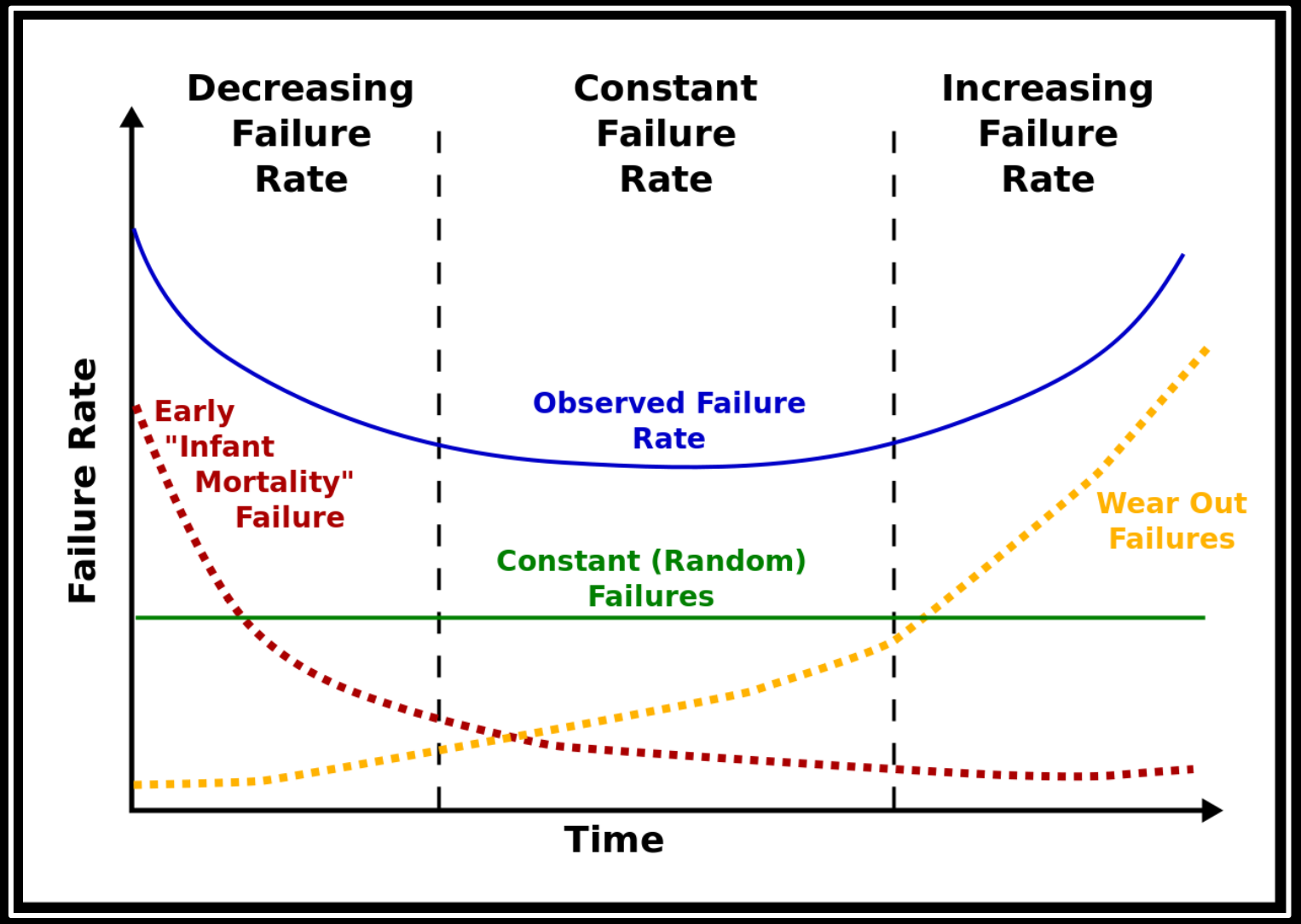
Semiconductor Reliability Bathtub Curve



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Internal Combustion Engines

Average Life Expectancy of ICE Automobile:

1970: 100,000 Miles

2020: 200,000 Miles

Average Speed in USA 37 MPH
= Less than 6000 hours!

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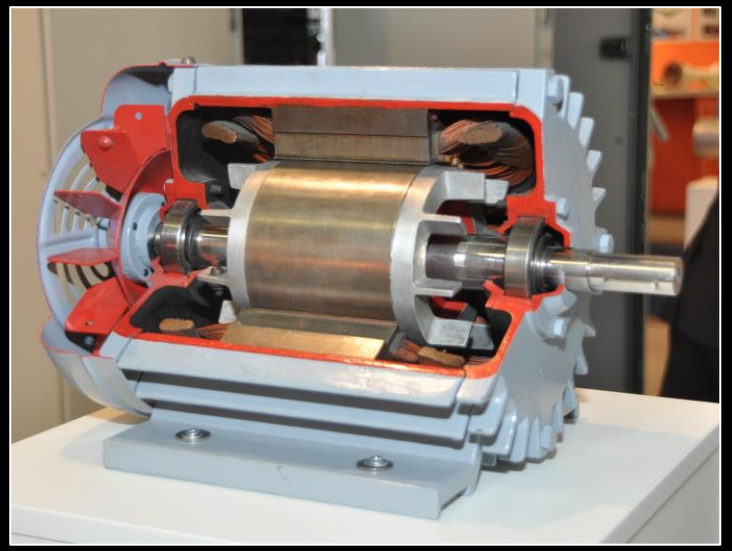
AC Induction Electric Motors

Life of commercial

AC induction motors typically

15 years



Tesla Model S Warranty:

8 Years with Unlimited Miles

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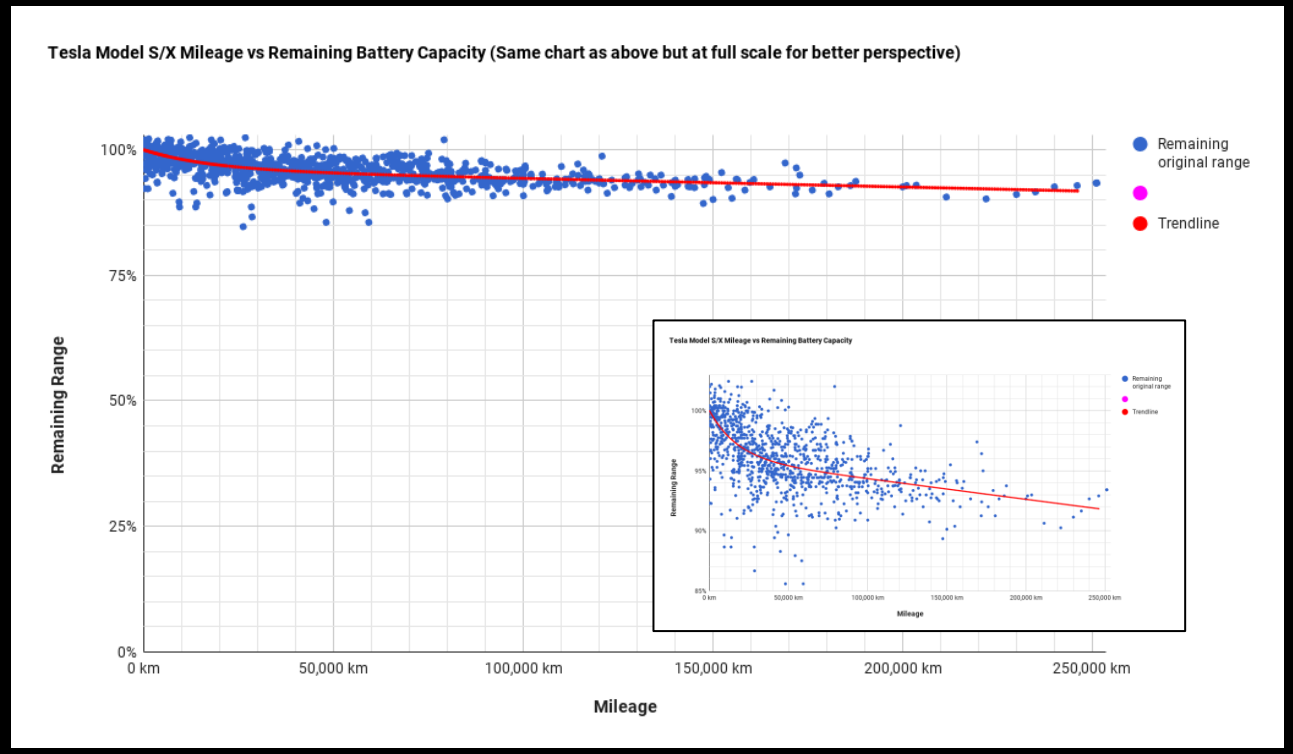
Tesla Model S Battery Capacity



On average the batteries have 92% remaining at 150,000 miles.

If the linear behavior would continue, then the ‘lifetime’ (still 80% capacity left) would be

500,000 miles!

https://steinbuch.wordpress.com/2015/01/24/tesla-model-s-battery-degradation-data/

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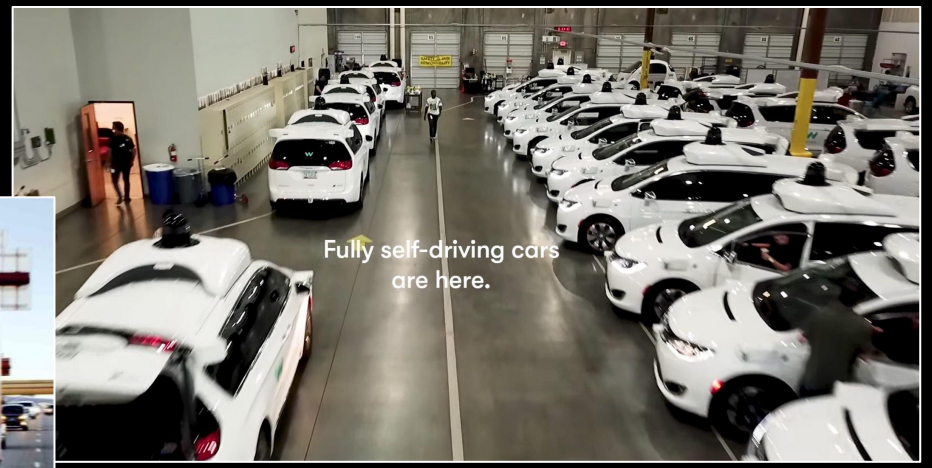
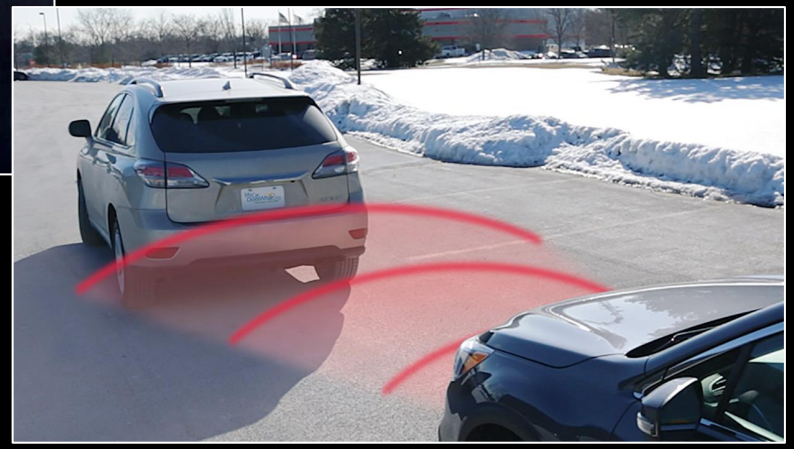
Vehicle Reliability and Safety





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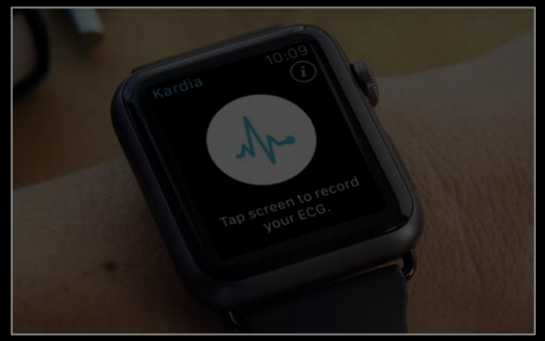

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Biometric Sensing based Security & Access

Integrated circuits and sensors use for biometric sensing based security and access have very high requirements and expectations for initial quality and long term reliability

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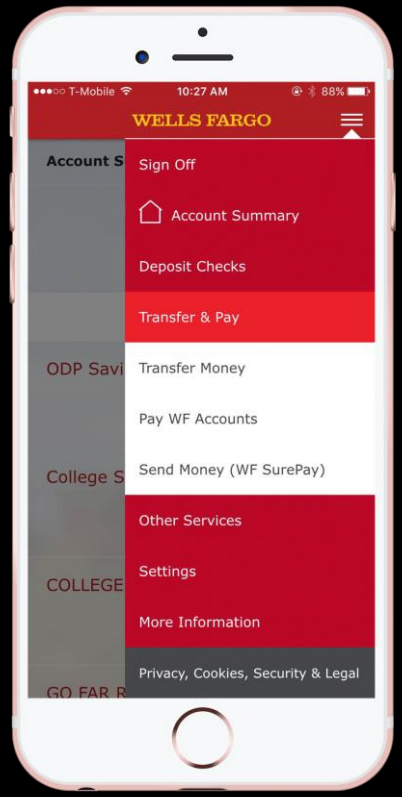
Financial Security & Access

Apple Pay



pay

Alipay™

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Physical Access & Security

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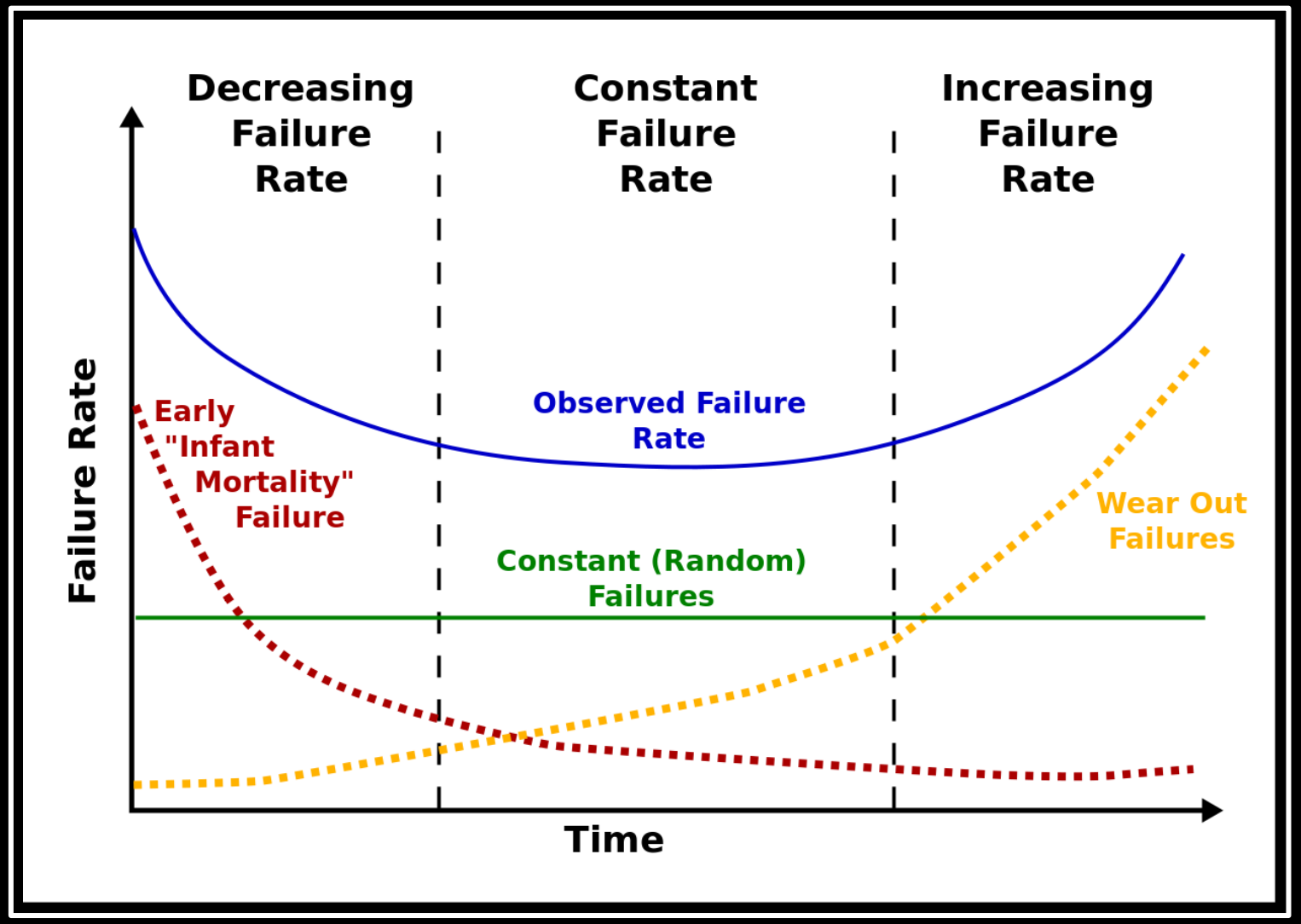
Semiconductor Reliability Bathtub Curve



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Test Coverage for High Quality

- Wafer Level and Package Part
- Test at Hot and Cold Extremes
- Functional & Parametric ATE Test
- Performance Grading?
- System Level Test?

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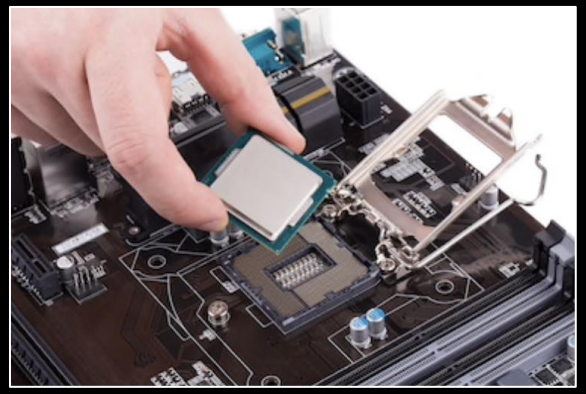
System Level Test

- What is System Level Test
- What is System Level Test Coverage
- Why System Level Test
- Is System Level Test Enough



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Test Coverage for High Reliability

- Device Sampling
- Test Vehicles
- Device Lot Acceptance Tests
- Statistical Process Control
- Just Enough Test

- 100% Burn-in

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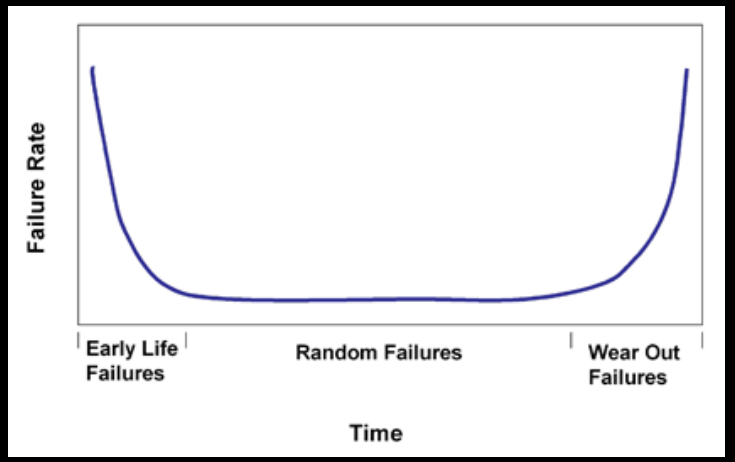
Sampling vs 100% Burn-in Test

- Many applications have come to expect burn-in sampling as a statistically accurate representation of long term quality
- Certainly cheaper to burn-in a small sample than 100%
- Sampling allows life tests - burn the device in for the equivalent of its expected life and if it passes, it can statistically represent the “lot” of devices. (These devices of course are not shippable as they have undergone accelerated life test and are “burned out”



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So Why not 100% Burn-in Test?

- Cost
- Logistics
- Confidence
- Tradition
- Competitive Alternatives

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The Real Cost of Burn-in

- Packaged Part Solutions Capital Depreciation per Hour per Device:

< $0.02 / hour

- Wafer Level Solutions Capital Depreciation per Hour per Device:

< $0.01 / hour

It's not the cost of the Capital,
it's the Logistics and Handling!

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Traditional Packaged Part Burn-in Processes

- Thermal Chamber based “Ovens”
- Hand or Pick and Place machine loaded Burn in Boards (BIBs)
- Low Cost Burn-in Sockets
- BIBs moved around in trolleys by operators and inserted individually or in cassettes manually
- “Not so clean” rooms
- Burn in Style
  - Static Burn-in
  - Dynamic Burn-in
  - Monitored Burn-in
  - Device Monitor or Test During Burn-in
- 100% Confidence of Valid Burn-in?

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Challenge to the Test Industry

What is the IDEAL production burn-in / reliability test solution

- 100% certainty of devices receiving valid burn in with per device traceability
- Devices are assured that they are not experiencing higher stress through inaccurate voltages, currents, or thermal temperatures
- Per device temperature, current, and power monitoring
- Parametric and functional data for burn-in effectiveness on every device
- Full Automation – remove human error and handling
- Massive Parallelism to achieve cost points to allow 100% infant mortality testing

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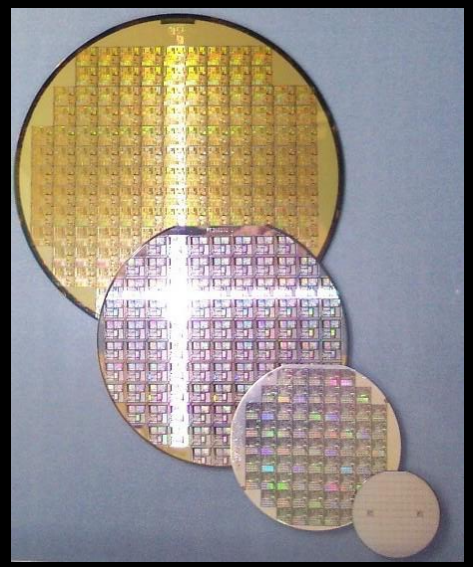
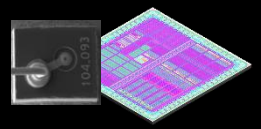
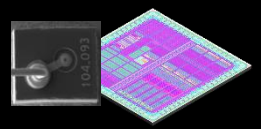
Production Burn-in / Reliability Test Options



Wafer



Singulated Die



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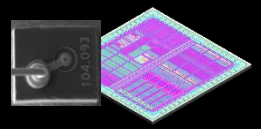
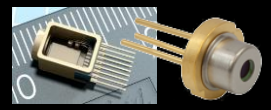
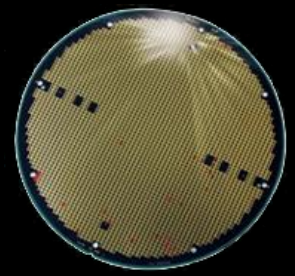


Singulated Die

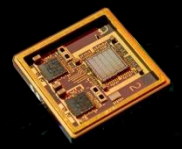


Single Die Package



Module "Panel"

Singulated Module



System in Package

System /Product/PCB

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Multi-Wafer (18) Test & Burn-in System

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