NINETEENTH ANNUAL

BiTS
Burn-in & Test Strategies Workshop ™

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Mesa, Arizona

Archive

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Setting the Test Standard for Tomorrow

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Test Industry – The Tough Questions

- Are we really providing enough test coverage

- What failure rate is good enough

- How long do semiconductors, optoelectronics, and sensors need to be reliable for?

- How critical is the impact of failures based on the market:

  - Automotive

  - Mobile

  - Communications

  - Security

Advanced Driver Assistance Systems & Autonomous Driving

Biometric Sensing based Security

Optical Communications Infrastructure

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Consumer Electronics in Automobiles
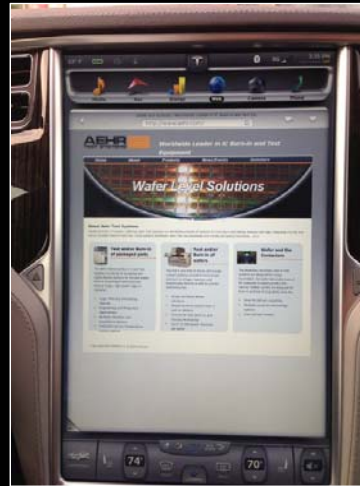
Advanced Driver Assistance in Automobiles

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

Semi- and Fully-Autonomous Cars

Autonomous Personal Vehicles

Autonomous Ride Share / Taxis

Autonomous Ride Share / Taxis
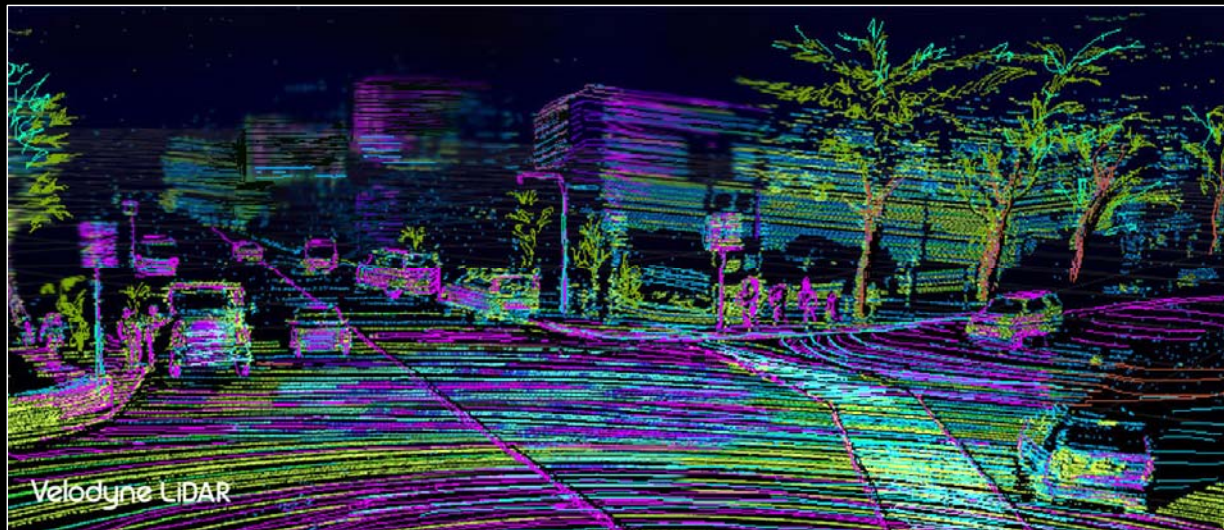
Autonomous Transport Vehicles

Autonomous Vehicle Sensor Systems

Autonomous Vehicle Sensors:
LIDAR, Radar, & Camera Systems

Biometric Sensing in Mobile

Semiconductor Reliability Bathtub Curve
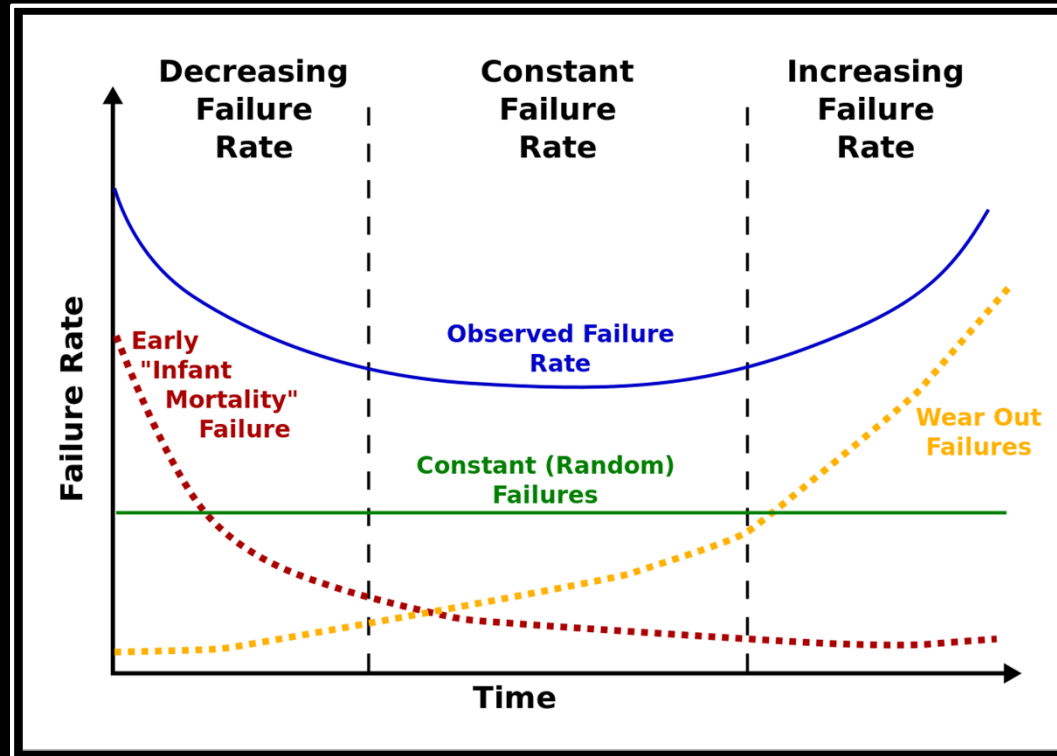
Near and Long Term Reliability

- Near term infant mortality
- What should the infant mortality rates be?

- How long is "long term"
- Is "long term" changing

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Internal Combustion Engines

Average Life Expectancy of ICE Automobile:
1970: 100,000 Miles
2020: 200,000 Miles

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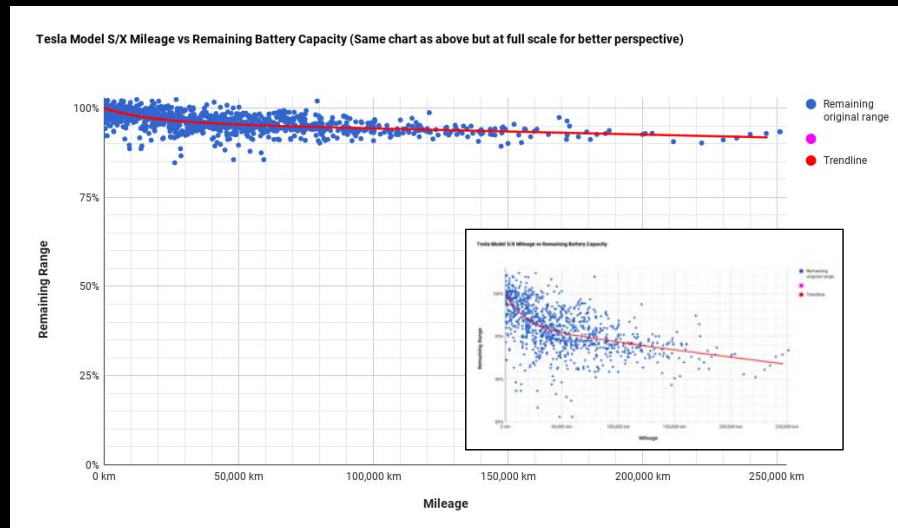
On average the batteries have 92% remaining at 150,000 miles.

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/

Automotive Semiconductor Suppliers
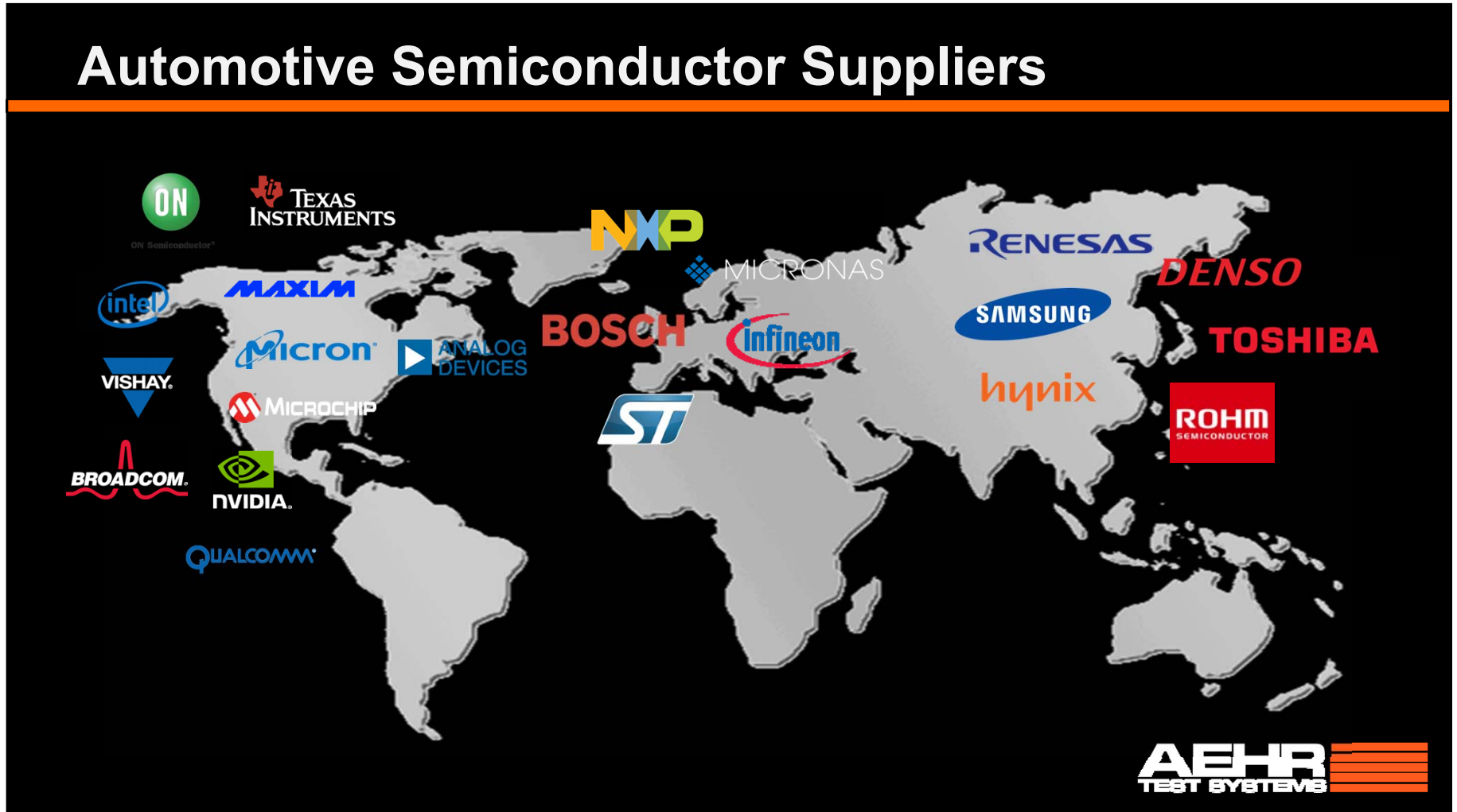
Automotive Semiconductor Defects

- Is there really such a thing as Zero DPPM?

- There are now specs at sub 1 DPPM

- < 500 Parts per Billion Defect Specifications

Background on Electromigration

- Electromigration: Metal atoms swept out of position by high current density -> failure (void/extrusion)

- Black's Equation (Mean time to failure of a wire)

Smaller Geometries (A) and Higher Current Densities (J) increase failure rates

$$\text{MTTF} = \frac{A}{J^2} \exp\left(\frac{E_a}{kT} \right)$$

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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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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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Burn-in Board – Hall of Shame
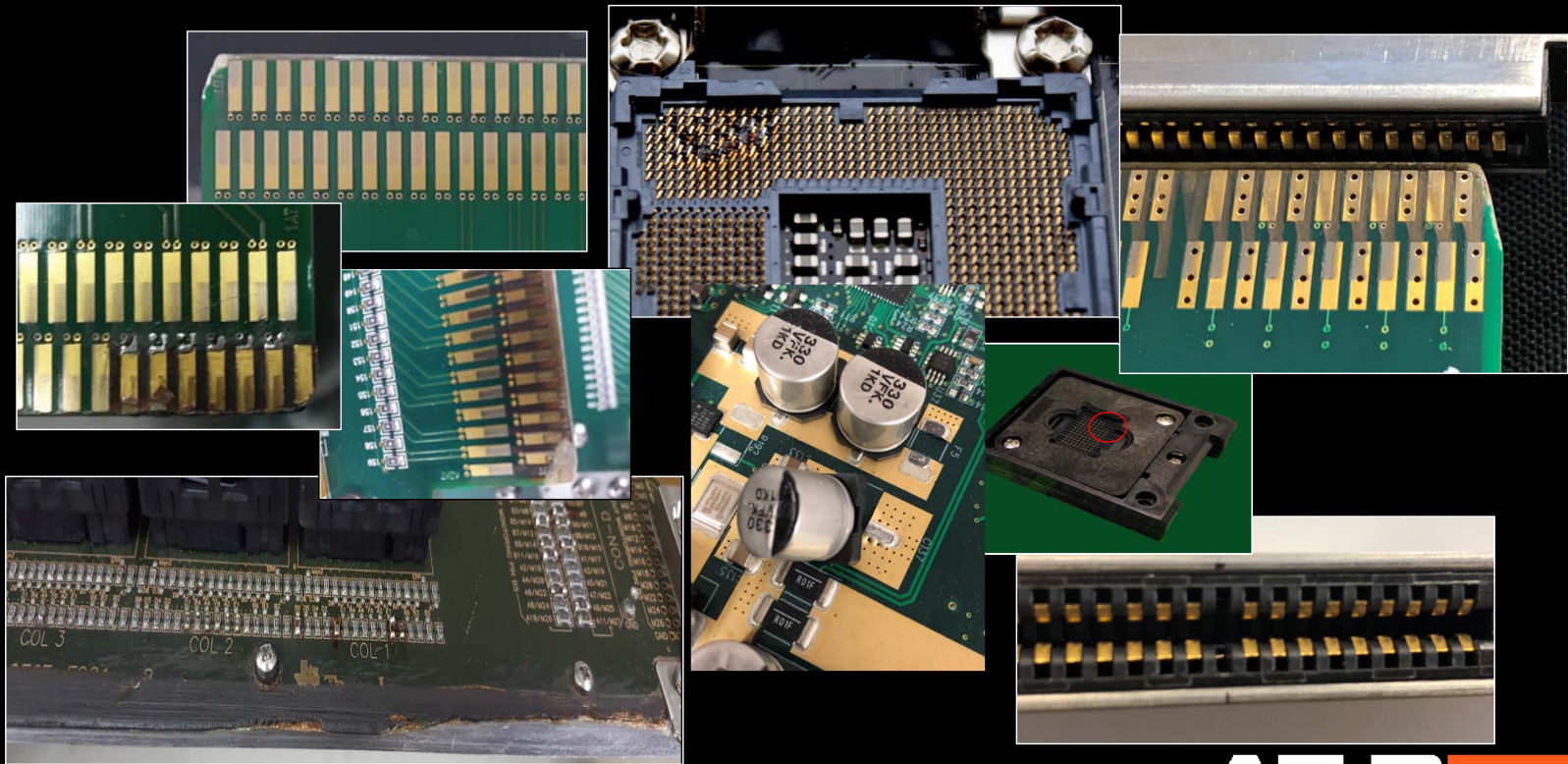
Challenge to the Test Industry

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
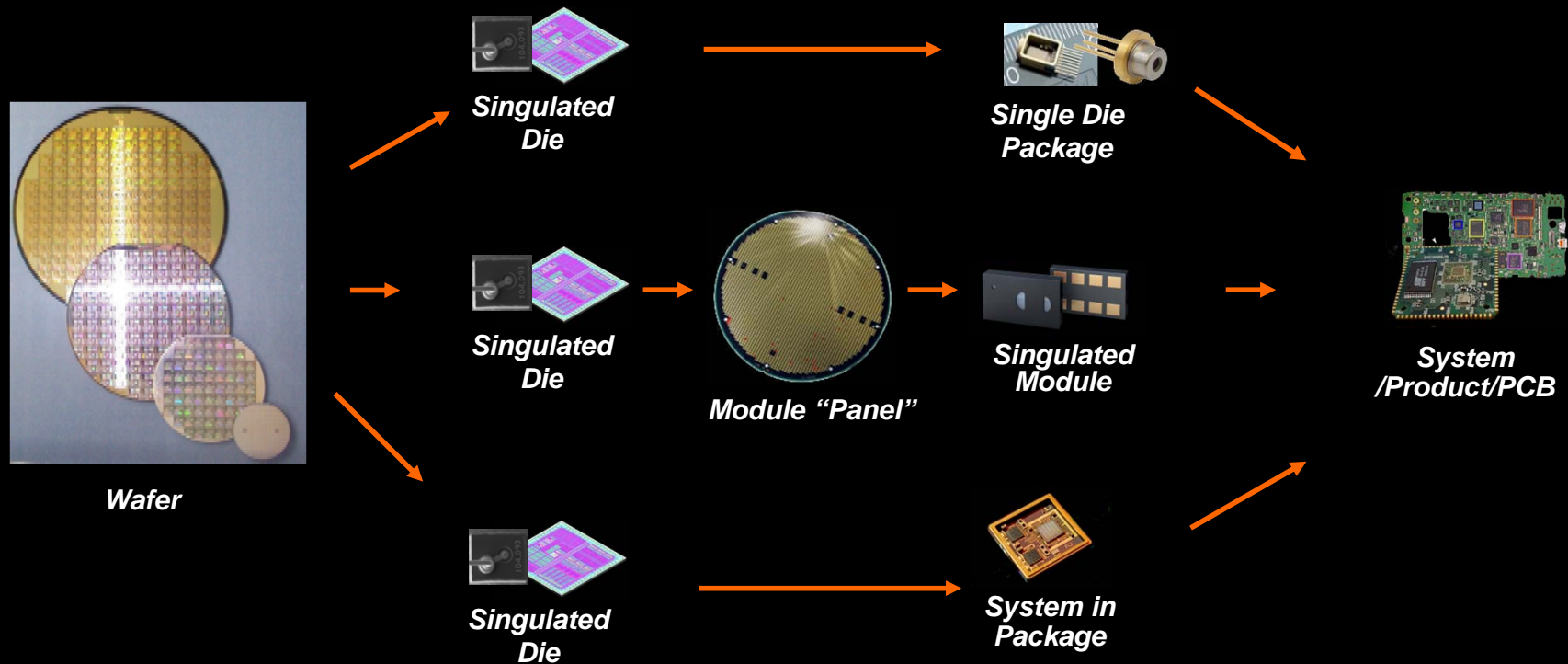
Vehicle Reliability and Safety

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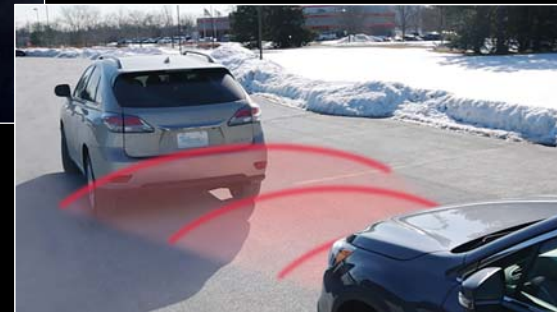
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Aehr Test Systems *(Nasdaq: AEHR)*

Production Semiconductor Test & Burn-in for over 40 Years

- Technology leader in massively parallel test & burn-in systems with 2,500 systems installed worldwide

- Unique full-wafer test & burn-in systems and contactors

- High parallel wafer level and package test products

Packaged Part Test & Burn-in

Multiple Wafer/Module Test & Burn-in

Single Wafer Test & Burn-in