
AEHR
TEST SYSTEMS
Setting the Test Standard for Tomorrow
Nasdaq: AEHR

Forward Looking Statements

This presentation contains forward-looking statements that involve risks and uncertainties relating to projections regarding industry growth and customer demand for the Company's products. Actual results may vary from projected results. These risks and uncertainties include without limitation, acceptance by new customers of the FOX™ wafer level burn-in and test system, world economic conditions, the timing of COVID-19 related business impacts, the Company's ability to maintain sufficient cash to support operations, and the potential emergence of alternative technologies, which could adversely affect demand for the Company's products in fiscal year 2023. See the Company's recent 10-K and 10-Q reports filed with the SEC for a more detailed description of the risks facing the Company's business. The Company disclaims any obligation to update information contained in any forward-looking statement to reflect events or circumstances occurring after the date of this presentation.

AEHR TEST SYSTEMS

Aehr Test Systems Company Overview

Production Semiconductor Test & Burn-in for over 40 Years!

- Technology leader in massively parallel test and burn-in systems
- World-wide leader in wafer-level burn-in and test systems
- Unique full-wafer test and burn-in systems and contactors

AEHR TEST SYSTEMS

Testing without Compromise

Reliability, Stress, and DFT Testing without compromise

- Solutions for **package parts, modules, panels,** or **wafers** allow testing at optimal process point
- **Confirm** which devices received desired test with **per device measurements, monitoring, & feedback**
- **100% traceability** with die location (wafer) or device ID read back (module) and electronic tracking ensures knowledge of “good” devices
- Thermal range, uniformity, and capacity permit **reduced test times** & **confidence** in target **test conditions**
- Vast system resources allow for minimal sharing (**higher sample size, higher yields, fewer hostage failures**)
- **Economical solutions** and **customizations** allow required testing to be performed at the **lowest cost**

AEHR TEST SYSTEMS

Worldwide Customer Base

Aehr Test Headquarters,
Fremont California

SIERRA WIRELESS
SAMSUNG
SEAGATE
NXP
hynix
SPANSION
SKORPIOS TECHNOLOGIES
U.S. DEPARTMENT OF DEFENSE
infineon
sicoya silicon photonics
infineon
Amkor Technology
RENESAS
BPIL
infineon
ISE LABS
ASE GROUP
MICROCHIP
BOSCH
SPREADTRUM
onsemi
ATMEL
TDK
ADVANCED
STATSChipPAC
tsmc
MACOM
LUMENTUM
TEXAS INSTRUMENTS
QRT
UMC
Inphi
FATC
MAXIM
ASE GROUP
amkor
NANYA
GLOBALFOUNDRIES

Aehr has been a leader in burn-in test solutions for over 40 years with thousands of systems shipped worldwide

AEHR TEST SYSTEMS

(Partial Customer List)

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Market Drivers

Need for cost-efficient wafer level and singulated die burn-in & testing as well as new requirements in package part burn-in are creating significant revenue opportunities in the following key markets

- **Automotive IC growth** in motor control and charging infrastructure using **Silicon Carbide devices**, as well as sensors, safety, information, and entertainment
- **Data Center Infrastructure** and unstoppable growth in **Data Storage**
- **Worldwide 5G Infrastructure** build out using **Silicon Photonics** fiber optic transceivers
- **3D and 2D Sensors** including facial recognition in smartphones, tablets, and other applications
- **Heterogeneous Integration of semiconductors** and **3D fabrication and stacking** driving technology and cost roadmaps pushing known good die with test and burn-in of device in wafer form prior to packaging

AEHR TEST SYSTEMS

FOX Family of Wafer Level Test & Burn-in Systems

Solutions for Engineering to Production

FOX-CP

Single Wafer Stepping Test & Burn-In System

FOX-NP

Dual WaferPak & Dual DiePak Test & Burn-In System

FOX-XP

Multi WaferPak & Multi DiePak Test & Burn-In Systems

FOX WaferPak Contactor

FOX DiePak Carrier

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Aehr Wafer Level Test & Burn-in Patents

- WaferPak temperature control methods
- Vacuum & pressure-based WaferPaks
- Maintaining probe contact over temperature
- Electrical components in WaferPak
- Individual DUT power supplies
- Per Die Current Protection
- Redundant power supplies
- Portable WaferPaks
- And more . . .

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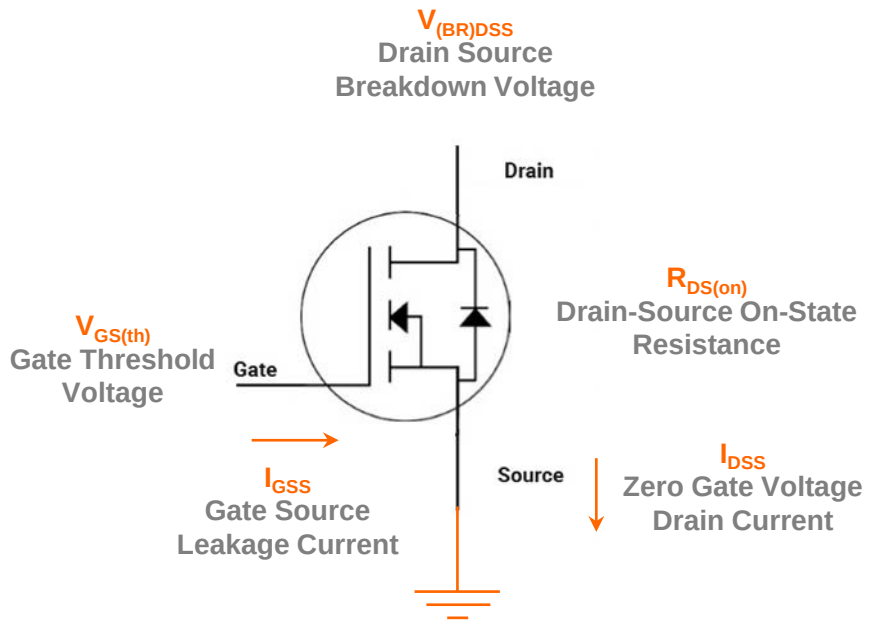
Critical SiC MOSFET Parameters & Stress Tests

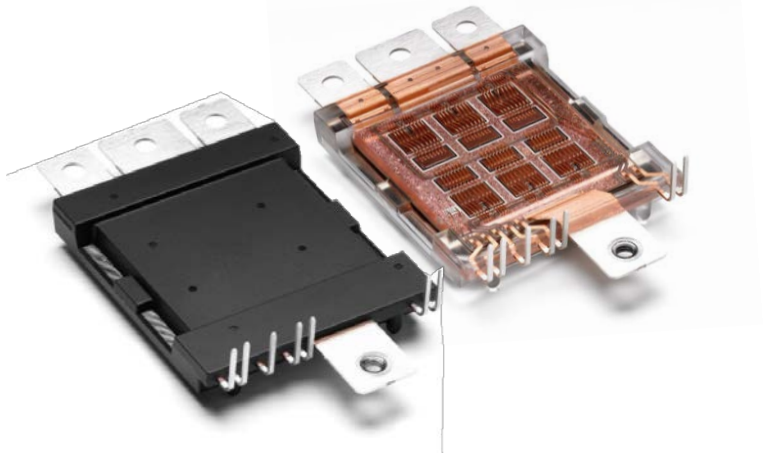
Higher than acceptable extrinsic (infant mortality) failure rates of silicon carbide MOSFETs require 100% production stress / burn-in testing to achieve automotive and industrial quality levels

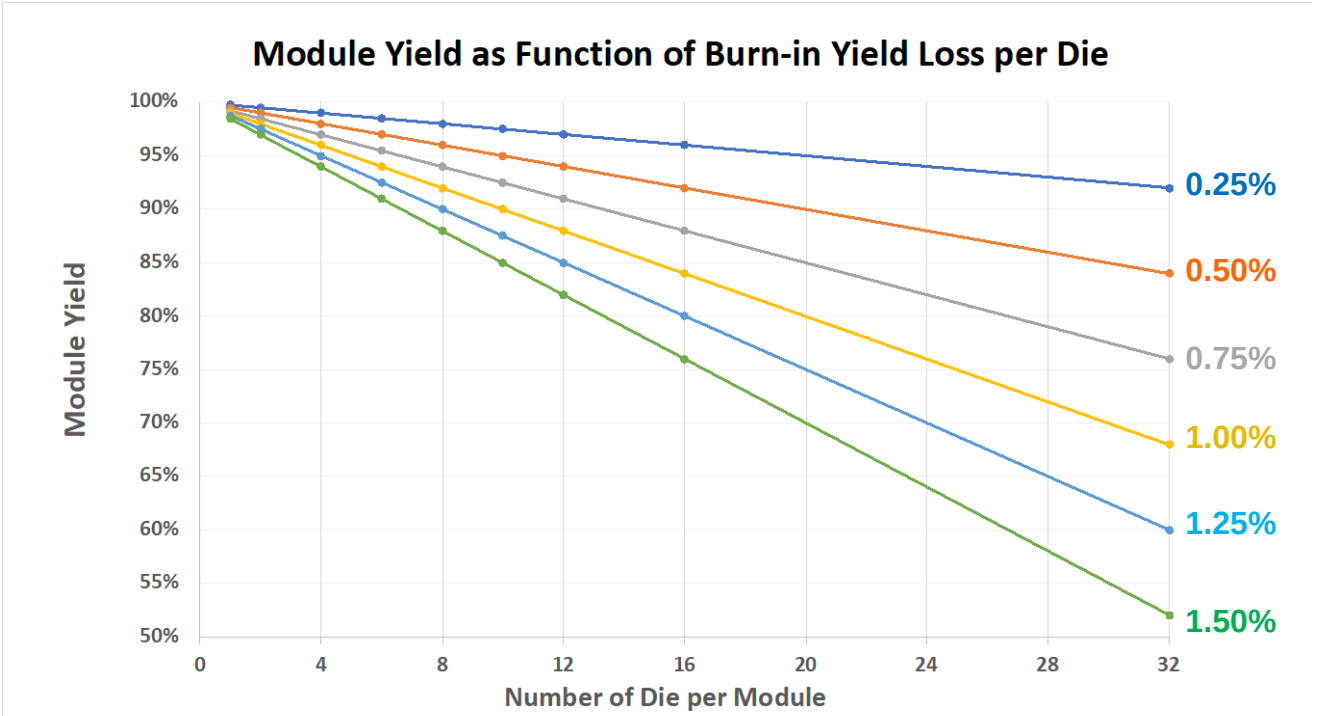
Example Stress / Burn-in Tests

- **Positive Gate Stress (HTGB+)**
  - Positive Gate Voltage (Vgs)
- **Negative Gate Stress (HTGB-)**
  - Negative Gate Voltage (Vgs)
- **Drain Stress (HTRB)**
  - Positive Drain Voltage (Vds)
- **Body Diode Stress**
  - High Current Source from Source to Drain



SiC and Multi-Die Packages / Modules





- Infant Mortality Yield loss of Modules linear with yield loss per die times number of die per module
- Cost of yield loss much greater than cost of burn-in test
- This is why the industry is driving to Wafer Level Burn-in

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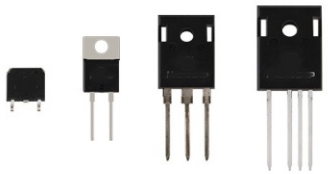
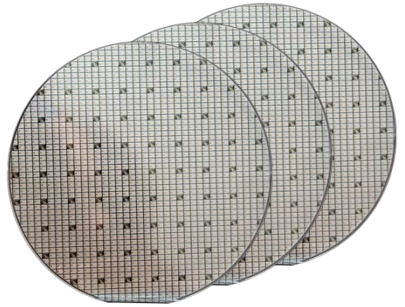
Package Part vs Wafer Level Burn in

Package / Module Part Burn-in



- Up to ~ 2,500 SiC devices per system
- Individual device handling with limited life sockets and scrub marks on device leads
- Convection Thermal Control (Oven)
- Equipment depreciation cost of ~ $0.01 per hour burn-in cost (fixed with standard discrete packages)

Wafer Level Burn-in



x18

- Up to ~ 45,000 SiC devices per system
- 1000s of devices handled at a time with micro-pogo contact to die >> 100,000 cycle life
- Conduction Thermal Control (Thermal Chuck)
- Equipment depreciation cost of ~ $0.01 per hour burn-in cost (typical 500 die per wafer inverter MOSFET) and ~ $0.002 per (2500 die per wafer charger or photovoltaic application MOSFET)

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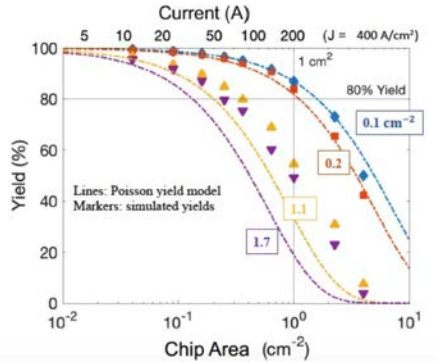
SiC Modules

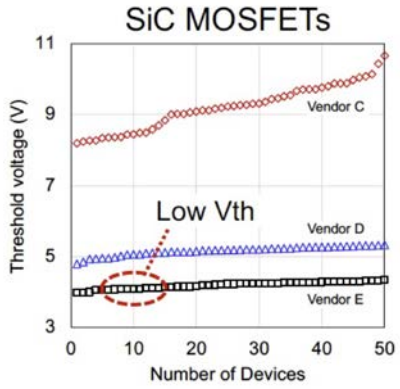
- A 100kW 3-phase inverter for use in future Electric Vehicle (EV's) chargers needs a 450A to 550A rated switch for a 400V rated battery
- The largest SiC dies available at a 650V voltage rating are listed below

Vendor	Rated Continuous ID at 25C (A)	Rdson Typ 25C (mOhms)	Part Number
Infineon	64	22	IMBG65R022M1H
ST Microelectronics	119	18	SCTWA90N65G2V-4
Wolfspeed	120	15	C3M0015065D



- Several devices needed in parallel for the 3-phase power module application.
- This can present challenges in matching device parameters within the module.
- **The variation and drift of the threshold voltage in the SiC MOSFET is a major concern**

Variation:



Device to device variations < 0.5 V to >3 V!

Ref: **The SiC MOSFET Reliability Studies at the Ohio State University: Threshold Voltage Stability and Gate Oxide Screening Challenges**
September 8, 2022 Sonu Daryanani

https://www.powerelectronicsnews.com/the-sic-mosfet-reliability-studies-at-the-ohio-state-university-threshold-voltage-stability-and-gate-oxide-screening-challenges/

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Variation of Devices' V_{TH} in Modules

"With multiple devices in parallel that have different V_{TH}s, the device with the lowest V_{TH} will turn on first, and for a fraction of a second it will have a very large current passing through it until the others also turn on. This is momentary, but in an extreme case where there is a large difference this could be catastrophic, with the device being overloaded and failing. However, even in a more fractional case, the device with the lowest V_{TH} will be more highly stressed because it will take slightly more current in the switching phase, which could be detrimental to its long-term reliability compared to the rest."

Peter Gammon, Professor of Power Electronic Devices at University of Warwick

Module Manufacturers are requesting/requiring devices with matching V_{TH} and/or R_{DSon}

AEHR TEST SYSTEMS

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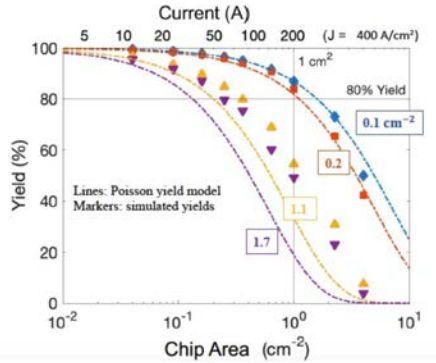

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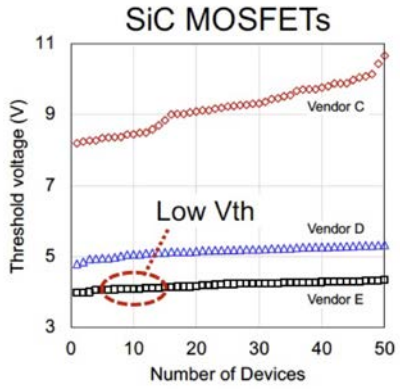
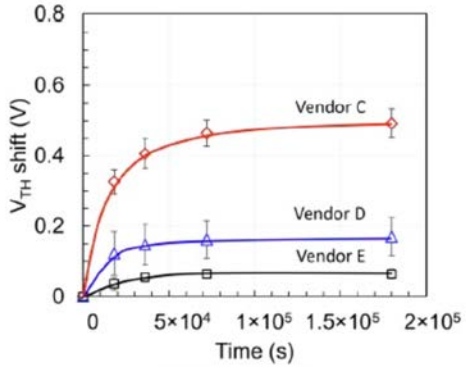


Drift:



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V_{TH} Stabilization during Stress / Burn-in Tests

- Beyond Extrinsic (infant Mortality) Failure detection
- V_{TH} substantially changes and stabilizes with time at elevated temperatures and elevated V_{GS} levels

- Given the variation in the devices to begin with, do they stabilize in the same duration, to the same end or even relative V_{TH} levels?

AEHR TEST SYSTEMS

FOX-NP SiC Gate and Drain Stress Test Solution

FOX-NP Dual Wafer Test & Burn-In System

- **SiC MOSFET Gate Stress (HTGB)**
  - Programmable Gate voltage -30V to +40V
  - Pulsing Gate Voltages
  - Up to 150C
- **SiC MOSFET Drain Stress (HTRB)**
  - Programmable Drain voltage up to 2,000V
  - Up to 135C
- **SiC MOSFET Body Diode Stress**
  - Programmable Source current up to > 1000A per wafer
  - Up to 150C

FOX WaferPak Contactor

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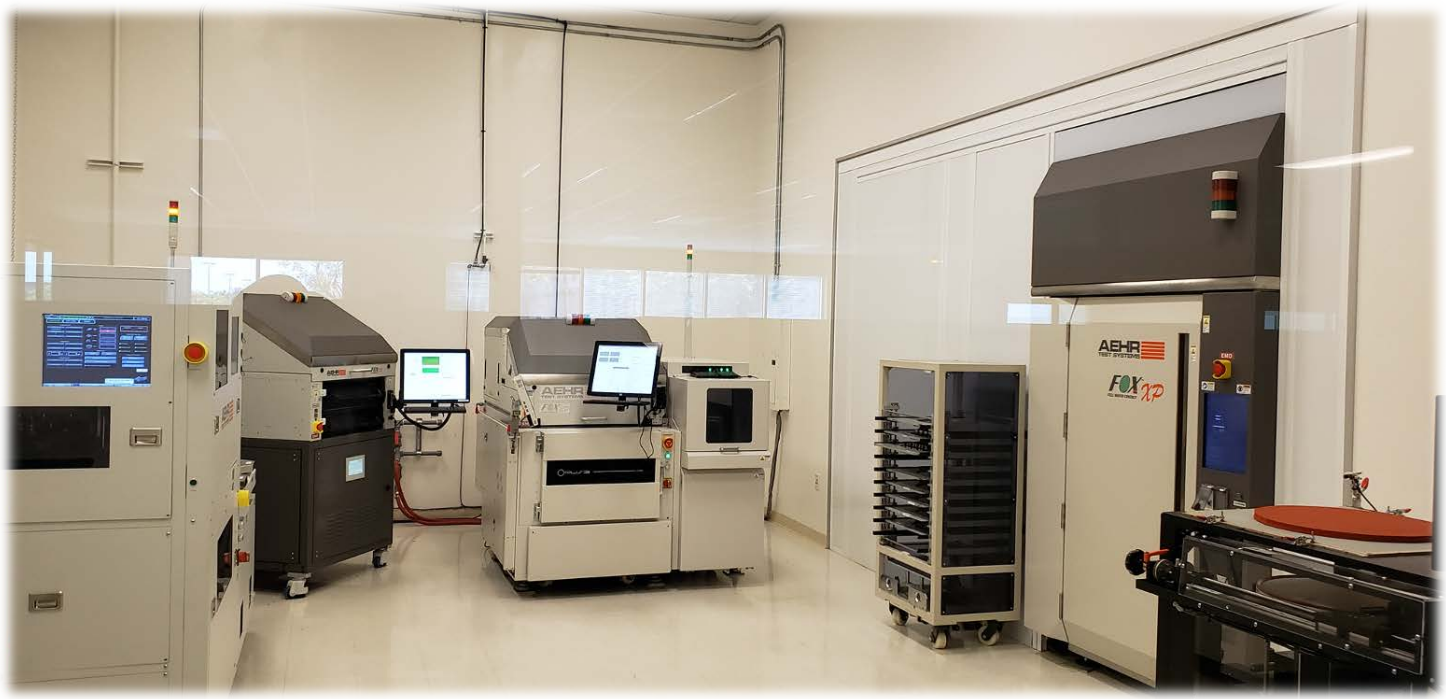
FOX-XP Production Test & Burn-In System

FOX-XP 18 Wafer SiC Test & Burn-In System configured for SiC Gate Stress Test

- **9 / 18 Wafer System for High Volume Production**
  - 100% compatible using the same Blade resources as FOX-NP
  - Configurable for Gate, Drain, and Body Diode Stress tests
  - Integrated standard 20ºC to 150ºC thermal control unit
- **FOX WaferPak Contactors**
  - Robust full wafer contactor with >> 100,000 cycle life
  - High compliance / robust micro pogo pins
  - Offline or online wafer alignment via Aehr proprietary WaferPak aligners

AEHR TEST SYSTEMS

Aehr Fremont Applications Lab



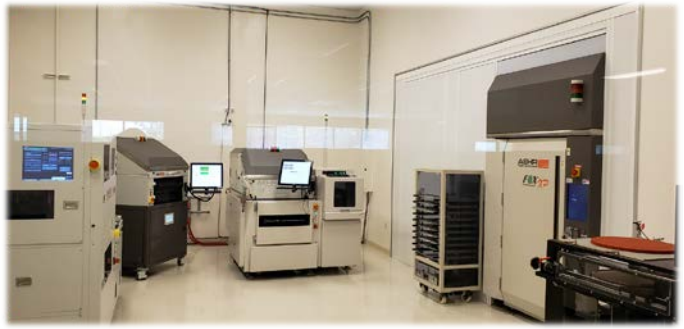
- FOX-XP Multi-Wafer WLBI System
- FOX-NP Dual-Wafer WLBI System
- FOX-CP Single Wafer Test Burn-in System with integrated high-power thermal chuck fully automated wafer prober
- FOX WaferPaks, DiePaks, & TLBs
- FOX WaferPak Automated Aligner
- FOX WaferPak Manual Aligner
- WaferPaks Racks & Accessories

AEHR TEST SYSTEMS

Aehr's SiC WLBI Qualification Program

- Customer and Aehr define success criteria for SiC wafer level qualification
- Aehr will develop and build a custom WaferPak and test program with monitoring for wafer level test and burn-in
- All development and testing can be done "remote and contact free" at Aehr Test Fremont facility
  - FOX-XP or NP Systems
  - Expert Test Engineering resources
  - Equipment and Devices in Aehr Fremont Clean Rooms
  - Remote access and video conferencing
  - 100% secure with restricted access, locks, and cameras

Aehr Fremont, CA Applications Lab

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