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Metal Oxide (MOX) Gas Sensor Device Testing

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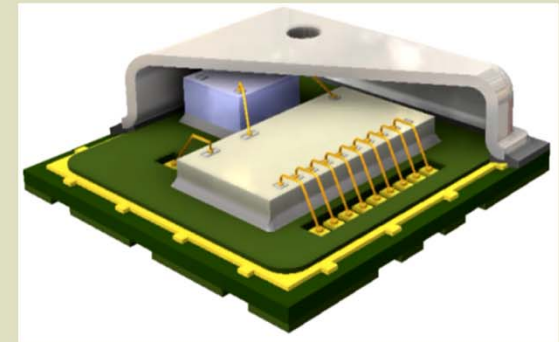
Topics

- Background / Applications for MOX Gas Sensors
- Test Requirements
- Test System Implementation

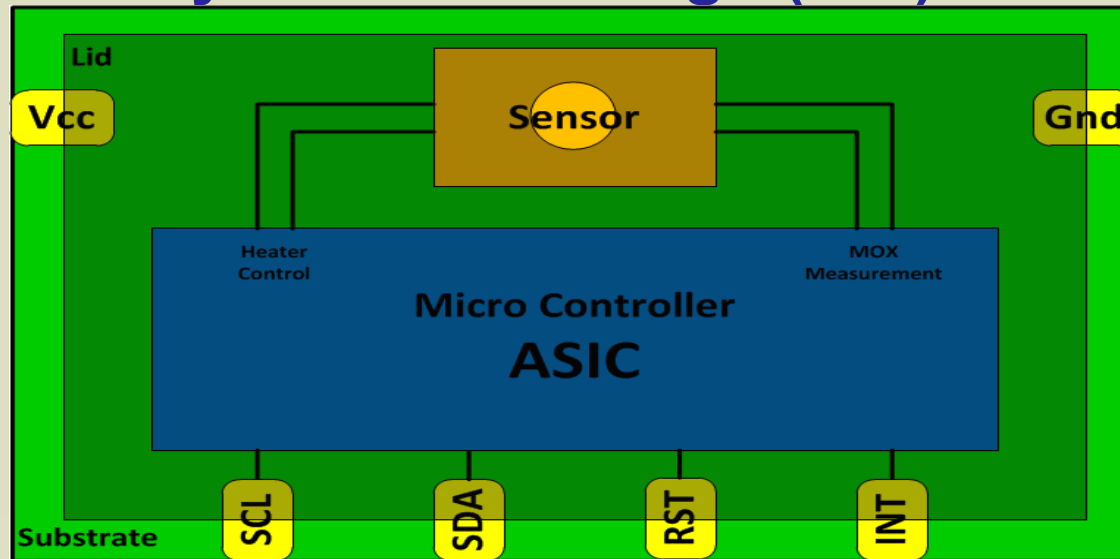


Metal Oxide Gas Sensors

- Multi-chip module (MCM): micro-controller ASIC and sensor placed on a common substrate
- The sensor: MOX material is a variable resistor that responds to the target gas when in the presence of heat
- Calibration of the device requires measuring the resistance of the MOX sensor in the presence of “clean air” and the target gas



MOX Gas Sensor Components: A System in Package (SiP) Device



- The device combines digital, analog & MOX sensor technologies in one package
- Control of the sensor heater, MOX measurements and access to device registers is performed via an I²C interface

MOX Gas Sensor Applications

- IoT Smart Home
- Precise measurement of Carbon Monoxide (CO) and Volatile Organic Compounds (VOCs)
- Biological research
- Industrial control
- Portable breathalyzers



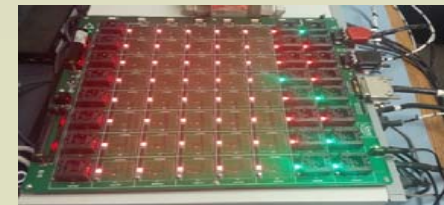
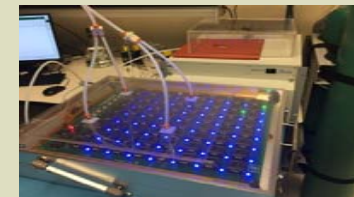
Metal Oxide (MOX) Gas Sensor Device Testing

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Gas Sensor Test Requirements

- The time to test/calibrate a MOX sensor can be several tens of minutes - using “big ATE” is not cost effective
- High parallel test capability with expandability - eliminates the burden of long “soak” or “dwell” time associated with these devices
- The DUT load board must reside in an enclosed environment
- Operator must be able to visually identify and manually bin passing and failing components
- All measurements must be completed in less than one second to avoid skewing results due to disparate soak times
- Support for the I²C bus as well as a contact test is needed, requiring both digital and PMU per pin test resources

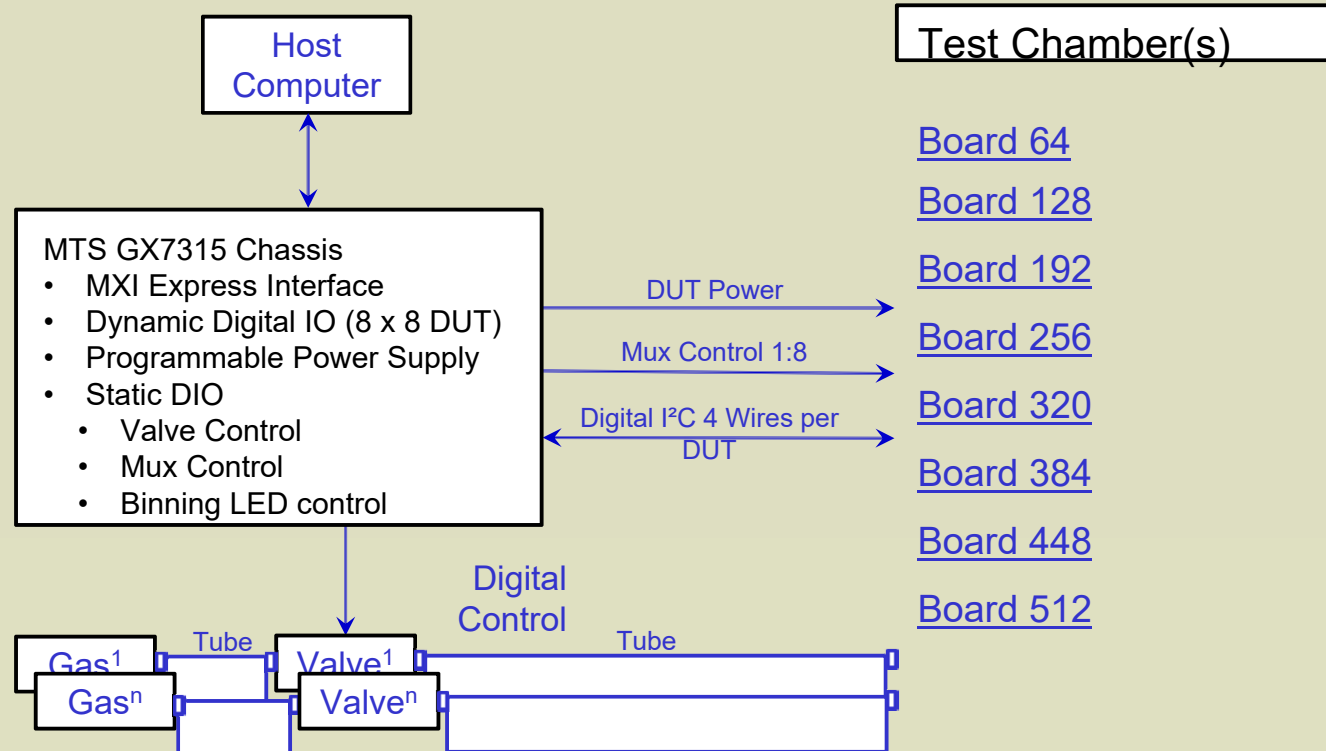


Gas Sensor Test Solution: PXI – Based Test System

- Core system for 64 devices: PXI chassis, interface test adapter, digital instrumentation, power supplies, DUT board
- Expansion for each additional 64 DUT board requires only one additional digital I/O module & load board
- ATEasy® test executive software provides multi-site test control
- Contact / ESD testing performed on each DUT verifies correct device insertion



Gas Sensor Test System Configuration

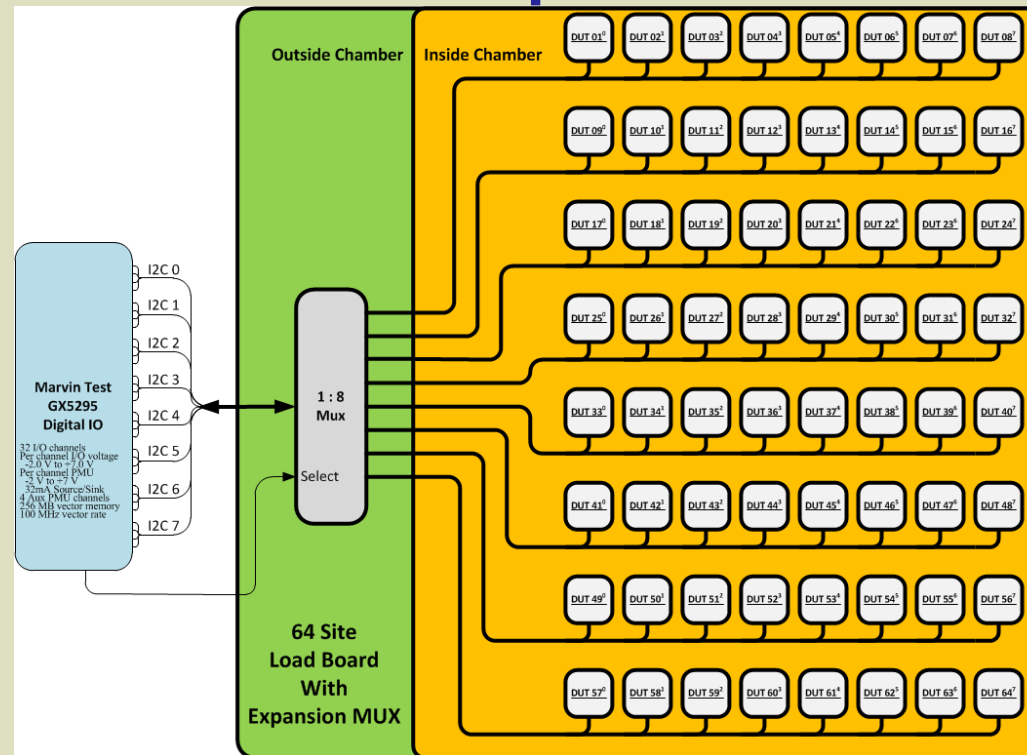


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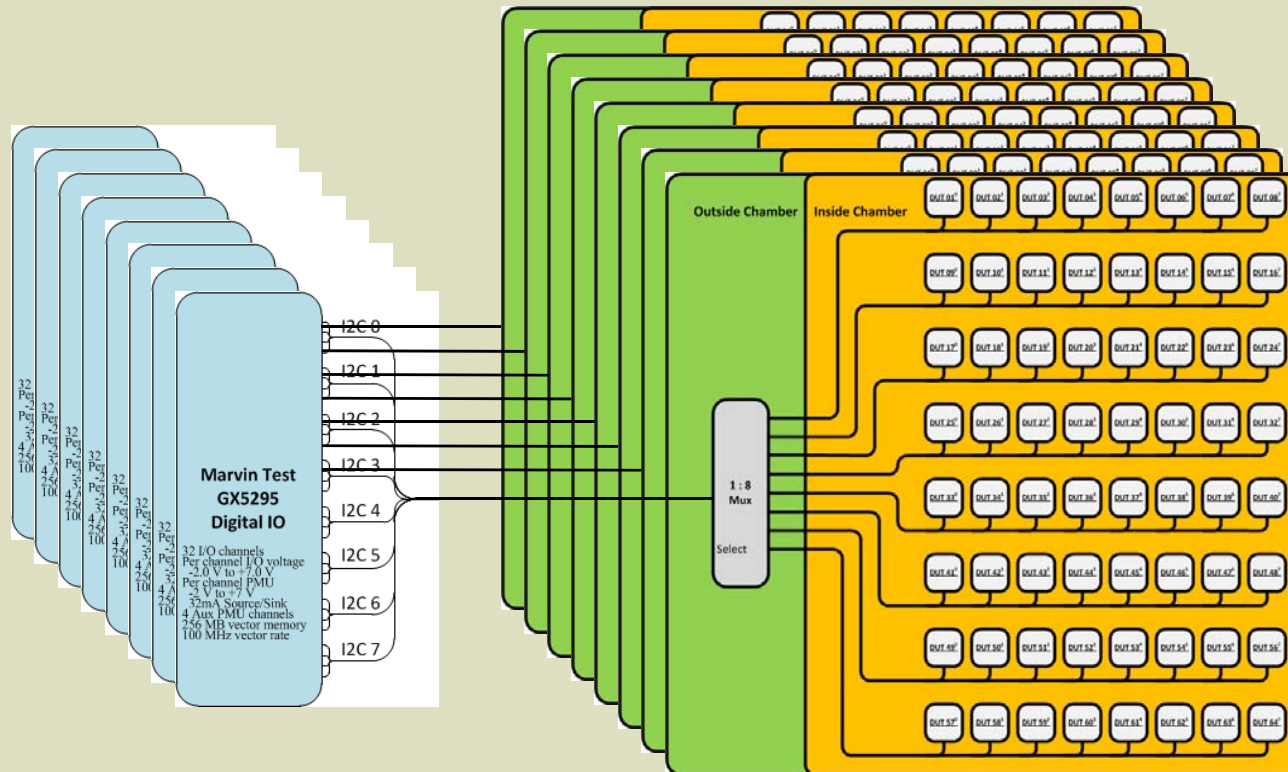
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System Architecture: 8 I²C Busses Multiplexed to 64 DUTs



Scalable Test Capabilities

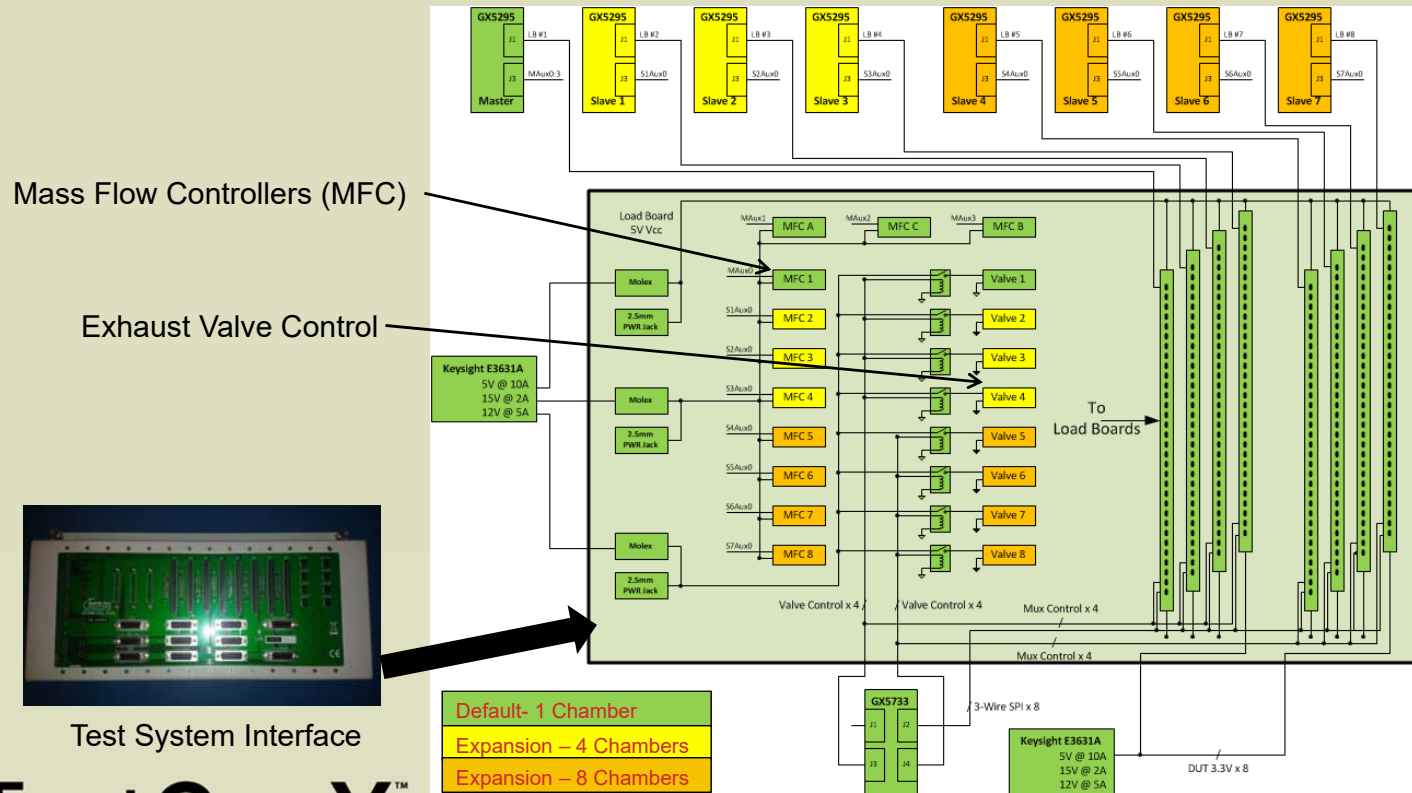


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Test System Resources & Interface Test Adapter

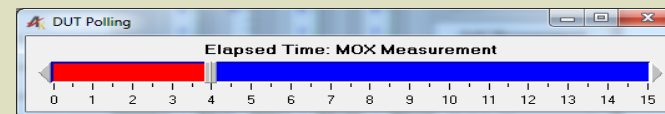
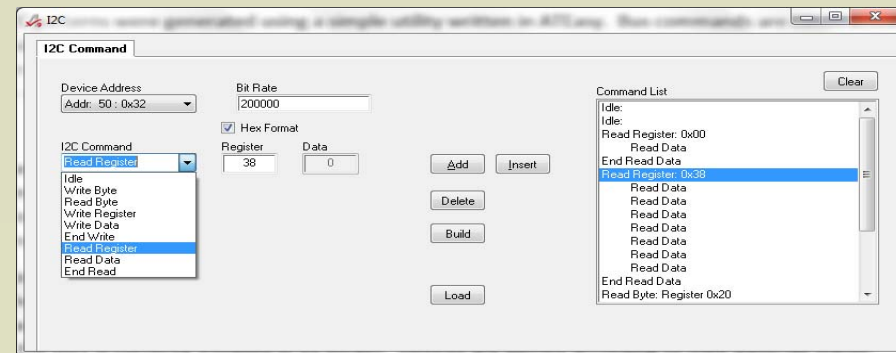
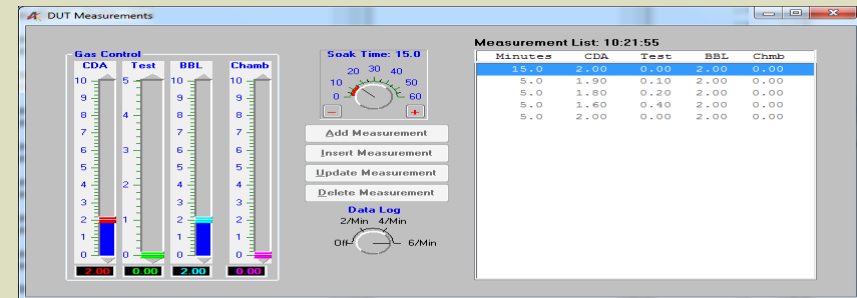


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Gas Control and System Software

- Control of gas to chamber via Mass Flow Controllers (MFCs) - meter & control Clean-Dry Air, Humidified Air and the Test Gas
- Exhaust valves allow gas to evacuate the test gas from the load board chamber
- All valve control provided by test system
- System Software – ATEasy
 - Multi-threading
 - Valve control
 - Data logging
 - User log-in, privileges
 - Profiles – select test parameters



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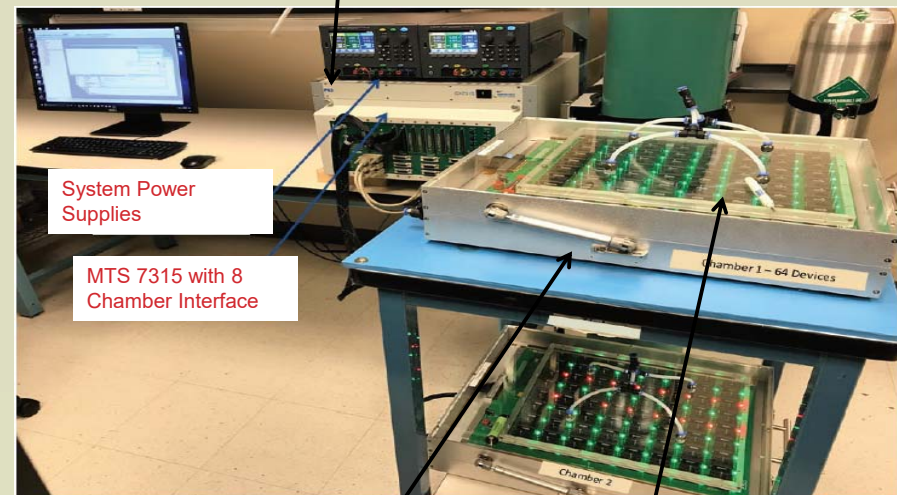
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Test Solution

- Custom gas manifold offered near optimal performance / distribution utilizing a minimum amount of test gas, without adversely affecting test throughput
- Large parallel test capability – expandable from 64 to 512 sites
- All measurements on 64 devices are performed in < 1 sec, ensuring uniform test results

PXI System



DUT Board &
Chamber

Gas Manifold

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Summary

- Test throughput rate of just over 4 seconds per device
- Device measurements are made in under one second with the time to measure the MOX resistance for 64 sites less than 800ms
- The PXI-based system provided the optimal solution – achieving both high throughput and very moderate cost, 20% of the cost of a conventional semiconductor test system

