



Geotest – Marvin Test Systems

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Agenda

- Geotest background
- Semiconductor market and trends
- PXI for semiconductor test
 - PXI background & market
 - Trends and applications for semiconductor ATE

Geotest – Part of The Marvin Group



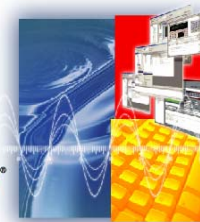
- Established in 1963, the Marvin Group is an aerospace firm with five main divisions, all located in Southern California
- Privately owned U. S. corporation
- Over \$350M in sales in 2011 and a current funded backlog of over \$1.6B USD
- More than 1000 employees
- Established supplier to the commercial and military aerospace markets world-wide



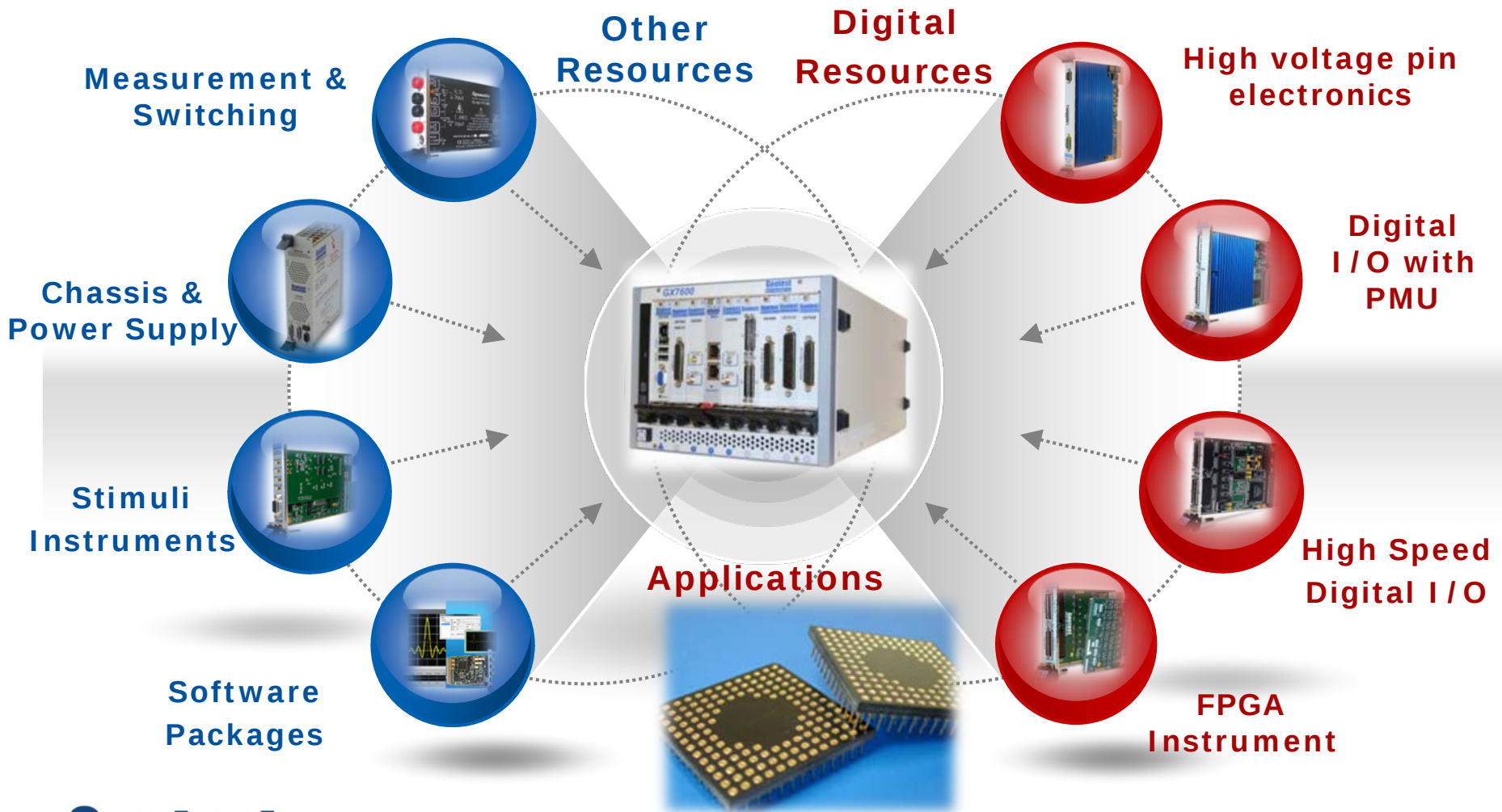
The
Marvin Group

Geotest Products

- PXI Products
 - Over 200 PXI and PXIe products including chassis, controllers, and mixed signal test instruments
 - Specialized, ATE-focused products and custom instrumentation
- Preconfigured PXI systems for functional and semiconductor test applications
- Software Products
 - Test Executive (ATEasy), Lasar Post Processor (DtifEasy), Digital vector editor (DIOEasy), analog waveform editor (WaveEasy)

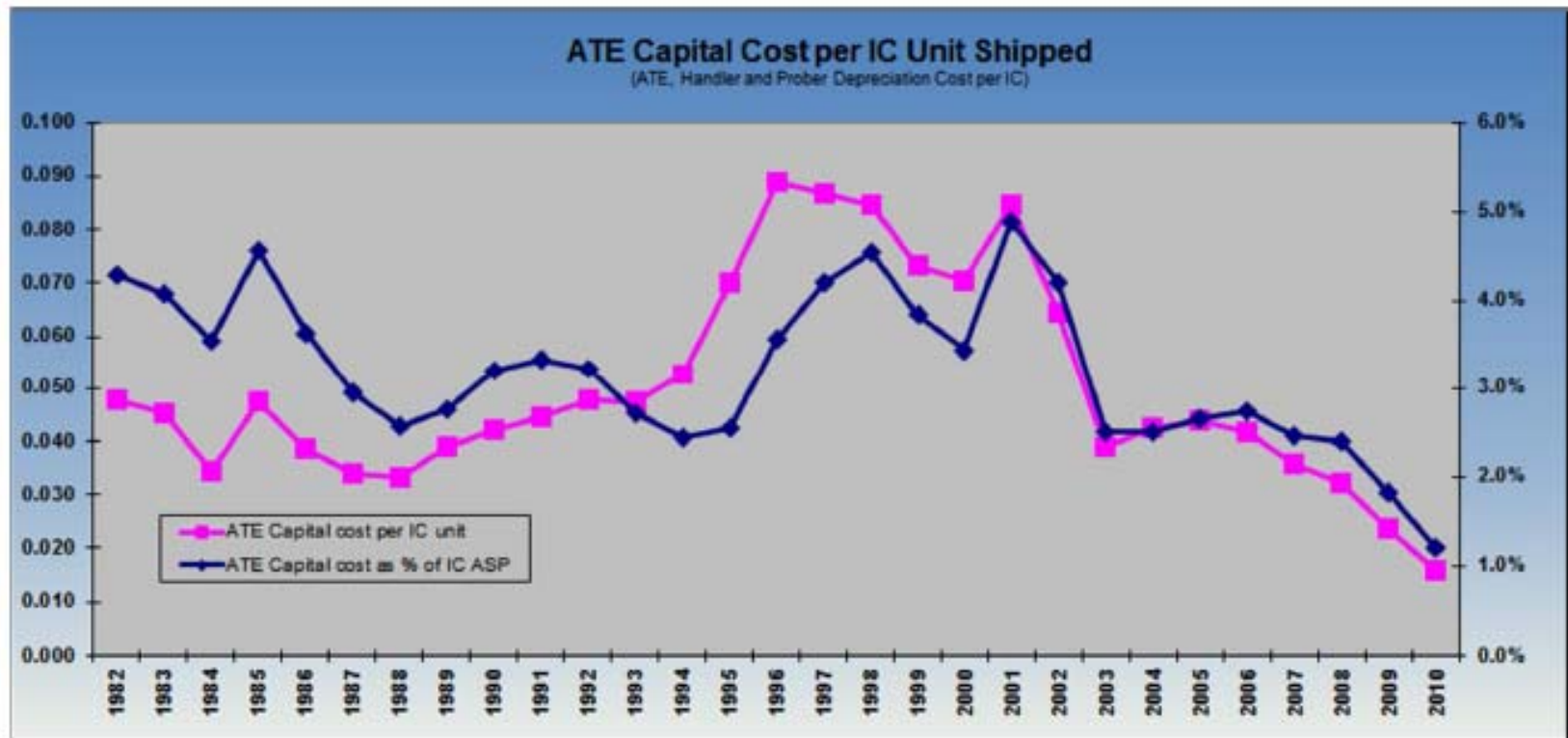


Geotest's PXI Product Portfolio



Semiconductor Market & Trends

- OEMs, packaging / test vendors & fabless semiconductor vendors need to their lower test costs
- Test share of IC cost continues to decline
- PXI capabilities: Flexible and cost effective solutions for digital , mixed-signal, and RF test



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Semiconductor Test Requirements

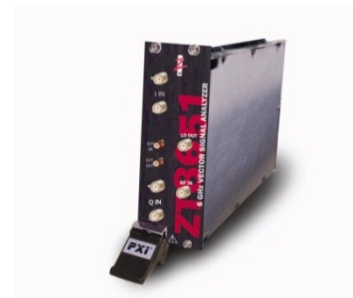
Tests Requirements	Prototype, Pilot Phase:, Design Verification Tests, Failure Analysis	Production Test: Test for process induced faults
Functional	Extensive, multiple files / vectors	Limited, test time constrained
DC parametric	Limited or complete test, depending on customer / application	All pins checked for DC parameters
Test throughput	Minutes to hours, single device testing	Seconds, may require multi-site testing
Devices tested / characterized	10's to 1000's	1000's to millions
Test system & cost	In-house or PXI-based \$50K - \$100K typical	Production IC Test System \$500K and up

PXI Components
& Systems

“Big Iron” ATE

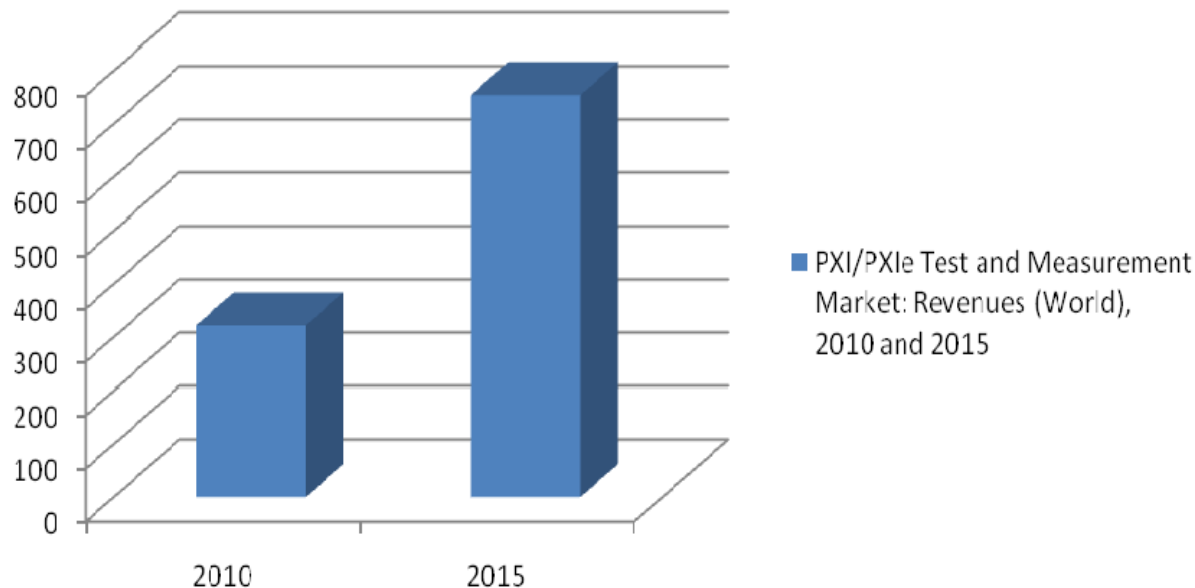
Why PXI for Semiconductor ATE?

- Cost effective
- Product capabilities: high performance instrumentation and bus bandwidth
- Flexible & robust open architecture
- Wide market adoption – drives product development and pricing



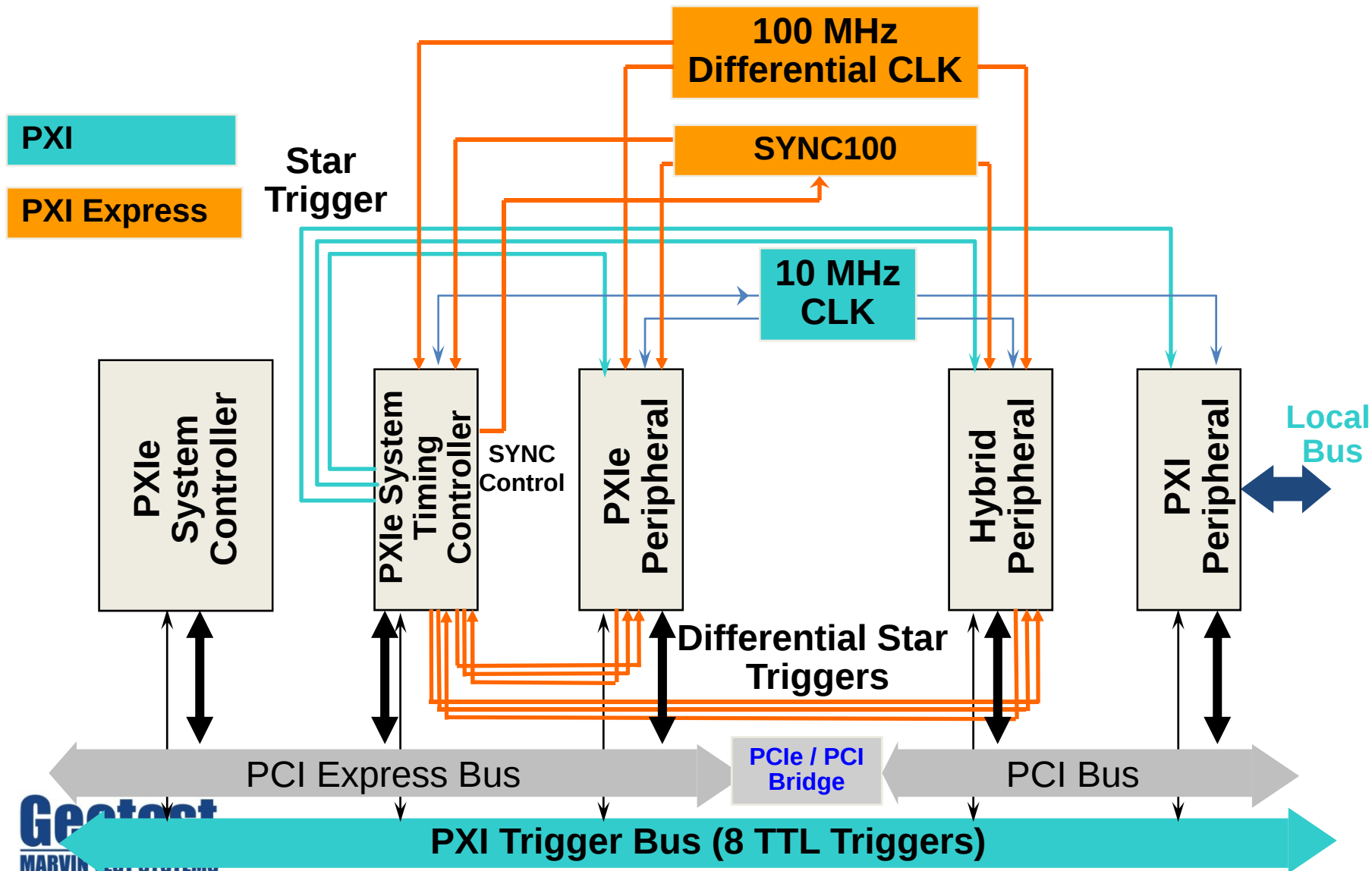


PXI/PXIe Test and Measurement Market: Revenues (World), 2010 and 2015



- PXI market is growing: 16.9% CAGR, 2010 – 2015
- Over 50 PXISA members and >1500 PXI products
- The dominant card modular instrumentation standard

PXI & PXI Express Architecture



PXI Architecture – A Robust Standard for ATE

- Timing / Synchronization
 - Triggering and clocking resources for coherent mixed signal testing
- Bus bandwidth
 - 2 GB/s data rate per slot
 - Peer to peer communication for high speed data processing
- Software – Flexibility & Open Architecture
 - Windows based environment supports many APIs -COM, VB, LabVIEW, .Net, C, etc.
 - Users can select from off the shelf test executives or create their own
 - Third party and OEM software tools for importing and converting digital test vectors – i.e. STIL, WGL, VCD

PXI Products for Semiconductor ATE - Digital Test



- Multiple vendors offering performance digital instrumentation
- 200 MHz vector rate with PMU per pin and per pin programmability
- High channel density: 32 channels per card, 512 channels in a single 3U PXI chassis
- Cost effective: \$250 / channel
- User FPGA cards for custom interfaces



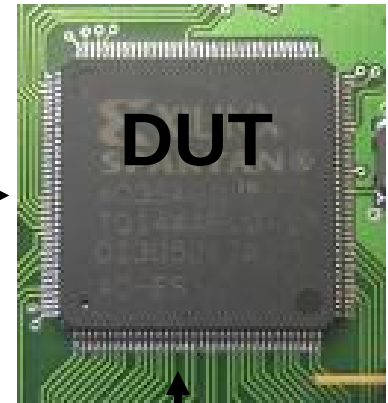
PXI Digital Instrumentation for Parametric and Functional Test

Digital
Instrument
• 100MHz

PMU or SMU
(Source / Measure Unit)

Multiplexer /
Switch

- -2 to +7 Drive / Sense
- Terminations: PU / PD
- 3 state drive
- Real time compare



Power
Supply

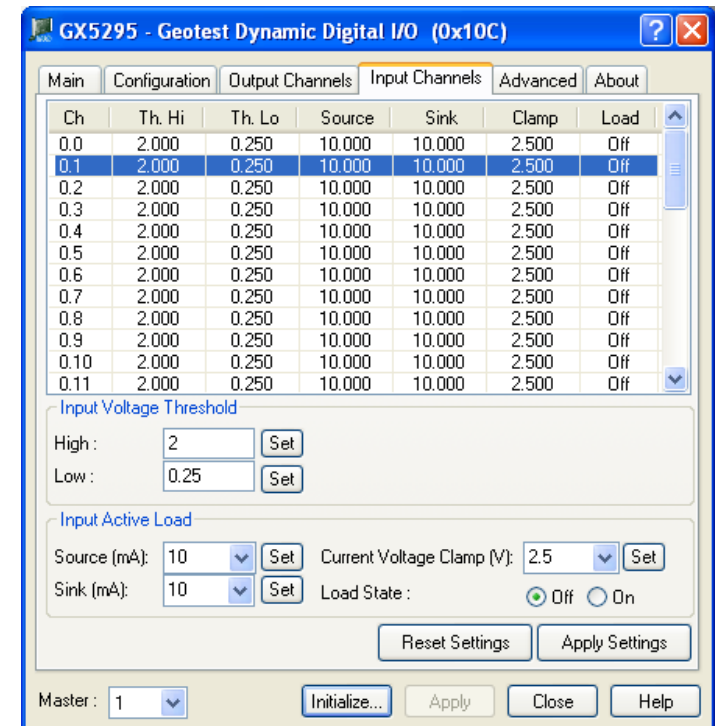


GX5295

- *Combining the digital and PMU :*
 - *Faster test time*
 - *Lower cost*
 - *Eliminates switching*

Semiconductor Test – Using PXI Instrumentation

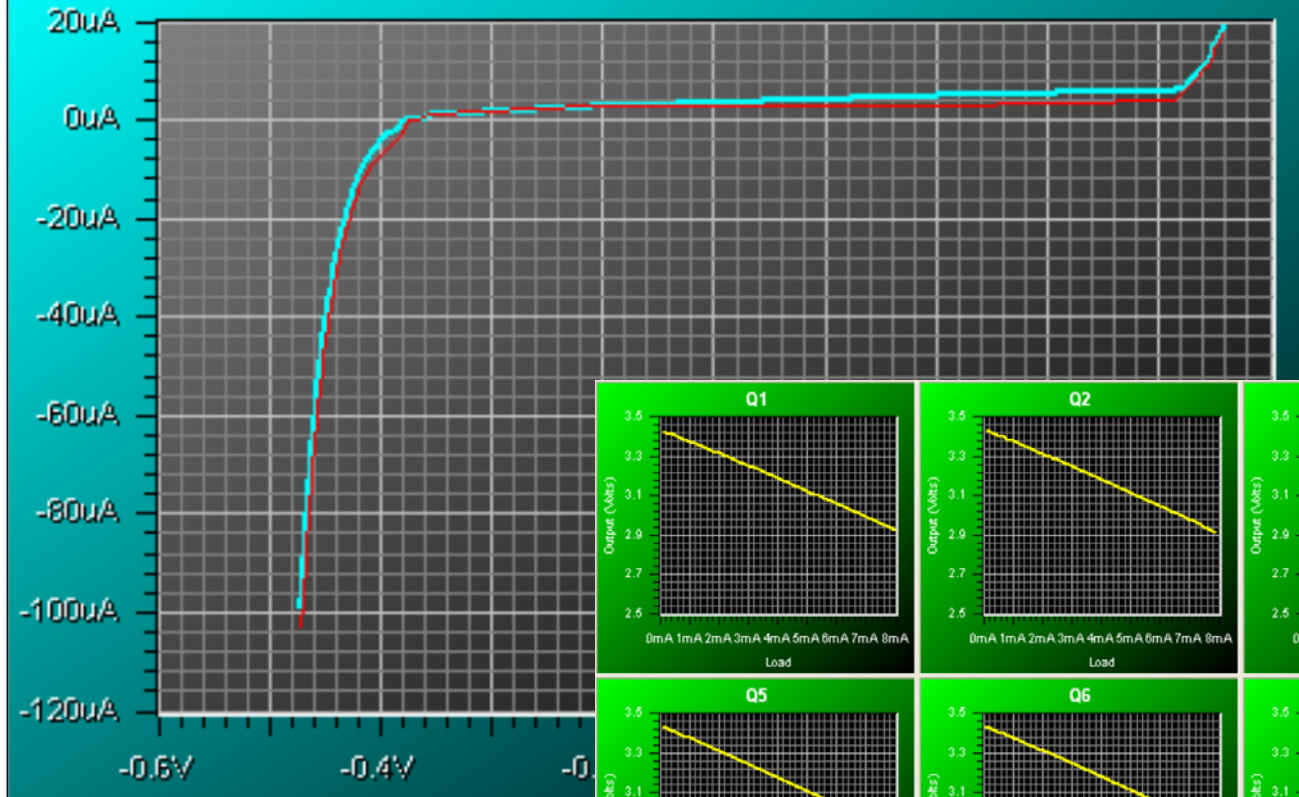
- Verify functionality
 - Generate or import test vectors
 - Test vectors can be large (megabytes) - requires deep memory
- Verify DC parameters
 - Opens / shorts test – verifies fixture / UUT connection
 - Input and output characteristics
 - Sink / source currents and voltages for all signal pins
- Maximize test throughput
 - Real-time compare for digital test
 - “Per-pin” DC measurement (parametric measurement unit or PMU)



Application – Device Characterization

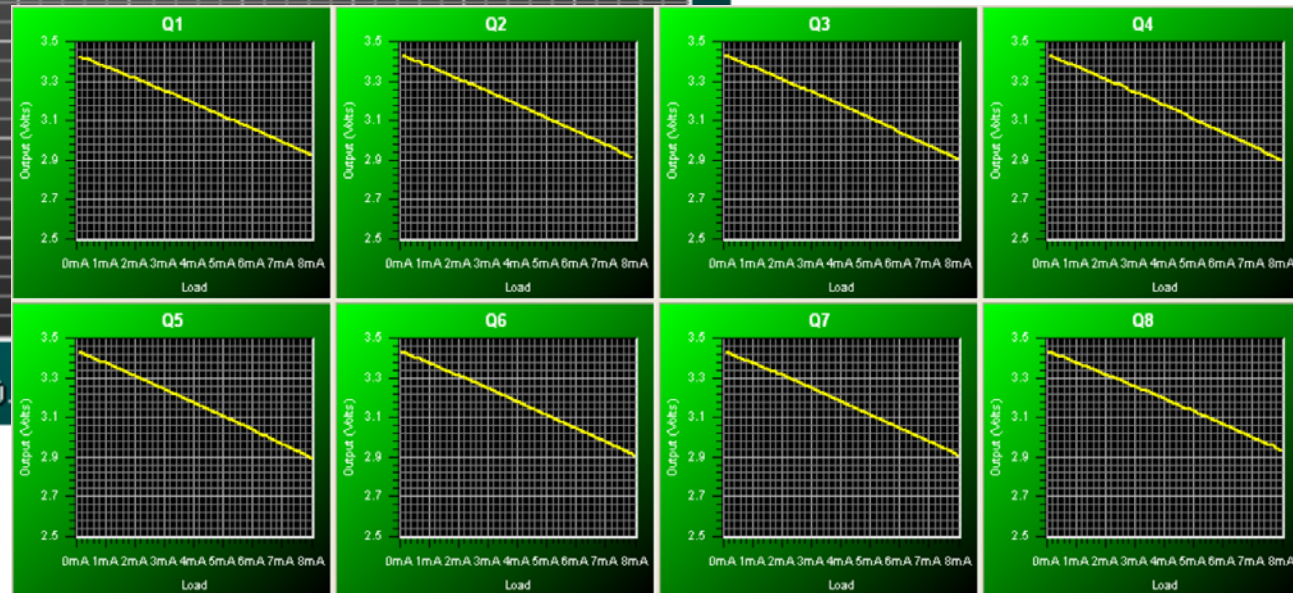


IV Curve: Pins 1 & 2



V-I Curve Characterization & Output Loading Tests

- Parallel measurement
- Fast with PMU per pin



PXI Products – Analog Instrumentation



- Multiple vendors producing high performance digitizers and waveform generators
- Time interval analyzer for jitter and fast frequency measurement
- SMUs & power supplies for DPS applications





- Multiple vendors producing generators, analyzers and VNAs for communication test applications
 - Frequency support > 6 GHz
 - Digital modulation / analysis capabilities



- Key features:
 - System power to support high channel count configuration (512 channels) – 60 watts /slot
 - Integrated receiver interface accepts DUT board fixtures
 - Open architecture – easy to reconfigure the system and receiver
 - Integrates with automated handlers

PXI System – 20 slot, 3U

Complete system for device test:

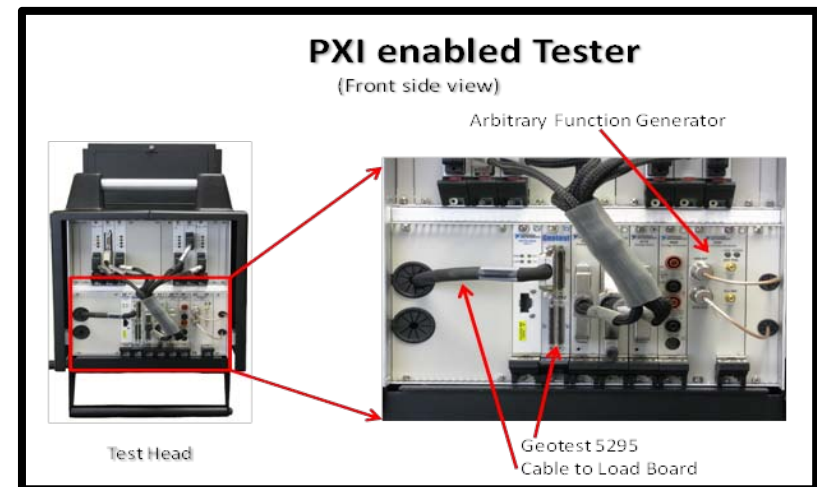
- User supply
- 64, 100 MHz digital channels (expandable to 512) with PMU per pin
- 64 static digital channels
- Vector conversion tools & test executive
- Receiver interface with self-test
- High power chassis

High
Performance,
Modular
Integrated
Receiver



Application Example

- Test a serial communication controller with high voltage isolation (2500V) , used for smart grid applications
- Requirement: Lower cost, smaller footprint solution needed
- Test requirements:
 - Support 16 digital channels with PMU capability with vector rates of > 20 MHz
 - Tools to import and convert WGL vector files
 - Analog instrumentation
 - Characterization and production test



Detailed Requirements / Solution

	Customer Requirement / Specification	PXI Based Solution
1.	560V- 2500V DC signal preferably without any external power supplies for transformer isolation and functional testing	12 bit PXI based ADC board and DAC board interfaced with custom bus based proprietary intelligent signal conditioning high voltage VI board
2	Multiple power supplies up to 5V, 5A	12 bit PXI based ADC board plus DAC board interfaced with custom bus based proprietary intelligent signal conditioning VI board
3	16 Digital channels with vectors pattern drive and strobe capability with data rate more than 20MHZ and with deep memory for Functional testing.	Geotest GX5295, 32 DIO & PMU card with 256MB of on board vector memory.
4	12 bit or better PMU for DC and parametric testing	
5	Very low leakage current measurement in 'pico Amps'.	PXI based 6.5 DMM with signal amplifier board.
6	8 bit or better high speed digitizing capability with deep on board memory for skew and switching characteristics testing	PXI based 100MHZ, 100MS/s high speed digitizer

Key Success Factors

- Test application required multiple digital channels with PMU
 - ✓ The PXI digital instrument with the per pin PMU offered a cost-effective solution
- Customer was looking to reduce size, power and cost of system
 - ✓ PXI platform helped achieve these goals
 - ✓ 3:1 size reduction, 3:1 power reduction, 3:1 cost reduction
- Customer was looking for a high throughput solution
 - ✓ The driver and PMU performance were optimized to meet the customer's requirements



Summary:

PXI Products for Semiconductor ATE

PXI Product	Availability (# of products)	Performance / Features	Comments
Digital	Excellent	Good	Trend is to higher performance digital products with better timing resolution / performance & lower cost
Analog	Excellent	Good / Excellent	Trend is to more features and performance
RF	Good	Good / Excellent	Products rival box instrumentation specs
Software tools	Fair / Good	Good	Combination of OEM and 3 rd party tools address program development needs today
SMU / DPS	Fair	Fair / Good	Current capability is limiting for some applications

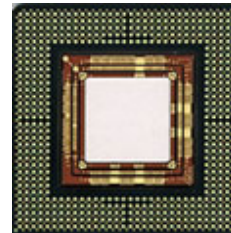
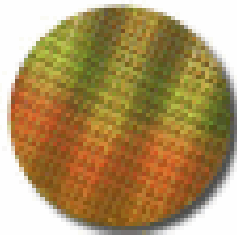
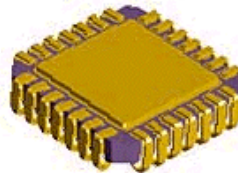
Summary

- PXI products and systems offer a cost effective platform for semiconductor test
 - Open hardware and software architecture
 - Access to a broad portfolio of PXI products from multiple vendors
- Market acceptance and adoption of PXI is driving product advancements for semi and other markets
- PXI adoption is moving from augmenting ATE systems to being the core for ATE systems



Thank You!

- Discussion / Questions



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