



ENGINEER  
NEXT

NIDays

The image features a background of diagonal stripes in various shades of blue, green, orange, and red. The text 'ENGINEER NEXT' is prominently displayed in white, with 'ENGINEER' in a smaller font above 'NEXT'. A yellow graphic element, resembling a stylized 'X' or a folded ribbon, is positioned between the two words. To the left of 'NEXT', the word 'NIDays' is enclosed in a white rectangular box, tilted to match the angle of the main text.



# Accelerated Mixed Signal Semiconductor Test

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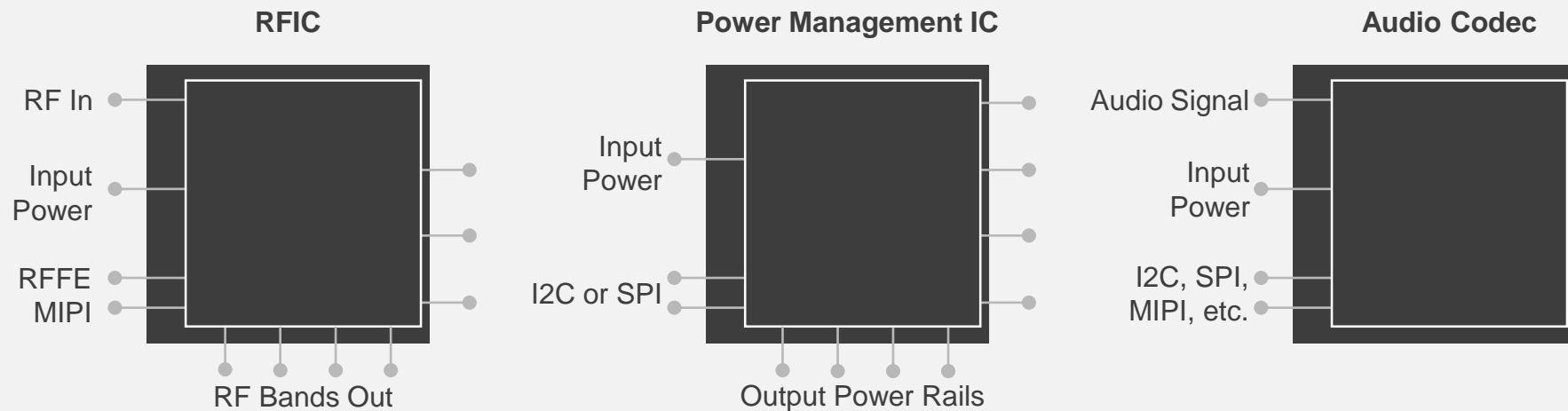
# Optimizing Test Execution is a Competitive Advantage



“Some ASIC manufacturers report that testing time consumes 40-50% of the entire IC product development cycle.”

*Source: IC Insights, McClean Report 2015*

# Why Focus on Source Measure Units and Digital Instruments?



# Key Innovations for Semiconductor Test

## NI Vector Signal Transceiver (VST)

- FPGA-based servoing for measurement acceleration
- Up to 1 GHz instantaneous bandwidth for wide range of wireless technologies
- R&D-grade measurement performance with up to -50 dB EVM for 802.11ax



## NI Source Measure Units (SMUs)

- Broad IV range: 200V(20W), 3A (10A pulse)
- Current resolution to 10fA
- Max sampling to 1.8MS/s
- SourceAdapt™ Technology for fast settling in presence of capacitive loads
- Best in class channel density



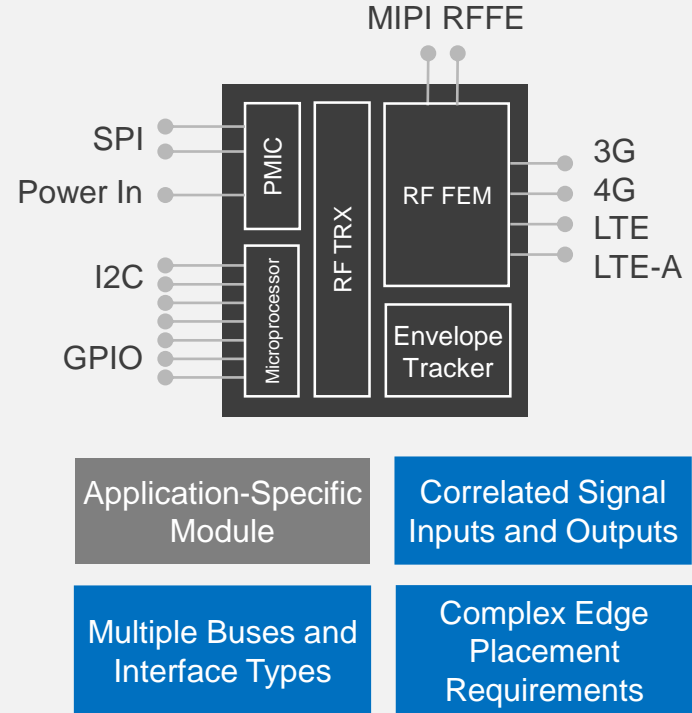
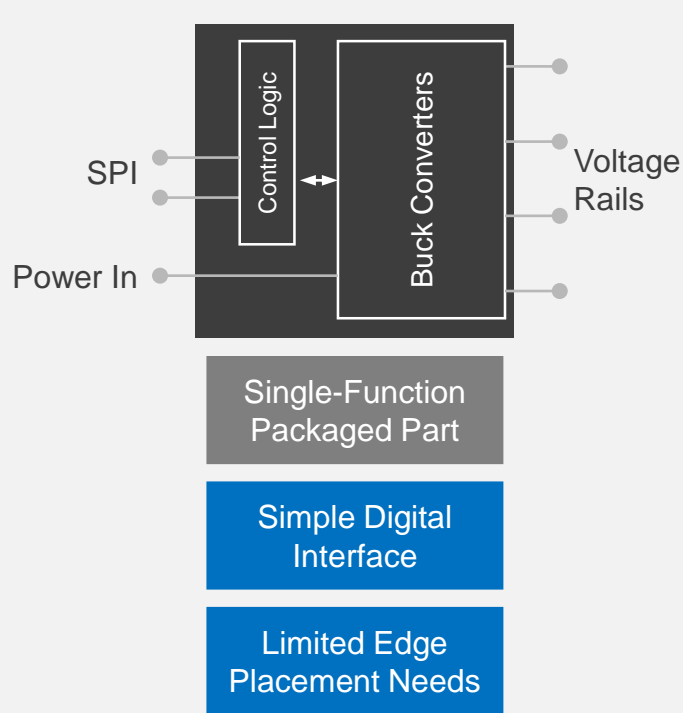
## NI Digital Pattern Instrument

- ATE-class digital (with PPMU) in PXI
- Out of the box Digital Pattern Editor software
- Time sets, drive formats, opcodes, HRAM, Source and capture, history RAM, Shmoo



# Digital Instruments

# Evolution of Single-Silicon Packages to Modules





# ATE Not Designed to Serve Validation

- Too expensive
- Custom cooling
- High power connections
- Designated space in labs
- I/O options are fixed and aging
- Renting ATE from other groups
- Trying to partner overseas to use production ATE
- Lack of ATE availability limits test productivity



# PXI Digital Pattern Instrument

## Built for Test of Semiconductor Devices

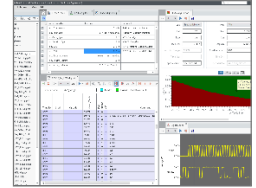
- RFICs and Transceivers
- Power Management ICs
- MEMS
- IoT Devices with Integrated MCUs and Sensors



PXIe-6570 Digital Pattern Instrument

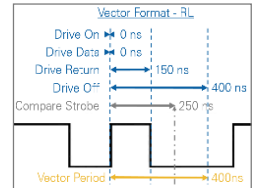
## ATE Development and Debug Features

- Source and Capture Memory
- History RAM, Digital Scope, Pin View, and System View
- Shmoo Plots



## ATE Test Capability

- Time Sets and Edge Placement
- Opcodes
- Multi-site Support
- Integrated Per-Pin PPMU Access
- Up to 256 Synchronized Channels

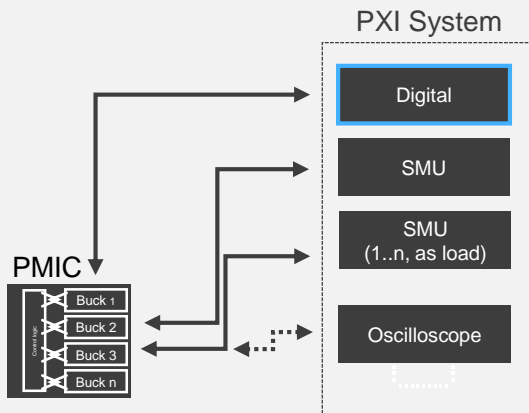


# Digital: ATE-Class Instruments and Tools

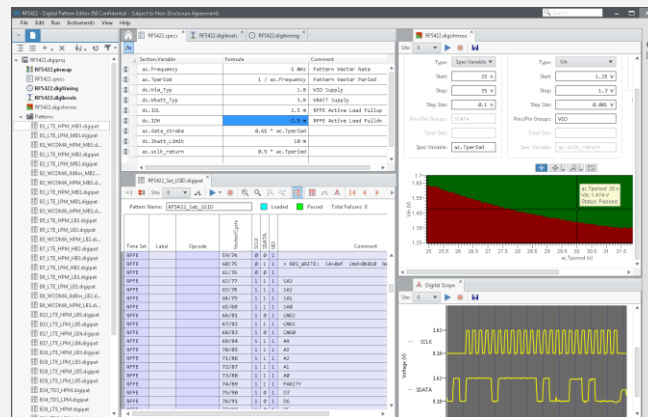
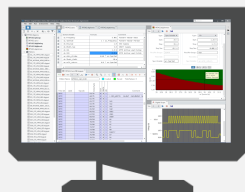
- DUT-centric paradigm: pin map assigns instrument pins to DUT pins
- Extensive test capability: timing sets, debugging tools, shmoo plotting, IV measurements
- Instrument integration: Multi-module and cross-instrument logical execution op-codes

## Why it matters

- ATE-class digital test instruments throughout test phases
- Consistency paves the way for code reuse and correlation with production ATEs



NI Digital Pattern Editor



# PXI Digital Pattern Instrument



PXIe-6570 Digital Pattern Instrument



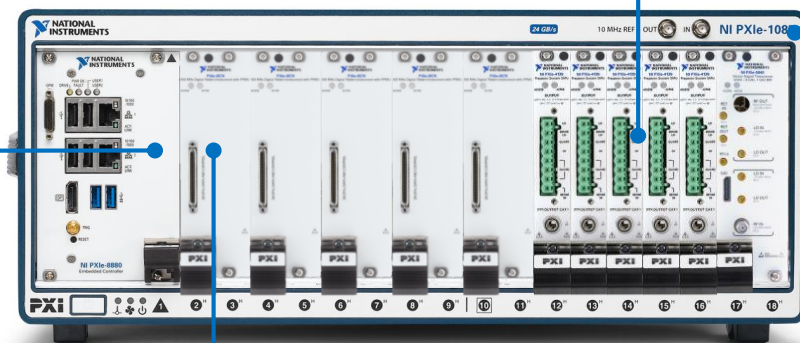
NI Semiconductor Test System (STS)

Pin Electronics	DCL: -2V to +6V, 32 mA PPMU: -2V to +6V, 32 mA Active load: 24 mA
Channels	32, in 2 PXI Express Slots
Vector Rate	100 MHz (10 ns vector period)
Pattern Timing	31 Timing Sets, Edge Placement Resolution 39.0625 ps
Pattern Formats	Non-Return, Return to Low, Return to High (100 MHz max) Surround By Complement (50 MHz max)
Vector Memory Depth	128 M/Channel
Opcode Functionality	Flow Control, Sequencer Flags and Registers, Signal, Source and Capture, Subroutine
Source and Capture Engines	4 each, 1 M/channel, Included with Product, Not Separately Licensed
SCAN Support	Flattened SCAN Patterns, up to 128 M
Operating System Support	Windows 7, 64-bit; Windows 10, 64-bit

# A Modular Approach to Digital Test

## Synchronized PXI Instruments

- Expand Digital Count to Up to 256 Channels per PXI System
- Sub-Nanosecond Synchronization with other PXI Modules
- Full Suite of Instruments from DC to mmWave



### PXIe-8880 Controller

- Intel Xeon 8 Core Processor (2.3 GHz)
- 24 GB/s System Bandwidth
- Up to 24 GB DDR4 1866 MHz RAM
- Gen 3 PCIe Express Technology

### PXIe-6570 Digital Pattern Instrument

- 32 Channels per Module
- Up to 256 Synchronized Channels
- 31 Timing Sets
- 100 MHz Vector Rate
- 128 M Vector Memory

### PXIe-1085 Chassis

- 18 PXI Express slots
- Up to 24 GB/s System Bandwidth
- Peer-to-Peer Data Streaming
- 10 MHz OCXO
- Gen 3 PCIe Express Technology

# NI Digital Pattern Editor

## Developing, Editing, or Importing Digital Patterns

Pin and Channel Map

Specifications, Timing, Levels, and Pattern Files

Standard ASCII Format for Pattern Files

## Debugging Tools for Digital Tests

History RAM Overlay and Viewer

Pin and System Views

Digital Scope

## Shmoo Plot Tool

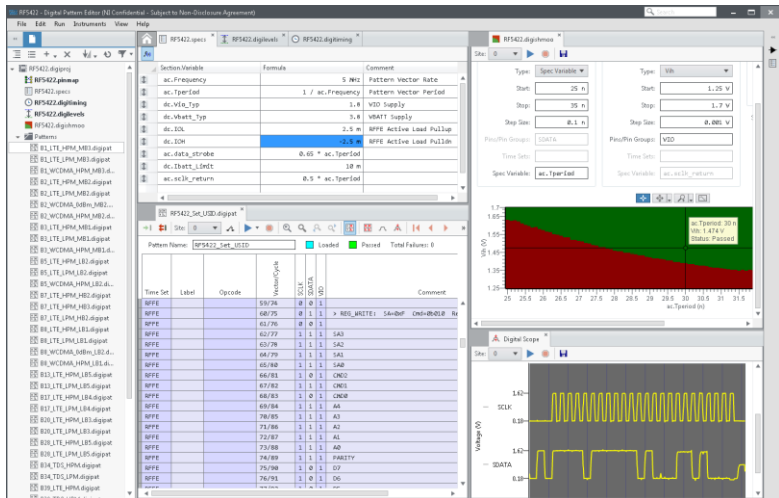
Sweep Specifications, Timing, and Voltage Levels

Sweep Multiple Sites in Parallel

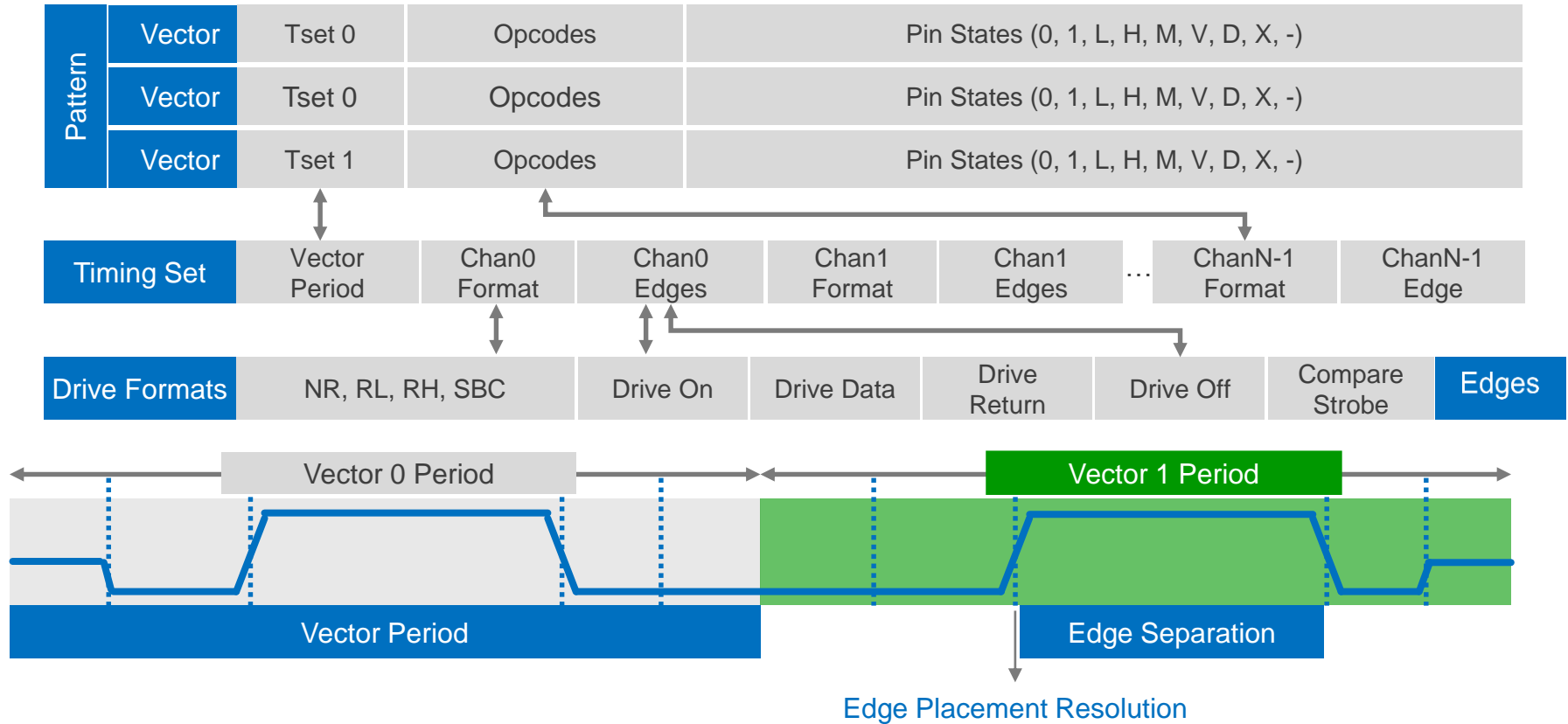
## Integration with TestStand Semiconductor Module

STDF Reports, Binning, Handler Integration

Add Break Points in Code to Debug

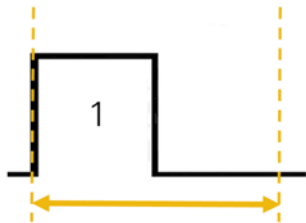


# Semiconductor ATE Digital

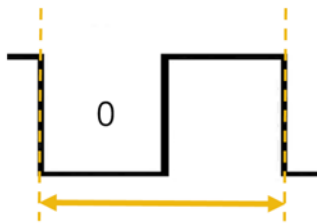


# Timing Set Drive Formats and Edges

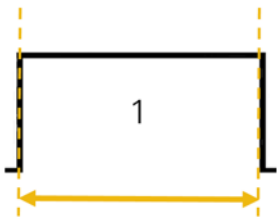
RL – Return to low



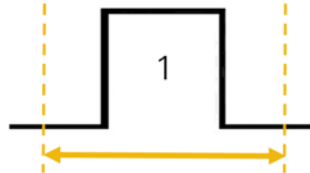
RH – Return to high



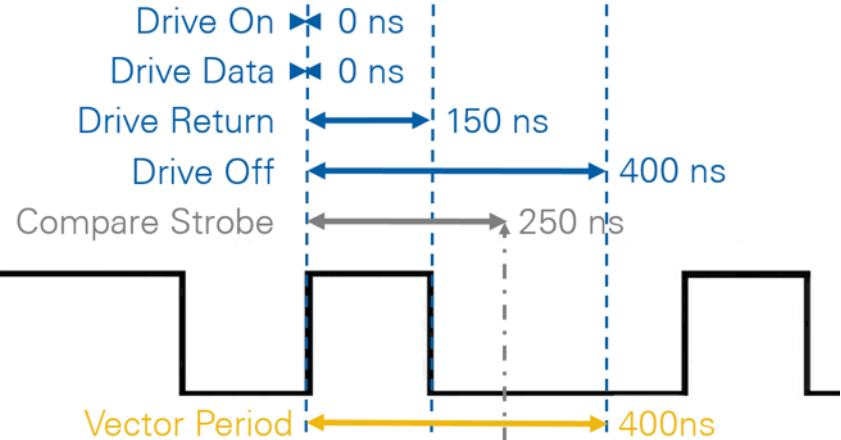
NR- Non-Return



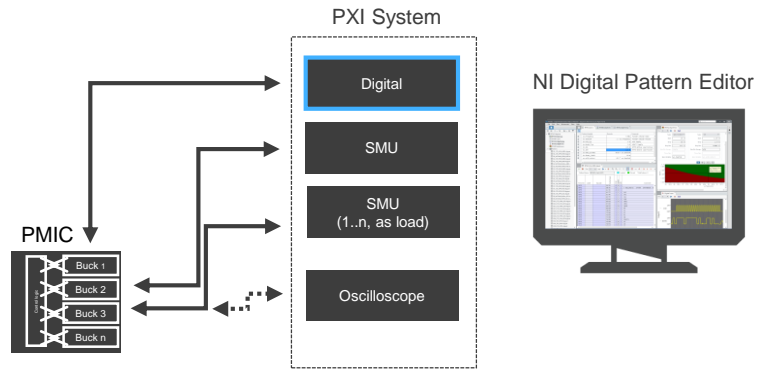
SBC – Surround by complement



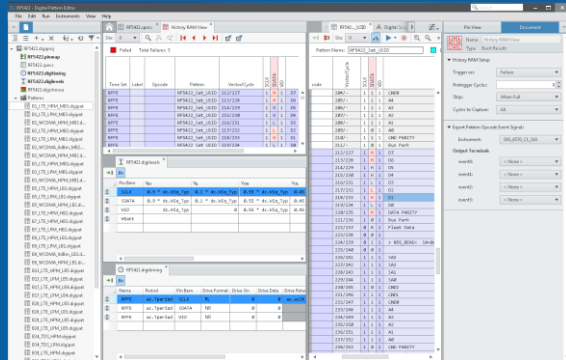
Drive Format - RL



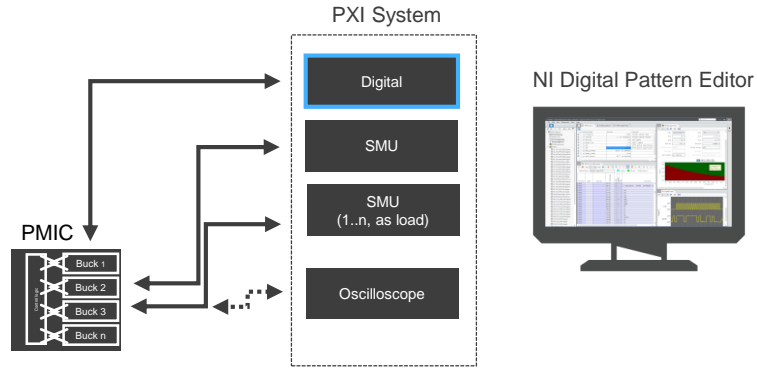




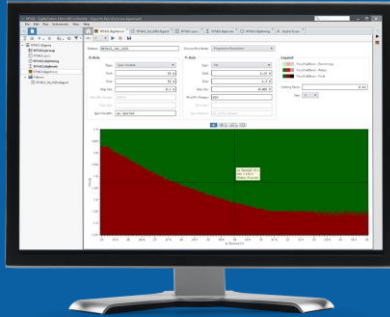
## DEMO: Create and Edit Digital Patterns



- Develop Digital Patterns with the NI Digital Pattern Editor
- Create Pin and Channel Maps
- Set specifications, timing, and levels
- Standard ASCII format for pattern files





## DEMO: Debug Digital Patterns and Create Shmoo Plots



- History RAM overlay and viewer
- Pin and system views
- Digital scope
- Shmoo plot



# Find more information on PXI Digital Pattern Instrument at [ni.com/digital-instruments](https://ni.com/digital-instruments)

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INNOVATIONS SHOP SUPPORT COMMUNITY

Home > Shop > Electronic Test and Instrumentation > Digital Instruments > What Are PXI Digital Pattern Instruments?

## What Are PXI Digital Pattern Instruments?


PXI Digital Pattern Instruments deliver ATE-class digital to the industry-standard PXI platform. They are designed for testing a broad range of RF and mixed-signal ICs from RF front ends and power management ICs to transceivers and Internet of Things systems on chip with built-in connectivity and sensors.

[VIEW PRODUCT DETAILS](#)[View Product Flyer](#)

### Digital Pattern Editor

The Digital Pattern Editor is an interactive tool for importing, editing, or creating test patterns. The software integrates editing sheets for device pin maps, specifications, and patterns to develop or edit imported digital test vectors and patterns.


[LEARN MORE](#)



### Tools to Debug Digital Test Patterns

The Digital Pattern Editor includes tools like Schmitt plots to provide a deeper understanding of device-under-test (DUT) performance across variation. The editor also offers debugging tools such as overlaying pattern failures on a pattern or using digital scope for an analog view of the pin data.

[LEARN MORE](#)



# Source Measure Units

# Functionality of Source Measure Units



DC VOLTAGE SOURCE



DC CURRENT SOURCE



PULSE GENERATOR



WAVEFORM GENERATOR



VOLTMETER



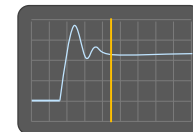
AMMETER



OHMMETER



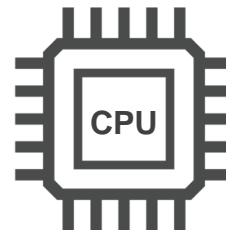
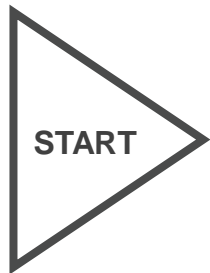
ISOLATED DIGITIZER



PROGRAMMABLE LOAD



# SMU Measurement Flow



TRIGGER

SOURCE

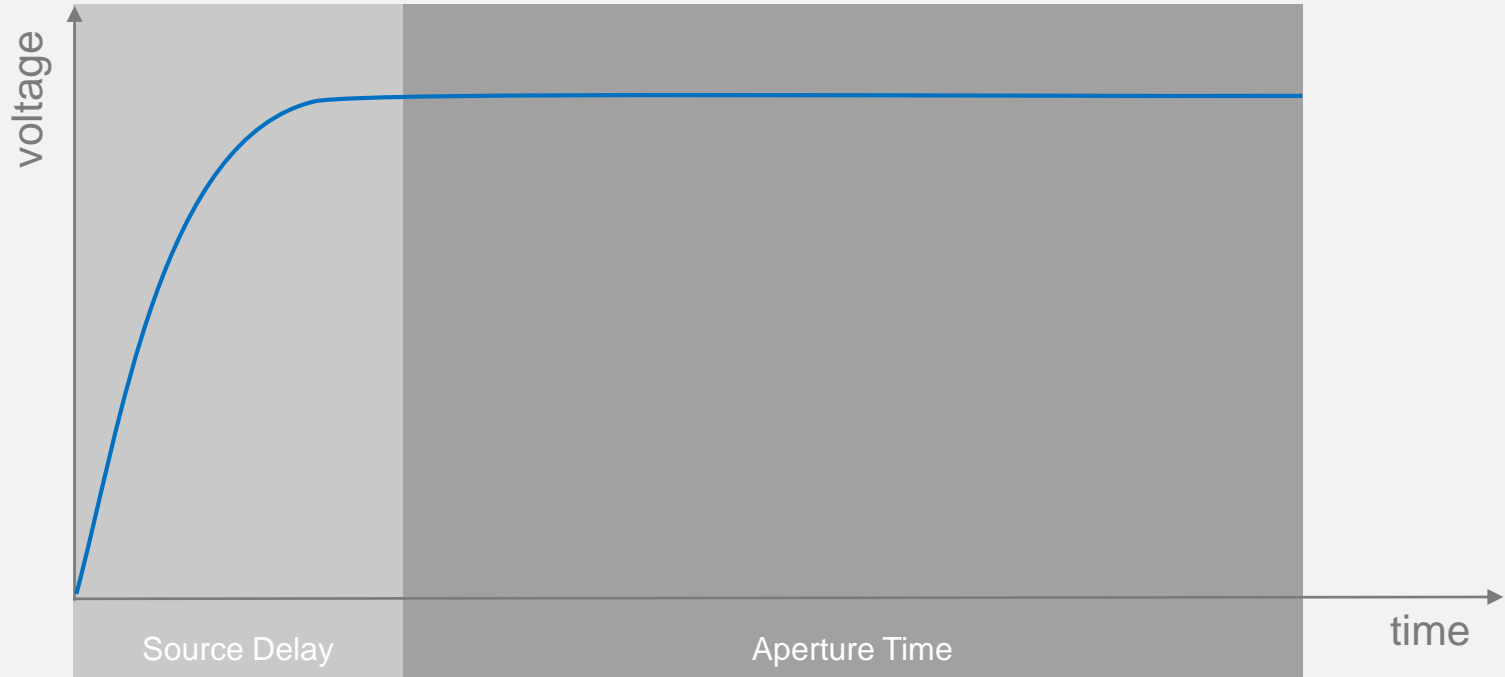
MEASURE

PROCESS

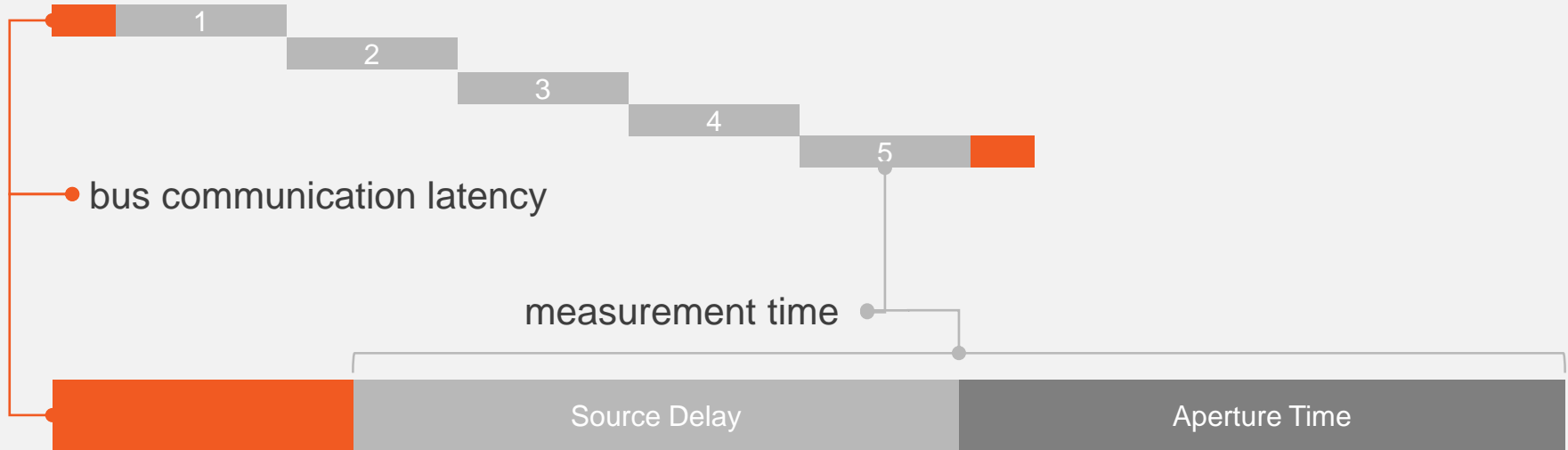
You can take high precision measurements quickly

Removing small inefficiencies in timing can reduce your cost of test

# Measurement Cycle

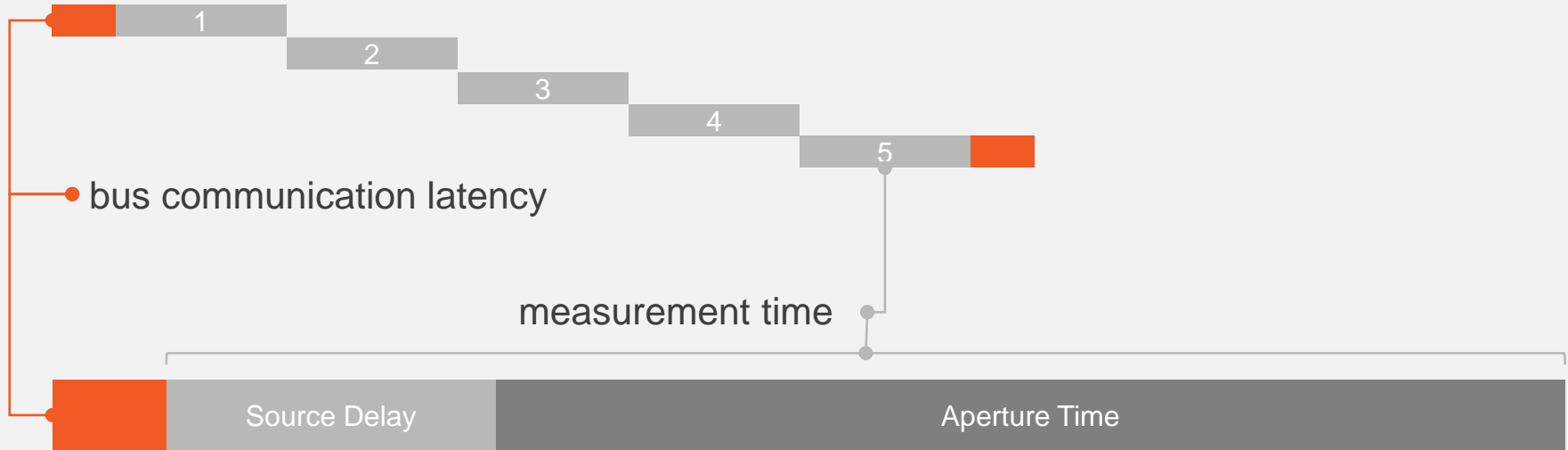


# Measurement vs. Overhead

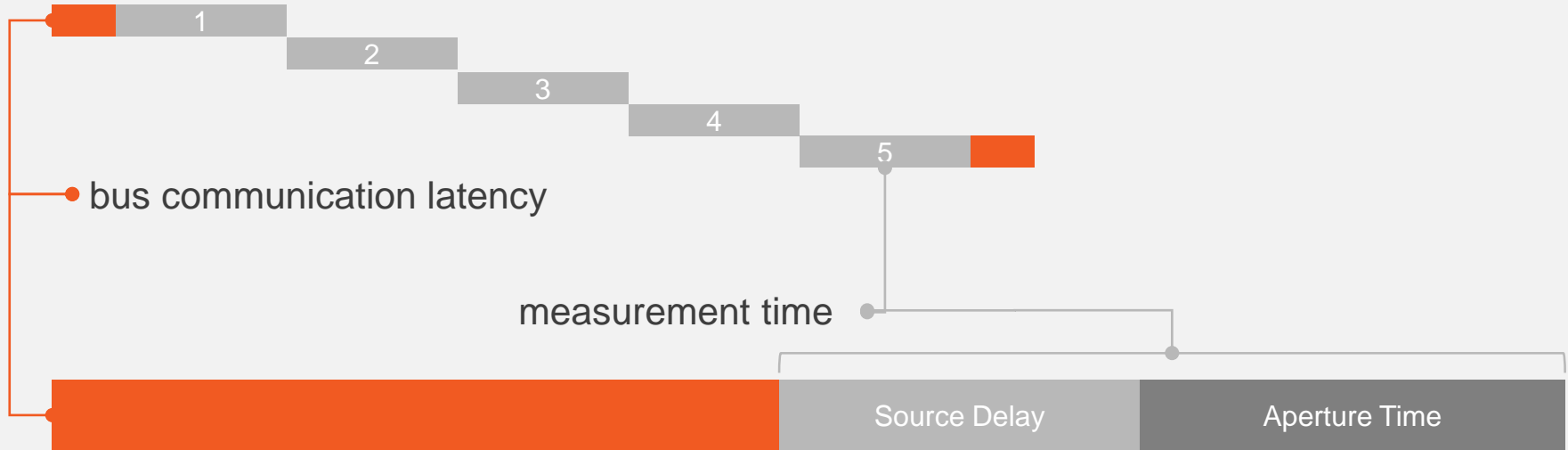




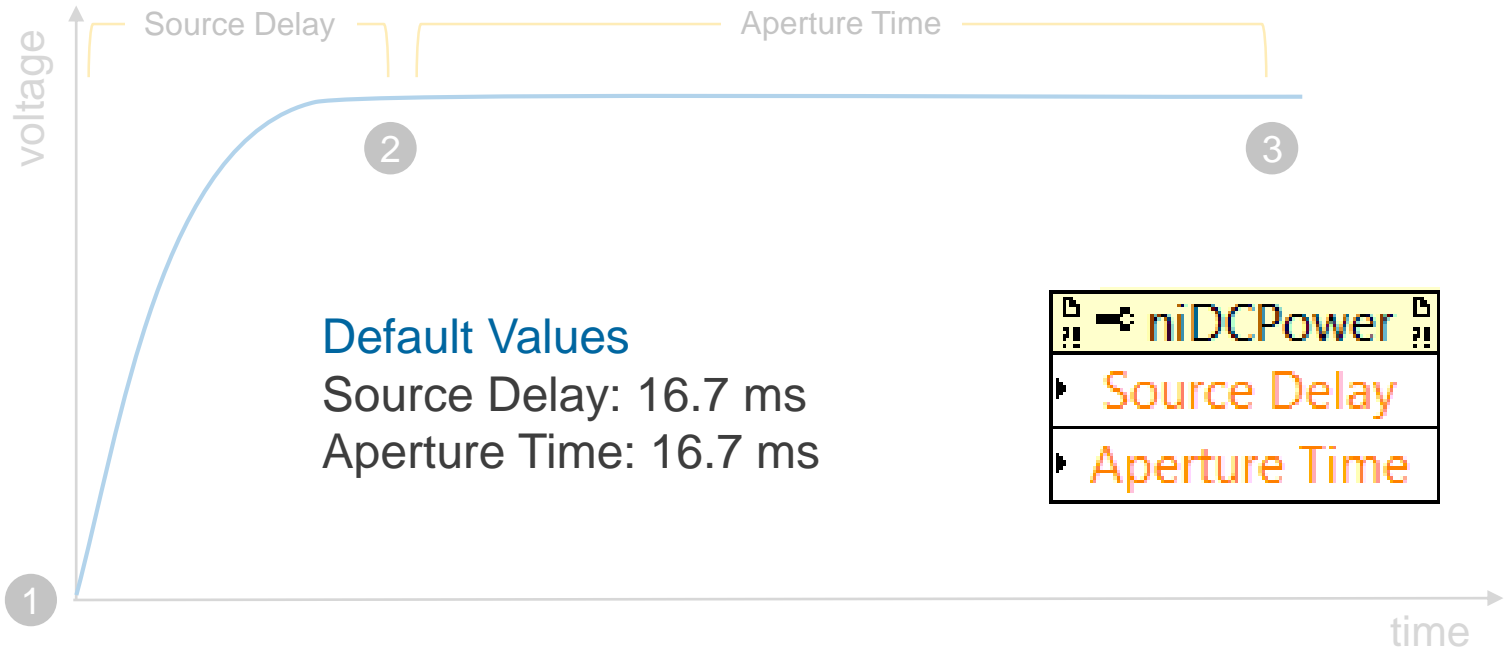
# Measurement vs. Overhead



# Measurement vs. Overhead

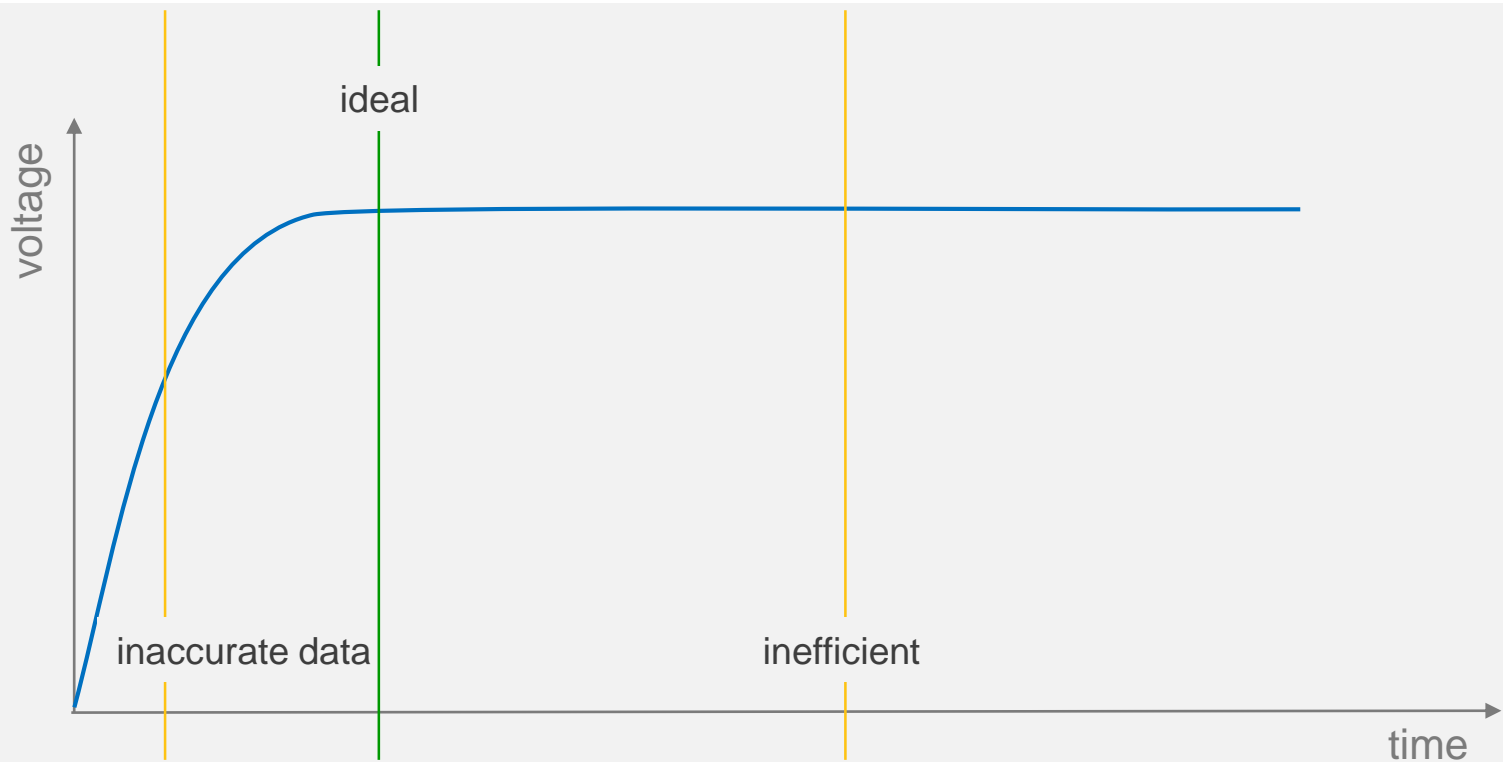


# Source and Measure Cycle



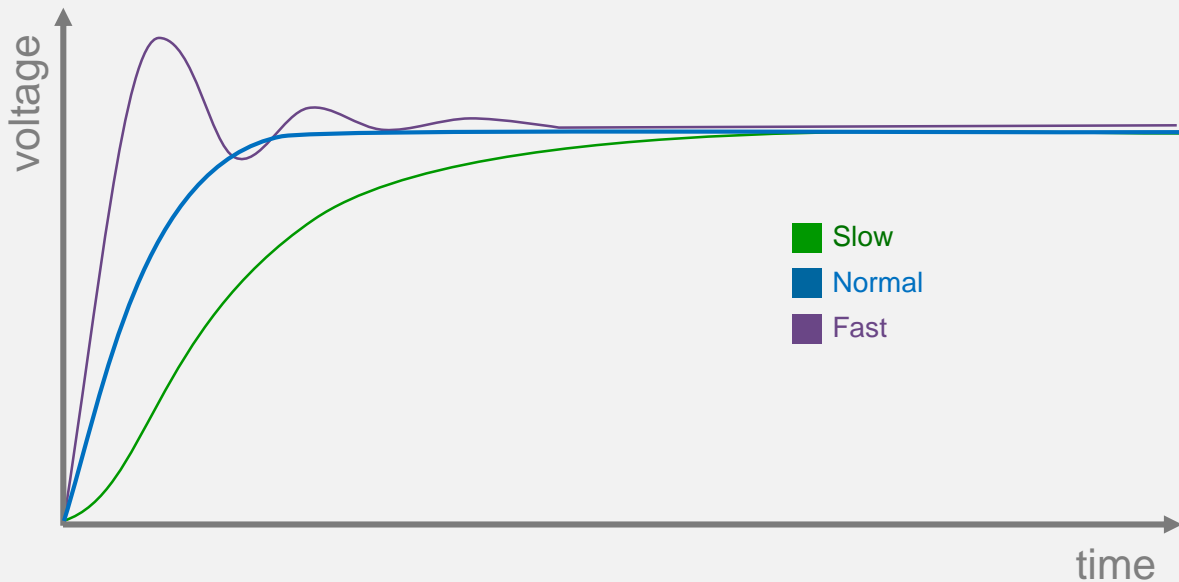
# Source Delay

16.7m → niDCPower  
Source Delay



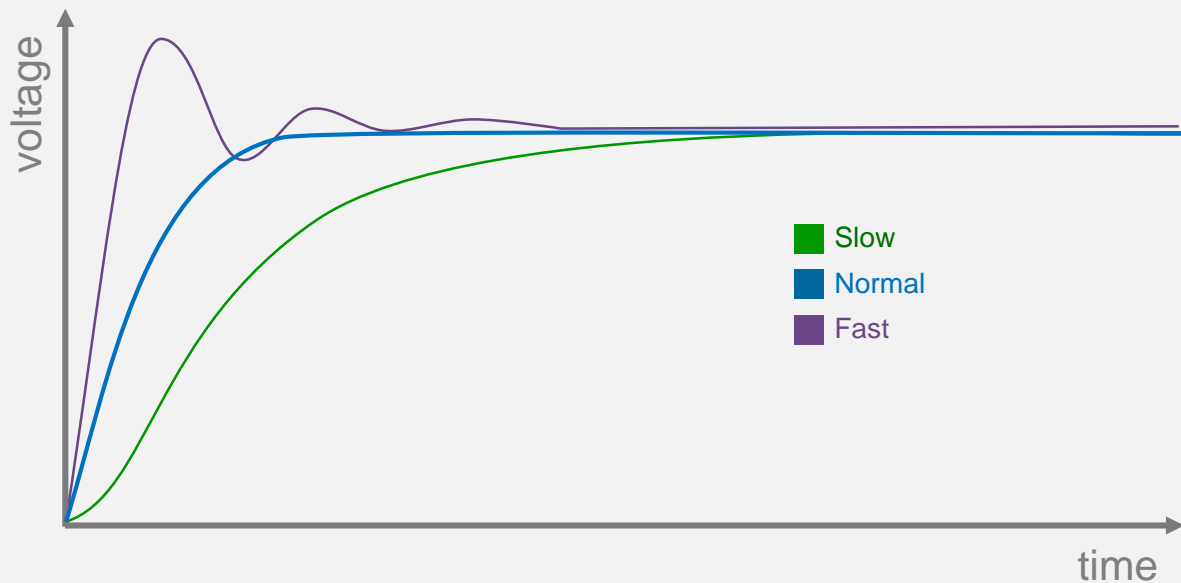
# Optimizing Source Delay

Normal



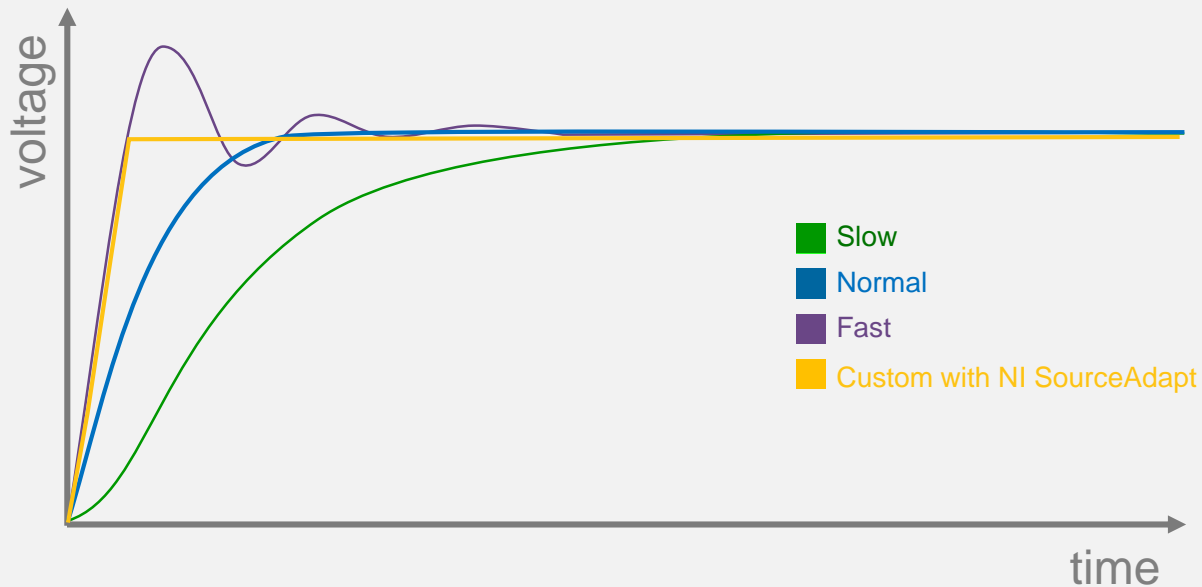
# Transient Response and Rise Time

Normal niDCPower Transient Response

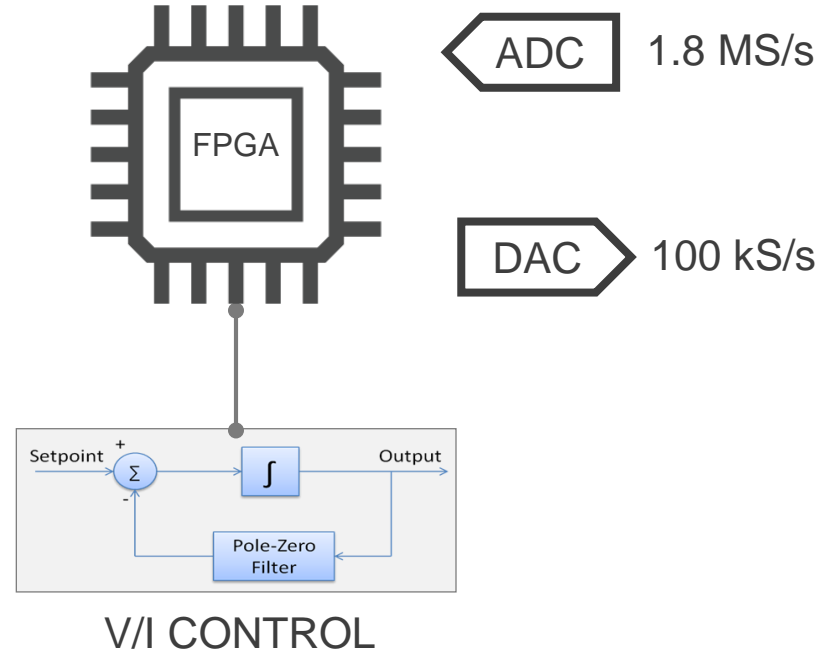
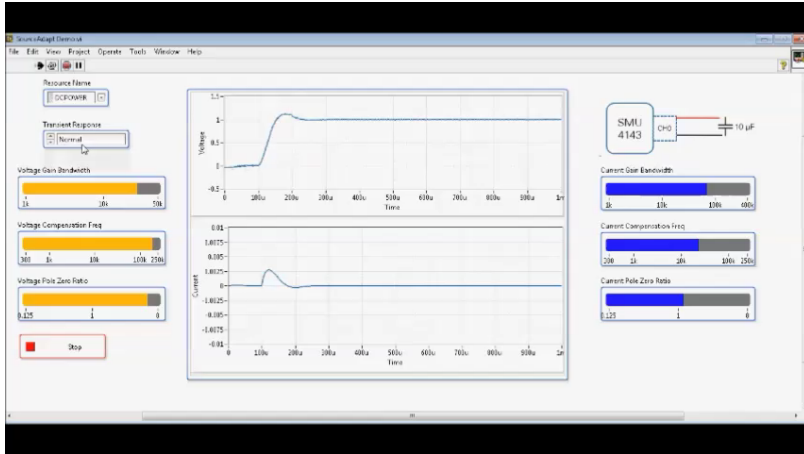


# Transient Response and Rise Time

Custom

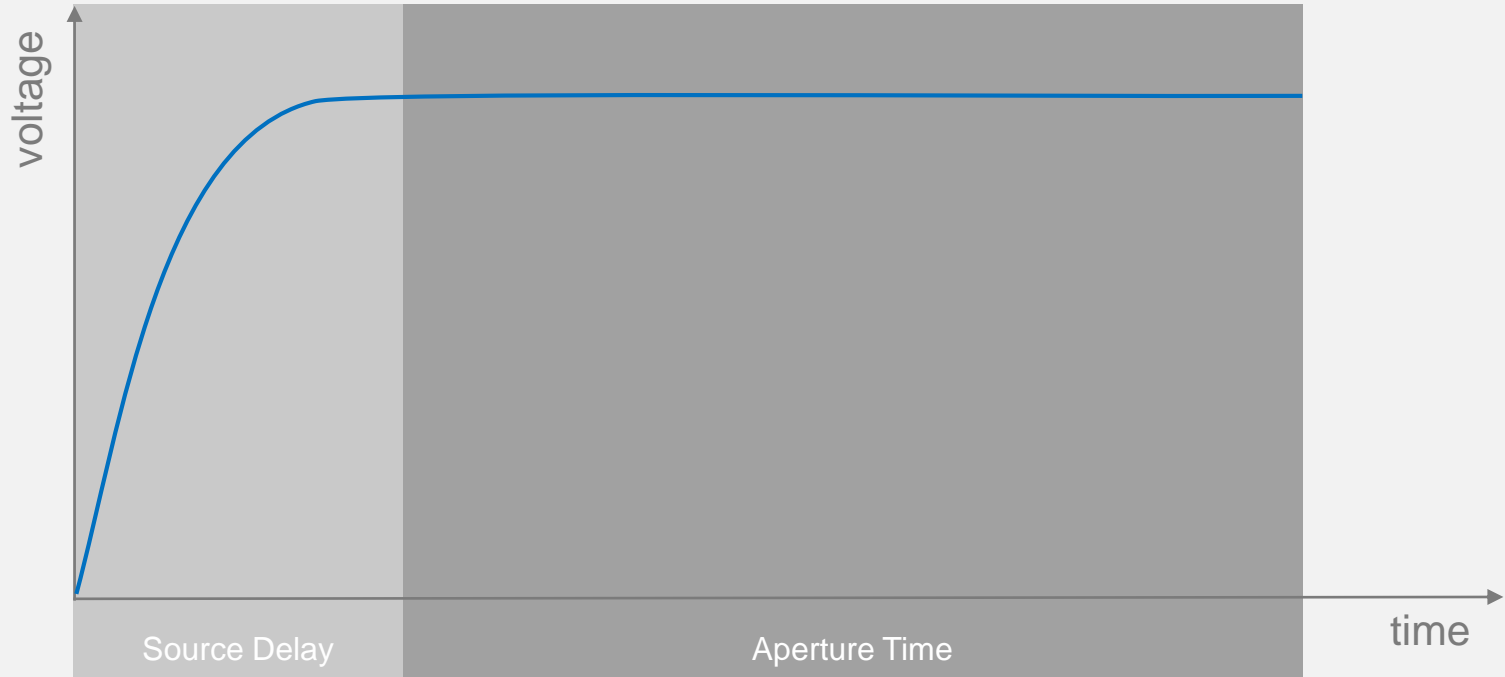


# SourceAdapt: Digital Control Loop



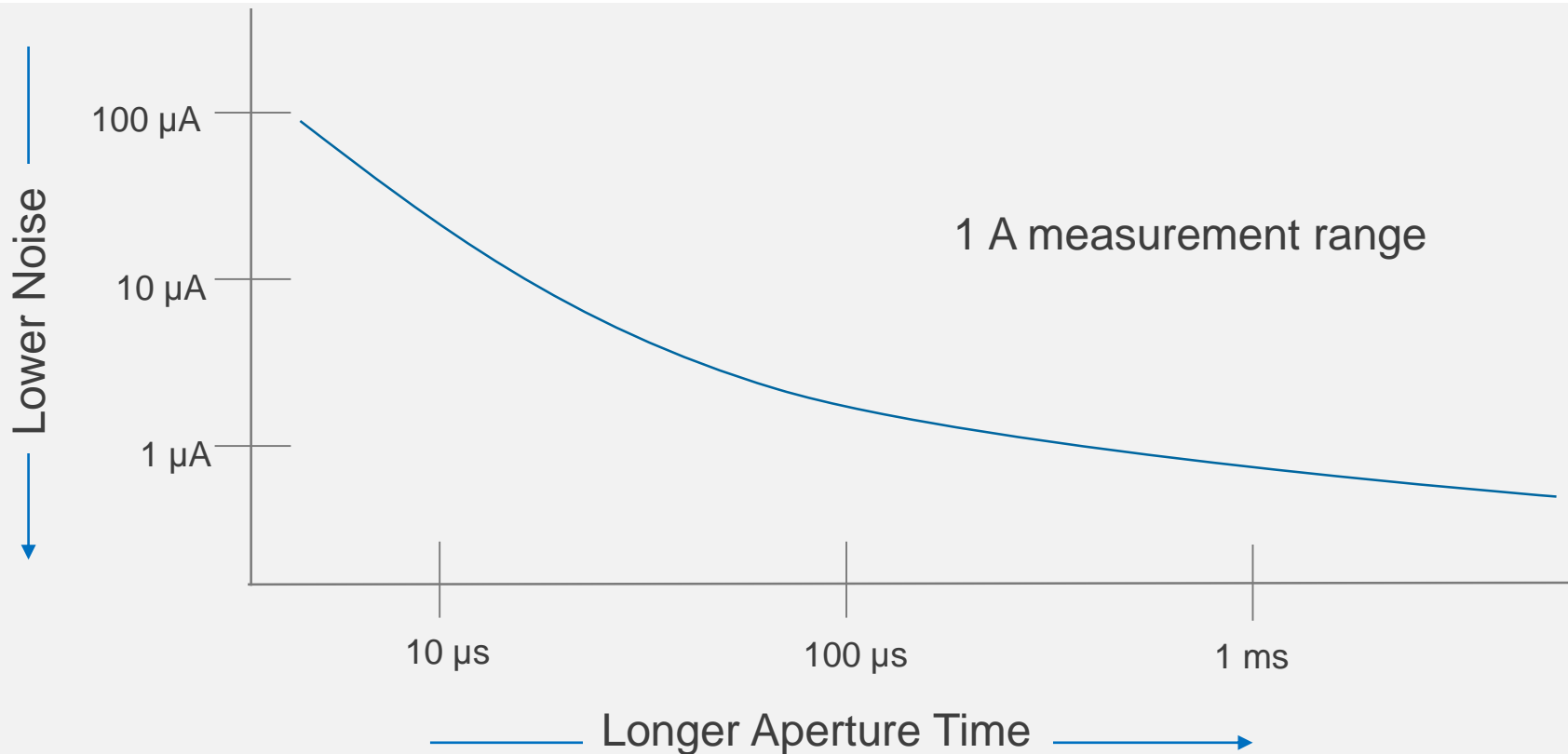


# Measurement Cycle

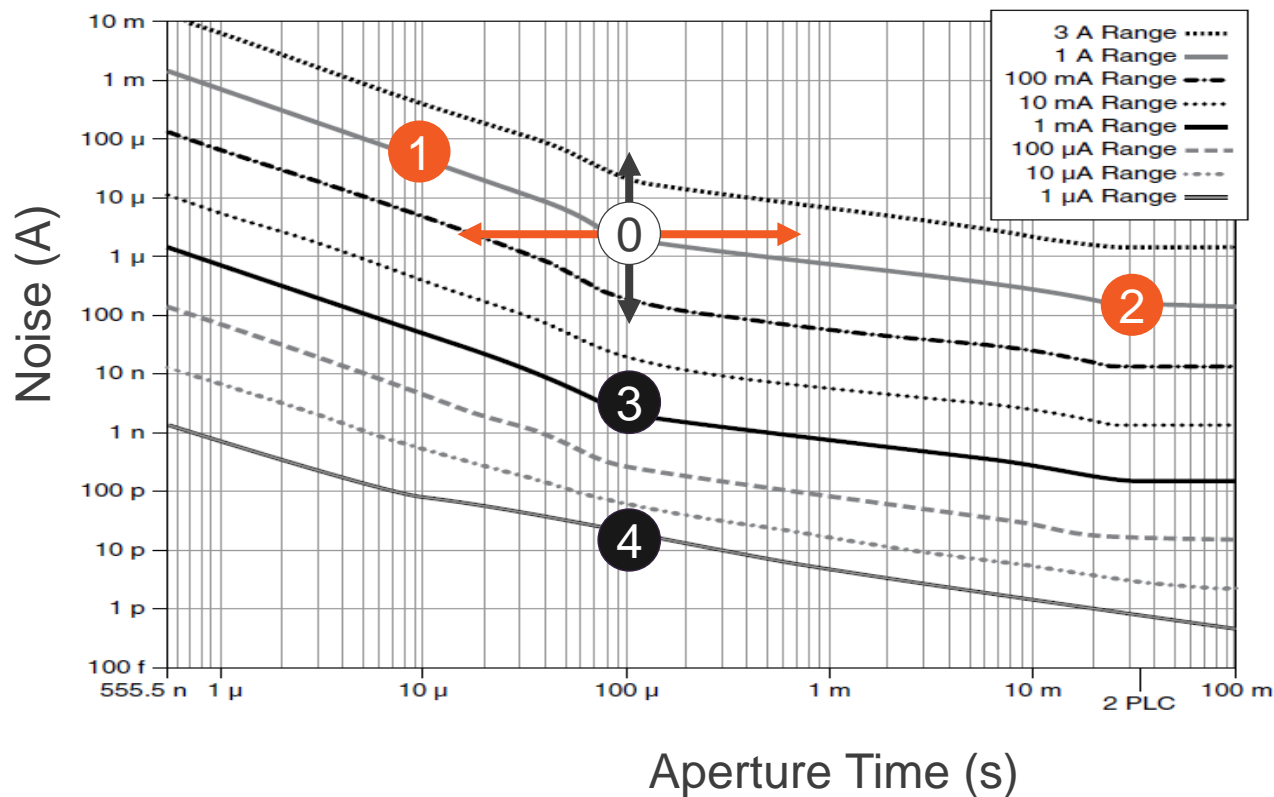


# Property: Aperture Time

niDCPower  
16.7m Aperture Time




# Noise vs. Aperture Time



## Noise

- 0 1 μA
- 1 100 μA
- 2 100 nA
- 3 1 nA
- 4 10 pA

Find more information on PXI Source Measure Units at [ni.com/smu](https://ni.com/smu)

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Home > Shop > Electronic Test and Instrumentation > Source Measure Units > What Are PXI Source Measure Units?

### What Are PXI Source Measure Units?

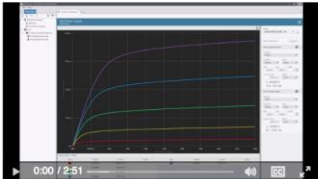
PXI Source Measure Units (SMUs) combine high-precision source and measure capability with features designed to reduce test time and increase flexibility.


[VIEW PRODUCT DETAILS](#) [View Product Flyer](#)

#### Interactive Soft Front Panel

PXI SMUs are shipped with an interactive soft front panel for ready-to-run measurements. It includes two modes: one for constantly outputting a DC current or voltage and another for multichannel sweeps. You can monitor and debug the instrument during automated measurement by enabling a debug session.

[LEARN MORE](#)





0:00 / 3:06

#### Hardware-Timed Sequences

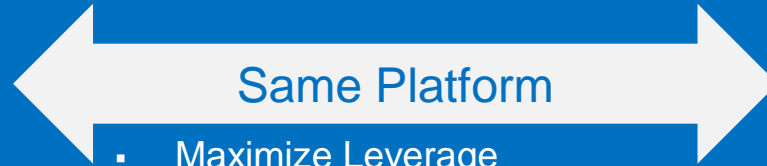
Get your results faster by removing the communication latency between the host computer and SMU among each measurement of a sequence and, at each step, change various SMU parameters such as output mode, aperture time, current range, and transient response.

Labs



## A Smarter Approach

Production Floor



- Maximize Leverage
  - Code, setup, training
- Simpler correlation
- Faster test cycles
- Lower cost





## Smarter Test System

- Open, Flexible Software
- Modular Hardware
- Vibrant Ecosystem
- “Customer knows best”
- Deployable from Validation to Production

A smart test system is more than a fixed-functionality instrument—  
it is built for automation and customization, across validation to production,  
with ultimate goal of meeting business needs.

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