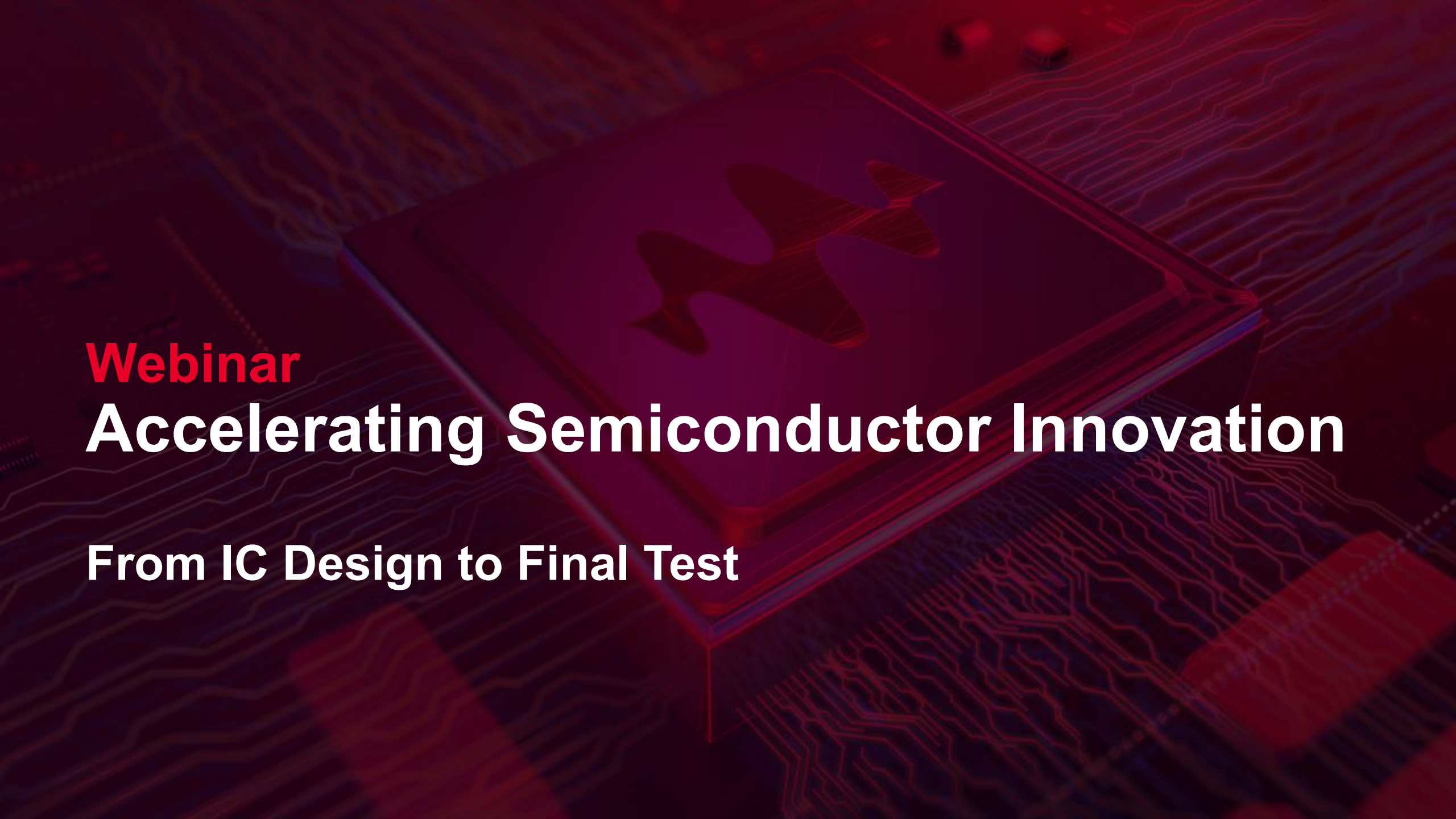


Webinar

Accelerating Semiconductor Innovation

From IC Design to Final Test



Gobinath Tamil Vanan

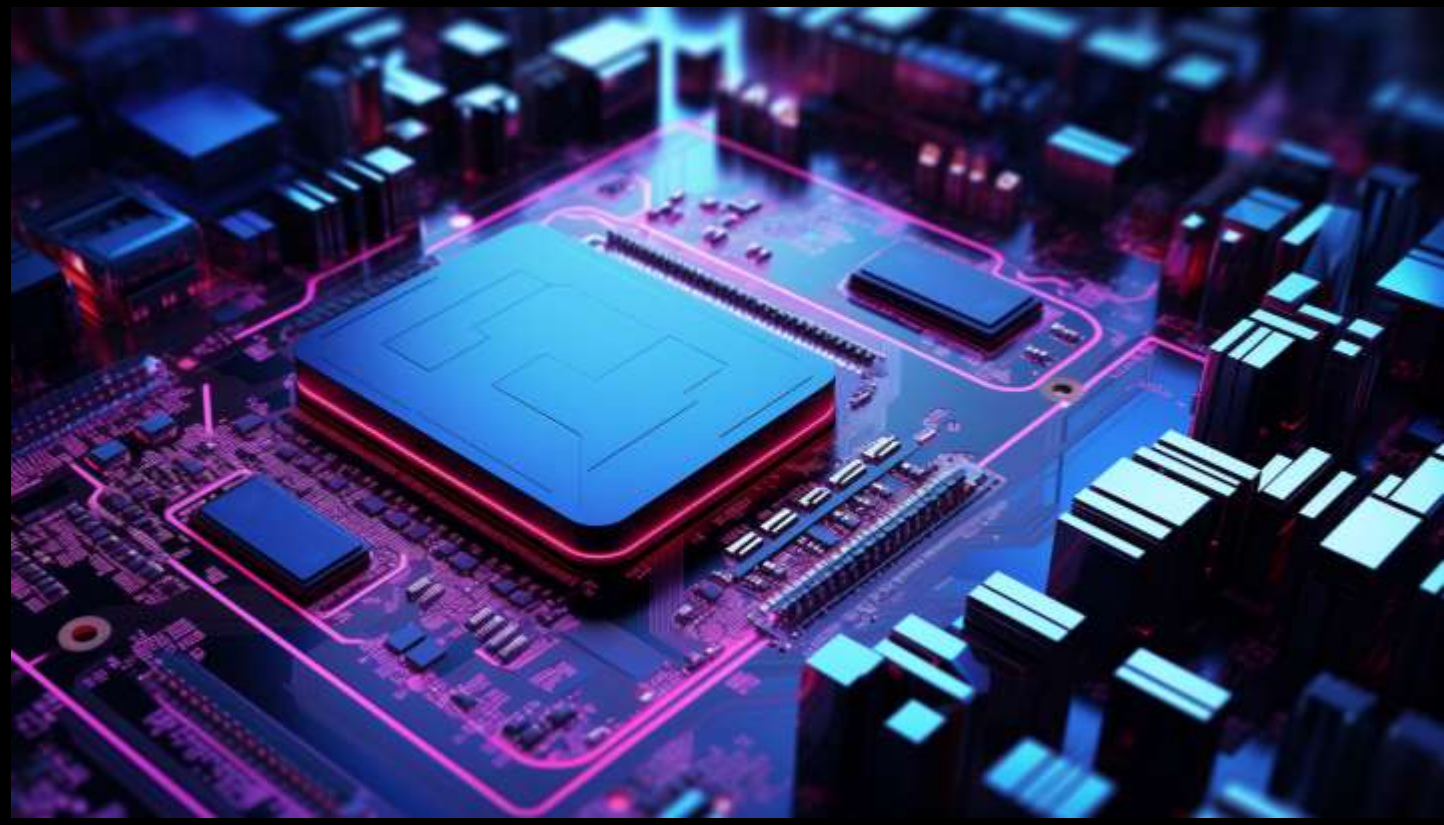
Power Test Portfolio Engineer
Keysight Technologies

Semiconductor Industry Growth & Market Overview

US $975B

2026 global semiconductor revenue (forecast)

+26% YoY



2026 growth drivers:

- Memory and logic lead the cycle.
- AI-related compute & data-center demand continues to pull leading-edge supply chains.
- Broad-based expansion expected across regions; America, Europe and Asia-Pacific contribute most.
- Equipment investment remains elevated into 2026, reflecting leading-edge logic, memory and advanced packaging.

Source: WSTS (Dec 2025 forecast).

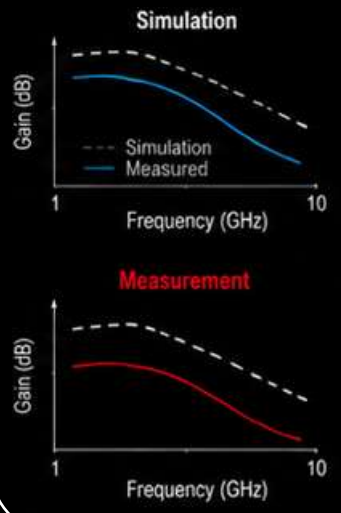
The Reality After First Silicon

Simulation said it would work. Measurements tell a different story.

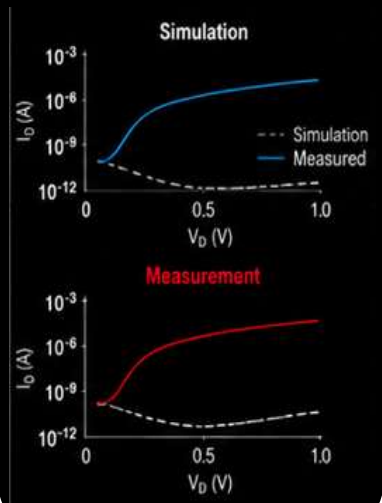
First silicon from foundry



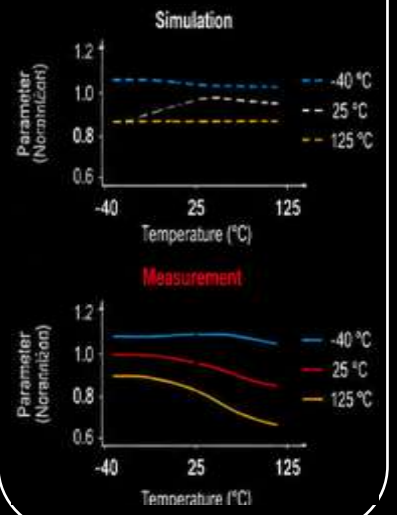
RF gain lower than expectation



Leakage current higher than expected



Performance changes with temperature



The real challenge

Finding the root cause remains difficult

Close validation gap

Accelerate time to production

Improve confidence

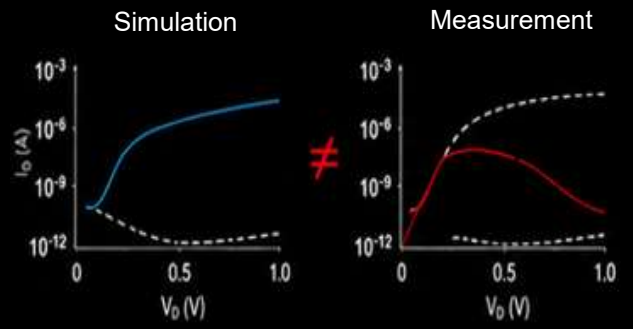
Ensure quality & reliability

Workflow Gaps That Delay Semiconductor Development

Common challenges with real impact on engineering efficiency

1

Simulation results do not correlate with measured silicon performance



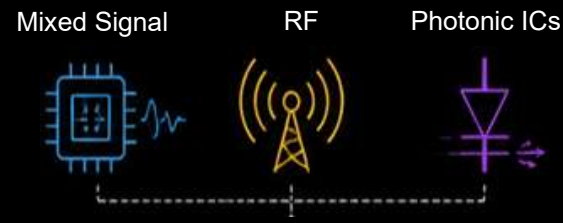
2

Wafer level characterization can be time consuming and difficult to automate



3

Validating advanced devices requires synchronized measurement across domains



Cross domain correlation and analysis

- Improve validation efficiency
- Accelerate debugging
- Increase engineering confidence
- Faster time to production

Real-World Use Cases

IC Design

Design Amplifiers Based on FET



Wafer Test

On-Wafer Id-Vd Application Test



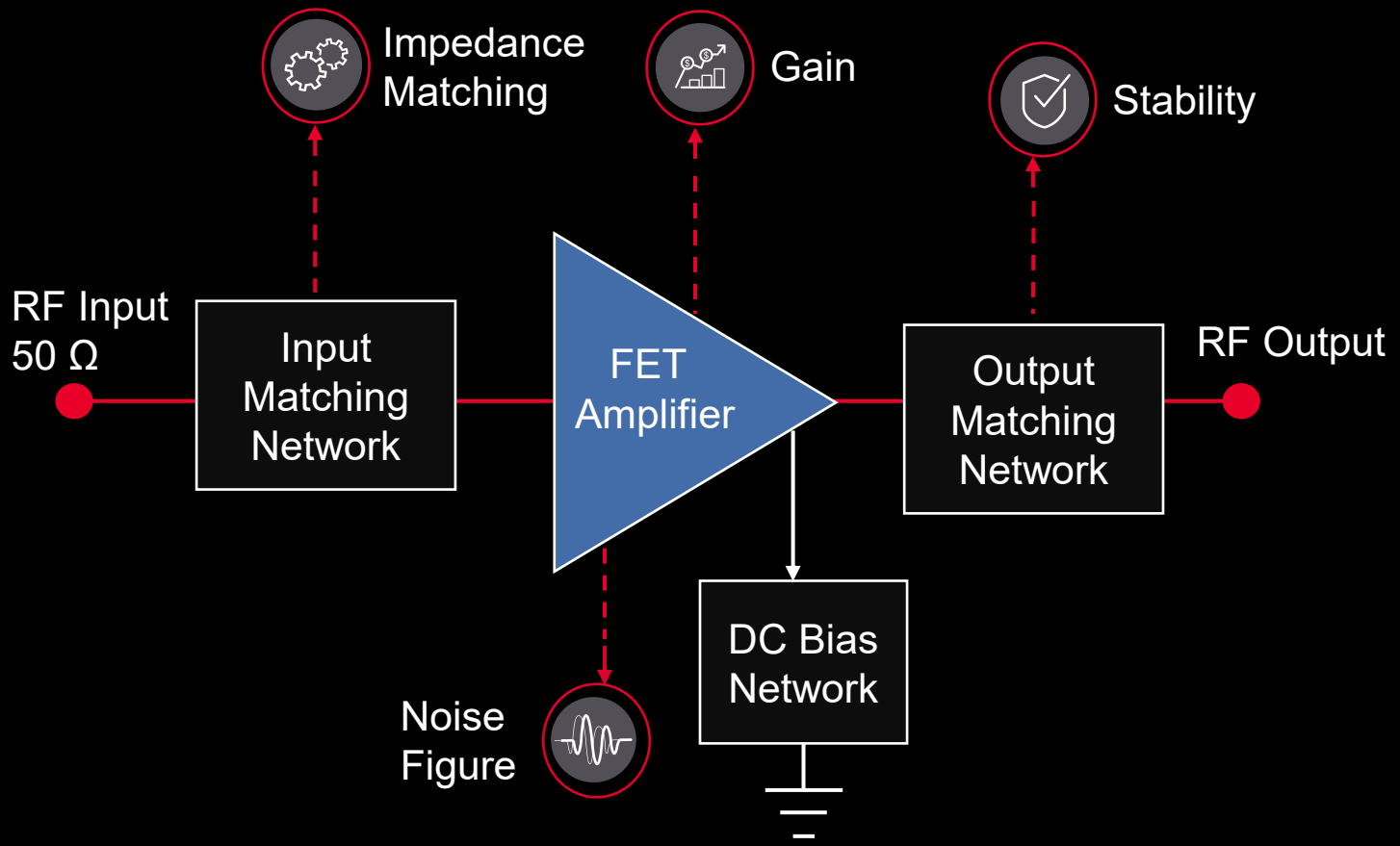
Functional Test

Photonics IC Functional Test



Use Case 1: RF Amplifier Design Based on FET

Why RF amplifier design is challenging



Engineering Challenges

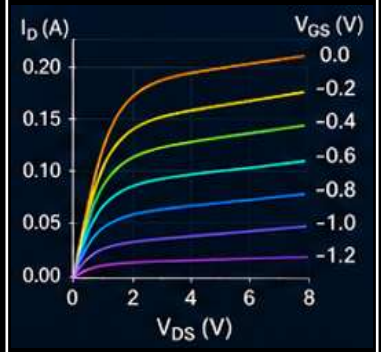
- Optimize impedance matching
- Maintain amplifier stability
- Minimize noise figure
- Balance gain and reduce design iterations

RF amplifier design requires simultaneous optimization of multiple, interdependent oarameters. These trade-offs often lead to multiple design iterations, increasing development time and cost.

RF Amplifier Design Workflow

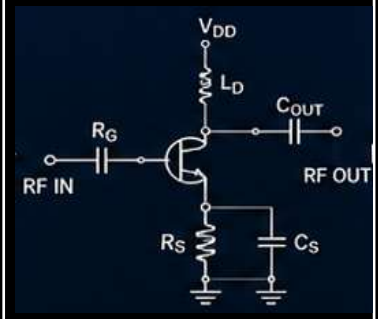
Integrated RF amplifier design workflow

1 Device Characterization



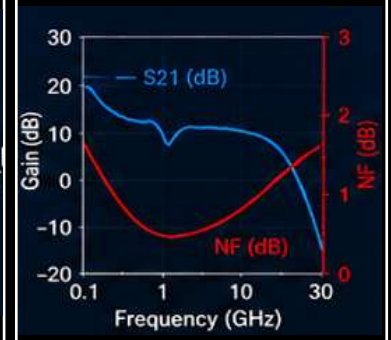
Measure FET behavior

2 Build RF Amplifier



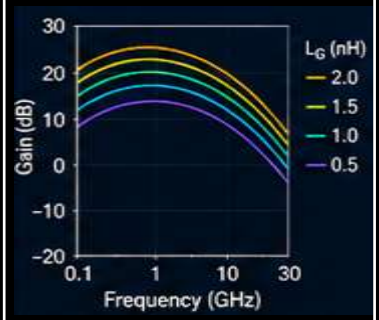
Create RF amplifier using selected model

3 DC & AC Simulation



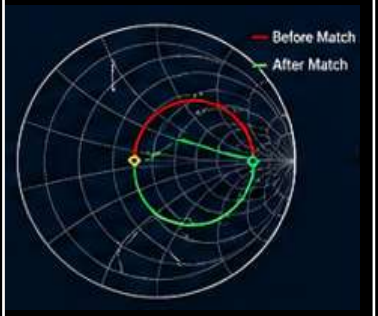
Verify performance conditions

4 Parameter Sweep



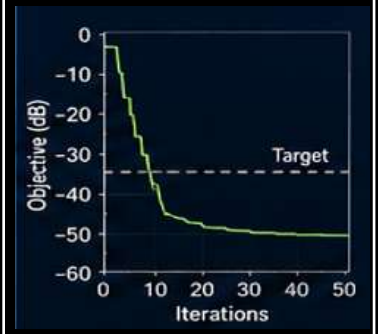
Evaluate gain, bandwidth, and stability

5 Smith Chart Matching



Optimize RF impedance using Smith chart

6 ADS Optimization

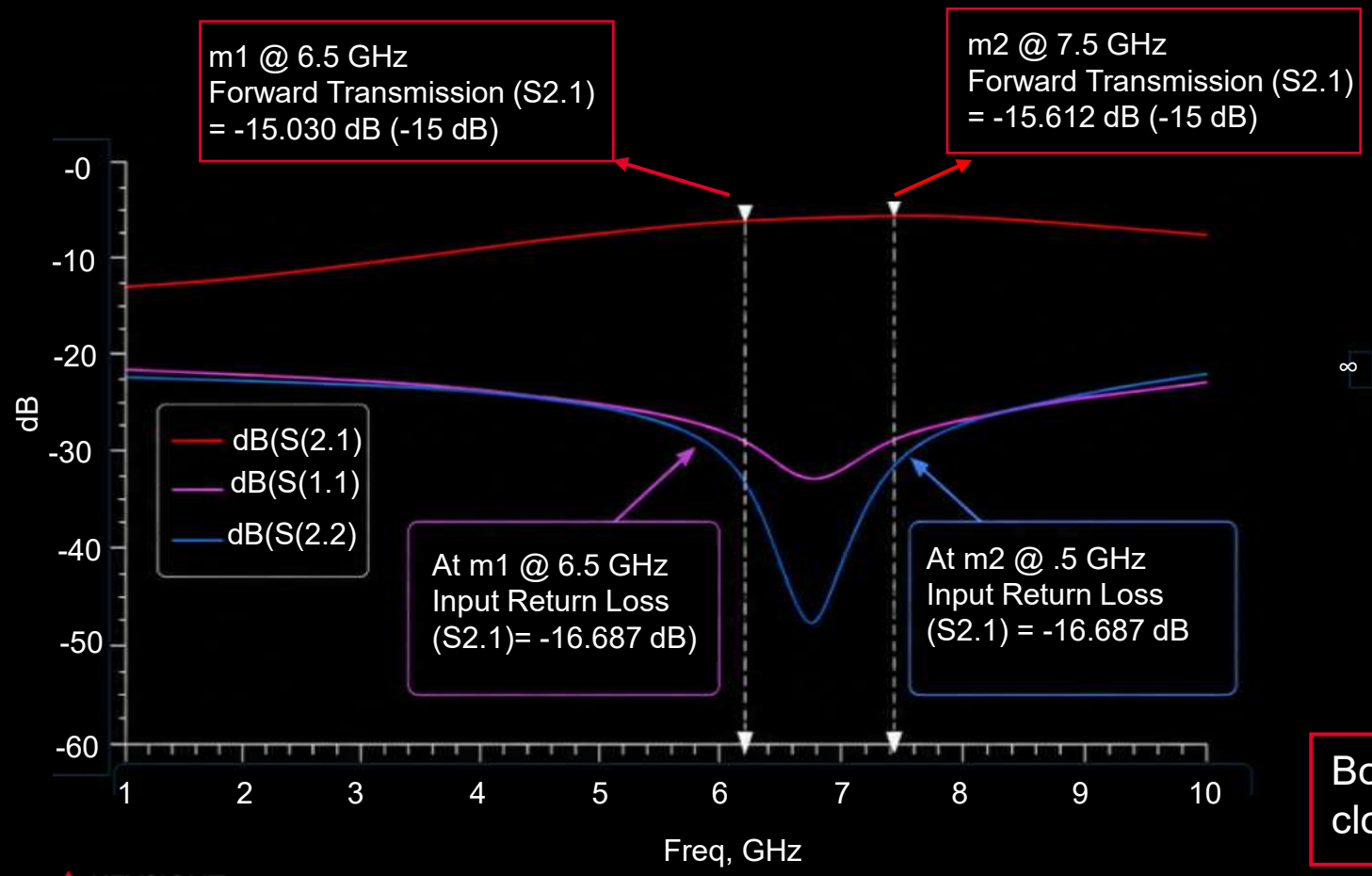


Optimize to meet objectives

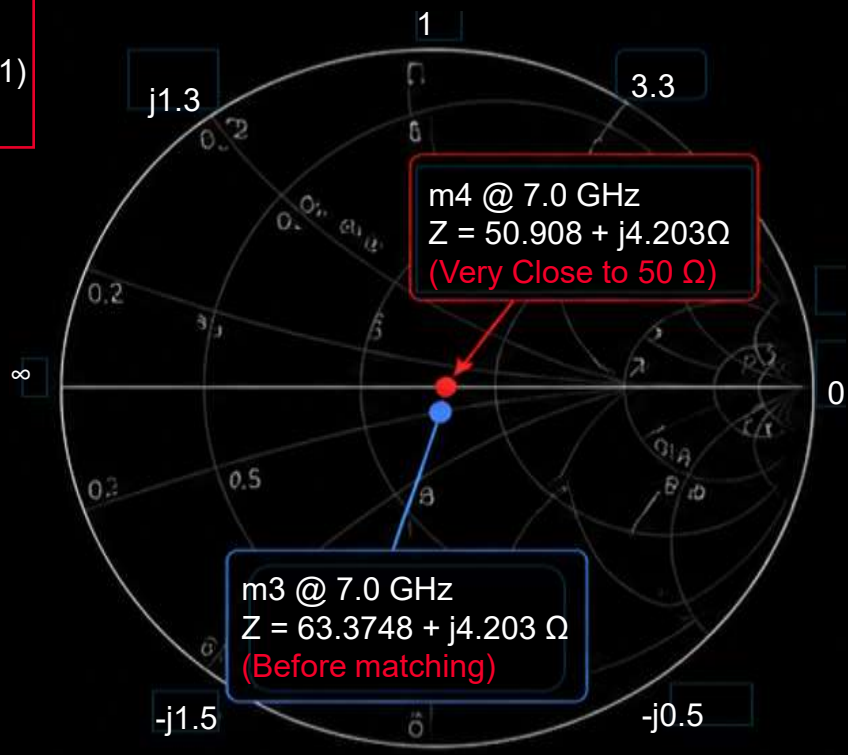
Simulation Results: Validating RF Amplifier Performance

Validating design performance with simulation and measurement

S-Parameter Plot



Smith Chart



Both input and output impedances are very close to the center (50 +J0 Ω) at 7.0GHz.

KEYSIGHT

Takeaway: Accelerate RF Amplifier Design with Simulation Software

Integrate simulation + automate optimization = greater design confidence



Simulation software enables engineers to validate RF amplifier performance before hardware fabrication, integrating device characterization, circuit simulation, impedance matching, and optimization into one seamless workflow for faster development and lower design risk



Earlier Design Validation



Optimized RF Performance



Produced Prototype Iterations

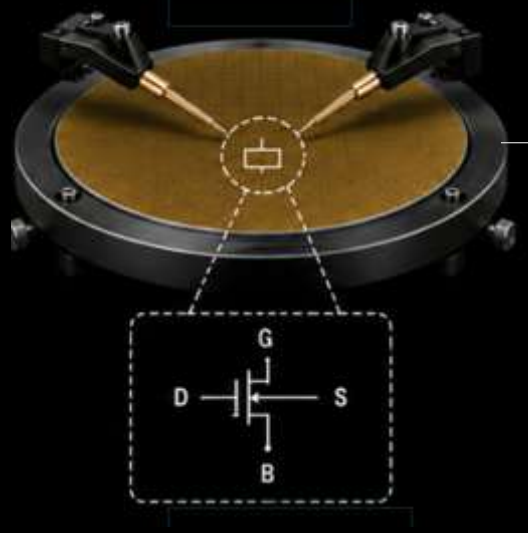


Geater Design Confidence

Use Case 2: On-Wafer I-V Characterization

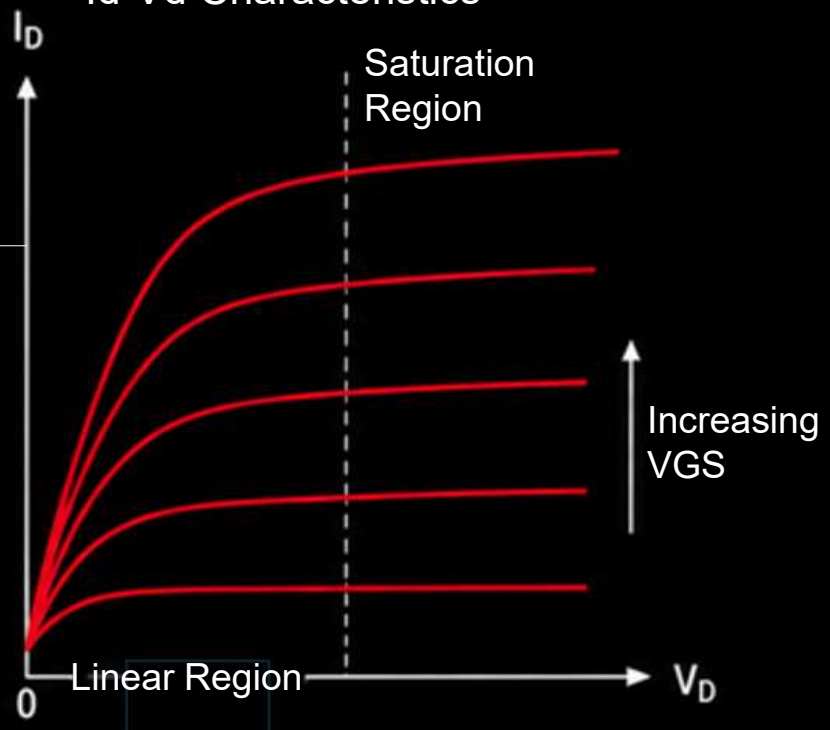
Understanding device behavior before it becomes a design issue

Probe Station
(On-Wafer)



MOSFET on wafer

Id-Vd Characteristics



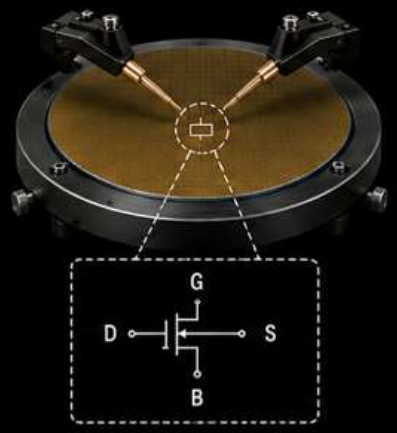
Accurate on-wafer Id-Vd characterization enables engineers to understand MOSFET behavior, improve device models, monitor process variation, and reduce development risk before manufacturing.

- Capture accurate Id-Vd characteristics
- Understand process variations
- Build accurate device models
- Improve yield and reliability

On-Wafer I-V Characterization

Workflow for accurate and efficient device characterization

1 Connect device to probe station

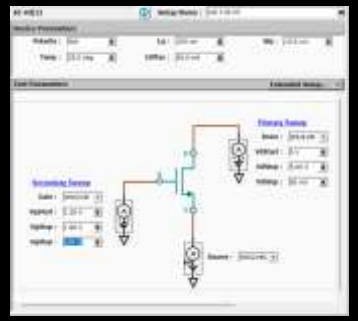


MOSFET on wafer

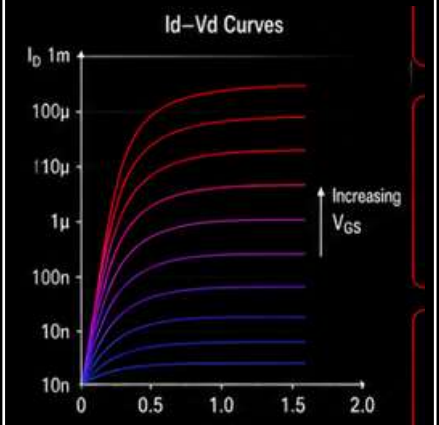
2 Assign SMUs to device terminals



3 Setup EasyEXPERT I-V application



4 Execute & view Id-Vd results



Accurate Measurements

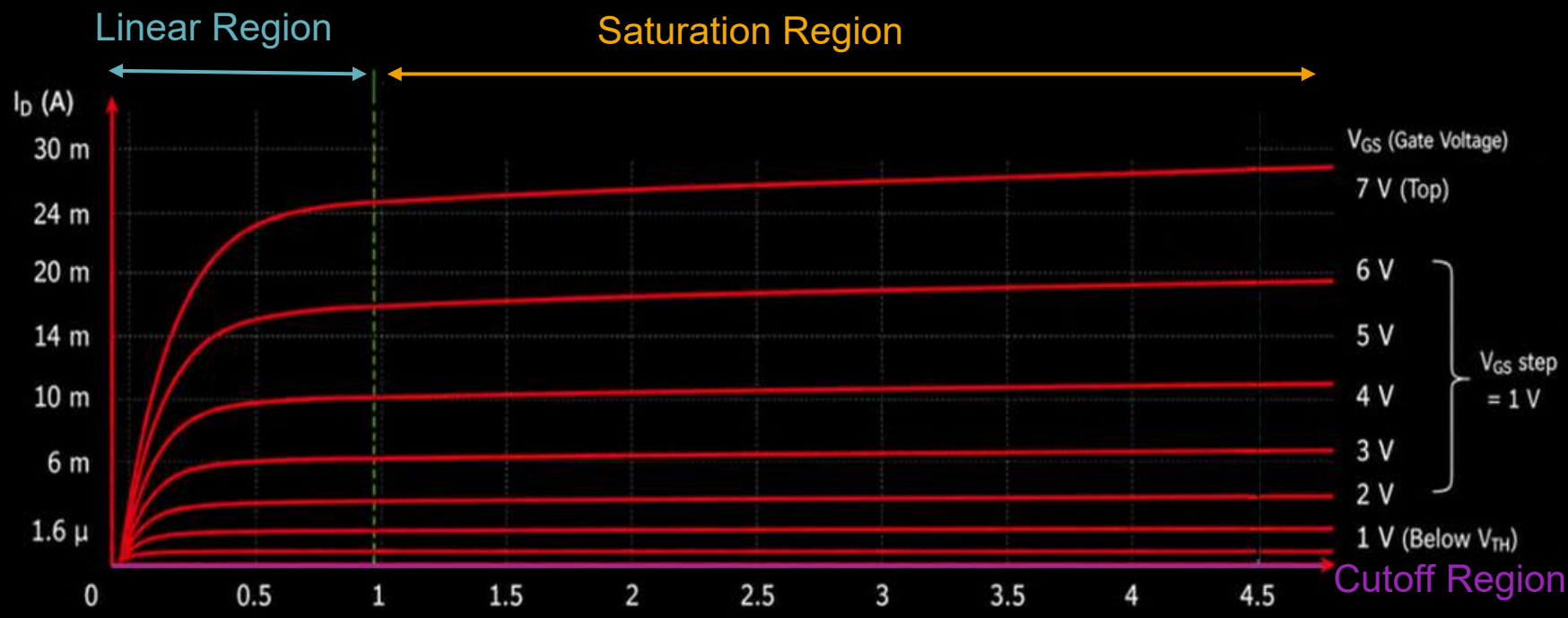
Efficient Workflow

Better Device Insights

Reliable Results

Measured Electrical Characteristics Reveal MOSFET Performance

Id-Vd measurements provide quantitative insight into device behavior and process consistency



Key Takeaway: Id-Vd measurements reveal the operating regions of a MOSFET and provide essential data for device characterization, SPICE model development, process monitoring, and manufacturing quality verification.

Takeaway: Faster On-Wafer I–V Characterization

Accurate, repeatable measurements for reliable device modelling and faster development



Accurate on-wafer Id-Vd characterization delivers trusted electrical data, improve model accuracy, ensures process consistency, and accelerates innovation while reducing development risk.



Foundation of reliable development



Complete, integrated station



Trust data, better decisions



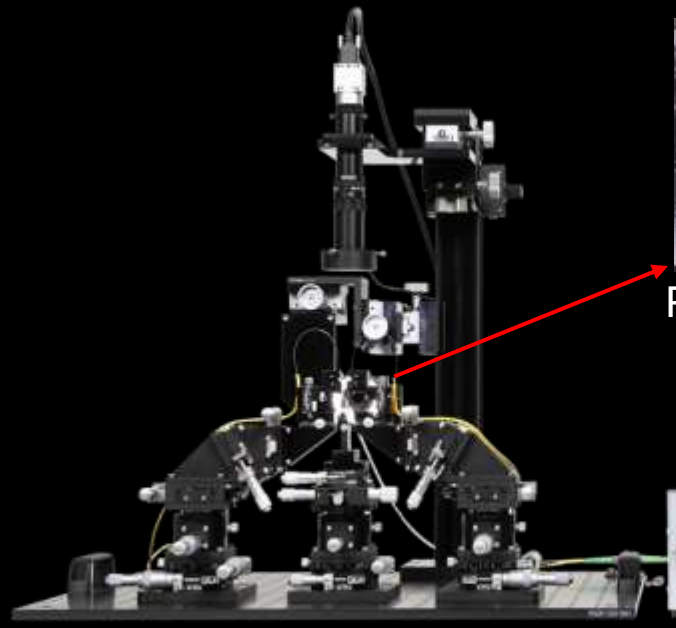
Faster development, lower risk



Accelerate innovation with confidence

Use Case 3: Photonics IC Functional Test

Functional validation is critical for any integrated circuits



Photonic Probe Station



Photonic IC DUT



Optical Power Meters, Tunable Lasers, Optical Polarization and Dispersion, Source Measure Units

Functional validation requires synchronized optical and electrical measurements to accurately characterize wavelength response, polarization behavior, and device performance.

Engineering Challenges

- Measure photonic device insertion loss
- Measure wavelength dependent response
- Enable repeatable polarization measurements
- Correlate optical and electrical responses

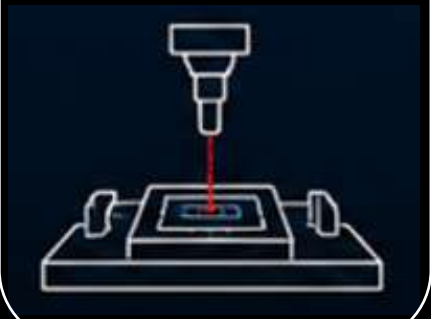
Automated Swept Wavelength Measurement Workflow

End-to-end workflow for accurate and repeatable photonic IC validation

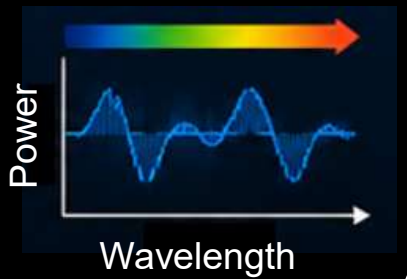
1 Reference Calibration



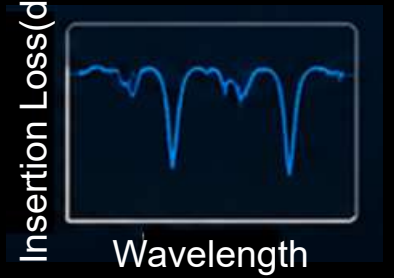
2 Fiber Alignment



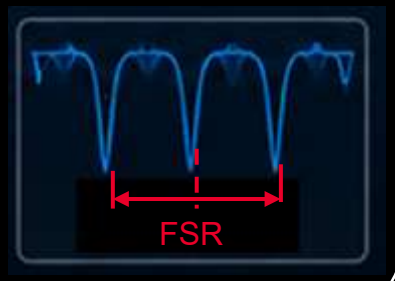
3 Swept Wavelength Scan



4 Insertion Loss Analysis



5 Resonance & FSK Extraction

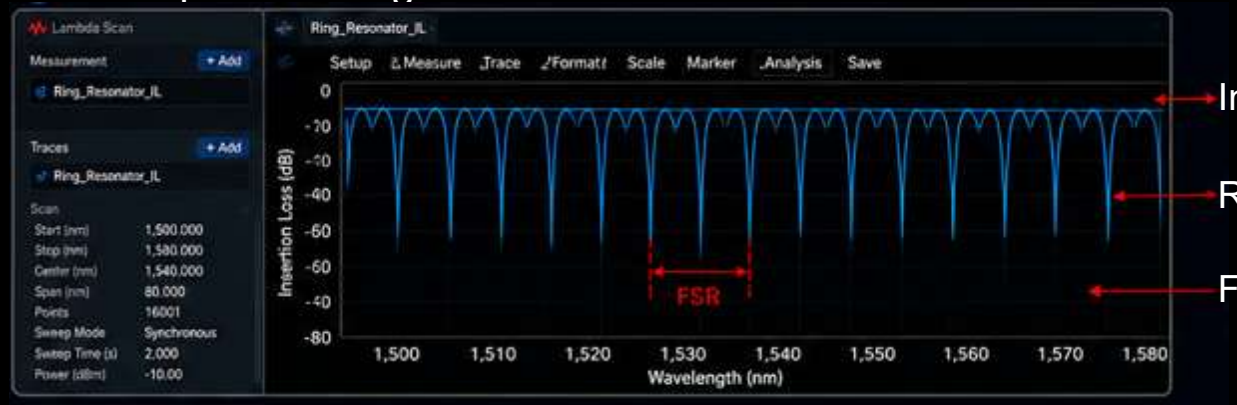


- Accelerate Characterization
- Improve Measurement Accuracy
- Ensure Repeatable Results
- Extract Actionable Insights

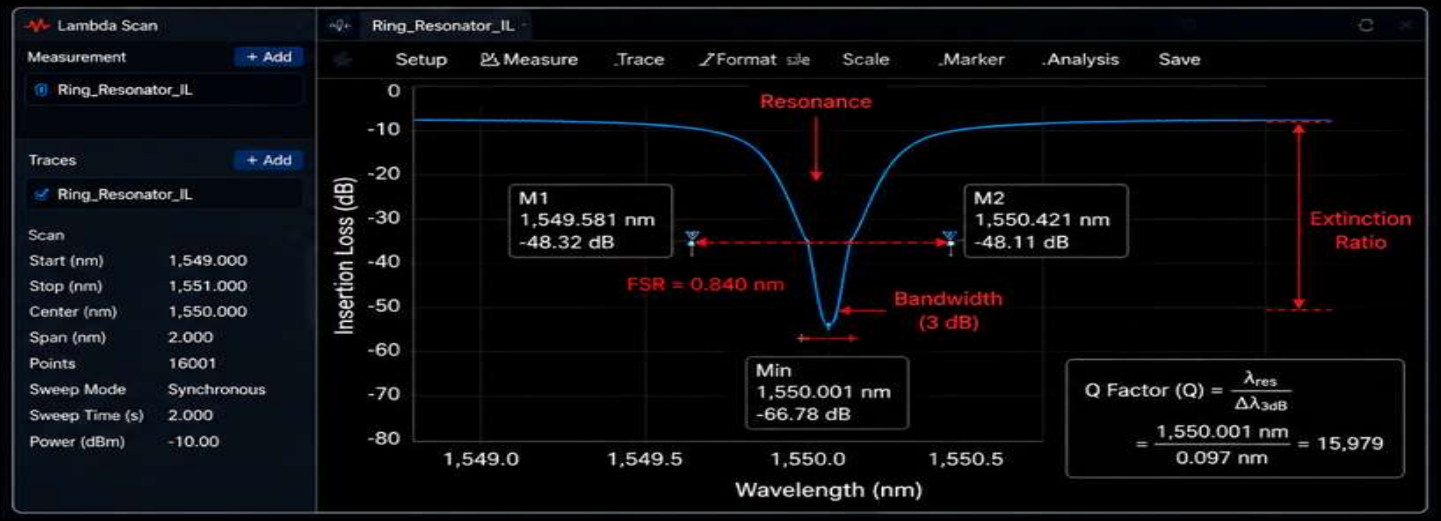
Photonic Device Characterization Results

Extract critical optical parameters from a single automated wavelength sweep

Full Swept Wavelength Scan



Zoomed Resonance



Key Benefits

- Automated High-Resolution Sweep
- Accurate Parameter Extraction
- Fast & Repeatable Result
- Actionable Insights for Better Designs

Takeaway: Faster Functional Validation for Photonic ICs

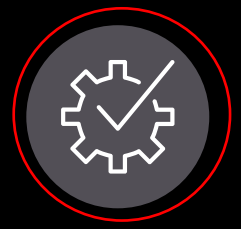
Accurate, repeatable, and scalable photonic IC functional validation



Accurate swept wavelength characterization enables engineer to validate photonic integrated circuit with greater confidence throughout development and manufacturing.



Faster validation cycles



Higher measurement repeatability



Deeper insight into optical device behavior



Scalable workflows from R&D to production

How Keysight Accelerates Semiconductor Innovation

Pre-silicon

Post-silicon

Material → Design → Mask → Wafer Foundry → Wafer Testing → Packaging → Package Testing → Functional Test

IC Design



On-Wafer / Parametric Test



Final / Functional Test



Why Choose Keysight Semiconductor Test Solution ?

Comprehensive Solutions

Covering design, validation, and test

Faster Development Cycles

Automated tools improve efficiency

Accelerating Chiplet Innovation

High-Speed Chiplet Validation

Precision You Can Depend On

Enabling End-to-End Innovation



Learn More




KEYSIGHT