



Bird[®]

What will you get from this class?



Class description

*A new **Bird Diagnostic System (BDS2)** sensor targets the retrofit market, expanding the capabilities of existing tools. Learn about the profiles of customers within this market as well as opportunities to optimize processes and minimize yield loss.*

Application Overview

Who are the customers?

What are user's pain points?

Product Overview

Competition

Key Questions to Ask

Sales Tools



Background:

- Consistency is a critical element of semiconductor manufacturing
- Better process repeatability allows recipes to be finetuned to improve performance and reduce yield loss
- RF power measurement at various points in the feedline provides insight to process performance.



Pre-Matching Network RF Measurement:

- Monitors generator performance
 - Setpoint accuracy
 - Amplitude drifts
 - Pulse shape inconsistencies
- Detects matching network performance issues



Post-Matching Network Measurement:

- Enhanced visibility of chamber performance
 - Delivered RF power into chamber
 - Chamber impedance changes
 - Micro-arcing detection



Bird Diagnostic System (BDS2):

Designed for Post-Matching Network Measurement

- Process Control
 - Detects recipe end points for process consistency
- Yield Loss Analysis
 - Captures excursions, such as micro-arcs, in real time
- Equipment Fingerprinting
 - Identifies chamber-to-chamber differences
- Recipe Optimization
 - Quantifies time domain details to correlated setpoints to delivered power



Who are the customers?



Semiconductor tool OEMs

OEMs who are developing new semiconductor tools with non-50ohm chambers

- Applied Materials
- LAM Research
- Tokyo Electron

Fab and foundries

Manufacturing sites that utilize non-50ohm chambers.

- Samsung
- Micron
- TI
- GlobalFoundries



Who are the customers?

Persona #1: Process Engineer

Objective: Developing recipes for new wafer designs

Primary Focus: Process optimization

Workflow Task:

- Experimental process development to generate a recipe in an engineering environment
- Proliferate the preliminary recipe to a production environment
- Continue to monitor and optimize the recipe



What are the user's pain points?

Persona #1: Process Engineer

Pain points:

- Costly to run multiple lots during recipe development
- Inability to identify cause of unexpected results between the engineering and production environments

Bird Diagnostic System (BDS2) Benefits:

- Capture Critical-to-Quality parameters during recipe development. That same dataset can be used for comparison to the production environment



Who are the customers?

Persona #2: Manufacturing Engineer

Objective: Improving production yields

Primary Focus: Product optimization

Workflow Task:

- Investigate yield loss
- Collate data available after lot is completed and tested



What are the user's pain points?

Persona #2: Manufacturing Engineer

Pain points:

- Inability to capture process excursions as they occur
- Lack of available data on the events happening within a chamber

Bird Diagnostic System (BDS2) Benefits:

- Identify excursions in real time to allow a process step to be stopped for investigation
- Logs performance data at the input to a chamber for failure analysis



Who are the customers?

Persona #3: Test Engineer

Objective: Maximizing tool utilization

Primary Focus: Equipment optimization

Workflow Task:

- Respond to equipment failure by swapping sub-systems to minimize downtime
- Determine failure after the fact by process of elimination



What are the user's pain points?

Persona #3: Test Engineer

Pain points:

- Insufficient data to uncover systems that are drifting from their baseline
- Cannot proactively identify and remove suspect equipment until a failure occurs

Bird Diagnostic System (BDS2) Benefits:

- Fingerprint each system and use the data for identifying failing components



Bird Diagnostic System (BDS2) Value Proposition

For semiconductor engineers who are optimizing their manufacturing processes, yields and equipment, we provide a precision diagnostic system that characterizes the events occurring within the dynamic complex impedance of a semiconductor tool chamber.

Unlike our competitor's solutions, the Bird Diagnostic System (BDS2) provides a cost-effective Voltage, Current and Phase measurement device that is calibrated using Bird's established calorimetry, is configurable into custom applications, and is accessible via a user-friendly Graphical User Interface delivering incisive details of each manufacturing step.



OEM Market

The Bird Diagnostic System (BDS2) effort has historically been OEM-focused

- For the most detailed measurements, the BDS2 sensor needs to be installed at the RF input to the chamber
- The interface between the matching network and the chamber is tool-specific
- Multiple OEM-specific sensors have been created while the tools were under development
 - Pro: Once accepted, the system is specified in for that the tool
 - Con: The development cycle can be lengthy

Retrofit Market

Bird is currently increasing its Bird Diagnostic System (BDS2) effort to expand into the retrofit market

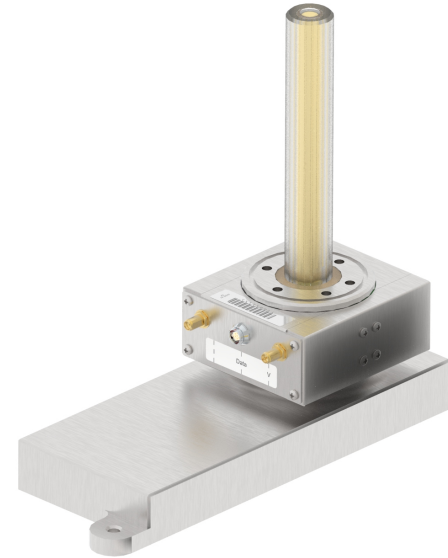
- The compact design of the probes within our BDS Sensor provides flexibility in developing tool-specific solutions
- A new sensor was developed for the Applied Materials Producer[®] CVD tool
- For easy installation, this sensor is a drop-in replacement to an existing feed-rod assembly

Product Overview



Bird P-CVD BDS2 Sensor

- Thousands of Applied Materials® Producer systems have been deployed since first introduced in 1998 and are still in use
- As fabs are working toward extending the lifespan of these tools, the BDS offers unprecedented insight into the chamber characteristics and system health



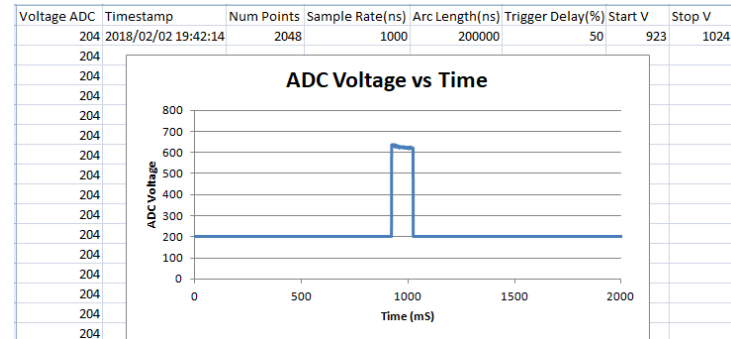
Micro-arcing

- New wafer designs with metal-rich surface areas are causing higher occurrences of micro-arcing that are difficult to detect
 - This failure mode is currently not noticed until the final test stage
 - The BDS can inform the Process Module of micro-arcing so a process can be stopped
 - Saves on process time for bad wafers
 - BDS2 logging during arcing captures 4000 readings before and after an event
 - Provides data for root cause failure analysis
- | Voltage ADC | Timestamp | Num Points | Sample Rate(ns) | Arc Length(ns) | Trigger Delay(%) | Start V | Stop V |
|-------------|---------------------|------------|-----------------|----------------|------------------|---------|--------|
| 204 | 2018/02/02 19:42:14 | 2048 | 1000 | 200000 | 50 | 923 | 1024 |

Sample Rate: 50ns to 4us

Max transient pulse width: 5ns to 2ms

Transient thresholds: 1dB, 2dB, 4dB, 6dB



Product Overview

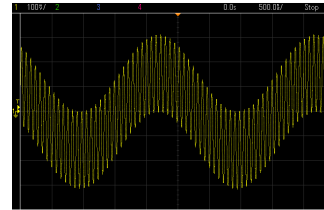


Bird P-CVD BDS2 Sensor

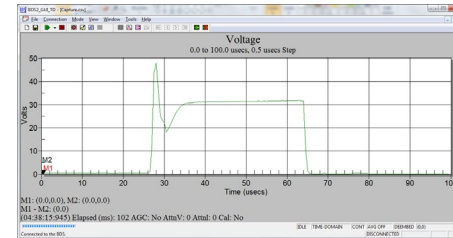
The initial customer interest in the P-CVD BDS2 Sensor has been due to micro-arcing issues.

Features that are also being explored:

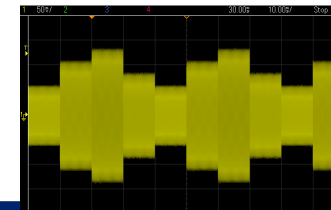
- Multifrequency measurements
 - Up to 3 fundamentals
 - Up to a total of 9 harmonics and intermodulation
- Time Domain pulse shape analysis
 - Calibrated measurements with 500ns resolution
- Multi level pulse measurements
 - Up to 4 states



400kHz and 13.56MHz



Time Domain View



4-level Pulse

Product Overview



The Bird P-CVD BDS2 System comprises:-

- P-CVD BDS2 Sensor
- BDS2 calibrated cable
- BDS2 Receiver

This system provides micro-arcing detection capabilities for Applied Materials® Producer CVD tools. It also enables data collection for process development, yield optimization, and downtime reduction.

Bird has developed many versions of the BDS2 Sensor and can help develop solutions to fit other semiconductor systems.



BIRD DIAGNOSTIC SYSTEM
Inline Voltage & Current Probe

P-CVD BDS2 SENSOR

NEW

Delivering RF Performance Insights for Applied Materials® Systems

The P-CVD BDS2 Sensor is a custom-designed drop-in Voltage & Current Probe for Applied Materials Producer CVD systems. For semiconductor engineers who are optimizing their system's performance, the BDS2 provides insights into plasma chamber operations during recipe development, process improvement analysis, failure investigations and system fingerprinting. By measuring voltage, current and phase at the input to a plasma chamber, the BDS2 provides unprecedented insight into chamber characteristics during each processing step.

The BDS2 is indispensable in capturing process excursions such as arc events. In addition, end point detection is simplified by the system's monitoring of the changing impedance of a plasma chamber. System fingerprinting can also be accomplished to ensure chamber-to-chamber matching and for early failure detection. Further, the optional Time-Domain mode displays the shape of pulsed RF waveforms at the input of the plasma chamber to provide data points during the generation of new process recipes.



Sensor

Cable

Receiver

The BDS2 system includes the custom sensor, cable and receiver.

PRODUCT FEATURES

- Up to 1% accuracy for V and I readings
- Drop-in installation into Applied Materials Producer CVD systems.
- Measures V, I and Phase into complex impedances:
 - Up to 3 fundamental frequencies
 - Up to 4 harmonics per fundamental frequency
 - Up to 6 intermodulation products
- Time domain analysis of waveform details
- Detection of arc events

APPLICATIONS

- Arcing, transient event detection
- Process end-point indication
- Chamber-to-chamber matching
- Recipe development
- Sub-system drift indication
- Delivery path failure analysis



What makes the Bird P-CVD BDS2 System unique?

- Ease of installation
 - Designed specifically for a drop-in fit
- Up to 1% accuracy for V and I
 - Backed by Bird's proven calorimetry
- Accurate measurement across the Smith Chart
 - V and I probe design to isolate the measured fields
- Advanced software tools
 - Tracking mode for tuning generators
 - Spectral search to identify harmonics and intermodulation
 - Time domain view for waveform analysis
 - Micro arc detection to detect excursions



Cable



Receiver

Questions to Ask



1. How are you currently measuring chamber performance?
2. How are a chamber's Critical to Quality performance parameters identified?
3. What data is being analyzed to root-cause yield loss?
4. How is equipment drift detected?
5. What is it about your system that you like and don't like?
6. How confident are you in the results?
7. What are the frequencies and power levels in your application?





Prospecting Toolkit

- Datasheet
- Webinar
- Maximizer contacts

Points of Differentiation

- Questions to Ask
- Competitive Selling Guide



First Customer Meeting

- Product PowerPoint Slides
- Leave-behinds:
 - Datasheet
 - App Notes

Second Customer Meeting

- Product Demonstration or Webex