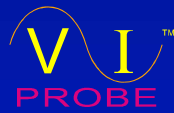


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RF & DC PLASMA SYSTEMS



RF Impedance Analyzer

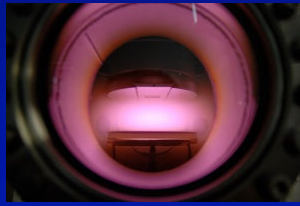
Plasma Applications

- ◆ Physical Vapor Deposition
- ◆ Chemical Vapor Deposition
- ◆ Dry Etch
- ◆ Ashing / Stripping
- ◆ Ion Implantation



ENERGY

- ◆ An invisible and almost mass-less electronic fluid, having *interchangeable forms*, such as *electrical* and *thermal*, and most important, having the *ability* to *communicate* or *travel* and do *useful work* such as making things run or physically *altering* materials, such as silicon wafer dry (Plasma) Etching.



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RF Plasma Generators



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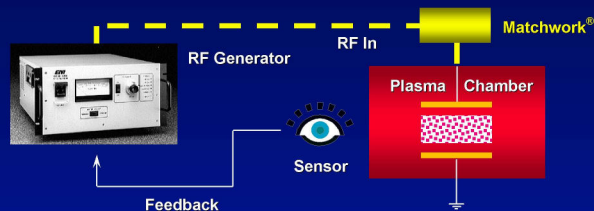
RF Matching Networks



5 雅森科技

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Matchworks®



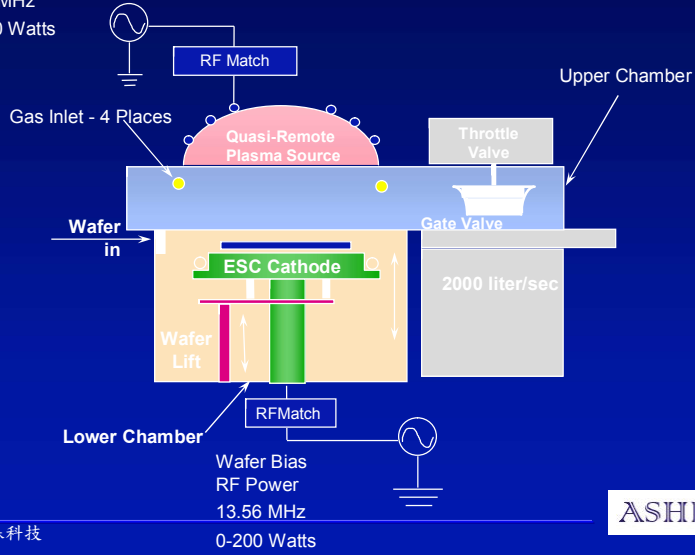
- ◆ Application: Provide constant impedance equalization between plasma chamber and RF Generator for maximum power transfer
- ◆ Power Range: 40-10000 Watts
- ◆ Frequency: 2-4MHz, 13.56MHz, 27.12MHz
- ◆ Performance Features:
 - ⇒ Auto/Manual Operation
 - ⇒ Digital Signal Processor(DSP) based "Fuzzy logic" Control
 - ⇒ Fast Response Time
 - ⇒ Custom Designs for Specific System Requirements

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Silicon Etch DPS Chamber

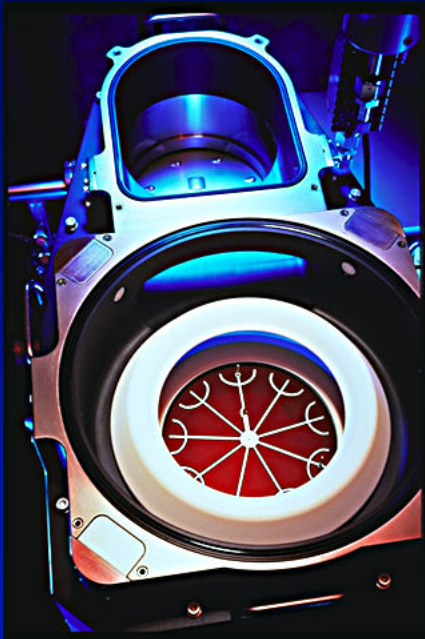
Source RF Power
12.56 MHz
0-2000 Watts



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Wafer Bias
RF Power
13.56 MHz
0-200 Watts

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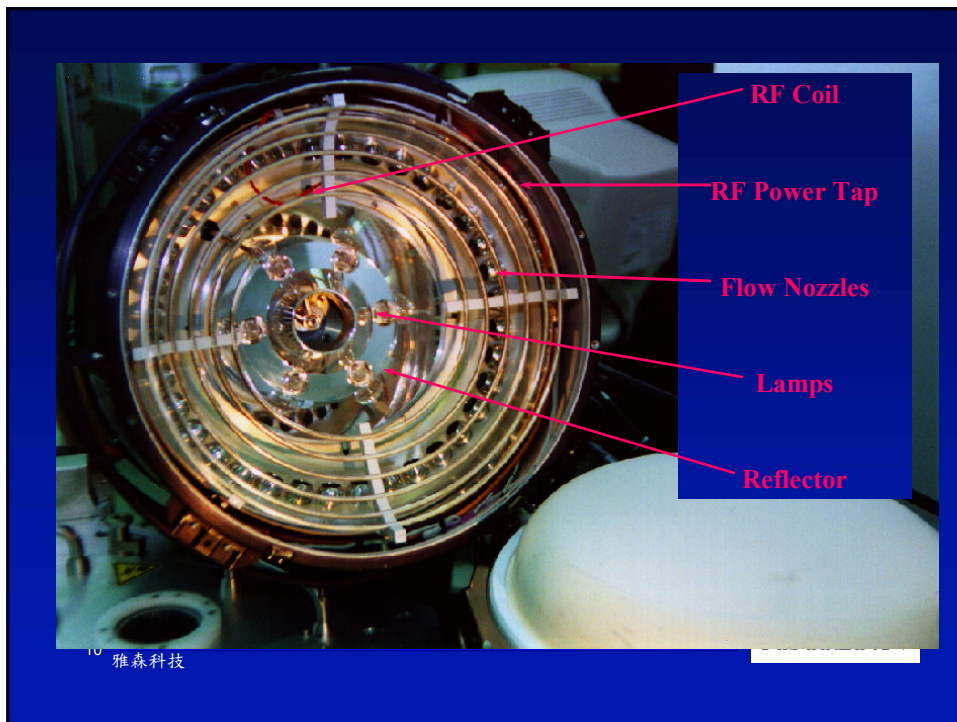
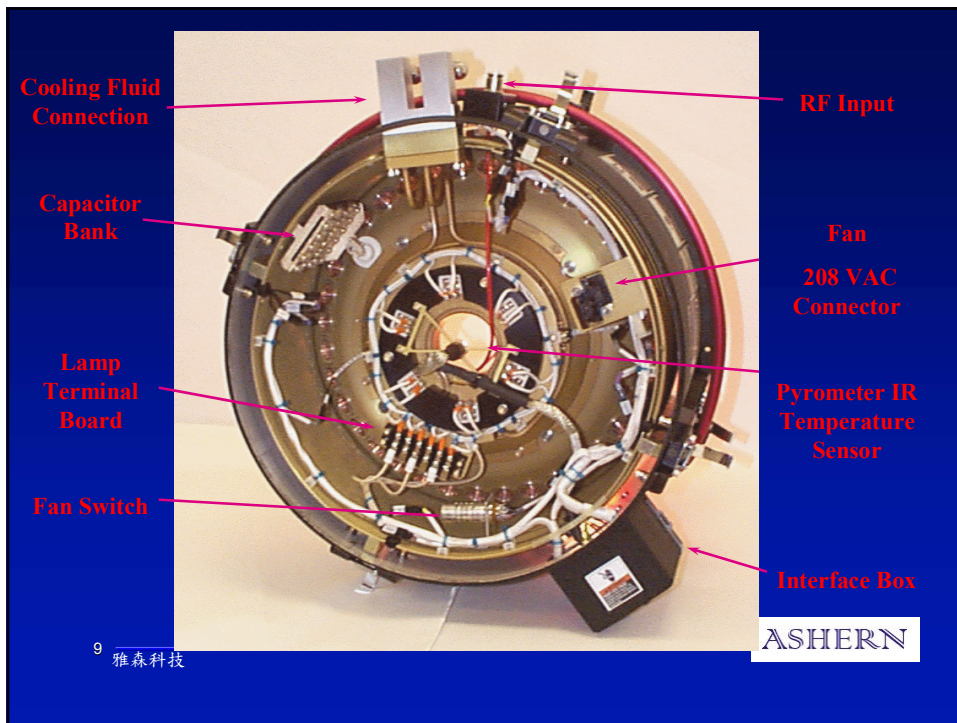


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Fixed Matcher

AMAT DPS Metal Etcher

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What is V/I PROBE

- ◆ RF Plasma Impedance Analyzer
 - Measure the Voltage and current values.
 - Measures the phase angle between the voltage and current.
 - Measure the value of impedance.
 - Measure the delivered power, forward power, reflected power, and reactive power.
 - Measures time since RF power turned on.

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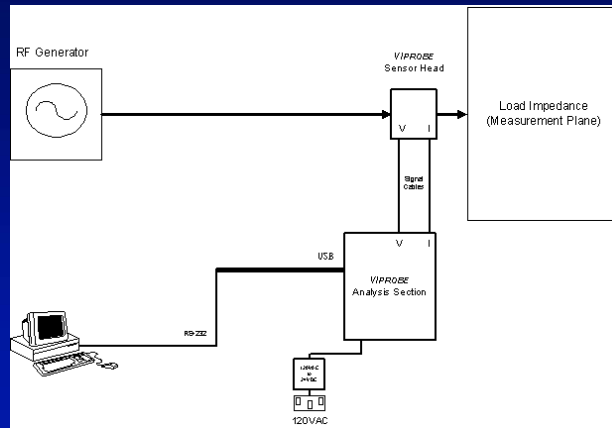
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12 雅森科技

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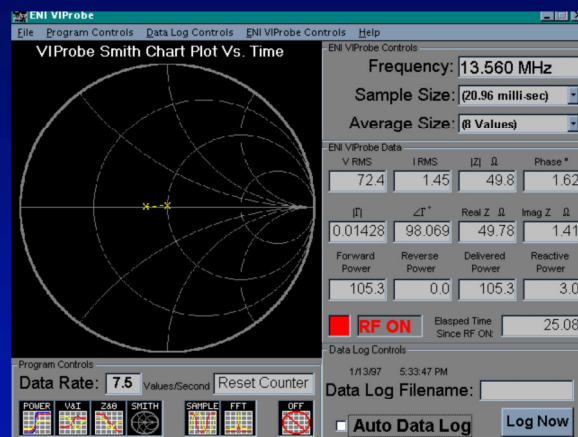
V/I Probe Setup



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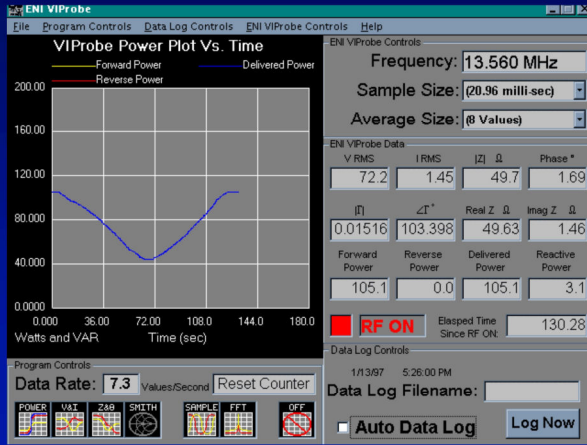
Data Display: Smith Chart



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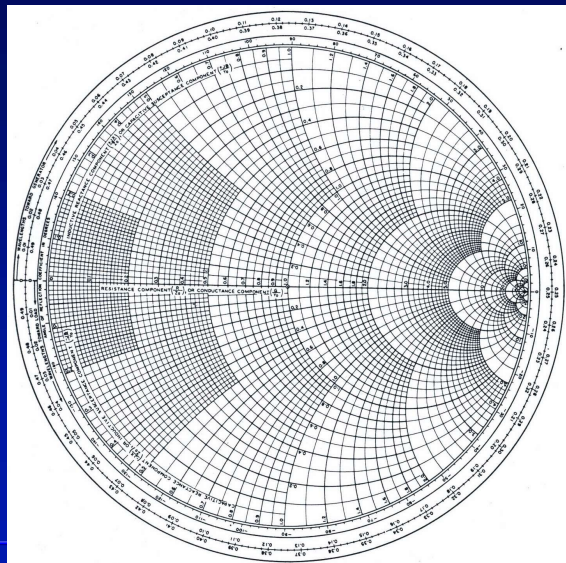
Data Display: Power



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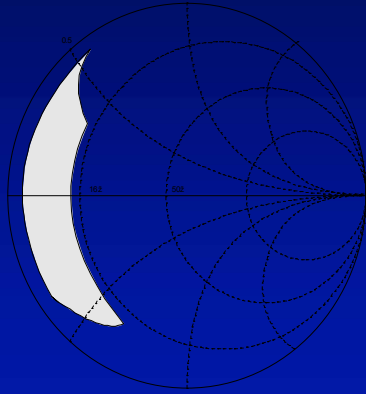
Transmission Line - Smith Chart



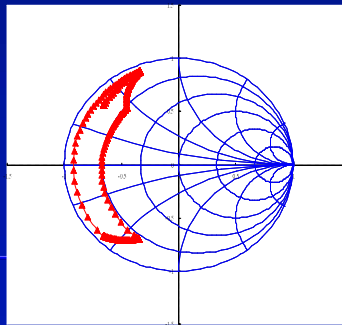
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MWD-25LD Standard Tuning Range

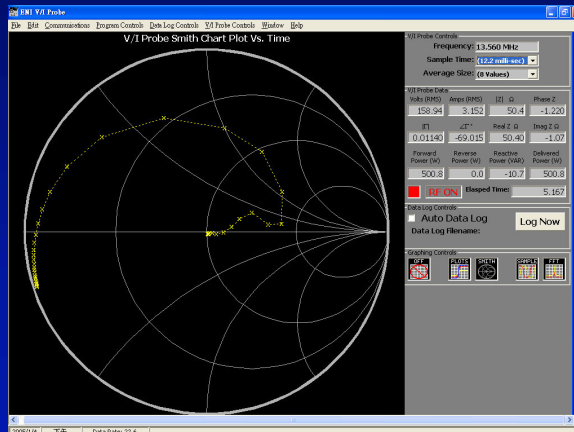


- Standard Setup:
- C1 PADDER: 360pF TOTAL
 - C2 PADDER: 99pF TOTAL
 - L: 0.7 μ H



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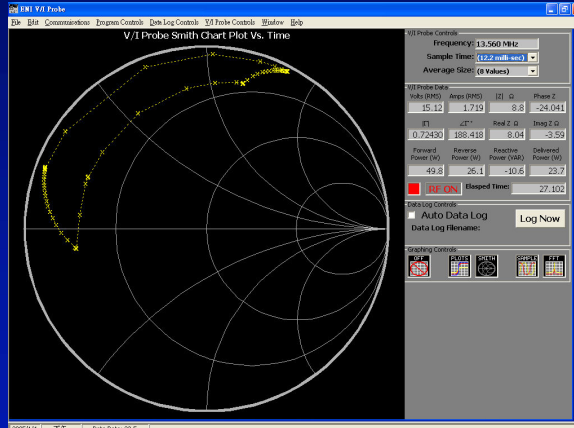
How to Tune?



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AMAT ETCH MxP+ Matcher 13.56MHz



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The ENI V/I Probe: Parameters, Functions & Advantages



◆ Advantages

➤ Accurate Measurement

- Uses V, I and Phase
- Other probes may use parameters such as Forward & Reflected Power, making accurate calculations precarious at high or low phase angles
- Low Cost
- No dedicated PC required

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The ENI V/I Probe: Parameters, Functions & Advantages



◆ Advantages (cont.)

➤ Wide Frequency Range

- ☐ 400kHz to 100MHz broadband, user selectable via serial interface.
- ☐ Other probes are typically single frequency systems.

➤ Connects Easily to System Controller

- ☐ All computations are performed internally.
- ☐ Other probes may require a PC to perform computations.

The ENI V/I Probe: Parameters, Functions & Advantages

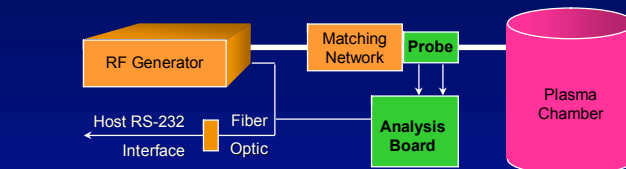


◆ Advantages (cont.)

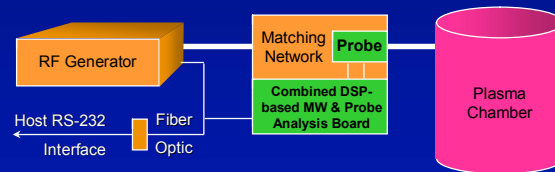
➤ Minimal Insertion Loss

- ☐ Typical loss is 5W with 1000W into matched load.
- ☐ Other probes may exhibit as much as 150W loss with 1000W into matched load, and may require a heat sink.

Block Diagrams & Installation



Standard Configuration



Optional Integrated Configuration

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Probe Installation

- ◆ Typically mounted as close as possible to chamber
- ◆ Probe is small: 57mm x 38mm x 48mm
 - Standard Type “N” Bird QC style connectors for input/output mounting flexibility
 - V and I samples are supplied via triaxial connectors to the analysis board.

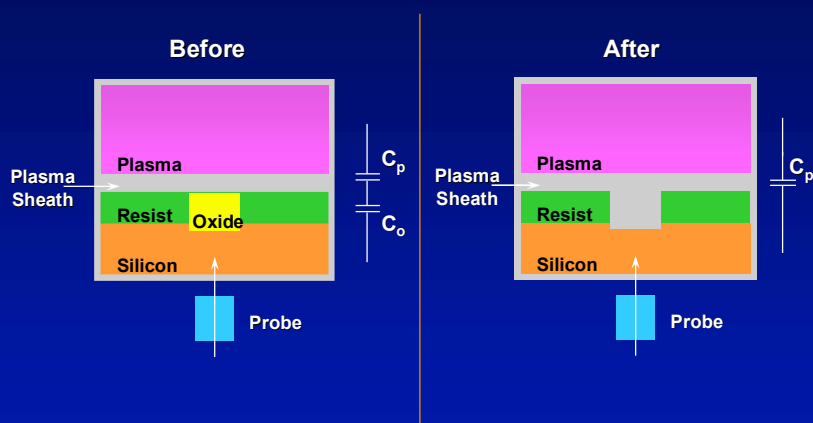
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Probe Applications

- ◆ Measurement of power delivered to plasma
 - more accurate than measurement of power delivered to matching network
- ◆ End point detection
 - Changes in probe measurements show when the oxide layer has been removed.
 - The change is due to the variation in capacitance.

End Point Detection



Probe Applications *(cont.)*

- ◆ Etch / Deposition thickness monitor
 - Directly monitor growth rate of film during deposition process
- ◆ Harmonic signature analysis
 - Chamber diagnostics
 - Process diagnostics
- ◆ RF Delivery System Diagnostics
 - Alternative tuning algorithms for matching networks (reduces process time)

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RF Impedance Analyzer

- Summary -

- ◆ Accurate Measurement of V, I and Phase Angle With Advanced DSP Technology
- ◆ Low Cost - No Dedicated PC Required
- ◆ Wide Frequency Range
- ◆ Connects Easily to System Controller
- ◆ Minimal Insertion Loss

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