

# PARAMOUNT® RF POWER-DELIVERY SYSTEMS

DIGITALLY CONTROLLED RF POWER SUPPLIES FROM 400 KHZ TO 60 MHZ, AND POWER FROM 1.5 TO 8 KW, WITH FREQUENCY TUNING, PULSING, AND PULSE SYNCHRONIZATION

With full digital control and dynamic response to plasma changes, the Paramount® platform keeps you at the leading edge of process innovation.

As manufacturing technologies evolve and rapid plasma transitions become the norm, the highly adaptable Paramount platform facilitates advanced process development. It combines accurate, repeatable power delivery with an inherently flexible digital architecture, wide output coverage, and a comprehensive feature set.



## BENEFITS

- Enhanced plasma stability and process repeatability
- Precise RF control
- Fast response to plasma changes
- Flexibility and adaptability to meet specific application needs

## FEATURES

- Full digital control
- Pulsing and pulse synchronization
- Frequency tuning
- Real-time power and impedance measurement
- Tightly regulated output power
- Models ranging from 400 kHz to 60 MHz and from 1.5 to 8 kW
- Set points as low as 5 W
- Arc management
- Phase synchronization (CEX)

## SEMICONDUCTOR APPLICATIONS

- PECVD
- Dielectric and conductor etch
- Sputtering

## PARAMOUNT SERIES

### Digital Architecture

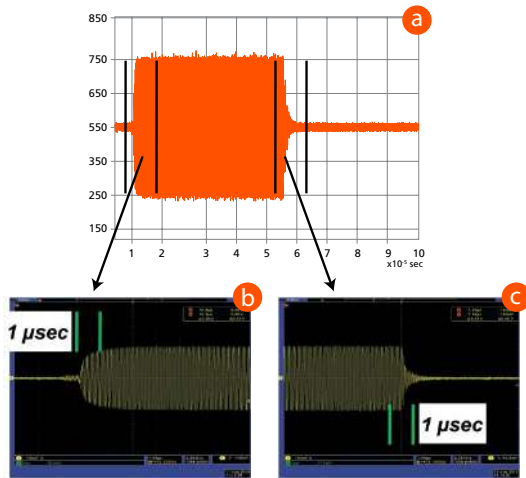
The Paramount platform's digital architecture allows extremely precise process measurement and control, as well as the adaptability to keep pace with increasing manufacturing demands. Advanced functions are easily integrated — without the lead times and integration issues associated with products requiring hardware changes.

### Wide Power and Frequency Coverage

With power set points from 5 to 8000 W and frequencies from 400 kHz to 60 MHz, the Paramount series enables you to stay within a familiar platform as your RF needs change. Process upgrades and new process development are more efficient, with reduced integration issues and no “new-product” learning curves.

### Pulsing

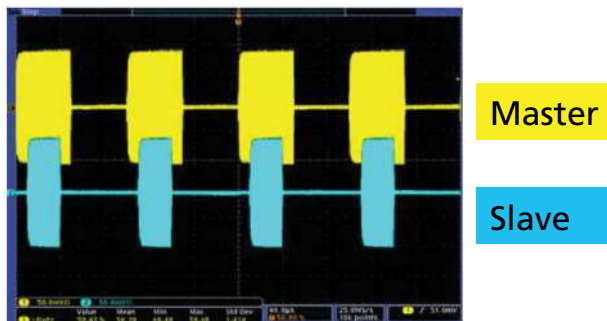
Reduced charge buildup, arcing, and feature distortion during etching



Example of pulsed RF waveform into a 50  $\Omega$  resistive load. (a) 10 kHz, 50% duty cycle (50  $\mu$ sec) waveform; (b) Close-up of the pulse's rising edge; (c) Close-up of the falling edge

### Pulsing Synchronization

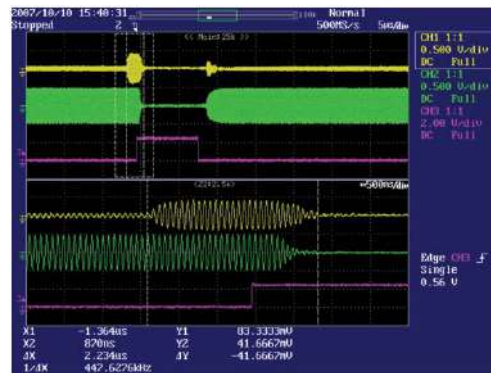
Synchronized pulses for multiple Paramount® units



Synchronized pulsing with timing offset and different pulse on-times

### Arc Management

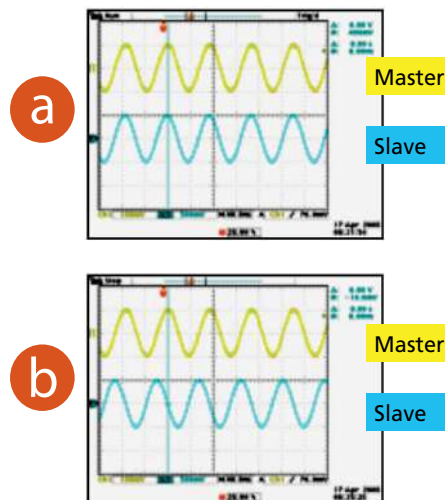
Reduced particle contamination, feature distortion, and equipment damage



Sudden change in reflected power indicating an arc; Rapid output power shutdown. All arc management parameters are user-selectable.

### Phase Synchronization (CEX)

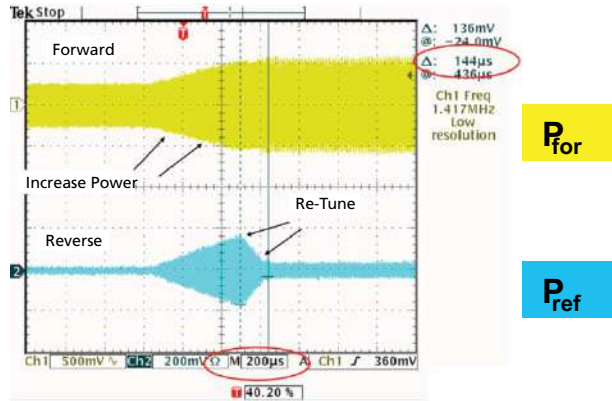
Synchronized output waveforms of connected Paramount® units



(a) 0° phase offset; (b) 90° offset. Phase offset is user-adjustable, 0 to 359°.

### Frequency Tuning

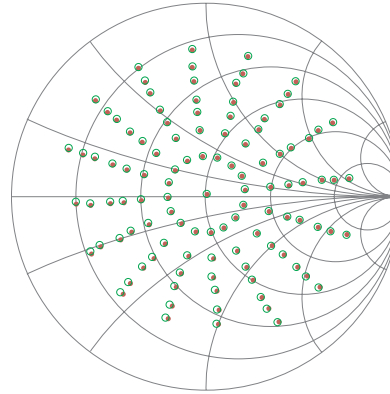
Fast tuning and repeatable power delivery during short process steps



Above, reflected power is minimized ~150 µsec after plasma power set point change.

### Advanced Power and Impedance Measurement

Paramount RF power supplies measure plasma characteristics in real time and detect changes with extreme sensitivity. This enables high-accuracy power output and repeatable performance.



Paramount® Power and Impedance Measurement Rivals the Accuracy of a Network Analyzer.

General Specifications <sup>1</sup>	Paramount® MF	Paramount® HF	Paramount® VHF
RF Power	2.0 kW 3.0 kW 5.0 kW 8.0 kW	5.0 kW	1.5 kW 3.0 kW 6.0 kW 7.0 kW
Frequencies	400 kHz Frequency tuning ±10%	2 MHz Frequency tuning ±10%	13.56 MHz Frequency tuning ±5%
Typical Tune Time	< 100 ms	< 100 ms	< 10 ms
Power Accuracy into 50 Ω	±2 W or ±1% of set point, whichever is greater	±1 W or ±1% of set point, whichever is greater	±1 W or ±1% of set point, whichever is greater Into 3:1 VSWR: ±1 W or ±2% of set point, whichever is greater
Pulsing Frequency Range	10 Hz to 2 kHz	10 Hz to 10 kHz	10 Hz to 100 kHz
Available Serial Interfaces	RS-232, Ethernet, DeviceNet®, Profibus, EtherCAT®		

<sup>1</sup> Electrical specifications vary by model number. Please contact an AE representative for more information.



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## **ABOUT ADVANCED ENERGY**

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

### **PRECISION | POWER | PERFORMANCE**

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