Led by experience. Driven by curiosity.

Synertia® RF Power Delivery Platform

The future of plasma control

comet
pct

Synertia®
Comet's integrated RF Power Delivery Platform offers a new level of real-time data insight, which improves the stability of the plasma processes. It reduces downtime, boosts yield, and enhances productivity. Synertia® enables the user to manage the complexities of multi-layer next-generation and atomic-scale plasma processes integral to the production of memory and logic microchips.

13.56 MHz, 1.5 / 2.5 / 3.5 / 5.0 kW RF Generator

Synertia® RFG

In Synertia®, the Generator and Matching Network controls interact at ultra-fast speed, creating a powerful synergy. Synertia® RFG is able to react in microseconds to data it receives from the Matching Network. Users fully control the unique performance accelerators of Synertia® RFG, including repeatability, multi-level pulsing and high-speed communication. This responsiveness provides actionable insights and enables more complex plasma applications than have ever been possible before: a new level of deep control.

Features

- Power accuracy and repeatability
- Multi-level pulsing (four user definable levels)
- Customizable frequency tuning per level
- Versatile arc management
- Digital metrology and intuitive graphical user interface
- Digital system control for advanced manufacturing technologies

Benefits

- Seamless integration into process systems
- Ultra-fast plasma process control
- Tighter repeatability delivers improved yield
- Fast configurable rise/fall time of pulsing
- Consistent process and wafer level uniformity

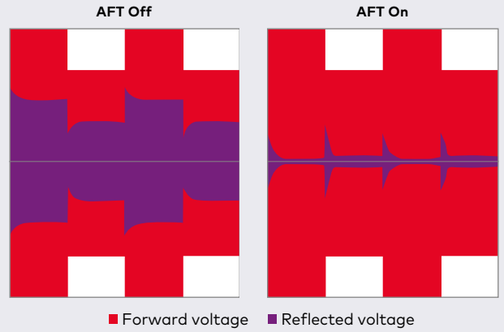
Synertia® RFG 15/13 and 50/13

Electrical specifications	RFG 15/13	RFG 50/13
Frequency	13.56 MHz +/- 10%	
Frequency stability and accuracy	± 50 ppm	
Output power	1.5 W to 1500 W	5 W to 5000 W
RF accuracy into 50 Ω	± 1 % of setpoint or ± 0.3 W whichever is greater	± 1 % of setpoint or ± 1 W whichever is greater
Spurious and harmonics		
Harmonics into 50 Ω	– 40 dBc	
Spurious into 50 Ω	– 50 dBc	
RF pulsing		
Pulse rate	0.05 Hz to 100 kHz	
Pulse rise/fall time	320/240 ns	650/240 ns
Multi-level pulsing	up to 4 individual levels	
Options		
CEX	400 kHz to 110 MHz	
Frequency tuning	within ± 10 % of nominal frequency	
Arc management	various detection and suppression options	
Interfaces	EtherCAT®, RS232, RS485, analog	
Power rating and coolant requirements		
AC input	208 to 240 VAC, 1~, ±10 % tolerant	200 to 480 VAC, 3~, ±10 % tolerant
AC_{eff} to RF efficiency	typically 73 %	
Ambient temperature	+5 °C to +35 °C	+5 °C to +40 °C
Cooling system	Forced air	Water-cooled
Mechanical specifications		
Form factor	3U, 19" half-rack	
Dimensions excl. connectors (w x h x d)	216 x 129 x 461 mm 8.5" x 5.08" x 18.15"	216 x 129 x 608 mm 8.5" x 5.08" x 24.0"
Weight	< 14 kg / < 31 lb	< 24 kg / < 53 lb
RF output connector types	default: N-type optional: HN, 7/16	default: 7/16 optional: HN, LC
Certification		
Compliance directives and industrial standards CE	2014 / 35 / EU low voltage directive 2014 / 30 / EU EMC directive RoHS 2011/65/EU and 2015/863/EU EN 55011, EN 61000-3-2 (RFG 15/13), EN 61000-3-3, EN 61000-6-2, EN 61010-1, EN 61326-1, SEMI S2, S8, S14, S22, F47, ISTA 1G, ISTA 3A	

All measurements were performed into non-reactive load at center frequency and nominal power using maximum AC voltage in laboratory environment unless otherwise stated.

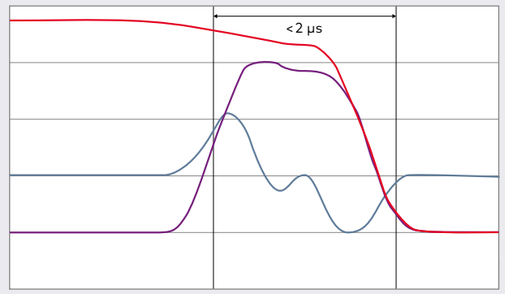
Auto Frequency Tuning

Rapid reduction of reflected power in multi-level pulsing



Arc management

Detection/handling within microseconds



Integrated measurement studio

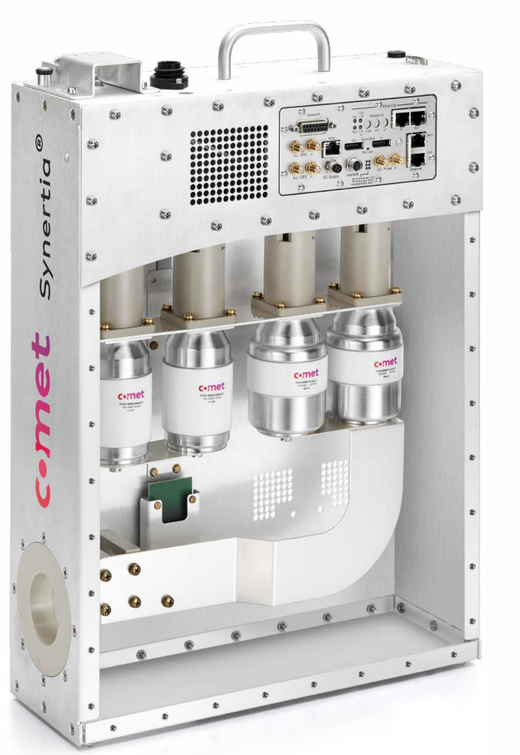
- Advanced oscilloscope functions for direct access to crucial process parameters
- Event based trigger and data logging functionality

Impedance Matching Networks

Synertia® RFM

Synertia® is the RF power delivery platform that ensures powerful command and control of plasma conditions at the highest speeds. The system allows the user to manage the complexities of multi-layer next-generation memory and atomic-scale plasma processes.

The Synertia® RFM works in powerful synergy with Synertia® RFG. Precise sensors and an enhanced tuning algorithm in the matching network ensure consistent and stable plasma processes. Onboard diagnostics enable actionable insights for more complex plasma applications.



Built for speed, accuracy, precision and repeatability

Features

- Advanced customer-accessible metrology data
- Real-time data streaming: Full access to all available data from Synertia® RFG and RFM devices that allows reaction in real-time to change, accelerate process development and post-analyze incidents
- On-board monitoring and diagnostics to assist with preventive maintenance and enable actionable insights for more complex plasma applications
- Integration of Comet Vacuum Capacitors: Standard and customized capacitor designs, equipped with advanced technologies such as Ultra Life* drive system or XtraVolt** features for low frequency applications

Benefits

- Continuous process improvement via real time signal processing and data collection
- Superior process control and repeatability with fully digital and customizable controls
- Consistent, stable RF plasma with enhanced tuning algorithm
- Reduced total cost of ownership with improved MTBF and enhanced reliability
- Robust design with RF expertise, state-of-the-art modeling/virtual prototyping and extensive library of RF tuning circuits

** Ultra Life vacuum capacitor drive systems with unbeaten durability and performance during sophisticated application and production processes.
** XtraVolt is Comet's advanced capacitor portfolio for low frequency applications.

Technical data Synertia® RFM

Electrical specifications	
Match types	Single frequency Dual frequency
Available matching topologies	L, T, and Pi match
Frequency range	400 kHz – 60 MHz
Output V/I	max. current (~150 A_{PEAK}) max. voltage (10 kV_{PEAK})
Input power	up to 15 kW
Communication interface	EtherCAT®, RS232, analog, Ethernet
Pulsing	Single, dual and multi-level
Pulsing state time	5 µsec to 1 second
Pulsing capability	0.5 Hz to 100 kHz
External pulse sync	TTL
Advanced features	± 10% frequency range
Optional sensors	Vpp, Vdc and others
Input voltage	24 VDC
Tune time	< 1 sec depending on pre-set points
Tuning range	Depends on unit frequency and on the tuning coil installed
Mechanical specifications	
Dimensions **Weight**	Designed per customer`s requirements
Cooling	Air
RF input connector	Designed per customer`s requirements
RF output connector	Various including 7-16, HN, LC, N
DC power input connector **Primary output connector**	Designed per customer`s requirements
Interlock requirement	Standard feature
Certification	
Compliance	Semi S2

Comet Matching Networks

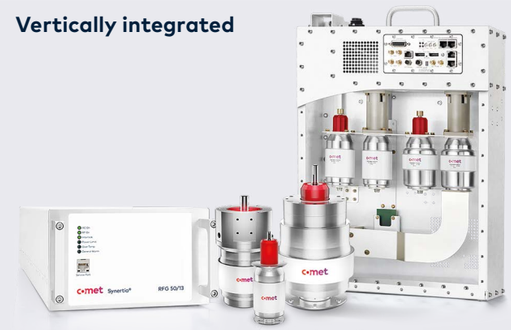
Powerful Command and Control

- Unique modular design that provides mix-match of features and seamless integration of RFM/RFG
- Wide-band frequency range sensors with high fidelity and sensitivity over a wide frequency range that continues to track and tune even when the RF fundamental frequency is varied up to ± 10 %
- Advanced single, dual, and multi-level pulsing
- Custom tuning parameters: Gamma, VSWR, Z target tune point, etc.
- Advanced motion control within a wide range of driving capability to accommodate various Vacuum Capacitor types

RF design expertise and customization

Industry-leading expertise in RF circuit modeling, design, development and manufacturing

Vertically integrated



- Comet is the only supplier that designs and builds every critical component, from capacitor to matching networks and RF generators
- Custom impedance matching add versatility to design and get the best value

Cutting edge features and full customer orientation

Smart and powerful control of plasma conditions at highest speed: highly synergized RF power delivery subsystems control atomic scale plasma processes and accelerate performance.

Synertia® includes a comprehensive development, testing and qualification infrastructure unmatched in its commitment to customer support.

Ultra-fast response
Synertia® enables real-time insights into plasma processes at a new level. Critical problems and challenges are solved faster leading to significant time and money savings and a faster time to market for new products.

Integrated advanced functionalities
The Auto Frequency Tuning (AFT) algorithm allows to quickly adapt to the plasma process, and arc management helps mitigate wafer damage and boost productivity. Additionally, the integrated measurement studio saves money in lab equipment, and applications like the advanced oscilloscope functions allow direct access to crucial process parameters. The integrated measurement suite is a toolbox for advanced users to visualize process performance issues and diagnose in a shorter time period.

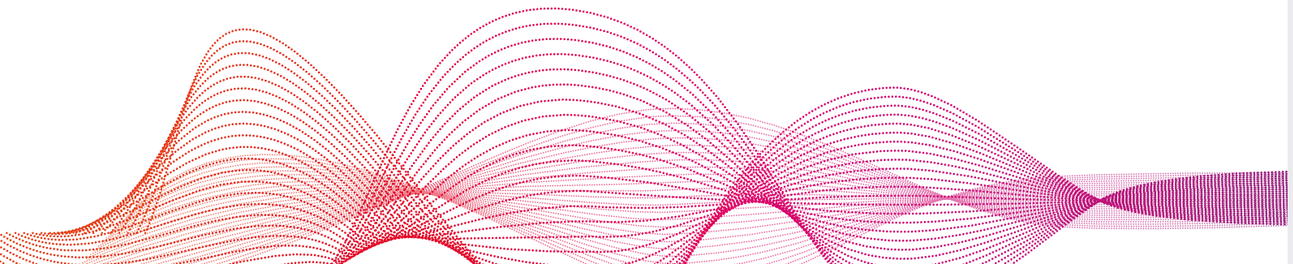
Co-optimized RF power source
RF systems can achieve optimal performance only if the RF power generator and corresponding matching network are optimally synchronized and communicating in real time.

Worldwide teams
Specialists in high-frequency technology, embedded software, material science, digitalization and more ensure Comet customers get the best and immediate R&D support.

Modern environment
Comet's high-power RF smartLABs form a worldwide interlinked lab environment for prototyping, in-the-loop testing, and automated data-driven design verification. This allows for faster qualification of new functions and provides the possibility of duplicating/analyzing field problems extremely fast.

Digital tool & process chain
Digitalized processes enhance the collaboration between the global Comet team and customers worldwide. This enables more complex and sustainable solutions that are fully traceable and transparent.

Progressive technology
The signal processing and data streaming capabilities of Synertia® offer a new level of process and yield optimization. More than 1000 parameters are monitored and analyzed.



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