

# IMPULSE™ 2-2 PULSED POWER MODULE

high power impulse magnetron sputtering by Starfire Industries



## OVERVIEW

The Starfire Industries IMPULSE™ is a versatile pulsed power module that converts a conventional DC sputtering system into a fully-functional High-Power Impulse Magnetron Sputtering (HiPIMS) system. The 2kHz-2kW IMPULSE™ is an affordable thin-film coating solution that is ideal for small 1" to 4" cylindrical and linear cathodes. High-performance dense, high-hardness, non-porous films and superior optical coatings for university, industrial and governmental R&D applications are within reach. The **CE marked design** is available with **standard afterglow** or **positive kick option** in either a single or dual module configuration in a 2U rack. The IMPULSE™ is ideal for reactive sputtering and synchronized co-sputtering or substrate timed pulse bias on dielectric and metal sputtering targets.



## FLEXIBLE, SCALABLE PULSE TOPOLOGY

The IMPULSE™ architecture allows combinations for sequential and parallel pulse firings to achieve the optimal operating environment for your application. Easily sputtered metals, like copper and aluminum, can draw high peak currents at lower repetition rate. More difficult metals or dielectrics can be effectively managed at high-repetition rate with lower peak currents. Higher frequency, higher power configurations are available; , i.e. 20kHz/20kW or 40kHz/40kW.

## BIAS & SYNCHRONIZATION

The IMPULSE™ 2-2 is offered with an optional user-adjustable positive kick pulse that engages after the termination of the main negative pulse to enhance ion transport to the substrate, increase deposition rate and tailor film stress, as well as clearing charge on surfaces for reactive applications—broadening the process envelope. In addition, the IMPULSE™ 2-2 retains the synchronization and substrate bias timing capability to selectively choose which ions will implant in the film densification phase. This allows users to tailor the substrate bias energy for metal or dielectric ion implantation while minimizing carrier gas ion effects. Multiple IMPULSE™ modules can be synchronized for cluster tool operation.

### Benefits of the IMPULSE™ 2-2

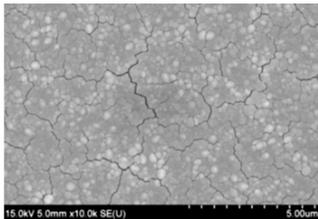
- Pulsed power add-on module for your existing DC power supply
- Flexible pulse topology allows high-frequency, lower-current (**4kHz, 200A**) or low-frequency, higher-current (**2kHz, 400A**) operation
- Optional positive pulse kicker for reactive and enhanced sputtering



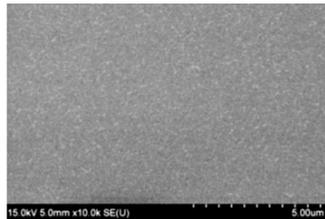
**IMPULSE™ 2-2 Dual Pulsed Power Module**

## APPLICATIONS

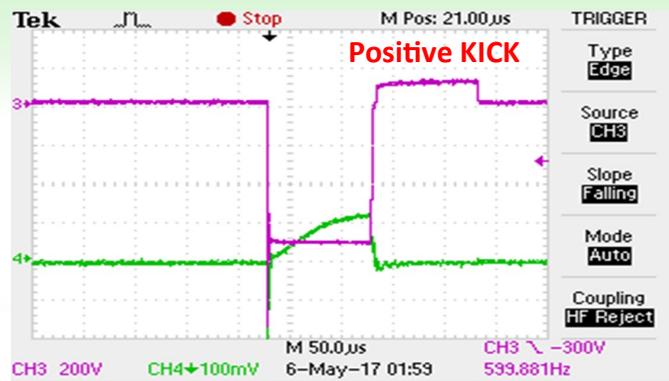
- ⇒ Dense, Hard Films
  - ⇒ Non-Porous Films
  - ⇒ Superior Optical Coatings
  - ⇒ Superconductors
  - ⇒ Multilayer Films
- For Linear & Cylindrical Cathodes*



Conventional dcMS copper deposition on silicon on showing rough surface morphology and globular microstructure



IMPULSE 2-2 HiPIMS deposition at same 500W, 10mTorr conditions showing dense, non-porous nanostructure



**IMPULSE™ 2-2 I-V Waveform**

## PHYSICAL AND PERFORMANCE SPECIFICATIONS

Parameter	BASE MODEL	ADVANCED KICK MODEL
	SF-IMPULSE2GX-SH (single) SF-IMPULSE2GX-DH (dual)	SF-IMPULSE2KX-SH (single) SF-IMPULSE2KX-DH (dual)
<b>Input Power Specifications</b>	1 Phase, 100-240 VAC, 50/60 Hz, 2.5 A per module	
<b>Input Charging Supply</b>	-1000 VDC nominal, -1250 VDC tolerant	
<b>Time-Average Power</b>	~2 kW; subject to duty factor and rep rate	
<b>Output Peak Voltage</b>	-1000 V nominal, -1250 V tolerant	
<b>Output Peak Current</b>	200 A nominal, 400 A tolerant	
<b>Arc Detection Time</b>	< 1 $\mu$ s	
<b>Peak Current Limiter</b>	User adjustable up to 400 A	
<b>Power Limit Mode</b>	User selectable; automatically throttles rep rate to hold cathode power constant	
<b>Pulse Frequency</b>	User selectable; 1kHz to 2kHz nominal range, subject to power derating curve	
<b>Pulse Width</b>	User selectable; 5 $\mu$ s to 500 $\mu$ s nominal range	
<b>Positive Kick Pulse Voltage</b>	N/A	User selectable in 1V increments from 0 to +200 V using internal supply
<b>Kick Pulse Set Points</b>	N/A	On/Off; User selectable in 1 $\mu$ s increments for pulse width and time delay
<b>External Communications</b>	RJ-45 control I/O, USB Type A, BNC sync line, BNC I-V monitor out	
<b>Pulse Module Sync</b>	< 0.1 $\mu$ s latency	
<b>Cabling</b>	N-type HV connector standard	
<b>Configuration Storage</b>	Onboard storage for 5 user selectable presets	
<b>Physical Dimensions</b>	2U rack; 19" (W) x 3.5" (H) x 22.5" (L) including handles and plugins 482.6mm (W) x 88.9mm (H) x 571.5mm (L) including handles and plugins	
<b>Weight</b>	Single module: 26 lbs, 1.8 oz. (11.84 kg) Dual Module: 30 lbs, 3.0 oz (13.69 kg)	Single module: 26 lbs, 14.8 oz. (12.21kg) Dual Module: 31 lbs, 13.0 oz (14.43 kg)
<b>Operating Temperature</b>	+5C to +40C, forced Air Cooling	

