

# HYBRID POWER FILTERING UNIT INCORPORATING LOW POWER, FAST SWITCHING CONVERTER IN CONJUNCTION WITH HIGH POWER, SLOW SWITCHING CONVERTER

## IITM Technology Available for Licensing

### Problem Statement

- Converters and inverters cause harmonic distortion in AC power supplies, leading to equipment overheating and power failures.
- Si IGBT-based converters are limited by their switching frequency, making them inefficient for higher-order harmonic mitigation.
- There is a need for a hybrid power filtering unit that combines low-power, fast-switching SiC MOSFET converters with high-power, slow-switching Si IGBT converters to improve harmonic rejection and compactness.

### Intellectual Property

- IITM IDF Ref. 1804
- IN 504454 - Patent Granted

### Technology

**Hybrid Filter Design:** Combines a high-capacity Si IGBT converter for lower-order harmonics (5th and 7th) with a smaller, fast-switching SiC MOSFET converter for higher-order harmonics (11th, 13th).

**Efficiency and Loss Management:** The Si IGBT converter operates at a low switching frequency, reducing switching losses, while the SiC MOSFET converter operates at a high frequency for efficient higher-order harmonic elimination.

**Parallel Configuration:** The SiC MOSFET converter is retrofitted in parallel with the Si IGBT converter, optimizing harmonic filtering across different frequency ranges.

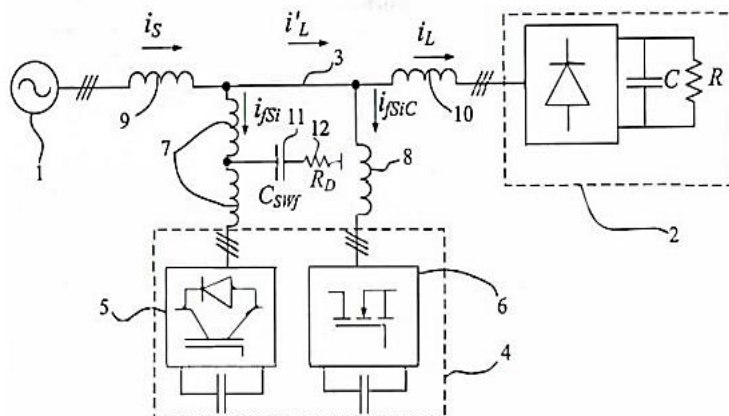


FIG. 1. illustrates a high-level circuit diagram demonstrating the power structure of the hybrid shunt active filter (HSAF).

### Technology Category/ Market

**Category - Power Electronics, Electronics & Circuits**

**Applications - Industrial Power Systems, Renewable Energy Systems, Electric Vehicle Charging Stations, HVAC Systems**

**Industry - Energy & Utilities**

**Market - HVAC market size was worth over USD 294 billion in 2023 and is estimated to expand at 5.6% CAGR from 2024 to 2032**

### TRL (Technology Readiness Level)

**TRL - 5: Technology validated in relevant environment.**

### Research Lab

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### Key Features / Value Proposition

- Effectively eliminates both lower-order (5th, 7th) and higher-order (11th, 13th) harmonics through a dual-converter approach.

#### 1. Comprehensive Harmonic Mitigation



- Utilizes a high-capacity Si IGBT converter for lower-order harmonics to minimize switching losses while achieving high efficiency.

#### 2. Optimized Efficiency



- Incorporates a small, fast-switching SiC MOSFET converter to handle high-frequency harmonic components, enhancing overall performance.

#### 3. Advanced High-Frequency Filtering



- Balances the use of cost-effective Si IGBT technology with the advanced capabilities of SiC MOSFETs, offering a high-performance yet economical solution.

#### 4. Cost-Effective Solution



- The parallel setup of converters maximizes harmonic rejection across various frequency ranges, ensuring a cleaner power supply.

#### 5. Parallel Configuration Benefits



- Designed to be easily retrofitted into existing systems, allowing for seamless integration and scalability based on power requirements.

#### 6. Scalable and Retro-Fittable



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