

Application Note

SEMI F47:

Clean DC Power to Ensure
High Quality Semiconductor
Fabrication



Tektronix® +



Elektro-Automatik

Introduction

Semiconductors are an important and indispensable part of our society. Traditionally, semiconductors are thought of as being part of complex machines such as airplanes, cars, spacecraft or production machines. In fact, they are part of every electronic device used in our daily lives like smartphones and other mobility devices, computers, household items, electric hand tools, temperature control systems, robotic vacuum cleaners and so much more.

The words "Semiconductor Industry" is a generic term and characterizes a specialized area of the electrical industry. Typical semiconductor products are, for example, discrete components like diodes, transistors, or thyristors

and complex components such as ICs, memory devices, microprocessors, graphical processing units and AI processors. The semiconductor industry includes manufacturers of such products, as well as suppliers or manufacturers of corresponding production systems. The manufacturers of semiconductor fabrication tools go to great lengths to ensure the highest quality of the semiconductors as they continue to shrink in size and are much faster.

Due to the constant demand for technological innovations, digitalization, and power efficiency, the market for semiconductors is expected to continue its growth trajectory for many years.

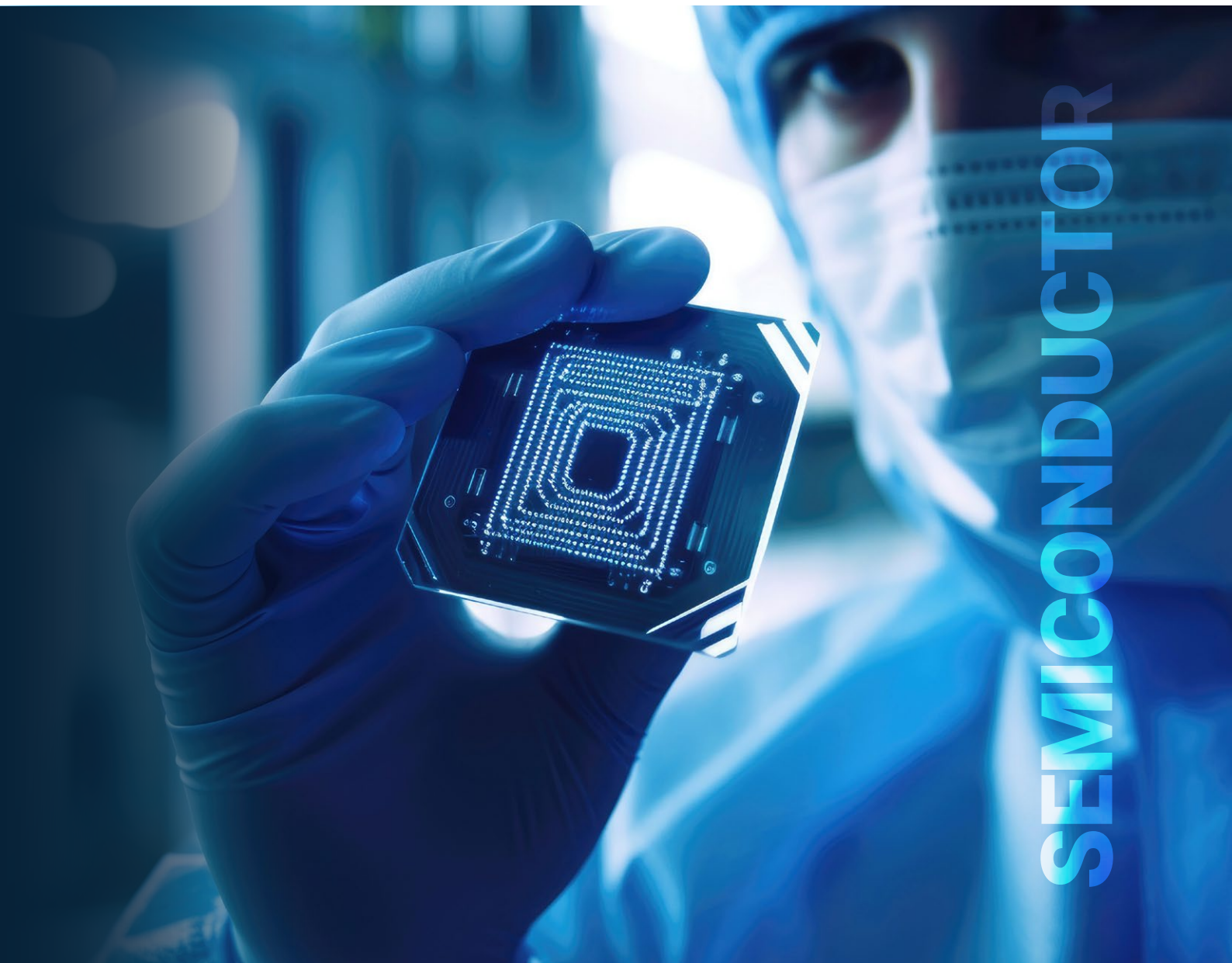


Modern life is no longer conceivable without semiconductors.

Semiconductor product process

Semiconductors are manufactured in a multi-stage process and in high specialized fabrication (fab or foundry) plants. Production in these plants is highly automated using very advanced fabrication systems that take raw materials to form silicon ingots which are sliced and then processed using photolithography, chemical vapor deposition, atomic layer and physical vapor deposition, etching, ion beam implantation, and polishing tools to produce various semiconductor components.

The level of precision required to make nanometer technology feature sizes of some complex devices is very high. Inaccuracies of the machines can lead to very expensive rejects in production which can lead to higher costs to the semiconductor companies. To achieve high precision and low rejection rates, the sophisticated fabrication machines require very clean power systems that are highly reliable and efficient given the 24/7 operations of foundries and fabs.



SEMI F47 standard

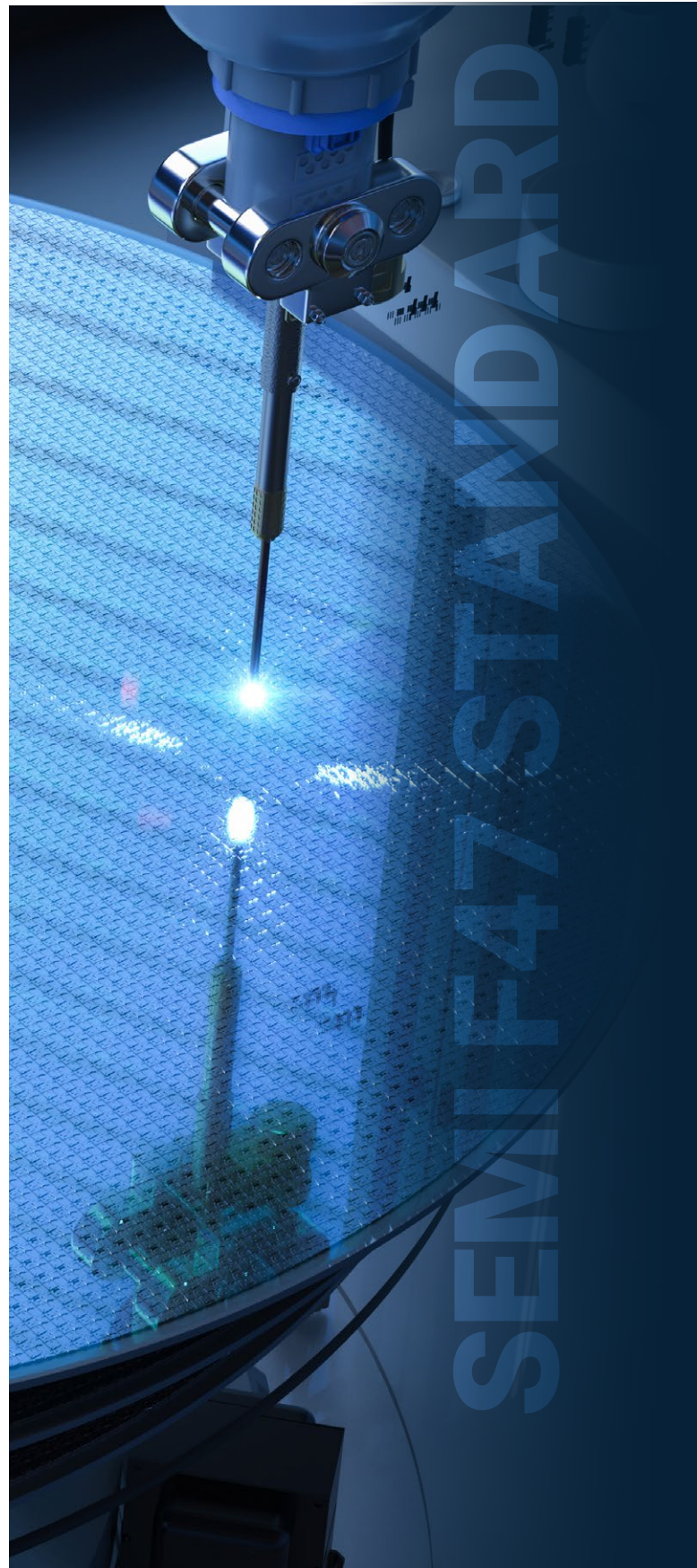
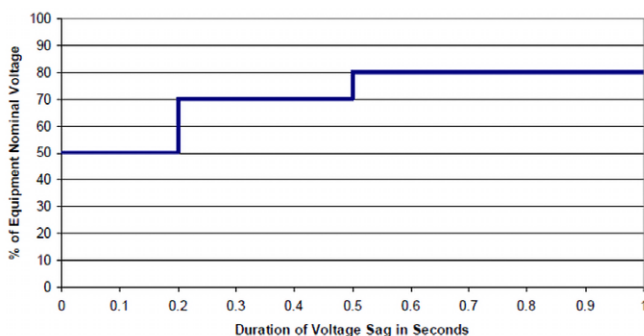
The “Semiconductor Equipment and Materials International” or SEMI, an international industry association comprising companies involved in the electronics design and manufacturing supply chain, has developed numerous internationally recognized standards for the fabrication of semiconductors. One such important standard for the semiconductor production process is the SEMI F47.

SEMI F47 “Specification for Semiconductor Processing Equipment Voltage Sag Immunity”, originally published in 2000, has saved the industry hundreds of millions of dollars of fab and tool downtime and has increased the level of tool reliability. The standard has been implemented by essentially all semiconductor tool suppliers and is now required by almost all fabs world-wide. SEMI F47 requires that tools be immune to voltage sags that commonly occur on AC power grids.

Today’s fabrication tools require high levels of power quality due to the sensitivity of fabrication processing equipment. The semiconductor processing equipment is especially vulnerable to voltage sags as these events will cause the processes to fail. This puts more importance on the quality of the power systems used in these sophisticated machines. The SEMI F47 specification defines the minimum voltage sag immunity that is needed for semiconductor processing and metrology/test equipment.

The current version of SEMI F47 specifies minimum voltage sag immunity requirements for equipment used in the semiconductor fabrication process. Immunity is specified in terms of voltage sag depth and voltage sag duration so that a device continues to work seamlessly without interruption in the event of a power failure in the form of an AC supply undervoltage (sag) of max. 50% of the rated line voltage with a maximum duration of 1.7 seconds. In detail, the standard specifies the following.

Sag of	Duration at 50 Hz	Duration at 60 Hz	Duration in seconds
50%	10 cycles	12 cycles	0,2
30%	25 cycles	30 cycles	0,5
20%	50 cycles	60 cycles	1



Highly Efficient Power Supplies for SEMI F47

SEMI F47-compliant power supplies must be designed with high expertise and quality. Additionally, as there is more emphasis on power quality and power efficiency given the amount of electrical power consumed by a fab, power supplies must themselves be highly efficient and reliable.

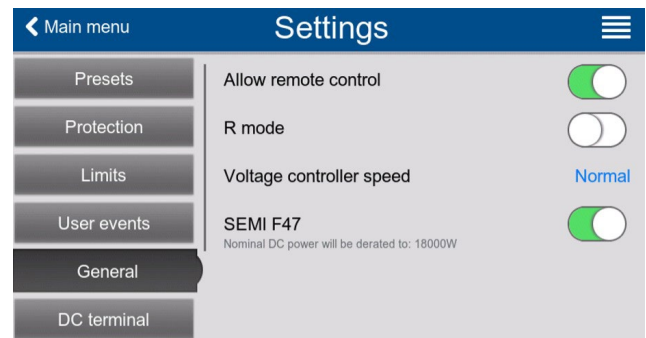
EA Elektro-Automatik, a supplier of highly efficient DC Power Supplies, offers power supplies which fulfill the requirements of the SEMI F47 standard. Leveraging the performance of Silicon Carbide technology, the EA-10000 series of bench and industrial supplies achieve upwards of 96% efficiency and are tolerant against the specified voltage sags. SEMI F47 is a built-in feature that enables EA DC programmable power supplies to contribute to a high level of process reliability within semiconductor fab processes.

The EA-10000 and the EA-10000 Industrial Series ensures stable DC output despite AC voltage fluctuations through advanced energy buffering. The EA-10000 series allows the fab process machine designer to choose between two operational modes.

In SEMI F47 compliance mode, maximum output power is adjusted to guarantee reliability and DC output stability during voltage sags. For applications requiring full power with acceptable DC output fluctuations, an additional mode is available. This mode supports grid monitoring and

low voltage ride through capability, maintaining full power operation suitable for processes that can tolerate brief DC output variations, such as thermal applications. The user can decide independently whether one of the two SEMI F47 functionalities should be used or not. The functionalities can be selected as an adjustable parameter in the menu of the device. With the EA-10000 series, this can be done directly in the front panel touch display. For the EA-10000 Industrial series, the function can be set remotely for example via the control software EA-PC.

The EA-10000 and EA-10000 Industrial power supply series are the perfect choice to improve process quality for semiconductor fabrication process machines and tools.



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At EA Elektro-Automatik 450 qualified associates, in a facility of 19000m², research, develop, manufacture and market high-tech equipment for laboratory power supply, high power mains adaptors and electronic loads with or without power feedback. The sales and service network includes branches in China, Singapore and USA, offices in Spain and Korea as well as an extensive partner network. Since 2024 EA Elektro-Automatik has been part of the Tektronix Group, which has increased sales and service coverage globally.

