



Application brochure

Power protection solutions Semiconductor industry

Power and productivity
for a better world™





Business as usual Power protection for the semi- conductor industry

The semiconductor industry is the foundation of twenty-first century technology - from smart devices and renewable energy generation to the automotive and data storage industries. The production of these sensitive components requires an extremely high quality of electrical power. Without advanced power protection this is simply not available from the electrical utility. The costs of lost production, down time, quality and, ultimately, lost profit can be huge in scale for semiconductor manufacturing fabrication plants (FABs) that are not adequately protected. Investing in the best power protection has many benefits, and choosing a solution that meets your needs will future proof your equipment from the devastating effects of a power quality event. ABB's power protection portfolio is a unique line up of power conditioning and UPS products, designed to solve power quality issues for semiconductor applications. It's business as usual with ABB's power protection solutions in place.



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Power conditioning and UPS systems

Active voltage conditioning

Semiconductor processes are extremely sensitive and are dependent on a stable and well regulated electrical power supply to tools and equipment. The most common and costly power quality problem is voltage sags. The PCS100 Active Voltage Conditioner (PCS100 AVC) is specifically designed to correct voltage sags. It does not store energy, instead taking power from the remaining electrical grid. As a result it has a very low cost of ownership as there are no batteries to maintain, and very low electrical losses. It has a small footprint making it suitable for effective use inside plants where floor area is limited. Typical loads include photolithography, ion implantations and etching tools, wafer testing and die cutting.

Reactive power conditioning

Many of the connected loads in semiconductor plants draw current from an electrical supply rich in harmonics, imbalance and poor power factor. Conventional capacitor based power factor correction can cause switching transients on the supply and be overloaded by harmonic resonance. The PCS100 Reactive Power Conditioner is an electronic power factor correction system that uses an insulated gate bipolar transistor (IGBT) inverter to correct power factor, imbalance and low order harmonics (5th and 7th). It is an ideal solution in a semiconductor manufacturing environment where many sensitive loads are present. Typical loads include photolithography, ion implantations and etching tools, wafer testing, die cutting and air handling.

Single-conversion Industrial UPS

The PCS100 Industrial UPS (PCS100 UPS-I) is an ideal complement to the PCS100 AVC. Unlike the PCS100 AVC, the PCS100 UPS-I incorporates energy storage, often in the form of ultracapacitors. This provides the energy to ride through very deep voltage sags and short power outage losses and a small footprint. It is available in a wide range of voltages, including 210 / 220 VAC up to multi-MVA ratings. This makes it suitable for direct connection to many semiconductor tool loads. Typical loads include photolithography, ion implantations and etching tools, wafer testing and die cutting.

Double-conversion industrial UPS

The threat of lost production or the possibility of damage to work in process is a key concern in the semiconductor manufacturing industry. The Cyberex® PowerBuilt™ industrial UPS features an insulated gate bipolar transistor (IGBT)-based pulse-width modulation (PWM) inverter design that employs active current limitation for higher short circuit tolerance. The active short-circuit method ensures the best possible current clearing waveform, while still protecting the inverter from catastrophic failure. In the event of a load-side short circuit or over-current that cannot be supplied by the inverter, the UPS logic will transfer away from the active inverter source, thereby preventing the fault condition from damaging the inverter.

Double-conversion online modular UPS

The compact design of UPS Skala DPA, consisting of modular power modules, integrated batteries and distribution, offers a small footprint solution to optimize space. It is used to provide power backup to operations and telecommunications systems.

Single-conversion medium voltage UPS

Space for power protection equipment is often very limited in semiconductor plants. The PCS100 MV UPS, which provides a high level of power protection at medium voltage levels, is an ideal centralized power protection solution. With best in class electrical efficiency, a small footprint and a very low cost of ownership, the PCS100 MV UPS can protect against deep voltage sags and short outages. Typical loads include photolithography, ion implantations and etching tools, wafer testing, die cutting and air handling.

Technical overview



PCS100 AVC

Active Voltage Conditioner

System rating: Up to 2.4 MVA

Power range: 150 kVA to 2.4 MVA

Efficiency: Typically 99 %

Efficiency in eco-mode: N/A

Backup time: N/A

Applications:

Photolithography, ion implantations and etching tools, wafer testing and die cutting.



PCS100 RPC

Reactive Power Conditioner

System rating: up to 2 MVAr

Power range: 100 kVAr to 2 MVAr

Efficiency: 97 %

Efficiency in eco-mode: N/A

Backup time: N/A

Applications:

Photolithography, ion implantations and etching tools, wafer testing, die cutting and air handling



PCS100 UPS-I

Single-conversion industrial UPS

System rating: Up to 3 MVA

Power range: 150 kVA to 3 MVA

Efficiency: Greater than 99 %

Efficiency in eco-mode: N/A

Backup time: Configurable

Applications:

CVD, gas supply, tools and sub-systems.



Cyberex® PowerBuilt™

Double-conversion industrial UPS

System rating: Up to 80 kVA

Power range: 10 to 80 kVA

Efficiency: 86 %

Efficiency in eco-mode: N/A

Backup time: Configurable

Applications:

Emergency operations, telecommunications systems.



PCS100 MV UPS

Medium voltage single-conversion UPS

System rating: Up to 6 MVA

Power range: 2,4,6 MVA

Efficiency: Greater than 99 %

Efficiency in eco-mode: N/A

Backup time: Configurable

Applications:

Protects all loads against deep voltage sags and short outages.

Power protection applications

The semiconductor industry has some of the most demanding applications in motion control. A combination of extreme accuracy and precision makes for super critical power protection. Semiconductor segments can be divided into two sequential sub-processes commonly referred to as front-end and back-end production, both of which contain many steps. The entire process is complex and requires sophisticated technology to protect the most sensitive processes.

ABB's variety of power protection solutions enhance your application's power supply. From substations through to sensitive tooling and machinery, ABB's low and medium voltage systems offer reliable and efficient solutions, eliminating voltage disturbances and improving productivity. Depending on the critical level of operation, local ABB specialists will ensure you get the solution that will best match your requirements.

Front-end

The growth in demand for memory has been huge and driven many new innovations. This includes ever-smaller dimensions of semiconductor elements and greatly increased transistor numbers. The costs of manufacturing equipment and complexity of processes has continued to increase. Although tool manufacturers have made some improvements in the immunity of their equipment to power quality events, a reliable and stable electrical power supply is an essential requirement to ensure system reliability. ABB has supplied many hundreds of megawatts of PCS100 Active Voltage Conditioners and PCS100 Industrial UPSs to protect these semiconductor plants increasing yield, production output and reducing waste.

Back-end

Assembly and test are increasing in automation and the drive for efficiency, cost reduction and miniaturization is ever-present. Costs associated with a power quality event, such as a sag or short outage, are typically not as high in back-end assembly processes. Often plants located in emerging economies, where voltage supply is irregular and power quality events are frequent, can find voltage fluctuations particularly problematic. ABB's PCS100 Active Voltage Conditioner, with its fast and continuous voltage regulation capability, is an ideal solution for the protection of test and assembly manufacturing lines.



Silicon wafer and ingot

The manufacture of silicon wafers involves growing a silicon ingot, slicing it into thin wafers, then polishing and cleaning them. Due to the exacting requirements, all of these processes depend on a continuous clean electricity supply. The wafer cutting is an area of particular sensitivity where voltage sags can cause breakages in the wire saws, resulting in expensive downtime and product loss. The PCS100 Active Voltage Conditioner products have been widely applied to wire saws, increasing yield, production downtime and reducing waste.

Light Emitting Diode

There has been a revolution in the development of Light Emitting Diode (LED) technology with precise applications, such as display back light, fiber-optics and, in particular, lighting driving demand and growth on fabrication plants. High volume manufacturing and semiconductor processes make LED manufacturing sensitive to power quality problems. ABB's PCS100 Active Voltage Conditioner and PCS100 Industrial UPS products have been implemented world-wide for plant protection.

Solar photovoltaic

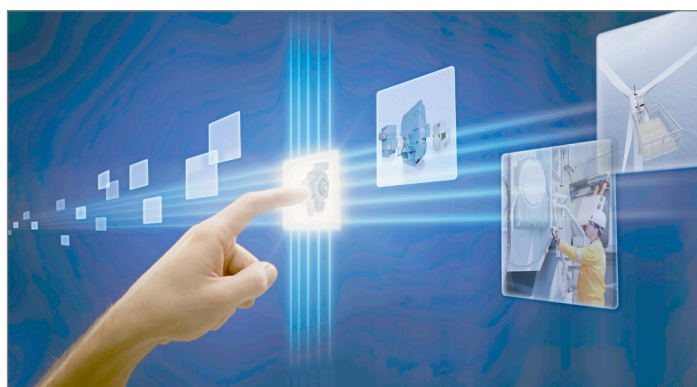
Thin film solar panels are made in a process similar to flat panel television and computer monitors. The manufacturing process starts with a glass substrate (base) and then the silicon is deposited onto the glass. The other types are based on square cast ingots of silicon or round grown silicon ingots. Both are sliced into wafers about 0.16 mm thick. ABB's PCS100 Active Voltage Conditioner and PCS100 Industrial UPS products are designed to ensure a stable power supply is maintained in all weather conditions.

Electronics and supply chain

High power semiconductors are applied widely from switching mosfets in consumer goods through to very high current and voltage semiconductor devices used in direct current power transmission. Like any semiconductor process, a stable and continuous electrical power supply is critical to maximize yield and minimize expensive product waste. ABB's PCS100 Industrial UPS and PCS100 Active Voltage Conditioner products are ideal solutions for process line protection.

Display (front-end)

Advances in flat panel display technology have been huge. New technologies driven by increased brightness and display resolution have led to increasingly complex and expensive manufacturing plants. ABB has provided PCS100 Active Voltage Conditioners and PCS100 Industrial UPSs to many of the world's leading display manufactures to protect their sensitive loads. This includes first stage precision glass manufacture through to protecting automated semiconductor processes, and cleaning and handling production lines.



Suppliers of over 800 MVA of power to the semiconductor industry

The semiconductor industry is becoming increasingly important as semiconductors serve as the core building materials for important electronic products. Semiconductor devices range from the extremely small, lightweight memory chips and microprocessors, through to power semiconductors that are highly efficient and reliable. Today, the semiconductor industry has grown to be a multi-billion dollar industry, representing close to 10 percent of world GDP.

Building on our reputation as a committed and passionate provider of innovative, leading-edge solutions, ABB's power protection products deliver energy efficiency and high industrial productivity for our customers. We have, so far, supplied over 800 MVA of power to the semiconductor industry.

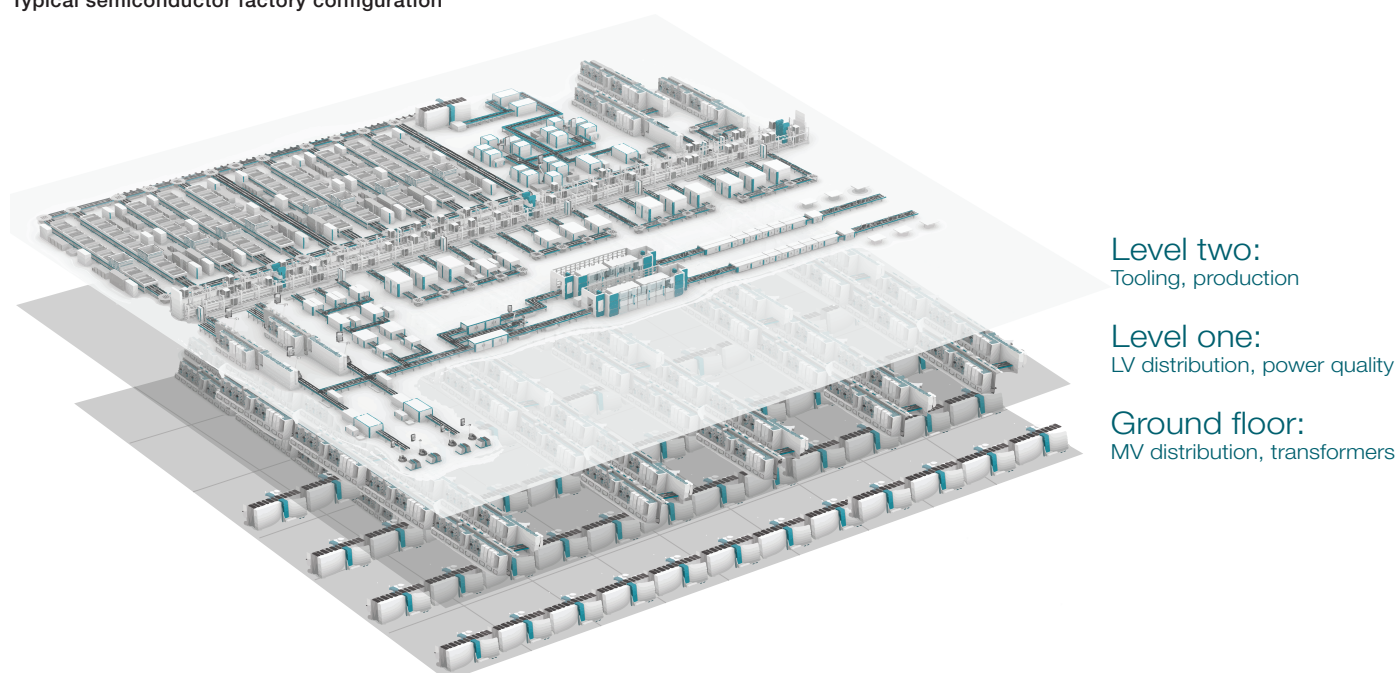
ABB provides a power protection solution for Malaysia's leading semiconductor wafer foundry

Established in 1995, the wafer foundry offers CMOS design and a broad range of fabrication processes for integrated chips (IC) in advanced logic, mixed signal and radio frequency as well as high voltage applications. The foundry relies on highly sophisticated equipment that is immensely sensitive to voltage fluctuations. Voltage dips, lasting as briefly as a few milliseconds, will have an adverse impact on the company's profile as the cost of scrapping damaged goods and plant start-up could run into millions.

With a sag or spike event occurring on average twice a month, the semiconductor manufacturer installed four 750 kVA PCS100 AVC units. This leading edge technology protects four fabrication lines, with another four PCS100 AVC units protecting the wafer fabrication production floor. The PCS100 AVCs are installed in a temperature-controlled room in order to prolong the lifetime of the units.

A true test of the equipment was a massive sag event shortly after the units were commissioned. ABB's technology was able to ride through this event, enabling the production line to operate as normal without any sags or swells, proving that the foundry can rely on the new power protection package.

Typical semiconductor factory configuration



Hynix-ST Semiconductor Fabrication (FAB) plant

Over 100MVAs of PCS100 Active Voltage Conditioners protect the critical plant in the Hynix-ST Semiconductor Fabrication (FAB) plant in Wuxi, near Shanghai, China.

A major power quality event can cost millions of dollars with the facility typically taking days to recover. The biggest contributor to poor power quality is weather, particularly electrical storms, compounded by the increasing use of sensitive electronic loads in fabrication plants. Power fluctuations in the utility supply network occur regularly and can cause sensitive control equipment to switch off and shut down the plant.

In the two years following the installation of a suite of ABB's power protection equipment, Hynix has experienced numerous voltage sags, especially during winter snowstorms, but has not seen one complete outage or even a micro-cut at their operation. No protected equipment faulted during any of the events, whilst unprotected lines did shut down during the sags.

A large number of PCS100 AVCs have now been operating for over five years with excellent reliability and have become a standard solution because of their proven performance in overcoming voltage sag problems.

Huahong Grace Semiconductor Manufacturing Corporation

ABB installed PCS100 Active Voltage Conditioners at HHGrace's FAB plant in Shanghai, to ensure the company, a world-leading 8-inch foundry, could operate throughout power quality events by protecting its semiconductor production line from potentially crippling power disruptions.

For HHGrace, expansion of their plant was needed in order to cater for the growing demand of silicon chips from their customers. The tools and processes needed to produce the silicon chips such as dry and wet etching, die preparation and packaging are sensitive to voltage sags that are caused by external environmental factors. A maintenance free reliable solution was required to protect these critical loads, with sag correction performance accompanied by local service.

ABB not only provided local support but was able to deliver and install a power protection solution that could withstand and correct the ongoing voltage sags that arose within the plant. In the past ten years, HHGrace has experienced over 100 voltage sags in their plant. In the six months after installation, the PCS100 AVC had protected HHGrace against a major power quality event, eliminating potential production shutdown and loss of materials and resources.



Other installations

Power protection systems are the backbone of some of the world's biggest semiconductor production companies. From substations through to sensitive tooling and machinery, power protection systems offer reliable and efficient solutions, eliminating voltage disturbances and improving productivity.

In 2013, the world's largest provider of independent semiconductor manufacturing services in assembly and testing, ASE (Advanced Semiconductor Engineering) based in Taiwan, ordered nine PCS100 AVCs. From 2013 to 2015, ASE has ordered a total of 14 PCS100 AVCs, to protect the packaging and testing of silicon chips, a total power protection plan exceeding 20 MVA.

In 2011, ABB secured an order to stabilize power supply for one of Malaysia's largest and most established manufacturers of semiconductor products, producing higher value semiconductor products, automotive pressure sensor and radio frequency identification devices. This industry giant has continually been confronted with loss of production and revenue caused by power fluctuations. The losses can be high as the cost of resuming operations and scrapping damaged products can amount to millions. The order comprised six 900kVA UPS-I units.

Full service

Service is really what makes ABB stand out. At ABB we recognize that designing and manufacturing innovative and high-quality power protection products is only half the story. To give you the peace of mind and return on investment you expect, your power protection equipment must be correctly specified, installed, commissioned and maintained. This is why we invest heavily in our pre- and post-sales support infrastructure and why we offer a comprehensive range of services to you for the entire working life of your ABB products.

Key features of your service plan

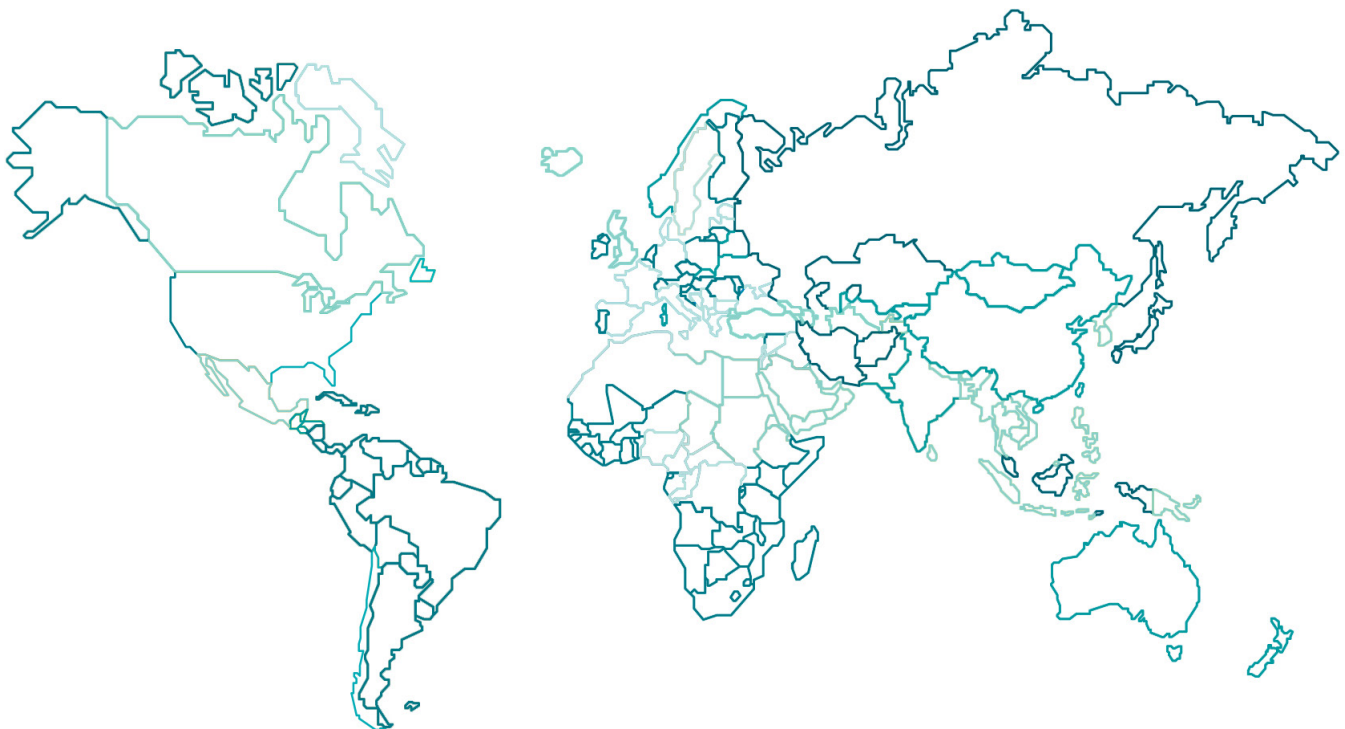
- Pre-purchase engineering
- Installation and commissioning
- Technical support
- Training
- Preventive and corrective maintenance
- Retrofit and refurbishment
- Globally available, supported by regional service hubs and operating in more than 100 countries
- Spare part availability and stocking
- Onsite repairs
- Any-time, year-round local support line

ABB's global network

ABB is one of the world's leading engineering companies, helping customers to increase industrial productivity and to lower environmental impact in a sustainable way. With strong market positions in its core businesses, ABB Group operates in around 100 countries and employs about 150,000 people.

ABB's technology competence, broad application, know-how and global presence offer customers easy access to leading engineering solutions and systems. Innovation and quality are key characteristics of ABB's service and product offering.

ABB is headquartered in Zurich, Switzerland. ABB Ltd shares are traded on the stock exchanges in Zurich, Stockholm and New York. The ABB Group was formed in 1988, when the Swedish Asea and the Swiss BBC Brown Boveri merged under the name ABB. Asea's history dates back to 1883. BBC Brown Boveri was founded in 1891.



Installation and commissioning

We can install and commission any PCS100 product on your site. Commissioning is carried out by fully-trained Service Engineers and can be packaged with operator/owner training on the product if desired. Full commissioning has the advantage of providing a customer-specific set of parameters in a Service Log which is saved at the factory and can be utilised at any time to reconfigure your unit, should this be required.

Training

Training for operators and maintenance staff is offered at two locations around the world on a regular basis (Napier, New Zealand, and Lodz, Poland). On site training can be done by arrangement.

Spares and consumables

A comprehensive range of spare parts for the PCS100 product portfolio is available for order via your local ABB unit. They are ordered online and dispatched from four holding facilities around the world to ensure quick delivery. Lists of recommended spares for all units are available on application.

Repairs and maintenance

While the PCS100 products require only low levels of regular maintenance, the fans and other components need to be checked periodically to ensure ongoing reliability of the product. Scheduled maintenance and report checking can be organised by your local ABB team.

End of life services

ABB also offers full end of life services including options around upgrades and replacements to ensure your plant continues to be protected long after your current unit has reached end of life.

Software and hardware upgrades are also available as required to extend the life and functionality of your PCS100 system.

Service agreements

We offer a range of service contracts to suit any application. These contracts cover anything from basic annual onsite checks and access to round-the-clock support through to fully comprehensive contracts which cover all parts as well as site time and emergency response. Service contracts provide you with improved cost controls, increased operational efficiency, lower capital expenditures and extended product life time.

Research and Development	Active	Classic	Limited	Obsolete
Defining and producing lifecycle services for the product	The unit with complete lifecycle services is available for purchase	The unit with complete lifecycle services is available for plant extensions and parts	Parts and repair are available as long as materials can be obtained (we typically replace with new units)	No guarantee of availability of services or new parts (we typically replace with new units)
Installation and commissioning	•	•		
Training	•	•		
Spares and consumables	•	•		
Maintenance	•	•		
Repair	•	•		
Extensions, upgrades and retrofits	•	•	Retrofits available	Retrofits available
End of life services		•	•	•
Replacement			•	•

Contact us

For more information contact your local ABB representative or visit:

[**www.abb.com/ups**](http://www.abb.com/ups)

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