

ARTICLE

ABB's innovative power electronics solutions for 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.

Semiconductors are everywhere!

When you switch on your smart devices for texting, web surfing, email, photo/video-taking, music, you're entering the world of semiconductors. They have changed the way we live and see the world. If you open your device you will find numbers of powerful chips and fine OLED inside. What you may not realize is the production of these sensitive chips requires and 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 of huge scale for semiconductor manufacturing fabrication plants (FAB's) that are not adequately protected. Investing in the best power protection has many benefits, and choosing a solution for your given

requirement, 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 UPS and power conditioning products, designed to solve power quality issues for semiconductor applications.

What are your options?

ABB's PCS100 Active Voltage Conditioner is a "battery free" solution to the most common utility problem, voltage sags, along with swell protection and continuous voltage regulation. The PCS100 Reactive Power Conditioner is designed for correcting power factor, low order harmonics and imbalance issues often created by some semiconductor tool loads. The PCS100 RPC reduces system current thus enhancing energy efficiency and power system capacity. The PCS100 UPS-I is tailored towards the demands of industrial applications such as sensitive tools, motors, drives etc. It also provides protection during deep sag and swell events, plus outages lasting between seconds and minutes depending on storage (super capacitors or batteries) and system loading. Payback time for a PCS100 UPS-I is typically less than 12 months as the problems it protects the plant from can be so expensive. The ultra-fast transfer time of less than 2 milliseconds, the exceptionally small footprint – 50 percent smaller than competing solutions, and the long and more economical operating life are also attractive features of the PCS100 UPS-I.

For complete power protection of large sensitive and critical loads, ABB's PCS100 Medium Voltage UPS (PCS100 MV UPS) is the solution. The first release, will be rated up to 6 MVA at 6.6 kV with even larger 15 kV class products to follow (including 11 kV and 13.2 kV options), with even higher MVA ratings. ABB's PCS100 MV UPS has been designed to provide clean, reliable and efficient power, and lower costs for customers in large industries. The single-conversion topology used is a natural choice for medium voltage as losses are extremely small, meaning efficiencies well in excess of 99.5 percent can be achieved. The PCS100 MV UPS can be installed to protect the complete supply or just selected sensitive loads.

The unparalleled efficiency of the PCS100 MV UPS, its minimized maintenance costs and small system footprint minimize ownership costs. The fact that the energy storage and converter is at the low voltage level also greatly simplifies maintenance and reduces system cost.

The modular and scalable architecture of ABB's power protection portfolio enables compatibility between the systems, ensuring success in combatting common power protection challenges. Semiconductor companies can add ABB's power conditioning systems, such as the PCS100 Active Voltage Conditioner, UPS-I or the Reactive Power Conditioner to their existing plants although many companies choose to apply the products extensively on new FAB builds.

A solid relationship is key

ABB has developed and installed many power protection solutions for the semiconductor industry. This year ABB has developed nine PCS100 Industrial UPS-Is (PCS100 UPS-I) for a major LCD plant in China and two PCS100 Active Voltage Conditioner (PCS100 AVC) for a world-leading semiconductor manufacturing corporation, also based in China. In addition, SK Hynix, a preeminent player in the memory chip industry, based in Korea, has selected multiple PCS100 AVCs for their M12 12 inch wafer fabrication line. ABB and SK Hynix have a past relationship, with SK Hynix using ABB's technology to protect their many production lines from voltage disturbances including the M11 production line. Now called the M12 production line, it is an extension of the M11 and M8 lines. With the completion of the M12 line, it can produce up to 40,000 of the 300-millimeter wafers on a monthly basis.

ABB has supplied leading edge solutions to Samsung's \$3 billion liquid crystal display production facility in Suzhou – the biggest single investment ever made by a South Korean company in China. To safeguard from potentially crippling power, Samsung selected eight PCS100 UPS-Is, which have a combined protection capacity of 16.5 megavolt amperes (MVA) of electric power. Furthermore, Samsung last year selected 22 PCS100 UPS-I units for the \$7 billion NAND flash plant in Xi'an. This facility has a monthly output of 100,000 nanometer chips which are used primarily in memory cards, USB flash drives, solid-state drives, and similar products for data storage and transfer.

Another turn-key solution that has been successfully installed was at Toshiba Mobile Display Co. Ltd's (TMD) manufacturing facility in Ishikawa, Japan. TMD chose ABB's PCS100 AVC and PCS100 UPS-I due to the proven market and cost performance in power quality and protection. TMD had found in other factories that voltage sags were mainly caused by extreme weather, such as thunderstorms. To prevent this, TMD had been predicting thunderstorms and temporarily switching to an alternative standby supply. However, this practice resulted in the expensive use of fuel and could be avoided in all but the worst situations once the ABB PCS100 products were installed.

Mr. Shinji Kubomae, TMD's Specialist Production Engineering Group 2, Process and Manufacturing Engineering Dept. states, "Since PCS100 AVC was introduced, we were able to be flexible in deciding whether or not to have full back up to the protected load. As a result, we achieved significant cost cut, as well as space saving and energy efficiency. "In addition, TMD experienced other benefits from working with ABB, including the achievement of a tight timescale for an intensive installation process that was required to be in place prior to the start of winter, in order to test the full extremities of environmental forces.

Mr. Yoshiyuki Iida, TMD's Group Manager, Manufacturing Group, New Clean room Promotion Dept. comments, "We appreciate ABB's efficient installation operation with professionalism and dedication of staff members demonstrated in the project. "Since the installation, both products have performed to a high standard and in the future, TMD predicts ABB will provide them with power protection technology as highlighted by Mr. Yoshiyuki Iida, "We are also looking forward to communicating with your team to exchange technical information on your wide range of portfolio."

ABB's PCS100 power protection products continue to supply solutions for semiconductor applications, and have supplied over 800 MVA of power so far to the semiconductor industry.

To find out more about ABB's power protection solutions:

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