LinPak and medium power modules spotlighted at PCIM 2015

PCIM Europe is, as every year, the annual event when it is about power electronics. PCIM 2015 attracted close to 9,000 visitors this year, a new record and significant increase of 12 percent compared to last year. Close to 420 exhibitors displayed the latest developments and trends in power electronics, intelligent drive technology, renewable energy and energy management for three days. Almost all of the power semiconductor manufacturers met in Nuremberg, Germany, highlighted their product range and launched their new products (a very nice review of this year’s PCIM technology trends is given on page 2). Our highlights were the new LinPak, a low inductive IGBT module, optimally suited for paralleling, and the newly launched medium power thyristor/diode and IGBT modules that complement and expand our high power product range towards lower powers. Articles on the LinPak and the medium power modules are on pages 5 and 3, respectively.

ABB was very visible at PCIM, not only with its stand right at the entrance of the exhibition hall, but also with 5 technical conference presentations (LinPak, low-loss PCT for HVDC, Si/SiC cross-switch, BIGT for HVDC breaker, integration technologies for multi-level concept converters), 2 forum presentations (LinPak, medium power modules) and 10 stand presentations (HVDC, new PCT for HVDC, LinPak, medium power modules). All of them are available on www.abb.com/semiconductors. (ch)
Dear reader!
Did you know that approximately 184,000 tons of Swiss chocolate will be sold this year? If you did not visit PCIM Europe in Nuremberg in May, you may wonder why I ask this question here. But if you visited PCIM you most probably enjoyed at least one of the 1,500 sweet and delicious IGBT modules we distributed during the PCIM (read more on page 4). This 15th ABB Semiconductors Newsletter is devoted to PCIM with a
− cover story reviewing the PCIM exhibition and the ABB highlights
− review on the LinPak that was presented for the first time (page 5)
− article regarding the launch of ABB’s new medium power IGBT and diode/thyristor modules (page 3) and finally with
− a review of technology trends that were highlighted with respect to power semiconductor devices, packages and applications (page 2).

Parallelizing of IGBT modules is simple – but not easy. Even if the LinPak will make parallelizing of IGBT modules easier than it was before, we summarize the ABB application note “Parallelizing of IGBT modules” in this newsletter. Make use of the huge know-how collected and made available in our application notes. I hope you enjoy reading this newsletter and I wish you a nice summer.

PS. If you have not been visiting PCIM last month and/or did not get a chocolate IGBT module, come and visit us in Lenzburg, there are still some available ...

Yours, Christoph Holtmann
PG Communications Manager

As expected, at the PCIM 2015 exhibition and technical conference, many new technology trends were highlighted with respect to power semiconductor devices, packages and applications. Major power semiconductor manufacturers were strongly present at the exhibition showing their existing product offering while providing an insight into new technology and product platforms with improved features. For ABB, our wide range of bipolar and IGBT based products were presented. However, the main three highlights at the exhibition stand featured ABB’s new medium power thyristor/diode and IGBT module range, the new 1,700 V dual package LinPak IGBT module, and the new small sizes thyristor range with voltage ratings between 1,800 V - 6,500 V. The new low inductance LinPak module equivalents were also shown from other power semiconductor manufacturers including Infineon, Hitachi and Mitsubishi. The importance of the LinPak “or equivalent” package platform was emphasized during the exhibition and conference since it is being strongly considered by many power semiconductor component makers and users as the next standard package for traction and industrial applications. Infineon presented their new RCDC Reverse Conducting IGBT technology in a 6,500 V / 1,000 A HiPak 2 equivalent module along with an optimized gate driver. This step will provide the industry with a second manufacturer with this technology along with ABB’s BiMode IGBT or BiGT platform. Dynex presented their new bidirectional thyristor range which is similar to ABB’s BCT products. Hitachi are providing the next generation higher power and low loss IGBT modules employing Advanced Trench IGBTs for the 3,300 V rating. Mitsubishi showed a new low power module range with an interesting resin insulated metal baseplate technology while employing the 7th generation 1,200 V IGBT chips. In addition, they provided a wide range of SiC modules ranging from Hybrid to Full SiC solutions. On the same wide bandgap developments front, for SiC available products, a next level maturity compared to last year can be sensed in terms of a wider range of offerings “SiC MOSFETs and diode up to 1,700 V” with improved performance especially from Rohm and Cree. Nevertheless, the challenges in terms of cost remain for the time being. Finally, the conference provided a lot of material for study from the technology viewpoint. The related keynotes focused on power devices from Fuji and reliability from Semikron. ABB published 5 papers including the new LinPak module, the novel low loss thyristor technology, the HVDC breaker BiGT StakPak, integration technologies for multi-level concept converters and the Cross Switch Hybrid Concept. The previously discussed 6,500 V / 1,000 A RCDC paper from Infineon won the best paper award. Also, a number of papers on high voltage RC-IGBTs (BIGT) were presented by Rostock University. Infineon and Hitachi presented their versions of the LinPak module while Hitachi also presented a new 4,500 V / 1,500 A HiPak2 equivalent as their new Advanced Trench IGBT is rolled up to higher voltages. Mitsubishi presented a very good paper on an improved module with higher reliability, which is one of the first to highlight the reliability issues related to Humidity. For WBG devices, clear improvements on SiC MOSFETs were presented including Cree’s 10 kV MOSFET chip. However, there is a new emphasis in this year’s publications with regard to investigating the device performance in terms of improved reliability, fault condition withstand capabilities, and EMI reductions to name a few. By tackling these issues and moving beyond the basic static losses and reverse blocking performance, SiC device are stepping up the challenge to reach their potentials for meeting the main requirements of power electronic systems while providing superior static and dynamic behavior compared to silicon. (mr)
ABB medium power modules launched at PCIM

Coming from high power semiconductors, ABB is regarded as one of the world’s leading suppliers setting standards in performance and quality. ABB’s unique knowledge in high-power semiconductors now expands to industry standard medium power IGBT and bipolar (thyristor/diode) modules.

ABB launched at PCIM 11 IGBT and bipolar (thyristor/diode) modules. The IGBT modules (62Pak) offered are 1,700 V phase leg modules in a 62 mm package rated 150 A, 200 A and 300 A. The thyristor/diode modules launched are the 20Pak, 34Pak, 50Pak, 60Pak and 77Pak. They are available in dual configuration from 1,600 V to 6,000 V and 110 A to 890 A.

The medium power product range will expand continuously over the next months and years: In 2016 and 2017, the IGBT modules LoPak1 and LoPak3 in phase leg and six-pack configuration for 1,700 V will be introduced. The bipolar module range will expand to 1,200 V.

All ABB medium power modules feature industry standard housings and are designed for very low losses and highest operating temperatures. Typical applications are AC motor soft starters, variable speed drives and renewable energies. Features used in ABB’s high power semiconductors are also used in ABB’s medium power modules, thus ensuring highest performance under load cycling, higher thermal utilization, increased overload capability and many more. (cw)

Process change notifications

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SEMS upgraded with StakPak device models

SEMS – a web-based interactive ABB tool based on the PLECS simulation software, has been upgraded with StakPak presspack IGBT module device models last month. SEMS simulates – among others – semiconductor switching losses, conduction losses and junction temperatures. It thus assists engineers at an early design phase in selecting the semiconductor device that best fits their application.

The StakPak device models are based on the ABB StakPak data sheets. They are available on our website in the XML format and can be used from PLECS users as a dedicated lookup table for referencing the semiconductor switching and conduction losses.

The next milestones on the SEMS roadmap are the following expansions:
- Thermal simulation of a 3-level VSC with ABB HiPak IGBTs
- Thermal simulation of 3-level VSC with ABB asymmetric IGCTs

To start using SEMS and downloading the available product models visit our website at www.abb.com/semiconductors. (ch)
Products in the pipeline

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Obsolete products

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<td>5SDD 50N5500</td>
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Product features

1,600 V and 1,800 V dual thyristors
- Bonded contact technology uses a copper baseplate with a soldered aluminum oxide ceramic as an insulator. This enables an optimum heat transfer.

1,700 V phase-leg medium power IGBT
- The Industry standard ABB 62Pak combines the well established copper technology for industrial applications with the renowned reliability and quality of the ABB HiPak IGBT modules
- The 1,700 V SPT++ chip-set offers lowest switching losses and an operation temperature range up to 175 °C.
- First electrical samples are available. Final qualification expected by the end of 2015

2,200 V, 5,000 V and 6,000 V dual diode modules
- Pressure contact technology modules with the highest reliability and quality in terms of power cycling capabilities
- Insulated baseplate with aluminum nitride ceramic achieves an excellent heat transfer and a high insulation voltage.

Publications calendar

- Bodo’s Power Systems, May 2015
  “SEMIS – An Interactive tool for selecting the right device for your application”
- Power Electronics Europe, July/August 2015
  “LinPak – a new low inductive phase-leg IGBT module for easy paralleling in high power-density converters”

Did you know?

184,000 tons of Swiss chocolate will be sold this year. Close to 40 percent will be sold in Switzerland and slightly more than 60 percent will be exported to more than 150 countries in the world. In May 2015, 30 kg of finest and highest quality of Swiss Max Felchlin chocolate was exported to Nuremberg, Germany. At PCIM, 1,500 pieces of sweet and delicious ABB IGBT modules were distributed and received with a nice and happy smile. (ch)
LinPak-mania at PCIM

Last month, ABB presented its new LinPak IGBT module at PCIM in Nuremberg, Germany. The first LinPak module in development is rated 1,700 V and 2 x 1,000 A. The module was exhibited in a real converter environment with laminated busbar, cooler and gate-unit. The exhibit showed four modules connected in parallel. It clearly demonstrated the straightforward paralleling capability of this new type of IGBT module. The LinPak draw significant attraction from the audience and we had many interesting discussions with potential customers at the ABB stand.

The conference presentation and the presentation in the forum were very well attended as well. Bottom line we can conclude that the LinPak module concept is well received and answers many requirements and wishes for IGBT modules from high-power converter OEMs. A big break-through for ABB is that the major traction customers prefer our LinPak proposal rather than other approaches for rated voltages up to 3,300 V. This is mainly thanks to the lower overall inductance and the higher current capability.

The next steps for ABB are now to work towards first samples in quarter four of this year for 1,700 V devices and 3,300 V LinPaks in the first half of 2016. With the LinPak ABB paves the way for next generation traction converters. It also has the potential to establish itself as a new package concept with full SiC readiness for medium to high power industrial converters, e.g. in wind applications.

Portrait:

ABB distributor
Hans H. Schive

Hans H. Schive AS was established in 1963. The basis for the company were high power microwave amplifiers, electron valves and semiconductors - primarily high power devices, which are still important parts of the company’s offering.

The company has positioned itself as a well-reputed and major Norwegian distributor of electronic components and systems. Serving the domestic as well as special segments of the international market.

When the Norwegian market for electronic components started eroding, due to production being flagged out to low cost countries, the company has always shown excellent ability to adapt to changes, tailoring its product portfolio to the new market situation. The company did focus strongly on battery technologies and is today heavily involved in design and manufacturing of high performance battery systems for the oil, offshore and subsea, industrial, heavy duty and military markets.

Hans H. Schive AS today has 12 employees, whereof 2 in production of small series and prototypes. All others are involved in marketing, sales, engineering and customer support. Our engineers are highly skilled and a high value adding factor for most of our business. The company is in process of being ISO-9001-qualified, which will take place in 2015 and is a member of the “Omni Alliance”, a group of Norwegian companies which together offer very attractive and high quality total enterprises to the market.

All activities are centralized and controlled from the facilities in Asker, 20 kilometers west of Oslo.

New Sales Manager for ABB Semiconductors in Prague

We are pleased to announce the appointment of Renata Ouředníková as new Sales Manager, effective March 1, 2015. Renata heads the sales department of ABB Semiconductors in Prague, Czech Republic. She is in charge of the Eastern European market, works closely together with the local planning and logistics departments and with ABB Semiconductors in Lenzburg, Switzerland.

Renata holds a Master degree in Mechanical Engineering from the Technical University in Prague (ČVUT), Czech Republic, and an MBA degree from the Hallam Sheffield University in Sheffield, United Kingdom. Before joining ABB, Renata held several senior management positions at Bosch Odbytová, 3M and a number of other companies, mainly in the automotive and electro industry.

In her new role, Renata reports directly to Mojmír Balous, Local Business Unit Manager ABB Semiconductors in Prague.
Application note
Paralleling of IGBT modules

With the LinPak, paralleling of IGBT modules becomes very easy! Paralleling of HiPak IGBT modules is easy, too, provided you follow some guidelines and instructions. The ABB application note (AN) “Paralleling of IGBT modules” provides these guidelines and is briefly summarized here. In an ideal case the current capability of IGBT modules scales with the number of modules connected in parallel. Due to a never completely matched impedance of each module connection and due to parameter variations between the different modules, a perfect current sharing is not realistic. Homogenous current sharing, however, is the key to maintain high ruggedness of the whole converter and to allow for an optimal utilization of the power modules with minimal de-rating. In addition, unequal cooling of the semiconductor devices can lead to further current imbalance in and between the modules since the semiconductor’s on-state and switching characteristics are temperature dependent.

The application note “Paralleling of IGBT modules” covers the following main chapters:

- Static current sharing
  The influence of the module parameter spread as well as the external influence on current sharing are described here.
- Dynamic current sharing
  As dynamic current sharing largely depends on the external power circuit design, here the AN describes how common gate drivers, common gate-drivers with common mode chokes, individual gate-drivers, stray-inductance & clamping as well as the phase connection influence the current sharing. Also the influence of the junction temperature and the influence of the device parameters on the current sharing are investigated in this chapter.
- General recommendations
  This chapter provides some general recommendations regarding the construction of the power circuit, it compares the different static and dynamic impact parameters and their influence on the current sharing mismatch and it explains how the de-rating of modules in parallel connection should be done.

The full application note “Paralleling of IGBT modules” as well as all the other 25 application notes are available for downloading on www.abb.com/semiconductors.