T he Powerex Pledge: Quality Products, Outstanding Service

Often, new ideas come and go, and goals fall by the wayside. But at Powerex, an innovative strategy launched in 1996 has continued to deliver positive results, thanks to a focused, corporate-wide commitment to providing services that delight customers.

Guided by this singular goal, Powerex took dramatic steps in 1996 toward improved customer service. By mid-year, Powerex completed transfer of its encapsulating line from Puerto Rico to Youngwood, a move that quickly generated a 40 percent improvement in manufacturing cycle time. Close on its heels was the consolidation of all Diamond Power products, previously shipped from a California distribution center, in a new finished goods warehouse at Youngwood. O pened in October 1996, the new warehouse met the target of 32-hour turnaround for standard orders and same-day shipment of emergency orders within three months. On-time delivery rate is consistently above 98 percent. The 15,000 square foot warehouse also now serves as a distribution center for select Rectifier and Thyristor products.

With consolidation the keynote of many changes, Powerex also put in place a powerful business information system that integrates all Powerex processes—from order entry to manufacturing—and enables real-time networking with field representatives as well as key customers. This system, coupled with management and administrative staff under one roof in new corporate headquarters, have resulted in drastically improved efficiency and top-notch response to customers.

Driving all Powerex initiatives is a deep commitment to quality—a commitment best demonstrated by its ISO 9001 certification in February 1998. This achievement has been followed by three successful ISO audits, along with Powerex’s adoption of Six Sigma, a metric-based improvement system universally recognized as the standard of excellence.

While developing in-house Six Sigma skills, Powerex recently brought on board a new director of Manufacturing, and Quality/Continuous Improvement managers, all highly trained in Six Sigma methodology (see photo lower left).

Designing Small Motor Drives? Check out the new Powerex FLEXPAK CIB™

To provide customers with greater flexibility when designing motor drive circuits, Powerex offers FLEXPAK CIB™ – a compact package complete with options that allows customers to readily match circuit form with function.

FLEXPAK CIB comes with two basic components: a three-phase rectifier converter and three-phase output IGBT inverter. Customers can then select any or all of the following options:

- **Thyristor** to ensure protection against large inrush current
- **Brake module** if the motor drive circuit requires dynamic braking
- **Temperature sensor** to monitor baseplate temperature
- **Current sensor** to protect against excessive current and enable shut-down

FLEXPAK is available in two configurations based on converter/inverter ratings. “Package A” is tailored for ratings of 600V at 10A through 20A, and for 1200V at 10A and 15A. “Package B” is designed for 600V at 30A and 50A, and 1200V at 25A.

For more information on the Powerex FLEXPAK CIB, call your sales representative or the Power Line at 1-800-451-1415 or visit the Powerex website at www.pwrx.com.
Powerex: Your Source for High Power Devices

Some applications require specialized attention, and at Powerex a key specialty is high power devices. Drawing from both Diamond Power and Rectifier and Thyristor product lines, Powerex meets the needs of customers in the locomotive and traction industries as well as those relying on medium and high voltage industrial drives.

Powerex’s Diamond Power Products business segment offers three prime candidates for high power applications: HVIGBTs, a Gate Commutated Turn-Off (GCT) Thyristor, and Ultra High Voltage Thyristors. Using an optimized “punch through” design, Powerex HVIGBTs deliver power cycling capability suitable for high voltage applications while retaining the long, reliable service life and 30 percent reduction in thermal resistance inherent to third generation IGBT technology. Also, to ensure maximum performance, all HVIGBTs undergo stringent quality control testing that includes x-ray inspection of soldering, as well as comprehensive static, switching, and SOA tests. Available in single, dual, and chopper configurations, the Powerex family of HVIGBTs includes 1700V, 2500V, and 3300V devices, with amperage ranging from 400 to 1200A.

Introduced in 1997, the Powerex GCT Thyristor is designed for medium voltage drives and high voltage power supplies. When coupled with low inductance gate driver GC-40, the 4500V/4000A GCT has a much higher dv/dt capability and permits operation without a dv/dt snubber. To aid customers in systems design, Powerex recently added the GCT System Set, a complete package which includes the GCT, gate driver GC-40, a 4500V/1500A free wheel diode, and 4500V/500A clamp diode.

Newest to the Diamond Power lineup is the Ultra High Voltage Thyristor FT1500AU-240, a 12000V/1500A device designed to eliminate or minimize the number of devices required in a series string for such applications as AC Switch and Static Var Generators. Also available is the FD 20000U-120 diode, rated at 6000V/2000A. As with the HVIGBTs and GCTs, the Ultra High Voltage Thyristors and Diodes are currently available in mass production quantities with lead times as short as 14-16 weeks.

From the Rectifier and Thyristor product line comes large area device technology led by Powerex founding companies Westinghouse and General Electric in the 1970s. Beginning with 50mm devices, this product line has grown to include 67mm, 77mm, and 100mm devices, as well as an ultra-thin (0.7”) Pow-R-Disc™ package. Typically used for power conversion, power quality, and large motor control drives, large area devices streamline components by requiring only one capacitor and resistor — thus reducing parts count and complexity, and increasing reliability. For more information, visit the Powerex website at www.powerex.com to view data sheets for Rectifier and Thyristor large area devices, as well as Diamond Power HVIGBTs, GCT (part number FGC 40000X-90S), and Ultra High Voltage thyristors and diodes (part numbers FT 1500AU-240 and FD 20000U-120). And for a behind-the-scenes look at Diamond Power design, click on the technical paper “New High Power Semiconductors: High Voltage IGBTs and GCTs.”

Powerex Rectifier and Thyristor Devices: Combining Tradition with Innovation

Evolving from high power semiconductor pioneers Westinghouse and General Electric, Powerex today is the major U.S. manufacturer of discrete high power rectifiers and thyristors. In that role, Powerex continues to supply field proven high power devices — while creating innovative products for today’s high power applications.

Powerex “High Powered” Examples:

(Top) Typical Powerex CM800 Series HVIGBT Module rated at 800A and 2500-3300V.
(Bottom) Powerex 4500V/4000A Gate Commutated Turn-Off (GCT) Thyristor.

For a look at more Powerex Rectifier and Thyristor high power devices, see “Powerex: Your Source for High Power Devices” also on this page.

For more information on Powerex Rectifier and Thyristor product lines and the Custom Module program, visit the Powerex website at www.powerex.com.
Powerex Announces New Additions to IGBT Family

600V and 1200V Trench Gate IGBTs Offer Improved Total Power Loss in a Low-Inductance Package

Building on the success of the 250V IGBTMOD™ Module, Powerex recently introduced 600V and 1200V trench gate IGBTMODs—an unprecedented move that represents nothing less than a breakthrough in trench gate technology.

“We’ve been developing trench gate products for several years, but because of difficulties adapting the technology to higher voltages, it’s been largely relegated to low voltage MOSFETs and 250V IGBTs,” says Powerex Diamond Power Product Director Ron Williams. “The 600V and 1200V trench gate IGBTs change all that—and Powerex can now provide high voltage devices that deliver improved total power loss in a low inductance package to customers in industrial control applications.” Because it produces a chip geometry that enables increased cell density and thus smaller packages as compared to conventional planar-structure chips, the trench gate manufacturing/design process is typically used for low voltage UPS and EV applications. However, trench gate design also results in extremely low saturation voltage—a key advantage built into Powerex’s 600V and 1200V trench gate IGBTs. The trench gate structure, combined with a local lifetime control process and discrete superfast recovery free-wheel diode, results in a V_{CE(SAT)} that is 0.9V lower at 1.4 times greater current density—which translates to a full 30 percent improvement in on-state losses at almost twice the current density, as compared to third generation planar devices.

While enhancing Powerex’s high voltage IGBTs, trench gate technology posed a significant design challenge during development—achieving low saturation voltage also meant that the short circuit safe operating area (SCSOA) required by high voltage applications might be sacrificed. To overcome this hurdle and to meet customer specifications for 10 microsecond short circuit withstand time, a new IGBT chip was developed that, in conjunction with a Real Time Control (RTC) circuit switch, provides active clamping of short circuit current to a safe level. The end result is an IGBT with all the benefits of trench gate technology, plus a robust short circuit SOA for high voltage power conversion applications.

Williams adds that while optimizing the trench gate process for high voltage IGBTs, Powerex also assembled the new modules in a package based on the highly successful U-Series IGBT concept. Developed by Powerex and Mitsubishi Electric in 1996, this innovative package design reduces internal inductance by using wider and shorter power electrodes, wire bonds, and a ceramic substrate pattern; eliminating the electrode S-bend needed for strain relief in conventional designs; and, aligning the electrodes in a parallel plate structure. The combined effect is an inductance approximately 30 percent that of existing modules.

The new IGBT package also carries forward the savings inherent to the U-Series modules, both for Powerex and customers. In manufacturing, the conventional two-step soldering process is replaced with one-step soldering, which not only streamlines assembly but also produces a device with improved quality and consistency and greater reliability. The result is reduced manufacturing and assembly time, lower internal components cost, and long term savings to customers in system design.

“With the addition of the 600V and 1200V trench gate IGBTs, Powerex now offers a complete family of trench gate IGBT products,” notes Williams. “Available in single, dual, and six-pack configurations and with ratings from 50A to 600A, Powerex has a full line of trench gate IGBTs for a full range of applications—from low-voltage battery operated vehicles to high end industrial AC motor drives.”

For more information on the Powerex family of trench gate IGBTs, call your sales representative or check out the Power Line at 1-800-451-1415. Also, visit the Powerex website for data sheets on the trench gate IGBTs. And, for an in-depth look at trench gate technology at high voltages, see the technical paper “Characteristics of a 1200V PT IGBT with Trench Gate and Local LifeTime Control,” also on the website.

(Continued on Page 4)
(Trench Gate IGBT continued from page 3)
provisions for a high current booster stage that can provide up to 20A of drive for efficient operation of IGBT modules rated up to 1000A. The driver boards can also accept Powerex's popular hybrid drivers with conventional desaturation detection. This allows them to be used with U-Series IGBT modules as well as 800A, 1000A and 1200A H-Series modules with ratings of 1200V and 1400V.

"Powerex offers these accessory products to save customers engineering man-hours and time," says Ron Williams, Powerex Diamond Power Products Director. "With a gate driver, power supply, and circuit board in one package, gate driver design is complete." Williams adds that Powerex will also provide customers with a complete list of components needed to fully populate the board.

For more information, call your local sales representative or the Power Line at 1-800-451-1415. Also, visit the Powerex website at www.pwrx.com.

Eric Motto: Keeping Powerex Technology in the News

Powerex's Eric Motto wears two hats at Powerex—senior applications engineer and published technical writer.

Appearing in the May 1999 issue of PCIM Magazine is Eric's article "High Voltage IGBT or GCT: Which is Best?" and tentatively slated for the August issue is a second article describing Powerex's 1200V trench gate IGBT. Both articles are drawn from technical papers Eric wrote in collaboration with engineers from Powerex and Mitsubishi Electric. Eric is currently working with this industry publication on an article detailing the Powerex application specific IPMs, to appear later this year.

Eric's writing career spans eight years and includes numerous technical papers for presentation at conferences. He has also written or contributed to published articles in Control Engineering and Motion Magazine.

Recent issues of PCIM and Control Engineering and Motion Magazines, featuring articles authored by Powerex Senior Applications Engineer Eric Motto.

Powerex Comes To You...

In the months to come, Powerex will be exhibiting at the following conferences. Our applications engineers and manufacturer's representatives will be on hand to answer your questions and provide up-to-date information on the latest in advanced power semiconductor products. Hope to see you there!


C h a n g i n g of the G u a r d

After 42 years of dedicated service at Westinghouse and at Powerex, Eastern Area Sales Manager Ed Freeley retired on July 1. Ed's retirement has meant not only major changes for him but also a sweeping restructuring of the Powerex area managers (see map). New to the sales team is Todd Holdorf, who brings with him seven years as Powerex marketing engineer and, more recently, two years as acting manager of Rectifier and Thyristor products.

"We'll miss Ed, and customers will miss their long association with him," notes Powerex OEM Sales Manager Jerry Wolfgang. "But with his experience and technical know-how, Todd is a valuable addition to our sales team and a familiar face to many customers."

For a full list of Powerex sales and manufacturer's representatives, visit the Powerex website at www.pwrx.com.

John Yurack
Newest Member of Powerex Team

"What I do is provide customers with the information they need. And if I don't have the information, I can find it. I'm the 'conduit' between customers and knowledgeable people here at Powerex."

Marketing Engineer John Yurack gives customer the "inside" scoop on Powerex high power capabilities during review of 4000V thyristor.

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Recently retired Area Manager Ed Freeley (top photo) and Todd Holdorf, now Powerex Mid-Central Area Manager (right).