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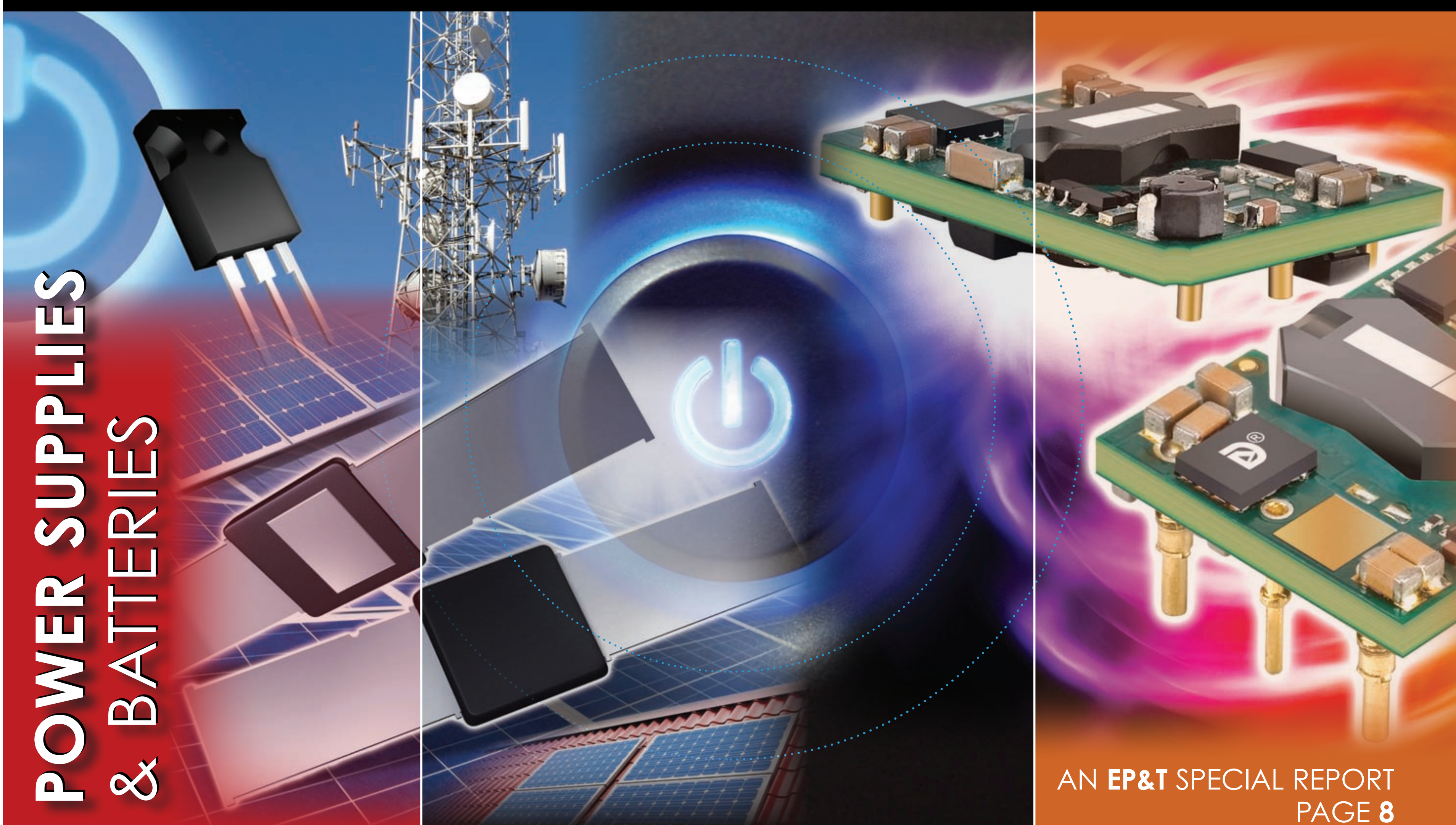

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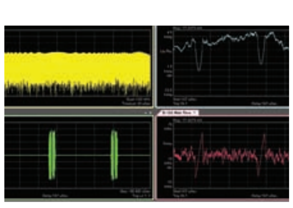

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Publications Mail Agreement No. 40069240
Canada Post: Return undeliverable Canadian addresses to:
Business Information Group,
80 Valleybrook Drive, Toronto, ON M3B 2S9
circulation@ept.ca

Power Supplies & Batteries

Green is not always black & white Sometimes it's RED!

By Jerry Rosenstein, president & COO,
Pioneer Magnetics Inc.

Green is a great colour. The movie industry has used green slime to frighten adults. Kermit the Frog has become a positive icon for children. Editors frequently use green as the new primary color on magazine covers and at the same time, advertisers, regardless of the product, find ways to incorporate green into the message.

The variety of shades and hues has conjured up a feeling of life, a sense of tranquility and, perhaps, best of all, money. More recently, green equates to ecology and efficiency. Industries associated with pollution, chemical run-offs and contaminated land, tout 'green' changes in corporate philosophies. Corporate CEO's claim innovated technologies geared to clean the environment and meet new or stricter standards.

The auto industry is in overdrive with its new hybrid, electric or battery operated vehicles. Provinces are offering incentives to homeowners willing to convert to a solar house. Companies not normally associated with green technologies have jumped onto the bandwagon. EcoTravel agencies are now attracting new clients. Office supply companies now sell green packing material such as green 'peanuts' and green recycled paper products. Even power supply companies have entered the EcoArena.

Green is the color of choice!

Several years ago, Pioneer Magnetics (PMI) recognized that its customers would be looking for innovative ways to reduce costs. Procuring greater material quantities, evolving to LEAN manufacturing techniques, automating and producing product offshore would not be sufficient to meet required cost reduction targets. PMI determined that a redesign of current and future power supplies geared for more efficiency might provide the desired cost reductions, as well as meet future green initiatives.

Most high-end switching power supplies have efficiency ratings in the 88% to 90% range. Some power supply companies have struggled to get product efficiencies to 91% or even 92%. Like trying to run that sub four-minute mile or break the sound barrier, each incremental step of efficiency improvement takes a significant amount of time, experimentation, money, energy and perseverance. Eventually, that evasive threshold is crossed. With standards continually evolving, the effort to traverse that > 92% efficiency barrier may soon be upon us.

From a historical standpoint and heralded as 'the big efficiency breakthrough,' the 1970's saw the use of Gallium arsenide in the manufacturing of semiconductors. Because of its higher bandwidth, it had great promise for high frequency electronics. Although widely used in the microwave industry, optical electronics and for making high frequency ICs, it was deemed that the next application would result in higher voltage components with higher speeds than silicon – a perfect fit for power electronics. Unfortunately, the Gallium arsenide-based power components turned out to be more expensive than anticipated. This was supposed to be the foundation for "the device of the future."

With silicon still dominating the market, there was another technological breakthrough. It was Silicon carbide. Traditionally, power components are manufactured using straight silicon. Once again, there was a large marketing campaign by the semi-conductor industry claiming that power supply designers were choosing Silicon carbide-based components as the best design approach for the next generation of power supplies.

Semiconductor manufacturers touted that characteristics such as high breakdown electrical field strength, wider band gaps and higher current densities translated into a smaller, less expensive and a better quality solution for those power supply companies striving to meet green initiatives, increased efficiencies and lower costs for the end-user. The SemiCon manufacturers even stated that NextGen (silicon carbide) semiconductors [YBK1] would not only become the platform for power supplies but for other green products as well.

So, if the silicon carbide-based components were so attractive, where are the brass bands? Why aren't the flags waving? Why isn't there a long line of power supply customers around the block for that super efficient power supply? Once again, the technical soothsayers were wrong.

Assume that power components represent about 20% of the bill of material cost for a typical switching power supply design. Using a PMI product as a reference, it turns out that for a given family of power supplies having the same power range (wattage), the cost for the silicon carbide power components may be 3X or even > 4X more expensive than the conventional, straight silicon components. And that's when PMI gets "quantity" quotes from its supplier.

5 kW Power Supply	Material Cost	Labor Cost	Total Cost	40% Margin	Cost Per Watt	3.5x Material	Cost Per Watt
BOM with straight silicon	$400	$400	$800	$1333	$.27	$1400	$.28
BOM with silicon carbide	$600	$400	$1000	$1633	$.33	$2100	$.42

To put the higher silicon carbide cost in perspective and what it means to the power supply customer, assume these hypothetical domestic cost projections.

Two approaches were used to calculate cost per watt – a 40% margin and a material multiplier. Interestingly, there is no industry standard used to calculate a selling price. Some power supply companies use a margin based on material costs (only), a combination of material and labor costs or, in a few cases, a multiplier against the material cost. There may not be a right or wrong approach. The key, of course, is profitability on a particular program. In any event, it's clear that the cost of Silicon carbide is a significant factor in pricing out a power supply.

"It's not easy being green"

Besides the Silicon carbide-based component cost increase, there are other issues. Similar to Gallium arsenide, Silicon carbide has a higher band gap and the forward drop losses (for our industry) are not acceptable if efficiency, size and temperature ratings are critical.

Size or the overall dimension of a product now comes into play. Not surprisingly, the market is ignoring technical reality with its new efficiency specifications. The end-user continues to pressure the power supply manufacturer to reduce the overall dimension of a power supply, as well as the cost, in the same breath expects better efficiencies. Unfortunately, there is an inverse relationship between size and efficiency.

With improved efficiency, there are indirect temperature issues. More efficient power supplies mean less heat. However, the smaller the power supply, the harder it is to dissipate heat. Therefore, the (indirect) increased temperatures require more heat sinking. More heat sinking requires more aluminum – all of which requires a larger product case to handle the dissipation of heat.

Using some of PMI's products as an example:

- 8 kW = 75 kilohertz = small package (387.5 sq. inches)
- 10 kW = 50 kilohertz = slightly larger package (437.3 sq. inches)
- 15 kW to 30 kW = 15 kilohertz = larger package (2018.9 sq. inches)

Then, there is the frequency issue coming into play. Higher frequencies usually result in smaller magnetic components, but the switching losses may reduce efficiency. Therefore, by reducing the frequency, efficiencies may improve but the product will then result in larger magnetic components. To further exasperate the situation, switching causes a loss of joules or power.

The key, of course, is to minimize cost-increase percentages, finding ways to keep the power supply from growing in size while striving to achieve the required increase fraction of efficiency. In addition, the customer continues to dictate that there is a time-to-market issue. As the 'Time-to-Ship' clock ticks away, it's

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fascinating to see design engineers struggle and then incrementally achieve 91.1%, 91.2%, 91.3…., 92% efficiency levels. Yet, when all is said and done, engineering designs may be compromised unless there is a technological break-through.

PMI engineers recently had an 'ah ha' moment while working on a customer's (new) efficiency requirement. Never ignoring customer's challenges and working with key component suppliers, PMI's engineering department went to work using known and unique design approaches with its development of a new power supply a 10kW (3U) unit that will soon become a platform for a family of 10kW products.

Knowing that higher efficiencies translate into a larger product, PMI engineering determined that choosing the right kind of diode would be critical. Schottkey diodes have some impact in improving efficiencies. Conversely, ORing diodes reduce efficiencies and create many issues when it comes to heat dissipation. However, ORing FETS may turn out to be a better solution for some products resulting in size and cost reduction.

Using what is known and trying different design techniques, PMI engineering strove for that extra incremental percent. The end result was that PMI's engineers developed another approach, which is expected to help the industry cross the efficiency threshold, resulting in a new standard.

One of the integral aspects of the 10kW design was the use of a different type of power component. It's anticipated that most of PMI's newer product lines, which tend to be low voltage-high power and with power ranging from 1000 to 30,000 watts, will soon go through design changes using the new *efficient* technology.

Although 100% efficiency may never be achieved, design engineers will find ways to reduce enough switching losses to ultimately yield a real 94%. Most likely, efficiencies of 96% and 98% will be obtainable in the near future. In the meantime, the additional semiconductor cost does not justify the price especially when product size, heat dissipation and minimal power losses come into play.

Solar panels savings may provide a pay back within 10 to 15 years. ECO-friendly cars are too expensive for the environmentally conscious driver who is trying to reduce costs. Homeowners expecting to get a free ride by putting power back into the grid will not see any ROI in the near future. Highly efficient power supplies that are small and inexpensive may not be readably available next month. However, being able to cross the threshold into purchasing the NextGen (eco-friendly) power supply may be nearer than we think. How soon, time will tell.

For more information on power supplies from Pioneer Electronics Inc., go to http://ept.hotims.com/34487-62

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Miniature 30W dc-dc converter mounts on pcb

ULS series of open frame, pcb board mount 30 Watt isolated dc-dc converters provide a 2:1 input voltage range of 36 – 75Vdc (48Vdc nominal). The miniature sixteenth-brick DOSA compatible device measures 33.27 x 23.11 x 8.13mm. Product comprises two models providing either a 12 or 15Vdc output. ULS-12/2.5-D48 12Vdc output model can provide up to 2.5A output and is suitable for use in regulated intermediate bus applications. 15Vdc model provides up to 2A. The output may be trimmed within +10% to -20% of nominal Vout allowing the user to compensate for voltage losses. The series provides tight line and load regulation of +/- 0.125% providing an extremely stable output without the need for any additional external components. An On/Off control input provides the choice of configuring for either negative or positive polarity.

MURATA

http://ept.hotims.com/34487-63

High density 3000W dc-ac inverters deliver up to 3000VA

PRP-3000 Series of efficient, pure sine wave inverters provide up to 3000VA of power and has versions that meet industrial (EN60950) or rail (EN50155) standards. Standard input voltages of 24Vdc, 36Vdc, 48Vdc, 72Vdc, and 110Vdc are inverted to adjustable 120Vac or 230Vac outputs that are regulated to 4% or better. Units can be configured for three phase synchronization. All models provide overload protection and an LED indicator for output OK or alarm conditions. A wide operating temperature of -25C to +70C allows for installations in extreme conditions and meets EN50155 Class 3.

SCHAEFER POWER

http://ept.hotims.com/34487-64

Low profile rectifier simplifies solar panel design

SBR12U45LH Super Barrier Rectifier (SBR) comes in the low profile PowerDI-5SP package. The 12A rated device has a maximum package height of 0.75mm, enabling it to be integrated within the solar panel, removing the need for separate junction boxes. With package-side located leads, the PowerDI-5SP can be mounted into recesses in the back layers, adding only 0.21mm to total solar panel depth.

DIODES INC.

http://ept.hotims.com/34487-65

newswatch

3M and Umicore expand license agreement

3M and Umicore have entered into a second technology license agreement that further expands the use of nickel, manganese and cobalt (NMC) cathode materials in lithium-ion batteries.

Under the agreement, 3M grants Umicore license to a family of low cobalt NMC cathode material compositions for manufacture and sales to lithium-ion battery manufacturers for automotive and consumer electronics applications.

The battery cathode compositions composed of nickel, manganese, and cobalt, covered by this agreement, offer a balance of power, energy, thermal stability and low cost. NMC cathode materials can meet demanding customer requirements ranging from high-energy handheld consumer electronics to high-power (hybrid) electric vehicles. For large format battery applications; the thermal stability of NMC cathode compositions contributes to improved battery safety performance thereby, enabling a lower total battery system cost.

Analytic Systems marine products ABS certified

Analytic Systems, Delta BC, has begun the process of certifying its marine specific power conversion products to ABS standards.

Responding to its commercial marine reseller's network in North America, Analytic Systems' has certified the BCA1505 (a 1500W AC charger); the BCA310 (a 300W AC charger); the IPS300 dc-ac inverter (a 300W inverter) and the VTC315 (an isolated dc-dc 300W converter).

Saft unveils lithium-ion battery plant

Saft, global manufacturer of high-tech industrial batteries, kicked off production at its highly advanced and automated lithium-ion battery factory in Jacksonville FL.

Saft estimates that half of the high-volume plant will be devoted to building advanced lithium-ion cells and batteries for renewable energy storage; the other half will be dedicated to smart grid support, broadband back-up, transportation, military and other applications. With more than 100 workers currently employed, another 200 are to be added over the next two years as production expands. The firm maintains that Jacksonville will play an important part in the development of the new-energy economy, while meeting growing customer demand for high performance and competitive energy storage solutions.