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Switching

# POWER

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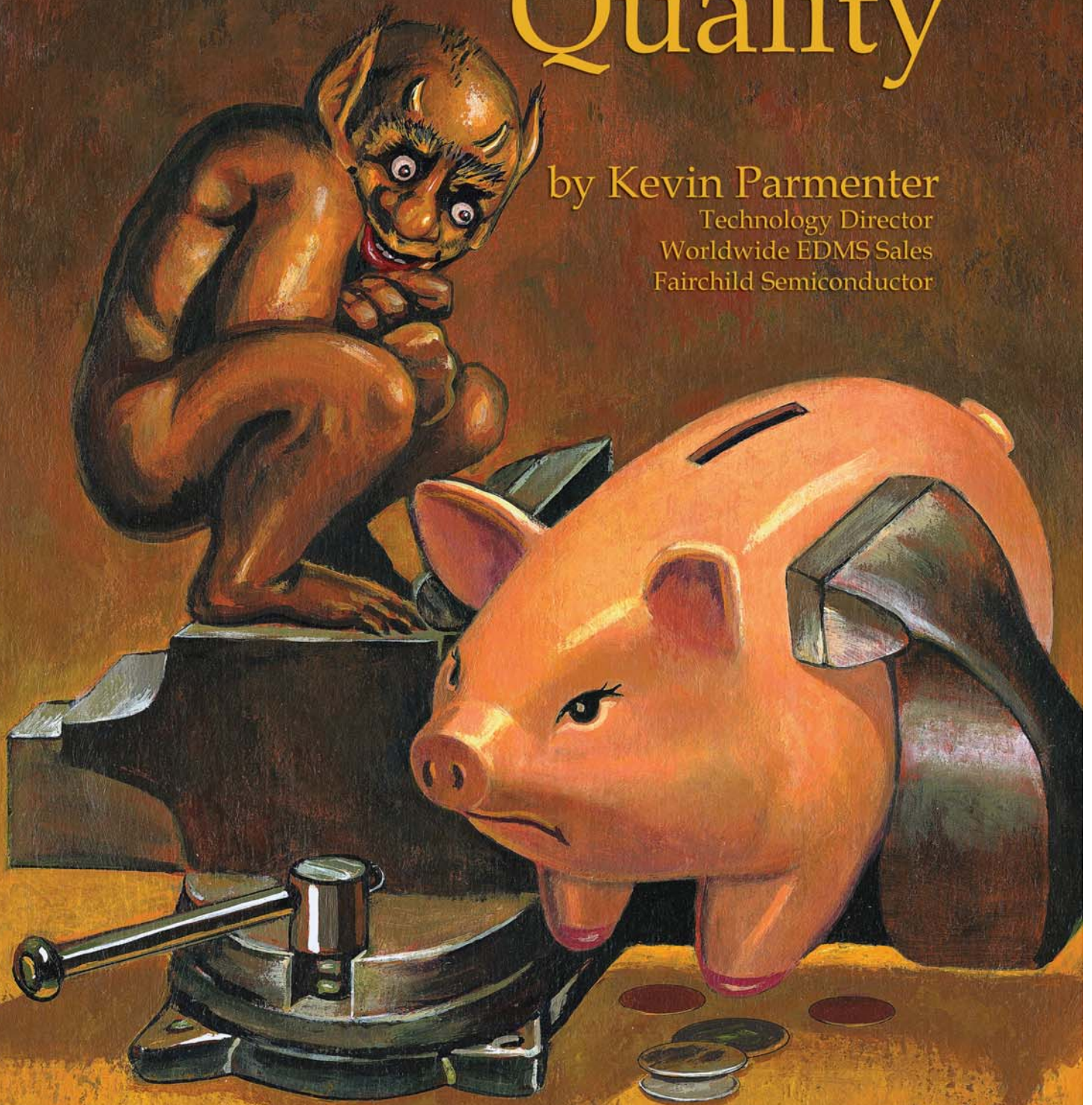
## IBM's Next Gen: Building Power Systems One Block at a Time

**Designers' Series - Part XVI**  
**Perils of a Low-Cost Power Supply:  
A Manager's Guide**

# The Reemergence of Quality

by Kevin Parmenter

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Worldwide EDMS Sales  
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**T**he power electronics industry was threatened, economically, by Japan in the 1980s. It awakened the industry and facilitated the move toward building quality products in Western countries. The cost of returned goods, warranty repairs, service calls, claims and lost business due to unhappy customers rose until we finally chose to do something about it.

Because of this movement, the 90's enjoyed an essentially clean bill of health in electronics. Quality problems became a thing of the past. Companies instituted new standards: TQM, Six Sigma, the Baldrige award competitions, supplier quality audits and certifications. Now, the current decade has declared a new hierarchy—low price is king, finance is in control, and engineering is the dispensable court jester. From a management standpoint, you can see the equation—increased global competition plus an economic downturn equals pressure on executives to cut costs and outsource.

As with many things in our industry, perhaps the pendulum has swung too far in the other direction. Driven by a maniacal, singular focus on price competition, quality has taken a back seat. Other than the quality department staff, not many people discuss quality as they did in the past. What we have in the 2000s is a movement where manufacturers have become financiers, not producers of quality product.

One of my favorite business books, *The Discipline of Market Leaders*, says, "You must maximize what your customers value most in your own delivery of products and services." The central principle of the book states that you must maximize one of three dimensions while maintaining a competent level in two others. For example: Price (or operational excellence), Technology (or product leadership), and Customer Intimacy (premium custom service). We have all seen recent incidences where off-shoring and downward spiraling prices have gone way beyond the compromise of the remaining two dimensions. Unfortunately, it is the consumer who ultimately suffers.

One of my recent customers, a VP of Design Engineering, believes that we crossed a line over three years ago. We have achieved the ultimate cost reduction at the price of quality and reliability. Today, it is assumed that a high-volume consumer product is disposable. This is one of the reasons lead-free and ROHS (Restriction of Hazardous Substances) issues are such a hot topic. We are generating an alarming amount of discarded electronics at an ever-increasing pace.

Consumers don't seem to mind—yet. As long as you can buy a \$39 DVD player, who cares if it stops working next year? Just toss it in the dumpster and get another one. Does it matter?

With power electronics it just might. With the advent of cheap electronics, we are seeing endless recalls, safety issues, returns, disappointed customers, fires and other issues that keep the legal system busy. The price to live on cheap electronics today generates tomorrow's "unmeasurable" warranty and environmental costs.

The business practice of turning a manufacturing business into a finance company is widespread. Part of the reason is because many OEM's make no money on the product they market and sell. Their real objective is to sell related consumables or services. Take a cell phone, for example. While the phone is dispensable, it sells air-time, downloadable games for a fee, custom ring tones and other software and services. The purpose of a satellite radio is to sell subscriptions. A cable box is intended to sell monthly recurring income or downloaded pay-per-view services. A printer's value is in the ink sales. PC hardware prices are now so low; more money is made on the financing, accessories or service contracts.

What happens when the commodity product becomes an immaterial and necessary evil, just to sell ancillary products and services? First, you must squeeze every penny out of the "product". The ripple flows through the design and supply chain. Parts are used from a low-cost region of the world, accompanied by cheaper chemicals in the battery pack, and the cheapest labor imaginable. And there's the finance-centric mentality that goes along with it—as long as we can make this quarter look good, then that's fine.

Business schools and Wall Street seem to be generating people with a numbers-only approach to business, "Prove it to me, give me a business case, ROI and a process or I can't listen to you." The problem with quality and reliability is that you can only measure them when the sky is already falling.

Compromised design is not the only issue. Counterfeit electronic components make up a hair-raising \$1 billion industry. And at low, low, business-case-pleasing prices. Not only may the design you sent off-shore be cost-reduced and altered in unimaginable ways, but the name-brand components may not be what they seem.

# Power Supply Design Workshop

Gain a lifetime  
of design experience  
... in four days.

## Workshop Agenda

### Day 1

#### Morning Theory

- Converter Topologies
- Inductor Design
- Transformer Design
- Leakage Inductance
- Design with Power 4-5-6

#### Afternoon Lab

- Design and Build Flyback Transformer
- Design and Build Forward Transformer
- Design and Build Forward Inductor
- Magnetics Characterization
- Snubber Design
- Flyback and Forward Circuit Testing

### Day 2

#### Morning Theory

- Small Signal Analysis of Power Stages
- CCM and DCM Operation
- Converter Characteristics
- Voltage-Mode Control
- Closed-Loop Design with Power 4-5-6

#### Afternoon Lab

- Measuring Power Stage Transfer Functions
- Compensation Design
- Loop Gain Measurement
- Closed Loop Performance

### Day 3

#### Morning Theory

- Current-Mode Control
- Circuit Implementation
- Modeling of Current Mode
- Problems with Current Mode
- Closed-Loop Design for Current Mode w/Power 4-5-6

#### Afternoon Lab

- Closing the Current Loop
- New Power Stage Transfer Functions
- Closing the Voltage Compensation Loop
- Loop Gain Design and Measurement

### Day 4

#### Morning Theory

- Multiple Output Converters
- Magnetics Proximity Loss
- Magnetics Winding Layout
- Second Stage Filter Design

#### Afternoon Lab

- Design and Build Multiple Output Flyback Transformers
- Testing of Cross Regulation for Different Transformers
- Second Stage Filter Design and Measurement
- Loop Gain with Multiple Outputs and Second Stage Filters

Only 24 reservations are accepted. \$2495 tuition includes POWER 4-5-6 Full Version, lab manuals, breakfast and lunch daily. Payment is due 30 days prior to workshop to maintain reservation.

For dates and reservations, visit [www.ridleyengineering.com](http://www.ridleyengineering.com)

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Counterfeit batteries for phones and laptops are commonplace. Price is easy to measure but cost is not. The law of unintended consequences applies here. Will the "new devices" work in the circuit - will "counterfeit devices" work in the circuit long term? Who knows?

Poor quality and counterfeit battery packs for cell phones and laptops have at best failed and at worst overheated and caught fire - the consequences of this risks shutting down an industry. Reputable companies have published detailed descriptions of how to recognize fake battery packs, so that the consumer can tell. To the untrained and uninformed eye it is very difficult to tell the difference. The potential legal action for damages can be significant.

The question begs, why skimp on the power electronics? We've gone a step beyond compromised quality into compromised safety. It is critical to hire people that know what they are doing in design engineering. There are EMI issues, electrical isolation and safety issues, regulatory compliance, heat, fire and high-voltage issues in off-line power supplies. Why cut costs in the most dangerous part of the system? The potential energy and chemical concerns of a battery pack may be dangerously explosive. That would be like cutting the cost on your pacemaker to the point of unreliability, or cost reducing the ABS or Airbag systems on a vehicle. It's just not worth it in the long run.

In other words, I don't want to outsource the construction design, materials and packing of my parachute before I go sky diving to the lowest cost region of the world to save money on materials and labor. I would, however, be okay with a low-priced pair of sunglasses, since the cost of failure is irrelevant. In survey after survey, the single most important issue for IT customers (a big market for power electronics) is that the systems supporting the business are fully aligned with the needs of that business including uptime and increased availability. With the goal of five nines or even six or seven nines of availability why is price such a driver for everything power related when the cost of failure is large and many times the cost of the equipment? And did we mention loss of good will and reputation?

One recent recall included external power supplies for laptop computers. These have been cost reduced to the extent that if the original supplier is making any money whatsoever, the warranty replacement and repair costs will consume the entire corporation's profit margin for the next 2 years! Executives can inadvertently erode critical competitive elements of their organization.

Supplier relationships can be damaged beyond repair resulting in the loss of quality high skill and talented employees, public confidence about quality ethics and reliability. One mid-sized company executive I spoke to recently stated, "We severely underestimated the issues of manufacturing off-shore."

So, let's say that a manufacturer sees merit in dropping the lower-priced power supply, and seeks their previous, higher-quality domestic supplier. Guess what-they may be out of business. If we narrow the focus to low, sub par makers, the quality makers slowly erase themselves from the industry.

No matter where your product is designed, it is best to have your own engineers qualify the design, do some worst-case analysis, testing and evaluation. Engineers need to specify what parts can be safely substituted with others and which cannot, and then stick to your guns. It is highly recommended to do some due diligence on suppliers. This is completely counter to the present trend. In many companies, the engineers are forbidden to look at schematics, or under the hood of a power supply. To do so would result in knowledge of problems, and liability for the purchasing company of the end product. Or, worse from the viewpoint of some managers, internal engineers would find a fault that would require an "expensive and time wasting" modification.

I would like to pose the following questions for consideration:

*Is your company about to face disaster because marginal power solutions of substandard quality are being shipped?*

*Does the leadership of your company understand the total cost of poor quality and reliability and the difference between price and cost?*

*Can you engage in an intelligent discussion with the leaders of your organization or have minds already been made up with the attitude "don't confuse me with data, I have decided"?*

*Have we reached a point where the disposable product mentality ends?*

*Does anyone remember the lessons of the 80's we will soon relearn?*

*Will the pendulum swing the other direction where companies and customers will demand and pay for quality and reliability?*

*Will we solve the "new" problems again as we solved them in the 80's or will everything be disposable com-*

# Only Need One Topology?

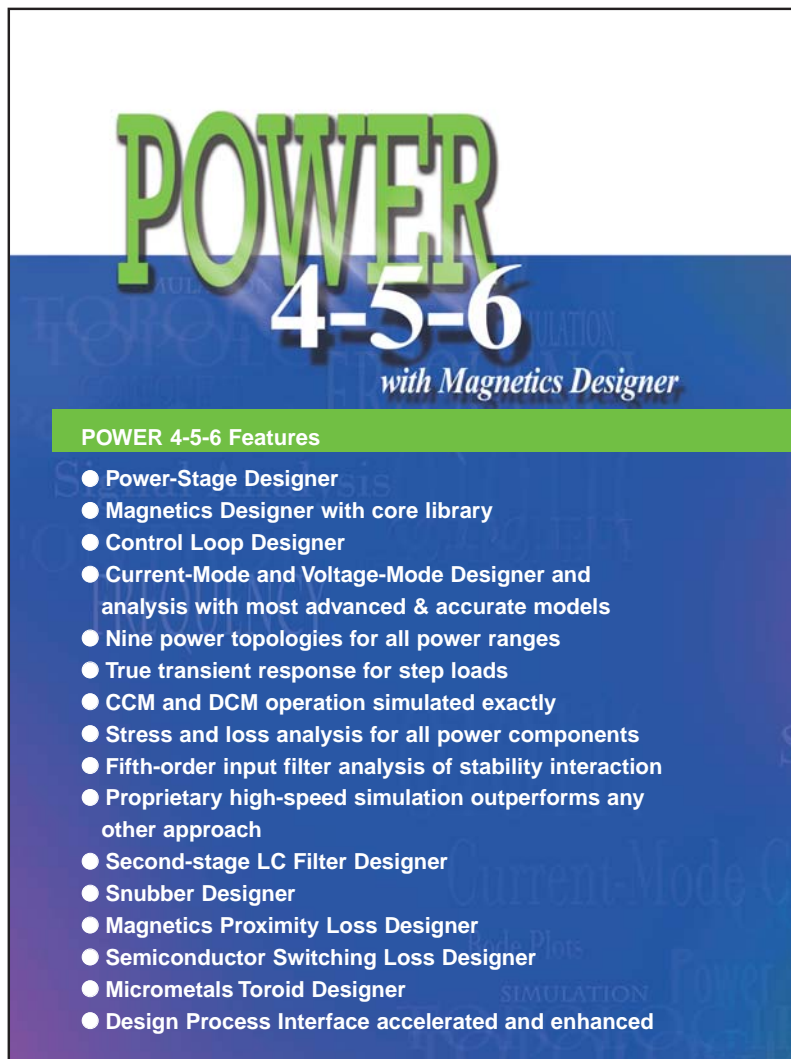
Buy a module at a time . . .

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<b>D</b>	Flyback Converter	\$595
<b>E</b>	Isolated Forward, Half Bridge, Full-Bridge, Push-Pull	\$595

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*modities designed and built in the lowest cost regions using any parts necessary to cut the price to make the quarter?*

I leave you with a quote from an anonymous top electronics manufacturing industry consultant: *"While economic pressures might persuade even me to put some of my eggs in an unknown supplier in some far-flung part of the world, if I were an electronics industry CEO, I'd sure as heck have a rapid action recovery alternative firmly planted in the top drawer of my desk."*

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