

IR International Rectifier

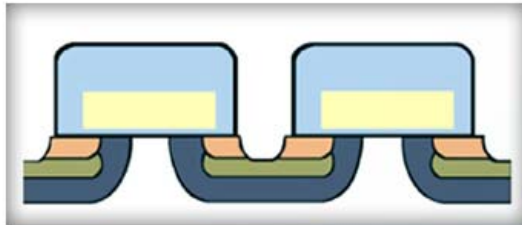
**Silicon and System Innovations to
Redefine Power Management**

February 24, 2004

Inefficiencies in Power Management

- **Power Management has not kept pace with the IT requirements**
 - Simple 50-100W systems with limited rails of 3.x~5V+ power have transitioned to . . .
 - Complex 150-1KW systems with proliferating rails of 5V down to sub-1V rails
- **Tremendous inefficiencies have developed through an incremental & fragmented approach to power mgmt**
 - Increasing power budgets in \$\$, PCB space, component count and power loss
- **The solution lies in completely re-engineering of system and silicon . . .**

Success Factors for the Future

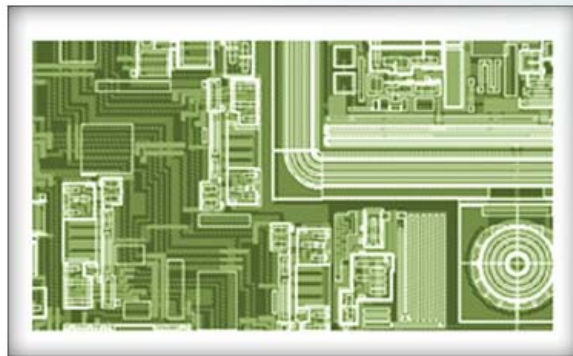


Benchmark Power Semiconductors

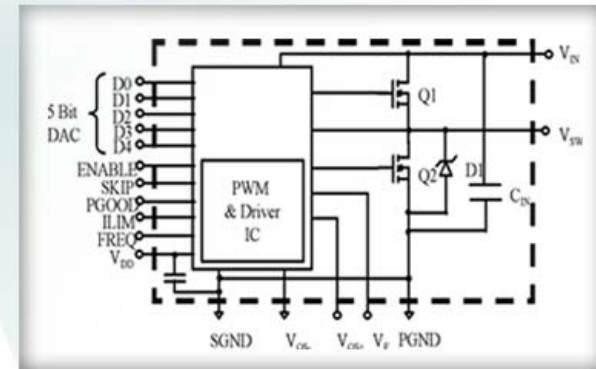


Thermal/Mechanical Design

CO-DESIGNED TOTAL SYSTEM SOLUTION

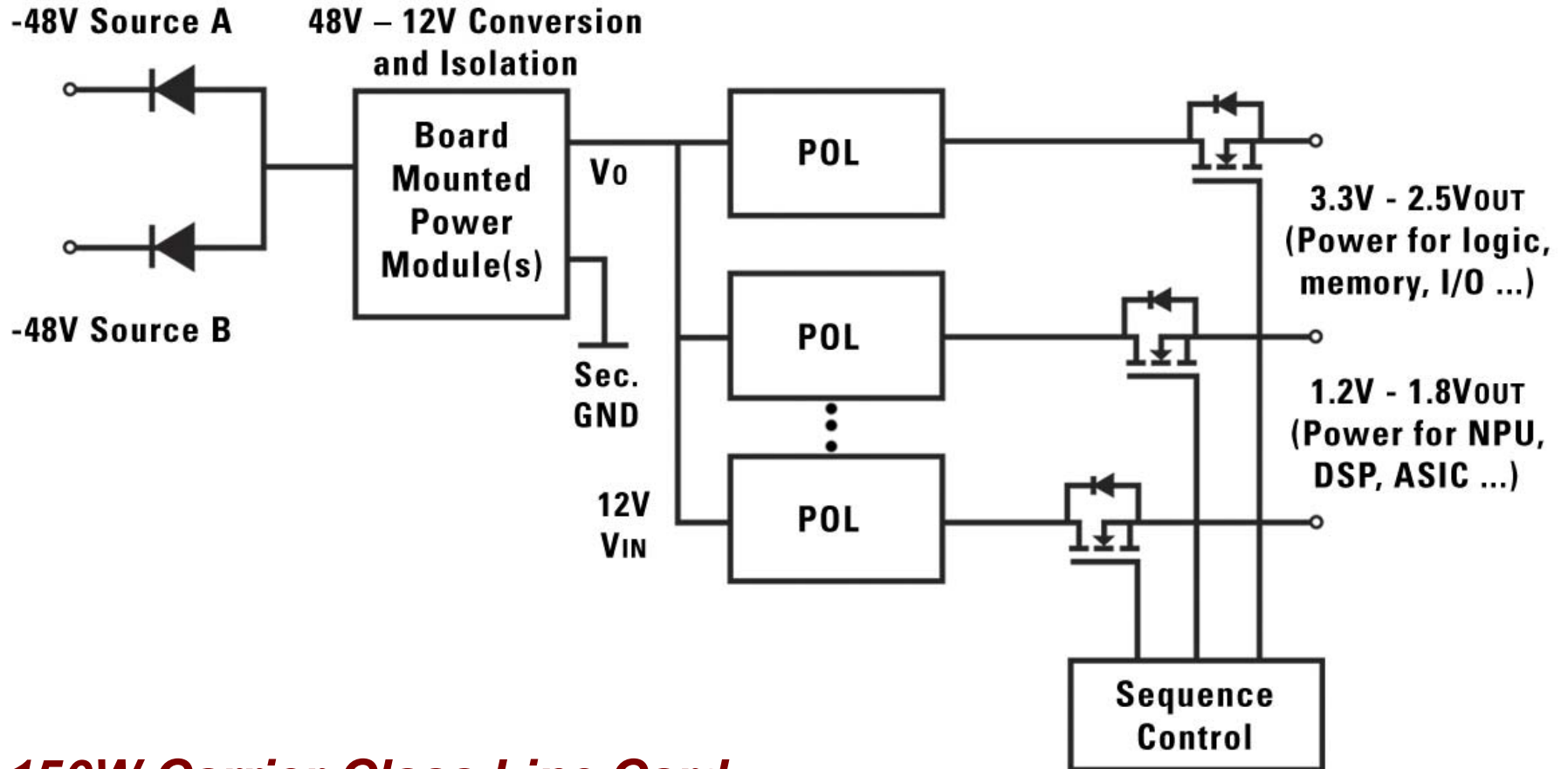


Innovative Control ICs



New Power Architectures

Existing 48V Systems



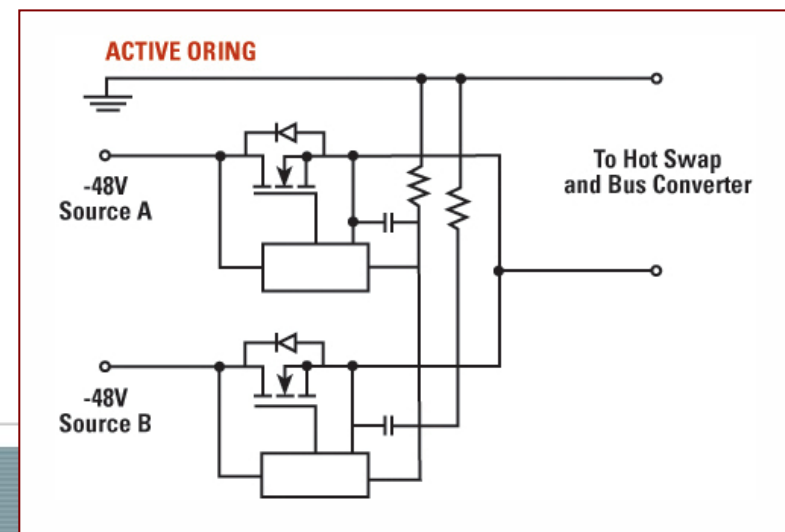
150W Carrier-Class Line Card

Active ORing Benefits

Power Loss Comparison: Diode ORing vs. Active ORing 150W, 48Vin example

	ORing Solution		
	16CTQ100S	63CTQ100S	New Active ORing
Package	D2Pak	D2Pak	SO-8 + SO-8
V_{DROD} @ 4A	600mV	370mV	~ 85mV
Power Loss	2.4W	1.48W	~ 0.37W

- Reduces power loss by 75~85%
- Board area reduces by at least 50%
- Integration can address complexity



Traditional Two Stage Power Distribution

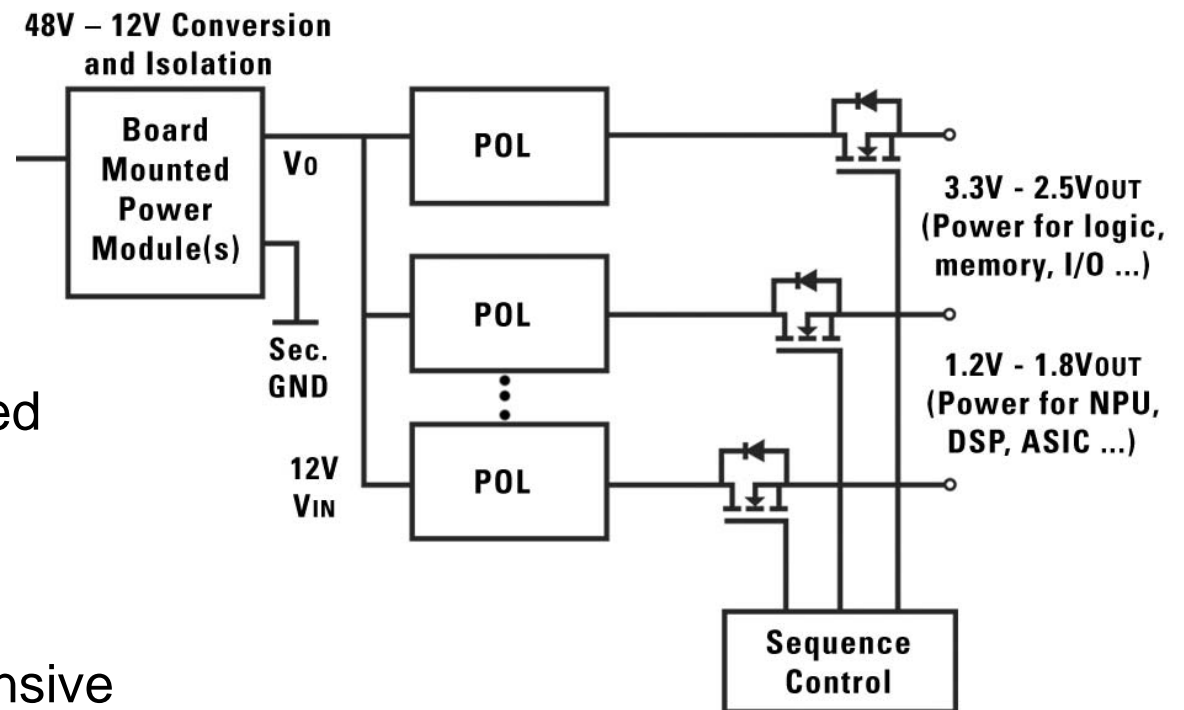
Uses a full-feature isolated BMP module to create a tightly regulated bus voltage

- **Advantages:**

- Each POL has a fixed input voltage

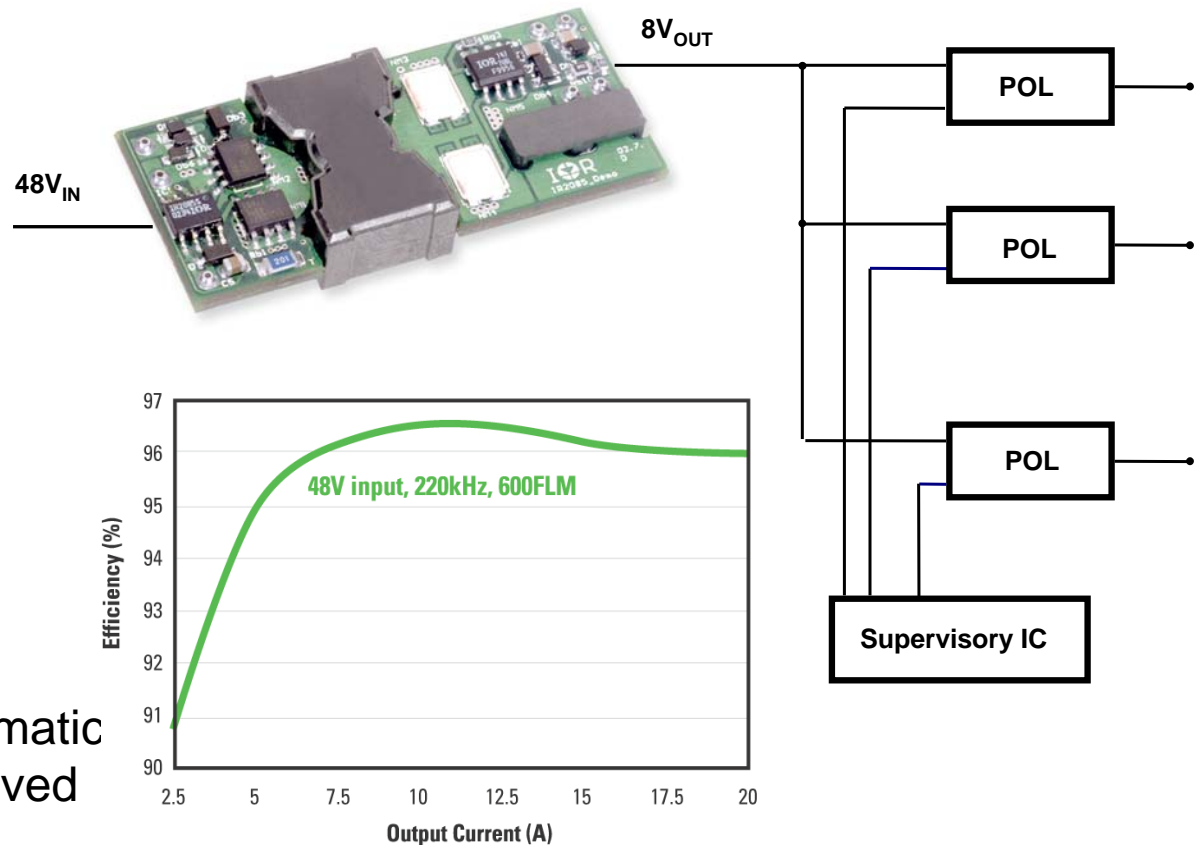
- **Disadvantages:**

- BMP module is expensive (\$0.30/W+) and inefficient (~92% full load efficiency)



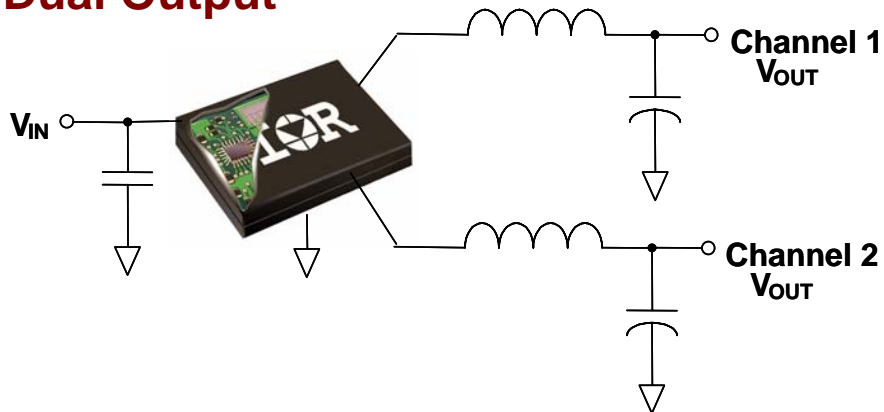
DC Bus Converter Architecture

- Single isolated 48V Bus Converter to generate unregulated 8V output
- For 48V systems:
 - $8V_{bus}$ enables lower distribution losses vs $3.3V_{bus}$ for same power level
 - $8V_{bus}$ reduces switching loss in the POL vs $12V_{bus}$
- New DC Bus enables dramatic cost reductions and improved efficiencies

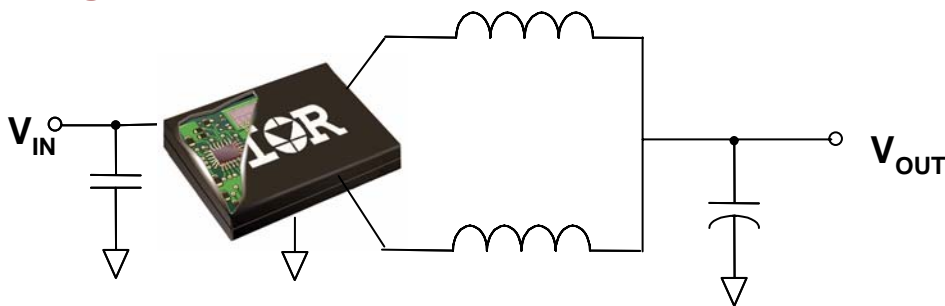


Re-Defining POL Power Conversion

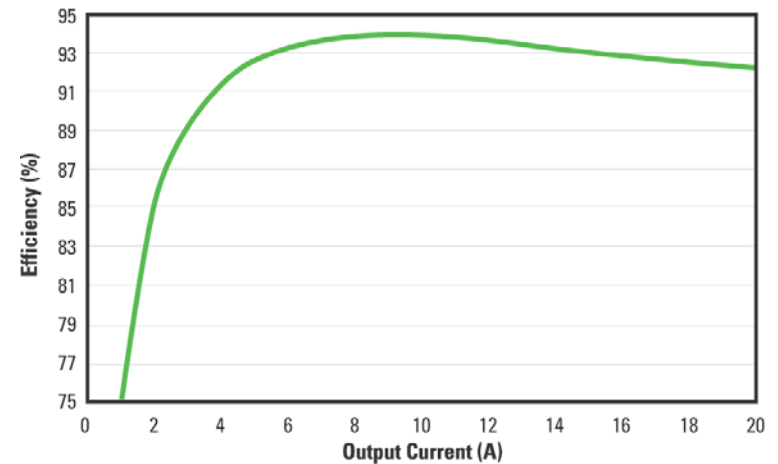
Dual Output



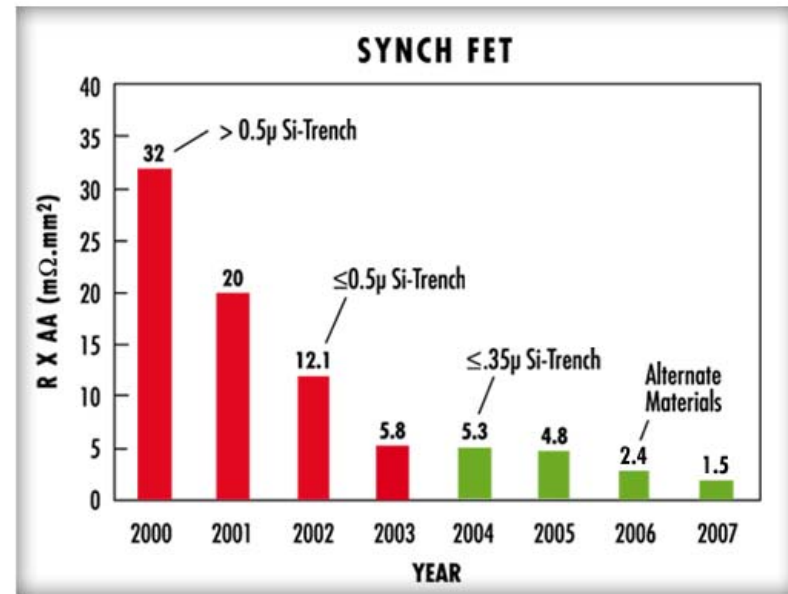
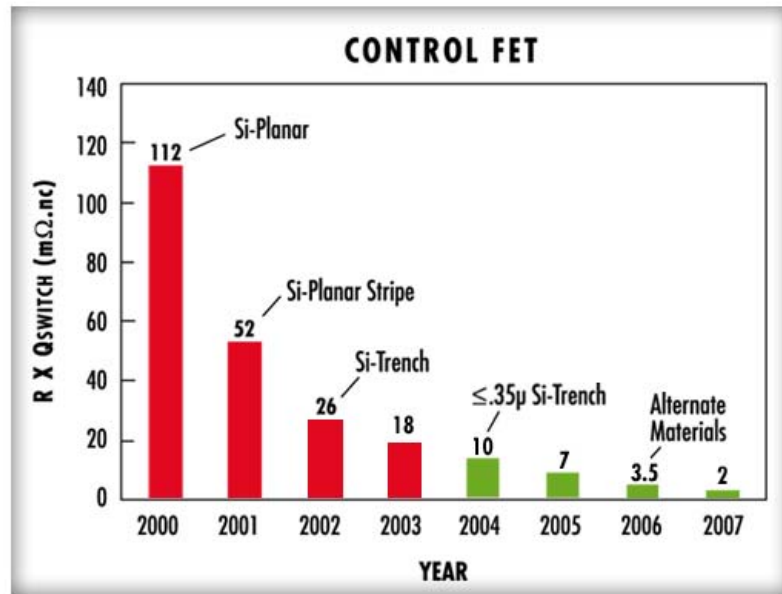
Single Output



- Full protection
- Reduces PCB area by up to 30%
- Lowers system cost by 20~30% vs module solutions (~\$0.15/W)
- Over 92% full load efficiency
- Cut component count by 20 pcs



Power Silicon Roadmap



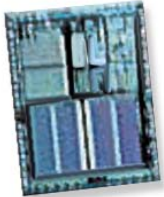



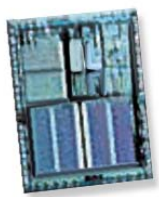







Future generations will enable . . .

- 10x P_{LOSS} reduction
- Silicon integration (power+control)

Existing Data
 Planned Performance

Semiconductor Roadmap

REDEFINING POWER MANAGEMENT

	1.25 μm	0.8 μm	0.6 μm	0.35 μm
Logic	 1x	 0.4x	 0.25x	 0.1x
Analog	 1x	 0.8x	 0.7x	 0.5x
Power	 1x	 0.8x	 0.7x	 0.5x

Re-defining Thermal Management Power Management Integration

REDEFINING POWER MANAGEMENT

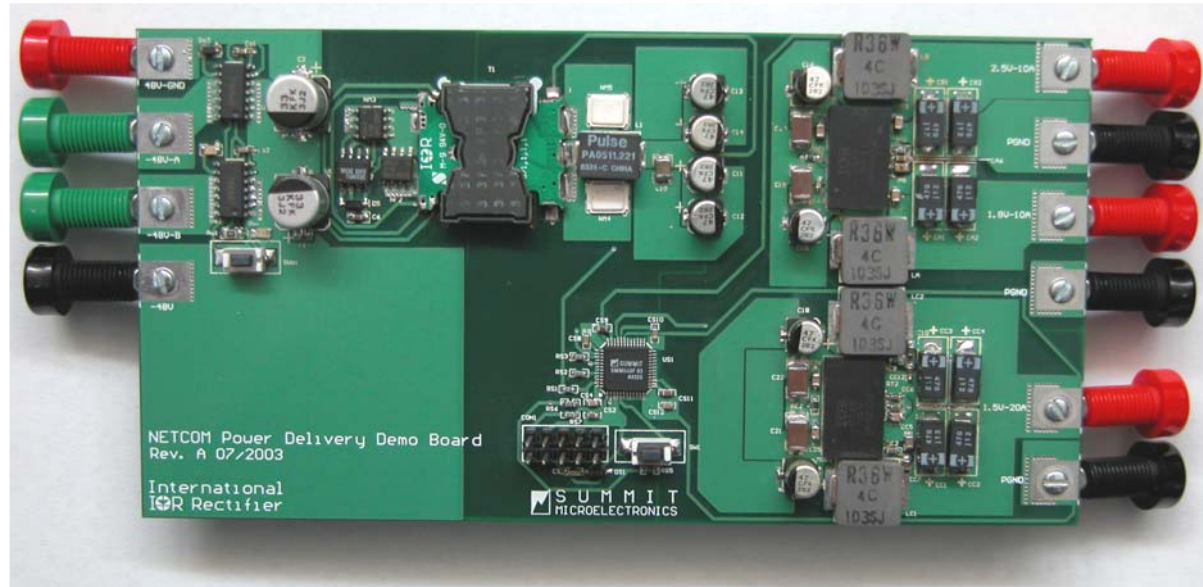


Enables . . .

- 2x power density
- Lower system cost

Solving the Inefficiency

A 48V, 150W Output Example



	Gen 1	Gen 2 (shown)	Gen 3
P_{Loss}	44W	27W	18W
PCB Space	8.9in ²	6in ²	3in ²
Component Count	202 pcs	74 pcs	25 pcs
BOM Cost	\$51	\$49	\$25



IR International Rectifier

Silicon and System Innovations to Redefine Power Management

February 24, 2004