ON Semiconductor Reference Design

ON, Texas Instruments, Philips, others enabling 80 Plus solutions with new silicon
Impacts of Moving to 80 Plus

- Lower circuit stresses
  - Temperature
  - Current
- Improved reliability
- Reduced fan noise
- Reduced energy waste at electrical outlet and in building distribution wiring (lower $I^2R$ losses)
- Operating cost savings large enough to pay back extra manufacturing costs in about a year
Key Design Changes

- Add active PFC
  - Reduces voltage and current stress at line extremes
  - Reduces EMI filtering
  - Improves reliability of a good design
  - Cost impact: ~ $1.50 @ 400W

- Add active clamp to main converter
  - Improves efficiency and increases parts integration
  - Optimizes design to adjust for regulated input voltage
  - Cost impact: ~ $0.75 @ 400W

- Improve output regulators
  - Add synchronous rectifiers
  - Replace rectifiers with switches and add control IC
  - Improves efficiency, especially at partial load
  - Cost Impact: ~ $0.75 @ 400W
Standby Efficiency Can Improve Dramatically in 80 Plus Designs

Standby mode (benchmark)

Source: Philips Semiconductors
“Right Sizing” – Matching Power Supply Size to Load

- Typical designs:
  - Idle at 20 to 40% of rated power supply output – precisely where efficiency curve can drop sharply
    - Provide extra output capacity and heat dissipation capability
      - most computers never need or use
    - Requires extra, unnecessary cost for larger fans and heat sinks

- “Right Sizing” a design can:
  - Afford higher performance technology
  - Reduce size and / or thermal stress
  - Reduce operating costs AND purchase price
Effect of PSU Efficiency & Sizing on Idle State Power, Intel-based system

Average Efficiency vs. Nameplate DC Power Rating (watts)

- 62.6 W at 70%
- 59.3 W at 85%
- 50.1 W at 90%

Nameplate DC Power Rating (watts):

0 100 200 300 400 500 600
Efficient, properly sized power supplies can have 50 to 70% lower net power consumption (ac input watts - dc output watts)

Commodity 200W Power Supply
- 143 watts AC
- 43 watts heat
- 100 watts DC

80 Plus 200W Power Supply
- 125 watts AC
- 25 watts heat
- 100 watts DC
Right-Sizing Pays for Most or All of the Extra Cost of a Well-Designed 80 Plus Power Supply

Cost Comparison Today vs 80 Plus

- EMI
- Bridge
- PFC
- Main
- Post Regulators
- Protection
- Fan

Legend:
- Today's Design
- 80 Plus Design
- Right Sized 80 Plus
80 Plus Product Status

- Four models from Seasonic qualify - 300, 400, 500, 600 watts. Volume prices from $27 to $85 each. Seasonic announced it intends to qualify every model it makes by end of 2005.
- Acbel qualifying model in commercial production for roughly a year
- Celetronix pre-production sample met 80 Plus levels two years ago; PC manufacturers asked for less efficient, cheaper model instead
- Delta also built highly efficient design years ago; did not pursue it after PC manufacturers showed no interest
- Crown Young Industries recently qualified and is coming to market
- OnSemi reference design is openly available to any manufacturer
- Sparkle is less than 1% away from qualifying
- Efficient manufacturers exploring licensing & private label options with other manufacturers that don’t have competitive designs
- 9 different VARs have already committed to offer 80 Plus power supplies in finished desktop systems – already purchased first wave of available inventory

www.80plus.org/wheretobuy.html
Server Power Supplies Lagging Desktop Efficiencies

Server Average Power Supply Efficiency

Average Efficiency (%) vs. Rated DC Output (watts)

- non-power factor corrected
- power factor corrected
Summary

- Efficient, right-sized power supply designs can cut power conversion losses (and resulting heat output) by 50 to 70%.
- Active power factor correction and high efficiency can improve performance and reliability through lower circuit stresses, lower cooling demands.
- Manufacturer extra cost of an optimized, right-sized design is typically less than $5; quotes higher than that are from power supply manufacturers without optimized designs or may not represent final quoted prices in a competitive bid.
- Market is already delivering cost-effective solutions – major manufacturers lagging behind smaller VARs and system integrators in meeting the needs of customers that want them.
- More utilities signing up each month to buy down the extra cost of 80 Plus power supplies and promote qualifying computer models to their customers.