

# Meeting Energy Efficiency Standards

*Balu Balakrishnan*

*President and CEO*

*Power Integrations*

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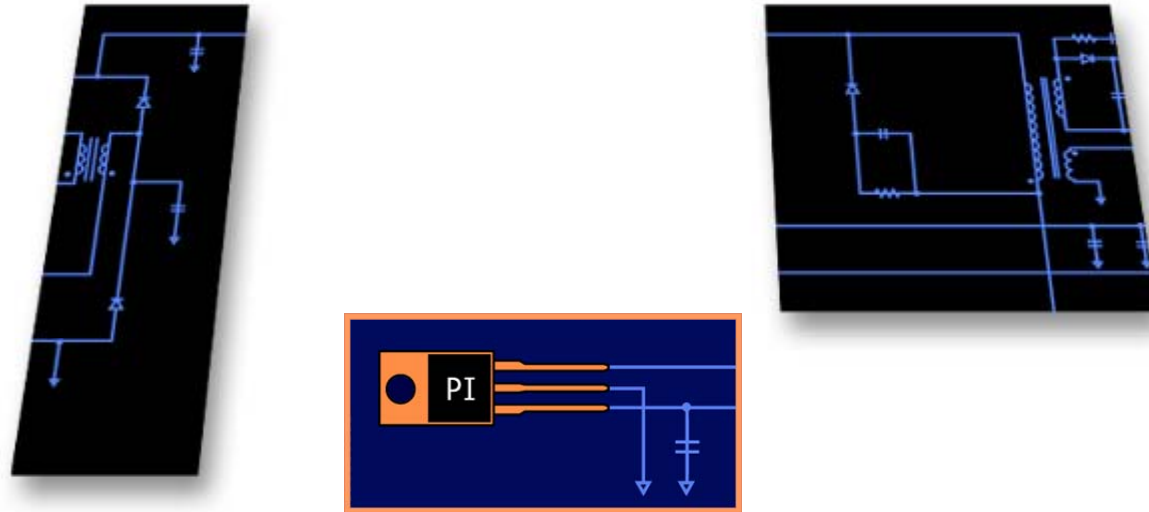
# The Leader in High Voltage AC-DC Power Conversion ICs



- **Revolutionary products**
  - *TOPSwitch*<sup>®</sup>, *TinySwitch*<sup>®</sup>, *LinkSwitch*<sup>®</sup>
- **Pioneer in energy efficiency (*EcoSmart*<sup>®</sup>)**
  - \$2.7 billion saved in energy waste to date
- **Products address 70% of all AC-DC power supplies**
- **Shipping > 650 million ICs per year**

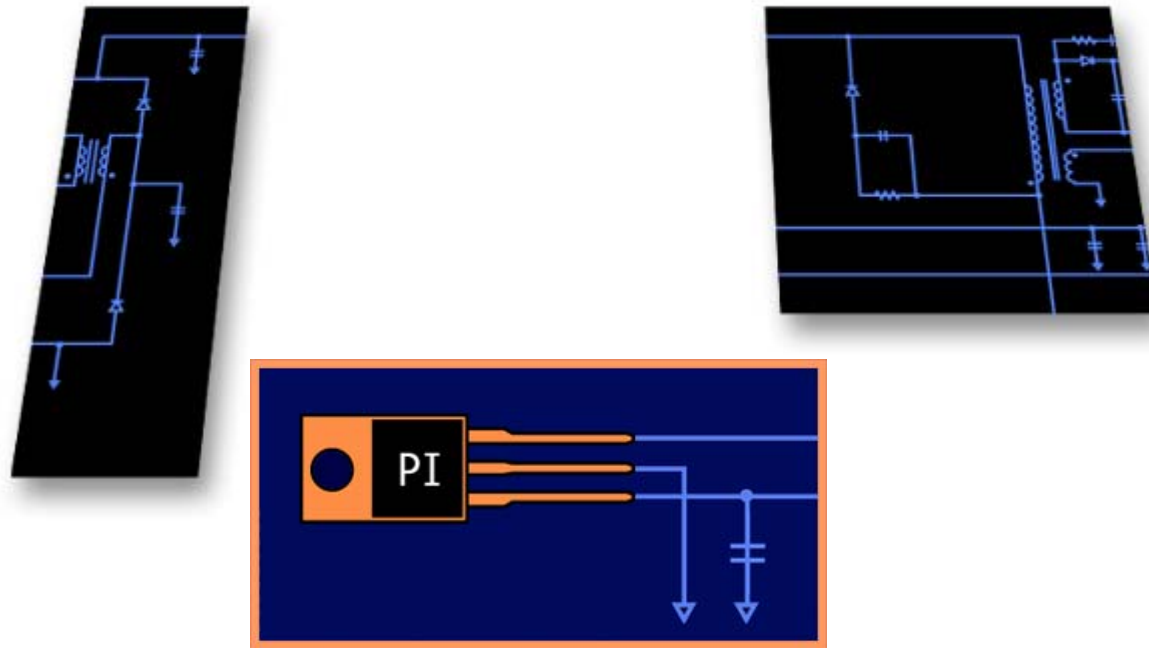


# Cost-Effective Integration



36-watt discrete adapter:  
75 discrete components

# Cost-Effective Integration



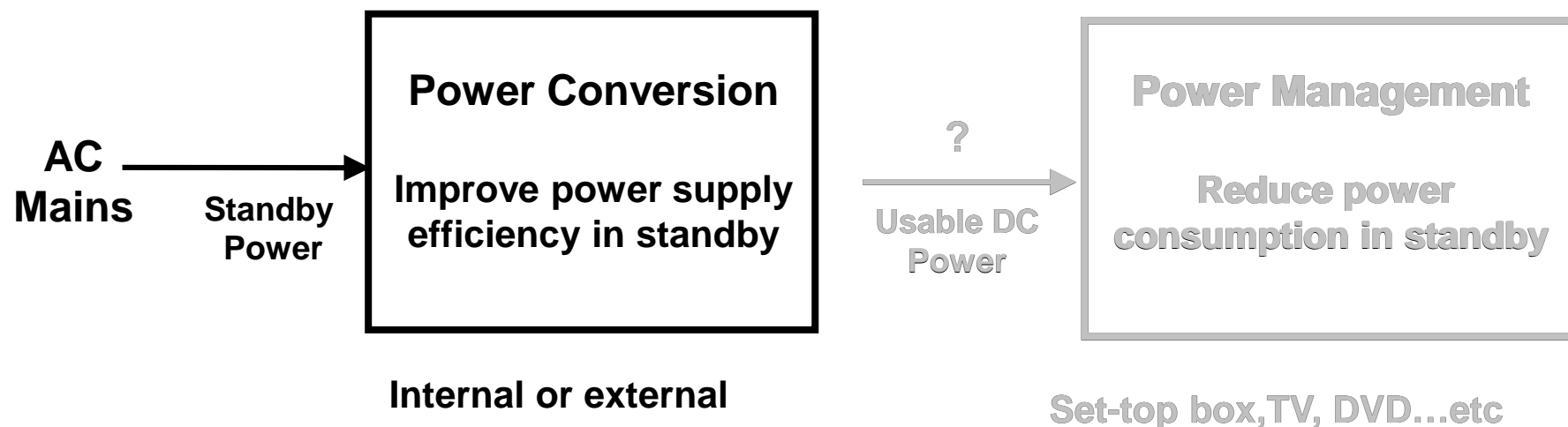
36-watt adapter with a PI chip: 25  
components

# Power Integrations - India

- **Established in 1995**
  - 600+ customers
  - 2 distributors (Spectra Innovations, SM Electronics & Components)
    - 1 more to be added in 2008
- **Applications design lab in Bangalore**
  - Conducted EMI test capability
- **Localized design support**
  - Customized designs for India mains
  - Design seminars



# Reducing Standby Power – Two Components



- **Each area can contribute to significant energy savings**
- **Many products need attention to both areas for maximum savings**
  - Power supply to improve standby efficiency
  - Power management to reduce consumption in standby

# Importance of Power Supply Standby Efficiency

Power supply standby efficiency	Total input power	Loss in Power supply	Power used by the product
33%	1.5 W	1.0 W	0.5W
67%	0.75 W	0.25 W	0.5W



- Doubling Standby Efficiency Saves: 0.75 W

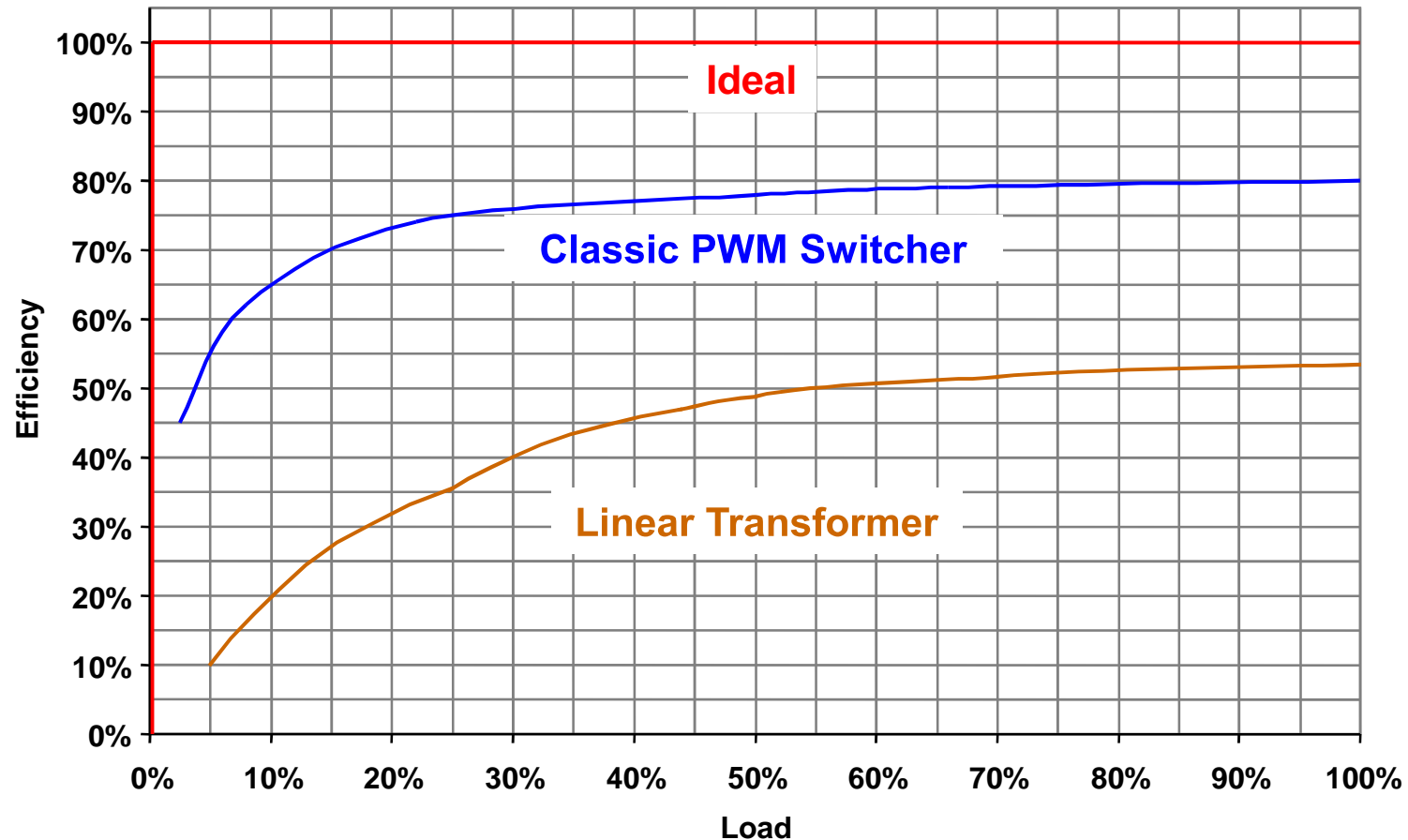
# A Good Example of Power Management



- Inexpensive phone (free with contract)
- Transmits and receives constantly
- Consumes only 20 mW in standby (180 hours)
- Consumes 1.15 W during calls (3 hours)
- On:Standby consumption ratio is 60:1

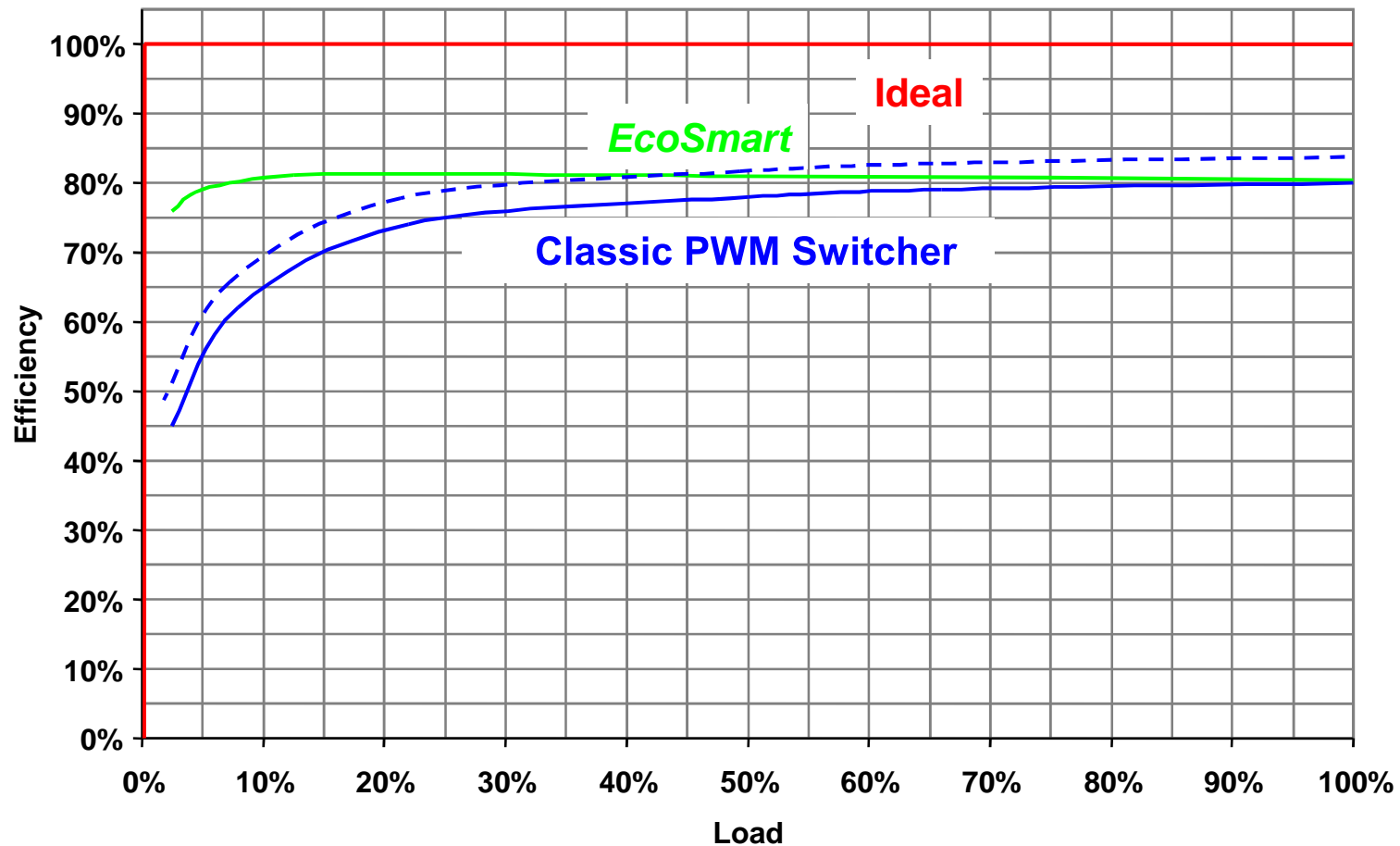
**Demonstrates what can be achieved through  
cost- effective power management**

# Switchers Offer High Efficiency



Switchers offer much higher efficiency at cost-parity with linears

# EcoSmart Cost Effectively Improves Stand-by and Active Mode Efficiency

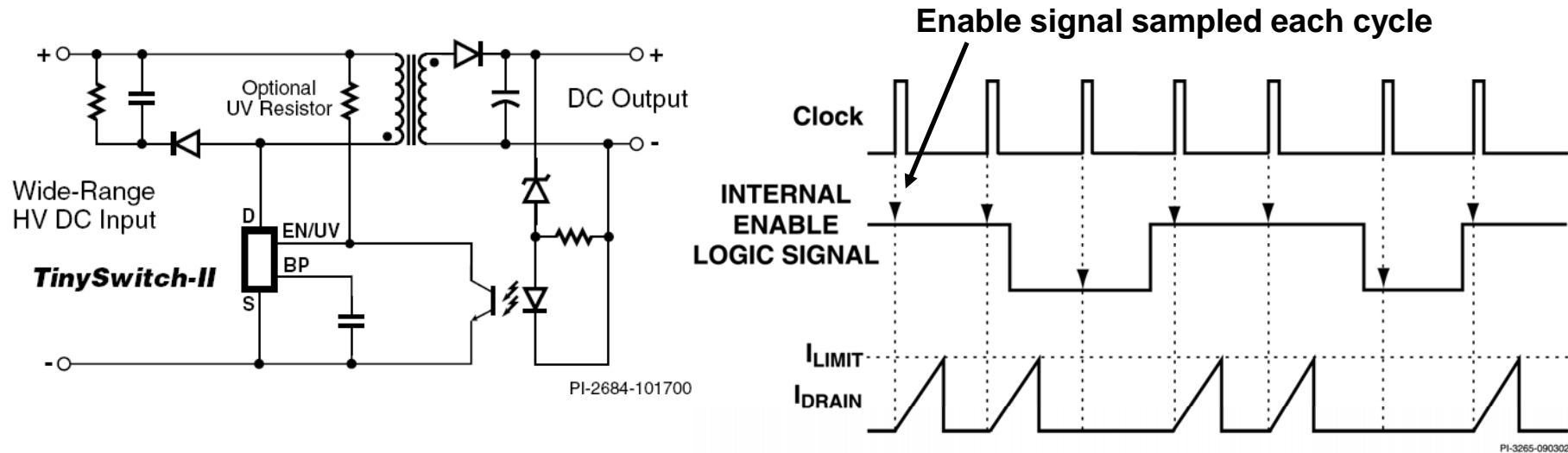


# Two Control Methods Cover All Power Ranges

Power Range	Architecture	Control Method
0 - 30 W	Single supply	<u>Digital ON/OFF</u> control
20 – 200 W	Single supply	<u>Multi-Mode PWM</u> control
>150 W	Dual supply	<u>Digital ON/OFF</u> control (for 0 - 50 W standby supply)

# Digital ON/OFF Control

# Digital ON/OFF Control



- **Each ON cycle delivers full power**
  - Cycles are disabled (OFF cycles) as needed to maintain regulation
- **Provides virtually constant efficiency over entire load range**
  - Effective switching frequency proportional to load
- **Much simpler than PWM control**
- **Meets 300mW no-load without bias winding**

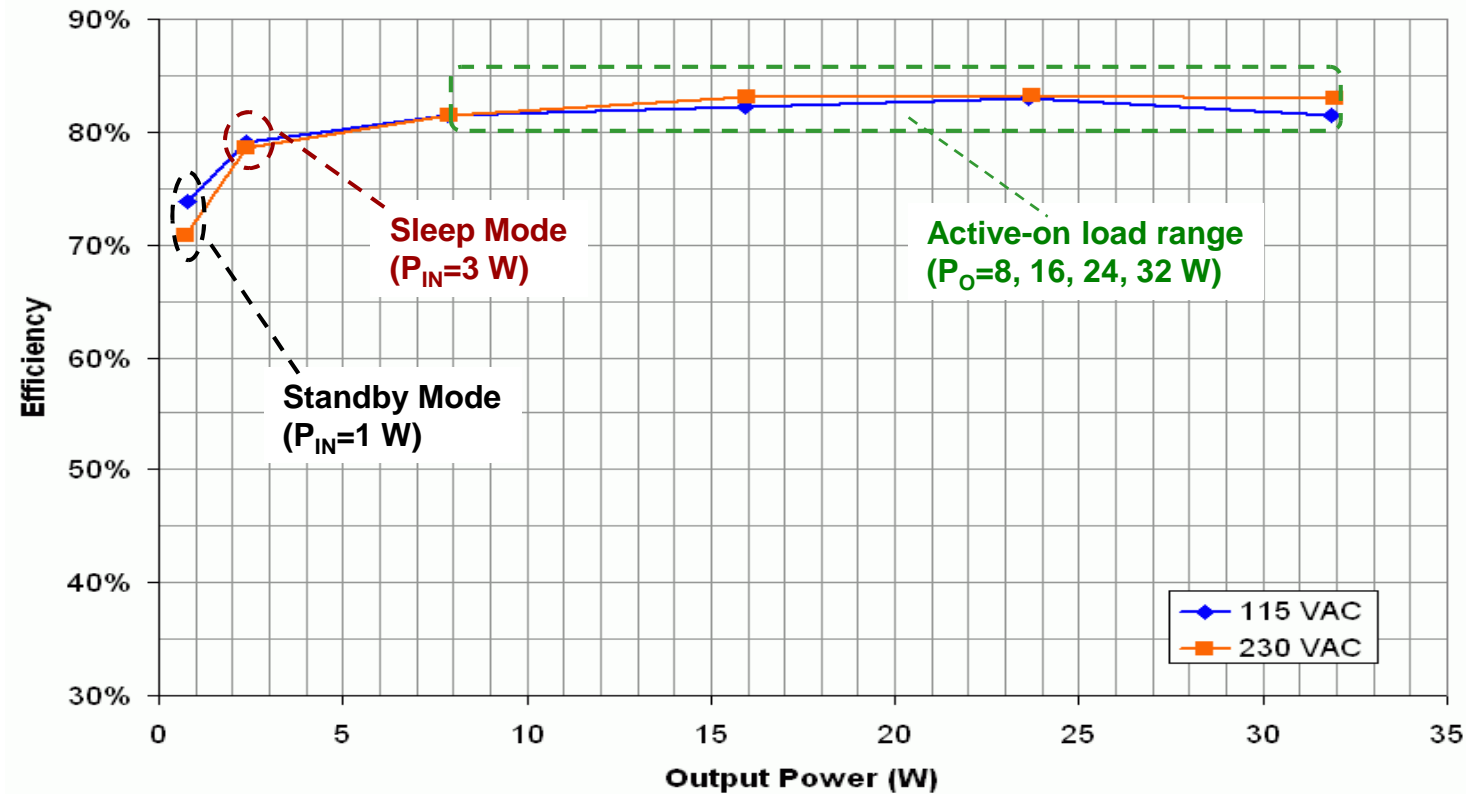


# 32 W (85 W Peak) Printer Power Supply



Greater than 70% efficiency at 1 W input

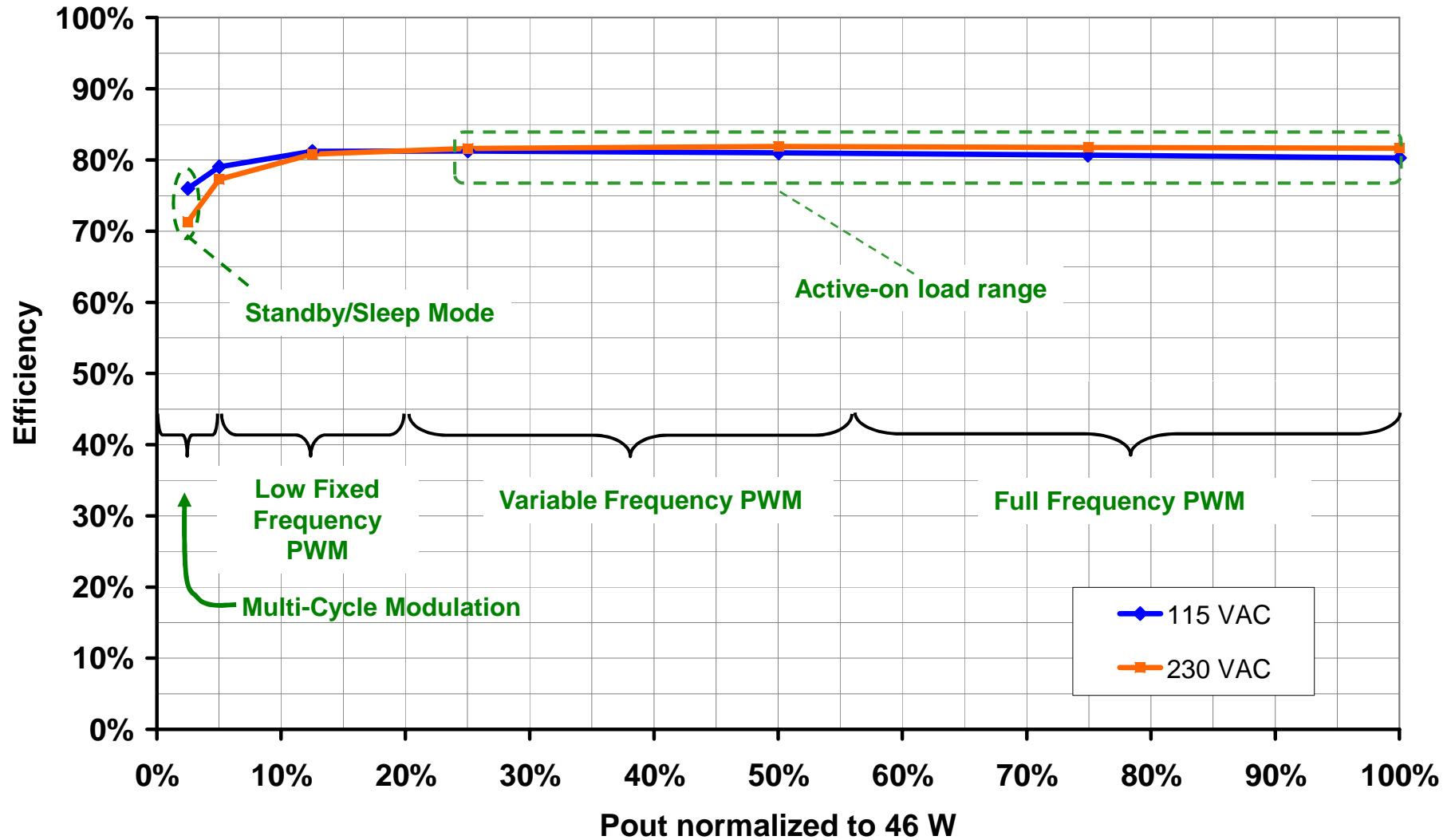
# Constant Efficiency Over a Wide Power Range



- **Average frequency automatically adjusted for line/load condition**
  - Constant efficiency operation over entire line and load range

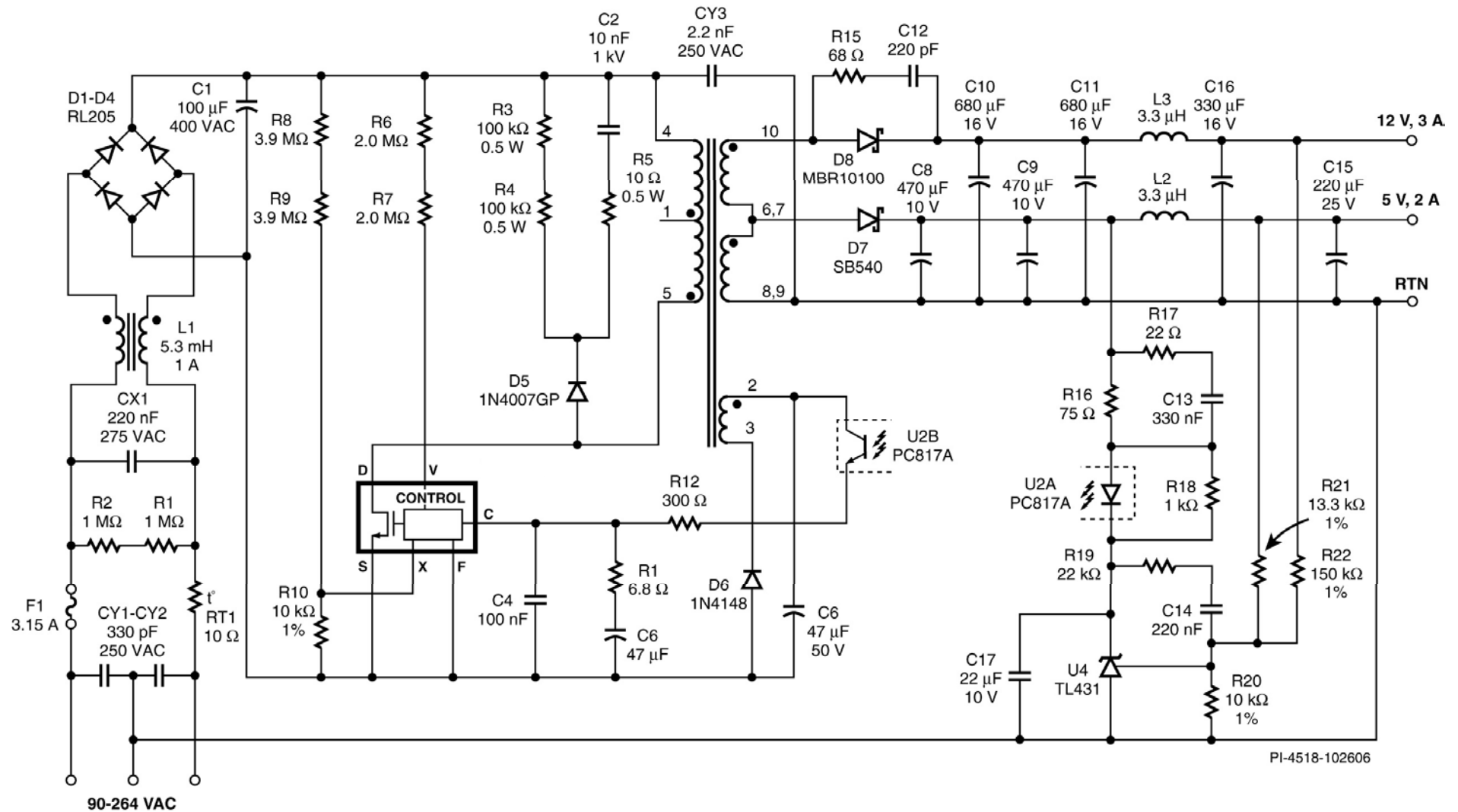
# Multi-Mode PWM Control

# Optimizing Operating Mode vs. Load



# Multi-Mode PWM Control Example

## 46 W LCD Monitor Supply

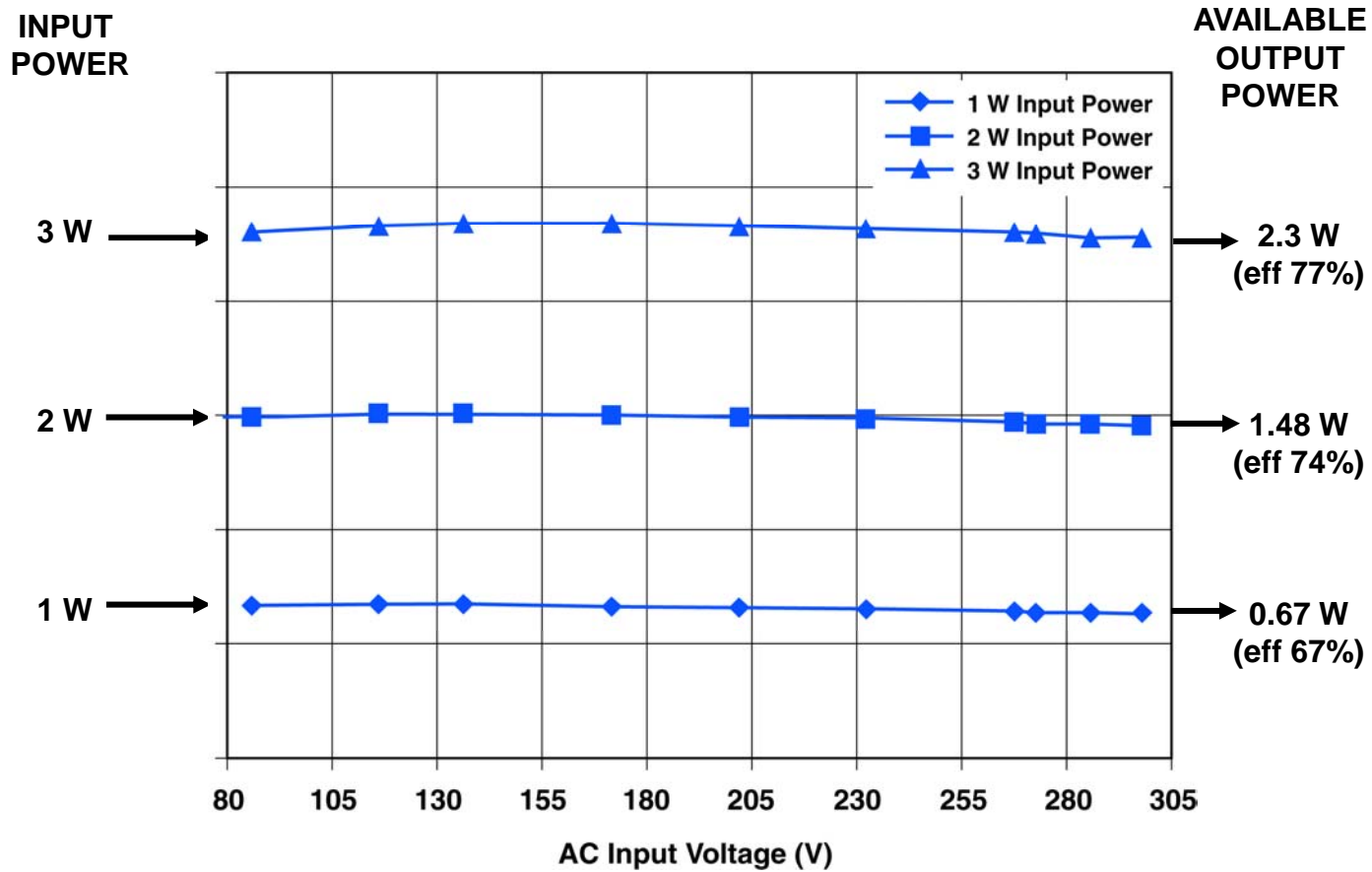


# Standby Power Supply (Digital ON/OFF Control)



# Usable Output Power

## PC Standby Supply



# Industry Begins Driving Energy Efficiency Specs

- **Proposed Energy Efficiency Index for Mobile Phones**
  - Driven by major OEMs
  - Suppliers commit by 2008 with updates every 3 years
- **Self certification**
  - Uses ENERGY STAR test method
- **Star rating to be shown on product or user guide**
- **Tighter than current standards**

Scoring	No-load power consumption
★★★★★	<b>0.03 W</b>
★★★★	<b>&gt; 0.03 W to 0.1 W</b>
★★★	<b>&gt; 0.1 W to 0.2 W</b>
★★	<b>&gt; 0.2 W to 0.3 W</b>
★	<b>&gt; 0.3 W to 0.5 W</b>
No stars	<b>&gt; 0.5 W</b>

# Conclusions

- **Increasing trend towards mandatory standards**
  - Energy efficiency: quick & painless way to slow down global warming
- **Some OEMs demanding even tighter requirements**
  - Proactively exploiting available technology
- **Two components to reducing standby consumption**
  - Power supply efficiency in standby
  - Product power management
- **Power supply standby efficiency is essentially free**
  - Design objective, not necessarily a cost issue



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