

Meeting Energy Efficiency Standards

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Power Integrations

International Conference on Standby Power

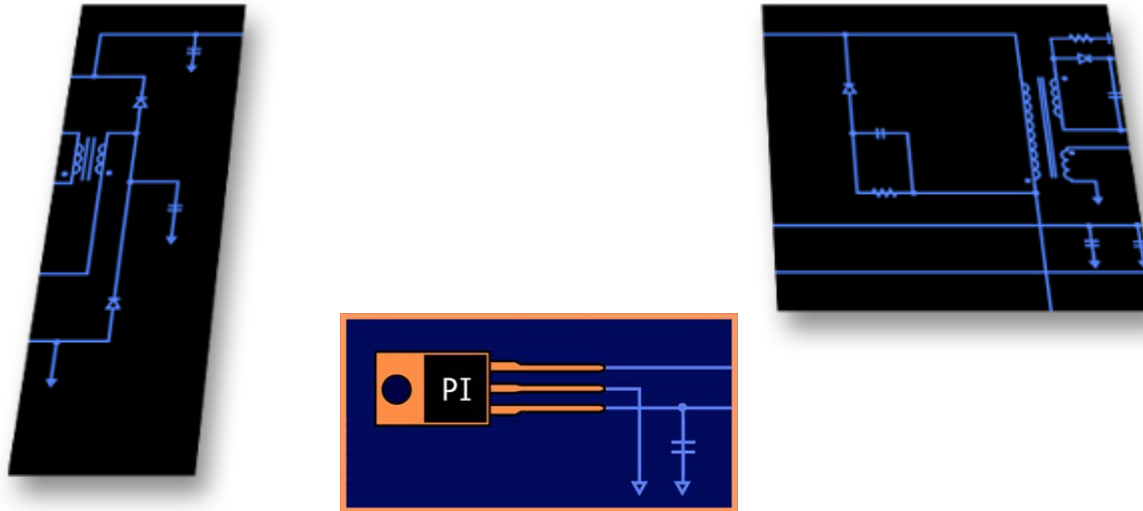
New Delhi, India April 3, 2008

The Leader in High Voltage AC-DC Power Conversion ICs

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

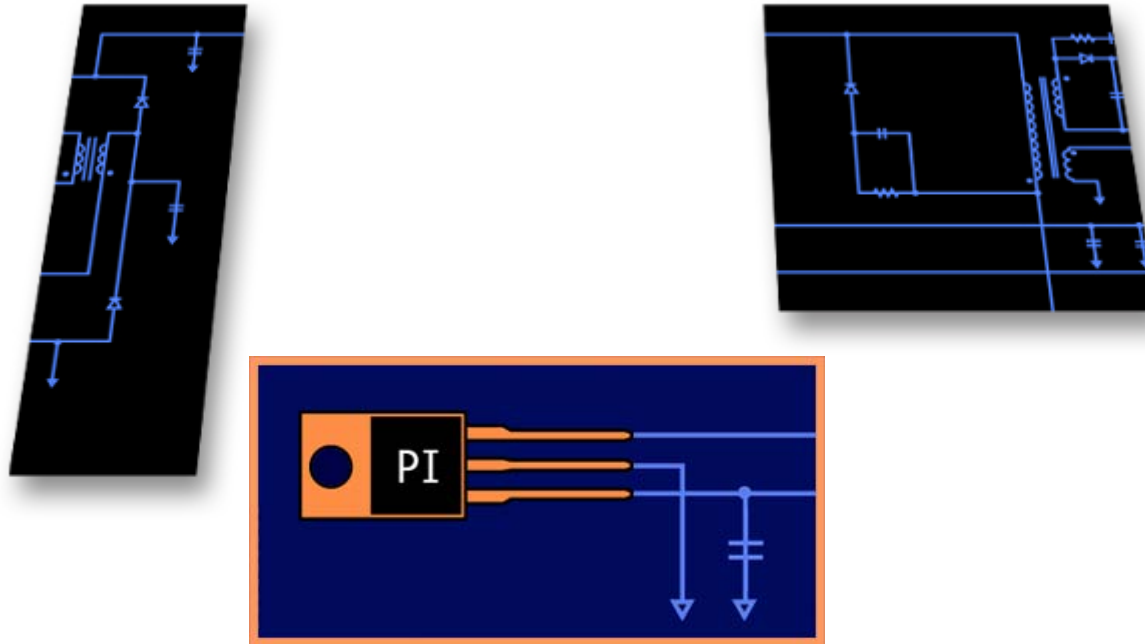


Cost-Effective Integration



36-watt discrete adapter:
75 discrete components

Cost-Effective Integration



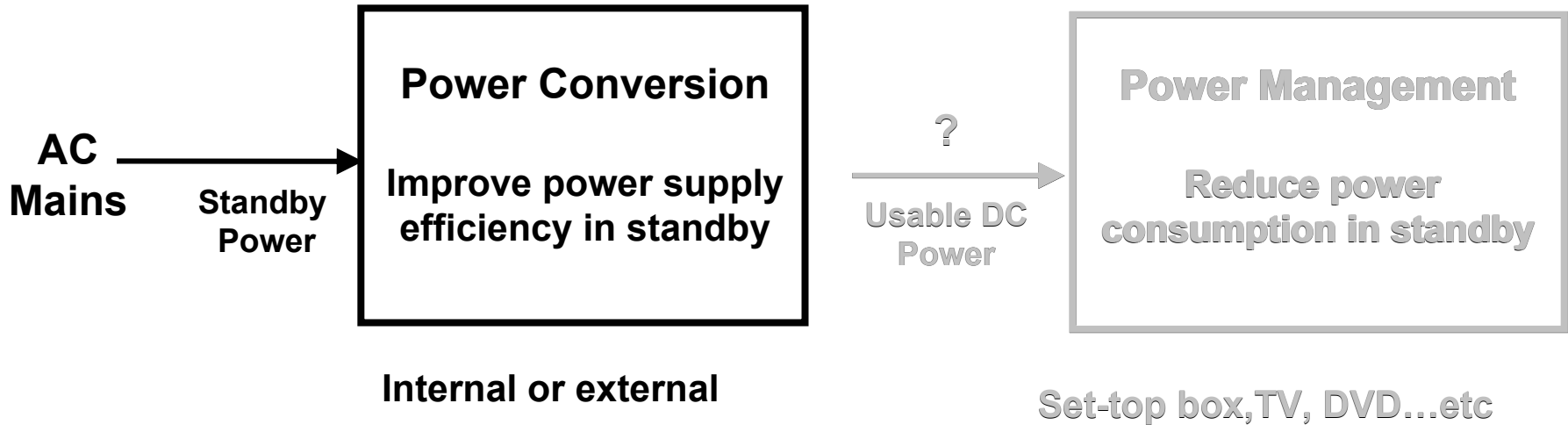
36-watt adapter with a PI chip: 25 components

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

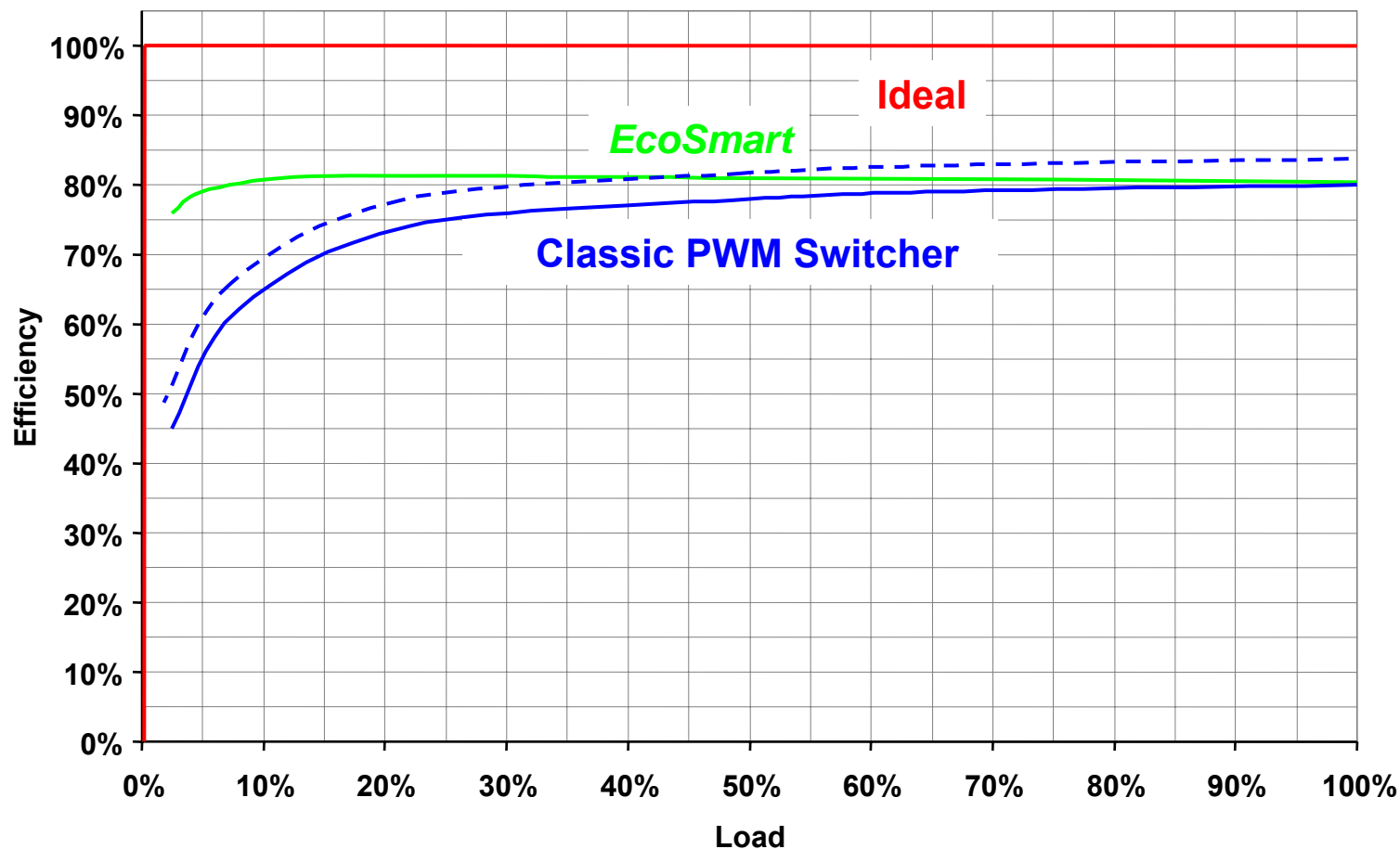
**Demonstrates what can be achieved through
cost- effective power management**

Switchers Offer High Efficiency



Switchers offer much higher efficiency at cost-parity with linears

EcoSmart Cost Effectively Improves Stand-by and Active Mode Efficiency

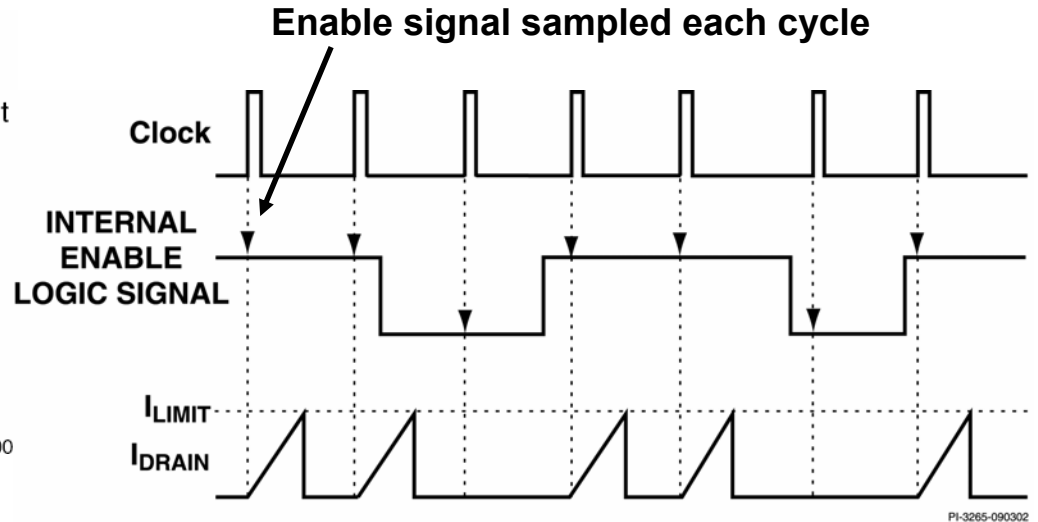
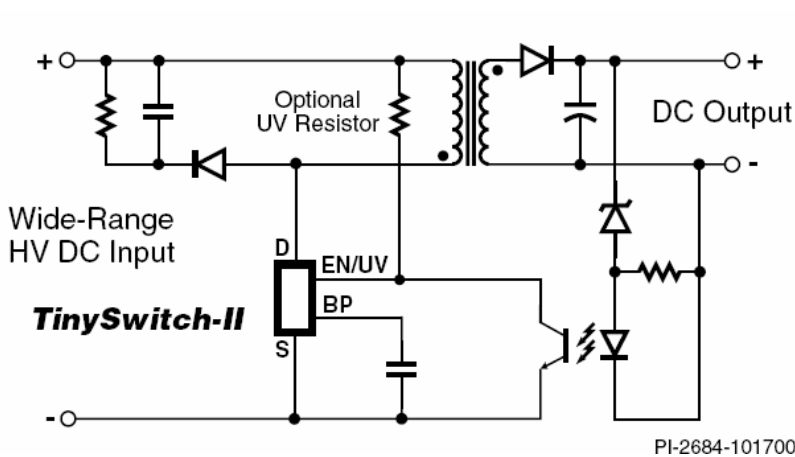


Two Control Methods Cover All Power Ranges

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

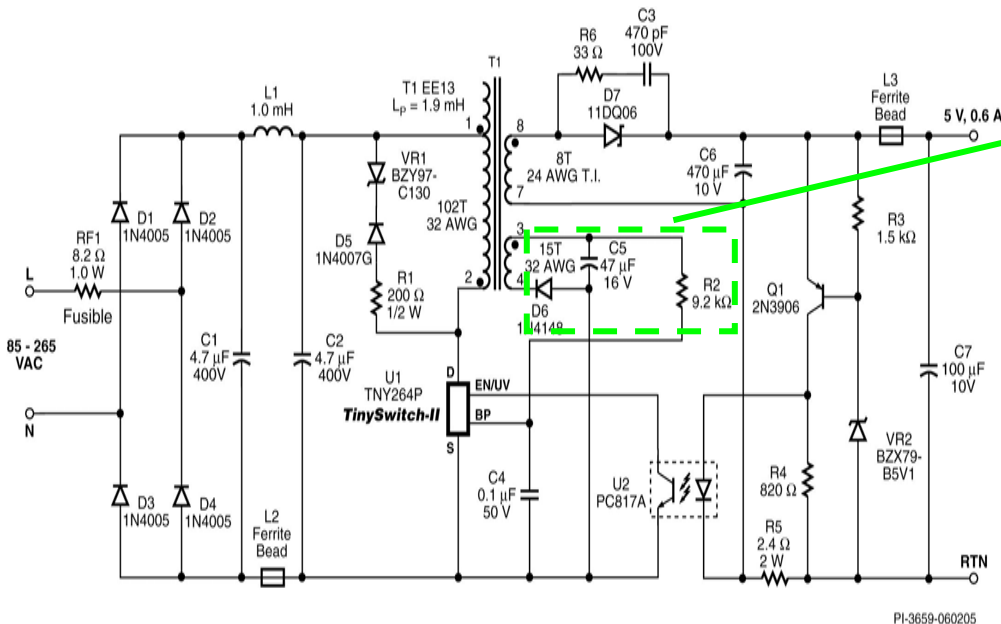
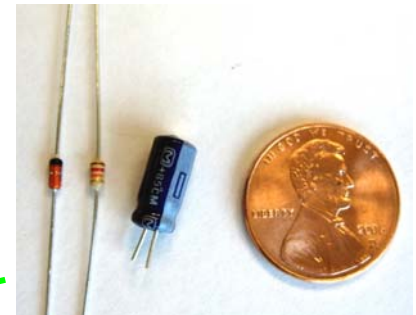
Digital ON/OFF Control



- **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**

Less Than 30mW No-load With Bias Winding

- Three parts reduce no-load consumption from ~300 mW to 30 mW
 - Energy saving is 27 cents per year
 - Component cost is 1 cent - about 5 cents at retail
 - Payback period only 2.2 months

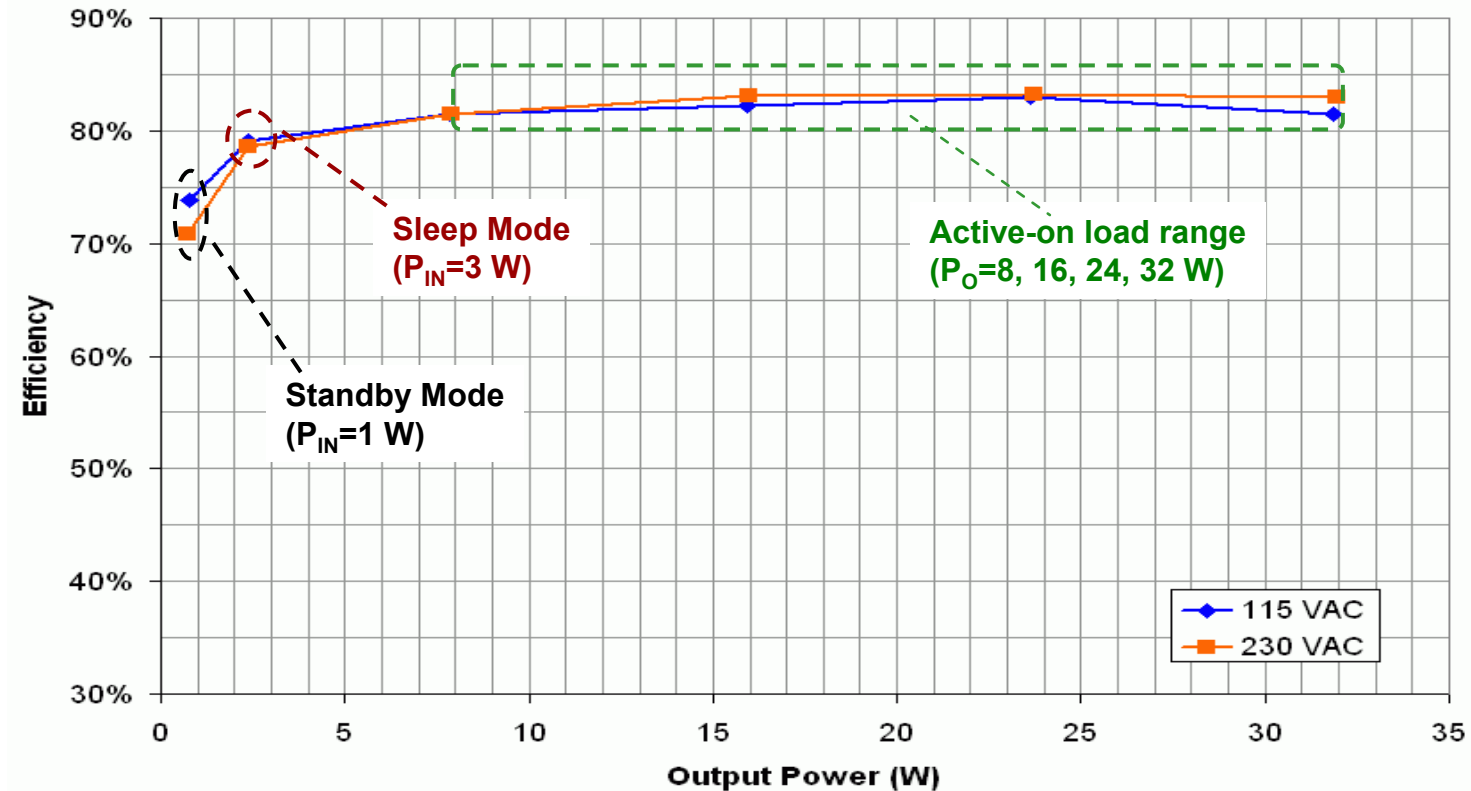


32 W (85 W Peak) Printer Power Supply



Greater than 70% efficiency at 1 W input

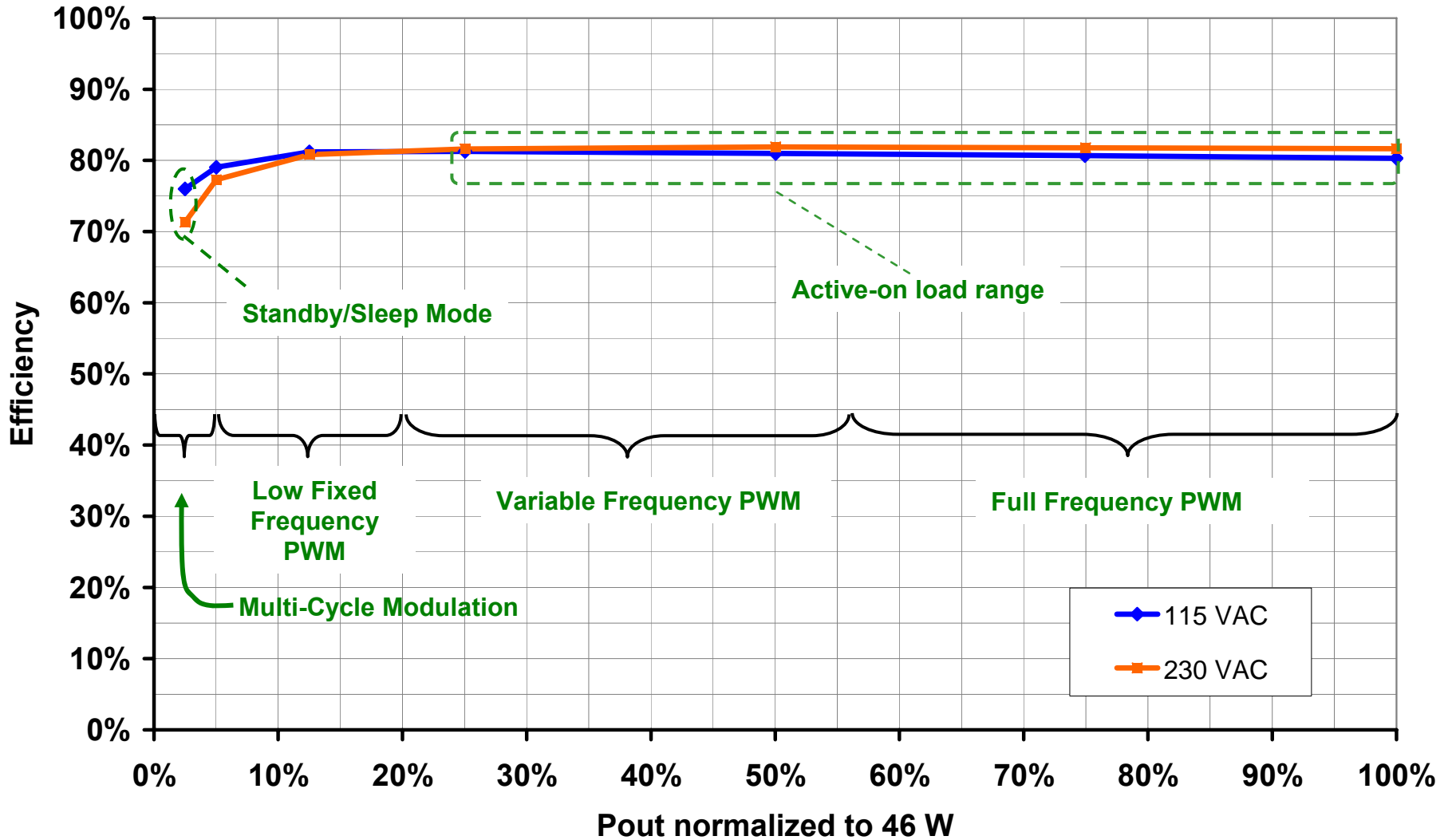
Constant Efficiency Over a Wide Power Range



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

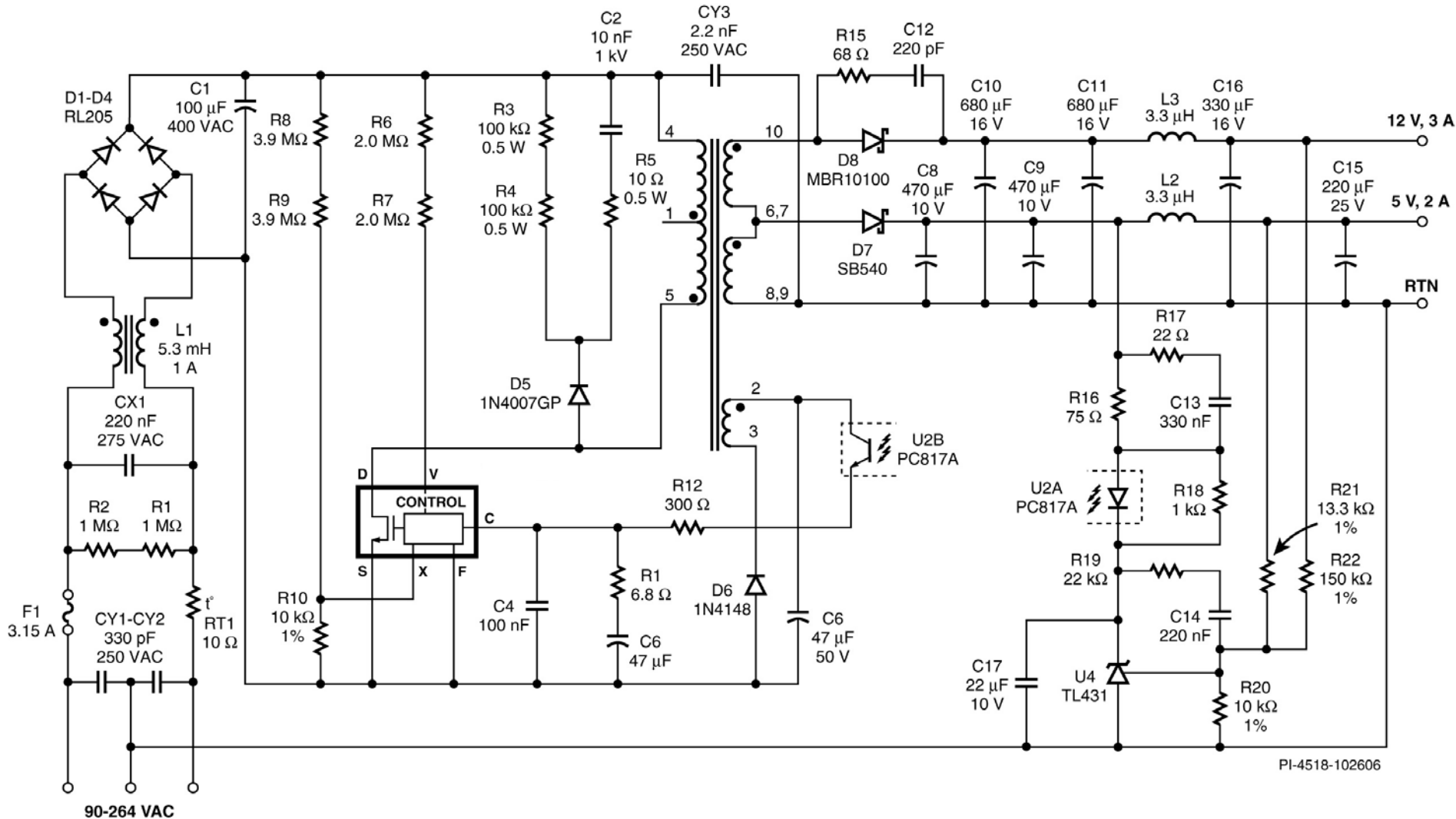
Multi-Mode PWM Control

Optimizing Operating Mode vs. Load



Multi-Mode PWM Control Example

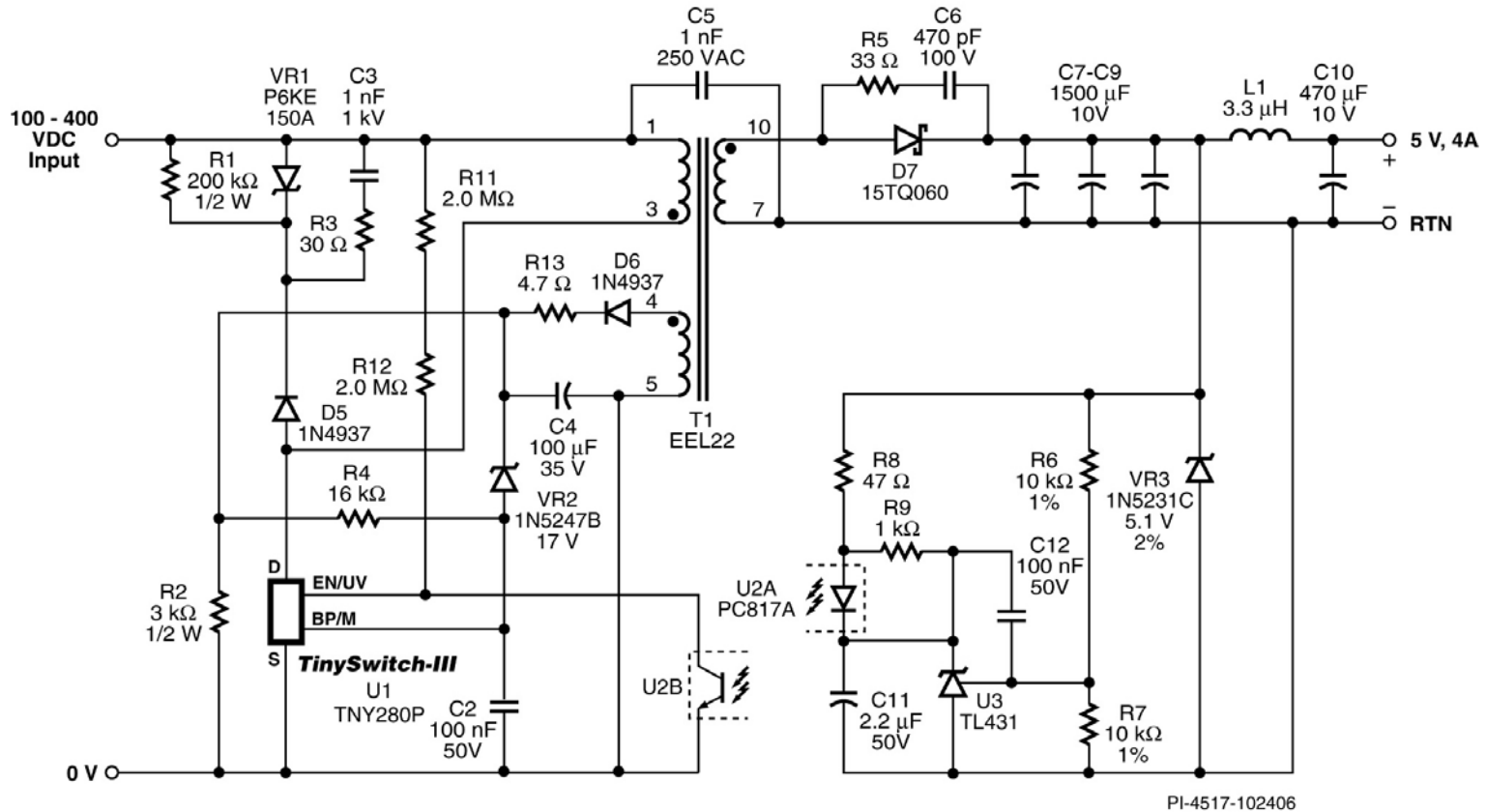
46 W LCD Monitor Supply



PI-4518-102606

Standby Power Supply (Digital ON/OFF Control)

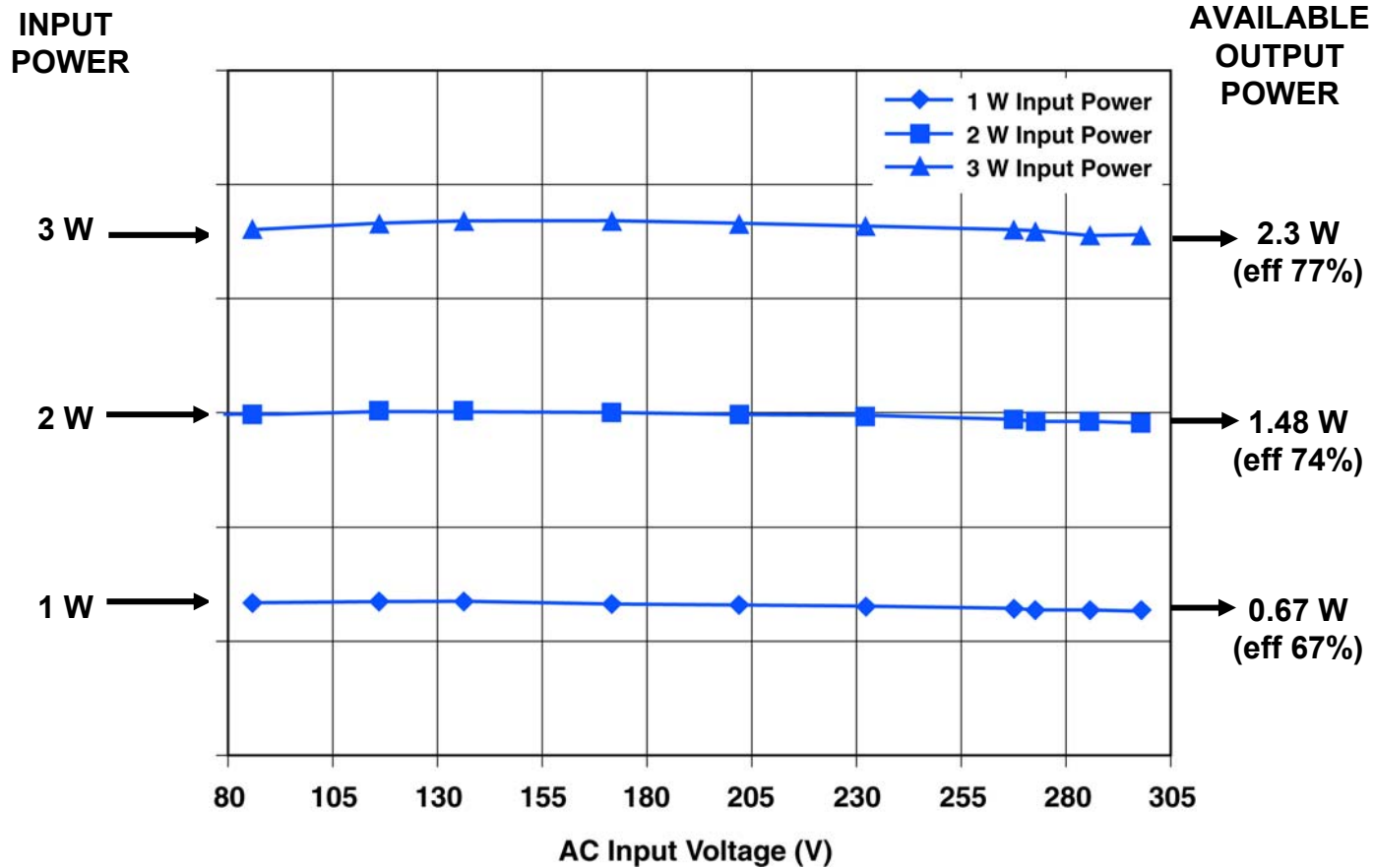
20 W PC Standby Supply



67% efficiency at 1 W input

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
	$\leq 0.03 \text{ W}$
	$> 0.03 \text{ W to } 0.1 \text{ W}$
	$> 0.1 \text{ W to } 0.2 \text{ W}$
	$> 0.2 \text{ W to } 0.3 \text{ W}$
	$> 0.3 \text{ W to } 0.5 \text{ W}$
No stars	$> 0.5 \text{ W}$

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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