

Design Idea DI-38

TinySwitch-II® 15 W PC Standby: Meets 1 W Standby Executive Order



Application	Device	Power Output	Input Voltage	Output Voltage	Topology
PC Standby	TNY268P	15 W	140-375 VDC	5 V, 15 V	Flyback

Design Highlights

- Low cost, low component count solution for PC standby.
- >600 mW output power with <1 W input power.
- 132 kHz operation allows small, low cost EE19 core.
- ON/OFF digital regulation – no loop compensation needed.
- $\pm 5\%$ output tolerance with simple Zener reference.

Operation

The *TinySwitch-II* PC standby supply in Figure 1 delivers 15 W output power. Two outputs are generated: 5 V for the processor and peripherals and a primary side 15 V for the main power supply switcher. The design shown in Figure 1 takes advantage of many of the built-in features of TNY268P.

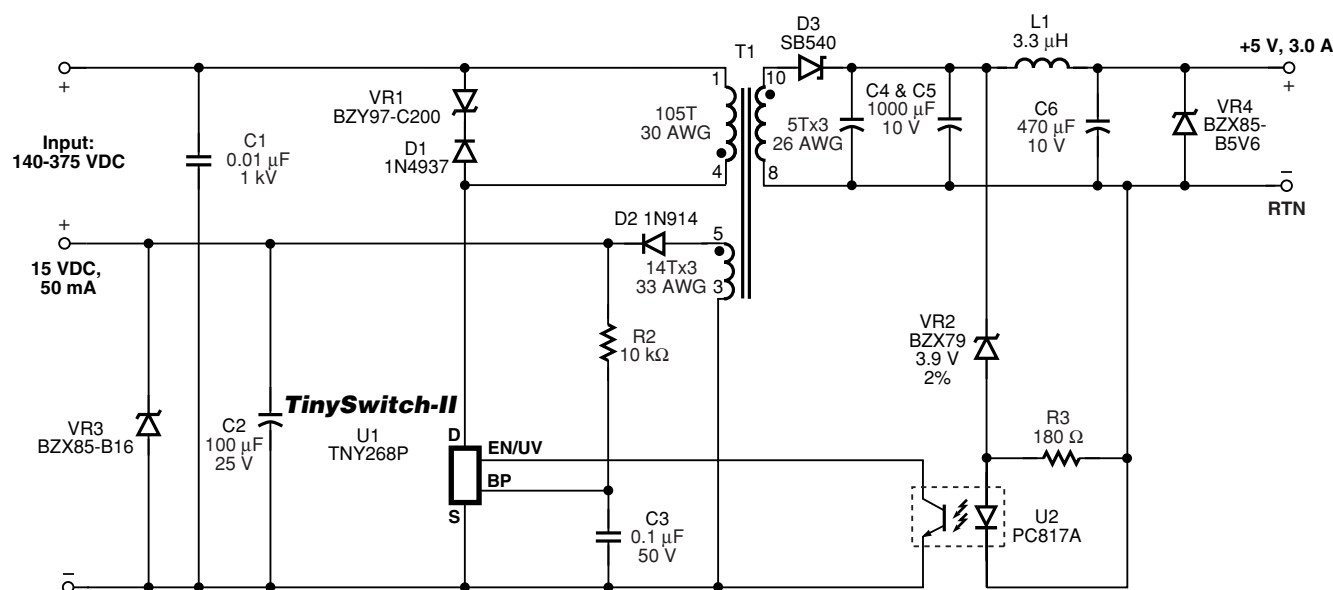
The combined voltage drops of Zener diode (VR2) and optocoupler (U2) set the output voltage. R3 biases VR2 according to its specification. The *TinySwitch-II* feedback current is independent of load allowing $\pm 5\%$ output voltage tolerance with this simple Zener reference.

Due to the digital nature of the *TinySwitch-II* control scheme, no loop compensation is required. In addition, the current transfer ratio (CTR) of the optocoupler is not critical and no DC gain setting resistor in series with VR2 is required.

The 15 V primary winding is used to provide a low voltage supply for the BYPASS pin. This optimizes efficiency by disabling the internal high voltage current source that normally powers the IC from the DRAIN. R2 is chosen to provide >500 μ A under standby conditions, exceeding the maximum IC current consumption. An internal Zener clamps the BYPASS pin to the required voltage.

Key Design Points

- To optimize efficiency:
 - Use continuous mode transformer design to reduce primary and secondary RMS currents.
 - Use low reflected voltage to reduce primary turns and minimize leakage inductance using complete winding layers fully utilizing bobbin width.
 - Place tape between primary layers to reduce capacitance and therefore switching losses.



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Figure 1. *TinySwitch-II* – TNY268P, 15 W PC Standby Power Supply.

- Minimize secondary circuit bias currents. Use a low current Zener feedback for best tolerance.
- Standby power is reduced further with a TL431 secondary reference, which requires less bias current.
- Optional UV sense resistor (2 M Ω for 100 VDC threshold) from input DC rail to EN/UV pin prevents turnoff glitches, if necessary.
- Layout – minimize high current loop area on primary and secondary to reduce ripple and noise on outputs.
- Optimum cross regulation on 5 V and 15 V windings is achieved by winding in full even layers using parallel wires

if necessary. An RCD clamp also improves cross - regulation, though increases losses – use >200 k Ω resistor to limit dissipation.

- The bias winding is also wound outside the secondary winding. As well as improving cross-regulation by isolating the bias from primary leakage spike voltages, this minimizes primary-to-secondary leakage inductance to improve efficiency.
- C1 provides local decoupling if main capacitors are located away from standby supply input.

TRANSFORMER PARAMETERS	
Core Material	PC40 EE19, A_L of 109 nH/T ²
Bobbin	EE19, vertical 10 pin
Winding Order (Pin Numbers)	Primary (4-1), tape, 5 V secondary TIW (10-8), tape, 15 V bias (5-3)
Primary Inductance	1.2 mH $\pm$ 5%
Primary Resonant Frequency	800 kHz (minimum)
Leakage Inductance	30 μ H (maximum)

Table 1. Transformer Construction Information.

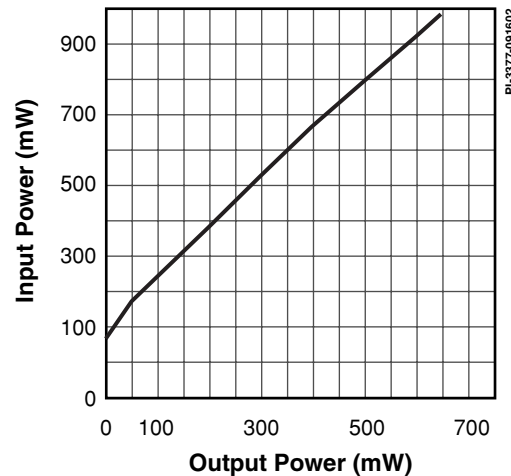


Figure 2. Standby Power Consumption vs. Output Power Measured at 325 VDC.

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WORLD HEADQUARTERS AMERICAS

Power Integrations, Inc.
San Jose, CA 95138 USA
Customer Service:
Phone: +1 408-414-9665
Fax: +1 408-414-9765
e-mail: usasales@powerint.com

CHINA

Power Integrations International
Holdings, Inc.
China
Phone: +86-755-8367-5143
Fax: +86-755-8377-9610
e-mail: chinasales@powerint.com

EUROPE & AFRICA

Power Integrations (Europe) Ltd.
United Kingdom
Phone: +44-1344-462-300
Fax: +44-1344-311-732
e-mail: eurosales@powerint.com

KOREA

Power Integrations
International Holdings, Inc.
Seoul, Korea
Phone: +82-2-782-2840
Fax: +82-2-782-4427
e-mail: koreasales@powerint.com

SINGAPORE

Power Integrations, Singapore
Republic of Singapore 308900
Phone: +65-6358-2160
Fax: +65-6358-2015
e-mail: singaporesales@powerint.com

JAPAN

Power Integrations, K.K.
Keihin-Tatemono 1st Bldg.
Japan
Phone: +81-45-471-1021
Fax: +81-45-471-3717
e-mail: japansales@powerint.com

APPLICATIONS HOTLINE

World Wide +1-408-414-9660

TAIWAN

Power Integrations
International Holdings, Inc.
Taipei, Taiwan
Phone: +886-2-2727-1221
Fax: +886-2-2727-1223
e-mail: taiwansales@powerint.com

INDIA (Technical Support)

Innovatech
Bangalore, India
Phone: +91-80-226-6023
Fax: +91-80-228-9727
e-mail: indiasales@powerint.com

APPLICATIONS FAX

World Wide +1-408-414-9760