

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Charger	TNY264P	3 W	85-265 VAC	5 V, 600 mA	Flyback

Design Highlights

- Less than 30 mW no-load power consumption (for 115/230 VAC input)
- Meets CISPR-22 Class B without Y capacitor
- Low cost, low component count solution

Operation

The *TinySwitch-II* flyback converter in Figure 1 generates a constant voltage, constant current (CV/CC) 5 V, 600 mA output. Typical applications include wall-mounted chargers for cell phones, PDAs and other battery powered portable equipment.

The key performance characteristic of the circuit shown is the extremely low no-load consumption of <30 mW. A linear transformer charger of similar rating will typically consume 1 W to 4 W at no-load. At \$0.12/kWh, the *TinySwitch-II* can therefore reduce energy costs by \$1 to \$4 per year.

The no-load performance is achieved by using a transformer bias winding as a low voltage source for *TinySwitch-II* operating current. Even without this winding, a *TinySwitch-II* circuit will consume <300 mW at no-load. However, by providing external bias, the internal high voltage current source, which normally powers the IC from the DRAIN pin, is disabled and a further reduction in consumption is therefore achieved.

The bias winding should provide enough current to fully disable

the internal current source at no-load. Other load conditions are not important as the device will be powered from the DRAIN pin if bias is lost, allowing a simple flyback winding to be used. Figure 2 shows that the bias winding and choice of R2 should provide approximately 550 μA at no-load to minimize consumption.

The circuit meets CISPR-22 Class B conducted EMI limits without a Y capacitor and therefore has very low AC leakage current. *TinySwitch-II* frequency jitter, use of the bias winding as a shield and capacitor C3 to soften leakage inductance spikes combine to provide the EMI performance.

Key Design Points

- Design bias winding circuit to provide approximately 550 μA at no-load. Figure 2 shows the details.
- Minimize secondary circuit bias currents. Use low current feedback Zeners for best tolerance. The very low bias current in this design will provide approximately $\pm 10\%$ output voltage tolerance. A precision reference (e.g. TL431) can be used to reduce this if required.
- Design transformer with low reflected voltage to minimize clamp losses. A bigger device (TNY266) may help to further reduce V_{OR} .
- Wind transformer for lowest leakage inductance. Choose wire gauges to completely fill winding layers.
- Winding transformer with tape between primary layers further reduces intra-winding capacitance and no-load consumption.

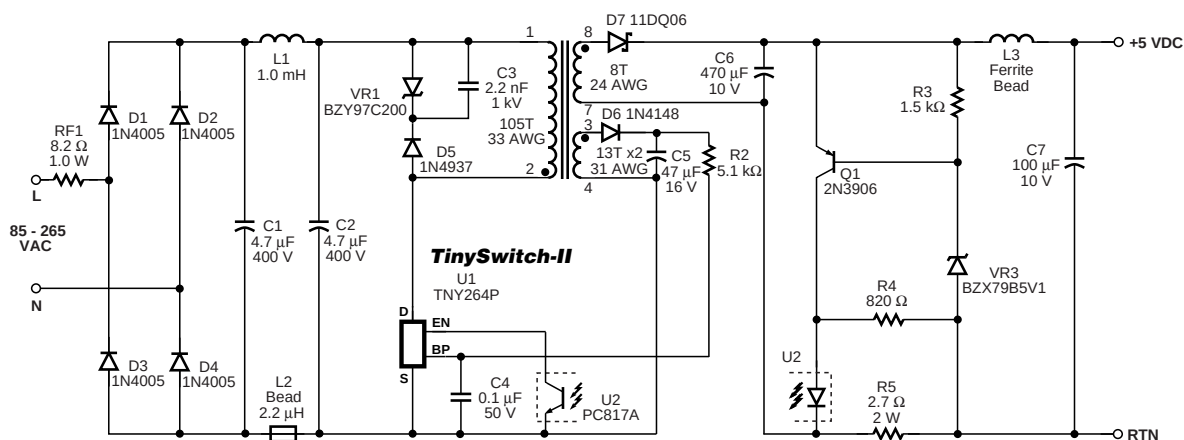


Figure 1. TinySwitch-II 3.0 W Cell Phone Charger.

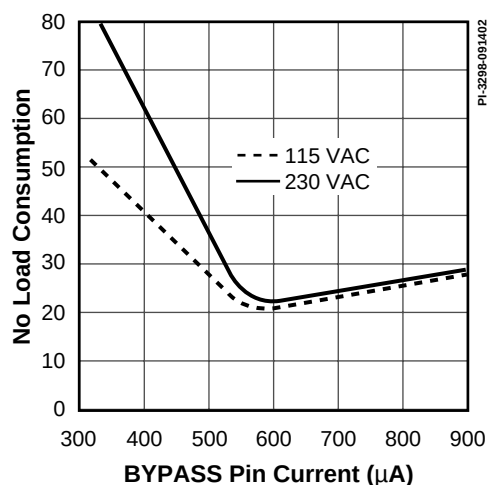


Figure 2. No-load Input Power vs. BYPASS Pin Current.

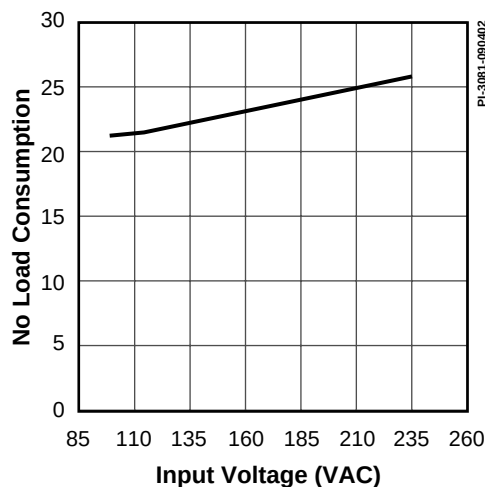


Figure 3. No-load Input Power vs. Line Voltage.

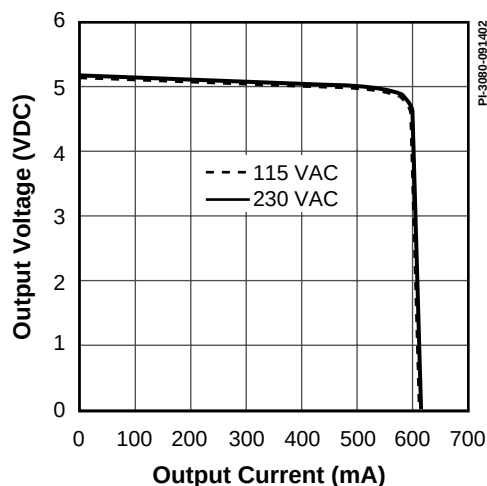


Figure 4. 5.0 VDC, 600 mA CV/CC Curve.

TRANSFORMER PARAMETERS	
Core Material	EE13 TDK PC40, or equivalent A_L of 128 nH/T ²
Bobbin	EE13, 8 pin
Winding Order (pin numbers)	Primary (1-2), tape, Bias (3-4), tape, Secondary (7-8), 5 V, tape
Primary Inductance	1.9 mH $\pm 10\%$
Primary Resonant Frequency	500 kHz (minimum)
Leakage Inductance	50 μ H (maximum)

Table 1. Transformer Construction Information.

For the latest updates, visit our Web site: www.powerint.com

Power Integrations reserves the right to make changes to its products at any time to improve reliability or manufacturability. Power Integrations does not assume any liability arising from the use of any device or circuit described herein, nor does it convey any license under its patent rights or the rights of others. The products and applications illustrated herein may be covered by one or more U.S. and foreign patents or potentially by pending U.S. and foreign patent applications assigned to Power Integrations. A complete list of Power Integrations' patents may be found at www.powerint.com.

The PI Logo, **TOPSwitch**, **TinySwitch** and **EcoSmart** are registered trademarks of Power Integrations, Inc. **PI Expert** is a trademark of Power Integrations Inc. ©Copyright 2002, Power Integrations, Inc.

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