



# Design Idea DI-43

## TOPSwitch-GX<sup>®</sup> 30 W, Universal Input, 12 V Supply with <250 mW No-load

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Adapter	TOP244Y	30 W	85-265 VAC	12 V	Flyback

### Design Highlights

- High efficiency (79% minimum)
- Low component count
- Excellent input no-load consumption <200 mW at 115 VAC and <250 mW at 230 VAC input
- Rugged supply includes UV/OV shutdown, thermal and short circuit protection with auto-recovery
- Comfortably meets EN55022B and CISPR22B conducted EMI standards
- Overload power delivery at 265 VAC limited to 160% of rated load

### Operation

The TOPSwitch-GX integrates many features to implement low cost, switched mode power supplies.

A single resistor (R1) implements input UV/OV protection using the L pin (UV typ. 100 VDC; OV typ. 450 VDC). Resistor R4 programs the U1 current limit to 85% of nominal, and resistor R2 reduces this current limit as input voltage increases,

limiting the maximum overload power of the supply. The reduced current limit allows continuous conduction mode operation with a small transformer, reducing primary and secondary peak currents, optimizing efficiency, and reducing component stress.

Diode D1 and VR1 form a clamp circuit that absorbs leakage inductance energy during normal operation, with Zener VR1 clamping the voltage to a safe level. Capacitor C2 diverts some of the leakage energy from VR1, reducing its temperature and increasing overall efficiency. After clamping, reverse current flows through D1, recovering some of the clamp energy. R3 limits the reverse current in D1 and improves EMI by limiting drain voltage ringing.

Resistors R9 and R10 set the output voltage. Components C10 and R8 provide compensation with R6 setting DC loop gain. Using a TL431 error amplifier gives better regulation and output voltage tolerance than a Zener reference and also provides better no-load performance due to lower (1 mA) bias current.

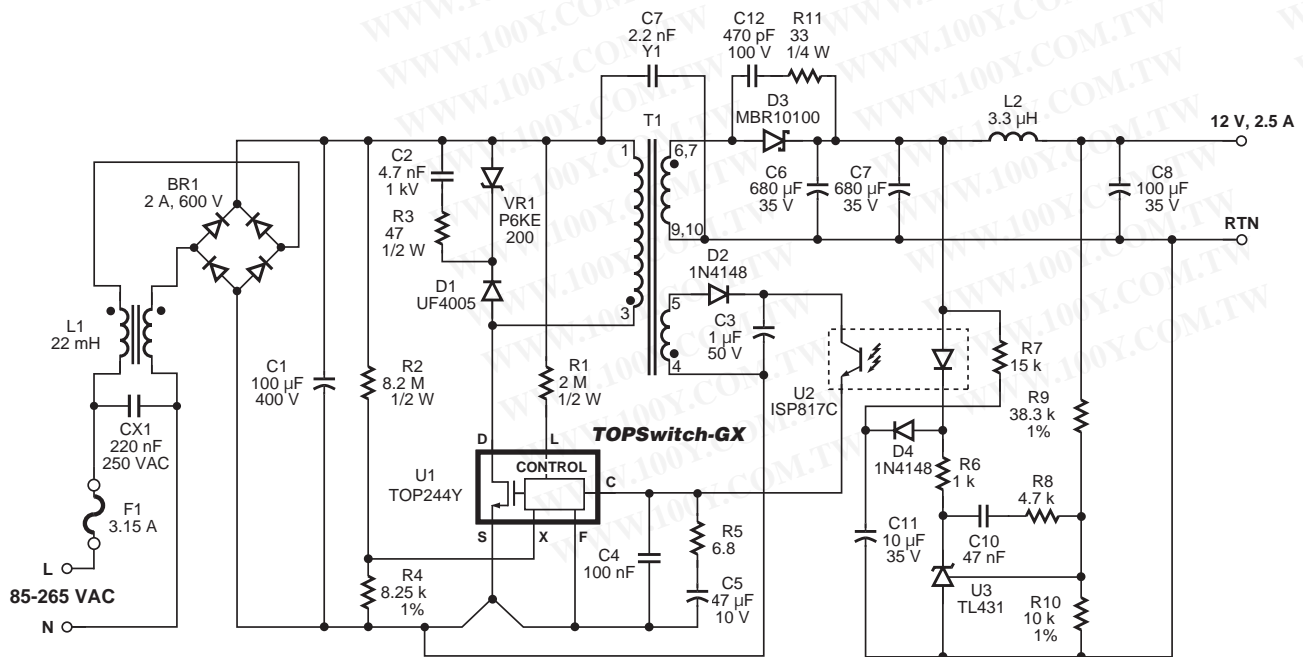


Figure 1. TOPSwitch-GX 12 V, 30 W Universal Power Supply.

PI-3405-112702

Optional components D4, C11, and R7 implement soft finish to limit startup overshoot. Resistor R7 discharges this soft-finish capacitor at power down.

## Key Design Points

- Use reflected voltage from 90 V to 120 V
- Compact layout for components D3, C6 and C7 will improve efficiency. Make sure the both capacitors C6 and C7 have equal secondary loop areas to balance the ripple currents in each.
- Clamp: for lowest cost use an RCD clamp replacing Zener VR1 with a power resistor. For best no-load performance, use the Zener clamp as shown.
- Reference voltage: Use low current Zener secondary reference with 5 mA bias current for lowest cost. Use TL431 as shown for both better regulation accuracy and no-load consumption (due to lower bias current 1 mA).

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-54151736  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

TRANSFORMER PARAMETERS	
Core Material	EF25 Nippon Ceramic NC-2H $A_{LG}$ of 264 nH/T <sup>2</sup>
Bobbin	EF25 10 pin (Miles Platts FE0100 with TBS-601)
Winding Details	Primary: 58T x 26 AWG Bias: 2T x 26 AWG 12 V: 6T 4 x 25 AWG T.I.W. (T.I.W. = Triple Insulated Wire)
Winding Order (Pin Numbers)	1/2 Primary, tape, 1/2 primary (1-3), tape, Bias (5-4), tape, 12 V (9-10, 6-7), tape
Inductance	Primary: 876 $\mu$ H $\pm$ 10% at 132 kHz, Leakage: 28 $\mu$ H (maximum)
Primary Resonant Frequency	570 kHz (minimum)

Table 1. Transformer Construction Information.

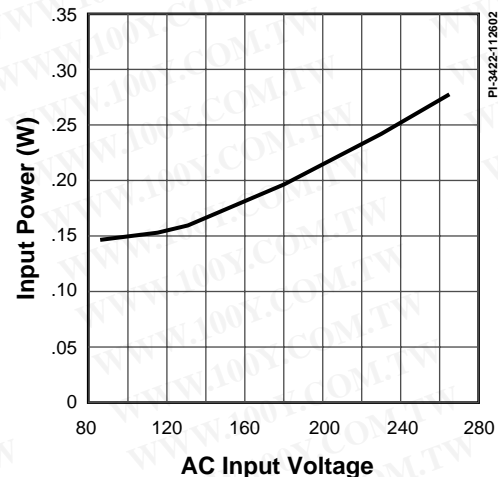


Figure 2.  $P_{IN}$  vs  $V_{IN}$  Curve.

For the latest updates, visit our Web site: [www.powerint.com](http://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 (including circuits external to the products and transformer construction) 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](http://www.powerint.com).

The PI Logo, **TOPSwitch**, **TinySwitch**, **LinkSwitch** 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](mailto: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](mailto: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](mailto: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](mailto:koreasales@powerint.com)

### SINGAPORE

Power Integrations, Singapore  
 Republic of Singapore 308900  
 Phone: +65-6358-2160  
 Fax: +65-6358-2015  
 e-mail: [singaporesales@powerint.com](mailto: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](mailto: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](mailto:taiwansales@powerint.com)

### INDIA (Technical Support)

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

### APPLICATIONS FAX

World Wide +1-408-414-9760

