Design Idea DI-10
TOPSwitch®-FX
PC Standby

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
PC Standby	TOP232Y	17 W	200 - 375 VDC	3.3 V / 5 V	Flyback

Design Highlights

- Exceeds Blue Angel efficiency requirements, achieving 78% at 3.9 W output (5 W input)
- Soft-start capability reduces start-up component stresses
- 132 kHz operation allow small, low cost EE19 transformer to deliver 17 W and prevents audio interaction with main converter
- Under-voltage detect eliminates turn-on/off glitches
- Dual sensing ensures 5% accuracy on 3.3 V and 5 V outputs
- 15 V bias supply for primary side circuitry

Operation

The *TOPSwitch-FX* PC Standby supply provides 17 W of output power. Three outputs are generated, 3.3 V and 5 V for the processor and peripherals, and 15 V for the main power supply switcher.

The design utilizes the TOP232 and takes advantage of many of the device's built in features. Soft-start is one of these, requiring no external components. During the first 10 ms of operation, the duty cycle is raised from 0 to 78%, lowering current and voltage stresses on the internal power MOSFET, clamp circuits and output rectifier.

Line under-voltage is implemented using a single 3.9 MΩ resistor (R1) to eliminate glitches during turn-on/off. This value was chosen to set V_{UV} at 195 VDC. This is just below the lowest operating DC input voltage for a doubler input configuration.

The input bypass capacitor C1 is needed only if the main supply filter is located remotely. Diode D1 and Zener VR1 are used to clamp the leading edge voltage spikes caused by transformer leakage inductance, to a safe value. The bias winding is rectified and filtered by D2 and C6 to create a bias voltage for the TOP232. This 15 V primary referenced voltage may also be used to power the main converter control circuitry. Shunt regulator U3 along with R6, R7, R9, R10 & R11 are used to sense and regulate the two output voltages.

Key Design Points

- The value of the under-voltage detection is set according to the equation V_{UV} = 50 µA X R1.
- Suitable layout and filtering (L1, L2, C11, C13) results

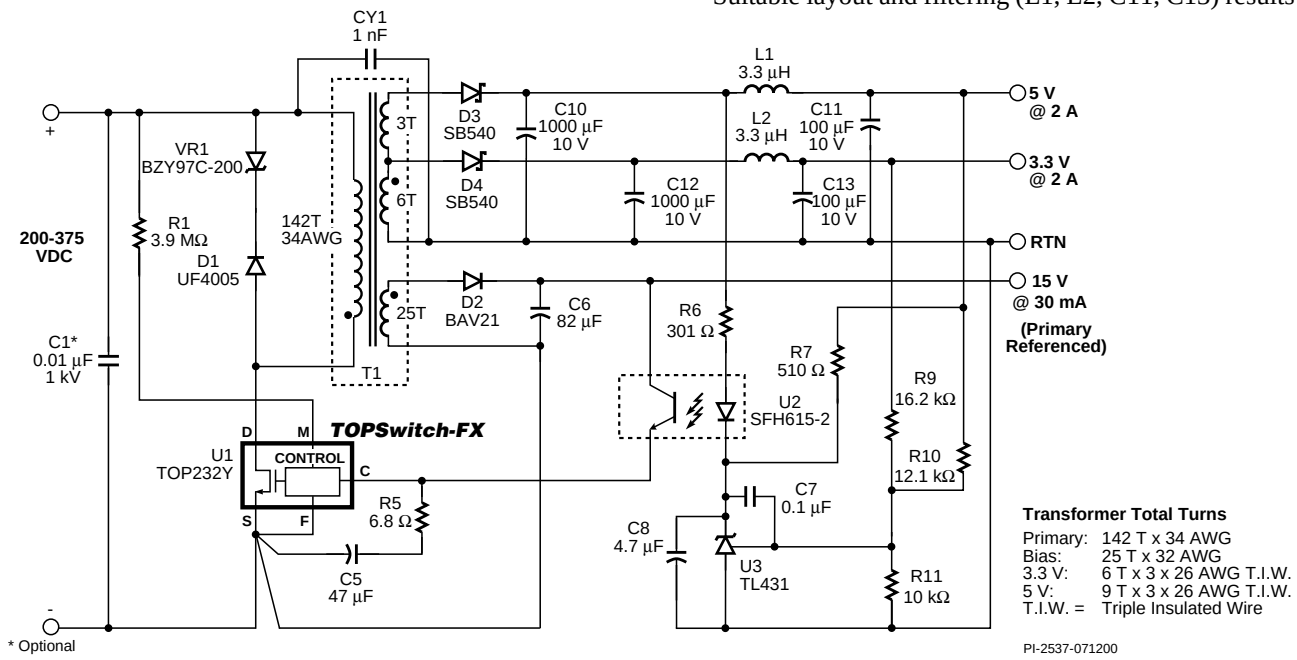

Figure 1. TOPSwitch-FX 17 W PC Standby

in low output ripple on 3.3 V and 5 V channels. At full load, peak-to-peak ripple is significantly below 50 mV.

- Y1 capacitor (CY1) is tied between secondary return and primary positive DC rail to minimize potential noise coupling to SOURCE pin during AC common mode surge events.
- Good cross regulation on the main channels is maximized with dual sense feedback to the 3.3 V and 5 V outputs (R9, R10).
- Capacitor (C8) is added to eliminate output start-up overshoot on DC output channels.
- Feedback compensation is accomplished with capacitor C7, across TL431 reference amplifier (U3), and correct choice of CONTROL pin capacitor and series resistor (C5, R5). Resistor R6 sets feedback gain while resistor R7 provides bias to the TL431 when the 5 V output is lightly loaded. Compensation is optimized for the transformer design and the power supply provides satisfactory phase margin and operating bandwidth across wide operating conditions.

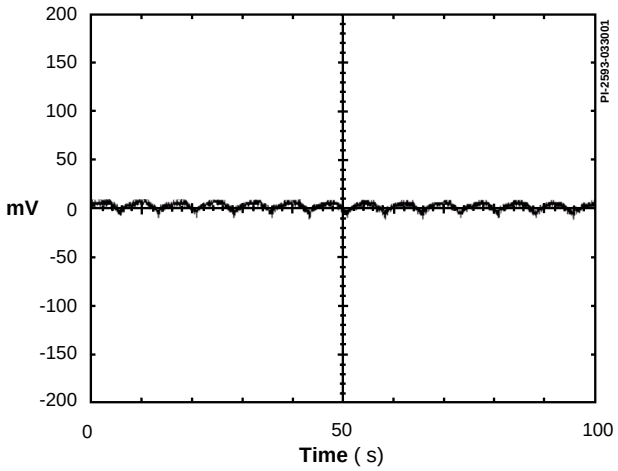

Figure 2. DC output ripple seen on +3.3 V output, full load

Transformer Parameters	
Core Material	EE 19 Nippon Ceramic NC-2H A_L of 116 nH/T^2
Bobbin	EE19 8 pin (TDK BE-19-118CPH or equivalent)
Winding Order (pin numbers)	Primary (1-2), Tape, 3.3 V (6-7/8), 5 V (7/8-5), Tape, Bias (3-4), Tape
Primary Inductance	2.4 mH ±10%
Primary Resonant Frequency	1 MHz (minimum)
Leakage Inductance	75 µH

Table 1. Transformer construction information

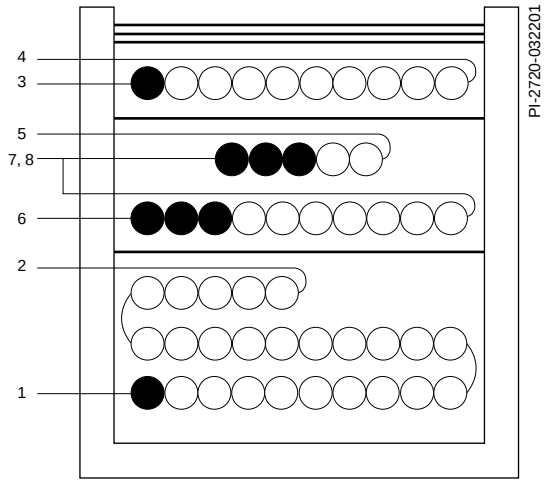

Figure 3. Transformer build diagram

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.

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

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

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

CHINA
Power Integrations
International Holdings, Inc.
China
Phone: +86-755-367-5143
Fax: +86-755-377-9610
e-mail: chinasales@powerint.com

KOREA
Power Integrations
International Holdings, Inc.
Seoul, Korea
Phone: +82-2-568-7520
Fax: +82-2-568-7474
e-mail: koreasales@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

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

APPLICATIONS HOTLINE
World Wide +1-408-414-9660

APPLICATIONS FAX
World Wide +1-408-414-9760