Design Idea DI-7
TinySwitch®
TV Standby

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
TV Standby	TNY253	1.3 W	120 - 375 VDC	7.5 V ± 5%	Flyback

Design Highlights

- Very low power consumption at no load (< 100 mW @ 375 VDC input)
- Lowest cost, lowest component count solution
- High efficiency
- Glitch free turn on and turn off
- Meets very low video noise requirements
- Small physical size (38 mm×24 mm×14.2 mm, W×L×H)
- Simple, two winding transformer

Operation

The *TinySwitch* TV standby power supply generates an isolated output voltage from a high voltage DC input. The circuit is designed to replace conventional linear supplies and self oscillating ringing choke converters (RCC) at lower cost and component count. There is no need for external under voltage lockout (UVLO) since the turn on and turn off are monotonic and glitch-free, (Figures 2 and 3).

The example shown delivers 7.5V at 0.18 A. Input voltage range is 120 - 375 VDC. Input bypass capacitor C1 is needed only if the main supply filter capacitor is located far away. C3 is the *TinySwitch* bypass capacitor. C6 may also be eliminated in the final application depending on the layout of the main power supply.

The ON/OFF control on the *TinySwitch* scales the switching losses with load allowing the use of simple RC (R1 and C2) snubber to clamp the drain voltage at these power levels. The snubber also reduces EMI and video noise.

The secondary winding of T1 is rectified and filtered by D1 and C4 to provide 7.5 V output. The output LC filter, L1 and C5, provide additional filtering for the 7.5 V output. The output voltage is directly sensed by optocoupler U2 and Zener diode VR1. The output voltage is determined by the voltage drop across the Zener diode and optocoupler LED. Due to the digital ON/OFF control of the *TinySwitch*, the current transfer ratio (CTR) of the optocoupler is not critical and a low cost ungraded optocoupler can be used. T1 is designed for discontinuous conduction mode. The transformer parameters are shown in Table 1.

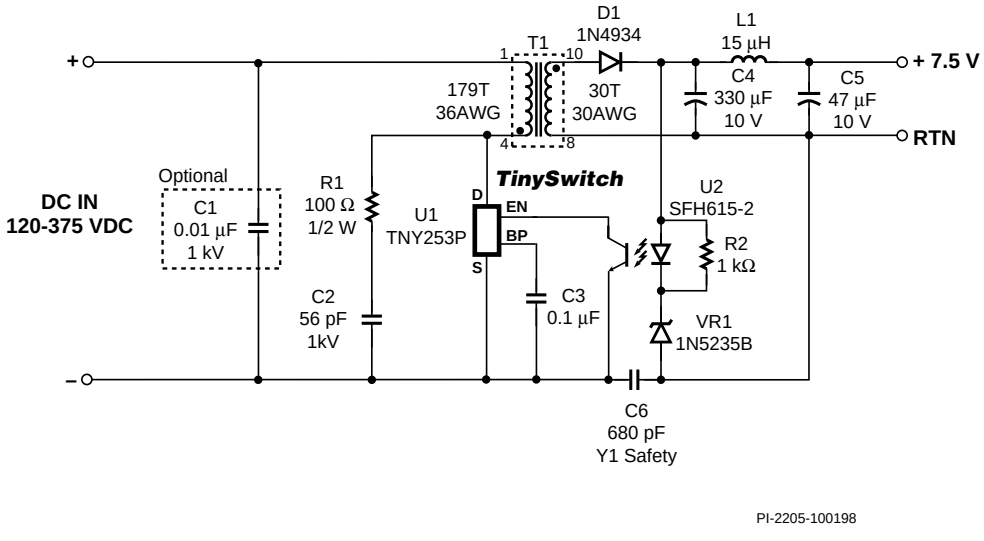

Figure 1. TinySwitch 1.3 W TV Standby Supply.

Key Design Points

- Design transformer for discontinuous mode operation.
- Select RC snubber circuit components, R1 and C2, to guarantee the peak DRAIN voltage will be less than 650 V. The maximum value of C2 is 56 pF. This snubber capacitor can be increased if the primary and secondary windings are seperated with tape.
- Select the rectifier D1 whose average current rating is higher than the output short circuit current.

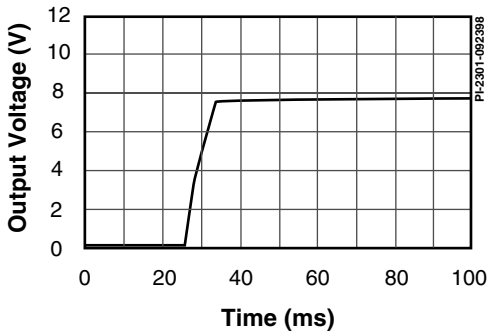

Figure 2. Output Turn On Voltage Waveform.

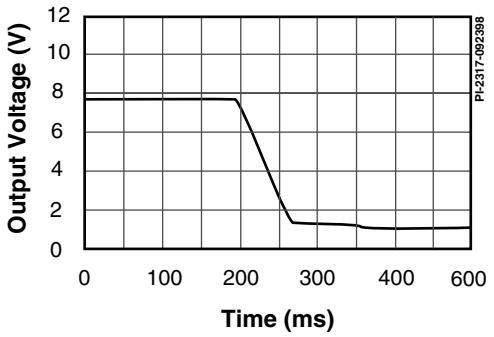

Figure 3. Output Turn Off Voltage Waveform.

Transformer Parameters	
Core Material	TDK PC40EE16-Z or equiv. Gap for A_L of 159 mH/T^2
Bobbin	Ying Chin YC1607
Winding Order	Primary (4-1), Secondary (10-8) [triple insulated secondary]
Primary Inductance (Pins 1-4, all others open)	5.1 mH ± 10% @ 44 kHz
Primary Resonant Frequency (Pins 1-4, all others open)	400 kHz minimum
Leakage Inductance (Pins 1-4, with Pins 8-10 shorted)	150 µH maximum

Table 1. Transformer Design Parameters.

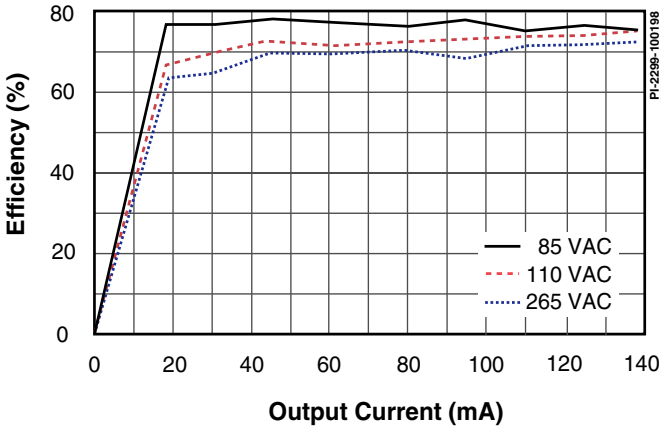

Figure 4. Efficiency vs. Output Load at 7.5 VDC.

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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

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