Design Idea DI-6

TinySwitch™

PC Standby

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
PC Standby	TNY255	10 W	200 - 375 VDC	5 V ± 5%	Flyback

Design Highlights

- Lowest cost, lowest component count solution
- Meets Blue Angel (delivers 3.6 W output at 5 W input)
- 73% efficiency at 10 W (nominal input)
- Glitch-free turn on and turn off
- Small physical size (47 mm×25.4 mm×23mm, W×L×H)

Operation

The *TinySwitch* PC standby power supply generates a single isolated output voltage from a high voltage DC input. Additional outputs can be generated as needed from additional windings. The circuit is designed to replace 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 (see Figures 1, 2, 3).

The example shown delivers 5 V at 2 A. Input voltage range is 200 - 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. A low cost RCD clamp circuit, D1, C2 and R1, is sufficient due to the ON/OFF control on the *TinySwitch* which scales switching losses with load.

The secondary winding of T1 is rectified and filtered by D2 and C4 to provide 5 V output. The output LC filter, L1 and C5, provide additional filtering for the 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. Due to the 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 continuous conduction mode. The transformer parameters are shown in Table 1.

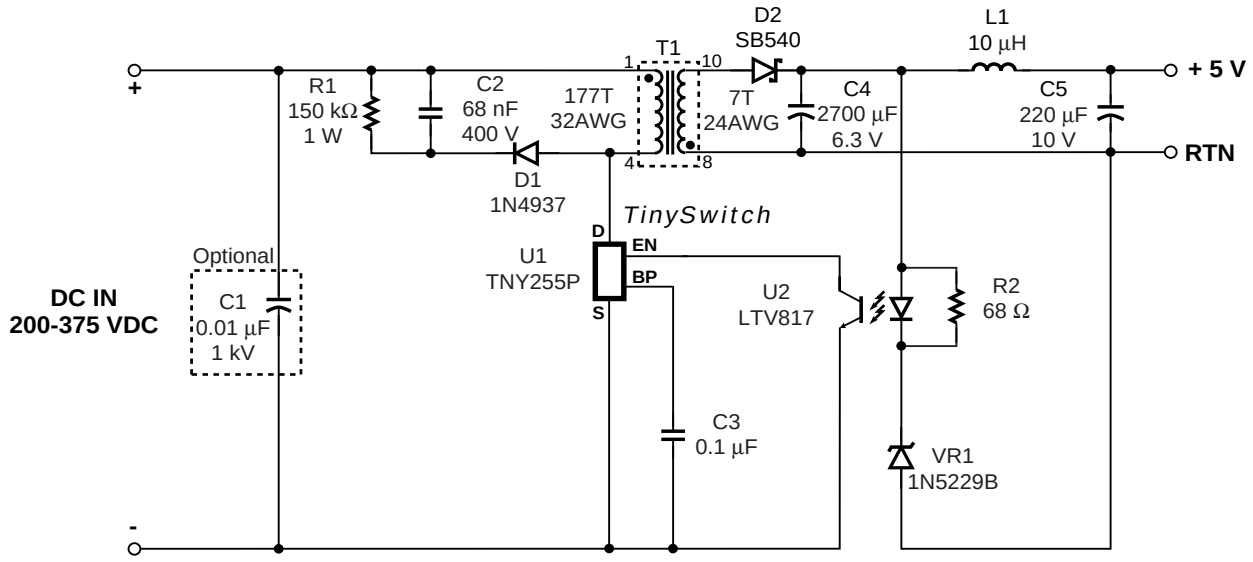

Figure 1. TinySwitch 10 W PC Standby Supply.

PI-2285-092498

Key Design Points

- Design transformer for continuous mode operation.
- Select RCD clamp circuit components R1, C2, and D1 to guarantee the peak DRAIN voltage is less than 650 V at high line and full load.
- The average current rating of the rectifier D1 should be higher than the output short circuit current limit (5A in this design).
- Primary bias voltage for a main converter can be generated by using an additional winding.
- Split primary winding is not required for less than 8 W output power.

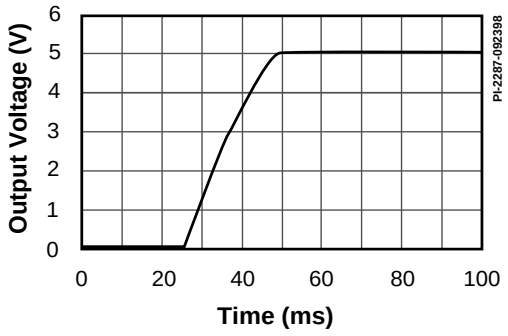

Figure 2. Output Turn On Voltage Waveform.

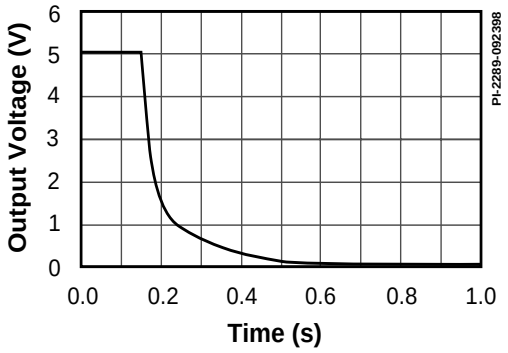

Figure 3. Output Turn Off Voltage Waveform.

Transformer Parameters	
Core Material	TDK PC40EE16-Z or equiv. Gap for A_L of 126 nH/T^2
Bobbin	EE16 10 pin (Ying Chin YC1607 or equiv.)
Winding Order*	1/2 Primary (4-2), Secondary (10-8) [triple insulated secondary], 1/2 Primary (2-1)
Primary Inductance (Pins 1-4 all others open)	4.0 mH ± 10% @ 130 kHz
Primary Resonant Frequency (Pins 1-4, all others open)	400 kHz minimum
Leakage Inductance (Pins 1-4, with Pins 8-10 shorted)	100 µH maximum

*Table 1. Transformer Design Parameters. (*Split primary winding is not required for less than 8 W output power.)*

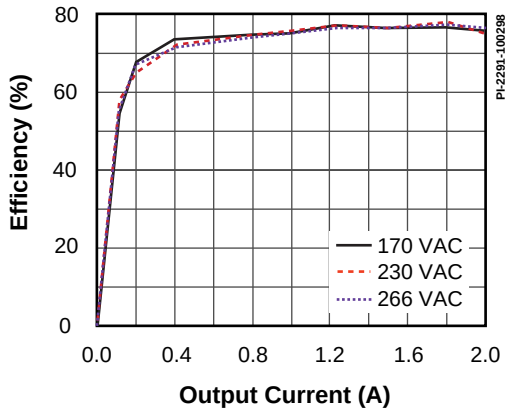

Figure 4. Efficiency vs. Output Current.

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