Design Idea DI-8

TinySwitch®

Cellular Phone Adapter

Application	Device	Power Output	Input Voltage	Output Voltage	Topology
Cellular Phone	TNY254	3.6 W	85 - 265 VAC	5.2 V ± 6%	Flyback

Design Highlights

- Constant current - constant voltage output
- Very low no-load power consumption (<100 mW @ 230 VAC)
- Lower cost than RCC converter and other solutions
- Universal input: 85 - 265 VAC
- Low component count
- Simple, two winding transformer

Operation

The *TinySwitch* flyback converter generates a regulated voltage and controlled current limit for charging cellular telephone batteries (Li-Ion, NiMH, NiCd).

In the example shown C1, L1, R1 and C2 filter the input rectified AC providing smoothed DC voltage for the converter. These components also provide the necessary filtering to meet conducted EMI requirements.

Diode D5 with C5, L2 and C6, rectify and filter the output from the secondary. The reference Zener diode VR1 and the LED of optocoupler U2 sense the output voltage and provide feedback to the *TinySwitch*. The output voltage is set by the combined voltage drops of U2, VR1 and R7. Q1, R3, R4, R5 and R6 provide the constant output current function. When the drop across R4 and R5 reaches ~0.6 V, Q1 activates the optocoupler U2 to inhibit the *TinySwitch*.

Diode D6, R2, and C4 form a clamp network to dissipate the energy from the leakage inductance of the transformer. The component values are chosen to limit the DRAIN voltage to less than 650 V at high line and full load.

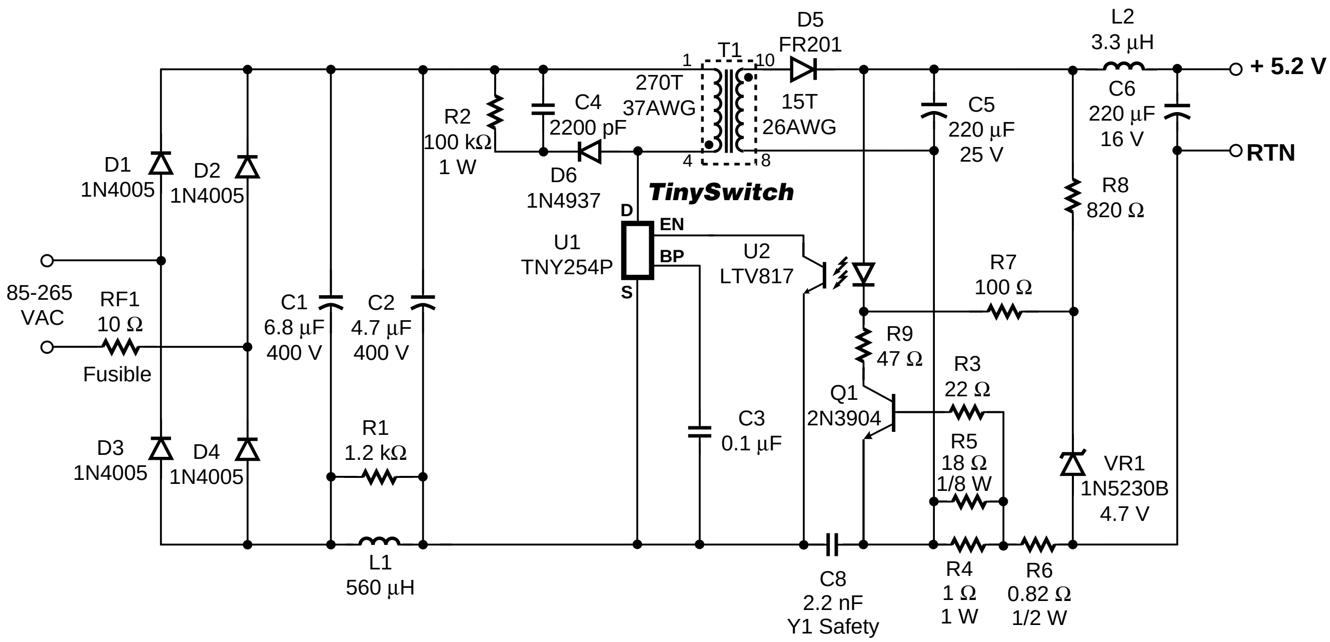

Figure 1. TinySwitch Cellular Phone Adapter.

Key Design Points

- To adjust the current limit (I_{CL}), adjust the value of the parallel combination of R4 and R5. The V_{be} of Q1 divided by the desired current equals this value.
- Choose a power rating for R4 at least twice $I_{CL}^2 \times R4$. Use R5 to adjust for the increments between standard values for R4.
- Choose R6 such that the drop across the parallel combination R4-R5 and R6 is at least 1.0V at I_{CL}. This will keep the short circuit output current constant at I_{CL}.
- Choose any general purpose silicon NPN transistor for Q1.
- Choose a fast recovery type rectifier for D5. It must have a reverse recovery time less than 150 ns. Its average current rating should be at least three times I_{CL}. A Shottky type may used to improve efficiency.
- To improve output voltage accuracy a precision reference may be used in place of VR1. In the circuit shown the Zener is operated below its specified Zener current to reduce standby power. Increasing this current by lowering the value of R8 will also improve accuracy.
- Efficiency can be significantly improved by employing current sense techniques with lower voltage thresholds.

Transformer Parameters	
Core Material	TDK PC40EE16-Z A_L of 70 nH/T^2
Bobbin	EE16 10 pin (Ying Chin YC1607 or equivalent)
Winding Order	Primary (4-1), Secondary (10-8) [triple insulated secondary]
Primary Inductance	5.2 mH ± 10%
Primary Resonant Frequency	375 kHz minimum
Leakage Inductance	250 µH maximum

Table 1. Transformer Design Parameters.

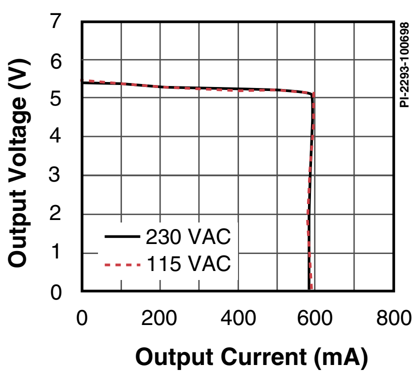

Figure 2. Typical Performance at the end of 6 ft. (1.8 m) cable.

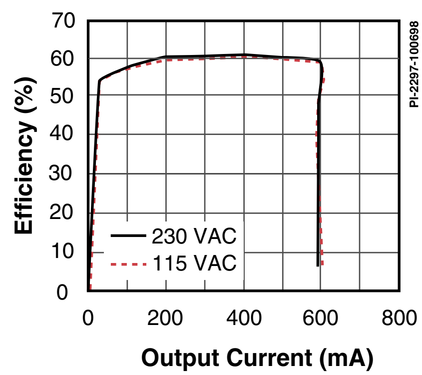

Figure 3. Efficiency vs Output Current.

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