

# Design Idea DI-13

## *TinySwitch-II*<sup>®</sup>

### 3 W Universal Adapter



| Application | Device | Power Output | Input Voltage | Output Voltage | Topology |
|-------------|--------|--------------|---------------|----------------|----------|
| 3 W Adapter | TNY264 | 3 W          | 85-265 VAC    | 9 V            | Flyback  |

#### Design Highlights

- No-load consumption less than 250 mW at 230 VAC
- Compact design: 2.0" x 1.2" x 0.75"
- Minimum parts count and single sided PC board ensures cost-effective solution
- High frequency operation allows compact EF12.6 transformer
- Enhanced ON/OFF control allows simple Zener reference and eliminates the need for loop compensation
- Built-in circuitry practically eliminates audible noise with standard varnished transformer
- No-load regulation achieved without pre-load resistor
- Well defined frequency jitter feature reduces EMI—simple input  $\pi$  filter meets CISPR22 Class B/EN55022B
- Self-protecting hysteretic thermal shutdown: power supply automatically recovers when fault is removed

This 3 W single output, universal input power supply is available as a Design Accelerator Kit (DAK-14) including samples and documentation. With 71% minimum efficiency at full load, compliance to CISPR22 Class B, small size, and low parts count, the DAK-14 showcases the significant advantages of *TinySwitch-II* in low power adapter applications.

#### Operation

The digital ON/OFF control scheme of *TinySwitch-II* allows tight regulation using a low cost secondary Zener reference and eliminates the need for loop compensation. In addition, no pre-load is required to maintain regulation at light load, helping to reduce measured no-load consumption to <250 mW at 265 VAC – see Figure 3. *TinySwitch-II* also provides auto-restart to reduce output overload current during fault conditions.

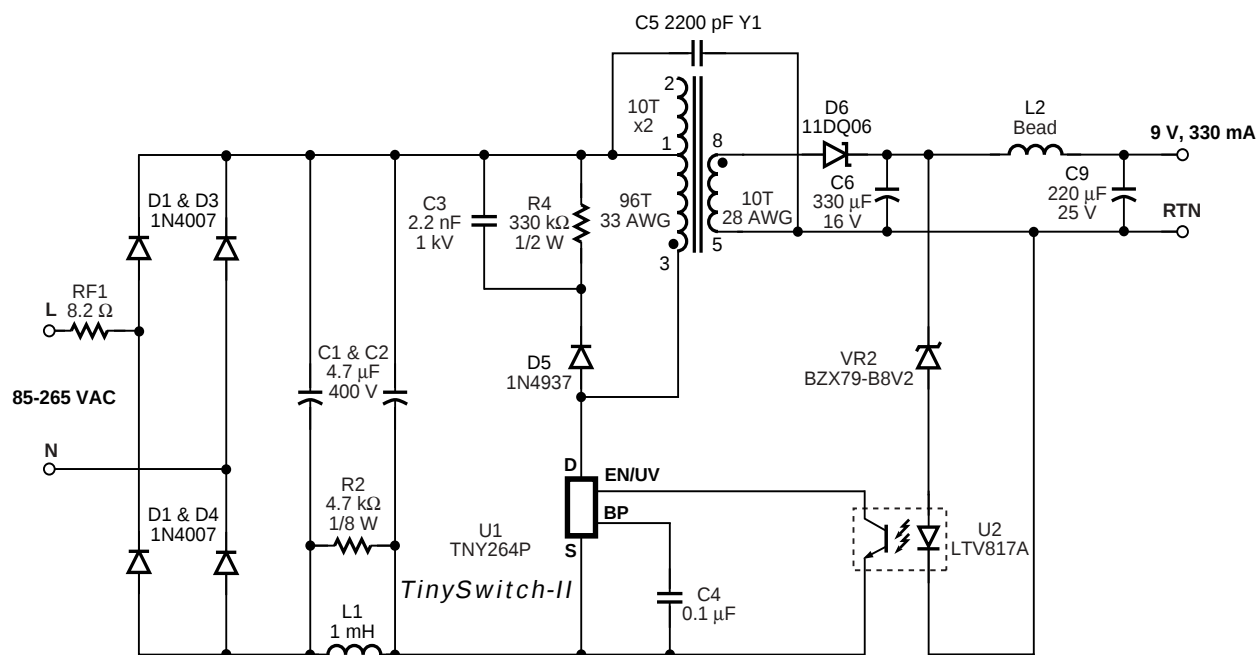


Figure 1. *TinySwitch-II* 3 W Universal Adapter.

PI-3074-091402

## Key Design Points

- Design transformer for low leakage inductance.
- Varnish transformer to practically eliminate acoustic noise - gluing not required.
- Maximum flux density of main transformer should be no more than 3000 gauss.
- Use primary RCD clamp that allows no more than 600 V across the *TinySwitch-II* DRAIN and SOURCE pins.
- Provide adequate copper area on PCB at the connection to the *TinySwitch-II* SOURCE pin, for heatsinking.

| Transformer Parameters                              |                                                          |
|-----------------------------------------------------|----------------------------------------------------------|
| Core Material                                       | Core: EF 12.6, gapped for $A_L$ of 135 nH/T <sup>2</sup> |
| Bobbin                                              | Bobbin: Hical EF 12.6, 8 pin                             |
| Winding Order                                       | Primary (3-1)<br>Shield winding (1-2)<br>Secondary (8-5) |
| Primary Inductance                                  | 1.25 mH                                                  |
| Primary Resonant                                    | 700 kHz (min)                                            |
| Leakage Inductance (all secondary windings shorted) | 50 $\mu$ H                                               |

Table 1. Transformer Construction Information.

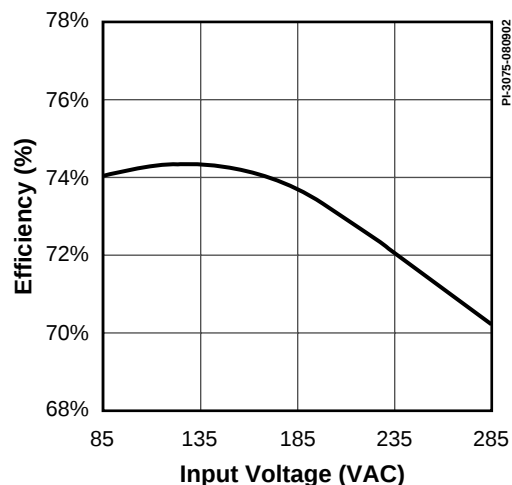


Figure 2. Efficiency vs. Input Voltage.

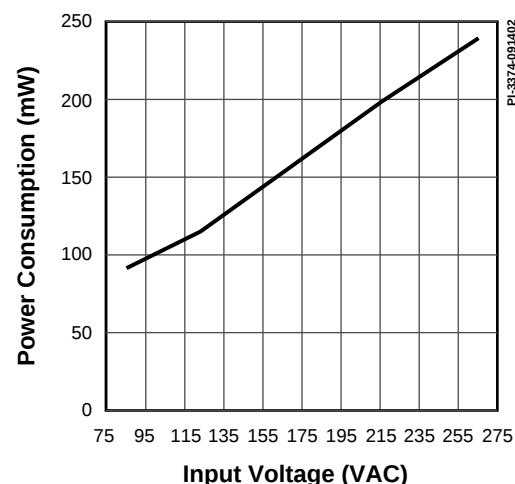


Figure 3. Efficiency vs. Input Voltage.

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