



Figure 14. 2.5 W Constant Voltage, Constant Current Battery Charger with Universal Input (85-265 VAC).

Figure 12 illustrates a typical power-down timing waveform of *TinySwitch-II*. Figure 13 illustrates a very slow power-down timing waveform of *TinySwitch-II* as in standby applications. The external resistor (2 M Ω) is connected to the EN/UV pin in this case to prevent unwanted restarts.

The *TinySwitch-II* does not require a bias winding to provide power to the chip, because it draws the power directly from the DRAIN pin (see Functional Description above). This has two main benefits. First, for a nominal application, this eliminates the cost of a bias winding and associated components. Secondly, for battery charger applications, the current-voltage characteristic often allows the output voltage to fall close to zero volts while still delivering power. This type of application normally requires a forward-bias winding which has many more associated components. With *TinySwitch-II*, neither are necessary. For applications that require a very low no-load power consumption (50 mW), a resistor from a bias winding to the BYPASS pin can provide the power to the chip. The minimum recommended current supplied is 750 μ A. The BYPASS pin in this case will be clamped at 6.3 V. This method will eliminate the drawing of the power from the DRAIN pin, thereby reducing the no-load power consumption and improving full-load efficiency.

Current Limit Operation

Each switching cycle is terminated when the DRAIN current reaches the current limit of the *TinySwitch-II*. Current limit

operation provides good line ripple rejection and relatively constant power delivery independent of input voltage.

BYPASS Pin Capacitor

The BYPASS pin uses a small 0.1 μ F ceramic capacitor for decoupling the internal power supply of the *TinySwitch-II*.

Application Examples

The *TinySwitch-II* is ideal for low cost, high efficiency power supplies in a wide range of applications such as cellular phone chargers, PC standby, TV standby, AC adapters, motor control, appliance control and ISDN or a DSL network termination. The 132 kHz operation allows the use of a low cost EE13 or EF12.6 core transformer while still providing good efficiency. The frequency jitter in *TinySwitch-II* makes it possible to use a single inductor (or two small resistors for under 3 W applications if lower efficiency is acceptable) in conjunction with two input capacitors for input EMI filtering. The auto-restart function removes the need to oversize the output diode for short circuit conditions allowing the design to be optimized for low cost and maximum efficiency. In charger applications, it eliminates the need for a second optocoupler and Zener diode for open loop fault protection. Auto-restart also saves the cost of adding a fuse or increasing the power rating of the current sense resistors to survive reverse battery conditions. For applications requiring under-voltage lock out (UVLO), such as PC standby, the