TNY253/254/255
TinySwitch™ Family

Energy Efficient, Low Power Off-line Switchers

Product Highlights

Lowest Cost, Low Power Switcher Solution

- Lower cost than RCC, discrete PWM and other integrated/hybrid solutions
- Cost effective replacement for bulky linear adapters
- Lowest component count
- Simple ON/OFF control – no loop compensation devices
- No bias winding – simpler, lower cost transformer
- Allows simple RC type EMI filter for up to 2 W from universal input or 4 W from 115 VAC input

Extremely Energy Efficient

- Consumes only 30/60 mW at 115/230 VAC with no load
- Meets Blue Angel, Energy Star, Energy 2000 and 200 mW European cell phone requirements for standby
- Saves $1 to $4 per year in energy costs (at $0.12/kWHr) compared to bulky linear adapters
- Ideal for cellular phone chargers, standby power supplies for PC, TV and VCR, utility meters, and cordless phones.

High Performance at Low Cost

- High-voltage powered – ideal for charger applications
- Very high loop bandwidth provides excellent transient response and fast turn on with practically no overshoot
- Current limit operation rejects line frequency ripple
- Glitch free output when input is removed
- Built-in current limit and thermal protection
- 44 kHz operation (TNY253/4) with snubber clamp reduces EMI and video noise in TVs and VCRs
- Operates with optocoupler or bias winding feedback

Description

The TinySwitch family uses a breakthrough design to provide the lowest cost, high efficiency, off-line switcher solution in the 0 to 10 W range. These devices integrate a 700 V power MOSFET, oscillator, high-voltage switched current source, current limit and thermal shutdown circuitry. They start-up and run on power derived from the DRAIN voltage, eliminating the need for a transformer bias winding and the associated circuitry. And yet, they consume only about 80 mW at no load, from 265 VAC input. A simple ON/OFF control scheme also eliminates the need for loop compensation.

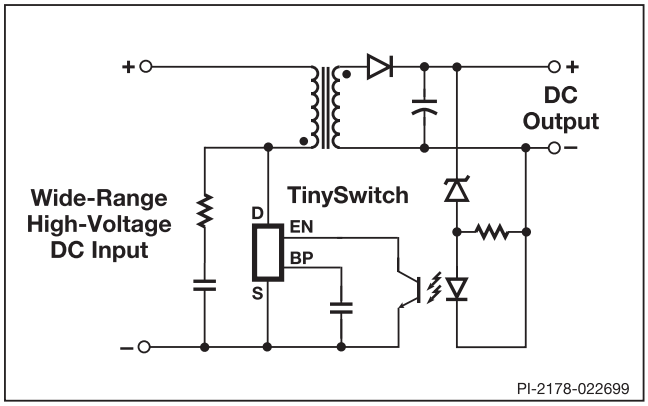

Figure 1. Typical Standby Application.

TinySwitch Selection Guide			
ORDER PART NUMBER	PACKAGE	Recommended Range for Lowest System Cost*	
		230 VAC or 115 VAC w/Doubler	85-265 VAC
TNY253P	DIP-8	0-4 W	0-2 W
TNY253G	SMD-8		
TNY254P	DIP-8	2-5 W	1-4 W
TNY254G	SMD-8		
TNY255P	DIP-8	4-10 W	3.5-6.5 W
TNY255G	SMD-8		

*Table 1. *Please refer to the Key Application Considerations section for details.*

The TNY253 and TNY254 switch at 44 kHz to minimize EMI and to allow a simple snubber clamp to limit DRAIN spike voltage. At the same time, they allow use of low cost EE16 core transformers to deliver up to 5 W. The TNY253 is identical to TNY254 except for its lower current limit, which reduces output short-circuit current for applications under 2.5 W. TNY255 uses higher switching rate of 130 kHz to deliver up to 10 W from the same low cost EE16 core for applications such as PC standby supply. An EE13 or EF13 core with safety spaced bobbin can be used for applications under 2.5 W. Absence of a bias winding eliminates the need for taping/margins in most applications, when triple insulated wire is used for the secondary. This simplifies the transformer construction and reduces cost.

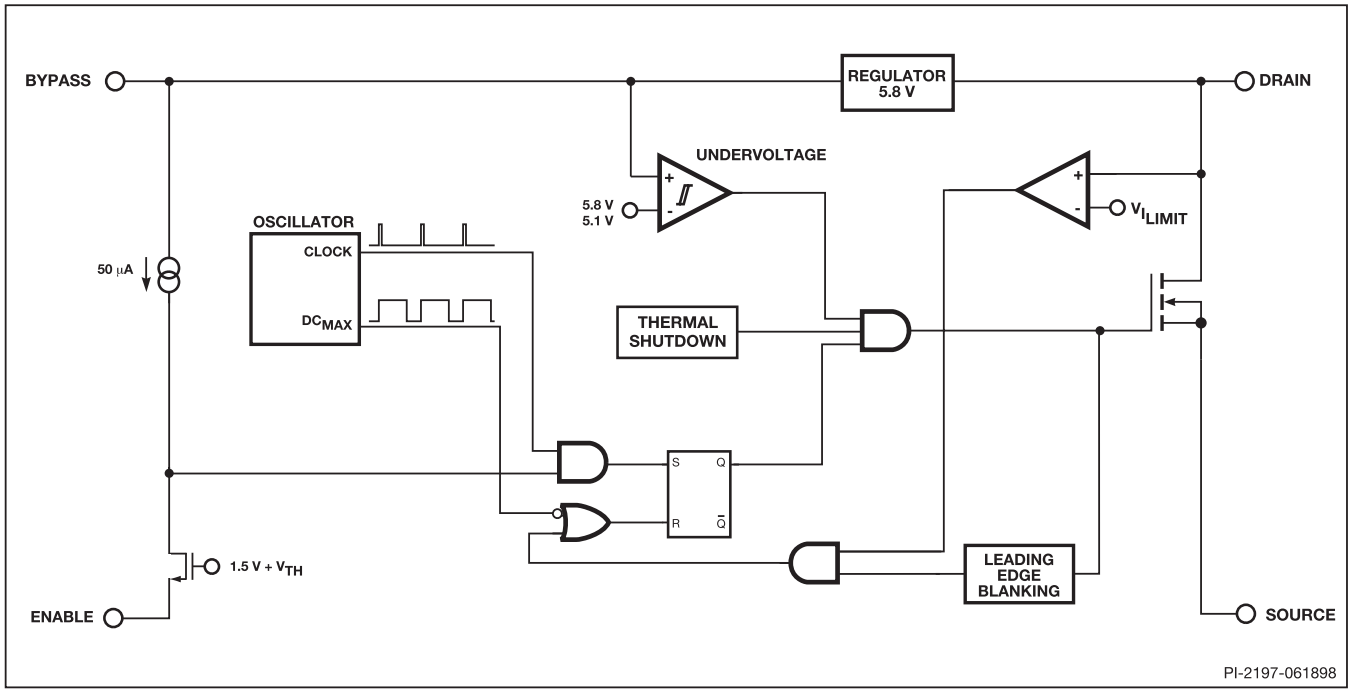

Figure 2. Functional Block Diagram.

Pin Functional Description

DRAIN (D) Pin:
Power MOSFET drain connection. Provides internal operating current for both start-up and steady-state operation.

BYPASS (BP) Pin:
Connection point for an external bypass capacitor for the internally generated 5.8 V supply. Bypass pin is not intended for sourcing supply current to external circuitry.

ENABLE (EN) Pin:
The power MOSFET switching can be terminated by pulling this pin low. The I-V characteristic of this pin is equivalent to a voltage source of approximately 1.5 V with a source current clamp of 50 µA.

SOURCE (S) Pin:
Power MOSFET source connection. Primary return.

TinySwitch Functional Description

TinySwitch is intended for low power off-line applications. It combines a high-voltage power MOSFET switch with a power supply controller in one device. Unlike a conventional PWM (Pulse Width Modulator) controller, the TinySwitch uses a simple ON/OFF control to regulate the output voltage.

The *TinySwitch* controller consists of an Oscillator, Enable (Sense and Logic) circuit, 5.8 V Regulator, Undervoltage circuit,

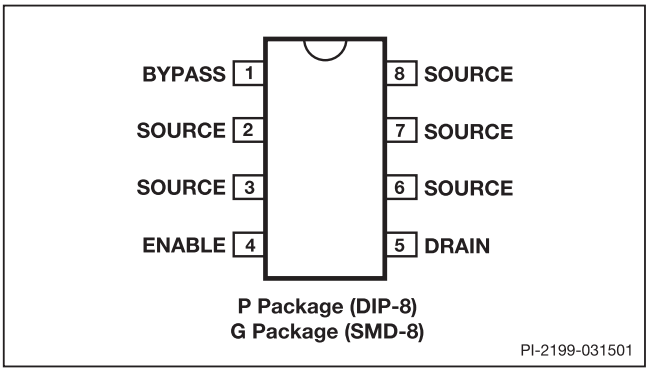

Figure 3. Pin Configuration.

Hysteretic Over Temperature Protection, Current Limit circuit, Leading Edge Blanking, and a 700 V power MOSFET. Figure 2 shows a functional block diagram with the most important features.

Oscillator
The oscillator frequency is internally set at 44 kHz (130 kHz for the TNY255). The two signals of interest are the Maximum Duty Cycle signal (D_{MAX}) which runs at typically 67% duty cycle and the Clock signal that indicates the beginning of each cycle. When cycles are skipped (see below), the oscillator frequency doubles (except for TNY255 which remains at 130 kHz). This increases the sampling rate at the ENABLE pin for faster loop response.

Enable (Sense and Logic)
The ENABLE pin circuit has a source follower input stage set at 1.5 V. The input current is clamped by a current source set at 50 µA with 10 µA hysteresis. The output of the enable sense