FAIRCHILD SEMICONDUCTOR®

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# FSQ510 / FSQ510MX
# Green Mode Fairchild Power Switch (FPS™)
## for Valley Switching Converter – *Low EMI and High Efficiency*

## Features

- Uses an LDMOS Integrated Power Switch
- Optimized for Valley Switching Converter (VSC)
- Low EMI through Variable Frequency Control and Inherent Frequency Modulation
- High Efficiency through Minimum Drain Voltage Switching
- Extended Valley Switching for Wide Load Ranges
- Small Frequency Variation for Wide Load Ranges
- Advanced Burst-Mode Operation for Low Standby Power Consumption
- Pulse-by-Pulse Current Limit
- Protection Functions: Overload Protection (OLP), Internal Thermal Shutdown (TSD) with Hysteresis
- Under-Voltage Lockout (UVLO) with Hysteresis
- Internal Startup Circuit
- Internal High-Voltage SenseFET: 700 V
- Built-in Soft-Start: 5 ms

## Applications

- Auxiliary Power Supplies for LCD TV, LCD Monitor, Personal Computer, and White Goods

## Description

A Valley Switching Converter (VSC) generally shows lower EMI and higher power conversion efficiency than a conventional hard-switched converter with a fixed switching frequency. The FSQ510 is an integrated Valley Switching Pulse Width Modulation (VS-PWM) controller and SenseFET specifically designed for offline Switch-Mode Power Supplies (SMPS) for valley switching with minimal external components. The VS-PWM controller includes an integrated oscillator, under-voltage lockout (UVLO), leading-edge blanking (LEB), optimized gate driver, internal soft-start, temperature-compensated precise current sources for loop compensation, and self-protection circuitry.

Compared with discrete MOSFET and PWM controller solutions, the FSQ510 can reduce total cost, component count, size and weight; while simultaneously increasing efficiency, productivity, and system reliability. This device provides a platform for cost-effective designs of a valley switching flyback converters.

## Ordering Information

| Part Number | Package | Operating Junction Temperature | Current Limit | $R_{DS(ON)}$ (Max.) | Output Power Table[1] | | | | Packing Method |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 230 $V_{AC}$ ± 15%[2] | | 85-265 $V_{AC}$ | | |
| | | | | | Adapter[3] | Open Frame[4] | Adapter[3] | Open Frame[4] | |
| FSQ510 | 7-DIP | -40 to +130°C | 320 mA | 32 Ω | 5.5 W | 9 W | 4 W | 6 W | Rail |
| FSQ510MX | 7-MLSOP | | | | | | | | Tape & Reel |

*For Fairchild's definition of "green" Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.*

**Notes:**
1. The junction temperature can limit the maximum output power.
2. 230 $V_{AC}$ or 100/115 $V_{AC}$ with voltage doubler.
3. Typical continuous power with a Fairchild charger evaluation board described in this datasheet in a non-ventilated, enclosed adapter housing, measured at 50°C ambient temperature.
4. Maximum practical continuous power for auxiliary power supplies in an open-frame design at 50°C ambient temperature.

## Application Circuit

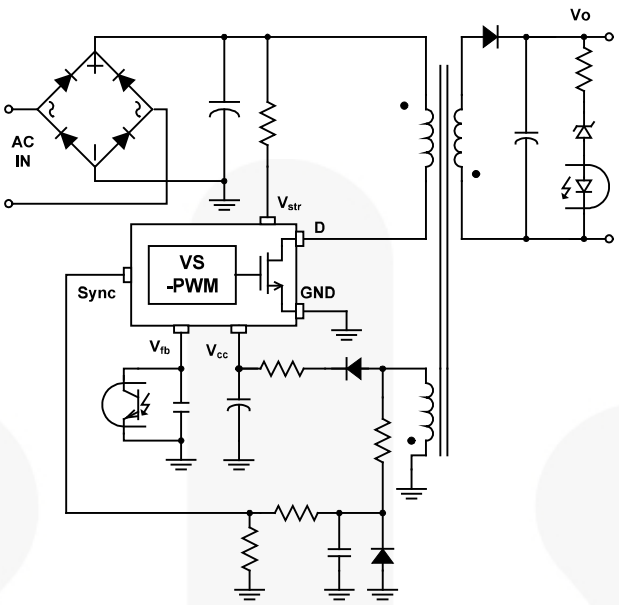


**Figure 1. Typical Application Circuit**

## Internal Block Diagram

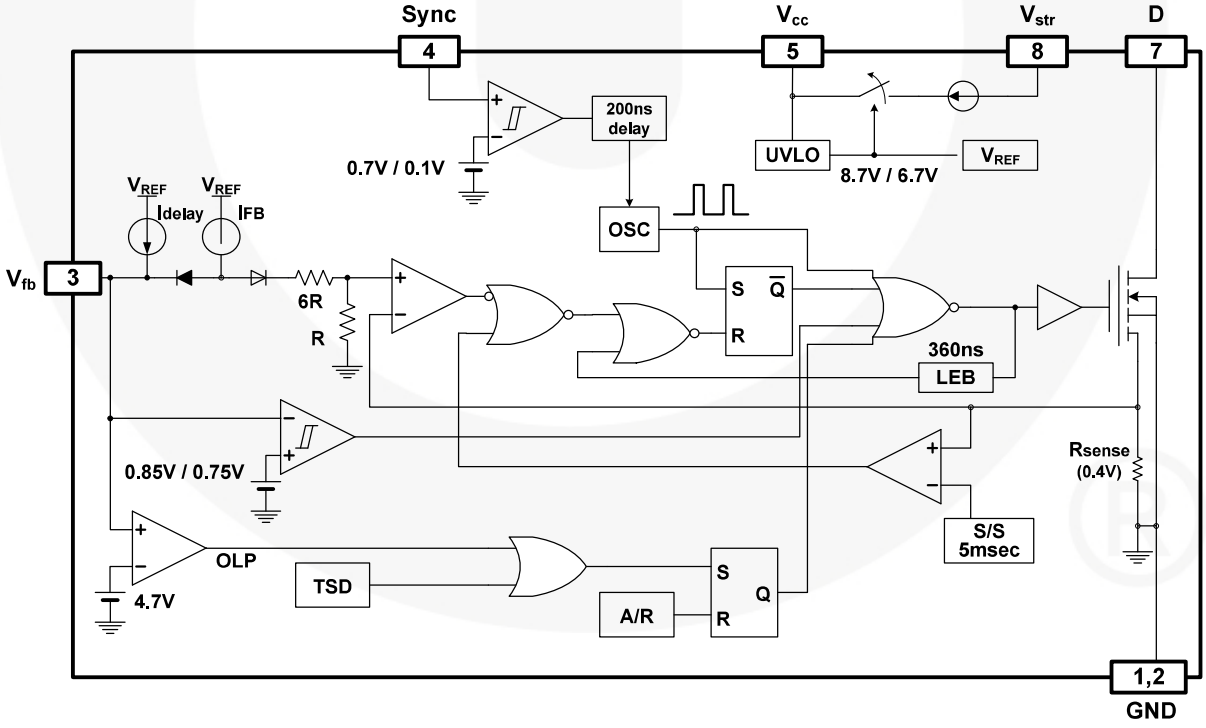


**Figure 2. Internal Block Diagram**

## Pin Configuration

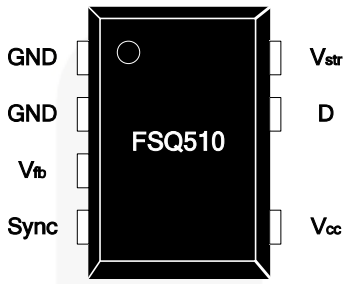


**Figure 3. Pin Assignments**

## Pin Definitions

| Pin # | Name | Description |
|---|---|---|
| 1, 2 | GND | This pin is the control ground and the SenseFET source. |
| 3 | $V_{fb}$ | This pin is internally connected to the inverting input of the PWM comparator. The collector of an opto-coupler is typically tied to this pin. For stable operation, a capacitor should be placed between this pin and GND. If the voltage of this pin reaches 4.7 V, the overload protection triggers, which shuts down the FPS. |
| 4 | Sync | This pin is internally connected to the sync-detect comparator for valley switching. In normal valley-switching operation, the threshold of the sync comparator is 0.7 V/0.1 V. |
| 5 | $V_{CC}$ | This pin is the positive supply input. This pin provides internal operating current for both startup and steady-state operation. |
| 7 | D | High-voltage power SenseFET drain connection. |
| 8 | $V_{str}$ | This pin is connected directly, or through a resistor, to the high-voltage DC link. At startup, the internal high-voltage current source supplies internal bias and charges the external capacitor connected to the $V_{CC}$ pin. Once $V_{CC}$ reaches 8.7 V, the internal current source is disabled. |