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Ultra Low Resistance Dual High Side Power Switch

Application Note

Demonstration Board- SW3526

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1. Overview and Scope

This application note is intended to describe the Ultra Low Resistance Dual High Side Power Switch (SW3526) and related circuitry within its demonstration board. This document includes the schematic, PCB layout, power up procedure and application highlight

2. General Description

SW3526 is an ultra-low resistance 2CH high side power switch. SW3526 operations form a single +2.7V to +5.5V supply, and features over-current protection to prevent device damage. It is designed for notebook and desktop computers, as well as other devices that use the Universal Serial Bus (USB) standard power switch.

The SW3526 eliminates overcurrent by preventing inrush current during hot-plug events.

Additionally, SW3526 provides a two-stage thermal protection mechanism per switch to eliminate short circuit or overcurrent occurrence. This includes a second switch to ensure the power supply is not disrupted if the first switch is turned off due to overheating.

3. Feature

Product	Description	Supply Voltage	R _{on}	I _{OCTH}	V _{UVLO}	T _{OTTH}	I _{DD}	Package
SW3526	Ultra Low Resistance Dual High Side Power Switch	2.7 to 5.5	85mΩ	1.3A	1.8V	165°C	110uA	MSOP-8

4. SW3526 Application – Demonstration Board

SW3526 demonstration board use SW3526 MSOP8 package with USB power switch application. The demonstration board schematic is shown in Figure 1, PCB layout is shown in Figure 2 to Figure 4. SW3526 has a flag to indicate SW3526 status such over-current, under voltage lockout and over temperature of OUTA and OUTB pins. The Flag pins should have a pull up resistance on the application. ENA and EN2 is used to enable the OUTA and OUTB respectively.

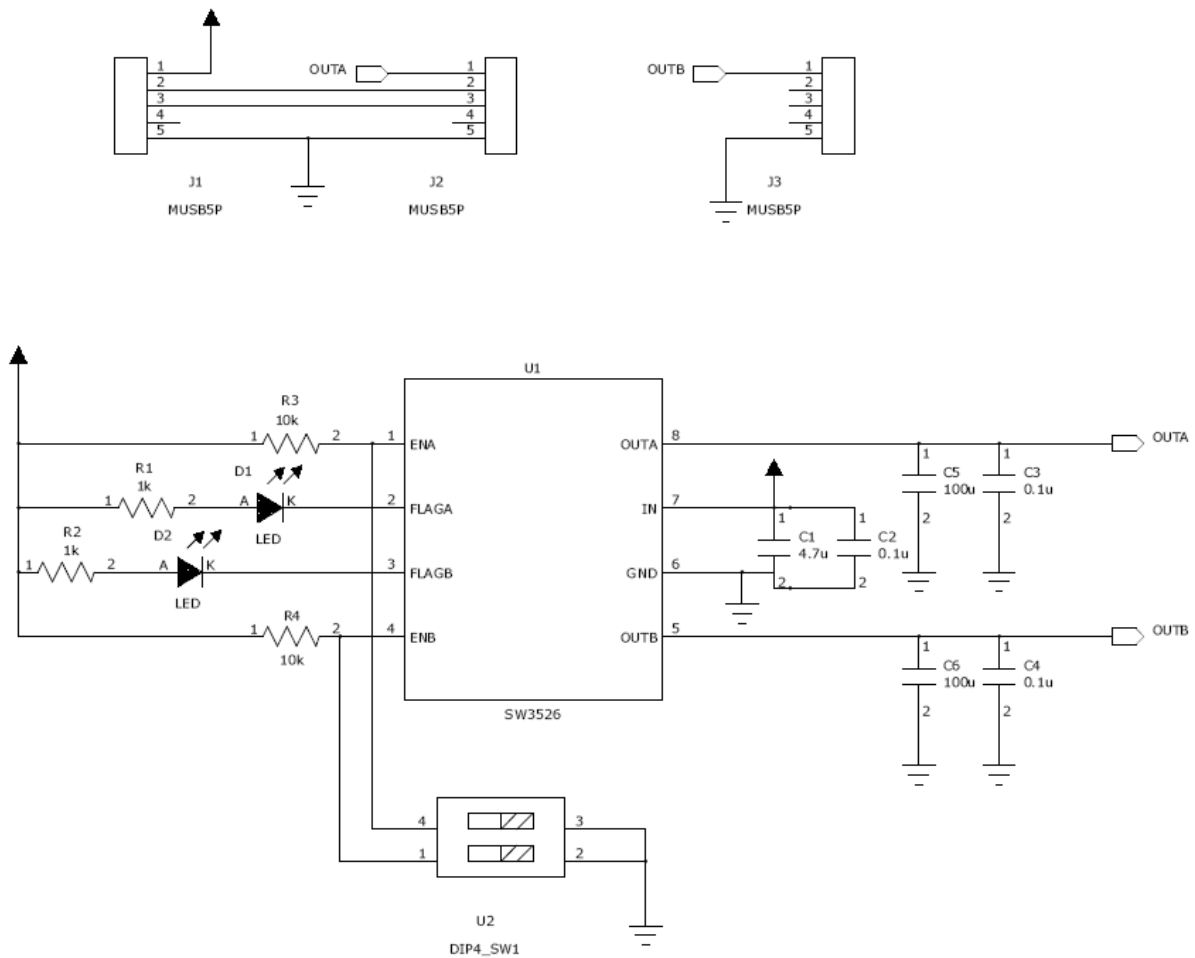


Figure 1 – Demonstration Board Schematic

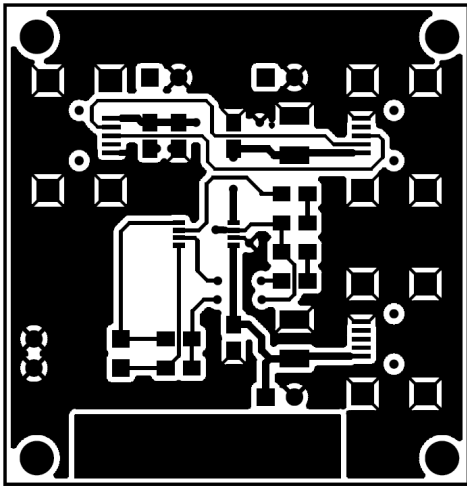


Figure 2 – PCB Layout (Top View)

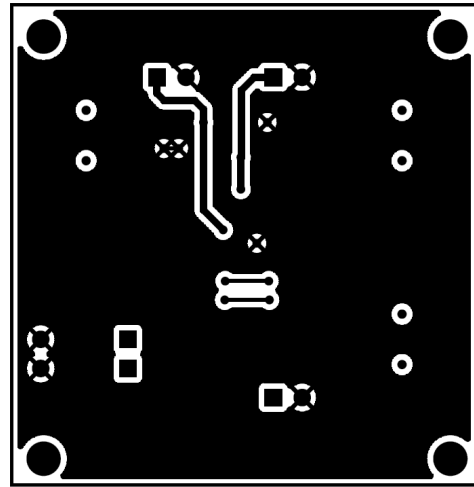


Figure 3 – PCB Layout (Bottom View)

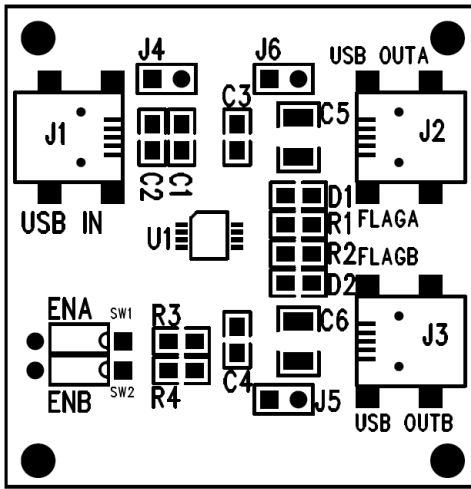


Figure 4 – Silkscreen

Table 1 – EN mode configuration

ENA/ENB	Status
Open	Switch Off
Short	Switch ON (IN connect to ENA/ENB)

* All logic input pins cannot be left floating, they must be connected to V_{IN} or V_{SS}

5. Components Description

Part #	Description
U1	SW3526MS08.
J1	Mini-USB input.
J2	Mini-USB Output and connected to OUTA of SW3526 with DATA+/-.
J3	Mini-USB Output and connected to OUTB of SW3526 without DATA+/-.
C1, C2	Power supply bypass capacitor for filtering (Note 1).
C3, C5	OUTA bypass capacitor for filtering (Note 1).
C4, C6	OUTB bypass capacitor for filtering (Note 1).
R1, R2	Pull up resistors that provide the voltage and current for D1 and D2.
R3, R4	Pull up resistors that provide logic high level to shutdown pin.
SW1, SW2	ENA/ENB logic control switch. Refer Table 1 for the detail.
D1, D2	LED indicates the FLAGA and FLAGB status. Light on denotes FLAG output low. Light off denotes FLAG output High.
J4	IN input pin of SW3526 for internal test only
J5, J6	OUTA and OUTB pins of SW3256 for internal test only

Note:

1. Bypass capacitor is used for filtering power supply noise to maximize the power supply rejection and reduce noise. The bypass capacitor should be placed as close to the device's power supply pins on the PCB layout as possible.

6. Application Highlight

1. All Logic inputs to the IC must be low or high and cannot be left floating.
2. Thermal Shutdown

Thermal protection circuit is built-in on SW3526 to protect excessive power dissipation. If the device temperature rises to approximately 135°C, the thermal shutdown circuitry turns off any switch that is current limited. Another switch continue to function normally. If the die temperature rises above 165°C, both switches are turned off and both fault flag outputs are activated. Hysteresis ensures that a switch turned off by thermal shutdown will not be turned on again until the die temperature is reduced to 115°C. Shorted switches will continue to cycle off and on, due to the rising and falling die temperature, until the short is removed.

3. Under Voltage Lockout

UVLO prevents the MOSFET switch from turning on, if input voltage below 1.8V (typical). MOSFET switch turn on when input voltage exceeds 1.8V (typical). FLAG will pull low when UVLO is present. UVLO functions only when device is enabled.

4. Current Limit

The current limit threshold is set internally to allow a minimum of 500 mA to OUTA/OUTB and the maximum output current is approximately 1.0A.

5. FLAG

The fault flag is an open-drain output capable of sinking 10 mA load current to typically 100 mV above ground. A parasitic diode or resistor is required connect between the flag pins and VIN pin. Pulling the flag pins to voltages higher. The fault flag is active (pulled low) when any of the following conditions are present: under-voltage, current limit, or thermal shutdown.

6. Filtering

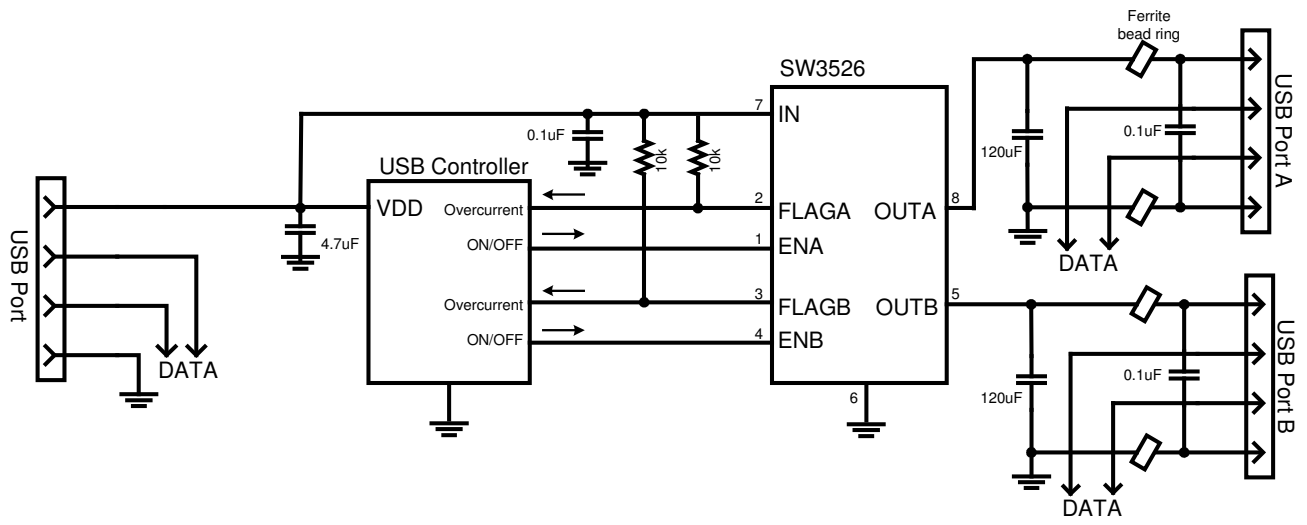
Refer to USB specification, tantalum capacitors is no less than 120 μF for output of each downstream port. This bulk capacitance provides the short-term transient current needed during a hot plug-in. To reduce EMI signals by input capacitance of the down stream device, ferrite beads in series with all power and ground lines are recommended. In selecting a ferrite bead, the DC resistance of the wire used must be kept to a minimum to reduce the voltage drop. A 0.01 μF ceramic capacitor is recommended on each port directly between the VIN/OUTA/OUTB and ground pins to prevent EMI damage to other components during the hot-detachment. Adequate capacitance must be connected to the input of the device to limit the input voltage drop during a hot-plug event to less than 330 mV. For a few tens of μs , the host must supply the in-rush current to the peripheral, charging its bulk capacitance to VIN/OUTA/OUTB. This current is initially supplied by the input capacitor. A 33 μF 16V tantalum capacitor is recommended. In choosing the capacitors, special attention must be paid to the Effective Series Resistance, ESR, of the capacitors to minimize the IR drop across the capacitor's ESR.

7. Soft Start

The maximum in-rush current is internally limited to 1.5A to eliminate the upstream voltage droop caused by the high in-rush current drawn by the output capacitors

7. Application Example

Figure 5 – USB Host Application



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