

# USB High-Side Power Switch

## FEATURES

- 70mΩ (5V Input) High-Side MOSFET Switch.
- 500mA Continuous Load Current per Channel.
- 75μA Typical On-State Supply Current.
- 1μA Typical Off-State Supply Current.
- Current-Limit / Short Circuit Protection.
- Thermal Shutdown Protection under Overcurrent Condition.
- Undervoltage Lockout Ensures that Switch is off at Start Up.
- Output can be Forced Higher than Input (Off-State).
- Open-Drain Fault Flag.
- Slow Turn ON and Fast Turn OFF.
- Enable Active-High or Active-Low.

## APPLICATIONS

- USB Power Management.
- Hot Plug-In Power Supplies.
- Battery-Charger Circuit.

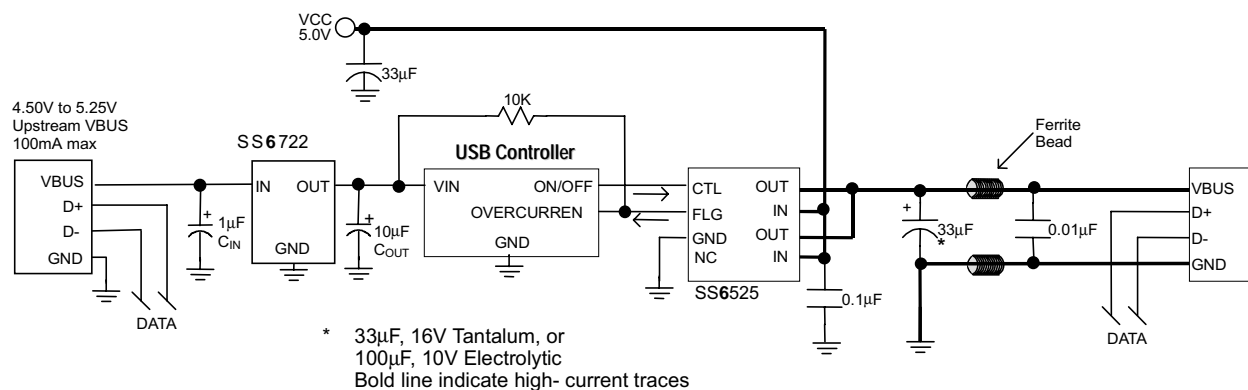
## DESCRIPTION

The SS6525 is an integrated high-side power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. The high-side switch is a MOSFET with 70mΩ  $R_{DS(ON)}$ , which meets USB voltage drop requirements for maximum transmission wire length.

Multi-purpose open-drain fault flag output indicates over-current limiting, thermal shutdown, or undervoltage lockout. Output current is typically limited to 0.85A below the 5A safety requirement, and thermal shutdown function shuts the switch off to prevent damage under overcurrent condition.

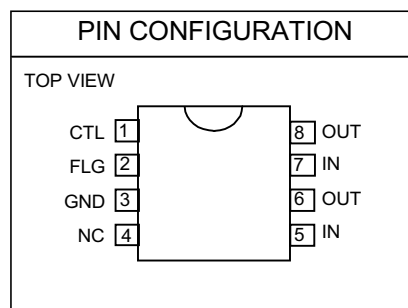
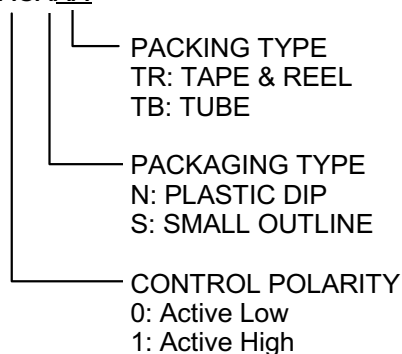
Guaranteed minimum output rise time limits inrush current during hot plug-in, minimizing EMI and preventing the voltage at upstream port from dropping excessively.

## TYPICAL APPLICATION CIRCUIT



One-Port Self-Powered Hub

## ORDERING INFORMATION

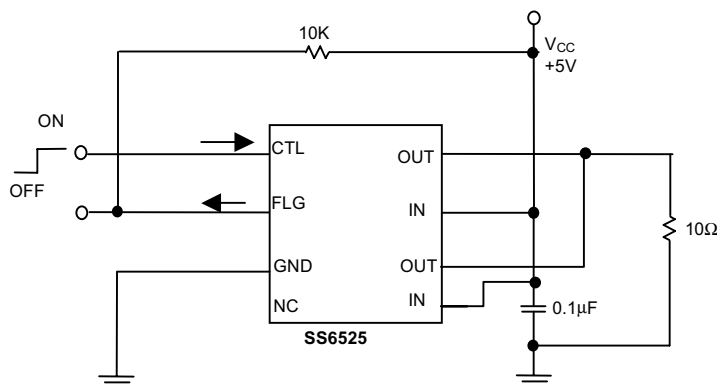
**SS6525-XCXXX**

 Example: **SS6525-0CSTR**

- Active Low Version in SO-8 Package & Taping & Reel Packing Type (CN is not available in TR packing type.)

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ( $V_{IN}$ ) .....	7.0V
Fault Flag Voltage ( $V_{FLG}$ ) .....	7.0V
Fault Flag Current ( $I_{FLG}$ ) .....	50mA
Control Input ( $V_{CTL}$ ) .....	-0.3V ~15V
Operating Temperature Range .....	-20°C~80°C
Storage Temperature Range .....	-65°C ~ 150°C

## TEST CIRCUIT



**ELECTRICAL CHARACTERISTICS** ( $V_{IN}= 5V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.)

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current	$V_{CTL} = \text{Logic "0"} , \text{OUT}=\text{Open}$		0.75	5	$\mu A$
	$V_{CTL} = \text{Logic "1"} , \text{OUT}=\text{Open}$		75	100	
Control Input Voltage	$V_{CTL} = \text{Logic "0"}$			0.8	V
	$V_{CTL} = \text{Logic "1"}$	2.4			
Control Input Current	$V_{CTL} = \text{Logic "0"}$		0.01	1	$\mu A$
	$V_{CTL} = \text{Logic "1"}$		0.01	1	
Control Input Capacitance			1		pF
Output MOSFET Resistance			70	100	m $\Omega$
Output Turn-On Rise Delay	$R_L = 10\Omega$ each Output		100		$\mu S$
Output Turn-On Rise Time	$R_L = 10\Omega$ each Output		1000	4000	$\mu S$
Output Turn-Off Delay	$R_L = 10\Omega$ each Output		0.8	20	$\mu S$
Output Turn-Off Fall Time	$R_L = 10\Omega$ each Output		0.7	20	$\mu S$
Output Leakage Current				10	$\mu A$
Current Limit Threshold		0.7	1.0	1.25	A
Overtemperature Shutdown Threshold	$T_J$ Increasing		135		$^{\circ}C$
	$T_J$ Decreasing		125		
Error Flag Output Resistance	$V_{IN} = 5V , I_L = 10 \text{ mA}$		10	25	$\Omega$
	$V_{IN} = 3.3V , I_L = 10\text{mA}$		15	40	
Error Flag Off Current	$V_{FLG} = 5V$		0.01	1	$\mu A$
UVLO Threshold	$V_{IN}$ Increasing		2.6		V
	$V_{IN}$ Decreasing		2.4		

**TYPICAL PERFORMANCE CHARACTERISTICS**

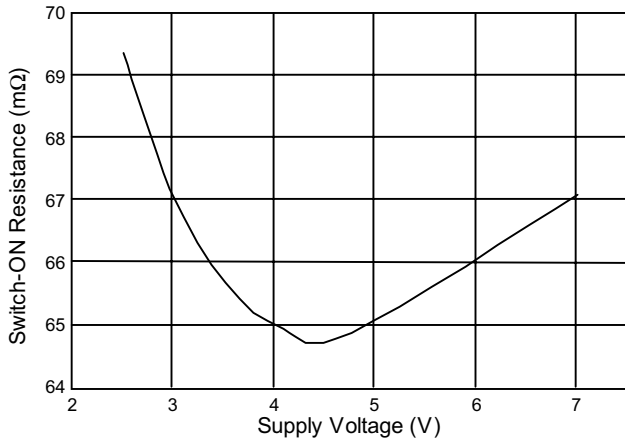


Fig. 1 Output ON Resistance vs. Supply Voltage

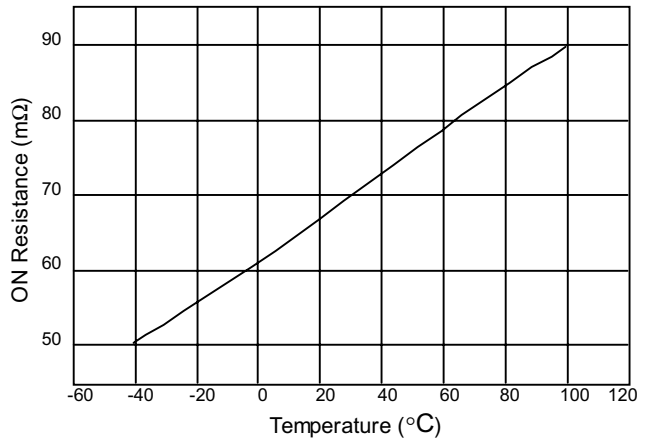


Fig. 2 On-Resistance vs. Temperature

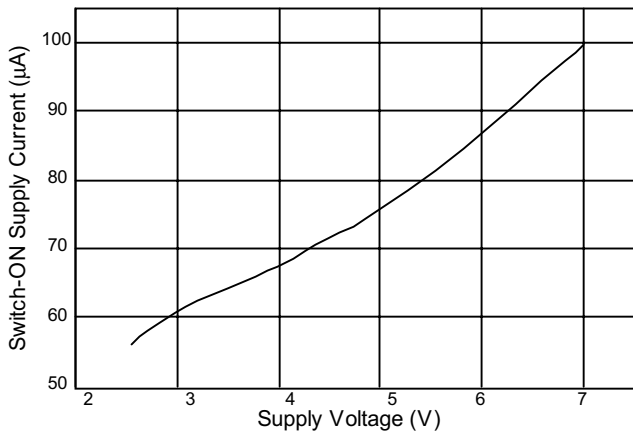


Fig. 3 ON-State Supply Current vs. Supply Voltage

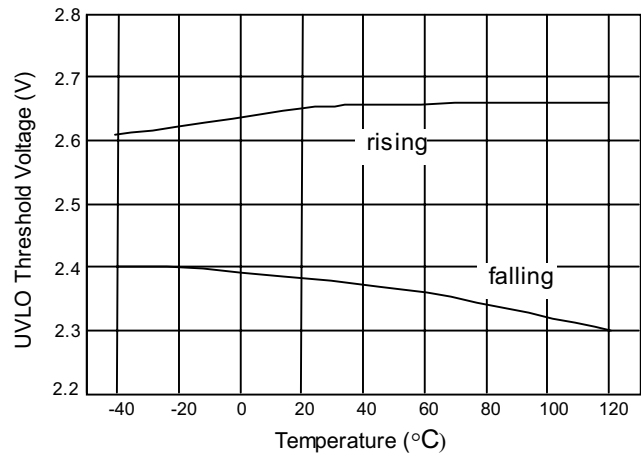


Fig. 4 UVLO Threshold Voltage vs. Temperature

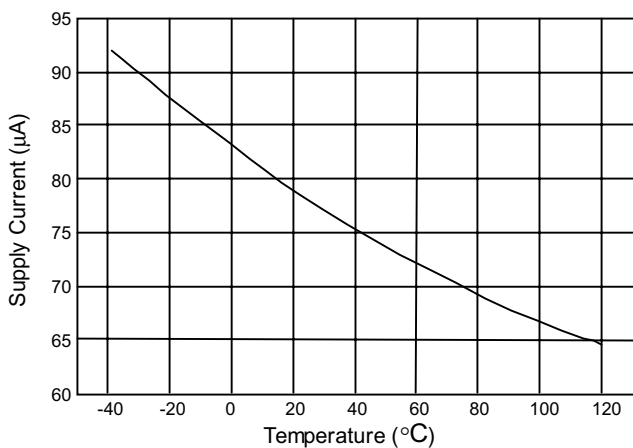


Fig. 5 ON-State Supply Current vs. Temperature

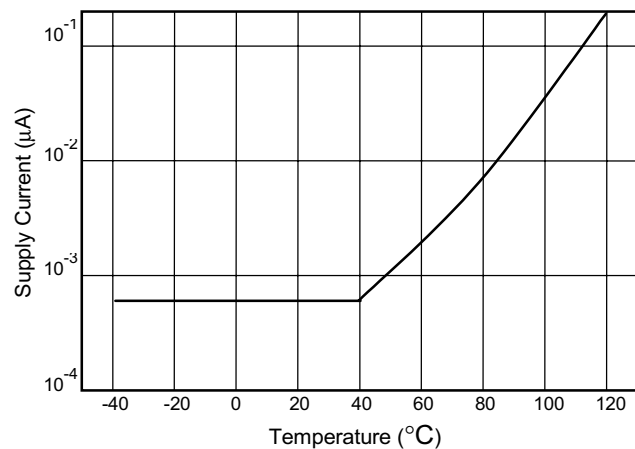


Fig. 6 OFF-State Supply Current vs. Temperature

**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

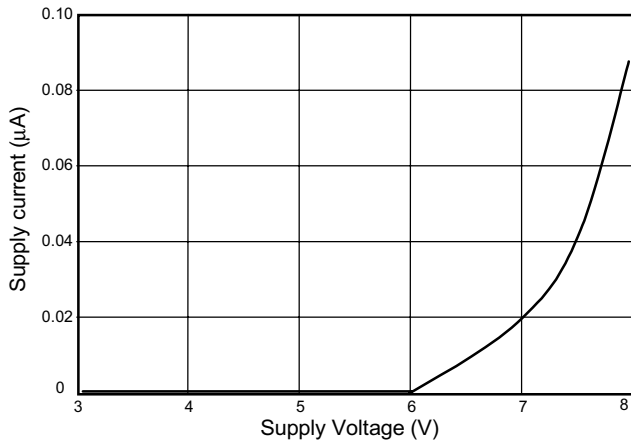


Fig. 7 OFF-State Current vs. Supply Voltage

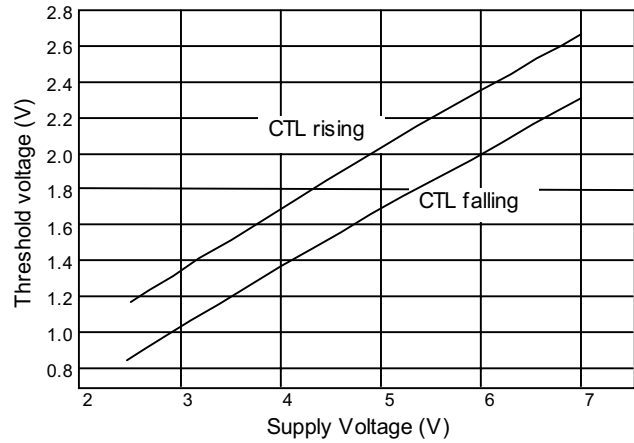


Fig. 8 CTL Threshold Voltage vs. Supply Voltage

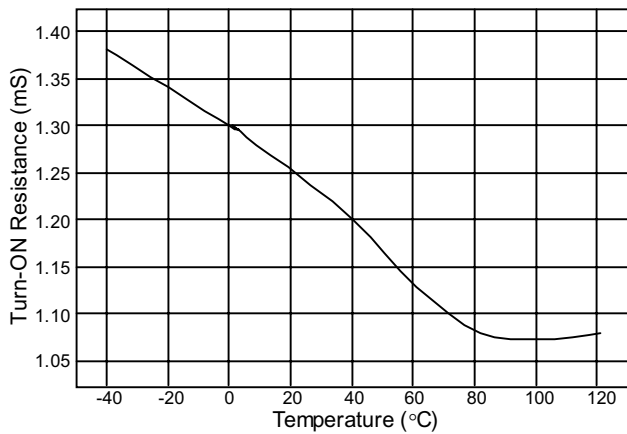


Fig. 9 Output Rise Time vs. Temperature

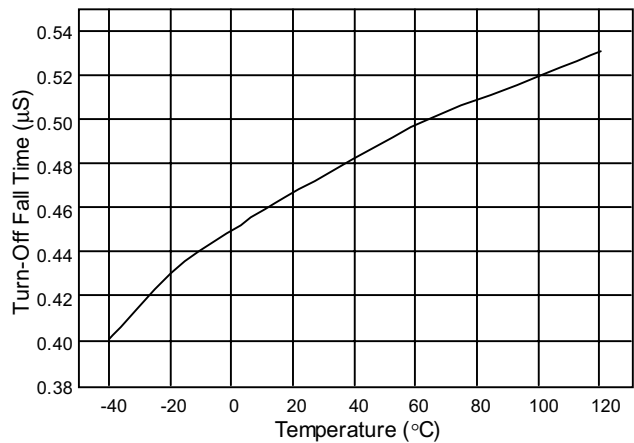


Fig. 10 Output fall Time vs. Temperature

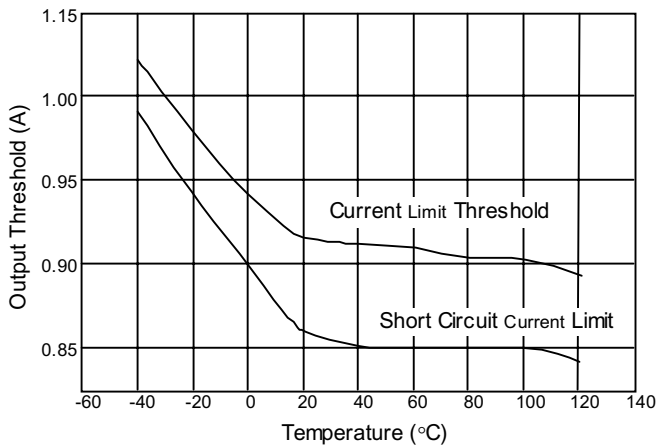


Fig. 11 Current Limit Threshold vs. Temperature

**TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

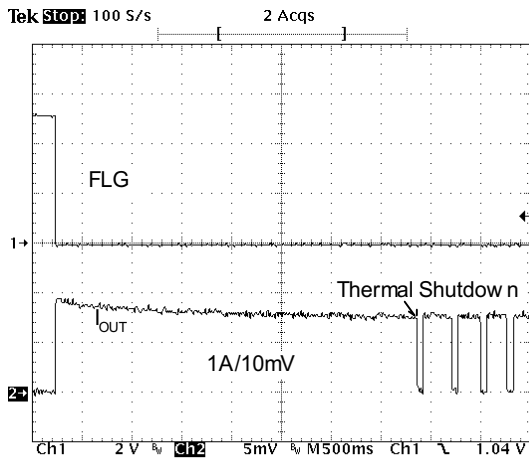


Fig. 12 Short Circuit Response

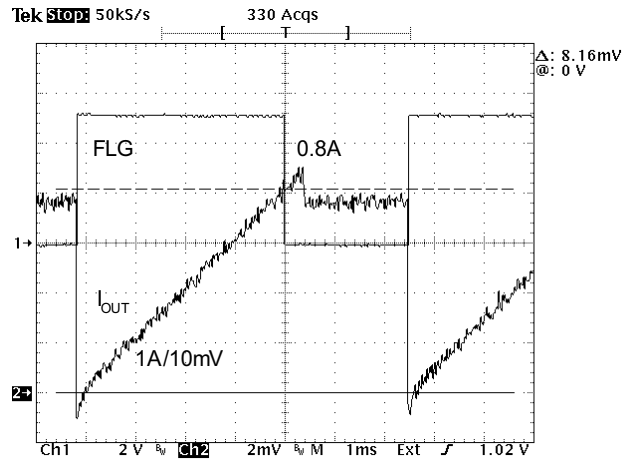


Fig. 13 Current Limit Response

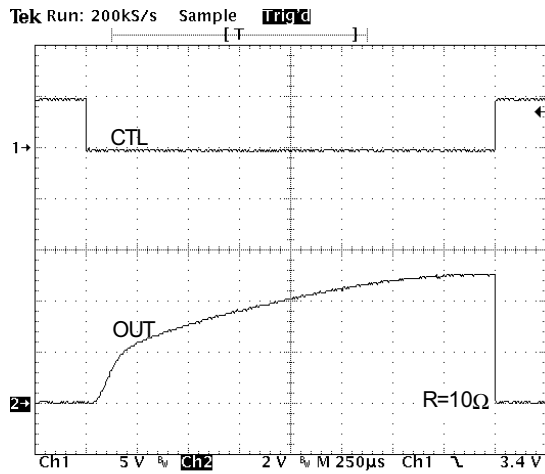


Fig. 14 Turn-On/Off Characteristic (I)

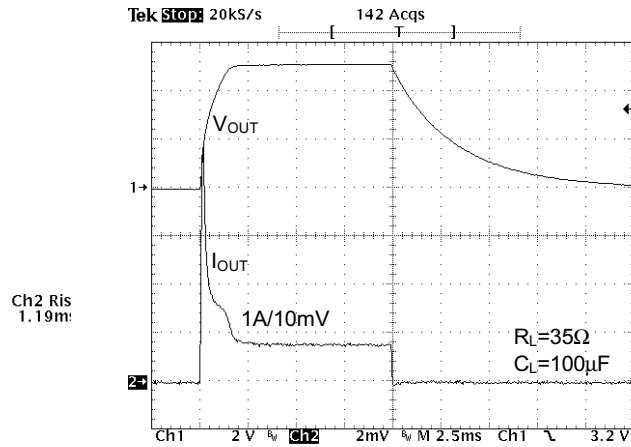
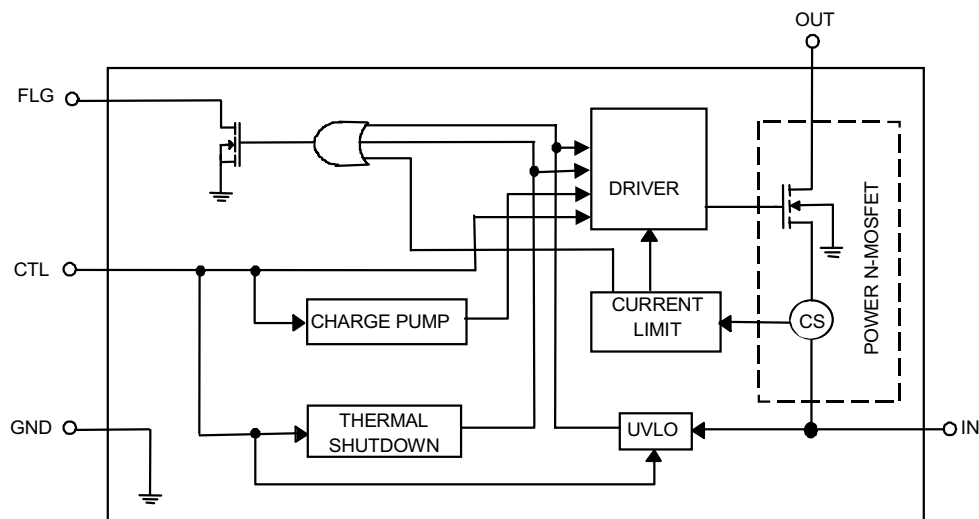


Fig. 15 Turn-On/Off Characteristic (II)

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## ■ BLOCK DIAGRAM



## ■ PIN DESCRIPTIONS

- PIN 1: CTL - TTL compatible control input. It controls the power switch turn-on/turn-off. Active High for SS6525-1 and active low for SS6525-0.
- PIN 2: FLG - An active-low and open-drain fault flag output for power switch. It can indicate current limit if CTL is active. In normal mode operation, it also can indicate thermal shutdown or undervoltage.
- PIN 3: GND - Chip power ground.
- PIN 4: NC - Not internally connected.
- PIN 5, 7: IN - Power supply Input.
- PIN 6, 8: OUT - MOSFET switch output.

## ■ APPLICATION INFORMATIONS

### ● Error Flag

An open-drained output of an N-channel MOSFET, the FLG output is pulled low to signal the following fault conditions: input undervoltage, output current limit, and thermal shutdown.

### ● Current Limit

The current limit threshold is preset internally. It protects the output MOSFET switches from damage due to undesirable short circuit conditions or excess inrush current often encountered during hot plug-in. The low limit of the current limit threshold of the SS6525 allows a minimum current of 0.5A through the MOSFET switches. A current limit condition will signal the error flag.

### ● Thermal Shutdown

When the chip temperature exceeds 135°C, the thermal shutdown function turns off MOSFET switch and signals the error flag. A hysteresis of 10°C prevents the MOSFET from turning back on until the chip temperature drops to below 125°C.

### ● Supply Filtering

A 0.1µF to 1µF bypass capacitor from IN to GND, located near the device, is strongly recommended to control supply transients. Without a bypass capacitor, an output short may cause sufficient ringing on the input (from supply lead inductance) to damage internal control circuitry.

### ● Transient Droop Requirements

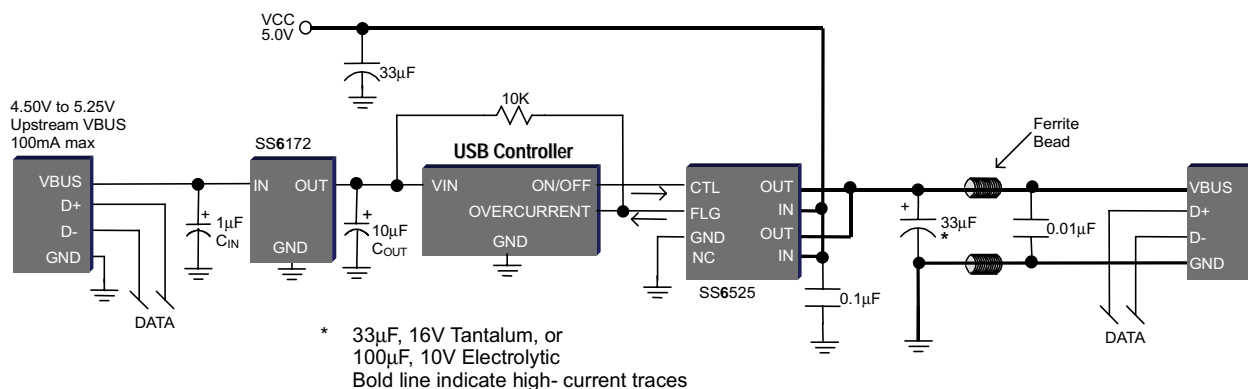
USB support dynamic attachment (hot plug-in) of peripherals. A current surge is caused by the input capacitance of downstream device. Ferrite beads are recommended in series with all power and ground connector pins. Ferrite beads reduce EMI and limit the inrush current during hot-attachment by filtering high-frequency signals.

Bulk capacitance provides the short-term transient current needed during a hot-attachment event. With a 33 $\mu$ F, 16V tantalum or 100 $\mu$ F, 10V electrolytic capacitor mounted close to downstream connector should provide transient drop protection.

### ● Short Circuit Transient

### ● Printed Circuit Layout

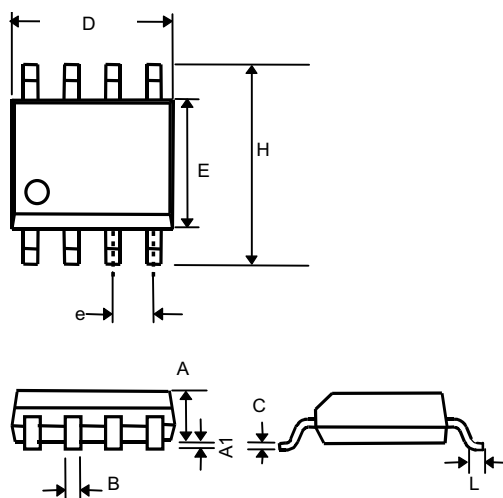
The power circuitry of USB printed circuit boards requires a customized layout to maximize thermal dissipation and to minimize voltage drop and EMI.



**One-Port Self-Powered Hub**

## ■ PHYSICAL DIMENSIONS

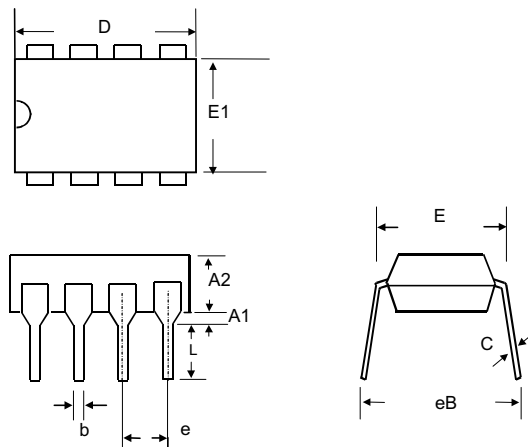
### ● 8 LEAD PLASTIC SO (unit: mm)



SYMBOL	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27(TYP)	
H	5.80	6.20
L	0.40	1.27



- **8 LEAD PLASTIC DIP (unit: mm)**



SYMBOL	MIN	MAX
A1	0.381	—
A2	2.92	4.96
b	0.35	0.56
C	0.20	0.36
D	9.01	10.16
E	7.62	8.26
E1	6.09	7.12
e	2.54 (TYP)	
eB	—	10.92
L	2.92	3.81

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