Single High-Side Power Switch With Control Function

FEATURES

- 120mΩ (5V Input) High-Side MOSFET Switch.
- 500mA Continuous Load Current.
- 80µA Typical On-State Supply Current.
- 1µA Typical Off-State Supply Current.
- Current-Limit / Short Circuit Protection.
- Thermal Limiting Protection under Overcurrent Condition.
- Undervoltage Lockout Ensures that Switch is off at Start Up.
- Output can be Forced Higher than Input (Off-State).
- Slow Turn ON and Fast Turn OFF.
- Active-High or Active-Low Enable.

APPLICATIONS

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

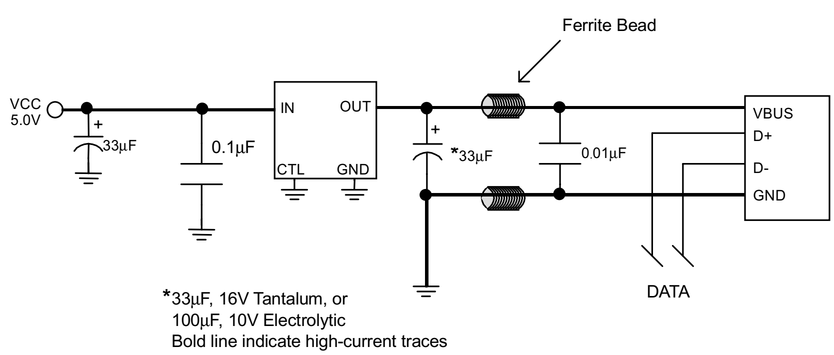
DESCRIPTION

The SS6521 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 120mΩ $R_{DS(ON)}$, which meets USB voltage drop requirements for maximum transmission wire length. The switch ON/OFF is controlled by CTL pin.

Output current is typically limited to 1.0A, well below the 5A safety requirement, and thermal shutdown function shuts the switch off to prevent damage under overcurrent conditions.

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



USB High-Side Power Switch

ORDERING INFORMATION

SS6521-XCXXX

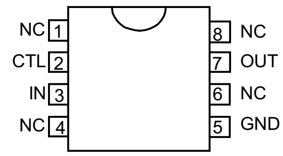
- PACKING TYPE
  - TR: TAPE & REEL
  - TB: TUBE
  - BG: BAG (for SOT-89-5)
- PACKAGING TYPE
  - O: MSOP
  - S: SO8
  - W: SOT-89-5
- CONTROL POLARITY
  - 0: Active Low
  - 1: Active High

Example: **SS6521-0COTR**

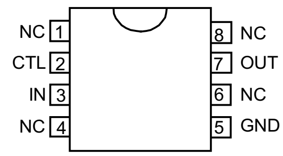
→ Active Low Version, in MSOP Package & Taping & Reel Packing Type

PIN CONFIGURATION

MSOP8
TOP VIEW



SO8
TOP VIEW



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{IN}) 7.0V

Operating Temperature Range .... -40°C ~ 85°C

Storage Temperature Range .... -65°C ~ 150°C

ELECTRICAL CHARACTERISTICS (V_{IN}= 5V, T_A=25°C, unless otherwise specified.)

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current	Switch Off, OUT=Open Switch On, OUT=Open		0.75 80	2 100	μA
Control Input Voltage	V_{CTL} =Logic "0" V_{CTL} =Logic "1"	 2.4		0.8 	V
Control Input Current	V_{CTL} =Logic "0" V_{CTL} =Logic "1"		0.01 0.01	1 1	μA
Output MOSFET Resistance	I_{OUT} = 500mA		120	180	mΩ
Output Turn-On Rise Delay	R_L = 10Ω		30		μS
Output Turn-On Rise Time	R_L = 10Ω		500		μS
Output Turn-Off Delay	R_L = 10Ω		0.2	10	μS

ELECTRICAL CHARACTERISTICS (Continued)

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Output Turn-Off Fall Time	R_L = 10Ω		0.2	10	µS
Output Leakage Current				2	µA
Current Limit Threshold		0.6	1.0	1.25	A
Thermal Limit			110		°C
UVLO Threshold	V_{IN} Increasing V_{IN} Decreasing		2.8 2.6		V

TYPICAL PERFORMANCE CHARACTERISTICS

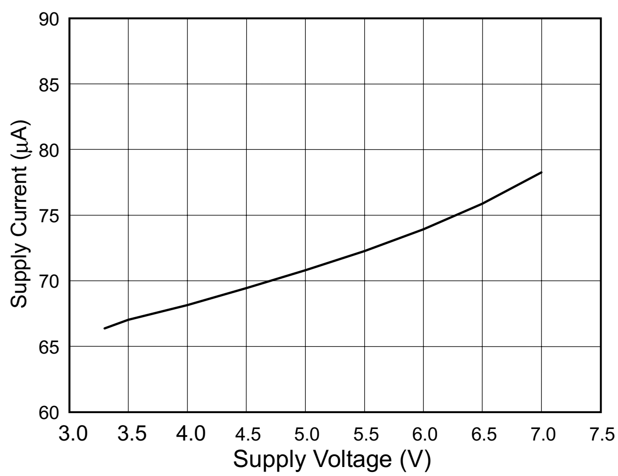


Fig. 1 On-State Supply Current vs. Supply Voltage

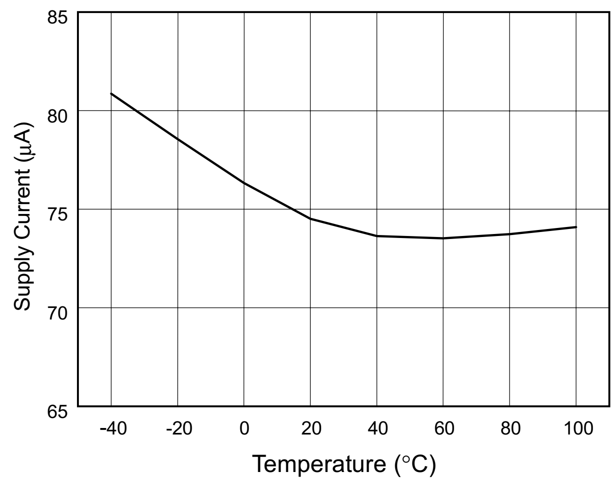


Fig. 2 On-State Supply Current vs. Temperature

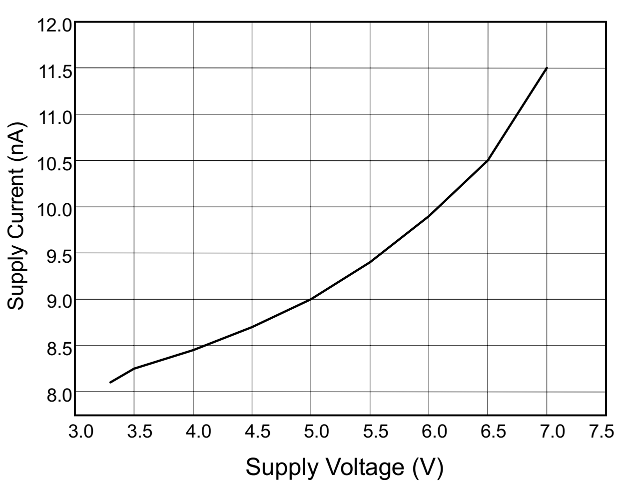


Fig. 3 Off-State Supply Current vs. Supply Voltage

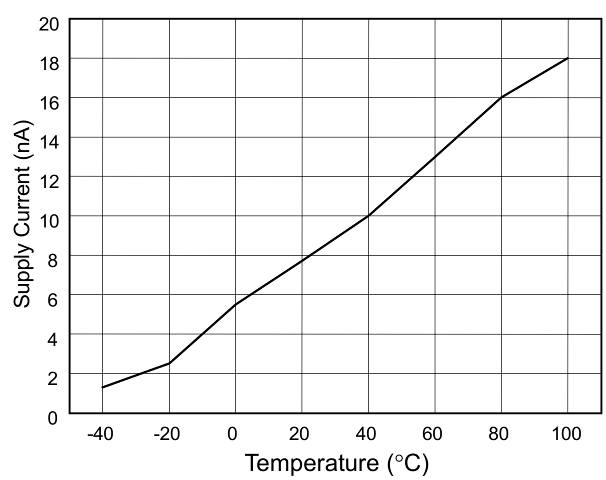


Fig. 4 Off-State Supply Current vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

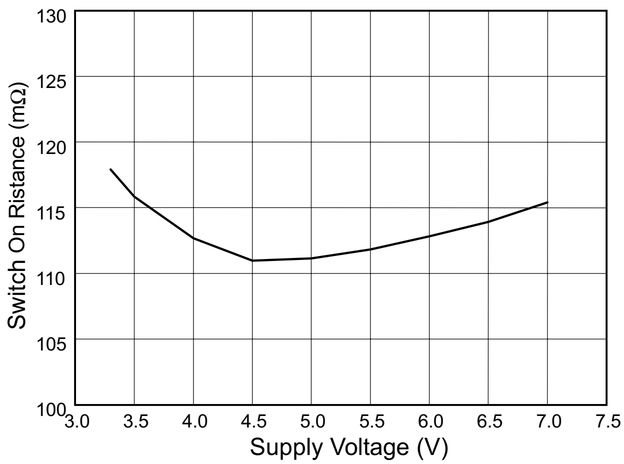


Fig. 5 Output On Resistance vs. Supply Voltage

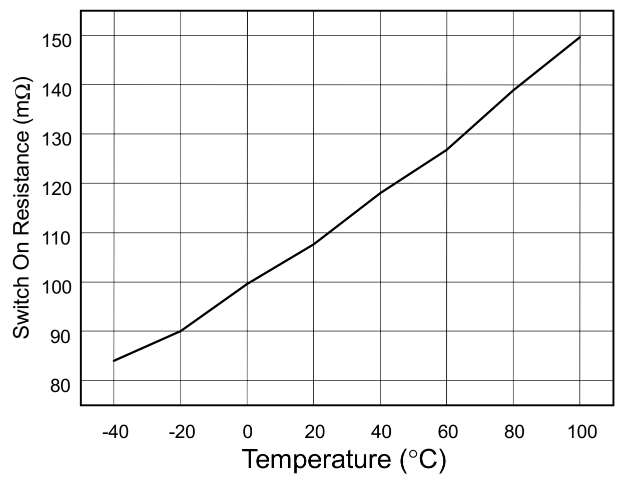


Fig. 6 Output On Resistance vs. Temperature

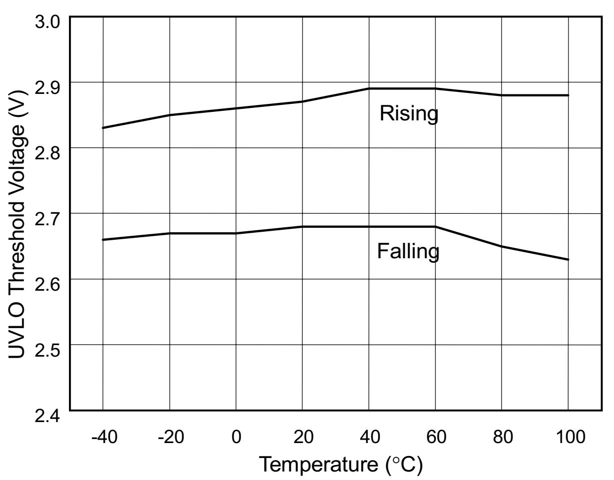


Fig. 7 UVLO Threshold Voltage vs. Temperature

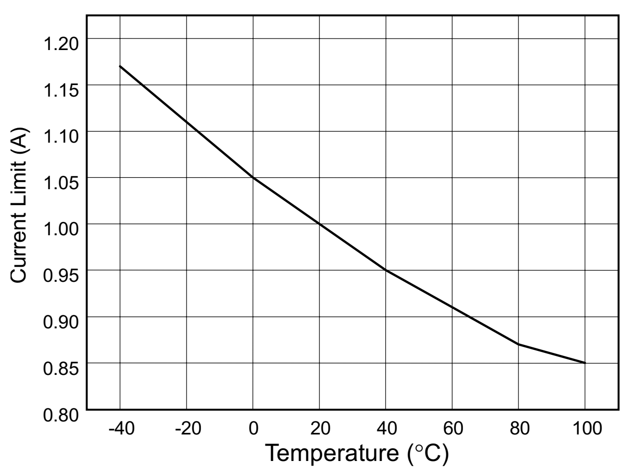


Fig. 8 Current Limit Threshold vs. Temperature

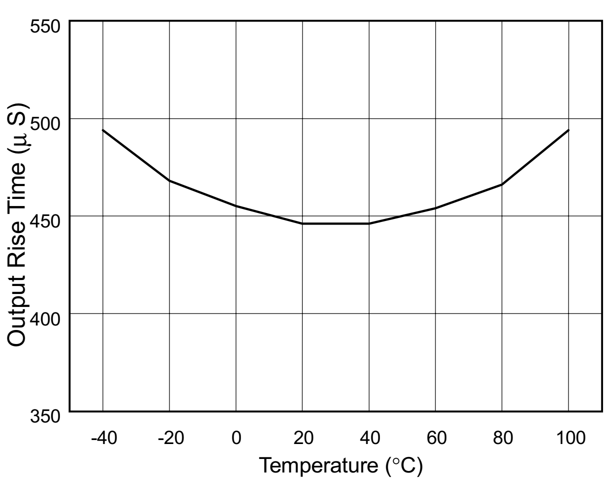


Fig. 9 Output Rise Time vs. temperature

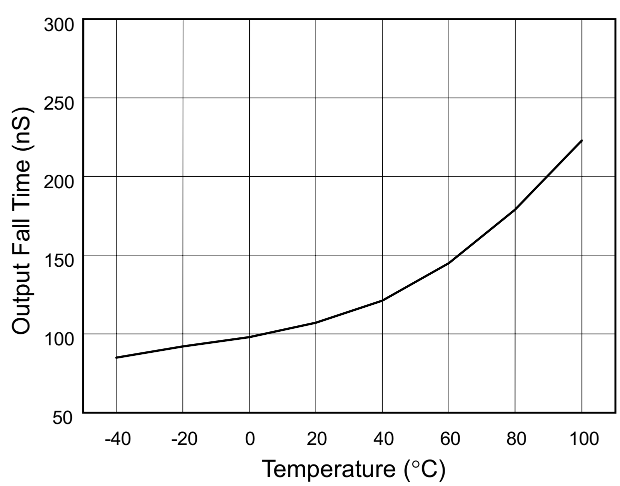


Fig. 10 Output Fall Time vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

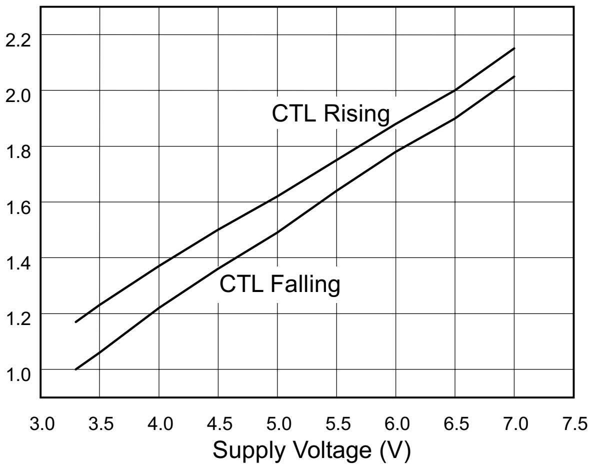


Fig. 11 CTL Threshold Voltage vs. Supply Voltage

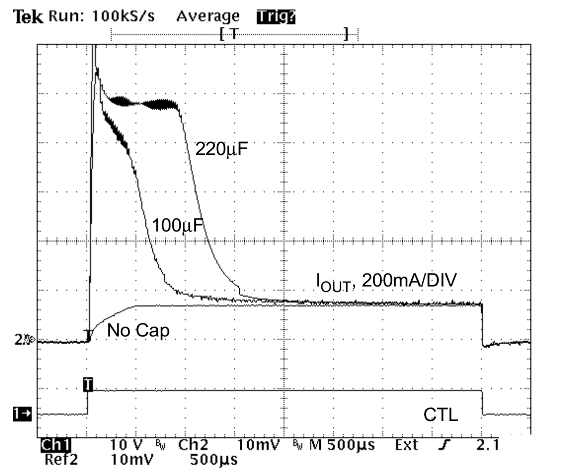


Fig. 12 Turn On Characteristic (35Ω, Loading)

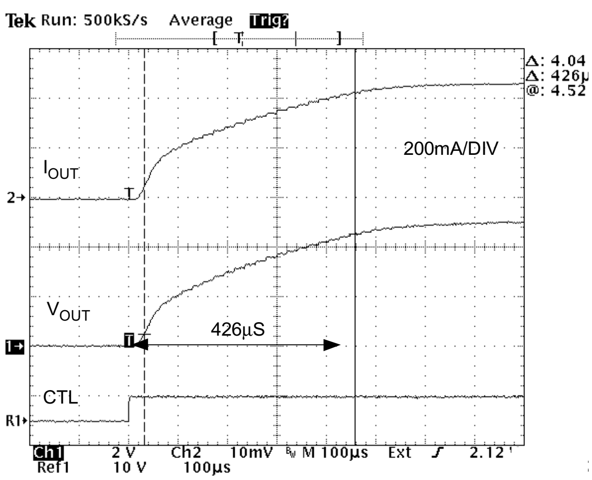


Fig. 13 Turn On Rising Time (10Ω loading)

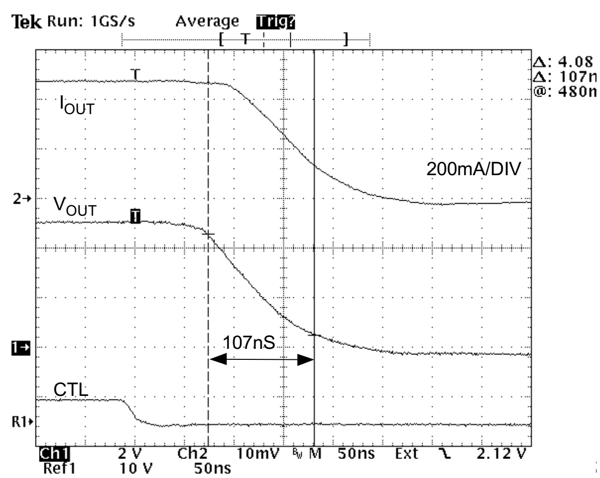


Fig. 14 Turn Off Falling Time (10Ω Loading)

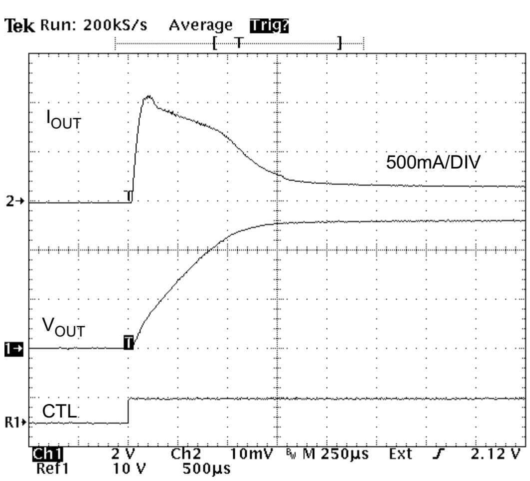


Fig. 15 Turn On Characteristic (35Ω, 100µF Loading)

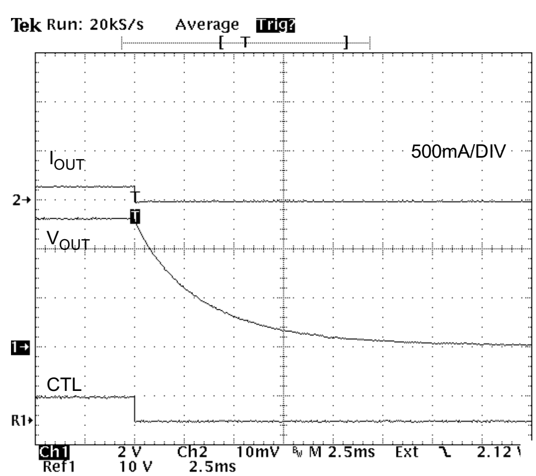


Fig. 16 Turn Off Falling Time (35Ω, 100µF Loading)

■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

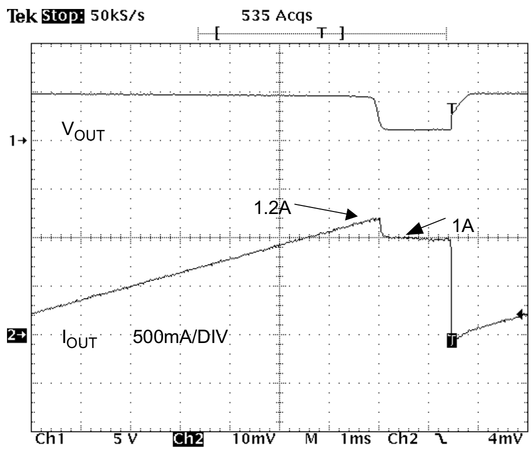


Fig. 17 Current Limit Threshold

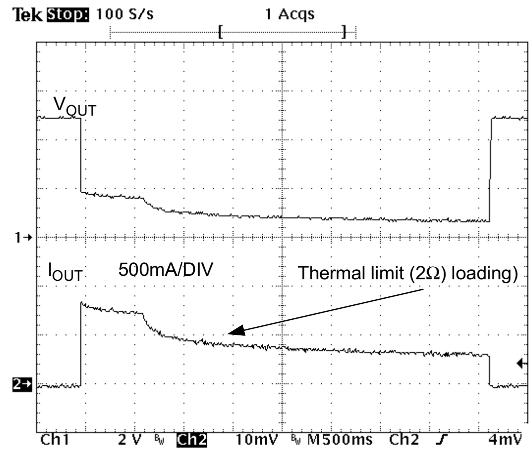


Fig. 18 Thermal Limiting Transient Response

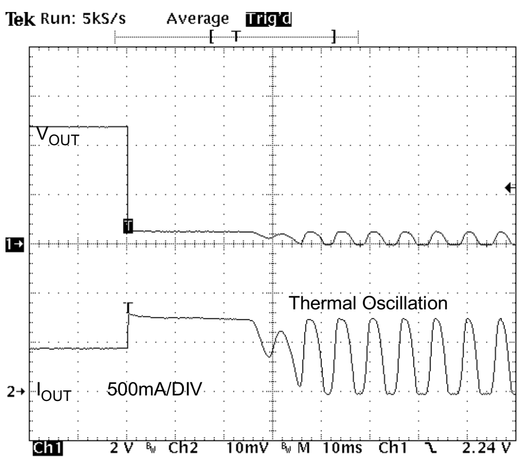


Fig. 19 Short Circuit Testing

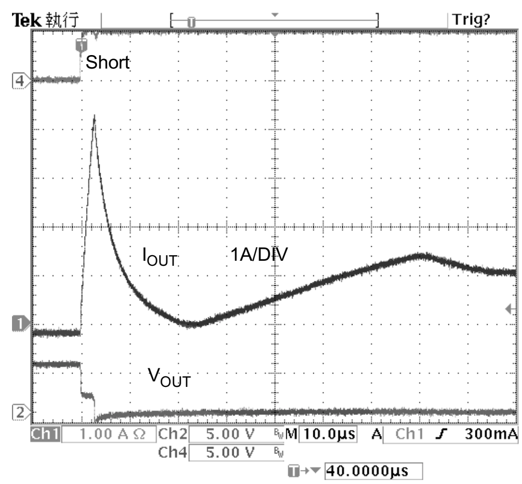
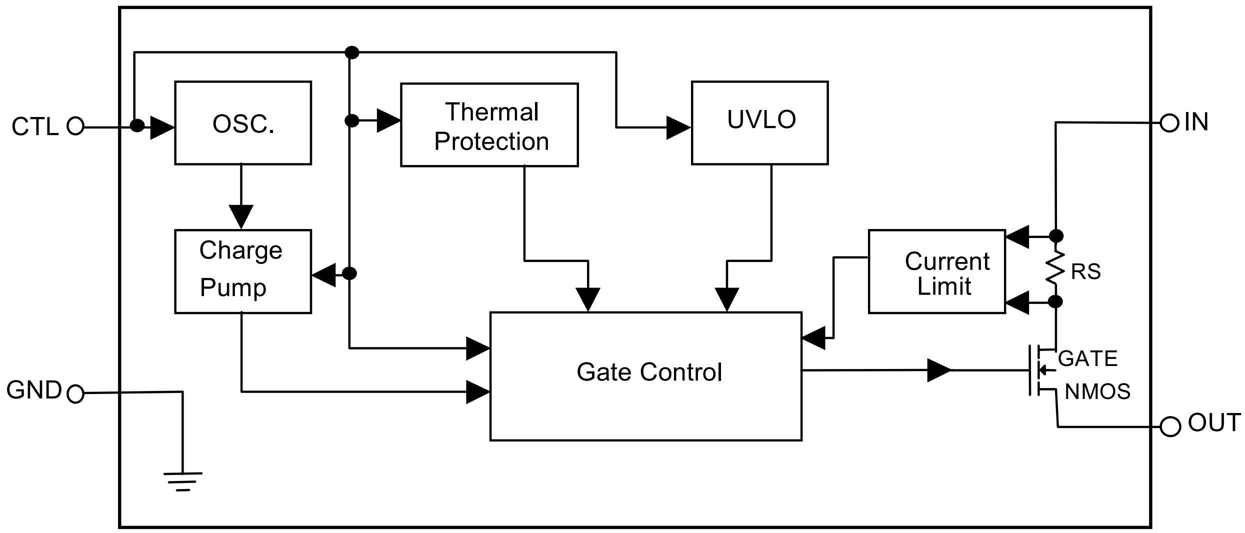


Fig. 20 Short Circuit Response Time

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN 1/4/6/8: NC:

PIN 2: CTL - TTL compatible control input. It controls the power switch turn-on/turn-off. Active High for SS6521-1 and active low for SS6521-0.

PIN 3: IN - Power supply input.

PIN 5: GND - Chip power ground.

PN 7: OUT - MOSFET switch output.

APPLICATION INFORMATIONS

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 SS6521 allows minimum 500mA continuous load current per Channel.

Thermal Protection

When the chip temperature exceeds 110°C, the thermal protection function works.

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.

Short Circuit Transient

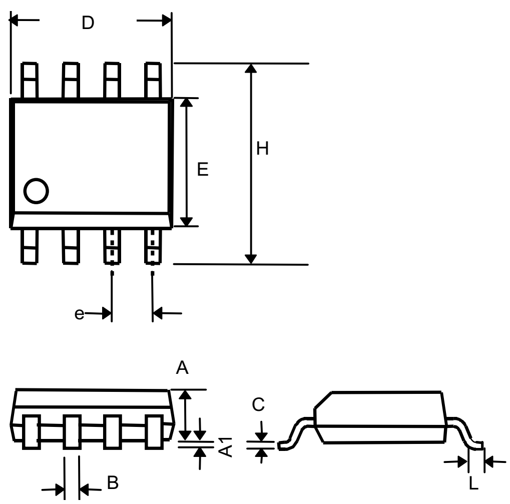
Bulk capacitance provides the short-term transient current needed during a hot-attachment event. With a 33uF, 16V tantalum or 100uF, 10V electrolytic capacitor mounted close to downstream connector should provide transient drop protection.

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.

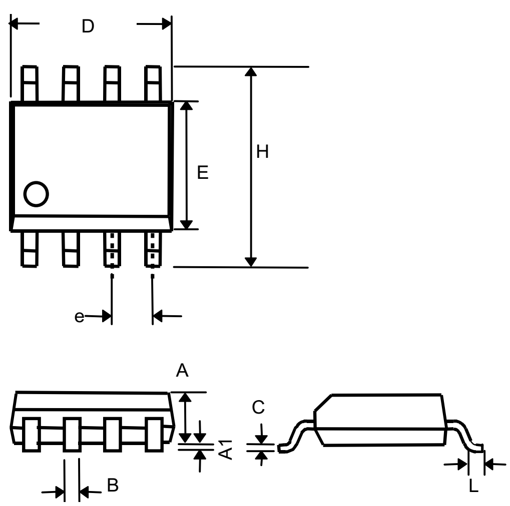
PHYSICAL DIMENSIONS

- **MSOP 8 (unit: mm)**



SYMBOL	MIN	MAX
A	0.76	0.97
A1	--	0.20
B	0.28	0.38
C	0.13	0.23
D	2.90	3.10
E	2.90	3.10
e	0.65	
H	4.80	5.00
L	0.40	0.66

- **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