

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.

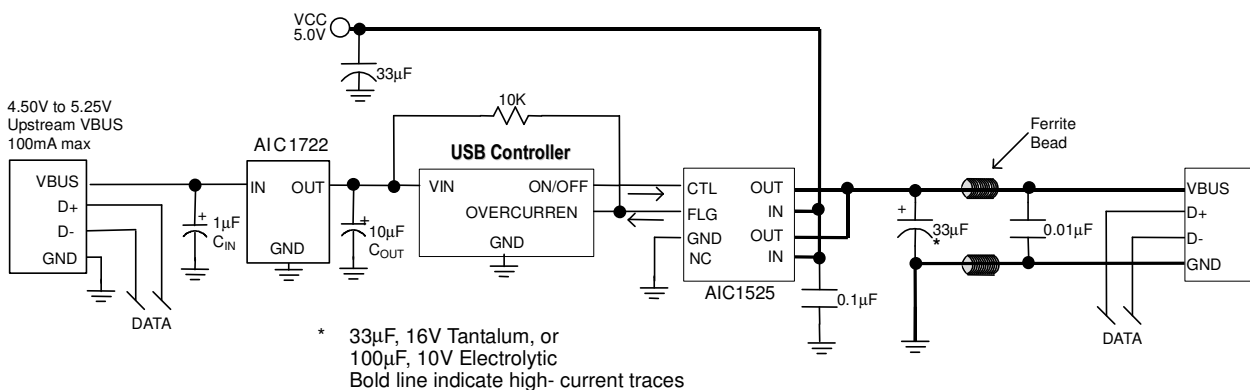
DESCRIPTION

The AIC1525 is an integrated high-side power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. The high-side switch is 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 the 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 as well as minimizing EMI and prevents the voltage at upstream port from dropping excessively.

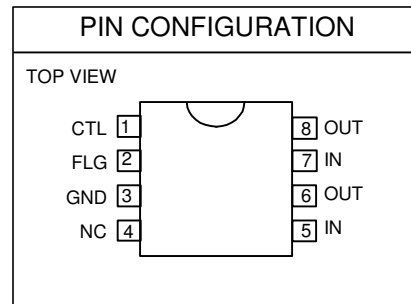
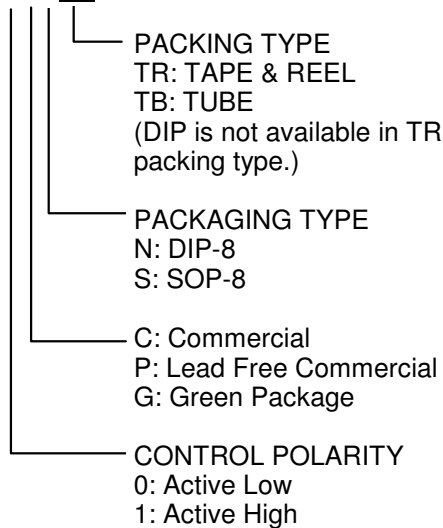
TYPICAL APPLICATION CIRCUIT



One-Port Self-Powered Hub

ORDERING INFORMATION

AIC1525-XXXXX

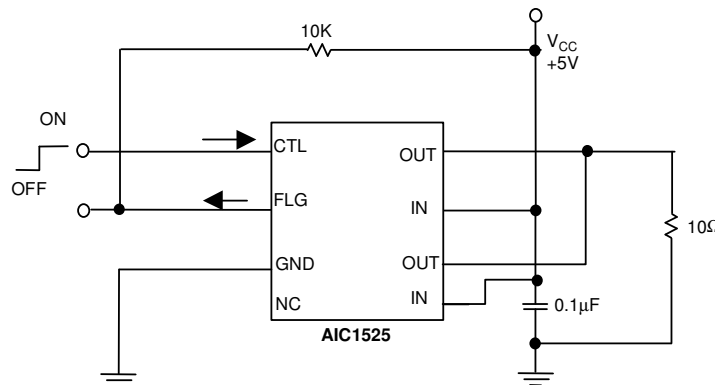


- Example: AIC1525-0GSTR
 → Active Low Version, in SOP-8 Package & Taping & Reel Packing Type
- AIC1525-0PSTR
 → Active Low Version, in Lead Free SOP-8 Package & Taping & Reel Packing Type

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	-40°C ~ 85°C
Junction Temperature	125°C
Storage Temperature Range	-65°C ~ 150°C
Lead Temperature (Soldering, 10sec)	260°C
Thermal Resistance, θ_{JA} (Junction to Ambient) DIP-8	100°C/W
(Assume no Ambient Airflow, no Heatsink) SOP-8	160°C/W

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

■ TEST CIRCUIT

■ ELECTRICAL CHARACTERISTICS

($V_{IN}=5V$, $T_A=25^{\circ}C$, unless otherwise specified.) (Note 1)

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

Note 1: Specifications are production tested at $T_A=25^{\circ}C$. Specifications over the $-40^{\circ}C$ to $85^{\circ}C$ operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

TYPICAL PERFORMANCE CHARACTERISTICS

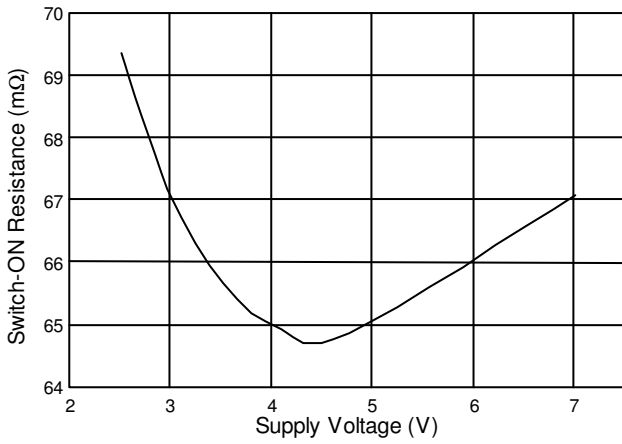


Fig. 1 Output ON Resistance vs. Supply Voltage

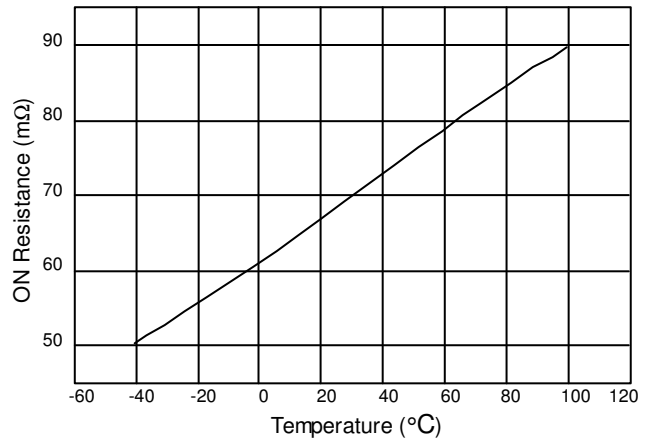


Fig. 2 On-Resistance vs. Temperature

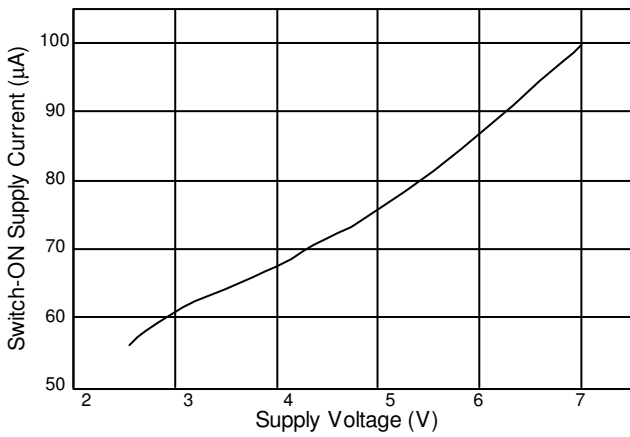


Fig. 3 ON-State Supply Current vs. Supply Voltage

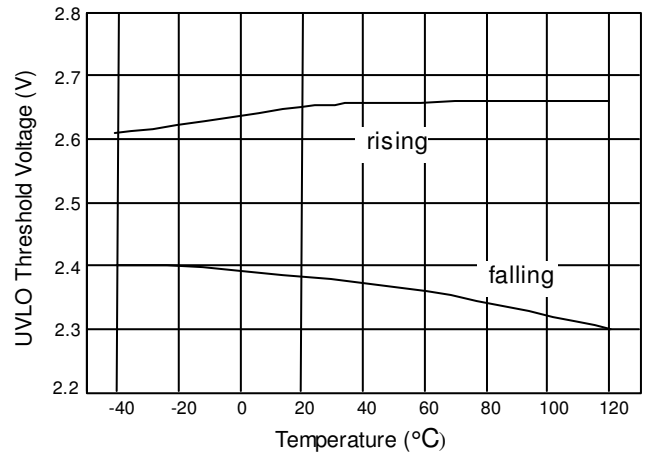


Fig. 4 UVLO Threshold Voltage vs. Temperature

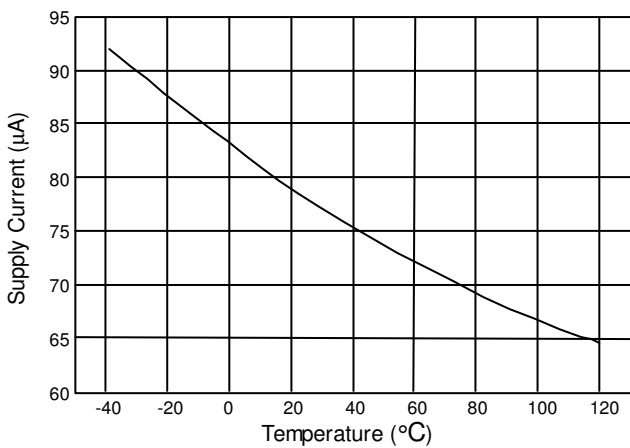


Fig. 5 ON-State Supply Current vs. Temperature

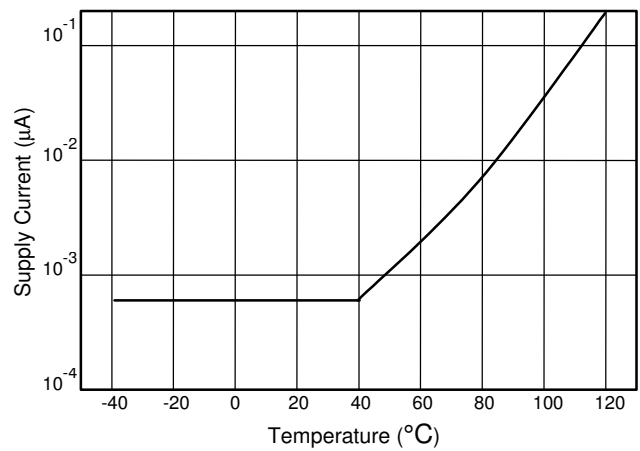


Fig. 6 OFF-State Supply Current vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

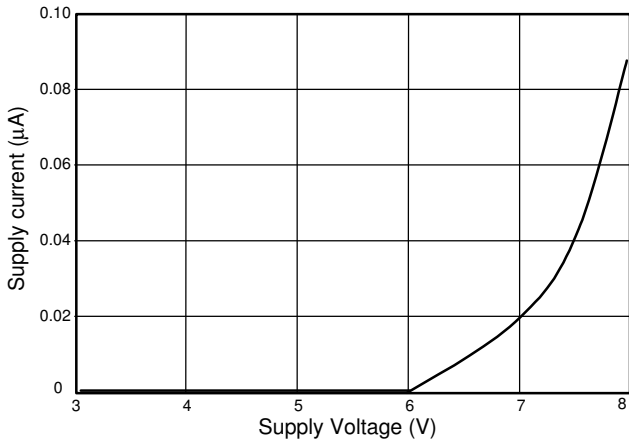


Fig. 7 OFF-State Current vs. Supply Voltage

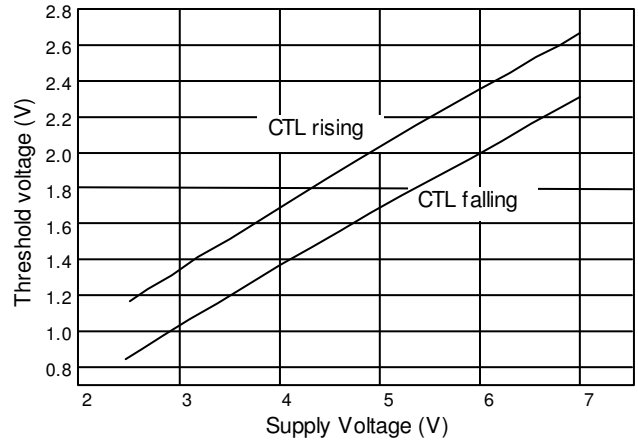


Fig. 8 CTL Threshold Voltage vs. Supply Voltage

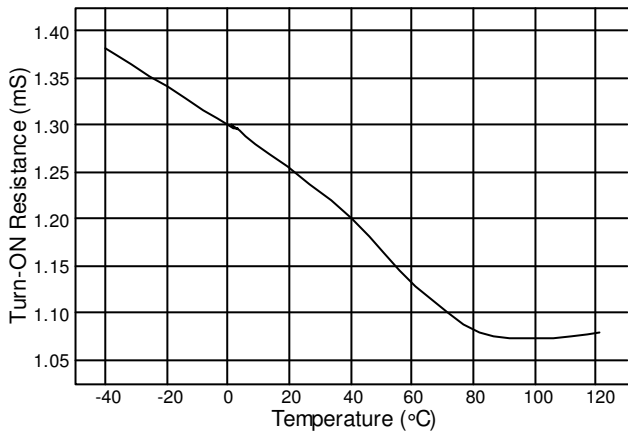


Fig. 9 Output Rise Time vs. Temperature

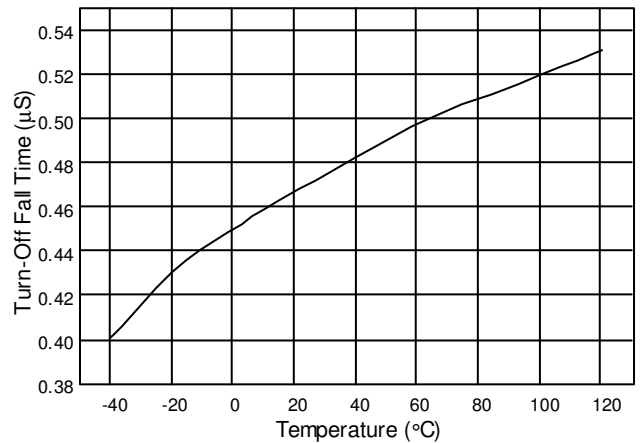


Fig. 10 Output fall Time vs. Temperature

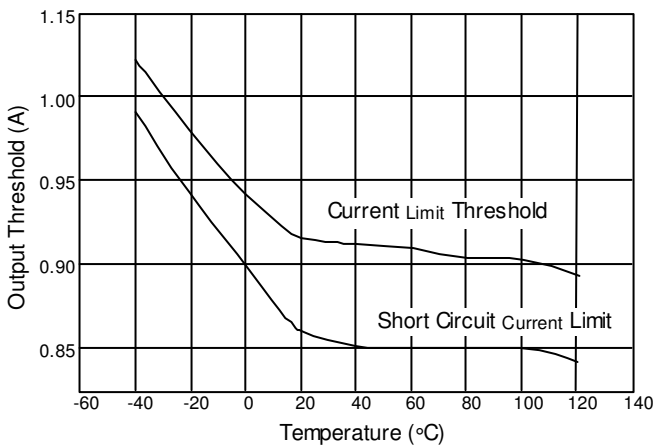


Fig. 11 Current Limit Threshold vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

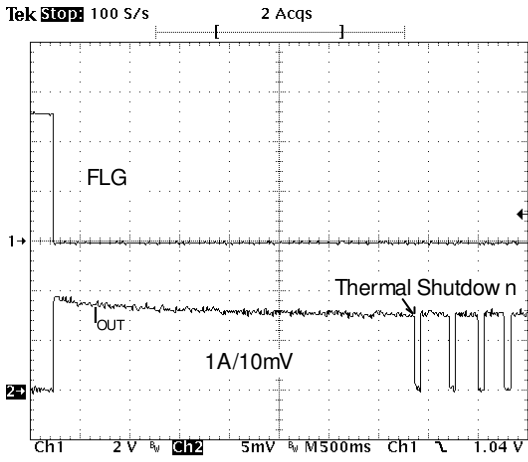


Fig. 12 Short Circuit Response

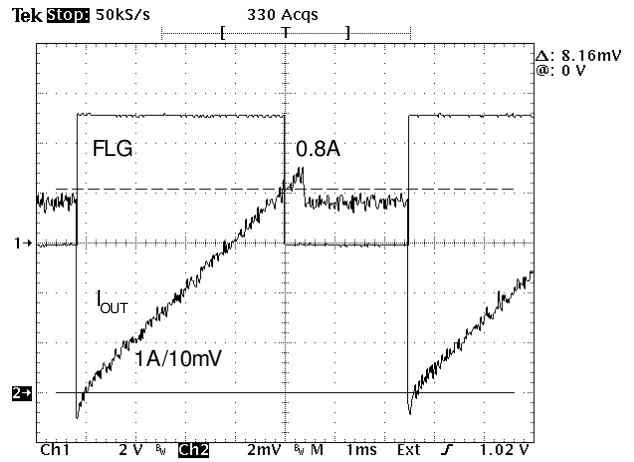


Fig. 13 Current Limit Response

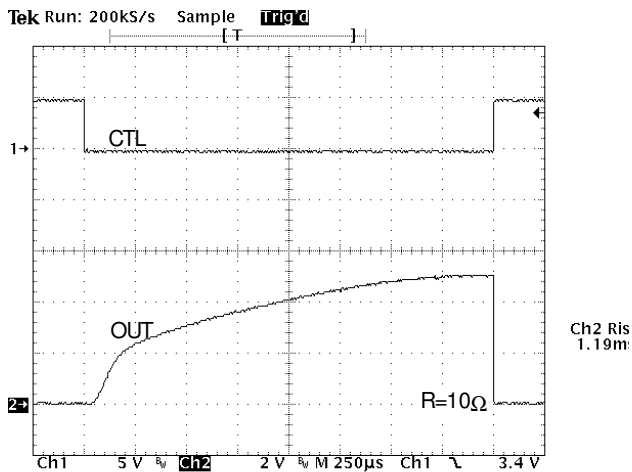


Fig. 14 Turn-On/Off Characteristic (I)

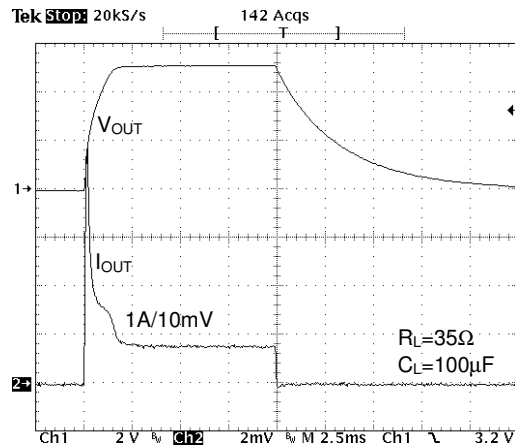
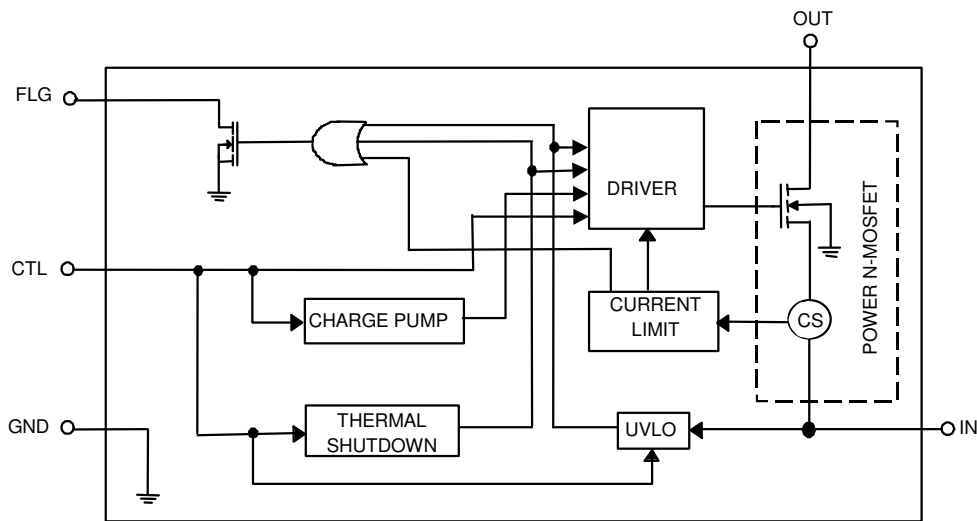


Fig. 15 Turn-On/Off Characteristic (II)

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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 AIC1525-1 and active low for AIC1525-0.
- 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 INFORMATION

● Error Flag

An error Flag is an open-drained output of an N-channel MOSFET. 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 resulting from undesirable short circuit conditions or excess inrush current, which is often encountered during hot plug-in. The low limit of the current limit threshold of the AIC1525 allows a minimum current of 0.5A through the MOSFET

switches. The error flag signals when any current limit conditions occur.

● Thermal Shutdown

When temperature of AIC1525 exceeds 135°C for any reasons, the thermal shutdown function turns both MOSFET switches off and signals the error flag. A hysteresis of 10°C prevents the MOSFETs from turning back on until the chip temperature drops 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 Requirements**

USB supports 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**

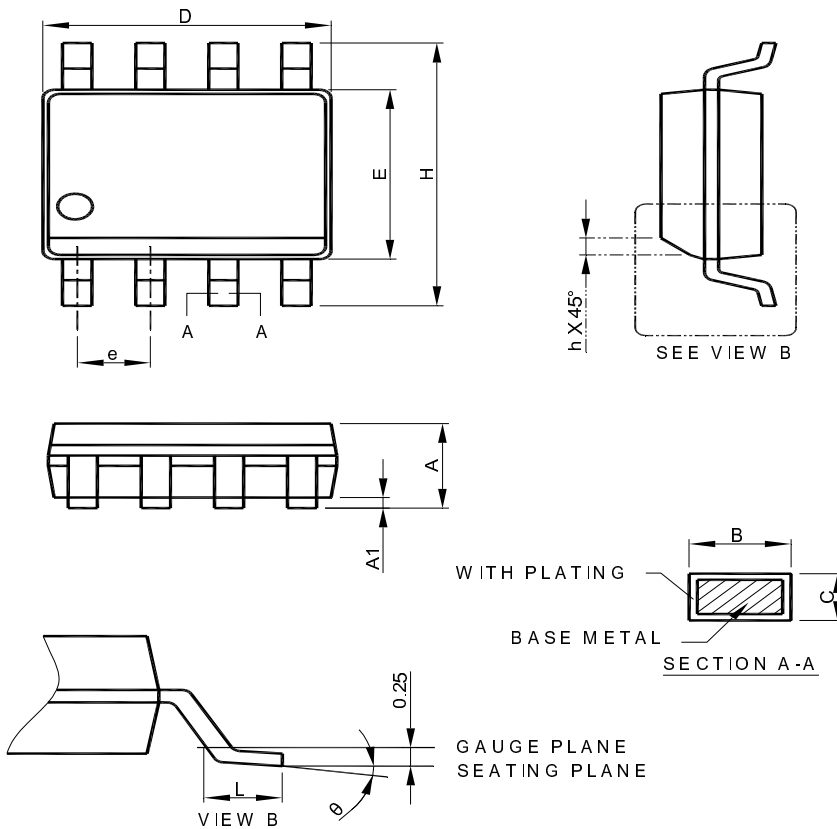
Bulk capacitance provides the short-term transient current needed during a hot-attachment event. A 33μF/16V tantalum or a 100μF/10V electrolytic capacitor mounted close to downstream connector each port should provide transient drop protection.

● **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 (unit: mm)**

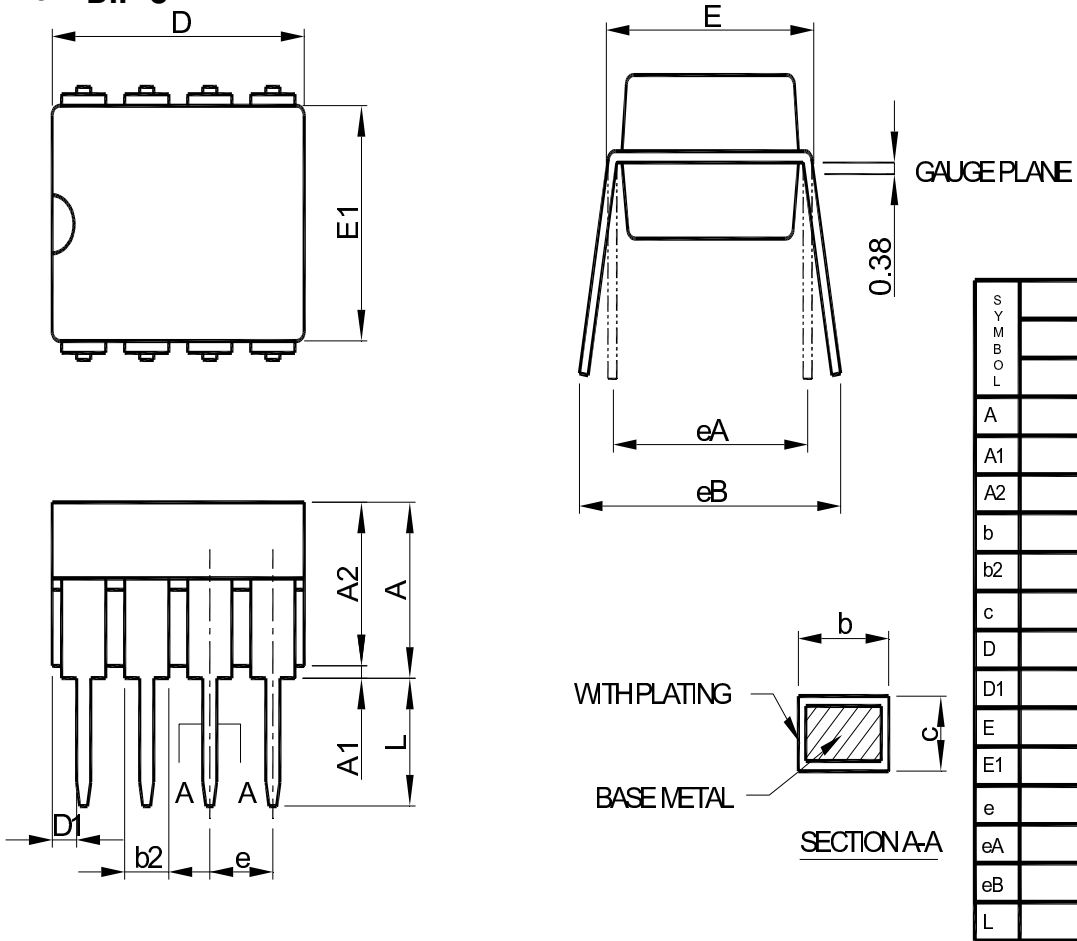
● **SOP-8**



SYMBOL	SOP-8	
	MILLIMETERS	
	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 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
θ	0°	8°

- Note: 1. Refer to JEDEC MS-012AA.
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
 3. Dimension "E" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

● DIP-8



SYMBOL	DIP-8	
	MILLIMETERS	
	MIN.	MAX.
A		5.33
A1	0.38	
A2	2.92	4.95
b	0.36	0.56
b2	1.14	1.78
c	0.20	0.35
D	9.01	10.16
D1	0.13	
E	7.62	8.26
E1	6.10	7.11
e	2.54 BSC	
eA	7.62 BSC	
eB		10.92
L	2.92	3.81

- Note: 1. Refer to JEDEC MS-001BA
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side .
 3. Dimension "D1" and "E1" do not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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