Dual Channel Bare-Bone USB Switch

FEATURES

- 170mΩ High-Side MOSFET Switch.
- 0.5A Continuous Load Current.
- 40μA Quiescent Supply Current Per Channel.
- 3.2V to 5.5V Input Voltage Range.
- Under-Voltage Lockout.
- Current-Limit / Short Circuit Protection.
- Thermal Shutdown Protection under Over Current Condition.
- Under Voltage Lockout Ensures that Switch is off at Start Up.
- No Reverse Current when Power off.
- Available in SOT-23-5 Packages.

APPLICATIONS

- USB Power Management
- High-Side Power Protection Switch
- Hot Plug-In Power Supplies
- Battery-Charger Circuits
- Portable Application.
- Digital televisions
- Computer
- Multimedia
- Mobile Phones

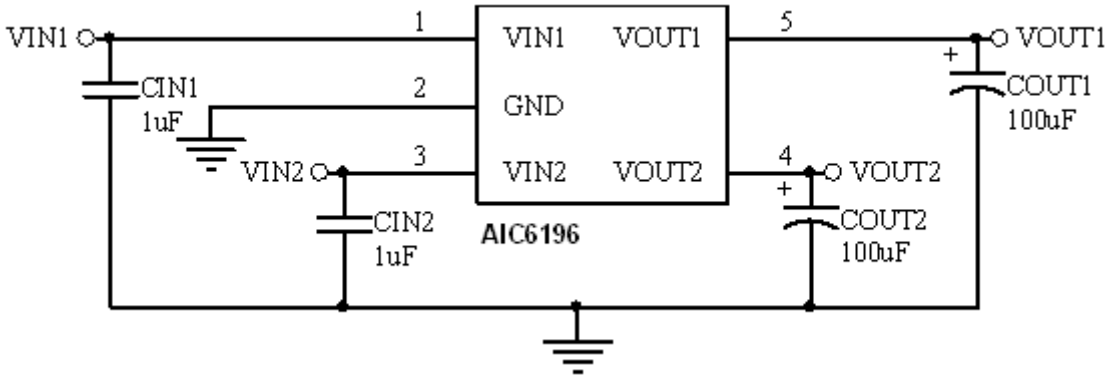
DESCRIPTION

The AIC6196 is a dual high-side power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. Both high-side switches are MOSFET with 170mΩ $R_{DS(ON)}$, which meets USB voltage drop requirements for maximum transmission wire length.

The protection includes current limiting with foldback, short circuit and thermal shutdown under overcurrent occurs.

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.

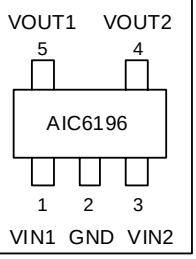
TYPICAL APPLICATION CIRCUIT



ORDERING INFORMATION

AIC6196X XX XX

- PACKING TYPE
  TR: TAPE & REEL
  BG: BAG
- PACKAGE TYPE
  V5: SOT-23-5
- G: Green Package

Package Type	Configuration
V5 (SOT-23-5)	

Example: AIC6196GV5TR

→ In SOT-23-5 Green package and
TAPE & REEL packing.

- **Marking**

Part No.	Package Code	Package Type	Marking
AIC6196-x	GV5	SOT-23-5	6196G

■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{IN}) 6.0V
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_{JC} (Junction to Case) SOT-23-5 ..... 115°C/W
Thermal Resistance, θ_{JA} (Junction to Ambient) SOT-23-5 ..... 250°C/W
(Assume no Ambient Airflow, no Heatsink)

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

ELECTRICAL CHARACTERISTICS

(V_{IN}= 5V, C_{IN1}=C_{IN2}=1 μF, C_{OUT1} =C_{OUT2} = 100 μF (Note 2), T_A=25°C, unless otherwise specified.)
(Note 1)

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage		3.2		5.5	V
Supply Current			40		μA
Current Limit Threshold		0.55	0.8	1	A
Output MOSFET Resistance			170		mΩ
Output Turn-On Rise Time	R_L = 10Ω each Output		1000	2500	μS
Output Turn-Off Fall Time	R_L = 10Ω each Output		0.7	20	μS
Over Temperature Shutdown Threshold	T_J Increasing T_J Decreasing		145 125		°C
Under Voltage Lockout			2.5		V
Under Voltage Lockout Hysteresis			200		mV

Note1: Specifications are production tested at T_A=25°C. Specifications over the -40°C to 85°C operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note2: Electrolytic Capacitor is recommended for C_{OUT1} & C_{OUT2} capacitor.

TYPICAL PERFORMANCE CHARACTERISTICS

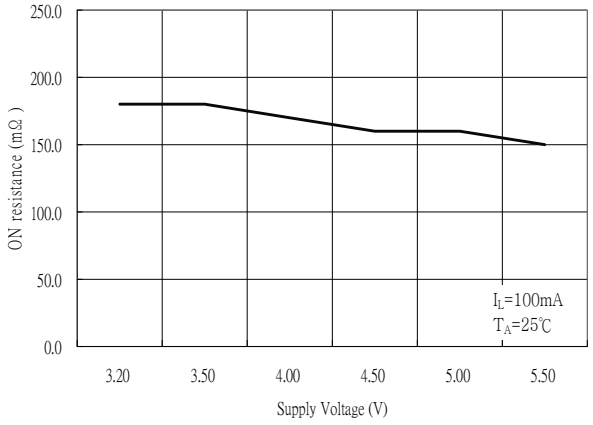


Fig. 1 ON Resistance vs. Supply voltage

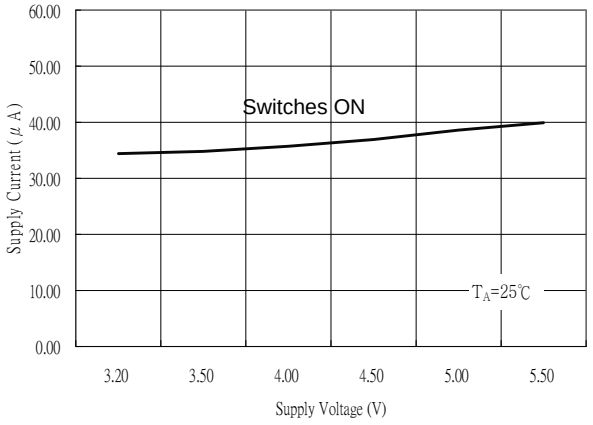


Fig. 2 On-State Supply Current vs. Supply Voltage

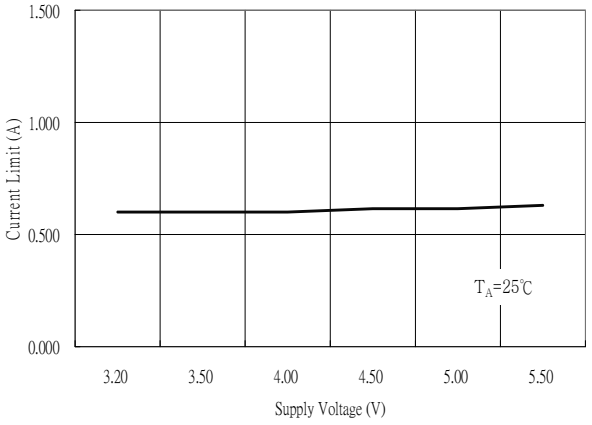


Fig. 3 Current Limit vs. Supply Voltage

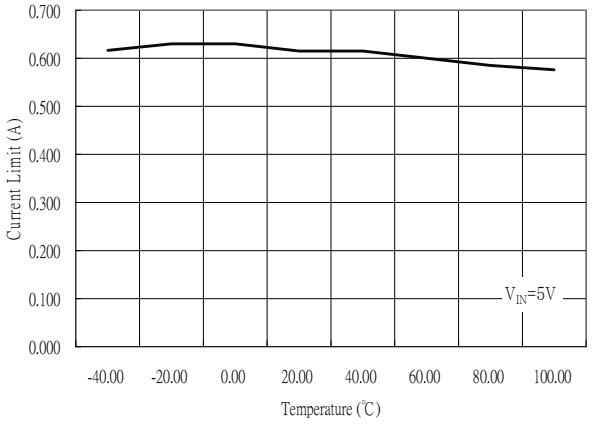


Fig. 4 Current Limit vs. Temperature

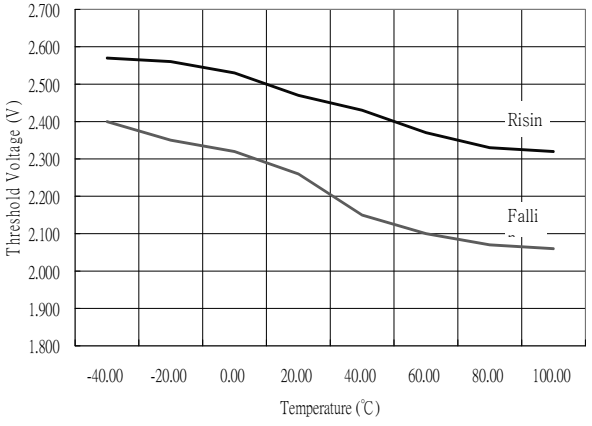


Fig. 5 UVLO Threshold Voltage vs. Temperature

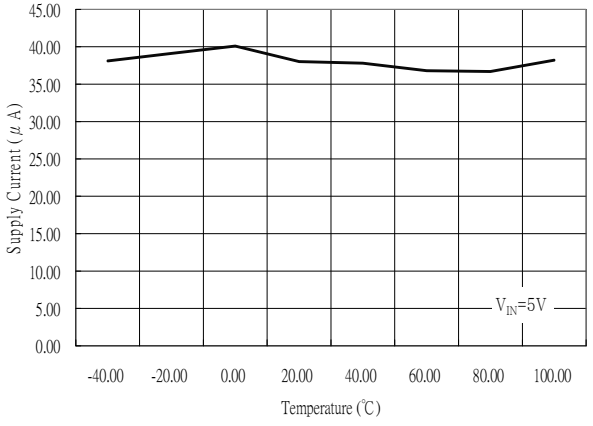


Fig. 6 Supply Current vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

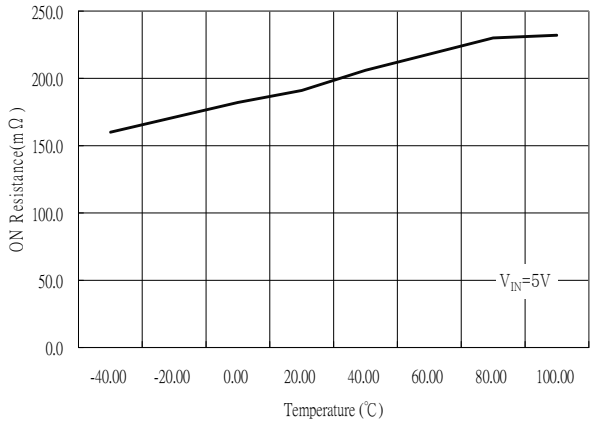
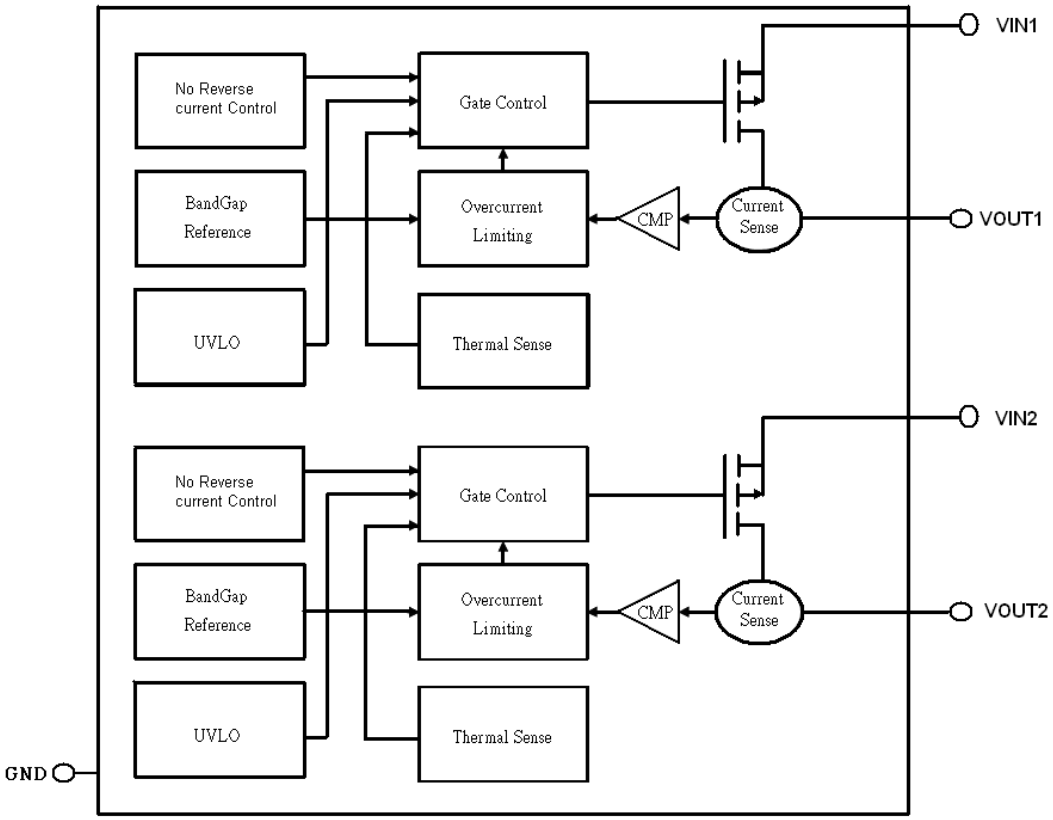


Fig. 7 ON resistance vs. Temperature

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN1 VIN1: Power supply input1.

PIN2 GND: Chip power ground.

PIN3 VIN2: Power supply input2.

PIN4 VOUT2: MOSFET switch output2.

PIN5 VOUT1: MOSFET switch output1.

APPLICATION INFORMATION

- **Current Limit**

  Current limiting is invoked when the load exceeds the set over-current threshold. 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.

- **Thermal Shutdown**

  When junction temperature of AIC6196 exceeds 145°C for any reasons, the thermal shutdown function turns MOSFET switch off. A hysteresis of 20°C prevents the MOSFETs from turning back on until the chip temperature drops below 125°C. thermal shutdown circuit functions only when the switch is enabled.

- **Under-voltage Lockout**

  UVLO prevents the MOSFET switch from turning on until input voltage exceeds 2.5V typically. After the switch turns on, if input voltage drops below 2.3V typically, UVLO shuts off the output MOSFET.

- **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. Input transients must not exceed the maximum V_{IN} voltage for a short duration.

- **Transient Requirements**

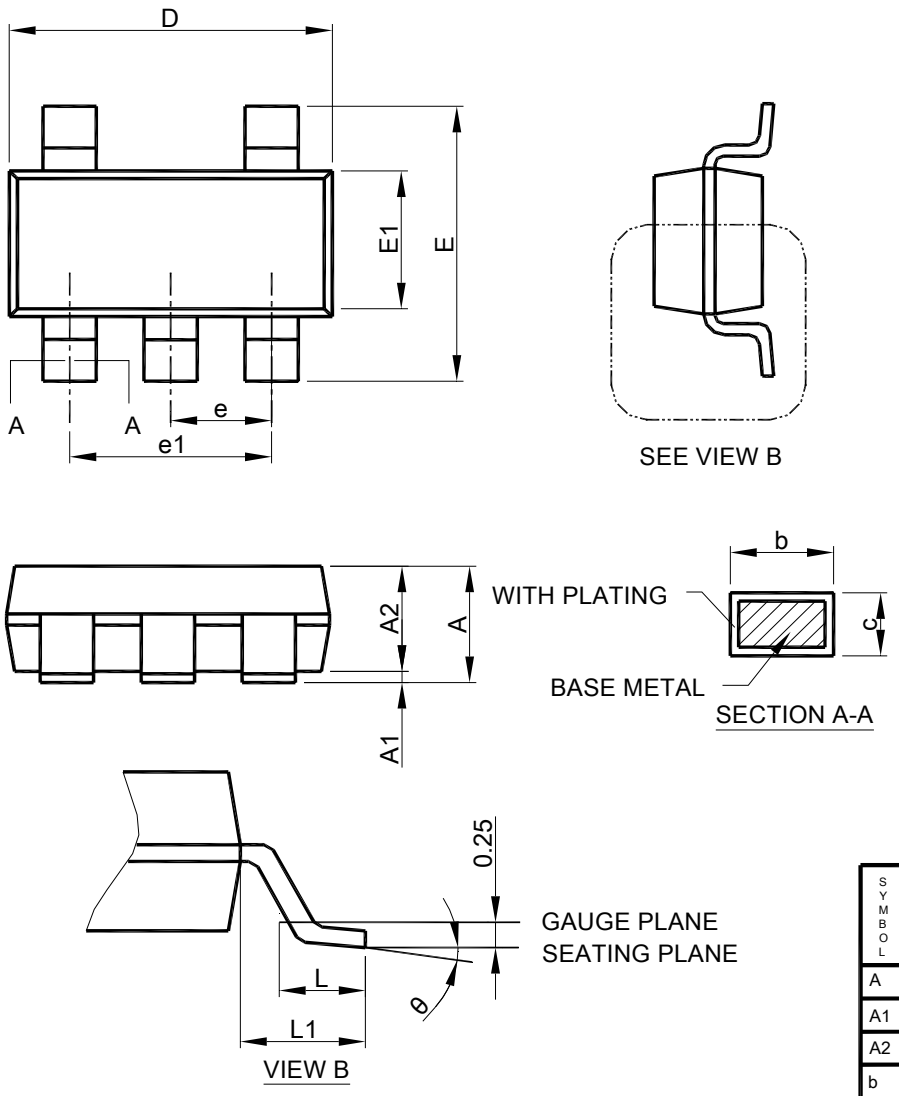
  USB supports dynamic attachment (hot plug-in) of peripherals. A current surge is caused by the input capacitance of downstream device. Ferrite beads are recommended in series with all power and ground connector pins. Ferrite beads reduce EMI and limit the inrush current during hot-attachment by filtering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

- **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)

- SOT-23-5



SYMBOL	SOT-23-5	
	MILLIMETERS	
	MIN.	MAX.
A	0.95	1.45
A1	0.00	0.15
A2	0.90	1.30
b	0.30	0.50
c	0.08	0.22
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC	
e1	1.90 BSC	
L	0.30	0.60
L1	0.60 REF	
θ	0°	8°

Note : 1. Refer to JEDEC MO-178AA.
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 "E1" does not include inter-lead flash or protrusions.
4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.