1A Single Channel USB Switch

FEATURES

- 85mΩ High-Side MOSFET Switch.
- 1A Continuous Load Current.
- 40μA Quiescent Supply Current.
- 1μA Maximum Shutdown Supply Current.
- 3.2V to 6.5V Input Voltage Range.
- Open-Drain Over-Current Flag Output.
- 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.
- Soft Start prevents large Inrush Current.
- No Reverse Current when Power off.
- Enable Active-High or Active-Low Version.
- 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

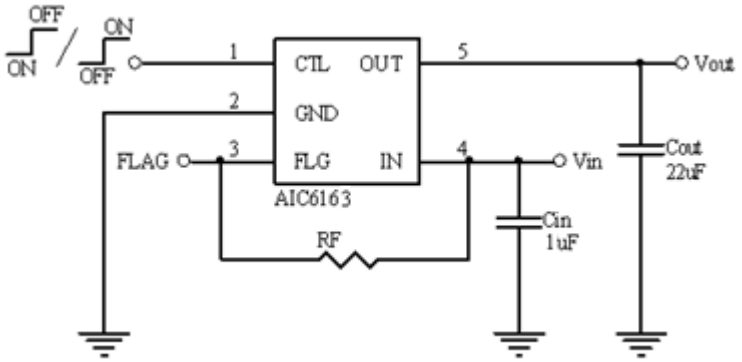
DESCRIPTION

The AIC6163 is integrated 85mΩ high-side power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. This switch operates with input ranging from 3.2V to 6.5V, making it ideal for 5V system.

The protection includes current limiting with foldback, short circuit and thermal shutdown. The AIC6163 is ideal for any system where current limiting and power control are desired. The AIC6163 has low quiescent current and small package, which is particularly suitable in battery powered portable application.

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

AIC6163-XXXXXX

- PACKING TYPE
  TR: TAPE & REEL
  BG: BAG
- PACKAGE TYPE
  V5: SOT-23-5
- G: Green Package
- ENABLE TYPE
  0: Active Low
  1: Active High

Package Type	5 Pin Configuration
V5 (SOT-23-5)	FRONT VIEW OUT 5 IN 4 AIC6163 1 2 3 CTL GND FLG

Example: AIC6163-1GV5TR

→ Active High Version, in SOT-23-5
Green package and TAPE & REEL
packing

- **SOT-23-5 Marking**

Part No.	Package	Package type	Marking	Note
AIC6163-x	GV5	SOT-23-5	HJFxG	x=0 for active low, x=1 for active High

■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{IN}) 7.0V
CTL Input (V_{CTL}) ..... -0.3V ~7V
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) SOT-23-5 ..... 250°C/W
(Assume no Ambient Airflow, no Heatsink)
Thermal Resistance, θ_{JC} (Junction to Case) SOT-23-5 ..... 115°C/W

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

ELECTRICAL CHARACTERISTICS

(V_{IN}= 5V, C_{IN} =C_{OUT} = 1 μF, T_A=25°C, unless otherwise specified.) (Note 1)

PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply Current			40		μA
Shutdown Supply Current			0.1	1	μA
Input Voltage Range		3.2		6.5	V
Current Limit Threshold		1.1	1.5	2	A
Output MOSFET Resistance			85		mΩ
Output Turn-On Rise Time	R_L = 10Ω each Output		400		μS
Output Turn-Off Fall Time	R_L = 10Ω each Output		0.7	20	μS
EN Input Threshold		0.4	0.8	1.2	V
Output Leakage Current	EN='0', V_{OUT} =0V		0.5	1	μA
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
Over Current Flag Response Delay	Apply V_{OUT} = 0V until FLG low	4	9		ms
FLG Output Low Voltage				0.4	V
FLG Off-State Current				1	μA

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).

TYPICAL PERFORMANCE CHARACTERISTICS

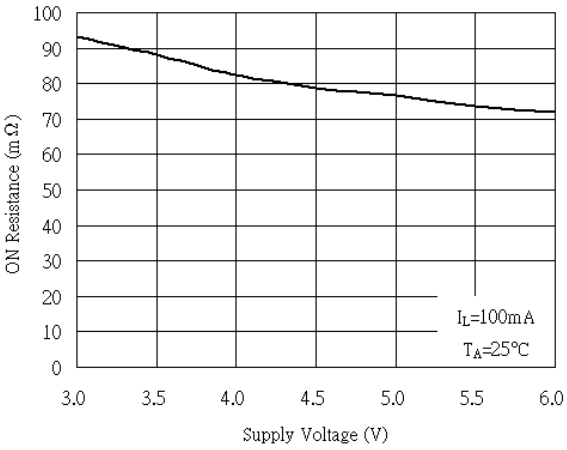


Fig. 1 ON Resistance vs. Supply Voltage

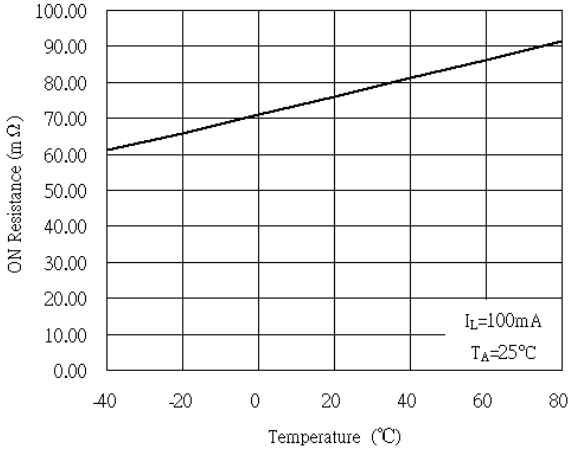


Fig. 2 ON Resistance vs. Temperature

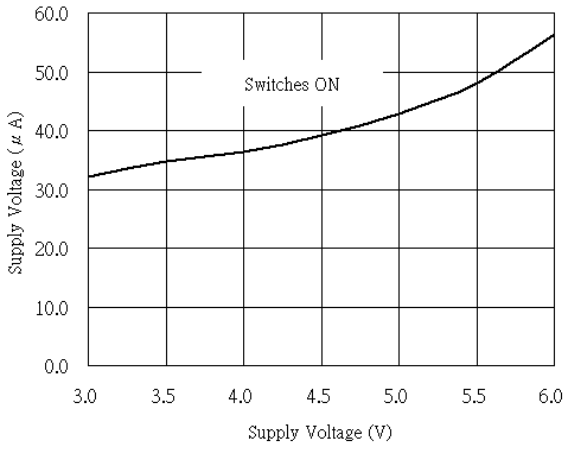


Fig. 3 ON-State Supply Current vs. Supply Voltage

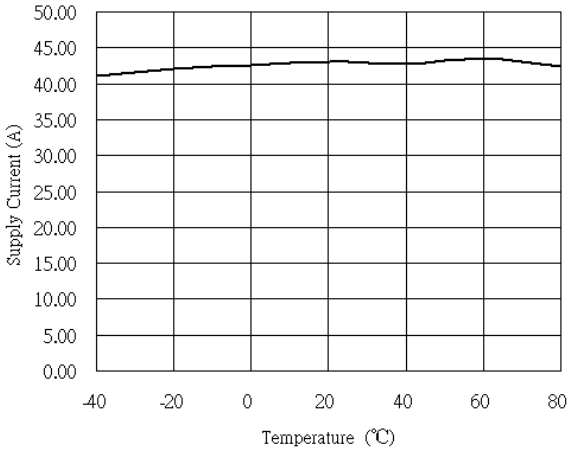


Fig. 4 ON State Current vs. Temperature

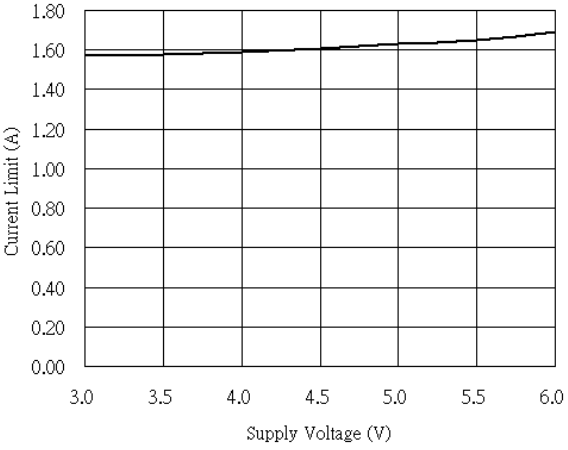


Fig. 5 Current Limit vs. Supply Voltage

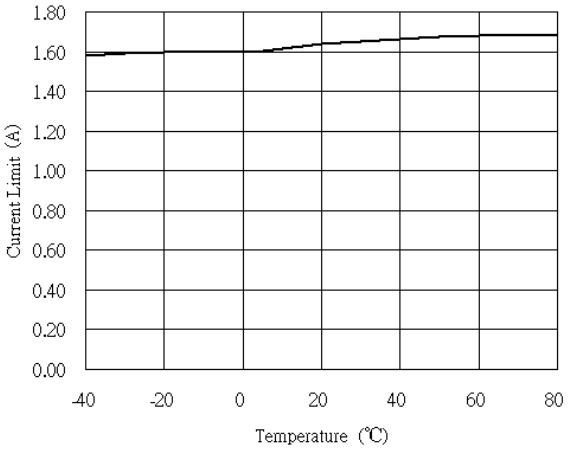


Fig. 6 Current Limit vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

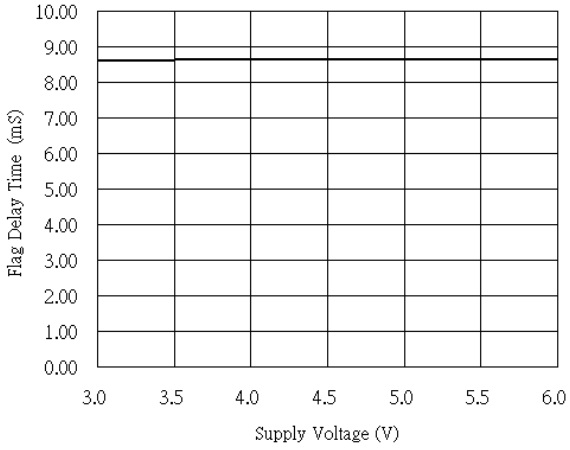


Fig. 7 Flag Delay Time vs. Supply Voltage

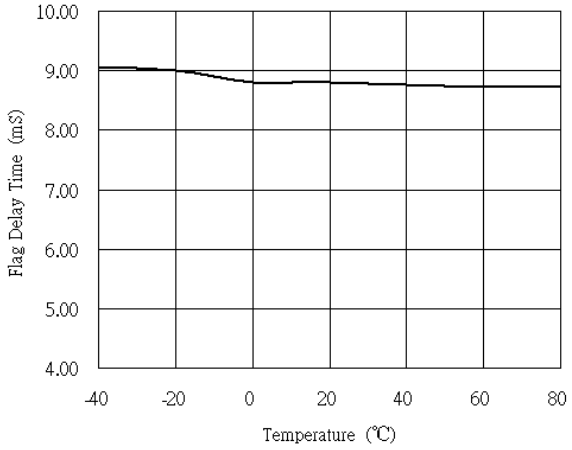


Fig. 8 Flag Delay Time vs. Temperature

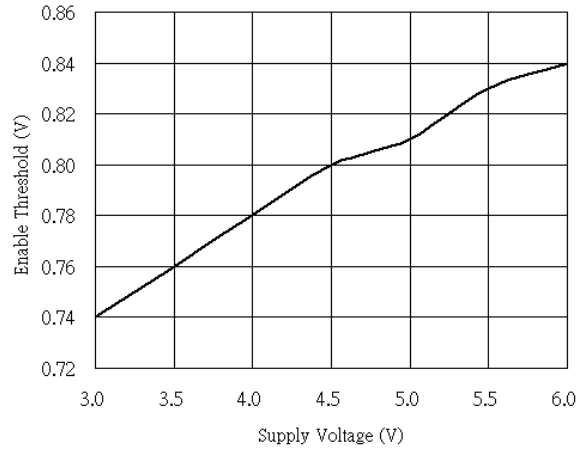


Fig. 9 Enable Threshold vs. Supply Voltage

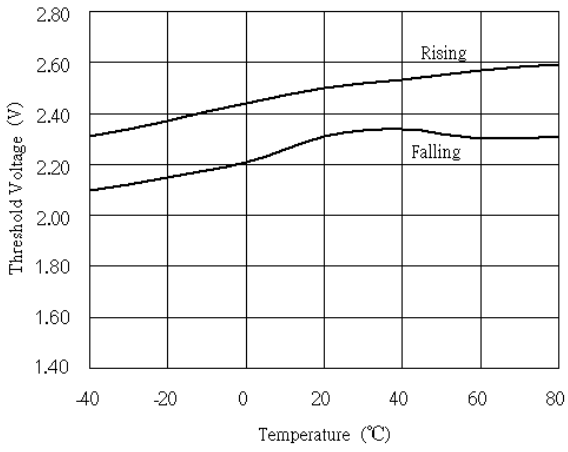


Fig. 10 UVLO Threshold Voltage vs. Temperature

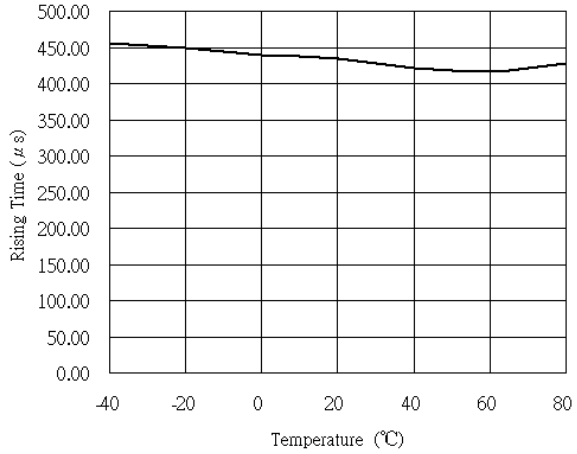
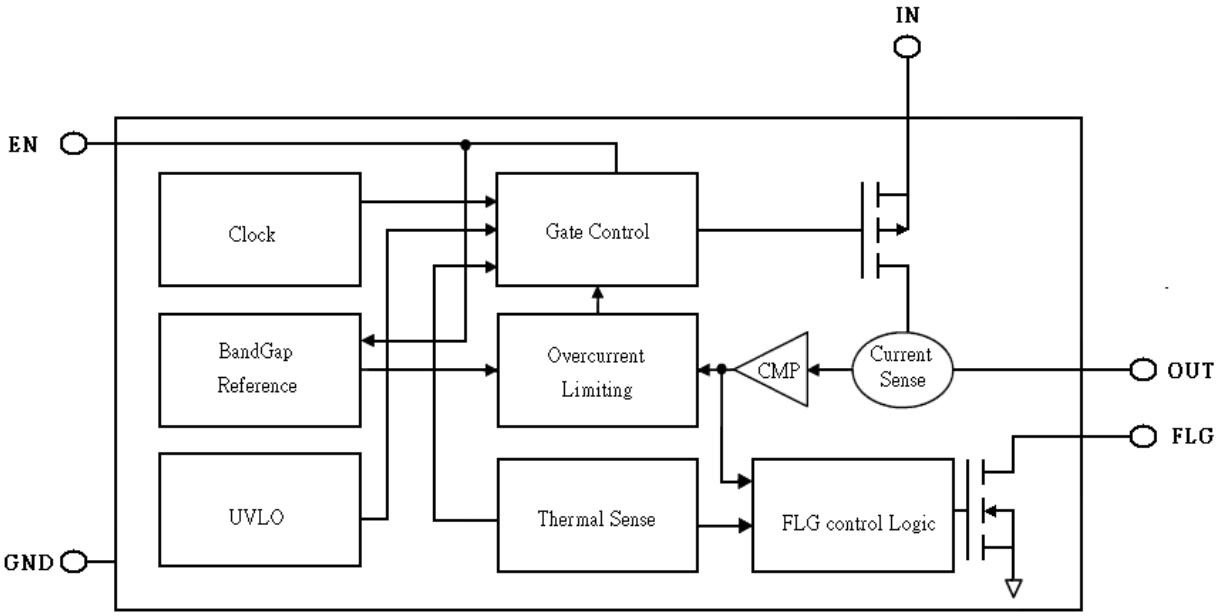


Fig. 11 Rising Time vs. Temperature

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN1 CTL : Switch Enable.

PIN2 GND: Chip power ground.

PIN3 FLG: Fault status. A logic low on this pin indicates the switch is in current limit, or has been shut down by the thermal protection circuit.

PIN4 IN: Power supply input.

PIN5 OUT: MOSFET switch output.

APPLICATION INFORMATION

- **Flag Output**

  An error Flag is an open-drained output of an N-channel MOSFET. Flag output is pulled low to signal the following fault conditions: input undervoltage, output current limit, and thermal shutdown. The current limit flag response delay time is 9ms.

- **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 error flag signals when any current limit conditions occur.

- **Thermal Shutdown**

  When temperature of AIC6163 exceeds 145°C for any reasons, the thermal shutdown function turns MOSFET switch off and signals the error flag. A hysteresis of 20°C prevents the MOSFETs from turning back on until the chip temperature drops below 125°C.

- **Enable Control**

  Enable must be driven logic high or logic low for a clearly defined input. Floating the input may cause unpredictable operation.

- **Under-voltage Lockout**

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

- **Supply Filtering**

  A 1μF bypass capacitor from USB 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**

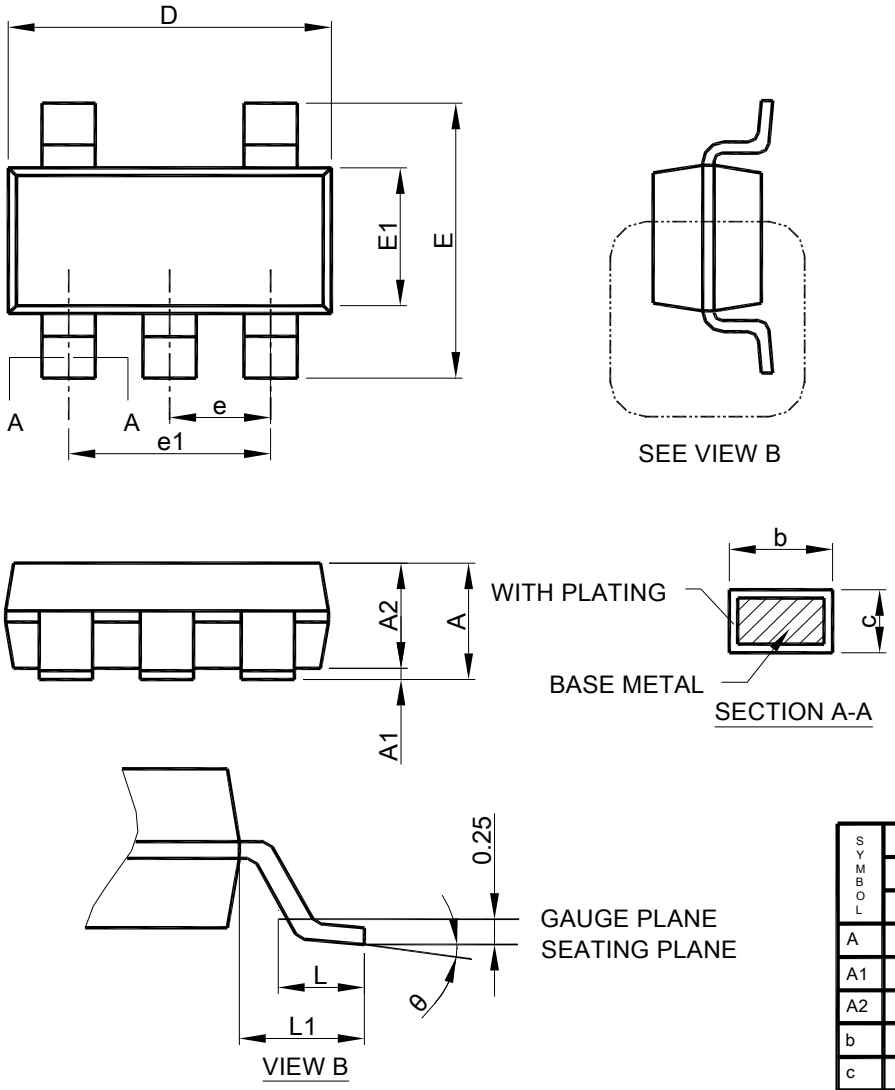
  Bulk capacitance provides the short-term transient current needed during a hot-attachment event. A 22μF/10V ceramic capacitor mounted close to downstream connector each port should provide transient drop protection.

- **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)

- **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.

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