

Linear Fan Control Driver IC

FEATURES

- VOUT Follows 1.6 Times of VSET
- 150mV Dropout at 500mA Output Current
- Over Current and Over Temperature Protection
- Enable Function
- 5uA Quiescent Current in Shutdown Mode
- SOP-8 Package

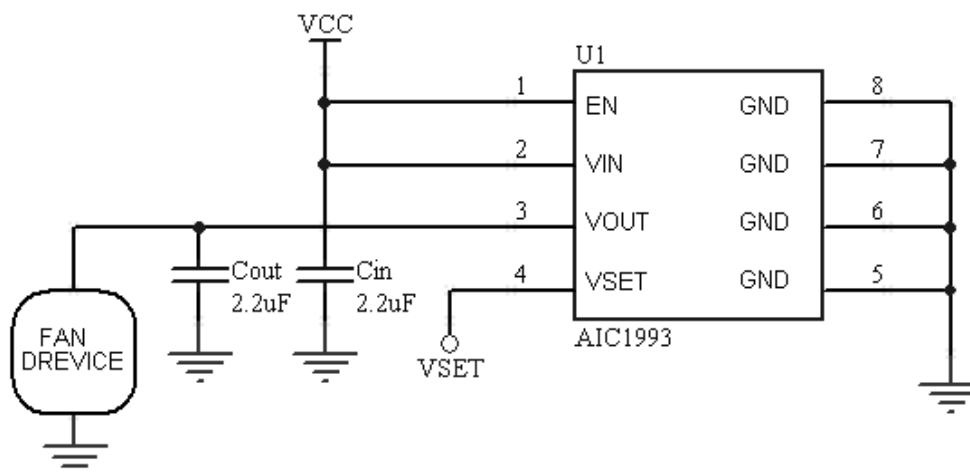
APPLICATIONS

- Notebook PC
- PC Motherboard
- Battery Powered Systems
- Peripheral Cards

GENERAL DESCRIPTION

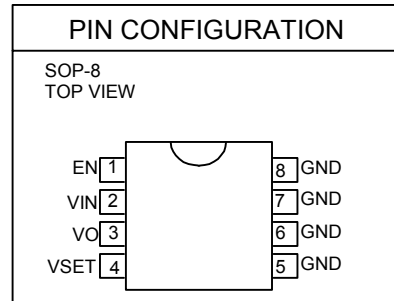
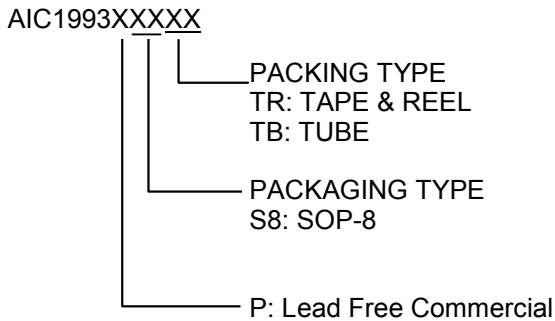
The AIC1993 is a high performance positive linear voltage regulator designed for applications requiring low dropout voltage at maximum 500mA output current. The AIC1993 VO output voltage follows 1.6 times of VSET voltage until it reaches VIN voltage. The VSET voltage must be larger than 1V to guarantee VOUT as 1.6 times of VSET voltage. An enable pin can be used to reduce power dissipation in shutdown mode. The AIC1993 provides excellent line and load regulation. The AIC1993 is available in SOP-8 package.

TYPICAL APPLICATION CIRCUIT



Typical Application Circuit

ORDERING INFORMATION



Example: AIC1993PS8TR
 → Lead Free SOP-8 Package & Taping & Reel
 Packing Type

ABSOLUTE MAXIMUM RATINGS

VIN, EN, VSET to GND	-0.3V to +6V
Ouput Switch Current	500mA
Operating Junction Temperature	125°C
Operating Ambient Temperature Range.....	-40~85°C
Maximum Storage Temperature Range.....	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s)	260°C
Thermal Resistance Junction to Case SOP8.....	40°C/W
Thermal Resistance Junction to Ambient SOP8.....	160°C/W

(Assume no ambient airflow)

TEST CIRCUIT

Refer to Typical Application Circuit.

■ **ELECTRICAL CHARACTERISTICS** ($V_{IN}=5V$, $V_{EN}=5V$, $V_{SET}=2V$, $C_{IN}=C_{OUT}=2.2 \mu F$, $T_A=T_J=25^\circ C$, Unless otherwise specified.) (Note1)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNITS
Operating Voltage		V_{IN}	4.5		5.5	V
Quiescent Current	$V_O = 5V$			0.5		mA
Shutdown Supply Current	$V_{EN} = 0$			5	30	μA
Output Voltage/ V_{SET} Voltage	$V_{IN} = 5.5V$, $V_{SET} = 1V$ to $3.2V$		1.552	1.6	1.648	V/V
Line Regulation	$V_{IN} = 4.5V$ to $5.5V$			0.2	0.5	%
Load Regulation	10mA I_O 500mA			0.5	0.8	%
Output Resistance	$I_O = 500mA$, $V_{SET} = 3.4V$			0.2	0.3	
Short Circuit Current				0.3		A
Minimum V_{SET} Voltage				1		V
V_{SET} Pin Current				80	200	nA
V_{EN} Voltage High			1.6			V
V_{EN} Voltage Low					0.4	V
V_{EN} Pin Bias Current	$V_{EN} = 0$			1.5	10	μA
Thermal-Shutdown Threshold				+150		
Thermal-Shutdown Hysteresis				20		

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

$V_{IN}=V_{EN}=5V$, $V_{SET}=2V$, $I_{OUT}=0.5A$, $C_{IN}=4.7\mu F$, $C_{OUT}=10\mu F$, $T_A=T_J=25^\circ C$

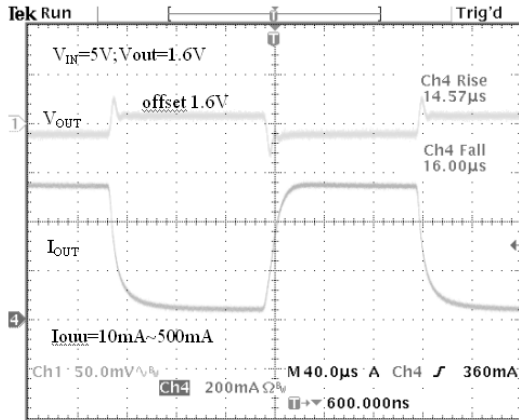


Fig.1 Load Transient Response

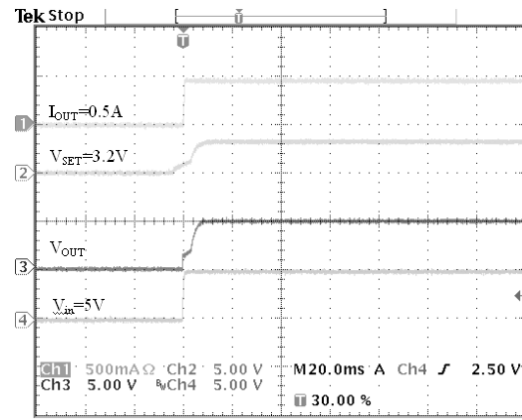


Fig.2 Start-UP

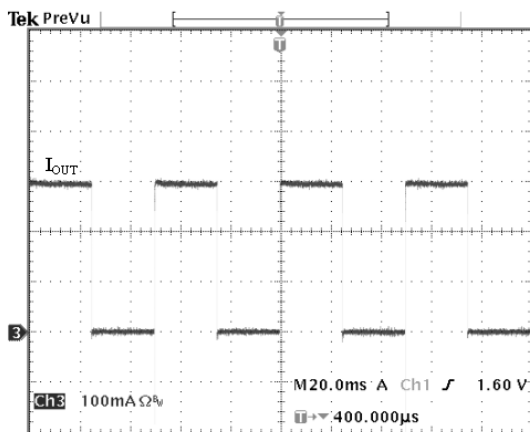


Fig.3 Short Circuit current

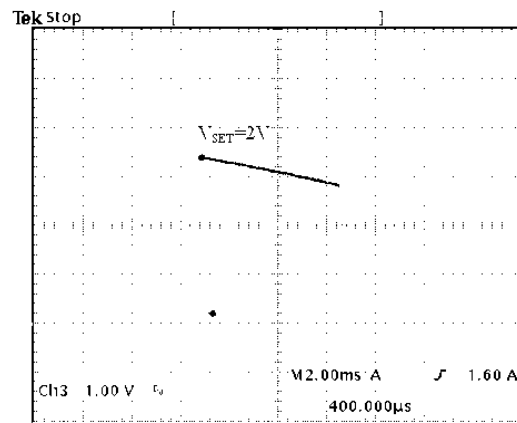


Fig.4 Overcurrent Protection Characteristics

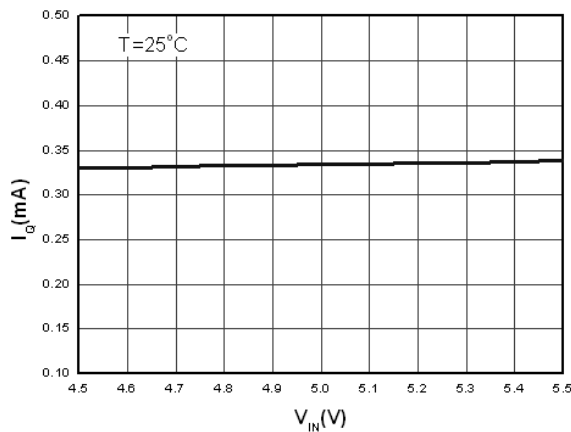


Fig.5 Quiescent Current vs. Vin

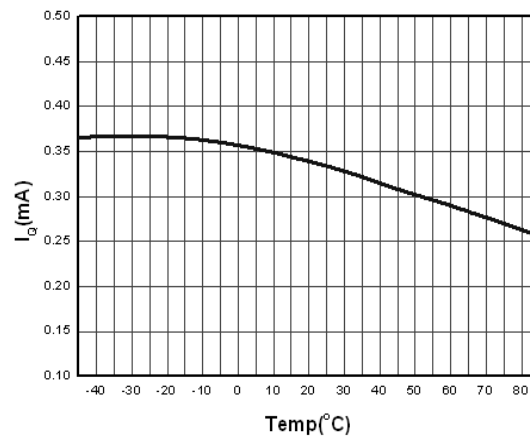


Fig.6 Quiescent Current vs. Temperature

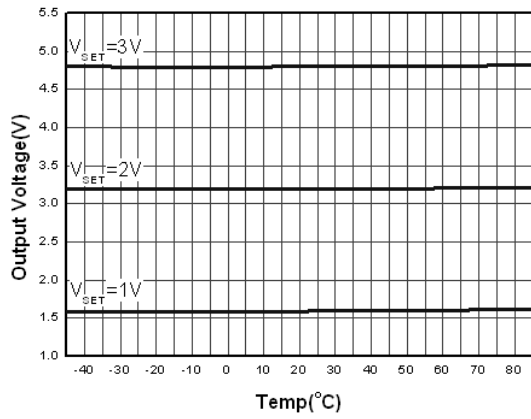


Fig.7 Output Voltage vs. Temperature

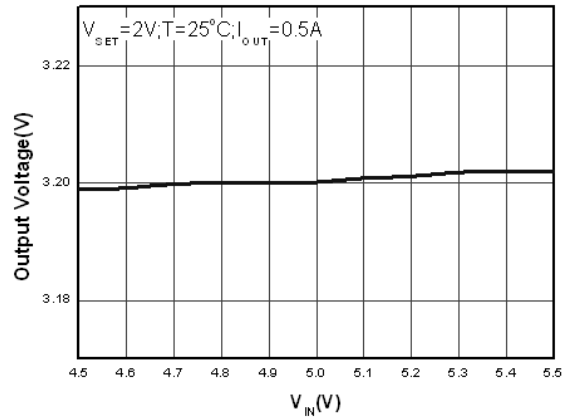


Fig.8 Output Voltage vs. VIN

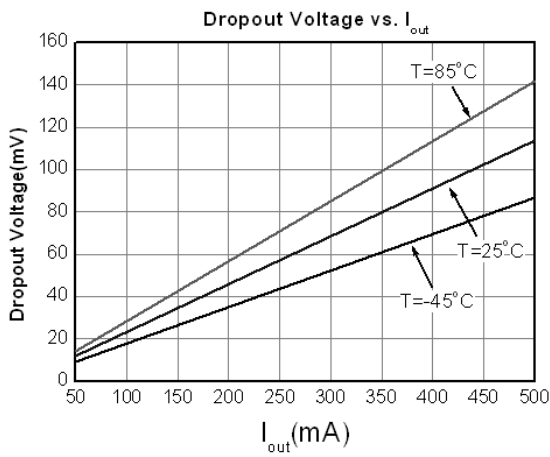


Fig.9 Dropout Voltage vs. Iout

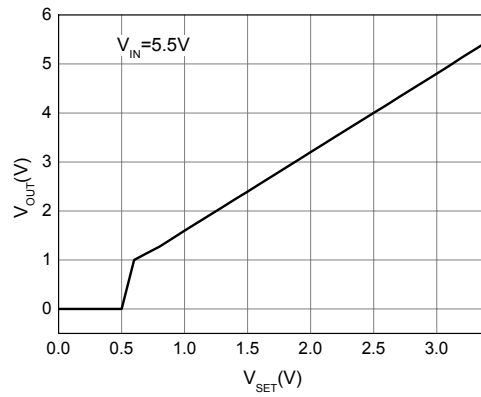
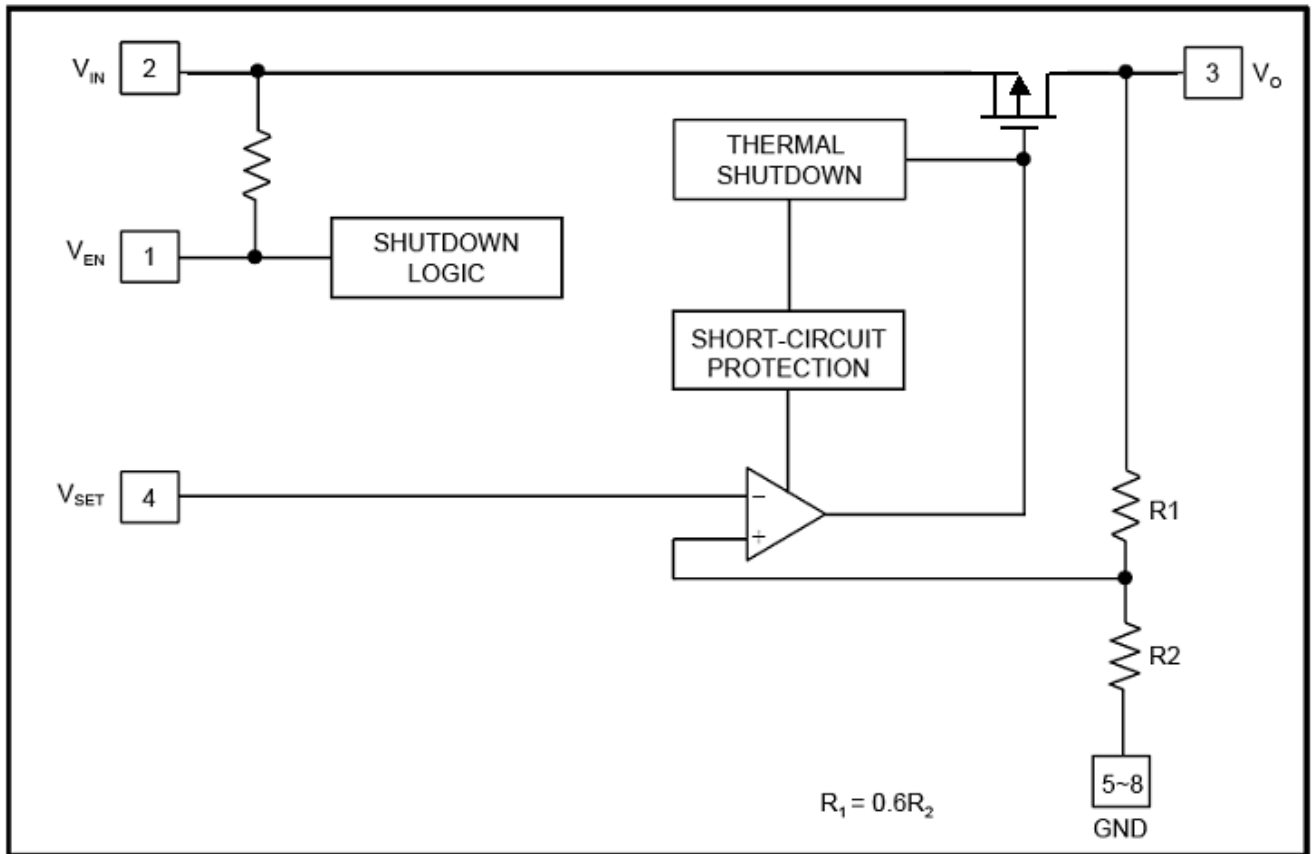


Fig.10 Vout vs. VSET

■ BLOCK DIAGRAM


Functional Block Diagram of AIC1993

■ PIN DESCRIPTIONS

- Pin 1: V_{EN} : Enable input. Pulling this pin under 0.4V turns the regulator off, reducing the quiescent current to a fraction of its operating value. The device will be enabled if this pin is left open. Connect to V_{IN} if not being used.
- Pin 2: V_{IN} : Power input pin. Supply the power to the IC.
- Pin 3: V_O : The pin is the power output of the regulator. Its voltage is 1.6 times of V_{SET} .
- Pin 4: V_{SET} : This pin sets the output voltage. Its voltage must be larger than 1V to guarantee V_O as 1.6 times of V_{SET} .
- Pin 5: GND: Reference ground. Use all four pins on the SOP-8 device.
- Pin 6: GND: Reference ground. Use all four pins on the SOP-8 device.
- Pin 7: GND: Reference ground. Use all four pins on the SOP-8 device.
- Pin 8: GND: Reference ground. Use all four pins on the SOP-8 device.

■ APPLICATION INFORMATIONS

INPUT-OUTPUT CAPACITORS

Linear regulators require input and output capacitors to maintain stability. Input ceramic capacitor at 2.2 μ F with a 2.2 μ F output ceramic capacitor is recommended.

EN

EN is used to make system enable and disable. It supply to output voltage in shutdown logic mode of fan control.

VSET

The output voltage control pin has 1.6 Time become the output voltage. Voltage limit form 0V to 3.125 V like to feedback control resistance in internal R1 and R2 modulation.

POWER DISSIPATION

The maximum power dissipation of AIC1993 depends on the thermal resistance of its case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The rate of temperature rise is greatly affected by the mounting pad configuration on the PCB, the board material, and the ambient temperature. When the IC mounting with good thermal conductivity is used, the junction

temperature will be low even when large power dissipation applies.

The power dissipation across the device is

$$P = I_{OUT} (V_{IN} - V_{OUT}).$$

The maximum power dissipation is:

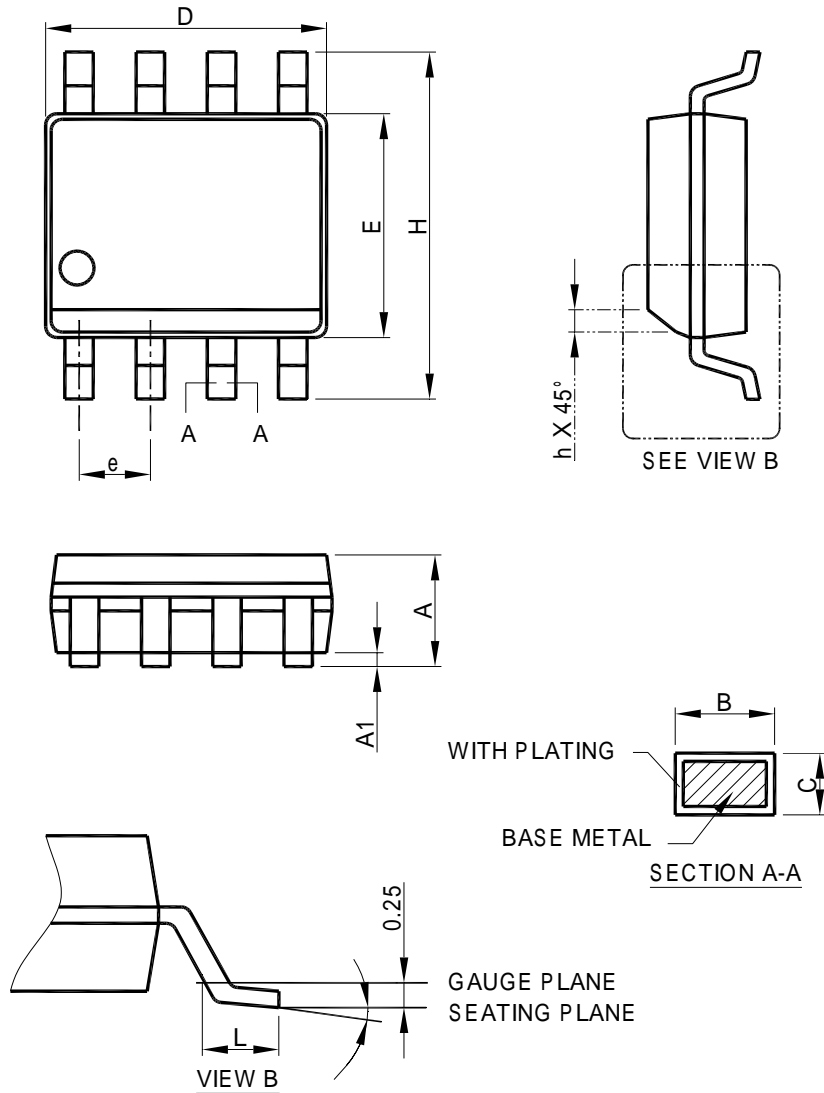
$$P_{MAX} = \frac{(T_J - T_A)}{(R_{\theta_{JB}} + R_{\theta_{BA}})}$$

Where $T_J - T_A$ is the temperature difference between the die junction and the surrounding air, $R_{\theta_{JB}}$ is the thermal resistance of the package, and $R_{\theta_{BA}}$ is the thermal resistance through the PCB, copper traces, and other materials to the surrounding air.

As a general rule, the lower temperature is, the better reliability of the device is. So the PCB mounting pad should provide maximum thermal conductivity to maintain low device temperature. GND pin performs a dual function of providing an electrical connection to ground and channeling heat away. Therefore, connecting the GND pin to ground with a large pad or ground plane would increase the power dissipation and reduce the device temperature.

■ PHYSICAL DIMENSIONS (unit: mm)

● SOP-8 PACKAGE OUTLINE DRAWING



- 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.

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
	0°	8°