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

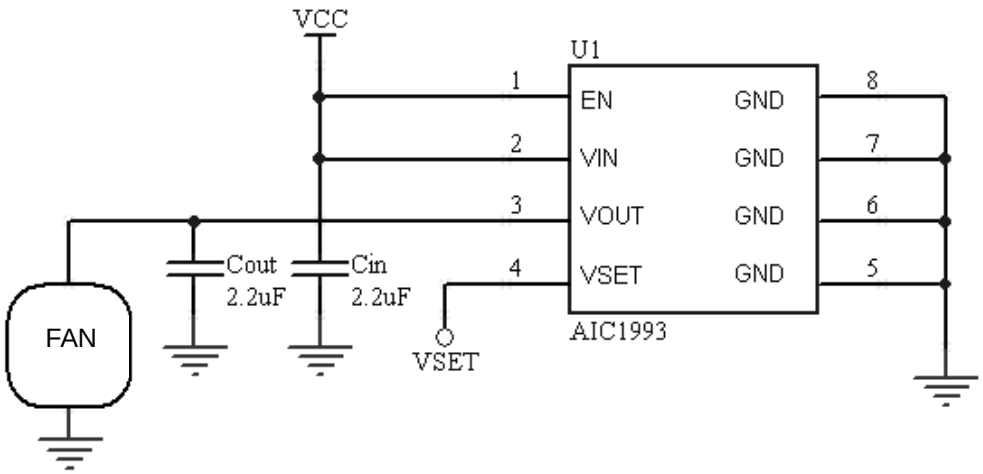
APPLICATIONS

- 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

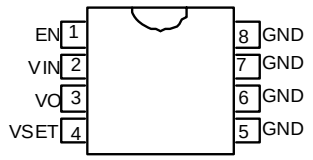
■ ORDERING INFORMATION

AIC1993XXXXX

- PACKING TYPE
  TR: TAPE & REEL
  TB: TUBE
- PACKAGING TYPE
  S8: SOP-8
- P: Lead Free Commercial
  G: Green Package

PIN CONFIGURATION

SOP-8
TOP VIEW



Example: AIC1993PS8TR

→ In SOP-8 Lead Free Package & Taping & Reel Packing Type

AIC1993G8TR

→ In SOP-8 Green 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 μF, T_A= T_J=25°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	Ω
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 TA=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

V_{IN}=V_{EN}=5V, V_{SET}=2V, I_{OUT}=0.5A, C_{IN}= 4.7 μF, C_{OUT}=10 μF, T_A= T_J=25°C

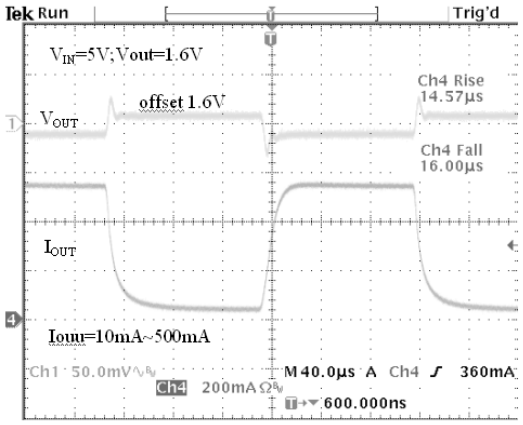


Fig.1 Load Transient Response

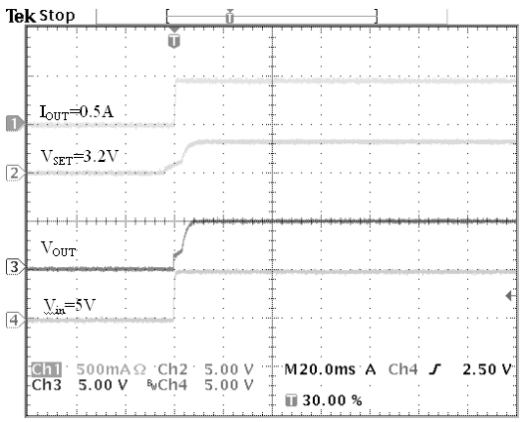


Fig.2 Start-UP

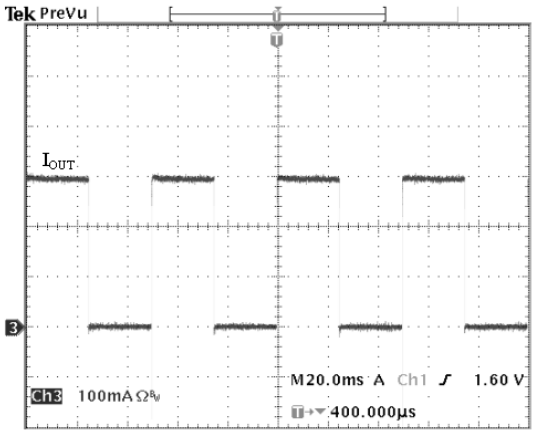


Fig.3 Short Circuit current

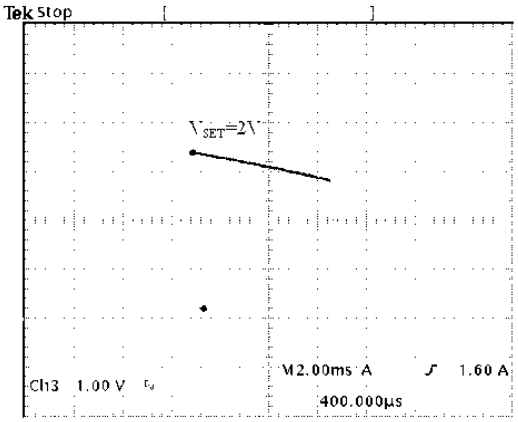


Fig.4 Overcurrent Protection Characteristics

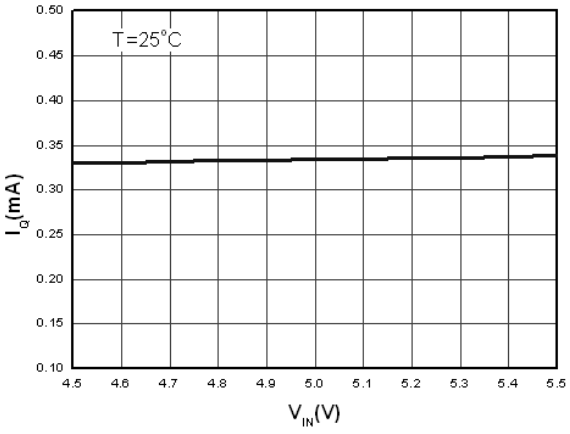


Fig.5 Quiescent Current vs. Vin

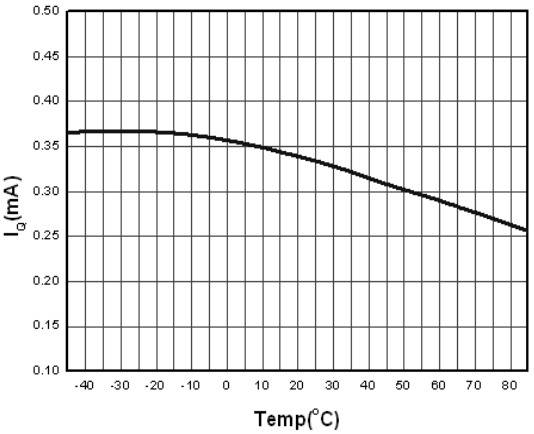


Fig.6 Quiescent Current vs. Temperature

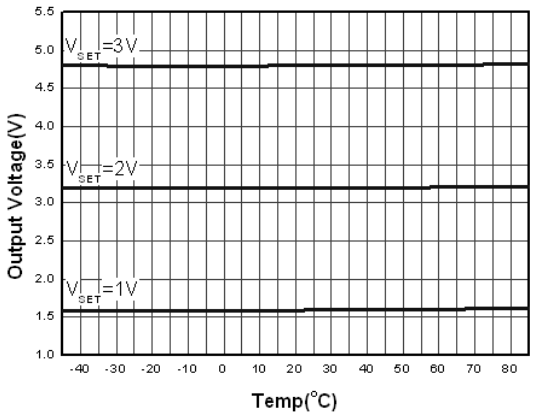


Fig.7 Output Voltage vs. Temperature

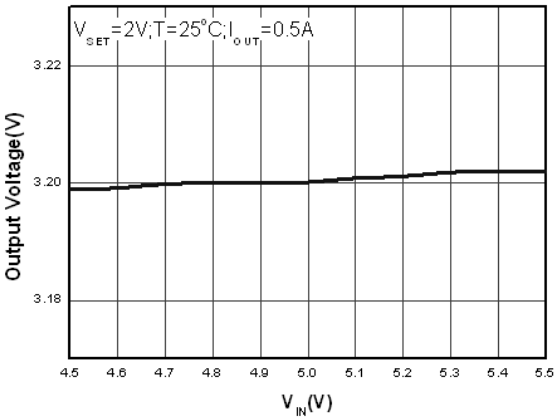


Fig.8 Output Voltage vs. V_{IN}

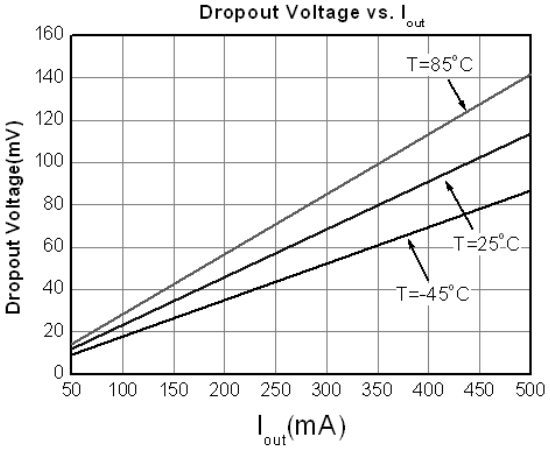


Fig.9 Dropout Voltage vs. Iout

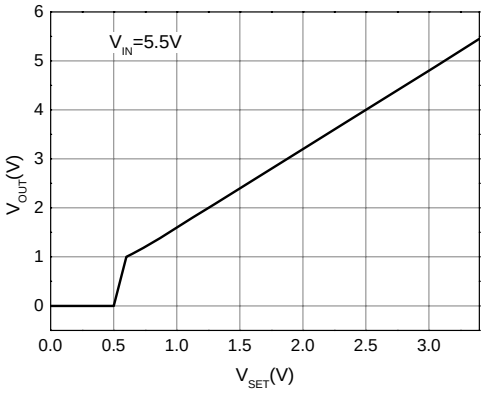
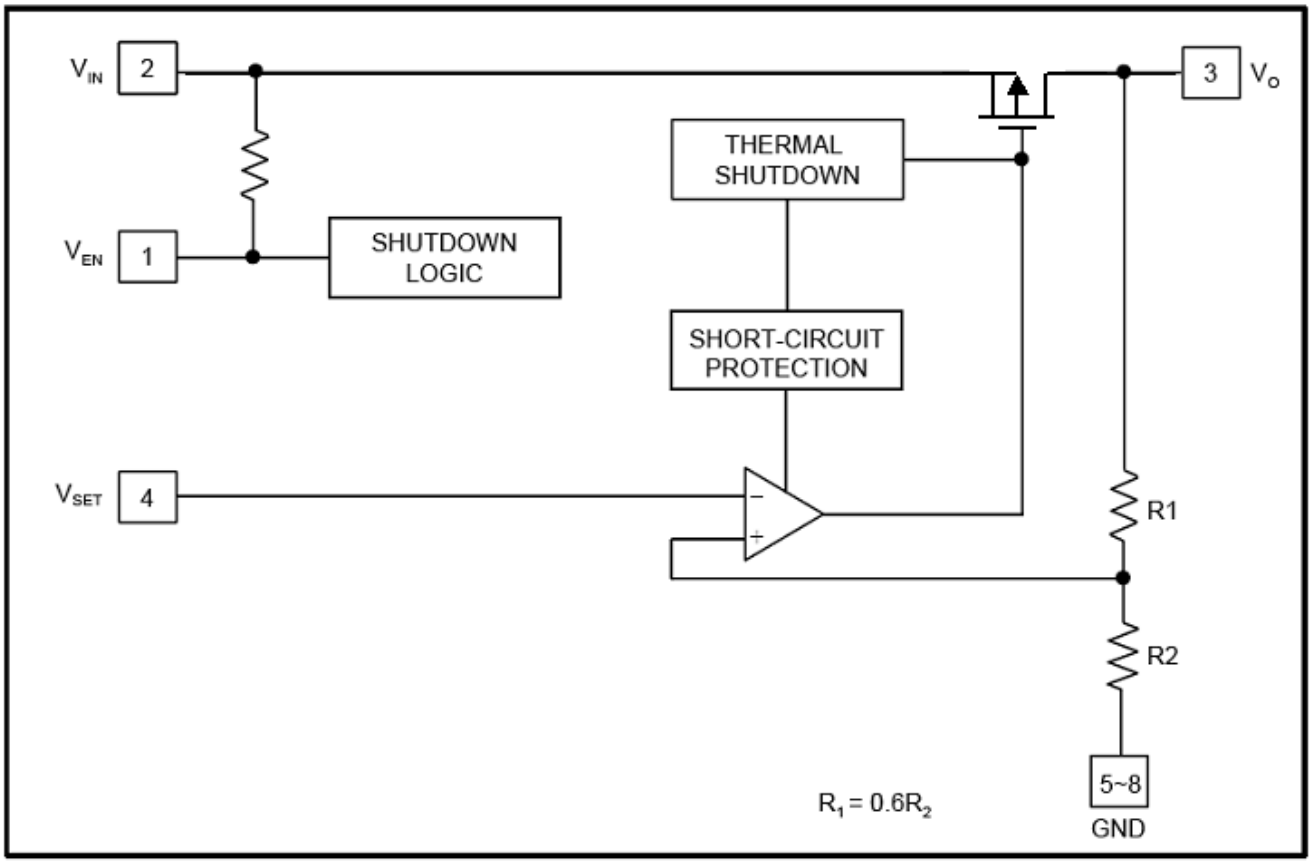


Fig.10 Vout vs. VSET

BLOCK DIAGRAM



Functional Block Diagram of AIC1993

PIN DESCRIPTIONS

Pin 1: VEN: 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 VIN if not being used.

Pin 2: VIN: Power input pin. Supply the power to the IC.

Pin 3: VO: The pin is the power output of the regulator. Its voltage is 1.6 times of VSET.

Pin 4: VSET: This pin sets the output voltage. Its voltage must be larger than 1V to guarantee VO as 1.6 times of VSET.

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 2.2μF with a 2.2uF 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 limilt 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:

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

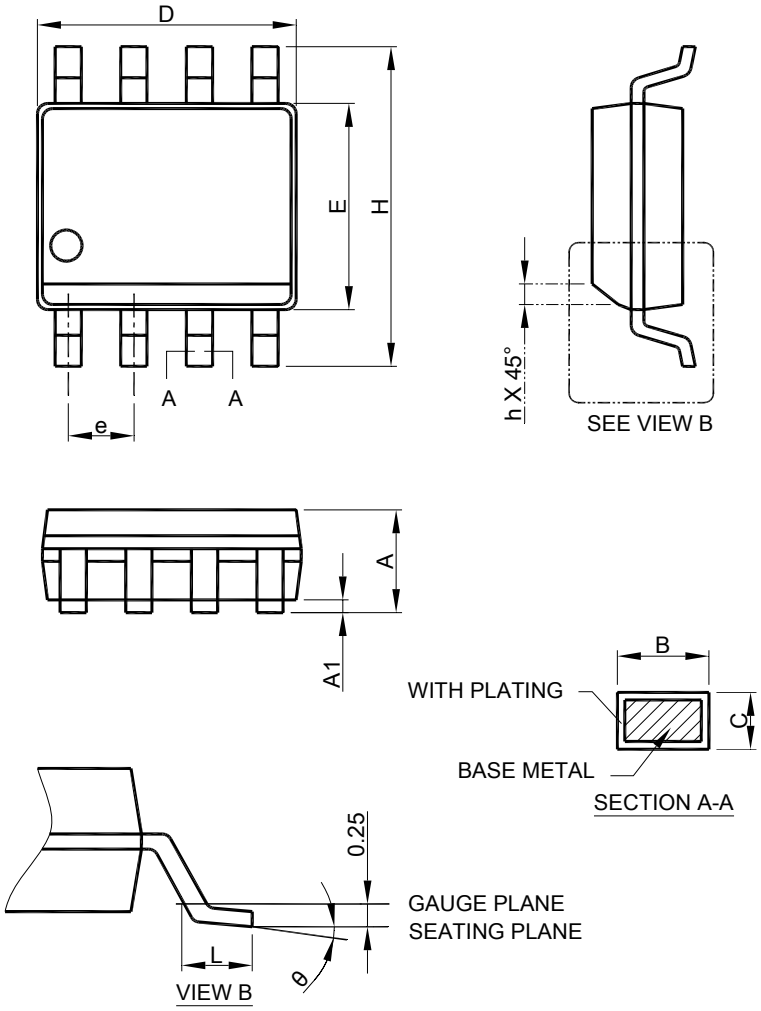
Where T_J-T_A is the temperature difference between the die junction and the surrounding air, $R\theta_{JB}$ is the thermal resistance of the package, and $R\theta_{BA}$ is the thermal resistance through the PCB, copper traces, and other materials to the surrounding air.

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**



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.

Note: