ALPHA SEMICONDUCTOR
Excellence in Analog Power Products

AS603

500 mA, Low-Noise LDO Voltage Regulator

FEATURES

- Ultra-Low Noise Output LDO
- 1% Initial Accuracy At 500mA
- Very Low Quiescent Current
- Low Dropout Voltage (160mV At 500mA)
- Current & Thermal Limiting
- Reverse-Battery Protection
- Several Fix Output Voltages 3.3 & 5.0V
- Zero Off-Mode Current
- Small 8-Pin SO-8

APPLICATIONS

- Battery Powered Systems
- Cordless Telephones
- Radio Control Systems
- Portable/Palm Top/Notebook Computers
- Portable Consumer Equipment
- Portable Instrumentation
- Bar Code Scanners
- SMPS Post-Regulator

PRODUCT DESCRIPTION

The ALPHA Semiconductor AS603 is a low powered positive voltage regulator with ultra low noise output and very low voltage dropout. In addition, this device offers very low quiescent current of approximately 300uA at 500mA output. The AS603 initial tolerance is less than 1% max with logic compatible ON/OFF switching input. The unique feature of AS603 includes a reference bypass pin for the best results of low noise.

This device is an excellent choice for the use in battery powered applications such as cordless telephones, radio control systems, and portable computers. When disable power consumption drop to nearly zero. This device has a very low output temperature coefficient, making it a low power voltage reference. The key features include protection against reversed battery, current limiting, and automotive load dump protection.

The AS603 is available in several fixed voltages 3.3V, 5.0V or adjustable output. This device is offered in a small 8-pin SO-8 package.

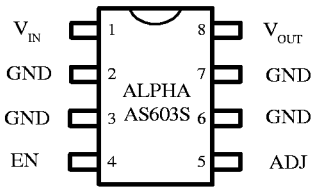
ORDERING INFORMATION

SO-8(S)
AS603S-X

X = Output Voltage (3.3 for 3.3V, 5.0 for 5.0V, Blank for Adjustable)

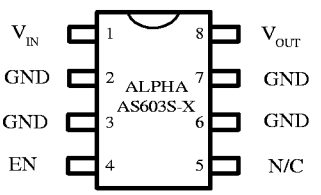
PIN CONNECTIONS

8-Pin Surface Mount (S)



Top View

8-Pin Surface Mount (S)



Top View

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Rev.8/26/99

ABSOLUTE MAXIMUM RATINGS

Power Dissipation..... Internally Limited
Lead Temp. (Soldering, 5 Seconds) ..... 260°C
Operating Junction Temperature Range... -40°C to +125°C
Input Supply Voltage.....-20V to +20V
Enable Input Voltage.....-20V to +20V

RECOMMENDED OPERATING CONDITIONS

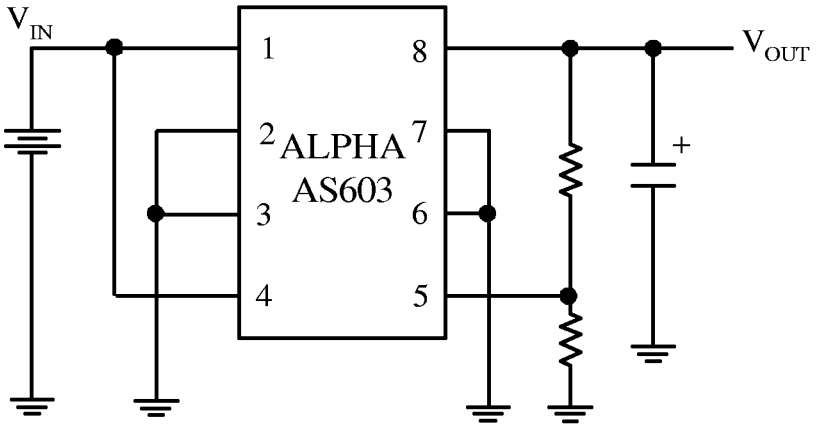
Input Voltage.....+2.5V to+16V
Operating Junction Temperature Range ... -40°C to +125°C
Enable Input Voltage ..... 0V to V_{IN}

ELECTRICAL CHARACTERISTICS

T_J = 25°C V_{OUT} + 1V, I_L = 100µA, C_L = 3.3µF, and $V_{ENABLE} \geq$ 2.0V. Unless otherwise specified boldface applies over the junction temperature range

Parameter	Test Conditions	Typ	Min	Max	Units
Output Voltage Tolerance			-1 -2	+1 +2	$\%V_{NOM}$
Output Voltage Temperature Coef. ($\Delta V/\Delta T$)		40			ppm/°C
Line Regulation ($\Delta V/V$)	$V_{IN} = V_{OUT}$ + 1V to 16V	0.004		0.04	%
Load Regulation($\Delta V/V$)	I_L = 0.1mA to 500mA	0.04		0.4	%
Dropout Voltage (V_{IN}- V_O)	I_L = 100 µA	10		50 70	mV
	I_L = 50 mA	110		150 230	
	I_L = 100 mA	140		250 300	
	I_L = 500 mA	300		500 600	
Quiescent Current (I_{GND})	$V_{ENABLE} \leq$ 0.55V $V_{ENABLE} \geq$ 1.4V	< 1		1 4	µA
Ground Pin Current (I_{GND})	I_L = 100 µA	80		125 150	µA
	I_L = 50 mA	350		600 800	
	I_L = 100 mA	1000		1500 1800	
	I_L = 150 mA	8000		15000 20000	
	$V_{ON/OFF}$ < 0.3V	0.01		0.8	
	$V_{ON/OFF}$ < 0.15V	0.05		2	
Ripple Rejection (PSRR)	V_{OUT} = 0V		75		dB
Current Limit (I_{LIMIT})	V_{OUT} = 0V		320	500	mA
Thermal Regulation($\Delta V_O/\Delta P_D$)			0.05		%/W
Output Noise (e_{NO})	I_L = 50mA, C_L = 4.7µF 0.01µF from Ref BYP to ground	500			nV/√Hz
	I_{OUT}=50mA, C_{OUT}=2.2uF C_{BYP}=470pF	300			
Input Voltage Level Logic Low (V_{IL})	OFF	0.55		0.15	V
Input Voltage Level Logic High (V_{IL})	ON	1.4		2	
ENABLE Input Current	$V_{IL} \leq$ 0.18V $V_{IH} \geq$ 2.0V		0.01 2	2 20	µA

TYPICAL APPLICATION



ENABLE may be tied directly to Vin

Application Hints

The AS603 requires an output capacitor for device stability. The value required varies greatly depending upon the application circuit and other factors. The high frequency characteristics of electrolytic capacitors depend greatly on the type and also on the manufacturer. Sometimes only bench testing is the only means to determine the proper capacitor type and value. The high quality 100 µF aluminum electrolytic covers all general application circuits, this stability can be obtained with a tantalum electrolytic value of 47 µF.

Another critical point of electrolytic characteristics is its performance over temperature. The AS603 is designed to operate starting at -40°C that may not be true in the case of electrolytic. Higher temperatures generally no problem. The electrolytic. type in aluminum will freeze around -30°C. This could cause an oscillation at output of regulator. At a lower temperature requirement by many applications the capacitor should maintain its performance. So as a result, for an application which regulator junction temperature does not exceed 25°C, the output capacitor can be reduced by the factor of two over the value needed for the entire temperature range.

Other points with linear regulators is that the twitch higher output current stability decreases. In most applications the AS603 is operating at few milliamps. In these applications the output capacitance can be further reduced. For example, when the regulator is running at 10mA output current the output capacitance value is half compared to the same regulator that is running at 100 mA.
With the AS603 adjustable regulator, the minimum value of output capacitance is a function of the output voltage. The value decreases with higher output voltages, since the internal loop gain is reduced.

The worst case occurs at the lower temperature and maximum operating currents, the entire circuit and the electrolytic, should be cooled down to the minimum temperature. The minimum of 0.6 volts required at the input of regulator above the output to keep the power dissipation and die heating to its minimum. After the value for the capacitor has been determined for actual use, the value should be doubled.

Typical Applications Circuits

The AS603 provides access to the internal reference. A 0.01µF capacitor on the Ref BYP pin will provide a significant reduction in output noise. This pin may be left unconnected if the output noise is not a major concern. The AS603 start-up speed is proportioned to the size of its capacitor. Applications requiring a slow ramp-up of output voltage should consider larger values of C_{BYP}. If the rapid turn-ON is necessary, use 470pF or less.

Figure 1 shows AS603 standard application circuit. The EN (enable bar) pin is either left open or pulled high (>1.4V) to enable the regulator. To disable the regulator, EN < 0.8V.

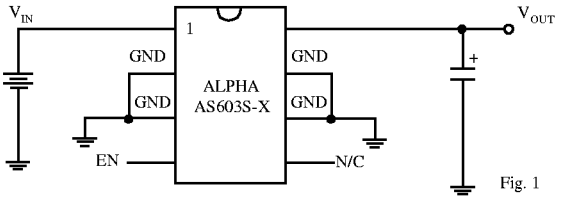


Fig. 1

The AS603 in figure 2 shows adjustable output voltage configuration. Two resistors set the output voltage. The formula for output voltage is:

$$V_{OUT} = 1.224V \times \left(\frac{R2}{R1} + 1\right)$$

Resistor values are not critical as the Adj pin has high input impedance, for best results use resistors of 470kΩ or less. A capacitor for Adj to ground will provide improved noise performance.

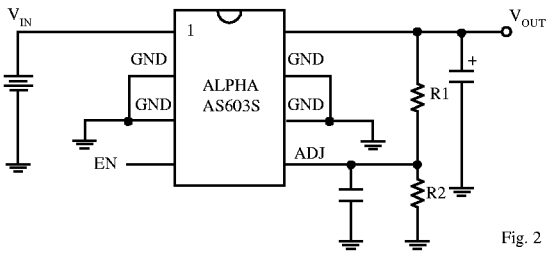


Fig. 2

PACKAGE DRAWING
SOIC-8 (S)