

Micropower SOT-23, 50 mA Low-Dropout Voltage Regulator, Bypass & ON/OFF Switch

FEATURES

- Low Quiescent Current500µA @ 30mA Output
- Ultra Low Dropout.....100mV @ 50mA Output
- 5V, 4.7V, 4V, 3.6V, 3.3V, 3.0V, 2.8V & 2.5V Fixed Output
- Bypass Pin Provides A Significant Reduction In Output Noise
- Smallest Possible Size (SOT-23-5)
- Internal Thermal Overload Protection/ Short Circuit Protection
- Pin Compatible with LP2980/82 & MIC5205
- Low Cost Solution

APPLICATIONS

- Palmtop/ Laptop Computer
- Cellular Phone
- DECT/ CT2/ Pager
- Personal Digital Assistance (PDA)
- Radio Control Systems
- Camcorder, Camera
- Radio Control Systems
- Cordless Telephones

PRODUCT DESCRIPTION

The AS2804 is a low power voltage regulator. This device is meets the requirement of battery-powered applications such as cordless telephones, radio control systems, and portable computers. The AS2804 features very low quiescent Current (1µA) and very low dropout voltage (typ. 50mV at light load and Dropout of 100 mV at 50mA Max). Other features like logic-compatible on/off input enables the regulator to be switched on and off. The AS2804 is offered in a small package 5-pin SOT-23 as fix, adjustable with ON/OFF Switch and BYP pin that provides a significant reduction in output noise.

The AS2804 is the same pin out as LP2980/82 and MIC5205. The regulator output voltage may be internally pin-strapped for a 5V, 4.8V, 4.5V, 4V, 3.6V, 3.3V, 3.V, 2.8V & 2.5V or programmed from 2.5V to 29V with an external pair of resistors. For other fix voltages consult with ALPHA Semiconductor.

ORDERING INFORMATION

| SOT-23 5-PIN | TO-92 | SOT-89 3-PIN | Oper. Temp. Range |
|-----------------|------------|-----------------|----------------------|
| AS2804YM-X | AS2804YN-X | AS2804M1-X | -40°C to 85°C |

Package marking information.

For SOT-23 & SOT-89

7YX

Example 4A50 = AS2804m1-5.0

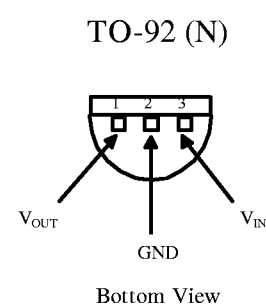
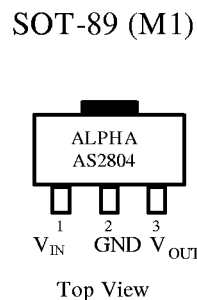
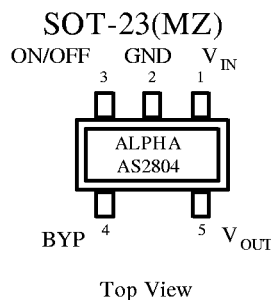
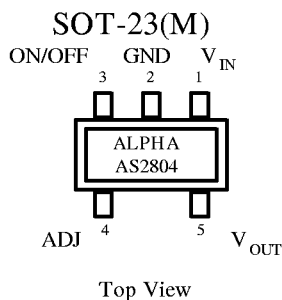
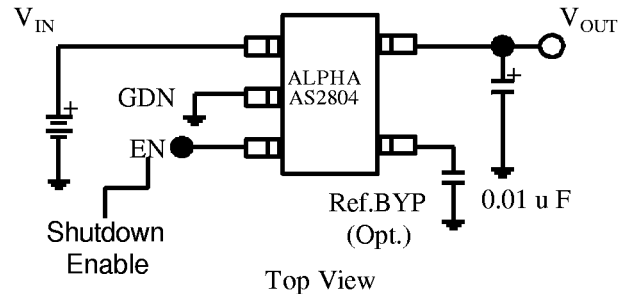
Or AS2804M-5.0

X = Output Voltage (X= 2.5V, 3.0V, 3.3V, 3.5V, 3.6V, 4.5V, 5.0V or

Blank for Adjustable.)

Consult factory for other fixed voltages.

PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|--------------------|---------------------|----------------|
| Power Dissipation..... | Internally Limited | Supply Voltage..... | + 3.2V to +30V |
| Lead Temp (soldering, 5 seconds)..... | 260°C | | |
| Storage Temperature Range..... | -65°C to +150°C | | |
| Operating Junction Temperature Range..... | -40°C to + 85°C | | |
| Input Supply Voltage..... | 2.5V to 16V | | |
| ESD Rating | 2KV | | |

ELECTRICAL CHARACTERISTICS at $V_S=14V$, $T_a=25^\circ C$, $I_o=10mA$, $C_2=100\mu F$, unless otherwise specified. (Note 1)

| Parameters | Conditions | AS2804 | | | AS2804A | | | AS2804C | | | Units |
|-----------------------------------|--|------------|-------|-------|-------------|-------|-------|-------------|-------|-------|---------------|
| | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| 3.0 Volt Version | | AS2804-3 | | | AS2804A-3 | | | AS2804C-3 | | | |
| Output Voltage | $V_{IN} = 6V$ $I_{OUT} = 50mA$ | 2.97 | 3.00 | 3.03 | 2.94 | 3.00 | 3.06 | 2.91 | 3.00 | 3.09 | V |
| 3.3 Volt Version | | AS2804-3.3 | | | AS2804A-3.3 | | | AS2804C-3.3 | | | |
| Output Voltage | $V_{IN} = 6V$, $I_{OUT} = 50mA$ | 3.27 | 3.30 | 3.33 | 3.23 | 3.30 | 3.36 | 3.20 | 3.30 | 3.39 | V |
| 5 Volt Version | | AS2804-5 | | | AS2804A-5 | | | AS2804C-5 | | | |
| Output Voltage | $V_{IN} = 6V$, $I_{OUT} = 50mA$ | 4.95 | 5.00 | 5.05 | 4.81 | 5.00 | 5.19 | 4.75 | 5.00 | 5.25 | V |
| All Voltage Options | | | | | | | | | | | |
| Long Term Stability | | | 20 | | | 20 | | | 20 | | mV/1000 |
| Line Regulation | $5V < V_{IN} < 16V$ | | 2.0 | 10 | | 2.0 | 10 | | 4.0 | 30 | mV |
| Load Regulation | $5mA < I_O < 50mA$ | | 14 | 50 | | 14 | 50 | | 14 | 50 | mV |
| Dropout Voltage | $I_O = 10mA$ $I_O = 30mA$ $I_O = 50mA$ | | 0.001 | 0.005 | | 0.001 | 0.005 | | 0.001 | 0.005 | V |
| | | | 0.005 | 0.01 | | 0.005 | 0.01 | | 0.005 | 0.01 | V |
| | | | 0.05 | 0.10 | | 0.05 | 0.10 | | 0.05 | 0.05 | V |
| Quiescent Current | $I_O < 10mA$ $I_O = 30mA$ $I_O = 50mA$ | | 1 | | | 1 | | | 1 | | μA |
| | | | 500 | 800 | | 500 | 800 | | 500 | 800 | μA |
| | | | 1200 | 1500 | | 1200 | 1500 | | 1200 | 1500 | μA |
| Maximum Operational Input Voltage | | | 16 | | | 16 | | | 16 | V | |
| Continuous Output Current | | | 50 | | | 50 | | | 50 | mA | |
| Pulse Output Current | | | 100 | | | 100 | | | 100 | mA | |
| Output Noise Voltage | 10Hz- 100kHz, $C_{OUT} = 100\mu F$ | | 500 | | | 500 | | | 500 | | μV_{rms} |
| Ripple Rejection | $f_O = 120Hz$ | | 80 | | | 80 | | | 80 | | dB |
| On/ Off Threshold Current | | | 50 | | | 50 | | | 26 | | μA |
| Threshold Voltage | On | | 1.6 | 1.2 | | 1.6 | 1.2 | | 1.6 | 1.2 | V |
| | Off | 3.25 | 2.6 | | 3.25 | 2.6 | | 3.25 | 2.6 | | |

Adjustable $V_{in}=14V$, $V_o=3V$, $I_o=10mA$, $R_1=27k$, $C_2=100\mu F$, $T_j=25^\circ$

| Parameter | Conditions | AS2804A/C | | | Units |
|-------------------|--|-----------|------|------|-------|
| | | Min | Typ | Max | |
| Reference Voltage | $I_o \leq 50mA$, over tem. $R_1 = 27K$ | 1.14 | 1.20 | 1.26 | V |
| | | 1.08 | | 1.32 | V |

Adjustable Version only $V_{in}=14V$, $V_o=3V$, $I_o=10mA$, $R_1=27k$, $C_2=100\mu F$, $T_j=25^\circ$ (Continued)

| Parameter | Conditions | AS2804A/C | | | Units |
|-----------------------------------|--|-----------|------|------|---------|
| | | Min | Typ | Max | |
| Output Voltage Range | | 2.5 | | 29 | V |
| Line Regulation | $V+0.6V < V_{IN} < 16V$ | | 0.2 | 1.5 | mV |
| Load Regulation | $5mA < I_o < 50mA$ | | 0.3 | 1.0 | % max |
| Output Impedance | 50mA DC and 10mArms, 100Hz-10kHz | | 40 | | mΩ/V |
| Quiescent Current | $I_o=10mA$ | | 0.4 | 1.0 | mA |
| | $I_o=50mA$ | | 0.8 | 1.0 | mA |
| Output Noise Voltage | 10Hz - 100kHz | | 100 | | μVrms/V |
| Long Term Stability | | | 0.4 | | %/1000h |
| Ripple Rejection | $f_o=120Hz$ | | 0.02 | | %/V |
| Dropout Voltage | $I_o < 10mA$ | | 0.05 | 0.08 | V |
| | $I_o = 50mA$ | | 0.07 | 0.1 | V |
| Maximum Operational Input Voltage | | | | 16 | V |
| Continuous Output Current | | | | 50 | mA |
| Pulse Output Current | 1% Duty Cycle, $T < 100ms$, $R_L = 500\Omega$ | | | 100 | mA |
| On/Off Threshold Current | | | 20 | 50 | μA |
| Threshold Voltage | $V_o=3V$ | | 2.0 | 1.2 | V |
| | | 3.25 | 2.2 | | V |

Note 1: See TYPICAL APPLICATIONS notes to ensure constant junction temperature, low duty cycle pulse testing used.

Note 2: All limits are at 25°C or over the full operating temperature junction range of -40°C to +125°C.

Note 3: The maximum power dissipation is a function of maximum junction temperature, total thermal resistance, and ambient temperature.

Note 4: Human body model, 100 μF discharged through 1.5 KΩ.

Application Hints

The AS2804 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 100µF 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 AS2804 is designed to operate starting at -40°C which 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 are that the twitch higher output current stability decreases. In most applications the AS2804 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 AS2804 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 AS2804 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 AS2804 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 AS2804 standard application circuit. The EN (enable bar) pin is pulled low (<1.2V) to enable the regulator. To disable the regulator, EN > 3.25V.

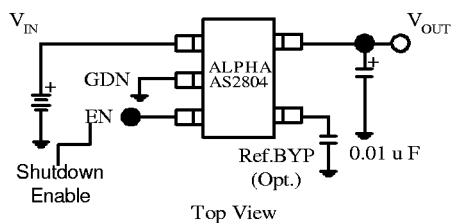


Fig. 1

The AS2804 in figure 2 shows adjustable output voltage configuration. Two resistors set the output voltage. The formula for output voltage is:

$$V_{OUT} = 1.20V \times \left(\frac{R2}{R1} + 1 \right)$$

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.

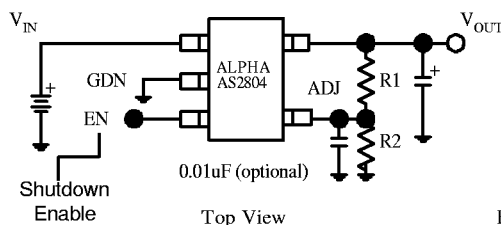


Fig. 2