ALPHA SEMICONDUCTOR
Excellence in Analog Power Products

AS2931

Low Dropout Voltage Regulator

FEATURES

- 5.0V, 4.5V, 4.0V, 3.5V, 3.3V, and 3.0V Versions are Available
- Output Current in Excess of 500 mA
- Input-Output Differential is Less Than 0.6V
- Mirror-Image Insertion Protection
- Internal Thermal Overload Protection
- Available in TO-220, TO-92, SOT-89, and SO-8 Package Types
- Available as Adjustable With TTL Compatible Switch
- Simular to Industry Standard LM2931
- Reverse Battery Protection
- Short Circuit Protection
- 60V Load Dump Protection
- -50 Reverse Transient Protection

APPLICATION

- Portable Instrumentation
- Radio Control Systems
- Cordless Telephones

PRODUCT DESCRIPTION

The AS2931 is a low power voltage regulator. This device is an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. The AS2931 features offers very low quiescent currents (0.4 mA.), and very low drop output voltage (typ. 50 mV at light load and 300 mV at 500 mA). Other features include the logic-compatible On/Off input which enables the regulator to be switched on and off. The AS2931 is offered in a 3-pin TO-92/TO-220 package compatible with other 5V regulators and SOT-89/SO-8 package. The AS2931 adjustable version is available in a 5-lead TO-220 package.

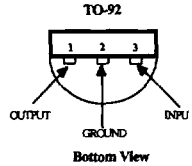
The regulator output voltage may be internally pin-strapped for a 5V, 4.5V,4.0V, 3.5V, 3.3V, 3.0V, or programmed from 3V to 24V with an external pair of resistors. Using ALPHA Semiconductors design, process and testing techniques make the AS2931 superior over similar products.

ORDERING INFORMATION

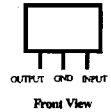
TO-92 3-PIN	SO-8	SOT-89 3-PIN	TO-220	OPER. TEMP. RANGE
AS2931AN-X	AS2931AS-X	AS2931AM-X	AS2931AU-X	IND.
AS2931N-X	AS2931S-X	AS2931M-X	AS2931U-X	IND.
	AS2931CS-X		AS2931CU-X	IND.

X = OUTPUT VOLTAGE (FOR OTHER OUTPUT VOLTAGES, CONSULT WITH FACTORY.)

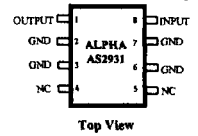
PIN CONNECTIONS



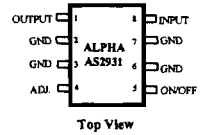
Bottom View



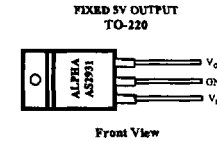
Front View



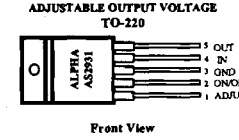
Top View



Top View



Front View



Front View

ABSOLUTE MAXIMUM RATINGS

Power Dissipation ..... Internally limited
Lead Temp. (soldering, 5 Seconds) ..... 260°C
Storage Temperature Range -65° to +150°C
Operating Junction Temperature Range..... -40° to +85°C
Input Supply Voltage ..... -0.3 to +26V
ESD Rating 2KV

ELECTRICAL CHARACTERISTICS at V_S = 14V, Ta = 25°C, Io = 10 mA, C2 = 100 µF, unless otherwise specified.

(Note 1)

Parameter	Conditions	AS2931A			AS2931			Units
		Min	Typ	Max	Min	Typ	Max	
3.0 Volt Version			**AS2931A-3**			**AS2931-3**		
Output Voltage		2.94	3.00	3.06	2.91	3.00	3.09	V
	6V < V_{in} < 26V, I_O = 100 mA Over Temp.	**2.88**	3.00	**3.12**	**2.85**	3.00	**3.15**	V
3.3 Volt Version			**AS2931A-3.3**			**AS2931-3.3**		
Output Voltage		3.23	3.30	3.36	3.20	3.30	3.39	V
	6V < V_{in} < 26V, I_O = 100 mA Over Temp.	**3.20**	3.30	**3.39**	**3.16**	3.30	**3.43**	V
5 Volt Version			**AS2931A-5**			**AS2931-5**		
Output Voltage		4.81	5.00	5.19	4.75	5.00	5.25	V
	6V<V_{in}<26V, I_O =100 mA Over Temp.	**4.75**		**5.25**	**4.5**		**5.5**	V
All Voltage Options								
Long Term Stability			20			20		mV/1000
Line Regulation	9V < V_{in} < 16V		2.0	10		4.0	30	mV
	6V < V_{in} < 26V,		4.0	30				
Load Regulation	5 mA < I_O < 100 mA		14	50		14	50	mV
Dropout Voltage	I_o=10 mA		0.05	0.2		0.05	0.2	V
	I_o=50 mA		0.07	0.1		0.07	0.1	V
	I_o=100 mA		0.3	0.6		0.3	0.6	V
Quiescent Current	I_o < 10 mA, 6V < V_{in} < 26V -40°C < Tj < 125°C		0.4	1.0		0.4	1.0	mA
	I_o = 100 mA, V_{in} = 14V,, Tj = 25°C		15			15		mA
Maximum Operational Input Voltage		26	33		26	33		V
Maximum Line Transient	R_L=500Ω, Vo<5.5V, 100ms	60	70		70	50		V
Reverse Polarity Input Voltage, DC	V_o > -0.3V, R_L = 500Ω	-15	-30		-15	30		V
Reverse Polarity Input Voltage, Transient	1% Duty Cycle, τ < 100ms, R_L = 500Ω	-50	-80		-50	-80		V
Output Noise Voltage	10Hz-100kHz, C_{out}=100µF		500			500		µVrms
Ripple Rejection	f_o = 120Hz		80			80		dB

Adjustable Version only **Vin=14V, Vo=3V, Io=10mA, R1=27k, C2=100µF, Tj=25°**

Parameter	Conditions	AS2931C Min / Max	Typ		Units
Reference Voltage		1.14	1.20	1.26	V
	$I_O \leq 100mA$, over tem. $R_1 = 27K$	**1.08**		**1.32**	V
Output Voltage Range		3.0		24	V
Line Regulation	$V_{out}+0.6V<V_{in}<26V$		0.2	1.5	mV
Load Regulation	$5mA<I_o<100mA$		0.3	1.0	% max
Output Impedance	100mADC and 10mArms, 100Hz-10kHz		40		mΩ/V
Quiescent Current	Io=10mA		0.4	1.0	mA
	Io=100mA		15		mA
	During Shutdown $R_L=500\Omega$		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	0.2	V
	I_o=100mA		0.3	0.6	
Maximum Operational Input Voltage		26	33		V
Maximum Line Transient	I_o=10mA, Reference Voltage <1.5V	60	70		V
Reverse Polarity Input Voltage, DC	$V_o>-0.3V$, $R_L=500\Omega$	-15	-30		V
Reverse Polarity Input Voltage, Transient	1% Duty Cycle, T<100ms, $R_L=500\Omega$	-50	-80		V
On/Off Treshold Current			20	50	µA
Treshold Voltage	V_o=3V				
On			2.0	1.2	V
Off		3.25	2.2		

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 AS2931 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.

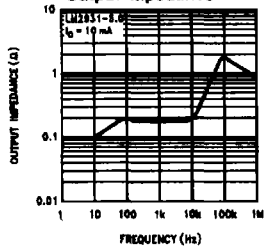
Another critical point of electrolytic characteristics is its performance over temperature. The AS2931 is designed to operate starting at -40°C which may not be true in the case of electrolytic. Higher temperatures generally no problem. The electrolytic. type in aluminum will freeze around -30°C. This 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 is that the twitch higher output current stability decreases. In most applications the AS2931 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 AS2931CT 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.

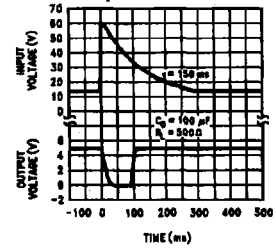
The worst case occurs at the lower temperature and maximum operating currents, the entire circuit and the electrolytic, should be cooled down to the minimum temperature. The minimum of 0.6 volts required at the input of regulator above the output to keep the power dissipation and die heating to its minimum.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

TYPICAL CHARACTERISTICS

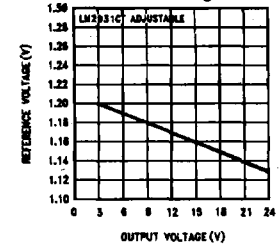
Output Impedance



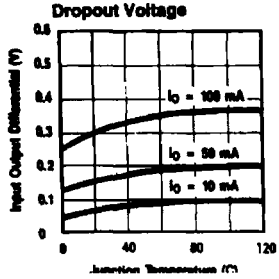
Operation During Load Dump



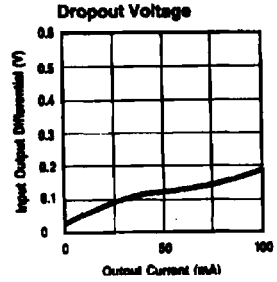
Reference Voltage



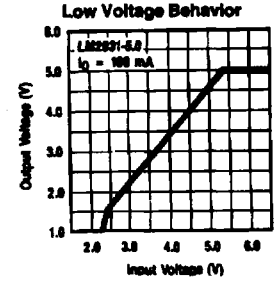
Dropout Voltage



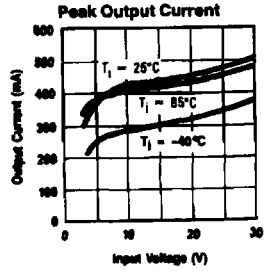
Dropout Voltage



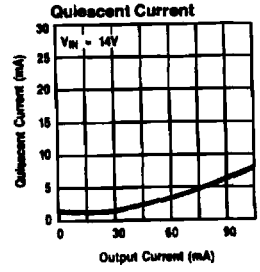
Low Voltage Behavior



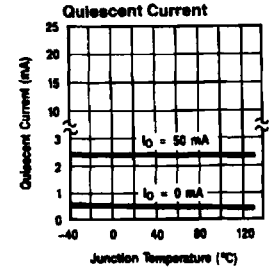
Peak Output Current



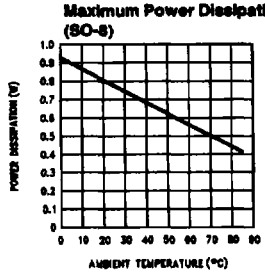
Quiescent Current



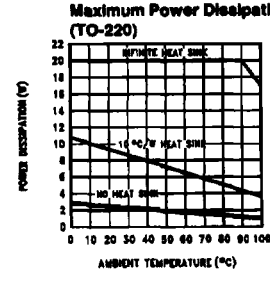
Quiescent Current



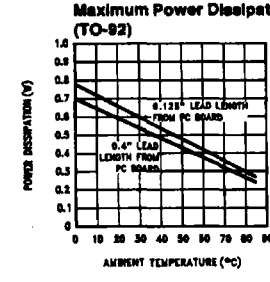
Maximum Power Dissipation (SO-8)



Maximum Power Dissipation (TO-220)

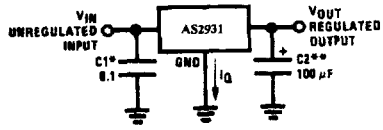


Maximum Power Dissipation (TO-92)

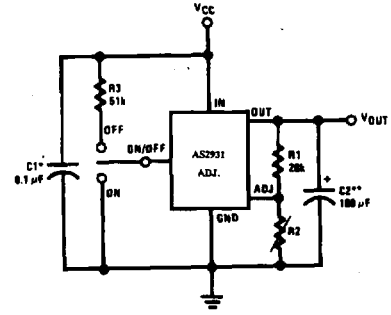


TYPICAL APPLICATIONS

AS2931 Fixed Output



AS2931 ADJUSTABLE OUTPUT



$$V_{OUT} = \text{Reference Voltage} \times \frac{R1 + R2}{R1}$$

SCHEMATIC DIAGRAM