

**CLM2931**

**FEATURES**

- 5V, 3.3V, 3.5V, 4.0V, and 4.5V Versions Available
- Output Current in Excess of 100mA
- Input-Output Differential is Less Than 0.6V
- Mirror-Image Insertion Protection
- Internal Thermal Overload Protection
- Available as Adjustable with TTL Compatible Switch
- Similar to Industry Standard LM2931
- Reverse Battery Protection
- Short Circuit Protection
- 60V Load Dump Protection
- -50V Reverse Transient Protection

**APPLICATIONS**

- Portable Instrumentation
- Radio Control Systems
- Cordless Telephones

**PRODUCT DESCRIPTION**

The CLM2931 is a positive 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 CLM2931 features very low quiescent current (0.4mA) and very low drop output voltage (typ. 50mV at light load and 300mV at 100mA). Other features include the logic-compatible on/off input which enables the regulator to be switched on and off.

The regulator output voltage may be internally pin-strapped for a 5V, 3V, 3.3V, 3.5V, 4.0V, 4.5V or programmed from 3V to 24V with an external pair of resistors. Using Calogic's design, process and testing technique make the CLM2931 superior over similar products.

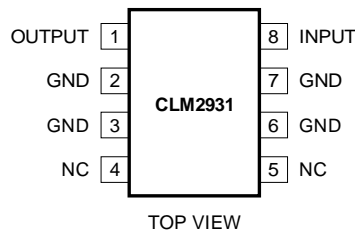
**ORDERING INFORMATION**

PART	PACKAGE	TEMPERATURE RANGE
CLM2931AS-X	Plastic SOIC (8-Pin)	Industrial

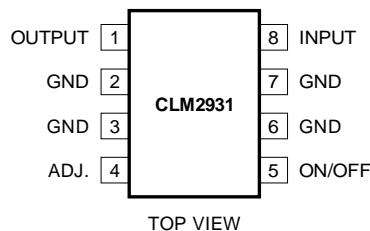
X = Output Voltage, 5V = standard product, for all other ranges contact factory.

**PIN CONNECTIONS**

**8-PIN SURFACE MOUNT, FIX OUTPUT**



**8-PIN SURFACE MOUNT, ADJ. OUTPUT**



1M-07

## 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 . . . . . 0.30 to +26V  
 ESD Rating . . . . . 2KV

## ELECTRICAL CHARACTERISTICS: $V_S = 14V$ , $T_A = 25^\circ C$ , $I_O = 10mA$ , $C_2 = 100\mu F$ , unless otherwise specified. (Note 1)

PARAMETER	CLM2931A			CLM2931			UNITS	CONDITIONS (Note 2)
	MIN	TYP	MAX	MIN	TYP	MAX		
<b>3V VERSION</b>	<b>CLM2931A-3</b>			<b>CLM2931-3</b>				
Output Voltage	2.94 <b>2.88</b>	3.0 3.0	3.06 <b>3.12</b>	2.91 <b>2.85</b>	3.0 3.0	3.09 <b>3.15</b>	V V	$6V < V_{IN} < 26V$ , $I_O = 100mA$ Over Temp.
<b>3.3V VERSION</b>	<b>CLM2931A-3.3</b>			<b>CLM2931-3.3</b>				
Output Voltage	3.23 <b>3.20</b>	3.30 3.30	3.36 <b>3.39</b>	3.20 <b>3.16</b>	3.30 3.30	3.39 <b>3.43</b>	V V	$6V < V_{IN} < 26V$ , $I_O = 100mA$ Over Temp.
<b>5V VERSION</b>	<b>CLM2931A-5</b>			<b>CLM2931-5</b>				
Output Voltage	4.81 <b>4.75</b>	5.0	5.19 <b>5.25</b>	4.75 <b>4.50</b>	5.0	5.25 <b>5.50</b>	V V	$6V < V_{IN} < 26V$ , $I_O = 100mA$ Over Temp.
<b>ALL VOLTAGE OPTIONS</b>								
Long Term Stability		20			20		mV/1000	
Line Regulation		2.0 4.0	10 30		4.0 30		mV	$9V < V_{IN} < 16V$ $6V < V_{IN} < 26V$
Load Regulation		14	50		14	50	mV	$5mA < I_O < 100mA$
Dropout Voltage		0.05 0.07 0.3	0.2 0.1 0.6		0.05 0.07 0.3	0.2 0.1 0.6	V V V	$I_O = 10mA$ $I_O = 50mA$ $I_O = 100mA$
Quiescent Current		0.4 15	1.0		0.4 15	1.0	mA mA	$I_O < 10mA$ , $6V < V_{IN} < 26V$ , $-40^\circ C < T_J < 125^\circ C$ $I_O = 100mA$ , $V_{IN} = 14V$ , $T_J = 25^\circ C$
Maximum Operational Input Current	26	33		26	33		V	
Maximum Line Transient	60	70		70	50		V	$R_L = 500\Omega$ , $V_O < 5.5V$ , 100ms
Reverse Polarity Input Voltage, DC	-15	-30		-15	30		V	$V_O > -0.3V$ , $R_L = 500\Omega$
Reverse Polarity Input Voltage, Transient	-50	-80		-50	-80		V	1% Duty Cycle, $\tau < 100ms$ , $R_L = 500\Omega$
Output Noise Voltage		500			500		$\mu V_{rms}$	10Hz-100kHz, $C_{OUT} = 100\mu F$
Ripple Rejection		80			80		dB	$f_o = 120Hz$

**ADJUSTABLE VERSION ONLY:**  $V_{IN} = 14V$ ,  $V_O = 3V$ ,  $I_O = 10mA$ ,  $R_1 = 27k$ ,  $C_2 = 100\mu F$ ,  $T_J = 25^\circ$ 

PARAMETER	CLM2931C			UNITS	CONDITIONS
	MIN	TYP	MAX		
Output Voltage Range	3.0		24	V	
Line Regulation		0.2	1.5	mV	$V_{OUT} + 0.6V < V_{IN} < 26V$
Load Regulation		0.3	1.0	mV	$5mA < I_O < 100mA$
Output Impedance		40		$m\Omega/V$	100mADC and 10mArms, 100Hz-10kHz
Quiescent Current		0.4 15 0.8	1.0 1.0	mA mA mA	$I_O = 10mA$ $I_O = 100mA$ During Shutdown $R_L = 500\Omega$
Output Noise Voltage		100		$\mu V_{rms}$	10Hz-100kHz
Long Term Stability		0.4		%/1000h	
Ripple Rejection		0.02		%/V	$f_O = 120Hz$
Dropout Voltage		0.05 0.3	0.2 0.6	V V	$I_O < 10mA$ $I_O = 100mA$
Maximum Operational Input Voltage	26	33		V	
Maximum Line Transient	60	70		V	$I_O = 10mA$ , Reference Voltage $< 1.5V$
Reverse Polarity Input Voltage, DC	-15	-30		V	$V_O > -0.3V$ , $R_L = 500\Omega$
Reverse Polarity Input Voltage, Transient	-50	-80		V	1% Duty Cycle, $T < 100ms$ , $R_L = 500\Omega$
On/Off Threshold Current		20	50	$\mu A$	
Threshold Voltage On Off	3.25	2.0 2.2	1.2	V	$V_O = 3V$

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

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

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

**Note 4:** Human body model,  $100\mu F$  discharged through  $1.5K\Omega$ .

## APPLICATION HINTS

The CLM2931 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  $100\mu F$  aluminum electrolytic covers all general application circuits, this stability can be obtained with a tantalum electrolytic value of  $47\mu F$ .

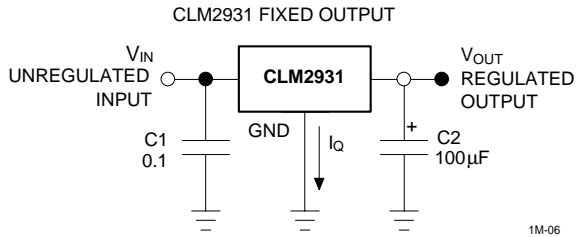
Another critical point of electrolytic characteristics is its performance over temperature. The CLM2931 is designed to operate starting at  $-40^\circ C$  which may not be true in the case of electrolytic. Higher temperatures are generally no problem. The electrolytic type in aluminum will freeze at around  $-30^\circ C$ . 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  $25^\circ C$ , 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 CLM2931 is operating at a 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 100mA.

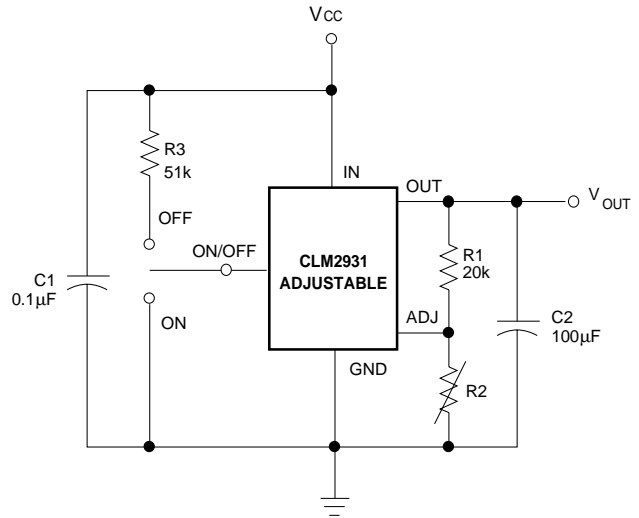
With the CLM2931CT adjustable regulator, the minimum value of output capacitance is a function of the output voltage. The value decreases with higher output voltages, since the internal loop gain is reduced.

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



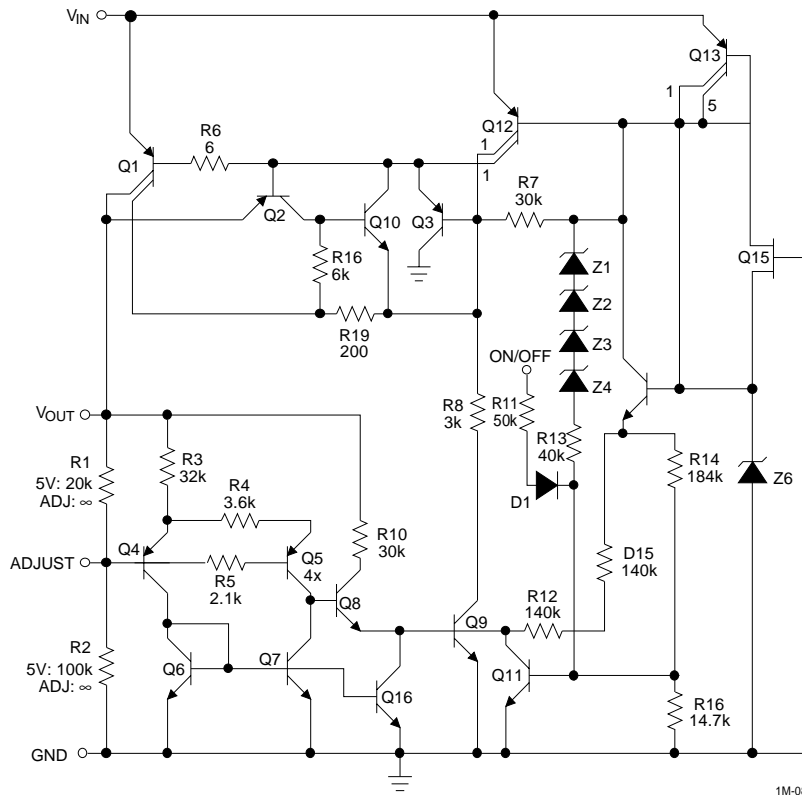
CLM2931 FIXED OUTPUT



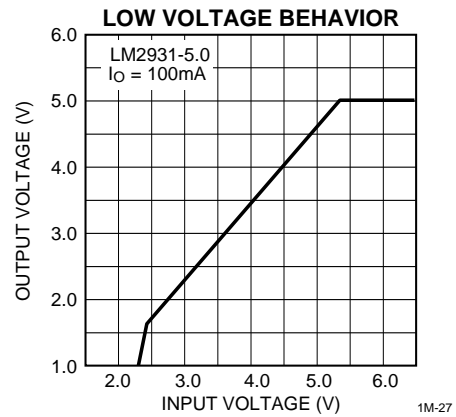
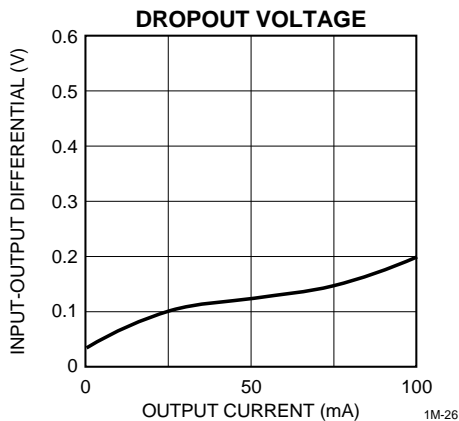
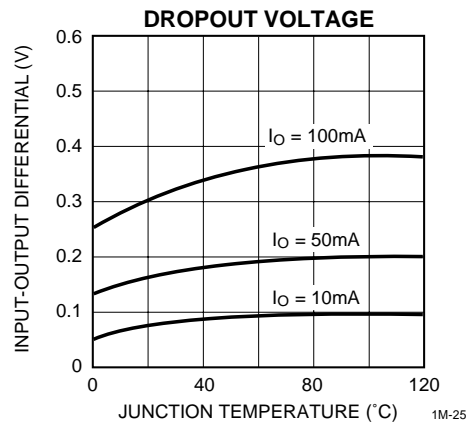
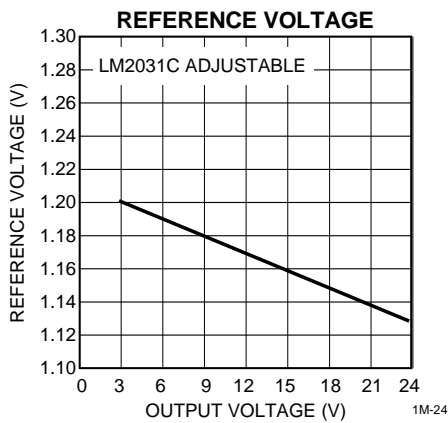
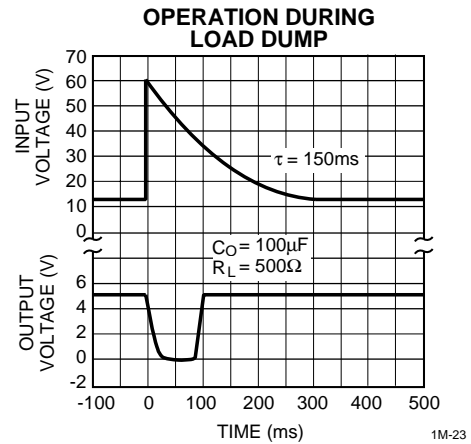
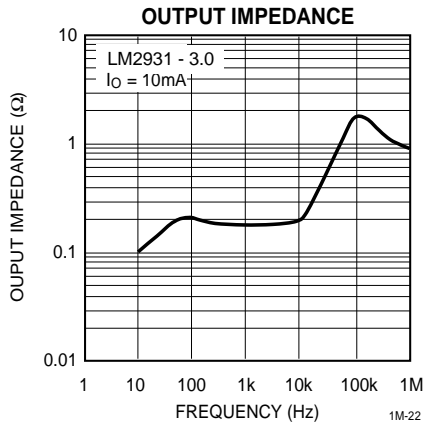
$$V_{OUT} = \text{Reference Voltage} \times \frac{R1 + R2}{R1}$$

CLM2931 ADJUSTABLE OUTPUT

SCHEMATIC DIAGRAM



**TYPICAL PERFORMANCE CHARACTERISTICS**



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

