1. DESCRIPTION

The XLM2931 consists of positive fixed and adjustable output voltage regulators that are specifically designed to maintain proper regulation with an extremely low input−to−output voltage differential. These devices are capable of supplying output currents in excess of 100 mA and feature a low bias current of 0.4 mA at 10 mA output.

Designed primarily to survive in the harsh operation environment,will protect all extern al load circuitry from input fault conditions caused by reverse battery connection,two battery jump starts,and excessive line transients during load dump.Also includes internal current limiting,thermal shutdown,and additionally,is able to withstand temporary power−up with mirror−image insertion.

Due to the low dropout voltage and bias current specifications, the XLM2931 is ideally suited for battery powered industrial and consumer equipment where an extension of useful battery life is desirable.

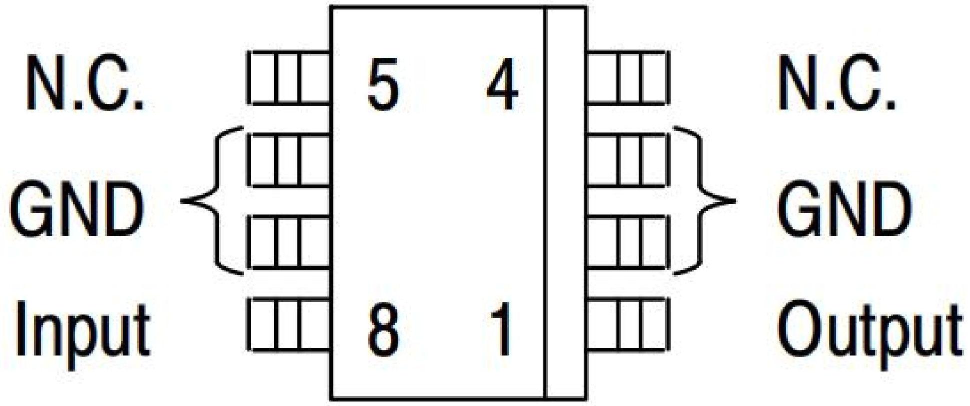
2. FEATURES

- Input−to−Output Voltage Differential of < 0.6 V @ 100 mA
- Output Current in Excess of 100 mA
- Low Bias Current
- 60 V Load Dump Protection
- −50 V Reverse Transient Protection
- Internal Current Limiting with Thermal Shutdown
- Temporary Mirror−Image Protection
- Ideally Suited for Battery Powered Equipment
- Pb−Free Packages are Available

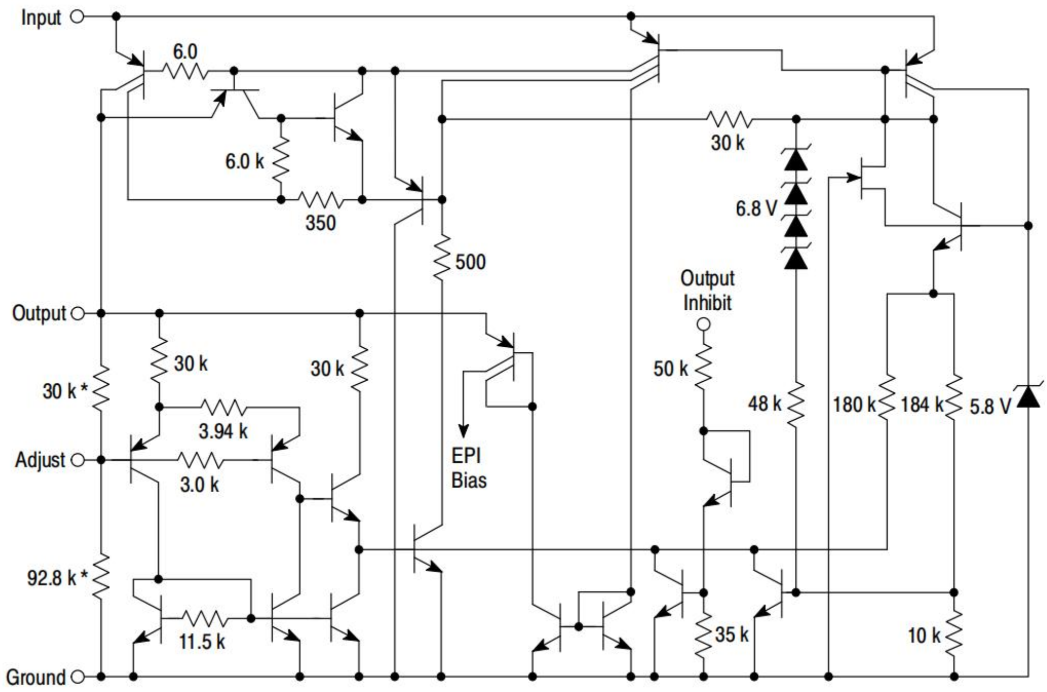
3. APPLICATIIONS

- Battery Powered Consumer Products
- Hand−held Instruments
- Camcorders and Cameras

4. PIN CONFIGURATIONS



5. REPRESENTATIVE SCHEMATIC DIAGRAM



6. MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Input Voltage Continuous	V_I	40	Vdc
Transient Input Voltage (≤ 100 ms)	$V_I(\tau)$	60	Vpk
Transient Reverse Polarity Input Voltage	$-V_I(\tau)$	-50	Vpk
Electrostatic Discharge Sensitivity (ESD)			
Human Body Model (HBM) Class 2, JESD22 A114−C	-	2000	V
Machine Model (MM) Class A, JESD22 A115−A	-	200	V
Charged Device Model (CDM), JESD22 C101−C	-	2000	V
Power Dissipation			
T_A = 25°C	P_D	Internally Limited	W
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	160	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	25	°C/W
Operating Ambient Temperature Range	T_A	-40 to +85	°C
Operating Die Junction Temperature	T_J	+150	°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. SOP−8 Junction−to−Ambient Thermal Resistance is for minimum recommended pad size. Refer to Figure 20 for Thermal Resistance variation versus pad size.

7. ELECTRICAL CHARACTERISTICS

(V_{in} = 14 V, I_O = 10 mA, C_O = 100 µF, $C_{O(ESR)}$ = 0.3 Ω, T_A = 25°C[Note 2])

Characteristic	Symbol	MIN	TYP	MAX	Unit
FIXED OUTPUT					
Output Voltage	V_O				V
V_{in} = 14 V, I_O = 10 mA, T_A = 25°C		4.81	5.0	5.19	
V_{in} = 6.0 V to 26 V, I_O ≤ 100 mA, T_A = -40°C to +85°C		4.75	-	5.25	
Line Regulation	Reg_{line}				mV
V_{in} = 9.0 V to 16 V		-	2.0	10	
V_{in} = 6.0 V to 26 V		-	4.0	30	
Load Regulation (I_O = 5.0 mA to 100 mA)	Reg_{load}	-	14	50	mV
Output Impedance	Z_O				mΩ
I_O = 10 mA, Δ I_O = 1.0 mA, f = 100 Hz to10 kHz		-	200	-	
Bias Current	I_B				mA
V_{in} = 14 V, I_O = 100 mA, T_A = 25°C		-	5.8	30	
V_{in} = 6.0 V to 26 V, I_O = 10 mA, T_A = -40°C to +85°C		-	0.4	1.0	
Output Noise Voltage (f = 10 Hz to 100 kHz)	Vn	-	700	-	µVrms
Long Term Stability	S	-	20	-	mV/kHR
Ripple Rejection (f = 120 Hz)	RR	60	90	-	dB
Dropout Voltage	V_I-V_O				V
I_O = 10 mA		-	0.015	0.2	
I_O = 100 mA		-	0.16	0.6	
Over-Voltage Shutdown Threshold	$V_{th(OV)}$	26	29.5	40	V
Output Voltage with Reverse Polarity Input (V_{in} = -15 V)	$-V_O$	-0.3	0	-	V

2. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.

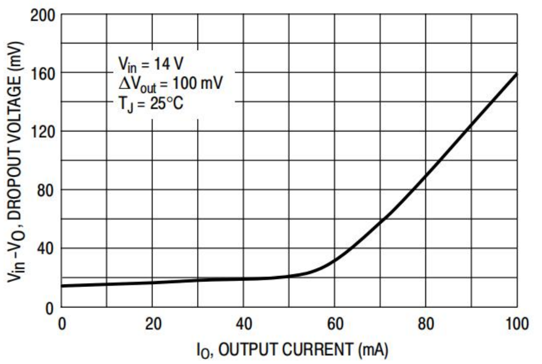


Figure 1. Dropout Voltage versus Output Current

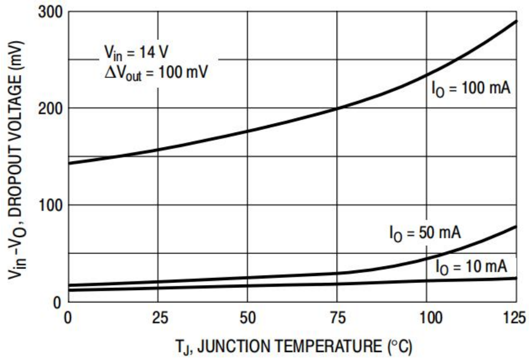


Figure 2. Dropout Voltage versus Junction Temperature

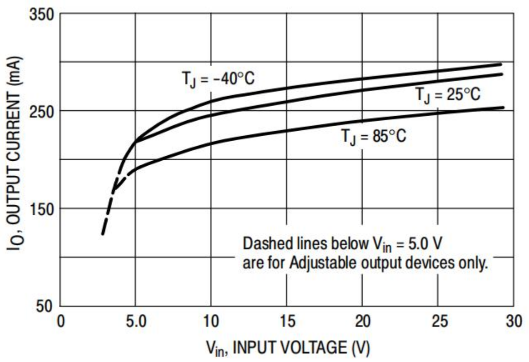


Figure 3. Peak Output Current versus Input Voltage

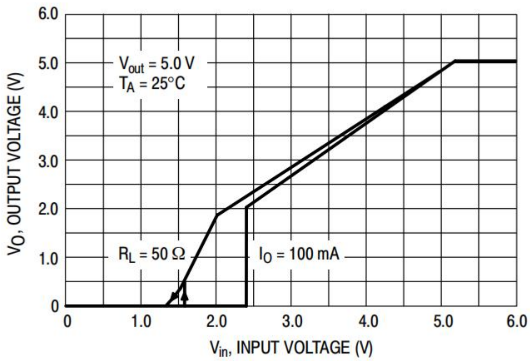


Figure 4. Output Voltage versus Input Voltage

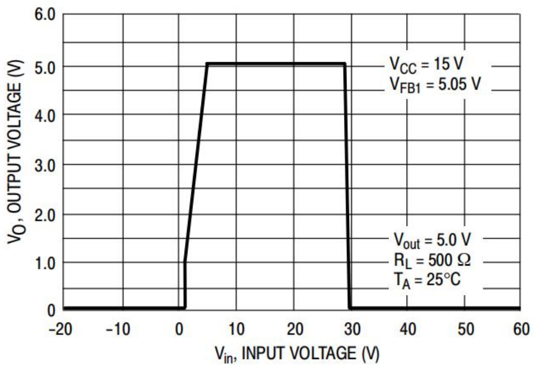


Figure 5. Output Voltage versus Input Voltage

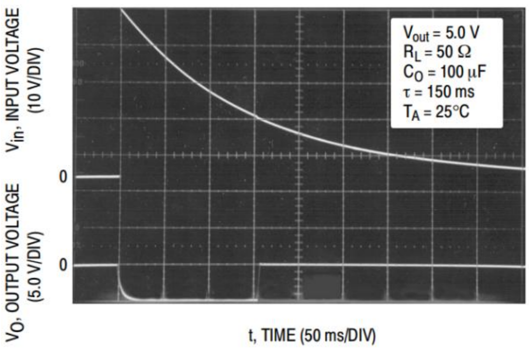


Figure 6. Load Dump Characteristics

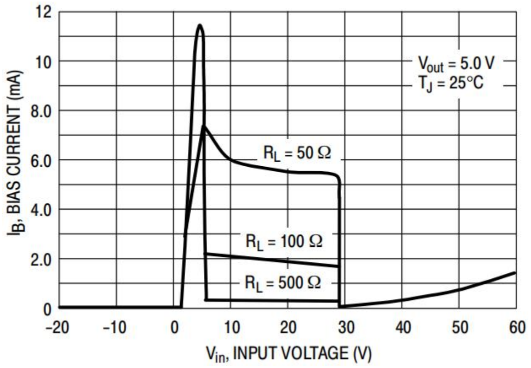


Figure 7. Bias Current versus Input Voltage

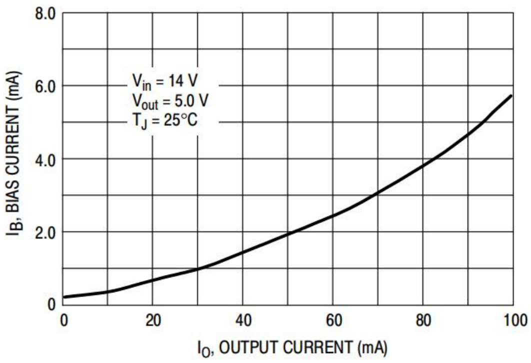


Figure 8. Bias Current versus Output Current

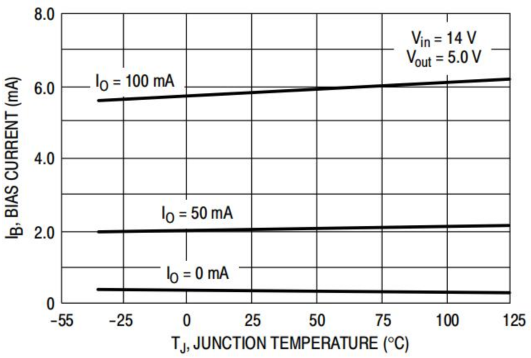


Figure 9. Bias Current versus Junction Temperature

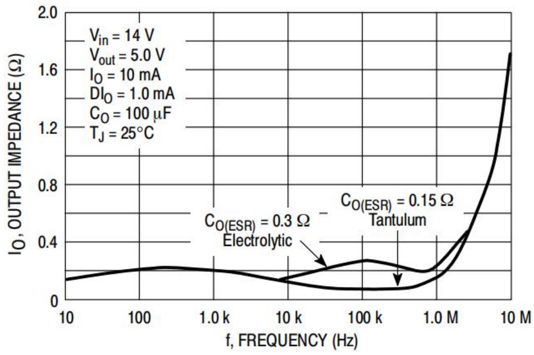


Figure 10. Output Impedance versus Frequency

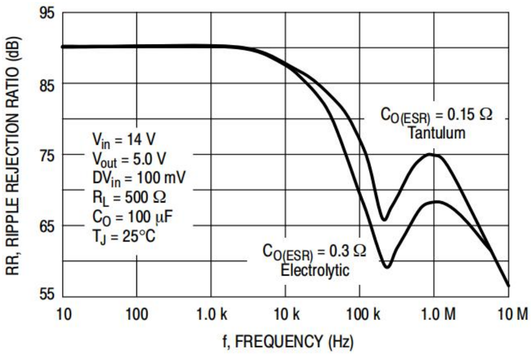


Figure 11. Ripple Rejection versus Frequency

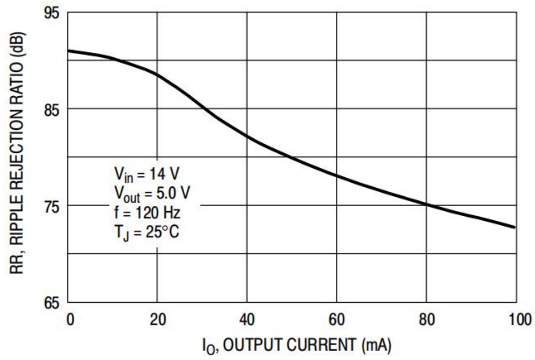


Figure 12. Ripple Rejection versus Output Current

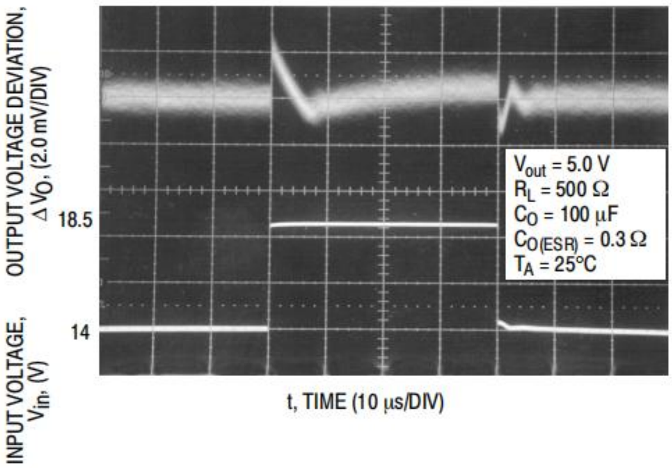


Figure 13. Line Regulation

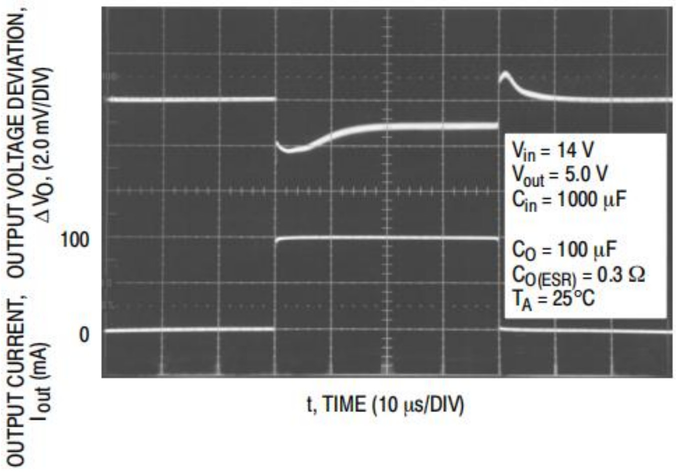


Figure 14. Load Regulation

8. APPLICATIONS INFORMATION

The XLM2931 series regulators are designed with many protection features making them essentially blow−out proof. These features include internal current limiting, thermal shutdown, overvoltage and reverse polarity input protection, and the capability to withstand temporary power−up with mirror−image insertion. Typical application circuits for the fixed output device are shown in Figures 15.

The input bypass capacitor Cin is recommended if the regulator is located an appreciable distance (≥ 4”) from the supply input filter. This will reduce the circuit’s sensitivity to the input line impedance at high frequencies.

This regulator series is not internally compensated and thus requires an external output capacitor for stability. The capacitance value required is dependent upon the load current, output voltage for the adjustable regulator, and the type of capacitor selected. The least stable condition is encountered at maximum load current and minimum output voltage. Figure 18 shows that for operation in the “Stable” region, under the conditions specified, the magnitude of the output capacitor impedance |ZO| must not exceed 0.4 . Thislimit must be observed over the entire operating temperature range of the regulator circuit.

With economical electrolytic capacitors, cold temperature operation can pose a serious stability problem. As the electrolyte freezes, around −30°C, the capacitance will decrease and the equivalent series resistance (ESR) will increase drastically, causing the circuit to oscillate. Quality electrolytic capacitors with extended temperature ranges of −40° to +85°C are readily available.

Note that in the stable region, the output noise voltage is linearly proportional to │ ZO│ . In effect, CO dictates the high frequency roll−off point of the circuit. Operation in the area titled “Marginally Stable” will cause the output of the regulator to exhibit random bursts of oscillation that decay in an under−damped fashion. Continuous oscillation occurs when operating in the area titled “Unstable”. It is suggested that oven testing of the entire circuit be performed with maximum load, minimum input voltage, and minimum ambient temperature.

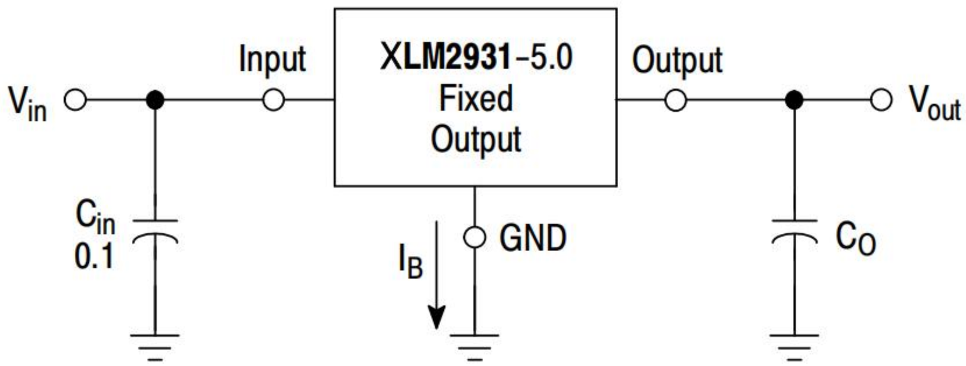
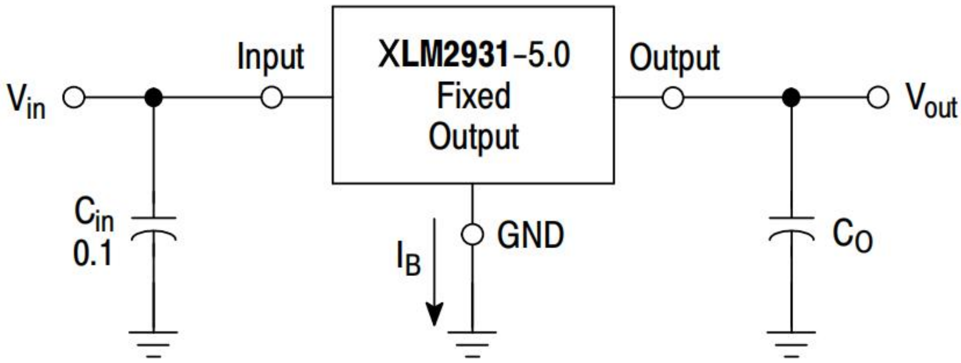
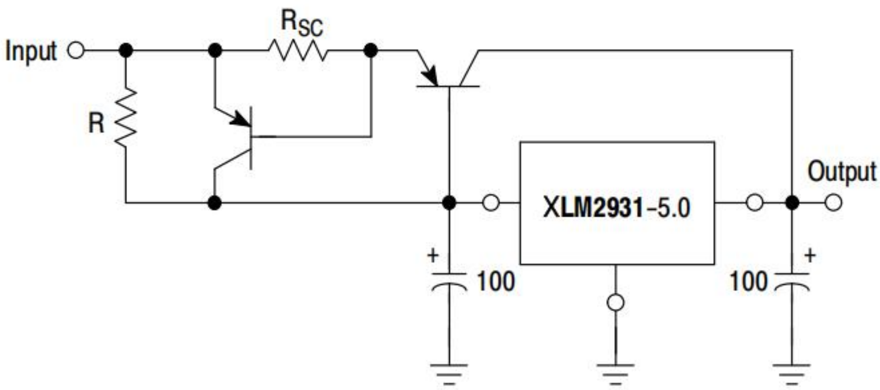


Figure 15. Fixed Output Regulator



The XLM2931 series can be current boosted with a PNP transistor. on a heatsink, will provide an output current of 5.0 A with an input to output voltage differential of approximately 1.0 V. Resistor R inconjunction with the VBE of the PNP determines when the pass transistor begins conducting. This circuit is not short circuit proof.

Figure 16. (5.0 A) Low Differential Voltage Regulator



The circuit of Figure 19 can be modified to provide supply protection against short circuits by adding the current sense resistor RSC and an additional PNP transistor. The current sensing PNP must be capable of handling the short circuit current of the XLM2931. Safe operating area of both transistors must be considered under worst case conditions.

Figure 17. Current Boost Regulator withShort Circuit Projection

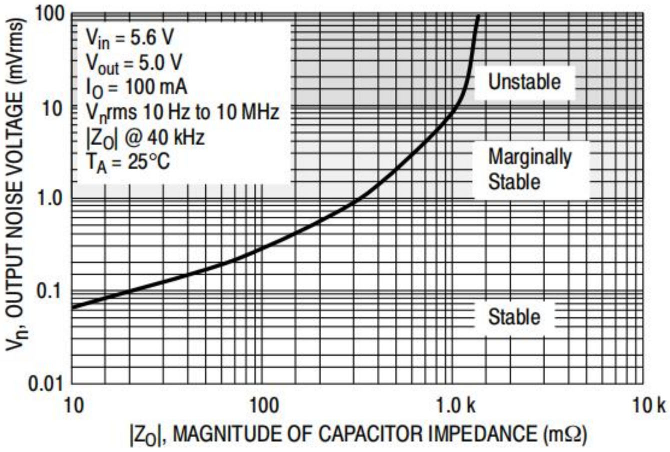


Figure 18. Output Noise Voltage vs. Output Capacitor Impedance

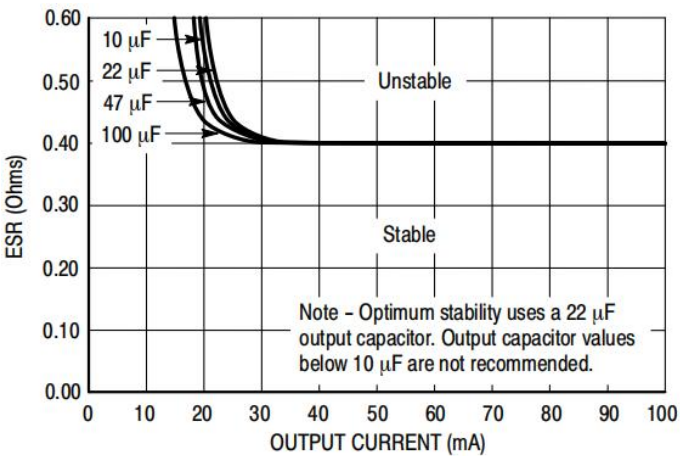


Figure 19. Output Capacitor ESR Stability vs. Output Load Current

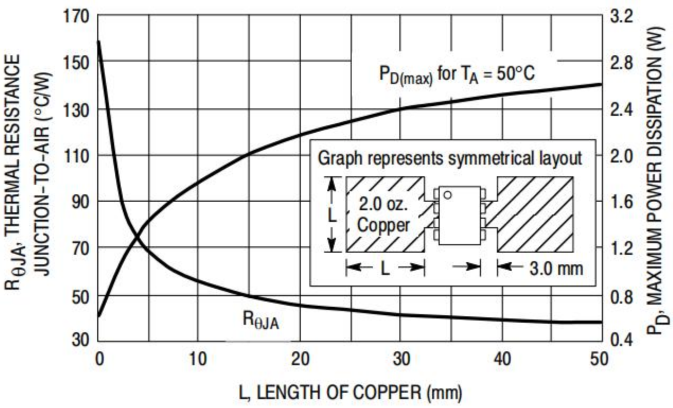


Figure 20. SOP−8 Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length

9. DEFINITIONS

Dropout Voltage − The input/output voltage differential at which the regulator output no longer maintains regulation against further reductions in input voltage. Measured when the output decreases 100 mV from nominal value at 14 V input, dropout voltage is affected by junction temperature and load current

Line Regulation − The change in output voltage for a change in the input voltage. The measurement is made under conditions of low dissipation or by using pulse techniques such that the average chip temperature is not significantly affected.

Load Regulation − The change in output voltage for a change in load current at constant chip temperature.

Maximum Power Dissipation − The maximum total device dissipation for which the regulator will operate within specifications.

Bias Current − That part of the input current that is not delivered to the load.

Output Noise Voltage − The rms AC voltage at the output, with constant load and no input ripple, measured over a specified frequency range.

Long−Term Stability − Output voltage stability under accelerated life test conditions with the maximum rated voltage listed in the devices electrical characteristics and maximum power dissipation.

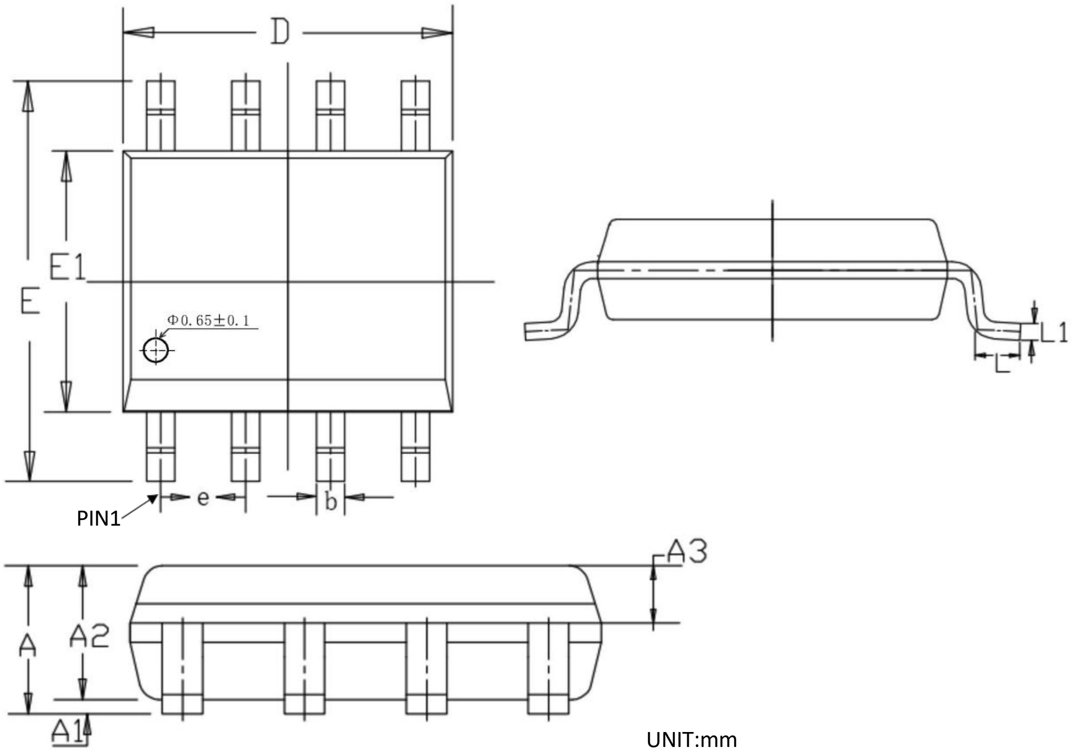
10. ORDERING INFORMATION

Ordering Information

Part Number	Device Making	Package type	Body size (mm)	Temperate (°C)	MSL	Transpo Rt	Package Quantit
XLM2931AMD-5.0	XL2931-5.0	SOP-8	4.90*3.90	-40 to +85	MSL3	T&R	1000

11. DIMENSIONAL DRAWINGS

SOP8



UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380	–	0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1	—	0.25BSC	—