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# LP2951

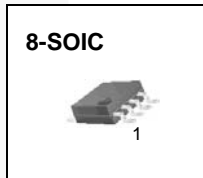
## Adjustable Micro-Power Voltage Regulator

### Features

- Adjustable or Fixed 5 V Output Voltage
- Low Quiescent Current
- Low Dropout Voltage
- Low Temperature Coefficient
- Tight Line and Load Regulation
- Guaranteed 100 mA Output Current
- Internal Short Current and Thermal Limit
- Error Signals of Output Dropout
- External Shut Down

### Description

The LP2951 is an adjustable micro-power voltage regulator suitable for battery-powered systems. This regulator has various functions such as alarm that warns of a low output voltage often due to falling batteries on the input, the external shutdown enables the regulator to be switched on and off, current and temperature limiting.



### Applications

- Automotive Electronics
- Voltage Reference

### Ordering Information

Part Number	Operating Temperature Range	Top Mark	Package	Packing Method
LP2951CM	-40°C to +125°C	LP2951CM	SOIC 8L	Rail
LP2951CMX	-40°C to +125°C	LP2951CM	SOIC 8L	Tape and Reel

### Block Diagram

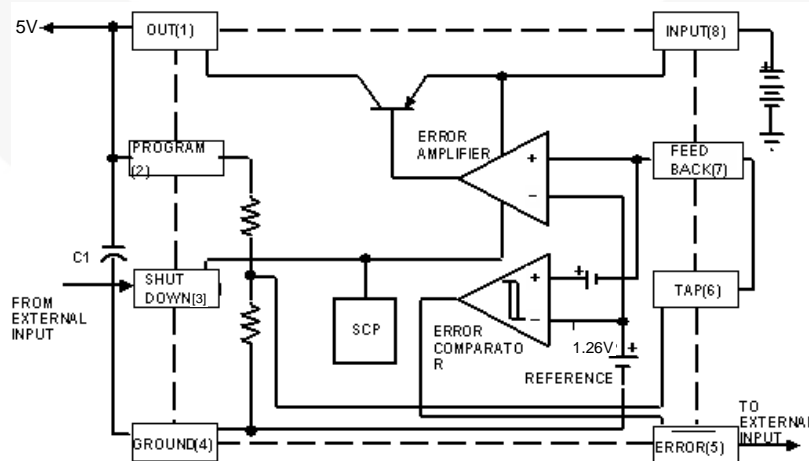


Figure 1. Block Diagram

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at  $T_A = 25^\circ\text{C}$  unless otherwise noted.

Symbol	Parameter	Value	Unit
$V_{IN}$	Input Supply Voltage	-0.3 to 30.0	V
$P_D$	Power Dissipation	Internally Limited	W
$R_{\theta JA}$	Thermal Resistance Junction-to-Air	127.5	$^\circ\text{C}/\text{W}$
$T_{STG}$	Storage Temperature Range	-65 to 150	$^\circ\text{C}$
$T_{OPR}$	Operating Junction Temperature Range	-40 to 125	$^\circ\text{C}$

## Electrical Characteristics

FEEDBACK (Pin 7) tied to TAP (Pin 6),  $V_{OUT}$  (Pin 1) tied to PROGRAM (Pin 2). Values are at  $T_A = 25^\circ\text{C}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{OUT}$	Fixed Output Voltage	$I_L = 50\text{ mA}$	4.9	5.0	5.1	V
<b>ALL VOLTAGE OPTIONS</b>						
$\Delta V/\Delta T$	Output Voltage Temperature Coefficient <sup>(1)</sup>			50		ppm/ $^\circ\text{C}$
$\Delta V$	Line Regulation <sup>(2)</sup>	$(V_O + 1)\text{ V} \leq V_{IN} \leq 28\text{ V}$ , $I_L = 50\text{ mA}$			0.4	%
$\Delta V$	Load Regulation <sup>(2)</sup>	$100\ \mu\text{A} \leq I_L \leq 100\text{ mA}$			0.3	%
$V_D$	Dropout Voltage	$I_L = 100\ \mu\text{A}$			150	mV
		$I_L = 100\text{ mA}$			600	
$I_G$	Ground Current	$I_L = 100\ \mu\text{A}$			140	$\mu\text{A}$
		$I_L = 100\text{ mA}$			7	mA
$I_{CL}$	Current Limit	$V_O = 0\text{ V}$	110	165	220	mA
$V_{REF}$	Reference Voltage	$V_{IN} = (V_O + 1)\text{ V}$ , $I_L = 100\ \mu\text{A}$	1.235	1.260	1.285	V
		<sup>(3)</sup>	1.225	1.260	1.295	
$I_{FB}$	Feedback Bias Current			20		nA
<b>ERROR COMPARATOR</b>						
$V_{OL}$	Output Low Voltage	$V_{IN} = (V_O - 0.5)\text{ V}$ , $I_{OL} = 400\ \mu\text{A}$		150	400	mV
$V_{TH}$	High Threshold Voltage <sup>(4)</sup>		25	60		mV
$V_{TL}$	Low Threshold Voltage <sup>(4)</sup>			75	140	mV
$V_{HYS}$	Hysteresis <sup>(4)</sup>			15		mV
<b>SHUTDOWN INPUT</b>						
$V_{SD}$	Shutdown Threshold Range	<sup>(5)</sup>	0.6	1.3	2.0	V
$I_{SD}$	Shutdown Input Current	$V_{SD} = 2.4\text{ V}$		30	100	$\mu\text{A}$
		$V_{SD} = 28\text{ V}$		450	750	

### Notes:

- Output or reference voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
- Regulation is measured at constant junction temperature, using pulse testing with a low duty cycle.
- $V_{REF} \leq V_{OUT} \leq (V_{IN} - 1\text{ V})$ ,  $2.5\text{ V} \leq V_{IN} \leq 28\text{ V}$ ,  $100\ \mu\text{A} \leq I_L \leq 100\text{ mA}$ ,  $T_A \leq T_{AMAX}$ .
- Threshold and hysteresis are expressed in terms of voltage differential at the feedback terminal below the normal reference. To express these thresholds in terms of output voltage change, multiply by the error amplifier gain  
 $= V_O / V_{REF} = (R1 + R2) / R2$ .
- $V_{shutdown} \leq 0.6\text{ V}$ ,  $V_{OUT} = \text{ON}$ ,  $V_{shutdown} \geq 2.0\text{ V}$ ,  $V_{OUT} = \text{OFF}$ .

## Typical Performance Characteristics

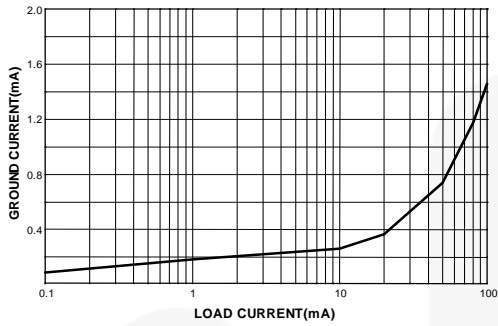


Figure 2. Quiescent Current

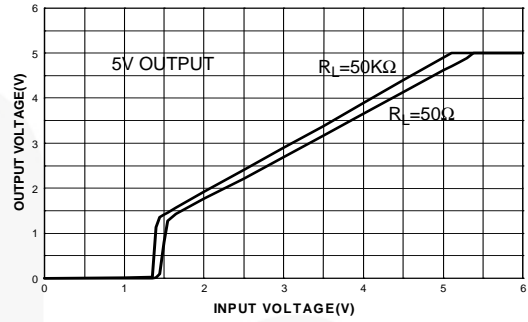


Figure 3. Dropout Characteristics

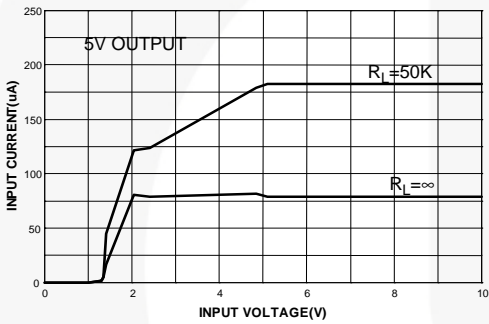


Figure 4. Input Current

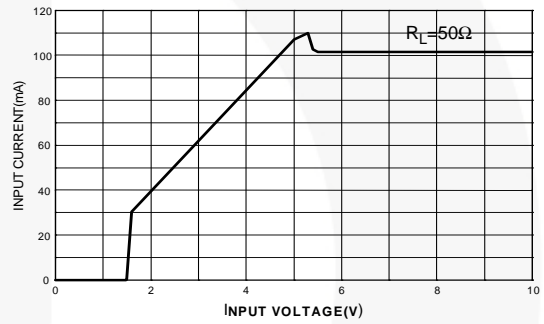


Figure 5. Input Current

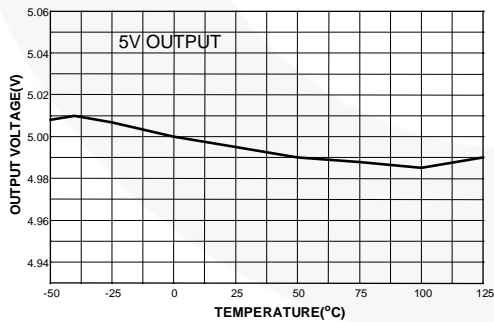


Figure 6. Output Voltage vs. Temperature

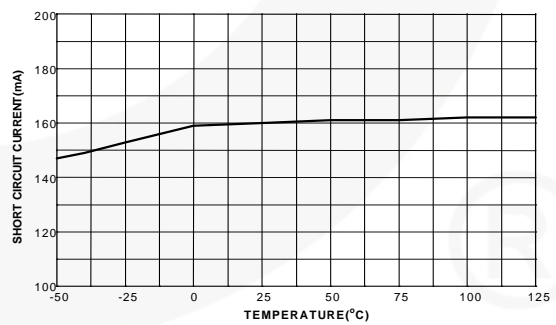


Figure 7. Short-Circuit Current

Typical Performance Characteristics (Continued)

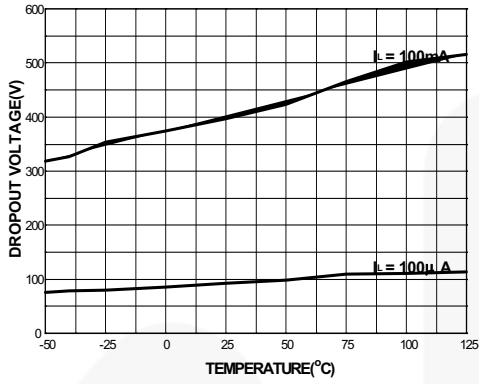


Figure 8. Dropout Voltage

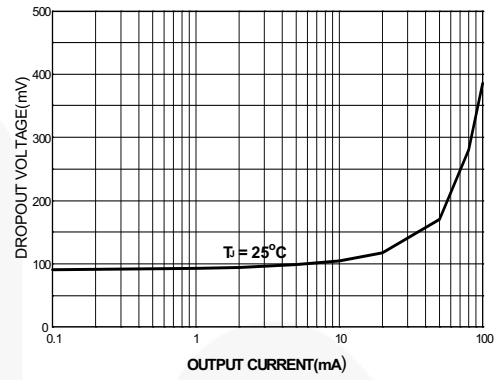
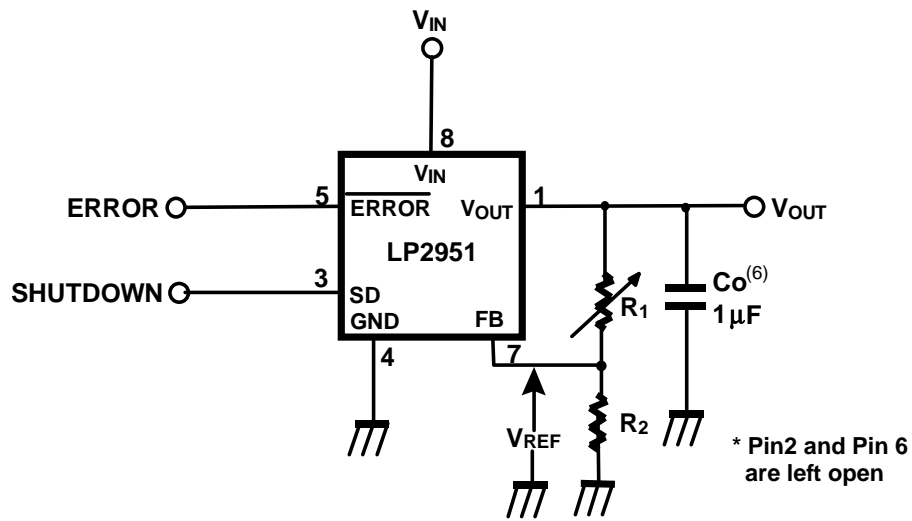


Figure 9. Dropout Voltage

Typical Application



$$V_O = V_{REF} (1 + R_1 / R_2) + I_{FB} R_1$$

Figure 10. Adjustable Regulator

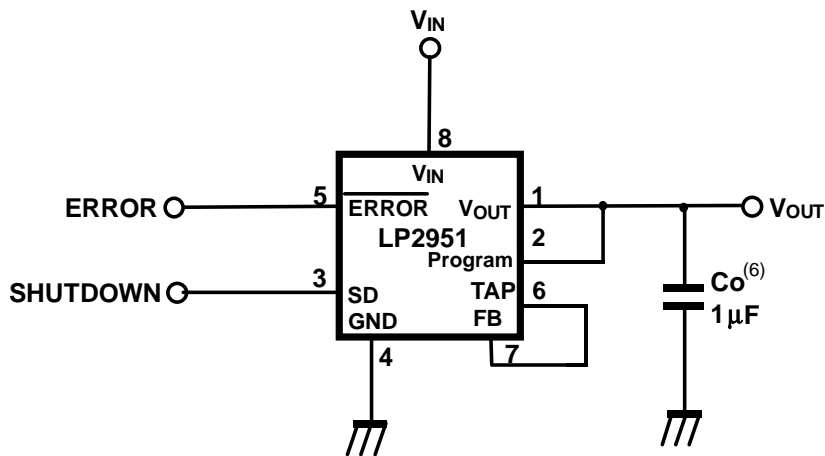
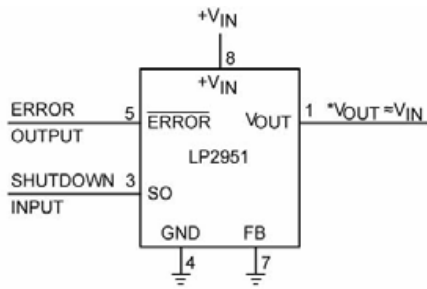


Figure 11. Fixed Output 5 V

Note:

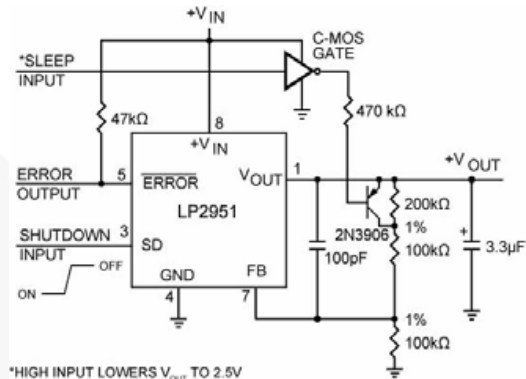
6.  $C_O$  is required between the output and ground for stability at output voltages of 5 V or more. Since  $I_{FB}$  is controlled to less than 40 nA, the error associated with this term is negligible in most applications. At lower output voltage, more capacitance is required. without this capacitance the part oscillates.

**Typical Application (Continued)**

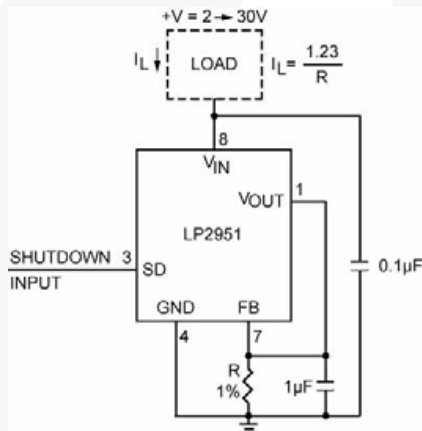


\*MINIMUM INPUT-OUTPUT VOLTAGE RANGES FROM 40mV TO 400mV, DEPENDING ON LOAD CURRENT. CURRENT LIMIT IS TYPICALLY 160mA.

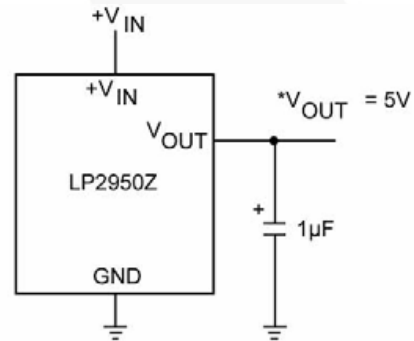
**Figure 12. Wide Input Voltage Range Current Limiter**



**Figure 13. 5 V Regulator with 2.5 V Sleep Function**

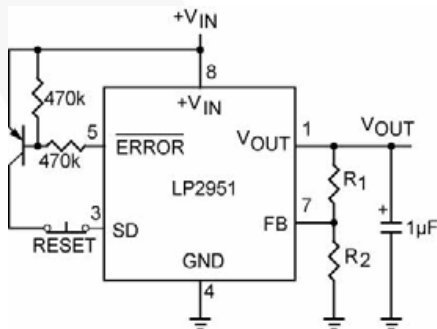


**Figure 14. Low Drift Current Source**

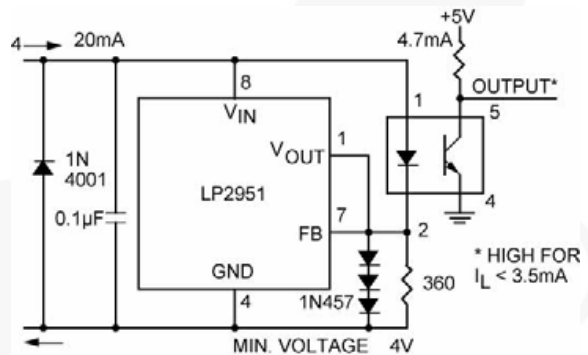


\* MINIMUM INPUT-OUTPUT VOLTAGE RANGES FROM 40mV TO 400mV, DEPENDING ON LOAD CURRENT.

**Figure 15. 5 V Current Limiter**



**Figure 16. Latch Off When Error Flag Occurs**



**Figure 17. Open Circuit Detector for 4 mA to 20 mA Current Loop**

Typical Application (Continued)

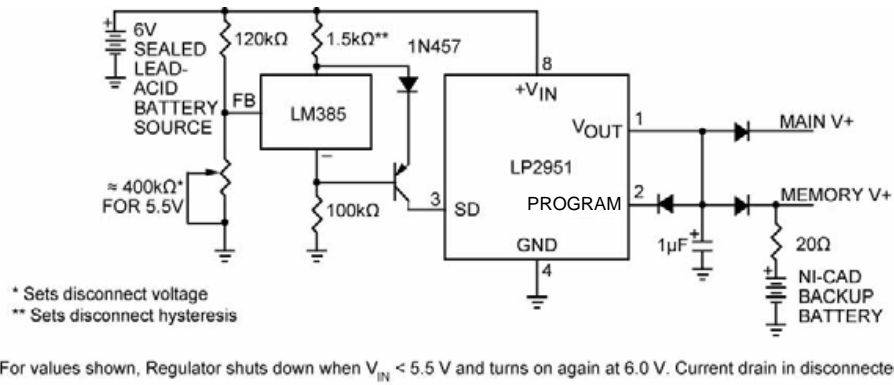


Figure 18. Low Battery Disconnect



Physical Dimensions

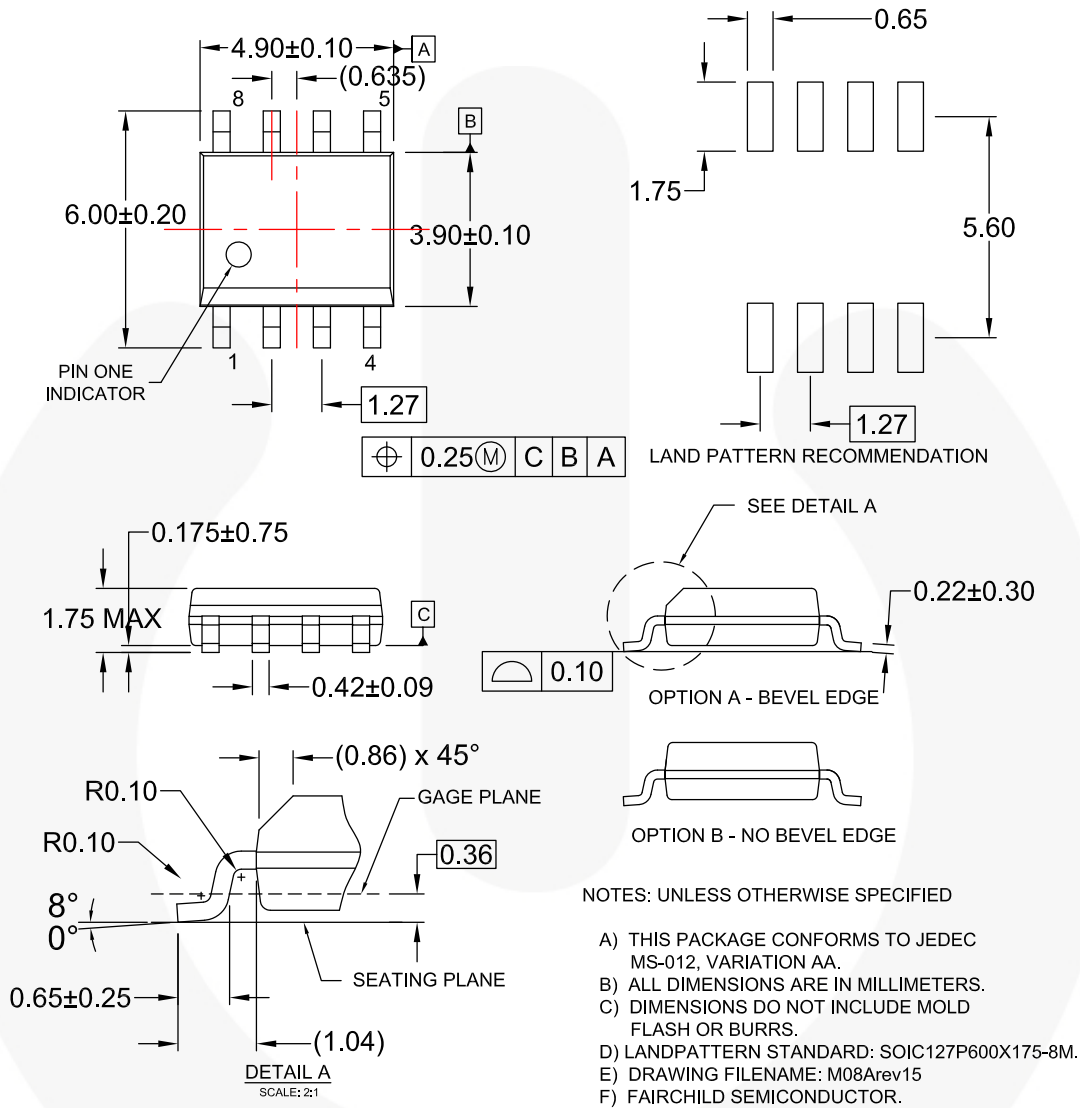


Figure 19. 8 Lead, SOIC, JEDEC MS-012, 0.150 inch NARROW BODY

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