The Future of Analog IC Technology

MP8201

Precision Adjustable Shunt Voltage Regulator

DESCRIPTION

The MP8201 is a low voltage, precision, adjustable shunt regulator. The MP8201 can operate from 1.2V to 12V where the desired value is set by external resistors. This wide dynamic rang, gives the designers outstanding flexibility in the development of power supplies and instrumentation. The operating current of 60uA makes the part well suited for battery-powered portable electronic applications. The 8201 regulates the output voltage from as low as 1.2V. The part has a sharp turn-on characteristic and a dynamic resistance of less than 1Ω.

The MP8201 is offered in 3-pin SOT23 packages.

FEATURES

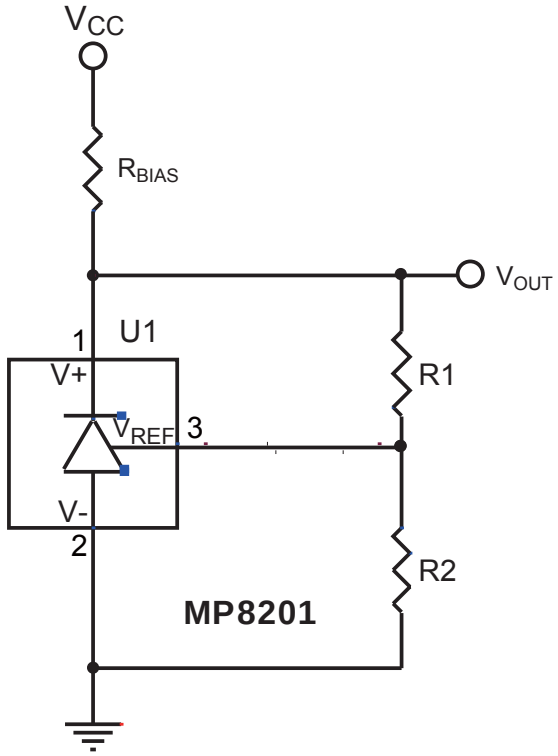
- Wide Input Voltage Range: 1.2V to 12V
- Operating Current From 60μA to 20mA
- SOT-23 Package
- Initial Accuracy: ±0.5%
- 1Ω Dynamic Output Resistance of
- Stable With No External Capacitor
- Temperature Range: –40°C to +85°C

APPLICATIONS

- Instrumentation
- Linear Regulators
- Notebook Computers
- Medical Electronics
- 3V/ 5V 8-12 Bit Data Converters
- Battery-Powered Equipment

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TYPICAL APPLICATION



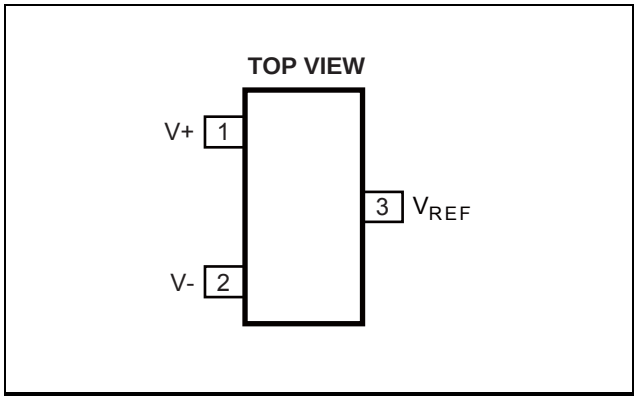
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ORDERING INFORMATION

Part Number*	Package	Top Marking	Temperature
MP8201DT	SOT23-3	IZ6	–40°C to +85°C

* For Tape & Reel, add suffix –Z (eg. MP8201DT–Z).
For RoHS compliant packaging, add suffix –LF (eg. MP8201DT–LF–Z)

PACKAGE REFERENCE



ABSOLUTE MAXIMUM RATINGS (1)

Reverse Current 20mA
Forward Current..... 20mA
Continuous Power Dissipation (T_A = +25°C) (2)
……...0.52W
Junction Temperature.....150°C
Lead Temperature .....260°C
Storage Temperature ..... –65°C to +150°C

Recommended Operating Conditions (3)

Input Voltage.....1.2V to 12V
Output Voltage.....1.2V to 10V
Operating Temperature..... –40°C to +85°C

Thermal Resistance (4)	θ_{JA}	θ_{JC}
SOT23-3	240	110 °C/W

Notes:

1) Exceeding these ratings may damage the device.
2) The maximum allowable power dissipation is a function of the maximum junction temperature T_J (MAX), the junction-to-ambient thermal resistance θ_{JA}, and the ambient temperature T_A. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P_D (MAX) = (T_J (MAX)-T_A)/θ_{JA}. Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
3) The device is not guaranteed to function outside of its operating conditions.
4) Measured on JESD51-7, 4-layer PCB.

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ELECTRICAL CHARACTERISTICS

Vout = 1.2V, I_{IN} = 100µA to 10mA, T_A = +25°C, typicals are at 25°C, unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage [5]	V_{REF}		159.2	160	160.8	mV
Initial Accuracy	V_{OERR}		–0.8		+0.8	mV
			–0.5		+0.5	%
Temperature Coefficient A Grade	TCV_O	0°C to < +70°C			70	ppm/°C
		–40°C to +85°C			85	
Ratio of the change in V_{REF} changed to V_{OUT} voltage change	$\Delta V_{REF}/\Delta V_{OUT}$	I_{IN} = 0.1mA to 10mA		1		mV
Dynamic Output Impedance	$(\Delta V_R/\Delta I_R)$	I_{IN} = 1mA ± 100µA		1		Ω
Minimum Operating Current	I_{IN}		100	60		µA
Voltage Noise		f = 0.1Hz to 10Hz		4		µV p-p
Turn-On Settling Time	t_R	Within 0.1% of Output		10		µs
Output Voltage Hysteresis				50		ppm

Note:

5) The forward diode voltage characteristic at –1mA is typically 0.65V.

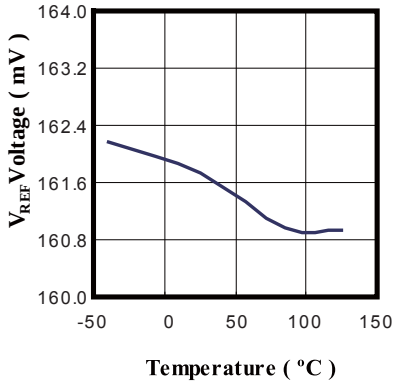
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TYPICAL PERFORMANCE CHARACTERISTICS

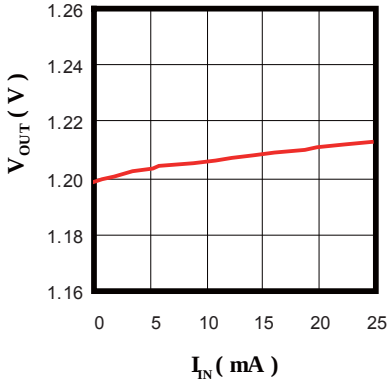
I_{IN}=100uA to 10mA, T_A=25ºC Unless otherwise noted.

V_{REF} vs. Temperature

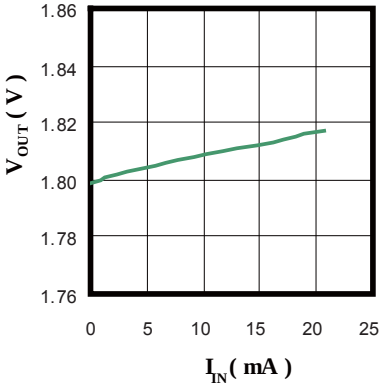
I_{IN}=0.1mA, V_{OUT}=2V



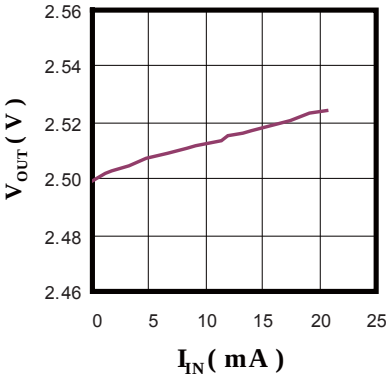
V_{OUT} =1.2V Load Regulation



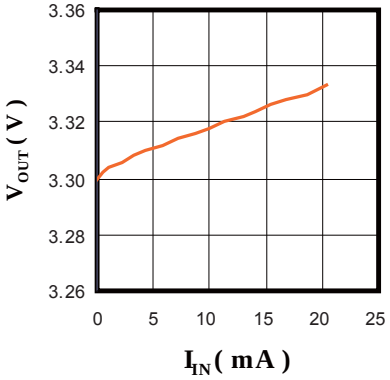
V_{OUT} =1.8 V Load Regulation



V_{OUT} =2.5V Load Regulation

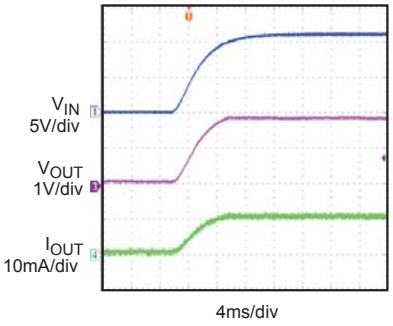


V_{OUT} =3.3V Load Regulation



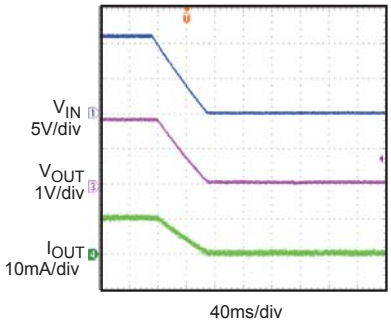
Turn On with Load Capacitor

I_{IN}=1mA, I_{OUT}=10mA, V_{OUT}=1.8V C_{OUT}=4.7uF



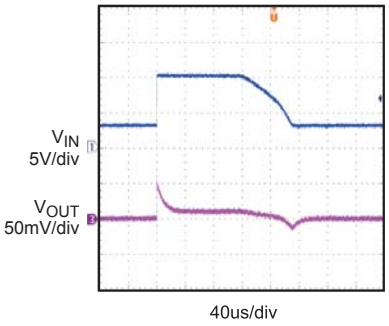
Turn Off with Load Capacitor

I_{IN}=1mA, I_{OUT}=10mA, V_{OUT}=1.8V C_{OUT}=4.7uF



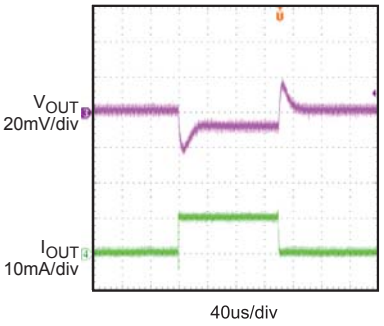
Line Transient

V_{IN}=3V to 10V, V_{OUT}=1.8V, C_{OUT}=4.7uF



Load Transient

V_{OUT}=1.8V, I_{OUT}=10mA, C_{OUT}=4.7uF



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PIN FUNCTIONS

Pin #	Name	Description
1	V+	Cathode
2	V–	Anode
3	VREF	Adjustable connection

FUNCTION BLOCK DIAGRAM

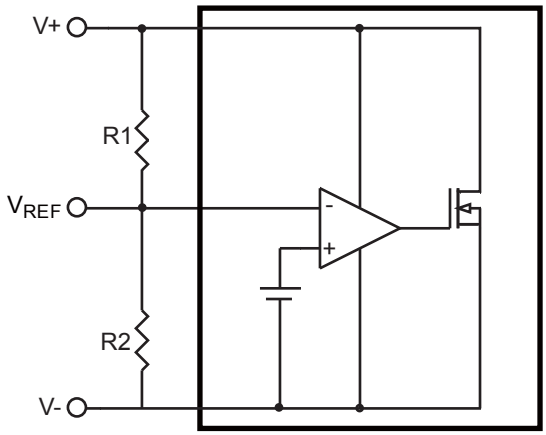


Figure 1—Functional Block Diagram

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APPLICATION INFORMATION

External Bias Resistor

In the case of shunt voltage references, an external bias resistor (R_{BIAS}) is required between the supply voltage and the MP8201. R_{BIAS} sets the current that is required to pass through the load and the IC.

The load and the supply voltage can vary, so R_{BIAS} should be chosen such that is it small enough to supply the minimum current to the MP8201 when the supply voltage is at its minimum and the load current is at its maximum. In addition, R_{BIAS} needs to be large enough that the quiescent current does not exceed 10mA when the supply voltage is at its maximum and the load current is at its minimum.

Choose R_{BIAS} using the following equation:

$$R_{BIAS} = \frac{V_{SUPPLY} - V_{OUT}}{I_L + I_Q}$$

Adjustable Precision Voltage Source

The MP8201 can be combined with a precision op amp to produce a precise adjustable output voltage. See Figure 1.

The output of the op amp is determined by the gain of the circuit using the following equation:

$$V_{OUT} = 1 + \frac{R1}{R2}$$

An optional capacitor can be added in parallel with R2 to filter out high frequency noise.

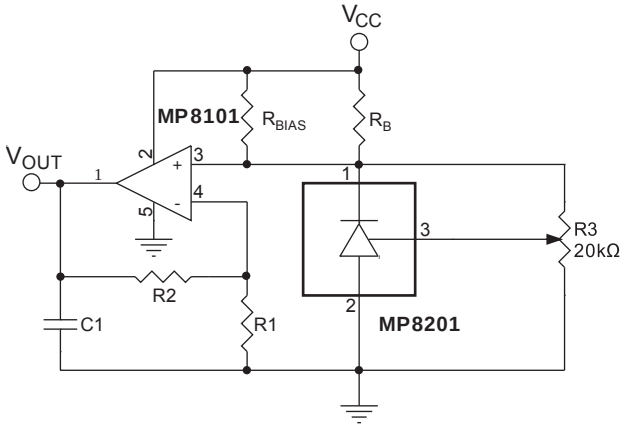


Figure 1—Adjustable Precision Voltage Source

Output Voltage Trim

Using a mechanical or digital potentiometer, the output voltage of the MP8201 can be trimmed to ±0.5%. See Figure 2. Note that trimming other resistor values may not produce an accurate output from the MP8200.

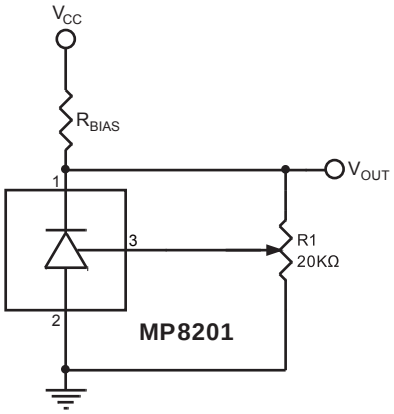


Figure 2—Output Voltage Trim

Precise Negative Voltage Reference

The MP8201 can be configured for use in applications where a precise negative voltage reference is needed.

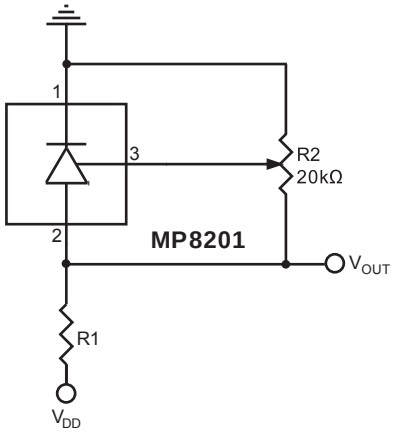


Figure 3—Precise –1.0V Reference

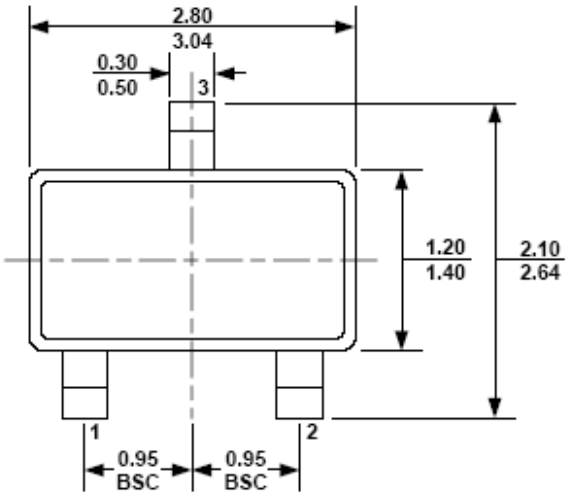
Choose R1 such that 60µA to 20mA is provided to properly bias the MP8201, using the equation:

$$R1 = \frac{V_{DD}}{I}$$

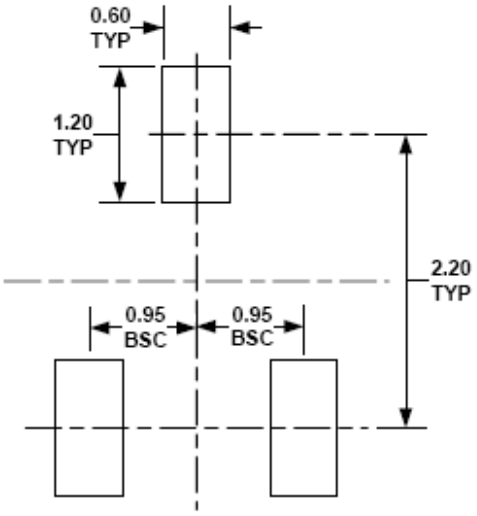
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PACKAGE INFORMATION

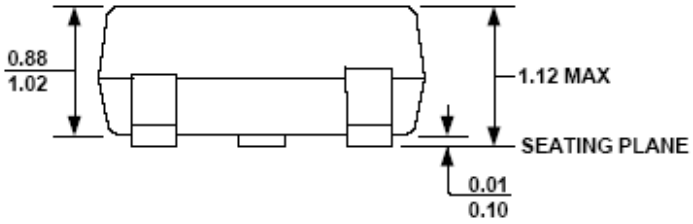
SOT23-3



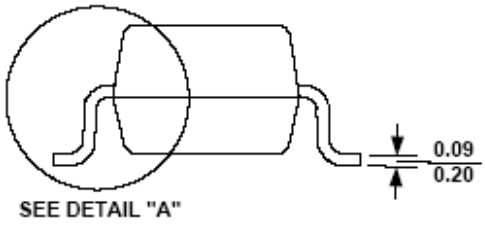
TOP VIEW



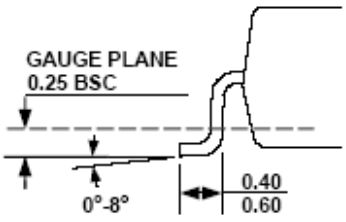
RECOMMENDED LAND PATTERN



FRONT VIEW



SIDE VIEW



DETAIL "A"

NOTE:

1) ALL DIMENSIONS ARE IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.10 MILLIMETERS MAX.
5) DRAWING CONFORMS TO JEDEC TO-236, VARIATION AB.
6) DRAWING IS NOT TO SCALE.

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