

#### 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 range, 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

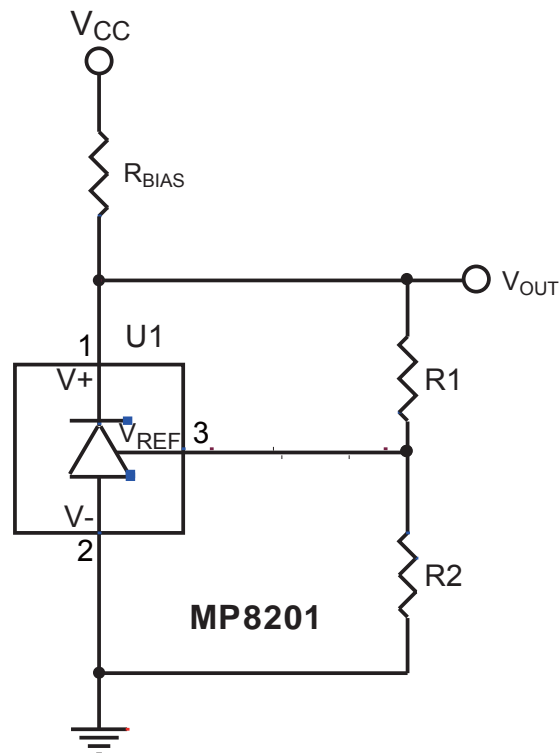
- Wide Input Voltage Range: 1.2V to 12V
- Operating Current From 60μA to 20mA
- SOT-23 Package
- Initial Accuracy: ±0.5%
- 1Ω Dynamic Output Resistance of
- Stable With No External Capacitor
- Temperature Range: -40°C to +85°C

#### APPLICATIONS

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

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#### TYPICAL APPLICATION



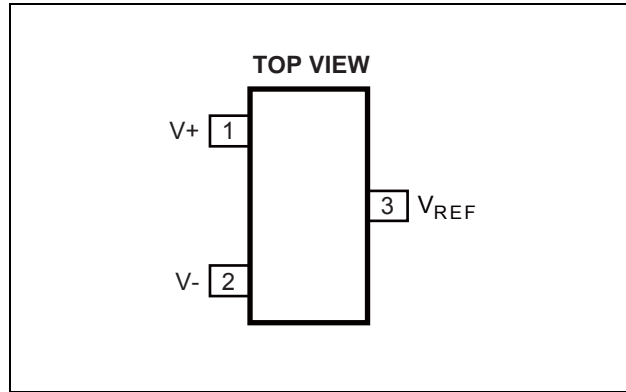
### ORDERING INFORMATION

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 <sup>(1)</sup>

Reverse Current .....	20mA
Forward Current.....	20mA
Continuous Power Dissipation (T <sub>A</sub> = +25°C) <sup>(2)</sup>	0.52W
Junction Temperature .....	150°C
Lead Temperature .....	260°C
Storage Temperature .....	-65°C to +150°C

#### Recommended Operating Conditions <sup>(3)</sup>

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

Thermal Resistance <sup>(4)</sup>	$\theta_{JA}$	$\theta_{JC}$
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<sub>J</sub> (MAX), the junction-to-ambient thermal resistance  $\theta_{JA}$ , and the ambient temperature T<sub>A</sub>. The maximum allowable continuous power dissipation at any ambient temperature is calculated by P<sub>D</sub> (MAX) = (T<sub>J</sub> (MAX)-T<sub>A</sub>)/ $\theta_{JA}$ . 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.

## ELECTRICAL CHARACTERISTICS

$V_{out} = 1.2V$ ,  $I_{IN} = 100\mu A$  to  $10mA$ ,  $T_A = +25^\circ C$ , typicals are at  $25^\circ C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Reference Voltage <sup>(5)</sup>	$V_{REF}$		159.2	160	160.8	mV
Initial Accuracy	$V_{OERR}$		-0.8		+0.8	mV
			-0.5		+0.5	%
Temperature Coefficient A Grade	$TCV_O$	$0^\circ C$ to $< +70^\circ C$			70	ppm/ $^\circ C$
		$-40^\circ C$ to $+85^\circ C$			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	$(\Delta V_R/\Delta I_R)$	$I_{IN} = 1mA \pm 100\mu A$		1		$\Omega$
Minimum Operating Current	$I_{IN}$		100	60		$\mu A$
Voltage Noise		$f = 0.1Hz$ to $10Hz$		4		$\mu V$ p-p
Turn-On Settling Time	$t_R$	Within 0.1% of Output		10		$\mu s$
Output Voltage Hysteresis				50		ppm

**Note:**

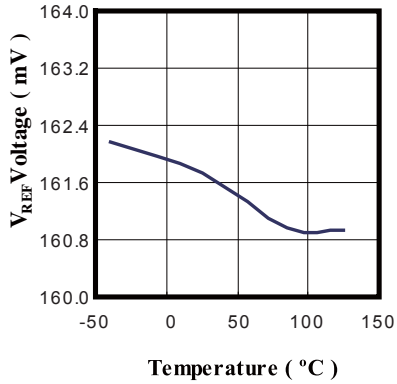
5) The forward diode voltage characteristic at  $-1mA$  is typically  $0.65V$ .

## TYPICAL PERFORMANCE CHARACTERISTICS

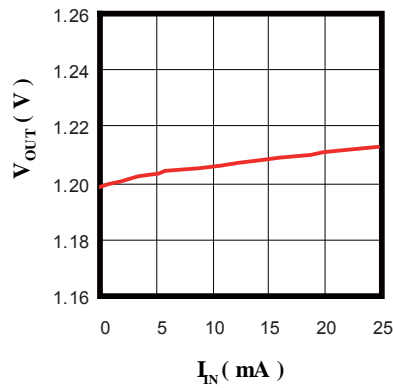
$I_{IN}$ =100uA to 10mA,  $T_A$ =25°C Unless otherwise noted.

**V<sub>REF</sub> vs. Temperature**

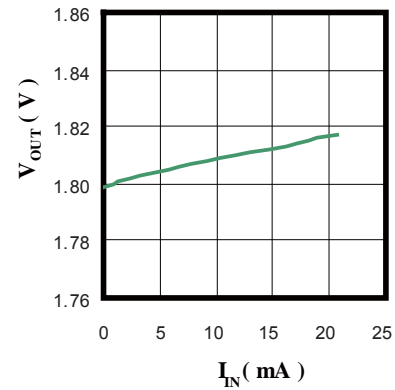
$I_{IN}$ =0.1mA,  $V_{OUT}$ =2V



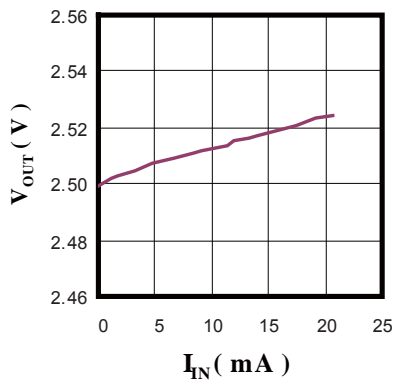
**V<sub>OUT</sub> =1.2V Load Regulation**



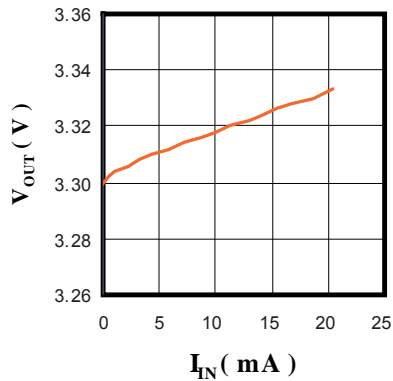
**V<sub>OUT</sub> =1.8 V Load Regulation**



**V<sub>OUT</sub> =2.5V Load Regulation**

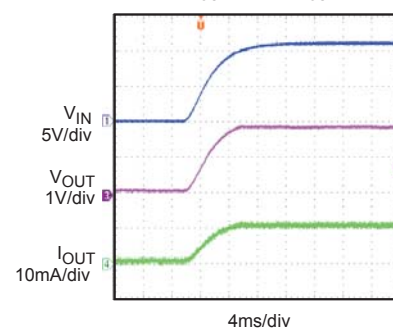


**V<sub>OUT</sub> =3.3V Load Regulation**



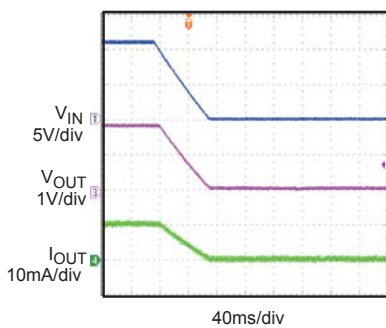
**Turn On with Load Capacitor**

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



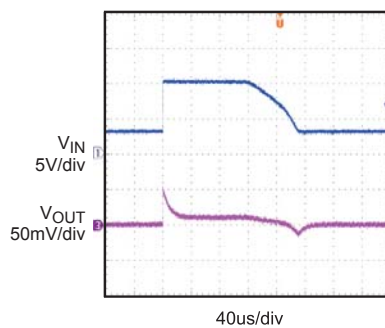
**Turn Off with Load Capacitor**

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



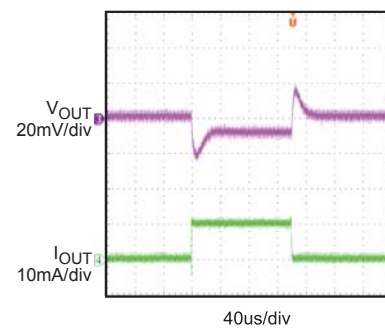
**Line Transient**

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



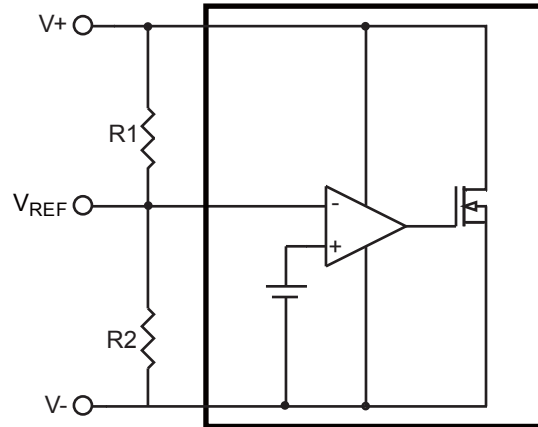
**Load Transient**

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



**PIN FUNCTIONS**

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

**FUNCTION BLOCK DIAGRAM**

**Figure 1—Functional Block Diagram**

## 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 it is 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:

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

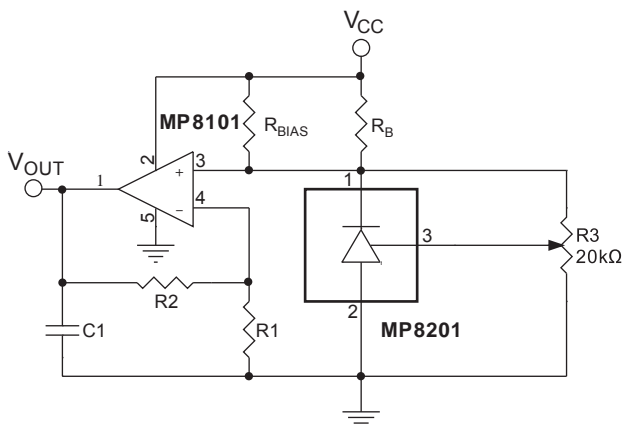
### Adjustable Precision Voltage Source

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:

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

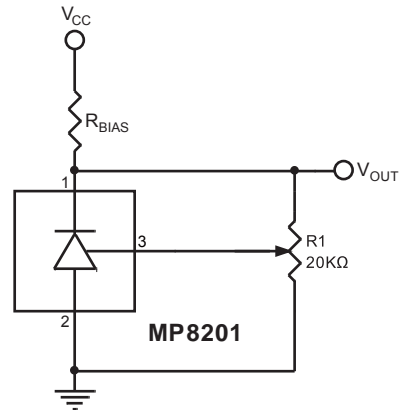
An optional capacitor can be added in parallel with  $R2$  to filter out high frequency noise.



**Figure 1—Adjustable Precision Voltage Source**

### Output Voltage Trim

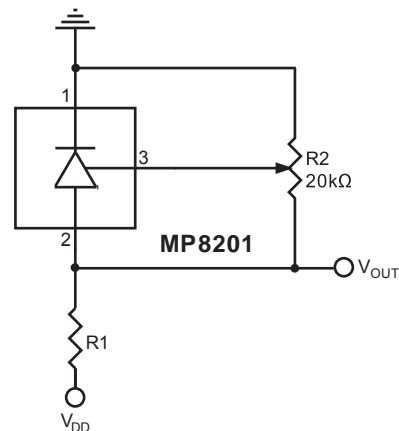
Using a mechanical or digital potentiometer, the output voltage of the MP8201 can be trimmed to  $\pm 0.5\%$ . See Figure 2. Note that trimming other resistor values may not produce an accurate output from the MP8200.



**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.



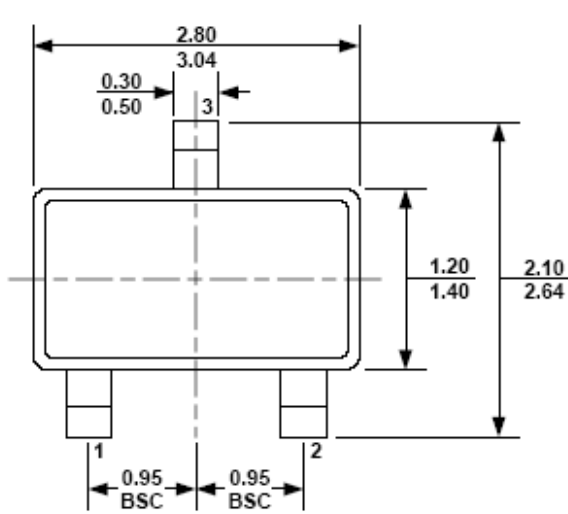
**Figure 3—Precise -1.0V Reference**

Choose  $R1$  such that 60 $\mu$ A to 20mA is provided to properly bias the MP8201, using the equation:

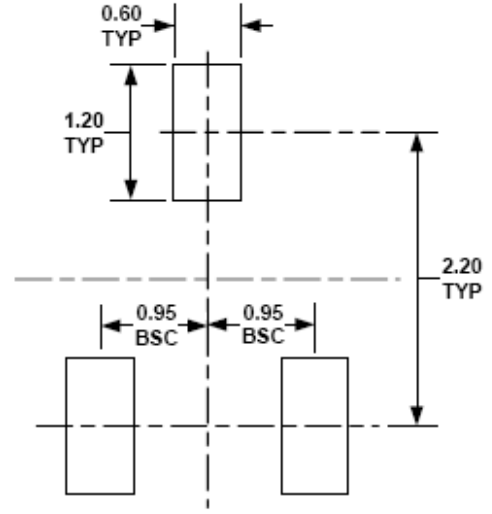
$$R1 = \frac{V_{DD}}{I}$$

PACKAGE INFORMATION

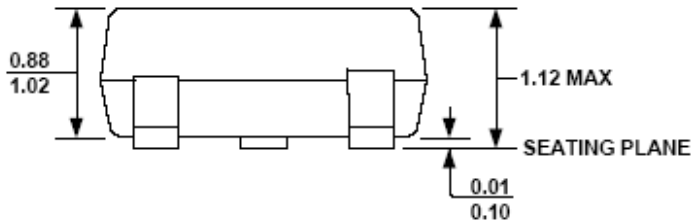
SOT23-3



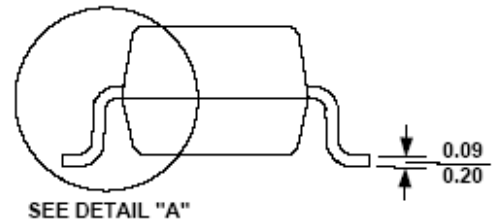
TOP VIEW



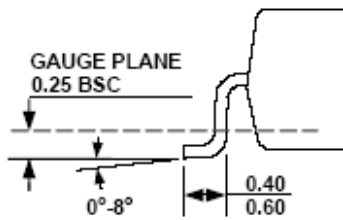
RECOMMENDED LAND PATTERN



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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