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# MP2000

## Low Input Voltage 150mA Linear Regulator

### DESCRIPTION

The MP2000 is a low-voltage, low-dropout bipolar linear regulator. It operates from 1.35V to 6.0V input voltage, and regulates the output voltage from as low as 0.5V.

The MP2000 can supply up to 150mA of load current. The MP2000 features thermal overload and current limit protection. It is available in a 5-pin TSOT23-5 package.

Part Number	Output Voltage
MP2000DJ-ADJ	Adjustable
MP2000DJ-1.0	1.0V

### EVALUATION BOARD REFERENCE

Board Number	Output*	Dimensions
EV2000DJ-00A	1.2V	2.0"X x 2.0"Y x 0.4"Z

\* Default output voltage adjustable from 0.5V to 5.0V using an external resistor divider.

### FEATURES

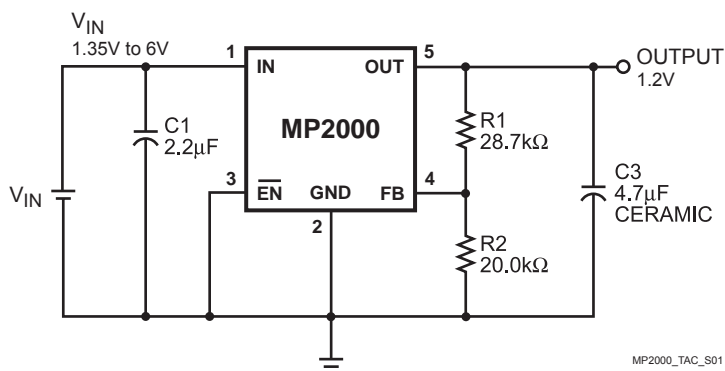
- Operates with  $V_{IN} = 1.35V$
- Low 300mV Dropout at 150mA Output
- $\pm 3\%$  Accurate Output Voltage
- Fixed and Adjustable Output Voltage Option
- Better Than 0.001%/mA Load Regulation
- Stable With Low-ESR Output Capacitor
- Low 65 $\mu A$  Ground Current
- Internal Thermal Protection
- Current Limit Protection
- 6 $\mu A$  Typical Quiescent Current at Shutdown

### APPLICATIONS

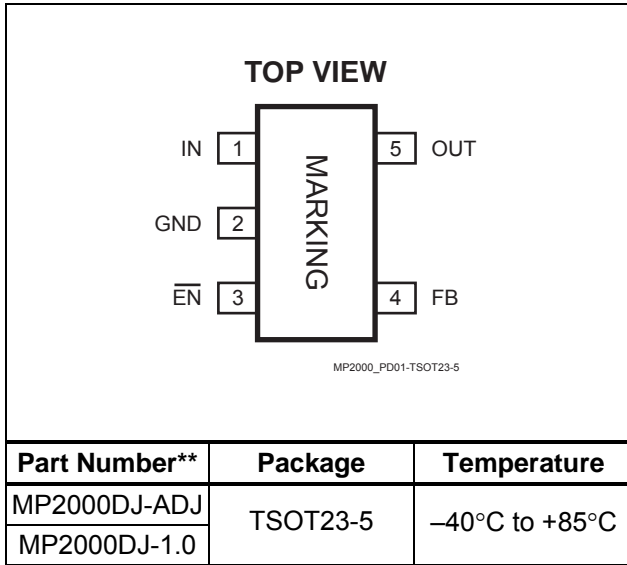
- Low Current Regulators
- Battery Powered Systems
- Cellular Phones

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### TYPICAL APPLICATION



## PACKAGE REFERENCE



\*\* For Tape & Reel, add suffix -Z (eg. MP2000DJ-ADJ-Z)  
For Lead Free, add suffix -LF (eg. MP2000DJ-ADJ-LF-Z)

ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

IN Supply Voltage ..... -0.3V to +7.0V  
 FB Voltage ..... -0.3V to  $V_{OUT} + 0.3V$   
 EN Voltage ..... IN - 0.7V  
 Junction Temperature ..... 150°C  
 Lead Temperature ..... 260°C  
 Storage Temperature ..... -65°C to +150°C

**Recommended Operating Conditions** <sup>(2)</sup>

Input Voltage ..... 1.35V to 6.0V  
 Output Voltage ..... 0.5V to 5V  
 Load Current ..... 150mA Maximum  
 Operating Temperature ..... -40°C to +85°C

**Thermal Resistance** <sup>(3)</sup>

$\theta_{JA}$   $\theta_{JC}$   
 TSOT23-5 ..... 220 .... 110.. °C/W

**Notes:**

- 1) Exceeding these ratings may damage the device.
- 2) The device is not guaranteed to function outside of its operating conditions.
- 3) Measured on approximately 1" square of 1 oz copper.

## ELECTRICAL CHARACTERISTICS

$V_{IN} = 1.8V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.

Parameter	Symbol	Condition	Min	Typ	Max	Units
Ground Pin Current		$I_{OUT} = 1mA$		65		$\mu A$
		$I_{OUT} = 150mA$		2.7		mA
Shutdown Current		$V_{EN} = 1.0V$ , $V_{IN} = 5V$		7	10	$\mu A$
FB Regulation Voltage			0.485	0.500	0.515	V
Dropout Voltage <sup>(4)</sup>		$I_{OUT} = 100mA$		250		mV
		$I_{OUT} = 150mA$		300		
Line Regulation		$I_{OUT} = 1mA$ , $V_{IN} = (V_{OUT} + 0.5V)$ to 6.0V <sup>(6)</sup>		0.01	0.08	%/V
Load Regulation		$I_{OUT} = 1mA$ to 150mA, $V_{IN} = V_{OUT} + 0.5V$ <sup>(6)</sup>		0.001	0.02	%/mA
PSRR <sup>(5)</sup>		$V_{IN} > V_{OUT} + 0.5V$ , $C_3 = 2.2\mu F$ , $V_{IN}(AC) = 100mV$ , $f = 1KHz$		50		dB
Output Voltage Noise <sup>(5)</sup>		$f = 1KHz$ , $C_{FB} > 0.1\mu F$ , $I_{OUT} = 1mA$		300		nV/ $\sqrt{Hz}$
EN Input Low Voltage				0.7		V
EN Input Bias Current		$V_{EN} = 5V$		0.01	1	$\mu A$
Thermal Protection <sup>(5)</sup>				145		°C
Thermal Protection Hysteresis <sup>(5)</sup>				30		°C

**Notes:**

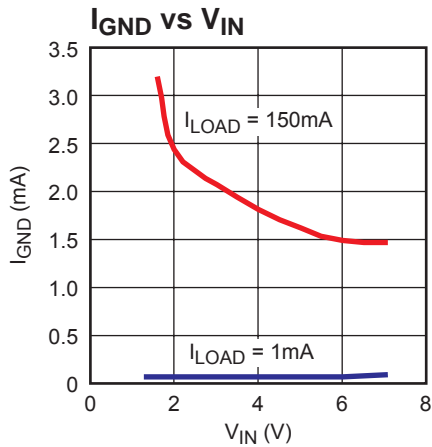
- 4) Dropout Voltage is defined as the input to output differential when the output voltage drops 1% below its normal value.
- 5) Parameter is guaranteed by design, not production tested.
- 6)  $V_{IN} = 1.35V$  for  $V_{OUT} = 0.5V$  to 0.85V

**PIN FUNCTIONS**

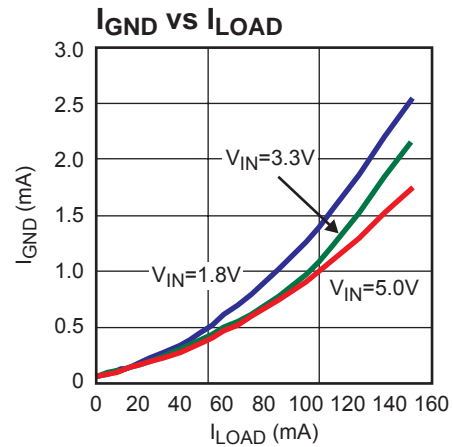
Pin #	Name	Description
1	IN	Power Source Input. IN supplies the internal power to the MP2000 and is the source of the pass transistor. Bypass IN to GND with a 2.2 $\mu$ F or greater capacitor.
2	GND	Ground.
3	$\overline{\text{EN}}$	Enable Input. Drive $\overline{\text{EN}}$ high to turn off the MP2000; low to turn it on. For automatic startup, connect EN to GND.
4	FB	Feedback Input. Connect a resistive voltage divider from OUT to FB to set the output voltage. OUT feedback threshold is 0.5V.
5	OUT	Regulator Output. OUT is the output of the linear regulator. Bypass OUT to GND with a 2.2 $\mu$ F or greater capacitor.

# TYPICAL PERFORMANCE CHARACTERISTICS

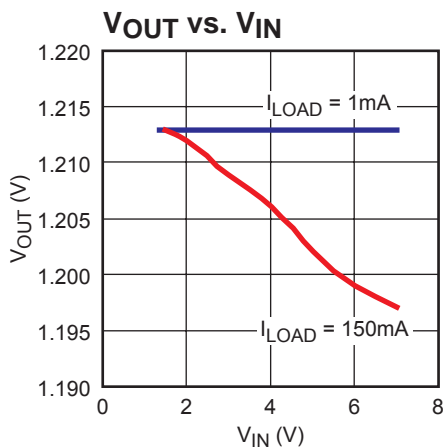
$V_{IN} = 1.8V$ ,  $V_{OUT} = 1.2V$ ,  $C1 = 2.2\mu F$ ,  $C3 = 4.7\mu F$ ,  $T_A = +25^\circ C$  unless otherwise noted.



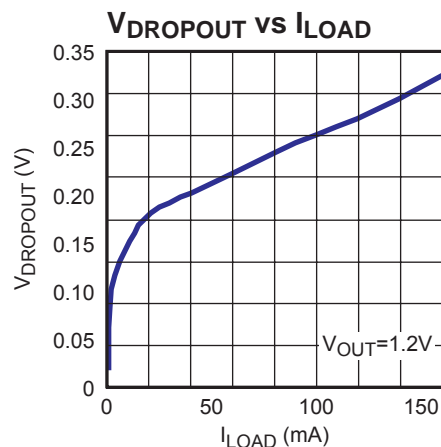
MP2000-TPC01



MP2000-TPC02



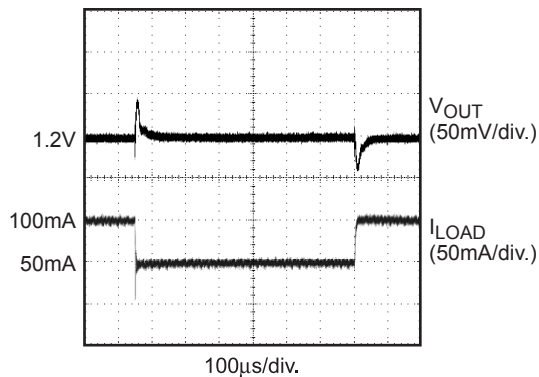
MP2000-TPC03



MP2000-TPC04

## Load-Transient Response

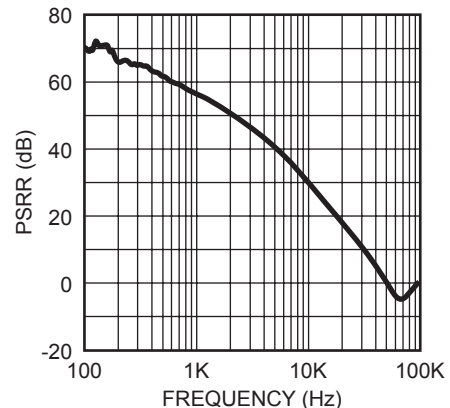
Circuit of Figure 2



MP2000-TPC05

## PSRR vs Frequency

$V_{IN} = 2.5V$ ,  $V_{OUT} = 1.0V$ ,  $I_{LOAD} = 10mA$

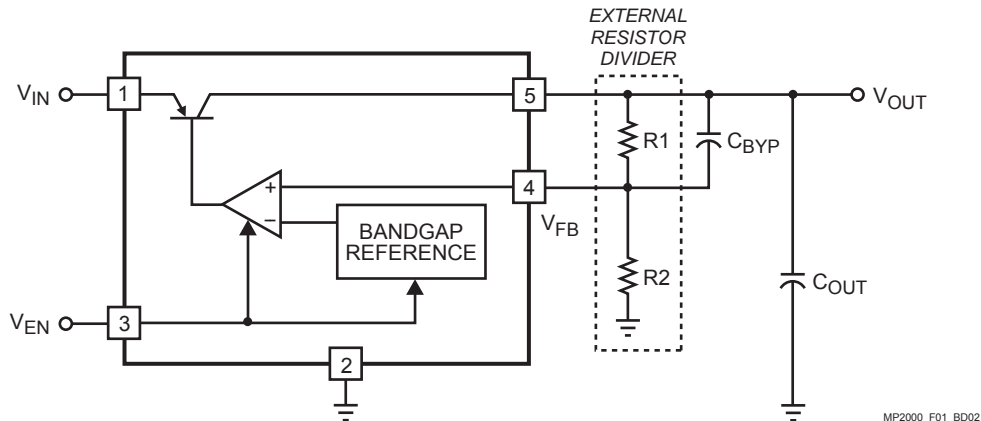


MP2000-TPC06

## OPERATION

The MP2000 is a low-current, low-voltage, low-dropout linear regulator. It is intended for use in devices that require very low voltage and low quiescent current power such as wireless modems, pagers and cellular phones.

The MP2000 uses a PNP pass element and features internal thermal shutdown and an internal current limit circuit.



**Figure 1—Adjustable Regulator**

## APPLICATION INFORMATION

### Setting the Output Voltage

The output voltage can be adjusted by changing the values of the external resistor divider.

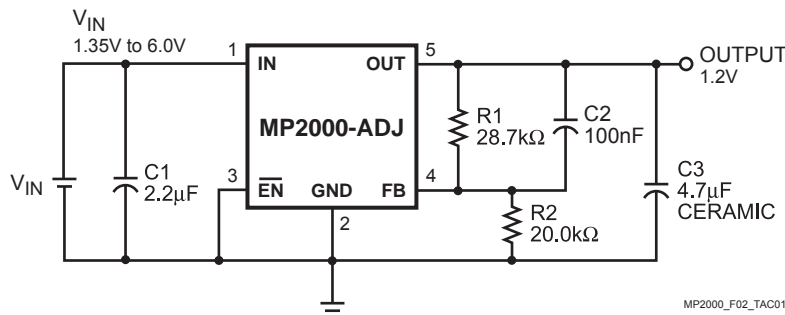
Use the following equation to determine these values:

$$V_{OUT} = 0.5V \times \left(1 + \frac{R1}{R2}\right)$$

Typically R1 + R2 are recommended to be less than 100kΩ.

In Figure 2, C2 is added for improved transient response.

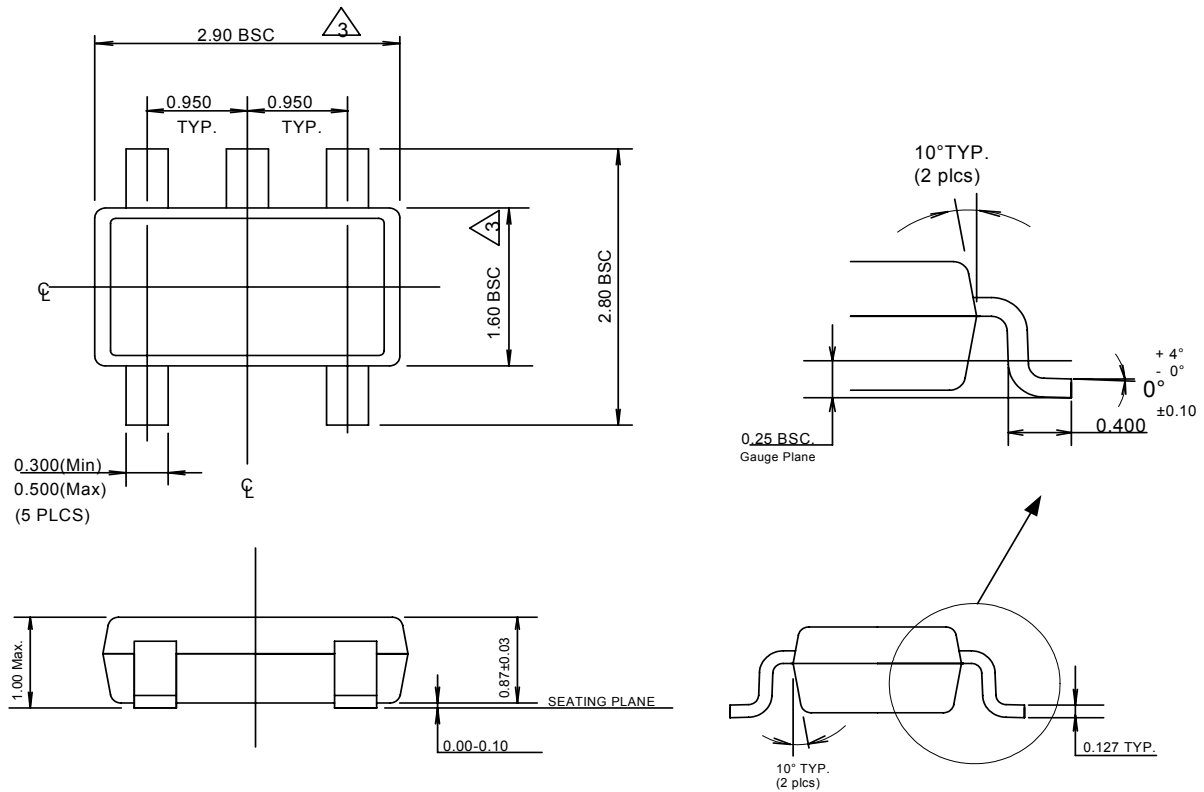
## TYPICAL APPLICATION CIRCUIT - ADJUSTABLE



**Figure 2—Typical Application Circuit with V<sub>OUT</sub> = 1.2V**

# PACKAGE INFORMATION

## TSOT23-5



Dimensions are in millimeters

### NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1994.
2. Die is facing up for mold. Die is facing down for trim/form, ie. reverse trim/form.
3. Dimensions are exclusive of mold flash and gate burr.
4. The footlength measuring is based on the gauge plane method.
5. All specification comply to Jedec Spec MO193 Issue C.

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