



# Bay Linear

Inspire the Linear Power

## 500 mA Low Dropout Voltage Regulators

# B4500

### Preliminary Information

### Description

The B4500 series are a group of positive output voltage, three-pin regulators, that provide a high current even when the input/output voltage differential is small. Very low power consumption, only 2 $\mu$ A typ., and high accuracy is achieved through CMOS construction and programmable fuse technologies. Output voltage: 2.0V to 6.0V in 0.1V increments.

The B4500 consists of a high-precision voltage reference, an error correction circuit, and a current limited output driver.

Available in SOT223 (500mW) and SOT-89 (300mW) packages minimizing the usage of board real state.

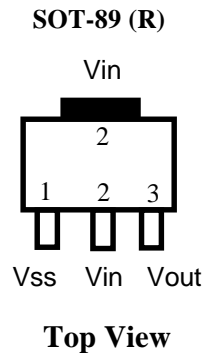
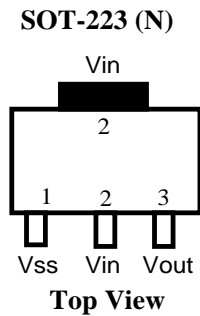
### Features

- **Maximum Output Current: 500 mA.**
- **Highly accurate: Output voltage +/- 2%.**
- **Only 2 $\mu$ A power Consumption.**
- **Very Low Dropout:**  
     **0.11V @ 100mA**  
     **0.3V @ 300mA**  
     **0.5V @ 450mA**
- **Offered in SOT-89 & SOT-223 Packages**

### Applications

- **Battery Powered Equipment**
- **Notebook PC, Palmtops, PDA**
- **Portable Cameras and Video Recorders**
- **Reference Voltage Sources**

### Pin Connection



### Ordering Information

Package	Part No.
SOT-223	B4500CN-X.X
SOT-89	B4500CR-X.X
X.X = Fixed Output Voltages from 2.0V to 6.0V	

**Absolute Maximum Ratings**

Parameter	Symbol	Ratings	Units
Input Voltage	$V_{IN}$	6.5	V
Output Current	$I_{OUT}$	800	mA
Output Voltage	$V_{OUT}$	$V_{SS} - 0.3$ to $V_{IN} - 0.3$	V
Continual Total Power Dissipation	SOT-223	500	mW
	SOT-89	300	
Operating Ambient Temperature	$T_{OPR}$	-30 to 80	°C
Storage Temperature	$T_{STG}$	-40 to 125	°C

**Electrical Characteristics ( $T_a = 25^\circ\text{C}$ ,  $V_{IN} = V_{OUT} + 0.5\text{V}$ ; unless otherwise noted)**

Parameter	Conditions	MIN	TYP	MAX	UNIT
Output Voltage	$I_O = 0\text{mA}$	-1.4%	-	+1.4%	V
	$I_O = 0$ to $500\text{mA}$	-2%	-	+2%	
Line Regulation $\Delta V_{OUT}/\Delta V_{IN} - V_{OUT}$	$I_O = 100\text{mA}$ , $(V_{OUT} + 0.1\text{V}) < V_{IN} < 6\text{V}$		0.2	0.3	%/V
Load Regulation	$V_{IN} = 6\text{V}$ , $0\text{mA} < I_O < 500\text{mA}$ $C_{OUT} = 1\mu\text{F}$			0.04	%/mV
Maximum Output Current		500			mA
Current Limit		900			
Ground Pin Current	$I_{OUT} = 100\text{mA}$		2	6	$\mu\text{A}$
Dropout Voltage	$I_O = 100\text{mA}$		110	160	mV
	$I_O = 300\text{mA}$		300	450	
	$I_O = 500\text{mA}$		450		
Thermal Shutdown Temperature			155		°C

## PRODUCT DESCRIPTION

The B4500 is precision fixed output voltage regulator. Unlike bipolar regulators, the B4500 supply current does not increase with load current. In addition,  $V_{out}$  remains stable and within regulator at very low load currents (an important consideration in RTC and CMOS RAM battery back-up application).

Figure 1 shows a typical application circuit. The regulator is enabled any time the shutdown input is at or above  $V_{IH}$ . And shutdown (disabled) when SHDN is at or below  $V_{IL}$ . SHDN maybe controlled by a CMOS logic gate, or I/O port of a micro controller. If the SHDN input is not. Required, it should be connected directly to the supply. While in shutdown, supply current decreases to  $0.05\mu A$  (typical) and  $V_{out}$  falls to zero volts.

## Output Capacitor

A  $1\mu F$  (min) capacitor from  $V_{out}$  to ground is required. Then output capacitor should have an effective series resistance of  $5\Omega$  or less. A  $1\mu A$  capacitor should be connected from  $V_{in}$  to GND if there is more than 10 inches of wire between the regulator and the AC filter capacitor, or if a battery is used as the power source. Aluminum electrolytic or tantalum capacitor types can be used. (since many aluminum electrolytic capacitors freeze at approximately-  $30^{\circ}C$ , solid tantalums are recommended for applications operating below  $-25^{\circ}C$ .) When operating from sources other than batteries, supply-noise rejection and transient response can be improved by increasing the value of the input and output capacitors and employing passive filtering techniques.

## Thermal Considerations

### Thermal Shutdown

Integrated thermal protection circuitry shuts the regulator off when die temperature exceeds  $160^{\circ}C$ . The regulator remaining off until the die temperature drops to approximately  $140^{\circ}C$ .

### Power Dissipation

The amount of power the regulator dissipates is primarily a function of input and output voltage, and output current. The following equation is used to calculate worst case power dissipation:

$$P_D = (V_{INMAX} - V_{OUTMIN}) I_{LOADMAX}$$

Where:

$P_D$  = worst case actual power dissipation

$V_{INMAX}$  = Maximum voltage on  $V_{IN}$

$V_{OUTMIN}$  = Minimum regulator output voltage

$I_{LOADMAX}$  = maximum output (LOAD) Current

The maximum allowable power dissipation is function of the maximum ambient temperature ( $T_{AMAX}$ ). The maximum allowable die temperature ( $125^{\circ}C$ ) and the thermal resistance from junction-to-air ( $\theta_{JA}$ ).

$$P_{DMAX} = (T_{JMAX} - T_{AMAX}) / \theta_{JA}$$

Where all terms are previously defined

This can be caused in conjunction with other equation to ensure regulator thermal operation is within limit. For example:

Given:

$$V_{INMAX} = 3.3V + 10\%$$

$$V_{OUTMIN} = 2.7V - 2.5\%$$

$$I_{LOADMAX} = 275 \text{ mA}$$

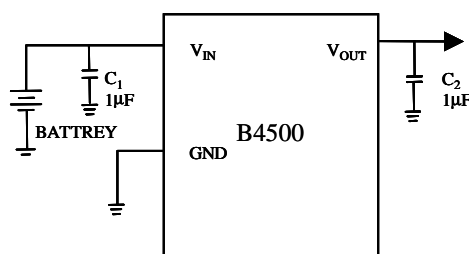
$$T_{JMAX} = 125^{\circ}C$$

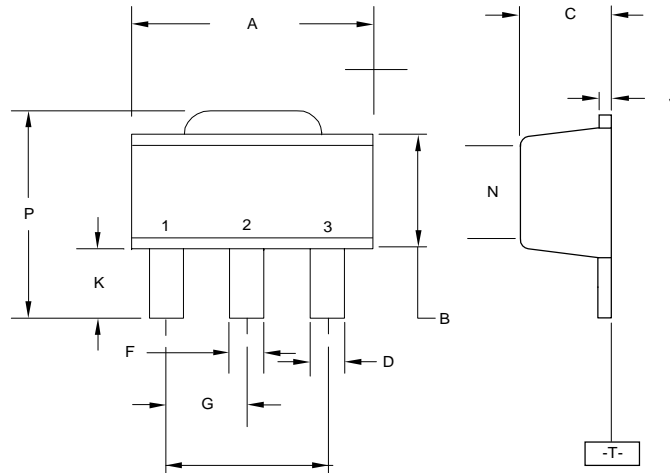
$$T_{AMAX} = 95^{\circ}C$$

$$\theta_{JA} = 59^{\circ}C/W$$

Find:

1. Actual power dissipation
2. Maximum allowable dissipation

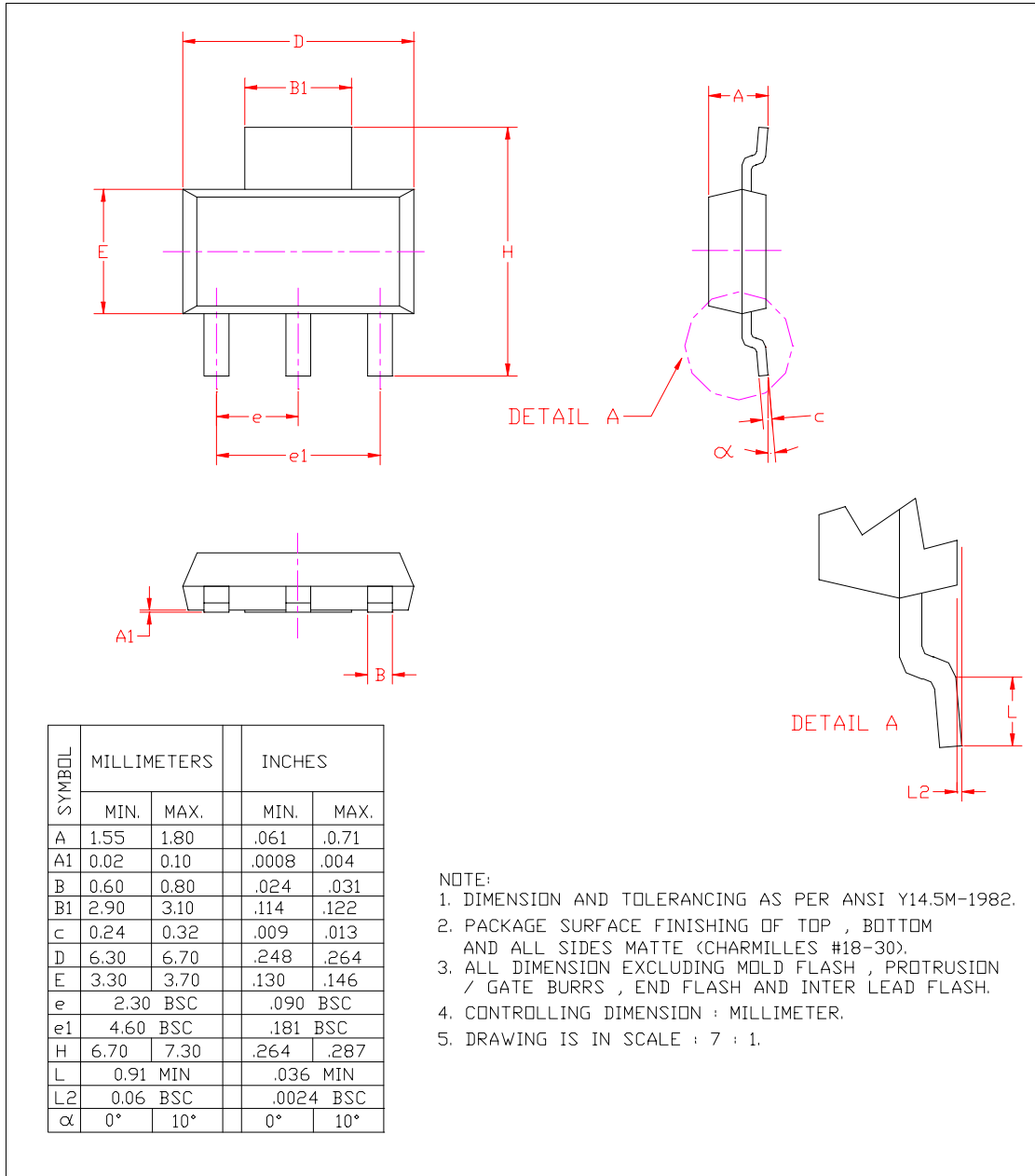




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|---|--|
| <p>STYLE 1<br/>PIN 1. BASE<br/>2. COLLECTOR<br/>3. EMITTER</p>      | <p>STYLE 3<br/>PIN 1. GATE<br/>2. ANODE<br/>3. CATHODE</p> |
| <p>STYLE 2<br/>PIN 1. ANODE<br/>2. CATHODE<br/>3. NO CONNECTION</p> | <p>STYLE 4<br/>PIN 1. DRAIN<br/>2. GATE<br/>3. SOURCE</p>  |

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.174	0.181
B	2.29	2.60	0.091	0.102
C	140	160	0.056	0.062
D	0.36	0.48	0.015	0.018
E	1.62	1.80	0.064	0.070
F	0.44	0.53	0.018	0.020
G	150 BSC		0.059 BSC	
J	0.35	0.44	0.014	0.017
K	0.80	1.04	0.032	0.040
L	300 BSC		0.118 BSC	
N	2.04	2.28	0.081	0.089
P	3.94	4.25	0.156	0.167

7.0 SOT-223



**Advance Information-** These data sheets contain descriptions of products that are in development. The specifications are based on the engineering calculations, computer simulations and/ or initial prototype evaluation.

**Preliminary Information-** These data sheets contain minimum and maximum specifications that are based on the initial device characterizations. These limits are subject to change upon the completion of the full characterization over the specified temperature and supply voltage ranges.

The application circuit examples are only to explain the representative applications of the devices and are not intended to guarantee any circuit design or permit any industrial property right to other rights to execute. Bay Linear takes no responsibility for any problems related to any industrial property right resulting from the use of the contents shown in the data book. Typical parameters can and do vary in different applications. Customer's technical experts must validate all operating parameters including "Typical" for each customer application.

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#### **LIFE SUPPORT AND NUCLEAR POLICY**

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Bay Linear products are not authorized for and should not be used within life support systems which are intended for surgical implants into the body to support or sustain life, in aircraft, space equipment, submarine, or nuclear facility applications without the specific written consent of Bay Linear President.

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