Bay Linear
Inspire the Linear Power

4.0A Low Dropout Voltage Regulator — B1587

Adjustable & Fix Output

Description

The Bay Linear B1587 is Monolithic low power 4.0A Adjustable and fixed NPN voltage regulator that are easy to use with minimum external components. It is suitable for applications requiring a well-regulated positive output voltage with low input-output differential voltage requirements and output voltage 1.5V, 2.5V, 3.0V, 3.3V, or 5V.

The B1587 Outstanding features include full power usage up to 4.0Amp of load current internal current limiting and thermal shutdown. Other fixed versions are also available consult with factory. The B1587 is offer in a new LPDD (Low Profile TO-263) package from 4.47 mm (DD) thickness down to only 1.27 mm (LPDD) total thickness.

The B1587 is offered in a 3-pin TO-220, TO-263 & TO-252 packages compatible with other 3 terminal regulators. For 5A Low dropout Regulator refer to the B1585 data sheet.

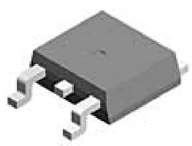
Features

- **Adjustable Output Down to 1.2V**
- **Fixed Output Voltages 2.5V, 3.0V 3.3V, and 5.0V**
- **Output Current of 4.0A**
- **Low Dropout Voltage 1.1V Typ.**
- **Current & Thermal Limiting**
- **Standard 3-Terminal Low Cost TO-220, D^2, D Packages**
- **Similar to industry Standard LT1085/LT1587/LT1585**

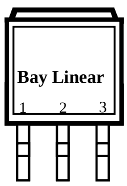
Applications

- **3.3V to 2.5V for Pentium Processor**
- **SMPS Post Regulator**
- **High Efficiency “Green” Computer Systems**
- **High Efficiency Linear Power Supplies**
- **5V to 3.XXV for Pentium Processor**
- **Battery Charger**

Pin Connection

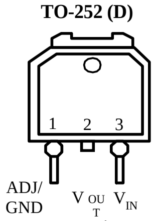


TO-263-3 (S)



Top View

TO-252 (D)



Front View

Ordering Information

Devices	Package	Temp.
B1587T	TO-220	0 °C to 70 °C
B1587S	TO-263	0 °C to 70 °C
B1587D	TO-252	0 °C to 70 °C
B1587J	LPDD	0 °C to 70 °C

LPDD (J)

Absolute Maximum Rating

Parameter	Symbol	Value	Unit
Maximum Input Voltage	V_{IN}	7	V
Power Dissipation	P_O	Internally Limited	W
Thermal Resistance Junction to Case	θ_{JC}	3	°C/W
Thermal Resistance Junction to Ambient	θ_{JA}	50	
Operating Junction Temperature Range Control Section Power Transistor	T_J	 0 to 125 0 to 150	°C
Storage Temperature Range	T_{STG}	-65 to 150	
Lead Temperature (Soldering 10 Sec.)	T_{LEAD}	260	

Electrical Characteristics

(V_{IN} = 4.75V to 5.25V; I_O = 10mA to 4.0Amp, unless otherwise specified)

Parameter	Symbol	Conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$0<I_{OUT}<4A, 3.3V<V_{IN}<7V$, T= 25 °C	1.485	1.5	1.515	V
		$0<I_{OUT}<4A, 3.3V<V_{IN}<7V$, Over Temp.	1.475		1.525	
		$0<I_{OUT}<4A, 4.0V<V_{IN}<7V$, T= 25 °C	2.475	2.5	2.525	
		$0<I_{OUT}<4A, 4.0V<V_{IN}<7V$, Over Temp.	2.460		2.540	
		$0<I_{OUT}<4A, 4.5V<V_{IN}<7V$, T= 25 °C	2.970	3.0	3.030	
		$0<I_{OUT}<4A, 4.5V<V_{IN}<7V$, Over Temp.	2.950		3.050	
		$0<I_{OUT}<4A, 4.8V<V_{IN}<7V$, T= 25 °C	3.267	3.3	3.333	
		$0<I_{OUT}<4A, 4.8V<V_{IN}<7V$, Over Temp.	3.247		3.353	
		$0<I_{OUT}<4A, 6.5V<V_{IN}<7V$, T= 25 °C	4.950	5.0	5.050	
		$0<I_{OUT}<4A, 6.5V<V_{IN}<7V$, Over Temp.	4.920		5.080	
Reference Voltage	V_{ref}	$V_{IN}<7V, 1.5V<V_{IN}<5.75, 10Ma<I_{out}<4Amp$	1.238	1.250	1.262	V
			1.230		1.270	
Line Regulation (1)	$REG_{(line)}$	I_O = 10mA, V_{IN} =5V, T= 25 °C		0.04	0.2	%
Load Regulation (1)	$REG_{(LOAD)}$	I_O = 10mA, V_{IN} =5V, T= 25 °C		0.08	0.40	
Dropout Voltage	V_D	T= 25 °C, I_{OUT}=3A		1.0	1.1	
		T= 25 °C, I_{OUT}=4A		1.1	1.3	V
Minimum load Current	I_{min}			5	10	mA
Current Limit	I_S	$(V_{in}-V_{out})$=3V	3	5		A
Ground Pin Current	I_Q	V_{IN} =5V		5	10	mA
Temperature Stability	T_S	I_O = 10mA, V_{IN} =5V		0.5		%
Thermal Regulation		T= 25 °C, 30ms pulse		0.003		%/W
Ripple Rejection	R_A	T= 25 °C, V_{IN} =5V	60	75		dB
Thermal Resistance	-	TO-220 Junction to Tab		3.0	3.0	°C/W
		Junction to Ambient		60	60	
		DD Package Junction to Tab		3.0	3.0	
		Junction to Ambient		60	60	

Note: Output Switch tests are performed under pulsed conditions to minimize power dissipation

APPLICATION HINTS

The Bay Linear B1587 incorporates protection against over-current faults, reversed load insertion, over temperature operation, and positive and negative transient voltage. However, the use of an output capacitor is required in order to insure the stability and the performances.

Stability

The output capacitor is part of the regulator's frequency compensation system. Either a 220µF aluminum electrolytic capacitor or a 47µF solid tantalum capacitor between the output terminal and ground guarantees stable operation for all operating conditions.
However, in order to minimize overshoot and undershoot, and therefore optimize the design, please refer to the section 'Ripple Rejection'.

Ripple Rejection

Ripple rejection can be improved by adding a capacitor between the ADJ pin and ground. When ADJ pin bypassing is used, the value of the output capacitor required increases to its maximum (220µF for an aluminum electrolytic capacitor, or 47µF for a solid tantalum capacitor). If the ADJ pin is not bypass, the value of the output capacitor can be lowered to 100µF for an electrolytic aluminum capacitor or 15µF for a solid tantalum capacitor.
However the value of the ADJ-bypass capacitor should be chosen with respect to the following equation:
$C = 1 / (6.28 * F_R * R_1)$

Where C = value of the capacitor in Farads (select an equal or larger standard value),
F_R = ripple frequency in Hz,
R_1 = value of resistor R_1 in Ohms.

If an ADJ-bypass capacitor is use, the amplitude of the output ripple will be independent of the output voltage. If an ADJ-bypass capacitor is not used, the output ripple will be proportional to the ratio of the output voltage to the reference voltage:
$M = V_{OUT} / V_{REF}$
Where M = multiplier for the ripple seen when the ADJ pin is optimally bypassed.

V_{REF} = Reference Voltage

Reducing parasitic resistance and inductance

One solution to minimize parasitic resistance and inductance is to connect in parallel capacitors. This arrangement will improve the transient response of the power supply if your system requires rapidly changing current load condition.

Thermal Consideration

Although the B1587 offers some limiting circuitry for overload conditions, it is necessary not to exceed the maximum junction temperature, and therefore to be careful about thermal resistance. The heat flow will follow the lowest resistance path, which is the Junction-to-case thermal resistance. In order to insure the best thermal flow of the component, a proper mounting is required. Note that the case of the device is electrically connected to the output. In case the case has to be electrically isolated, a thermally conductive spacer can be used. However do not forget to consider its contribution to thermal resistance.

Assuming:
$V_{IN} = 10V$, $V_{OUT} = 5V$, $I_{OUT} = 4A$, $T_A = 90°C$, $\theta_{CASE} = 1°C/W$ (no external heat sink, no wind)

Power dissipation under these conditions
$P_D = (V_{IN} - V_{OUT}) * I_{OUT} = 15W$

Junction Temperature
$T_J = T_A + P_D * (\theta_{CASE} + \theta_{JC})$

For the Control Section
$T_J = 90°C + 15W*(1°C/W + 0.6°C/W) = 114°C$
$114°C < T_{JUNCTION\ MAX}$ for the control section.

For the Power Section
$T_J = 90°C + 15W*(1°C/W + 1.6°C/W) = 129°C$
$129°C < T_{JUNCTION\ MAX}$ for the power transistor.

In both case reliable operation is insured by adequate junction temperature.

Basic Adjustable Regulator

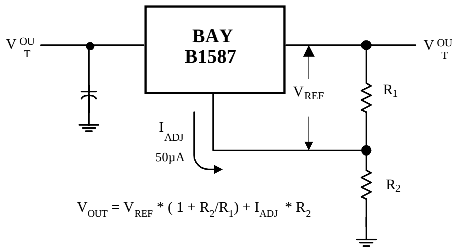


Fig.2 Basic Adjustable Regulator

Output Voltage

Consider Figure 2. The resistance R_1 generates a constant current flow, normally the specified load current of 10mA

This current will go through the resistance R_2 to set the overall output voltage. The current I_{ADJ} is very small and constant. Therefore its contribution to the overall output voltage is very small and can generally be ignored

Load Regulation

Parasitic line resistance can degrade load regulation. In order not to affect the behavior of the regulator, it is best to connect directly the R_1 resistance from the resistor divider to the case,
and not to the load. For the same reason, it is best to connect the resistor R_2 to the Negative side of the load.

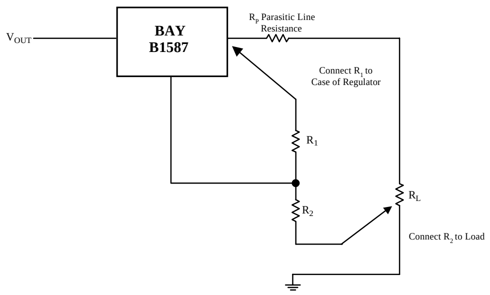


Fig.3 Basic Adjustable Regulator

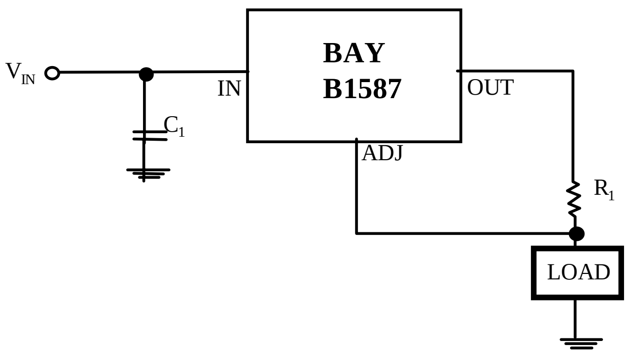
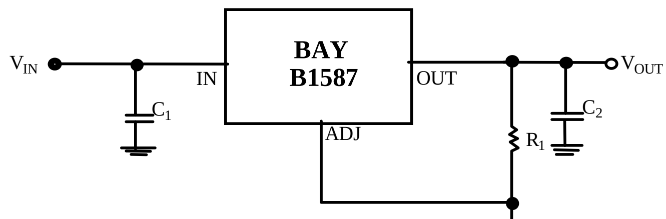


Fig.4 4A Current Output Regulator



$$V_{OUT} = V_{REF}\left(1 + \frac{R_2}{R_1}\right) + I_{ADJ} R_2$$

Fig 5. Typical Adjustable Regulator

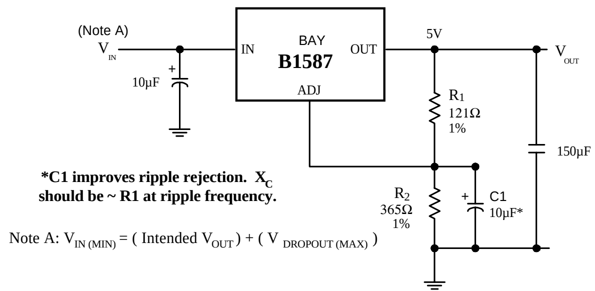


Fig. 6 Improving Ripple Rejection

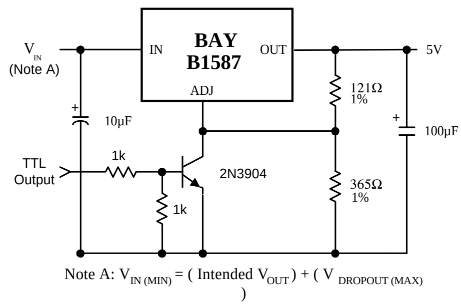
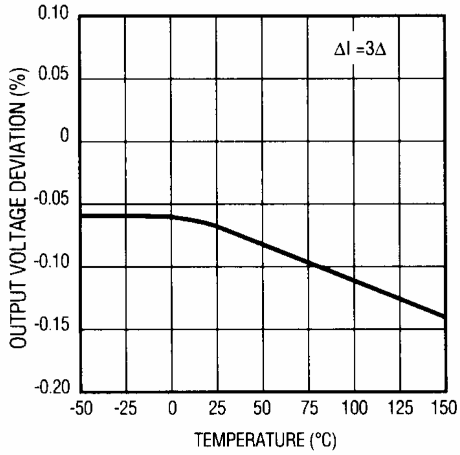


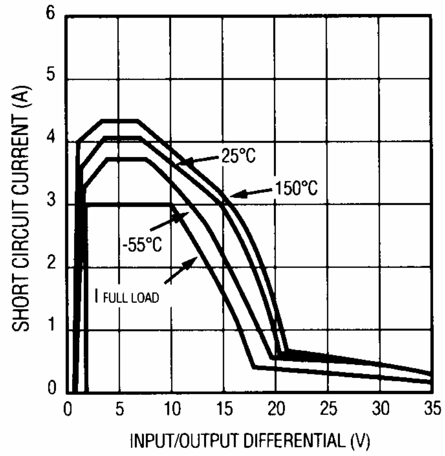
Fig.7 5V Regulator with Shutdown

TYPICAL CHARACTERISTICS

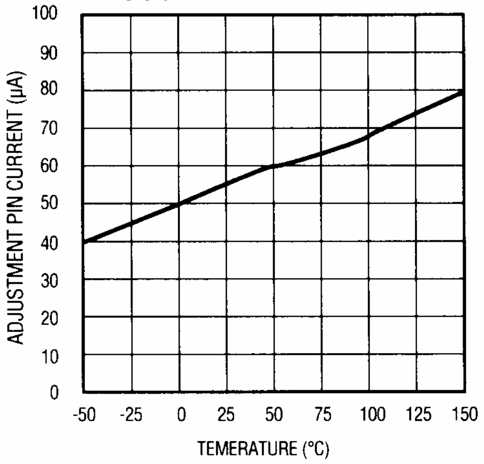
LOAD REGULATION



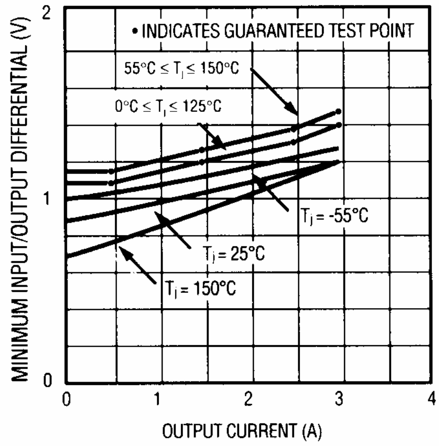
SHORT CIRCUIT CURRENT



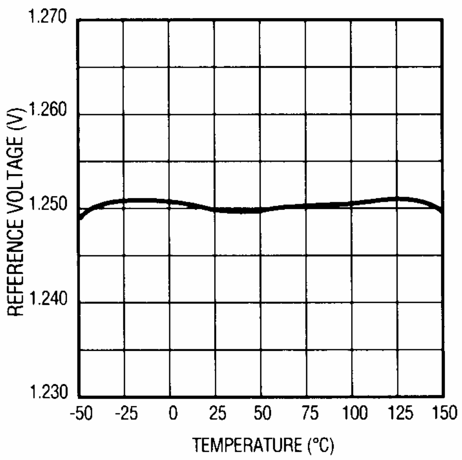
ADJUSTMENT PIN CURRENT



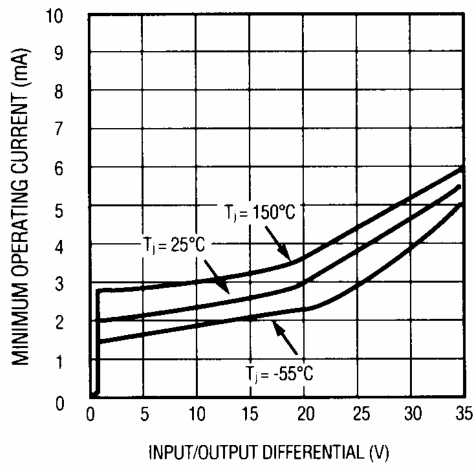
DROPOUT VOLTAGE

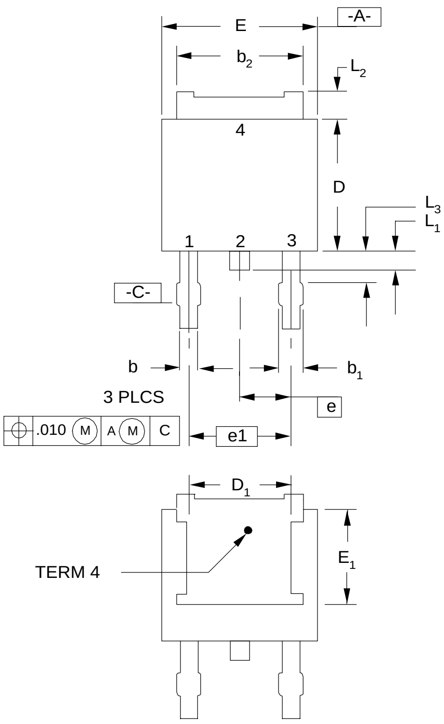


TEMPERATURE STABILITY

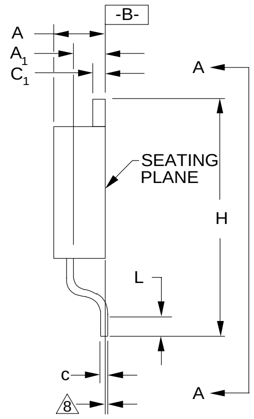


MINIMUM OPERATING CURRENT



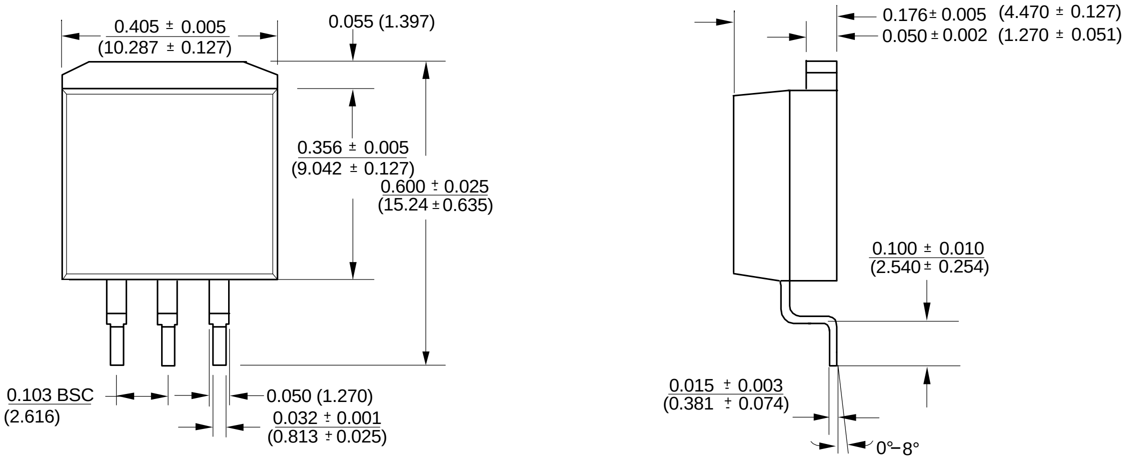


BACK VIEW A-A



NOTES
1. Refer To Applicable Symbol List.
2. Dimensions And Tolerancing Per Ansi Y14.5m - 1982.
3. Lead Dimension Uncontrolled in L_3.
4. Tab Contour Optional Within Dim. b_2 & L_2 And E_1 & D_1
5. D1 & E1 Establishes A Minimum Mounting Surface for Terminal 4.
6. L is the Termal Length for Soldering.
7. Controlling Dimension: Inch
8. 2 Mils Suggested For Postive Contact At Mounting.

SYMBOL	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	0.086	0.094	2.184	2.3876	
A1	0.035	0.045	0.889	1.143	
b	0.025	0.035	0.635	0.889	
b1	0.300	0.045	7.620	1.143	
b2	0.205	0.215	5.207	5.461	4
c	0.018	0.023	0.457	0.5842	
c1	0.018	0.023	0.457	0.5842	
D	0.235	0.245	5.969	6.223	
D1	0.170	-	4.318	-	4,5
E	0.250	0.265	6.350	6.731	
E1	0.170	-	4.318	-	4,5
e	0.098		2.489		
e1	0.180		4.572		
H	0.370	0.410	9.398	10.414	
L	0.020	-	0.508	-	6
L1	0.025	0.040	0.635	1.016	
L2	0.035	0.050	0.889	1.270	4
L3	0.045	0.060	1.143	1.524	3



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.

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