

# AN6500, AN6500S, AN6501

## Built-in Reference Voltage Operational Amplifiers

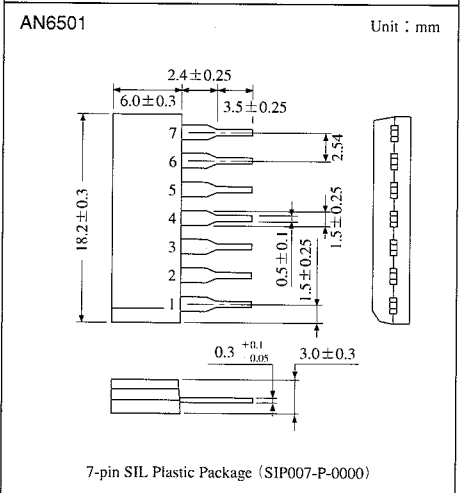
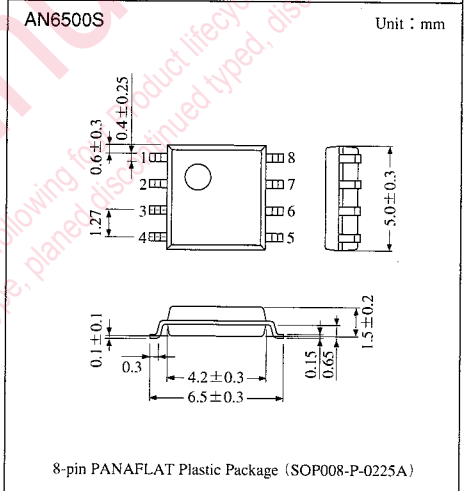
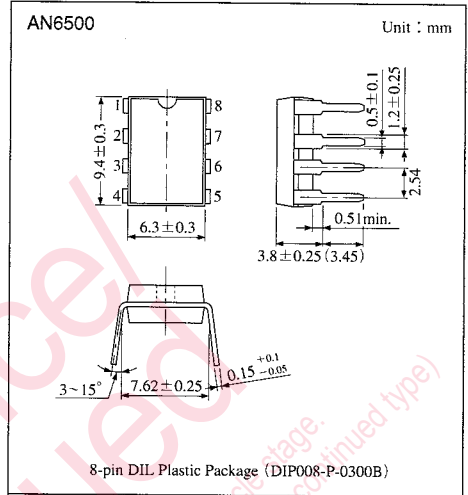
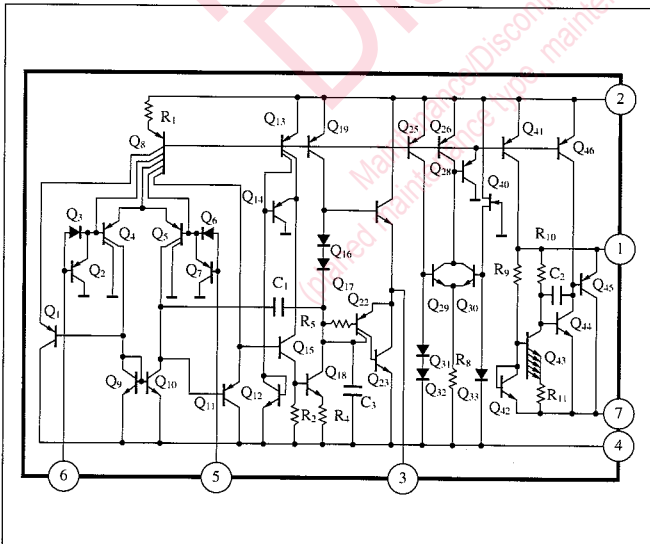
### Overview

The AN6500, the AN6500S, and the AN6501 are high-performance operational amplifiers with reference voltage built-in, allowing single power supply voltage operation and wide application with reference voltage.

### Features

- Wide range of operating voltage : 3 to 24V
- Single power supply voltage operation
- Large output current :  $I_{O+} = +120\text{mA}$  typ.  
 $I_{O-} = -110\text{mA}$  typ.
- Low reference voltage :  $V_{REF} = 1.33\text{V}$  typ.
- Easy to compose variable regulator with reference voltage
- 3 types of packages are available
- Little cross-over distortion in operational amplifier circuit

### Schematic Diagram



Operational Amplifiers

### Pin Descriptions

Pin No.	Pin name
1	Ref. voltage (+)
2	Supply voltage
3	OP. amp. output
4	GND
5	OP. amp. input (+)
6	OP. amp. input (-)
7	Ref. voltage (-)
8	NC

### Absolute Maximum Ratings (Ta = 25°C)

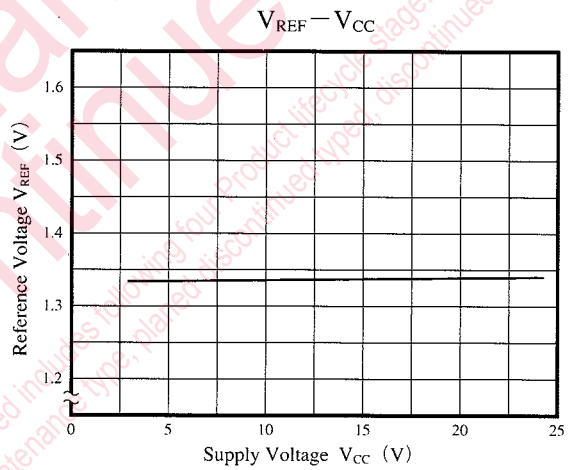
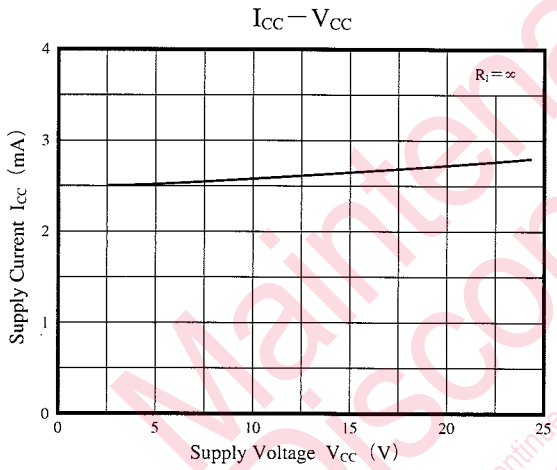
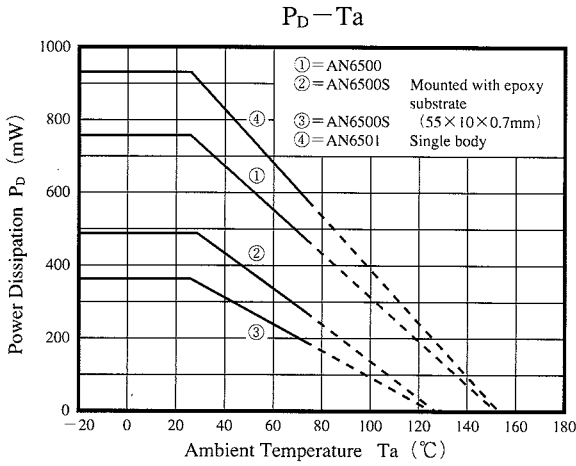
Parameter		Symbol	Rating	Unit
Supply voltage		V <sub>CC</sub>	24	V
Supply current		I <sub>CC</sub>	160	mA
Reference voltage outflow current		(V <sub>REF</sub> ) - I * <sup>1</sup>	-100	μA
Reference voltage inflow current		(V <sub>REF</sub> ) + I * <sup>2</sup>	500	μA
Common-mode input voltage range		V <sub>ICM</sub>	-0.3 to +24	V
Differential input voltage		V <sub>ID</sub>	24	V
Output sink current		V <sub>SINK</sub>	150	mA
Power dissipation	AN6500	P <sub>D</sub> * <sup>3</sup>	750	mW
	AN6500S		360	mW
	AN6501		925	mW
Operating ambient temperature		T <sub>opr</sub>	-20 to +75	°C
Storage temperature	AN6500, AN6501	T <sub>stg</sub>	-55 to +150	°C
	AN6500S		-40 to +125	°C

\*1 Current flowed out from Pin①. \*2 Current flowed into Pin①. \*3 When enlarging output current, watch power consumption.

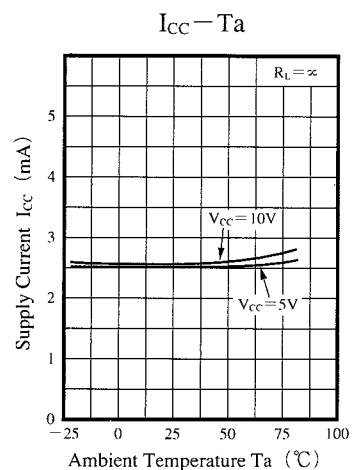
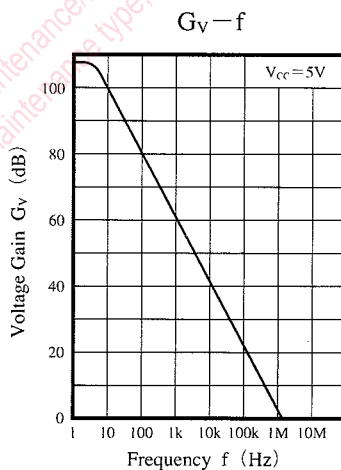
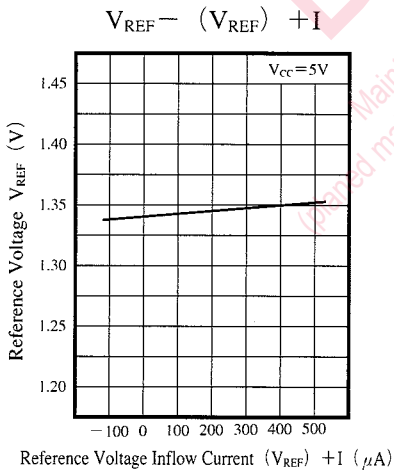
### Electrical Characteristics (V<sub>CC</sub> = 5V, Ta = 25°C ± 2°C)

Parameter	Symbol	Condition	min	typ	max	Unit
Reference voltage	V <sub>REF</sub>		1.25	1.33	1.45	V
Reference voltage temperature variation characteristics	ΔV <sub>REF</sub> /Ta	Ta = 0 to 50°C	—	-30	—	ppm/°C
Input offset voltage	V <sub>I(offset)</sub>	R <sub>S</sub> = 50 Ω	—	2	7	mV
Input bias current	I <sub>Bias</sub>		—	100	500	nA
Input offset current	I <sub>IO</sub>		—	5	300	nA
Common-mode input voltage range	V <sub>CM</sub>		—	—	3.5	V
Supply current	I <sub>CC</sub>	R <sub>L</sub> = ∞	—	2.5	3.5	mA
Voltage gain	G <sub>V</sub>	R <sub>L</sub> ≥ 2k Ω	80	108	—	dB
Maximum output voltage (1)	V <sub>O(max)1</sub>	R <sub>L</sub> ≥ 2k Ω	3.5	—	—	V
Maximum output voltage (2)	V <sub>O(max)2</sub>	V <sub>CC</sub> = 5V, I <sub>O</sub> = 70mA	3	4.1	—	V
Common-mode rejection ratio	CMR		—	85	—	dB
Supply voltage rejection ratio	SVR		—	90	—	dB
Output source current	I <sub>O(source)</sub>	V <sub>IN</sub> <sup>+</sup> = 1V, V <sub>IN</sub> <sup>-</sup> = 0V	70	110	—	mA
Output sink current	I <sub>SINK</sub>	V <sub>IN</sub> <sup>+</sup> = 0V, V <sub>IN</sub> <sup>-</sup> = 1V	70	120	—	mA
Zero-cross frequency	f <sub>(T)</sub>		—	1	—	MHz

■ Characteristics Curve



Operational Amplifiers



## Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book are intended to be used for standard applications or general electronic equipment (such as office equipment, communications equipment, measuring instruments and household appliances).  
Consult our sales staff in advance for information on the following applications:
  - Special applications (such as for airplanes, aerospace, automobiles, traffic control equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.
  - Any applications other than the standard applications intended.
- (4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
  - Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.