AH0010C
AH0010F

Optical Electronics Incorporated

LINEAR VOLTAGE FOLLOWER AND CURRENT BOOSTER

FEATURES

- SLEW RATE: ±1500V/μsec
- OUTPUT: ±100mA, ±10V
- SETTLING TIME: 100 ns to 0.1%
- VOLTAGE DRIFT: ±100μV/° C

APPLICATIONS

- BUFFER
- CURRENT BOOSTERS
- VIDEO LINE DRIVER
- SAMPLE AND HOLD

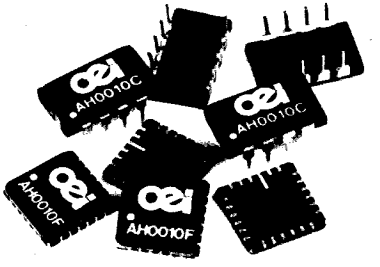
DESCRIPTION

The AH0010 Linear Voltage Follower and Current Booster is well suited for any applications where exceptionally high slew rate, fast settling and recovery times, and high drive capability are needed. Also very useful is the wide small signal bandwidth.

Since the AH0010 guarantees an output current of ±100mA at an output voltage of ±10V, the user can fully realize the high speed features of the device. This current capability allows use for booster applications and in the feedback loop of op amps, which can then provide the necessary gain. The voltage gain of the AH0010 unloaded is typically 0.96 but can drop to .90 when a load is applied. Due to its internal structure, a no load condition can cause the device to show a distorted signal at the output, and therefore, evaluation should always include some sort of a load (10K ohms).

When the device is used in the feedback loop of an op amp the biasing pins are connected. This mode allows highest output current drive, but can also cause crossover distortion. Therefore, the gain of the op amp should be relatively high to eliminate this effect.

The 1500V/μs slew rate and the settling time of a mere 80ns (to .1%) could invite the use of this device in sample and hold applications. However, the designer should remember that the AH0010 has a bipolar front end and should only be used in the first stage of such a system. Bias currents could probably not be tolerated by the charge capacitor without incurring large errors.



Another feature of this device is its overload recovery time of only 100ns. This allows use in areas where unexpected overloads occur and rapid recovery is necessary to guarantee system accuracy. This, together with the small signal bandwidth capability of DC to 30MHz, certainly makes the AH0010 an excellent candidate for test equipment applications. Also video, sonar, and certain radar applications can benefit from the high speed and wide bandwidth.

SPECIFICATIONS

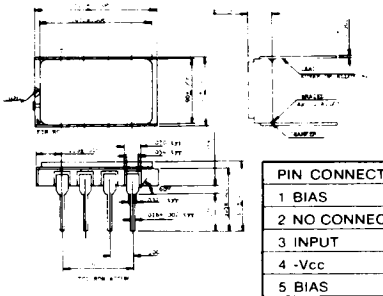
ELECTRICAL

Specifications at T_A = +25°C, V_{CC} = ±15VDC unless otherwise noted.

MODEL		AH0010			
PARAMETER	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNITS**
VOLTAGE GAIN		0.90	0.96		V/V
INPUT					
Resistance			500		KΩ
Voltage			±12		V
Bias Current			±20		μA
Offset Voltage			±5	±20	mV
Offset Voltage Drift				±100	μV/°C
OUTPUT					
Voltage Swing	Io = ±100mA	±10			V
Maximum Load Current	Vo = ±10V	±100			mA
Output Resistance				20	Ω
Maximum Load Capacitance				10	nF
FREQUENCY RESPONSE					
Slew Rate	R_L = 1kΩ		1500		V/μsec
Maximum Full Output Frequency			24		MHz
Overload Recovery Time			100		ns
Settling Time to 0.1%			100		ns
TEMPERATURE ENVIRONMENT					
Thermal Resistance of Pkg (8 pin)			175		°C/W
Quiescent Temperature Rise			5		°C
POWER REQUIREMENTS					
Voltage		±6	±15	±18	V
Quiescent Supply Current	V_{CC} = ±15V			±5	mA
TEMPERATURE RANGE					
Specification					
Operating		0		+70	°C
Storage		−65		+150	°C

AH0010C

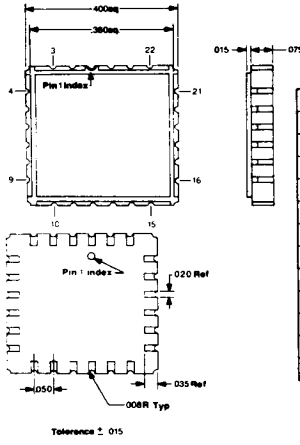
MECHANICAL DESCRIPTION: The AH0010C is a standard 8-pin, ceramic mini-DIP. Its pins are compatible with standard 0.3-in dual in-line sockets.



PIN CONNECTIONS
1 BIAS
2 NO CONNECTION
3 INPUT
4 -Vcc
5 BIAS
6 OUTPUT
7 +Vcc
8 NO CONNECTION

AH0010F

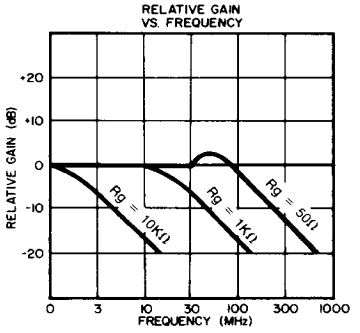
MECHANICAL DESCRIPTION: The AH0010F is a standard ceramic 24 lead chip carrier.

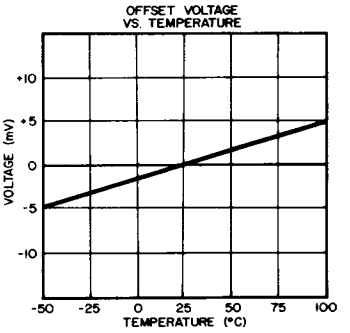


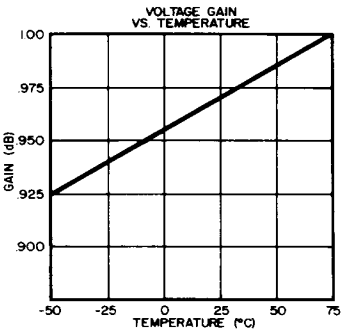
PIN CONNECTIONS
1-5 NO CONNECTION
6 BIAS
7 OUTPUT
8 NO CONNECTION
9 +Vcc
10-15 NO CONNECTION
16 BIAS
17-18 NO CONNECTION
19 INPUT
20 NO CONNECTION
21 -Vcc
22-24 NO CONNECTION

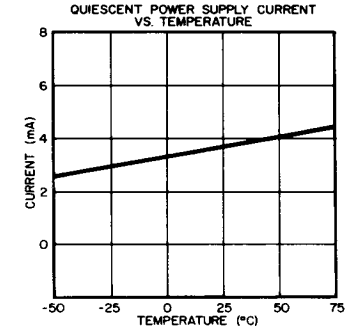
AH0010
TYPICAL PERFORMANCE CURVES

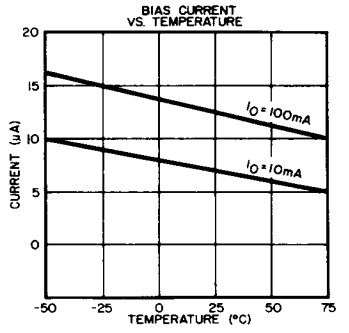
(T_A = +25°C, V_{CC} = ±15VDC unless otherwise noted)

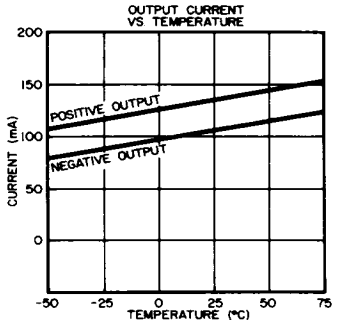












GENERAL INFORMATION, APPLICATIONS

The AH0010 is a linear voltage follower and current booster that finds applications in a variety of areas. The device has a near equivalent, the 9910, which is available in the same package type (8 pin DIP). Actually, the 9910 conforms to the AH0010 in fit, form and function.

Shown in Figure 1 are the basic connections needed for the device. At the input to the AH0010, Rg, the source resistance, is shown. In practical applications, the designer should remember that the front end, which is constructed of bipolar devices, needs a certain drive current to allow for proper operation. If this current is allowed to go too low, the frequency response of the item will suffer. Therefore, if the full frequency response capability is needed, the resistance should be from a 50 ohm source, and not above approximately 1K ohm. The section with the typical performance curves provides a graph depicting the relationship of Rg to the frequency response. This will afford the designer the proper choice of trade-offs.

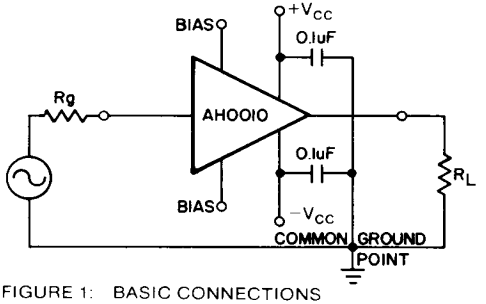


FIGURE 1: BASIC CONNECTIONS

The current driver output is standard and the load resistor can be chosen to suit the output load condition. This resistance can be chosen to be as low as 100 ohm. For the full output swing of ±10V and ±100mA, this resistor should not be less than 100 ohm. Since the AH0010 does not have any internal bypass provisions, capacitors must be provided between both power supply rails and ground. For very noisy systems, parallel values of 1.0μF, 0.1μF and 330pF are recommended to afford low, median, and high frequency noise suppression. The capacitors should be located as closely as possible to the device and be connected to a common ground point. Generally accepted good layout practices are recommended, with resistors of the metal film type, and with input and output load capacitances minimized. Otherwise, the device will not be able to perform to the limits of its frequency range and slew rate capabilities.

The bias connections are used to increase circuit tolerance to load conditions in current booster circuits and will be discussed in an application note.

HIGH SPEED SAMPLE AND HOLD

Because of its bipolar front end and high slew rate, the AH0010 is an ideal candidate in sample and hold circuits. Additionally, its high current drive capability allows it to charge the hold capacitor with ease and it can, therefore, be used as the first stage in such a system. The relatively high input bias current would probably load the hold capacitor too much and would cause appreciable errors. On the other hand, the 9963 from OEI with its FET front end (100G ohm resistance) is very well suited for this task. Add to this a rapid switch, such as a DG181 CMOS analog switch from Siliconix, and an excellent and inexpensive sample and hold circuit with outstanding features can be built.

Depending on the TTL command voltage, the system can be alternated between a sampling and a holding mode. The voltage on Cx will then follow the input to the AH0010 or provide the sampled output to the external user. The 50 to 100 ohm resistor between the switch and the 9963 is a damping resistor which will promote stability. In many cases, this resistor is not needed. For details on the performance and connections of the 9963, refer to the pertinent data sheet. It suffices to say that the AH0010 with its 1500V/μs slew rate matches the same parameter of the 9963. The overall system will easily accommodate a 24MHz signal with ±10V at 200mA at the output of the 9963.

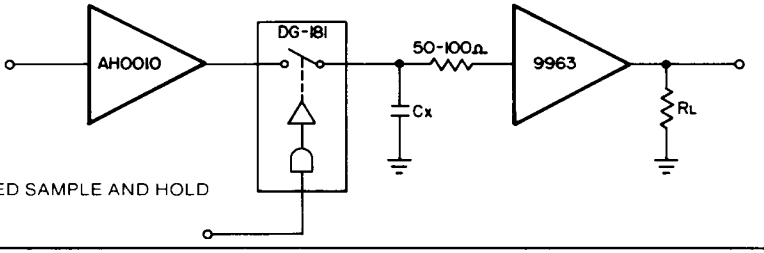


FIGURE 2: HIGH SPEED SAMPLE AND HOLD

CURRENT LIMITING

The AH0010 does not have internal current limiting. It is therefore possible to destroy it with short circuits or appreciable overloads over a short period of time. To prevent this, a few components can be added and the device can be protected. The cost for this protection runs at perhaps 1/20th of the cost of the device, an investment that certainly is worthwhile.

The circuit shown in Figure 3 exploits the base to emitter voltage of two transistor pairs, to regulate the current across two 10 ohm resistors. The voltage of approximately 0.6V limits the current through the resistors to around 100mA, which is a safe value even for extended periods. The circuit is highly recommended, if there is any potential for short circuits.

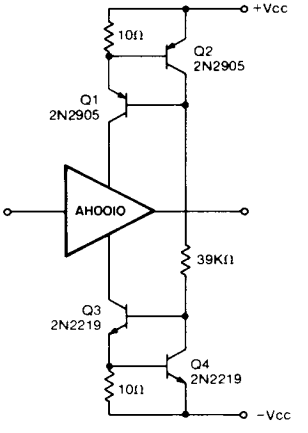


FIGURE 3: CURRENT LIMIT USING CURRENT SOURCE

CURRENT BOOSTER

The AH0010 has, because of its excellent drive capabilities, yet another application: Inside the feedback loop of an operational amplifier that does not have the necessary drive. Shown in Figure 4 is a circuit that allows amplification, coupled with sufficient current drive, to allow video signal processing. The AH0008 can, because of its FET front end, be used as a transconductance amplifier.

The operational amplifier is configured in the usual way with the two resistors, Rin and Rf, determining the overall amplification. The difference in this circuit is the AH0010 in the feedback loop. Since it has essentially unity gain, no other precautions are required. The 50 to 100 ohm resistor between the two devices promotes stability.

To arrive at the highest possible current drive the bias pins are jumpered. This will cause crossover distortion which will, at high gains of the op amp, not be too noticeable. If the total drive capability of ±100mA at ±10V is not required, the jumper can be left off and crossover distortion will be nonexistent. The AH0008 can also be compensated with a capacitor, which will negate the requirement for the resistor.

It should be noted that the bandwidth of the current driver is wider than that of the op amp. Otherwise, interaction of poles could create an accelerated rolloff.

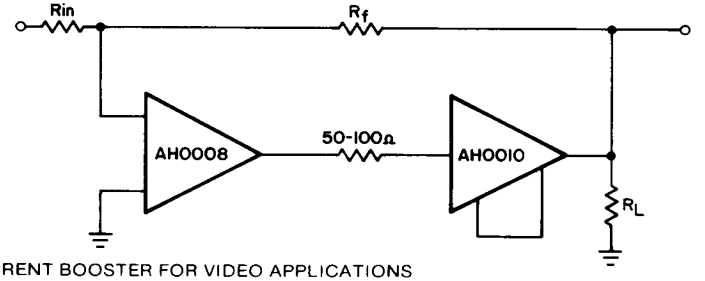


FIGURE 4: CURRENT BOOSTER FOR VIDEO APPLICATIONS

VOLTAGE FOLLOWER

Figure 5 shows the AH0010 in a standard voltage follower circuit. To repeat an earlier statement, the source resistance Rg of 1K should not be exceeded, lest the frequency response be degraded.

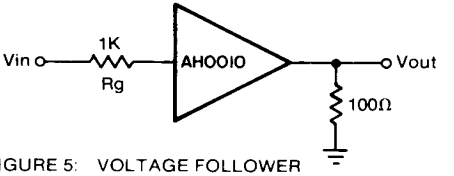


FIGURE 5: VOLTAGE FOLLOWER

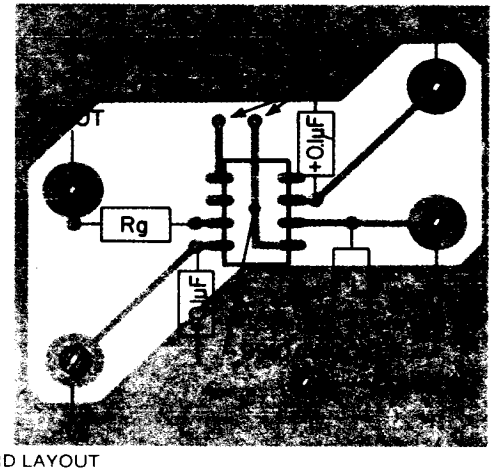


FIGURE 6: TYPICAL BOARD LAYOUT