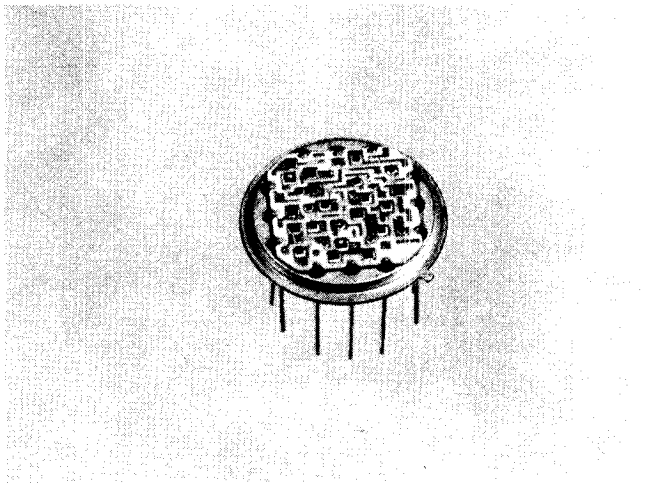
Fast Settling Video Operational Amplifier

HOS-050, 050A

FEATURES
- 80ns Settling to 0.1%; 200ns Settling Time to 0.01%
- 100MHz Gain Bandwidth Product
- 55MHz 3dB Bandwidth
- 100mA Output Capability @ ±10V
- Maximum Tempco of 35μV/°C (HOS-050A)

APPLICATIONS
- A to D Input Amplifier
- D to A Current Converter
- Video Pulse Amplifier
- CRT Deflection Amplifier
- Wideband Current Booster



GENERAL DESCRIPTION

The HOS-050 and HOS-050A op amps are very high speed wideband operational amplifiers specially designed to complement the Analog Devices' line of high speed data acquisition products. Both models feature a 100MHz gain bandwidth product, slew rate of 300μV/μs and settling time of 80ns to 0.1%.

Model HOS-050 has an input offset voltage of 25mV, typical; HOS-050A has an offset voltage of 10mV, typical. Both models have a rated output of ±100mA, min, and an exceptionally low input voltage noise of only 7μV rms, dc to 2MHz, making them ideally suited for a broad range of video applications.

D/A's AND FAST SETTLING

It used to be sufficient to specify op amps according to their slewing rates, bandwidth, and drive capability. Settling times were unimportant until the recent increase in the use of high speed video D/A converters. Since the conversion speed of D/A's can be limited by the settling time of the output amplifier, it has become essential to choose an op amp which will have a settling time which is compatible to the D/A.

Settling time is determined not only by the slew rate of an op amp, but also by the amount of overshoot and ringing experienced at the tail end of a step function change. This is largely due to the bandwidth limitations experienced in many op amps operating with closed loop gains greater than one. The HOS series avoids this problem since its 100MHz gain bandwidth product is more than large enough for most video applications.

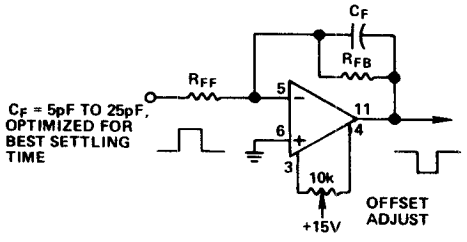


Figure 1. Settling Time Measurement

For additional information on fast amplifiers, see Analog Devices' model 48, 50, 51 data sheets.

For example, at a gain of 1 in the inverting mode, it has a bandwidth of 55MHz and a settling time of 80ns to 0.1% for a 5-volt input step voltage.

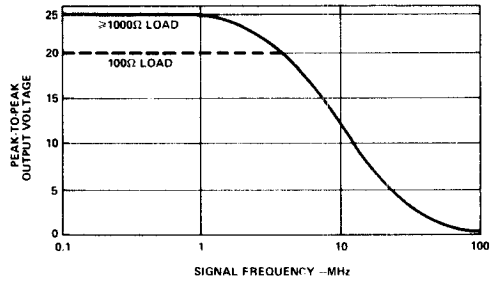


Figure 2. Output Voltage vs Signal Frequency

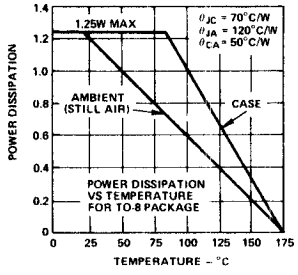


Figure 3. Power Dissipation vs Temperature

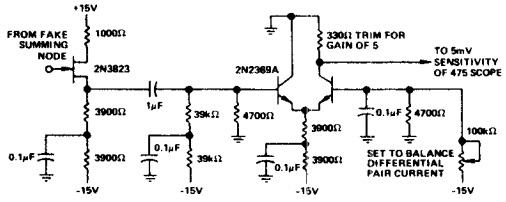


Figure 4. Settling Time Test Circuit for 0.01% Settling

SPECIFICATIONS (typical @ +25°C and ±15V unless otherwise noted)

Model	HOS-050 (HOS-050A)
OPEN LOOP GAIN, DC	
Load = 100Ω	100dB min
RATED OUTPUT[1]	
Voltage, $R_L \geq 100\Omega$	±10V min
Current	±100mA min
FREQUENCY RESPONSE (Circuit of Figure 1)	
Gain Bandwidth Product, $R_{FF} = R_{FB} = 500\Omega$	100MHz
Small Signal Bandwidth, -3dB (See Table 1)	55MHz
Full Power (See Figure 2 for 3% distortion levels)	4MHz
Harmonic Distortion (See Table 2)	-60dB
Slew Rate	300V/μs
Overload Recovery (50% overdrive)	400ns
SETTLING TIME to 0.1% Full Scale (See Table 3)	
Inverting A = 1, $R_{FF} = R_{FB} = 500\Omega$	
V_{OUT} = ±5V/±2.5V	100ns/80ns
Noninverting A = 2, $R_{FF} = 500\Omega$, $R_{FB} = 500\Omega$	
V_{OUT} = ±5V/±2.5V	200ns (135ns)
INPUT OFFSET VOLTAGE	
Initial @ +25°C (adjustable to zero, see Figure 1)	35mV max (15mV max)
vs. Temperature μV/°C	150 max (35 max)
vs. Power Supply Voltage	±75μV/%
INPUT BIAS CURRENT	
Initial @ +25 °C	1mA typ, 2nA max
vs. Temperature	doubles/+10°C
INPUT IMPEDANCE	
Differential	$10^{10}\Omega \| 5pF$
Common Mode	$10^{10}\Omega \| 5pF$
INPUT NOISE ($R_{FF} = 100\Omega$, $R_{FB} = 1000\Omega$)	
dc to 100kHz	5μV rms
dc to 2MHz	7μV rms
INPUT VOLTAGE RANGE	
Common Mode Voltage	±10V min
Max Safe Differential Voltage	±Supply Voltage
Common Mode Rejection	70dB
POWER SUPPLY	
Voltage, Rated Performance	±15V dc
Voltage, Operating Range	±12V to ±18V (Absolute max)
Current, Quiescent max/typ	±25/±20mA
Power Consumption	0.6W (quiescent)
Allowable Power Dissipation (See Figure 3)	1.25W max
TEMPERATURE RANGE[2]	
Operating (See Figure 3 for derating)	-55°C to +125°C (case)
Storage	-65°C to +150°C

NOTE

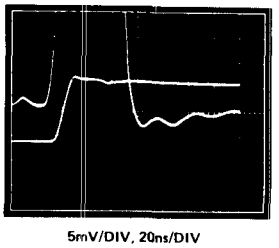
[1] Output is short circuit protected for momentary shorts of 100ms or less.

[2] With case temperature of +125°C, max junction temperature is +175°C.

Specifications subject to change without notice.

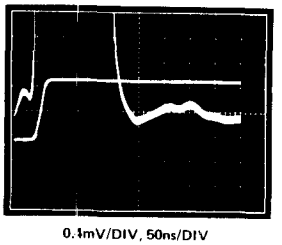
R_{FF}	R_{FB}	Gain	Bandwidth
500Ω	500Ω	1	55MHz
1000Ω	1000Ω	1	35MHz
500Ω	1000Ω	2	35MHz
250Ω	1000Ω	4	30MHz

Table 1.



5mV/DIV, 20ns/DIV

0.1% Settling, 5V Step



0.1mV/DIV, 50ns/DIV

0.01% Settling, 5V Step

HARMONIC DISTORTION — INVERTING MODE

The following data are useful for video applications where driving a 50Ω or a 75Ω coax cable is desirable. It is assumed that the cable is source and load terminated. Therefore, a 50Ω cable represents a 100Ω load to the amplifier, and a 75Ω cable represents a 150Ω load.

Case I DC load = 100Ω; Signal = 4MHz

Signal Output	Harmonics
2V p-p	60dB down
4V p-p	55dB down

Case II DC load = 150Ω; Signal = 4MHz

Signal Output	Harmonics
2V p-p	65dB down
4V p-p	60dB down

Case III DC load = 100Ω; Signal = 5MHz

Signal Output	Harmonics
2V p-p	60dB down
4V p-p	55dB down

Case IV DC load = 150Ω; Signal = 5MHz

Signal Output	Harmonics
2V p-p	60dB down
4V p-p	55dB down

Case V DC load = 1000Ω; Signal = 4MHz

Signal Output	Harmonics
2V p-p	70dB down
4V p-p	60dB down

Case VI DC load = 1000Ω; Signal = 5MHz

Signal Output	Harmonics
2V p-p	65dB down
4V p-p	55dB down

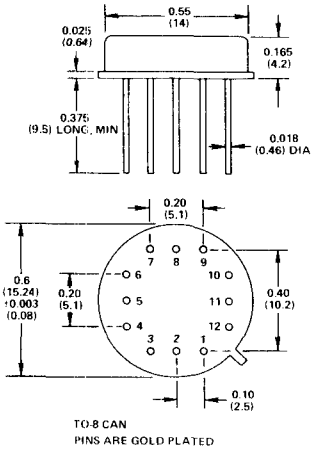
Table 2. Harmonic Distortion — Inverting Mode

P-P Output Voltage	to 1% FS	to 0.1% FS	to 0.05% FS	to 0.01% FS
10V	65ns	100ns	120ns	300ns
5V	50ns	80ns	90ns	200ns

Table 3. Settling Time — Inverting Mode (Measured with Gain of 1; $R_{FF}=R_{FB}=500\Omega$)

OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).



PIN DESIGNATIONS

PINS	FUNCTION
1	+V
2	GROUND
3	OFFSET ADJ*
4	OFFSET ADJ*
5	-INPUT
6	+INPUT
7	NC
8	GROUND
9	-V
10	-V
11	OUTPUT
12	+V

*PINS FOR CONNECTING OPTIONAL OFFSET POTENTIOMETER. SEE FIGURE 1.

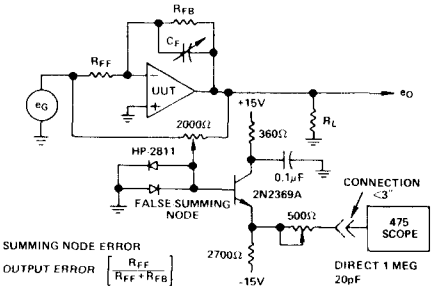


Figure 5. Settling Time Test Circuit for 0.1% Settling