

**OBSOLETE PRODUCT  
POSSIBLE SUBSTITUTE PRODUCT  
HFA1100, HFA1109**

**600MHz Current Feedback  
Amplifier with Compensation Pin**

**Description**

The HFA1102 is a high speed wideband current feedback amplifier featuring a compensation pin for bandwidth limiting. Built with Harris' proprietary complementary bipolar UHF-1 process, it has excellent AC performance and low distortion.

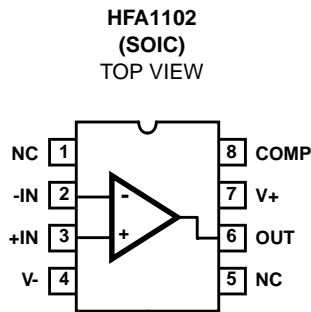
Because the HFA1102 is already unity gain stable, the primary purpose for limiting the bandwidth is to reduce the total noise (broadband) of the circuit. The bandwidth of the HFA1102 may be limited by connecting a capacitor and series damping resistor from pin 8 to ground. Typical bandwidths for various values of compensation capacitors are shown in the Electrical Specifications section of this datasheet.

A variety of packages and temperature grades are available. See the ordering information below for details.

**Part Number Information**

PART NUMBER (BRAND)	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HFA1102IB (H1102I)	-40 to 85	8 Ld SOIC	M8.15
HFA11XXEVAL	DIP Evaluation Board for High Speed Op Amps		

**Pinout**



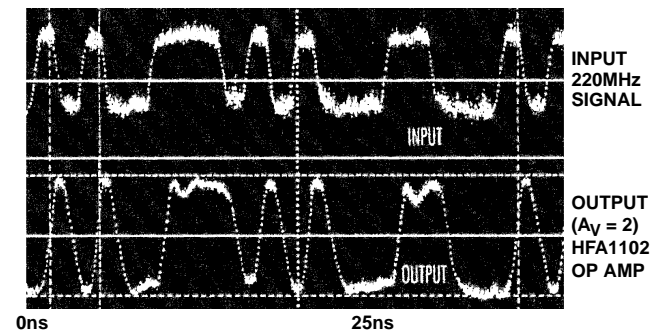
**Features**

- Compensation Pin for Bandwidth Limiting
- Low Distortion (HD2 at 30MHz) . . . . . -56dBc
- -3dB Bandwidth . . . . . 600MHz
- Very Fast Slew Rate . . . . . 2000V/μs
- Fast Settling Time (0.1%) . . . . . 11ns
- Excellent Gain Flatness
  - (100MHz) . . . . . ±0.05dB
  - (50MHz) . . . . . ±0.02dB
  - (30MHz) . . . . . ±0.01dB
- High Output Current . . . . . 60mA
- Overdrive Recovery . . . . . <10ns

**Applications**

- Low Noise Amplifiers
- Video Switching and Routing
- Pulse and Video Amplifiers
- RF/IF Signal Processing
- Flash A/D Driver
- Medical Imaging Systems

**The Op Amps with Fastest Edges**



# HFA1102

## Absolute Maximum Ratings

Voltage Between V+ and V- .....	12V
DC Input Voltage .....	V <sub>SUPPLY</sub>
Differential Input Voltage .....	5V
Output Current (50% Duty Cycle) .....	60mA

## Thermal Information

Thermal Resistance (Typical, Note 1)	$\theta_{JA}$ (°C/W)	$\theta_{JC}$ (°C/W)
SOIC Package .....	170	N/A
Maximum Junction Temperature (Plastic Package) .....	150°C	
Maximum Storage Temperature Range .....	-65°C to 150°C	
Maximum Lead Temperature (Soldering 10s) .....	300°C (SOIC - Lead Tips Only)	

## Operating Conditions

Temperature Range .....

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### NOTE:

- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications

V<sub>SUPPLY</sub> = ±5V, A<sub>V</sub> = +1, R<sub>F</sub> = 510Ω, R<sub>L</sub> = 100Ω, C<sub>COMP</sub> = 0pF, Unless Otherwise Specified

PARAMETER	TEST CONDITIONS	TEMP. (°C)	MIN	TYP	MAX	UNITS
<b>INPUT CHARACTERISTICS</b>						
Input Offset Voltage		25	-	2	6	mV
		Full	-	-	10	mV
Input Offset Voltage Drift		Full	-	10	-	μV/°C
V <sub>IO</sub> CMRR	ΔV <sub>CM</sub> = ±2V	25	40	46	-	dB
		Full	38	-	-	dB
V <sub>IO</sub> PSRR	ΔV <sub>S</sub> = ±1.25V	25	45	50	-	dB
		Full	42	-	-	dB
Non-Inv. Input Bias Current	+IN = 0V	25	-	25	40	μA
		Full	-	-	65	μA
+I <sub>BIAS</sub> Drift		Full	-	40	-	nA/°C
+I <sub>BIAS</sub> CMS	ΔV <sub>CM</sub> = ±2V	25	-	20	40	μA/V
		Full	-	-	50	μA/V
Inv. Input Bias Current	-IN = 0V	25	-	12	50	μA
		Full	-	-	60	μA
-I <sub>BIAS</sub> Drift		Full	-	40	-	nA/°C
-I <sub>BIAS</sub> CMS	ΔV <sub>CM</sub> = ±2V	25	-	1	7	μA/V
		Full	-	-	10	μA/V
-I <sub>BIAS</sub> PSS	ΔV <sub>S</sub> = ±1.25V	25	-	6	15	μA/V
		Full	-	-	27	μA/V
Non-Inv. Input Resistance		25	25	50	-	kΩ
Inv. Input Resistance		25	-	16	30	Ω
Input Capacitance	Either Input	25	-	2	-	pF
Input Common Mode Range		Full	±2.5	±3.0	-	V
Input Noise Voltage	100kHz	25	-	4	-	nV/√Hz
+Input Noise Current	100kHz	25	-	18	-	pA/√Hz
-Input Noise Current	100kHz	25	-	21	-	pA/√Hz
<b>TRANSFER CHARACTERISTICS</b> A <sub>V</sub> = +1, R <sub>F</sub> = 150Ω, R <sub>DAMP</sub> = 120Ω, Unless Otherwise Specified						
Open Loop Transimpedance		25	-	500	-	kΩ

## HFA1102

**Electrical Specifications**  $V_{SUPPLY} = \pm 5V$ ,  $A_V = +1$ ,  $R_F = 510\Omega$ ,  $R_L = 100\Omega$ ,  $C_{COMP} = 0pF$ ,  
Unless Otherwise Specified **(Continued)**

PARAMETER	TEST CONDITIONS	TEMP. (°C)	MIN	TYP	MAX	UNITS
Linear Phase Deviation	DC to 100MHz	25	-	0.6	-	Degrees
Differential Gain	NTSC, $R_L = 75\Omega$	25	-	0.03	-	%
Differential Phase	NTSC, $R_L = 75\Omega$	25	-	0.03	-	Degrees
Minimum Stable Gain		Full	1	-	-	V/V
Bandwidth Limiting Characteristics -3dB Bandwidth ( $V_{OUT} = 0.2V_{P-P}$ , $A_V = +1$ )	$C_{COMP} = 0pF$	25	-	600	-	MHz
	$C_{COMP} = 1pF$	25	-	350	-	MHz
	$C_{COMP} = 3pF$	25	-	190	-	MHz
	$C_{COMP} = 7pF$	25	-	55	-	MHz
Gain Flatness (To 30MHz)	$C_{COMP} = 0pF$	25	-	$\pm 0.01$	-	dB
	$C_{COMP} = 1pF$	25	-	$\pm 0.05$	-	dB
	$C_{COMP} = 3pF$	25	-	$\pm 0.10$	-	dB
Gain Flatness	To 100MHz	25	-	$\pm 0.05$	-	dB
Gain Flatness	To 50MHz	25	-	$\pm 0.02$	-	dB
<b>OUTPUT CHARACTERISTICS</b> $A_V = +2$ , Unless Otherwise Specified						
Output Voltage	$A_V = -1$	25	$\pm 3.0$	$\pm 3.3$	-	V
		Full	$\pm 2.5$	$\pm 3.0$	-	V
Output Current	$R_L = 50\Omega$ , $A_V = -1$	25	50	65	-	mA
		Full	40	60	-	mA
Closed Loop Output Impedance	DC	25	-	0.1	-	$\Omega$
2nd Harmonic Distortion	30MHz, $V_{OUT} = 2V_{P-P}$	25	-	-56	-	dBc
3rd Harmonic Distortion	30MHz, $V_{OUT} = 2V_{P-P}$	25	-	-80	-	dBc
3rd Order Intercept	100MHz	25	-	30	-	dBm
1dB Compression	100MHz	25	-	20	-	dBm
<b>TRANSIENT RESPONSE</b> $A_V = +1$ , $R_F = 150\Omega$ , $R_{DAMP} = 120\Omega$ , Unless Otherwise Specified						
Rise Time	$V_{OUT} = 2.0V$ Step	25	-	600	-	ps
Overshoot	$V_{OUT} = 2.0V$ Step	25	-	10	-	%
Slew Rate	$A_V = +1$ , $V_{OUT} = 5V_{P-P}$	25	-	1200	-	V/ $\mu s$
	$A_V = +2$ , $V_{OUT} = 5V_{P-P}$	25	-	2000	-	V/ $\mu s$
0.1% Settling Time	$V_{OUT} = 2V$ to $0V$	25	-	11	-	ns
0.2% Settling Time	$V_{OUT} = 2V$ to $0V$	25	-	7	-	ns
<b>POWER SUPPLY CHARACTERISTICS</b>						
Supply Voltage Range		Full	$\pm 4.5$	-	$\pm 5.5$	V
Supply Current		25	-	21	26	mA
		Full	-	-	33	mA

## Application Information

### Optimum Feedback Resistor ( $R_F$ )

All current feedback amplifiers require a feedback resistor, even for unity gain applications. The  $R_F$ , in conjunction with the internal compensation capacitor, sets the dominant pole of the frequency response. Thus, the amplifier's bandwidth is inversely proportional to  $R_F$ . The HFA1102 design is optimized for a  $150\Omega$   $R_F$ , at a gain of +1. Decreasing  $R_F$  in a unity gain application decreases stability, leading to excessive peaking and overshoot. At higher gains the amplifier is more stable, so  $R_F$  can be decreased in a trade-off of stability for bandwidth.

### Bandwidth Limiting

The bandwidth of the HFA1102 may be limited by connecting a resistor ( $R_{DAMP}$ ) and capacitor in series from pin 8 to GND. The series resistor is required to damp the interaction between the package parasitics and  $C_{COMP}$ . Typical bandwidths for various values of compensation capacitor are shown in the specification tables. Because the HFA1102 is already unity gain stable, the main reason for limiting the bandwidth is to reduce the total noise (broadband) of the circuit. Additionally, compensating the HFA1102 allows the use of a lower value  $R_F$  for a given gain. The decreased bandwidth due to  $C_{COMP}$  offsets the bandwidth increase from the lower  $R_F$ , keeping the amplifier stable. Reducing  $R_F$  provides the double benefits of reduced DC errors ( $-I_B \times R_F$ ) and reduced total noise ( $I_{NI} \times R_F$  and  $4KTR_F$ ).

### PC Board Layout

The frequency performance of this amplifier depends a great deal on the amount of care taken in designing the PC board.

**The use of low inductance components such as chip resistors and chip capacitors is strongly recommended, while a solid ground plane is a must!**

Attention should be given to decoupling the power supplies. A large value ( $10\mu F$ ) tantalum in parallel with a small value chip ( $0.1\mu F$ ) capacitor works well in most cases.

Terminated microstrip signal lines are recommended at the input and output of the device. Output capacitance, such as that resulting from an improperly terminated transmission line will degrade the frequency response of the amplifier and may cause oscillations. In most cases, the oscillation can be avoided by placing a resistor in series with the output.

Care must also be taken to minimize the capacitance to ground seen by the amplifier's inverting input. The larger this capacitance, the worse the gain peaking, resulting in pulse overshoot and possible instability. To this end, it is recommended that the ground plane be removed under traces connected to pin 2, and connections to pin 2 should be kept as short as possible.

An example of a good high frequency layout is the Evaluation Board shown.

### Evaluation Board

The HFA1102 may be evaluated using the HFA11XX Evaluation Board which is available from your local sales office (part number HFA11XXEVAL).  $R_{DAMP}$  and  $C_{COMP}$  should be connected in series from the socket pin to the GND plane. The trace from pin 8 to the  $V_H$  connector should be cut near the socket to remove this parallel capacitance. The layout and schematic of the board are shown below:

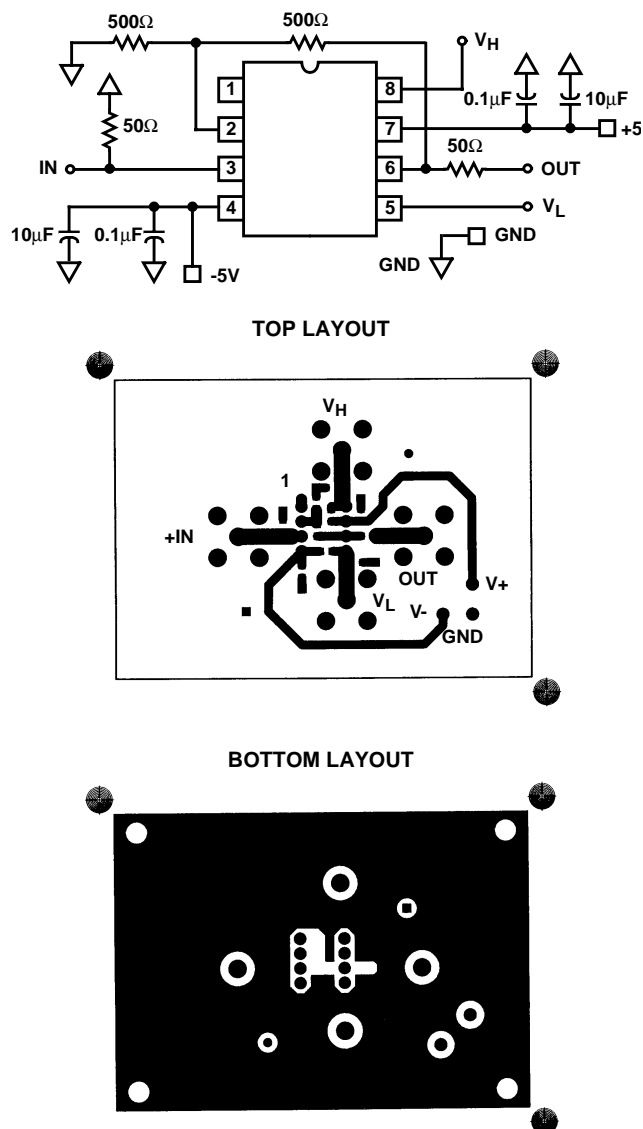


FIGURE 1. EVALUATION BOARD SCHEMATIC AND LAYOUT

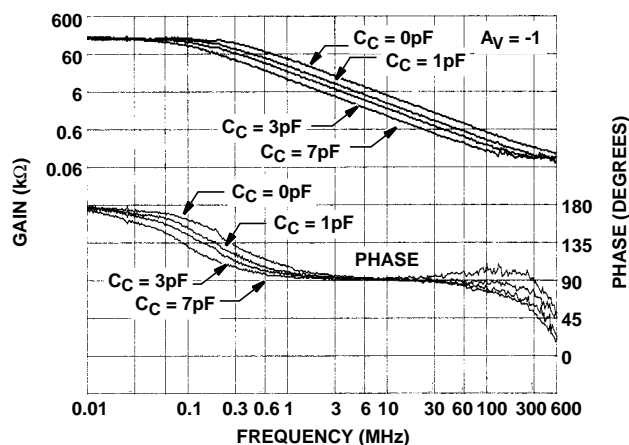


FIGURE 2. OPEN LOOP TRANSIMPEDANCE FOR VARIOUS COMPENSATION CAPACITORS

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