HARRIS

HA-5110/5115

Wideband, JFET Input, Uncompensated, Operational Amplifier

Not Recommended For New Designs See HA-5160

FEATURES

- WIDE GAIN BANDWIDTH 60MHz
- HIGH SLEW RATE 50V/μs
- SETTLING TIME 850ns
- POWER BANDWIDTH 800KHz
- OFFSET VOLTAGE 0.5mV
- BIAS CURRENT 50pA

APPLICATIONS

- VIDEO AND RF AMPLIFIERS
- DATA ACQUISITION
- PULSE AMPLIFIERS
- PRECISION SIGNAL GENERATION

DESCRIPTION

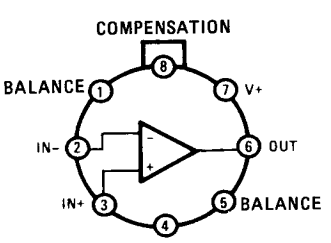
HA-5110/5115 are wideband, uncompensated, operational amplifiers manufactured with FET/Bipolar technologies and dielectric isolation. These monolithic amplifiers feature superior high frequency capabilities further enhanced by precision laser trimming of the input stage to provide excellent input characteristics. These devices are controlled at closed loop gains greater than 10 without compensation.

With excellent dynamic and input characteristics, HA-5110/5115 are well suited for many wideband, pulse, and video applications. These amplifiers are ideal components for video and RF circuitry requiring up to 60MHz gain-bandwidth-product and 800KHz power bandwidth. 50V/μs slew rate and 850ns settling time make these devices useful in pulse amplification and data acquisition designs. HA-5110/5115's 0.5mV offset voltage, 10pA offset current, and extremely high impedance coupled with excellent AC parameters make these amplifiers ideal selections for accurate signal conditioning designs. For applications requiring less critical input characteristics, HA-5115 is available in untrimmed form.

HA-5110/5115 are available in metal can (TO-99) packages. Suffix -2 denotes a range to -55°C to +125°C and -5 denotes a 0°C to +75°C range.

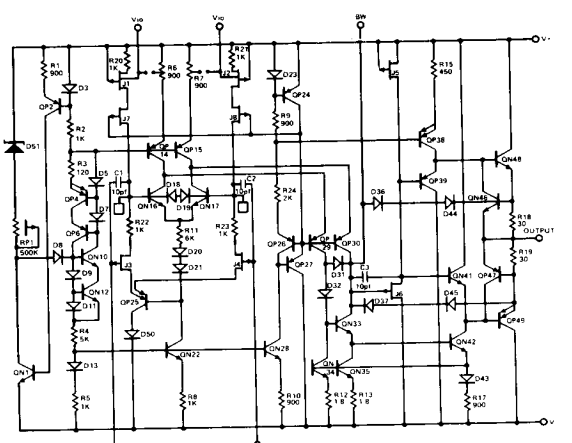
PINOUT

TOP VIEW



Case Connected to V-

SCHEMATIC



This Material Copyrighted By Its Respective Manufacturer

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Voltage Between V^+ and V^-	40V	Internal Power Dissipation (Note 2)	510mW
Differential Input Voltage	±40V	Storage Temperature Range	-65°C to +150°C
Peak Output Current	Full Short Circuit Protection		

ELECTRICAL CHARACTERISTICS

$V+ = 15VDC$; $V- = -15VDC$
Parameters are guaranteed at indicated ambient temperature after warm-up.

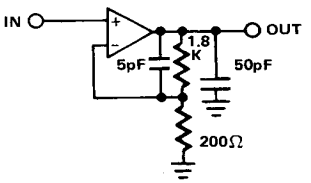
		HA-5110-2 -55°C to +125°C			HA-5110-5 0°C to +75°C			HA-5115-5 0°C to +75°C			
PARAMETER	TEMP	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS											
Offset Voltage	+25°C		0.5	1.0		0.5	1.0		0.5	1.5	mV
	Full		0.50	2.0		0.50	2.0		0.75	3.5	mV
Offset Voltage Average Drift	Full		5			10			15		µV/°C
Bias Current	+25°C		20	50		20	50		50	100	pA
	Full		5	10			10		10	20	nA
Offset Current	+25°C		2	10		2	10		5	50	pA
	Full		2	5		2	5		5	10	nA
Input Resistance	+25°C		10^{12}			10^{12}			10^{12}		Ω
Common Mode Range	Full	±10	±11		±10	±11		±10	±10.5		V
TRANSFER CHARACTERISTICS											
Large Signal Voltage Gain (Note 3)	+25°C	75K	150K		75K	150K		50K	100K		V/V
	Full	60K	100K		60K	100K		40K	80K		V/V
Common Mode Rejection Ratio (Note 4)	Full	80	86		80	86		80	86		dB
Gain Bandwidth Product (A_V = 10)	Full		60			60			50		MHz
OUTPUT CHARACTERISTICS											
Output Voltage Swing (Note 5)	+25°C	±12	±13		±12	±13		±11	±12		V
	Full	±12	±13		±12	±13		±11	±12		V
Output Current (Note 6)	+25°C	±10	±15		±10	±15		±8	±15		mA
Full Power Bandwidth (Note 7)	+25°C	550	625		550	625		550	625		kHz
Output Resistance (Note 8)	+25°C		30			30			40		Ω
TRANSIENT RESPONSE (Note 9)											
Rise Time (A_V = 10)	+25°C		20			20			20		nsec
Slew Rate (A_V = 10)	+25°C	35	50		35	50		35	40		V/µsec
Settling Time (Note 10)	+25°C		.85			.85			1.0		µsec
POWER SUPPLY CHARACTERISTICS											
Supply Current	Full		5	7		5	7		6	8	mA
Power Supply Rejection Ratio (Note 11)	+25°C	80	94		80	94		80	94		dB

NOTES:

1. Absolute maximum ratings are limiting values, applied individually, beyond which the serviceability of the circuit may be impaired. Functional operability under any of these conditions is not necessarily implied.
2. Derate at 6.8mW/°C for operation at ambient temperatures above +75°C.
3. $V_{OUT} = ±10V$. $R_L = 2K$
4. $V_{CM} = ±10$ V.D.C.
5. $R_L = 10K$
6. $V_{OUT} = 0V$
7. $R_L = 2K$; Full power bandwidth guaranteed, based on slew rate measurement using $FPBW = \frac{SLEW\ RATE}{2\pi V_{PEAK}}$
8. Output resistance measured under open loop conditions.
9. Refer to Test Circuits section of the data sheet.
10. Settling Time is measured to 0.1% of final value for a 10 volt output step and $A_V = -10$.
11. $V_{SUPP} = ±10$ V.D.C. to ±20 V.D.C.

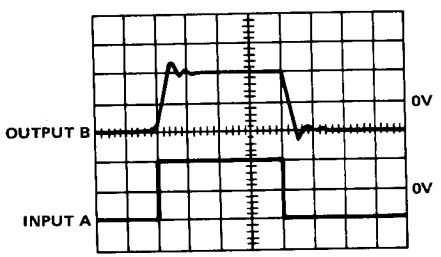
This Material Copyrighted By Its Respective Manufacturer

LARGE AND SMALL SIGNAL RESPONSE CIRCUIT



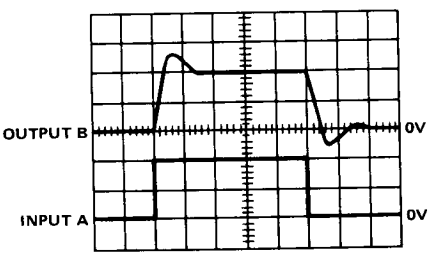
LARGE SIGNAL RESPONSE

Vertical Scale: (Volts: A=.5V/Div,B=5V/Div.)
Horizontal Scale: (Time: 500ns/Div.)

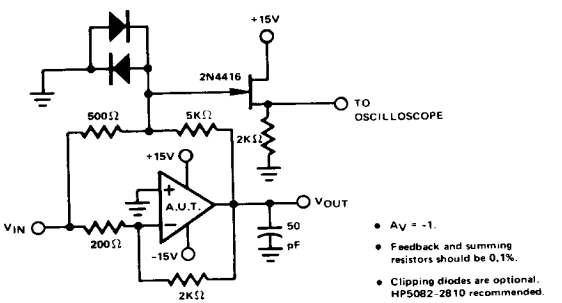


SMALL SIGNAL RESPONSE

Vertical Scale: (Volts: A=10mV/Div., B=100mV/Div.)
Horizontal Scale: (Time: 100ns/Div.)



SETTLING TIME CIRCUIT



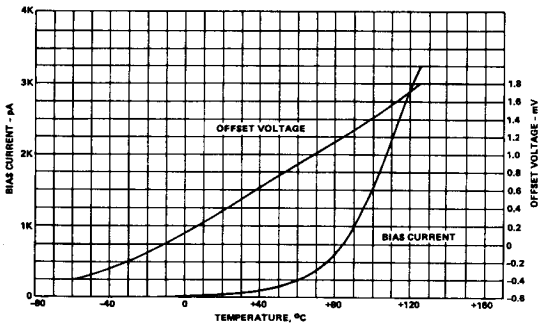
- $A_V = -1$.
- Feedback and summing resistors should be 0.1%.
- Clipping diodes are optional. HP5082-2810 recommended.

This Material Copyrighted By Its Respective Manufacturer

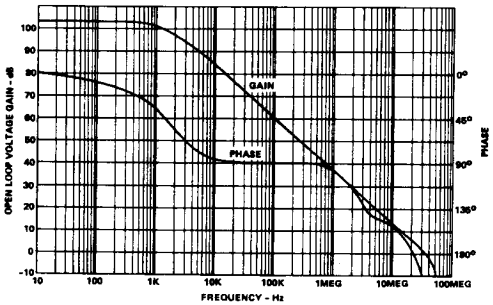
PERFORMANCE CURVES

V+ = +15V, V- = -15V, T_A = +25°C Unless Otherwise Stated.

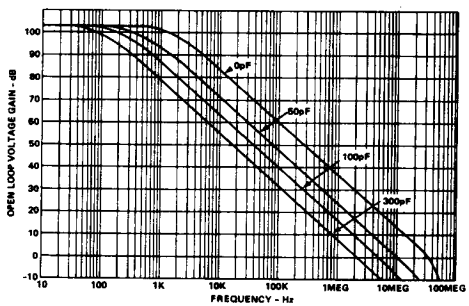
INPUT OFFSET VOLTAGE AND BIAS CURRENT vs. TEMPERATURE



OPEN LOOP FREQUENCY RESPONSE

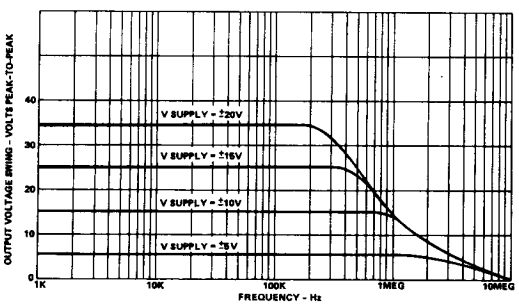


OPEN LOOP FREQUENCY RESPONSE FOR VARIOUS COMPENSATION CAPACITORS

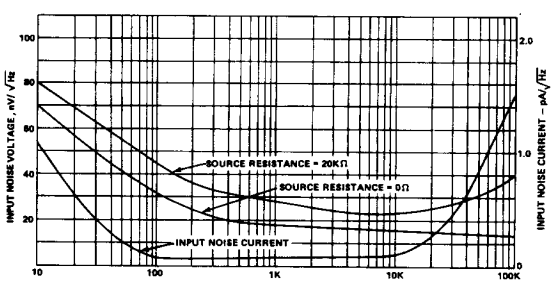


NOTE: External compensation components are not required for closed loop gains > 10, but may be added to reduce bandwidth if desired.

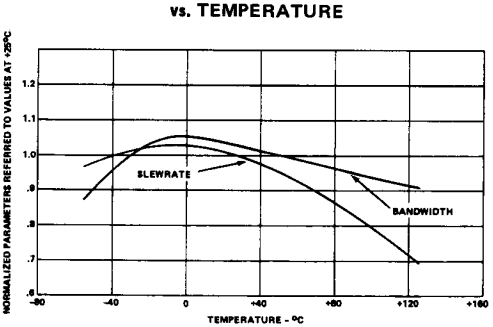
OUTPUT VOLTAGE SWING vs. FREQUENCY



INPUT NOISE VOLTAGE AND NOISE CURRENT vs. FREQUENCY

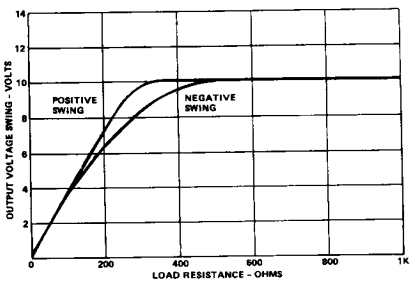


NORMALIZED AC PARAMETERS vs. TEMPERATURE

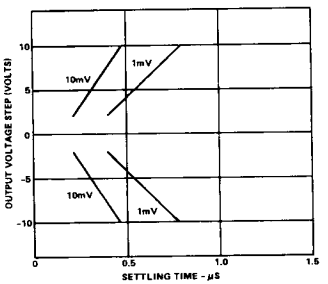


This Material Copyrighted By Its Respective Manufacturer

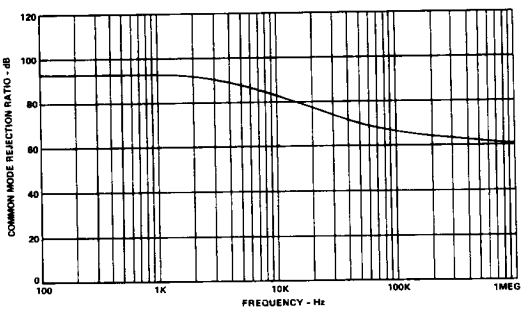
OUTPUT VOLTAGE SWING
vs. LOAD RESISTANCE



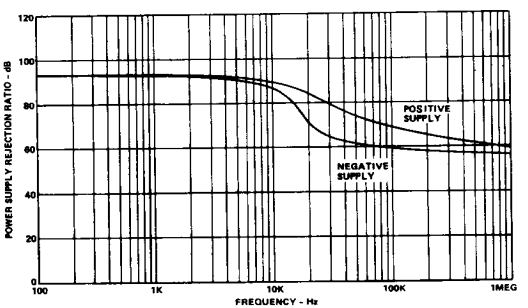
SETTLING TIME FOR VARIOUS
OUTPUT STEP VOLTAGES



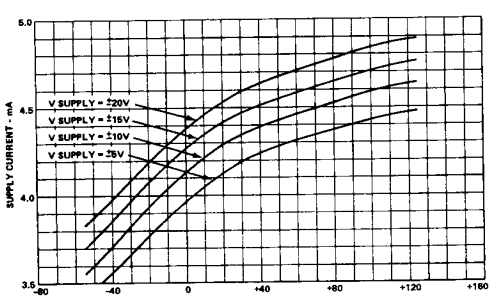
COMMON MODE REJECTION
RATIO vs. FREQUENCY



POWER SUPPLY REJECTION
RATIO vs. FREQUENCY



POWER SUPPLY CURRENT
vs. TEMPERATURE



This Material Copyrighted By Its Respective Manufacturer

APPLYING THE HA-5110/5115

1. POWER SUPPLY DECOUPLING: Although not absolutely necessary, it is recommended that all power supply lines be decoupled with .01 μF ceramic capacitors to ground. Decoupling capacitors should be located as near to the amplifier terminals as possible.

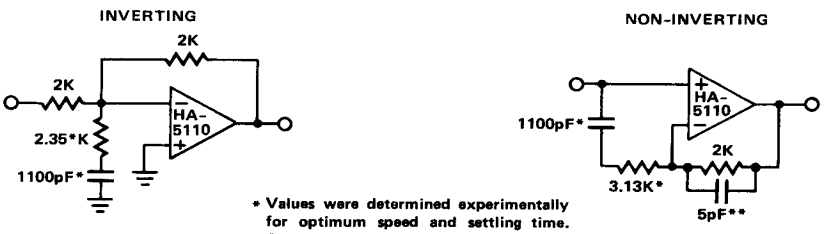
2. STABILITY CONSIDERATIONS: In applications where large value feedback resistors are used, a small compacitor ($\approx$ 3pF) may be needed in parallel with the feedback resistor to neutralize the pole introduced by the input capacitance.

3. HEAVY CAPACITIVE LOADS: When driving heavy capacitive loads ($\geq$ 100pF) a small capacitor ($\approx$ 10pF) should be connected in parallel with the feedback resistor.

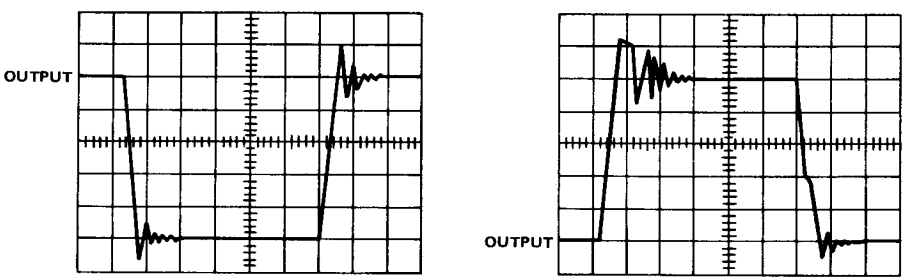
4. OFFSET VOLTAGE NULLING: Offset nulling, if required, is accomplished with a 100KΩ pot between pins 1 and 5; wiper to V+. Alteration of initial offset voltage may affect the temperature coefficient of the offset voltage.

APPLICATIONS

SUGGESTED COMPENSATION FOR UNITY GAIN STABILITY

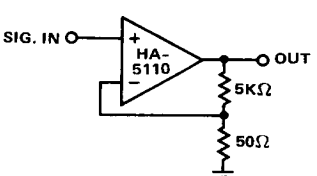


* Values were determined experimentally for optimum speed and settling time.
** Optional

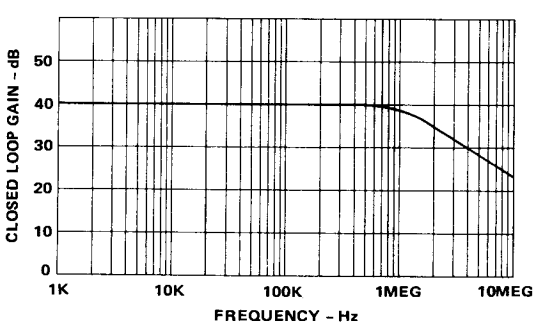


Vertical Scale: (Volts: 2V/Div.)
Horizonal Scale: (Time: 500ns/Div.)

40dB, 1MHz BANDWIDTH AMPLIFIER



CLOSED LOOP FREQUENCY RESPONSE (A_V = 100)



This Material Copyrighted By Its Respective Manufacturer