μA102 • μA302 • μA110 • μA310

VOLTAGE FOLLOWER OPERATIONAL AMPLIFIER

FAIRCHILD LINEAR INTEGRATED CIRCUITS

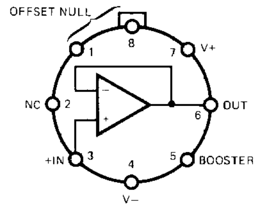
GENERAL DESCRIPTION – The μA102/302 and μA110/310 are monolithic Operational Amplifiers internally connected as unity gain non-inverting amplifiers. They are constructed using the Fairchild Planar* epitaxial process. These circuits are ideal for such applications as fast sample and hold circuits, active filters, or as general purpose buffers. Super-beta transistors are used allowing the devices to operate at very low input currents without sacrificing speed. They may be used interchangeably with the μA101 and the μA741 in voltage follower applications. The μA110/310 are suggested for new designs and are direct replacements for the μA102/302. They feature lower offset voltage, drift, bias current, noise, plus higher speed and a wider operating voltage range.

- **HIGH SLEW RATE – 30 V/μs**
- **LOW INPUT CURRENT**
- **INTERNALLY COMPENSATED**
- **PLUG-IN REPLACEMENT FOR BOTH THE μA101 AND μA741 VOLTAGE FOLLOWER APPLICATIONS**
- **WIDE RANGE OF SUPPLY VOLTAGES**

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±18 V
Internal Power Dissipation (Note 1)	500 mW
Input Voltage (Note 2)	±15 V
Output Short Circuit Duration (Note 3)	Indefinite
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	
Military (μA102, μA110)	−55°C to +125°C
Commercial (μA302, μA310)	0°C to +70°C
Pin Temperature (Soldering, 60 s)	300°C

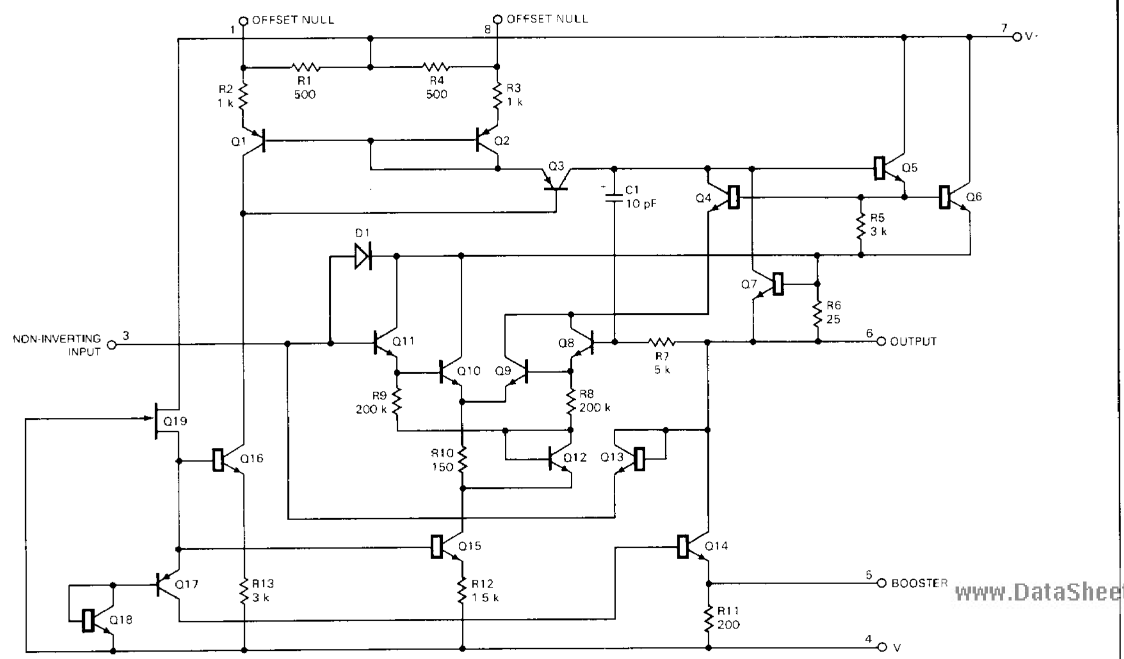
CONNECTION DIAGRAM
8-PIN METAL CAN
(TOP VIEW)
PACKAGE OUTLINE 5S
PACKAGE CODE H



ORDER INFORMATION

TYPE	PART NO.
μA102	μA102HM
μA302	μA302HC
μA110	μA110HM
μA310	μA310HC

EQUIVALENT CIRCUIT



See notes on following pages

*Planar is a patented Fairchild process.

μA102

ELECTRICAL CHARACTERISTICS: $V_S = \pm 15$ V, $T_A = 25°C$, $C_L \leq 100$ pF, unless otherwise specified.

CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Offset Voltage			2.0	5.0	mV
Average Temperature Coefficient of Offset Voltage			6.0		μV/°C
Input Current			3.0	10	nA
Input Resistance		10^{10}	10^{12}		Ω
Voltage Gain	$R_L \geq 10$ kΩ	0.999	0.9996		
Output Resistance			0.8	2.5	Ω
Output Voltage Swing (Note 4)	$R_L \geq 8$ kΩ	±10	±13		V
Supply Current			3.5	5.5	mA
Positive Supply Rejection		60			dB
Negative Supply Rejection		70			dB
Input Capacitance				3.0	pF
Offset Voltage	$-55°C \leq T_A \leq 125°C$			7.5	mV
Input Current	$T_A = 125°C$		3.0	10	nA
	$T_A = -55°C$		30	100	nA
Voltage Gain	$-55°C \leq T_A \leq 125°C$ $R_L \geq 10$ kΩ	0.999			
Output Voltage Swing	$R_L \geq 10$ kΩ	±10			V
Supply Current	$T_A = 125°C$		2.6	4.0	mA

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μA302

ELECTRICAL CHARACTERISTICS: $V_S = \pm 15$ V, $T_A = 25°C$, $C_L \leq 100$ pF, unless otherwise specified.

CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Offset Voltage			5.0	15	mV
Average Temperature Coefficient of Offset Voltage			20		μV/°C
Input Current			10	30	nA
Input Resistance		10^9	10^{12}		Ω
Voltage Gain	$R_L > 8$ kΩ	0.9985	0.9995	1.000	
Output Resistance			0.8	2.5	Ω
Output Voltage Swing (Note 4)	$R_L \geq 8$ kΩ	±10			V
Supply Current			3.5	5.5	mA
Positive Supply Rejection		60			dB
Negative Supply Rejection		70			dB
Input Capacitance			3.0		pF
Offset Voltage	$0°C \leq T_A \leq 70°C$			20	mV
Input Current	$T_A = 70°C$		3.0	15	nA
	$T_A = 0°C$		20	50	nA

μA110

ELECTRICAL CHARACTERISTICS: $\pm5.0\ V \leq V_S \leq \pm18\ V$, $-55°C < T_A \leq +125°C$, unless otherwise specified.

CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$T_A = 25°C$		1.5	4.0	mV
Input Bias Current	$T_A = 25°C$		1.0	3.0	nA
Input Resistance	$T_A = 25°C$	10^{10}	10^{12}		Ω
Input Capacitance			1.5		pF
Large Signal Voltage Gain	$T_A = 25°C$, $V_S = \pm15\ V$ $V_{OUT} = \pm10\ V$, $R_L = 8\ k\Omega$	0.999	0.9999		
Output Resistance	$T_A = 25°C$		0.75	2.5	Ω
Supply Current	$T_A = 25°C$		3.9	5.5	mA
Input Offset Voltage				6.0	mV
Offset Voltage Temperature Drift	$-55°C \leq T_A \leq 85°C$		6.0		μV/°C
	$T_A = 125°C$		12		μV/°C
Input Bias Current				10	nA
Large Signal Voltage Gain	$V_S = \pm15\ V$, $V_{OUT} = \pm10\ V$ $R_L = 10\ k\Omega$	0.999			
Output Voltage Swing (Note 4)	$V_S = \pm15\ V$, $R_L = 10\ k\Omega$	±10			V
Supply Current	$T_A = 125°C$		2.0	4.0	mA
Supply Voltage Rejection Ratio	$\pm5\ V \leq V_S \leq \pm18\ V$	70	80		dB

μA310

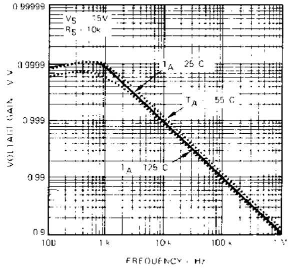
ELECTRICAL CHARACTERISTICS: $\pm5.0\ V \leq V_S \leq \pm18\ V$, $0°C \leq T_A \leq +70°C$, unless otherwise specified.

CHARACTERISTICS	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$T_A = 25°C$		2.5	7.5	mV
Input Bias Current	$T_A = 25°C$		2.0	7.0	nA
Input Resistance	$T_A = 25°C$	10^{10}	10^{12}		Ω
Input Capacitance			1.5		pF
Large Signal Voltage Gain	$T_A = 25°C$, $V_S = \pm15\ V$ $V_{OUT} = \pm10\ V$, $R_L = 8\ k\Omega$	0.999	0.9999		
Output Resistance	$T_A = 25°C$		0.75	2.5	Ω
Supply Current	$T_A = 25°C$		3.9	5.5	mA
Input Offset Voltage				10	mV
Offset Voltage Temperature Drift			10		μV/°C
Input Bias Current				10	nA
Large Signal Voltage Gain	$V_S = \pm15\ V$, $V_{OUT} = \pm10\ V$ $R_L = 10\ k\Omega$	0.999			
Output Voltage Swing (Note 4)	$V_S = \pm15\ V$, $R_L = 10\ k\Omega$	±10			V
Supply Voltage Rejection Ratio	$\pm5\ V \leq V_S \leq \pm18\ V$	70	80		dB

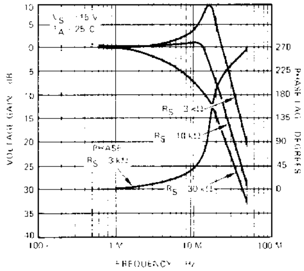
NOTES:
1. Rating applies to ambient temperatures up to +70°C. Above +70°C ambient, derate linearly at 6.3 mW/°C.
2. For supply voltages less than ±15 V, the absolute maximum input voltage is equal to the supply voltage.
3. For 102 and 110 continuous short circuit is allowed for case temperature of +125°C and ambient temperature to +70°C. For 302 and 310 continuous short circuit is allowed for case temperature to +70°C and ambient temperature to +55°C. It is necessary to insert a resistor greater than 2 kΩ in series with the input when the amplifier is driven from low impedance sources to prevent damage when the output is shorted.
4. Increased output swing under load can be obtained by connecting an external resistor between the booster and V− terminals (see curve).

TYPICAL PERFORMANCE CURVES FOR μA102 • μA302 • μA110 • μA310

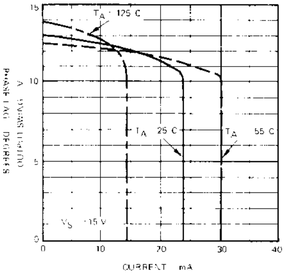
VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



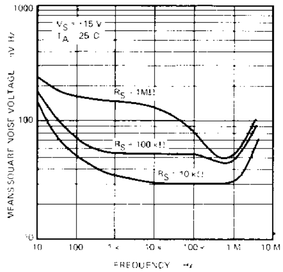
VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



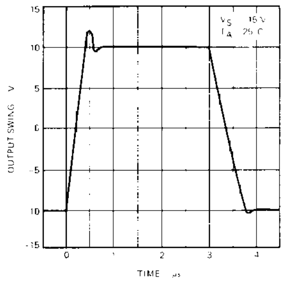
POSITIVE OUTPUT SWING AS A FUNCTION OF CURRENT



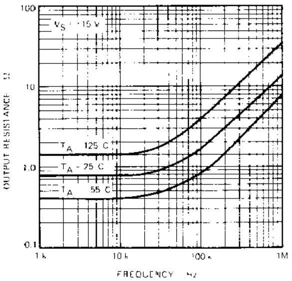
OUTPUT NOISE VOLTAGE AS A FUNCTION OF FREQUENCY



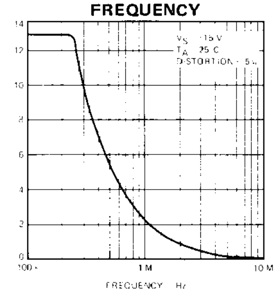
LARGE SIGNAL PULSE RESPONSE



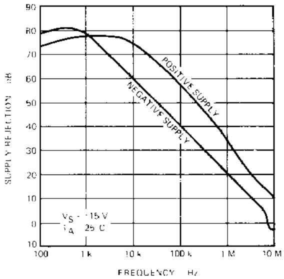
OUTPUT RESISTANCE AS A FUNCTION OF FREQUENCY



LARGE SIGNAL FREQUENCY RESPONSE AS A FUNCTION OF FREQUENCY



POWER SUPPLY REJECTION AS A FUNCTION OF FREQUENCY



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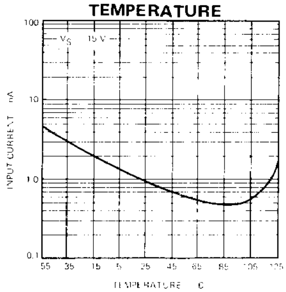
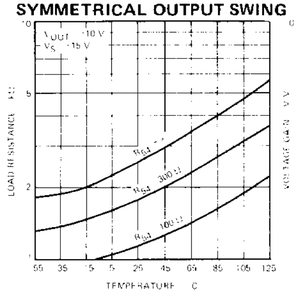
TYPICAL PERFORMANCE CURVES FOR μA102 • μA110

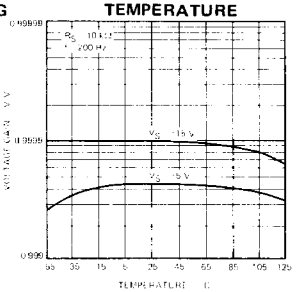
INPUT CURRENT AS A FUNCTION OF TEMPERATURE



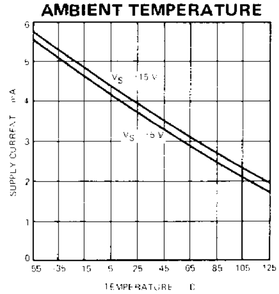
SYMMETRICAL OUTPUT SWING



VOLTAGE GAIN AS A FUNCTION OF TEMPERATURE

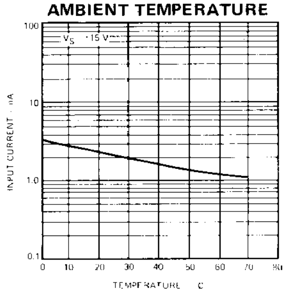


SUPPLY CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE

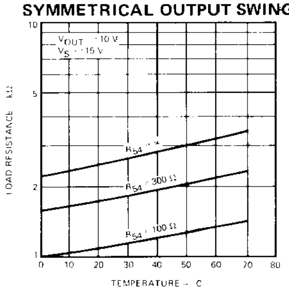


TYPICAL PERFORMANCE CURVES FOR μA302 • μA310

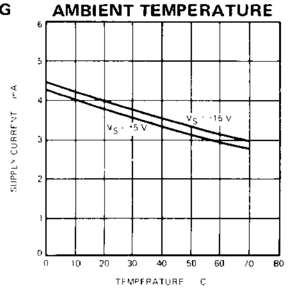
INPUT CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE



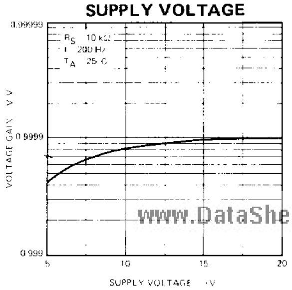
SYMMETRICAL OUTPUT SWING



SUPPLY CURRENT AS A FUNCTION OF AMBIENT TEMPERATURE

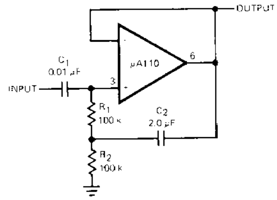


VOLTAGE GAIN AS A FUNCTION OF SUPPLY VOLTAGE

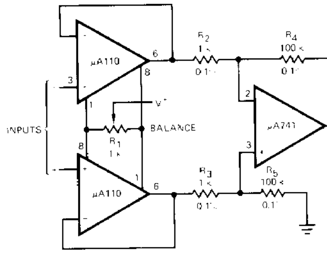


TYPICAL APPLICATIONS

HIGH INPUT IMPEDANCE AC AMPLIFIER



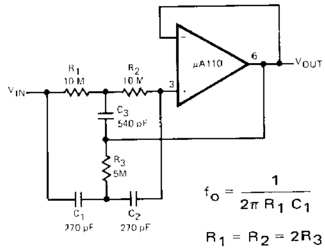
DIFFERENTIAL INPUT INSTRUMENTATION AMPLIFIER



$$\frac{R_4}{R_2} = \frac{R_5}{R_3}$$

$$A_V = \frac{R_4}{R_2}$$

HIGH Q NOTCH FILTER

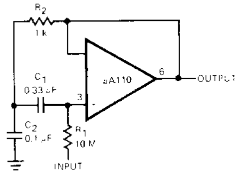


$$f_o = \frac{1}{2\pi R_1 C_1}$$

$$R_1 = R_2 = 2R_3$$

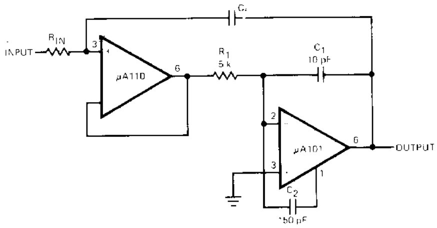
$$C_1 = C_2 = \frac{C_3}{2}$$

BANDPASS FILTER

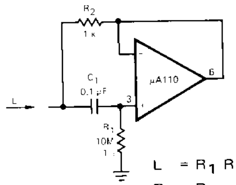


$$f_o = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}}$$

FAST INTEGRATOR WITH LOW INPUT CURRENT



SIMULATED INDUCTOR

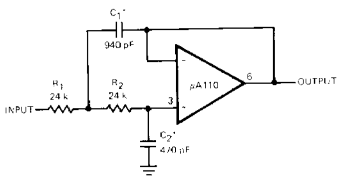


$$L = R_1 R_2 C_1$$

$$R_S = R_2$$

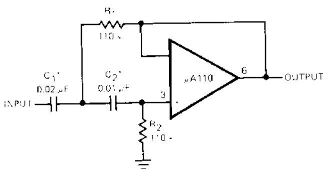
$$R_P = R_1$$

LOW PASS ACTIVE FILTER



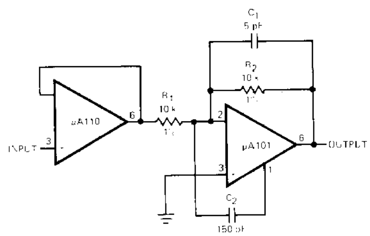
*Values are for 10 kHz cutoff. Use silvered mica capacitors for good temperature stability.

HIGH PASS ACTIVE FILTER

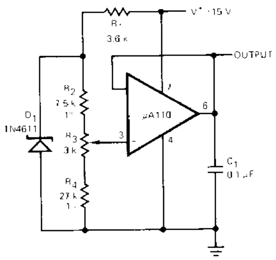


*Values are 100 Hz cutoff. Use metalized polycarbonate capacitors for good temperature stability

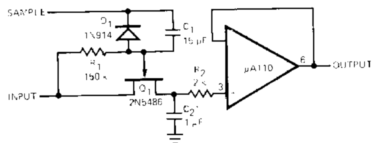
FAST INVERTING AMPLIFIER WITH HIGH INPUT IMPEDANCE



BUFFERED REFERENCE SOURCE

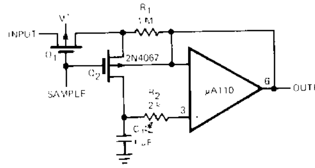


SAMPLE AND HOLD



*Use capacitor with polycarbonate teflon or polyethylene dielectric.

LOW DRIFT SAMPLE AND HOLD**



*Teflon, polyethylene or polycarbonate dielectric capacitor

**Worst case drift less than 3 mV/s