

μA798

DUAL OPERATIONAL AMPLIFIERS

FAIRCHILD LINEAR INTEGRATED CIRCUITS

GENERAL DESCRIPTION — The μA798 is a monolithic pair of independent, high gain, internally frequency compensated operational amplifiers designed to operate from a single power supply or dual power supplies over a wide range of voltages. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage. They are constructed using the Fairchild Planar® epitaxial process.

- INPUT COMMON MODE VOLTAGE RANGE INCLUDES GROUND OR NEGATIVE SUPPLY
- OUTPUT VOLTAGE CAN SWING TO GROUND OR NEGATIVE SUPPLY
- INTERNALLY COMPENSATED
- WIDE POWER SUPPLY RANGE: SINGLE SUPPLY OF 3.0 TO 36 V
DUAL SUPPLY OF ±1.5 TO ±18 V
- CLASS AB OUTPUT STAGE FOR MINIMAL CROSSOVER DISTORTION
- SHORT CIRCUIT PROTECTED OUTPUT
- HIGH OPEN LOOP GAIN — 200 k
- EXCEEDS 1458 TYPE PERFORMANCE

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Between V+ and V-	36 V
Differential Input Voltage (Note 1)	±30 V
Input Voltage (V-) (Note 1)	-0.3 V (V-) to V+
Internal Power Dissipation (Note 2)	
Metal Can, Hermetic Mini DIP	500 mW
Molded Mini DIP	310 mW
Operating Temperature Range	
Commercial (C)	0°C to +70°C
Military (M)	-55°C to +125°C
Storage Temperature Range	
Molded Package (9T)	-55°C to +125°C
Hermetic Package (5S, 6T)	-65°C to +150°C
Lead Temperature	
Molded Package (Soldering, 10 s)	260°C
Hermetic Package (Soldering, 60 s)	300°C
Output Short Circuit Duration	Note 5

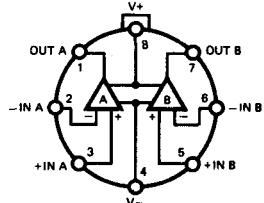
CONNECTION DIAGRAMS

8-LEAD METAL CAN

(TOP VIEW)

PACKAGE OUTLINE 5S

PACKAGE CODE H



ORDER INFORMATION

TYPE PART NO.

μA798 μA798HM

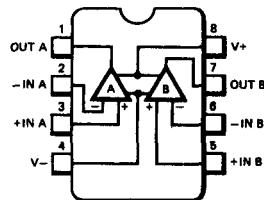
μA798C μA798HC

8-LEAD MINI DIP

(TOP VIEW)

PACKAGE OUTLINE 6T 9T

PACKAGE CODE R T



ORDER INFORMATION

TYPE PART NO.

μA798 μA798RM

μA798C μA798RC

μA798C μA798TC

*Planar is a patented Fairchild process.

μA798

ELECTRICAL CHARACTERISTICS ($V_S = \pm 15 V$, $T_A = 25^\circ C$ unless otherwise noted)

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	5.0	mV
Input Offset Current			10	25	nA
Input Bias Current			-50	-100	nA
Input Impedance	$f = 20 \text{ Hz}$	0.3	1.0		MΩ
Input Common Mode Voltage Range		+13 to $-V_S$	+13.5 to $-V_S$		V
Common Mode Rejection Ratio	$R_S < 10 \text{ k}\Omega$	70	90		dB
Large Signal Open Loop Voltage Gain	$V_{OUT} = \pm 10 V$, $R_L = 2 \text{ k}\Omega$	50	200		V/mV
Power Bandwidth	$A_V = 1$, $R_L = 2 \text{ k}\Omega$, $V_{OUT} = 20 \text{ V pk-pk}$		9.0		kHz
Small Signal Bandwidth	$A_V = 1$, $R_L = 10 \text{ k}\Omega$, $V_{OUT} = 50 \text{ mV}$		1.0		MHz
Slew Rate	$A_V = 1$, $V_{IN} = -10 \text{ V}$ to $+10 \text{ V}$		0.6		V/μs
Rise Time	$A_V = 1$, $R_L = 10 \text{ k}\Omega$, $V_{OUT} = 50 \text{ mV}$		0.3		μs
Fall Time	$A_V = 1$, $R_L = 10 \text{ k}\Omega$, $V_{OUT} = 50 \text{ mV}$		0.3		μs
Overshoot	$A_V = 1$, $R_L = 10 \text{ k}\Omega$, $V_{OUT} = 50 \text{ mV}$		20		%
Phase Margin	$A_V = 1$, $R_L = 2 \text{ k}\Omega$, $C_L = 200 \text{ pF}$		60		Degree
Crossover Distortion at $f = 10 \text{ kHz}$	$V_{IN} = 30 \text{ mV pk-pk}$, $V_{OUT} = 2 \text{ V pk-pk}$		1.0		%
Output Voltage Range	$R_L = 10 \text{ k}\Omega$	±13	±14		V
	$R_L = 2 \text{ k}\Omega$	±12	±13.5		V
Individual Output Short Circuit Current (Note 3)		±20	±30		mA
Output Impedance	$f = 20 \text{ Hz}$		800		Ω
Power Supply Rejection Ratio	Positive		30	150	μV/V
	Negative		30	150	μV/V
Power Supply Current	$V_{OUT} = 0$, $R_L = \infty$		2.0	3.0	mA
The following specification apply for $-55^\circ C \leq T_A \leq +125^\circ C$					
Input Offset Voltage				6.0	mV
Average Temperature Coefficient of Input Offset Voltage			10		μV/°C
Input Offset Current				200	nA
Average Temperature Coefficient of Input Offset Current			50		pA/°C
Input Bias Current				-300	nA
Large Signal Open Loop Voltage Gain	$R_L = 2 \text{ k}\Omega$, $V_{OUT} = \pm 10 \text{ V}$	25	300		V/mV
Output Voltage Range	$R_L = 2 \text{ k}\Omega$	±10			V

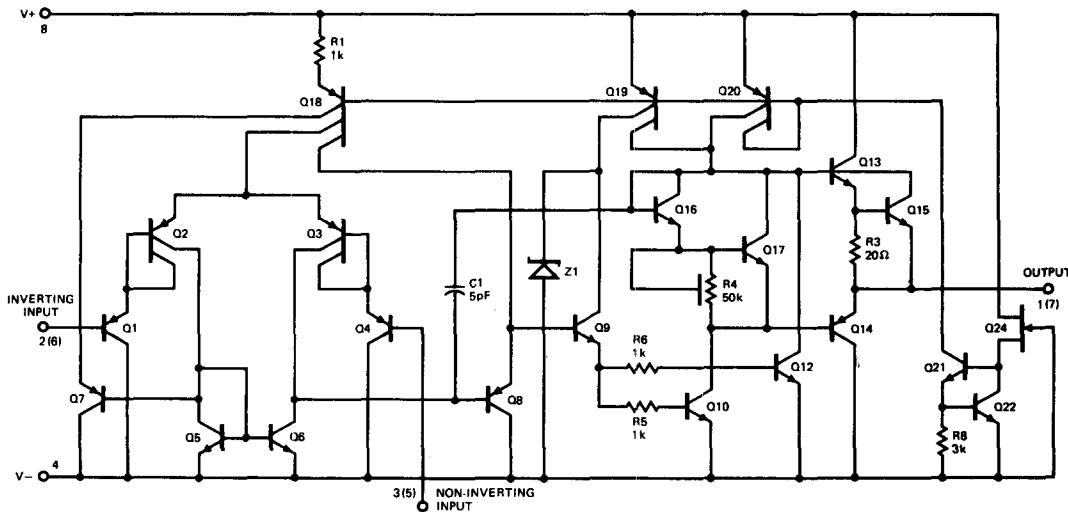
ELECTRICAL CHARACTERISTICS ($V_S = +5 V$ and Ground, $T_A = 25^\circ C$ unless otherwise noted)

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	5.0	mV
Input Offset Current			30	100	nA
Input Bias Current			-200	-500	nA
Large Signal Open Loop Voltage Gain	$R_L = 2 \text{ k}\Omega$	20	200		V/mV
Power Supply Rejection Ratio				150	μV/V
Output Voltage Range (Note 4)	$R_L = 10 \text{ k}\Omega$ $R_L = 10 \text{ k}\Omega$, $5.0 \text{ V} \leq V_S \leq 30 \text{ V}$	3.5 (V+) - 1.5			V pk-pk V pk-pk
Output Sink Current	$V_{IN} \leq -10 \text{ mV}$, $V_{OUT} = 400 \text{ mV}$	1.0			mA
Power Supply Current			2.0	3.0	mA
Channel Separation	$f = 1 \text{ kHz}$ to 20 kHz (Input Referenced)		-120		dB

NOTES:

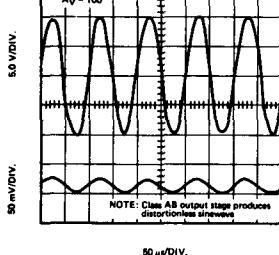
- For supply voltage less than 30 V between V_+ and V_- , the absolute maximum input voltage is equal to the supply voltage.
- Rating applies to ambient temperature up to $70^\circ C$. Above $T_A = 70^\circ C$, derate linearly $6.3 \text{ mW}/^\circ C$ for the Metal Can (5S) and Hermetic Mini DIP (6T), $5.6 \text{ mW}/^\circ C$ for the Molded Mini DIP (9T).
- Not to exceed maximum package power dissipation.
- Output will swing to ground.
- Indefinite on shorts to ground or V_- supply. Shorts to V_+ supply may result in power dissipation exceeding the absolute maximum rating.

1/2 OF EQUIVALENT CIRCUIT

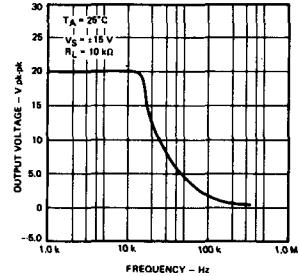


TYPICAL PERFORMANCE CURVES

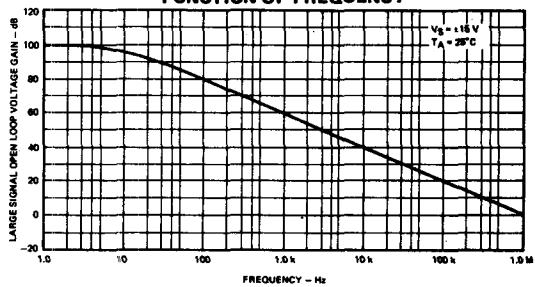
SINEWAVE RESPONSE



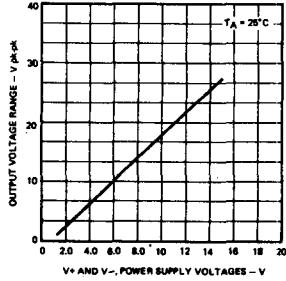
OUTPUT VOLTAGE AS A FUNCTION OF FREQUENCY



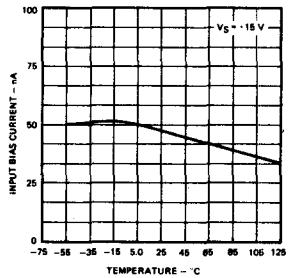
LARGE SIGNAL OPEN LOOP VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



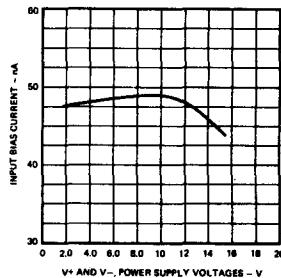
OUTPUT SWING AS A FUNCTION OF SUPPLY VOLTAGE



INPUT BIAS CURRENT AS A FUNCTION OF TEMPERATURE

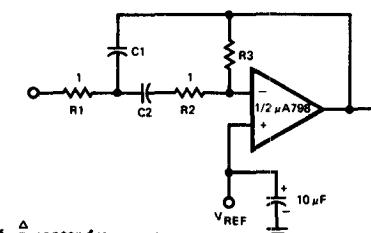


INPUT BIAS CURRENT AS A FUNCTION OF SUPPLY VOLTAGE



TYPICAL APPLICATIONS

MULTIPLE FEEDBACK BANDPASS FILTER

 f_o = center frequency BW = Bandwidth

R in kΩ

C in μF

$$Q = \frac{f_o}{BW} < 10$$

$$C_1 = C_2 = \frac{Q}{3}$$

$$R_1 = R_2 = 1$$

$$R_3 = 9Q^2 - 1$$

Use scaling factors in these expressions.

Design example:

$$\text{given: } Q = 5, f_o = 1 \text{ kHz}$$

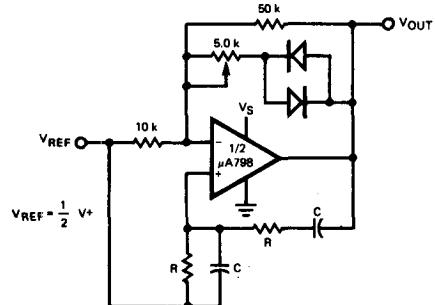
$$\text{Let } R_1 = R_2 = 10 \text{ kΩ}$$

$$\text{then } R_3 = 9(5)^2 - 10$$

$$R_3 = 215 \text{ kΩ}$$

$$C = \frac{5}{3} = 1.6 \text{ nF}$$

WEIN BRIDGE OSCILLATOR



$$V_{REF} = \frac{1}{2} V_+$$

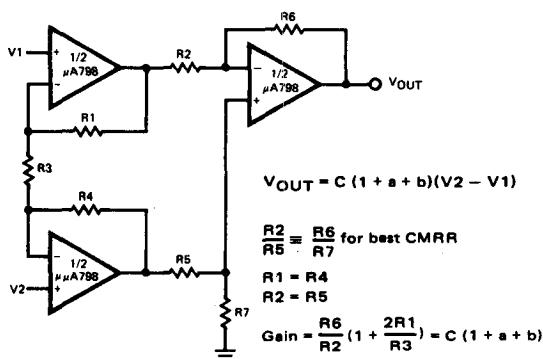
$$f_o = \frac{1}{2\pi RC} \text{ for } f_o = 1 \text{ kHz}$$

$$R = 16 \text{ kΩ}$$

$$C = 0.01 \mu\text{F}$$

If source impedance is high or varies, filter may be preceded with voltage follower buffer to stabilize filter parameters.

HIGH IMPEDANCE DIFFERENTIAL AMPLIFIER



$$V_{OUT} = C(1 + a + b)(V_2 - V_1)$$

$$R_2 = R_6 \text{ for best CMRR}$$

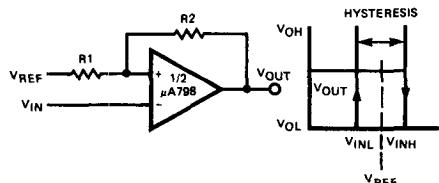
$$R_5 = R_7$$

$$R_1 = R_4$$

$$R_2 = R_5$$

$$\text{Gain} = \frac{R_6}{R_2} \left(1 + \frac{2R_1}{R_3}\right) = C(1 + a + b)$$

COMPARATOR WITH HYSTERESIS

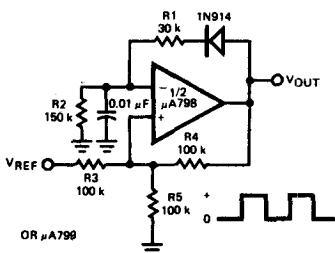


$$V_{INL} = \frac{R_1}{R_1 + R_2} (V_{OL} - V_{REF}) + V_{REF}$$

$$V_{INH} = \frac{R_1}{R_1 + R_2} (V_{OH} - V_{REF}) + V_{REF}$$

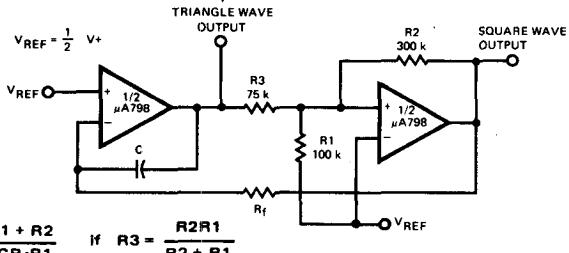
$$H = \frac{R_1}{R_1 + R_2} (V_{OH} - V_{OL})$$

PULSE GENERATOR



OR μA798

FUNCTION GENERATOR

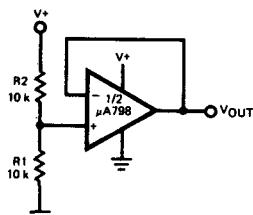


$$f = \frac{R_1 + R_2}{4CR_fR_1}$$

$$\text{If } R_3 = \frac{R_2R_1}{R_2 + R_1}$$

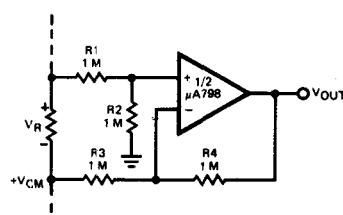
TYPICAL APPLICATIONS (Cont'd)

VOLTAGE REFERENCE



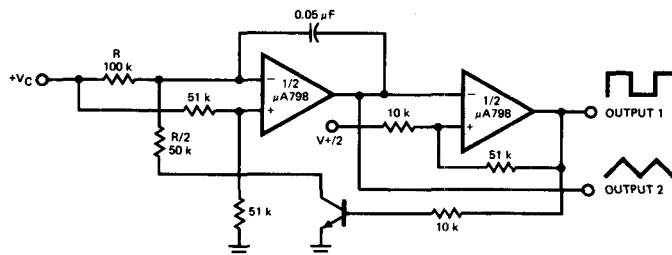
$$V_{OUT} = \frac{R_1}{R_1 + R_2} \cdot V_+$$

GROUND REFERENCING A DIFFERENTIAL INPUT SIGNAL



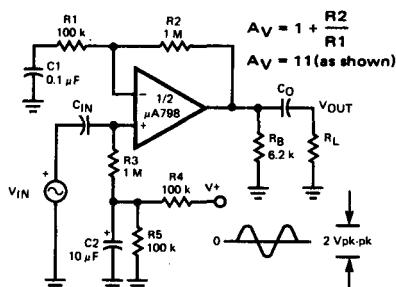
$$V_{OUT} = V_R$$

VOLTAGE CONTROLLED OSCILLATOR



*Wide Control Voltage Range:
0V_{DC} ≤ V_C ≤ 2(V₊ - 1.5V_{DC})

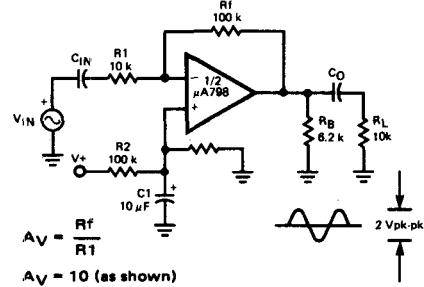
AC COUPLED NON-INVERTING AMPLIFIER



$$A_V = 1 + \frac{R_2}{R_1}$$

$$A_V = 11 \text{ (as shown)}$$

AC COUPLED INVERTING AMPLIFIER



$$A_V = \frac{R_f}{R_1}$$

$$A_V = 10 \text{ (as shown)}$$