μA798
DUAL OPERATIONAL AMPLIFIERS
FAIRCHILD LINEAR INTEGRATED CIRCUITS

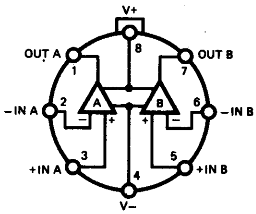
GENERAL DESCRIPTION — The μA798 is a monolithic pair of independent, high gain, internally frequency compensated operational amplifiers designed to operate from a single power supply or dual power supplies over a wide range of voltages. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components ni 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

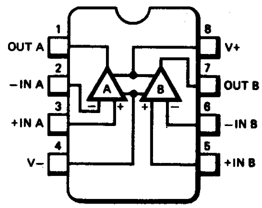
CONNECTION DIAGRAMS
8-LEAD METAL CAN
(TOP VIEW)
PACKAGE OUTLINE 5S
PACKAGE CODE H



ORDER INFORMATION

TYPE	PART NO.
μ798	μA798HM
μ798C	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 = ±15 V, T_A = 25°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 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 kΩ	70	90		dB
Large Signal Open Loop Voltage Gain	V_{OUT} = ±10 V, R_L = 2kΩ	50	200		V/mV
Power Bandwidth	A_V = 1, R_L = 2 kΩ, V_{OUT} = 20 V pk-pk		9.0		kHz
Small Signal Bandwidth	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		1.0		MHz
Slew Rate	A_V = 1, V_{IN} = –10 V to +10 V		0.6		V/μs
Rise Time	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		0.3		μs
Fall Time	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		0.3		μs
Overshoot	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		20		%
Phase Margin	A_V = 1, R_L = 2k Ω, C_L = 200 pF		60		Degree
Crossover Distortion at f = 10 kHz	V_{IN} = 30 mV pk-pk, V_{OUT} = 2 V pk-pk		1.0		%
Output Voltage Range	R_L = 10k Ω	±13	±14		V
	R_L = 2 kΩ	±12	±13.5		V
Individual Output Short Circuit Current	(Note 3)	±20	±30		mA
Output Impedance	f = 20 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 = ∞		2.0	3.0	mA
The following specification apply for –55°C ≤ T_A ≤ +125°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 kΩ, V_{OUT} = ±10 V	25	300		V/mV
Output Voltage Range	R_L = 2 kΩ	±10			V

ELECTRICAL CHARACTERISTICS (V_S = +5 V and Ground, T_A = 25°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 kΩ	20	200		V/mV
Power Supply Rejection Ratio				150	μV/V
Output Voltage Range (Note 4)	R_L = 10 kΩ	3.5			V pk-pk
	R_L = 10 kΩ, 5.0 V ≤ V_S ≤ 30 V	(V+)–1.5			V pk-pk
Output Sink Current	V_{IN} ≤ –10 mV, V_{OUT} = 400 mV	1.0			mA
Power Supply Current			2.0	3.0	mA
Channel Separation	f = 1 kHz to 20 kHz (Input Referenced)		–120		dB

NOTES:

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

μA798C

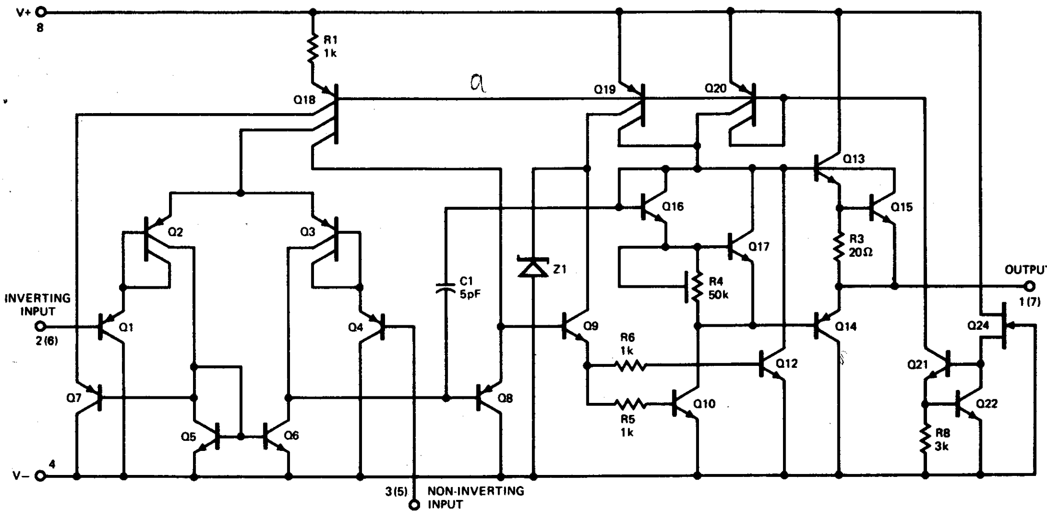
ELECTRICAL CHARACTERISTICS ($V_S = \pm 15$ V, $T_A = 25°C$ unless otherwise noted)

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	6.0	mV
Input Offset Current			10	75	nA
Input Bias Current			–50	–250	nA
Input Impedance	f = 20 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	$R_S < 10$ kΩ	70	90		dB
Large Signal Open Loop Voltage Range	$V_{OUT} = \pm 10$ V, $R_L = 2$ kΩ	20	200		V/mV
Power Bandwidth	$A_V = 1$, $R_L = 2$ kΩ, $V_{OUT} = 20$ V pk-pk THD = 5%		9.0		kHz
Small Signal Bandwidth	$A_V = 1$, $R_L = 10$ kΩ, $V_{OUT} = 50$ mV		1.0		MHz
Slew Rate	$A_V = 1$, $V_{IN} = -10$ V to +10 V		0.6		V/μs
Rise Time	$A_V = 1$, $R_L = 10$ kΩ, $V_{OUT} = 50$ mV		0.3		μs
Fall Time	$A_V = 1$, $R_L = 10$ kΩ, $V_{OUT} = 50$ mV		0.3		μs
Overshoot	$A_V = 1$, $R_L = 10$ kΩ, $V_{OUT} = 50$ mV		20		%
Phase Margin	$A_V = 1$, $R_L = 2$ kΩ, $C_L = 200$ pF		60		Degree
Crossover Distortion	$V_{IN} = 30$ mV pk-pk, $V_{OUT} = 2$ V pk-pk f = 10 kHz		1.0		%
Output Voltage Range	$R_L = 10$ kΩ	±13	±14		V
	$R_L = 2$ kΩ	±12	±13.5		V
Individual Output Short Circuit Current	(Note 3)	±10	±30		mA
Output Impedance	f = 20 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	4.0	mA
The following specification apply for $0°C < T_A < 70°C$					
Input Offset Voltage				7.5	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				–400	nA
Large Signal Open Loop Voltage Gain	$R_L = 2$ kΩ, $V_{OUT} = \pm 10$ V	15			V/mV
Output Voltage Range	$R_L = 2$ kΩ	±10			V

ELECTRICAL CHARACTERISTICS ($V_S = +5.0$ V and Ground, $T_A = 25°C$ unless otherwise noted)

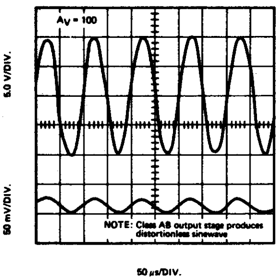
PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	10	mV
Input Offset Current			30	100	nA
Input Bias Current			–200	-500	nA
Large Signal Open Loop Voltage Gain	$R_L = 2$ kΩ	20	200		V/mV
Power Supply Rejection Ratio				150	μV/V
Output Voltage Range	$R_L = 10$ kΩ	3.5			V pk-pk
	$R_L = 10$ kΩ, $5.0\ V < V_S < 30$ V	(V+)–1.5			V pk-pk
Output Sink Current	$V_{IN} < -10$ mV, $V_{OUT} = 400$ mW	1.0			mA
Power Supply Current			2.0	4.0	mA
Channel Separation	f = 1 kHz to 20 kHz (Input Referenced)		–120		dB

1/2 OF EQUIVALENT CIRCUIT

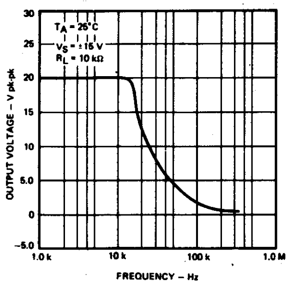


TYPICAL PERFORMANCE CURVES

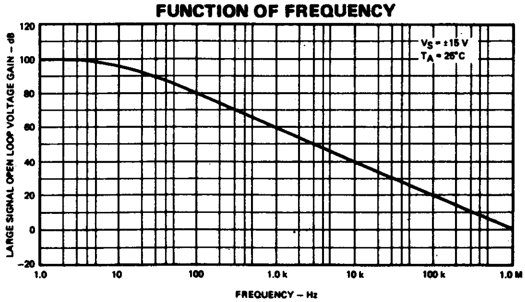
SINEWAVE RESPONSE



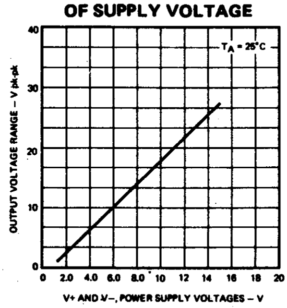
OUTPUT VOLTAGE AS A FUNCTION OF FREQUENCY



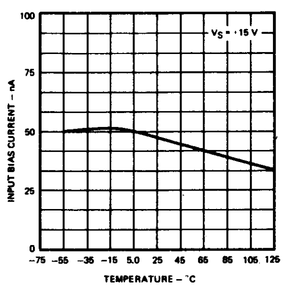
LARGE SIGNAL OPEN LOOP VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



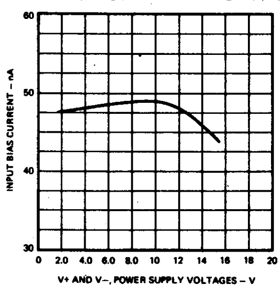
OUTPUT SWING AS A FUNCTION OF SUPPLY VOLTAGE



INPUT BIAS CURRENT AS A FUNCTION OF TEMPERATURE

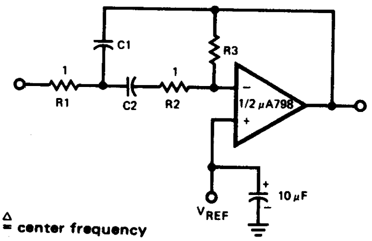


INPUT BIAS CURRENT AS A FUNCTION OF SUPPLY VOLTAGE



TYPICAL APPLICATIONS

MULTIPLE FEEDBACK BANDPASS FILTER



$f_o \stackrel{\Delta}{=}$ center frequency

BW $\stackrel{\Delta}{=}$ Bandwidth

R in kΩ

C in μF

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

$C1 = C2 = \frac{Q}{3}$

$R1 = R2 = 1$
$R3 = 9Q^2 - 1$ } Use scaling factors in these expressions.

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

Design example:

given: $Q = 5$, $f_o = 1$ kHz

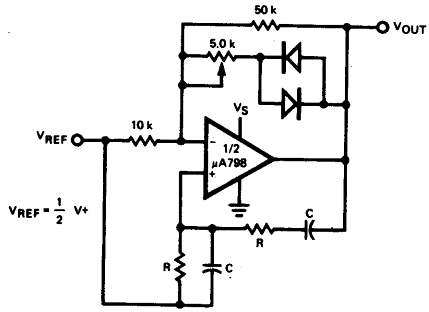
Let $R1 = R2 = 10$ kΩ

then $R3 = 9(5)^2 - 10$

$R3 = 215$ kΩ

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

WEIN BRIDGE OSCILLATOR

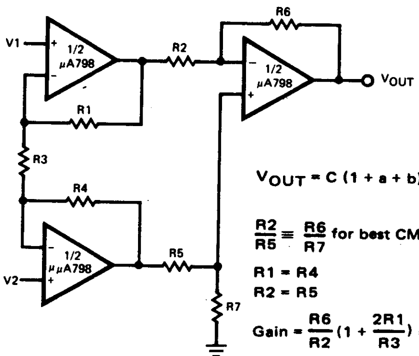


$f_o = \frac{1}{2\pi RC}$ for $f_o = 1$ kHz

R = 16 kΩ

C = 0.01 μF

HIGH IMPEDANCE DIFFERENTIAL AMPLIFIER



$V_{OUT} = C(1 + a + b)(V2 - V1)$

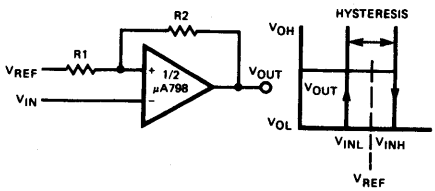
$\frac{R2}{R5} \equiv \frac{R6}{R7}$ for best CMRR

R1 = R4

R2 = R5

$\text{Gain} = \frac{R6}{R2}\left(1 + \frac{2R1}{R3}\right) = C(1 + a + b)$

COMPARATOR WITH HYSTERESIS

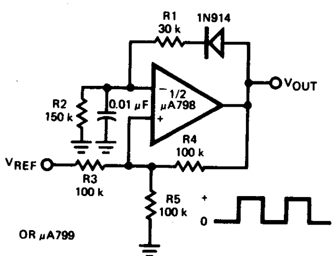


$V_{INL} = \frac{R1}{R1 + R2}(V_{OL} - V_{REF}) + V_{REF}$

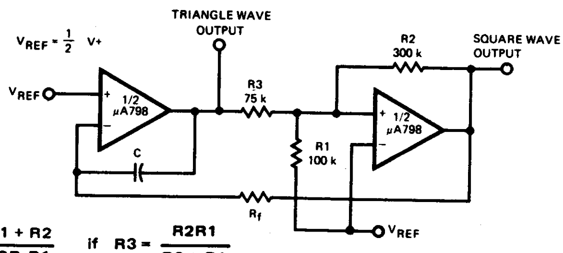
$V_{INH} = \frac{R1}{R1 + R2}(V_{OH} - V_{REF}) + V_{REF}$

$H = \frac{R1}{R1 + R2}(V_{OH} - V_{OL})$

PULSE GENERATOR



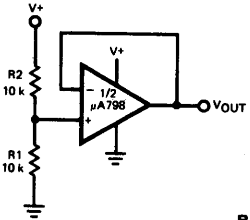
FUNCTION GENERATOR



$f = \frac{R1 + R2}{4CR_fR1}$ if $R3 = \frac{R2R1}{R2 + R1}$

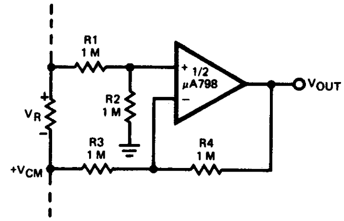
TYPICAL APPLICATIONS (Cont'd)

VOLTAGE REFERENCE



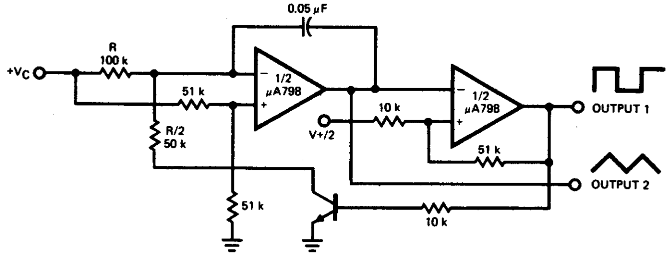
$$V_{OUT} = \frac{R1}{R1 - R2} = \frac{V+}{2}$$

GROUND REFERENCING A DIFFERENTIAL INPUT SIGNAL



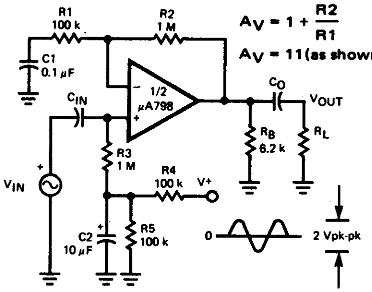
$$V_{OUT} = V_R$$

VOLTAGE CONTROLLED OSCILLATOR



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

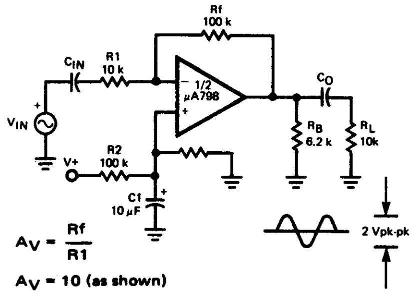
AC COUPLED NON-INVERTING AMPLIFIER



$$A_V = 1 + \frac{R2}{R1}$$

$A_V = 11$ (as shown)

AC COUPLED INVERTING AMPLIFIER



$$A_V = \frac{Rf}{R1}$$

$A_V = 10$ (as shown)

μA799
OPERATIONAL AMPLIFIER
FAIRCHILD LINEAR INTEGRATED CIRCUIT

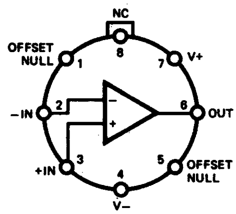
GENERAL DESCRIPTION – The μA799 is a monolithic Operational Amplifier consisting of a high gain, internally frequency compensated operational amplifier designed to operate from a single power supply or dual power supplies over a wide range of voltages. The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage range also includes the negative power supply voltage. It is 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 OUTPUTS**
- **HIGH OPEN LOOP GAIN – 200 k**
- **EXCEEDS μA741 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	
μA799C	0°C to +70°C
μA799	–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

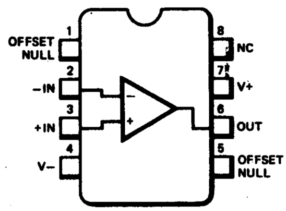
CONNECTION DIAGRAMS
8-LEAD METAL CAN
(TOP VIEW)
PACKAGE OUTLINE 5S
PACKAGE CODE H



ORDER INFORMATION

TYPE	PART NO.
μA799	μA799HM
μA799C	μA799HC

8-LEAD MINI DIP
(TOP VIEW)
PACKAGE OUTLINE 6T
PACKAGE CODE R



ORDER INFORMATION

TYPE	PART NO.
μA799C	μA741TC
μA799C	μA741RC
μA799	μA741RM

*Planar is a patented Fairchild process.

μA799C

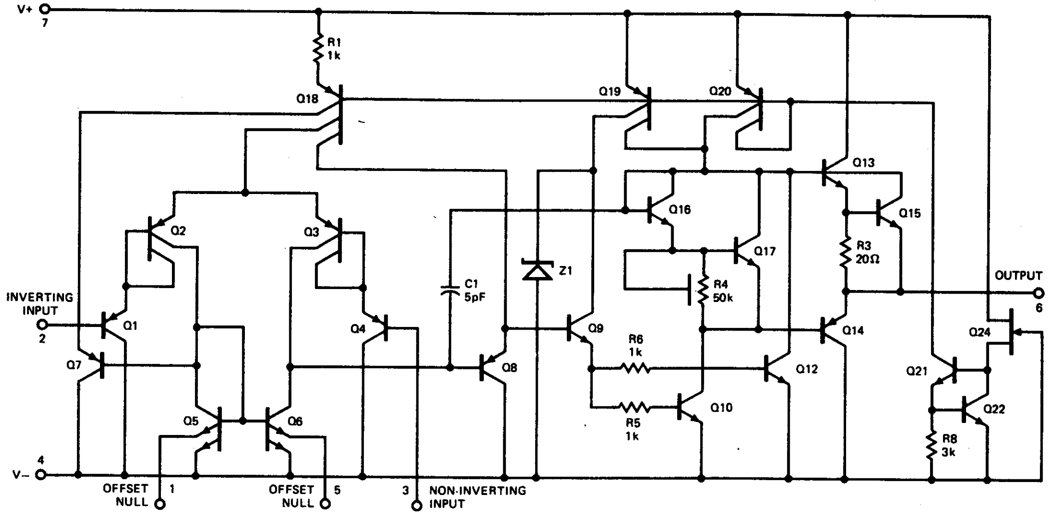
ELECTRICAL CHARACTERISTICS (V_S = ±15 V, T_A = 25°C unless otherwise noted)

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	6.0	mV
Input Offset Current			10	75	nA
Input Bias Current			−50	−250	nA
Input Impedance	f = 20 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 kΩ	70	90		dB
Large Signal Open Loop Voltage Range	V_{OUT} = ±10 V, R_L = 2 kΩ	20	200		V/mV
Power Bandwidth	A_V = 1, R_L = 2 kΩ, V_{OUT} = 20 V pk-pk THD = 5%		9.0		kHz
Small Signal Bandwidth	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		1.0		MHz
Slew Rate	A_V = 1, V_{IN} = −10 V to +10 V		0.6		V/μs
Rise Time	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		0.3		μs
Fall Time	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		0.3		μs
Overshoot	A_V = 1, R_L = 10 kΩ, V_{OUT} = 50 mV		20		%
Phase Margin	A_V = 1, R_L = 2 kΩ, C_L = 200 pF		60		Degree
Crossover Distortion	V_{IN} = 30 mV pk-pk, V_{OUT} = 2 V pk-pk f = 10 kHz		1.0		%
Output Voltage Range	R_L = 10 kΩ R_L = 2 kΩ	±13 ±12	±14 ±13.5		V V
Individual Output Short Circuit Current	(Note 3)	±10	±30		mA
Output Impedance	f = 20 Hz		800		Ω
Power Supply Rejection Ratio	Positive Negative		30 30	150 150	μV/V μV/V
Power Supply Current	V_{OUT} = 0, R_L = ∞		1.0	4.0	mA
The following specification apply for 0°C < T_A < 70°C					
Input Offset Voltage				7.5	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				−400	nA
Large Signal Open Loop Voltage Gain	R_L = 2 kΩ, V_{OUT} = ±10 V	15			V/mV
Output Voltage Range	R_L = 2 kΩ	±10			V

ELECTRICAL CHARACTERISTICS (V_S = +5.0 V and Ground, T_A = 25°C unless otherwise noted)

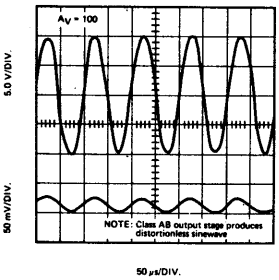
PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Input Offset Voltage			2.0	10	mV
Input Offset Current			30	100	nA
Input Bias Current			−200	−500	nA
Large Signal Open Loop Voltage Gain	R_L = 2 kΩ	20	200		V/mV
Power Supply Rejection Ratio				150	μV/V
Output Voltage Range	R_L = 10 kΩ R_L = 10 kΩ, 5.0 V < V_S < 30 V	3.5 (V+)−1.5			V pk-pk V pk-pk
Output Sink Current	V_{IN} < −10 mV, V_{OUT} = 400 mV	1.0			mA
Power Supply Current			1.0	4.0	mA
Channel Separation	f = 1 kHz to 20 kHz (Input Referenced)		−120		dB

EQUIVALENT CIRCUIT

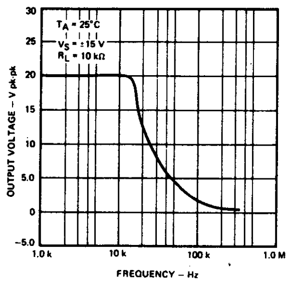


TYPICAL PERFORMANCE CURVES

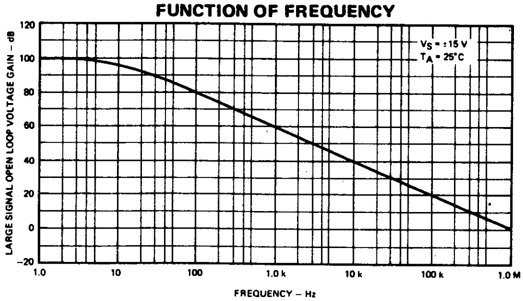
SINEWAVE RESPONSE



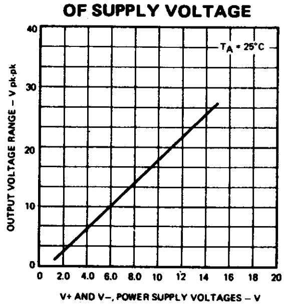
OUTPUT VOLTAGE AS A FUNCTION OF FREQUENCY



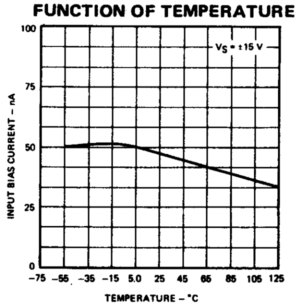
LARGE SIGNAL OPEN LOOP VOLTAGE GAIN AS A FUNCTION OF FREQUENCY



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