Quad Operational Amplifier

GENERAL DESCRIPTION

The XR-4212 is an array of four independent internally compensated operational amplifiers on a single silicon chip, each similar to the popular 741, but with a power consumption less than one 741. Good thermal tracking and matched gain-bandwidth products make these Quad Op-amps useful for active filter applications.

FEATURES

Same Pinout as MC3403 and LM324
Low Power Consumption—50 mW typ. and 120mW max.
Short-Circuit Protection
Internal Frequency Compensation
No Latch-Up
Wide Common-Mode and Differential Voltage Ranges
Matched Gain-Bandwidth

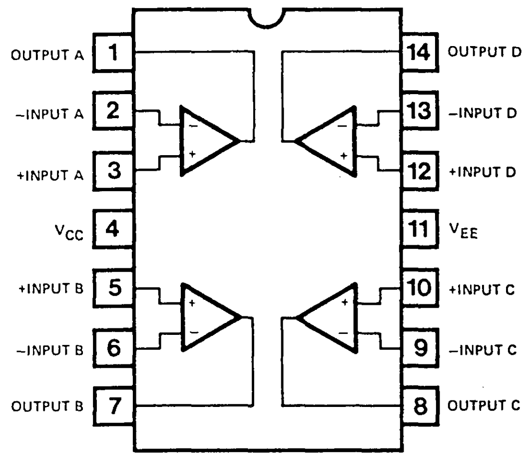
APPLICATIONS

Buffer Amplifiers
Summing/Differencing Amplifiers
Instrumentation Amplifiers
Active Filters
Signal Processing
Sample and Differencing
I to V Converters
Integrators
Simulated Components
Analog Computers

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	
XR-4212M	±22V
XR-4212C	±18V
Common Mode	
Voltage	V_{EE} to V_{CC}
Output Short-Circuit Duration	Indefinite
Differential Input Voltage	±30V
Internal Power Dissipation	
Ceramic Package:	750 mW
Derate above T_A = +25°C	6 mW/°C
Plastic Package:	625 mW
Derate above T_A = +25°C	5 mW/°C
Storage Temperature Range:	−65°C to +150°C

FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-4212M	Ceramic	−55°C to +125°C
XR-4212CN	Ceramic	0°C to +70°C
XR-4212CP	Plastic	0°C to +70°C

SYSTEM DESCRIPTION

The XR-4212 is a quad operational amplifier featuring improved performance over industry standard devices such as the 741.

XR-4212

ELECTRICAL CHARACTERISTICS

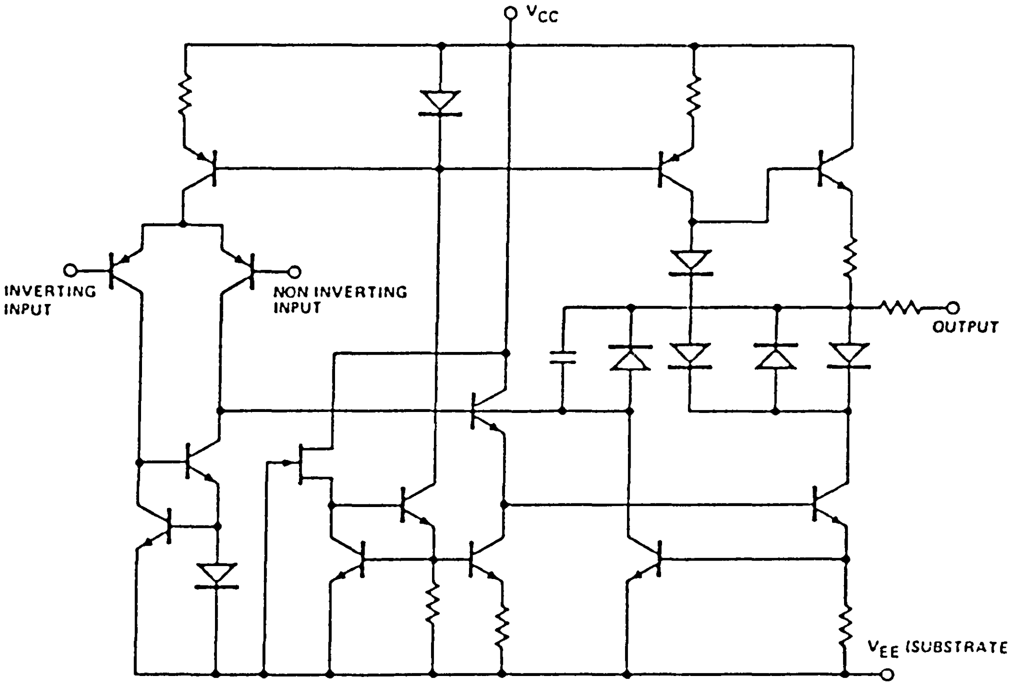
Test Conditions: $T_A = +25°C$, $V_S = \pm15V$, unless otherwise specified.

PARAMETERS	XR-4212M MIN	XR-4212M TYP	XR-4212M MAX	XR-4212C MIN	XR-4212C TYP	XR-4212C MAX	UNITS	SYMBOLS	CONDITIONS
Input Offset Voltage		1	5.0		1	6.0	mV	$\lvert V_{io} \rvert$	$R_S \le 10$ KΩ
Input Offset Current		10	50		10	50	nA	$\lvert I_{io} \rvert$	
Input Bias Current		80	500		80	500	nA	$\lvert I_b \rvert$	
Input Resistance	0.3	1.8		0.3	1.8		MΩ	R_{in}	
Large Signal Voltage Gain	20	60		5	40		V/mV	A_{VOL}	$R_L \ge 2$ KΩ $V_{out} = \pm10V$
Output Voltage Swing	±12	±14		±12	±14		V	V_{out}	$R_L \ge 10$ KΩ
	±10	±12		±10	±12		V	V_{out}	$R_L \ge 2$ KΩ
Input Voltage Range	±12	±13.5		±12	±13.5		V	V_{ICM}	
Common Mode Rejection Ratio	70	105		70	105		dB	CMRR	$R_S \le 10$ KΩ
Supply Voltage Rejection Ratio		10	150		10	150	µV/V	PSRR	$R_S \le 10$ KΩ
Power Consumption		50	120		50	120	mW	P_i	
Transient Response (unity gain) Risetime Overshoot		 0.07 20			 0.07 20		 µs %	 t_r t_o	$V_{in} = 20$ mV $R_L = 2$ KΩ $C_L \le 100$ pF
Unity Gain Bandwidth	2.0	3.0			3.0		MHz	BW	
Slew Rate (unity gain)		1.6			1.6		V/µs	dV_{out}/dt	$R_L \ge 2$ KΩ
Channel Separation (open loop)		120			120		dB		f = 10 KHz $R_S = 1$ KΩ
(Gain of 100)		105			105		dB		f = 10 KHz $R_S = 1$ KΩ
The following specifications apply for $-55°C \le T_A \le +125°C$ for XR-4212M: $0°C \le T_A \le +70°C$ for XR-4212C									
Input Offset Voltage			6.0			7.5	mV	$\lvert V_{io} \rvert$	$R_S \le 10$ KΩ
Input Offset Current			200			200	nA	$\lvert I_{io} \rvert$	
Input Bias Current			1500			800	nA	I_b	
Large-Signal Voltage Gain	20			5			V/mV	A_{VOL}	$R_L \ge 2$ KΩ $V_{out} = \pm10V$
Output Voltage Swing	±10			±10			V	V_{out}	$R_L \ge 2$ KΩ
Power Consumption			150 200			150 200	mW mW	P_i P_i	$V_S = \pm15$ V T_A = High T_A = Low
Output Short-Circuit Current	5	17	35	5	17	35	mA	I_{SC}	

TYPICAL PARAMETER MATCHING:

Test Conditions: $T_A = +25°C$, $V_S = \pm15V$ unless otherwise noted

PARAMETERS	XR-4212M TYP	XR-4212C TYP	UNITS	SYMBOLS	CONDITIONS
Input Offset Voltage	±1.0	±2.0	mV	$\lvert V_{io} \rvert$	$R_S \ge 10$ KΩ
Input Offset Current	±7.5	±7.5	nA	$\lvert I_{io} \rvert$	
Input Bias Current	±15	±15	nA	I_b	
Voltage Gain	±0.5	±1.0	dB	A_{VOL}	$R_S \ge 2$ KΩ



1/4 of XR-4212

EQUIVALENT SCHEMATIC DIAGRAM

Dual Low Noise Operational Amplifier

GENERAL DESCRIPTION

The XR-4560 is a dual low noise, wide bandwidth operational amplifier ideal for active filter applications. The device is similar to the XR-1458/4558, with greatly enhanced slew rate, bandwidth, and guaranteed noise characteristics.

Pin for pin compatibility allows direct substitution for industry standard dual op amps where the low noise and wide bandwidth of the XR-4560 is imperative.

FEATURES

High Gain, Low Input Noise
Internally Compensated
Wide Small Signal Bandwidth
Interchangeable with General Purpose Dual Op Amps

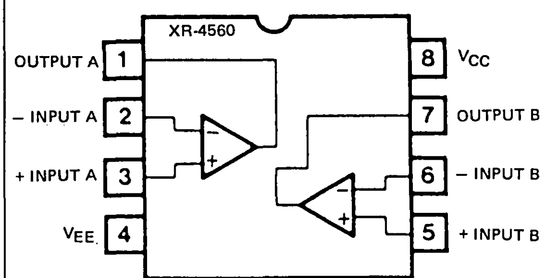
APPLICATIONS

High Gain, Low Noise Amplifier
High Performance Active Filter
Small Signal Amplifier
Servo Control System
Telephone Channel Amplifier

ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±18 V
Power Dissipation	500 mW
Derate Above at 25°C	5 mW/°C
Operating Temperature	0°C to +70°C
Storage Temperature	-55°C to +125°C
Differential Input Voltage	±30 V
Common Mode Range	V_{EE} to V_{CC}

FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-4560CP	Plastic	0°C to 70°C
XR-4560CN	Ceramic	0°C to 70°C
XR-4560MD	SO-8	0°C to 70°C

SYSTEM DESCRIPTION

The XR-4560 dual op amp offers guaranteed low noise and a 10 MHz small signal bandwidth. Slew rate typically exceeds 4 V/μS. Internal protection circuitry includes latch-up elimination, short circuit current limiting, and internal compensation.

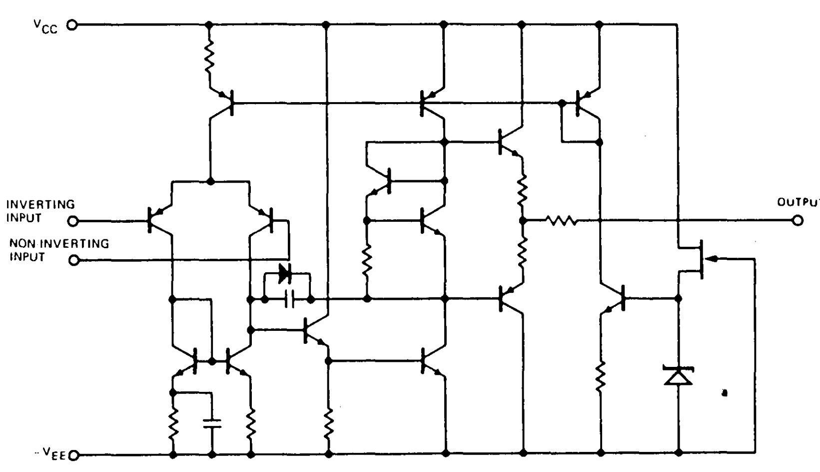
The two amplifiers are completely independent, sharing only power supply connections.

ELECTRICAL CHARACTERISTICS

Test Conditions: T_A = 25°C, V_{CC} = +15 V, V_{EE} = -15 V, unless specified otherwise.

SYMBOL	PARAMETERS	MIN.	TYP.	MAX.	UNIT	CONDITIONS
V_{OS}	Input Offset Voltage		0.5	6.0	mV	$R_S \leq 10K\Omega$
I_{OS}	Input Offset Current		5	200	nA	
I_B	Input Bias Current		50	500	nA	
R_{in}	Input Resistance		5		MΩ	
A_V	Open Loop Gain	86	100		dB	$R_L \geq 2K\Omega$
	Output Voltage Swing	±12 ±10	±14 ±13		V V	$R_L \geq 10K\Omega$ $R_L \geq 2K\Omega$
V_{ICM}	Common Mode Range	±12	±14		V	
CMRR	Common Mode Rejection Ratio	70	90		dB	$R_S \leq 10K\Omega$
PSRR	Supply Voltage Rejection Ratio		30	150	μV/V	$R_S \leq 10K\Omega$
S_R	Slew Rate		4.0		V/μs	$A_V = 1$, $R_L \geq 2K\Omega$
BW	Unity Gain Bandwidth		10		MHz	$A_V = 1$
P_i	Power Consumption		50		mW	$R_L = \infty$
	Channel Separation		100		dB	$A_V = 100$
e_n	Input Noise Voltage			2.2	μV	f = 10 Hz to 30 kHz Circuit of Figure 7

EQUIVALENT SCHEMATIC DIAGRAM



(One Channel Only)

TYPICAL CHARACTERISTICS

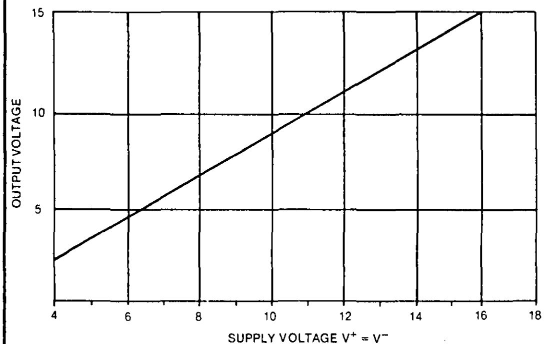


Figure 1. Output Voltage Swing vs Supply Voltage

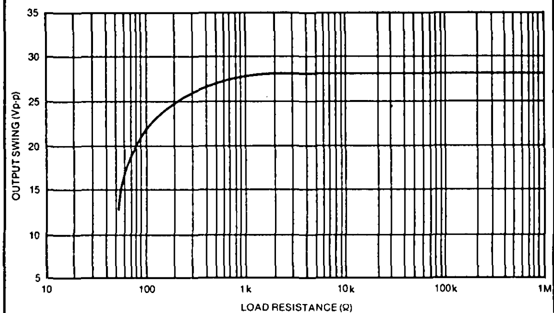


Figure 2. Loaded Output Voltage Swing

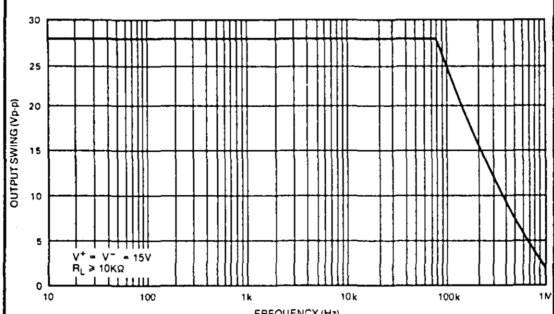


Figure 3. Large Signal Frequency Response

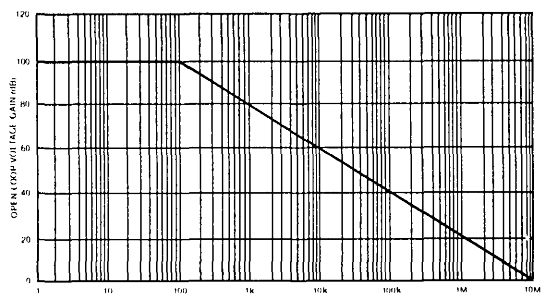


Figure 4. Open Loop Gain

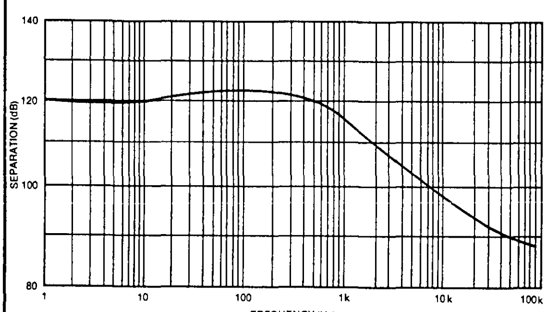


Figure 5. Channel Separation vs Frequency

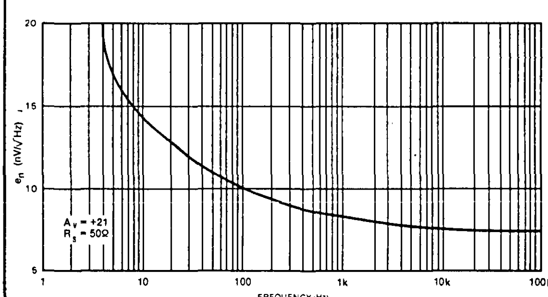


Figure 6. Input Noise Voltage Spectral Density

Noise measurements made on a Quantek 2173-2181 noise analyzer with the XR-4560 in a standard noninverting circuit with $A_V = 21$.

TYPICAL APPLICATIONS

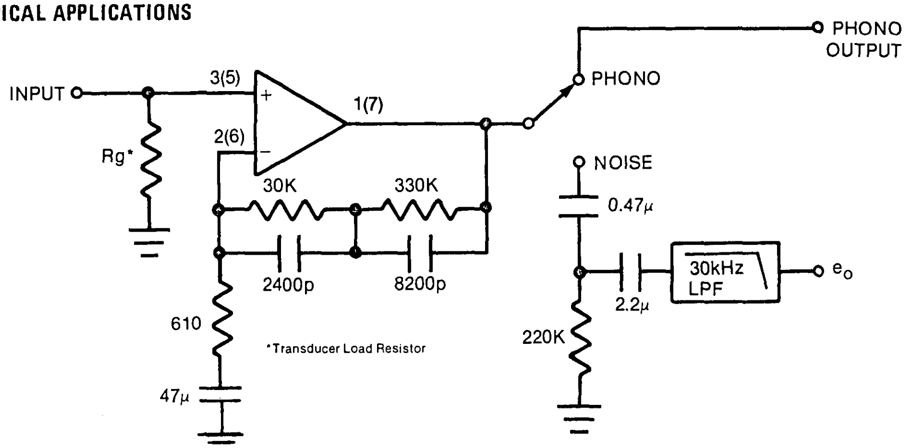


Figure 7. RIAA Equalized Phonograph Preamplifier (One Channel) & Broadcast Noise Test Circuit

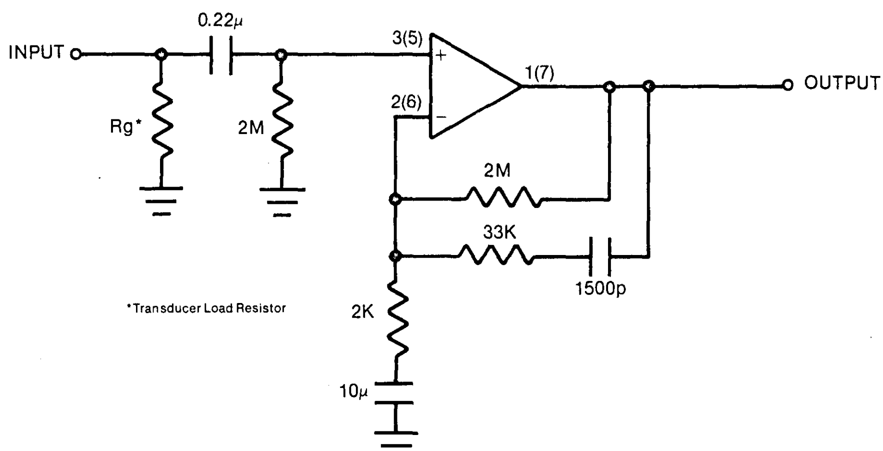


Figure 8. NAB Equalized Tape Playback Preamplifier (One Channel)

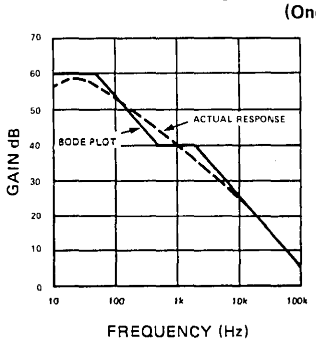


Figure 9. RIAA-Type Phonograph Equalization

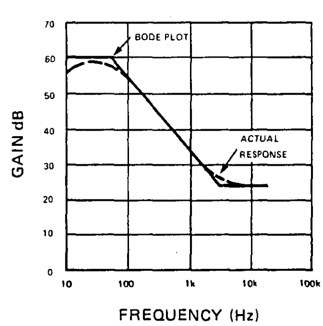


Figure 10. NAB-Type Tape Player Equalization