

## 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.

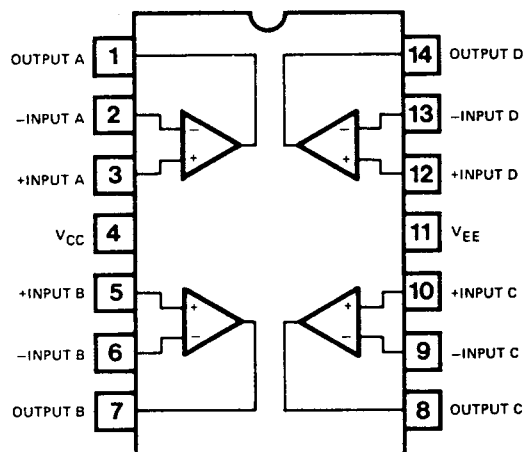
### FEATURES

- 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

### FUNCTIONAL BLOCK DIAGRAM



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### 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          |

### ABSOLUTE MAXIMUM RATINGS

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

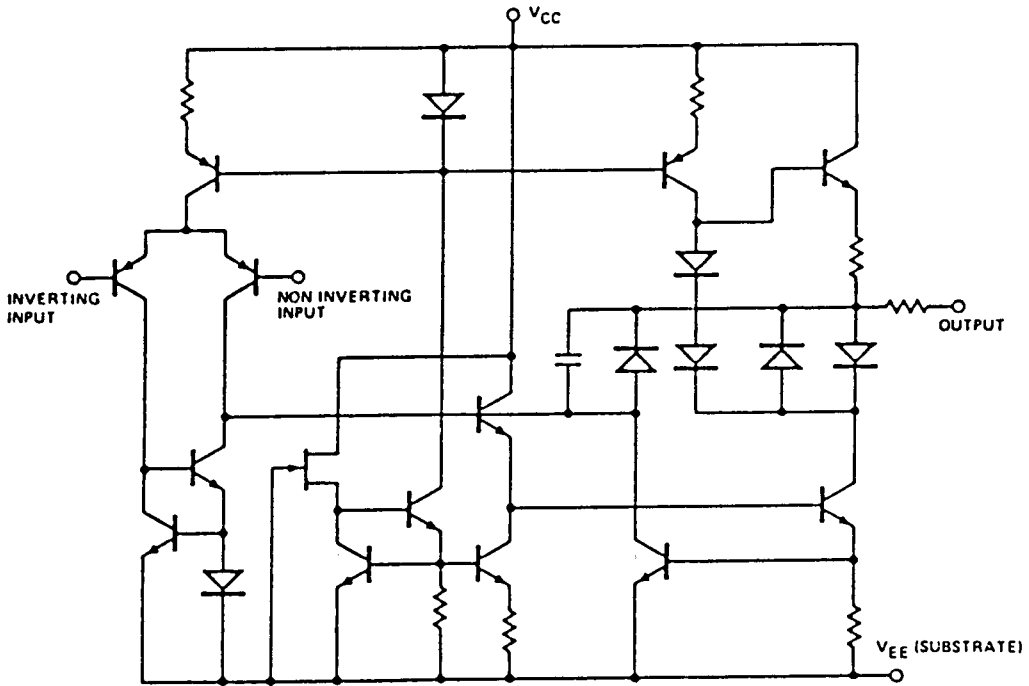
Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$ , unless otherwise specified.

| PARAMETERS                                                                                                                                                               | XR-4212M |            |            | XR-4212C |            |            | UNITS            | SYMBOLS        | CONDITIONS                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|------------|----------|------------|------------|------------------|----------------|----------------------------------------------------------------------|
|                                                                                                                                                                          | MIN      | TYP        | MAX        | MIN      | TYP        | MAX        |                  |                |                                                                      |
| Input Offset Voltage                                                                                                                                                     |          | 1          | 5.0        |          | 1          | 6.0        | mV               | $ V_{IO} $     | $R_S \leq 10\text{ K}\Omega$                                         |
| Input Offset Current                                                                                                                                                     |          | 10         | 50         |          | 10         | 50         | nA               | $ I_{IO} $     |                                                                      |
| Input Bias Current                                                                                                                                                       |          | 80         | 500        |          | 80         | 500        | nA               | $I_b$          |                                                                      |
| Input Resistance                                                                                                                                                         | 0.3      | 1.8        |            | 0.3      | 1.8        |            | M $\Omega$       | $R_{in}$       |                                                                      |
| Large Signal Voltage Gain                                                                                                                                                | 20       | 60         |            | 5        | 40         |            | V/mV             | $A_{VOL}$      | $R_L \geq 2\text{ K}\Omega$<br>$V_{out} = \pm 10\text{V}$            |
| Output Voltage Swing                                                                                                                                                     | $\pm 12$ | $\pm 14$   |            | $\pm 12$ | $\pm 14$   |            | V                | $V_{out}$      | $R_L \geq 10\text{ K}\Omega$                                         |
|                                                                                                                                                                          | $\pm 10$ | $\pm 12$   |            | $\pm 10$ | $\pm 12$   |            | V                | $V_{out}$      | $R_L \geq 2\text{ K}\Omega$                                          |
| Input Voltage Range                                                                                                                                                      | $\pm 12$ | $\pm 13.5$ |            | $\pm 12$ | $\pm 13.5$ |            | V                | $V_{ICM}$      |                                                                      |
| Common Mode Rejection Ratio                                                                                                                                              | 70       | 105        |            | 70       | 105        |            | dB               | CMRR           | $R_S \leq 10\text{ K}\Omega$                                         |
| Supply Voltage Rejection Ratio                                                                                                                                           |          | 10         | 150        |          | 10         | 150        | $\mu\text{V/V}$  | PSRR           | $R_S \leq 10\text{ K}\Omega$                                         |
| Power Consumption                                                                                                                                                        |          | 50         | 120        |          | 50         | 120        | mW               | $P_i$          |                                                                      |
| Transient Response (unity gain)                                                                                                                                          |          |            |            |          |            |            |                  |                |                                                                      |
| Risetime                                                                                                                                                                 |          | 0.07       |            |          | 0.07       |            | $\mu\text{s}$    | $t_r$          | $V_{in} = 20\text{ mV}$                                              |
| Overshoot                                                                                                                                                                |          | 20         |            |          | 20         |            | %                | $t_o$          | $R_L = 2\text{ K}\Omega$<br>$C_L \leq 100\text{ pF}$                 |
| Unity Gain Bandwidth                                                                                                                                                     | 2.0      | 3.0        |            |          | 3.0        |            | MHz              | BW             |                                                                      |
| Slew Rate (unity gain)                                                                                                                                                   |          | 1.6        |            |          | 1.6        |            | V/ $\mu\text{s}$ | $dV_{out}/dt$  | $R_L \geq 2\text{ K}\Omega$                                          |
| Channel Separation (open loop)                                                                                                                                           |          | 120        |            |          | 120        |            | dB               |                | $f = 10\text{ KHz}$<br>$R_S = 1\text{ K}\Omega$                      |
| (Gain of 100)                                                                                                                                                            |          | 105        |            |          | 105        |            | dB               |                | $f = 10\text{ KHz}$<br>$R_S = 1\text{ K}\Omega$                      |
| The following specifications apply for $-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ for XR-4212M: $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$ for XR-4212C |          |            |            |          |            |            |                  |                |                                                                      |
| Input Offset Voltage                                                                                                                                                     |          |            | 6.0        |          |            | 7.5        | mV               | $ V_{IO} $     | $R_S \leq 10\text{ K}\Omega$                                         |
| Input Offset Current                                                                                                                                                     |          |            | 200        |          |            | 200        | nA               | $ I_{IO} $     |                                                                      |
| Input Bias Current                                                                                                                                                       |          |            | 1500       |          |            | 800        | nA               | $I_b$          |                                                                      |
| Large-Signal Voltage Gain                                                                                                                                                | 20       |            |            | 5        |            |            | V/mV             | $A_{VOL}$      | $R_L \geq 2\text{ K}\Omega$<br>$V_{out} = \pm 10\text{V}$            |
| Output Voltage Swing                                                                                                                                                     | $\pm 10$ |            |            | $\pm 10$ |            |            | V                | $V_{out}$      | $R_L \geq 2\text{ K}\Omega$                                          |
| Power Consumption                                                                                                                                                        |          |            | 150<br>200 |          |            | 150<br>200 | mW<br>mW         | $P_i$<br>$P_i$ | $V_S = \pm 15\text{ V}$<br>$T_A = \text{High}$<br>$T_A = \text{Low}$ |
| Output Short-Circuit Current                                                                                                                                             | 5        | 17         | 35         | 5        | 17         | 35         | mA               | $I_{SC}$       |                                                                      |

## TYPICAL PARAMETER MATCHING:

Test Conditions:  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$  unless otherwise noted

| PARAMETERS           | XR-4212M  |           | XR-4212C |     | UNITS | SYMBOLS    | CONDITIONS                   |
|----------------------|-----------|-----------|----------|-----|-------|------------|------------------------------|
|                      | TYP       | TYP       | TYP      | TYP |       |            |                              |
| Input Offset Voltage | $\pm 1.0$ | $\pm 2.0$ |          |     | mV    | $ V_{IO} $ | $R_S \geq 10\text{ K}\Omega$ |
| Input Offset Current | $\pm 7.5$ | $\pm 7.5$ |          |     | nA    | $ I_{IO} $ |                              |
| Input Bias Current   | $\pm 15$  | $\pm 15$  |          |     | nA    | $I_b$      |                              |
| Voltage Gain         | $\pm 0.5$ | $\pm 1.0$ |          |     | dB    | $A_{VOL}$  | $R_S \geq 2\text{ K}\Omega$  |



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EQUIVALENT SCHEMATIC DIAGRAM

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**EXAR**

91D 04225

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**XR-1488/1489A**

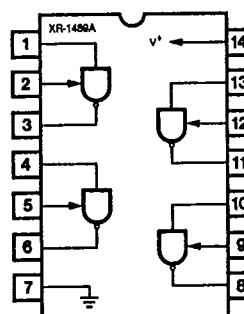
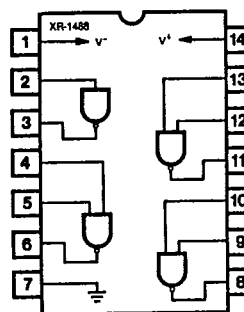
## Quad Line Driver/Receiver

### GENERAL DESCRIPTION

The XR-1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard No. RS232C. This extremely versatile integrated circuit can be used to perform a wide range of applications. Features such as output current limiting, independent positive and negative power supply driving elements, and compatibility with all DTL and TTL logic families greatly enhance the versatility of the circuit.

The XR-1489A is a monolithic quad line receiver designed to interface data terminal equipment with data communications equipment. The XR-1489A quad receiver along with its companion circuit, the XR-1488 quad driver, provide a complete interface system between DTL or TTL logic levels and the RS232C defined voltage and impedance levels.

### FUNCTIONAL BLOCK DIAGRAMS



### ABSOLUTE MAXIMUM RATINGS

|                    |              |
|--------------------|--------------|
| Power Supply       |              |
| XR-1488            | $\pm 15$ Vdc |
| XR-1489A           | + 10 Vdc     |
| Power Dissipation  |              |
| Ceramic Package    | 1000 mW      |
| Derate above +25°C | 6.7 mW/°C    |
| Plastic Package    | 650 mW/°C    |
| Derate above +25°C | 5 mW/°C      |

### ORDERING INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-1488N    | Ceramic | 0°C to +70°C          |
| XR-1488P    | Plastic | 0°C to +70°C          |
| XR-1489AN   | Ceramic | 0°C to +70°C          |
| XR-1489AP   | Plastic | 0°C to +70°C          |

### SYSTEM DESCRIPTION

The XR-1488 and XR-1489A are a matched set of quad line drivers and line receivers designed for interfacing between TTL/DTL and RS232C data communication lines.

The XR-1488 contains four independent split supply line drivers, each with a  $\pm 10$  mA current limited output. For RS232C applications, the slew rate can be reduced to the 30 V/ $\mu$ S limit by shunting the output to ground with a 410 pF capacitor. The XR-1489A contains four independent line receivers, designed for interfacing RS232C to TTL/DTL. Each receiver features independently programmable switching thresholds with hysteresis, and input protection to  $\pm 30$  V. The output can typically source 3 mA and sink 20 mA.