

Apr 82  
HOUSE



# PRODUCT GUIDE

*First in Quality... First in Service • Custom, Semicustom and Standard IC's*

# Introduction

This Product Guide contains a complete summary of technical data and information covering Exar's full line of IC products. Each of the products presented in the Product Guide covers a wide range of applications which will greatly simplify most system designs. To help the designer find the right devices for his applications, the products listed are grouped by function and a convenient cross-reference chart is provided which shows Exar's direct replacement for a number of popular industry products.

## EXPERIENCE AND PRODUCTS

Exar's innovativeness, product quality and responsiveness to customer needs have been the key to its success. Exar today offers a broad line of linear and interface circuits. In the field of standard linear IC products, Exar has extended its circuit technological leadership into the areas of communications and control circuits. Today Exar has one of the most complete lines of IC oscillators, timing circuits and phase-locked loops in the industry. Exar also manufactures a large family of telecommunication circuits such as tone decoders, companders, modulators, PCM repeaters and FSK Modem Circuits. In the field of industrial control circuits, Exar manufactures a broad line of quad and dual operational amplifiers, voltage regulators, radio-control and servo driver IC's, and power control circuits.

Exar's experience and expertise in the area of bipolar IC technology extends both into custom and standard IC products. In the area of custom IC's, Exar has designed, developed, and manufactured a wide range of full-custom monolithic circuits, particularly for applications in the areas of telecommunications, consumer electronics, and industrial controls.

In addition to the full-custom capability, Exar also offers a unique semi-custom IC development capability for low to medium-volume custom circuits. This semi-custom program, is intended for those customers seeking cost-effective solutions to reduce component count and board size in order to compete more effectively in a changing marketplace. The program allows a customized monolithic IC to be developed with a turnaround time of several weeks at a small fraction of the cost of a full-custom development program.

## EXCELLENCE IN ENGINEERING

Exar quality starts in Engineering where highly qualified people are backed up with the advanced instruments and facilities needed for design and manufacture of custom, semi-custom and standard integrated circuits. Exar's engineering and facilities are geared to handle all three classes of IC design: (1) semi-custom design programs using Exar's bipolar and I<sup>2</sup>L master chips; (2) full-custom IC design; (3) development and high-volume production of standard products.

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Exar reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Some of the challenging and complex development programs successfully completed by Exar include analog companders and PCM repeaters for telecommunication, electronic fuel-injection, anti-skid braking systems and voltage regulators for automotive electronics, digital voltmeter circuits, 40-MHz frequency synthesizers, high-current and high-voltage display and relay driver ICs, and many others.

## NEW TECHNOLOGIES

Through company sponsored research and development activities, Exar constantly stays abreast of all technology areas related to changing customer needs and requirements. Exar has recently completed development efforts in Integrated Injection Logic (I<sup>2</sup>L) technology, which offers unique advantages in the area of low-power, high-density logic arrays. Exar has a complete design engineering group dedicated to this new technology, and is currently supplying over twenty different custom and semi-custom I<sup>2</sup>L products.

## FIRST IN QUALITY

From incoming inspection of all materials to the final test of the finished goods, Exar performs sample testing of each lot to ensure that every product meets Exar's high quality standards. Exar's manufacturing process is inspected or tested in accordance with its own stringent Quality Assurance Program, which is in compliance with MIL-Q-9858A. Additional special screening and testing can be negotiated to meet individual customer requirements.

Throughout the wafer fab and assembly process, the latest scientific instruments, such as scanning electron microscopes, are used for inspection, and modern automated equipment is used for wafer probe, AC, DC, and functional testing. Environmental and burn-in testing of finished products is also done in-house. For special environmental or high reliability burn-in tests outside testing laboratories are used to complement Exar's own extensive in-house facilities.

## FIRST IN SERVICE

Exar has the ability and flexibility to serve the customer in a variety of ways from wafer fabrication to full parametric selection of assembled units for individual customer requirements. Special marking, special packaging and military screening are only a few of the service options available from Exar. We are certain that Exar's service is flexible enough to satisfy 99% of your needs. The company has a large staff of Applications Engineers to assist the customer in the use of the product and to handle any request, large or small.

Exar cannot assume responsibility for any circuits shown or represented, as being free from patent infringement.

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# Industry-wide Product Cross Reference

| XR Devices                                       | Fairchild  | Intersil | Motorola   | National                                     | Raytheon   | Signetics  | Silicon General                              | Sprague  | Texas Instruments  |
|--|--|----------|--|--|--|--|--|--|--|
| 082<br>083<br>084                                |  |          |  |  |  |  |  |  | TL082<br>TL083<br>TL084  |
| 146<br>246<br>346<br>346-2<br>555                | UA555  | NE555    | MC1455   | LM146<br>LM246<br>LM346<br>LM346-2<br>LM555  | RC555  | NE555  | SG555  |  | SN72555  |
| L555<br>556<br>L556<br>558<br>559                | UA556  | NE556    | MC3456   | LM556  | RC556  | NEL555<br>NE556<br>NEL556<br>NE558<br>NE559          | SG556  |  |  |
| 567<br>1310<br>1468<br>1488<br><br>1489          | UA1488<br><br><br>UA1489A                        |          | MC1310<br>MC1468<br>MC1488<br><br>MC1489A        | LM567<br>LM1310<br><br>LM1488<br><br>LM1489A | <br><br><br>RC1488<br><br>RC1489A                  | NE567<br>MC1310<br><br>MC1488<br><br>MC1489A         | SG1468<br>SG1488<br><br>SG1489A              | ULN2210  | SN76115N<br><br>MC1488<br>SN75188<br>SN75189A  |
| 1524<br>2201<br><br>2202<br><br>2203<br><br>2204 | UA9665<br><br>UA9666<br><br>UA9667<br><br>UA9668 |          | MC1411<br><br>MC1412<br><br>MC1413<br><br>MC1416 | LM1524                                       |  | ULN2001<br><br>ULN2002<br><br>ULN2003<br><br>ULN2004 | SG1524<br>SG2001<br><br>SG2002<br><br>SG2003 | ULN2001<br><br>ULN2002<br><br>ULN2003<br><br>ULN2004 | SG1524<br>ULN2001<br>SN75466<br>ULN2002<br>SN75467<br>ULN2003<br>SN75468<br>ULN2004<br>SN75469 |
| 2206<br>2207<br>2211<br>2240<br>2524             | UA2240   | ICL8240  | MC14541  | LM2524                                       | RC2207<br>RC2211                                   | SG2524   | SG2206<br><br>SG2524                         |  | UA2240   |
| 2567<br>3403<br>3503<br>3524<br>4136             | UA3403<br>UA3503<br><br>UA4136                   |          | MC3403<br>MC3503                                 | LM3524                                       | RC2567<br>RC3403<br>RC3503<br><br>RC4136           | SG3524   | SG3503<br>SG3524                             |  | MC3403<br>MC3503<br>SG3524<br>RC4136   |
| 4151<br>4194<br>4195<br>4558<br><br>4739         | UA4151<br><br>UA4558<br><br>UA739                |          | MC4558   | LM1458                                       | RC4151<br>RC4194<br>RC4195<br>RC4558<br><br>RC4739 | MC1458   | SG4194<br><br>SG1458                         |  | RC4558<br>SN72558  |
| 4741<br>5532<br>5533<br>5534<br>6118             |  | LM348    | MC4741   | LM348  | HA4741-5   | NE5532<br>NE5533<br>NE5534                           |  | ULN6118  | NE5534   |
| 6128<br>8038<br>13600                            |  | ICL8038  |  | LM13600                                      |  |  |  | ULN6128  |  |

# Applications Guide

Exar's line of monolithic IC products cover a wide range of applications. This *Applications Guide* is intended as a brief selection guide for the IC user, to assist him in finding the Exar product most suited to his application.

The application categories, or classes, are listed in alphabetical order, dictionary style, to allow the user to locate the product he needs at a glance. In certain applications, *two* of Exar's products used in combination may be necessary to perform the complete function. In such a case, these products are grouped together as a pair. For example, to make a complete FSK Modem may require the XR-2206 Modulator and the XR-2211 Decoder. Thus, in the Applications Guide shown below, both of these products will be grouped under the Modem category as XR-2206/XR-2211.

In many of the applications, more than one product type is recommended. In such cases, the user can choose the device best suited to his specific application by either consulting with Exar's Applications Department, or by reviewing the electrical specifications of individual devices involved.

## —A—

| APPLICATION   | RECOMMENDED EXAR PRODUCT   |
|---|--|
| Active Filters  | XR-084, XR-094, XR-096, XR-346, XR-3403, XR-4202                                 |
| Acoustical Couplers (Also See Modems)   | XR-2206, XR-2207, XR-2211  |
| A/D Conversion (Pulse Counting Type)  | XR-2240  |
| Amplitude Detection<br>Phase-Locked AM Detection<br><br>Synchronous AM Detection<br><br>Amplitude Level Detection | XR-215/XR-2228, XR-2212/XR-2228<br>XR-S200, XR-2208, XR-2228<br>XR-2276, XR-2277 |
| Amplitude Modulated Oscillator<br>Crystal Controlled AM Oscillator  | XR-205, XR-2206<br>XR-S200, XR-205   |
| Amplitude Modulation  | XR-2206, XR-2208, XR-2228, XR-13600  |
| Analog Computation<br>Analog Multiplication/Division<br>Analog Square/Square-Root Operation                       | XR-2208, XR-2228<br>XR-2208  |
| Analog-To-Frequency Conversion  | XR-2209, XR-4151   |
| Analog Sample-Hold  | XR-13600/XR-082  |
| Analog Semi-Custom Design (Master Chips)  | XR-A100, XR-B100, XR-C100, XR-D100<br>XR-F100, XR-G100, XR-X100                  |
| Appliance Timing  | XR-555, XR-556, XR-558, XR-559, XR-2240, XR-2242                                 |
| Audio Amplifier/Preamp  | XR-5532, XR-5534   |
| Audio Level Detector  | XR-2276, XR-2279   |
| Automatic Gain Control (AGC)  | XR-2208, XR-2216, XR-2228, XR-13600  |

## —B—

| APPLICATION  | RECOMMENDED EXAR PRODUCT    |
|--|-----------------------------|
| Bar Graph Display  | XR-2276, XR-2277            |
| Battery Charger Timing   | XR-2242                     |
| Battery Operated Instruments (Low Power)<br>Timing<br>Tone Detection | XR-L555, XR-L556<br>XR-L567 |
| Bit-Pattern Generation   | XR-2240                     |

## —C—

| APPLICATION  | RECOMMENDED EXAR PRODUCT  |
|--|---|
| Carrier Detection (Also See AM and Tone Detection)<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz)<br><br>Low Power | XR-215/XR-2228<br>XR-567, XR-2211, XR-2567<br>XR-L567                     |
| Carrier-Tone Transceiver   | XR-2567   |
| Clock Generation (See Also Oscillators)<br>Low Frequency (<1 MHz)<br><br>Low Power<br>High Frequency<br>Phase-Locked     | XR-555, XR-2209, XR-2242<br>XR-L555, XR-L556<br>XR-205<br>XR-215, XR-2212 |
| Clock Extraction<br>Phase-Locked<br><br>PCM Signal Clock   | XR-210, XR-215, XR-2212<br>XR-C262, XR-C277                               |
| Clock Pattern Generation   | XR-2240   |
| Clock Synchronization<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz)   | XR-210, XR-215<br>XR-2212   |
| Compandor (Speech/Data)  | XR-2216   |
| Current-to-Frequency Converter   | XR-2206, XR-2207, XR-2209   |

## —D—

| APPLICATION  | RECOMMENDED EXAR PRODUCT   |
|--|--|
| Darlington Arrays (High-Current, High-Voltage)                               | XR-2200, XR-2201, XR-2202, XR-2203, XR-2204  |
| Data Synchronization<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz)    | XR-210, XR-215<br>XR-2212  |
| DC-DC Converter (Also See Switching Regulators)                              | XR-1524, XR-2524, XR-3524  |
| Detector<br>FM<br>FSK<br>Tone<br><br>Amplitude Level<br>Amplitude Modulation | XR-215, XR-2212<br>XR-210, XR-2211<br>XR-567, XR-L567, XR-2211, XR-2567<br>XR-2276, XR-2279<br>XR-2208 |

|  |  |
|--|--|
| Differential Multiplier  | XR-2228  |
| Digital Sample-Hold  | XR-2240  |
| Digital Semi-Custom Design (I <sup>2</sup> L Gate Arrays)<br>Complete Digital Design<br>Combined Analog/Digital Design | XR-200, XR-300,<br>XR-500<br>XR-400  |
| Display Driver<br>Fluorescent<br>Bar-Graph   | XR-2271, XR-2272,<br>XR-6118, XR-6128<br>XR-2276, XR-2277<br>XR-2278 XR-2279   |
| Plasma Displays:   | XR-2284, XR-2288   |
| Division (Analog)  | XR-2208  |
| Division (Frequency)   | XR-2240  |
| Dual Operational Amplifiers<br>Dual-741 Type<br>Low Noise<br>Bifet<br>Transconductance                                 | XR-1458, XR-4558,<br>XR-4739<br>XR-5532, XR-5533<br>XR-082, XR-083<br>XR-13600 |
| Dual Oscillator<br>Low Power   | XR-556, XR-2556,<br>XR-2567<br>XR-L556   |
| Dual Tone Detector   | XR-2567  |

—E—

| APPLICATION             | RECOMMENDED EXAR PRODUCT               |
|-------------------------|--|
| Electronic Gain Control | XR-2208, XR-2216,<br>XR-2228, XR-13600 |
| Expander (Speech/Data)  | XR-2216                                |

—F—

| APPLICATION  | RECOMMENDED EXAR PRODUCT  |
|--|---|
| Filters<br>Active Filters<br>Tracking Filters (Phase-Locked)   | XR-084, XR-094,<br>XR-346, XR-3403,<br>XR-4202<br>XR-S200, XR-215,<br>XR-2212 |
| Fluorescent Display Driver<br>Medium Voltage ( $\leq 50V$ )<br>High Voltage ( $> 50V$ )<br>Bar-Graph Display                     | XR-2271, XR-2272<br>XR-6118, XR-6128<br>XR-2276, XR-2279                      |
| Frequency Detection (Also See Tone Detection)<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)<br>Multiple Frequency | XR-215/XR-2228<br>XR-567, XR-2211<br>XR-2567                                  |
| Frequency Discriminator (Also See F/V Converter)<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)                    | XR-215<br>XR-2212, XR-4151  |
| Frequency Division   | XR-320, XR-555,<br>XR-2240, XR-2242   |
| Frequency Doubling   | XR-2208, XR-2228  |
| FM Detection<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)  | XR-215<br>XR-215, XR-2212   |
| FM Generation<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)   | XR-S200, XR-205<br>XR-2206, XR-2207,<br>XR-2209, XR-8038                      |
| Frequency Multiplication (Synthesis)<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)                                | XR-S200, XR-215<br>XR-2212  |

|  |  |
|--|--|
| Frequency Translation<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)   | XR-215/XR-2228<br>XR-2212/XR-2228                |
| Frequency/Voltage (F/V) Converter<br>Wide Band<br>Narrow Band  | XR-4151<br>XR-2212                               |
| FSK Detection (Decoding)<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)  | XR-210<br>XR-2211                                |
| FSK Generation (Encoding)<br>High Frequency ( $> 1$ MHz)<br>Low Frequency ( $< 1$ MHz)<br>Sinusoidal Output<br>Multiple Frequency Levels | XR-210<br>XR-2206, XR-2207<br>XR-2206<br>XR-2207 |
| FSK Modem (Modulator/<br>Demodulator)  | XR-2211/XR-2206,<br>XR-2211/XR-2207              |

—G—

| APPLICATION   | RECOMMENDED EXAR PRODUCT                         |
|---|--|
| Gate Arrays (I <sup>2</sup> L)—(Also See Digital Semi-Custom) | XR-200, XR-300,<br>XR-400, XR-500                |
| Generator (See Function Generators)                           | XR-205, XR-2206,<br>XR-8038                      |
| Ground-Sensing Op Amps  | XR-3403  |
| Gyrator Design  | XR-094, XR-346,<br>XR-3403, XR-4202,<br>XR-13600 |

—H—

| APPLICATION                                   | RECOMMENDED EXAR PRODUCT                          |
|---|---|
| Hammer Driver (Also See High Current Drivers) | XR-2200, XR-2201,<br>XR-2202, XR-2203,<br>XR-2204 |
| High Voltage Driver                           | XR-6118, XR-6128<br>XR-2284, XR-2288              |

—I—

| APPLICATION  | RECOMMENDED EXAR PRODUCT                               |
|--|--|
| Indicator, Amplitude<br>(Also See AM Detector, Level Detector) | XR-2208, XR-2228,<br>XR-2276 XR-2279                   |
| Indicator, Frequency (Also See Frequency Detector)             | XR-215, XR-2212,<br>XR-4151                            |
| Intercom   | XR-2206/XR-2211,<br>XR-2567                            |
| Interval Timing  | XR-555, XR-L555,<br>XR-556, XR-L556,<br>XR-558, XR-559 |

—L—

| APPLICATION                  | RECOMMENDED EXAR PRODUCT                          |
|------------------------------|---|
| LED Driver                   | XR-2200, XR-2201,<br>XR-2202, XR-2203,<br>XR-2204 |
| Linear Ramp Generation       | XR-320, XR-2207                                   |
| Linear Sweep Oscillator      | XR-2206, XR-2207,<br>XR-2209                      |
| Line Compander               | XR-2216   |
| Line Driver (RS-232C Spec)   | XR-1488   |
| Line Receiver (RS-232C Spec) | XR-1489A  |

|                              |                  |
|------------------------------|------------------|
| Long Delay Generation        | XR-2242          |
| Low Power Oscillator         | XR-L555          |
| Low Power PLL                | XR-L567          |
| Low Power Timer              | XR-L555, XR-L556 |
| Low Voltage Timer/Oscillator | XR-L555, XR-L556 |

—M—

| APPLICATION  | RECOMMENDED EXAR PRODUCT  |
|--|---|
| Micropower Circuits (Also See Low Power)<br>Micropower Oscillator<br>Micropower Tone Decoder (PLL)<br>Micropower Timer   | XR-L555, XR-L556<br>XR-L567<br>XR-L555, XR-L556   |
| Missing Pulse Detection  | XR-320, XR-555, XR-L555   |
| Modem Filter Design  | XR-346, XR-3403, XR-4202  |
| Modem (Frequency-Shift Keyed)  | XR-210, XR-2206, XR-2207, XR-2211   |
| Modulators (Also See Multipliers)<br>Amplitude Modulator<br>FSK Modulator<br>Frequency Modulator<br><br>Phase Modulator<br>Motor Speed Control<br>Multi-Function PLL<br>Multiplier, Analog | XR-2212<br>XR-2206, XR-2207<br>XR-205, XR-2206, XR-2209<br>XR-2212<br>XR-2208, XR-2212<br>XR-S200<br>XR-2208, XR-2228 |

—O—

| APPLICATION   | RECOMMENDED EXAR PRODUCT  |
|---|---|
| Operational Amplifiers<br>Single Op Amp<br>Dual Op Amp<br><br>Quad Op Amp<br><br>Programmable Op Amp<br><br>Ground Sensing Quad Op Amp<br>Ultra Low Noise Op Amp<br><br>Bifet Op Amps<br>Dual Bifet<br>Quad Bifet<br>Programmable Bifet   | XR-5534<br>XR-082, XR-083, XR-1458, XR-4558, XR-4739<br>XR-084, XR-3403, XR-4136, XR-4212, XR-4741<br>XR-094, XR-095, XR-096, XR-346, XR-4202<br>XR-3403<br>XR-5532, XR-5333, XR-5534<br><br>XR-082, XR-083<br>XR-084<br>XR-094, XR-095, XR-096 |
| Operational Transconductance Amplifier (OTA)  | XR-13600  |
| Oscillators (Also See Function Generators)<br>High Frequency Oscillator (>1 MHz)<br><br>Low Frequency Oscillator (<1 MHz)<br><br>High Current Output Oscillator<br>Low Cost Oscillator<br>Low Power Oscillator (Single)<br>Low Power Oscillator<br>Quad Oscillator<br>Sinusoidal Output<br><br>FSK Keyed Oscillator<br>Oscillator with Quadrature Outputs | XR-205, XR-210, XR-215<br>XR-2206, XR-2207, XR-2209, XR-8038<br>XR-567<br>XR-555, XR-L555<br>XR-L555, XR-L567<br>XR-L-556<br>XR-558, XR-559<br>XR-205, XR-2206, XR-8038<br>XR-2206, XR-2207<br>XR-2212  |

—P—

| APPLICATION  | RECOMMENDED EXAR PRODUCT   |
|--|--|
| PCM Repeater (See Regenerator)   | XR-C240, XR-C262, XR-C277  |
| Phase-Comparator (Phase-Detector)  | XR-2208, XR-2228   |
| Phase-Locked Loop<br>High Frequency (>1 MHz)<br><br>Low Frequency (<1 MHz)<br><br>Ultra-Stable<br>FM Detector<br>FSK Detector<br>Tone Detector<br><br>Low Power<br>AM Detector<br><br>Stereo Decoder | XR-S200, XR-210, XR-215<br>XR-567, XR-L567, XR-2567, XR-2211, XR-2212<br>XR-2211, XR-2212<br>XR-215, XR-2212<br>XR-210, XR-2211<br>XR-567, XR-L567, XR-2567<br>XR-L567<br>XR-215/XR-2228, XR-2212/XR-2228<br>XR-1310 |
| Plasma Display Driver  | XR-2284, XR-2288   |
| Power-On-Reset   | XR-320, XR-555, XR-L555  |
| Precision Oscillator   | XR-2206, XR-2209   |
| Precision PLL  | XR-2212  |
| Process Controller   | XR-2206/XR-2211, XR-2240, XR-4151  |
| Programmable Op Amp (Also See Op Amps)<br>Quad Bipolar<br><br>Quad Bifet   | XR-346, XR-346-2, XR-4202<br>XR-094, XR-095<br>XR-096  |
| Programmable Oscillator  | XR-2206, XR-2207   |
| Programmable Timer   | XR-2240  |
| PSK Generation (Bi-phase)  | XR-205, XR-2206, XR-2228   |
| Pulse-Blanking   | XR-556, XR-2556  |
| Pulse-Code Modulation (PCM) Regenerator  | XR-C240, XR-C262, XR-C277  |
| Pulse Counting   | XR-2240  |
| Pulse Generation   | XR-320, XR-555, XR-L555, XR-556  |
| Pulse-Position Modulation (PPM)  | XR-320   |
| Pulse-Proportioned Servo Controller  | XR-2264, XR-2265, XR-2266  |
| Pulse Shaping  | XR-555, XR-556, XR-558, XR-559   |
| Pulse Stretching   | XR-320, XR-555, XR-556   |
| Pulse-Width Modulation (PWM)   | XR-320, XR-555   |
| Pulse-Width Modulating Regulator   | XR-1524, XR-2524, XR-3524  |

—Q—

| APPLICATION                  | RECOMMENDED EXAR PRODUCT |
|------------------------------|--------------------------|
| Quadrature AM Detector       | XR-2208, XR-2228         |
| Quadrature-Output Oscillator | XR-2212                  |

—R—

| APPLICATION | RECOMMENDED EXAR PRODUCT |
|-------------|--------------------------|
|-------------|--------------------------|

|  |   |
|--|---|
| Radio-Controlled Servo Driver                    | XR-2264, XR-2265,<br>XR-2266                      |
| Radio-FM I.F. Demodulation<br>-AM I.F. Detection | XR-215<br>XR-2228                                 |
| Relay Driver (Also See Hammer Driver)            | XR-2200, XR-2201,<br>XR-2202, XR-2203,<br>XR-2204 |
| Remote-Control Timer/Sequencer                   | XR-L555, XR-L556,<br>XR-2240                      |
| Remote-Control Transceiver                       | XR-567, XR-L567,<br>XR-2567                       |
| Reset Controller (Also See<br>Power-On Reset)    | XR-L555, XR-L556                                  |

-S-

| APPLICATION   | RECOMMENDED EXAR PRODUCT                                   |
|---|--|
| Sample-Hold Amplifier (Also See<br>Bifet Op Amps)   | XR-082, XR-084   |
| Saw-Tooth Generator                                 | XR-320, XR-2207  |
| Semi-Custom Design<br>Linear Master Chips           | XR-A100, XR-B100,<br>XR-C100, XR-D100,<br>XR-F100, XR-X100 |
| Digital (I <sup>2</sup> L) Master Chips             | XR-200, XR-300,<br>XR-400, XR-500                          |
| Sequential Timing                                   | XR-556, XR-L556,<br>XR-558, XR-559                         |
| Sequential Tone Decoding                            | XR-567, XR-L567,<br>XR-2567                                |
| Servo Controller/Driver                             | XR-2264, XR-2266   |
| Signal Conditioning<br>High Frequency (>1MHz)       | XR-S200, XR-215,<br>XR-2212                                |
| Low Frequency (<1 MHz)                              | XR-2212  |
| Simultaneous AM/FM Detection                        | XR-215/XR-2228,<br>XR-2212/XR-2228                         |
| Simultaneous AM/FM Generation                       | XR-205, XR-2206  |
| Sine Wave Converter                                 | XR-2212/XR-2228  |
| Sine Wave Generator                                 | XR-205, XR-2206,<br>XR-8038                                |
| Solenoid Driver (Also See Relay Driver)             | XR-2200, XR-2201,<br>XR-2202, XR-2203,<br>XR-2204          |
| Speech Compressor                                   | XR-2216  |
| Square-Root Extraction                              | XR-2208  |
| Squaring (Analog)                                   | XR-2208, XR-2228   |
| Stable PLL  | XR-2211, XR-2212   |
| Stereo Demodulator (Decoder)                        | XR-1310  |
| Suppressed Carrier AM Generator                     | XR-205, XR-2206,<br>XR-2208, XR-2228                       |
| Sweep Generation (Also See Saw-Tooth<br>Generation) | XR-320, XR-2207  |
| Synchronization (Clock Frequency)                   | XR-215, XR-2212  |
| Synchronous AM Detection                            | XR-215/XR-2228,<br>XR-2212/XR-2228                         |

-T-

| APPLICATION   | RECOMMENDED EXAR PRODUCT     |
|---|------------------------------|
| Telecommunication Circuits<br>PCM Repeater (T-1 Type) | XR-C240, XR-C262,<br>XR-C277 |

|   |   |
|---|---|
| Speech Compressor<br>Tone Decoder (PLL Type)  | XR-2216<br>XR-567, XR-L567,<br>XR-2211, XR-2567   |
| Tone Encoder  | XR-2206, XR-2207  |
| Timing Circuits (Timers)<br>General Purpose Timers - Single<br>General Purpose Timers - Dual<br>General Purpose Timers - Quad<br>Low Power Timers<br>Long Delay Timer<br>Programmable Timer | XR-320, XR-555<br>XR-556, XR-2556<br>XR-558, XR-559<br>XR-L555, XR-L556<br>XR-2242<br>XR-2240 |
| Tone Decoder (PLL Type)<br>General Purpose - Single<br>General Purpose - Dual<br>Precision<br>Low Power   | XR-567<br>XR-2567<br>XR-2211<br>XR-L567   |
| Tone Encoder  | XR-2206, XR-2207  |
| Tracking Filter<br>High Frequency (>1MHz)<br>Low Frequency (<1 MHz)   | XR-S200, XR-215<br>XR-2212  |
| Tracking Regulator  | XR-1468, XR-4194,<br>XR-4195  |
| Transceiver (Wireless Intercom)   | XR-2567   |
| Triangle-to-Sine Wave Converter   | XR-2208, XR-2228  |
| Triangle-Wave Oscillator  | XR-2206, XR-2207,<br>XR-2209, XR-8038   |
| TV Sound Detection  | XR-215  |

-U-

| APPLICATION                    | RECOMMENDED EXAR PRODUCT    |
|--------------------------------|-----------------------------|
| Ultra-Low Frequency Oscillator | XR-2242                     |
| Ultra-Sonic Remote Control     | XR-567, XR-2211,<br>XR-2567 |
| Universal Sine Wave Converter  | XR-2212/XR-2228             |

-V-

| APPLICATION  | RECOMMENDED EXAR PRODUCT                                 |
|--|--|
| Voltage-Controlled Amplifier   | XR-2208, XR-2228,<br>XR-13600                            |
| Voltage-Controlled Oscillator (VCO)<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz) | XR-S200, XR-205<br>XR-2206, XR-2207,<br>XR-2209, XR-8038 |
| Ultra-Stable   | XR-2206, XR-2207,<br>XR-2209                             |
| Sinusoidal Output<br>Wide Linear Sweep   | XR-2206, XR-8038<br>XR-2207, XR-2209                     |
| Voltage-to-Current Conversion  | XR-13600   |
| Voltage-to-Frequency (V/F) Conversion  | XR-2209, XR-4151   |

-W-

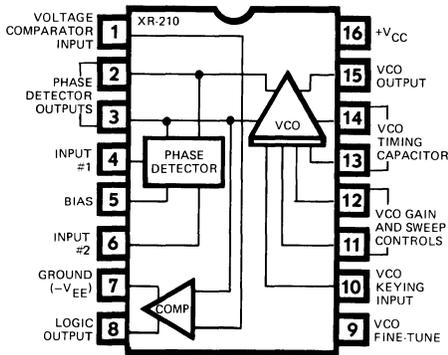
| APPLICATION  | RECOMMENDED EXAR PRODUCT               |
|--|--|
| Waveform Generator (Also See Oscillators)<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz) | XR-205<br>XR-2206, XR-2209,<br>XR-8038 |
| Waveform Shaping/Modulation  | XR-2208, XR-2228                       |
| Wide Band Discriminator (FM)<br>High Frequency (>1 MHz)<br>Low Frequency (<1 MHz)              | XR-S200, XR-215<br>XR-2212, XR-4151    |
| Wireless Intercom  | XR-215, XR-567,<br>XR-2212             |

# Phase-Locked Loops

## XR-210 FSK MODULATOR/ DEMODULATOR

The XR-210 is a highly versatile monolithic phase-locked loop system especially designed for data communications. It is particularly well suited for FSK modulation/demodulation (MODEM) applications, frequency synthesis, tracking filters and tone decoding. The XR-210 operates over a power supply range of 5V to 26V and over a frequency band of 0.5 Hz to 20 MHz. The circuit can accommodate analog signals between 300  $\mu$ V and 3V and can interface with conventional DTL, TTL, and ECL logic families.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Digital Programming Capability
- RS-232C Compatible Demodulator Output
- ON-OFF Keying and Sweep Capability
- Wide Tracking Range: Adjustable from  $\pm 1\%$  to  $\pm 50\%$
- Good Temperature Stability (200 ppm/ $^{\circ}$ C)
- High Current Logic Output (50 mA)
- Independent "Mark" and "Space" Frequency Adjustment
- VCO Duty Cycle Control

### APPLICATIONS

- |                         |                         |
|-------------------------|-------------------------|
| FSK Demodulation        | Tracking Filter         |
| FSK Generation          | Signal Conditioning     |
| Data Synchronization    | Tone Decoding           |
| Frequency Synthesis     | FM Detection            |
| FM and Sweep Generation | Wideband Discrimination |

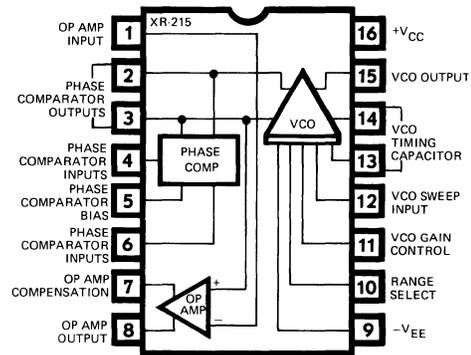
### ORDER INFORMATION

| Part Number | Package | Operating Temperature               |
|-------------|---------|-------------------------------------|
| XR-210M     | Ceramic | $-55^{\circ}$ C to $+125^{\circ}$ C |
| XR-210CN    | Ceramic | $0^{\circ}$ C to $+75^{\circ}$ C    |

## XR-215 HIGH-FREQUENCY PHASE-LOCKED LOOP

The XR-215 is a highly versatile monolithic phase-locked loop (PPL) system designed for a wide variety of applications in both analog and digital communication systems. It is especially well suited for FM demodulation, frequency synthesis and tracking filter applications. The XR-215 operates over a power supply voltage ranging from 5V to 26V and has a wide frequency band of 0.5 Hz to 35 MHz. It can interface with conventional DTL, TTL, and ECL logic families.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Wide Frequency Range: 0.5 Hz to 35 MHz
- Wide Supply Voltage Range: 5V to 26V
- Digital Programming Capability
- DTL, TTL, and ECL Logic Compatibility
- Wide Dynamic Range: 300 $\mu$ V to 3V
- ON-OFF Keying and Sweep Capability
- Wide Tracking Range: Adjustable from  $\pm 1\%$  to  $\pm 50\%$
- High-Quality FM Detection: Distortion 0.15%  
Signal/Noise 65 dB

### APPLICATIONS

- FM Demodulation
- Frequency Synthesis
- FSK Coding/Decoding (MODEM)
- Tracking Filters
- Signal Conditioning
- FM, FSK, and Sweep Generation
- Crystal Controlled Detection
- Wideband Frequency Discrimination
- Voltage-to-Frequency Conversion

### ORDER INFORMATION

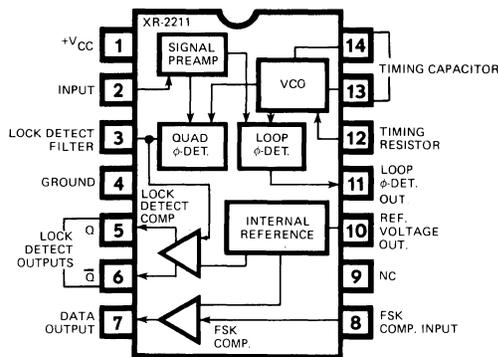
| Part Number | Package | Operating Temperature            |
|-------------|---------|----------------------------------|
| XR-215CN    | Ceramic | $0^{\circ}$ C to $+75^{\circ}$ C |

# Phase-Locked Loops

## XR-2211 FSK DEMODULATOR/ TONE DECODER

The XR-2211 is a monolithic phase-locked loop system especially designed for data communications and is particularly well-suited for FSK modem applications. It has a supply voltage range of 4.5V to 20V and a wide frequency range of 0.01 Hz to 300 kHz. The circuit accommodates analog signals between 2 mV and 3V and interfaces with conventional DTL, TTL, and ECL logic families. The XR-2211 consists of a basic PLL for tracking an input signal within the passband, a quadrature phase detector for carrier detection, and an FSK voltage comparator for FSK demodulation. Independent external components set center frequency, bandwidth, and output delay.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

|   |                                      |
|---|--------------------------------------|
| Wide Frequency Range                                  | 0.01 Hz to 300 kHz                   |
| Wide Supply Voltage Range                             | 4.5V to 20V                          |
| DDT/TTL/ECL Logic Compatibility                       |                                      |
| FSK Demodulation, with Carrier-Detection              |                                      |
| Wide Dynamic Range                                    | 2 mV to 3 Vrms                       |
| Adjustable Tracking Range ( $\pm 1\%$ to $\pm 80\%$ ) |                                      |
| Excellent Temperature Stability                       | 20 ppm/ $^{\circ}\text{C}$ , Typical |

### APPLICATIONS

FSK Demodulation  
Data Synchronization  
Tone Decoding  
FM Detection  
Carrier Detection

### ORDER INFORMATION

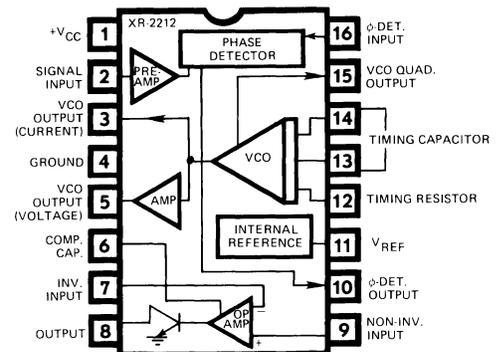
| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-2211M    | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-2211N    | Ceramic | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |
| XR-2211P    | Plastic | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |
| XR-2211CN   | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-2211CP   | Plastic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

## XR-2212 PRECISION PHASE-LOCKED LOOP

The XR-2212 is an ultra-stable monolithic phase-locked loop (PLL) system especially designed for data communication and control system applications. It offers 20 ppm/ $^{\circ}\text{C}$  temperature stability and is ideally suited for frequency synthesis, FM detection, and tracking filter applications.

The XR-2212 precision PLL is directly compatible with MOS, DTL, and TTL logic families and microprocessor peripheral systems. The circuit consists of a PLL system made up of an input preamplifier, a phase detector, a stable voltage-controlled oscillator (VCO), and a high-gain differential amplifier. The center frequency, bandwidth, and the tracking range of the PLL are controlled independently by the choice of external components.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

|   |                                      |
|---|--------------------------------------|
| Quadrature VCO Outputs                                |                                      |
| Wide Frequency Range                                  | 0.01 Hz to 300 kHz                   |
| Wide Supply Voltage Range                             | 4.5V to 20V                          |
| MOS/TTL/ECL Logic Compatibility                       |                                      |
| Wide Dynamic Range                                    |                                      |
| Adjustable Tracking Range ( $\pm 1\%$ to $\pm 80\%$ ) |                                      |
| Excellent Temperature Stability                       | 20 ppm/ $^{\circ}\text{C}$ , Typical |

### APPLICATIONS

|                      |                     |
|----------------------|---------------------|
| Frequency Synthesis  | FSK Demodulation    |
| Data Synchronization | Signal Conditioning |
| FM Detection         | Clock Extraction    |
| Tracking Filters     |                     |

### ORDER INFORMATION

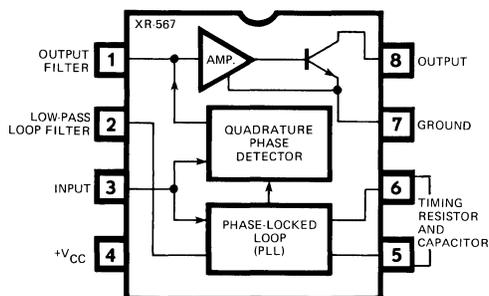
| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-2212M    | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-2212N    | Ceramic | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |
| XR-2212P    | Plastic | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |
| XR-2212CN   | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-2212CP   | Plastic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

# Tone Decoders

## XR-567 MONOLITHIC TONE DECODER

The XR-567 is a monolithic phase-locked loop system designed for general purpose tone and frequency decoding. It offers a wide frequency band of 0.01 Hz to 500 kHz and has a logic compatible output capable of sinking up to 100 mA of load current. Four independent external components determine the bandwidth, center frequency, and output delay.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct replacement for SE/NE567
- Bandwidth Adjustable from 0 to 14%
- Logic Compatible Output with 100 mA Current Sinking Capability
- Center Frequency Adjustable from 0.01 Hz to 500 kHz
- Inherent Immunity to False Signals
- High Rejection of Out-of-Band Signals and Noise
- Frequency Range Adjustable over 20:1 Range by External Resistor

### APPLICATIONS

- Touch-Tone® Decoding
- Sequential Tone Decoding
- Communications Paging
- Ultrasonic Remote-Control and Monitoring
- Carrier-Tone Transceiver
- Wireless Intercom
- Precision Oscillator

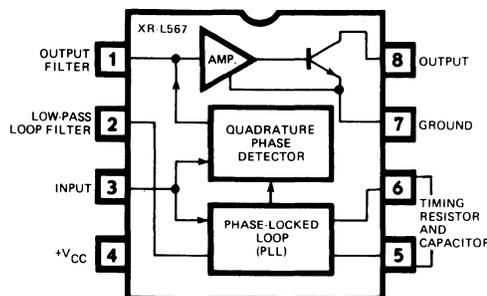
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-567M     | Ceramic | -55°C to +125°C       |
| XR-567CN    | Ceramic | 0°C to +75°C          |
| XR-567CP    | Plastic | 0°C to +75°C          |

## XR-L567 MONOLITHIC TONE DECODER

The XR-L567 is a micropower phase-locked loop (PLL) circuit designed for general purpose tone and frequency decoding. It is a direct replacement for the popular 567-type tone decoder IC's in applications requiring very low power dissipation. The XR-L567 offers approximately 1/10th the power dissipation of the conventional 567-type tone decoder, without sacrificing its key features such as the oscillator stability, frequency selectivity and detection threshold. At 5 volt operation, typical quiescent power dissipation is less than 4 mW.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Very Low Power Dissipation (≈4 mW at 5V).
- Bandwidth Adjustable from 0 to 14%.
- Logic Compatible Output with 10 mA Current Sinking Capability.
- Highly Stable Center Frequency.
- Center Frequency Adjustable from 0.01 Hz to 50 kHz.
- Inherent Immunity to False Signals.
- High Rejection of Out-of-Band Signals and Noise.
- Frequency Range Adjustable Over 20:1 Range by External Resistor.

### APPLICATIONS

- Battery-Operated Tone Detection
- Touch-Tone® Decoding
- Sequential Tone Decoding
- Communications Paging
- Ultrasonic Remote-Control
- Telemetry Decoding

### ORDER INFORMATION

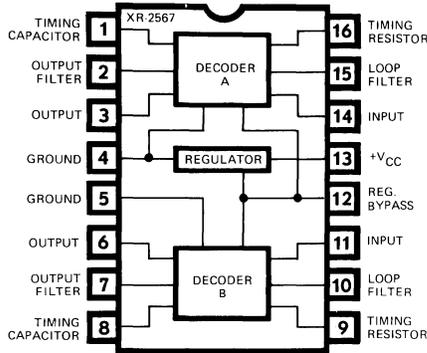
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-L567CN   | Ceramic | 0°C to +75°C          |
| XR-L567CP   | Plastic | 0°C to +75°C          |

## XR-2567 DUAL MONOLITHIC TONE DECODER

The XR-2567 is a dual monolithic tone decoder well-suited for tone or frequency decoding in a multiple-tone communication system. Each decoder can be used independently or both sections can be interconnected for dual operation. The matching and temperature tracking characteristics between decoders on this one chip are superior to those available from two separate tone decoder packages.

The XR-2567 operates over a frequency range of 0.01 Hz to 500 kHz with supply voltages from 4.5V to 12V and internal voltage regulation is provided for supplies between 7V and 12V.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

Replaces Two 567-Type Decoders  
 Excellent Temperature Tracking Between Decoders  
 Bandwidth Adjustable from 0 to 14%  
 Logic Compatible Outputs with 100 mA Sink Capability  
 Center Frequency Matching (1%, Typical)  
 Center Frequency Adjustable from 0.01 Hz to 500 kHz  
 Inherent Immunity to False Triggering

### APPLICATIONS

|  |                              |
|--|------------------------------|
| Touch-Tone® Decoding                     | Full-Duplex Carrier-Tone     |
| Sequential Tone Decoding                 | Transceiver                  |
| Dual-Tone Decoding/Encoding              | Wireless Intercom            |
| Communications Paging                    | Dual Precision Oscillator    |
| Ultrasonic Remote-Control and Monitoring | FSK Generation and Detection |

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2567M    | Ceramic | -55°C to +125°C       |
| XR-2567CN   | Ceramic | 0°C to +75°C          |
| XR-2567CP   | Plastic | 0°C to +75°C          |

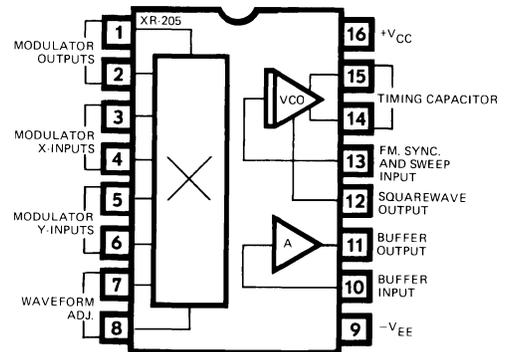
# Function Generators

## XR-205 MONOLITHIC WAVEFORM GENERATOR

The XR-205 is a highly versatile, monolithic waveform generator designed for diverse applications in communication and telemetry equipment, as well as in systems design and testing. It is a self-contained, totally monolithic signal generator that provides sine, square, triangle, ramp, and sawtooth output waveforms, which can be both amplitude and frequency modulated.

The circuit has three separate sections: a VCO, a balanced modulator, and a buffer amplifier.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

High Frequency Capability (to 4 MHz)  
 Wide Supply Range (+8V to +26V)  
 Output Current Swing of ±10 mA  
 Frequency Sweep Range of 10:1, Typical  
 Low Sinewave Distortion (THD 2.5%, Typical)

### APPLICATIONS

Waveform Generation  
 Sinewave      Sawtooth  
                  Triangle      Ramp  
                  Square        Pulse

AM Generation  
 FM Generation  
 Sweep Generation  
 Tone Burst Generation  
 Simultaneous AM/FM  
 FSK Signal Generation  
 On-Off Keyed Oscillation  
 Clock Generation

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-205CN    | Ceramic | 0°C to +75°C          |

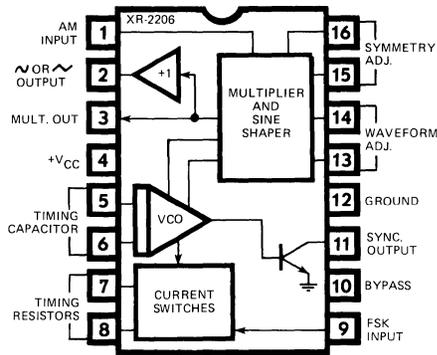
# Function Generators

## XR-2206 MONOLITHIC FUNCTION GENERATOR

The XR-2206 is a monolithic function generator integrated circuit capable of producing high quality sine, square, triangle, ramp, and pulse waveforms of high stability and accuracy. The output waveforms can be both amplitude and frequency modulated by an external voltage. Frequency of operation can be selected externally over a range of 0.01 Hz to more than 1 MHz.

This circuit is ideally suited for communications, instrumentation, and function generator applications requiring sinusoidal tone, AM, FM, or FSK generation. It has a typical drift specification of 20 ppm/°C.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Low Sinewave Distortion (THD .5%)
- Insensitive to Signal Sweep
- Excellent Stability (20 ppm/°C, Typical)
- Wide Sweep Range (2000:1, Typical)
- Low Supply Sensitivity (0.01%/V, Typical)
- Linear Amplitude Modulation
- Adjustable Duty-Cycle (1% to 99%)
- TTL Compatible FSK Controls
- Wide Supply Range (10V to 26V)

### APPLICATIONS

- Waveform Generation
  - Sine, Square, Triangle, Ramp
- Sweep Generation
- AM/FM Generation
- FSK and PSK Generation
- Voltage-to-Frequency Conversion
- Tone Generation
- Phase-Locked Loops

### ORDER INFORMATION

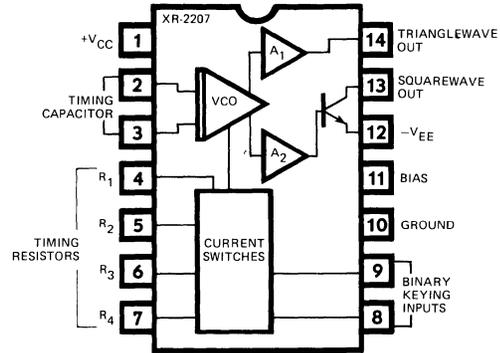
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2206M    | Ceramic | -55°C to +125°C       |
| XR-2206N    | Ceramic | 0°C to +75°C          |
| XR-2206P    | Plastic | 0°C to +75°C          |
| XR-2206CN   | Ceramic | 0°C to +75°C          |
| XR-2206CP   | Plastic | 0°C to +75°C          |

## XR-2207 VOLTAGE-CONTROLLED OSCILLATOR

The XR-2207 is a monolithic voltage-controlled oscillator (VCO) integrated circuit featuring excellent frequency stability and a wide tuning range. The circuit provides simultaneous triangle and squarewave outputs over a frequency range of 0.01 Hz to 1 MHz. It is ideally suited for FM, FSK, sweep or tone generation, and phase-locked loop applications.

The XR-2207 has a typical drift specification of 20 ppm/°C. The oscillator frequency can be linearly swept over a 1000:1 range with an external control voltage.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Excellent Temperature Stability (20 ppm/°C)
- Linear Frequency Sweep
- Adjustable Duty Cycle (0.1% to 99.9%)
- Two or Four Level FSK Capability
- Wide Sweep Range (1000:1 Minimum)
- Logic Compatible Input and Output Levels
- Wide Supply Voltage Range ( $\pm 4V$  to  $\pm 13V$ )
- Low Power Sensitivity (0.15%/V)
- Wide Frequency Range (0.01 Hz to 1 MHz)
- Simultaneous Triangle and Squarewave Outputs

### APPLICATIONS

- FSK Generation
- Voltage and Current-to-Frequency Conversion
- Stable Phase-Locked Loop
- Waveform Generation
  - Triangle, Sawtooth, Pulse, Squarewave
- FM and Sweep Generation

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2207M    | Ceramic | -55°C to +125°C       |
| XR-2207N    | Ceramic | 0°C to +75°C          |
| XR-2207P    | Plastic | 0°C to +75°C          |
| XR-2207CN   | Ceramic | 0°C to +75°C          |
| XR-2207CP   | Plastic | 0°C to +75°C          |

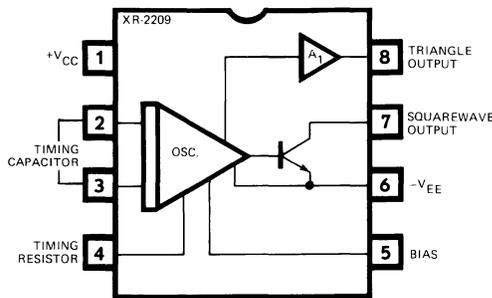
# Function Generators

## XR-2209 PRECISION OSCILLATOR

The XR-2209 is a monolithic variable frequency oscillator circuit featuring excellent temperature stability and a wide linear sweep range. The circuit provides simultaneous triangle and squarewave outputs over a frequency range of 0.01 Hz to 1 MHz. The frequency is set by an external RC product. It is ideally suited for frequency modulation, voltage-to-frequency or current-to-frequency conversion, sweep or tone generation, as well as for phase-locked loop applications when used in conjunction with a phase comparator such as the XR-2208.

The circuit is comprised of three functional blocks: a variable frequency oscillator, and two buffer amplifiers. The XR-2209 has a typical drift specification of 20 ppm/°C. Its frequency can be linearly swept over a 1000:1 range with an external control signal.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Excellent Temperature Stability (20 ppm/°C)
- Linear Frequency Sweep
- Wide Sweep Range (1000:1 Minimum)
- Wide Supply Voltage Range ( $\pm 4V$  to  $\pm 13V$ )
- Low Supply Sensitivity (0.15%/V)
- Wide Frequency Range (0.01 Hz to 1 MHz)
- Simultaneous Triangle and Squarewave Outputs

### APPLICATIONS

- Voltage and Current-to-Frequency Conversion
- Stable Phase-Locked Loop Oscillator
- Waveform Generation
- FM and Sweep Generation

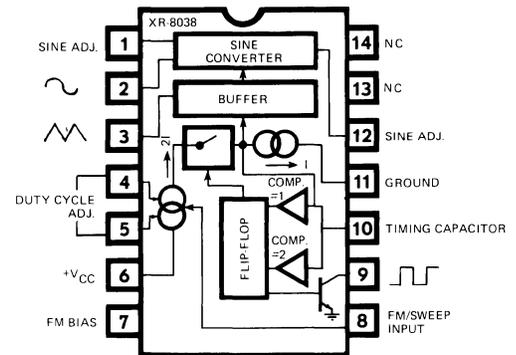
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2209M    | Ceramic | -55°C to +125°C       |
| XR-2209CN   | Ceramic | 0°C to +75°C          |
| XR-2209CP   | Plastic | 0°C to +75°C          |

## XR-8038 PRECISION WAVEFORM GENERATOR

The XR-8038 is a precision waveform generator IC capable of producing sine, square, triangular, sawtooth, and pulse waveforms with a minimum of external components and adjustments. Its operating frequency can be selected over nine decades of frequency, from 0.001 Hz to 1 MHz by the choice of external RC components. The frequency of oscillation is highly stable over a wide temperature and supply voltage range. The frequency modulation and sweeping can be accomplished with an external control voltage without affecting the quality of the output waveforms; and the frequency can be programmed digitally through the use of either resistors or capacitors.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for Intersil I8038
- Low Frequency Drift: 50 ppm/°C
- Simultaneous Sine-, Triangle- and Square-Wave Outputs
- Low Distortion: THD 1%
- High FM and Triangle Linearity
- Wide Frequency Range: 0.001 Hz to 1 MHz
- Minimum External Component Count
- Variable Duty-Cycle: 2% to 98%

### APPLICATIONS

- Precision Waveform Generation
- Sine, Square, Triangle, Pulse
- Test Instrumentation Design
- Phase-Locked Clock Generation
- Sweep and FM Generation
- Tone Generation
- Precision PLL Design

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-8038M    | Ceramic | -55°C to +125°C       |
| XR-8038N    | Ceramic | 0°C to +70°C          |
| XR-8038P    | Plastic | 0°C to +70°C          |
| XR-8038CN   | Ceramic | 0°C to +70°C          |
| XR-8038CP   | Plastic | 0°C to +70°C          |

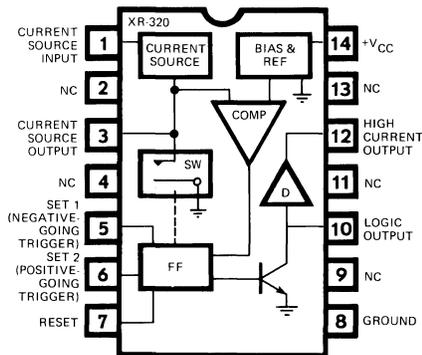
# Timing Circuits

## XR-320 MONOLITHIC TIMING CIRCUIT

The XR-320 monolithic timing circuit is designed for use in instrumentation and digital communications equipment, industrial control, and special testing applications. In many cases, this circuit provides a monolithic replacement for mechanical or electro-mechanical timing devices.

The XR-320 features a precision current source, a voltage comparator, a flip-flop, a timing switch, and a pair of output logic drivers. When triggered, it produces a highly-linear positive-going ramp voltage across the external timing capacitor for a duration of  $2.0 RC$ . The high current output at pin 12 can sink or source up to 100 mA of current. The XR-320 is specified over the commercial temperature range of  $0^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$ .

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Wide Timing Range:  $1\mu\text{sec}$  to 1 Hour
- Positive- and Negative-Going Outputs
- Excellent Temperature Stability:  $100\text{ ppm}/^{\circ}\text{C}$
- Wide Supply Voltage Range: 4.5V to 18V
- Triggering with Positive- or Negative-Going Pulses
- Programmable Timing
  - 3 Decades of Resistor Programming
  - 9 Decades of Capacitor Programming
- Logic Compatible Outputs
- High Current Drive Capability: 100 mA

### APPLICATIONS

- Precision Timing
- Time-Delay Generation
- Sequential Timing
- Pulse Generation/Shaping
- Pulse-Position Modulation
- Pulse-Width Modulation
- Sweep Generation

### ORDER INFORMATION

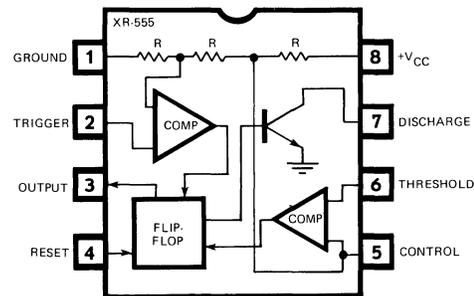
| Part Number | Package | Operating Temperature                        |
|-------------|---------|--|
| XR-320P     | Plastic | $0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ |

## XR-555 TIMING CIRCUIT

The XR-555 monolithic timing circuit is a highly stable controller capable of producing accurate timing pulses. It is a direct, pin-for-pin replacement for the SE/NE 555 timer. The circuit contains independent control terminals for triggering or resetting, if desired.

The mode of operation can be either monostable or astable. The XR-555 may be triggered or reset on falling waveforms and its output can source or sink up to 200 mA or drive TTL circuits.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for SE/NE 555
- Timing from Microseconds through Hours
- Operates in Both Monostable and Astable Modes
- High Current Drive Capability (200 mA)
- TTL and DTL Compatible Outputs
- Adjustable Duty Cycle
- Temperature Stability of  $.005\%/^{\circ}\text{C}$

### APPLICATIONS

- Precision Timing
- Pulse Generation
- Sequential Timing
- Pulse Shaping
- Clock Generation
- Missing-Pulse Detection
- Pulse-Width Modulation
- Frequency Division
- Pulse-Position Modulation
- Appliance Timing

### ORDER INFORMATION

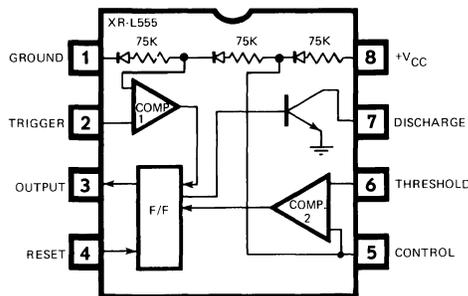
| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-555M     | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-555CN    | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-555CP    | Plastic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

# Timing Circuits

## XR-L555 MICROPOWER TIMING CIRCUIT

The XR-L555 is a stable micropower controller capable of producing accurate timing pulses with low power dissipation. Typical power dissipation is 900 microwatts at 5V. The circuit offers both the monostable or the astable modes of operation and can operate with power supplies as low as 2.7 volts. It may be triggered or reset on falling waveforms. The output can source up to 50 mA or drive TTL circuits. The XR-L555 features temperature stability and low-voltage operation, ideal as a micropower clock oscillator or VCO for low-power CMOS systems. It can operate up to 1500 hours with only two 300 mA-Hr NiCd batteries.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Pin Compatible with Standard 555 Timer
- Less than 1 mW Power Dissipation ( $V+ = 5V$ )
- Timing from Microseconds to Minutes
- Over 1000-Hour Operation with 2 NiCd Batteries
- Low Voltage Operation ( $V+ = 2.7V$ )
- Operates in Both Monostable and Astable Modes
- CMOS, TTL, and DTL Compatible Outputs
- Adjustable Duty Cycle
- Temperature Stability of  $.005\%/^{\circ}C$

### APPLICATIONS

- |                             |                           |
|-----------------------------|---------------------------|
| Battery Operated Timing     | Micropower Oscillator     |
| Micropower Clock Generator  | Sequential Timing         |
| Pulse Shaping and Detection | Pulse-Width Modulation    |
| Micropower PLL Design       | Pulse Position Modulation |
| Missing Pulse Detection     | Appliance Timing          |
| Power-On Reset Controller   | Remote-Control Sequencer  |

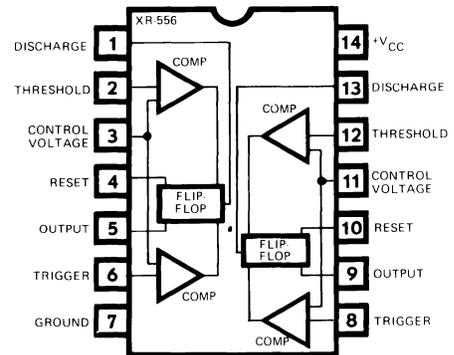
### ORDER INFORMATION

| Part Number | Package | Operating Temperature             |
|-------------|---------|-----------------------------------|
| XR-L555M    | Ceramic | $-55^{\circ}C$ to $+125^{\circ}C$ |
| XR-L555CN   | Ceramic | $0^{\circ}C$ to $+75^{\circ}C$    |
| XR-L555CP   | Plastic | $0^{\circ}C$ to $+75^{\circ}C$    |

## XR-556 DUAL TIMER

The XR-556 dual timing circuit contains two independent type timers on a single monolithic chip. It is a direct pin-for-pin replacement for the SE/NE 556 dual timer. Each timer section is a highly stable controller capable of producing accurate time delays or oscillations, and each has independent outputs and control terminals. The circuit can be used for monostable or astable operation. The XR-556 may be triggered or reset on falling waveforms and each output can source up to 150 mA or drive TTL circuits. Each timer section features excellent matching and temperature tracking characteristics.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for SE/NE 556
- Replaces Two 555-Type Timers
- TTL Compatible Pinouts for  $+V_{CC}$  and Ground
- Timing from Microseconds Through Hours
- Excellent Matching Between Timer Sections
- Operates in Both Monostable and Astable Modes
- High Current Drive Capability (150 mA each output)
- TTL and DTL Compatible Outputs
- Adjustable Duty Cycle
- Temperature Stability of  $0.005\%/^{\circ}C$

### APPLICATIONS

- |                          |                           |
|--------------------------|---------------------------|
| Precision Timing         | Missing-Pulse Detection   |
| Pulse Generation         | Pulse-Width Modulation    |
| Sequential Timing        | Frequency Division        |
| Pulse Shaping            | Clock Synchronization     |
| Time Delay Generation    | Pulse-Position Modulation |
| Clock Pattern Generation | Appliance Timing          |

### ORDER INFORMATION

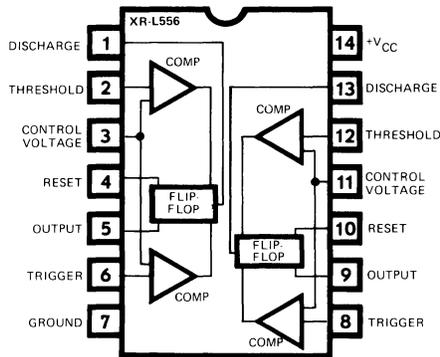
| Part Number | Package | Operating Temperature             |
|-------------|---------|-----------------------------------|
| XR-556M     | Ceramic | $-55^{\circ}C$ to $+125^{\circ}C$ |
| XR-556CN    | Ceramic | $0^{\circ}C$ to $+75^{\circ}C$    |
| XR-556CP    | Plastic | $0^{\circ}C$ to $+75^{\circ}C$    |

# Timing Circuits

## XR-L556 DUAL MICROPOWER TIMER

The XR-L556 is the dual-version of the XR-L555 micro-power timer. It contains two low-power timer circuits on a single IC chip. Each timer section has completely independent control terminals, and independent outputs. The typical stand-by power dissipation for the entire circuit (i.e. both timer sections) is less than 2 mW at 5V. The circuit offers both the monostable or the astable modes of operation and can operate with power supplies as low as 2.7 volts. It may be triggered or reset on falling waveforms. Each of the outputs can source up to 50 mA or drive TTL circuits. Each timer section features excellent matching and temperature tracking characteristics.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Micropower Equivalent of 556-Type Dual Timer
- Less than 2 mW Power Dissipation ( $V+ = 5V$ )
- Timing from Microseconds to Minutes
- Over 500-Hour Operation with 2 NiCd Batteries
- Low Voltage Operation ( $V+ = 2.7V$ )
- Operates in Both Monostable and Astable Modes
- CMOS, TTL, and DTL Compatible Outputs
- Adjustable Duty Cycle
- Temperature Stability of  $.005\%/^{\circ}C$

### APPLICATIONS

- Battery Operated Timing
- Micropower Clock Generator
- Pulse Shaping and Detection
- Micropower PLL Design
- Missing Pulse Detection
- Power-On Reset Controller
- Micropower Oscillator
- Sequential Timing
- Pulse-Width Modulation
- Pulse Position Modulation
- Appliance Timing
- Remote-Control Sequencer

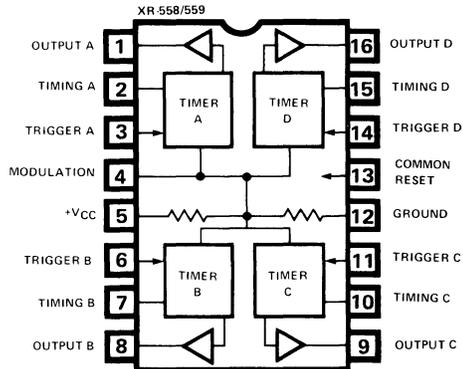
### ORDER INFORMATION

| Part Number | Package | Operating Temperature             |
|-------------|---------|-----------------------------------|
| XR-L556M    | Ceramic | $-55^{\circ}C$ to $+125^{\circ}C$ |
| XR-L556CN   | Ceramic | $0^{\circ}C$ to $+75^{\circ}C$    |
| XR-L556CP   | Plastic | $0^{\circ}C$ to $+75^{\circ}C$    |

## XR-558/XR-559 QUAD TIMER CIRCUITS

The XR-558 and the XR-559 are quad-timer circuits which contain four separate timers in a single IC package. These four timer sections share a common reset control; however each section has its own independent trigger, timing and output terminals. The XR-558 quad timer has four independent outputs each of which can *source* up to 100 mA of current. The XR-559 has four independent outputs which can *sink* up to 100 mA per output. All of the four timing sections are edge-triggered, and they can be cascaded without requiring coupling capacitors.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for NE558/NE559
- 100 mA Output Current per Section
- Edge-Triggered Inputs
- Produces Four Independent Time Delays
- Wide Supply Range: 4.5V to 15V
- Timing Interval from Microseconds to Minutes
- Time Interval Equal to 1.0 RC

### APPLICATIONS

- Sequential Timing
- Time Delay Generation
- Precision Timing
- Industrial Controls
- Quad One-Shot

### ORDER INFORMATION

| Part Number | Package | Operating Temperature             |
|-------------|---------|-----------------------------------|
| XR-558M     | Ceramic | $-55^{\circ}C$ to $+125^{\circ}C$ |
| XR-558CN    | Ceramic | $0^{\circ}C$ to $+70^{\circ}C$    |
| XR-558CP    | Plastic | $0^{\circ}C$ to $+70^{\circ}C$    |
| XR-559M     | Ceramic | $-55^{\circ}C$ to $+125^{\circ}C$ |
| XR-559CN    | Ceramic | $0^{\circ}C$ to $+70^{\circ}C$    |
| XR-559CP    | Plastic | $0^{\circ}C$ to $+70^{\circ}C$    |

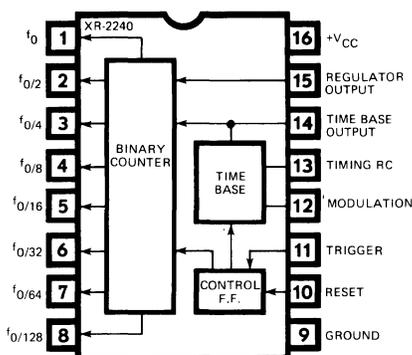
# Timing Circuits

## XR-2240 PROGRAMMABLE TIMER/COUNTER

The XR-2240 Programmable Timer/Counter is a monolithic controller capable of producing ultra-long time delays, from microseconds up to five days, without sacrificing accuracy. Two timing circuits can be cascaded to generate time delays up to three years. The circuit is comprised of an internal time-base oscillator, a programmable 8-bit counter, and a control flip-flop. The time delay is set by an external RC network and can be programmed to any value from 1 RC to 255 RC.

In most timing applications, one or more of the counter outputs are connected back to the reset terminal. The circuit will then start timing when a trigger is applied and will automatically reset itself to complete the timing cycle when a programmed count is completed. If none of the counter outputs are connected back to the reset terminal, the circuit will operate in its astable or free-running mode, subsequent to a trigger input.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Timing from Microseconds to Days
- Programmable Delays: 1 RC to 255 RC
- Wide Supply Range: 4V to 15V
- TTL and DTL Compatible Outputs
- High Accuracy: 0.5%
- External Sync and Modulation Capability
- Excellent Supply Rejection: 0.2%/V

### APPLICATIONS

- Precision Timing
- Long Delay Generation
- Sequential Timing
- Binary Pattern Generation
- Frequency Synthesis
- Pulse Counting/Summing
- A/D Conversion
- Digital Sample and Hold

### ORDER INFORMATION

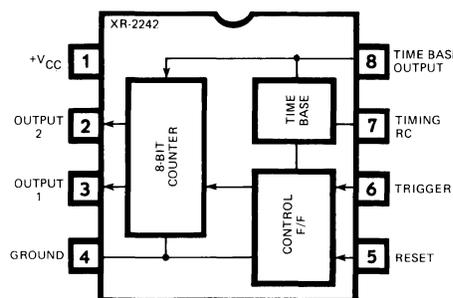
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2240M    | Ceramic | -55°C to +125°C       |
| XR-2240N    | Ceramic | 0°C to +75°C          |
| XR-2240P    | Plastic | 0°C to +75°C          |
| XR-2240CN   | Ceramic | 0°C to +75°C          |
| XR-2240CP   | Plastic | 0°C to +75°C          |

## XR-2242 LONG-RANGE TIMER

The XR-2242 is a monolithic Timer/Controller capable of producing ultra-long time delays from microseconds to days. Two timing circuits can be cascaded to generate time delays or timing intervals of up to one year. The circuit is comprised of an internal time-base oscillator, an 8-bit binary counter and a control flip-flop. For a given external RC network connected to the timing terminal, the circuit produces an output timing pulse of 128 RC. If two circuits are cascaded, a total time delay of  $(128)^2$  or 16,384 RC is obtained.

In monostable timer applications, the output terminal (pin 3) is connected back to the reset terminal, the circuit continues to operate in an astable mode, subsequent to a trigger input.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Timing from Microseconds to Days
- Wide Supply Range: 4.5V to 15V
- TTL and DTL Compatible Outputs
- High Accuracy: 0.5%
- Excellent Supply Rejection: 0.2%/V
- Monostable and Astable Operation

### APPLICATIONS

- Long Delay Generation
- Sequential Timing
- Precision Timing
- Ultra-Low Frequency Oscillator
- Interval Timing

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2242M    | Ceramic | -55°C to +125°C       |
| XR-2242CN   | Ceramic | 0°C to +75°C          |
| XR-2242CP   | Plastic | 0°C to +75°C          |

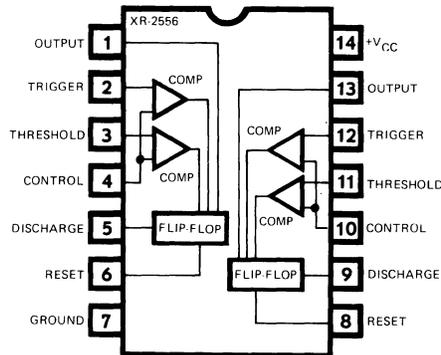
# Timing Circuits

## XR-2556 DUAL TIMING CIRCUIT

The XR-2556 dual timing circuit contains two independent 555-type timers on a single monolithic chip. Each timer section is a highly stable controller capable of producing accurate time delays or oscillations. Each timer has independent output and control terminals and can be used for monostable or astable operation.

The XR-2556 may be triggered or reset on falling waveforms, and each output can source or sink up to 200 mA of load current, or drive DTL and TTL circuits. The matching and temperature tracking characteristics of the two timer sections of the XR-2556 are superior to those available from timers in separate packages.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Replaces Two 555-Type Timers
- TTL Compatible Pinouts (Gnd – Pin 7, VCC – Pin 14)
- Timing from Microseconds Through Hours
- Excellent Matching Between Timer Sections
- Operates in Both Monostable and Astable Modes
- High Current Drive Capability (200 mA each output)
- TTL and DTL Compatible Outputs
- Adjustable Duty Cycle
- Temperature Stability of 0.005%/°C

### APPLICATIONS

|                       |                           |
|-----------------------|---------------------------|
| Precision Timing      | Missing-Pulse Detection   |
| Pulse Generation      | Pulse-Width Modulation    |
| Sequential Timing     | Frequency Division        |
| Pulse Shaping         | Clock Synchronization     |
| Time Delay Generation | Pulse-Position Modulation |

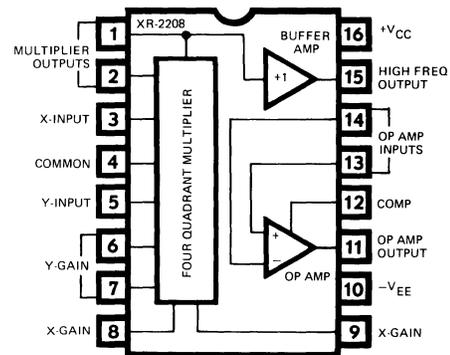
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2556M    | Ceramic | -55°C to +125°C       |
| XR-2556CN   | Ceramic | 0°C to +75°C          |
| XR-2556CP   | Plastic | 0°C to +75°C          |

# Multipliers and Modulators

## XR-2208 OPERATIONAL MULTIPLIER

The XR-2208 operational multiplier combines a four-quadrant analog multiplier (or modulator), a high-frequency buffer amplifier and an operational amplifier in a monolithic circuit that is ideally suited for both analog computation and communications signal processing applications. The multiplier/buffer amplifier combination extends the small signal 3 dB bandwidth to 8 MHz and the transconductance bandwidth to 100 MHz.



### FEATURES

- Maximum Versatility
  - Independent Multiplier, Op Amp and Buffer
  - Excellent Linearity (0.3%, typical)
- Wide Bandwidth
  - 3 dB Bandwidth – 8 MHz typical
  - 3° Phase Shift Bandwidth – 1.2 MHz typical
  - Transconductance Bandwidth – 100 MHz typical
- Simplified Offset Adjustments
- Wide Supply Voltage Range ( $\pm 4.5V$  to  $\pm 16V$ )

### APPLICATIONS

|                          |                                |
|--------------------------|--------------------------------|
| Analog Computation       | Triangle-to-Sinewave Converter |
| Multiplication           | AGC Amplifier                  |
| Division                 | Phase Detector                 |
| Signal Processing        | Motor Speed Control            |
| AM Generation            | Phase-Locked AM Demodulation   |
| Frequency Doubling       |                                |
| Frequency Translation    |                                |
| Synchronous AM Detection |                                |

### ORDER INFORMATION

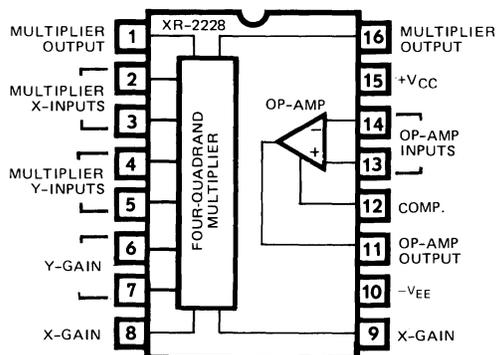
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2208M    | Ceramic | -55°C to +125°C       |
| XR-2208N    | Ceramic | 0°C to +75°C          |
| XR-2208P    | Plastic | 0°C to +75°C          |
| XR-2208CN   | Ceramic | 0°C to +75°C          |
| XR-2208CP   | Plastic | 0°C to +75°C          |

# Multipliers and Modulators

## XR-2228 MULTIPLIER/DETECTOR

The XR-2228 multiplier/detector circuit is designed as a basic building block for analog signal processing and communication systems. It contains a four-quadrant analog multiplier/modulator and a high-gain op-amp on the same chip. Because of its wide common-mode range and differential inputs, the XR-2228 can interface with any of the existing PLL circuits in designing synchronous AM detection or frequency translation systems. It can be used as a phase-detector for frequencies up to 100 MHz.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Independent Multiplier and Op Amp
- Differential X and Y Inputs
- Interfaces with all PLL and VCO Circuits
- Wide Common Mode Range
- Wide Transconductance Bandwidth (100 MHz, Typ.)

### APPLICATIONS

- Phase-Locked Loop Design
- Phase Detection
- Synchronous AM Detection
- AM Generation
- Triangle-to-Sinewave Conversion
- Frequency Translation

### ORDER INFORMATION

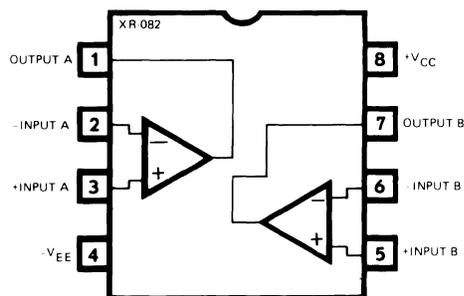
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2228M    | Ceramic | -55°C to +125°C       |
| XR-2228N    | Ceramic | -40°C to +85°C        |
| XR-2228P    | Plastic | -40°C to +85°C        |
| XR-2228CN   | Ceramic | -40°C to +85°C        |
| XR-2228CP   | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-082 DUAL BIFET OPERATIONAL AMPLIFIER

The XR-082 family of junction-FET input (BIFET) dual operational amplifiers are designed to offer high performance and a wider selection than conventional bipolar op amps. Each amplifier features high slew rate, low input bias and offset currents, and low offset voltage drift with temperature.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for Texas Instruments TL082
- Low Harmonic Distortion (0.01% Typ.)
- Same Pin Configuration as XR-1458/XR-4558
- Low Power Consumption
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- High Input Impedance . . . FET-Input Stage
- Internal Frequency Compensation
- Latch-Up-Free Operation
- High Slew-Rate . . . 13 V/ $\mu$ s, Typ.

### APPLICATIONS

- Low-Level Signal Detection
- Active Filter Design
- Signal Conditioning
- Analog Amplification
- Audio Signal Processing
- Analog Sample-and-Hold

### ORDER INFORMATION

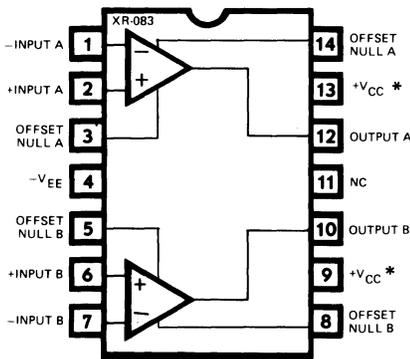
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-082M     | Ceramic | -55°C to +125°C       |
| XR-082N     | Ceramic | -25°C to +85°C        |
| XR-082P     | Plastic | -25°C to +85°C        |
| XR-082CN    | Ceramic | 0°C to +75°C          |
| XR-082CP    | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-083 DUAL BIFET OPERATIONAL AMPLIFIER

The XR-083 junction-FET input dual operational amplifier contains two independent op amp sections on the same chip. Each op amp section offers independent offset-null terminals. Except for the offset adjustment capability, the electrical characteristics of both op amp sections are similar to those of the XR-082 Bifet op amp family.

### FUNCTIONAL BLOCK DIAGRAM



\* Note: Pins 9 and 13 are internally connected.

### FEATURES

- Direct Replacement for Texas Instrument TL083
- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- High Input Impedance: FET Input Stage
- Internal Frequency Compensation
- Latch-Up Free Operation
- High Slew Rate: 13V/ $\mu$ s, Typical
- Independent Offset-Trim Adjustments

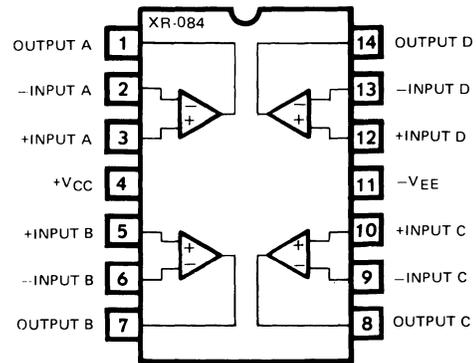
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-083M     | Ceramic | -55°C to +125°C       |
| XR-083N     | Ceramic | -25°C to +85°C        |
| XR-083P     | Plastic | -25°C to +85°C        |
| XR-083CN    | Ceramic | 0°C to +75°C          |
| XR-083CP    | Plastic | 0°C to +75°C          |

## XR-084 QUAD BIFET OPERATIONAL AMPLIFIER

The XR-084 junction-FET input (BIFET) quad operational amplifier is designed to offer higher performance than conventional bipolar quad op amps. Each of the four op amps on the chip is closely matched in performance characteristics, and each amplifier features high slew rate, low input bias and offset currents, and low offset voltage drift with temperature. The XR-084 FET input quad op amp is fabricated using ion-implantation technology which combines well-matched junction FETs and high-performance bipolar transistors on the same monolithic integrated circuit.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for Texas Instrument TL084
- Same Pin Configuration as XR-3403, LM324
- High-Impedance Junction-FET Input Stage
- Internal Frequency Compensation
- Low Power Consumption
- Wide Common-Mode and Differential Voltage Ranges
- Low Input Bias and Offset Currents
- Output Short-Circuit Protection
- Latch-Up Free Operation
- High Slew Rate: 13V/ $\mu$ s, Typical

### APPLICATIONS

- Active Filter Design
- Sample/Hold and Servo Systems
- Audio Signal Processing
- Analog Control Systems

### ORDER INFORMATION

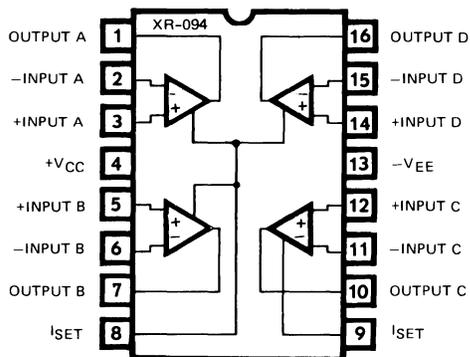
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-084M     | Ceramic | -55°C to +125°C       |
| XR-084N     | Ceramic | -25°C to +85°C        |
| XR-084P     | Plastic | -25°C to +85°C        |
| XR-084CN    | Ceramic | 0°C to +75°C          |
| XR-084CP    | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-094 QUAD PROGRAMMABLE BIFET OPERATIONAL AMPLIFIER

The XR-094 is a programmable version of the XR-084 family of quad FET-input operational amplifiers. The circuit offers partitioned programming where the three of the four op amps on the chip are programmed by one external bias-setting resistor, and the fourth op amp is programmed by a second bias-setting resistor. These two external setting resistors permit the user to program the gain-bandwidth product, slew-rate and the supply current, especially for low power applications. The XR-094 programmable BIFET quad op amp is fabricated using ion-implantation technology which combines well-matched junction FETs and high-performance bipolar transistors on the same monolithic integrated circuit.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Programmable Version of Texas Instruments TL084
- Same Pin Configuration as LM146/246/346
- Programmable for Micropower Operation
- Partitioned Programming (Single/Triple Combination)
- High-Impedance Junction-FET Input Stage
- Internal Frequency Compensation
- Low Input Bias and Offset Currents

### APPLICATIONS

|                               |                           |
|-------------------------------|---------------------------|
| Active Filter Design          | Audio Signal Processing   |
| Sample/Hold and Servo Systems | Analog Control Systems    |
|                               | Telephone Channel Filters |

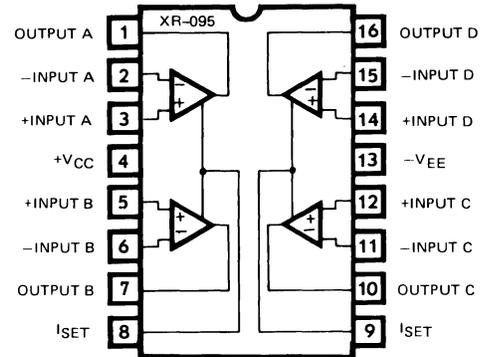
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-094M     | Ceramic | -55°C to +125°C       |
| XR-094N     | Ceramic | -25°C to +85°C        |
| XR-094P     | Plastic | -25°C to +85°C        |
| XR-094CN    | Ceramic | 0°C to +75°C          |
| XR-094CP    | Plastic | 0°C to +75°C          |

## XR-095 QUAD PROGRAMMABLE BIFET OPERATIONAL AMPLIFIER

The XR-095 is a programmable version of the XR-084 family of quad FET-input operational amplifiers. The circuit offers partitioned programming of the individual op amp sections on the chip: two of the op amps are programmed by one bias-setting resistor, and the remaining two op amps are programmed by a separate bias-setting resistor. These two external setting resistors permit the user to program the gain-bandwidth product, slew-rate and the supply current, especially for low power applications. The XR-095 programmable BIFET quad op amp is fabricated using ion-implantation technology which combines well-matched junction FETs and high-performance bipolar transistors on the same monolithic integrated circuit.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Programmable Version of Texas Instruments TL084
- Same Pin Configuration as LM346-2
- Partitioned Programming (Two Dual Combination)
- Programmable for Micropower Operation
- High-Impedance Junction-FET Input Stage
- Internal Frequency Compensation
- Low Input Bias and Offset Currents

### APPLICATIONS

|                               |                           |
|-------------------------------|---------------------------|
| Active Filter Design          | Audio Signal Processing   |
| Sample/Hold and Servo Systems | Analog Control Systems    |
|                               | Telecommunication Systems |

### ORDER INFORMATION

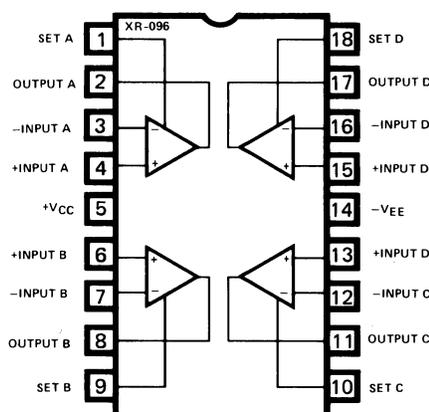
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-095M     | Ceramic | -55°C to +125°C       |
| XR-095N     | Ceramic | -25°C to +85°C        |
| XR-095P     | Plastic | -25°C to +85°C        |
| XR-095CN    | Ceramic | 0°C to +75°C          |
| XR-095CP    | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-096 QUAD PROGRAMMABLE BIFET OPERATIONAL AMPLIFIER

The XR-096 is the independently-programmable version of the XR-084 family of quad FET-input operational amplifiers. The circuit offers *fully independent* programming of each of the four separate op amps on the chip, by means of four external bias setting resistors. These external setting resistors allow the user to program the gain-bandwidth product, slew-rate and the supply-current for each of the four op amps independently, or permit the unused op amps to be shut-off or powered down.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Programmable Version of XR-084
- Independent Programming of All Four Op Amps
- Programmable for Micropower Operation
- High-Impedance Junction-FET Input Stage
- Internal Frequency Compensation
- Low Input Bias and Offset Currents

### APPLICATIONS

- Active Filter Design
- Sample/Hold and Servo Systems
- Analog Multiplexers
- Audio Signal Processing
- Analog Control Systems
- Telecommunication Systems

### ORDER INFORMATION

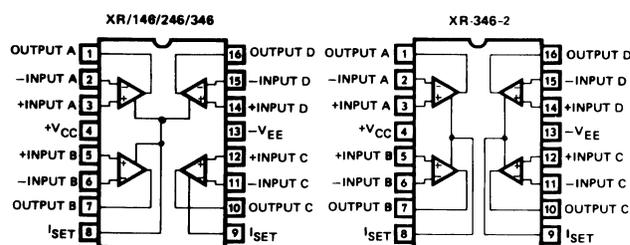
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-096M     | Ceramic | -55°C to +125°C       |
| XR-096N     | Ceramic | -25°C to +85°C        |
| XR-096P     | Plastic | -25°C to +85°C        |
| XR-096CN    | Ceramic | 0°C to +75°C          |
| XR-096CP    | Plastic | 0°C to +75°C          |

## XR-146/246/346 PROGRAMMABLE QUAD OPERATIONAL AMPLIFIER

The XR-146 family of quad operational amplifiers contain four independent high-gain, low-power, programmable op amps on a monolithic chip. The use of external bias setting resistors permit the user to program gain-bandwidth product, supply current, input bias current, input offset current, input noise and the slew rate.

The basic XR-146 family of circuits offer partitioned programming of the internal op-amps where one setting resistor is used to set the bias levels in the three op amps, and a second bias setting is used for the remaining op amp. Its modified version, the XR-346-2 provides a separate bias setting resistor for each of the two op amp pairs.

### FUNCTIONAL BLOCK DIAGRAMS



### FEATURES

- Direct Replacement for LM146/246/346 (XR-146 Family)
- Direct Replacement for LM346-2 (XR-346-2)
- Programmable Electrical Characteristics
- Low Supply Current (350  $\mu$ A per Amplifier)
- Large DC Voltage Gain (120 dB)
- Low Noise Voltage (25 nV/ $\sqrt{\text{Hz}}$ )
- Wide Power Supply Range ( $\pm 1.5$ V to  $\pm 22$ V)
- Class AB Output Stage—No Crossover Distortion

### ORDER INFORMATION

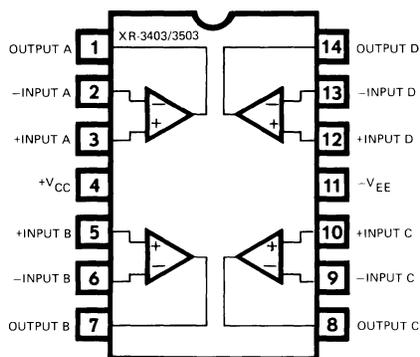
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-146M     | Ceramic | -55°C to +125°C       |
| XR-246N     | Ceramic | -25°C to +85°C        |
| XR-246P     | Plastic | -25°C to +75°C        |
| XR-346CN    | Ceramic | 0°C to +75°C          |
| XR-346CP    | Plastic | 0°C to +75°C          |
| XR-346-2CN  | Ceramic | 0°C to +75°C          |
| XR-346-2CP  | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-3403/3503 QUAD OPERATIONAL AMPLIFIER

The XR-3403 is an array of four independent operational amplifiers, each with true differential inputs. The device has electrical characteristics similar to the popular 741. However, the XR-3403 has several distinct advantages over standard operational amplifier types in single supply applications. The XR-3403 can operate at supply voltages as low as 3.0 volts or as high as 36 volts with quiescent currents about one-fifth of those associated with the 741 (on a per amplifier basis). The common mode input range includes the negative supply, thereby eliminating the necessity for external biasing components in many applications. The output voltage swing extends to the negative supply.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Pin-for-Pin Replacement for MC3403/3503, LM324, and RC4137
- Suitable for Single-Supply Operation
- Short Circuit Protected Outputs
- Class AB Output Stage (No Crossover Distortion)
- Single Supply Operation: 3.0 to 36 Volts
- Split Supply Operation:  $\pm 1.5$  to  $\pm 18$  Volts
- Low Input Bias Currents: 500 nA Maximum
- Four Amplifiers per Package
- Internally Compensated

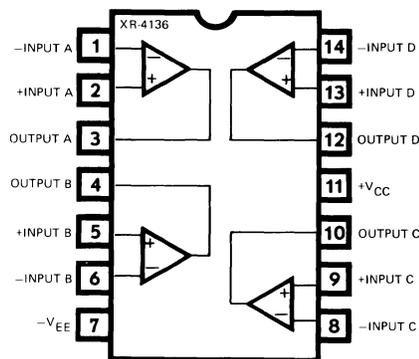
### ORDER INFORMATION

| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-3503M    | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-3403CN   | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-3403CP   | Plastic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

## XR-4136 QUAD OPERATIONAL AMPLIFIER

The XR-4136 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.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Pin-for-Pin Replacement for RC4136 and RM4136
- Low Power Consumption (50 mW typ and 120 mW max)
- Short-Circuit Protection
- Internal Frequency Compensation
- No Latch-Up
- Wide Common-Mode and Differential Voltage Ranges
- Matched Gain-Bandwidth

### APPLICATIONS

- Active Filter Design
- Signal Conditioning
- Analog Amplification
- Audio Signal Processing

### ORDER INFORMATION

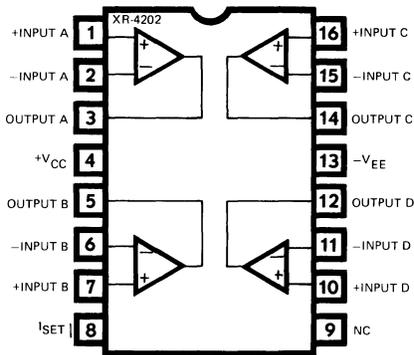
| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-4136M    | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-4136CN   | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-4136CP   | Plastic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

# Operational Amplifiers

## XR-4202 PROGRAMMABLE QUAD OPERATIONAL AMPLIFIER

The XR-4202 is an array of four independent operational amplifiers on a single silicon chip. The operating current of the array is externally controlled by a single setting resistor or current source, allowing the user to trade-off power dissipation for bandwidth for all of the four amplifiers in the package.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Programmable
- Micropower Operation
- Wide Input Voltage and Common Mode Range
- Internal Frequency Compensation
- No Latch-Up
- Matched Parameters
- Short Circuit Protection

### APPLICATIONS

- Active Filter Design
- Signal Conditioning
- Analog Amplification
- Audio Signal Processing

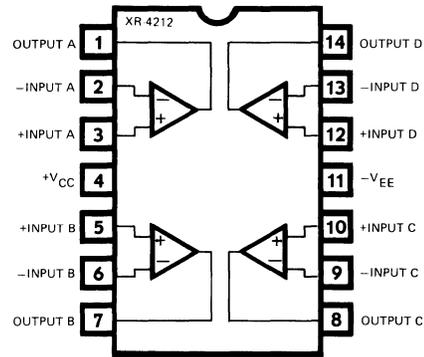
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-4202N    | Ceramic | -40°C to +85°C        |
| XR-4202P    | Plastic | -40°C to +85°C        |

## XR-4212 QUAD OPERATIONAL AMPLIFIER

The XR-4212 is an array of four independent, internally-compensated operational amplifiers on a single silicon chip, each similar in performance to the popular 741. However, the combined power consumption of all four op amps is less than that of a single, conventional 741-type op amp. Good thermal tracking and matched gain-bandwidth products make these quad op amps useful for active filter applications.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Same Pinout as MC3403, LM324, and HA4741
- Low Power Consumption (50 mW typ and 120 mW max)
- Short-Circuit Protection
- Internal Frequency Compensation
- No Latch-Up
- Wide Common-Mode and Differential Voltage Ranges
- Matched Gain-Bandwidth

### APPLICATIONS

- Active Filter Design
- Signal Conditioning
- Analog Amplification
- Audio Signal Processing

### ORDER INFORMATION

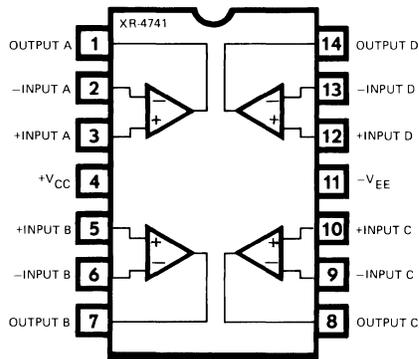
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-4212M    | Ceramic | -55°C to +125°C       |
| XR-4212CN   | Ceramic | 0°C to +75°C          |
| XR-4212CP   | Plastic | 0°C to +75°C          |

# Operational Amplifiers

## XR-4741 QUAD OPERATIONAL AMPLIFIER

The XR-4741 is an array of four independent internally-compensated operational amplifiers on a single silicon chip, each similar to the popular 741. Each amplifier offers performance equal to or better than the 741 type in all respects. It has high slew rate, superior bandwidth, and low noise, which makes it excellent for audio amplifiers or active filter applications

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

Pin-for-Pin Replacement for HA4741  
 Pin Compatible with MC3403 and LM324  
 High Slew Rate  
 Unity Gain-Bandwidth  
 Low Noise Voltage  
 Input Offset Current  
 Wide Supply Range

1.6V/ $\mu$ S (Typ)  
 3.5 MHz (Typ)  
 9 nV/ $\sqrt{\text{Hz}}$  (Typ)  
 .5 mV (Typ)  
 $\pm 2\text{V}$  to  $\pm 20\text{V}$

### APPLICATIONS

Active Filter Design  
 Signal Conditioning  
 Analog Amplification  
 Audio Signal Processing

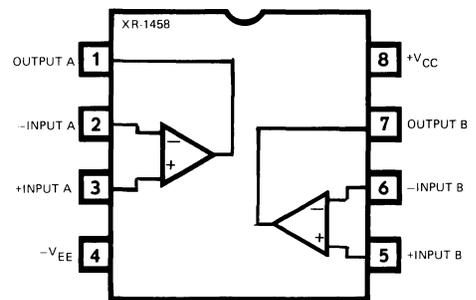
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-4741M    | Ceramic | -55°C to +125°C       |
| XR-4741CN   | Ceramic | 0°C to +75°C          |
| XR-4741CP   | Plastic | 0°C to +75°C          |

## XR-1458/4558 DUAL OPERATIONAL AMPLIFIER

The XR-1458/4558 is a pair of independent internally-compensated operational amplifiers on a single silicon chip, each similar in performance to the popular 741. However, the power consumption of each of the op amps is less than one-half of the power consumption of a conventional 741. Good thermal tracking and matched gain-bandwidth products make these dual op amps useful for active filter applications.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

Direct Pin-for-Pin Replacement for MC1458, RC4558, SA1458  
 Low Power Consumption (50 mW typ and 120 mW max)  
 Short-Circuit Protection  
 Internal Frequency Compensation  
 No Latch-Up  
 Wide Common-Mode and Differential Voltage Ranges  
 Matched Gain-Bandwidth

### APPLICATIONS

Active Filter Design  
 Signal Conditioning  
 Analog Amplification  
 Audio Signal Processing

### ORDER INFORMATION

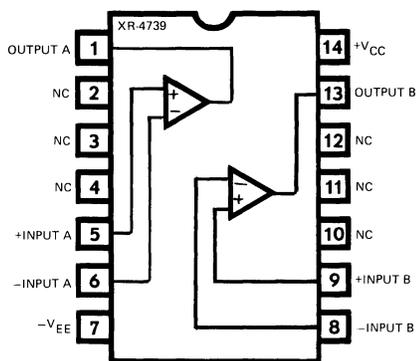
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-1458CN   | Ceramic | 0°C to +70°C          |
| XR-1458CP   | Plastic | 0°C to +70°C          |
| XR-4558CN   | Ceramic | 0°C to +70°C          |
| XR-4558CP   | Plastic | 0°C to +70°C          |

# Operational Amplifiers

## XR-4739 DUAL LOW-NOISE OPERATIONAL AMPLIFIER

The XR-4739 dual low-noise operational amplifier is fabricated on a single silicon chip using Exar's low-noise planar epitaxial process. It is designed primarily for pre-amplifiers in a consumer and industrial signal processing equipment. The device is pin-compatible with the  $\mu$ A739 and MC1303, with internal compensation added. This permits a reduced external parts count and simplified application.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Pin-for-Pin Replacement for RC4739
- Internally Compensated Replacement for  $\mu$ A739 and MC1303
- Signal-to-Noise Ratio 76 dB (R1AA 10 mV ref.)
- Channel Separation 125 dB
- Unity Gain-Bandwidth 3 MHz
- Output Short-Circuit Protected
- 0.1% Distortion at 8.5V RMS Output into 2K $\Omega$  Load

### APPLICATIONS

- High-Quality Audio Pre amplification
- Low-Level Signal Detection
- Active Filter Design
- Signal Conditioning
- Analog Amplification
- Audio Signal Processing

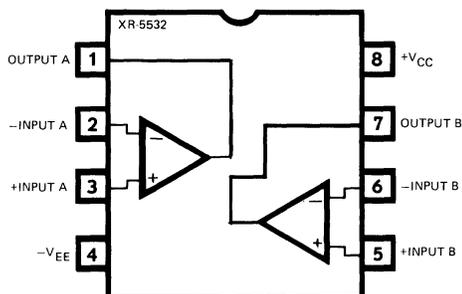
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-4739CN   | Ceramic | 0°C to +75°C          |
| XR-4739CP   | Plastic | 0°C to +75°C          |

## XR-5532 DUAL LOW-NOISE OPERATIONAL AMPLIFIER

The XR-5532 ultra-low noise dual operational amplifier is especially designed for high quality audio and instrumentation applications. Compared to the standard 741- or 301A type op amps, these operational amplifiers show an order of magnitude, better noise performance and small signal bandwidth, higher output drive capability, and they are internally compensated. The XR-5532A is specially screened for a guaranteed ultra-low noise specification.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Pin for Pin Replacement MC1458, RC4558, TL072, TL082, LF353
- Direct Replacement for NE5532/NE5532A
- Ultra-Low Input Noise (4 nV/ $\sqrt{\text{Hz}}$  Typ.)
- Wide Small-Signal Bandwidth (10 MHz Typ.)
- High Output Drive Capability (10 V rms into 600 $\Omega$ )
- Wide Supply Range ( $\pm 3\text{V}$  to  $\pm 20\text{V}$ )
- Wide Power Bandwidth (200 kHz)
- High Slew-Rate: 6V/ $\mu\text{sec}$

### APPLICATIONS

- Professional Audio Equipment
- Instrumentation and Servo Control
- Telephone Channel Amplifier
- Low-Level Signal Processing
- Audio Pre amplification

### ORDER INFORMATION

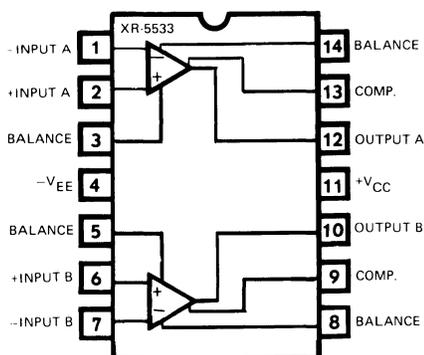
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-5532ACN  | Ceramic | 0°C to +75°C          |
| XR-5532CN   | Ceramic | 0°C to +75°C          |

# Operational Amplifiers

## XR-5533 DUAL LOW-NOISE OPERATIONAL AMPLIFIER

The XR-5533 ultra-low noise dual operational amplifier is especially designed for high quality audio and instrumentation applications. Compared to the standard 741- or 301A type op amps, these operational amplifiers show an order of magnitude better noise performance, small signal bandwidth and high output drive capability. The XR-5533 is internally compensated for a voltage gain of three or more and offers independent offset adjustments for each of the two op amps. The XR-5533A is specially screened for a guaranteed ultra-low noise specification.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for NE5533/NE5533A
- Dual Version of XR-5534 or NE5534
- Ultra-Low Input Noise (4 nV/ $\sqrt{\text{Hz}}$  Typ.)
- Wide Small-Signal Bandwidth (10 MHz Typ.)
- High Output Drive Capability (10 V rms into 600 $\Omega$ )
- Wide Supply Range ( $\pm 3\text{V}$  to  $\pm 20\text{V}$ )
- Wide Power Bandwidth (200 kHz)
- High Slew-Rate: 13 V/ $\mu\text{sec}$
- Independent Offset Adjustments

### APPLICATIONS

- |                                   |                             |
|-----------------------------------|-----------------------------|
| Professional Audio Equipment      | Telephone Channel Amplifier |
| Instrumentation and Servo Control | Low-Level Signal Processing |
|                                   | Audio Preamplification      |

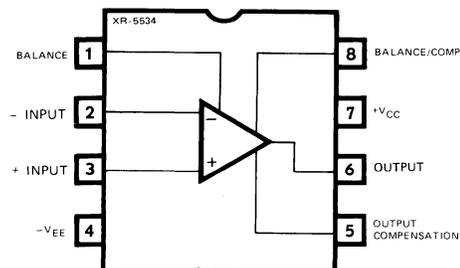
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-5533ACN  | Ceramic | 0°C to +75°C          |
| XR-5533CN   | Ceramic | 0°C to +75°C          |
| XR-5533ACP  | Plastic | 0°C to +75°C          |
| XR-5533CP   | Plastic | 0°C to +75°C          |

## XR-5534 LOW-NOISE OPERATIONAL AMPLIFIER

The XR-5534 is a high performance, ultra-low noise operational amplifier. Compared to standard 741- or 301-type op amps, it shows an order of magnitude, better noise performance and small signal bandwidth and significantly better output drive capability. The XR-5534 is ideally suited for applications in high quality and professional audio equipment, instrumentation, control circuits and telephone channel amplifiers. The op amp is internally compensated for a gain of three or greater. The frequency response can be optimized with an external compensation capacitor for applications requiring unity-gain, low-overshoot response, or capacitive load driving. The XR-5534A is specially screened for a guaranteed ultra-low noise specification.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for NE5534/NE5534A
- Ultra-Low Input Noise (4 nV/ $\sqrt{\text{Hz}}$  Typ.)
- Wide Small-Signal Bandwidth (10 MHz Typ.)
- High Output Drive Capability (10V rms into 600 $\Omega$ )
- Wide Supply Range ( $\pm 3\text{V}$  to  $\pm 20\text{V}$ )
- Wide Power Bandwidth (200 kHz)
- High Voltage Gain:
  - $A_v = 100,000$  at DC
  - $A_v = 6,000$  at 10 kHz
- High Slew-Rate: 13 V/ $\mu\text{sec}$

### APPLICATIONS

- Professional Audio Equipment
- Instrumentation and Servo Control
- Telephone Channel Amplifier
- Low-Level Signal Processing
- Audio Preamplification

### ORDER INFORMATION

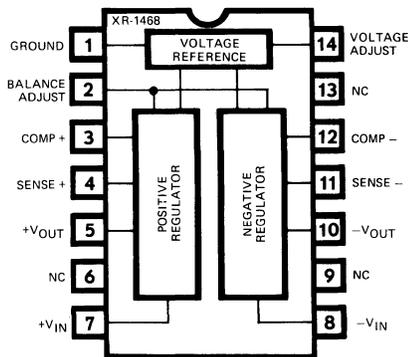
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-5534AM   | Ceramic | -55°C to +125°C       |
| XR-5534M    | Ceramic | -55°C to +125°C       |
| XR-5534ACN  | Ceramic | 0°C to +75°C          |
| XR-5534CN   | Ceramic | 0°C to +75°C          |
| XR-5534ACP  | Plastic | 0°C to +75°C          |
| XR-5534CP   | Plastic | 0°C to +75°C          |

# Voltage Regulators

## XR-1468/1568 DUAL-POLARITY TRACKING VOLTAGE REGULATOR

The XR-1568/1468 is a dual-polarity tracking voltage regulator combining two separate regulators with a common reference element in a single monolithic circuit, thus providing very close balance between the positive and negative output voltages. Outputs are internally set to  $\pm 15$  volts but can be externally adjusted between  $\pm 8.0$  to  $\pm 20$  volts with a single control. The circuit features  $\pm 100$  mA output current, externally adjustable current limiting, and provision for remote voltage sensing.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Internally Set for  $\pm 15$ V Outputs
- $\pm 100$  mA Peak Output Current
- Output Voltages Balanced Within 1% (XR-1568)
- 0.06% Line and Load Regulation
- Low Stand-By Current
- Output Externally Adjustable from  $\pm 14.5$  to  $\pm 20$  Volts
- Externally Adjustable Current Limiting
- Remote Sensing

### APPLICATIONS

- Main Regulation in Small Instruments
- On-Card Regulation in Analog and Digital Systems
- Point-of-Load Precision Regulation

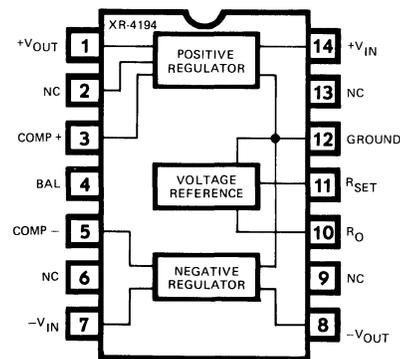
### ORDER INFORMATION

| Part Number | Package | Operating Temperature                           |
|-------------|---------|---|
| XR-1568M    | Ceramic | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-1568N    | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |
| XR-1468CN   | Ceramic | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

## XR-4194 DUAL-TRACKING VOLTAGE REGULATOR

The XR-4194 is a dual-polarity tracking regulator designed to provide balanced or unbalanced positive and negative output voltages at currents up to 200 mA. It features a single resistor to adjust both outputs between the limits of  $+50$  mV and  $+42$ V. It is ideal for local "on-card" regulation in analog and digital systems as well as in small instruments.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for RM/RC-4194
- Both Outputs Adjust with Single Resistor
- Load Current to  $\pm 200$  mA with 0.2% Load Regulation
- Low External Parts Count
- Internal Thermal Shutdown at  $T_j = 175^{\circ}\text{C}$
- External Adjustment for  $\pm V_O$  Unbalancing

### APPLICATIONS

- On-Card Regulation in Analog and Digital Systems
- Main Regulation in Small Instruments
- Point-of-Load Precision Regulation

### ORDER INFORMATION

| Part Number | Package     | Operating Temperature                           |
|-------------|-------------|---|
| XR-4194M    | Ceramic DIP | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ |
| XR-4194CN   | Ceramic DIP | $0^{\circ}\text{C}$ to $+75^{\circ}\text{C}$    |

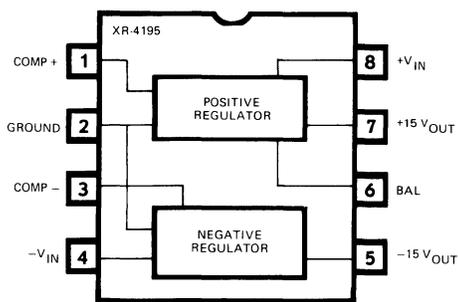
# Voltage Regulators

## XR-4195 $\pm 15V$ DUAL-TRACKING VOLTAGE REGULATOR

The XR-4195 is a dual-polarity tracking regulator designed to provide balanced positive and negative 15V output voltages at currents of up to 100 mA.

The device is ideal for local "on-card" regulation, which eliminates the distribution problems associated with single-point regulation. Intended for ease of application, the XR-4195 requires only two external components for operation.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for RM/RC-4195
- $\pm 15V$  Operational Amplifier Power
- Thermal Shutdown at  $T_j = 175^\circ C$
- Output Currents to 100 mA
- Available in 8-Pin Plastic Mini-DIP
- Low External Parts Count

### APPLICATIONS

- On-Card Regulation
- Main Regulation in Small Instruments

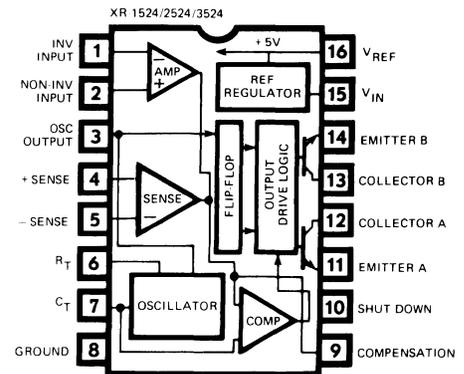
### ORDER INFORMATION

| Part Number | Package | Operating Temperature        |
|-------------|---------|------------------------------|
| XR-4195CP   | Plastic | $0^\circ C$ to $+70^\circ C$ |

## XR-1524/2524/3524 PULSE WIDTH MODULATING REGULATOR

This monolithic integrated circuit contains all the control circuitry for a regulating power supply inverter or switching regulator. Included in a 16-pin dual-in-line package is the voltage reference, error-amplifiers, oscillator, pulse-width modulator, pulse-steering flip-flop, dual alternating output switches and current-limiting and shut-down circuitry. This device can be used for switching regulators of either polarity, transformer coupled DC to DC converters, transformerless voltage doublers and polarity converters, as well as other power control applications. The XR-1524 is specified for operation over the full military temperature range of  $-55^\circ C$  to  $+125^\circ C$ , while the XR-2524 and XR-3524 are designed for commercial applications of  $0^\circ C$  to  $+70^\circ C$ .

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for SG1524/2524/3524
- Complete PWM Power Control Circuitry
- Single-Ended or Push-Pull Outputs
- Lines and Load Regulation of 0.2%
- 1% Maximum Temperature Variation
- Total Supply Current Less than 10 mA
- Operation Beyond 100 kHz

### ORDER INFORMATION

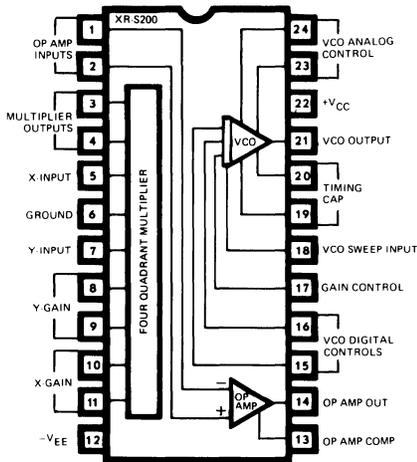
| Part Number | Package | Operating Temperature           |
|-------------|---------|---------------------------------|
| XR-1524M    | Ceramic | $-55^\circ C$ to $+125^\circ C$ |
| XR-2524N    | Ceramic | $0^\circ C$ to $+75^\circ C$    |
| XR-2524P    | Plastic | $0^\circ C$ to $+75^\circ C$    |
| XR-3524CN   | Ceramic | $0^\circ C$ to $+75^\circ C$    |
| XR-3524CP   | Plastic | $0^\circ C$ to $+75^\circ C$    |

# Special Functions

## XR-S200 MULTI-FUNCTION INTEGRATED CIRCUIT

The XR-S200 integrated circuit is a highly versatile, multi-purpose circuit that contains all of the essential functions of most communication system designs on a single monolithic substrate. The functions contained in the XR-S200 include: (1) a four quadrant analog multiplier, (2) a high frequency voltage controlled oscillator (VCO) and (3) a high performance operational amplifier. The three functions can be used independently, or directly interconnected in any order to perform a large number of complex circuit functions from phase-locked loops to the generation of complex waveforms.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Three Independent Circuit Functions:
  - A Four Quadrant Analog Multiplier
  - A High Frequency Voltage Controlled Oscillator (VCO)
  - A High Performance Operational Amplifier
- Analog and Digital Signal Conditioning
- A Frequency Range of 0.1 Hz to 30 MHz
- A Power Supply Range of  $\pm 3V$  to  $\pm 30V$

### APPLICATIONS

- Phase-Locked Loops
- FM Demodulation
- FSK Detection
- Signal Conditioning
- Tracking Filters
- Frequency Synthesis
- Telemetry Coding/Decoding
- Linear Sweep/FM Waveform Generation

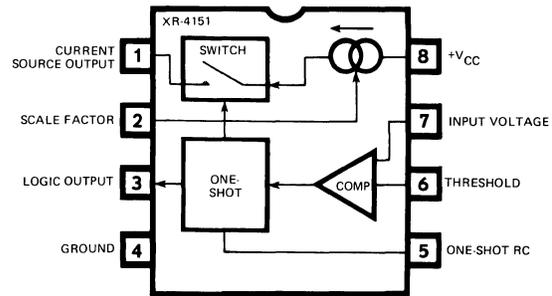
### ORDER INFORMATION

| Part Number | Package | Operating Temperature          |
|-------------|---------|--------------------------------|
| XR-S200     | Ceramic | $0^{\circ}C$ to $+75^{\circ}C$ |

## XR-4151 VOLTAGE-TO-FREQUENCY CONVERTER

The XR-4151 is a device designed to provide a simple, low-cost method for converting a DC voltage into a proportional pulse repetition frequency. It is also capable of converting an input frequency into a proportional output voltage. The XR-4151 is useful in a wide range of applications including A/D and D/A conversion and data transmission.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Single Supply Operation (+8V to +22V)
- Pulse Output Compatible with all Logic Forms
- Programmable Scale Factor
- Linearity  $\pm 0.05\%$  typical (precision mode)
- Temperature Stability  $\pm 100\%$  ppm/ $^{\circ}C$  typical
- High Noise Rejection
- Inherent Monotonicity
- Easily Transmittable Output
- Simple Full-Scale Trim
- Single-Ended Input
- Also Provides Frequency-to-Voltage Conversion
- Direct Replacement for RC/RV/RM-4151

### APPLICATIONS

- Voltage-to-Frequency Conversion
- A/D and D/A Conversion
- Data Transmission
- Frequency-to-Voltage Conversion
- Transducer Interface
- System Isolation

### ORDER INFORMATION

| Part Number | Package | Operating Temperature            |
|-------------|---------|----------------------------------|
| XR-4151P    | Plastic | $-40^{\circ}C$ to $+85^{\circ}C$ |
| XR-4151CP   | Plastic | $0^{\circ}C$ to $+70^{\circ}C$   |

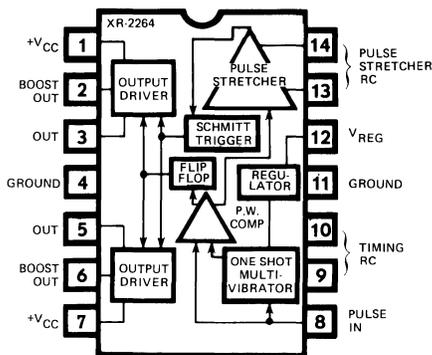
# Special Functions

## XR-2264/2265 PULSE-PROPORTIONAL SERVO CIRCUIT

The XR-2264/2265 are monolithic circuits designed for use in pulse-proportional servo systems and specifically designed for radio control applications. They are capable of controlling positions in direct proportion to the width of input pulses.

The XR-2264 can interface directly with servo motors requiring up to 350 mA of drive current. The XR-2265, with open collector outputs, can directly drive relays, optical couplers, and triacs. Both circuits can drive external PNP transistors for 500 mA output drive requirements. The XR-2264/2265, combined with a servo motor and a feedback potentiometer, form a closed-loop system.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Wide Supply Voltage Range (3.0V to 6.0V)
- Bidirectional Operation with Single Supply
- Separately Adjustable Dead Band and Pulse Stretching
- XR-2264 – 350 mA Source and Sink on Chip  
500 mA with External PNP
- XR-2265 – 500 mA Sink Capability on Chip  
500 mA Sink or Source Capability with External PNP

### APPLICATIONS

- Radio Control
- Remote Control
- Servo Driver

### ORDER INFORMATION

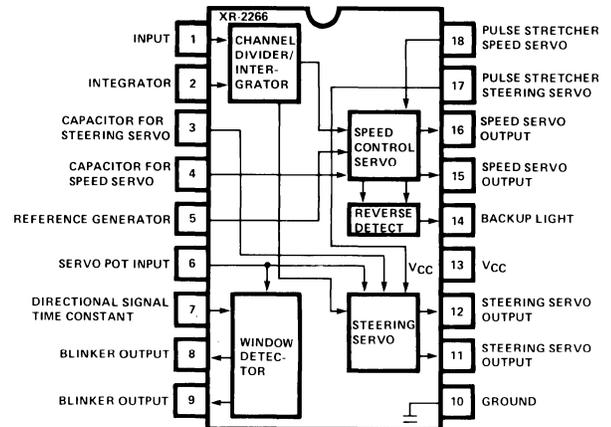
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2264CP   | Plastic | -10°C to +50°C        |
| XR-2265CP   | Plastic | -10°C to +50°C        |

## XR-2266 SERVO CONTROLLER

The XR-2266 is a monolithic servo controller system specifically designed for radio-controlled model cars. It is a self-contained system made up of two servo controller channels: one to control the direction and the speed of travel; and the other to provide the steering function. The circuit contains an internal channel separator section which automatically steers the incoming control signal to the appropriate servo controller channel.

The channel controlling the direction and the speed of travel requires external power transistors. The steering channel is completely self-contained and has an internal  $\pm 350$  mA output drive capability.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Internal Channel Divider
- Internal Steering Servo with Direct Drive for Servomotor and Turn Signal Indicators
- Directional Signal Time Constant Externally Settable
- Variable Speed Control with Direct Drive for Backup Lights
- Wide Supply Range (3.5 - 8.0 volts)
- Steering and Speed Servos Independently Programmed

### APPLICATIONS

- Radio Controlled cars

### ORDER INFORMATION

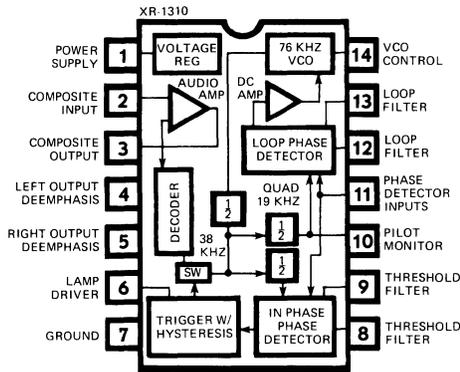
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2266     | Plastic | 0°C to +75°C          |

# Special Functions

## XR-1310 STEREO DEMODULATOR

The XR-1310 is a unique FM stereo demodulator which uses phase-locked loop techniques to extract the right and the left audio channels from the composite signal. Using a phase-locked loop to regenerate the 38 kHz subcarrier, it requires no external L-C circuit for tuning. Alignment is accomplished with a single potentiometer.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Requires No Inductors
- Low External Part Count
- Simple, Noncritical Tuning by Single Potentiometer Adjustment
- Internal Stereo/Monaural Switch with 100 mA Lamp Driving Capability
- Wide Dynamic Range: 600 mV (RMS) Maximum Composite Input Signal
- Wide Supply Voltage Range: 8 to 14 Volts
- Excellent Channel Separation
- Low Distortion
- Excellent SCA Rejection

### APPLICATIONS

FM Stereo Demodulation

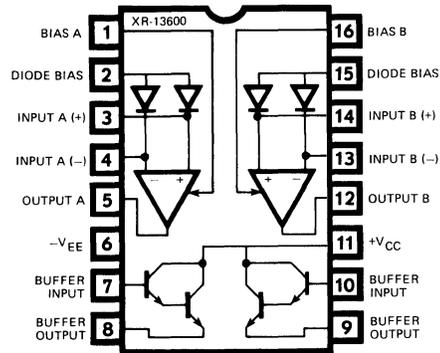
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-1310CP   | Plastic | -40°C to +85°C        |

## XR-13600 DUAL OPERATIONAL TRANSCONDUCTANCE AMPLIFIER

The XR-13600 consists of 2 programmable transconductance amplifiers with high input impedance and push-pull outputs. The 2 amplifiers share common supplies but otherwise operate independently. Each amplifier's transconductance is directly proportional to its applied bias current. To improve signal-to-noise performance, predistortion diodes are included on the inputs; the use of these diodes results in a 10 dB improvement referenced to 0.5% THD. Independent Darlington emitter followers are included to buffer the outputs.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for LM-13600
- Transconductance Adjustable Over 4 Decades
- Excellent Transconductance-Control Linearity
- Uncommitted Darlington Output Buffers
- On-Chip Predistortion Diodes
- Excellent Matching Between Amplifiers
- Wide Supply Range:  $\pm 2V$  to  $\pm 18V$

### APPLICATIONS

- Current-Controlled Amplifiers
- Current-Controlled Impedances
- Current-Controlled Filters
- Current-Controlled Oscillators
- Multipliers/Attenuators
- Sample and Hold Circuits
- Electronic Music Synthesis

### ORDER INFORMATION

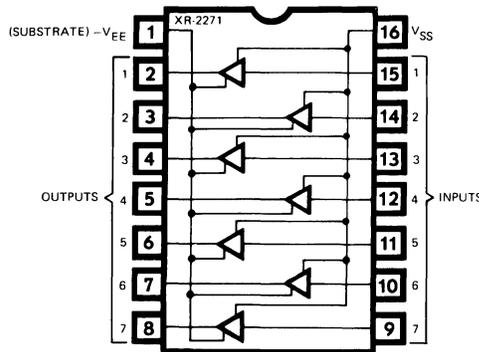
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-13600CP  | Plastic | 0°C to +75°C          |

# Display Drivers

## XR-2271 FLUORESCENT DISPLAY DRIVER

The XR-2271 is a monolithic 7-digit or 7-segment driver designed to interface MOS logic with fluorescent displays. The circuit features active high logic and low input current and it can drive all seven digits with complete input and output isolation. No external parts are necessary to interface fluorescent displays.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Active High Logic
- Low Input Current
- Complete Input Output Isolation
- Output Pull Up Resistors On Chip
- No External Parts Required to Drive Fluorescent Displays

### APPLICATIONS

- Fluorescent Display Driver
- MOS Logic/High-Voltage Interface

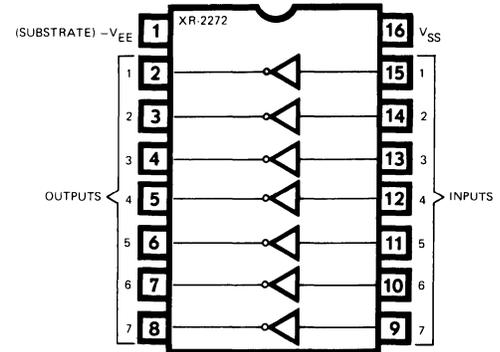
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2271CN   | Ceramic | 0°C to +75°C          |
| XR-2271CP   | Plastic | 0°C to +75°C          |

## XR-2272 HIGH-VOLTAGE 7-DIGIT DISPLAY DRIVER

The XR-2272 is a monolithic high-voltage 7-digit driver specifically designed to drive a gas-filled digit display. The main application is to act as buffers between MOS outputs and the anodes of a gas discharge panel.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Active Low Inputs
- Versatile Circuits for a Wide Range of Display Applications
- High Breakdown Voltages
- Low Power Dissipation
- 16-Pin Dual-in-Line Plastic Package

### APPLICATIONS

- Gas-Discharge Display Driver
- Panaplex® Display Driver
- MOS Logic to High-Voltage Interface

### ORDER INFORMATION

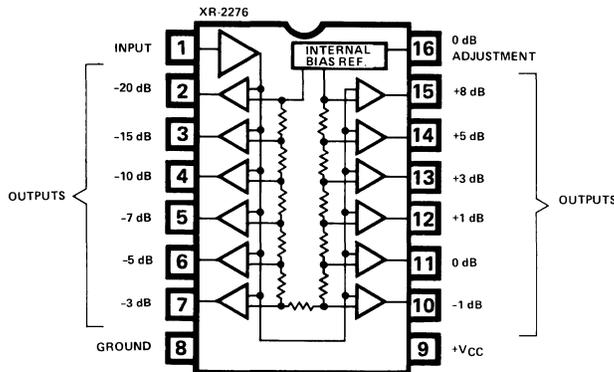
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2272CP   | Plastic | 0°C to +75°C          |

# Display Drivers

## XR-2276 BAR-GRAPH DISPLAY GENERATOR

The XR-2276 is a 12-point level-detector circuit particularly designed for interfacing with fluorescent displays. The circuit is comprised of an input buffer amplifier, 12 high-gain comparators, an internal voltage reference and a bias-setting resistor string. All of the twelve comparator stages have independent buffered outputs. Each of the comparators have a threshold level higher than the preceding comparator stage. With no input signal, all of the comparators are "off" and all the outputs are at a *low* state. As the input level is increased, the outputs successively switch to their *high* state, at 12 discrete input levels. These threshold levels are set to be within the range of -20 dB to +8 dB; with reference to a 0 dB level setting.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Can Drive Fluorescent or LED Displays
- High Input Impedance
- Internal Pull-Down Resistors
- Logarithmic Display Characteristics
- External Reference Level Adjustment

### APPLICATIONS

- Bar-Graph Display Generator
- 12-Point Display Driver
- Audio Level Indicator
- Channel Separation Indicator
- 12-Point Digital Controller
- Sequential Display Generator

### ORDER INFORMATION

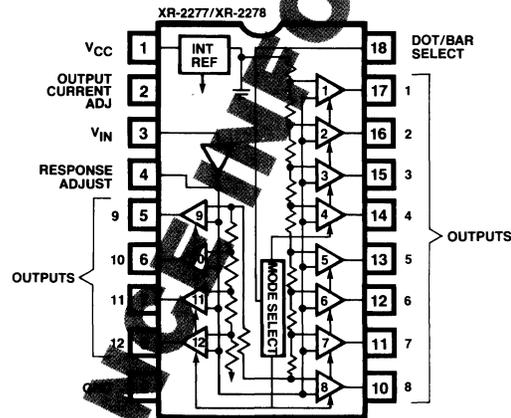
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2276CP   | Plastic | 0°C to +75°C          |

## XR-2277/XR-2278 DOT OR BAR-GRAPH DISPLAY GENERATORS

The XR-2277 and the XR-2278 are 12-point level-detector circuits designed for interfacing directly with LED moving-dot or bar-graph displays. Each circuit is comprised of an input buffer amplifier and a set of 12 comparators. Each are biased from an internal voltage reference and a resistor string. Each comparator provides a high impedance current source output; each of the output currents is closely matched and can be adjusted simultaneously with a single external setting resistor. The control signal applied to the mode-select pin determines whether the display is driven in a moving dot or bar-graph format.

The XR-2277 has 12 discrete output levels, over a range of -30 dB to +6 dB, referenced to an externally set zero dB reference level. The XR-2278 has similar electrical characteristics except for a dynamic range of -20 dB to +8 dB.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct LED Interface
- Constant-Current Outputs
- Adjustable Output Currents
- High Input Impedance
- External Mode-Select for Dot/Bar-Graph Format
- Adjustable/zero dB Reference

### APPLICATIONS

- Bar-Graph Display Generator and Driver
- Dot Display Generator
- Audio Level Indicator
- Sequential Display Indicator

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2277CP   | Plastic | 0°C to +75°C          |
| XR-2278CP   | Plastic | 0°C to +75°C          |

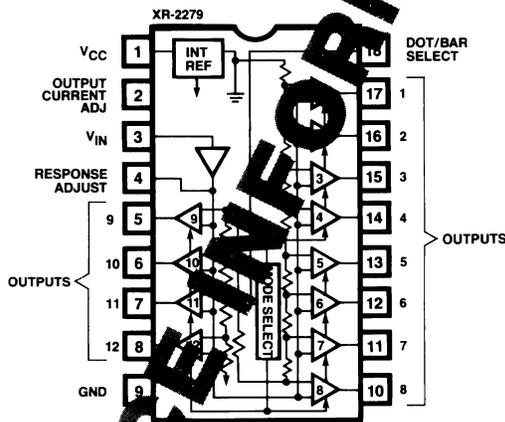
# Display Drivers

## XR-2279 DOT AND BAR-GRAPH DISPLAY GENERATOR

The XR-2279 is a 12-point logarithmic level-detector circuit comprised of an input buffer amplifier and a set of 12 voltage comparators. The circuit produces 12 discrete output levels, spaced in three dB intervals, over a dynamic range of -27 dB to +6 dB, referenced to an externally adjusted zero dB level. It is designed for interfacing directly with moving-dot or bar-graph displays. Each of the comparator outputs provides a high impedance constant-current drive which is well matched and can be adjusted by an external resistor setting.

The output can be either in a moving-dot or a continuous bar-graph format, depending on the control voltage applied to the mode-select pin.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct LED Interface
- Constant/Three dB/Step Logarithmic Scale
- External Mode Select for Dot/Bar-Graph/Formats
- Adjustable Output Current Levels
- Adjustable zero dB Reference

### APPLICATIONS

- Bar-Graph Generator
- Moving-Dot Display Generator
- Logarithmic Level Indicator
- Sequential Level Indicator

### ORDER INFORMATION

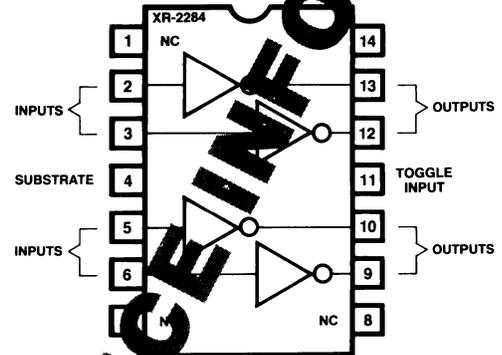
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2279CP   | Plastic | 0°C to +75°C          |

## XR-2284 HIGH VOLTAGE PLASMA DISPLAY DRIVER

The XR-2284 is a four channel display driver circuit especially designed for interfacing with high voltage ac plasma display systems. Each driver array can be used for either the segment or the column (or digit) drive, and several driver arrays can be "stacked" together to drive a large number of display segments or columns.

All four channels of the driver IC are driven by a common ac toggle voltage, each output can sink or source up to 100 mA of load current and can operate with toggle frequencies of up to 200 kHz. The input threshold levels of each of the driver channels is compatible with TTL or CMOS logic levels. The XR-2284 is designed to operate with 360 volt ac plasma systems and has a minimum stand-off voltage of 90 volts. The commercial version, the XR-2284 C, is designed for 240 volt plasma systems and has a maximum voltage rating of 60 volts.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- High Stand-Off Voltage ( $\geq 90V$  for XR-2284;  $\geq 60V$  for XR-2284 C)
- Very Low  $I_{CC}$  Standby Power ( $\approx 25$  mW/channel at 100 kHz)
- Zero  $I_{CC}$  Standby Power
- 100 mA Output Drive Capability
- TTL and CMOS Compatible Inputs

### APPLICATIONS

- High Voltage AC Plasma Panels
- High Voltage Pulsed Displays
- Pulsed AC Switching

### ORDER INFORMATION

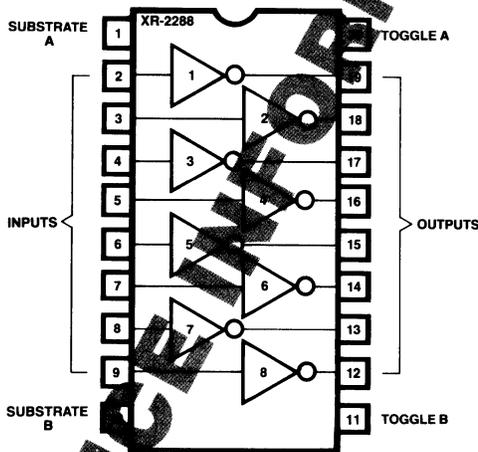
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2284P    | Plastic | 0°C to +75°C          |
| XR-2284CP   | Plastic | 0°C to +75°C          |

# Display Drivers

## XR-2288 HIGH-VOLTAGE AC PLASMA DISPLAY DRIVER

The XR-2288 is an eight channel high voltage display driver circuit especially designed for ac plasma displays. It contains the equivalent of two XR-2284 type driver channels in a single IC package. Each driver channel can sink or source up to 100 mA of capacitive load current and can operate with toggle frequencies up to 200 kHz. The XR-2288 is designed to operate with 360 volt ac plasma systems and has a minimum stand-off voltage of 90 volts. The commercial version, the XR-2288 C, is designed for 240 volt plasma systems and has a maximum voltage rating of 150 volts.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- High Stand-off Voltage (90 volts, typical)
- Eight Independent Driver Channels
- Very Low AC Standby Power
- (25 mW/channel at 100 kHz)
- Zero DC Standby Power
- 100 mA Output Drive Capability
- TTL and CMOS Compatible Inputs

### APPLICATIONS

- High Voltage AC Plasma Panels
- High Voltage Pulsed Displays
- Pulsed AC Switching

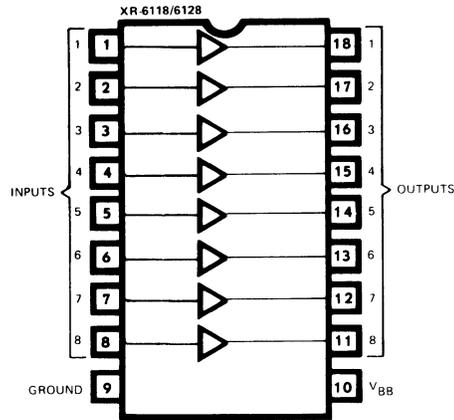
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2288P    | Plastic | 0°C to +75°C          |
| XR-2288CP   | Plastic | 0°C to +75°C          |

## XR-6118/6128 FLUORESCENT DISPLAY DRIVER

The XR-6118 and the XR-6128 are high-voltage display driver arrays which are designed to interface between low-level digital logic and vacuum fluorescent displays. Each circuit consists of eight independent signal channels comprised of Darlington output stages and common-emitter type inputs. All stages on the chip share common power supply and ground connections. Both device types are capable of driving digits and/or segments of fluorescent displays, and all of the eight outputs can be activated simultaneously. The XR-6118 is compatible with TTL, Schottky TTL, DTL and 5-Volt CMOS logic families. The XR-6128 is intended for use with PMOS or CMOS logic families operating with supply voltages of 6V to 15V.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for Sprague UDN-6118A and UDN-6128A
- Digit or Segment Drivers
- Low Input Current
- Internal Output Pull-Down Resistors
- Low Power
- High Output Breakdown Voltage (75 V, min.)

### APPLICATIONS

- Fluorescent Driver
- Gas-Discharge Display Driver
- High-Voltage Switching

### ORDER INFORMATION

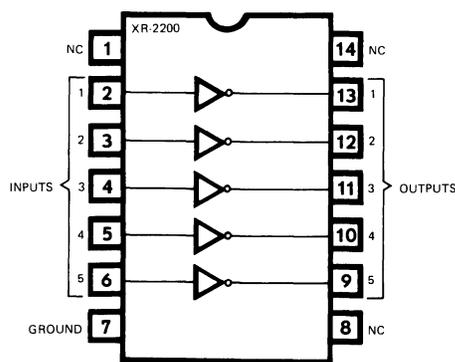
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-6118P    | Plastic | 0°C to +85°C          |
| XR-6128P    | Plastic | 0°C to +85°C          |

# High Current Drivers

## XR-2200 HAMMER DRIVER

The XR-2200 is an array of five Darlington transistor pairs which are capable of driving high-current loads such as solenoids, relays, and LED's. Each of the five circuits contained on the XR-2200 is capable of sinking up to 400 mA. The XR-2200 was specifically designed for use with 14V to 25V PMOS devices.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Output Capability of 400 mA for each Driver
- Drivers May be Used in Parallel for Increased Output Drive Capability
- Input is Directly Compatible with PMOS Outputs

### APPLICATIONS

- Printing Calculator Hammer Driver
- High Current LED Driver
- Solenoid and Relay Driver
- Tungsten Lamp Driver
- High Current Switch

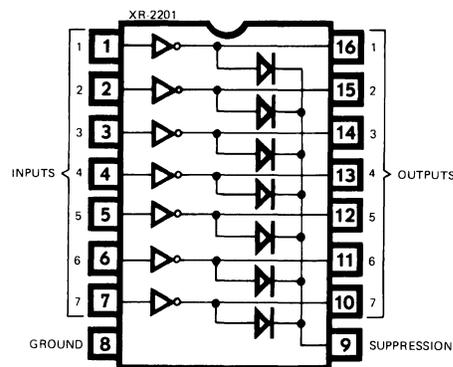
### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2200CP   | Plastic | -25°C to +75°C        |

## XR-2201/2202/2203/2204 HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

The XR-2201/2202/2203/2204 Darlington transistor arrays are comprised of seven silicon NPN Darlington pairs on a single monolithic substrate. All feature open-collector outputs and internal protection diodes for driving inductive loads. Peak inrush currents of up to 600 mA are allowable, making them also ideal for driving tungsten filament lamps. Although the maximum continuous collector current rating is 500 mA for each driver, the outputs may be paralleled to achieve higher load current capability.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- High Peak Current Capability: 600 mA
- Internal Protection Diodes for Driving Inductive Loads
- Directly Compatible with TTL, CMOS, PMOS, and DTL Logic Families
- Exact Replacement for Sprague Types ULN2001A, ULN2002A, ULN2003A, and ULN2004A

### APPLICATIONS

- Solenoid and Relay Driver
- High Current LED Driver
- Printing Calculator Hammer Driver
- High Current Switch
- Tungsten Lamp Driver

### ORDER INFORMATION

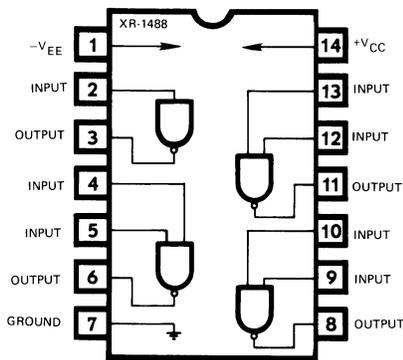
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2201CP   | Plastic | 0°C to +85°C          |
| XR-2202CP   | Plastic | 0°C to +85°C          |
| XR-2203CP   | Plastic | 0°C to +85°C          |
| XR-2204CP   | Plastic | 0°C to +85°C          |

# Line Interface Circuits

## XR-1488 QUAD LINE DRIVER

The XR-1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment. It meets EIA Standard No. RS232C. This circuit features output current limiting, independent positive and negative power supply driving elements, and compatibility with all DTL and TTL logic families.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for MC1488
- Current Limited Output
- Compatible with DTL and TTL Logic
- Meets EIA Standard RS232C

### APPLICATIONS

- Data-Terminal Interface
- Driving Capacitive Loads
- Data Bus Interface

### ORDER INFORMATION

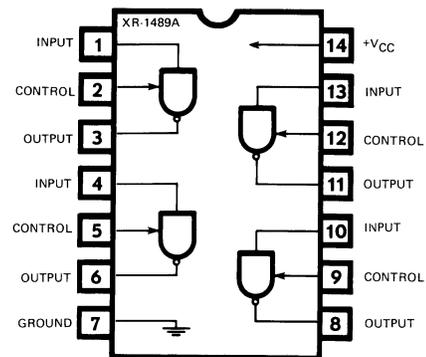
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-1488N    | Ceramic | 0°C to +75°C          |
| XR-1488P    | Plastic | 0°C to +75°C          |

## XR-1489A QUAD LINE RECEIVER

The XR-1489A is a monolithic quad line receiver especially designed for data bus interface. Each of the line receiver sections have adjustable hysteresis characteristics for improved noise-rejection. The input and output levels of the circuit are designed to provide direct interface between RS232C data bus standards and the DTL or TTL type logic levels.

The XR-1489A line receiver and the XR-1488 line driver circuits are designed to provide the complete interface function between terminal equipment and the data communication or telemetry systems.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Direct Replacement for MC1489A
- Current Limited Output
- Compatible with DTL and TTL Logic
- Meets EIA Standard RS232C

### APPLICATIONS

- Data-Bus Interface
- Microprocessor Interface
- Remote Terminal Interface

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-1489AN   | Ceramic | 0°C to +75°C          |
| XR-1489AP   | Plastic | 0°C to +75°C          |

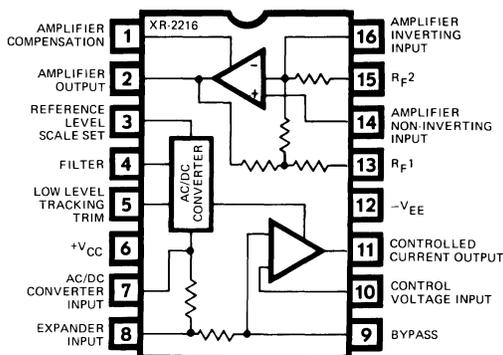
# Telecommunication Circuits

## XR-2216 MONOLITHIC COMPANDOR

The XR-2216 is a monolithic audio frequency compandor designed to compress or expand the dynamic range of speech or other analog signals transmitted through telecommunication systems. External circuitry determines whether the circuit is connected as either a compressor or an expander.

The circuit features four basic blocks: (1) an internal voltage reference, (2) an AC/DC converter, (3) an impedance converter, and (4) a high-gain operational amplifier. The XR-2216 can be operated with positive or negative single supply systems or dual power supplies over a 6V to 20V power supply range.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Functions as Either a Compressor or an Expander
- Wide Dynamic Range: 60 dB
- Wide Supply Range: 6 to 20 Volts
- Excellent Transfer Function Tracking
- Low Power Supply Drain
- Controlled Attack and Release Times
- Low Noise and Low Distortion

### APPLICATIONS

- Telephone Trunk-Line Compandor
- Speech/Data Compression and Expansion
- Telecommunications Systems
- Mobile Communications
- Analog Data Processing

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-2216CN   | Ceramic | -40°C to +60°C        |
| XR-2216CP   | Plastic | -40°C to +60°C        |

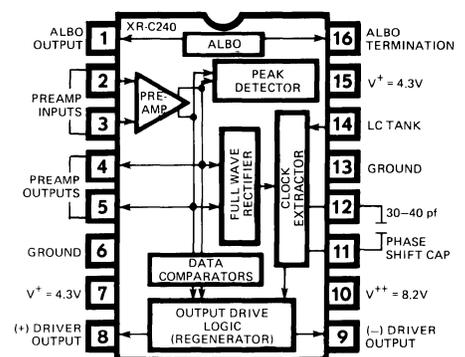
## XR-C240 MONOLITHIC PCM REPEATER

The XR-C240 is a monolithic repeater circuit for Pulse-Code Modulated (PCM) telephone systems. It is designed to operate as a regenerative repeater at 1.544 Megabits per second (Mbps) data rates on T-1 type PCM lines.

The XR-240 monolithic IC is packaged in a hermetic 16-pin DIP package and is designed to operate over a temperature range of -40°C to +85°C. It contains all the basic functional blocks of a regenerative repeater system including Automatic Line Build-Out (ALBO) and equalization, and is insensitive to reflections caused by cable discontinuities.

Compared to conventional repeater designs using discrete components, the XR-C240 monolithic repeater IC offers greatly improved reliability and performance and provides significant savings in power consumption and system cost.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Contains all Active Components of PCM Repeater
- On-Chip ALBO Equalizer
- High-Current Output Drivers
- Low-Power Consumption
- Increased Reliability over Discrete Designs
- 2 Megabit Operation Capability

### APPLICATIONS

- PCM Repeater for T-1 Systems
- Repeater for 2 Megabit PCM Systems

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-C240     | Ceramic | -40°C to +85°C        |

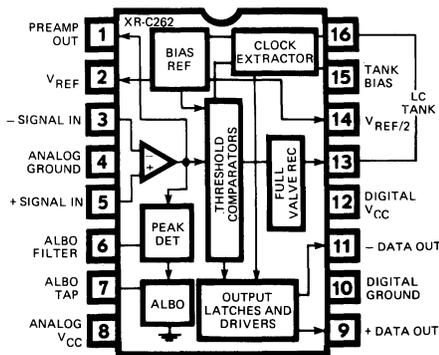
# Telecommunication Circuits

## XR-C262 HIGH-PERFORMANCE PCM REPEATER

The XR-C262 is a high-performance monolithic repeater IC for pulse-code modulated (PCM) telephone lines. It is designed to operate as a regenerative repeater at 1.544 Megabits per second (Mbps) data rates on T-1 type PCM lines.

The XR-C262 operates with a single 6.8 volt power supply and with a typical supply current of 13 mA. It provides bipolar output drive with high-current handling capability. The clock-extractor section of XR-262 uses the resonant-tank circuit principle, rather than the injection-locked oscillator technique used in earlier monolithic repeater designs. The bipolar output drivers are designed to go "off" state automatically when there is no input signal present.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Contains all Necessary Active Components of a PCM Repeater
- Uses L-C Tank for Clock Recovery
- Low-Voltage Operation (6.8 volts)
- Low-Current Drain (13 mA, typical)
- High-Current Bipolar Output Drivers
- On-Chip ALBO Equalizer
- Automatic Zero-Input Shutdown
- Increased Reliability Over Discrete Designs
- 2 Megabit Operation Capability

### APPLICATIONS

- PCM Repeater for T-1 Systems
- Repeater for 2 Megabit PCM Systems

### ORDER INFORMATION

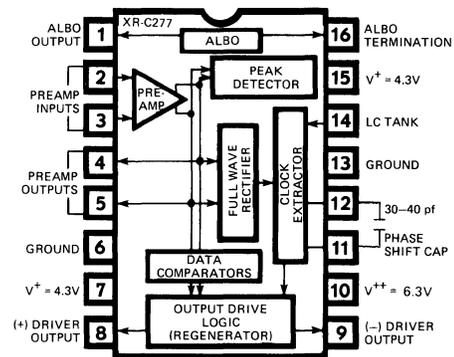
| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-C262     | Ceramic | -40°C to +85°C        |

## XR-C277 LOW-VOLTAGE PCM REPEATER

The XR-C277 is a monolithic repeater circuit for Pulse-Code Modulated (PCM) telephone systems. It is designed to operate as a regenerative repeater at 1.544 Megabits per second (Mbps) data rates on T-1 type PCM lines. It is packaged in a hermetic 16-pin Cerdip package and is designed to operate over a temperature range of -40°C to +85°C. It contains all the basic functional blocks of a regenerative repeater system including Automatic Line Build-Out (ALBO) and equalization, and is insensitive to reflections caused by cable discontinuities.

The key feature of the XR-C277 is its ability to operate with low supply voltages (6.3 volts and 4.3 volts) with a supply current of less than 13 mA. Compared to conventional repeater designs using discrete components, the XR-C277 monolithic repeater IC offers greatly improved reliability and performance and provides significant savings in power consumption and system cost.

### FUNCTIONAL BLOCK DIAGRAM



### FEATURES

- Contains all Active Components of PCM Repeater
- Low-Voltage Operation (6.3 volts)
- Low-Power Dissipation (13 mA)
- On-Chip ALBO Equalizer
- High-Current Output Drivers
- Increased Reliability over Discrete Designs
- 2 Megabit Operation Capability
- Pin-Compatible with XR-C240

### APPLICATIONS

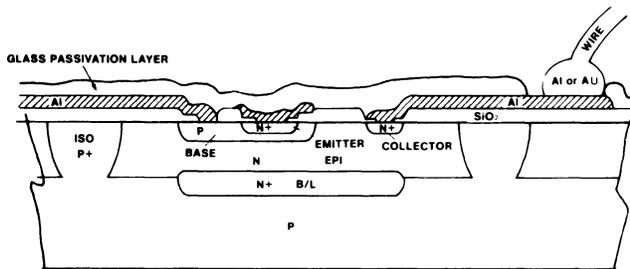
- PCM Repeater for T-1 Systems
- Repeater for 2 Megabit PCM Systems

### ORDER INFORMATION

| Part Number | Package | Operating Temperature |
|-------------|---------|-----------------------|
| XR-C277     | Ceramic | -40°C to +85°C        |

# Monolithic Chips for Hybrid Assemblies

The major performance characteristics of Exar products are also available in chip form. All chips are 100% electrically tested for guaranteed DC parameters at 25°C; and 100% visually inspected at 30x to 100x magnification using Exar's standard visual inspection criteria or MIL-STD-883, Method 201, depending on the individual customer requirements. Each chip is protected with an inert glass passivation layer over the metal interconnections. The chips are packaged in waffle-pack carriers with an anti-static shield and cushioning strip plated over the active surface to assure protection during shipment. All chips are produced on the same well-proven production lines that produce Exar's standard encapsulated devices. The Quality Assurance testing of dice is provided by normal production testing of packaged devices.



Typical Bipolar Chip Cross Section

## FEATURES

- DC Parameters Guaranteed at 25°C
- 100% Visual Inspection
- Care in Packaging
- 100% Stabilization Bake (Wafer Form)
- 10% LTPD on DC Electrical Parameters

## CHIPS IN WAFER FORM

Probed and inked wafers are also available from Exar. The hybrid microcircuit designer can specify either scribed or unscribed wafers and receive a fully tested silicon wafer. Rejected die are clearly marked with an ink dot for easy identification in wafer form.

## ELECTRICAL PARAMETERS

Probing the IC chips in die form limits the electrical testing to low level DC parameters at 25°C. These DC parameters are characteristic of those parameters contained on the individual device data sheet and are guaranteed to an LTPD of 10%.

The AC parameters, which are similar to those in the standard Exar device data sheets, have been correlated to selected DC probe parameters and are guaranteed to an LTPD of 20%.

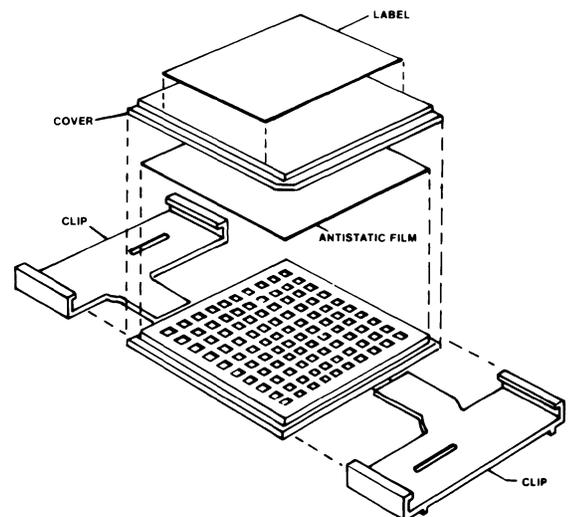
## HANDLING PRECAUTIONS AND PACKAGING OPTIONS

Extreme care must be used in the handling of unencapsulated semiconductor chips or dice to avoid damage to the chip surface. Exar offers the following three handling or packaging options for monolithic chips supplied to the customer:

**Cavity or Waffle Pack:** The dice are placed in individual compartments of the waffle pack (see figure). The plastic snap clips permit inspection and resealing.

**Vial Pack:** The vial is filled with inert freon TF and a plastic cap seals the vial. The freon acts as a motion retarder and cleansing agent.

**Wafer Pack:** The entire wafer is sandwiched between two pieces of mylar and vacuum sealed in a plastic envelope.



Typical Cavity Pack (Waffle Pack)

# Semi-custom Bipolar Program

The Exar bipolar semi-custom design program offers a variety of "semi-custom" chips to fulfill various application performance requirements and complexities.

These semi-custom chips offer a unique method of manufacturing an almost unlimited variety of custom linear and digital integrated circuits with greatly reduced cost and development time. Exar makes this possible by stocking wafers that are completely fabricated except for the final process step of device interconnection which metalizes the selected components together in the required circuit configurations.

## BIPOLAR SEMI-CUSTOM CHIPS

| Chip Type | Chip Size in Mils | Breakdown Voltage | NPN | PNP |
|-----------|-------------------|-------------------|-----|-----|
| A100      | 73 X 83           | 20V               | 60  | 18  |
| B100      | 85 X 85           | 20V               | 69  | 12  |
| C100A     | 56 X 62           | 20V               | 23  | 8   |
| D100      | 80 X 80           | 36V               | 50  | 16* |
| F100      | 91 X 110          | 20V               | 97  | 32* |
| G100      | 90 X 90           | 20V               | 60  | 18* |
| J100      | 61 X 65           | 20V               | 38  | 12* |
| X100      | 115 X 95          | 75V               | 34  | 16  |

\*Dual collector PNP transistor

Exar offers a design kit which contains simple instructions and guidelines for designing the metal mask as well as actual breadboard components (consisting of NPN and PNP arrays and integrated resistors), which are representative of the devices available on the semi-custom chips. This provides the design engineer with the ability to closely evaluate his design performance prior to integrating it on a monolithic chip.

# Semi-custom I<sup>2</sup>L Program

With the introduction of the I<sup>2</sup>L Gate-Array chips, Exar has extended its semi-custom design program to the Integrated Injection Logic (I<sup>2</sup>L) technology. This unique method of custom LSI development technique now makes it possible to manufacture an almost unlimited variety of digital or analog/digital circuits using I<sup>2</sup>L technology, at a greatly reduced development cost and time.

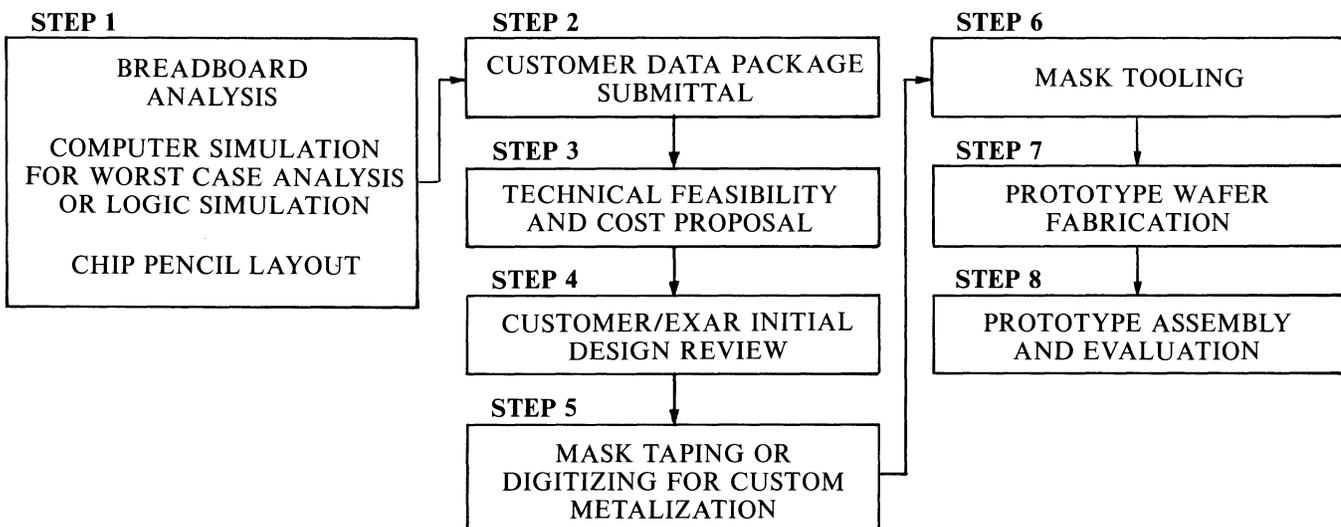
## I<sup>2</sup>L SEMI-CUSTOM CHIPS

| Characteristics        | Chip Type |           |           |           |
|------------------------|-----------|-----------|-----------|-----------|
|                        | XR-200    | XR-300    | XR-400    | XR-500    |
| Chip Size (mils)       | 98 X 119  | 104 X 146 | 119 X 156 | 122 X 185 |
| I <sup>2</sup> L Gates | 192       | 288       | 256       | 520       |
| Max. Operating Voltage |           |           |           |           |
| A-Option               | 6V        | 6V        | 6V        | 6V        |
| B-Option               | 15V       | 15V       | 15V       | 15V       |
| Bipolar I/O Interfaces | 24        | 28        | 18        | 40        |
| Bonding Pads           | 30        | 34        | 40        | 42        |

The XR-300 and the XR-500 gate-arrays are intended primarily for digital LSI designs. The XR-400 gate-array features the advantages of combining analog and digital functions on the same IC chip. These I<sup>2</sup>L gate-array chips are customized using two or more custom mask patterns which are simultaneously generated from a pencil layout, using Exar's unique computerized mask generation technique. In this manner, the chip layout is greatly simplified and gate-utilization efficiency is increased.

Exar also offers an I<sup>2</sup>L design kit which is intended to familiarize the designer with the basic features of I<sup>2</sup>L technology and provide helpful design guidelines in reducing his design from concept to breadboard and finally to the IC layout stage.

## TYPICAL FLOW FOR SEMI-CUSTOM DEVELOPMENT



# Full Custom Development

Exar offers a complete design and production capability for full-custom IC development using Exar's bipolar and I<sup>2</sup>L technologies. This provides an excellent complement to Exar's unique semi-custom capability.

Exar's full-custom IC development and production capabilities offer complete flexibility to meet changing customer needs or design problems. We can develop a complete custom IC starting from your "black-box" specifications or reduce your working breadboard prototype to a monolithic chip. Alternately, if you have the facilities and resources to do the IC design and the layout, Exar will provide you with the device characteristics and IC layout rules for the particular process suitable to your design and review your IC layout for you. Then, Exar can generate the IC tooling and fabricate your IC prototypes for you.

Exar's bipolar process technology is compatible with the manufacturing processes available from many of the other IC manufacturers. Thus, if you have developed a set of IC tooling with another manufacturer and would like an alternate or substitute supplier for your custom IC product, in most cases your existing IC tooling may be directly compatible with Exar's technology.

Exar's Engineering Department has two custom IC design groups dedicated to the development of linear and digital custom LSI. We pride ourselves in our flexibility and quick response to your needs.

## CONVERTING SEMI-CUSTOM TO FULL CUSTOM

Exar offers the unique ability to start a program using a combination of semi-custom bipolar and/or I<sup>2</sup>L arrays during the early phases of a customer's product, taking full advantage of the low tooling cost and short development cycle. As a customer's product matures and its market expands, resulting in higher volume production run rates, Exar can convert the multiple semi-custom chip approach into a single custom IC, achieving a cost reduction and in many cases, a performance improvement. The significant advantage of this type of program is that the risk associated with a custom development is greatly reduced; the IC design approach has been proven, production "bugs" are out of your product and your production line continues to flow during the full custom chip development. Once the custom chip is completely characterized and found acceptable, the semi-custom IC system in your product can be phased-out while the full-custom IC is being phased-in.

Exar is the only company that can offer you the advantages of semi-custom and full-custom bipolar design programs because of our in-house complete semiconductor manufacturing capability.

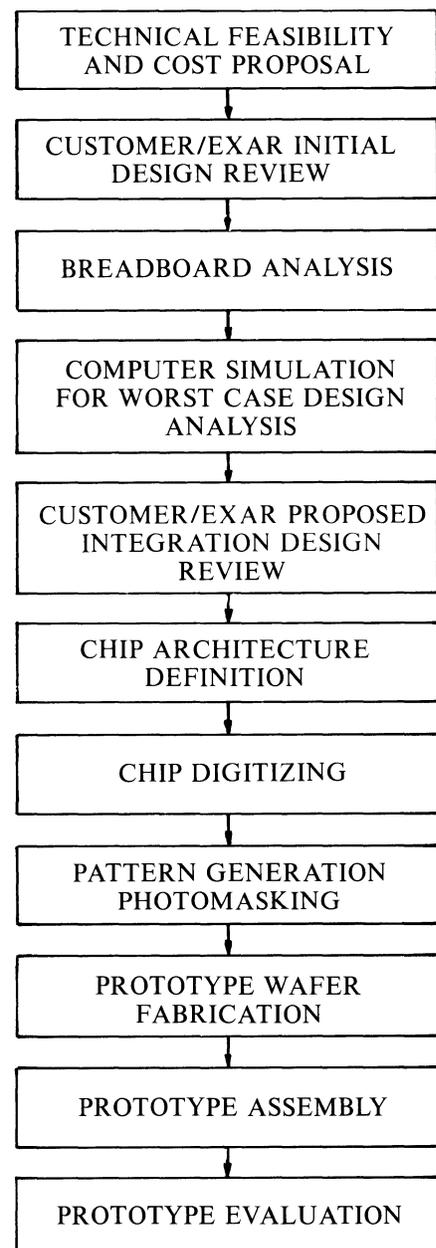
## YOUR FIRST STEP

The following technical data package is required in order for Exar to provide you with a firm quotation for your full-custom development program:

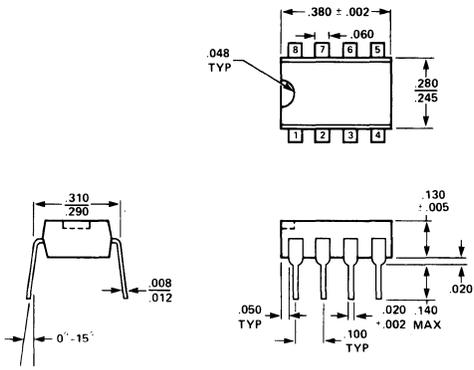
1. Circuit block diagram with sub-blocks (as required).

2. Circuit Schematic or Logic Diagram.
3. Description of circuit operation and pertinent application information.
4. Preliminary or objective device specification indicating min/max conditions and limits for the critical parameters (i.e., input/output voltage and current levels, operating frequency, timing diagrams, input/output impedances, power dissipation, etc.)
5. Production requirements and the desired development time table.

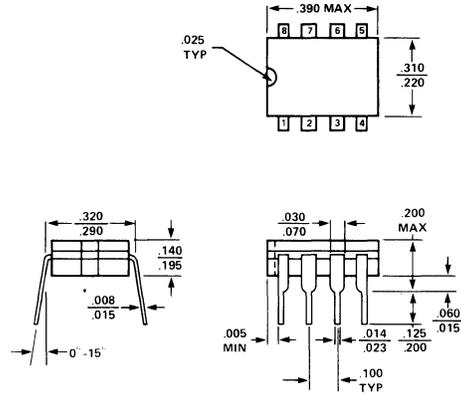
## FLOW-CHART OF TYPICAL FULL CUSTOM DEVELOPMENT PROGRAM



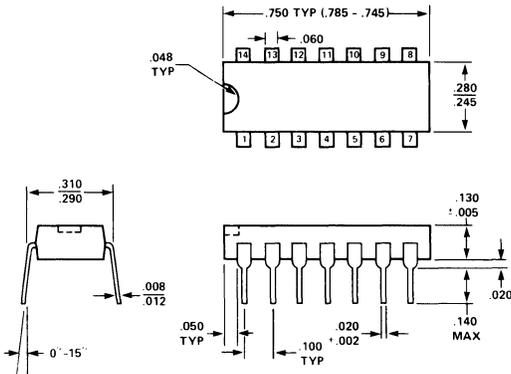
# Packaging Information



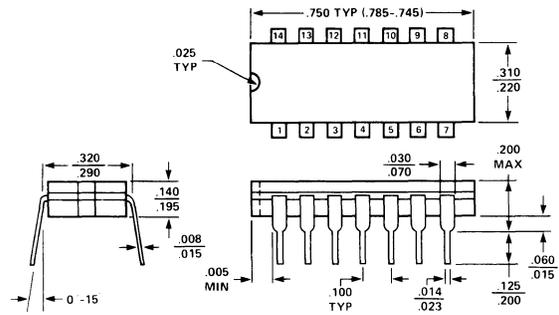
**8 PIN MOLDED PLASTIC DIP**



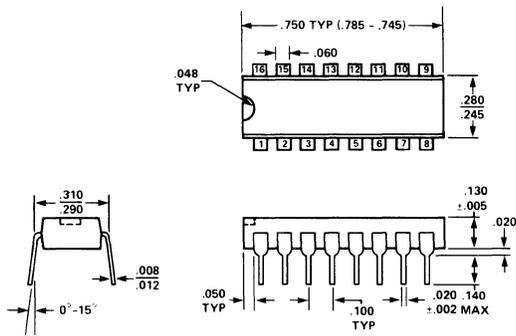
**8 PIN CERAMIC CAVITY DIP (CERDIP)**



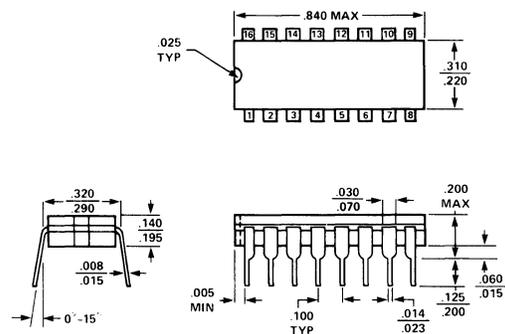
**14 PIN MOLDED PLASTIC DIP**



**14 PIN CERAMIC CAVITY DIP (CERDIP)**

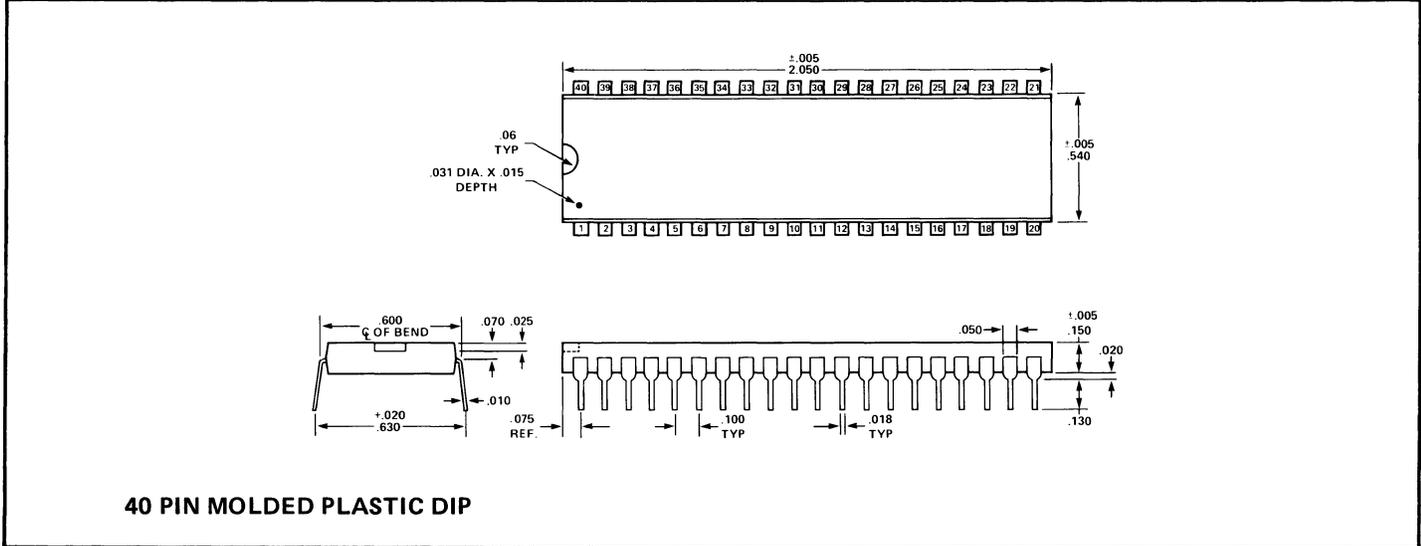
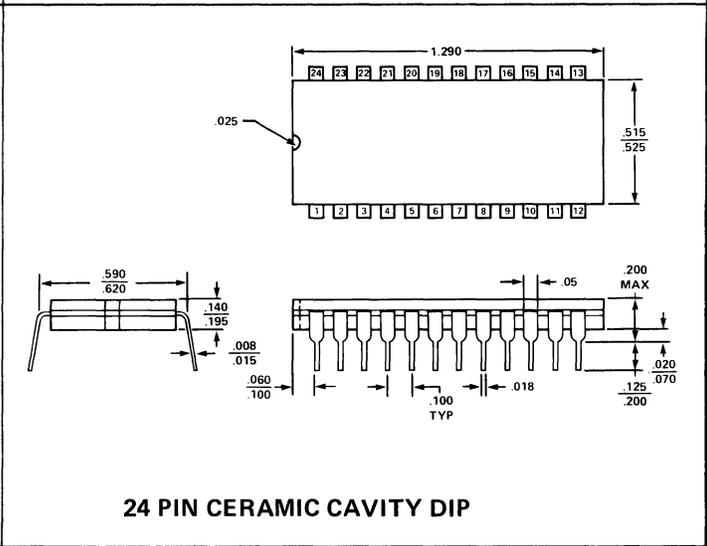
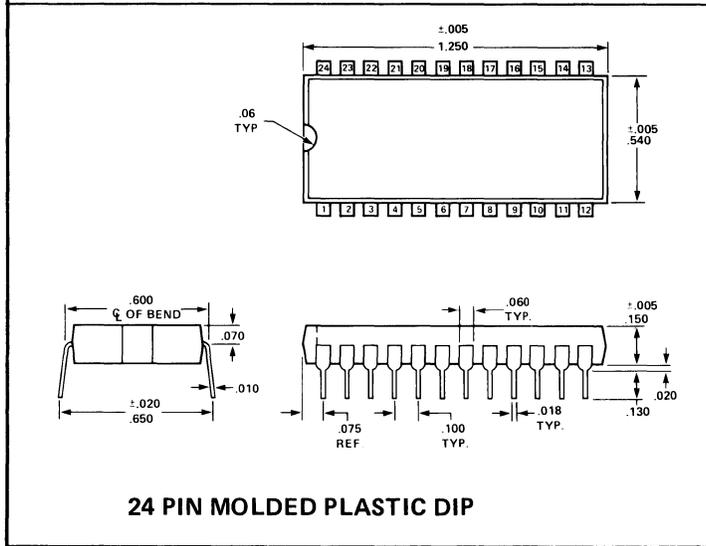
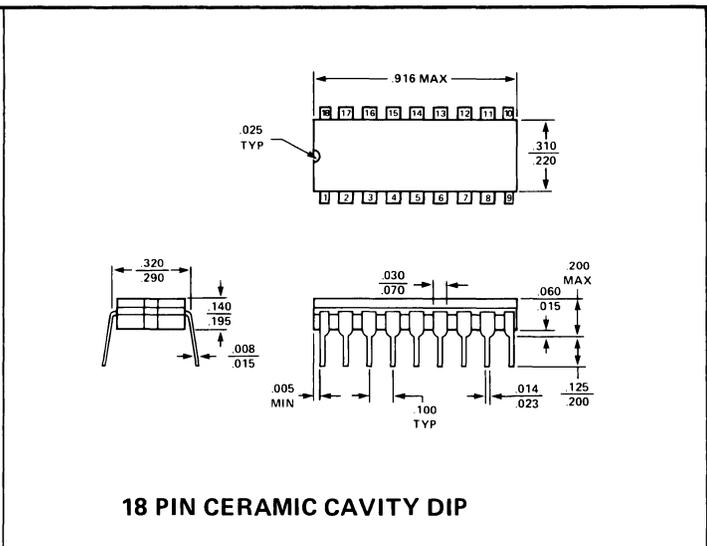
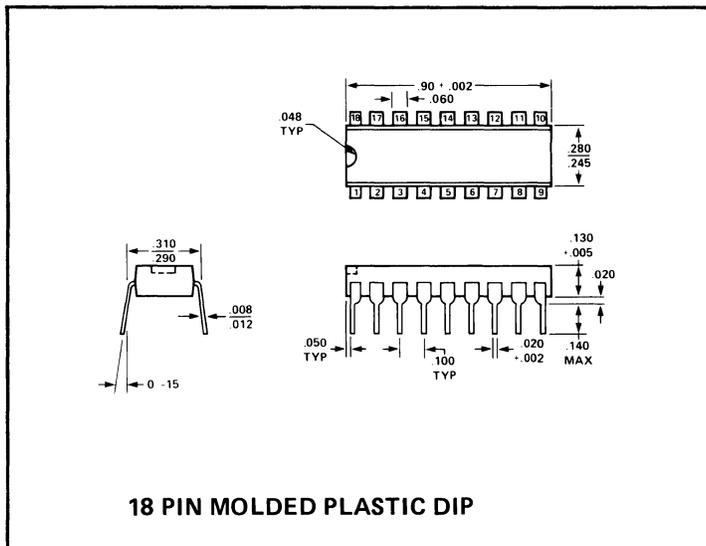


**16 PIN MOLDED PLASTIC DIP**



**16 PIN CERAMIC CAVITY DIP (CERDIP)**

# Packaging Information



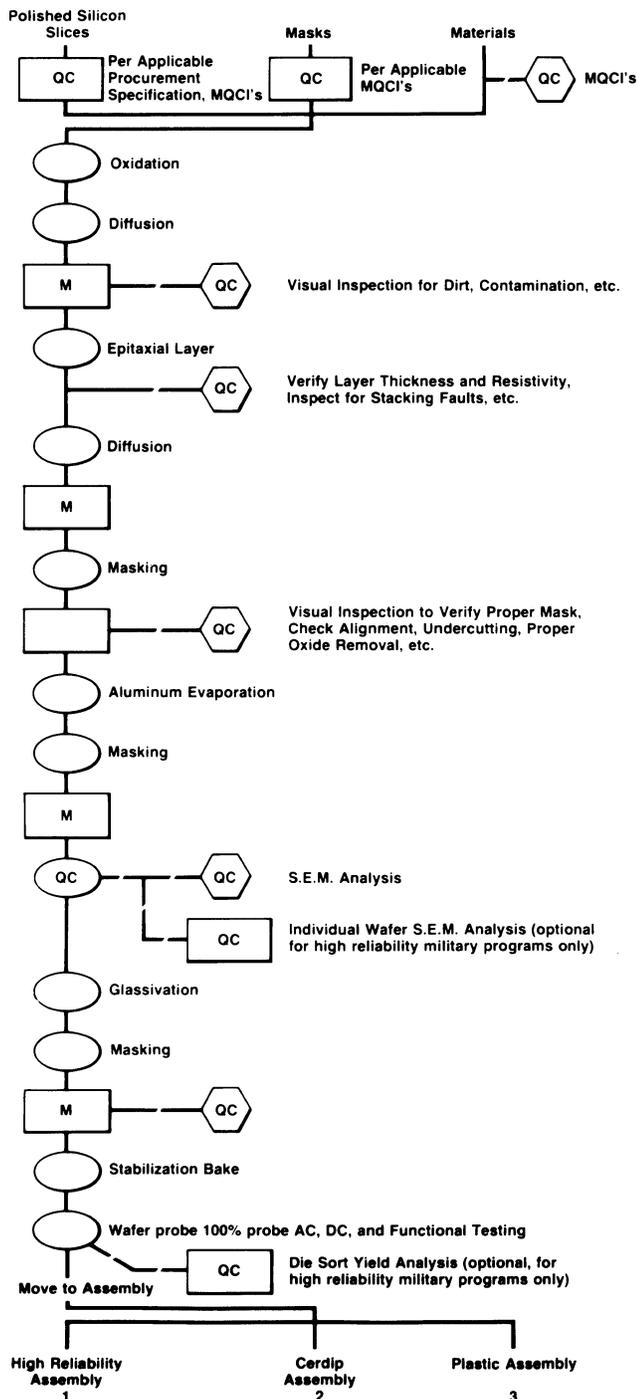
# QUALITY ASSURANCE STANDARDS

The quality assurance program at Exar Integrated Systems defines and establishes standards and controls on manufacturing, and audits product quality at critical points during manufacturing. The accompanying Manufacturing/QA process flows illustrate where quality assurance audits, by inspection or test, the manufacturing process. The insertion of these quality assurance points is designed to insure the highest quality standards are maintained on Exar product during its manufacture.

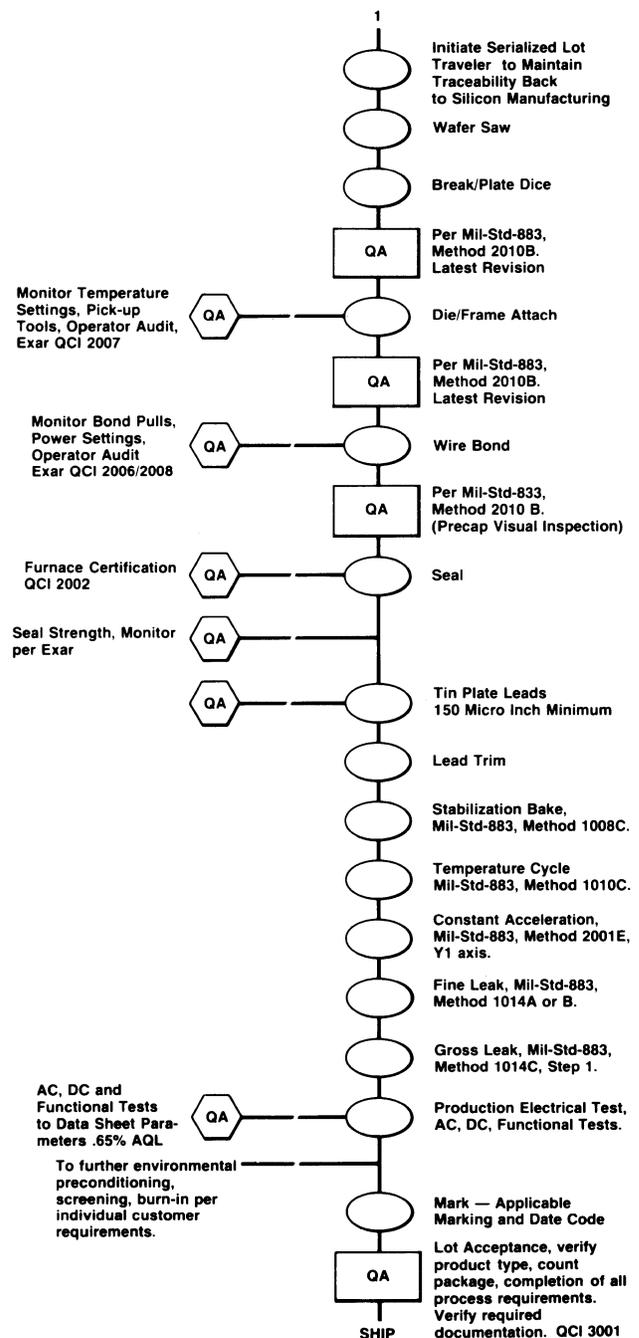
Realizing that these standard Manufacturing/QA process flows do not meet the needs of every customer's specific requirements, Exar quality assurance can negotiate and will screen product to meet any individual customer's specific requirement.

All products ending with the suffix M are fully screened to the requirements of MIL-STD-883, Method 5004, Condition C.

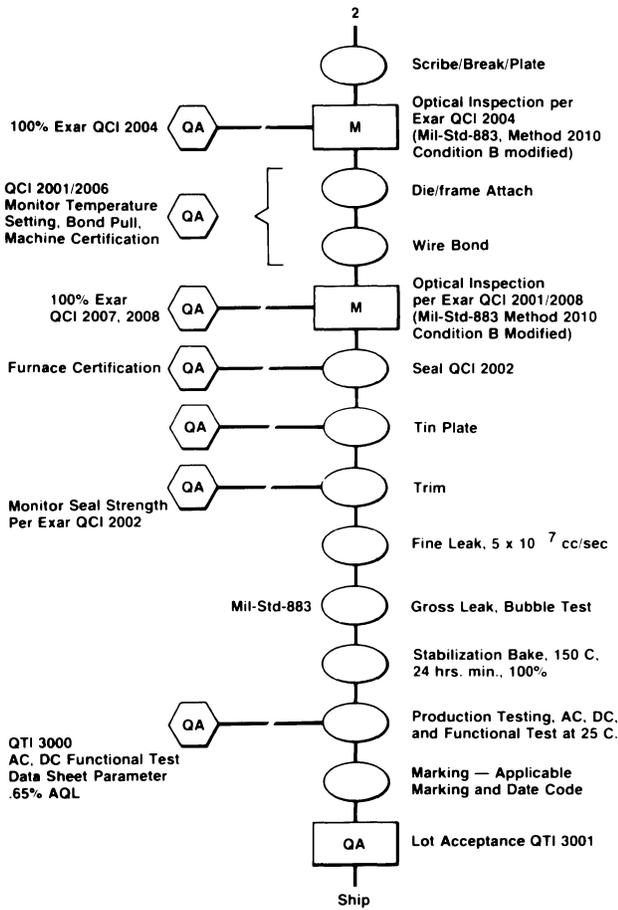
## Wafer Fabrication/QA Flow



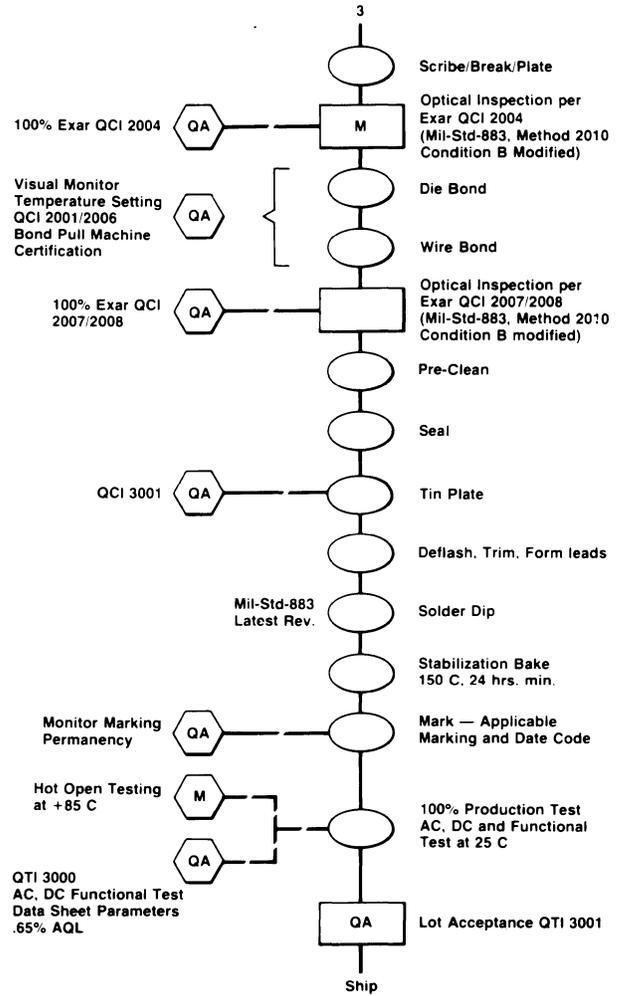
## High Reliability Assembly/QA Flow



## Cerdip Assembly/QA Flow



## Plastic Assembly/QA Flow



## PRODUCT ORDERING INFORMATION

### Part Identification

#### XR

Manufacturer's Prefix

#### Grade

- M = Military Electrical
- N = Prime Electrical
- P = Prime Electrical
- C = Commercial
- K = Kit

#### XXXXX

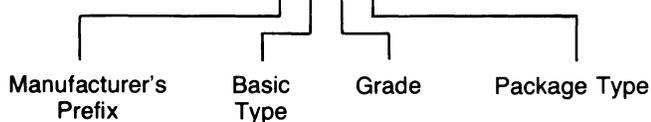
Basic Type (5 spaces)

#### Package Type

- N = Ceramic Dual-in-line
- P = Plastic Dual-in-line

Example:

**XR-2216 CN**



### Definition of Symbols:

- M = Military Grade Part, Ceramic Package Only. All Military Grades have been processed to MIL-STD-883 Level C, and are guaranteed to operate over military temperature range.
- N = Prime Grade Part, Ceramic Package.
- P = Prime Grade Part, Plastic Package.
- CN = Commercial Grade Part, Ceramic Package.
- CP = Commercial Grade Part, Plastic Package.

N, P, CN and CP parts are electrically identical and guaranteed to operate over 0°C to + 75°C range unless otherwise stated. In addition, N and P parts generally have operating parameters more tightly controlled than the CN or CP parts.

For details, consult Exar Sales Headquarters or Sales /Technical Representatives.

### Legend:

- Surveillance
- Operation
- 100% inspection
- QC = Quality Control
- M = Manufacturing

# Application Notes

Exar's Applications Engineering Department has prepared a comprehensive set of application notes and information in Exar's products and technologies. A list of these application notes, along with a brief description of their contents, is given below:

## **AN-01: Stable FSK Modems Featuring the XR-2206, XR-2207 and XR-2211**

Design of stable full-duplex FSK modems is described using the XR-2206 or the XR-2207 as the modulator, and the XR-2211 as the demodulator with carrier-detection capability. Complete design examples are given for FSK modems covering mark/space frequencies from a few Hertz to 100 KHz.

## **AN-02: XR-C240 Monolithic PCM Repeater**

The principle of operation of the XR-C240 monolithic regenerative repeater IC is described. Design examples and external connections of the circuit are discussed for applications in T-1 type 1.544 Megabit PCM telephone lines.

## **AN-03: Active Filter Design With IC Op Amps**

Fundamentals of active filters are discussed, transfer functions and design equations for various classes of high-, low- and bandpass filters are given. Particular design examples are provided for FSK modem filters, using the XR-4202 programmable quad op amp.

## **AN-04: XR-C277 Low-Voltage PCM Repeater IC**

The design principles and the applications of the XR-C277 low-voltage (6.3 volt) regenerative PCM repeater are described. The monolithic IC contains all the basic functional blocks of a conventional PCM repeater, including the automatic line build-out section. Circuit connection diagrams and application examples are given for operation in 1.544 Megabit T-1 type PCM telephone systems.

## **AN-05: Tri-State FSK Modem Design Using XR-2206/ XR-2211**

Design of FSK modems with carrier detection and control capability are discussed. Such a "tri-state" modem uses a third carrier frequency for control functions, in addition to the normal "mark" and "space" frequencies used in conventional "bi-state" FSK systems. This carrier control feature allows each transmitter in a modem system to be automatically interrogated, one at a time, by a control processor, without interference from other modem transmitters within the system.

## **AN-06: Precision PLL System Using XR-2207/XR-2208**

A two-chip versatile phase-locked loop system is described, using the XR-2207 oscillator as the VCO, and the XR-2208 multiplier as the phase detector. The resulting PLL system features 20 ppm/ $^{\circ}$ C temperature stability. Design equations are given to tailor the circuit parameters to specific applications.

## **AN-07: Single-Chip Frequency Synthesizer Employing the XR-2240**

The operation of the XR-2240 programmable/counter IC as a frequency synthesizer is described. The circuit can simultaneously multiply an input frequency by an integer modulus M, and divide it by a different modulus N+1. Thus, a wide range of non-integer output frequencies can be produced from a single input reference frequency.

## **AN-08: Dual-Tone Decoding with XR-567 and XR-2567**

Application examples are given for simultaneous or sequential decoding of dual-tone control signals using either two XR-567 PLL tone decoders, or a single XR-2567 dual tone decoder. The examples include high-speed, narrow-band tone detection and Touch-Tone<sup>®</sup> decoding.

## **AN-09: Sinusoidal Output From XR-215 Monolithic PLL Circuit**

A simple circuit technique is described to convert the VCO output of the XR-215 into a low-distortion sine wave. The external sine wave shaping circuit is obtained using the XR-C101 monolithic NPN transistor array.

## **AN-10: XR-C262 High-Performance PCM Repeater**

The design principle and the electrical characteristics of the XR-C262 high-performance PCM repeater IC are described. The circuit contains all the active components necessary for a regenerative PCM repeater system and operates with a single 6.8 volt power supply. Circuit connection and application examples are given for its use in 1.5 Megabit or 2 Megabit PCM systems.

## **AN-11: A Universal Sinewave Converter Using the XR-2208 and XR-2211**

A circuit technique is described which can convert *any* periodic waveform into a low-distortion sine wave. The circuit operation is completely independent of input waveform amplitude and frequency as long as the input signal is periodic, and can operate over a frequency range of .1 Hz to over 100 KHz.

# Application Notes

## **AN-12: Designing High Frequency Phase-Locked Loop Carrier-Detector Circuits**

A design technique is described for high frequency tone or carrier detection. The two-chip circuit uses either the XR-210 or the XR-215 PLL circuit, in conjunction with the XR-2228 multiplier/detector, and can operate with carrier frequencies up to 20 MHz.

## **AN-13: Frequency Selective AM Detection Using Monolithic Phase-Locked Loops**

Design of frequency selective coherent AM and AM/FM demodulator systems is described using the XR-2228 Multiplier/Detector and the XR-215 or the XR-2212 PLL ICs.

## **AN-14: A Complete Function Generator System Using the XR-2206**

A laboratory quality self-contained function generator system is described, using the XR-2206 waveform generator IC. Complete circuit connection diagram, parts list and assembly instructions are given for a DC to 100 kHz self-contained function generator system with AM/FM capability and triangle, sine and square wave output.

## **AN-15: An Electronic Music Synthesizer Using the XR-2207 and the XR-2240**

Design of a simple, low-cost "music synthesizer" system is described. The electronic music synthesizer is comprised of the XR-2207 voltage controlled oscillator IC which is driven by the pseudo-random binary pulse pattern generated by the XR-2240 counter/timer circuit.

## **AN-16: Semi-Custom LSI Design with I<sup>2</sup>L Gate Arrays**

A unique design approach to developing complex LSI systems is described using XR-300 and XR-500 I<sup>2</sup>L gate arrays. This technique greatly reduces the design and tooling cost and the prototype fabrication cycle associated with the conventional full-custom IC development cycle; and thus makes custom ICs economically feasible even at low production volumes.

## **AN-17: XR-C409 Monolithic I<sup>2</sup>L Test Circuit**

A monolithic test circuit has been developed for evaluation of speed and performance capabilities of Exar's Integrated Injection Logic (I<sup>2</sup>L) technology. This test circuit, designated the XR-C409, is intended to familiarize the I<sup>2</sup>L user and the system designer with some of the performance features of I<sup>2</sup>L such as its frequency capability and power-speed tradeoffs.

# Technical Literature

Exar's technical staff and applications engineers have prepared a number of comprehensive Data Books which cover some of the key features and applications of Exar's IC products. These Data Books also present a number of tutorial articles on the fundamentals of such important IC products as operational amplifiers, timers, phase-locked loops voltage-controlled oscillators. These books are available directly from your Exar sales or technical representative.

A brief description of each of these data books is given below:

## **TIMER DATA BOOK:**

This data book provides a collection of technical articles and application information on monolithic timer IC products. Also included are the data sheets and the detailed electrical specifications of all of Exar's timer circuits, including the programmable timer/counters, micropower and long-delay timers.

## **PHASE-LOCKED LOOP DATA BOOK:**

This data book covers the fundamentals of design and applications of monolithic phase-locked loop (PLL) circuits. A long list of PLL applications are illustrated covering FM demodulation, frequency synthesis, FSK and tone detection. Particular emphasis is given to application of PLL circuits in data interface and communication systems such as FSK modems. This book also contains the data sheets and electrical specifications of all of Exar's PLL products.

## **FUNCTION GENERATOR DATA BOOK:**

This comprehensive data book contains a number of technical articles and application notes on monolithic voltage-controlled oscillator (VCO) and function generator IC products. In addition, the data sheets and technical specifications of Exar's monolithic VCO's and function generators are given.

## **OPERATIONAL AMPLIFIER DATA BOOK:**

This book contains a collection of technical articles on the fundamentals of monolithic IC op-amps. Some of the basic op-amp circuits are given, and the applications of IC op-amps in active filter design are discussed. The book also contains a complete set of electrical specifications in Exar's bipolar and BIFET op-amp products.

## **APPLICATIONS DATA BOOK:**

This book contains a complete and up-to-date set of application notes prepared by Exar's technical staff. These application notes cover a wide range of subjects such as FSK modems, active filters, telecommunication circuits, electronic music synthesis and many more. In each case, specific design examples are given to demonstrate the applications discussed.

# Ordering Additional Technical Literature from Exar

## PRODUCT GUIDE:

A complete short-form catalogue of all of Exar's standard and custom products, quality assurance programs and technical capabilities. Key features and applications of each of Exar's products are given, along with their functional block diagrams, package types and operating temperature ranges. Products are grouped according to their applications, and a complete industry-wide cross reference chart is provided.

## LINEAR AND DIGITAL SEMI-CUSTOM DESIGN BROCHURE:

This brochure contains a detailed description of Exar's unique bipolar and integrated injection logic (I<sup>2</sup>L) semi-custom design technology. Economic advantages of the semi-custom designs are discussed and economic guidelines are given for choosing the most cost-effective solution to a custom IC requirement. In addition, this brochure provides technical information on Exar's Master Chips and IC Design Kits.

## APPLICATIONS DATA BOOK:

This book contains a complete and up-to-date set of application notes prepared by Exar's technical staff. These application notes cover a wide range of subjects such as FSK modems, active filters, telecommunication circuits, electronic music synthetics and many more. In each case, specific design examples are given to demonstrate the applications discussed. (\$2.95)

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This book contains a collection of technical articles on the fundamentals of monolithic IC op amps. Some of the basic op amp circuits are given and the application of IC op amps in active filter design are discussed. The book also contains a complete set of electrical specifications in Exar's bipolar and BIFET op amp products. (\$2.95)

## PHASE-LOCKED LOOP DATA BOOK:

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## TIMER DATA BOOK:

This data book provides a collection of technical articles and application information on monolithic timer IC products. Also included are the data sheets and the detailed specifications of all of Exar's timer circuits, including the programmable timer/counters, micropower and long-delay timers. (\$2.95)

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To obtain the technical literature of interest to you, contact the Exar sales representative nearest you, or write Exar, Integrated Systems Inc., P.O. Box 62229, Sunnyvale, CA 94088, on your company letterhead.

Data Books can also be ordered directly from Exar, at a nominal charge, by completing and sending this request card to Exar, with an appropriate check or money order (include \$2.00 for postage and handling). Please make checks payable to Exar Integrated Systems, Inc.

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## FLORIDA

Donato & Assoc., Inc.  
2660 West Oakland  
Park Blvd.  
Suite 210  
Ft. Lauderdale, FL  
33311  
(305) 733-3450  
TWX 510-955-9789

## GEORGIA

Rep, Incorporated  
1944 Cooledge Road  
Tucker, GA 30084  
(404) 938-4358  
TWX 810-766-0822

## HAWAII

(Call Exar Direct)

## IDAHO

(See Washington)

## ILLINOIS (NORTH)

Janus, Incorporated  
3166 Des Plaines Ave.  
Suite 14  
Des Plaines, IL 60018  
(312) 298-9330

## ILLINOIS (SOUTH)

(See Missouri)

## INDIANA

(See Ohio)

## IOWA

Dytronix, Inc.  
23 Twixt Town Road  
NorthEast  
Suite 201  
Cedar Rapids, IA  
52402  
(319) 377-8275

## KANSAS

(See Missouri)

## KENTUCKY

(See Ohio)

## LOUISIANA

(See Texas)

## MAINE

(See Massachusetts)

## MARYLAND

Component Sales, Inc.  
3701 Old Court Rd.  
Suite 14  
Baltimore, MD 21208  
(301) 484-3647  
TWX 710-862-0852

## MASSACHUSETTS

Contact Sales, Inc.  
101 Cambridge Street  
Burlington, MA 01803  
(617) 273-1520  
TWX 710-332-6569

## MICHIGAN

(See Ohio)

## MINNESOTA

Dan'l Engineering  
12350 W. 175th St.  
Lakeville, MN 55044  
(612) 435-6000

## MISSISSIPPI

(See Alabama)

## MISSOURI

Dy-Tronix, Inc.  
11190 Natural Bridge  
Bridgeton, MO 63044  
(314) 731-5799  
TWX 910-762-0651

Dy-Tronix, Inc.  
13700 E. 42nd Terrace  
Suite 202  
Independence, MO  
64055  
(816) 373-6600

## MONTANA

(See Colorado)

## NEBRASKA

(See Missouri)

## NEVADA

(See California No.)

## NEW HAMPSHIRE

(See Massachusetts)

## NEW MEXICO

Syntech  
302C San Pablo S.E.  
Albuquerque, NM  
87108  
(505) 266-7951

## NEW JERSEY (NO.)

(See New York City)

## NEW JERSEY (SO.)

(See Pennsylvania)

## NEW YORK (UPSTATE)

Quality Components  
3343 Harlem Road  
Buffalo, NY 14225  
(716) 837-5430

Quality Components  
116 E. Fayette St.  
Manlius, NY 13104  
(315) 682-8885  
TWX 710-545-0663

## NEW YORK (CITY)

ERA, Incorporated  
354 Veterans  
Memorial Hwy.  
Commack, NY 11725  
(516) 543-0510  
In NJ: 800-645-5500/1  
TWX 510-226-1485

## NORTH CAROLINA

Component Sales, Inc.  
P.O. Box 18821  
Raleigh, NC 27619  
(919) 782-8433  
TWX 510-928-0513

## NORTH DAKOTA

(See Minnesota)

## OHIO

McFadden Sales  
4645 Executive Drive  
Columbus, OH 43220  
(614) 459-1280  
TWX 810-482-1623

## OKLAHOMA

(See Texas)

## OREGON

SD-R<sup>2</sup> Products & Sales  
1526 S.E. Claybourne  
Portland, OR 97202  
(503) 231-7638

## PENNSYLVANIA (WEST)

(See Ohio)

## PENNSYLVANIA (EAST)

Vantage Sales Company  
21 Bala Avenue  
Bala Cynwyd, PA 19004  
(215) 667-0990  
TWX 510-662-5846

## RHODE ISLAND

(See Massachusetts)

## SOUTH CAROLINA

(See North Carolina)

## SOUTH DAKOTA

(See Minnesota)

## TENNESSEE

Rep, Incorporated  
113 S. Branner Ave.  
Jefferson City, TN  
37760  
(615) 475-4105  
TWX 810-570-4203

## TEXAS

Technical Marketing  
9027 Northgate Blvd.  
Suite 140  
Austin, TX 78758  
(512) 835-0064

Technical Marketing  
3320 Wiley Post Road  
Carrollton, TX 75006  
(214) 387-3601  
TWX 910-860-5158

Technical Marketing  
6430 Hillcroft  
Suite 104  
Houston, TX 77081  
(713) 777-9228

## UTAH

Waugeman Assoc., Inc.  
2520 S. State, Ste. 159  
Salt Lake City, UT  
84118  
(801) 467-4263  
TWX 910-925-4026

## VERMONT

(See Massachusetts)

## VIRGINIA

(See Maryland)

## WASHINGTON

SD-R<sup>2</sup> Products & Sales  
14230 NE 8th Street  
Bellevue, WA 98007  
(206) 747-9424  
TWX 910-443-2483

## WASHINGTON, D.C.

(See Maryland)

## WEST VIRGINIA

(See Ohio)

## WISCONSIN (S. EAST)

Janus, Incorporated  
11430 Bluemound Rd.  
Milwaukee, WI 53026  
(414) 476-9104

## WISCONSIN (WEST)

(See Minnesota)

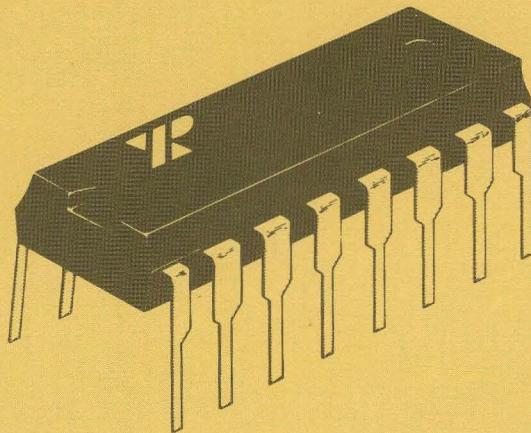
## WYOMING

(See Colorado)

## CANADA (EAST)

R.F.O. Limited  
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Suite 251  
Etobicoke, Ontario  
M9C 1E7  
(416) 626-1445  
TWX 610-492-2540

R.F.O. Limited  
2249 Carling Avenue  
Suite 204  
Ottawa, Ontario  
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