

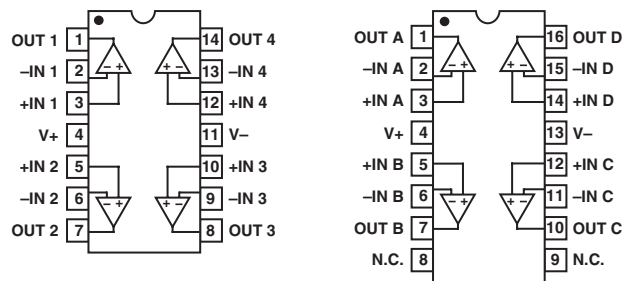
### FEATURES

**Low Supply Current:** 200  $\mu\text{A}$  Max @  $V_S = 5\text{ V}$   
**Single-Supply Operation:** 5 V to 30 V  
**Dual-Supply Operation:** 2.5 V to 15 V  
**Low Input Offset Voltage:** 500  $\mu\text{V}$  Typ  
**Low Input Offset Voltage Drift:** 5  $\mu\text{V}/^\circ\text{C}$  Typ  
**High Common-Mode Input Range:**  $V_-$  to  $(V_+ - 1.5\text{ V})$   
**High CMRR:** 100 dB Typ  
**High Open-Loop Gain:** 1100 V/mV Typ  
**LM 148 Pinout**

### GENERAL DESCRIPTION

The OP420 quad micropower operational amplifier is a single-chip quad patterned after the OP20 precision micropower single operational amplifier. A Darlington PNP input stage allows the input common-mode voltage to include  $V_-$ . The wide input range combined with low power supply drain ( $\sim 40\text{ }\mu\text{A}/\text{section}$  at 5 V) provides a unique solution for designs requiring high functional density and portable operation. Applications include 2-wire transmitters for process control loops, battery-operated remote-line filters, signal preconditioning amplifiers, and a variety of multiple-gain block arrays.

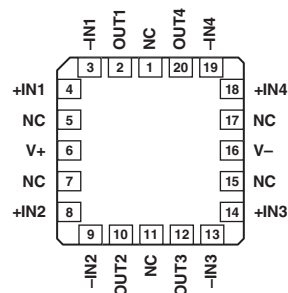
### PIN CONNECTIONS



**14-Pin Hermetic DIP  
(Y-Suffix)**

**14-Pin Epoxy DIP  
(P-Suffix)**

**16-Pin SOL  
(S-Suffix)**



**OP420CRC/883  
20-Lead LCC  
(RC-Suffix)**

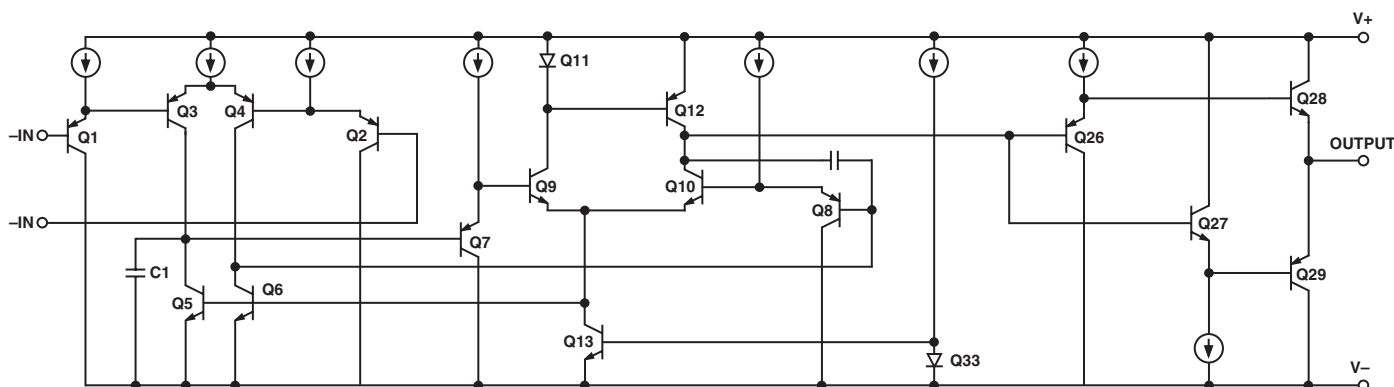


Figure 1. Simplified Schematic (1/4 Shown)

REV. A

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.  
 Tel: 781/329-4700  
 Fax: 781/326-8703  
[www.analog.com](http://www.analog.com)  
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# OP420—SPECIFICATIONS

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

| Parameter                           | Symbol   | Conditions                                                                                                                                                        | Min                       | OP420C<br>OP420G<br>Typ | Max        | Unit                                                         |
|-------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------|------------|--------------------------------------------------------------|
| INPUT OFFSET VOLTAGE                | $V_{OS}$ | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                                                     |                           | 1                       | 4          | mV                                                           |
| INPUT OFFSET CURRENT*               | $I_{OS}$ | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                                                     |                           | 0.8                     | 2.5        | nA                                                           |
| INPUT BIAS CURRENT*                 | $I_B$    | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                                                     |                           | 12                      | 30         | nA                                                           |
| INPUT NOISE VOLTAGE DENSITY         | $e_n$    | $f_O = 10\text{ Hz}$<br>$f_O = 100\text{ Hz}$                                                                                                                     |                           | 50<br>50                |            | $\text{nV}/\sqrt{\text{Hz}}$<br>$\text{nV}/\sqrt{\text{Hz}}$ |
| INPUT NOISE CURRENT DENSITY         | $i_n$    | $f_O = 10\text{ Hz}$<br>$f_O = 100\text{ Hz}$                                                                                                                     |                           | 0.12<br>0.12            |            | $\text{pA}/\sqrt{\text{Hz}}$<br>$\text{pA}/\sqrt{\text{Hz}}$ |
| INPUT VOLTAGE RANGE                 | IVR      | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$<br>$V_S = \pm 15\text{ V}$                                                                                                | 0/3.5<br>-15/13.5         |                         |            | V<br>V                                                       |
| COMMON-MODE REJECTION RATIO         | CMRR     | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$<br>$0\text{ V} \leq V_{CM} \leq 3.5\text{ V}$<br>$V_S = \pm 15\text{ V}$<br>$-15\text{ V} \leq V_{CM} \leq 13.5\text{ V}$ | 80<br>80                  | 96<br>96                |            | dB<br>dB                                                     |
| POWER SUPPLY REJECTION RATIO        | PSRR     | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$ ,<br>$V_- = 0\text{ V}$ , $V_+ = 5\text{ V}$ to $30\text{ V}$                                                       |                           | 20                      | 50         | $\mu\text{V}/\text{V}$                                       |
| LARGE SIGNAL VOLTAGE GAIN           | $A_{VO}$ | $R_L = 25\text{ k}\Omega$ ,<br>$V_O = \pm 10\text{ V}$                                                                                                            | 400                       | 900                     |            | V/mV                                                         |
| SLEW RATE                           | SR       |                                                                                                                                                                   |                           | 0.05                    |            | V/ $\mu\text{s}$                                             |
| CLOSED-LOOP BANDWIDTH               | BW       | $A_{VCL} = 1.0$<br>$R_L = 10\text{ k}\Omega$                                                                                                                      |                           | 150<br>150              |            | kHz<br>kHz                                                   |
| OUTPUT VOLTAGE SWING                | $V_O$    | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$ ,<br>$R_L = 10\text{ k}\Omega$<br>$V_S = \pm 15\text{ V}$<br>$R_L = 25\text{ k}\Omega$                                    | 0.8/4.0<br><br>$\pm 14.0$ |                         |            | V<br>V                                                       |
| SUPPLY CURRENT<br>(Four Amplifiers) | $I_{SY}$ | $V_S = \pm 2.5\text{ V}$ , No Load<br>$V_S = \pm 15\text{ V}$ , No Load                                                                                           | —                         | 170<br>360              | 300<br>460 | $\mu\text{A}$<br>$\mu\text{A}$                               |

NOTE

\* $I_{OS}$  and  $I_B$  are measured at  $V_{CM} = 0^\circ$ .

Specifications subject to change without notice.

# **ELECTRICAL CHARACTERISTICS** ( $V_S = \pm 15\text{ V}$ , $-55^\circ\text{C} \leq +125^\circ\text{C}$ for OP420C, $-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ for OP420G, unless otherwise noted.)

| Parameter                                       | Symbol                   | Conditions                                                                                                                       | OP420C/OP420G     |     |     | Unit                        |
|-------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------|-------------------|-----|-----|-----------------------------|
|                                                 |                          |                                                                                                                                  | Min               | Typ | Max |                             |
| AVERAGE INPUT OFFSET Voltage Drift <sup>1</sup> | $\text{TCV}_{\text{OS}}$ | Unnullled                                                                                                                        |                   | 8   | 15  | $\mu\text{V}^\circ\text{C}$ |
| INPUT OFFSET VOLTAGE                            | $V_{\text{OS}}$          | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                    |                   |     | 5.5 | mV                          |
| INPUT OFFSET CURRENT <sup>2</sup>               | $I_{\text{OS}}$          | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                    |                   |     | 4   | nA                          |
| INPUT BIAS CURRENT <sup>2</sup>                 | $I_{\text{B}}$           | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$                                                                                    |                   |     | 40  | nA                          |
| INPUT VOLTAGE RANGE                             | IVR                      | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$<br>$V_S = \pm 15\text{ V}$                                                               | 0/3.2<br>-15/13.2 |     |     | V<br>V                      |
| COMMON-MODE Rejection Ratio                     | CMRR                     | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$ ,<br>$0\text{ V} \leq V_{\text{CM}} \leq 3.2\text{ V}$<br>$V_S = \pm 15\text{ V}$        | 73                | 92  |     | dB                          |
|                                                 |                          | $-15\text{ V} \leq V_{\text{CM}} \leq 13.2\text{ V}$                                                                             | 73                | 92  |     | dB                          |
| POWER SUPPLY Rejection Ratio                    | PSRR                     | $V_S = \pm 2.5\text{ V}$ to $\pm 15\text{ V}$ ,<br>$V_- = 0\text{ V}$ , $V_+ = 5\text{ V}$ to $30\text{ V}$                      |                   | 25  | 80  | $\mu\text{V/V}$             |
| LARGE-SIGNAL VOLTAGE GAIN                       | $A_{\text{VO}}$          | $V_S = \pm 15\text{ V}$ , $R_L = 50\text{ k}\Omega$ ,<br>$V_O = 10\text{ V}$                                                     | 200               | 650 |     | V/mV                        |
| OUTPUT VOLTAGE SWING                            | $V_O$                    | $V_+ = 5\text{ V}$ , $V_- = 0\text{ V}$ ,<br>$R_L = 20\text{ k}\Omega$<br>$V_S = \pm 15\text{ V}$ ,<br>$R_L = 50\text{ k}\Omega$ | 1.0/3.8           |     |     | V                           |
|                                                 |                          |                                                                                                                                  | $\pm 13.8$        |     |     | V                           |
| SUPPLY CURRENT (Four Amplifiers)                | $I_{\text{SY}}$          | $V_S = \pm 2.5\text{ V}$ , No Load                                                                                               |                   | 210 | 400 | $\mu\text{A}$               |
|                                                 |                          | $V_S = \pm 15\text{ V}$ , No Load                                                                                                |                   | 420 | 640 | $\mu\text{A}$               |

## NOTES

<sup>1</sup>Sample tested.<sup>2</sup> $I_{\text{OS}}$  and  $I_{\text{B}}$  are measured at  $V_{\text{CM}} = 0^\circ$ .

# OP420

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

|                                            |                 |
|--------------------------------------------|-----------------|
| Supply Voltage                             | ±18 V           |
| Differential Input Voltage                 | ±30 V           |
| Input Voltage                              | Supply Voltage  |
| Output Short-Circuit Duration              | Continuous      |
| (One Amplifier Only)                       |                 |
| Storage Temperature Range                  | –65°C to +150°C |
| Lead Temperature Range (Soldering, 60 sec) | 300°C           |
| Operating Temperature Range                |                 |
| OP420CY, OP420CRC                          | –55°C to +125°C |
| OP420G                                     | –40°C to +85°C  |
| Junction Temperature (T <sub>J</sub> )     | –65°C to +150°C |

| Package Type            | $\theta_{JA}$ <sup>2</sup> | $\theta_{JC}$ | Unit |
|-------------------------|----------------------------|---------------|------|
| 14-Pin Hermetic DIP (Y) | 99                         | 12            | °C/W |
| 14-Pin Plastic DIP (P)  | 76                         | 33            | °C/W |
| 16-Pin SOL (S)          | 92                         | 27            | °C/W |

## NOTES

<sup>1</sup>Absolute Maximum Ratings apply to packaged parts, unless otherwise noted.

<sup>2</sup> $\theta_{JA}$  is specified for worst-case mounting conditions, i.e.,  $\theta_{JA}$  is specified for device in socket for CerDIP and P-DIP packages;  $\theta_{JA}$  is specified for device soldered to printed circuit board for SOL package.

## ORDERING GUIDE

| T <sub>A</sub> = 25°C V <sub>OS</sub> Max (mV) | Package Options |                |          | Operating Temperature Range |
|------------------------------------------------|-----------------|----------------|----------|-----------------------------|
|                                                | Cer DIP 14-Pin  | LCC 20-Contact | Plastic  |                             |
| 4.0                                            | OP420CY*        | OP420CRC/883   |          | MIL                         |
| 4.0                                            |                 |                | OP420GP* | XIND                        |
| 4.0                                            |                 |                | OP420GS* | XIND                        |

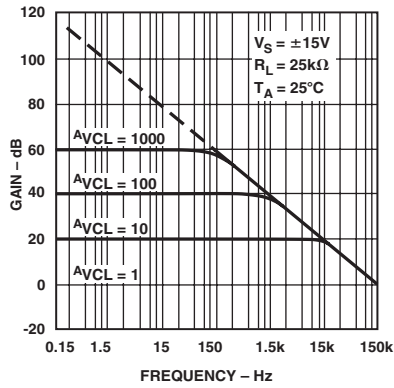
\*Not for new design; obsolete April 2002.

## CAUTION

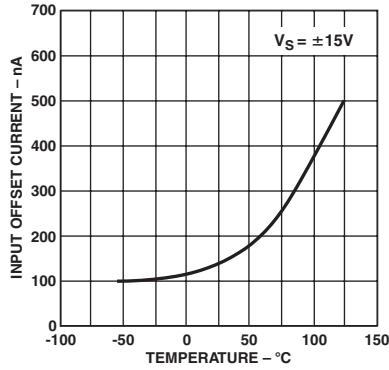
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the OP420 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high-energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



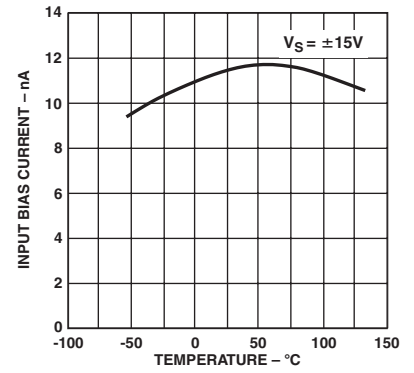
# Typical Performance Characteristics—OP420



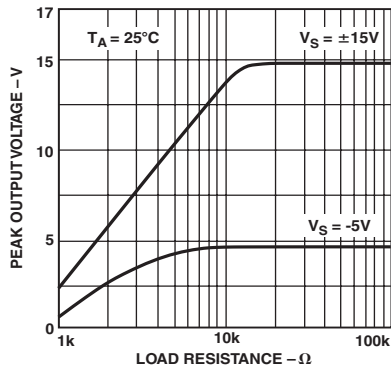
TPC 1. Closed-Loop Gain vs. Frequency



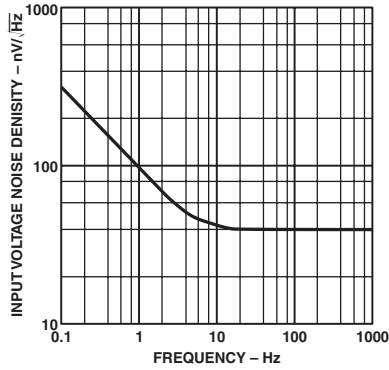
TPC 2. Input Offset Current vs. Temperature



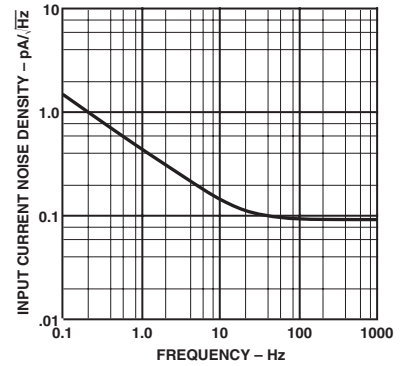
TPC 3. Input Bias Current vs. Temperature



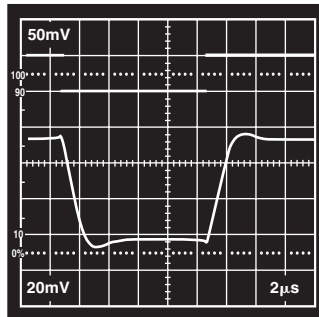
TPC 4. Maximum Output Voltage vs. Load Resistance



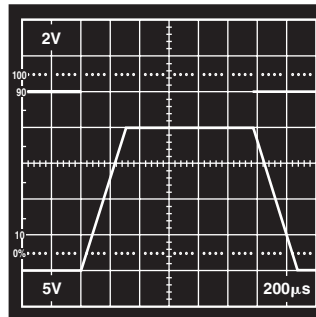
TPC 5. Input Voltage Noise Density ( $e_n$ ) vs. Frequency



TPC 6. Input Current Noise Density ( $i_n$ ) vs. Frequency



TPC 7. Small-Signal Transient Response



TPC 8. Large-Signal Transient Response

# OP420

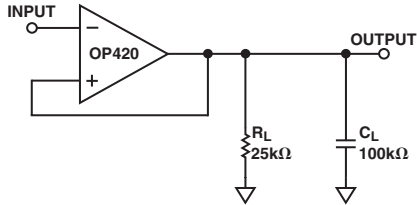


Figure 2. Small-Signal Transient Response

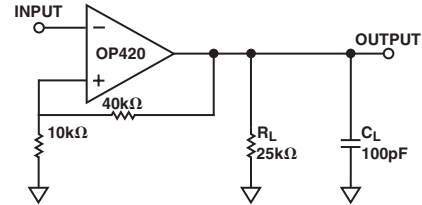


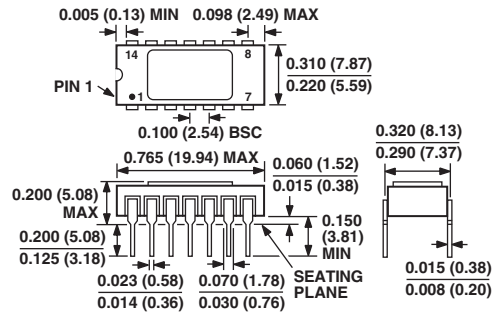
Figure 3. Large-Signal Transient Response

## OUTLINE DIMENSIONS

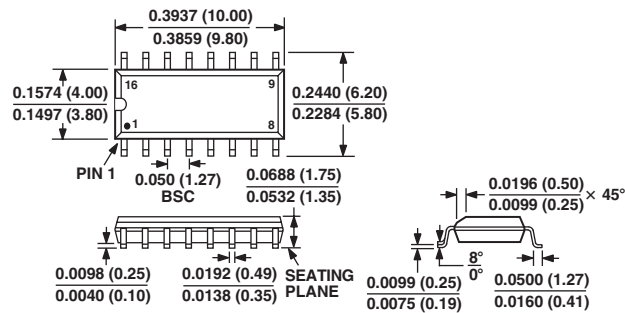
Dimensions shown in inches and (mm).

### 14-PIN HERMETIC DIP

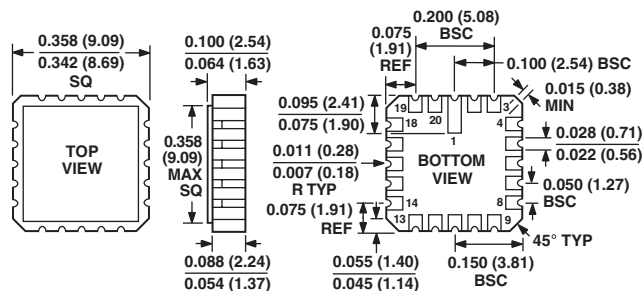
### 14-PIN EPOXY DIP



### 16-PIN SOL



### OP420CRC/883 20-LEAD LCC



Revision History

| Location                                        | Page |
|-------------------------------------------------|------|
| 11/01—Data Sheet changed from REV. 0 to REV. A. |      |
| Edits to GENERAL DESCRIPTION .....              | 1    |
| Edits to ELECTRICAL CHARACTERISTICS .....       | 2, 3 |
| Edits to ORDERING INFORMATION .....             | 4    |
| Edits to ABSOLUTE MAXIMUM RATINGS .....         | 4    |
| Deleted DICE CHARACTERISTICS .....              | 4    |
| Deleted WAFER TEST LIMITS .....                 | 4    |

