

Logic Diagram

### FEATURES:

- RAD-PAK® Technology
- - Total Dose Hardness > 100 Krads(Si)
- Package:
  - 8 Pin RAD-PAK® Flat Package
- Excellent  $TCV_{OS}$   
-21 $\mu$ V/C MAX
- Low Input Offset Voltage:  
-150mV Max
- Low Supply Current:  
-100 $\mu$ A
- Single Supply Operation:  
+5 to +30 Volts
- Low Input Offset Voltage Drift  
-0.75 $\mu$ V/C
- High Open Loop Gain:  
-2000V/mV
- Low Input Bias Current
- Wide Common Mode Voltage Range

**DESCRIPTION:** The OP220RP (RP for RAD-PAK®) monolithic dual operational amplifier microcircuit features a minimum 100 kilorad (Si) total dose tolerance. Using Maxwells radiation hardened RAD-PAK® packaging technology, the OP220RP can be used either in single or dual supply operation. The OP220RP is the first micropower precision dual operational amplifier capable of surviving space environments. The OP220RP is ideal for satellite, spacecraft, and space probe missions. The patented radiation hardened RAD-PAK® technology incorporates radiation shielding in the microcircuit package. It eliminates the need for box shielding while providing a lifetime in orbit. This product is available in Class E, I, B and S screening.

TABLE 1. OP220 PINOUT DESCRIPTION

| PIN | SYMBOL | DESCRIPTION                     |
|-----|--------|---------------------------------|
| 1   | Out A  | Output Amplifier A              |
| 2   | -IN A  | Inverting Input Amplifier A     |
| 3   | + IN A | Non-Inverting Input Amplifier A |
| 4   | -V     | Negative Supply Voltage         |
| 5   | + IN B | Non-Inverting Input Amplifier B |
| 6   | -IN B  | Inverting Input Amplifier B     |
| 7   | Out B  | Output Amplifier B              |
| 8   | +V     | Positive Supply Voltage         |

TABLE 2. OP220 ABSOLUTE MAXIMUM RATINGS

| PARAMETER                     | SYMBOL | MIN        | MAX            | UNIT |
|-------------------------------|--------|------------|----------------|------|
| Supply Voltage                |        | --         | ±18            | V    |
| Differential Input Voltage    |        | --         | 30             | V    |
| Input Voltage                 | $V_I$  | --         | Supply Voltage | V    |
| Output Short-Circuit Duration |        | Indefinite |                |      |
| Power Dissipation             | $P_D$  |            | 500            | mW   |
| Storage Temperature Range     | $T_S$  | -65        | 150            | °C   |
| Operating Temperature Range   | $T_A$  | -55        | 125            | °C   |

TABLE 3. DELTA LIMITS

| PARAMETER | VARIATION                          |
|-----------|------------------------------------|
| $I_{SY}$  | ±10% of specified value in Table 4 |

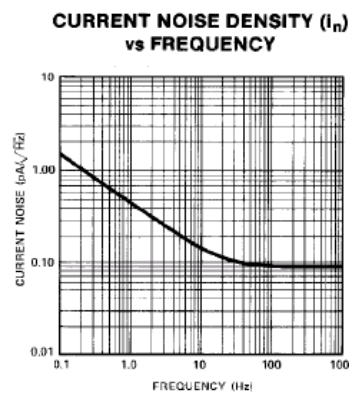
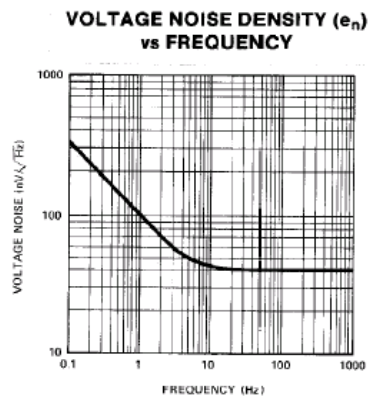
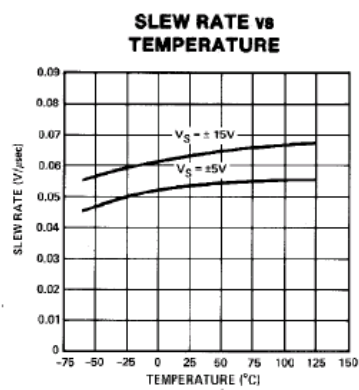
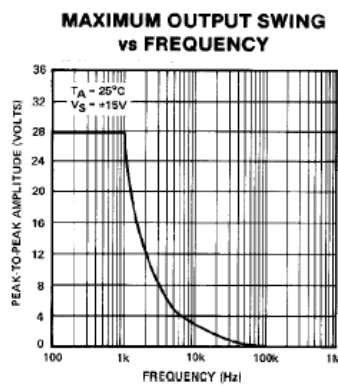
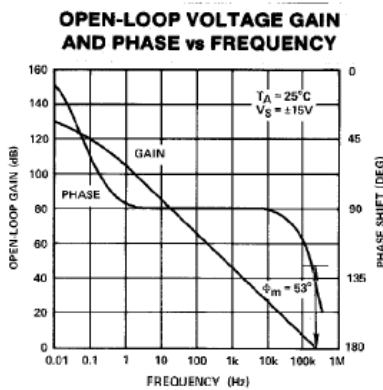
TABLE 4. OP220 ELECTRICAL CHARACTERISTICS  
( $V_S = \pm 2.5V$  TO  $\pm 15V$ ,  $T_A = -55$  TO  $+125^\circ C$ , UNLESS OTHERWISE SPECIFIED)

| PARAMETER                         | SYMBOL   | TEST CONDITIONS   | SUBGROUPS | MIN      | TYP        | MAX        | UNITS |
|-----------------------------------|----------|---|-----------|----------|------------|------------|-------|
| Supply Current<br>Both Amplifiers | $I_{SY}$ | $V_S = \pm 2.5V$ , No Load<br>$V_S = \pm 15V$ , No Load   | 1, 2, 3   | --<br>-- | 135<br>190 | 170<br>250 | uA    |
| Common-Mode Rejection Ratio       | CMRR     | $V_S = \pm 15V$<br>$T_A = 25^\circ C$                     | 4         | 90       | 100        |            | dB    |
| Power Supply Rejection Ratio      | PSRR     | $V_S = \pm 2.5V$ TO $V_S = \pm 15V$<br>$T_A = 25^\circ C$ | 1, 2, 3   | --       | 6          | 18         | uV/V  |

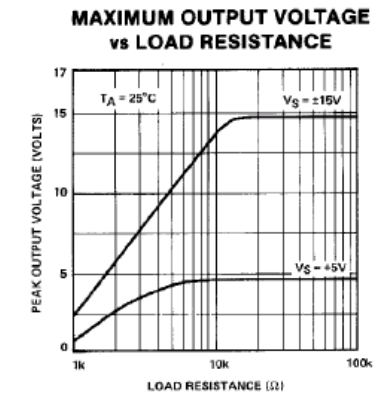
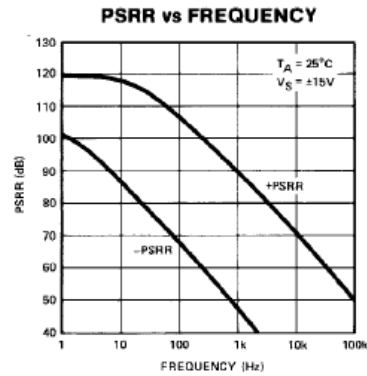
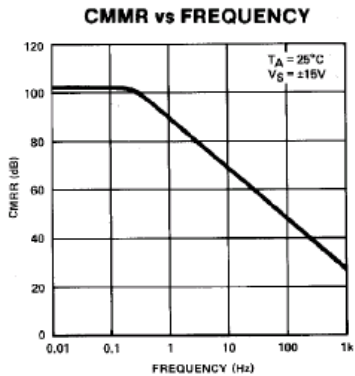
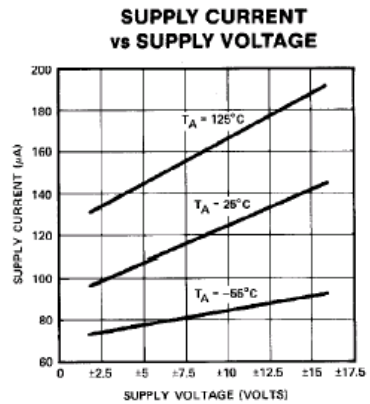
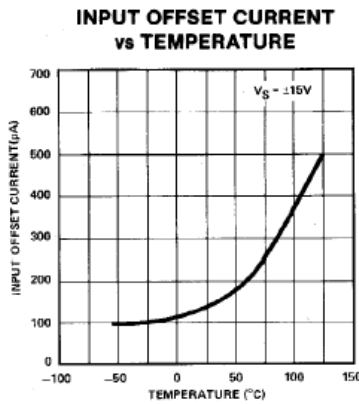
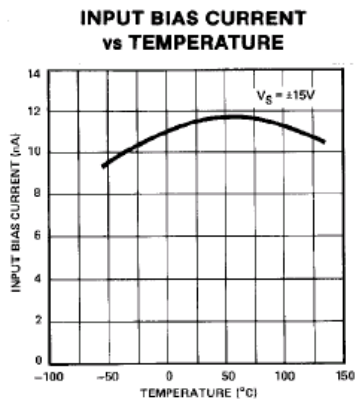
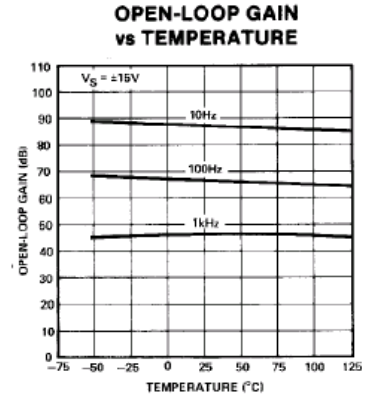
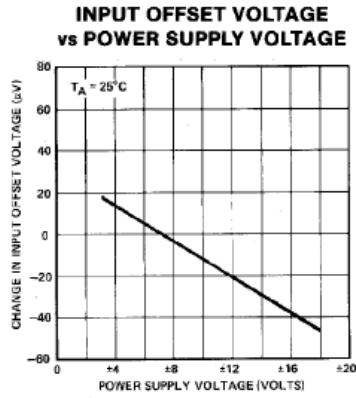
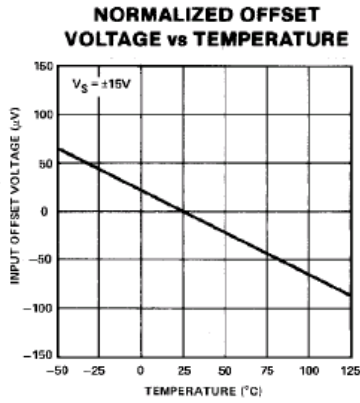
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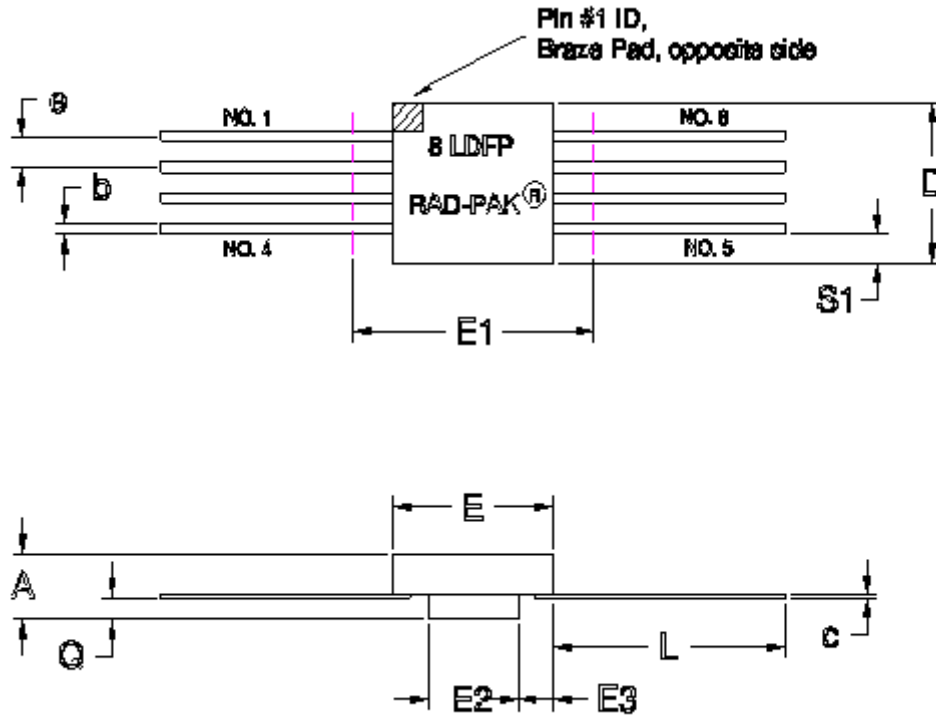
| PARAMETER                       | SYMBOL     | TEST CONDITIONS   | SUBGROUPS | MIN   | TYP  | MAX  | UNITS            |
|---------------------------------|------------|---|-----------|-------|------|------|------------------|
| Input Offset Voltage            | $V_{OS}$   | $V_S = \pm 15V$   | 1, 2, 3   |       | 120  | 300  | $\mu V$          |
| Input Offset Voltage Drift      | $TCV_{OS}$ | $V_S = \pm 15V$   | 1, 2, 3   |       | 0.75 | --   | $\mu V/^\circ C$ |
| Input Offset Current            | $I_{OS}$   | $V_{CM} = 0$  | 1, 2, 3   | --    | 0.5  | 2    | nA               |
| Input Offset Current Drift      |            | $R_S = 0\Omega$   | 1, 2, 3   | --    | 10   | --   | $\mu A/^\circ C$ |
| Input Bias Current              | $I_B$      | $V_{CM} = 0$  | 1, 2, 3   | --    | 12   | 20   | nA               |
| Input Common-Mode Voltage Range | $I_{VR}$   | $V_S = \pm 15V$   | 1, 2, 3   | -15   |      | 13.2 | V                |
| Large Signal Voltage Gain       | $A_{VO}$   | $V_S = \pm 15V$<br>$V_O = \pm 10V$<br>$R_L = 50K\Omega$ | 1, 2, 3   | 500   | 1000 |      | V/mV             |
| Output Voltage Swing            | $V_O$      | $V_S = \pm 15V, R_L = 50K\Omega$                        | 1, 2, 3   | -13.8 | --   | 13.8 | V                |

## Typical Performance Characteristics



## Typical Performance Characteristics





8-PIN RAK-PAK® FLAT PACKAGE

| SYMBOL | DIMENSION |       |       |
|--------|-----------|-------|-------|
|        | MIN       | NOM   | MAX   |
| A      | 0.119     | 0.132 | 0.149 |
| b      | 0.010     | 0.017 | 0.022 |
| c      | 0.004     | 0.005 | 0.009 |
| D      | 0.250     | 0.255 | 0.260 |
| E      | 0.250     | 0.255 | 0.260 |
| E1     | --        | --    | 0.290 |
| E2     | 0.125     | 0.145 | 0.150 |
| E3     | 0.045     | 0.055 | --    |
| e      | 0.050 BSC |       |       |
| L      | 0.338     | 0.348 | 0.358 |
| Q      | 0.021     | 0.025 | 0.045 |
| S1     | 0.005     | 0.019 | --    |
| N      | 8         |       |       |

F8-01

Note: All dimensions in inches.

## Important Notice:

These data sheets are created using the chip manufacturer's published specifications. Maxwell Technologies verifies functionality by testing key parameters either by 100% testing, sample testing or characterization.

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## Product Ordering Options

