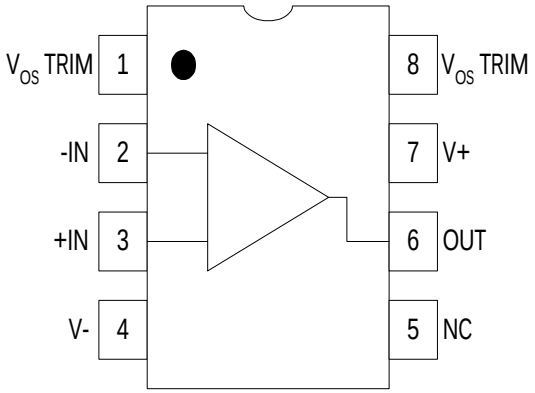
PRELIMINARY

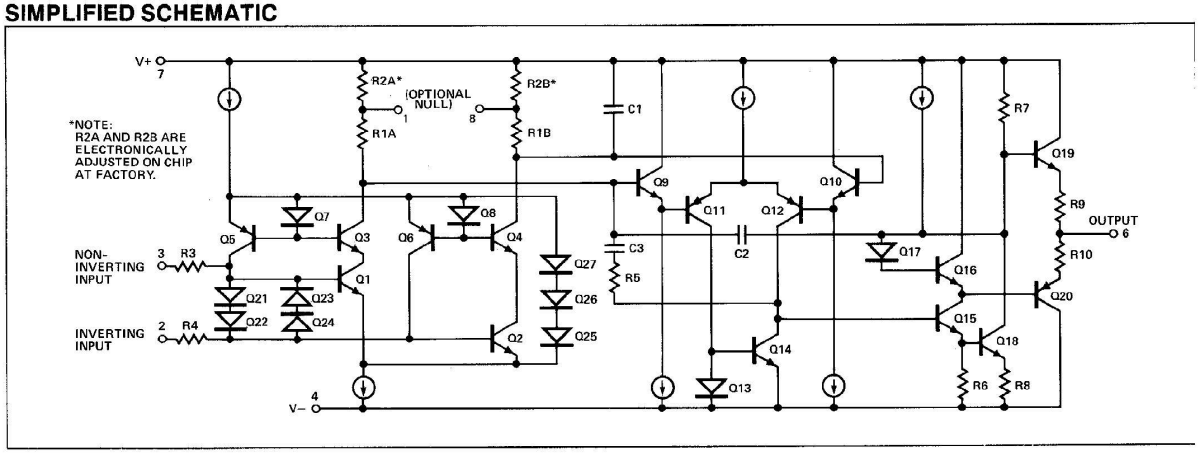
SPACE ELECTRONICS INC.
SPACE PRODUCTS

ULTRALOW OFFSET VOLTAGE OPERATIONAL AMPLIFIER

OP77RP



SIMPLIFIED SCHEMATIC



FEATURES:

- Total dose hardness: typical 100 krad (Si), dependent upon orbit
- Outstanding gain linearity
- Ultra high gain:
  - 5000V/mV min.
- Low VOS over temperature range:
  - 120µV max
- Excellent TCVOS:
  - 0.3µV/°C max
- High PSRR:
  - 3µV/V max
- Low power consumption:
  - 60mW max

DESCRIPTION:

Space Electronics' OP77RP (RP for RAD-PAK®) pushes forward the state-of-the-art in precision op amps. The OP77RP has a maintained gain of 10,000,000 or more over the full ±10V output range. This exceptional gain-linearity eliminates uncorrectable system non-linearities common in previous monolithic op amps, and provides superior performance in high closed-loop-gain applications. Low initial V_{OS} drift and rapid stabilization time, combined with only 60mW power consumption, are significant improvements over previous designs. These characteristics, plus the exceptional TCV_{OS} of 0.3µV/°C maximum and the low V_{OS} of 45µV maximum, eliminates the need for V_{OS} adjustment and increases system accuracy over temperature. Capable of surviving in space environments, the OP77RP is designed for high reliability in the most demanding space applications. The patented radiation-hardened RAD-PAK® technology incorporates radiation shielding in the microcircuit package. It provides a 100 krad (Si) total dose survivability.

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TABLE 1. OP77RP ABSOLUTE MAXIMUM RATINGS

PARAMETER	MIN	MAX	UNITS
Supply Voltage	-22	+22	V
Differential Input Voltage	-30	+30	V
Input Voltage	-22	+22	V
Output Short-circuit Duration	Indefinite		
Storage Temperature Range	-65	+150	°C
Operating Temperature Range	-55	+125	°C
Junction Temperature (Tj)	-65	+150	°C
Lead Temperature (Soldering, 60 sec.)	-	+300	°C

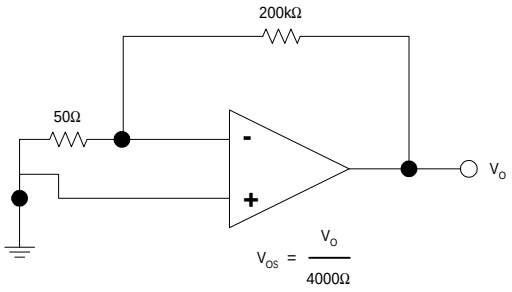
TABLE 2. OP77RP ELECTRICAL CHARACTERISTICS

($V_S = \pm 15V$, $-55°C \leq +125°C$, UNLESS OTHERWISE SPECIFIED)

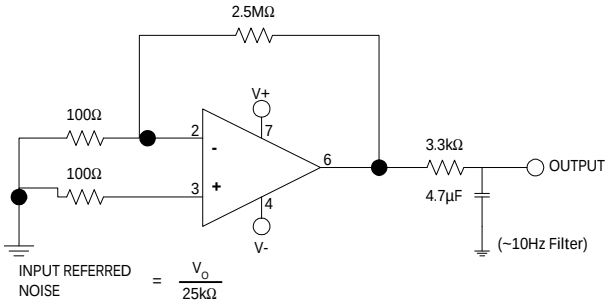
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	V_{OS}		---	45	120	µV
Average Input Offset Voltage Drift	TCV_{OS}		---	0.2	0.6	µV/°C
Input Offset Current	I_{OS}		---	0.5	4.5	nA
Average Input Offset Current Drift[1]	TCI_{OS}		---	1.5	50	rA/°C
Input Bias Current	I_B		-0.2	2.4	6	nA
Average Input Bias Current Drift[1]	T_{CIB}		---	15	35	ρA/°C
Input Voltage Range	I_{VR}		±13	±13.5	---	V
Common-mode Rejection Ratio	CMRR	$V_{CM} = \pm 13V$	---	0.1	3	µV/V
Power-supply Rejection Ratio	PSRR	$V_S = \pm 3V$ to $\pm 18V$	---	1	5	µV/V
Large-signal Voltage Gain	AV_O	$R_L \geq 2k\Omega$, $V_O = \pm 10V$	1000	4000	---	V
Output Voltage Swing	V_O	$RL \geq 2k\Omega$	±12	±13.0	---	V
Power Consumption	Pd	$V_S = \pm 15V$, No Load	---	60	75	mW

1. Guaranteed by end-point limits.

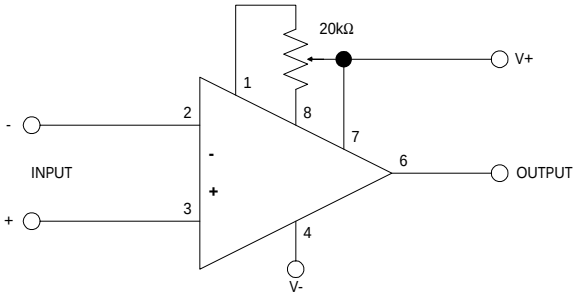
TYPICAL OFFSET VOLTAGE TEST CIRCUIT



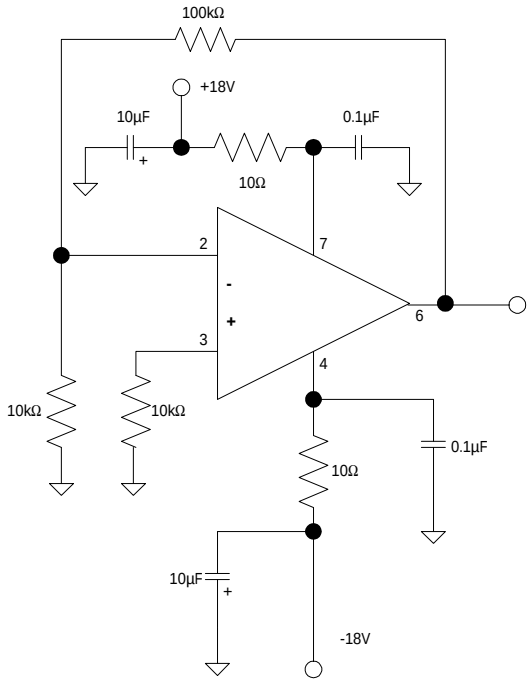
TYPICAL LOW-FREQUENCY NOISE TEST CIRCUIT



OPTIONAL OFFSET NULLING CIRCUIT

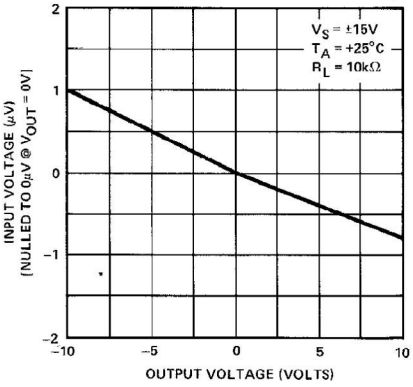


BURN-IN CIRCUIT

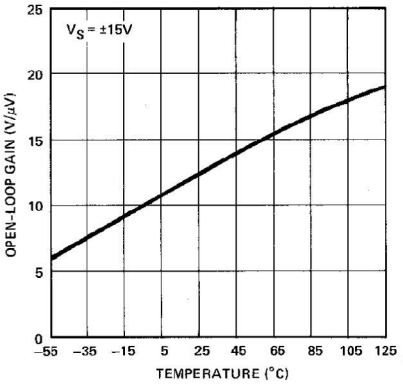


TYPICAL PERFORMANCE CHARACTERISTICS

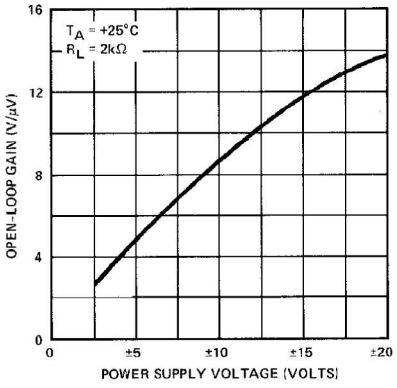
GAIN LINEARITY (INPUT VOLTAGE vs OUTPUT VOLTAGE)



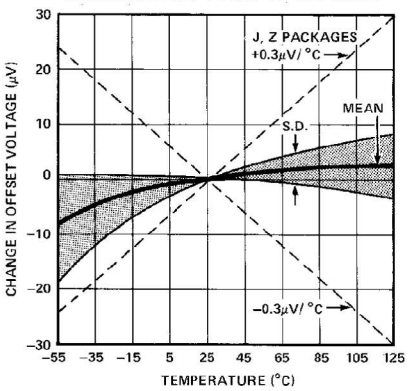
OPEN-LOOP GAIN vs TEMPERATURE



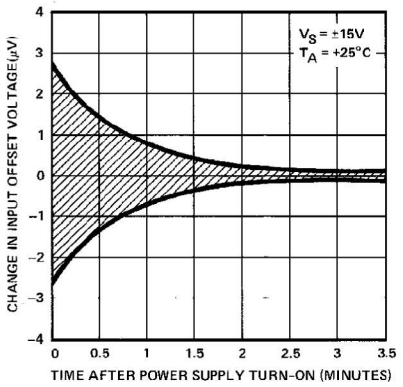
OPEN-LOOP GAIN vs POWER SUPPLY VOLTAGE



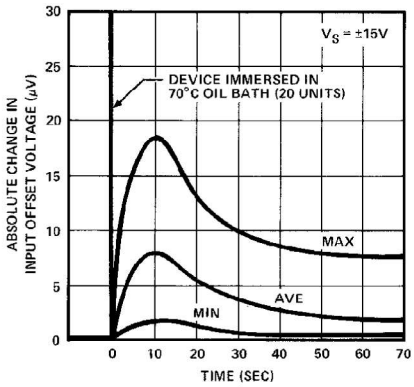
UNTRIMMED OFFSET VOLTAGE vs TEMPERATURE



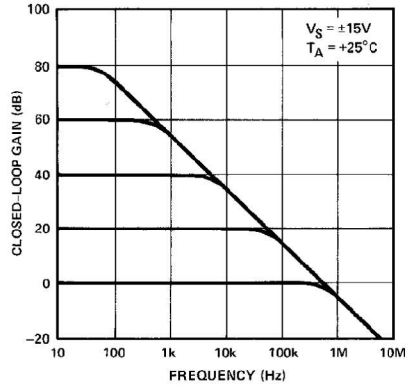
WARM-UP DRIFT



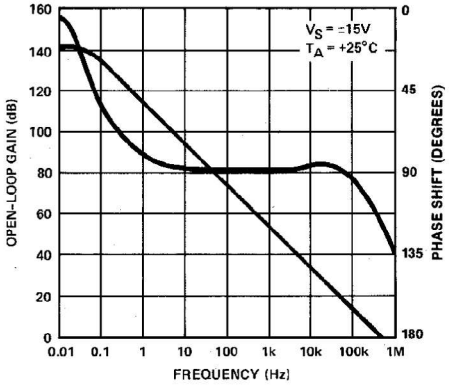
OFFSET VOLTAGE CHANGE DUE TO THERMAL SHOCK



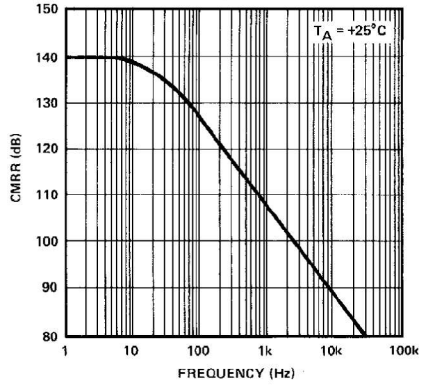
CLOSED-LOOP RESPONSE FOR VARIOUS GAIN CONFIGURATIONS



OPEN-LOOP GAIN/PHASE RESPONSE

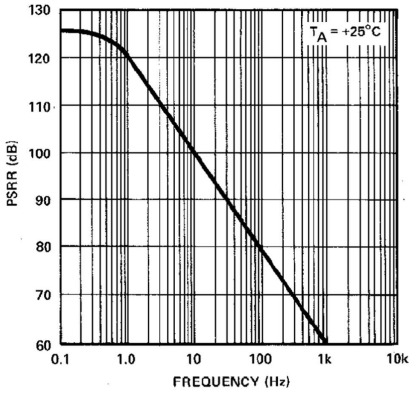


CMRR vs FREQUENCY

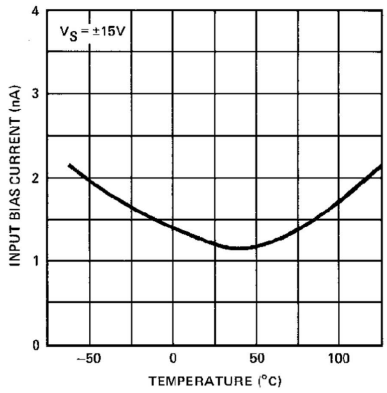


TYPICAL PERFORMANCE CHARACTERISTICS

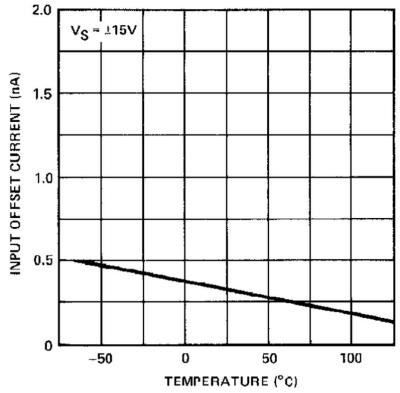
PSRR vs FREQUENCY



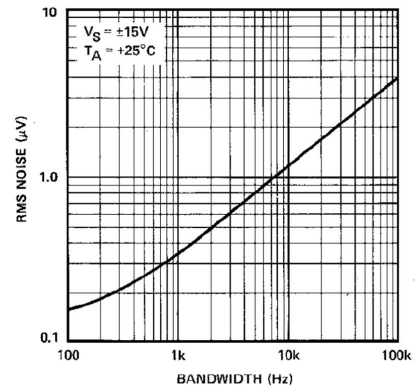
INPUT BIAS CURRENT vs TEMPERATURE



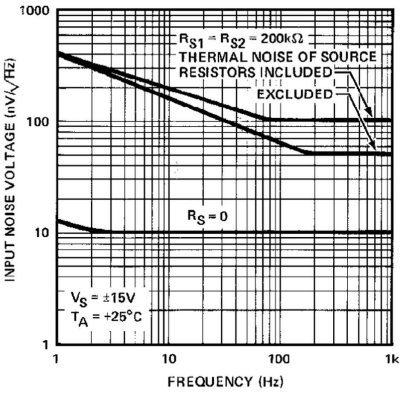
INPUT OFFSET CURRENT vs TEMPERATURE



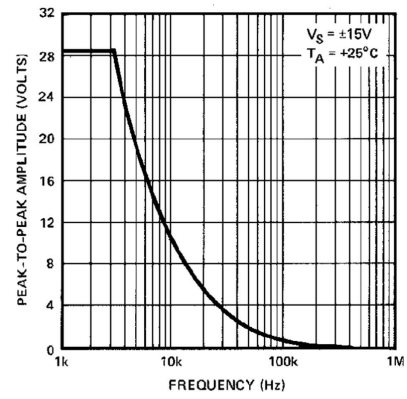
INPUT WIDEBAND NOISE vs BANDWIDTH (0.1Hz TO FREQUENCY INDICATED)



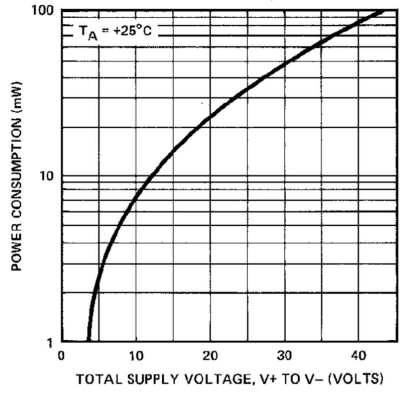
TOTAL INPUT NOISE VOLTAGE vs FREQUENCY



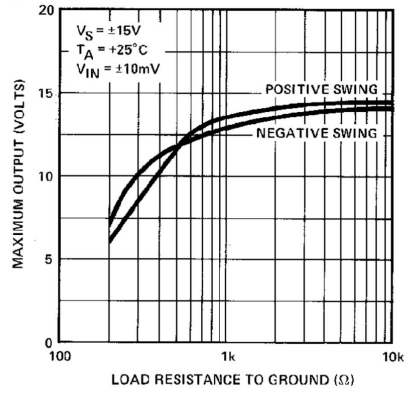
MAXIMUM OUTPUT SWING vs FREQUENCY



POWER CONSUMPTION vs POWER SUPPLY



MAXIMUM OUTPUT VOLTAGE vs LOAD RESISTANCE



OUTPUT SHORT-CIRCUIT CURRENT vs TIME