

FEATURES:

- RAD-PAK® technology-hardened against natural space radiation
- Package:
 - 16 pin Rad-Pak® flat package
- Low input offset voltage: 5 μV max
- Low offset voltage drift
 - 5 $\mu\text{V}/^\circ\text{C}$ max (over -55 to +125 $^\circ\text{C}$)
- Low supply current (per amplifier) 20 μA max
- High open-loop gain 700 V/me min.
- Outstanding PSRR: 5.6 $\mu\text{V}/\text{V}$ min.

DESCRIPTION:

Maxwell Technologies' OP490 micropower quad operational amplifier microcircuit features Maxwell's radiation-hardened RAD-PAK® packaging technology, the OP490 has an extremely low input offset voltage no less than 0.5 mV with a drift of under 5 $\mu\text{V}/^\circ\text{C}$, guaranteed over the full military temperature range. The OP490 features low power consumption, drawing less than 20 μA per amplifier.

Maxwell Technologies' patented RAD-PAK packaging technology incorporates radiation shielding in the microcircuit package. It eliminates the need for box shielding while providing the required radiation shielding for a lifetime in orbit or space mission. This product is available with screening up to Class S.

TABLE 1. PINOUT DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1, 7, 10, 16	OUT A - D	Output Signal
2, 6, 11, 15	-IN A - D	Negative Input Signal
3, 5, 12, 14	+IN A - D	Positive Input Signal
8, 9	NC	Not Connected
4	V+	Positive Voltage
13	V-	Negative Voltage

TABLE 2. OP490 ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	V_{CC}		± 18	V
Differential Input Voltage		(V-) - 20	(V+) + 20	V
Common-Mode Input Voltage		(V-) - 20	(V+) + 20	V
Output Short-Circuit Duration		Continuous		
Thermal Impedance	Θ_{JC}	--	3.35	$^{\circ}\text{C}/\text{W}$
Storage Temperature Range	T_S	-65	+150	$^{\circ}\text{C}$
Operating Temperature Range	T_A	-55	+125	$^{\circ}\text{C}$

TABLE 3. DELTA LIMITS

PARAMETER	VARIATION
I_{CC}	$\pm 10\%$ of specified value in Table 4.

TABLE 4. OP490 DC ELECTRICAL CHARACTERISTICS

($V_S = \pm 15\text{V}$, $T_A = -55$ TO 125°C , UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS	
Input Offset Voltage	V_{OS}		+25 $^{\circ}\text{C}$	--	0.2	0.5	mV
			-55 to 125 $^{\circ}\text{C}$	--	0.4	1.0	
Input Offset Current	I_{OS}	$V_{CM} = 0\text{V}$	+25 $^{\circ}\text{C}$	--	0.4	3	nA
			-55 to 125 $^{\circ}\text{C}$	--	1.5	5	
Input Bias Current	I_B	$V_{CM} = 0\text{V}$	+25 $^{\circ}\text{C}$	--	4.2	15	nA
			-55 to 125 $^{\circ}\text{C}$		4.4	20	

TABLE 4. OP490 DC ELECTRICAL CHARACTERISTICS

(VS = ±15V, TA = -55 to 125°C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS		
Large Signal Voltage Gain	A _{VO}	V _S = ±15V, V _O = ±10V				V/mV		
		R _L = 100 kΩ	+25°C	700	1200		--	
			-55 to 125°C	225	400		--	
		R _L = 10 kΩ	+25°C	350	600		--	
			-55 to 125°C	125	240		--	
		R _L = 2 kΩ	+25°C	125	250		--	
			-55 to 125°C	50	110		--	
		V ₊ = 5V, V ₋ = 0V, 1V < V _O < 4V						
		R _L = 100 kΩ	+25°C	--	400		--	
			-55 to 125°C	--	200		--	
R _L = 10 kΩ	+25°C	--	180	--				
	-55 to 125°C	--	110	--				
Input Voltage Range ¹	IVR	V ₊ = 5V, V ₋ = 0V V _S = ±15V	0/4 -15/13.5	-- --	-- --	V		
Output Voltage Swing	V _O	R _L = 10 kΩ	+25°C	±13.5	±14.2	--		
			-55 to 125°C	±13	±14	--		
		R _L = 2 kΩ	+25°C	±10.5	±11.5	--		
			-55 to 125°C	±10	±11	--		
	V _{OH}	V ₊ = 12V, V ₋ = 0V R _L = 2 kΩ	+25°C	--	4.2	--		
			-55 to 125°C	--	4.1	--		
V _{OL}	V ₊ = 5V, V ₋ = 0V R _L = 10 kΩ	--	100	--	μV			
Common Mode Rejection	CMR	V ₊ = 5V, V ₋ = 0V, 0V < V _{CM} < 4	+25°C	--	110	---		
			-55 to 125°C	--	108	--		
		V ₊ = 5V, V ₋ = 0V, 0V < V _{CM} < 3.5	+25°C	100	130	--		
			-55 to 125°C	95	115	--		
Power Supply Rejection Ratio	PSRR		+25°C	---	1.0	5.6		
			-55 to 125°C	--	3.2	10		
Slew Rate	SR	V _S = ±15V	+25°C	--	12	---		
Supply Current (All Amplifiers)	I _{SY}	V _S = ±1.5V, No Load	+25°C	--	40	60		
			-55 to 125°C	--	70	100		
		V _S = ±15V, No Load	+25°C	--	60	80		
			-55 to 125°C	--	90	120		
Capacitive Load Stability		AV = +1	+25°C	---	650	---		

TABLE 4. OP490 DC ELECTRICAL CHARACTERISTICS

($V_S = \pm 15V$, $T_A = -55$ TO $125^\circ C$, UNLESS OTHERWISE SPECIFIED)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Channel Separation	CS	$V_O = 20V_{p-p}$, $f_O = 10$ Hz, $V_S = \pm 15V^2$	+25°C	120	150	---	dB

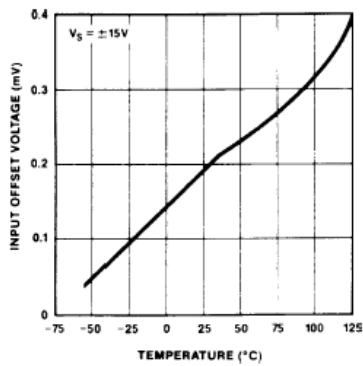
1. Guaranteed by CMR test.
2. Guaranteed but not 100% tested.

TABLE 5. OP490 AC ELECTRICAL CHARACTERISTICS

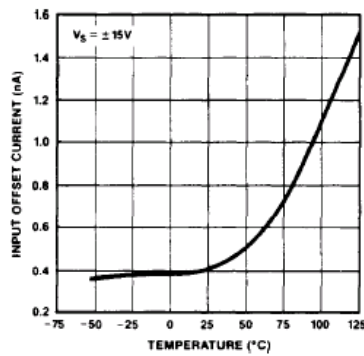
($V_S = \pm 15V$, $T_A = -55$ TO $125^\circ C$ UNLESS OTHERWISE SPECIFIED.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Input Noise Voltage	$e_{n,p-p}$	$f_O = 0.1$ Hz to 10 Hz	+25°C	---	3	---	μV_{p-p}
Input Resistance Differential Mode	R_{IN}	$V_S = \pm 15V$	+25°C	---	30	---	$M\Omega$
Input Resistance Common Mode	R_{INCM}	$V_S = \pm 15V$	+25°C	---	20	---	$G\Omega$
Gain Bandwidth Product	GBWP	$A_V = +1$	+25°C	---	500	---	kHz

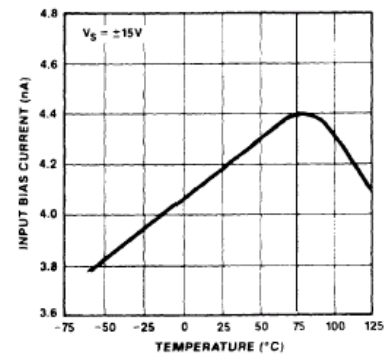
OP490RP TYPICAL OPERATING CHARACTERISTICS



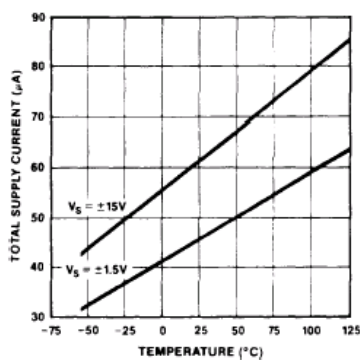
Input Offset Voltage vs. Temperature



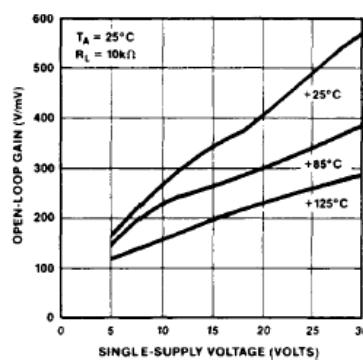
Input Offset Current vs. Temperature



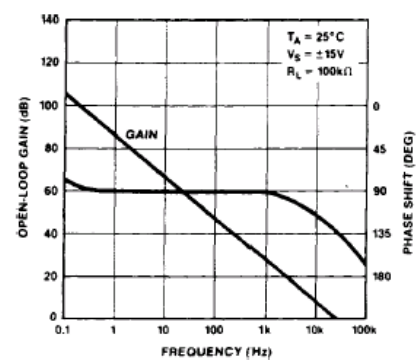
Input Bias Current vs. Temperature



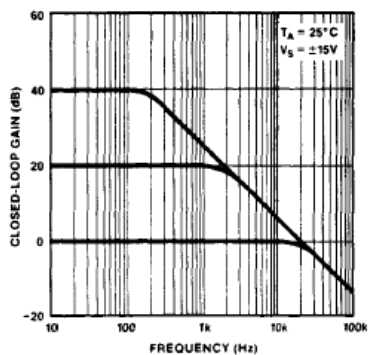
Total Supply Current vs. Temperature



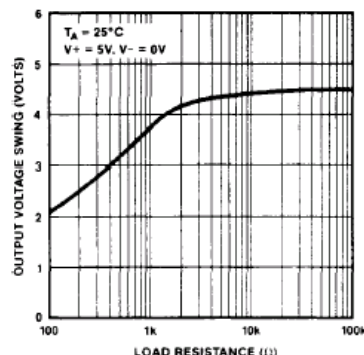
Open-Loop Gain vs. Single-Supply Voltage



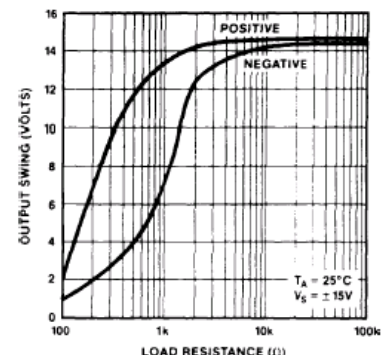
Open-Loop Gain and Phase Shift vs. Frequency



Closed-Loop Gain vs. Frequency

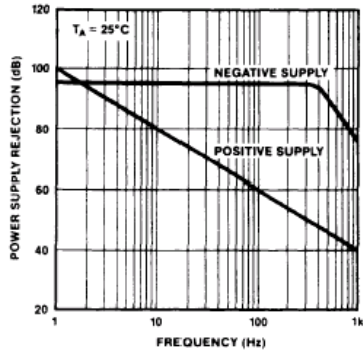


Output Voltage Swing vs. Load Resistance

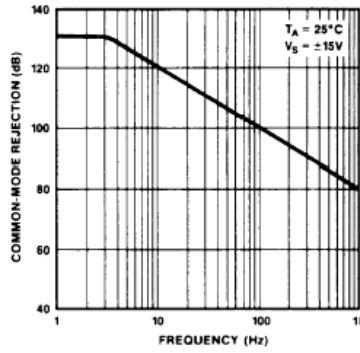


Output Voltage Swing vs. Load Resistance

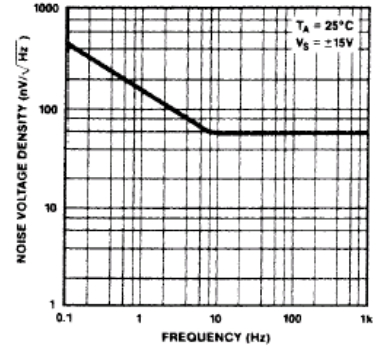
OP490RP TYPICAL OPERATING CHARACTERISTICS



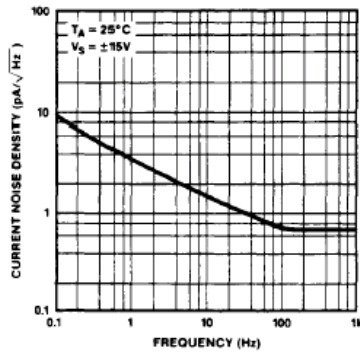
Power Supply Rejection vs. Frequency



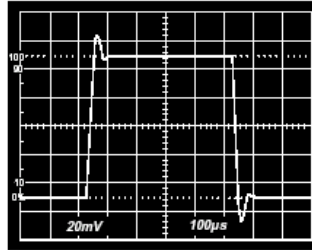
Common-Mode Rejection vs. Frequency



Noise Voltage Density vs. Frequency

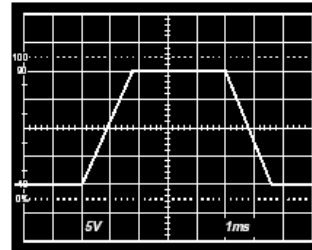


Current Noise Density vs. Frequency



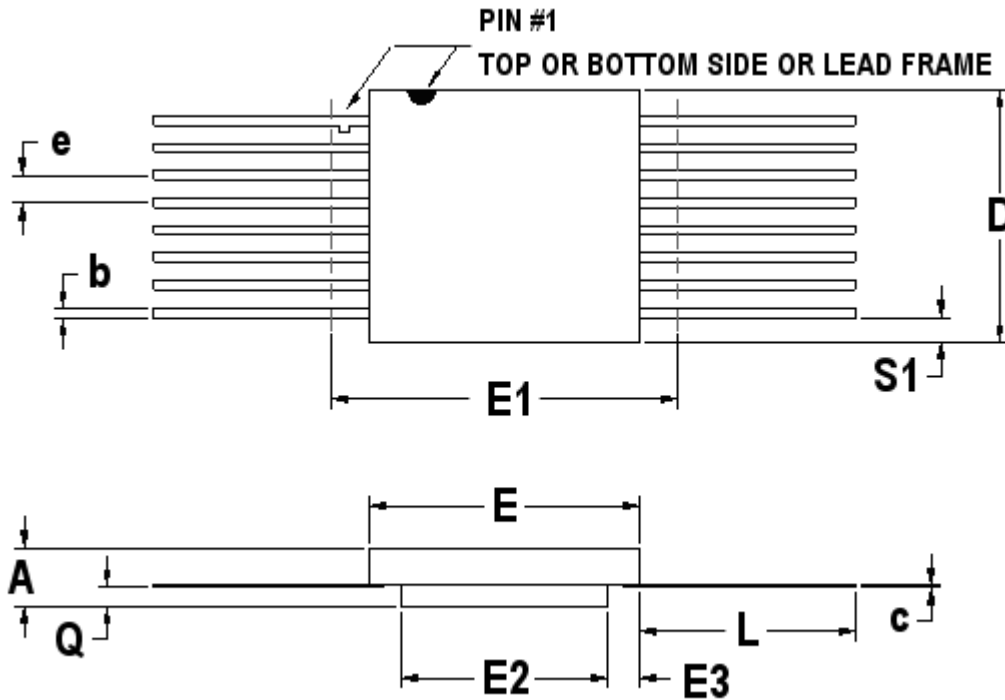
$T_A = 25^\circ\text{C}$
 $V_S = \pm 15\text{V}$
 $A_V = +1$
 $R_L = 10\text{k}\Omega$
 $C_L = 500\text{pF}$

Small-Signal Transient Response



$T_A = 25^\circ\text{C}$
 $V_S = \pm 15\text{V}$
 $A_V = +1$
 $R_L = 10\text{k}\Omega$
 $C_L = 500\text{pF}$

Large-Signal Transient Response



16-PIN RAK-PAK® FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.115	0.135	0.150
b	0.015	0.017	0.022
c	0.004	0.005	0.009
D	--	0.415	0.440
E	0.245	0.280	0.285
E1	--	--	0.315
E2	0.120	0.156	--
E3	0.030	0.062	--
e	0.050 BSC		
L	0.325	0.335	0.345
Q	0.020	0.033	0.045
S1	0.005	0.024	--
N	16		

F16-01

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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