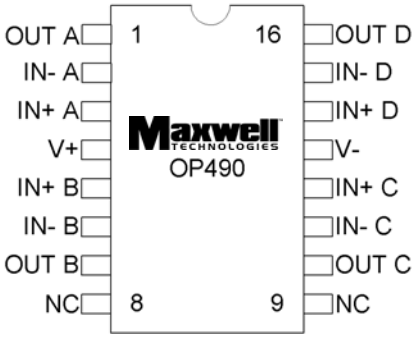
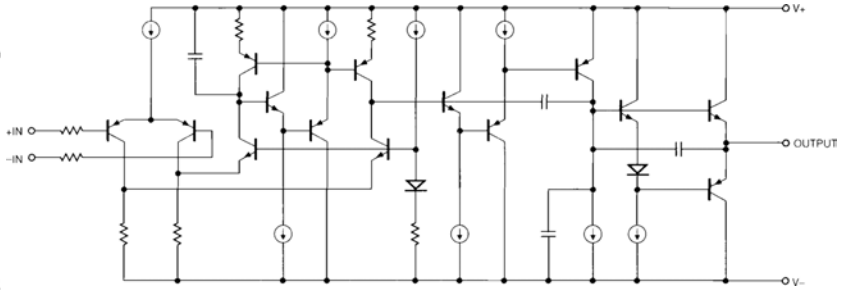
OP490
Low Voltage Micropower Quad Operational Amplifier





Logic Diagram

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 µV/°C max (over -55 to +125°C)
- Low supply current (per amplifier) 20 µA max
- High open-loop gain 700 V/me min.
- Outstanding PSRR: 5.6 µV/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 µV/°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.

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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	°C/W
Storage Temperature Range	T_S	-65	+150	°C
Operating Temperature Range	T_A	-55	+125	°C

Table 3. Delta Limits

Parameter	Variation
I_{CC}	±10% of specified value in Table 4.

Table 4. OP490 DC Electrical Characteristics

(VS = ±15V, T_A = -55 to 125°C, unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Units
Input Offset Voltage	V_{OS}		+25°C	--	0.2	0.5	mV
			-55 to 125°C	--	0.4	1.0	
Input Offset Current	I_{OS}	V_{CM} = 0V	+25°C	--	0.4	3	nA
			-55 to 125°C	--	1.5	5	
Input Bias Current	I_B	V_{CM} = 0V	+25°C	--	4.2	15	nA
			-55 to 125°C		4.4	20	

TABLE 4. OP490 DC ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Large Signal Voltage Gain	A_{VO}	V_S = ±15V, VO = ±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<VO<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	VS = ±15V					V
		RL = 10 kΩ	+25°C	±13.5	±14.2	--	
			-55 to 125°C	±13	±14	--	
		RL = 2 kΩ	+25°C	±10.5	±11.5	--	
			-55 to 125°C	±10	±11	--	
	V_{OH}	V+ = 12V, V- = 0V RL = 2 kΩ	+25°C	--	4.2	--	
			-55 to 125°C	--	4.1	--	
	V_{OL}	V+ = 5V, V- = 0V RL = 10 kΩ		--	100	--	µV
Common Mode Rejection	CMR	V+ = 5V, V = 0V, 0V < V_{CM} < 4	+25°C	--	110	---	dB
		V+ = 5V, V = 0V, 0V < V_{CM} < 3.5	-55 to 125°C	--	108	--	
		VS = ±15V, -15V < V_{CM} < 13.5V	+25°C	100	130	--	
			-55 to 125°C	95	115	--	
Power Supply Rejection Ratio	PSRR		+25°C	---	1.0	5.6	µV/V
			-55 to 125°C	--	3.2	10	
Slew Rate	SR	VS = ±15V	+25°C	--	12	---	V/ms
Supply Current (All Amplifiers)	I_{SY}	VS = ±1.5V, No Load	+25°C	--	40	60	µA
			-55 to 125°C	--	70	100	
		VS = ±15V, No Load	+25°C	--	60	80	
			-55 to 125°C	--	90	120	
Capacitive Load Stability		AV = +1	+25°C	---	650	---	pF

TABLE 4. OP490 DC ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Channel Separation	CS	V_O = 20Vp-p, f_O = 10 Hz, VS = ±15V [2]	+25°C	120	150	---	dB

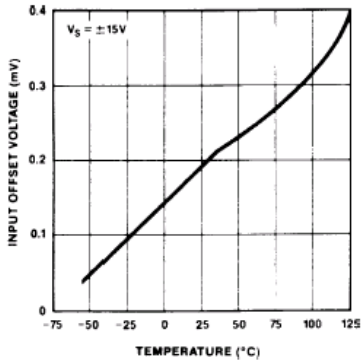
1. Guaranteed by CMR test.
2. Guaranteed but not 100% tested.

TABLE 5. OP490 AC ELECTRICAL CHARACTERISTICS

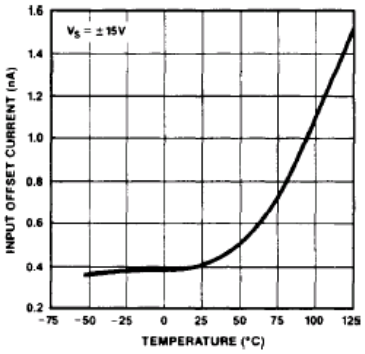
(VS = ±15V, TA = -55 TO 125°C UNLESS OTHERWISE SPECIFIED.)

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

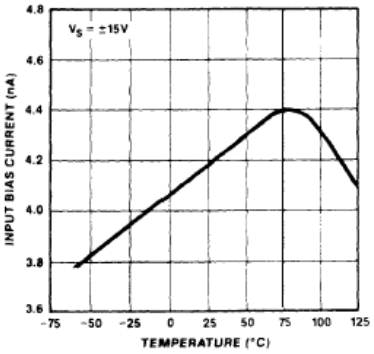
OP490RP Typical Operating Characteristics



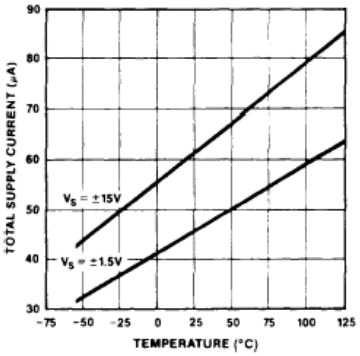
Input Offset Voltage vs. Temperature



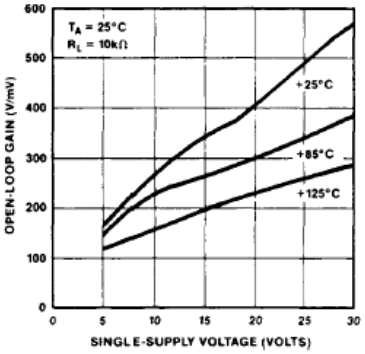
Input Offset Current vs. Temperature



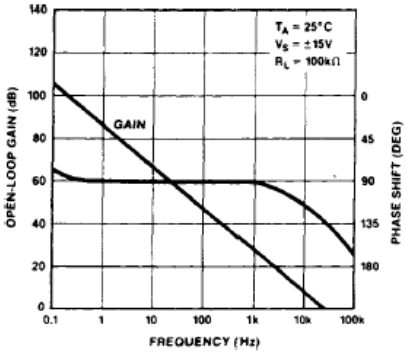
Input Bias Current vs. Temperature



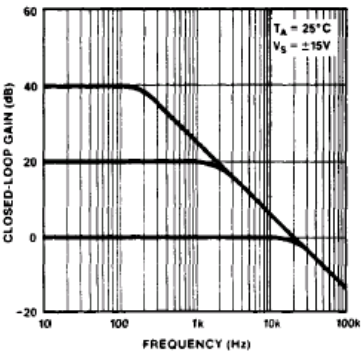
Total Supply Current vs. Temperature



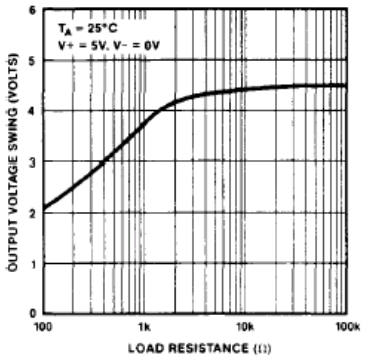
Open-Loop Gain vs. Single-Supply Voltage



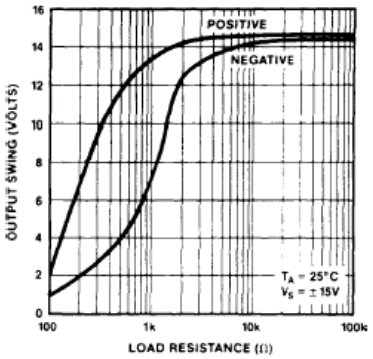
Open-Loop Gain and Phase Shift vs. Frequency



Closed-Loop Gain vs. Frequency

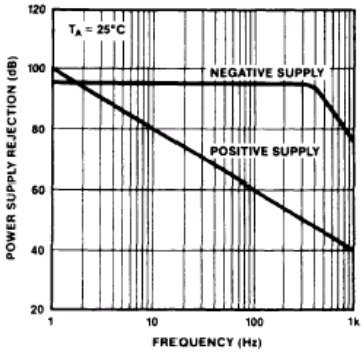


Output Voltage Swing vs. Load Resistance

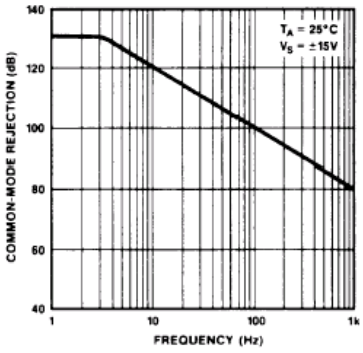


Output Voltage Swing vs. Load Resistance

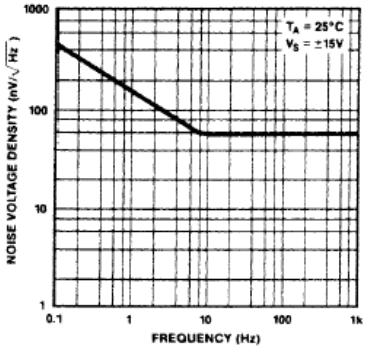
OP490RP Typical Operating Characteristics



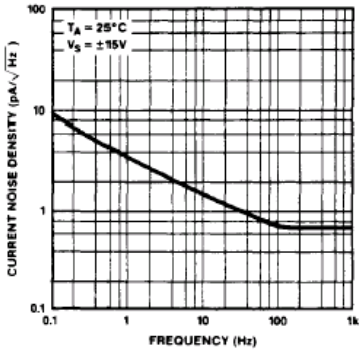
Power Supply Rejection vs. Frequency



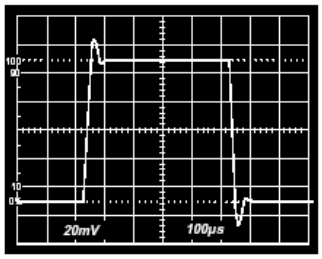
Common-Mode Rejection vs. Frequency



Noise Voltage Density vs. Frequency

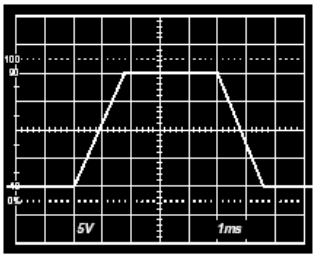


Current Noise Density vs. Frequency



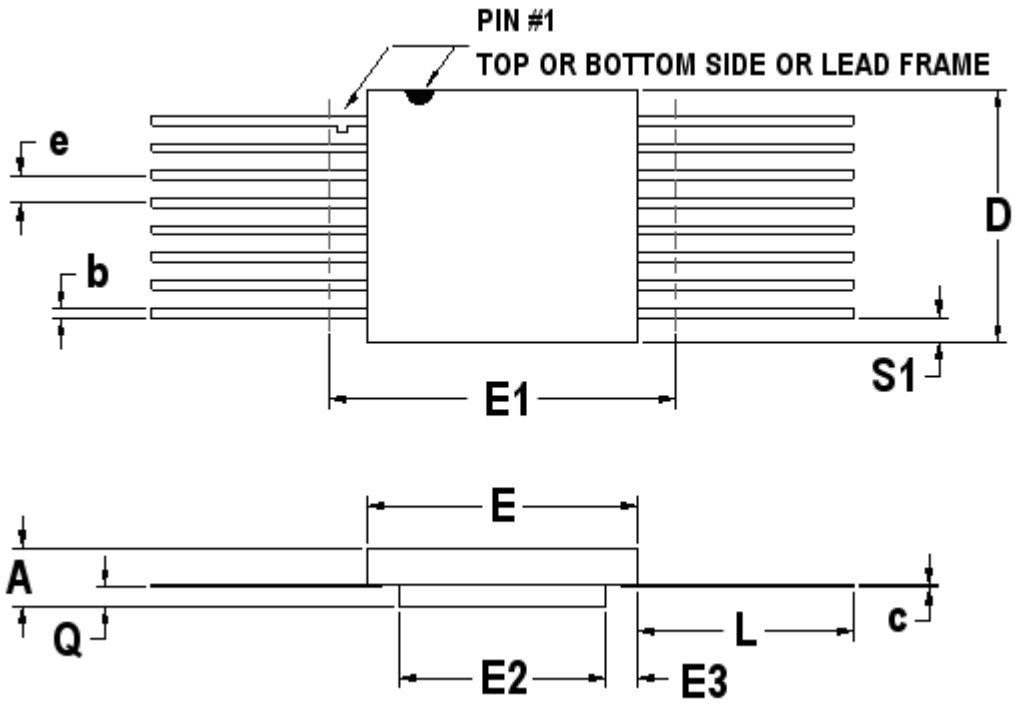
T_A = 25°C
V_S = ±15V
A_V = +1
R_L = 10kΩ
C_L = 500pF

Small-Signal Transient Response



T_A = 25°C
V_S = ±15V
A_V = +1
R_L = 10kΩ
C_L = 500pF

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.

The specifications presented within these data sheets represent the latest and most accurate information available to date. However, these specifications are subject to change without notice and Maxwell Technologies assumes no responsibility for the use of this information.

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