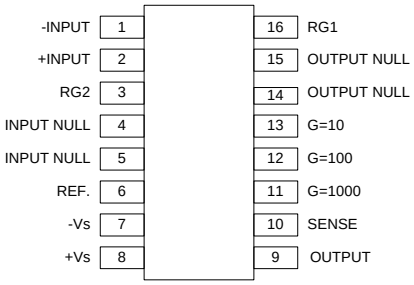
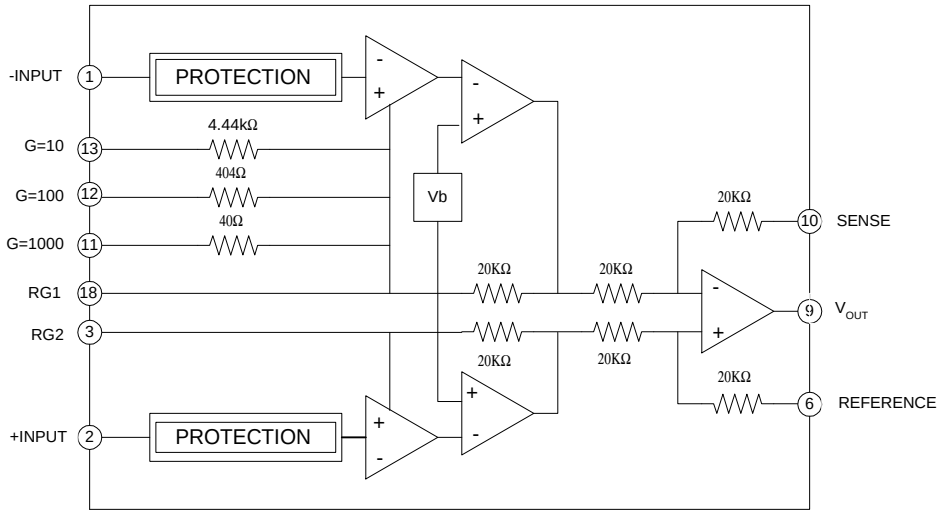
PRELIMINARY

SPACE ELECTRONICS INC.
SPACE PRODUCTS

PRECISION INSTRUMENTATION AMPLIFIER

524RP





FEATURES:

- Low noise: 0.3uV p-p 0.1Hz to 10 Hz
- Low nonlinearity: 0.003% (G=1)
- High CMRR: 120 dB (g=1000)
- Low offset voltage: 50uV
- Low offset voltage drift: 0.5uV/ºC
- Gain bandwidth product: 25MHz
- Pin programmable gains: 1, 10, 100, 1000
- Input protection, power-on, power-off
- No external components required
- Internally compensated
- No single event latchup
- Total dose hardness to 100 KRads (Si), dependent upon orbit and mission duration

DESCRIPTION:

Space Electronics' 524RP (RP for RAD-PAK®) is a precision monolithic instrumentation amplifier designed for data acquisition applications requiring high accuracy under worst-case operating conditions. An outstanding combination of high linearity, high common mode rejection, low offset voltage drift, and low noise makes the 524RP suitable for use in many data acquisition systems.

The 524RP has an output offset voltage drift of less than 25 µV/ºC, input offset voltage drift of less than 0.5 µV/ºC, CMR above 90 dB at unity gain (120 dB at G = 1000) and maximum nonlinearity of 0.003% at G = 1. In addition to the outstanding dc specifications, the 524RP also has a 25 MHz gain bandwidth product (G = 100). To make it suitable for high speed data acquisition systems, the 524RP has an output slew rate of 5V/µs and settles in 15 µs to 0.01% for gains of 1 to 100.

As a complete amplifier, the 524RP does not require any external components for fixed gains of 1, 10, 100 and 1,000. For other gain settings between 1 and 1000, only a single resistor is required. The 524RP is fully protected for both power on and power off fault conditions. This product is available with packaging and screening up to Class S.

(619) 452-4167 - Fax: (619) 452-5499 - www.spaceelectronics.com

TABLE 1. 524RP ABSOLUTE MAXIMUM RATINGS[1]

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	V_{SS}	--	±18	V
Internal Power Dissipation	P_D	--	450	mW
Input Voltage (Either Input Simultaneously) [2]	$\|V_{IN}\| + \|V_S\|$	--	36	V
Output Short Circuit Duration		--	--	
Storage Temperage Range	T_{STG}	-65	150	°C
Operating Temperature Range	T_{OPR}	-55	125	°C
Lead Temperature (Soldering 60 secs)	T_{LD}	--	300	°C

1. Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
2. Max input voltage specification refers to maximum voltage to which either input terminal may be raised with or without device power applied. For example, with ±18V supplies max V_{IN} is ±18V, with zero supply voltage max V_{IN} is ±36V.

TABLE 2. 524RP SPECIFICATIONS

(V_S = ±15V, RL = 2 kΩ AND T_A = +25 °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	MIN	TYP	MAX	UNIT
GAIN Gain Equation (External Resistor Gain Programming)		$\left[\frac{40,000}{R_G} + 1\right]$ ±20%		--
Gain Range (Pin Programmable)		1 to 1000		
Gain Error				
G = 1	--		±0.05	%
G = 10	--		±0.25	%
G = 100	--		±0.5	%
G = 1000	--		±2.0	%
Nonlinearity				
G = 1	--	--	±0.01	%
G = 10, 100	--	--	±0.01	%
G = 1000	--	--	±0.01	%
Gain vs. Temperature				
G = 1	--	--	5	ppm/°C
G = 10	--	--	10	ppm/°C
G = 100	--	--	25	ppm/°C
G = 1000	--	--	50	ppm/°C

TABLE 2. 524RP SPECIFICATIONS

(V_S = ±15V, RL = 2 kΩ AND T_A = +25 °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	MIN	TYP	MAX	UNIT
VOLTAGE OFFSET (May be Nulled)				
Input Offset Voltage	--	--	100	µV
vs. Temperature	--	--	2.0	µV/°C
Output Offset Voltage	--	--	3.0	mV
vs. Temperature	--	--	50	µV/°C
Offset Referred to the Input vs. Supply				
G = 1	75	--	--	dB
G = 10	95	--	--	dB
G = 100	105	--	--	dB
G = 1000	110	--	--	dB
INPUT CURRENT				
Input Bias Current	--	--	±50	nA
vs. Temperature	--	±100	--	pA/°C
Input Offset Current	--	--	±35	nA
vs. Temperature	--	±100	--	pA/°C
INPUT				
Input Impedance				
Differential Resistance	--	10^9	--	Ω
Differential Capacitance	--	10	--	pF
Common-Mode Resistance	--	10^9	--	Ω
Common-Mode Capacitance	--	10	--	pF
Input Voltage Range				
Max Differential Input Lineat (V_{DL})	±10	--	--	V
Max Common-Mode Linear (V_{CM})	--	--	--	
Common-Mode Rejection dc to 60 Hz with 1 kΩ Source Imbalance		$12V-\left[\frac{G}{2}xV_D\right]$		V
G = 1	70		--	dB
G = 10	90		--	dB
G = 100	100		--	dB
G = 1000	110		--	dB
OUTPUT RATING				
V_{OUT}, R_L = 2 kΩ		±10		±
DYNAMIC RESPONSE				
Small Signal - 3 dB				
G = 1	--	1	--	MHz
G = 10	--	400	--	kHz
G = 100	--	150	--	kHz
G = 1000	--	25	--	kHz
Slew Rate	--	5.0	--	V/µs
Setting Time to 0.01%, 20 V Step				
G = 1 to 100	--	15	--	µs
G = 1000	--	75	--	µs

TABLE 2. 524RP SPECIFICATIONS

(V_S = ±15V, RL = 2 kΩ AND T_A = +25 °C, UNLESS OTHERWISE SPECIFIED)

PARAMETER	MIN	TYP	MAX	UNIT
NOISE				
Voltage Noise, 1 kHz				
R.T.I.	--	7	--	nV/√Hz
R.T.O.	--	90	--	nV√Hz
R.T.I., 0.1 Hz to 10 Hz				
G = 1	--	15	--	µV p-p
G = 10	--	2	--	µV p-p
G = 100, 1000	--	0.3	--	µV p-p
Current Noise				
0.1 Hz to 10 Hz	--	60	--	pA p-p
SENSE INPUT				
R_{IN}	--	20	--	kΩ ±20%
I_{IN}	--	15	--	µA
Voltage Range	±10	--	--	V
Gain to Output	--	1	--	%
REFERENCE INPUT				
V_{IN}	--	40	--	kΩ ±20%
I_{IN}	--	15	--	µA
Voltage Range	10	--	--	V
Gain to Output	--	1	--	%
TEMPERATURE RANGE				
Specified Performance	-55	--	+125	°C
Storage	-65	--	+150	°C
POWER SUPPLY				
Power Supply Range	±6	±15	±18	V
Quiescent Current	--	3.5	5.0	mA

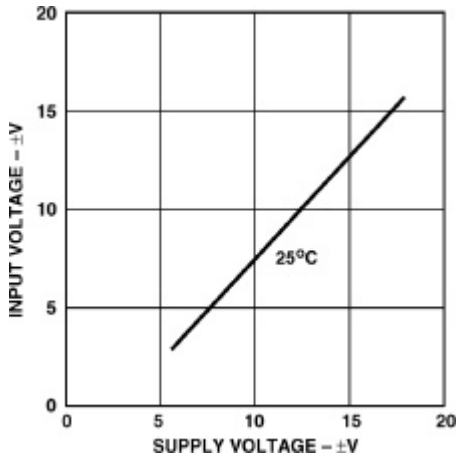


FIGURE 1. INPUT VOLTAGE RANGE VS. SUPPLY VOLTAGE, G=1

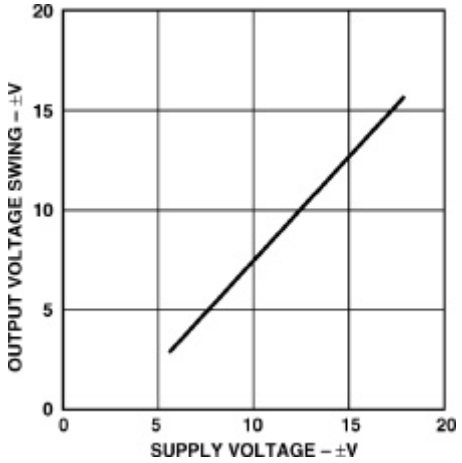


FIGURE 2. OUTPUT VOLTAGE SWING VS. SUPPLY VOLTAGE

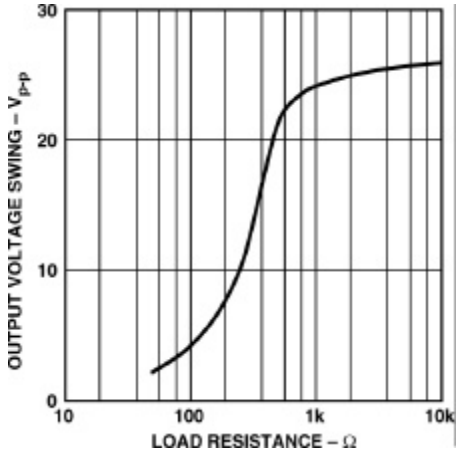


FIGURE 3. OUTPUT VOLTAGE SWING VS. LOAD RESISTANCE

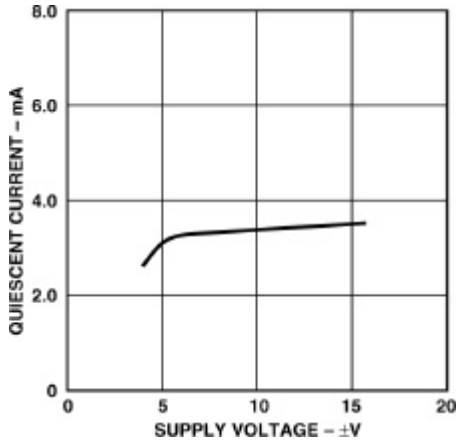


FIGURE 4. QUIESCENT CURRENT VS. SUPPLY VOLTAGE

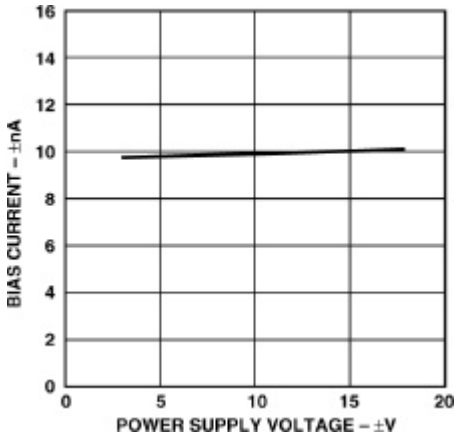


FIGURE 5. INPUT BIAS CURRENT VS. SUPPLY VOLTAGE

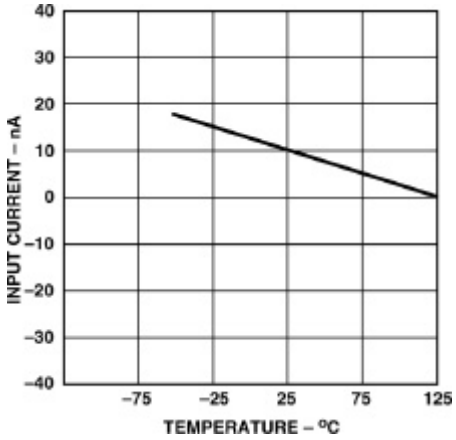


FIGURE 6. INPUT BIAS CURRENT VS. TEMPERATURE

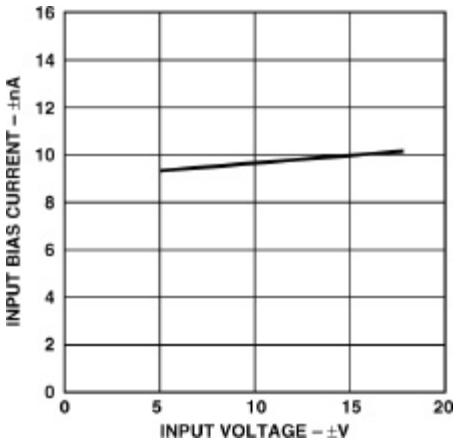


FIGURE 7. INPUT BIAS CURRENT VS. CMV

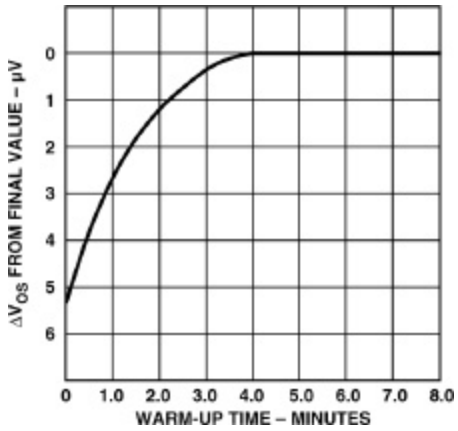


FIGURE 8. OFFSET VOLTAGE, RTI, TURN ON DRIFT

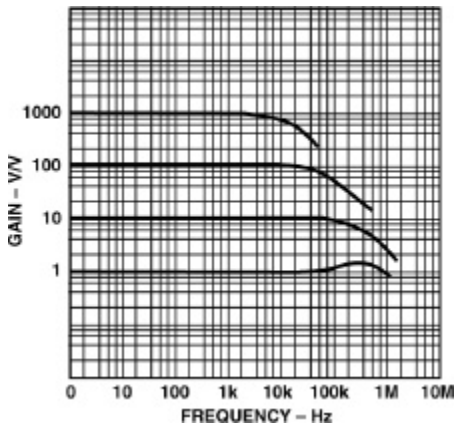


FIGURE 9. GAIN VS. FREQUENCY

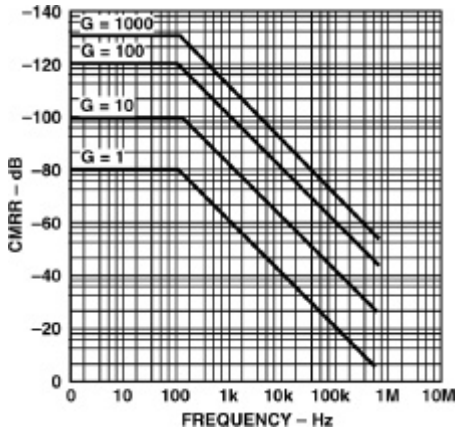


FIGURE 10. CMRR VS. FREQUENCY RTI, ZERO TO 1K SOURCE IMBALANCE

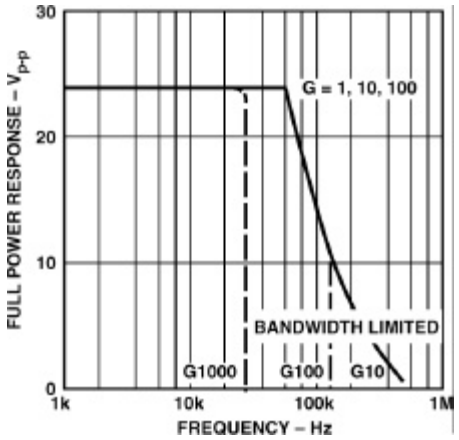


FIGURE 11. LARGE SIGNAL FREQUENCY RESPONSE

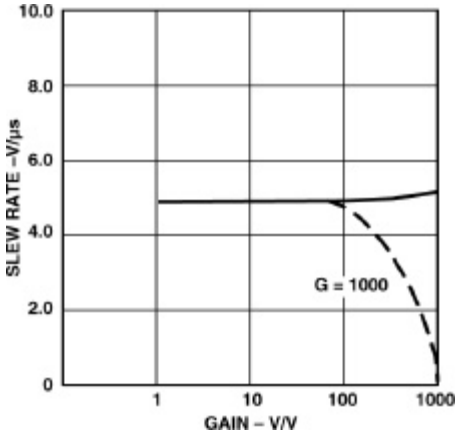


FIGURE 12. SLEW RATE VS. GAIN

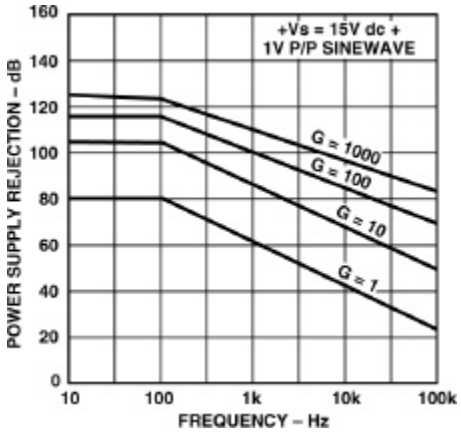


FIGURE 13. POSITIVE PSRR VS. FREQUENCY

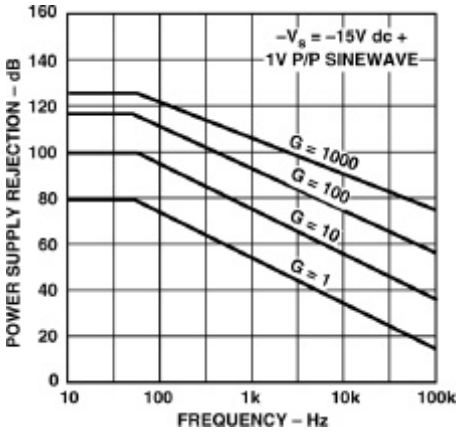


FIGURE 14. NEGATIVE PSRR VS. FREQUENCY

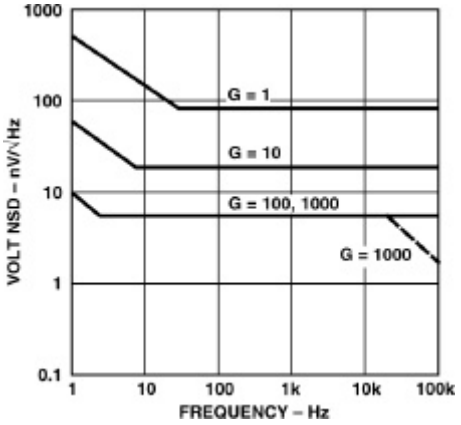


FIGURE 15. RTI NOISE SPECTRAL DENSITY VS. GAIN

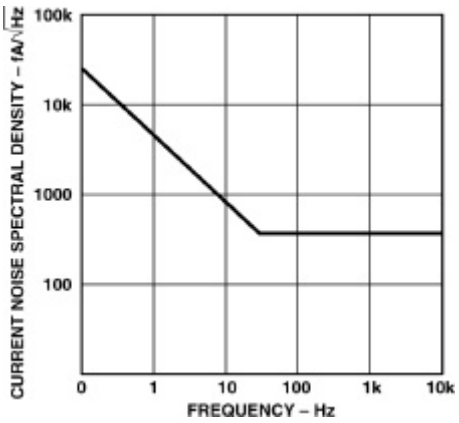


FIGURE 16. INPUT CURRENT NOISE

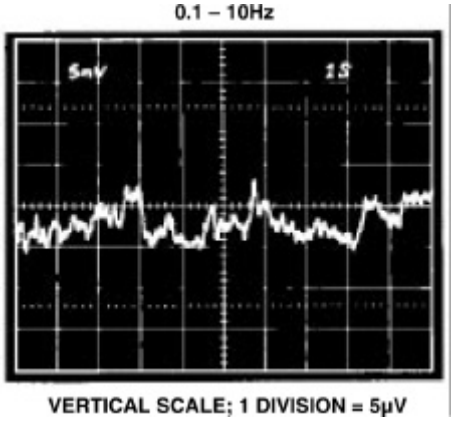


FIGURE 17. LOW FREQUENCY NOISE - G=1 (SYSTEM GAIN = 1000)

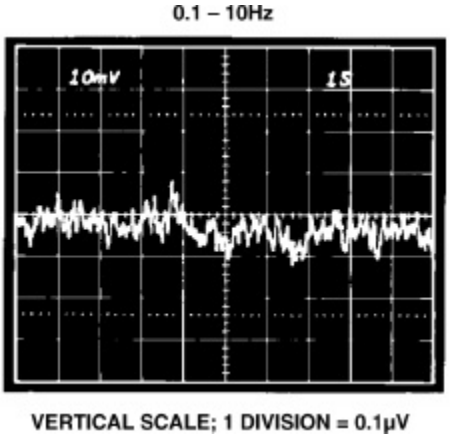


FIGURE 18. LOW FREQUENCY NOISE - G=1000 (SYSTEM GAIN = 100,000)

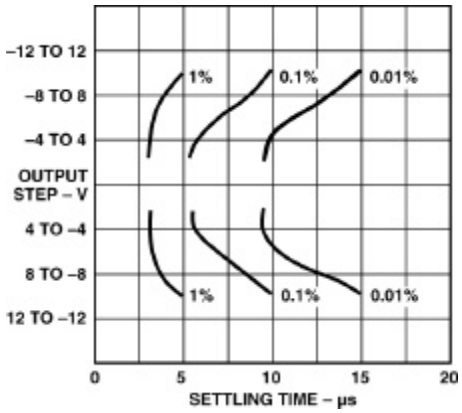


FIGURE 19. SETTLING TIME GAIN=1

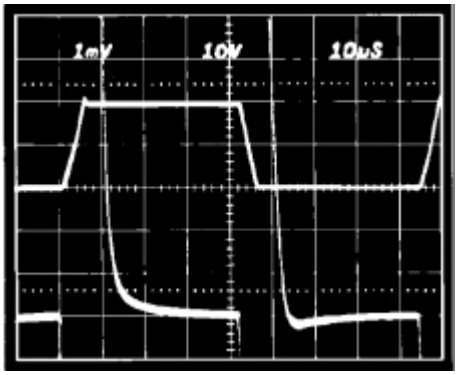


FIGURE 20. LARGE SIGNAL PULSE RESPONSE AND SETTLING TIME - G=1

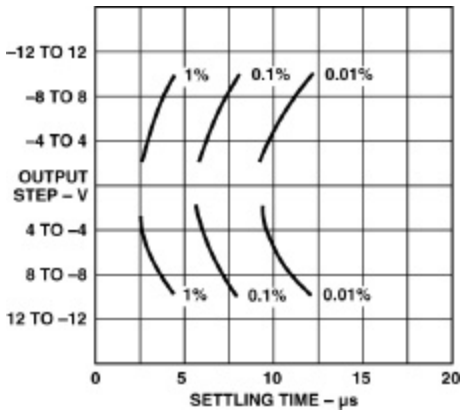


FIGURE 21. SETTLING TIME GAIN=10

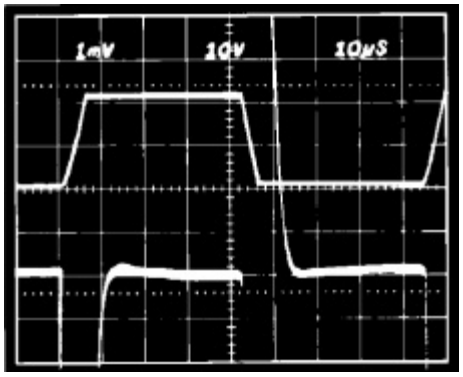


FIGURE 22. LARGE SIGNAL PULSE RESPONSE AND SETTLING TIME G=10

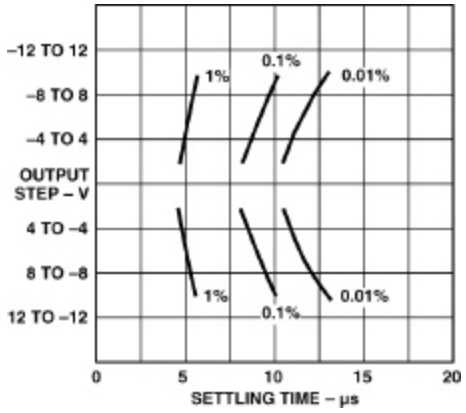


FIGURE 23. SETTLING TIME GAIN=100

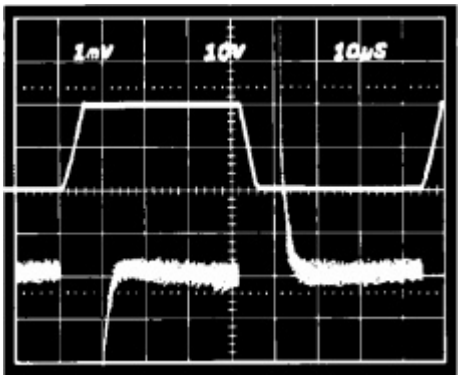


FIGURE 24. LARGE SIGNAL PULSE RESPONSE AND SETTLING TIME G=100

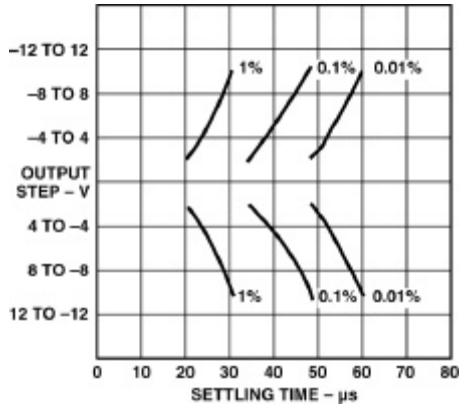


FIGURE 25. SETTLING TIME GAIN=1000

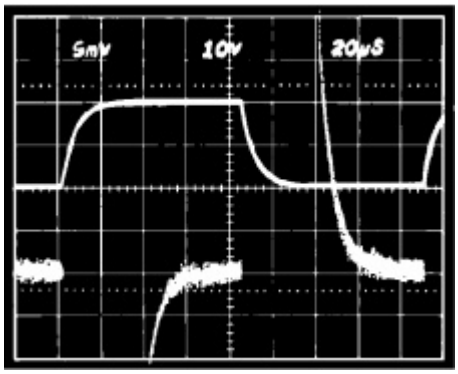
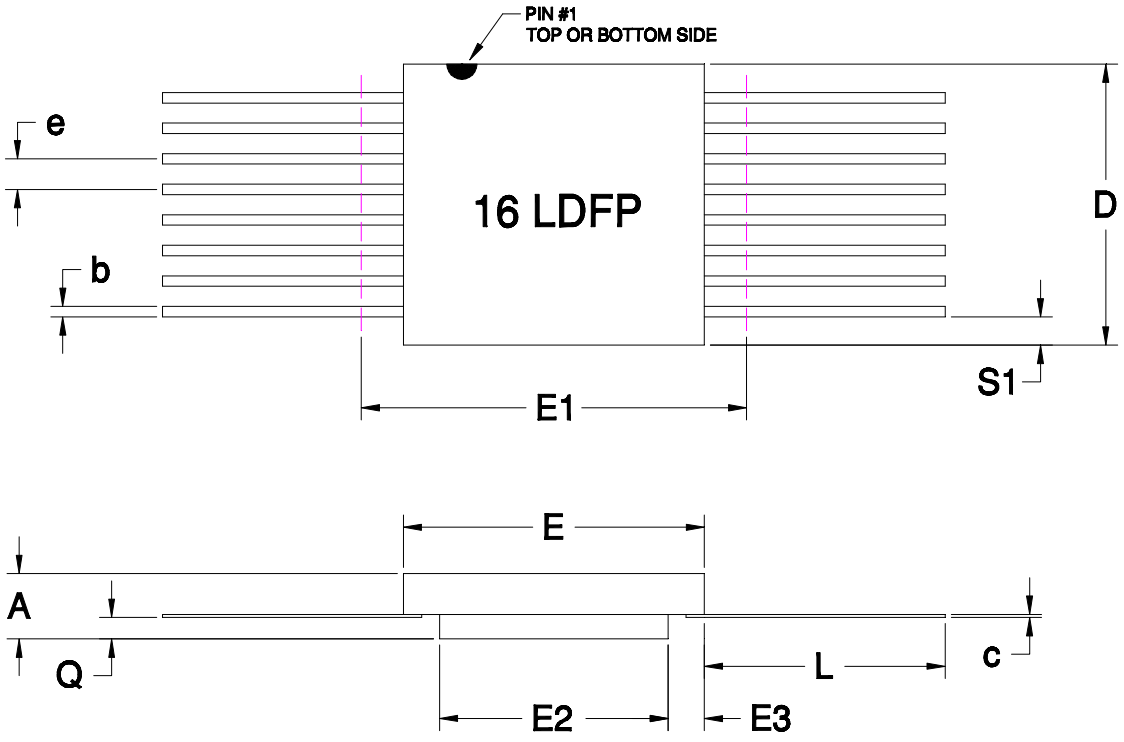


FIGURE 26. LARGE SIGNAL PULSE RESPONSE AND SETTLING TIME G=1000



16 PIN RAD-PAK® FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.117	0.130	0.143
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	0.130	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