Dual/Quad Low Noise, Precision Operational Amplifiers

FEATURES

■ Low Noise	5nV/√Hz @ 1kHz Max
■ Input Offset Voltage	OP-270: 75μV Max
	OP-470: 400μV Max
■ Low Offset Voltage Drift	OP-270: 1μV/°C Max
	OP-470: 2μV/°C Max
■ Very High Gain	OP-270: 1500V/mV Min
	OP-470: 1000V/mV Min
■ Outstanding CMRR	OP-270: 106dB Min
	OP-470: 110dB Min
■ Slew Rate	3.0V/μs Typ
■ Gain Bandwidth Product	6MHz Typ
■ Industry Standard Pinouts	

APPLICATIONS

- Two and Three Op Amp Instrumentation Amplifiers
- Low Noise Signal Processing
- Microvolt Accuracy Threshold Detection
- Strain Gauge Amplifiers
- Accelerometer Amplifiers
- Infrared Detectors

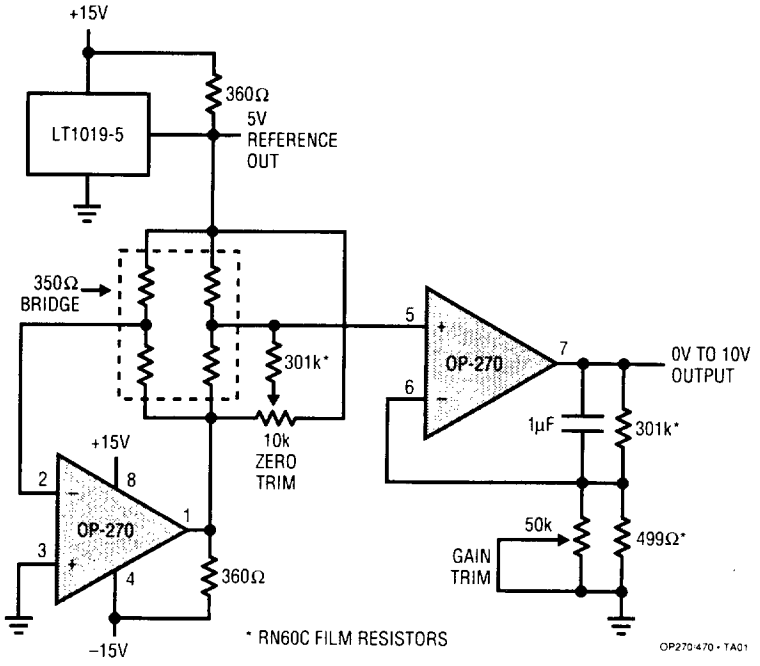
DESCRIPTION

The OP-270 dual and OP-470 quad are high performance op amps with 80nVp-p noise, from 0.1Hz to 10Hz, offering comparable performance to the industry standard OP-27.

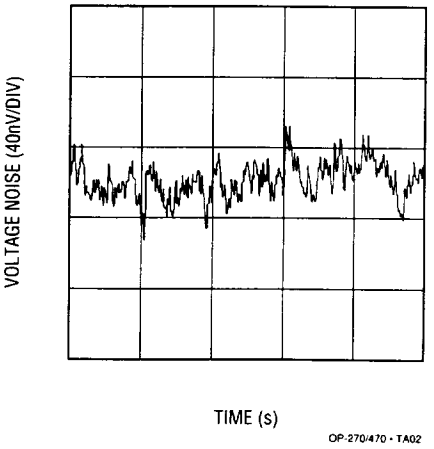
The OP-270 (OP-470) feature input offset voltage below 75μV (400μV) and offset drift under 1μV/°C (2μV/°C), guaranteed over the full military temperature range. Open-loop gain of the OP-270 (OP-470) is over 1.5 million (1.0 million) into a 10kΩ load ensuring excellent gain accuracy and linearity, even in high-gain applications. Input bias current is under ±20nA (±25nA) which reduces errors due to signal source resistance. The OP-270's (OP-470's) CMRR of over 106dB (110dB) and PSRR of less than 3.2μV/V (1.8μV/V) significantly reduce errors due to ground noise and power supply fluctuations. Power consumption of the dual OP-270 (quad OP-470) is one-third less than two (four) OP-27's, a significant advantage for power conscious applications. The OP-270 and OP-470 are unity-gain stable with a gain bandwidth product of 6MHz and a slew rate of 3.0V/μs.

For applications requiring higher performance, see the LT1124 and LT1125 data sheets.

Strain Gauge Signal Conditioner with Bridge Excitation



0.1Hz to 10Hz Voltage Noise

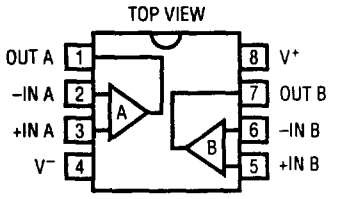


ABSOLUTE MAXIMUM RATINGS

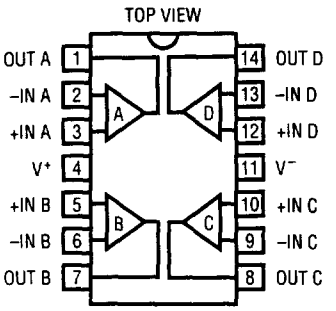
Supply Voltage ..... ±18V
Differential Input Voltage (Note 4) ..... ±1.0V
Differential Input Current (Note 4) ..... ±25mA
Input Voltages ..... Equal to Supply Voltages
Output Short Circuit Duration ..... Indefinite

Operating Temperature Range
OP270A/OP470A ..... –55°C to 125°C
OP270E/OP470E
OP270G/OP470G ..... –40°C to 85°C
Storage Temperature Range
All Grades ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec.) ..... 300°C

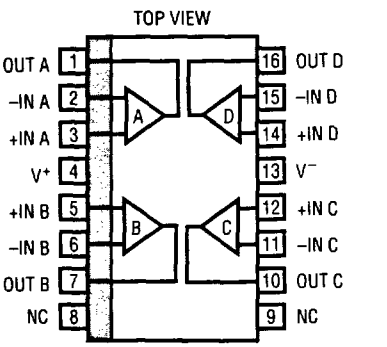
PACKAGE/ORDER INFORMATION



J8 PACKAGE
8-LEAD CERAMIC DIP
N8 PACKAGE
8-LEAD PLASTIC DIP
OP270/470 • POI03



J PACKAGE
14-LEAD CERAMIC DIP
N PACKAGE
14-LEAD PLASTIC DIP
OP270/470 • POI02



S PACKAGE
16-LEAD PLASTIC SOL
OP270/470 • POI01

ORDER PART NUMBER	ORDER PART NUMBER	ORDER PART NUMBER
OP-270AJ8 OP-270EJ8 OP-270GN8	OP-470AJ OP-470EJ OP-470GN	OP-470GS

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $T_A = 25°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	OP-270A/E MIN	OP-270A/E TYP	OP-270A/E MAX	OP-470A/E MIN	OP-470A/E TYP	OP-470A/E MAX	OP-270G OP-470G MIN	OP-270G OP-470G TYP	OP-270G OP-470G MAX	UNITS
V_{OS}	Input Offset Voltage	OP-270		10	75					50	250	µV
		OP-470					100	400		400	1000	µV
I_{OS}	Input Offset Current	OP-270 V_{CM} = 0V		5	15					6	20	nA
		OP-470 V_{CM} = 0V					6	20		12	30	nA
I_B	Input Bias Current	V_{CM} = 0V		±7	±20		±7	±25		±15	±60	nA
e_n p-p	Input Noise Voltage	0.1Hz to 10Hz (Note 1)		80	200		80	200		80	200	nVp-p
e_n	Input Noise Voltage Density	f_O = 10Hz (Note 2)		3.6	6.5		3.6	6.5		3.6	6.5	nV/√Hz
		f_O = 100Hz (Note 2)		3.2	5.5		3.2	5.5		3.2	5.5	nV/√Hz
		f_O = 1000Hz (Note 2)		3.2	5.0		3.2	5.0		3.2	5.0	nV/√Hz

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $T_A = 25°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	OP-270A/E MIN	OP-270A/E TYP	OP-270A/E MAX	OP-470A/E MIN	OP-470A/E TYP	OP-470A/E MAX	OP-270G OP-470G MIN	OP-270G OP-470G TYP	OP-270G OP-470G MAX	UNITS
i_n	Input Noise Current Density	$f_O = 10Hz$ $f_O = 100Hz$ $f_O = 1000Hz$		1.5 0.5 0.4			1.5 0.5 0.4			1.5 0.5 0.4		$pA/\sqrt{Hz}$ $pA/\sqrt{Hz}$ $pA/\sqrt{Hz}$
A_{VOL}	Large Signal Voltage Gain	$V_{OUT} = \pm 10V$, $R_L = 10k\Omega$ $V_{OUT} = \pm 10V$, $R_L = 2k\Omega$	1500 750	5000 2000		1000 500	5000 2000		800 400	2000 1000		V/mV V/mV
V_{CM}	Input Voltage Range	(Note 3)	±12	±12.5		±12	±12.5		±12	±12.5		V
V_{OUT}	Output Voltage Swing	$R_L \geq 2k\Omega$	±12	±13.5		±12	±13.5		±12	±13.5		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 12V$	106	125		110	125		100	120		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4.5V$ to $\pm 18V$		0.56	3.2		0.56	1.8		1.0	5.6	µV/V
SR	Slew Rate		1.7	3.0		1.7	3.0		1.7	3.0		V/µs
I_S	Supply Current	OP-270 No Load OP-470 No Load		4.5	6.5		9.0	11.0		4.0 9.0	6.5 11.0	mA mA
GBW	Gain Bandwidth Product	$A_V = +10$		6			6			6		MHz
CS	Channel Separation	$V_{OUT} = 20Vp\text{-}p$, $f_O = 10Hz$ (Note 1)	125	175		125	175		125	175		dB
C_{IN}	Input Capacitance			3			3			3		pF

ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $-55°C \leq T_A \leq 125°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		OP-270A MIN	OP-270A TYP	OP-270A MAX	OP-470A MIN	OP-470A TYP	OP-470A MAX	UNITS
V_{OS}	Input Offset Voltage		●		30	175		140	600	µV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Voltage Drift		●		0.2	1.0		0.4	2.0	µV/°C
I_{OS}	Input Offset Current	$V_{CM} = 0V$	●		10	45		10	55	nA
I_B	Input Bias Current	$V_{CM} = 0V$	●		±15	±60		±15	±50	nA
A_{VOL}	Large Signal Voltage Gain	$R_L \geq 10k\Omega$, $V_{OUT} = \pm 10V$ $R_L \geq 2k\Omega$, $V_{OUT} = \pm 10V$	● ●	750 400	3000 1500		750 400	3000 1500		V/mV V/mV
V_{CM}	Input Voltage Range	(Note 3)	●	±11	±12		±11	±12		V
V_{OUT}	Output Voltage Swing	$R_L \geq 2k\Omega$	●	±12	±13		±12	±13		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 11V$	●	100	120		100	120		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4.5V$ to $\pm 18V$	●		1.0	5.6		1.0	5.6	µV/V
I_S	Supply Current All Amplifiers	No Load	●		5.0	7.5		10	13	mA

The ● denotes the specifications which apply over the full operating temperature range.

Note 1: This parameter is guaranteed but not 100% tested.

Note 2: This parameter is sample tested only.

Note 3: This parameter is guaranteed by the CMRR test.

Note 4: The inputs are protected by back-to-back diodes. Current limiting resistors are not used in order to achieve low noise. If differential input voltage exceeds ±1.4V, the input current should be limited to 25mA.

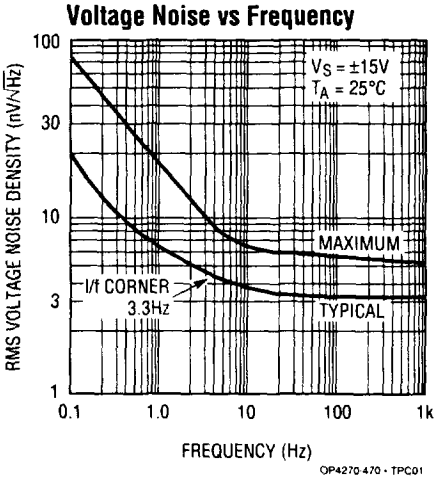
ELECTRICAL CHARACTERISTICS $V_S = \pm 15V$, $-40°C \le T_A \le 85°C$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		OP-270E MIN	OP-270E TYP	OP-270E MAX	OP-470E MIN	OP-470E TYP	OP-470E MAX	OP-270G OP-470G MIN	OP-270G OP-470G TYP	OP-270G OP-470G MAX	UNITS
V_{OS}	Input Offset Voltage	OP-270	●		25	150					100	400	µV
		OP-470	●					120	500		500	1500	µV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Voltage Drift	OP-270	●		0.2	1.0					0.7	3.0	µV/°C
		OP-470	●					0.4	2.0		2.0		µV/°C
I_{OS}	Input Offset Current	$V_{CM} = 0V$	●		15	30		17	20		17	50	nA
I_B	Input Bias Current	$V_{CM} = 0V$	●		±15	±60		±17	±50		±18	±75	nA
A_{VOL}	Large Signal Voltage Gain	$V_{OUT} = \pm 10V$, $R_L \ge 10k\Omega$	●	1000	2000		800	2000		600	1500		V/mV
		$V_{OUT} = \pm 10V$, $R_L \ge 2k\Omega$	●	500	1000		400	1000		300	800		V/mV
V_{CM}	Input Voltage Range	(Note 3)	●	±11	±12		±11	±12		±11	±12		V
V_{OUT}	Output Voltage Swing	$R_L \ge 2k\Omega$	●	±12	±13		±12	±13		±12	±13		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 11V$	●	100	120		100	120		90	110		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4.5V$ to $\pm 18V$	●		0.7	5.6		0.7	5.6		1.8	10	µV/V
I_S	Supply Current All Amplifiers	OP-270 No Load	●		4.8	7.2					4.8	7.2	mA
		OP-470 No Load	●					9.6	13		9.6	13	mA

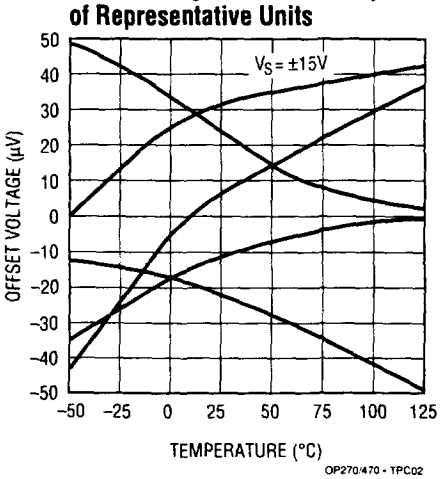
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TYPICAL PERFORMANCE CHARACTERISTICS

Voltage Noise vs Frequency



Offset Voltage Drift with Temperature of Representative Units



Small Signal Transient Response

