Dual Matched Low Noise Precision Op Amp and Dual High Speed Low Noise Precision Op Amp

FEATURES

- *Guaranteed* 80μV Max. V_{OS}
- *Guaranteed* 6.0nV/$\sqrt{Hz}$ 10Hz Voltage Noise Density
- *Guaranteed* 3.9nV/$\sqrt{Hz}$ 1kHz Voltage Noise Density
- *Guaranteed* 1μV/°C Max. V_{OS} Drift
- *Guaranteed* 1 Million Min. Voltage Gain
- *Guaranteed* Matching Characteristics
- *Guaranteed* 10V/μs Min. Slew Rate (OP-237)

APPLICATIONS

- Instrumentation Amplifiers
- Low Level Signal Processing
- Low Noise Audio Amplifiers
- Strain Gauge Amplifiers

DESCRIPTION

The OP-227 is a dual matched precision op amp which combines low offset, low noise, and high gain with excellent matching characteristics. Typical individual amplifier specifications of 20μV V_{OS}, 0.2μV/°C drift, 10nA I_B and 2.8nV/$\sqrt{Hz}$ 10Hz noise voltage density make the OP-227 an impressive performer in terms of single amplifiers. Matching characteristics are specified with guaranteed limits on all critical parameters including V_{OS}, V_{OS} drift, I_{BIAS} and CMRR (see the Features section), which make the OP-227 an ideal choice for two and three op amp instrumentation amplifier applications.

The OP-237 offers DC specifications identical to the OP-227 and is decompensated for higher speed operation at inverting gains greater than 5.

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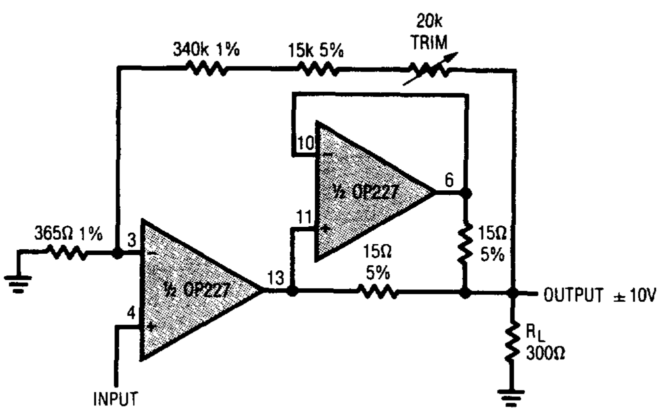
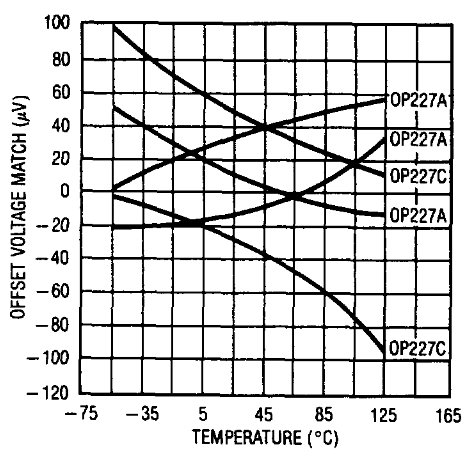
Precision Amplifier Drives 300Ω Load to ±10V with 0.05% Accuracy



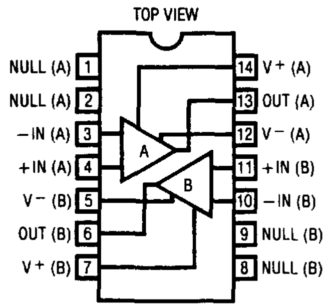
Matching Characteristic; Drift of Offset Voltage Match of Representative Units



ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Note 9) . . . . ±22V
Internal Power Dissipation 500mW
Input Voltage . . . . Equal to Supply Voltage
Output Short-Circuit Duration . . . . Indefinite
Differential Input Current (Note 8) . . . . ±25mA
Storage Temperature Range . . . . . . −65°C to +150°C
Operating Temperature
  OP-227A/237A/227C/237C . . −55°C to +125°C
  OP-227E/237E/227G/237G . . . −25°C to +85°C
Lead Temperature Range (Soldering, 10 sec.) . . 300°C

PACKAGE/ORDER INFORMATION



J PACKAGE 14 PIN HERMETIC
N PACKAGE 14 PIN PLASTIC

NOTE: DEVICE MAY BE OPERATED EVEN IF INSERTION IS REVERSED; THIS IS DUE TO INHERENT SYMMETRY OF PIN LOCATIONS OF AMPLIFIERS A AND B (NOTE 9).

ORDER PART NUMBER	
OP-227AJ	OP-237AJ
OP-227CJ	OP-237CJ
OP-227EJ	OP-237EJ
OP-227GJ	OP-237GJ
OP-227EN	OP-237EN
OP-227GN	OP-237GN

ELECTRICAL CHARACTERISTICS Individual Amplifiers

$V_S = \pm15V$, $T_A = 25°C$, unless otherwise noted

SYMBOL	PARAMETER	CONDITIONS	OP-227A, E OP-237A, E			OP-227C, G OP-237C, G			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	(Note 1)	—	20	80	—	60	180	μV
$\frac{\Delta V_{OS}}{\Delta Time}$	Long Term V_{OS} Stability	(Notes 2, 3)	—	0.2	1.0	—	0.2	2.0	μV/Mo
I_{OS}	Input Offset Current		—	7	35	—	12	75	nA
I_B	Input Bias Current		—	±10	±40	—	±15	±80	nA
e_{np-p}	Input Noise Voltage	0.1Hz to 10Hz (Notes 3, 5)	—	0.06	0.20	—	0.06	0.28	μVp-p
e_n	Input Noise Voltage Density	f_0 = 10Hz (Note 3) f_0 = 30Hz (Note 3) f_0 = 1000Hz (Note 3)	— — —	2.8 2.6 2.5	6.0 4.7 3.9	— — —	2.8 2.6 2.5	9.0 5.9 4.6	nV/√Hz nV/√Hz nV/√Hz
i_n	Input Noise Current Density	f_0 = 10Hz (Notes 3, 6) f_0 = 30Hz (Notes 3, 6) f_0 = 1000Hz (Notes 3, 6)	— — —	1.5 1.0 0.4	4.5 2.5 0.7	— — —	1.5 1.0 0.4	— — 0.7	pA/√Hz pA/√Hz pA/√Hz
	Input Resistance—Common Mode		—	7	—	—	5	—	GΩ
	Input Voltage Range		±11.0	±12.5	—	±11.0	±12.5	—	V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm11V$	114	126	—	100	126	—	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm4V$ to $\pm18V$	—	1	10	—	2	20	μV/V
A_{VOL}	Large-Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_O = \pm12V$ $R_L \geq 600\Omega$, $V_O = \pm10V$	3 1	20 12	— —	2 0.8	20 12	— —	V/μV V/μV
V_{OUT}	Output Voltage Swing	$R_L \geq 2k\Omega$ $R_L \geq 600\Omega$	±12.0 ±10.0	±13.8 ±12.5	— —	±11.5 ±10.0	±13.5 ±12.5	— —	V V
SR	Slew Rate OP-227 OP-237	$R_L \geq 2k\Omega$ $A_{VCL} \geq 5$	1.7 10	2.8 15	— —	1.7 10	2.8 15	— —	V/μs V/μs
GBW	Gain Bandwidth Prod. OP-227 OP-237 OP-237	f_0 = 100kHz (Note 4) f_0 = 10kHz (Note 4) f_0 = 1MHz ($A_{VCL} \geq 5$)	5 35 —	8 63 40	— — —	5 35 —	8 63 40	— — —	MHz MHz MHz
Z_O	Open-Loop Output Resistance	$V_O = 0$, $I_O = 0$	—	70	—	—	70	—	Ω
P_d	Power Consumption	Each Amplifier	—	80	140	—	90	170	mW
	Offset Adjustment Range	$R_P = 10k\Omega$	—	±4	—	—	±4	—	mV

LINEAR TECHNOLOGY

ELECTRICAL CHARACTERISTICS Individual Amplifiers

$V_S = \pm15V$, $-25°C \leq T_A \leq 85°C$, unless otherwise noted

SYMBOL	PARAMETER	CONDITIONS		OP-227E OP-237E MIN	TYP	MAX	OP-227G OP-237G MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 1)	●	—	40	140	—	85	280	µV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Drift	(Note 7)	●	—	0.2	1.0	—	0.3	1.8	µV/°C
I_{OS}	Input Offset Current		●	—	15	50	—	20	135	nA
I_B	Input Bias Current		●	—	±20	±60	—	±35	±150	nA
	Input Voltage Range		●	±10.5	±11.5	—	±10.5	±11.5	—	V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm10V$	●	110	124	—	96	118	—	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm4.5V$ to $\pm18V$	●	—	2	15	—	2	32	µV/V
A_{VOL}	Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_O = \pm10V$	●	1	14	—	0.8	14	—	V/µV
V_{OUT}	Output Voltage Swing	$R_L \geq 2k\Omega$	●	±11.7	±13.6	—	±11.0	±13.3	—	V

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ELECTRICAL CHARACTERISTICS Individual Amplifiers

$V_S = \pm15V$, $-55°C \leq T_A \leq 125°C$, unless otherwise noted

SYMBOL	PARAMETER	CONDITIONS		OP-227A OP-237A MIN	TYP	MAX	OP-227C OP-237C MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 1)	●	—	60	180	—	110	350	µV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Input Offset Drift	(Note 7)	●	—	0.2	1.0	—	0.3	1.8	µV/°C
I_{OS}	Input Offset Current		●	—	15	50	—	30	135	nA
I_B	Input Bias Current		●	—	±20	±60	—	±35	±150	nA
	Input Voltage Range		●	±10.5	±11.8	—	±10.2	±11.8	—	V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm10V$	●	108	122	—	94	116	—	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm4.5V$ to $\pm18V$	●	—	2	16	—	4	51	µV/V
A_{VOL}	Large Signal Voltage Gain	$R_L \geq 2k\Omega$, $V_O = \pm10V$	●	1	14	—	0.8	14	—	V
V_{OUT}	Output Voltage Swing	$R_L \geq 2k\Omega$	●	±11.5	±13.5	—	±10.5	±13.0	—	V

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

For MIL-STD components, please refer to LTC 883C data sheet for test listing and parameters.

Note 1: Input offset voltage measurements are performed by automated test equipment approximately 0.5 seconds after application of power.

Note 2: Long-Term Input Offset Voltage Stability refers to the average trend line of V_{OS} vs Time over extended periods after the first 30 days of operation.

Note 3: Sample tested.

Note 4: Parameter is guaranteed by design.

Note 5: See test circuit and frequency response curve for 0.1Hz to 10Hz tester.

Note 6: See test circuit for current noise measurement.

Note 7: The input offset drift performance is within the specifications unnulled or when nulled with $R_P = 8k\Omega$ to $20k\Omega$.

Note 8: 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 ±0.7V, the input current should be limited to 25mA.

Note 9: The V^+ supply terminals are completely independent and may be powered by separate supplies if desired (this approach, however, would sacrifice the advantages of the power supply rejection ratio matching). The V^- supply terminals are both connected to the common substrate and must be tied to the same voltage. *Both* V^- pins should be used.