LINEAR INTEGRATED CIRCUITS

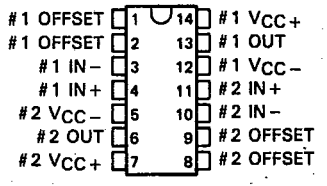
TYPES OP-227E, OP-227F, OP-227G LOW-NOISE DUAL OPERATIONAL AMPLIFIERS

D2805, OCTOBER 1983

T-79-06-20

- Low Offset Voltage . . . 20 μV Typ (OP-227E)
- Low Coefficient of Input Offset Voltage . . . 0.4 μV/°C Typ (OP-227F)
- Low Equivalent Input Noise Voltage:
  3 nV/√Hz Typ at f = 1 kHz (OP-227E and OP-227F)
  0.2 μV p-p Max at f = 0.1 to 10 Hz (OP-227E and OP-227F)
- High Slew Rate . . . 2.8 V/μs Typ
- High Voltage Amplification . . . 1.8 × 10^6 Typ at R_L ≥ 2 kΩ (OP-227E and OP-227F)
- Direct Replacements for PMI OP-227E, OP-227F, OP-227G

J OR N DUAL-IN-LINE PACKAGE
(TOP VIEW)

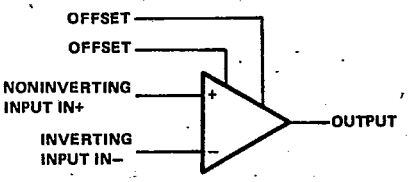


description

The OP-227 family of dual operational amplifiers offers low offset, low noise, and high slew rates. The temperature coefficient of input offset voltage is typically only 0.4 μV/°C for the OP-227F. Both the OP-227E and OP-227F achieve typical voltage gains of 1.8 million with a 2-kΩ load, and both have maximum peak-to-peak noise voltage of 0.2 microvolts and equivalent input noise voltage of typically 3 nV/√Hz. The 2.8-V/μs slew rate and 8-Megahertz bandwidth bring a high level of performance to instrumentation designs. These devices usually require no external components for offset nulling or frequency compensation.

The OP-227E, OP-227F, and OP-227G will be characterized for operation over the temperature range of −25°C to 85°C.

symbol (each amplifier)



3 Operational Amplifiers

PRODUCT PREVIEW

This document contains information on a product under development. Texas Instruments reserves the right to change or discontinue this product without notice.

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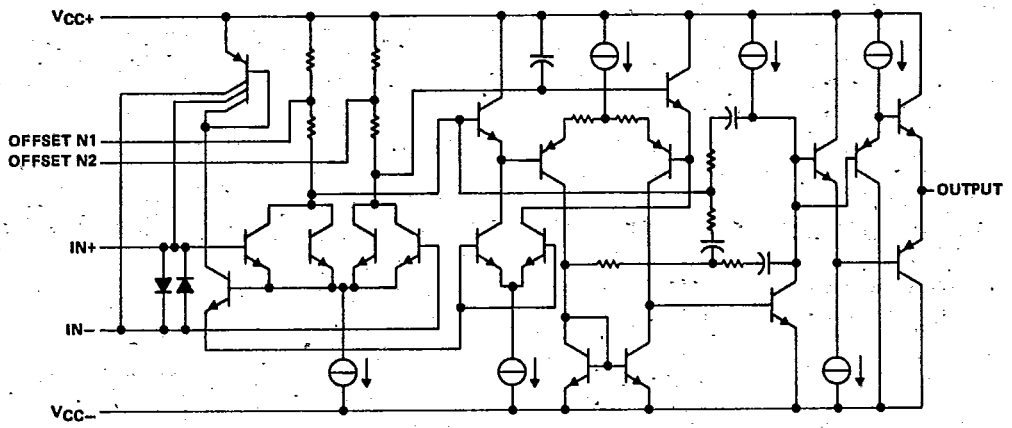
TYPES OP-227E, OP-227F, OP-227G
LOW-NOISE DUAL OPERATIONAL AMPLIFIERS

schematic (each half of amplifier)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltages, V_{CC} (see Note 1)	±22 V
Differential input current (see Note 2)	±25 mA
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 3):	
J package	1025 mW
N package	875 mW
Operating free-air temperature range	−25°C to 85°C
Storage temperature range	−65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: N package	260°C

NOTES: 1. All voltage values, except differential input voltage, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. Because of the back-to-back diodes protecting the differential inputs, input current can become excessive if differential input voltage reaches approximately 0.7 volts.
3. For operation above 25°C free-air temperature, refer to Dissipation Derating Curves, Section 2. In the J package, OP-227 chips are glass mounted.

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electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±15 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		OP-227E			OP-227F			OP-227G			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 0, R_S = 50 Ω	25°C		20	80		40	120		60	180	µV
			−25°C to 85°C		40	140		60	200		85	280	
α_{VIO}	Temperature coefficient of input offset voltage	R_P = 8 kΩ to 20 kΩ (nulled)	−25°C to 85°C		0.5	1		0.4	1.5		0.5	1.8	µV/°C
		Unnulled	−25°C to 85°C										
	Long-term drift of input offset voltage	See Note 4			0.2	1		0.3	1.5		0.4	2	µV/mo
	Offset adjustment range	R_P = 10 kΩ,	25°C		±4			±4			±4		mV
I_{IO}	Input offset current	V_O = 0	25°C		7	35		9	50		12	75	nA
			−25°C to 85°C		10	50		14	85		20	135	
I_{IB}	Input bias current	V_O = 0	25°C		±10	±40		±12	±55		±15	±80	nA
			−25°C to 85°C		±14	±60		±18	±95		±25	±150	
V_{ICR}	Common-mode input voltage range		25°C	±11	±12.3		±11	±12.3		±11	±12.3		V
			−25°C to 85°C	±10.5	±11.8		±10.5	±11.8		±10.5	±11.8		
V_{OM}	Maximum output voltage swing	R_L ≥ 600 kΩ	25°C	±10	±11.5		±10	±11.5		±10	±11.5		V
		R_L ≥ 2 kΩ		±12	±13.8		±12	±13.8		±11.5	±13.5		
			−25°C to 85°C	±11.7	±13.6		±11.4	±13.5		±11	±13.3		
A_{VD}	Large-signal differential voltage amplification	$V_{CC\pm}$ = ±4 V, V_O = ±1 V, R_L ≥ 600 Ω	25°C	250	700		250	700		200	500		V/mV
		V_O = ±10 V, R_L ≥ 1 kΩ		800	1500		800	1500			1500		
		V_O = ±10 V, R_L ≥ 2 kΩ		1000	1800		1000	1800		700	1500		
			−25°C to 85°C	750	1500		700	1500		450	1000		
r_i	Input resistance	Differential-mode	25°C	1.5	6		1.2	5		0.8	4		MΩ
		Common-mode			3			2.5			2		GΩ
CMRR	Common-mode rejection ratio	V_{IC} = ±11 V	25°C	114	126		106	123		100	120		dB
		V_{IC} = ±10 V	−25°C to 85°C	110	124		102	121		96	118		
k_{SVS}	Supply voltage sensitivity ($\Delta V_{IO}/\Delta V_{CC}$)	$V_{CC\pm}$ = ±4 V to ±18 V,	25°C		1	10		1	10		2	20	µV/V
		$V_{CC\pm}$ = ±4.5 V to ±18 V	−25°C to 85°C		2	15		2	16		2	32	
P_D	Power dissipation (each amplifier)	V_O = 0	25°C		90	140		90	140		90	140	mW

†All characteristics are measured under open-loop conditions with zero common-mode input voltage unless otherwise noted.

NOTE 4: Since long-term drift cannot be measured on the individual devices prior to shipment, this specification is not intended to be a guarantee or warranty. It is an engineering estimate of the averaged trend line of drift versus time over extended periods after the first thirty days of operation.

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operating characteristics, $V_{CC} = \pm 15$ V, $T_A = 25°C$

PARAMETER		TEST CONDITIONS	OP-227E			OP-227F			OP-227G			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
B_1	Unity-gain bandwidth		5	8		5	8		5	8		MHz
SR	Slew rate at unity gain		1.7	2.8		1.7	2.8		1.7	2.8		V/μs
V_{NPP}	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 10 Hz, R_S = 100 Ω		0.08	0.2		0.08	0.2		0.09	0.28	μV
V_n	Equivalent input noise voltage	f = 10 Hz, R_S = 100 Ω		3.5	6		3.5	6		3.8	9	nV/√Hz
		f = 30 Hz, R_S = 100 Ω		3.1	4.7		3.1	4.7		3.3	5.9	
		f = 1000 Hz, R_S = 100 Ω		3	3.9		3	3.9		3.2	4.6	
I_n	Equivalent input noise current	f = 10 Hz		1.7	4.5		1.7	4.5		1.7		pA/√Hz
		f = 30 Hz		1	2.5		1	2.5		1		
		f = 1 kHz		0.4	0.7		0.4	0.7		0.4	0.7	
V_{o1}/V_{o2}	Crosstalk attenuation	A_V = 100	126	154		126	154		126	154		dB

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