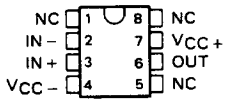
TYPES OP-12A, OP-12B, OP-12C, OP-12E, OP-12F, OP-12G PRECISION LOW-INPUT-CURRENT OPERATIONAL AMPLIFIERS

D2817, OCTOBER 1983

- **Internally Frequency Compensated**
- **Improved Version of LM108**
- **Direct Replacement for PMI OP-12A, OP-12B, OP-12C, OP-12E, OP-12F, and OP-12G.**

OP-12A, OP-12B, OP-12C . . . JG PACKAGE
OP-12E, OP-12F, OP-12G . . . D, JG, OR P PACKAGE
(TOP VIEW)



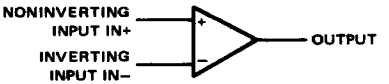
NC—No internal connection

description

The OP-12 devices are precision low-input-current internally compensated operational amplifiers. The devices are improved versions of the LM108 series. The OP-12 amplifiers exhibit low input bias current and input offset voltage and current to improve the accuracy of high-impedance circuits using these devices. The devices feature short-circuit protection and internal frequency compensation.

The OP-12A, OP-12B, and OP-12C are characterized for operation over the full military temperature range of −55°C to 125°C. The OP-12E, OP-12F, and OP-12G are characterized for operation from 0°C to 70°C.

symbol



DEVICE FEATURES

PARAMETER	OP-12A OP-12E	OP-12B OP-12F	OP-12C OP-12G
Input offset voltage (Max)	150 μV	300 μV	1000 μV
Temperature coefficient of input offset voltage (Max)	2.5 μV/°C	3.5 μV/°C	10 μV/°C
Input offset current (Max)	200 pA	200 pA	500 pA
Input bias current (Max)	2 nA	2 nA	5 nA
Common-mode input voltage range	±13 V	±13 V	±13 V
Power dissipation (Max)	6 mW	6 mW	8 mW

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

		OP-12A, OP-12B OP-12C	OP-12E, OP-12F OP-12G	UNIT
Supply voltage, V_{CC+} (see Note 1)		20	18	V
Supply voltage, V_{CC-} (see Note 1)		−20	−18	V
Input voltage (either input, see Note 2)		±15	±15	V
Differential input current (see Note 3)		±10	±10	mA
Duration of output short circuit (see Note 4)		unlimited	unlimited	
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 5)		500	500	mW
Operating free-air temperature range		−55 to 125	0 to 70	°C
Storage temperature range		−65 to 150	−65 to 150	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds	JG package	300	300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	D or P package		260	°C

NOTES: 1. All voltage values, except otherwise noted, are with respect to the midpoint between V_{CC+} and V_{CC-}.
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
3. The inputs are shunted with back-to-back diodes for input overvoltage protection. Therefore, excessive current will flow if a differential voltage in excess of 1 volt is applied between the inputs unless some limiting resistance is provided.
4. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded.
5. For operation above 25°C free-air temperature, refer to Dissipation Derating Curves, Section 2. In the JG packages, OP-12A, OP-12B, and OP-12C chips are alloy-mounted; OP-12E, OP-12F, and OP-12G chips are glass-mounted.

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electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±20 V for OP-12A and OP-12B, ±15 V for OP-12C (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		OP-12A			OP-12B			OP-12C			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage		25°C		0.07	0.15		0.18	0.3		0.25	1	mV
			−55°C to 125°C		0.12	0.35		0.28	0.6		0.4	2	
α_{VIO}	Average temperature coefficient of input offset voltage	V_O = 0	−55°C to 125°C		0.5	2.5		1	3.5		1.5	10	µV/°C
I_{IO}	Input offset current		25°C		0.05	0.2		0.05	0.2		0.08	0.5	nA
			−55°C to 125°C		0.12	0.4		0.12	0.4		0.18	1	
α_{IIO}	Average temperature coefficient of input offset current	V_O = 0	−55°C to 125°C		0.5	2.5		0.5	2.5		1	5	pA/°C
I_{IB}	Input bias current		25°C		0.8	2		0.8	2		1	5	nA
			−55°C to 125°C		1.2	3		1.2	3		1.8	10	
V_{ICR}	Common-mode input voltage range	V_{CC} = ±15 V	25°C	±13	±14		±13	±14		±13	±14		V
			−55°C to 125°C	±13	±14		±13	±14		±13	±14		
V_{OM}	Maximum peak output voltage swing	$V_{CC\pm}$ = ±15 V, R_L = 10 kΩ	25°C	±13	±14		±13	±14		±13	±14		V
		$V_{CC\pm}$ = ±15 V, R_L = 2 kΩ		±10	±12		±10	±12		±10	±12		
		$V_{CC\pm}$ = ±15 V, R_L = 10 kΩ	−55°C to 125°C	±13	±14		±13	±14		±13	±14		
		$V_{CC\pm}$ = ±15 V, R_L = 5 kΩ		±10	±13		±10	±13		±10	±12		
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V, R_L ≥ 10 kΩ	25°C	80	300		80	300		40	250		V/mV
		V_O = ±10 V, R_L ≥ 2 kΩ		50	150		50	150			100		
		V_O = ±10 V, R_L ≥ 5 kΩ	−55°C to 125°C	40	120		40	120		15	80		
B_1	Unity-gain bandwidth	A_{VD} = 1	25°C		0.8			0.8			0.8		MHz
r_i	Input resistance		25°C	26	70		26	70		10	50		MΩ
r_o	Output resistance		25°C		200			200			200		Ω
CMRR	Common-mode rejection ratio	V_{IC} = ±13 V	25°C	104	120		104	120		84	116		dB
			−55°C to 125°C	100	116		100	116		80	112		
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{CC\pm}/V_{IO}$)	V_{CC} = ±5 V to ±15 V	25°C	104	120		104	120		84	116		dB
			−55°C to 125°C	100	116		100	116		80	112		
P_D	Power dissipation	$V_{CC\pm}$ = ±15 V, V_O = 0, No load	−55°C to 125°C		9	18		9	18		15	24	mW
		$V_{CC\pm}$ = ±5 V, V_O = 0, No load	25°C		3	6		3	6		4	8	
I_{CC}	Supply current	$V_{CC\pm}$ = ±15 V, V_O = 0, No load	25°C		0.3	0.6		0.3	0.6		0.4	0.8	mA

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

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operating characteristics at 25°C free-air temperature, $V_{CC\pm}$ = ±20 V for OP-12A and OP-12B, ±15 V for OP-12C (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	OP-12A			OP-12B			OP-12C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	$R_L \geq 2\ k\Omega$		0.12			0.12			0.12		V/μs
V_n	Equivalent input noise voltage	f = 10 Hz		22			22			22		nV/√Hz
		f = 100 Hz		21			21			21		
		f = 1000 Hz		20			20			20		
I_n	Equivalent input noise current	f = 10 Hz		0.15			0.15			0.15		pA/√Hz
		f = 100 Hz		0.14			0.14			0.14		
		f = 1000 Hz		0.13			0.13			0.13		
V_{NPP}	Peak-to-peak input noise voltage	f = 0.1 Hz to 10 Hz		0.9			0.9			0.9		μV
I_{NPP}	Peak-to-peak input noise current	f = 0.1 Hz to 10 Hz		3			3			3		pA

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

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electrical characteristics at specified free-air temperature, $V_{CC\pm}$ = ±20 V for OP-12E and OP-12F, ±15 V for OP-12G (unless otherwise noted)

PARAMETER		TEST CONDITIONS†		OP-12E			OP-12F			OP-12G			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_O = 0, R_S = 50 Ω	25°C		0.07	0.15		0.18	0.3		0.25	1	mV
			0°C to 70°C		0.1	0.26		0.23	0.45		0.32	1.4	
α_{VIO}	Average temperature coefficient of input offset voltage	V_O = 0	0°C to 70°C		0.5	2.5		1	3.5		1.5	10	μV/°C
I_{IO}	Input offset current	V_O = 0	25°C		0.05	0.2		0.05	0.2		0.08	0.5	nA
			0°C to 70°C		0.08	0.3		0.11	0.6		0.12	0.7	
α_{IIO}	Average temperature coefficient of input offset current	V_O = 0	0°C to 70°C		0.5	2.5		1	5		1	5	pA/°C
I_{IB}	Input bias current	V_O = 0	25°C		0.8	2		0.8	2		1	5	nA
			0°C to 70°C		1	2.6		1.2	5.2		1.4	6.5	
V_{ICR}	Common-mode input voltage range	V_{CC} = ±15 V	25°C	±13	±14		±13	±14		±13	±14		V
			0°C to 70°C	±13	±14		±13	±14		±13	±14		
V_{OM}	Maximum peak output voltage swing	$V_{CC\pm}$ = ±15 V, R_L ≥ 10 kΩ	25°C	±13	±14		±13	±14		±13	±14		V
		$V_{CC\pm}$ = ±15 V, R_L ≥ 2 kΩ		±10	±12		±10	±12		±10	±12		
		$V_{CC\pm}$ = ±15 V, R_L ≥ 10 kΩ	0°C to 70°C	±13	±14		±13	±14		±13	±14		
		$V_{CC\pm}$ = ±15 V, R_L ≥ 5 kΩ		±10	±12		±10	±12		±10	±12		
A_{VD}	Large-signal differential voltage amplification	V_O = ±10 V, R_L ≥ 10 kΩ	25°C	80	300		80	300		40	250		V/mV
		V_O = ±10 V, R_L ≥ 2 kΩ		50	150		50	150			100		
		V_O = ±10 V, R_L ≥ 10 kΩ	0°C to 70°C	25	100		15	100			80		
		V_O = ±10 V, R_L ≥ 2 kΩ		60	200		60	200		25	150		
B_{OM}	Maximum-output swing bandwidth	A_{VD} = 1	25°C		0.8			0.8			0.8		MHz
r_i	Input resistance		25°C	26	70		26	70		10	50		MΩ
r_o	Output resistance		25°C		200			200			200		Ω
CMRR	Common-mode rejection ratio	V_{IC} = ±13 V, R_S = 50 Ω, V_O = 0	25°C	104	120		102	120		84	116		dB
			0°C to 70°C	100	116		100	116		80	112		
k_{SVR}	Supply voltage rejection ratio ($\Delta V_{CC\pm}/V_{IO}$)	V_{CC} = ±5 V to ±15 V, V_O = 0, R_S = 50 Ω	25°C	104	120		102	120		84	116		dB
			0°C to 70°C	100	116		100	116		80	112		
P_D	Power dissipation	$V_{CC\pm}$ = ±15 V, V_O = 0, No load	0°C to 70°C		9	18		9	18		15	24	mW
		$V_{CC\pm}$ = ±5 V, V_O = 0, No load	25°C		3	6		3	6		4	8	
I_{CC}	Supply current	$V_{CC\pm}$ = ±15 V, V_O = 0, No load	25°C		0.3	0.6		0.3	0.6		0.4	0.8	mA

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

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operating characteristics at 25°C free-air temperature, $V_{CC\pm}$ = ±20 V for OP-12E and OP-12F, ±15 V for OP-12G (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	OP-12E			OP-12F			OP-12G			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
SR	Slew rate at unity gain	$R_L \geq 2\ k\Omega$		0.12			0.12			0.12		V/μs
V_n	Equivalent input noise voltage	f = 10 Hz		22			22			22		nV/√Hz
		f = 100 Hz		21			21			21		
		f = 1000 Hz		20			20			20		
I_n	Equivalent input noise current	f = 10 Hz		0.15			0.15			0.15		pA/√Hz
		f = 100 Hz		0.14			0.14			0.14		
		f = 1000 Hz		0.13			0.13			0.13		
V_{NPP}	Peak-to-peak input noise voltage	f = 0.1 Hz to 10 Hz		0.9			0.9			0.9		μV
I_{NPP}	Peak-to-peak input noise current	f = 0.1 Hz to 10 Hz		3			3			3		pA

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

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