

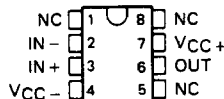
- Internally Frequency Compensated
- Improved Version of LM108
- Direct Replacement for PMI OP-12A, OP-12B, OP-12C, OP-12E, OP-12F, and OP-12G.

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.

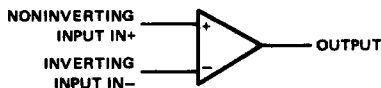
The OP-12A, OP-12B, and OP-12C are characterized for operation over the full military temperature range of -55°C to 125°C . The OP-12E, OP-12F, and OP-12G are characterized for operation from 0°C to 70°C .

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

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 $\mu\text{V}/^{\circ}\text{C}$	3.5 $\mu\text{V}/^{\circ}\text{C}$	10 $\mu\text{V}/^{\circ}\text{C}$
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	$\pm 13\text{ V}$	$\pm 13\text{ V}$	$\pm 13\text{ V}$
Power dissipation (Max)	6 mW	6 mW	8 mW

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

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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Operational Amplifiers

**TYPES OP-12A, OP-12B, OP-12C
PRECISION LOW-INPUT-CURRENT OPERATIONAL AMPLIFIERS**

electrical characteristics at specified free-air temperature, $V_{CC} \pm = \pm 20$ 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	0.15	0.18	0.3	0.25	1		mV	
	-55°C to 125°C	0.12	0.35	0.6	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	3.5	1	3.5	1.5	10		$\mu V/^\circ C$	
I_{IO} Input offset current	25°C	0.05	0.2	0.2	0.05	0.2	0.08	0.5		nA	
	-55°C to 125°C	0.12	0.4	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	2.5	0.5	2.5	1	5		$PA/^\circ C$	
I_{IB} Input bias current	25°C	0.8	2	2	0.8	2	1	5		nA	
	-55°C to 125°C	1.2	3	3	1.2	3	1.8	10			
V_{ICR} Common-mode input voltage range	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	$V_{CC} \pm = \pm 15$ V, $R_L = 10$ k Ω $V_{CC} \pm = \pm 15$ V, $R_L = 2$ k Ω $V_{CC} \pm = \pm 15$ V, $R_L = 10$ k Ω $V_{CC} \pm = \pm 15$ V, $R_L = 5$ k Ω	± 13	± 14		± 13	± 14	± 13	± 14		V	
	$V_O = \pm 10$ V, $R_L \geq 10$ k Ω	80	300		80	300	40	250		V/mV	
	$V_O = \pm 10$ V, $R_L \geq 2$ k Ω	50	150		50	150	100	100			
	$V_O = \pm 10$ V, $R_L \geq 5$ k Ω	40	120		40	120	15	80			
A_{VD} Large-signal differential voltage amplification	$V_O = \pm 10$ V, $R_L \geq 5$ k Ω	40	120		40	120	15	80			
B_1 Unity-gain bandwidth	$A_{VD} = 1$ 25°C	0.8	0.8		0.8	0.8	0.8	0.8		MHz	
r_i Input resistance	25°C	26	70		26	70	10	50		M Ω	
r_o Output resistance	25°C	200	200		200	200	200	200		Ω	
CMRR Common-mode rejection ratio	25°C	104	120		104	120	84	116		dB	
	-55°C to 125°C	100	116		100	116	80	112			
KSVR Supply voltage rejection ratio ($\Delta V_{CC} \pm / V_{IO}$)	$V_{IC} = \pm 13$ V 25°C	104	120		104	120	84	116		dB	
	$V_{CC} = \pm 5$ V to ± 15 V -55°C to 125°C	100	116		100	116	80	112			
P_D Power dissipation	$V_{CC} \pm = \pm 15$ V, $V_O = 0$, No load -55°C to 125°C	9	18		9	18	15	24		mW	
	$V_{CC} \pm = \pm 5$ V, $V_O = 0$, No load 25°C	3	6		3	6	4	8			
I_{CC} Supply current	$V_{CC} \pm = \pm 15$ 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.



Operational Amplifiers

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

operating characteristics at 25°C free-air temperature, $V_{CC\pm} = \pm 20$ 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 Ω	0.12			0.12			0.12			V/ μ s
V_n Equivalent input noise voltage	f = 10 Hz	22			22			22			nV/ \sqrt{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/ \sqrt{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			μ V
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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Operational Amplifiers

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

electrical characteristics at specified free-air temperature, $V_{CC} \pm = \pm 20$ 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}	$V_O = 0, R_S = 50 \Omega$ 25°C 0°C to 70°C	0.07	0.15	0.3	0.18	0.3	0.45	0.25	1	1.4	mV
α_{VIO}	$V_O = 0$ 0°C to 70°C	0.5	2.5	3.5	1	3.5		1.5	10		$\mu V/^\circ C$
I_{IO}	$V_O = 0$ 25°C 0°C to 70°C	0.05	0.2	0.2	0.05	0.2	0.6	0.08	0.5	0.7	nA
α_{IIO}	$V_O = 0$ 0°C to 70°C	0.06	0.3		0.11	0.6		0.12	0.7		nA
I_{IB}	$V_O = 0$ 25°C 0°C to 70°C	0.5	2.5	2	1	5	2	1	5	5	$\mu A/^\circ C$
V_{ICR}	$V_O = 0$ Common-mode input voltage range $V_{CC} = \pm 15$ V	0.8	2	2	0.8	2	5.2	1	5	6.5	nA
VOM	Maximum peak output voltage swing $V_{CC} \pm = \pm 15$ V, $R_L \geq 10$ k Ω	± 13	± 14		± 13	± 14		± 13	± 14		V
	$V_{CC} \pm = \pm 15$ V, $R_L \geq 2$ k Ω	± 13	± 14		± 13	± 14		± 13	± 14		V
	$V_{CC} \pm = \pm 15$ V, $R_L \geq 10$ k Ω	± 10	± 12		± 10	± 12		± 10	± 12		V
	$V_{CC} \pm = \pm 15$ V, $R_L \geq 5$ k Ω	± 10	± 12		± 10	± 12		± 10	± 12		V
AVD	Large-signal differential voltage amplification $V_O = \pm 10$ V, $R_L \geq 10$ k Ω	80	300	300	80	300	250	40	250		V/mV
	$V_O = \pm 10$ V, $R_L \geq 2$ k Ω	50	150	150	50	150	100	50	100		V/mV
	$V_O = \pm 10$ V, $R_L \geq 10$ k Ω	25	100	100	15	100	80	15	80		V/mV
	$V_O = \pm 10$ V, $R_L \geq 2$ k Ω	60	200	200	60	200	150	25	150		V/mV
BOM	$AVD = 1$ Maximum-output swing bandwidth	0.8			0.8			0.8			MHz
f_i	Input resistance	26	70	200	26	70	200	10	50	200	M Ω
r_o	Output resistance	200			200			200			Ω
CMRR	Common-mode rejection ratio $V_{IC} = \pm 13$ V, $R_S = 50 \Omega$, $V_O = 0$	104	120		102	120		84	116		dB
	Supply voltage rejection ratio $(\Delta V_{CC} \pm / V_O)$ $V_{CC} = \pm 5$ V to ± 15 V, $V_O = 0, R_S = 50 \Omega$	100	116		100	116		80	112		dB
PD	$V_{CC} \pm = \pm 15$ V, $V_O = 0$, No load	104	120		102	120		84	116		dB
	$V_{CC} \pm = \pm 15$ V, $V_O = 0$, No load	100	116		100	116		80	112		dB
Power dissipation	$V_{CC} \pm = \pm 15$ V, $V_O = 0$, No load	9	18		9	18		15	24		mW
	$V_{CC} \pm = \pm 5$ V, $V_O = 0$, No load	3	6		3	6		4	6		mW
I_{CC}	$V_{CC} \pm = \pm 15$ V, $V_O = 0$, No load	0.3	0.6	0.6	0.3	0.6	0.6	0.4	0.8	0.8	mA

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



**TYPES OP-12E, OP-12F, OP-12G
PRECISION LOW-INPUT-CURRENT OPERATIONAL AMPLIFIERS**

operating characteristics at 25 °C free-air temperature, $V_{CC\pm} = \pm 20$ 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 Ω	0.12			0.12			0.12			V/ μ s
V_n	Equivalent input noise voltage	f = 10 Hz			22			22			nV $\sqrt{\text{Hz}}$
		f = 100 Hz			21			21			
		f = 1000 Hz			20			20			
I_n	Equivalent input noise current	f = 10 Hz			0.15			0.15			pA $\sqrt{\text{Hz}}$
		f = 100 Hz			0.14			0.14			
		f = 1000 Hz			0.13			0.13			
V_{NPP}	Peak-to-peak input noise voltage	f = 0.1 Hz to 10 Hz			0.9			0.9			μ V
I_{NPP}	Peak-to-peak input noise current	f = 0.1 Hz to 10 Hz			3			3			pA

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

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Operational Amplifiers