



Low Power Precision Operational Amplifier

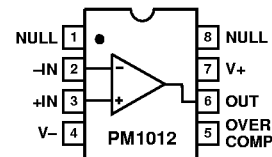
PM1012

FEATURES

- Low Supply Current: 600 μ A Max
- Very Low Offset: 35 μ V Max
- Low Drift: 1.5 μ V/ $^{\circ}$ C Max
- Very Low Bias Current
25 $^{\circ}$ C: 100 pA Max
- Low Noise: 0.5 μ V p-p Typ
- High Common-Mode Rejection: 114 dB Min

PIN CONNECTIONS

- Plastic Mini-DIP (P Suffix)
- 8-Lead SO (S Suffix)



GENERAL DESCRIPTION

The PM1012 is a general purpose, precision operational amplifier. Offering several performance enhancements over industry-standard precision op amps such as the OP07, the PM1012 requires less than 1/6 the supply current. These enhancements include exceptionally low bias currents of only ± 80 pA, typical, over the full military temperature range, and 132 dB of common-mode rejection and power-supply rejection. The PM1012's low offset voltage of 35 μ V maximum frees the user from external nulling in most circuits.

An open-loop gain of two million into a 10 k Ω load ensures that excellent linearity is maintained even in high gain configurations, and 5 mA of output current allows 2 k Ω loads to be driven with an open-loop gain of one million. The PM1012 offers low noise, especially for a low power amplifier—only 17 nV/ $\sqrt{\text{Hz}}$ at 10 Hz. Exceptionally low current noise minimizes

noise contributions when high source impedances are used. The PM1012 may be overcompensated, using Pin 5 to limit the amplifier's bandwidth, further reducing system noise and increasing stability with large capacitive loads.

The PM1012 conforms to the OP07 pinout with nulling through Pins 1 and 8 to the positive supply. It offers an upgrade to the OP07 in sockets where reduced power dissipation or low bias currents are attractive. It may also be used as an upgrade from the OP12, OP05 and 725 type op amps. The PM1012 may replace 741 type op amps by removing the nulling potentiometer, if used.

REV. C

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One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781/329-4700 World Wide Web Site: <http://www.analog.com>
Fax: 781/326-8703 © Analog Devices, Inc., 1998

PM1012–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (@ $V_S = \pm 15\text{ V}$, $V_{CM} = 0\text{ V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Conditions	PM1012G			Units
			Min	Typ	Max	
Input Offset Voltage	V_{OS}	(Note 1)		10 25	50 120	μV μV
Long-Term V_{OS} Stability	$\Delta V_{OS}/\text{Time}$			0.3		$\mu\text{V}/\text{Month}$
Input Offset Current	I_{OS}	(Note 1)		20 30	150 200	pA pA
Input Bias Current	I_B	(Note 1)		± 30 ± 40	± 150 ± 200	pA pA
Input Noise Voltage	$e_{n\text{P-P}}$	0.1 Hz to 10 Hz		0.5		$\mu\text{V p-p}$
Input Noise Voltage Density	e_n	$f_O = 10\text{ Hz}^2$ $f_O = 1000\text{ Hz}^3$		17 14	30 22	$\text{nV}/\sqrt{\text{Hz}}$ $\text{nV}/\sqrt{\text{Hz}}$
Input Noise Current Density	I_n	$f_O = 10\text{ Hz}$		20		$\text{fA}/\sqrt{\text{Hz}}$
Large-Signal Voltage Gain	A_{VO}	$V_O = \pm 12\text{ V}$; $R_L = 10\text{ k}\Omega$ $V_O = \pm 10\text{ V}$; $R_L = 2\text{ k}\Omega$	200 120	2000 1000		V/mV V/mV
Common-Mode Rejection	CMR	$V_{CM} = \pm 13.5\text{ V}$	110	132		dB
Power-Supply Rejection	PSR	$V_S = \pm 2\text{ V}$ to $\pm 20\text{ V}$	110	132		dB
Input Voltage Range	IVR	(Note 4)	± 13.5	± 14.0		V
Output Voltage Swing	V_O	$R_L = 10\text{ k}\Omega$	± 13	± 14		V
Slew Rate	SR		0.1	0.2		$\text{V}/\mu\text{s}$
Full-Power Bandwidth	BW_P			3		kHz
Gain Bandwidth Product	GBW	$A_V = +100$		0.5		MHz
Supply Current	I_{SY}	(Note 1)		380	600	μA
Supply Voltage	V_S	Operating Range	± 2	± 15	± 20	V

NOTES

¹These specifications apply for $\pm 2\text{ V} \leq V_S \leq \pm 20\text{ V}$ and $-13.5\text{ V} \leq V_{CM} \leq +13.5\text{ V}$ (for $V_S = \pm 15\text{ V}$).

²10 Hz noise voltage density is sample tested. Devices 100% tested for noise are available on request.

³Sample tested.

⁴Guaranteed by CMR test.

Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS (@ $V_S = \pm 15\text{ V}$, $V_{CM} = 0\text{ V}$, $-40^\circ\text{C} \leq T_A \leq +85^\circ\text{C}$ for PM1012GP, GS, unless otherwise noted)

Parameter	Symbol	Conditions	PM1012G			Units
			Min	Typ	Max	
Input Offset Voltage	V_{OS}			20 30	120 200	μV μV
Average Temperature Coefficient of V_{OS}	TCV_{OS}	(Note 1)		0.2	1.5	$\mu\text{V}/^\circ\text{C}$
Input Offset Current	I_{OS}	(Note 1)		20 40	230 300	pA pA
Average Temperature Coefficient of I_{OS}	TCI_{OS}			0.3	2.5	$\text{pA}/^\circ\text{C}$
Input Bias Current	I_B	(Note 1)		± 35 ± 50	± 230 ± 300	pA pA
Average Temperature Coefficient of I_B	TCI_B			0.3	2.5	$\text{pA}/^\circ\text{C}$
Large Signal Voltage Gain	A_{VO}	$V_O = \pm 12\text{ V}$; $R_L = 10\text{ k}\Omega$ $V_O = \pm 10\text{ V}$; $R_L = 2\text{ k}\Omega$	150 100	1500 800		V/mV V/mV
Common-Mode Rejection	CMR	$V_{CM} = \pm 13.5\text{ V}$	108	130		dB
Power Supply Rejection	PSR	$V_S = \pm 2.5\text{ V}$ to $\pm 20\text{ V}$	108	128		dB
Input Voltage Range	IVR	(Note 2)	± 13.5	± 14.0		V
Output Voltage Swing	V_O	$R_L = 10\text{ k}\Omega$	± 13	± 14		V
Slew Rate	SR		0.05	0.15		$\text{V}/\mu\text{s}$
Supply Current	I_{SY}	(Note 1)		400	800	μA
Supply Voltage	V_S	Operating Range	± 2.5	± 15	± 20	V

NOTES

¹These specifications apply for $\pm 2.5\text{ V} \leq V_S \leq \pm 20\text{ V}$ and $-13.5\text{ V} \leq V_{CM} \leq +13.5\text{ V}$ (for $V_S = \pm 15\text{ V}$).

²Guaranteed by CMR test.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS¹

Supply Voltage	±20 V
Input Voltage ²	±20 V
Differential Input Voltage ³	±1 V
Differential Input Current ³	±10 mA
Output Short-Circuit Duration	Indefinite
Operating Temperature Range	
PM1012G (P, S)	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 60 sec)	+300°C

Package Type	θ_{JA} ⁴	θ_{JC}	Units
8-Lead Plastic DIP (P)	103	43	°C/W
8-Lead SO (S)	158	43	°C/W

NOTES

- ¹Absolute maximum ratings apply to both DICE and packaged parts, unless otherwise noted.
- ²For supply voltages less than ±20 V, the absolute maximum input voltage is equal to the supply voltage.
- ³The PM1012's inputs are protected by back-to-back diodes. Current-limiting resistors are not used in order to achieve low noise. Differential input voltages greater than 1 V will cause excessive current to flow through the input protection diodes unless limiting resistance is used.
- ⁴ θ_{JA} is specified for worst case mounting conditions, i.e., θ_{JA} is specified for device in socket for cerdip, and P-DIP packages; θ_{JA} is specified for device soldered to printed circuit board for SO package.

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Options
PM1012GP	-40°C to +85°C	Plastic DIP	N-8
PM1012GS	-40°C to +85°C	SOIC	SO-8

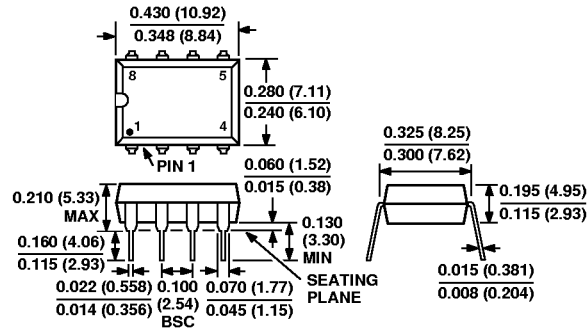
CAUTION

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the PM1012 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



OUTLINE DIMENSIONS
 Dimensions shown in inches and (mm).

**8-Lead Plastic DIP
 (N-8)**



**8-Lead SOIC
 (SO-8)**

