ANALOG DEVICES

Low Power Precision Operational Amplifier

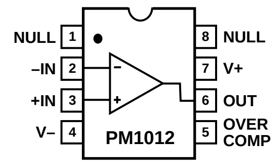
PM1012

FEATURES

Low Supply Current: 600 μA Max
Very Low Offset: 35 μV Max
Low Drift: 1.5 μV/°C Max
Very Low Bias Current
25°C: 100 pA Max
Low Noise: 0.5 μV 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 μV maximum frees the user from external nulling in most circuits.

An open-loop gain of two million into a 10 kΩ load ensures that excellent linearity is maintained even in high gain configurations, and 5 mA of output current allows 2 kΩ 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.

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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

PM1012–SPECIFICATIONS

ELECTRICAL CHARACTERISTICS (@ V_S = ±15 V, V_{CM} = 0 V, T_A = +25°C, unless otherwise noted)

Parameter	Symbol	Conditions	PM1012G Min	PM1012G Typ	PM1012G Max	Units
Input Offset Voltage	V_{OS}	(Note 1)		10	50	µV
				25	120	µV
Long-Term V_{OS} Stability	ΔV_{OS}/Time			0.3		µV/Month
Input Offset Current	I_{OS}	(Note 1)		20	150	pA
				30	200	pA
Input Bias Current	I_B	(Note 1)		±30	±150	pA
				±40	±200	pA
Input Noise Voltage	e_n p-p	0.1 Hz to 10 Hz		0.5		µV p-p
Input Noise Voltage Density	e_n	f_O = 10 Hz[2]		17	30	$nV/\sqrt{Hz}$
		f_O = 1000 Hz[3]		14	22	$nV/\sqrt{Hz}$
Input Noise Current Density	I_n	f_O = 10 Hz		20		$fA/\sqrt{Hz}$
Large-Signal Voltage Gain	A_{VO}	V_O = ±12 V; R_L = 10 kΩ	200	2000		V/mV
		V_O = ±10 V; R_L = 2 kΩ	120	1000		V/mV
Common-Mode Rejection	CMR	V_{CM} = ±13.5 V	110	132		dB
Power-Supply Rejection	PSR	V_S = ±2 V to ±20 V	110	132		dB
Input Voltage Range	IVR	(Note 4)	±13.5	±14.0		V
Output Voltage Swing	V_O	R_L = 10 kΩ	±13	±14		V
Slew Rate	SR		0.1	0.2		V/µs
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
[1]These specifications apply for ±2 V ≤ V_S ≤ ±20 V and –13.5 V ≤ V_{CM} ≤ +13.5 V (for V_S = ±15 V).
[2]10 Hz noise voltage density is sample tested. Devices 100% tested for noise are available on request.
[3]Sample tested.
[4]Guaranteed by CMR test.
Specifications subject to change without notice.

ELECTRICAL CHARACTERISTICS (@ V_S = ±15 V, V_{CM} = 0 V, –40°C ≤ T_A ≤ +85°C for PM1012GP, GS, unless otherwise noted)

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

NOTES
[1]These specifications apply for ±2.5 V ≤ V_S ≤ ±20 V and –13.5 V ≤ V_{CM} ≤ +13.5 V (for V_S = ±15 V).
[2]Guaranteed by CMR test.
Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

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
[1]Absolute maximum ratings apply to both DICE and packaged parts, unless otherwise noted.
[2]For supply voltages less than ±20 V, the absolute maximum input voltage is equal to the supply voltage.
[3]The 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

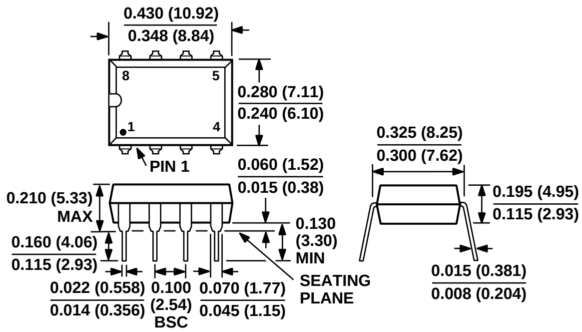
CAUTION

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.

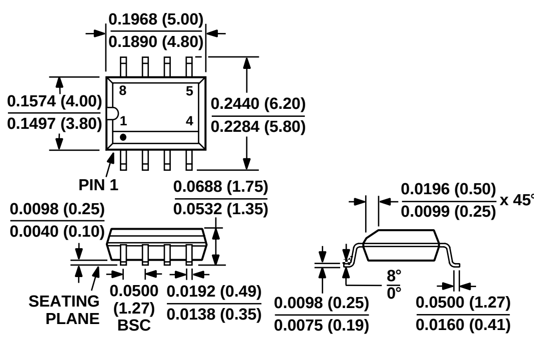
OUTLINE DIMENSIONS

Dimensions shown in inches and (mm).

8-Lead Plastic DIP (N-8)



8-Lead SOIC (SO-8)



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