



PM-146/PM-246

PROGRAMMABLE QUAD
OPERATIONAL AMPLIFIER

Precision Monolithics Inc.

ADVANCE PRODUCT INFORMATION

FEATURES

- **Wide Supply Range** $\pm 1.2V$ to $\pm 22V$
- **Programmable Operation**
Supply Current (per Amplifier) $3.5\mu A$ to $1.75mA$
Gain-Bandwidth Product $10kHz$ to $4MHz$
- **High Gain** $100dB$ Min*
- **Low Noise** $28nV/\sqrt{Hz}$ Typ*
- **High Power-Supply Rejection** $80dB$ Min*
- **Excellent Channel Separation** $120dB$ Typ*

* At $I_{SET} = 10\mu A$.

ORDERING INFORMATION†

$T_A = 25^\circ C$ V_{OS} MAX (mV)**	CERAMIC DIP PACKAGE	OPERATING TEMPERATURE RANGE
5	PM146Q*	MIL
6	PM246Q	IND

* For devices processed in total compliance to MIL-STD-883, add /883 after part number. Consult factory for 883 data sheet.

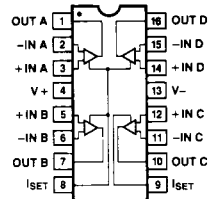
** At $I_{SET} = 10\mu A$.

† All commercial and industrial temperature range parts are available with burn-in. For ordering information see 1986 Data Book, Section 2.

CROSS REFERENCE

PMI	NATIONAL	EXAR
PM146Q	LM146J	XR-146M
PM246Q	LM246J	XR-246N

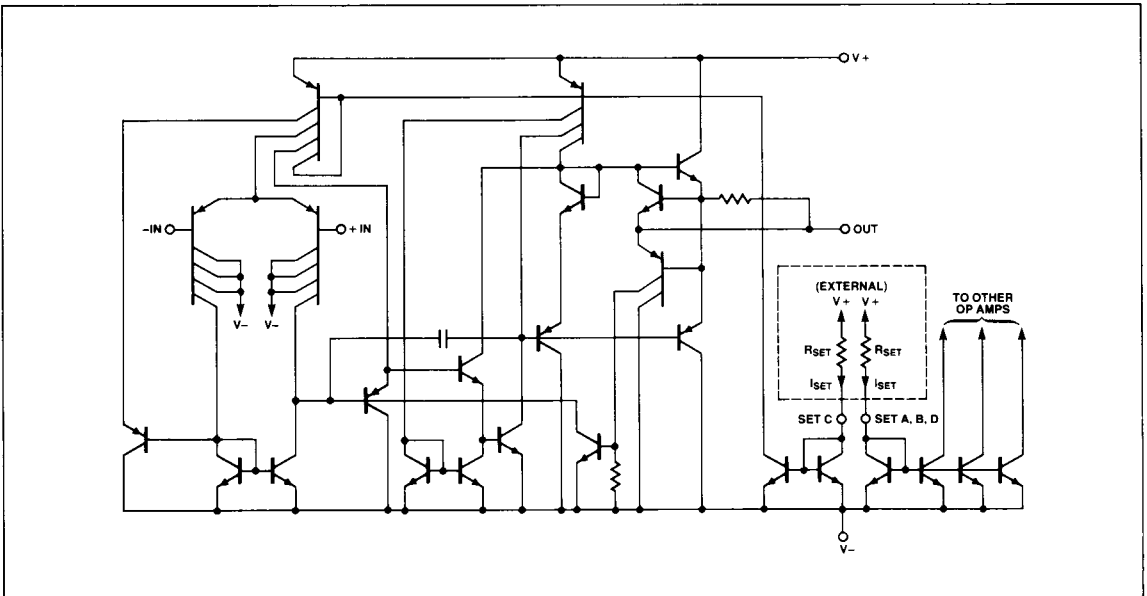
PIN CONNECTIONS



16-PIN CERAMIC DIP
(Q-Suffix)

16-PIN EPOXY DIP
(P-Suffix)

SIMPLIFIED SCHEMATIC



This advance product information describes a product in development at the time of this printing. Final specifications may vary. Please contact local sales office or distributor for final data sheet.



GENERAL DESCRIPTION

The PM-146 monolithic quad operational amplifier incorporates four independent programmable low-power amplifiers. Using two external resistors, the supply currents may be programmed for the optimal combination of bias and offset currents, gain-bandwidth product, slew rate, input noise, and output currents. By means of this capability, the user can achieve the required level of speed and performance while maintaining the minimum possible power consumption.

Gain-bandwidth products of 2MHz with slew rates of 1V/ μ s, at a supply current drain of 1mA per amplifier, are achieved using a programming ("set") current of 30 μ A. At the other end of the spectrum, bias currents of 1nA at a supply drain of only 3.5 μ A per amplifier are obtained with a set current of 0.1 μ A for applications where speed is not important.

The PM-146 operates with a supply voltage down to ± 1.5 V, which makes the amplifier well-suited to applications utilizing battery or solar-cell supplies. Since speed is controlled by the programming current, the slew rate and gain-bandwidth of the PM-146 remain relatively unchanged with varying supply voltages. The extreme versatility afforded by the PM-146's programmability allows the device to be tailored to a wide variety of applications, including active filters, oscillators, and general-purpose amplifiers.

The pin configuration of the PM-146 matches the OP-11 pin-out, with the addition of the two programming pins on one end. These pins are internally protected to survive a momentary short to the power supply rails.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15$ V, $I_{SET} = 10\mu$ A, $T_A = 25^\circ$ C, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-146Q			PM-246Q			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{OS}	$R_S \leq 50\Omega$ (Note 1)	—	0.5	5	—	0.5	6	mV
Input Offset Current	I_{OS}	(Note 1)	—	2	20	—	2	100	nA
Input Bias Current	I_B	(Note 1)	—	50	100	—	50	250	nA
Supply Current (4 Op Amps)	I_{SV}		—	1.4	2.0	—	1.4	2.5	mA
Open Loop Voltage Gain	A_{VO}	$R_L = 10k\Omega$, $\Delta V_{OUT} = \pm 10$ V	100	1000	—	50	1000	—	V/mV
Input Voltage Range	IVR	(Note 2)	± 13.5	± 14	—	± 13.5	± 14	—	V
Common-Mode Rejection	CMR	$V_{CM} = \pm 13.5$ V, $R_S \leq 10k\Omega$	80	100	—	70	100	—	dB
Power-Supply Rejection	PSR	$R_S \leq 10k\Omega$	80	100	—	74	100	—	dB
Output Voltage Swing	V_O	$R_L \geq 10k\Omega$	± 12	± 14	—	± 12	± 14	—	V
Short-Circuit Output Current	I_{SC}		5	20	35	5	20	35	mA
Gain-Bandwidth Product	GBW		0.8	1.2	—	0.5	1.2	—	MHz
Phase Margin	ϕ_o		—	60	—	—	60	—	Degrees
Slew Rate	SR		—	0.4	—	—	0.4	—	V/ μ s
Input Noise Voltage Density	e_n	$f = 1$ kHz	—	28	—	—	28	—	nV/ \sqrt Hz
Channel Separation	CS	$R_L = 10k\Omega$, $\Delta V_{OUT} = 0$ V to ± 12 V	—	120	—	—	120	—	dB
Input Resistance	R_{IN}		—	1.0	—	—	1.0	—	M Ω
Input Capacitance	C_{IN}		—	2.0	—	—	2.0	—	pF

NOTES:

- $V_{CM} = 0$ V.
- Guaranteed by CMR test.



ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $I_{SET} = 10\mu A$, $-55^\circ C \leq T_A \leq +125^\circ C$ for PM-146Q, $-25^\circ C \leq T_A \leq +85^\circ C$ for PM-246Q, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-146Q			PM-246Q			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{OS}	$R_S \leq 50\Omega$ (Note 1)	—	0.5	6	—	0.5	7.5	mV
Input Offset Current	I_{OS}	(Note 1)	—	2	25	—	2	100	nA
Input Bias Current	I_B	(Note 1)	—	50	100	—	50	250	nA
Supply Current (4 Op Amps)	I_{SY}		—	1.5	2.0	—	1.5	2.5	mA
Open Loop Voltage Gain	A_{VO}	$R_L = 10k\Omega$, $\Delta V_{OUT} = \pm 10V$	50	1000	—	25	1000	—	V/mV
Input Voltage Range	IVR	(Note 2)	± 13.5	± 14	—	± 13.5	± 14	—	V
Common-Mode Rejection	CMR	$R_S \leq 50\Omega$ $V_{CM} = \pm 13.5V$	70	100	—	70	100	—	dB
Power-Supply Rejection	PSR	$R_S \leq 50\Omega$	76	100	—	74	100	—	dB
Output Voltage Swing	V_O	$R_L \geq 10k\Omega$	± 12	± 14	—	± 12	± 14	—	V

NOTES:

- $V_{CM} = 0V$.
- Guaranteed by CMR test.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $I_{SET} = 1\mu A$, $T_A = 25^\circ C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-146Q			PM-246Q			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{OS}	$R_S \leq 50\Omega$ (Note 1)	—	0.5	5	—	0.5	7	mV
Input Bias Current	I_B	(Note 1)	—	7.5	20	—	7.5	100	nA
Supply Current (4 Op Amps)	I_{SY}		—	140	250	—	140	300	μA
Gain-Bandwidth Product	GBW		80	100	—	50	100	—	kHz

NOTE:

- $V_{CM} = 0V$.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 1.5V$, $I_{SET} = 10\mu A$, $T_A = 25^\circ C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-146Q			PM-246Q			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Input Offset Voltage	V_{OS}	$R_S \leq 50\Omega$ (Note 1)	—	0.5	5	—	0.5	7	mV
Input Voltage Range	IVR	(Note 2)	± 0.7	—	—	± 0.7	—	—	V
Common-Mode Rejection	CMR	$R_S \leq 50\Omega$ $V_{CM} = \pm 0.7V$	—	80	—	—	80	—	dB
Output Voltage Swing	V_O	$R_L \geq 10k\Omega$	± 0.6	—	—	± 0.6	—	—	V

NOTES:

- $V_{CM} = 0V$.
- Guaranteed by CMR test.