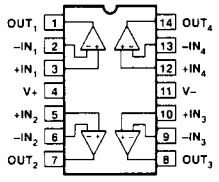
FEATURES

Improved Specifications Over Industry Standard LM148

- **Input Offset Voltage** . . . . . **2.5mV Max**
- **Input Offset Current** . . . . . **10nA Max**
- **Input Bias Current** . . . . . **75nA Max**
- **Small Signal Bandwidth** . . . . . **0.8MHz Typ**
- **Common-Mode Rejection Ratio** . . . . . **105dB Typ**
- **Power Supply Rejection Ratio** . . . . . **115dB Typ**
- **Phase Margin** . . . . . **80° Typ**
- **Available in Die Form**

Fully Specified Over Military and Industrial Temperature Range

PIN CONNECTIONS



14-PIN HERMETIC DIP
(Y-Suffix)

ORDERING INFORMATION†

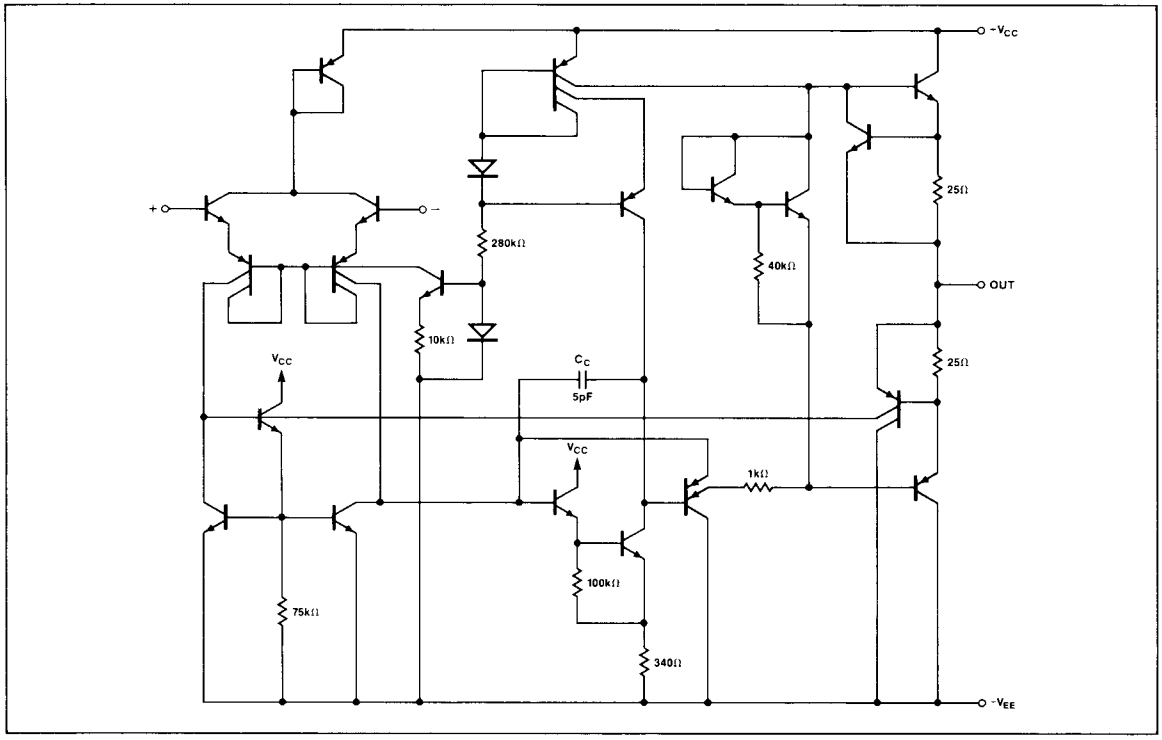
V_{OS} MAX (mV)	PACKAGE	OPERATING TEMPERATURE RANGE
2.5	PM-148Y	MIL
2.5	PM-248Y	IND

† Burn-in is available on commercial and industrial temperature range parts in CerDIP, plastic DIP, and TO-can packages. For ordering information, see PMI's Data Book, Section 2.

GENERAL DESCRIPTION

The PM-148 is Precision Monolithics' improved version of the industry-standard LM148 quad 741, high gain, internally compensated, low-power operational amplifier, offered over the full military and industrial temperature ranges. The PM-148 provides functional characteristics identical to the LM148 and is a pin-for-pin replacement with significant improvements on the key parameters of input offset voltage, input bias current, and input offset current.

SIMPLIFIED SCHEMATIC (One of Four Amplifiers)



Excellent isolation between amplifiers is achieved by independently biasing each amplifier and using layout techniques that minimize thermal coupling.

The PM-148 can be used anywhere multiple 741 or 1558 type amplifiers are being used and in applications where amplifier matching or high packing density is required. The improved performance of the PM-148 allows immediate upgrading of LM148 applications.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... ±22V
Differential Input Voltage ..... ±44V
Input Voltage ..... ±22V
Output Short Circuit Duration (Note 1) ..... Continuous
Maximum Junction Temperature ..... +150°C
Operating Temperature Range
PM-148 ..... $-55°C \le T_A \le +125°C$
PM -248 ..... $-25°C \le T_A +85°C$
Storage Temperature Range ..... −65°C to +150°C
Lead Temperature Range ..... +300°C

PACKAGE TYPE	Θ_{JA} (Note 2)	Θ_{JC}	UNITS
14-Pin Hermetic DIP (Y)	108	16	°C/W

NOTES:
1. Any of the amplifier outputs can be shorted to ground indefinitely; however, more than one should not be simultaneously shorted as the maximum junction temperature will be exceeded.
2. Θ_{JA} is specified for worst case mounting conditions, i.e., Θ_{JA} is specified for device in socket for CerDIP package.

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $T_A = 25°C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-148/PM-248 MIN	TYP	MAX	UNITS
Input Offset Voltage	V_{OS}	$R_S \le 10k\Omega$	—	0.1	2.5	mV
Input Offset Current	I_{OS}		—	0.1	10	nA
Input Bias Current	I_B		—	20	75	nA
Input Resistance	R_{IN}	(Note 1)	0.8	2.5	—	MΩ
Supply Current	I_{SY}	$V_S = \pm 15V$	—	2.4	3.6	mA
Large Signal Voltage Gain	A_{VO}	$V_S = \pm 15V$ $V_{OUT} = \pm 10V$, $R_L \ge 2k\Omega$	50	150	—	V/mV
Positive Short Circuit Current	I_{SC}^+		—	18	—	mA
Negative Short Circuit Current	I_{SC}^-		—	36	—	mA
Common-Mode Rejection Ratio	CMRR	$R_S \le 10k\Omega$	80	105	—	dB
Input Voltage Range	IVR	$V_S = \pm 15V$	±12	—	—	V
Power Supply Rejection Ratio	PSRR	$R_S \le 10k\Omega$	85	115	—	dB
Output Voltage Swing	V_O	$V_S = \pm 15V$ $R_L = 10k\Omega$ $R_L = 2k\Omega$	±12 ±11	±13 ±12.5	— —	V
Slew Rate	SR	$A_V = 1$	—	0.4	—	V/μs
Small Signal Bandwidth	BW		—	0.8	—	MHz
Phase Margin	0°	$A_V = 1$	—	80	—	degrees

NOTE:
1. Guaranteed by formula $R_{IN} = \frac{4KT}{qI_B}$.

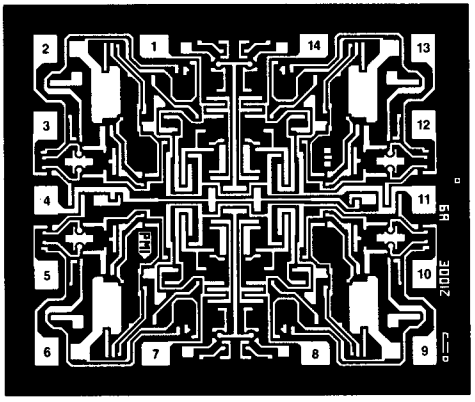
ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $-55°C \leq T_A \leq +125°C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-148 MIN	PM-148 TYP	PM-148 MAX	UNITS
Input Offset Voltage	V_{OS}	$R_S \leq 10k\Omega$	—	0.6	6	mV
Input Offset Current	I_{OS}		—	0.5	25	nA
Input Bias Current	I_B		—	30	100	nA
Supply Current	I_{SY}	$V_S = \pm 15V$, $T_A \leq +125°C$	—	2.4	3.6	mA
		$V_S = \pm 15V$, $T_A \geq -55°C$	—	3.5	4.5	
Large Signal Voltage Gain	A_{VO}	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L \geq 2k\Omega$	25	75	—	V/mV
Common-Mode Rejection Ratio	CMRR	$R_S \leq 10k\Omega$	80	100	—	dB
Power Supply Rejection Ratio	PSRR		80	95	—	dB
Output Voltage Swing	V_O	$V_S = \pm 15V$, $R_L = 10k\Omega$	±12	±13	—	V
		$V_S = \pm 15V$, $R_L = 2k\Omega$	±10	±12	—	
Input Voltage Range	IVR	$V_S = \pm 15V$	±12	—	—	V

ELECTRICAL CHARACTERISTICS at $V_S = \pm 15V$, $-25°C \leq T_A \leq 85°C$, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-248 MIN	PM-248 TYP	PM-248 MAX	UNITS
Input Offset Voltage	V_{OS}	$R_S \leq 10k\Omega$	—	—	7.5	mV
Input Offset Current	I_{OS}		—	—	125	nA
Input Bias Current	I_B		—	—	500	nA
Supply Current	I_{SY}	$V_S = \pm 15V$	—	2.4	4.5	mA
Large Signal Voltage Gain	A_{VO}	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$, $R_L \geq 2k\Omega$	15	—	—	V/mV
Common-Mode Rejection Ratio	CMRR	$R_S \leq 10k\Omega$	70	90	—	dB
Power Supply Rejection Ratio	PSRR	$R_S \leq 10k\Omega$	77	96	—	dB
Output Voltage Swing	V_O	$V_S = \pm 15V$, $R_L = 10k\Omega$	±12	±13	—	V
		$V_S = \pm 15V$, $R_L = 2k\Omega$	±10	±12	—	
Input Voltage Range	IVR	$V_S = \pm 15V$	±12	—	—	V

DICE CHARACTERISTICS



DIE SIZE 0.064 × 0.075 inch, 4800 sq. mils (1.62 × 1.90 mm, 3.08 sq. mm)

1. OUT 1
2. IN 1
3. IN 1+
4. V+
5. IN 2+
6. IN 2
7. OUT 2
8. OUT 3
9. IN 3
10. IN 3+
11. V-
12. IN 4+
13. IN 4
14. OUT 4

For additional DICE ordering information, refer to PMI's Data Book, Section 2.

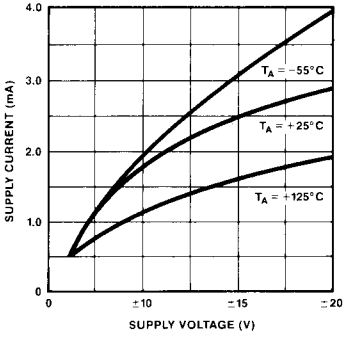
WAFER TEST LIMITS at $V_S = \pm 15V$, $T_A = 25°C$ for PM-148GBC, $T_A = 125°C$ for PM-148GTBC, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	PM-148GBC LIMIT	PM-148GTBC LIMIT	UNITS
Input Offset Voltage	V_{OS}	$R_S \leq 10k\Omega$	2.5	6.0	mV MAX
Input Offset Current	I_{OS}		10	25	nA MAX
Input Bias Current	I_B		75	100	nA MAX
Supply Current	I_{SY}	$V_S = \pm 15V$	3.6	3.6	mA MAX
Large Signal Voltage Gain	A_{VO}	$V_S = \pm 15V$ $V_{OUT} = \pm 10V$, $R_L \geq 2k\Omega$	50	25	V/mV MIN
Common-Mode Rejection Ratio	CMRR	$R_S \leq 10k\Omega$	80	80	dB MIN
Power Supply Rejection Ratio	PSRR	$R_S \leq 10k\Omega$	85	80	dB MIN
Output Voltage Swing	V_O	$V_S = \pm 15V$, $R_L = 10k\Omega$ $R_L = 2k\Omega$	± 12 ± 11	± 12 ± 10	V MIN
Input Voltage Range	IVR	$V_S = \pm 15V$	± 12	± 12	V MIN

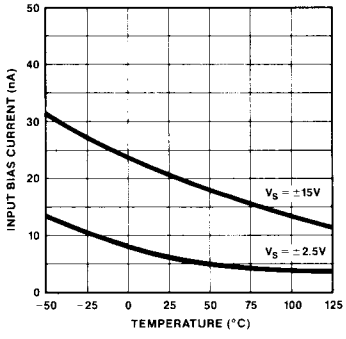
NOTE:
Electrical tests are performed at wafer probe to the limits shown. Due to variations in assembly methods and normal yield loss, yield after packaging is not guaranteed for standard product dice. Consult factory to negotiate specifications based on dice lot qualification through sample lot assembly and testing.

TYPICAL PERFORMANCE CHARACTERISTICS

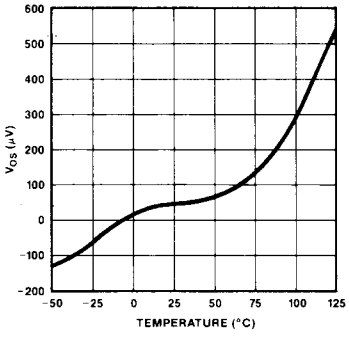
SUPPLY CURRENT vs SUPPLY VOLTAGE



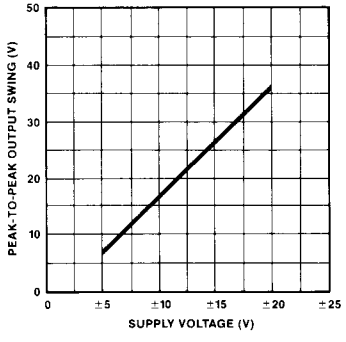
INPUT BIAS CURRENT vs TEMPERATURE



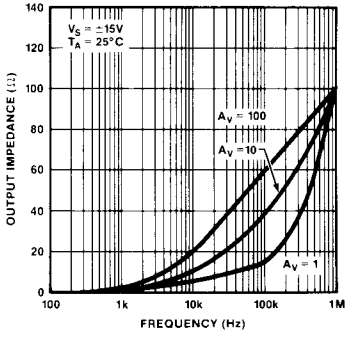
INPUT OFFSET VOLTAGE vs TEMPERATURE



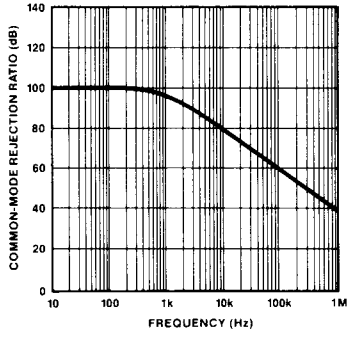
VOLTAGE SWING vs SUPPLY VOLTAGE



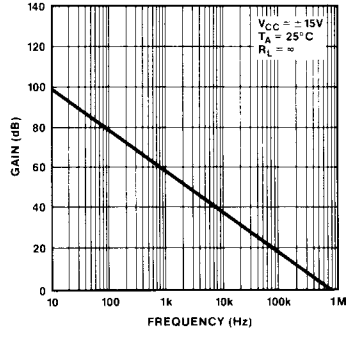
OUTPUT IMPEDANCE vs FREQUENCY



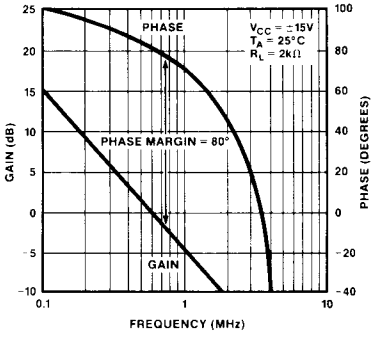
COMMON-MODE REJECTION RATIO vs FREQUENCY



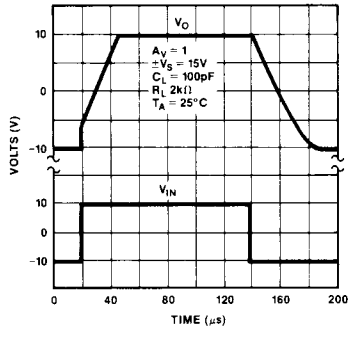
OPEN-LOOP FREQUENCY RESPONSE vs GAIN



GAIN AND PHASE vs FREQUENCY

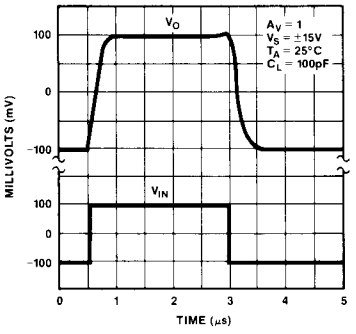


LARGE SIGNAL PULSE RESPONSE



TYPICAL PERFORMANCE CHARACTERISTICS

SMALL SIGNAL PULSE RESPONSE



SLEW RATE vs TEMPERATURE