



# JM38510/13501/13502

ULTRA-LOW OFFSET VOLTAGE  
OPERATIONAL AMPLIFIERS

Precision Monolithics Inc.

T-79-06-10

## FEATURES

- Low  $V_{OS}$  .....  $25\mu V$
- Low  $V_{OS}$  Drift .....  $0.6\mu V/^\circ C$
- Low Noise .....  $0.6\mu V_{p-p}$
- Wide Supply Voltage Range .....  $\pm 4.5V$  to  $\pm 20V$

have identical operational performance characteristics across the military temperature range or reliability factors equivalent to the MIL-M-38510 device.

## ORDERING INFORMATION

JAN SLASH SHEET	PMI DEVICE
JM38510/13501BGC	OP07AJ1/38510
JM38510/13501BGA	OP07AJ5/38510
JM38510/13501SGA	OP07SAJ5/38510
JM38510/13501BPB	OP07AZ2/38510
JM38510/13501BPA	OP07AZ5/38510
JM38510/13501SPA	OP07SAZ5/38510
JM38510/13502BGC	OP07J1/38510
JM38510/13502BGA	OP07J5/38510
JM38510/13502SGA	OP07SJ5/38510
JM38510/13502BPB	OP07Z2/38510
JM38510/13502BPA	OP07Z5/38510
JM38510/13502SPA	OP07SZ5/38510

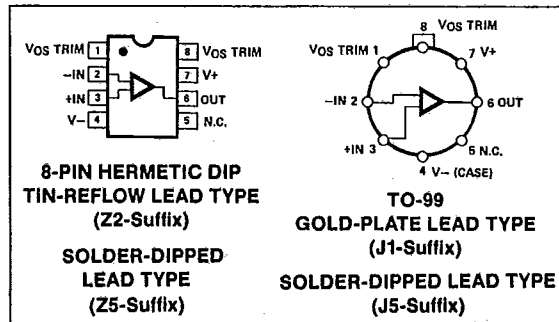
MILITARY DEVICE TYPE	GENERIC-INDUSTRY TYPE
01	OP07A
02	OP07

For an 833-processed device with improved electrical specifications, review the OP-07 data sheet.

## GENERAL DESCRIPTION

This data sheet covers the electrical requirements for a monolithic, low offset voltage, internally-compensated operational amplifier as specified in MIL-M-38510/135 for device type 01 and 02. Devices supplied to this data sheet are manufactured and tested at PMI's MIL-M-38510 certified facility and are listed in QPL-38510.

## PIN CONNECTIONS



Complete device requirements will be found in MIL-M-38510 and MIL-M-38510/135 for Class B and Class S processed devices.

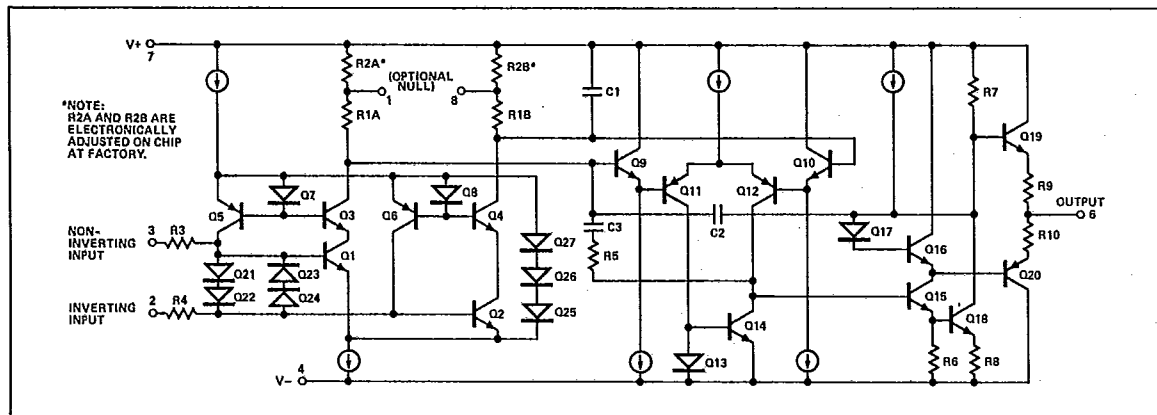
## POWER AND THERMAL CHARACTERISTICS

Case Outline	Package	Maximum Allowable Power Dissipation	Maximum $\theta_{JC}$	Maximum $\theta_{JA}$
P	Dual-In-Line	208mW @ $T_A = 125^\circ C$	50°C/W	120°C/W
G	8-Lead CAN	167mW @ $T_A = 125^\circ C$	40°C/W	150°C/W

## GENERIC CROSS-REFERENCE INFORMATION

This cross-reference information is presented for the convenience of the user. The generic-industry types listed may not

## SIMPLIFIED SCHEMATIC



**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage ( $V_{CC}$ ) .....  $\pm 22V$   
 Input Voltage Range ( $V_{IN}$ ) .....  $\pm V_{CC}$   
 Differential Input Voltage Range .....  $\pm 30V$   
 Output Short-Circuit Duration (Note 1)  
 Lead Temperature (Soldering, 60 sec) .....  $+300^{\circ}C$   
 Storage Temperature Range .....  $-65^{\circ}C$  to  $+150^{\circ}C$   
 Junction Temperature ( $T_J$ ) .....  $+150^{\circ}C$   
 Maximum Power Dissipation ( $P_D$ ) (Note 2) ..... 500mW

**RECOMMENDED OPERATING CONDITIONS**

Supply Voltage Range .....  $\pm 4.5V$  to  $\pm 20V$   
 Ambient Temperature Range .....  $-55^{\circ}C$  to  $+125^{\circ}C$

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**NOTES:**

- Output may be shorted to ground indefinitely at  $V_S = \pm 15V$ ,  $T_A = 25^{\circ}C$ . Temperature and/or supply voltages must be limited to ensure dissipation rating is not exceeded.
- Maximum power dissipation versus ambient temperature.

**ELECTRICAL CHARACTERISTICS** at  $\pm 4.5V \leq V_{CC} \leq \pm 20V$  and  $-55^{\circ}C \leq T_A \leq 125^{\circ}C$ ,  $R_S = 50\Omega$  unnull'd, unless otherwise noted.

PARAMETER	SYMBOL	CONDITIONS	01 LIMITS		02 LIMITS		UNITS
			MIN	MAX	MIN	MAX	
Input Offset Voltage	$V_{IO}$	$T_A = 25^{\circ}C$ (Notes 1, 2)	-25 -80	25 80	-75 -200	75 200	$\mu V$
Input Offset Voltage Temperature Sensitivity	$\Delta V_{IO}/\Delta T$	(Note 1)	-0.6	0.6	-1.3	1.3	$\mu V/^{\circ}C$
Input Bias Current	$+I_{IB}$	$T_A = 25^{\circ}C$ (Note 1)	-2 -4	2 4	-3 -6	3 6	nA
	$-I_{IB}$	$T_A = 25^{\circ}C$ (Note 1)	-2 -4	2 4	-3 -6	3 6	
Input Offset Current	$I_{IO}$	$T_A = 25^{\circ}C$ (Note 1)	-2 -4	2 4	-2.8 -5.6	2.8 5.6	nA
	+PSRR	$+V_{CC} = 20V$ to $5V$ , $-V_{CC} = -15V$ $T_A = 25^{\circ}C$	—	10	—	10	
	-PSRR	$+V_{CC} = 15V$ , $-V_{CC} = -20V$ to $-5V$ $T_A = 25^{\circ}C$	—	10	—	10	
	+PSRR	$+V_{CC} = 20V$ to $5V$ , $-V_{CC} = -15V$	—	20	—	20	
	-PSRR	$+V_{CC} = 15V$ , $-V_{CC} = -20V$ to $-5V$	—	20	—	20	
Power Supply Rejection Ratio	PSRR	$V_{CC} = \pm 4.5V$ to $\pm 20V$ $T_A = 25^{\circ}C$	—	10	—	10	$\mu V/V$
		$V_{CC} = \pm 4.5V$ to $\pm 20V$	—	20	—	20	



OPERATIONAL AMPLIFIERS/BUFFERS

**NOTES:**

- Tested at  $V_{CM} = 0$ ,  $V_{CC} = \pm 15V$ .
- Due to the inherent warm-up drift, testing shall occur no sooner than three (3) minutes after application of power.



**ELECTRICAL CHARACTERISTICS** at  $\pm 4.5V \leq V_{CC} \leq \pm 20V$  and  $-55^\circ C \leq T_A \leq +125^\circ C$ ,  $R_S = 50\Omega$  unnull'd, unless otherwise noted. *Continued*

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PARAMETER	SYMBOL	CONDITIONS	01 LIMITS		U2 LIMITS		UNITS
			MIN	MAX	MIN	MAX	
Common-Mode Rejection Ratio	CMRR	$V_{CM} = \pm 13V, T_A = +25^\circ C, V_{CC} = \pm 15V$	110	-	110	-	dB
		$V_{CM} = \pm 13C, V_{CC} = \pm 15V$	106	-	106	-	
Adjustment for Input Offset	$V_{IO} \text{ Adj (+)}$	$T_A = +25^\circ C$ (Note 1)	0.5	-	0.5	-	mV
	$V_{IO} \text{ Adj (-)}$	$T_A = +25^\circ C$ (Note 1)	-	0.5	-	0.5	
Output Short-Circuit Current	$I_{OS(+)}$	$t \leq 25ms$ (Notes 1, 3) $T_A = +25^\circ C, +125^\circ C$ $T_A = -55^\circ C$	-65	-	-65	-	mA
	$I_{OS(-)}$	$t \leq 25ms$ (Notes 1, 3) $T_A = +25^\circ C, +125^\circ C$ $T_A = -55^\circ C$	-	65	-	65	
Supply Current	$I_{CC}$	$T_A = +25^\circ C$	-	4	-	4	mA
		(Note 1)	-	5	-	5	
Output Voltage Swing (Minimum)	$V_{OP}$	$R_L = 1k\Omega$ (Note 1)	-10	10	-10	10	V
		$R_L = 2k\Omega$ (Note 1)	-12	12	-12	12	
Open-Loop Voltage Gain (Single-Ended)	$A_{VS}$	$T_A = +25^\circ C$	300	-	200	-	V/mV
		(Notes 1, 2)	200	-	150	-	
Slew Rate	$SR(+), SR(-)$	$V_{IN} = 10V, T_A = +25^\circ C$ , (Note 1)	0.08	-	0.08	-	V/ $\mu s$
Input Noise Voltage Density	$e_n$	$f_O = 10Hz$	-	18	-	18	nV/ $\sqrt{Hz}$
		$f_O = 100Hz, T_A = +25^\circ C$ (Note 1)	-	14	-	14	
		$f_O = 1kHz$	-	12	-	12	
Low Frequency Input Noise Voltage	$e_{np-p}$	$f = 0.1Hz$ to $10Hz, T_A = 25^\circ C$ , (Note 1)	-	0.6	-	0.6	$\mu V_{p-p}$

**NOTES:**

1. Tested at  $V_{CM} = 0, V_{CC} = \pm 15V$ .
2.  $V_{OUT} = 0$  to  $+10V$  for  $A_{VS(+)}$  and  $V_{OUT} = 0$  to  $-10V$  for  $A_{VS(-)}$ ;  $R_L = 2k\Omega$ .
3. Continuous short-circuit limits are considerably less than the indicated test limits, since maximum power dissipation cannot be exceeded.