



**THE DATASHEET OF  
JM38510/13503BGA**





# JM38510/13503

LOW-NOISE PRECISION  
OPERATIONAL AMPLIFIER

Precision Monolithics Inc.

T-79-06-10

### FEATURES

- Low  $V_{OS}$  .....  $25\mu V$
- Low  $V_{OS}$  Drift .....  $0.6\mu V/^\circ C$
- High Speed .....  $1.7V/\mu s$
- Low Noise .....  $0.18\mu V_{p-p}$
- High Gain ..... 1.0 Million
- Wide Supply Voltage Range .....  $\pm 4.5V$  to  $\pm 18V$

temperature range or reliability factors equivalent to the MIL-M-38510 device.

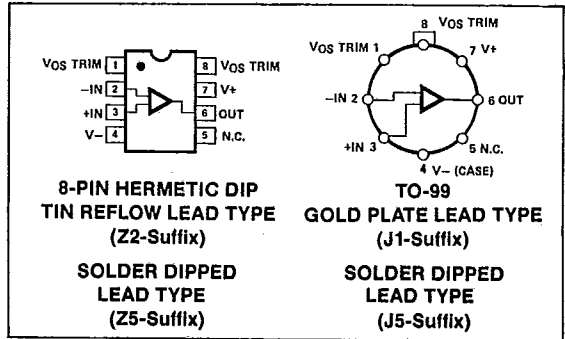
MILITARY DEVICE TYPE	GENERIC-INDUSTRY TYPE
03	OP27A

For an 833-processed device with improved electrical specifications, review the OP-27 data sheet.

### ORDERING INFORMATION

JAN SLASH SHEET	PMI DEVICE
JM38510/13503BGC	OP27AJ1/38510
JM38510/13503BGA	OP27AJ5/38510
JM38510/13503SGA	OP27SAJ5/38510
JM38510/13503BPB	OP27AZ2/38510
JM38510/13503BPA	OP27AZ5/38510
JM38510/13503SPA	OP27SAJ5/38510

### PIN CONNECTIONS



### 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 03. Devices supplied to this data sheet are manufactured and tested at PMI's MIL-M-38510 certified facility and are listed in QPL-38510.

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

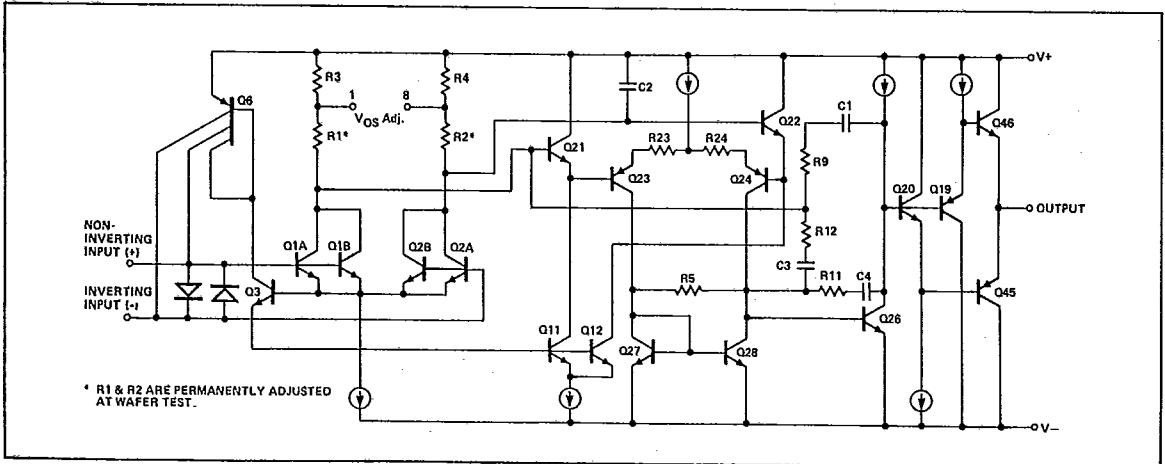
### GENERIC CROSS-REFERENCE INFORMATION

This cross-reference information is presented for the convenience of the user. The generic-industry types listed may not have identical operational performance characteristics across the military

### 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

### SIMPLIFIED SCHEMATIC



5-601

8/89, Rev. A3

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OPERATIONAL AMPLIFIERS/BUFFERS

PMI

JM38510/13503 LOW-NOISE PRECISION OPERATIONAL AMPLIFIER

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage ( $V_{CC}$ ) .....  $\pm 22V$   
 Input Voltage Range ( $V_{IN}$ ) .....  $\pm V_{CC}$   
 Differential Input Voltage Range .....  $\pm 0.7V$   
 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  $\pm 18V$   
 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  $-55^{\circ}C \leq T_A \leq 125^{\circ}C$ ,  $R_S = 50\Omega$  unnullled, unless otherwise noted.**

PARAMETER	SYMBOL	CONDITIONS	03 LIMITS		UNITS
			MIN	MAX	
Input Offset Voltage	$V_{IO}$	$T_A = 25^{\circ}C$ (Notes 1, 2)	-25 -60	25 60	$\mu V$
Input Offset Voltage Temperature Sensitivity	$\Delta V_{IO}/\Delta T$	(Note 1)	-0.6	0.6	$\mu V/^{\circ}C$
Input Bias Current	$+I_{IB}$	$T_A = 25^{\circ}C$ (Note 1)	-40 -60	40 60	nA
	$-I_{IB}$	$T_A = 25^{\circ}C$ (Note 1)	-40 -60	40 60	
Input Offset Current	$I_{IO}$	$T_A = 25^{\circ}C$ (Note 1)	-35 -50	35 50	nA
	$+PSRR$	$+V_{CC} = 18V$ to $5V$ , $-V_{CC} = -15V$ $T_A = 25^{\circ}C$	—	10	
Power Supply Rejection Ratio	$-PSRR$	$+V_{CC} = 15V$ , $-V_{CC} = -18V$ to $-5V$ $T_A = 25^{\circ}C$	—	10	$\mu V/V$
	$+PSRR$	$+V_{CC} = 18V$ to $5V$ , $-V_{CC} = -15V$	—	16	
	$-PSRR$	$+V_{CC} = 15V$ , $-V_{CC} = -18V$ to $-5V$	—	16	
	$PSRR$	$V_{CC} = \pm 4.5V$ to $\pm 18V$ $T_A = 25^{\circ}C$	—	10	
		$V_{CC} = \pm 4.5V$ to $\pm 18V$	—	16	

**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	03 LIMITS		UNITS
			MIN	MAX	
Common-Mode Rejection Ratio	CMRR	$V_{CM} = \pm 11V, T_A = +25^\circ C, V_{CC} = \pm 15V$	114	—	dB
		$V_{CM} = \pm 10V, V_{CC} = \pm 15V$	108	—	
Adjustment for Input Offset	$V_{IO} \text{ Adj (+)}$ $V_{IO} \text{ Adj (-)}$	$T_A = +25^\circ C, \text{ (Note 1)}$	0.5	—	mV
		$T_A = +25^\circ C, \text{ (Note 1)}$	—	-0.5	
Output Short-Circuit Current	$i_{OS(+)}$ $i_{OS(-)}$	$t \leq 25\text{ms}, \text{ (Notes 1,3)}$	-70	—	mA
		$t \leq 25\text{ms}, \text{ (Notes 1,3)}$	—	70	
Supply Current	$I_{CC}$	$T_A = +25^\circ C$ (Note 1)	—	5	mA
			—	6	
Output Voltage Swing (Minimum)	$V_{OP}$	$R_L = 600\Omega, \text{ (Note 1)}$	-10	10	V
		$R_L = 2k\Omega, \text{ (Note 1)}$	-11.5	11.5	
Open Loop Voltage Gain (Single Ended)	$A_{VS}$	$T_A = +25^\circ C$ (Note 2)	1000	—	V/mV
			600	—	
Slew Rate	$SR(+), SR(-)$	$V_{IN} = 10V, T_A = +25^\circ C, \text{ (Note 1)}$	1.7	—	V/ $\mu s$
Input Noise Voltage Density	$e_n$	$f_O = 10\text{Hz}$ $f_O = 100\text{Hz}$ $T_A = +25^\circ C, \text{ (Note 1)}$ $f_O = 1\text{kHz}$	—	5.5	nV/ $\sqrt{\text{Hz}}$
			—	4.0	
			—	3.8	
Low Frequency Input Noise Voltage	$e_{np-p}$	$f = 0.1\text{Hz to } 10\text{Hz}$ $T_A = +25^\circ C, \text{ (Note 1)}$	—	0.18	$\mu V_{p-p}$
Input Noise Current Density	$i_n$	$f_O = 10\text{Hz}$ $f_O = 100\text{Hz}$ $T_A = +25^\circ C, \text{ (Note 1)}$ $f_O = 1\text{kHz}$	—	5.66	pA/ $\sqrt{\text{Hz}}$
			—	1.88	
			—	0.84	



**NOTES:**

1. Tested at  $V_{CM} = 0, V_{CC} = \pm 15V$ .
2.  $V_{OUT} = 0$  to  $+10$  for  $A_{VS}(+)$  and  $V_{OUT} = 0$  to  $-10V$  for  $A_{VS}(-)$ .  $R_L = 2,000\Omega$ .
3. Continuous short-circuit limits are considerably less than the indicated test limits, since maximum power dissipation cannot be exceeded.




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