REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																				
SHEET																				
REV																				
SHEET	15	16	17																	
REV STATUS				REV																
OF SHEETS				SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14		

PMIC N/A

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DRAWING APPROVAL DATE
15-12-01

REVISION LEVEL

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

DLA LAND AND MARITIME
COLUMBUS, OHIO 43218-3990
http://www.landandmaritime.dla.mil

MICROCIRCUIT, LINEAR, LOW OFFSET VOLTAGE AND DRIFT, PRECISION, OPERATIONAL AMPLIFIER, MONOLITHIC SILICON

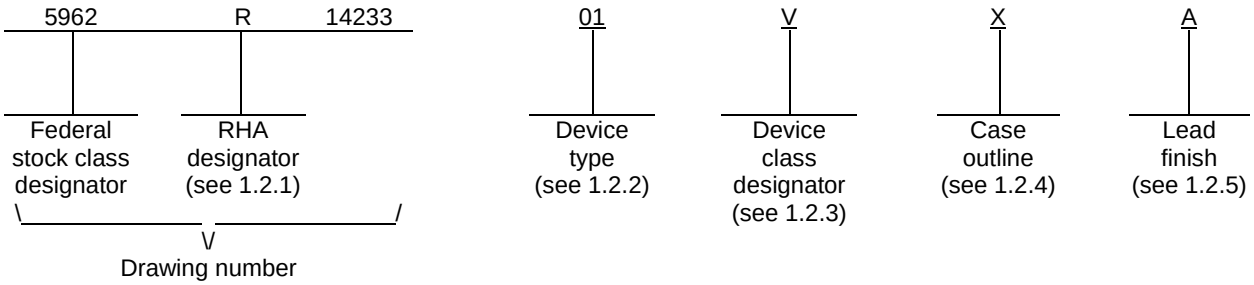
SIZE	CAGE CODE	
A	**67268**	**5962-14233**

SHEET 1 OF 17

1. SCOPE

1.1 Scope. This drawing documents two product assurance class levels consisting of high reliability (device class Q) and space application (device class V). A choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of Radiation Hardness Assurance (RHA) levels is reflected in the PIN.

1.2 PIN. The PIN is as shown in the following example:



1.2.1 RHA designator. Device classes Q and V RHA marked devices meet the MIL-PRF-38535 specified RHA levels and are marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) identify the circuit function as follows:

Device type	Generic number	Circuit function
01	ADA4077-2	Radiation hardened, dual, 4 MHz, low offset voltage and drift, precision, operational amplifier

1.2.3 Device class designator. The device class designator is a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
Q or V	Certification and qualification to MIL-PRF-38535

1.2.4 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	CDFP3-F10	10	Bottom brazed flat pack

1.2.5 Lead finish. The lead finish is as specified in MIL-PRF-38535 for device classes Q and V.

1.3 Absolute maximum ratings. 1/

Supply voltage ($+V_S$ to $-V_S$)	36 V
Input voltage	$\pm V_{SY}$
Input current	$\pm$10 mA 2/
Differential input voltage	$\pm V_{SY}$
Output short-circuit duration to GND	Indefinite
Storage temperature range	-65°C to +150°C
Maximum junction temperature (T_J)	+150°C 3/
Lead temperature (soldering, 10 seconds)	+300°C
Thermal resistance, junction-to-case (θ_{JC})	33°C/W 4/
Thermal resistance, junction-to-ambient (θ_{JA})	52°C/W 4/

1.4 Recommended operating conditions.

Dual Supply voltage ($\pm$VS)	±2.5 V to ±15 V
Single supply voltage (+VS / 0 V)	+5.0 V to +30.0 V
Ambient operating temperature range (T_A)	-55°C to +125°C

1.4.1 Operating performance characteristics. 5/

V_S = ±5.0 V:

Common mode input resistance	70 GΩ
Common mode input capacitance	3 pF
Unity-Gain Crossover, V_{IN} = 10 mVp-p, R_L = 2 kΩ, A_V = +1	3.9 MHz
Phase margin, V_{IN} = 10 mV p-p, R_L = 2 kΩ, A_V = +1	85°
Total Harmonic Distortion plus noise, V_{IN} = 1 V rms, A_V = +1, R_L = 2 kΩ, f = 1 kHz	0.004%
Current noise density	0.2 pA/$\sqrt{Hz}$
Multiple amplifiers channel separation, f = 1 kHz, RL = 10 kΩ	-125 dB

V_S = ±15.0 V:

Common mode input resistance	100 GΩ
Differential input capacitance	3pF
Common mode input capacitance	5 pF
Unity-Gain Crossover, V_{IN} = 10 mVp-p, R_L = 2 kΩ, A_V = +1	3.9 MHz
Settling time to 0.01% VIN = 10 V p-p, RL = 2 kΩ, AV = −1	16 µs
Phase margin, V_{IN} = 10 mV_{PP}, R_L = 2 kΩ, A_V = 1	58°
Total harmonic distortion plus noise , V_{IN} = 1 V rms, A_V = +1, R_L = 2 kΩ, f = 1	0.004%
Current noise density	0.2 pA/$\sqrt{Hz}$
Multiple amplifiers channel separation, f = 1 kHz, RL = 10 kΩ	-125 dB

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

2/ The input pins have clamp diodes to the power supply pins and to each other. Limit the input current to 10 mA or less Whenever input signals exceed the power supply rail by 0.3 V.

3/ While the device is internally short circuit protected, this may not be sufficient to guarantee that the maximum junction temperature is not exceeded under all conditions. Do not exceed maximum T_J in application with output current load.

4/ Measurement taken under absolute worst case conditions of still air and represents data taken with a thermal camera for highest power density location. See MIL-STD-1835 for average package θ_{JC} numbers with smaller die size.

5/ Unless otherwise specified, T_A = 25°C, V_{SY} = ±5 V, V_{SY} = ±15 V, and V_{CM} = 0 V.

1.5 Radiation features.

Maximum total dose available (dose rate = 50 – 300 rads(Si)/s) ..... 100 krads(Si) 6/
Single Event Phenomenon (SEP):
No Single Event latchup (SEL) occurs at Effective linear energy transfer (LET) (see 4.4.4.2):
Device type 01: ..... $\leq$ 80MeV-cm^2/mg 7/

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-38535 - Integrated Circuits, Manufacturing, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-883 - Test Method Standard Microcircuits.
MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-103 - List of Standard Microcircuit Drawings.
MIL-HDBK-780 - Standard Microcircuit Drawings.

(Copies of these documents are available online at http://quicksearch.dla.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are the issues of the documents cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

ASTM F1192 - Standard Guide for the Measurement of Single Event Phenomena (SEP) Induced by Heavy Ion Irradiation of Semiconductor Devices.

(Copies of these documents are available online at http://www.astm.org or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA, 19428-2959).

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements for device classes Q and V shall be in accordance with MIL-PRF-38535 as specified herein, or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein for device classes Q and V.

6/ These parts may be dose rate sensitive in a space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions specified in MIL-STD-883, method 1019, condition A.

7/ Limits are characterized at initial qualification and after any design or process changes that may affect the SEP characteristics, but are not production lot tested unless specified by the customer through the purchase order or contract. For more information on single event effect (SEE) test results, customers are requested to contact the manufacturer.

TABLE IA. Electrical performance characteristics.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 2.5$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input characteristics							
Offset voltage	V_{OS}		1	01		35	µV
			2, 3			65	
		M,D,P,L,R	1			35	
Offset voltage drift 3/	$\Delta V_{OS}/\Delta T$		1, 2, 3	01		0.3	µV/°C
Input bias current	I_B		1, 2, 3	01	-1	+1	nA
		M,D,P,L,R	1		-1	+1	
Input offset current	I_{OS}		1	01	-0.5	+0.5	nA
			2, 3		-1	+1	
		M,D,P,L,R	1		-0.5	+0.5	
Input voltage range 4/	I_{VR}		1, 2, 3	01	-1.3	+0.5	V
		M,D,P,L,R	1		-1.3	+0.5	
Common-mode rejection ratio	CMRR	V_{CM} = -1.3 V to +0.5 V	1	01	122		dB
			2		87		
			3		120		
		M,D,P,L,R	1		122		
Large signal voltage gain	A_V	R_L = 2 kΩ,	1	01	121		dB
		V_{OUT} = -0.5 V to +0.5 V	2, 3		120		
		M,D,P,L,R	1		121		
Output characteristics							
Output voltage high	V_{OH}	I_L = 1 mA	1	01	1.5		V
			2, 3		1.2		
		M,D,P,L,R	1		1.5		
Output voltage low	V_{OL}	I_L = 1 mA	1	01		-0.9	V
			2, 3			-0.5	
		M,D,P,L,R	1			-0.9	
Dropout voltage	$V_{DROPOUT}$	I_{OUT} = -10mA	1,2,3	01		1.6	V
		M,D,P,L,R	1			1.6	
		I_{OUT} = 10mA	1,2,3	01	-1.6		
		M,D,P,L,R	1		-1.6		
Short-circuit current 5/	I_{SC+}	Source	1, 2, 3	01	-30		mA
		M,D,P,L,R	1		-30		
	I_{SC-}	Sink	1, 2, 3	01		30	
		M,D,P,L,R	1			30	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 2.5$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Power supply							
Power supply rejection ratio	PSRR	$V_S = \pm 2.5$ V to ± 18 V	1	01	123		dB
			2, 3		120		
		M,D,P,L,R	1		123		
Supply current both amplifiers	I_{SY}	$V_{OUT} = 0$ V	1	01		900	µA
			2, 3			1300	
		M,D,P,L,R	1			900	
Dynamic Performance							
Slew rate 3/ 6/	SR+	$R_L = 2$ kΩ	4	01	1.2		V/µs
			5		1.8		
			6		0.74		
	SR-		4		1.19		
			5		1.55		
			6		0.7		
Settling time 0.1% 3/ 6/	$+t_S$	$V_{IN} = 1$ V step, $R_L = 2$ kΩ, $A_V = -1$	9	01		2.9	µs
			10			2.4	
			11			3.3	
	$-t_S$		9			2.9	
			10			2.5	
			11			3.4	
Gain bandwidth product	GBP	$V_{IN} = 10$ mV p-p, $R_L = 2$ kΩ, $A_V = +100$	4,5,6	01	2.9		MHz
		M,D,P,L,R	4		2.9		
−3 dB closed-loop bandwidth 3/ 6/	−3 dB	$A_V = +1$, $V_{IN} = 10$ mV p-p, $R_L = 2$ kΩ	4,5	01	6.8		MHz
			6		3.8		
Voltage noise 3/ 6/	e_n p-p	0.1 Hz to 10 Hz	4	01		0.35	µVp-p
			5			0.75	
			6			0.6	
Voltage noise density 3/ 6/	e_n	F=10 kHz	4	01		6.9	nVp-p
			5			8	
			6			6.3	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 5.0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input characteristics							
Offset voltage	V_{OS}		1	01		25	µV
			2, 3			65	
		M,D,P,L,R	1			25	
Offset voltage drift 3/ 5/	$\Delta V_{OS}/\Delta T$		1, 2, 3	01		0.3	µV/°C
Input bias current	I_B		1	01	-1	+1	nA
			2, 3		-1.5	+1.5	
		M,D,P,L,R	1		-1	+1	
Input offset current	I_{OS}		1	01	-0.5	+0.5	nA
			2, 3		-1	+1	
		M,D,P,L,R	1		-0.5	+0.5	
Input voltage range 4/	I_{VR}		1, 2, 3	01	-3.8	+3	V
		M,D,P,L,R	1		-3.8	+3	
Common-mode rejection ratio	CMRR	V_{CM} = -3.8 V to +3 V	1	01	122		dB
			2		112		
			3		120		
		M,D,P,L,R	1		122		
Large signal voltage gain	A_V	R_L = 2 kΩ,	1	01	121		dB
		V_{OUT} = -3.0 V to +3.0 V	2, 3		120		
		M,D,P,L,R	1		121		
Output characteristics							
Output voltage high	V_{OH}	I_L = 1 mA	1	01	4.1		V
			2		4		
			3		3		
		M,D,P,L,R	1		4.1		
Output voltage low	V_{OL}	I_L = 1 mA	1	01		-3.5	V
			2			-3.2	
			3			-3	
		M,D,P,L,R	1			-3.5	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$, $V_{SY} = \pm 5.0$ V, $V_{CM} = 0$ V unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
Output characteristics –continued.								
Dropout voltage	$V_{DROPOUT}$	I_{OUT} = -10 mA		1, 2, 3	01		1.6	V
			M,D,P,L,R	1			1.6	
		I_{OUT} = 10 mA		1, 2		-1.6		
				3		-2.0		
			M,D,P,L,R	1		-1.6		
Short-circuit current 5/	I_{SC+}	Source		1, 2, 3	01	-30		mA
			M,D,P,L,R	1		-30		
	I_{SC-}	Sink		1, 2, 3			30	
			M,D,P,L,R	1			30	
Power supply								
Power supply rejection ratio	PSRR	$V_S = \pm 2.5$ V to ± 18 V		1	01	123		dB
				2, 3		120		
			M,D,P,L,R	1		123		
Supply current both amplifier	I_{SY}	V_{OUT} = 0 V		1	01		900	µA
				2, 3			1300	
			M,D,P,L,R	1			900	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 5.0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Dynamic Performance							
Slew Rate 3/ 6/	SR+	R_L = 2kΩ	4	01	1.17		V/µs
			5		1.68		
			6		0.7		
	SR-	R_L = 2kΩ	4		1.19		V/µs
			5		1.55		
			6		1.67		
Settling Time 0.1% 3/ 6/	$+t_S$	V_{IN} = 1V step, R_L = 2 kΩ, A_V = −1	9	01		3.2	µs
			10			2.5	
			11			3.7	
	$-t_S$	V_{IN} = 1V step, R_L = 2 kΩ, A_V = −1	9			3.2	
			10			2.5	
			11			3.8	
Gain Bandwidth Product	GBP	V_{IN} = 10 mV p-p, R_L = 2 kΩ, A_V = +100	4,5,6	01	3.4		MHz
		M, D, P, L, R	4		3.4		
−3 dB Closed-Loop Bandwidth 3/ 6/	−3 dB	A_V = +1, V_{IN} = 10 mV p-p, R_L = 2 kΩ	4, 5	01	5.9		MHz
			6		3.8		
Voltage Noise 3/ 6/	e_n p-p	0.1 Hz to 10 Hz	4	01		0.45	µVp-p
			5			0.78	
			6			0.58	
Voltage Noise Density 3/ 6/	e_n	F=10 kHz	4	01		6.9	nV p-p
			5			8	
			6			6.3	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 15.0$ V, $V_{CM} = 0$ V unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
Input characteristics								
Offset voltage	V_{OS}		1	1	01		35	µV
				2, 3			65	
			M,D,P,L,R	1			35	
Offset voltage drift 3/ 5/	$\Delta V_{OS}/\Delta T$			1, 2, 3	01		0.3	µV/°C
Input bias current	I_B		1	1	01	-1	+1	nA
				2, 3		-1.5	+1.5	
			M,D,P,L,R	1		-1	+1	
Input offset current	I_{OS}		1	1	01	-0.5	+0.5	nA
				2, 3		-1	+1	
			M,D,P,L,R	1		-0.5	+0.5	
Input voltage range 4/	I_{VR}			1, 2, 3	01	-13.8	+13	V
			M,D,P,L,R	1		-13.8	+13	
Common-mode rejection ratio	CMRR	V_{CM} = -13.8 V to +13 V	1	1	01	132		dB
				2, 3		130		
			M,D,P,L,R	1		132		
Large signal voltage gain	A_V	R_L = 2 kΩ,	1	1	01	125		dB
		V_{OUT} = -13.0 V to +13.0 V		2, 3		120		
			M,D,P,L,R	1		125		
Output characteristics								
Output voltage high	V_{OH}	I_L = 1 mA	1	1	01	14.1		V
				2		14		
				3		13		
			M,D,P,L,R	1		14.1		
Output voltage low	V_{OL}	I_L = 1 mA	1	1	01		-13.5	V
				2, 3			-13.2	
			M,D,P,L,R	1			-13.5	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$, $V_{SY} = \pm 15.0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output characteristics –continued.							
Dropout voltage	$V_{DROPOUT}$	I_{OUT} = -10 mA	1, 2, 3	01		1.2	V
		M,D,P,L,R	1			1.2	
		I_{OUT} = 10 mA	1, 2		-1.2		
			3		-2.0		
		M,D,P,L,R	1		-1.2		
Short-circuit current 5/	I_{SC+}	Source	1	01	-34		mA
			2		-48		
			3		-30		
		M,D,P,L,R	1		-34		
	I_{SC-}	Sink	1			29	
			2			26	
			3			30	
		M,D,P,L,R	1			29	
Power supply							
Power supply rejection ratio	PSRR	$V_S = \pm 2.5$ V to ± 18 V	1	01	123		dB
			2, 3		120		
		M,D,P,L,R	1		123		
Supply current both amplifier	I_{SY}	V_{OUT} = 0 V	1	01		1000	µA
			2, 3			1300	
		M,D,P,L,R	1			1000	

See footnotes at end of table.

TABLE IA. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ $V_{SY} = \pm 15.0$ V, $V_{CM} = 0$ V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Dynamic Performance							
Slew Rate	SR+	$R_L = 2k\Omega$	4	01	1.1		V/µs
			5		1.2		
			6		0.5		
		M, D, P, L, R	4		1.1		
	SR-	$R_L = 2k\Omega$	4		1.0		V/µs
			5		1.2		
			6		0.5		
		M, D, P, L, R	4		1.0		
Settling Time 0.1% 3/ 6/	$+t_S$	V_{IN} = 1 V step, R_L = 2 kΩ, A_V = −1	9	01		9.2	µs
			10			8.2	
			11			13.9	
	$-t_S$	V_{IN} = 1 V step, R_L = 2 kΩ, A_V = −1	9			9.6	
			10			8.4	
			11			14.4	
Gain Bandwidth Product	GBP	V_{IN} = 10 mVp-p, R_L = 2 kΩ, A_V = +100	4,5,6	01	3.4		MHz
		M, D, P, L, R	4		3.4		
−3 dB Closed-Loop Bandwidth 3/ 6/	−3 dB	A_V = +1, V_{IN} = 10 mVp-p, R_L = 2 kΩ	4, 5	01	5.5		MHz
			6		3.6		
Voltage Noise 3/ 6/	e_n p-p	0.1 Hz to 10 Hz	4	01		0.47	µVp-p
			5			0.82	
			6			0.68	
Voltage Noise Density 3/ 6/	e_n	F=10kHz	4	01		6.9	nVp-p
			5			8	
			6			6.3	

1/ Device type 01 supplied to this drawing has been characterized through all levels M, D, P, L, R of irradiation. However, device type 01 is only tested at the "R" level. Pre and post irradiation values are identical unless otherwise specified in Table I. When performing post irradiation electrical measurement for any RHA level, T_A = +25°C.
2/ These parts may be dose rate sensitive in a space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions specified in MIL-STD-883, method 1019, condition A.
3/ Parameter is not tested post radiation.
4/ Do not exceed input voltage range for this device. Functionality is not guaranteed beyond this input voltage range.
5/ While the device is internally short circuit protected, this may not be sufficient to guarantee that the maximum junction temperature is not exceeded under all conditions. Do not exceed maximum TJ in application with output current load.
6/ Parameter is part of device initial characterization which is only repeated after design and process changes or with subsequent wafer lots.

TABLE IB. SEP test limits. 1/

Device types	SEP	Temperature	Bias V_S	Linear energy transfer (LET)
01	No SEL	+125	± 2.5V to ±15V	Effective LET≤ 80MeV-cm^2/mg

1/ For single event phenomenon (SEP) test conditions, see 4.4.4.2 herein.

Device type	01	
Case outline	X	
Terminal number	Terminal symbol	Description
1	NC/GND	Not connected, can be grounded.
2	OUTA	Operational amplifier output, amplifier A.
3	-INA	Operational amplifier negative input, amplifier A.
4	+INA	Operational amplifier positive input, amplifier A.
5	$-V_S$	Negative power supply.
6	NC/GND	Not connected, can be grounded.
7	+INB	Operational amplifier positive input, amplifier B.
8	-INB	Operational amplifier negative input, amplifier B.
9	OUTB	Operational amplifier output, amplifier B.
10	$+V_S$	Positive power supply.

FIGURE 1. Terminal connections.

3.2.1 Case outline. The case outline shall be in accordance with 1.2.4 herein.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.3 Radiation exposure circuit. The radiation exposure circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing and acquiring activity upon request.

3.3 Electrical performance characteristics and postirradiation parameter limits. Unless otherwise specified herein, the electrical performance characteristics and postirradiation parameter limits are as specified in table IA and shall apply over the full ambient operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table IIA. The electrical tests for each subgroup are defined in table IA.

3.5 Marking. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked. For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device. For RHA product using this option, the RHA designator shall still be marked. Marking for device classes Q and V shall be in accordance with MIL-PRF-38535.

3.5.1 Certification/compliance mark. The certification mark for device classes Q and V shall be a "QML" or "Q" as required in MIL-PRF-38535. .

3.6 Certificate of compliance. For device classes Q and V, a certificate of compliance shall be required from a QML-38535 listed manufacturer in order to supply to the requirements of this drawing (see 6.6.1 herein). The certificate of compliance submitted to DLA Land and Maritime-VA prior to listing as an approved source of supply for this drawing shall affirm that the manufacturer's product meets, for device classes Q and V, the requirements of MIL-PRF-38535 and herein.

3.7 Certificate of conformance. A certificate of conformance as required for device classes Q and V in MIL-PRF-38535 shall be provided with each lot of microcircuits delivered to this drawing.

4. VERIFICATION

4.1 Sampling and inspection. For device classes Q and V, sampling and inspection procedures shall be in accordance with MIL-PRF-38535 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein.

4.2 Screening. For device classes Q and V, screening shall be in accordance with MIL-PRF-38535, and shall be conducted on all devices prior to qualification and technology conformance inspection.

4.2.1 Additional criteria for device classes Q and V.

a. The burn-in test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document revision level control of the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table IIA herein.

c. Additional screening for device class V beyond the requirements of device class Q shall be as specified in MIL-PRF-38535, appendix B.

4.3 Qualification inspection for device classes Q and V. Qualification inspection for device classes Q and V shall be in accordance with MIL-PRF-38535. Inspections to be performed shall be those specified in MIL-PRF-38535 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

4.4 Conformance inspection. Technology conformance inspection for classes Q and V shall be in accordance with MIL-PRF-38535 including groups A, B, C, D, and E inspections, and as specified herein.

TABLE IIA. Electrical test requirements.

Test requirements	Subgroups (in accordance with MIL-PRF-38535, table III)	
	Device class Q	Device class V
Interim electrical parameters (see 4.2)	1	1
Final electrical parameters (see 4.2)	1, 2, 3, 1/ 3/ 4, 5, 6, 9, 10, 11	1, 2, 3, 1/ 2/ 3/ 4, 5, 6, 9, 10, 11
Group A test requirements (see 4.4)	1, 2, 3, 4, 5, 6 3/	1, 2, 3, 4, 5, 6, 9, 10, 11 3/
Group C end-point electrical parameters (see 4.4)	1, 2, 3, 4, 5, 6	1, 2, 3, 4 2/
Group D end-point electrical parameters (see 4.4)	1, 2, 3	1, 2, 3
Group E end-point electrical parameters (see 4.4)	---	1

1/ PDA applies to subgroup 1.
2/ Delta limits as specified in Table IIB shall be required where specified, and the delta limits shall be computed with reference to the zero hour electrical parameters (see table IA).
3/ See table IA for parameters characterized for subgroups 4, 5, 6, 9, 10, and 11.

TABLE IIB. Burn-in and operating life test delta parameters. 1/

Parameters	Symbol	Delta limits	Units
Supply current at V_S = ±2.5 V	I_{SY}	±0.025	mA
Supply current at V_S = ±5 V	I_{SY}	±0.025	mA
Supply current at V_S = ±15 V	I_{SY}	±0.03	mA
Offset voltage at V_S = ±2.5 V	V_{OS}	±14.00	µV
Offset voltage at V_S = ±5 V	V_{OS}	±12.00	µV
Offset voltage at V_S = ±15 V	V_{OS}	±12.50	µV
Input bias current at V_S = ±2.5 V	I_B	±0.60	nA
Input bias current at V_S = ±5 V	I_B	±0.55	nA
Input bias current at V_S = ±15 V	I_B	±0.50	nA

1/ 240 hour burn in and group C end point electrical parameters.
Deltas are performed at T_A = +25°C.

4.4.1 Group A inspection.

a. Tests shall be as specified in table IIA herein.

b. Subgroups 7 and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

4.4.2 Group C inspection. The group C inspection end-point electrical parameters shall be as specified in table IIA herein.

4.4.2.1 Additional criteria for device classes Q and V. The steady-state life test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The test circuit shall be maintained under document revision level control by the device manufacturer's TRB in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.

4.4.3 Group D inspection. The group D inspection end-point electrical parameters shall be as specified in table IIA herein.

4.4.4 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein).

a. End-point electrical parameters shall be as specified in table IIA herein.

b. For device classes Q and V, the devices or test vehicle shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535 for the RHA level being tested. All device classes must meet the postirradiation end-point electrical parameter limits as defined in table IA at T_A = +25°C ±5°C, after exposure, to the subgroups specified in table IIA herein.

4.4.4.1 Total dose irradiation testing. Total dose irradiation testing shall be performed in accordance with MIL-STD-883 method 1019, condition A for device type 01, and as specified herein.

4.4.4.2 Single event phenomena (SEP). When specified in the purchase order or contract, SEP testing shall be performed on class V devices. SEP testing shall be performed on the Standard Evaluation Circuit (SEC) or alternate SEP test vehicle as approved by the qualifying activity at initial qualification and after any design or process changes which may affect the upset or latchup characteristics. Test four devices with zero failures. ASTM F1192 may be used as a guideline when performing SEP testing. The recommended test conditions for SEP are as follows:

a. The ion beam angle of incidence shall be between normal to the die surface and 60° to the normal, inclusive (i.e. 0° ≤ angle ≤ 60°). No shadowing of the ion beam due to fixturing or package related affects is allowed.

b. The fluence shall be ≥ 10^7 ions/cm^2.

c. The flux shall be between 10^2 and 10^5 ions/cm^2/s.

d. The particle range shall be ≥ 20 micron in silicon.

e. The test temperature shall be +125°C and the maximum rated operating temperature ±10°C single event latchup testing.

f. Bias conditions shall be VSS = ±16.5 V, ±15 V, and/or ±5 V for the latchup measurements.

g. For SEP test limits, see Table IB herein.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535 for device classes Q and V.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.1.1 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor prepared specification or drawing.

6.2 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished using DD Form 1692, Engineering Change Proposal.

6.3 Record of users. Military and industrial users should inform DLA Land and Maritime when a system application requires configuration control and which SMD's are applicable to that system. DLA Land and Maritime will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DLA Land and Maritime-VA, telephone (614) 692-8108.

6.4 Comments. Comments on this drawing should be directed to DLA Land and Maritime-VA, Columbus, Ohio 43218-3990, or telephone (614) 692-0540.

6.5 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535 and MIL-HDBK-1331.

6.6 Sources of supply.

6.6.1 Sources of supply for device classes Q and V. Sources of supply for device classes Q and V are listed in MIL-HDBK-103 and QML-38535. The vendors listed in QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DLA Land and Maritime-VA and have agreed to this drawing.

6.7 Application notes.

6.7.1 General Description . The device is a dual precision operational amplifier. It features an extremely low offset voltage and drift, and low input bias current, noise, and power consumption. Outputs are stable with capacitive loads of more than 1000 pF with no external compensation. See manufacturer's datasheet for more application information regarding these specifications.

6.8 Additional information. When applicable, a copy of the following additional data shall be maintained and available from the device manufacturer:

a. RHA test conditions (SEP).

b. Occurrence of latchup (SEL).

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 15-12-01

Approved sources of supply for SMD 5962-14233 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38535 during the next revision. MIL-HDBK-103 and QML-38535 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DLA Land and Maritime-VA. This information bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535. DLA Land and Maritime maintains an online database of all current sources of supply at http://www.landandmaritime.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962R1423301VXA	24355	ADA4077-2AF/QMLR

1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the vendor to determine its availability.

2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE number	Vendor name and address
24355	Analog Devices Rt 1 Industrial Park PO Box 9106 Norwood, MA 02062 Point of contact: 7910 Triad Center Drive Greensboro, NC 27409-9605

The information contained herein is disseminated for convenience only and the Government assumes no liability whatsoever for any inaccuracies in the information bulletin.