REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Make change to input offset voltage tests as specified under sections; "V_S = +5 V, V_{CM} = 2.5 V" and "V_S = +3 V, V_{CM} = 1.5 V" in table I. - ro	00-11-28	R. MONNIN
B	Make change to supply current test as specified under section; "V_S = +3 V, V_{CM} = 1.5 V" in table I. - ro	00-12-19	R. MONNIN
C	Make change to V_{OS} delta limit as specified in TABLE IIB. - ro	01-10-05	R. MONNIN
D	Add radiation hardened requirements. - ro	01-11-13	R. MONNIN
E	Drawing updated to reflect current requirements. -rrp	06-06-27	R. MONNIN
F	Update drawing as part of 5 year review. - jt	12-01-05	C. SAFFLE
G	Add device type 02. Delete device class M references. - ro	13-10-22	C. SAFFLE

REV																				
SHEET																				
REV																				
SHEET																				

REV STATUS	REV	G	G	G	G	G	G	G	G	G	G	G			
OF SHEETS	SHEET	1	2	3	4	5	6	7	8	9	10	11			

PMIC N/A

PREPARED BY
Rajesh Pithadia

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

STANDARD MICROCIRCUIT DRAWING

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

AMSC N/A

CHECKED BY
Rajesh Pithadia

APPROVED BY
Rajesh Pithadia

DRAWING APPROVAL DATE
00-04-14

REVISION LEVEL
G

MICROCIRCUIT, LINEAR, QUAD, RAIL-TO-RAIL, PRECISION, OPERATIONAL AMPLIFIER, MONOLITHIC SILICON

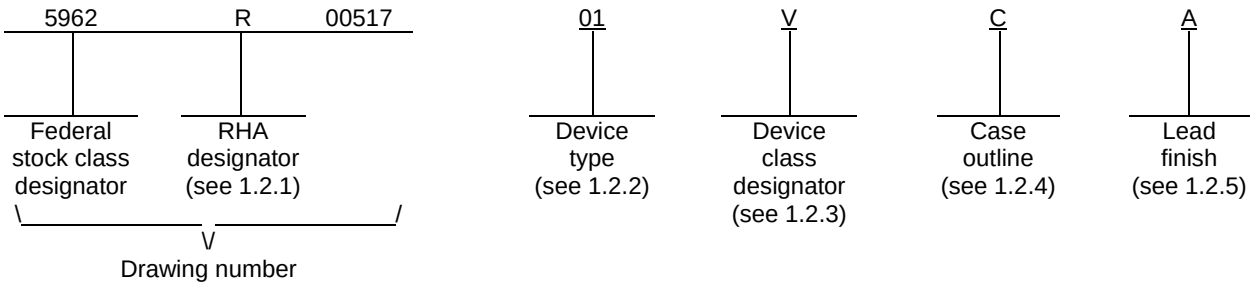
SIZE	CAGE CODE	
A	**67268**	**5962-00517**

SHEET 1 OF 11

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	OP484A	Precision, rail-to-rail input and output, quad operational amplifier
02	OP484A	Precision, rail-to-rail input and output, quad 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
C	GDIP1-T14 or CDIP2-T14	14	Dual-in-line
D	GDFP1-F14 or CDFP2-F14	14	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	±18 V
Power dissipation	500 mW
Differential input voltage	±0.6 V
Input voltage	±18 V
Output short-circuit duration	Indefinite
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 60 seconds)	+300°C
Junction temperature (T_J)	-65°C to +150°C
Thermal resistance, junction-to-case (θ_{JC})	See MIL-STD-1835
Thermal resistance, junction-to-ambient (θ_{JA}):	
Case C	108°C/W
Case D	160°C/W

1.4 Recommended operating conditions.

Supply voltage (V_S)	-15 V to +15 V
Operating temperature range (T_A)	-55°C to +125°C

1.5 Radiation features:

Maximum total dose available (dose rate = 50 – 300 rads(Si)/s):	
Device type 01	100 krads(Si) 2/
Maximum total dose available (dose rate ≤ 10 mrads(Si)/s):	
Device type 02	50 krads(Si) 3/

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.)

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/ Device type 01 may be dose rate sensitive in space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions as specified in MIL-STD-883, method 1019, condition A.
3/ For device type 02, radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, method 1019, condition D.

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.

3.2.1 Case outlines. The case outlines 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 I 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 I.

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.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
V_S = +5 V, V_{CM} = 2.5 V section								
Input offset voltage	V_{OS}			1	01,02		200	µV
				2, 3			400	
			M,D,P,L,R	1	01		600	
			M,D,P,L	1	02		600	
Input offset current	I_{OS}	3/		1, 2, 3	01,02		50	nA
		V_S = +5 V, M,D,P,L,R		1	01		400	
		V_S = +5 V, M,D,P,L		1	02		400	
Input bias current	I_B	3/		1	01,02		350	nA
				2, 3			575	
		V_S = +5 V, M,D,P,L,R		1	01		3000	
		V_S = +5 V, M,D,P,L		1	02		3000	
Common-mode 4/ rejection ratio	CMRR	V_{CM} = 1.0 V to 4.0 V		1, 2, 3	01,02	86		dB
Output high voltage 4/	V_{OH}	I_L = 1 mA		4	01,02	4.85		V
				5, 6		4.7		
			M,D,P,L	4	02	4.8		
Output low voltage 4/	V_{OL}	I_L = 1 mA		4	01,02		125	mV
				5, 6			200	
Large signal voltage gain	A_{VO}	R_L = 2 kΩ,		4	01,02	50		V/mV
		V_{OUT} = 1 V to 4 V		5, 6		25		
		R_L = 10 kΩ,	M,D,P,L,R	4	01	25		
		V_{OUT} = 1 V to 4 V						
		R_L = 10 kΩ,	M,D,P,L	4	02	25		
		V_{OUT} = 1 V to 4 V						
Supply current 5/	I_{SY}	V_{OUT} = 2.5 V		1	01,02		5.8	mA
			M,D,P,L,R	1	01		5.85	
		V_{OUT} = 25 V	M,D,P,L	1	02		5.85	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
V_S = +3 V, V_{CM} = 1.5 V section							
Input offset voltage 4/	V_{OS}		1	01,02		200	µV
			2, 3			400	
Input offset current 4/	I_{OS}	3/	1, 2, 3	01,02		50	nA
Input bias current 4/	I_B	3/	1	01,02		350	nA
			2, 3			575	
Common-mode 4/ rejection ratio	CMRR	V_{CM} = 0 V to 3 V	1	01,02	60		dB
			2, 3		56		
Output high voltage 4/	V_{OH}	I_L = 1 mA	4	01,02	2.85		V
			5, 6		2.65		
Output low voltage 4/	V_{OL}	I_L = 1 mA	4	01,02		125	mV
			5, 6			200	
Supply current 4/ 5/	I_{SY}	V_{OUT} = 1.5 V	1	01,02		5.4	mA
V_S = ±15 V, V_{CM} = 0 V section							
Input offset voltage 4/	V_{OS}		1	01,02		250	µV
			2, 3			500	
Average input offset 4/ voltage	TCV_{OS}		8	01,02		2	µV/°C
Input offset current 4/	I_{OS}		1, 2, 3	01,02		50	nA
Input bias current 4/	I_B		1	01,02		350	nA
			2, 3			575	
Common-mode 4/ rejection ratio	CMRR	V_{CM} = -15 V to +15 V	1, 2, 3	01,02	80		dB
Power supply rejection 4/ ratio	PSRR	V_S = ±2 V to ±18 V	1, 2, 3	01,02	90		dB
Output high voltage 4/	V_{OH}	I_L = 1 mA	4	01,02	14.8		V
			5, 6		14.7		
Output low voltage 4/	V_{OL}	I_L = 1 mA	4	01,02		-14.875	V
			5, 6			-14.8	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
$V_S = \pm 15$ V, $V_{CM} = 0$ V section – Continued							
Large-signal voltage gain 4/	A_{VO}	$R_L = 2\ k\Omega$, $V_{OUT} = \pm 10$ V	4	01,02	150		V/mV
			5, 6		75		
Supply current 4/ 5/	I_{SY}	$V_{OUT} = 0$ V	1	01,02		8	mA
		$V_S = \pm 18$ V, $V_{OUT} = 0$ V	1, 2, 3			9	
Slew rate 4/	SR	$R_L = 2\ k\Omega$	7	01,02	2.4		V/µs

1/ Device type 01 supplied to this drawing have been characterized through all levels M, D, P, L, R of irradiation. Device type 02 supplied to this drawing has been characterized through all levels P and L of irradiation. However, device type 01 is only tested at the "R" level and device type 02 is only tested at the "L" 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/ Device type 01 may be dose rate sensitive in space environment and may demonstrate enhanced low dose rate effects. Radiation end point limits for the noted parameters are guaranteed only for the conditions as specified in MIL-STD-883, method 1019, condition A for device type 01. For device type 02, radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, method 1019, condition D.

3/ Guaranteed by $V_S = \pm 15$ V test.

4/ This parameter is not tested to post irradiation.

5/ I_{SY} limit equals total of all four amplifiers.

Device types	01, 02
Case outlines	C and D
Terminal number	Terminal symbol
1	OUTPUT A
2	-INPUTA
3	+INPUT A
4	$+V_S$
5	+INPUT B
6	-INPUT B
7	OUTPUT B
8	OUTPUT C
9	-INPUT C
10	+INPUT C
11	$-V_S$
12	+INPUT D
13	-INPUT D
14	OUTPUT D

FIGURE 1. Terminal connections.

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.

4.4.1 Group A inspection.

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

b. Subgroups 9, 10, and 11 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.

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)	1,2,3,4,5,6, 1/ 7,8	1,2,3,4, 1/ 2/ 5,6,7,8
Group A test requirements (see 4.4)	1,2,3,4,5,6, 7,8	1,2,3,4,5,6, 7,8
Group C end-point electrical parameters (see 4.4)	1	1 2/
Group D end-point electrical parameters (see 4.4)	1	1
Group E end-point electrical parameters (see 4.4)	1,4	1,4

1/ PDA applies to subgroup 1. V_{OS} excluded from PDA.
2/ Delta limits as specified in table IIB shall be required where specified, and delta limits shall be computed with reference to the previous endpoint electrical parameters.

TABLE IIB. 240 hour burn-in and group C end-point electrical parameters. T_A = 25°C

Parameter	Device type	Limit	Delta 1/
V_{OS}	01, 02	±250 µV	±250 µV
I_{IB}		350 nA	100 nA
I_{OS}		50 nA	40 nA

1/ Delta limits apply to ±15 V operation.

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 I 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 condition D for device type 02, and as specified 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 MIL-HDBK-103 and QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DLA Land and Maritime-VA and have agreed to this drawing.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 13-10-22

Approved sources of supply for SMD 5962-00517 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/
5962-0051701VCA	24355	OP484AY/QMLV
5962-0051701VDA	24355	OP484AM/QMLV
5962R0051701VCA	24355	OP484AY/QMLR
5962R0051701VDA	24355	OP484AM/QMLR
5962L0051702VDA	24355	OP484AM/QMLL

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 P.O. 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.