REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Make changes to TR(tr), TR(os), SR+, SR-, NI(BB), NI(PC), CS tests as specified in table I , 1.5, 4.4.1b, and table II. - ro	99-10-20	R. MONNIN
B	Add test conditions to the input offset voltage temperature sensitivity test and the input offset current temperature sensitivity test in table I. Make changes to the title in table IIB. Editorial changes throughout. - rrp	99-11-17	R. MONNIN
C	Add radiation hardened level “L” devices and delete figures 1 and 3. - ro	02-06-13	R. MONNIN

REV																				
SHEET																				
REV	C	C																		
SHEET	15	16																		

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

PMIC N/A

PREPARED BY
RAJESH PITHADIA

CHECKED BY
RAJESH PITHADIA

APPROVED BY
RAYMOND MONNIN

DRAWING APPROVAL DATE
98-11-06

REVISION LEVEL
C

DEFENSE SUPPLY CENTER COLUMBUS
COLUMBUS, OHIO 43216
http://www.dscc.dla.mil

STANDARD MICROCIRCUIT DRAWING

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

AMSC N/A

MICROCIRCUIT, LINEAR, RADIATION HARDENED, QUAD OPERATIONAL AMPLIFIER, MONOLITHIC SILICON

SIZE	CAGE CODE	
A	**67268**	**5962-99504**

SHEET 1 OF 16

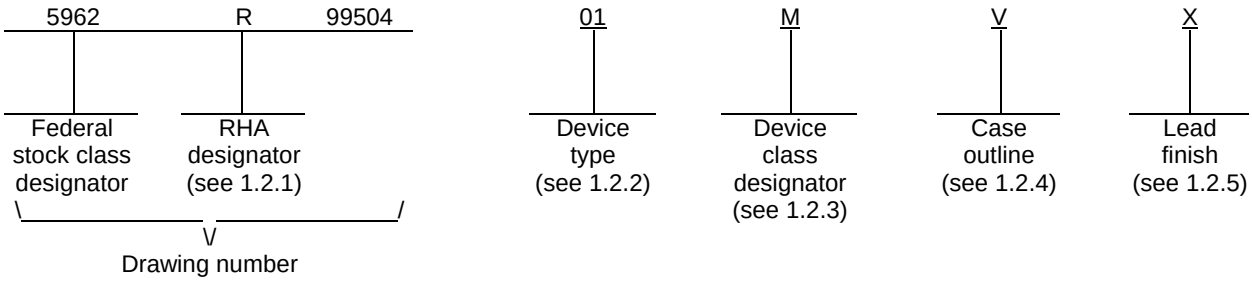
DSCC FORM 2233
APR 97

5962-E448-02

1. SCOPE

1.1 Scope. This drawing documents two product assurance class levels consisting of high reliability (device classes Q and M) 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 are 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. Device class M RHA marked devices meet the MIL-PRF-38535, appendix A 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	LM124A	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
M	Vendor self-certification to the requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A
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
Z	GDFP1-G14	14	Flat pack with gull wing leads

1.2.5 Lead finish. The lead finish is as specified in MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

1.3 Absolute maximum ratings. 1/

Supply voltage range ($+V_{CC}$)	32 V dc or ±16 V dc
Input voltage range	-0.3 V dc to +32 V dc
Differential input voltage	32 V dc
Input current (V_{IN} < -0.3 V dc)	50 mA 2/
Power dissipation: 3/	
Case C	1260 mW
Cases D and Z	700 mW
Storage temperature range	-65°C to +150°C
Output short-circuit to GND: 4/	
(One amplifier, $+V_{CC} \leq 15$ V dc and $T_A = 25°C$)	Continuous
Lead temperature (soldering, 10 seconds)	260°C
Maximum junction temperature (T_J)	150°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case C	19°C/W
Cases D and Z	18°C/W
Thermal resistance, junction-to-ambient (θ_{JA}):	
Case C	103°C/W (still air) 51°C/W (500 LF/min air flow)
Cases D and Z	176°C/W (still air) 116°C/W (500 LF/min air flow)

1.4 Recommended operating conditions.

Supply voltage range	±5 V to ±30 V
Ambient 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)	
RHA designator L	50 Krads (Si) 5/
Maximum total dose available (dose rate = 50 – 300 rads(Si) / s)	
RHA designator R	100 Krads (Si) 5/

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/ This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the operational amplifiers to go to the $+V_{CC}$ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than –0.3 V dc at 25°C.

3/ The maximum power dissipation must be derated at elevated temperatures and is dictated by T_J, θ_{JA}, and T_A. The maximum allowable power dissipation at any temperature is $P_D = (T_J - T_A) / \theta_{JA}$ or the number given in 1.3 herein, whichever is lower.

4/ Short circuits from the output to $+V_{CC}$ can cause excessive heating and eventual destruction. When considering short circuits to ground, the maximum output current is approximately 40 mA independent of the magnitude of $+V_{CC}$. At values of supply voltage in excess of +15 V dc, continuous short-circuits can exceed the power dissipation ratings and cause eventual destruction. Destructive dissipation can result from simultaneous shorts on all amplifiers.

5/ 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, test method 1019, condition A.

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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARDS

DEPARTMENT OF DEFENSE

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

HANDBOOKS

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the specification, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 and 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. The individual item requirements for device class M shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified 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 or MIL-PRF-38535, appendix A and herein for device class M.

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 post irradiation parameter limits. Unless otherwise specified herein, the electrical performance characteristics and post irradiation 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.

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	
Input offset voltage	V_{IO}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{CM} = -15 V		1	01	-2	2	mV
				2, 3		-4	4	
			L, R	1		-2.2	2.2	
		$+V_{CC}$ = 2 V, $-V_{CC}$ = -28, V_{CM} = 13 V		1	01	-2	2	mV
				2, 3		-4	4	
			L, R	1		-2.2	2.2	
		$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V		1	01	-2	2	mV
				2, 3		-4	4	
			L, R	1		-2.2	2.2	
		$+V_{CC}$ = 2.5 V, $-V_{CC}$ = -2.5, V_{CM} = -1.1 V		1	01	-2	2	mV
				2, 3		-4	4	
			L, R	1		-2.2	2.2	
Input offset current	I_{IO}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{CM} = -15 V		1, 2	01	-10	10	nA
				3		-30	30	
			L, R	1		-15	15	
		$+V_{CC}$ = 2 V, $-V_{CC}$ = -28, V_{CM} = 13 V		1, 2	01	-10	10	nA
				3		-30	30	
			L, R	1		-15	15	

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	
Input offset current	I_{IO}	$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V		1, 2	01	-10	10	nA
				3		-30	30	
			L, R	1		-15	15	
		$+V_{CC}$ = 2.5 V, $-V_{CC}$ = -2.5, V_{CM} = 1.1 V		1, 2	01	-10	10	nA
				3		-30	30	
			L, R	1		-15	15	
Input bias current	$+I_{IB}$	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{CM} = -15 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 2 V, $-V_{CC}$ = -28, V_{CM} = 13 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 2.5 V, $-V_{CC}$ = -2.5 V, V_{CM} = 1.1 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	

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	
Input bias current	$-I_{IB}$	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{CM} = -15 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 2 V, $-V_{CC}$ = -28, V_{CM} = 13 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
		$+V_{CC}$ = 2.5 V, $-V_{CC}$ = -2.5 V, V_{CM} = 1.1 V		1, 2	01	-50	+0.1	nA
				3		-100	+0.1	
			L, R	1		-75	+0.1	
Power supply rejection ratio	+PSRR	$-V_{CC}$ = GND, V_{CM} = -1.4 V, 5 V $\le V_{CC} \le$ 30 V		1, 2, 3	01	-100	100	µV/V
Common mode rejection ratio	CMRR			1, 2, 3	01	76		dB
Output short circuit current	I_{OS+}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{OUT} = 25 V		1, 2, 3	01	-70		mA

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	
Power supply current	I_{CC}	$+V_{CC}$ = 30 V,	1, 2	01		3	mA
		$-V_{CC}$ = GND	3			4	
Input offset voltage temperature sensitivity	$\Delta V_{IO} / \Delta T$	$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V 3/	2, 3	01	-30	30	µV/°C
Input offset current temperature sensitivity	$\Delta I_{IO} / \Delta T$	$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, V_{CM} = -1.4 V 3/	2	01	-400	400	pA/°C
			3		-700	700	
Logical “0” output voltage	V_{OL}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, R_L = 10 kΩ	4, 5, 6	01		35	mV
		$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, I_{OL} = 5 Ma	4, 5, 6	01		1.5	V
		$+V_{CC}$ = 4.5 V, $-V_{CC}$ = GND, I_{OL} = 2 µA	4, 5, 6	01		0.4	V
Logical “1” output voltage	V_{OH}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, I_{OH} = -10 mA	4, 5, 6	01	27		V
		$+V_{CC}$ = 4.5 V, $-V_{CC}$ = GND, I_{OH} = -10 mA	4, 5, 6	01	2.4		V

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	
Voltage gain	A_{VS+}	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, 1 V ≤ V_{OUT} ≤ 26 V, R_L = 10 kΩ	4	01	50		V/mV
			5, 6		25		
		L, R	1		40		
		$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, 5 V ≤ V_{OUT} ≤ 20 V, R_L = 2 kΩ	4	01	50		V/mV
			5, 6		25		
		L, R	1		40		
Voltage gain	A_{VS}	$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, 1 V ≤ V_{OUT} ≤ 2.5 V, R_L = 10 kΩ	4, 5, 6	01	10		V/mV
		$+V_{CC}$ = 5 V, $-V_{CC}$ = GND, 1 V ≤ V_{OUT} ≤ 2.5 V, R_L = 2 kΩ	4, 5, 6	01	10		
Maximum output voltage swing	$+V_{OP}$	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{OUT} = +30 V, R_L = 10 kΩ	4, 5, 6	01	27		V
		$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{OUT} = +30 V, R_L = 2 kΩ	4, 5, 6	01	26		V
Transient response: rise time	TR(t_r)	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND	7, 8A, 8B	01		1	µs
Transient response: overshoot	TR(os)	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND	7, 8A, 8B	01		50	%

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	
Slew rate: rise	SR+	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND	7, 8A, 8B	01	0.1		V/µs
Slew rate: fall	SR-	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND	7, 8A, 8B	01	0.1		V/µs
Noise broadband	NI(BB)	$+V_{CC}$ = 15 V, $-V_{CC}$ = -15 V, BW = 10 Hz to 5 kHz	7	01		15	µV/rms
Noise popcorn	NI(PC)	$+V_{CC}$ = 15 V, $-V_{CC}$ = -15 V, R_S = 20 kΩ, BW = 10 Hz to 5 kHz	7	01		50	µV/peak
Channel separation	CS	$+V_{CC}$ = 30 V, $-V_{CC}$ = GND, R_L = 2 kΩ	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, A to B	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, A to C	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, A to D	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, B to A	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, B to C	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, B to D	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, C to A	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, C to B	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, C to D	7	01	80		dB

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	
Channel separation	CS	R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, D to A	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, D to B	7	01	80		dB
		R_L = 2 kΩ, 4/ V_{IN} = 1 V and 16 V, D to C	7	01	80		dB

1/ Devices supplied to this drawing have been characterized through all levels M, D, P, L, R of irradiation. However, this device is only tested at the “L” and “R” levels. Pre and Post irradiation values are identical unless otherwise specified in table I. When performing post irradiation electrical measurements 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, test method 1019, condition A.

3/ Calculated parameter.

4/ $+V_{CC}$ = 30 V, $-V_{CC}$ = 0 V.

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 as listed in MIL-HDBK-103. 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. Marking for device class M shall be in accordance with MIL-PRF-38535, appendix A.

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. The compliance mark for device class M shall be a "C" as required in MIL-PRF-38535, appendix A.

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). For device class M, a certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.6.2 herein). The certificate of compliance submitted to DSCC-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 or for device class M, the requirements of MIL-PRF-38535, appendix A and herein.

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

3.8 Notification of change for device class M. For device class M, notification to DSCC-VA of change of product (see 6.2 herein) involving devices acquired to this drawing is required for any change as defined in MIL-PRF-38535, appendix A.

3.9 Verification and review for device class M. For device class M, DSCC, DSCC's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

3.10 Microcircuit group assignment for device class M. Device class M devices covered by this drawing shall be in microcircuit group number 49 (see MIL-PRF-38535, appendix A).

Device type	01
Case outlines	C, D, and Z
Terminal number	Terminal symbol
1	OUTPUT 1
2	-INPUT 1
3	+INPUT 1
4	$+V_{CC}$
5	+INPUT 2
6	-INPUT 2
7	OUTPUT 2
8	OUTPUT 3
9	-INPUT 3
10	+INPUT 3
11	GND
12	+INPUT 4
13	-INPUT 4
14	OUTPUT 4

FIGURE 1. Terminal connections.

4. QUALITY ASSURANCE PROVISIONS

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. For device class M, sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

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. For device class M, screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection.

4.2.1 Additional criteria for device class M.

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015.

(2) T_A = +125°C, minimum.

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

4.2.2 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 test 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. Quality conformance inspection for device class M shall be in accordance with MIL-PRF-38535, appendix A and as specified herein. Inspections to be performed for device class M shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

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.

TABLE IIA. Electrical test requirements.

Test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table I)	Subgroups (in accordance with MIL-PRF-38535, table III)	
	Device class M	Device class Q	Device class V
Interim electrical parameters (see 4.2)	1	1	1
Final electrical parameters (see 4.2)	1, 2, 3, 4 1/	1, 2, 3, 4 1/	1, 2, 3, 4 1/
Group A test requirements (see 4.4)	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7	1, 2, 3, 4, 5, 6, 7, 8A, 8B
Group C end-point electrical parameters (see 4.4)	1	1	1, 2, 3 2/
Group D end-point electrical parameters (see 4.4)	1	1	1, 2, 3
Group E end-point electrical parameters (see 4.4)	1	1	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 previous endpoint electrical parameters.

Table IIB. Group C end-point electrical parameters (+25°C).

Parameter	Device type	Delta limit	
		Min	Max
V_{IO} 1/	01	-0.5 mV	0.5 mV
$+I_{IB}$ 1/	01	-10 nA	10 nA
$-I_{IB}$ 1/	01	-10 nA	10 nA

1/ $+V_{CC}$ = 30 V, $-V_{CC}$ = GND, V_{CM} = -15 V.

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 class M. Steady-state life test conditions, method 1005 of MIL-STD-883:

a. Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

b. T_A = +125°C, minimum.

c. Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.4.2.2 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 test 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). RHA levels for device classes M, Q, and V shall be as specified in MIL-PRF-38535. End-point electrical parameters shall be as 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 and as specified herein.

4.4.4.1.1 Accelerated aging test. Accelerated aging tests shall be performed on all devices requiring a RHA level greater than 5k rads(Si). The post-anneal end-point electrical parameter limits shall be as specified in table I herein and shall be the pre-irradiation end-point electrical parameter limit at 25°C ±5°C. Testing shall be performed at initial qualification and after any design or process changes which may affect the RHA response of the device.

4.4.4.2 Dose rate burnout. When required by the customer test shall be performed on devices, SEC, or approved test structures at technology qualifications and after any design or process changes which may effect the RHA capability of the process. Dose rate burnout shall be performed in accordance with test method 1023 of MIL-STD-883 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 or MIL-PRF-38535, appendix A for device class M.

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.

6.1.2 Substitutability. Device class Q devices will replace device class M devices.

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 Defense Supply Center Columbus when a system application requires configuration control and which SMD's are applicable to that system. DSCC 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 DSCC-VA, telephone (614) 692-0544.

6.4 Comments. Comments on this drawing should be directed to DSCC-VA , Columbus, Ohio 43216-5000, or telephone (614) 692-0547.

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 QML-38535. The vendors listed in QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DSCC-VA and have agreed to this drawing.

6.6.2 Approved sources of supply for device class M. Approved sources of supply for class M are listed in MIL-HDBK-103. The vendors listed in MIL-HDBK-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DSCC-VA.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 02-06-13

Approved sources of supply for SMD 5962-99504 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 DSCC-VA. This bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962L9950401VCA	27014	LM124AJLQMLV
5962L9950401VDA	27014	LM124AWLQMLV
5962L9950401VZA	27014	LM124AWGLQMLV
5962R9950401QCA	3/	LM124AJRQML
5962R9950401QDA	3/	LM124AWRQML
5962R9950401QZA	3/	LM124AWGRQML
5962R9950401VCA	27014	LM124AJRQMLV
5962R9950401VDA	27014	LM124AWRQMLV
5962R9950401VZA	27014	LM124AWGRQMLV

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.
3/ Not available from an approved source of supply.

Vendor CAGE number	Vendor name and address
27014	National Semiconductor 2900 Semiconductor Drive P.O. Box 58090 Santa Clara, CA 95052-8090