REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Change paragraph 3.2.3. Remove radiation test circuit. – rrp	00-10-13	R. MONNIN
B	Drawing updated to reflect current requirements. – gt	02-05-10	R. MONNIN
C	Add case outline H. Make changes to 1.2.4, 1.3, and figure 1. - ro	03-03-07	R. MONNIN
D	Add RHA designator “L” devices. Make changes to 1.5 and footnote 2 under Table I. Delete 4.4.4.1.1 and 4.4.4.2. - ro	05-11-30	R. MONNIN
E	Add device type 02 tested at Low Dose Rate. Add RHA designator “R” requirements. Make changes to 1.2.2, 1.5, Table I, figure 1, Table IIB, and 4.4.4.1. - ro	08-06-24	R. HEBER
F	Add paragraph 3.1.1 and Appendix A for microcircuit die. Delete device class M references. Delete the words, “Radiation hardened” from the title block. - ro	13-12-16	C. SAFFLE

REV																				
SHEET																				
REV	F	F	F	F	F	F														
SHEET	15	16	17	18	19	20														

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

PMIC N/A

PREPARED BY
RICK OFFICER

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
RAYMOND MONNIN

DRAWING APPROVAL DATE
00-05-11

REVISION LEVEL
F

MICROCIRCUIT, LINEAR, PRECISION VOLTAGE COMPARATOR / BUFFER, MONOLITHIC SILICON

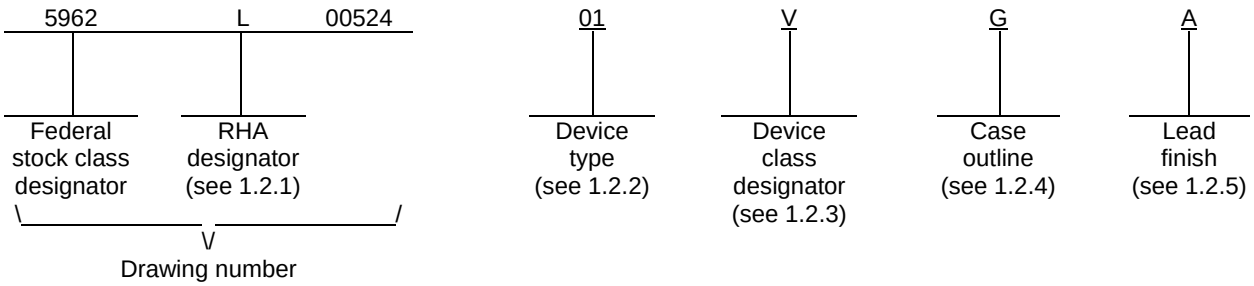
SIZE	CAGE CODE	
A	**67268**	**5962-00524**

SHEET 1 OF 20

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	LM111	Radiation hardened precision voltage comparator / buffer
02	LM111	Low dose rate radiation hardened precision voltage comparator / buffer

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
G	MACY1-X8	8	Can
H	GDFP1-F10 or CDFP2-F10	10	Flat pack
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
Z	GDFP1-G10	10	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.

1.3 Absolute maximum ratings. 1/

Positive supply voltage ($+V_{CC}$) ..... +30.0 V
Negative supply voltage ($-V_{CC}$) ..... -30.0 V
Total supply voltage ($+V_{CC}$ to $-V_{CC}$) ..... 36.0 V
Output to negative supply voltage ..... 50.0 V
GND to negative supply voltage ..... 30 V
Differential input voltage ..... ±30.0 V
Sink current ..... 50 mA
Input voltage (V_{IN}) ..... ±15 V 2/
Maximum strobe current ..... 10 mA
Voltage at STROBE pin ..... $\pm V_{CC}$ – 5 V
Power dissipation (P_D): 3/
  Cases G, H, and Z ..... 330 mW at T_A = +25°C
  Case P ..... 400 mW at T_A = +25°C
Output short circuit duration ..... 10 seconds
Storage temperature range ..... -65°C ≤ T_A ≤ +150°C
Junction temperature (T_J) ..... +175°C
Lead temperature (soldering, 60 seconds) ..... +300°C
Thermal resistance, junction-to-case (θ_{JC}):
  Case G ..... 50°C/W
  Cases H and Z ..... 24°C/W
  Case P ..... 21°C/W
Thermal resistance, junction-to-ambient (θ_{JA}):
  Case G ..... 162°C/W (still air at 0.5 W)
    92°C/W (500 linear feet per minute air flow at 0.5 W)
  Cases H and Z ..... 231°C/W
    153°C/W (500 linear feet per minute air flow at 0.5 W)
  Case P ..... 134°C/W
    76°C/W (500 linear feet per minute air flow at 0.5 W)

1.4 Recommended operating conditions.

Supply voltage ($\pm V_{CC}$) ..... ±15 V
Ambient operating temperature range (T_A) ..... -55°C ≤ T_A ≤ +125°C

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 rating applies to V_{CC} = ±15 V supplies. The positive input voltage limit is 30 V above the negative supply. The negative input voltage limit is equal to the negative supply voltage or 30 V below the positive supply, whichever is less.

3/ The maximum power dissipation must be derated at elevated temperatures and is dictated by T_J maximum, θ_{JA} maximum, and T_A. The maximum allowable power dissipation at any temperature is P_D max = (T_J max – T_A) / θ_{JA} or the number given in the absolute maximum ratings, whichever is lower.

1.5 Radiation features. 4/ 5/

Maximum total dose available (dose rate = 50 – 300 rads(Si)/s):
Device type 01:
RHA designator L ..... 50 krads(Si)
Maximum total dose available (dose rate = 10 mrads(Si)/s):
Device type 02:
RHA designator R ..... 100 krads(Si)

The manufacturer supplying device type 02 RHA parts on this drawing has performed a characterization test to demonstrate that the parts do not exhibit enhanced low dose rate sensitivity (ELDRS) according to MIL-STD-883 method 1019 paragraph 3.13.1.1. Therefore this part may be considered ELDRS free. However, the manufacturer will continue to perform low dose rate lot acceptance testing on each wafer lot or wafer until characterization testing has been performed according to test method 1019 of MIL-STD-883. Since the redesigned part did not demonstrate ELDRS per Method 1019 and the previously tested device type 01 was not tested for ELDRS, device type 02 will be added to distinguish it from the 01 device type.

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 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.

4/ For device type 01, this part 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 as specified in MIL-STD-883, method 1019, condition A.
5/ For device type 02, this part has been tested and does not demonstrate low dose rate sensitivity. These parts may be sensitive in a high dose environment. Radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, method 1019, condition D.

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.

3.1.1 Microcircuit die. For the requirements of microcircuit die, see appendix A to this document.

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/ 3/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input offset voltage	V_{IO}	V_{IN} = 0 V, R_S = 50 Ω	1	All	-3.0	+3.0	mV
			2,3		-4.0	+4.0	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 Ω,	1		-3.0	+3.0	
		V_{CM} = -14.5 V	2,3		-4.0	+4.0	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 Ω,	1		-3.0	+3.0	
		V_{CM} = +13 V	2,3		-4.0	+4.0	
		$+V_{CC}$ = +2.5 V, V_{IN} = 0 V,	1		-3.0	+3.0	
		$-V_{CC}$ = -2.5 V, R_S = 50 Ω	2,3		-4.0	+4.0	
Raised input offset voltage	$V_{IO(R)}$	V_{IN} = 0 V, R_S = 50 Ω	1	All	-3.0	+3.0	mV
			2,3		-4.5	+4.5	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 Ω,	1		-3.0	+3.0	
		V_{CM} = -14.5 V	2,3		-4.5	+4.5	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 Ω,	1		-3.0	+3.0	
		V_{CM} = 13 V	2,3		-4.5	+4.5	
Input offset current	I_{IO}	V_{IN} = 0 V, R_S = 50 kΩ	1,2	All	-10	+10	nA
			3		-20	+20	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 kΩ,	1,2		-10	+10	
		V_{CM} = -14.5 V	3		-20	+20	
		M, D, P, L	1	01	-50	+50	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 kΩ,	1,2	All	-10	+10	
		V_{CM} = 13 V	3		-20	+20	
		M, D, P, L	1	01	-50	+50	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ 3/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Raised input offset current	$I_{IO(R)}$	V_{IN} = 0 V, R_S = 50 kΩ	1,2	All	-25	+25	nA
			3		-50	+50	
		M, D, P, L, R	1	02	-100	+100	
Input bias current	$+I_{IB}$	V_{IN} = 0 V, R_S = 50 kΩ	1,2	All	-100	+0.1	nA
			3		-150	+0.1	
		M, D, P, L	1	01	-150	+0.1	
		M, D, P, L, R	1	02	-180	+0.1	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 kΩ, V_{CM} = -14.5 V	1,2	All	-150	+0.1	
			3		-200	+0.1	
		M, D, P, L	1	01	-175	+0.1	
		M, D, P, L, R	1	02	-225	+0.1	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 kΩ, V_{CM} = 13 V	1,2	All	-150	+0.1	
			3		-200	+0.1	
	$-I_{IB}$	V_{IN} = 0 V, R_S = 50 kΩ	1,2	All	-100	+0.1	
			3		-150	+0.1	
		M, D, P, L	1	01	-150	+0.1	
		M, D, P, L, R	1	02	-180	+0.1	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 kΩ, V_{CM} = -14.5 V	1,2	All	-150	+0.1	
			3		-200	+0.1	
		M, D, P, L	1	01	-175	+0.1	
		M, D, P, L, R	1	02	-225	+0.1	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 kΩ, V_{CM} = 13 V	1,2	All	-150	+0.1	
			3		-200	+0.1	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ 3/ $-55°C \le T_A \le +125°C$ unless otherwise specified		Group A subgroups	Device type	Limits		Unit
						Min	Max	
Collector output voltage 4/ (STROBED)	$V_{O(STB)}$	$+V_{IN}$ = GND, $-V_{IN}$ = 15 V, R_S = 50 Ω, I_{STB} = -3.0 mA		1,2,3	All	14		V
Common mode rejection	CMR	-28 V ≤ $-V_{CC}$ ≤ -0.5 V, R_S = 50 Ω		1,2,3	All	80		dB
		2 V ≤ $+V_{CC}$ ≤ 29.5 V, R_S = 50 Ω				80		
		-14.5 V ≤ V_{CM} ≤ 13 V, R_S = 50 Ω				80		
Low level output voltage	V_{OL}	$+V_{CC}$ = 4.5 V, $-V_{CC}$ = GND, V_{ID} = -6 mV, I_{OUT} = 8 mA, ±V_{IN} = 0.5 V		1,2,3	All		0.4	V
		$+V_{CC}$ = 4.5 V, $-V_{CC}$ = GND, V_{ID} = -6 mV, I_{OUT} = 8 mA, ±V_{IN} = 3 V					0.4	
		V_{ID} = -5 mV, I_{OUT} = 50 mA, ±V_{IN} = 13 V					1.5	
		V_{ID} = -5 mV, I_{OUT} = 50 mA, ±V_{IN} = -14 V					1.5	
Output leakage current	I_{CEX}	$+V_{CC}$ = 18 V,		1	All	-1	10	nA
		$-V_{CC}$ = -18 V,		2		-1	500	
		V_{OUT} = 32 V	M, D, P, L	1	01	-25	+25	
			M, D, P, L, R	1	02	-1	+25	
Input leakage current 5/	I_I	$+V_{CC}$ = 18 V, $-V_{CC}$ = -18 V, $+V_{IN}$ = +12 V, $-V_{IN}$ = -17 V		1,2,3	All	-5	500	nA
		$+V_{CC}$ = 18 V, $-V_{CC}$ = -18 V, $+V_{IN}$ = -17 V, $-V_{IN}$ = +12 V				-5	500	
Positive supply current	$+I_{CC}$			1,2	All		6.0	mA
				3			7.0	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions 1/ 2/ 3/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Negative supply current	$-I_{CC}$		1,2	All	-5		mA
			3		-6		
Temperature coefficient input offset voltage	ΔV_{IO} / ΔT	$+25°C \le T_A \le +125°C$	2	All	-25	25	µV/°C
		$-55°C \le T_A \le +25°C$	3		-25	25	
Temperature coefficient input offset current	ΔI_{IO} / ΔT	$+25°C \le T_A \le +125°C$	2	All	-100	100	pA/°C
		$-55°C \le T_A \le +25°C$	3		-200	200	
Output short circuit 6/ current	I_{OS}	V_{OUT} = 5 V, t ≤ 10 ms, $+V_{IN}$ = 0 V, $-V_{IN}$ = 0.1 V	1	All		200	mA
			2			150	
			3			250	
Adjustment for input offset voltage	V_{IO} (ADJ)+	V_{OUT} = 0 V, V_{IN} = 0 V, R_S = 50 Ω, T_A = +25°C	1	All	+5		mV
	V_{IO} (ADJ)-					-5	
Voltage gain (emitter)	+AVE	R_L = 600 Ω	4	All	10		V/mV
			5,6		8		
	-AVE		4		10		
			5,6		8		
Response time, 7/ collector output	t_{RLHC}	$V_{OD(overdrive)}$ = -5 mV, C_L = 50 pF(min), V_{IN} = -100 mV	7,8B	All	0	300	ns
			8A		0	640	
Response time, 7/ collector output	t_{RHLC}	$V_{OD(overdrive)}$ = +5 mV, C_L = 50 pF(min), V_{IN} = 100 mV	7,8B	All	0	300	ns
			8A		0	500	

1/ Unless otherwise specified, $\pm V_{CC} = \pm 15$ V and V_{CM} = 0 V.
2/ Devices supplied to this drawing have been characterized through all levels M, D, P, L and R of irradiation. However, device 01 is only tested at the "M, D, P, and L" levels and device 02 is only tested at the "M, D, P, 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.
3/ For device type 01, this part 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 as specified in MIL-STD-883, method 1019, condition A. For device type 02, this part has been tested and does not demonstrate low dose rate sensitivity. These parts may be sensitive in a high dose environment. Radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, test method 1019, condition D.
4/ I_{STB} = -2 mA at T_A = -55°C.
5/ V_{ID} is voltage difference between inputs.
6/ Actual minimum limit used is 5 mA due to test setup.
7/ Uses AC test tape and hardware.

Device types	01 and 02	
Case outlines	G and P	H and Z
Terminal number	Terminal symbol	
1	GROUND	GROUND
2	+INPUT	+INPUT
3	-INPUT	-INPUT
4	$-V_{CC}$	NC
5	BALANCE	$-V_{CC}$
6	BAL / STRB	BALANCE
7	OUTPUT	BAL / STB
8	$+V_{CC}$	NC
9	---	OUTPUT
10	---	$+V_{CC}$

NC = No connection

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)	---	---
Final electrical parameters (see 4.2)	1,2,3,4,5, 1/ 6,7,8A,8B	1,2,3,4, 1/ 2/ 5,6,7,8A,8B
Group A test requirements (see 4.4)	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	1,2,3 2/
Group D end-point electrical parameters (see 4.4)	1	1,2,3
Group E end-point electrical parameters (see 4.4)	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 completed with reference to the previous electrical parameters.

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, condition D for device type 02, and as specified herein.

TABLE IIB. Delta limits at +25°C.

Test	Symbol	Conditions 1/ 2/ 3/ $-55°C \le T_A \le +125°C$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Input offset voltage	V_{IO}	V_{IN} = 0 V, R_S = 50 Ω	1	All	-0.5	0.5	mV
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 Ω, V_{CM} = -14.5 V			-0.5	0.5	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 Ω, V_{CM} = 13 V			-0.5	0.5	
Input bias current	$+I_{IB}$	V_{IN} = 0 V, R_S = 50 kΩ	1	All	-12.5	12.5	nA
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 kΩ, V_{CM} = -14.5 V			-12.5	12.5	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 kΩ, V_{CM} = 13 V			-12.5	12.5	
	$-I_{IB}$	V_{IN} = 0 V, R_S = 50 kΩ			-12.5	12.5	
		$+V_{CC}$ = 29.5 V, V_{IN} = 0 V, $-V_{CC}$ = -0.5 V, R_S = 50 kΩ, V_{CM} = -14.5 V			-12.5	12.5	
		$+V_{CC}$ = 2 V, V_{IN} = 0 V, $-V_{CC}$ = -28 V, R_S = 50 kΩ, V_{CM} = 13 V			-12.5	12.5	
Output leakage current	I_{CEX}	$+V_{CC}$ = 18 V, $-V_{CC}$ = -18 V, V_{OUT} = 32 V	1	All	-5	5	nA

1/ Unless otherwise specified, $\pm V_{CC}$ = ±15 V and V_{CM} = 0 V.

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.

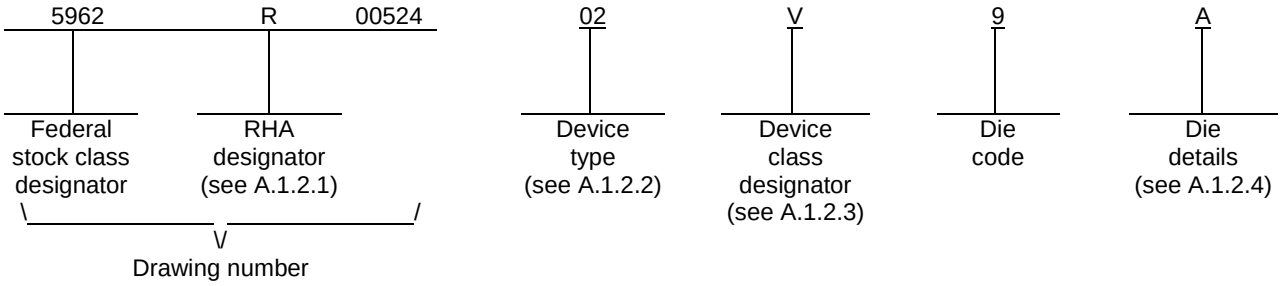
6.6.1 Sources of supply for device classes Q and V. Sources of supply for device classes Q and V are listed in MIL-HDBK-103 and QML-38535. The vendors listed in MIL-HDBK-103 and QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DLA Land and Maritime-VA and have agreed to this drawing.

APPENDIX A
APPENDIX A FORMS A PART OF SMD 5962-00524

A.1 SCOPE

A.1.1 Scope. This appendix establishes minimum requirements for microcircuit die to be supplied under the Qualified Manufacturers List (QML) Program. QML microcircuit die meeting the requirements of MIL-PRF-38535 and the manufacturers approved QM plan for use in monolithic microcircuits, multi-chip modules (MCMs), hybrids, electronic modules, or devices using chip and wire designs in accordance with MIL-PRF-38534 are specified herein. Two product assurance classes consisting of military high reliability (device class Q) and space application (device class V) are reflected in the Part or Identification Number (PIN). When available, a choice of Radiation Hardiness Assurance (RHA) levels are reflected in the PIN.

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



A.1.2.1 RHA designator. Device classes Q and V RHA identified die meet the MIL-PRF-38535 specified RHA levels. A dash (-) indicates a non-RHA die.

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

Device type	Generic number	Circuit function
02	LM111	Low dose rate radiation hardened precision voltage comparator / buffer

A.1.2.3 Device class designator.

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

A.1.2.4 Die details. The die details designation is a unique letter which designates the die's physical dimensions, bonding pad location(s) and related electrical function(s), interface materials, and other assembly related information, for each product and variant supplied to this appendix.

A.1.2.4.1 Die physical dimensions.

Die type	Figure number
02	A-1

A.1.2.4.2 Die bonding pad locations and electrical functions.

Die type	Figure number
02	A-1

A.1.2.4.3 Interface materials.

Die type	Figure number
02	A-1

A.1.2.4.4 Assembly related information.

Die type	Figure number
02	A-1

A.1.3 Absolute maximum ratings. See paragraph 1.3 herein for details.

A.1.4 Recommended operating conditions. See paragraph 1.4 herein for details.

A.2 APPLICABLE DOCUMENTS.

A.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 STANDARD

MIL-STD-883 - Test Method Standard Microcircuits.

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.)

A.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.

A.3 REQUIREMENTS

A.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.

A.3.2 Design, construction and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein and the manufacturer's QM plan for device classes Q and V.

A.3.2.1 Die physical dimensions. The die physical dimensions shall be as specified in A.1.2.4.1 and on figure A-1.

A.3.2.2 Die bonding pad locations and electrical functions. The die bonding pad locations and electrical functions shall be as specified in A.1.2.4.2 and on figure A-1.

A.3.2.3 Interface materials. The interface materials for the die shall be as specified in A.1.2.4.3 and on figure A-1.

A.3.2.4 Assembly related information. The assembly related information shall be as specified in A.1.2.4.4 and on figure A-1.

A.3.2.5 Radiation exposure circuit. The radiation exposure circuit shall be as defined in paragraph 3.2.3 herein.

A.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 of the body of this document.

A.3.4 Electrical test requirements. The wafer probe test requirements shall include functional and parametric testing sufficient to make the packaged die capable of meeting the electrical performance requirements in table I.

A.3.5 Marking. As a minimum, each unique lot of die, loaded in single or multiple stack of carriers, for shipment to a customer, shall be identified with the wafer lot number, the certification mark, the manufacturer's identification and the PIN listed in A.1.2 herein. The certification mark shall be a "QML" or "Q" as required by MIL-PRF-38535.

A.3.6 Certification 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 A.6.4 herein). The certificate of compliance submitted to DLA Land and Maritime -VA prior to listing as an approved source of supply for this appendix shall affirm that the manufacturer's product meets, for device classes Q and V, the requirements of MIL-PRF-38535 and the requirements herein.

A.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 microcircuit die delivered to this drawing.

A.4 VERIFICATION

A.4.1 Sampling and inspection. For device classes Q and V, die 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 modifications in the QM plan shall not affect the form, fit, or function as described herein.

A.4.2 Screening. For device classes Q and V, screening shall be in accordance with MIL-PRF-38535, and as defined in the manufacturer's QM plan. As a minimum, it shall consist of:

a. Wafer lot acceptance for class V product using the criteria defined in MIL-STD-883, method 5007.

b. 100% wafer probe (see paragraph A.3.4 herein).

c. 100% internal visual inspection to the applicable class Q or V criteria defined in MIL-STD-883, method 2010 or the alternate procedures allowed in MIL-STD-883, method 5004.

A.4.3 Conformance inspection.

A.4.3.1 Group E inspection. Group E inspection is required only for parts intended to be identified as radiation assured (see A.3.5 herein). RHA levels for device classes Q and V shall be as specified in MIL-PRF-38535. End point electrical testing of packaged die shall be as specified in table IIA herein. Group E tests and conditions are as specified in paragraphs 4.4.4 and 4.4.4.1 herein.

A.5 DIE CARRIER

A.5.1 Die carrier requirements. The requirements for the die carrier shall be accordance with the manufacturer's QM plan or as specified in the purchase order by the acquiring activity. The die carrier shall provide adequate physical, mechanical and electrostatic protection.

A.6 NOTES

A.6.1 Intended use. Microcircuit die conforming to this drawing are intended for use in microcircuits built in accordance with MIL-PRF-38535 or MIL-PRF-38534 for government microcircuit applications (original equipment), design applications, and logistics purposes.

A.6.2 Comments. Comments on this appendix should be directed to DLA Land and Maritime -VA, Columbus, Ohio, 43218-3990 or telephone (614)-692-0540.

A.6.3 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535 and MIL-HDBK-1331.

A.6.4 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 within MIL-HDBK-103 and QML-38535 have submitted a certificate of compliance (see A.3.6 herein) to DLA Land and Maritime -VA and have agreed to this drawing.

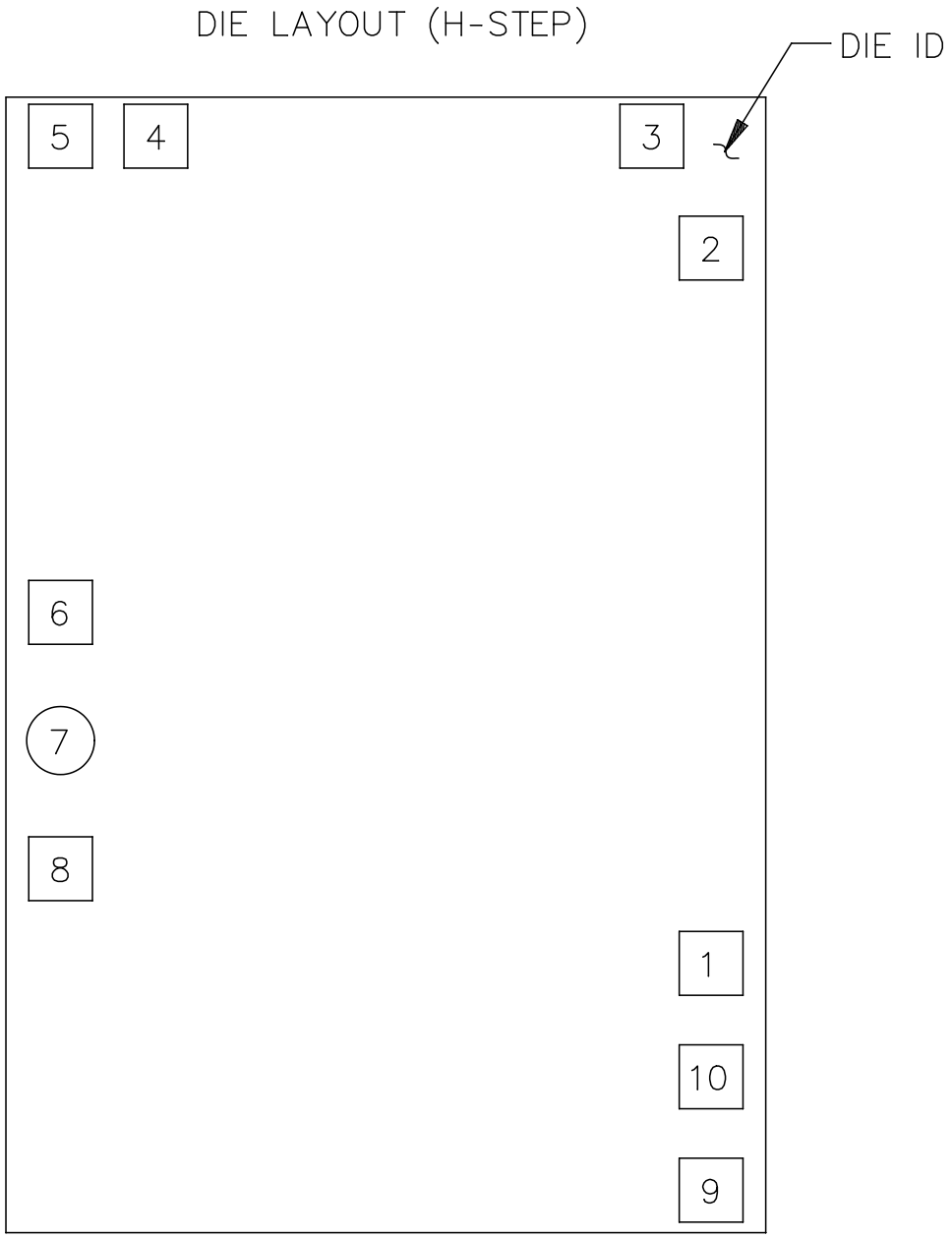


FIGURE A-1. Die bonding pad locations and electrical functions.

Die bond pad coordinate locations (H step)					
(Referenced to die center, coordinates in μm) NC = no connection. NU = not used.					
Terminal symbol	Pad number	X / Y Coordinates		Pad size	
		X	Y	X	Y
GROUND	1	485.14	-434.34	111.76	91.44
+INPUT	2	492.76	607.06	96.52	96.52
-INPUT	3	400.05	770.89	104.14	99.06
$-V_{CC}$	4	-355.60	770.89	91.44	99.06
BALANCE	5	-495.30	770.89	91.44	99.06
BAL / STB	6	-488.95	68.58	104.14	106.68
NC	7	-482.60	-114.30	116.84	116.84
NC	8	-495.30	-298.45	91.44	104.14
OUTPUT	9	478.79	-768.35	99.04	104.14
$+V_{CC}$	10	485.14	-593.09	111.76	99.06

Die bonding pad locations and electrical functions

Die physical dimensions.
Die size: 1143.00 μm x 1651.00 μm
45.0 mils x 65.0 mils
Die thickness: 304.8 μm

Interface materials.
Top metallization: Al 0.5% Cu
Backside metallization: Bare back

Glassivation.
Type: Vapox
Thickness: 10 kÅ

Substrate:

Assembly related information.
Substrate potential: floating
Special assembly instructions: None

FIGURE A-1. Die bonding pad locations and electrical functions - continued.

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 13-12-16

Approved sources of supply for SMD 5962-00524 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/
5962L0052401VGA	27014	LM111HLQMLV
5962L0052401VHA	27014	LM111WLQMLV
5962L0052401VPA	27014	LM111J-8LQMLV
5962L0052401VZA	27014	LM111WGLQMLV
5962P0052401QGA	27014	LM111HPQML
5962P0052401VGA	27014	LM111HPQMLV
5962P0052401VHA	27014	LM111WPQMLV
5962P0052401QPA	27014	LM111J-8PQML
5962P0052401VPA	27014	LM111J-8PQMLV
5962P0052401QZA	27014	LM111WGPQML
5962P0052401VZA	27014	LM111WGPQMLV
5962R0052402VGA	27014	LM111HRLQMLV
5962R0052402VHA	27014	LM111WRLQMLV
5962R0052402VPA	27014	LM111J-8RLQMLV
5962R0052402VZA	27014	LM111WGRLQMLV
5962R0052402V9A	27014	LM111-MDE

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