REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add case X which is a 16 lead flat pack. Make changes to 1.2.4, 1.3, 3.2.1, 3.2.2, figure 1, slew rate test, and footnote 1 as specified in table I herein.	99-02-10	R. MONNIN
B	Add Table IIB and delete figure 1. –ro	01-03-29	R. MONNIN
C	Add radiation hardened requirements. –ro	01-08-07	R. MONNIN
D	Drawing updated to reflect current requirements. -rrp	05-09-07	R. MONNIN
E	Add device types 02 and 03. Make change to paragraphs 1.2.2, 1.2.4, 1.3, and 1.5. Make change to Table I and figure 1. Make change to Table IIA, Table IIB, and paragraph 4.4.4.1. Delete paragraphs 4.4.4.1.1 and 4.4.4.2. -rrp	11-11-15	C. SAFFLE
F	Add paragraph 3.1.1 and appendix A for microcircuit die. - ro	12-04-19	C. SAFFLE
G	Delete references to device class M requirements. Update document paragraphs to current MIL-PRF-38535 requirements. - ro	17-09-19	C. SAFFLE

REV																				
SHEET																				
REV	G	G	G	G	G															
SHEET	15	16	17	18	19															

REV STATUS	REV	G	G	G	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	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
96-08-01

REVISION LEVEL
G

MICROCIRCUIT, LINEAR, DUAL, HIGH SPEED, LOW POWER, FEEDBACK AMPLIFIER, MONOLITHIC SILICON

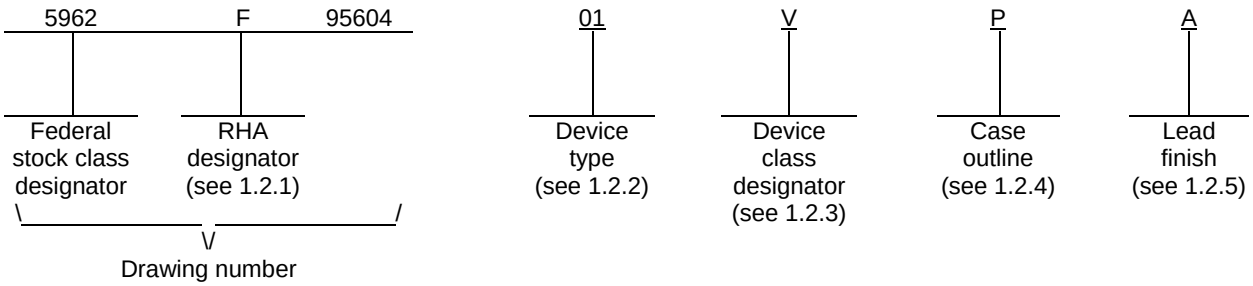
SIZE	CAGE CODE	
A	**67268**	**5962-95604**

SHEET 1 OF 19

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 1/	Generic number	Circuit function
01	LM6172	Dual, high speed, low power, voltage feedback amplifier
02	LM6172	Radiation hardened, dual, high speed, low power, voltage feedback amplifier
03	LM6172	Radiation hardened, dual, high speed, low power, voltage feedback 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
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
X 1/	GDFP1-G16	16	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/ For case outline X, package material for device types 01 is aluminum nitride and package material for device types 02 and 03 is aluminum oxide.

1.3 Absolute maximum ratings. 2/

Supply voltage ($\pm V_S$)	36 V
Differential input voltage	$\pm$ 10 V 3/
Output short circuit to ground	Continuous 4/
Power dissipation (P_D)	1.03 W
Storage temperature range	-65°C to +150°C
Junction temperature (T_J)	+150°C
Lead temperature (soldering, 5 seconds)	+260°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case P	2°C/W
Case X (Device type 01)	6°C/W 1/
Case X (Device types 02 and 03)	7°C/W 1/
Thermal resistance, junction-to-ambient (θ_{JA}):	
Case P	100°C/W still air 46°C/W 500 LFPM air flow
Case X (Device type 01)	124°C/W still air 74°C/W 500 LFPM air flow 1/
Case X (Device type 02 and 03)	135°C/W still air 85°C/W 500 LFPM air flow 1/

1.4 Recommended operating conditions.

Supply voltage (V_S)	5.5 V to 36 V
Ambient operating temperature range (T_A)	-55°C to +125°C

1.5 Radiation features. 5/

Maximum total dose available (dose rate = 50 – 300 rads(Si)/s) :	
Device types 01 and 02	300 krads(Si)
Maximum total dose available (dose rate = .010 rad(Si)/s):	
Device type 03	100 krads(Si)

2/ 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.

3/ Differential input voltage is measured at $V_S = \pm$ 15V.

4/ Continuous short circuit operation can result in exceeding the maximum allowed junction temperature of +150°C.

5/ For device types 01 and 02, 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 as specified in MIL- STD-883, method 1019, condition A. For device type 03, this part has been tested and does not demonstrate low dose rate sensitivity. Radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, method 1019, condition D.

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.

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.

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	
±5 V section.								
Input offset voltage	V_{IO}		1	01,02		1	mV
			2,3			3	
		M,D,P,L,R,F	1			1	
		M,D,P,L,R	1	03		1	
Input bias current	I_{IB}		1	01,02		2.5	µA
			2,3			3.5	
		M,D,P,L,R,F	1			2.5	
		M,D,P,L,R	1	03		2.5	
Input offset current	I_{IO}		1	01,02		1.5	µA
			2,3			2.2	
		M,D,P,L,R,F	1			1.5	
		M,D,P,L,R	1	03		1.5	
Common mode rejection ratio	CMRR	V_{CM} = ±2.5 V	1	01,02	70		dB
			2,3		65		
		M,D,P,L,R,F	1		70		
		M,D,P,L,R	1	03	70		
Power supply rejection ratio	PSRR	V_S = ±15 V to ± 5 V	1	01,02	75		dB
			2,3		70		
		M,D,P,L,R,F	1		75		
		M,D,P,L,R	1	03	75		

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	
±5 V section – continued.							
Large signal voltage gain	A_V	R_L = 1 kΩ, 4/	1	01,02	70		dB
		V_{OUT} = ±1 V	2,3		65		
		M,D,P,L,R,F	1		70		
		M,D,P,L,R	1	03	70		
		R_L = 100 Ω, 4/	1	01,02	65		
		V_{OUT} = ±1 V	2,3		60		
		M,D,P,L,R,F	1		65		
		M,D,P,L,R	1	03	65		
Output voltage swing	V_O	R_L = 1 kΩ	1	01,02	3.1	-3.1	V
			2,3		3	-3	
		M,D,P,L,R,F	1		3.1	-3.1	
		M,D,P,L,R	1	03	3.1	-3.1	
		R_L = 100 Ω	1	01,02	2.5	-2.4	
			2,3		2.4	-2.3	
		M,D,P,L,R,F	1		2.5	-2.4	
		M,D,P,L,R	1	03	2.5	-2.4	
Output current (open loop)	I_{OUTL}	Sourcing, R_L = 100 Ω 5/	1	01,02	25		mA
			2,3		24		
		M,D,P,L,R,F	1		25		
		M,D,P,L,R	1	03	25		
		Sinking, R_L = 100 Ω 5/	1	01,02		-24	
			2,3			-23	
		M,D,P,L,R,F	1			-24	
		M,D,P,L,R	1	03		-24	

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	
±5 V section – continued.								
Supply current	IS	Both amplifiers		1	01,02		6	mA
				2,3			7	
			M,D,P,L,R,F	1			6	
			M,D,P,L,R	1	03		6	
±15 V section.								
Input offset voltage	V_{IO}			1	01,02		1.5	mV
				2,3			3.5	
			M,D,P,L,R,F	1			1.5	
			M,D,P,L,R	1	03		1.5	
Input bias current	I_{IB}			1	01,02		3	µA
				2,3			4	
			M,D,P,L,R,F	1			3	
			M,D,P,L,R	1	03		3	
Input offset current	I_{IO}			1	01,02		2	µA
				2,3			3	
			M,D,P,L,R,F	1			2	
			M,D,P,L,R	1	03		2	
Common mode rejection ratio	CMRR	$V_{CM} = \pm 10$ V		1	01,02	70		dB
				2,3		65		
			M,D,P,L,R,F	1		70		
			M,D,P,L,R	1	03	70		

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	
±15 V section – continued.								
Power supply rejection ratio	PSRR	V_S = ±15 V to ±5 V		1	01,02	75		dB
				2,3		70		
			M,D,P,L,R,F	1		75		
			M,D,P,L,R	1	03	75		
Large signal voltage gain	A_V	R_L = 1 kΩ, 4/		1	01,02	75		dB
		V_{OUT} = ±5 V		2,3		70		
			M,D,P,L,R,F	1		75		
			M,D,P,L,R	1	03	75		
		R_L = 100 Ω, 4/		1	01,02	65		
		V_{OUT} = ±5 V		2,3		60		
			M,D,P,L,R,F	1		65		
			M,D,P,L,R	1	03	65		
Output voltage swing	V_O	R_L = 1 kΩ		1	01,02	12.5	-12.5	V
				2,3		12.0	-12.0	
			M,D,P,L,R,F	1		12.5	-12.5	
			M,D,P,L,R	1	03	12.5	-12.5	
		R_L = 100 Ω		1	01,02	6.0	-6.0	
				2,3		5.0	-5.0	
			M,D,P,L,R,F	1		6.0	-6.0	
			M,D,P,L,R	1	03	6.0	-6.0	

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	
±15 V section – continued.								
Output current (open loop)	I_{OUTL}	Sourcing, R_L = 100 Ω 5/		1	01,02	60		mA
				2,3		50		
			M,D,P,L,R,F	1		60		
			M,D,P,L,R	1	03	60		
		Sinking, R_L = 100 Ω 5/		1	01,02		-60	
				2,3			-50	
			M,D,P,L,R,F	1			-60	
			M,D,P,L,R	1	03		-60	
Supply current	I_S	Both amplifiers		1	01,02		8	mA
				2,3			9	
			M,D,P,L,R,F	1			8	
			M,D,P,L,R	1	03		8	
Slew rate 6/	SR	A_V = 2, V_{IN} = ± 2.5 V, t_R, t_F = 3 ns		4	01,02, 03	1700		V/µs
Unity gain bandwidth 6/	GBW			4	01,02, 03	80		MHz

1/ $+V_S$ = +15 V, $-V_S$ = -15 V, V_{CM} = 0 V, and $R_L > 1$ MΩ.

2/ Device types 01 and 02 supplied to this drawing meet all levels M, D, P, L, R, and F of irradiation. However, these devices are only tested at the "F" level. Device type 03 supplied to this drawing meets all levels M, D, P, L, and R of irradiation. However, this device 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 measurements for any RHA level, T_A = +25°C.

3/ For device types 01 and 02, 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 as specified in MIL- STD-883, method 1019, condition A. For device type 03, this part has been tested and does not demonstrate low dose rate sensitivity. Radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, method 1019, condition D.

4/ The large signal voltage gain is the total output swing divided by the input signal required to produce that swing.

5/ Output current open loop is guaranteed by the measurement of open loop output voltage swing using 100 Ω output load.

6/ This parameter is not tested to post irradiation.

Device types	01	01, 02, 03
Case outlines	P	X
Terminal number	Terminal symbol	
1	OUTPUT	NC
2	-INPUT A	OUTPUT A
3	+INPUT A	-INPUT A
4	$-V_S$	+INPUT A
5	+INPUT B	NC
6	-INPUT B	$-V_S$
7	OUTPUT B	NC
8	$+V_S$	NC
9	---	NC
10	---	+INPUT B
11	---	-INPUT B
12	---	OUTPUT B
13	---	NC
14	---	$+V_S$
15	---	NC
16	---	NC

NC = No connection.

FIGURE 1. Terminal connections.

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.

4.4.1 Group A inspection.

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

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

1/ PDA applies to subgroup 1.
2/ Delta limits as specified in table IIB herein shall be required where specified, and the delta values shall be computed with reference to the zero hour electrical parameters (see table I).

TABLE IIB. Delta electrical characteristics. T_A = +25°C 1/

Test 2/	Symbol	Delta limits		Unit
		Min	Max	
Input offset voltage	V_{IO}	-0.25	0.25	mV
Input bias current	I_{IB}	-0.50	0.50	µA
Input offset current	I_{IO}	-0.25	0.25	µA

1/ Deltas performed on QMLV devices at Group B, subgroup 5, only.
2/ $\pm V_S$ = ±5 V and ±15 V.

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 types 01 and 02, condition D for device type 03 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.

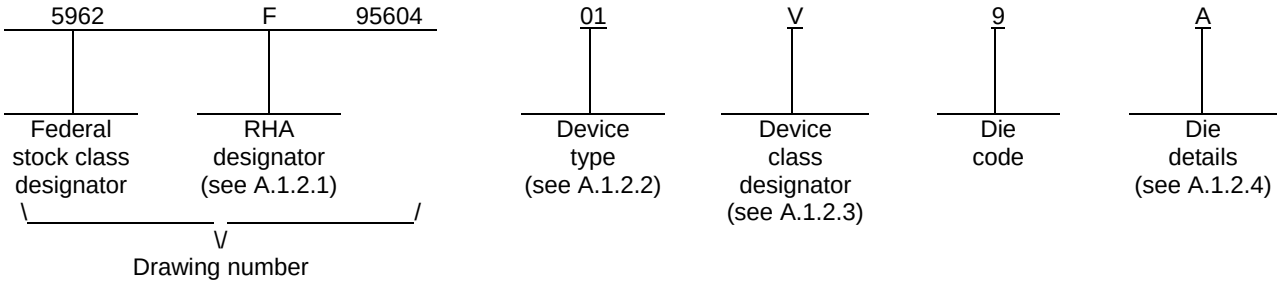
6.6.1 Sources of supply for device classes Q and V. Sources of supply for device classes Q and V are listed in MIL-HDBK-103 and QML-38535. The vendors listed in MIL-HDBK-103 and QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DLA Land and Maritime-VA and have agreed to this drawing.

APPENDIX A
APPENDIX A FORMS A PART OF SMD 5962-95604

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 Hardness 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
01	LM6172	Dual, high speed, low power, voltage feedback amplifier
03	LM6172	Radiation hardened, dual, high speed, low power, voltage feedback amplifier

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
01, 03	A-1

A.1.2.4.2 Die bonding pad locations and electrical functions.

Die type	Figure number
01, 03	A-1

A.1.2.4.3 Interface materials.

Die type	Figure number
01, 03	A-1

A.1.2.4.4 Assembly related information.

Die type	Figure number
01, 03	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.

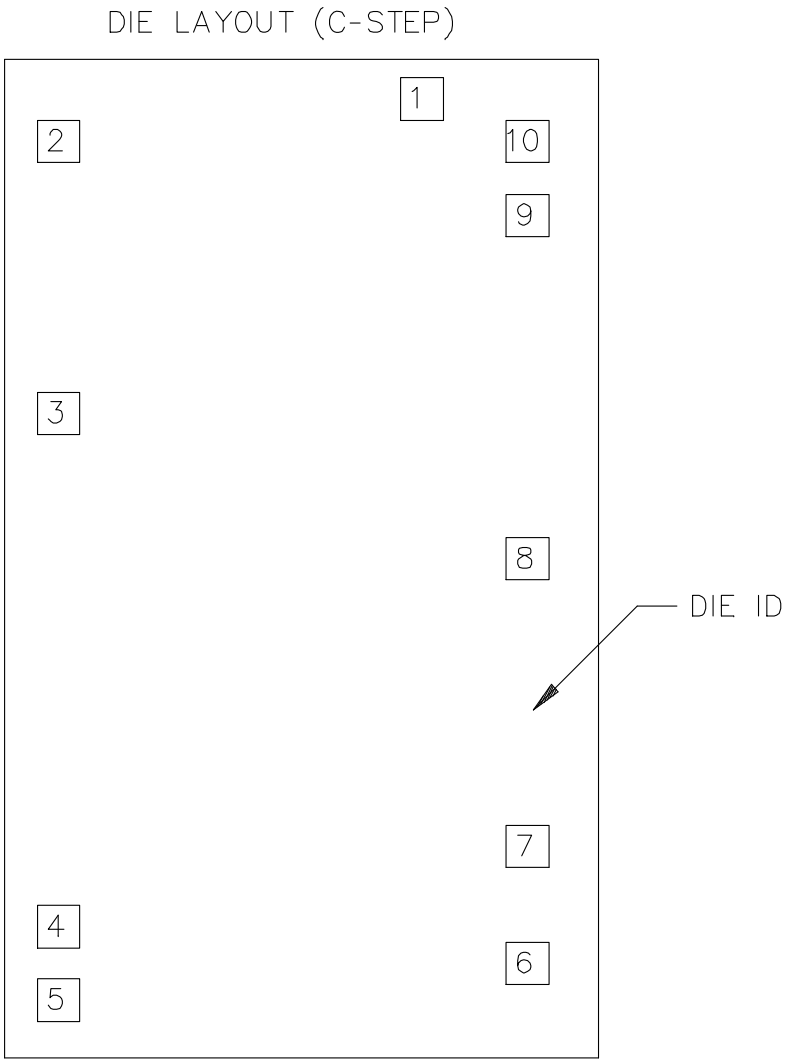


FIGURE A-1. Die bonding pad locations and electrical functions.

Die bond pad coordinate locations (C-step)						
(Referenced to die center, coordinates in μm) NC = no connection, NU = not used						
Signal name	Pad number	X / Y coordinates		Pad size		
		X	Y	X		Y
OUTPUT A	1	461.00	1406.00	80.00	x	80.00
-INPUT A	2	-750.00	1301.00	80.00	x	80.00
+INPUT A	3	-771.00	437.00	80.00	x	80.00
$-V_S$	4	-771.00	-1271.00	80.00	x	80.00
$-V_S$	5	-771.00	-1406.00	80.00	x	80.00
+INPUT B	6	698.00	-1333.00	80.00	x	80.00
-INPUT B	7	698.00	-1068.00	80.00	x	80.00
OUTPUT B	8	698.00	-70.50	80.00	x	80.00
$+V_S$	9	694.50	1191.00	80.00	x	80.00
$+V_S$	10	694.50	1326.00	80.00	x	80.00

Die bonding pad locations and electrical functions for device types 01 and 03.

Die physical dimensions.
Wafer diameter: 152.4 mm
Die size: 1778.00 μm x 3048.00 μm
Die thickness: 304.8 μm nominal
Minimum pitch: 135.00 μm

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

Glassivation.
Type: PECVDOX NITRIDE
Thickness: Oxide 9 kÅ to 11 kÅ
Nitride 9 kÅ to 11 kÅ

Substrate: Silicon

Assembly related information.
Substrate potential: Floating or GND
Special assembly instructions: Actual die size is rounded to the nearest micron.

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

STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 17-09-19

Approved sources of supply for SMD 5962-95604 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 https://landandmaritimeapps.dla.mil/Programs/Smcr/.

Standard microcircuit drawing PIN 1/	Vendor CAGE number	Vendor similar PIN 2/
5962-9560401QPA	01295	LM6172AMJ-QML
5962-9560401QXA	3/	NL6172Q1
	3/	LM6172AMWG-QML
5962-9560401VPA	3/	LM6172AMJ-QMLV
5962-9560401VXA	3/	LM6172AMWG-QMLV
5962F9560401QPA	01295	LM6172AMJFQML
5962F9560401QXA	3/	LM6172AMWGFQML
5962F9560401VPA	01295	LM6172AMJFQMLV
5962F9560401VXA	3/	LM6172AMWGFQML
5962-9560402QXA	01295	LM6172AMGW-QML
5962F9560402VXA	01295	LM6172AMGWFQMLV
5962R9560403VXA	01295	LM6172AMGWRLQV
5962F9560401V9A	01295	LM6172 MDR
5962R9560403V9A	01295	LM6172-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
01295	Texas Instruments, Inc. Semiconductor Group 8505 Forest Lane P.O. Box 660199 Dallas, TX 75243