

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add a device class V device. Make changes to table II and add table IIB.	96-11-19	R. MONNIN
B	Add case outlines H and X. Make changes to 1.2.4, 1.3, and FIGURE 1.	97-06-13	R. MONNIN
C	Change case outline X dimensions L, R, and R1 for FIGURE 1. - lgt	97-11-25	R. MONNIN
D	Change values for thermal resistance under the absolute maximum ratings. Change footnote 1 for table I. Change test conditions for Slew rate in table I. - lgt	98-09-22	R. MONNIN
E	Add radiation hardened requirements. - ro	00-03-15	R. MONNIN
F	Change the maximum total dose available value in 1.5. Remove radiation test circuit. - rrp	00-08-18	R. MONNIN
G	Delete figure 1 and update drawing to reflect current requirements. - ro	03-02-26	R. MONNIN
H	Add device type 02 tested at low dose rate. Make changes to footnotes 1/ and 2/ as specified under Table I. Make a change to paragraph 4.4.4.1. Delete the Accelerated aging test. - ro	09-03-10	R. HEBER
J	Update drawing to current MIL-PRF-38535 requirements. Removed class M references. -rrp	15-12-14	C. SAFFLE



THE ORIGINAL FIRST SHEET OF THIS DRAWING HAS BEEN REPLACED.

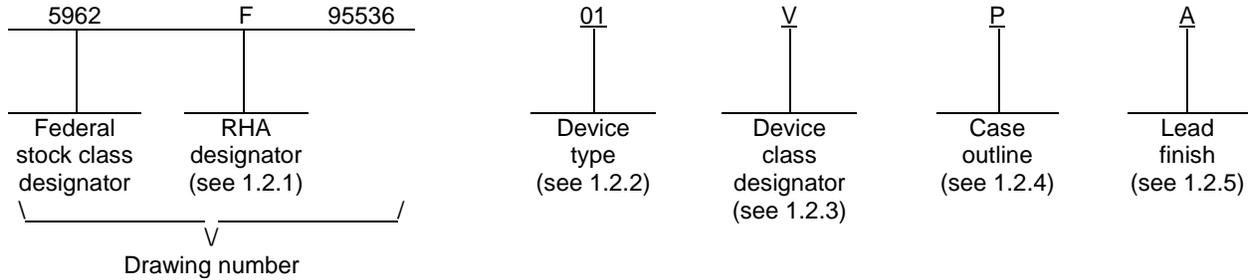
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REV STATUS OF SHEETS	REV	J	J	J	J	J	J	J	J	J	J	J	J	J						
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PMIC N/A	PREPARED BY RICK OFFICER	<p align="center">DLA LAND AND MARITIME COLUMBUS, OHIO 43218-3990 http://www.landandmaritime.dla.mil</p> <p align="center">MICROCIRCUIT, LINEAR, HIGH SPEED, HIGH OUTPUT CURRENT, VOLTAGE FEEDBACK AMPLIFIER, MONOLITHIC SILICON</p>																	
<p align="center">STANDARD MICROCIRCUIT DRAWING</p> <p>THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p>	CHECKED BY RAJESH PITHADIA																		
	APPROVED BY MICHAEL FRYE																		
	DRAWING APPROVAL DATE 96-04-29																		
AMSC N/A	REVISION LEVEL J	SIZE A	CAGE CODE 67268	5962-95536															
		SHEET		1 OF 11															

1. SCOPE

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

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



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

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

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>
01	LM7171	High speed, high output current, voltage feedback amplifier
02	LM7171	High speed, high output current, voltage feedback amplifier and not sensitive at low dose rate

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

<u>Device class</u>	<u>Device requirements documentation</u>
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:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
H	GDFP1-F10 or CDFP2-F10	10	Flat pack
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
X	GDFP1-G10	10	Flat pack with gullwing leads

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

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1.3 Absolute maximum ratings. 1/

Supply voltage (+V _S to -V _S)	36 V
Differential input voltage	±10 V 2/
Output short circuit to ground	Continuous 3/
Storage temperature range	-65°C to +150°C
Power dissipation (P _D)	730 mW
Lead temperature (soldering, 10 seconds)	+260°C
Junction temperature (T _J)	+150°C
Thermal resistance, junction-to-case (θ _{JC}):	
Cases H and X	5°C/W
Case P	3°C/W
Thermal resistance, junction-to-ambient (θ _{JA}):	
Cases H and X	182°C/W still air
	105°C/W at 500 linear feet per minute
Case P	106°C/W still air
	53°C/W at 500 linear feet per minute

1.4 Recommended operating conditions.

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

1.5 Radiation features. 4/ 5/

Device type 01:	
Maximum total dose available (dose rate = 50 – 300 rads (Si)/s)	300 Krads (Si)
Device type 02:	
Maximum total dose available (dose rate = 10 mrad/s (Si)/s)	300 Krads (Si)

The manufacturer supplying RHA device 02 parts on this drawing has completed Lot Acceptance testing at Low Dose Rate (10 mrad/s) on these RHA marked parts. The Low Dose Rate (LDR) testing that was performed demonstrates that these parts from the lot tested do not have an Enhanced Low Dose rate Sensitivity as defined by Method 1019. Lot Acceptance Testing at LDR will continue to be performed on each wafer. 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.

- 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/ Input differential voltage is measured at V_S = ±15 V.
- 3/ Applies to both single-supply and split-supply operation. Continuous short circuit operation at elevated ambient temperature can result in exceeding the maximum allowed T_J of +150°C.
- 4/ For device type 01, 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.
- 5/ For device type 02, these parts have been tested and do not demonstrate low dose rate sensitivity. Radiation end point limits for the noted parameters are guaranteed for the conditions specified in MIL-STD-883, test method 1019, condition D.

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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.

3.2 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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions <u>1/ 2/ 3/</u> -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
±5 V section							
Input offset voltage	V _{OS}		1	01, 02		1.5	mV
			2,3			7	
Input bias current	I _{IB}		1	01, 02		10	μA
			2,3			12	
Input offset current	I _{OS}		1	01, 02		4	μA
			2,3			6	
Common mode rejection ratio	CMRR	V _{CM} = ±2.5 V	1	01, 02	80		dB
			2,3		70		
Large signal voltage gain	A _V	R _L = 1 kΩ <u>4/</u>	1	01, 02	75		dB
			2,3		70		
		R _L = 100 Ω <u>4/</u>	1		72		
			2,3		67		
Output voltage swing	V _{OUT}	R _L = 1 kΩ	1	01, 02	3.2	-3.2	V
			2,3		3.0	-3.0	
		R _L = 100 Ω	1		2.9	-2.9	
			2,3		2.8	-2.75	
Output current	I _{OUT}	Sourcing, R _L = 100 Ω <u>5/</u>	1	01, 02	29		mA
			2,3		28		
		Sinking, R _L = 100 Ω <u>5/</u>	1		29		
			2,3		27.5		
Supply current	I _{CC}		1	01, 02		8	mA
			2,3			9	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions <u>1/ 2/ 3/</u> -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
±15 V section							
Input offset voltage	V _{OS}		1	01, 02		1	mV
			2,3			7	
Input bias current	I _{IB}		1	01, 02		10	μA
			2,3			12	
Input offset current	I _{OS}		1	01, 02		4	μA
			2,3			6	
Common mode rejection ratio	CMRR	V _{CM} = ±10 V	1	01, 02	85		dB
			2,3			70	
Power supply rejection ratio	PSRR	V _S = ±15 V to ±5 V	1	01, 02	85		dB
			2,3			80	
Large signal voltage gain	A _V	R _L = 1 kΩ <u>4/</u>	1	01, 02	80		dB
			2,3			75	
		R _L = 100 Ω <u>4/</u>	1		75		
			2,3			70	
Output voltage swing	V _{OUT}	R _L = 1 kΩ	1	01, 02	13	-13	V
			2,3			12.7	
		R _L = 100 Ω	1		10.5	-9.5	
			2,3			9.5	
Output current, open loop	I _{OUT}	Sourcing, R _L = 100 Ω <u>5/</u>	1	01, 02	105		mA
			2,3			95	
		Sinking, R _L = 100 Ω <u>5/</u>	1			95	
			2,3			90	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics – Continued.

Test	Symbol	Conditions <u>1/ 2/ 3/</u> -55°C ≤ T _A ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
±15 V section - continued							
Supply current	I _{CC}		1	01, 02		8.5	mA
			2,3			9.5	
Slew rate	SR	A _V = 2, V _{IN} = ±2.5 V, <u>6/</u> rise and fall time = 3 ns, T _A = +25°C	4	01, 02	2000		V/μs
Unity gain bandwidth	UGBW		4	01, 02	170		MHz

1/ RHA devices supplied to this drawing have been characterized through all levels M, D, P, L, R, F of irradiation. 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/ The 01 device 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 01. Device type 02, has been tested at low dose rate and does not demonstrate low dose rate sensitivity (see 1.5 herein).

3/ Unless otherwise specified V_{CM} = 0 V and R_L > 1 MΩ for subgroups 1, 2, 3 only. V_{CM} = 0 V for subgroup 4. For the ±5 V section tests, +V_S = +5 V and -V_S = -5 V. For the ±15 V section tests, +V_S = +15 V and -V_S = -15 V.

4/ Large signal voltage gain is the total output swing divided by the input signal required to produce that swing. For the ±5 V section tests, V_{OUT} = ±1 V. For the ±15 V section tests, V_{OUT} = ±5 V.

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

6/ The slew rate is measured between ±4 V.

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.

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Device types	01 and 02	
Case outlines	H and X	P
Terminal number	Terminal number	
1	NC	NC
2	-INPUT	-INPUT
3	NC	+INPUT
4	+INPUT	-V _S
5	-V _S	NC
6	NC	OUTPUT
7	OUTPUT	+V _S
8	NC	NC
9	+V _S	---
10	NC	---

NC = No connection

FIGURE 1. Terminal connections.

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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.

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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 <u>1/</u>	1,2,3,4 <u>1/ 2/</u>
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 <u>2/</u>
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 shall be required where specified and the delta limits shall be computed with reference to the previous endpoint parameters.

TABLE IIB. Delta electrical characteristics (+25°C).

Parameters	Symbol <u>1/</u>	Delta limits
Input offset voltage	V_{IO}	$\pm 250 \mu V$
Positive input bias current	$+I_{IB}$	$\pm 500 \text{ nA}$
Negative input bias current	$-I_{IB}$	$\pm 500 \text{ nA}$

1/ All delta parameters are tested at $\pm 5 \text{ V}$ and $\pm 15 \text{ V}$.

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

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

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

b. For device classes Q and V, the devices or test vehicle shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535 for the RHA level being tested. All device classes must meet the postirradiation end-point electrical parameter limits as defined in table I at $T_A = +25^\circ\text{C} \pm 5^\circ\text{C}$, 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.

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5. PACKAGING

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

6. NOTES

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

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

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

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

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

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

6.6 Sources of supply.

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

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STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 15-12-14

Approved sources of supply for SMD 5962-95536 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 <u>1/</u>	Vendor CAGE number	Vendor similar PIN <u>2/</u>
5962-9553601QHA	<u>3/</u>	LM7171AMW-QML
5962-9553601QPA	27014	LM7171AMJ-QML
5962-9553601QXA	27014	LM7171AMWG-QML
5962-9553601VHA	<u>3/</u>	LM7171AMW-QMLV
5962-9553601VPA	<u>3/</u>	LM7171AMJ-QMLV
5962-9553601VXA	<u>3/</u>	LM7171AMWG-QMLV
5962F9553601QPA	<u>3/</u>	LM7171AMJFQML
5962F9553601QXA	<u>3/</u>	LM7171AMWGFQML
5962F9553601VHA	27014	LM7171AMWFQMLV
5962F9553601VPA	27014	LM7171AMJFQMLV
5962F9553601VXA	27014	LM7171AMWGFQMLV
5962F9553602VHA	27014	LM7171AMWFLQMLV
5962F9553602VXA	27014	LM7171AMWGFLQV

- 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

27014

Vendor name
and address

National Semiconductor
2900 Semiconductor Drive
P.O. Box 58090
Santa Clara, CA 95052-8090

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