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| LTR | DESCRIPTION | DATE (YR-MO-DA) | APPROVED |
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| SHEET | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | | | |
| REV STATUS | | | | REV | | | | | | | | | | | | | | | | |
| 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
CHARLES F. SAFFLE

DRAWING APPROVAL DATE
14-09-17

REVISION LEVEL

MICROCIRCUIT, LINEAR, SINGLE, ADJUSTABLE 2.5 V / 5.5V PRECISION SHUNT VOLTAGE REFERENCE, MONOLITHIC SILICON

| SIZE | CAGE CODE | |
|---|---|---|
| A | **67268** | **5962-14222** |

SHEET 1 OF 21



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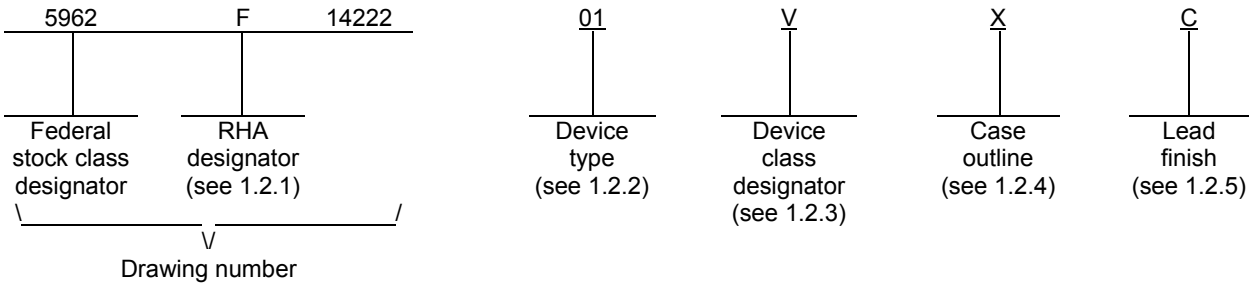
1. SCOPE

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 | RHF1009A | Radiation hardened, adjustable 2.5 V / 5.5 V precision shunt voltage reference |

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 |
|---|---|---|---|
| X | See figure 1 | 10 | Flat pack 1/ |

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

1/ $Al_2O_3$ ceramic header with metalized bottom side and pullback of 0.01 inch x 0.02 inch.



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1.3 Absolute maximum ratings. 2/ 3/

Reverse breakdown cathode current ($I_K$) ..... 15 mA
Forward current ($I_F$) ..... 20 mA
Reverse breakdown voltage in standby mode ($V_{REF} = V_A$) ..... 6 V
Storage temperature range ($T_{stg}$) ..... -65°C to +150°C
Maximum junction temperature ($T_J$) ..... +150°C
Lead temperature (soldering, 10 seconds) ..... +260°C 4/
Thermal resistance, junction-to-ambient ($\theta_{JA}$) ..... 140°C/W 5/
Thermal resistance, junction-to-case ($\theta_{JC}$) ..... 40°C/W 5/

1.4 Recommended operating conditions.

Minimum operating cathode current ($I_{Kmin}$) ..... 60 μA 6/
Maximum operating cathode current ($I_{Kmax}$) ..... 12 mA 7/
Reverse breakdown voltage in standby mode ($V_{REF} = V_A$) ..... 5.5 V
Ambient operating temperature range ($T_A$) ..... -55°C to +125°C

1.5 Radiation features.

Maximum total dose available (effective dose rate = 3 rads(Si)/s) ..... 300 krads(Si) 8/
Single event phenomenon (SEP) :
No single event latch up (SEL) occurs at effective LET (see 4.4.4.3) ..... ≤ 120 MeV/(mg/cm$^2$)
Single event transient (SET) ($\sigma_{sat}$ = 4.3 x 10$^{-4}$ cm$^2$/device) at threshold LET ..... = 2.7 MeV/(mg/cm$^2$)

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/ All voltage values, except differential voltage are within respect to network ground terminal.
4/ Distance of not less than 1.5 mm from the device body and the same lead shall not be re-soldered until three minutes have elapsed.
5/ Short circuits can cause excessive heating and destructive dissipation.
6/ The minimum operating cathode current ($I_{KMIN}$) is a combination of parameters (such as reference voltage, stability, noise, and process drift) that are taken over the ambient temperature range. For this device, $I_{KMIN}$ is 60 μA. $I_{KMIN}$ is guaranteed over the ambient temperature range by the following equation: $V_K$ ($I_K$ = 60 μA) ≥ $V_K$ ($I_K$ = 100 μA, 25°C) – 100 μV; $V_{REF} = V_K$.
7/ The maximum operating cathode current ($I_{KMAX}$) is limited by the output ballast current capabilities and process drift. For this device, $I_{KMAX}$ is 12 mA. $I_{KMAX}$ is guaranteed by the $\Delta V_K$ versus $\Delta I_K$ parameter and the following equation (at $T_A$ = 25°C): $V_K$ ($I_K$ = 12 mA) ≤ $V_K$ ($I_K$ = 100 μA, 25°C) + 3 mV; $V_{REF} = V_K$.
8/ Device type 01 is irradiated at dose rate = 50 - 300 rad(Si)/s in accordance with MIL-STD-883, method 1019, condition A, and condition D and is guaranteed to a maximum total dose specified. The effective dose rate after extended room temperature anneal = 3 rad (Si)/s per MIL-STD-883, method 1019, condition A, section 3.11.2. The total dose specification for this device only applies to the specified effective dose rate, or lower, environment.



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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 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are the issues of the documents cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

ASTM F1192 - Standard Guide for the Measurement of Single Event Phenomena (SEP) Induced by Heavy Ion Irradiation of semiconductor Devices.

(Copies of these documents are available online at http://www.astm.org or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA, 19428-2959).

2.3 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 outline. The case outline shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

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.



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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 IA 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 IA.

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.



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TABLE IA. Electrical performance characteristics.

| Test | Symbol | Conditions<br>$-55°C \le T_A \le +125°C$<br>unless otherwise specified | Group A subgroups | Device type | Limits | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | | Min | Max | |
| Reverse input voltage | $V_{REF}$ | $I_K$ = 100 µA, $V_K = V_{REF}$ | 1 | 01 | 2.495 | 2.505 | V |
| | | | 2 | | 2.491 | 2.509 | |
| | | | 3 | | 2.491 | 2.509 | |
| | | F 1/ | 1 | | 2.49 | 2.51 | |
| Reference input voltage tolerance. | $\Delta V_{REF}$ | $I_K$ = 100 µA,<br>$\Delta V_K = V_{K(100\ \mu A)} / V_{REF}$ | 1 | 01 | -0.2 | 0.2 | % |
| | | with $V_{REF}$ = 2.5 V F 1/ | 1 | | -0.4 | 0.4 | |
| Minimum operating cathode current | $I_{KMIN}$ | $V_K(I_{KMIN}) = V_K(I_K = 100\ \mu A) - 100\ \mu V$,<br>$V_K = V_{REF}$ | 1,2,3 | 01 | | 60 | µA |
| Off state cathode current | $I_{KOFF}$ | $V_{REF} = V_A$,<br>$V_{KA}$ = 2.5 V | 1,2,3 | 01 | | 1 | µA |
| | | F 1/ | 1 | | | 2 | |
| Reference input current | $I_{REF}$ | $I_K$ = 100 µA to 10 mA,<br>$V_K = V_{REF}$ through R1 =10 kΩ | 1,2,3 | 01 | | 1 | µA |
| Equivalent reverse static resistance | $R_{KA}$ | $\Delta I_K = I_{KMIN}$ to 10 mA,<br>$V_K = V_{REF}$ | 1 | 01 | | 0.12 | Ω |
| | | | 2 | | | 0.2 | |
| | | | 3 | | | 0.1 | |
| Load regulation: ratio of change in reference input voltage to change in cathode to anode voltage | $\Delta V_{REF} / \Delta I_K$ | $I_{KMIN} \le I_K \le 1$ mA,<br>$V_K = V_{REF}$ | 1 | 01 | | 0.16 | mV |
| | | | 2 | | | 0.3 | |
| | | | 3 | | | 0.15 | |
| | | F 1/ | 1 | | | 0.2 | |
| | | 1 mA $\le I_K \le$ 12 mA,<br>$V_K = V_{REF}$ | 1 | | | 1.4 | |
| | | | 2 | | | 2 | |
| | | | 3 | | | 1.3 | |
| Ratio of change in reference input voltage to change in cathode to anode voltage | $\Delta V_{REF} / \Delta V_{KA}$ | $I_K$ = 100 µA,<br>$V_{KA}$ = 2.5 V to 5.5 V,<br>R1=10 kΩ, R2 variable | 1,2,3 | 01 | | 2.5 | mV |
| | | $I_K$ = 10 mA,<br>$V_{KA}$ = 2.5 V to 5.5 V,<br>R1=10 kΩ, R2 variable | 1,2,3 | | | 2.5 | |

See footnotes at end of table.



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TABLE IA. Electrical performance characteristics – continued.

| Test | Symbol | Conditions<br>$-55°C \le T_A \le +125°C$<br>unless otherwise specified | Group A subgroups | Device type | Limits | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | | Min | Max | |
| Temperature stability 2/ | $\Delta V_K$ | $T_{min} \le T_A \le T_{max}$ | 1, 2, 3 | 01 | | 11.25 | mV |
| Average temperature 2/ 3/ coefficient | $\Delta V_K / \Delta T$ | $I_K$ = 100 μA, $V_K = V_{REF}$ | 1, 2, 3 | 01 | | 25 | ppm/°C |
| Average temperature 2/ 3/ coefficient | $\Delta V_K / \Delta T$ | $I_K$ = 10mA, $V_K = V_{REF}$ | 1, 2, 3 | 01 | | 25 | ppm/°C |

1/ RHA device type 01 supplied to this drawing has been characterized through all levels P, L, R and F of irradiation. However device type 01 tested at RHA level F.

Device type 01 is irradiated at dose rate = 50 - 300 rad(Si)/s in accordance with MIL-STD-883, method 1019, condition A, and condition D and is guaranteed to a maximum total dose specified. The effective dose rate after extended room temperature anneal = 3 rad (Si)/s per MIL-STD-883, method 1019, condition A, section 3.11.2. The total dose specification for this device only applies to the specified effective dose rate, or lower, environment

Pre and post irradiation values are identical unless otherwise specified in table IA. When performing post irradiation electrical measurements for any RHA level, $T_A = +25^oC$.

2/ If not tested, shall be guaranteed to the limits specified in table IA herein.

3/ $[(V_{Kmax} – V_{Kmin}) / (180°C \times V_{K(25°C)})] \times 10^6$. See figure 3.

TABLE IB. SEP test limits. 1/ 2/ 3/

| Device type | $I_K$ = 12 mA | | Bias $I_K$ = 12 mA for latch-up test, no latch up(SEL) effective LET = 4/ |
|---|---|---|---|
| | Single event transient at threshold LET | Maximum device cross section | |
| 01 | LET = 2.7 MeV/(mg/cm$^2$) | 4.3 x $10^{-4}$ cm$^2$/device | LET ≤ 120 MeV/mg/cm$^2$ |

1/ For SEP test conditions, see 4.4.4.3 herein.
2/ Technology characterization and model verification supplemental by in line data may be used in lieu of end of line testing. Test plan must be approved by technical review board (TRB) and qualifying activity.
3/ Worst case temperature is $T_A = +125°C \pm 10°C$ for SEL test and $T_A = +25°C \pm 10°C$ for SET test.
4/ Tested to a LET of ≤ 120 MeV/mg/cm$^2$ for device type 01 with no latch up (SEL).



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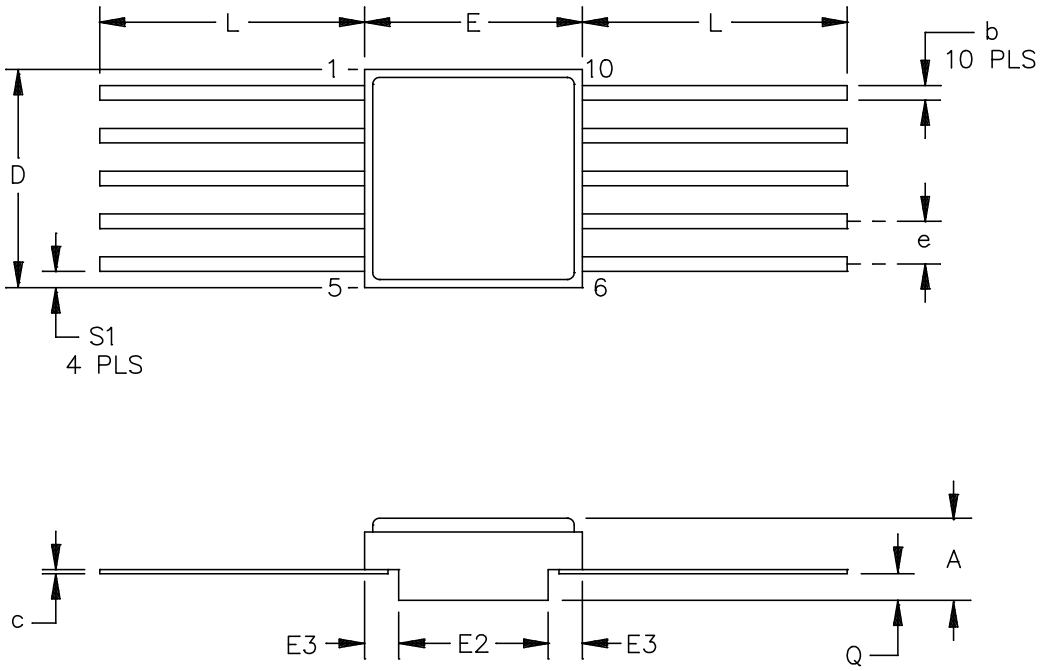


FIGURE 1. Case outline.



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| Symbol | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Inches | | | Millimeters | | |
| | Minimum | Medium | Maximum | Min | Medium | Max |
| A | .089 | .096 | .103 | 2.26 | 2.44 | 2.62 |
| b | .015 | .017 | .019 | 0.38 | 0.43 | 0.48 |
| c | .004 | .005 | .006 | 0.102 | 0.127 | 0.152 |
| D | .250 | .255 | .260 | 6.35 | 6.48 | 6.60 |
| E | .250 | .255 | .260 | 6.35 | 6.48 | 6.60 |
| E2 | .170 | .175 | .180 | 4.32 | 4.45 | 4.58 |
| E3 | .035 | .040 | .045 | 0.88 | 1.01 | 1.14 |
| e | .050 BSC | | | 1.27 BSC | | |
| L | .250 | --- | .370 | 6.35 | --- | 9.40 |
| Q | .026 | .031 | .036 | 0.66 | 0.79 | 0.92 |
| S1 | .006 | .019 | .032 | 0.16 | 0.485 | 0.81 |
| N | 10 | | | 10 | | |

NOTES:

1. The US government preferred system of measurement is the metric SI system. However, since this item was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch pound units, the inch pound units shall take precedence.

2. N is the maximum number of terminal positions.

FIGURE 1. Case outline - continued.



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| Device type | 01 | |
|---|---|---|
| Case outline | X | |
| Terminal number | Terminal symbol | Description |
| 1 | NC | No connection. |
| 2 | NC | No connection. |
| 3 | NC | No connection. |
| 4 | A | Anode. |
| 5 | NC | No connection. |
| 6 | NC | No connection. |
| 7 | $V_{REF}$ | Reverse breakdown voltage. |
| 8 | K | Cathode. |
| 9 | NC | No connection. |
| 10 | NC | No connection. |

FIGURE 2. Terminal connections.

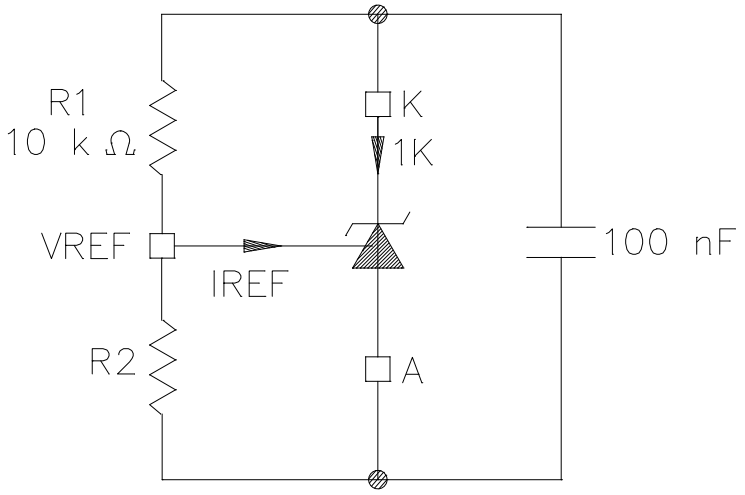


FIGURE 3. Cathode to anode voltage test circuit.



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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 4, 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.



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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) | 1 | 1 |
| Final electrical parameters (see 4.2) | 1,2,3 1/ | 1,2,3 2/ |
| Group A test requirements (see 4.4) | 1,2,3 | 1,2,3 |
| 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 | 1 |
| Group E end-point electrical parameters (see 4.4) | 1 | 11 |

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.

TABLE IIB. Burn-in and operating life test delta parameters.

| Parameters | Symbol | Conditions | Device type | Limit |
|---|---|---|---|---|
| Reverse breakdown voltage | $\Delta V_{REF}$ | $I_K$ = 100 μA, $V_K = V_{REF}$ | 01 | ±2.5 mV |
| Equivalent reverse static resistance | $\Delta R_{KA}$ | $\Delta I_K = I_{KMIN}$ to 10 mA, $V_K = V_{REF}$ | | ±100 mΩ |

1/ Deltas are performed at room temperature, $T_A$ = +25°C.



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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 IA 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, and condition D, as specified herein.

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

4.4.4.2 Dose rate induced latchup testing. When required by the customer, dose rate induced latchup testing shall be performed in accordance with test method 1020 of MIL-STD-883 and as specified herein. Tests shall be performed on devices, SEC, or approved test structures at technology qualification and after any design or process changes which may effect the RHA capability of the process.

4.4.4.3 Single event phenomena (SEP). When specified in the purchase order or contract, SEP testing shall be performed on class V devices. SEP testing shall be performed on the Standard Evaluation Circuit (SEC) or alternate SEP test vehicle as approved by the qualifying activity at initial qualification and after any design or process changes which may affect the upset or latchup characteristics. Test four devices with zero failures. ASTM F1192 may be used as a guideline when performing SEP testing. The recommended test conditions for SEP are as follows:

a. The ion beam angle of incidence shall be between normal to the die surface and 60° to the normal, inclusive (for example: 0° ≤ angle ≤ 60°). No shadowing of the ion beam due to fixturing or package related affects is allowed.

b. The fluence shall be ≥ 100 errors or ≥ $10^7$ ions/$cm^2$.

c. The flux shall be between $10^2$ and $10^5$ ions/$cm^2$/s. The cross-section shall be verified to be flux independent by measuring the cross-section at two flux rates which differ by at least an order of magnitude.

d. The particle range shall be ≥ 20 micron in silicon.

e. The test temperature shall be +25°C for the transient measurements and the maximum rated operating temperature ±10°C for the latchup measurements.

f. Bias conditions shall be $I_K$ = $I_K$ maximum for the latchup measurements.

g. For SEL test limits, see Table IB 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 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.

6.7 Additional information. When applicable, a copy of the following additional data shall be maintained and available from the device manufacturer:

a. RHA test conditions (SEP).

b. Number of transients (SET).

c. Occurrence of latchup (SEL).



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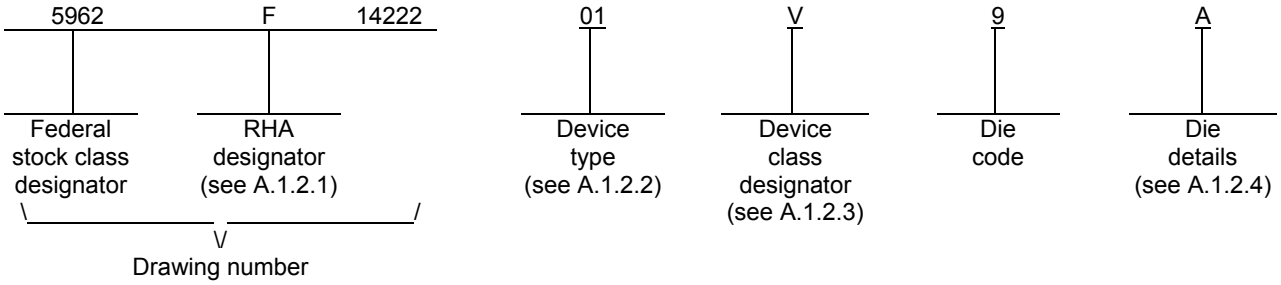
APPENDIX A
APPENDIX A FORMS A PART OF SMD 5962-14222

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 |
|---|---|---|
| 01 | RHF1009A | Radiation hardened, adjustable 2.5 V / 5.5 V precision shunt voltage reference |

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 |



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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 | A-1 |

A.1.2.4.2 Die bonding pad locations and electrical functions.

| Die type | Figure number |
|---|---|
| 01 | A-1 |

A.1.2.4.3 Interface materials.

| Die type | Figure number |
|---|---|
| 01 | A-1 |

A.1.2.4.4 Assembly related information.

| Die type | Figure number |
|---|---|
| 01 | 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.



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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.



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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 IA 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 IA.

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, 4.4.4.1, 4.4.4.1.1, 4.4.4.2, and 4.4.4.3 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.



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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.



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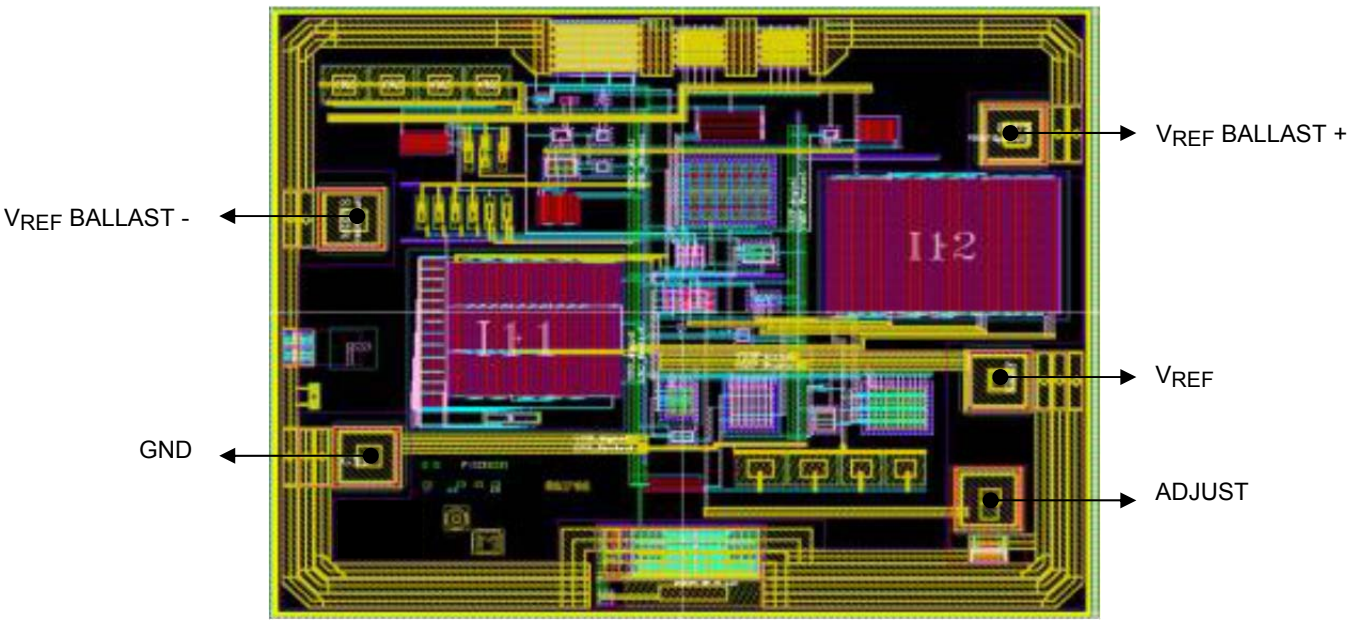


FIGURE A-1. Die bonding pad locations and electrical functions.



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Die bonding pad locations and electrical functions

Pad placements.

| PAD | X (µm) | Y (µm) |
|---|---|---|
| $V_{REF}$ BALLAST- | -562 | +174 |
| GND | -535 | -266 |
| ADJUST | +520 | -345 |
| $V_{REF}$ | +537 | -126 |
| $V_{REF}$ BALLAST+ | +563 | +330 |
| GND linked to $V_{REF}$ BALLAST- | | |
| $V_{REF}$ linked to $V_{REF}$ BALLAST+ | | |

Die physical dimensions.
Die size: 59 x 48 mils
Die thickness: 375 µm (± 20 µm)

Pad size: 100 x 100 µm

Interface materials.
Top metallization: Metal 1: W = 0.6 µm (± 0.06 µm)
Metal 2: Ti/AlCu/TiN = 0.607 µm (± 0.061 µm)
Metal 3: Ti/AlCu/TiN = 0.607 µm (± 0.061 µm)
Metal 4: Ti/AlCu/TiN = 0.607 µm (± 0.061 µm)
Metal 5: Ti/AlCu/TiN = 2.5 µm (± 0.25 µm)

Backside metallization: Bare silicon

Glassivation.
$SiO_2$ = 0.5 µm (± 0.05 µm)
SiOnN = 0.6 µm (± 0.05 µm)

Substrate: Silicon

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



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STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 14-09-17

Approved sources of supply for SMD 5962-14222 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/ |
|---|---|---|
| 5962F1422201VXA | F8859 | RHF1009AK02V |
| 5962F1422201VXC | F8859 | RHF1009AK01V |
| 5962F1422201V9A | F8859 | RHF1009AD2V |

1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the vendor to determine its availability.

2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

| Vendor CAGE number | Vendor name and address |
|---|---|
| F8859 | ST Microelectronics<br>3 rue de Suisse<br>CS 60816<br>35208 RENNES cedex2-FRANCE |

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