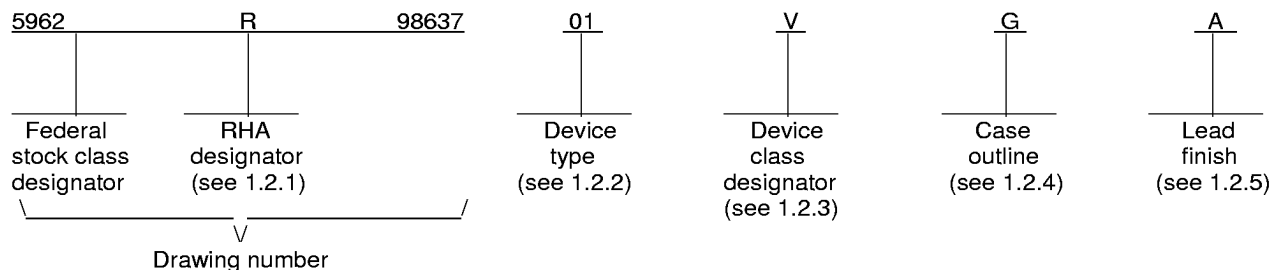


| REVISIONS                                                                                                                                                                          |             |    |    |                                   |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----|----|-----------------------------------|----|---------------|---|---|---|----------------------------------------------------------------|---------------------------|---|-------------------|---|----|----------|----|----|----|
| LTR                                                                                                                                                                                | DESCRIPTION |    |    |                                   |    |               |   |   |   |                                                                | DATE (YR-MO-DA)           |   |                   |   |    | APPROVED |    |    |    |
|                                                                                                                                                                                    |             |    |    |                                   |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
| REV                                                                                                                                                                                |             |    |    |                                   |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
| SHEET                                                                                                                                                                              |             |    |    |                                   |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
| REV                                                                                                                                                                                |             |    |    |                                   |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
| SHEET                                                                                                                                                                              | 15          | 16 | 17 | 18                                | 19 |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
| 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<br>L.G. TRAYLOR       |    |               |   |   |   | <b>DEFENSE SUPPLY CENTER COLUMBUS<br/>COLUMBUS, OHIO 43216</b> |                           |   |                   |   |    |          |    |    |    |
| <b>STANDARD<br/>MICROCIRCUIT<br/>DRAWING</b><br><br>THIS DRAWING IS AVAILABLE<br>FOR USE BY ALL<br>DEPARTMENTS<br><br>AND AGENCIES OF THE<br>DEPARTMENT OF DEFENSE<br><br>AMSC N/A |             |    |    | CHECKED BY<br>Rajesh Pithadia     |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
|                                                                                                                                                                                    |             |    |    | APPROVED BY<br>Ray Monnin         |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
|                                                                                                                                                                                    |             |    |    | DRAWING APPROVAL DATE<br>99-02-12 |    |               |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |
|                                                                                                                                                                                    |             |    |    | REVISION LEVEL                    |    |               |   |   |   | SIZE<br>A                                                      | CAGE CODE<br><b>67268</b> |   | <b>5962-98637</b> |   |    |          |    |    |    |
|                                                                                                                                                                                    |             |    |    |                                   |    | SHEET 1 OF 19 |   |   |   |                                                                |                           |   |                   |   |    |          |    |    |    |

## 1. SCOPE

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

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



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

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

| Device type | Generic number | Circuit function                               |
|-------------|----------------|------------------------------------------------|
| 01          | PM108A         | Single Low-Input-Current Operational Amplifier |
| 02          | LM108A         | Single Low-Input-Current Operational Amplifier |

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

| Device class | Device requirements documentation                                                                                                                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| M            | Vendor self-certification to the requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A |
| Q or V       | Certification and qualification to MIL-PRF-38535                                                                                                          |

1.2.4 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

| Outline letter | Descriptive designator | Terminals | Package style |
|----------------|------------------------|-----------|---------------|
| C              | GDIP1-T14 or CDIP2-T14 | 14        | Dual-in-line  |
| G              | MACY1-X8               | 8         | Can           |
| H              | GFP1-F10 or CDFP2-F10  | 10        | Flat pack     |
| P              | GDIP1-T8 or CDIP2-T8   | 8         | Dual-in-line  |
| Z              | See Figure 1           | 10        | Flat pack     |

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

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>2        |

### 1.3 Absolute maximum ratings. 1/

|                                                                |                                     |
|----------------------------------------------------------------|-------------------------------------|
| Supply voltage ( $V_{CC}$ ) .....                              | $\pm 22$ V                          |
| Input voltage ( $V_{IN}$ ) 2/ .....                            | $\pm 15$ V                          |
| Differential input current 3/ .....                            | $\pm 10$ mA                         |
| Output short-circuit duration .....                            | Indefinite                          |
| Storage temperature range .....                                | $-65^{\circ}$ C to $+150^{\circ}$ C |
| Lead temperature                                               |                                     |
| Device type 01:                                                |                                     |
| (soldering, 60 seconds) .....                                  | $300^{\circ}$ C                     |
| Device type 02:                                                |                                     |
| (soldering, 10 seconds) .....                                  | $300^{\circ}$ C                     |
| Power dissipation ( $P_D$ ) 4/ .....                           | 500 mW                              |
| Thermal resistance, junction-to-case ( $\theta_{JC}$ ) :       |                                     |
| Case C, G, H, P .....                                          | See Mil-Std-1835                    |
| Case Z .....                                                   | $21^{\circ}$ C/W                    |
| Thermal resistance, junction-to-ambient ( $\theta_{JA}$ ) : 5/ |                                     |
| Device type 01:                                                |                                     |
| Case G .....                                                   | $150^{\circ}$ C/W                   |
| Case H .....                                                   | $119^{\circ}$ C/W                   |
| Case P .....                                                   | $119^{\circ}$ C/W                   |
| Device type 02:                                                |                                     |
| Case C .....                                                   | $94^{\circ}$ C/W                    |
| Case G .....                                                   | $159^{\circ}$ C/W                   |
| Case H .....                                                   | $229^{\circ}$ C/W                   |
| Case P .....                                                   | $123^{\circ}$ C/W                   |
| Case Z .....                                                   | $225^{\circ}$ C/W                   |
| Junction temperature ( $T_J$ ) .....                           | $+175^{\circ}$ C                    |

### 1.4 Recommended operating conditions.

|                                   |                                     |
|-----------------------------------|-------------------------------------|
| Supply voltage ( $V_{CC}$ ) ..... | $\pm 5$ V dc to $\pm 20$ V dc       |
| Ambient temperature range .....   | $-55^{\circ}$ C to $+125^{\circ}$ C |

### 1.5 Radiation features.

|                                                   |                  |
|---------------------------------------------------|------------------|
| Total Dose (Dose rate = 50-300 rads (SI)/s) ..... | $\leq 100$ Krads |
|---------------------------------------------------|------------------|

- 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/ For supply voltages less than  $\pm 15$  V, the absolute maximum input voltage is equal to the supply voltage.
- 3/ The inputs are shunted with back-to-back diodes for overvoltage protection. Therefore, if a differential input voltage in excess of 1 V is applied between the inputs, excessive current will flow, unless some limiting resistance is provided.
- 4/ The maximum power dissipation must be derated at elevated temperatures and is dictated by  $T_J$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any temperature is  $P_D = (T_J - T_A)/\theta_{JA}$  or the number in 1.3 herein, whichever is lower.
- 5/  $\theta_{JA}$  is specified for worst case mounting conditions, i.e.,  $\theta_{JA}$  is specified for device in socket for TO, CerDIP, and P-DIP packages.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>3        |

## 2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

### SPECIFICATION

#### DEPARTMENT OF DEFENSE

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

### STANDARDS

#### DEPARTMENT OF DEFENSE

MIL-STD-883 - Test Method Standard Microcircuits.  
MIL-STD-973 - Configuration Management.  
MIL-STD-1835 - Interface Standard For Microcircuit Case Outlines.

### HANDBOOKS

#### DEPARTMENT OF DEFENSE

MIL-HDBK-103 - List of Standard Microcircuit Drawings (SMD's).  
MIL-HDBK-780 - Standard Microcircuit Drawings.

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

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

## 3. REQUIREMENTS

3.1 Item requirements. The individual item requirements for device classes Q and V shall be in accordance with MIL-PRF-38535 and as specified herein or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. The individual item requirements for device class M shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein for device classes Q and V or MIL-PRF-38535, appendix A and herein for device class M.

3.2.1 Case outline(s). The case outline(s) 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 as specified on figure 3.

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.

|                                                                                                 |           |                |            |
|-------------------------------------------------------------------------------------------------|-----------|----------------|------------|
| STANDARD<br>MICROCIRCUIT DRAWING<br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br>A |                | 5962-98637 |
|                                                                                                 |           | REVISION LEVEL | SHEET<br>4 |

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 as listed in MIL-HDBK-103. For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device. For RHA product using this option, the RHA designator shall still be marked. Marking for device classes Q and V shall be in accordance with MIL-PRF-38535. Marking for device class M shall be in accordance with MIL-PRF-38535, appendix A.

3.5.1 Certification/compliance mark. The certification mark for device classes Q and V shall be a "QML" or "Q" as required in MIL-PRF-38535. The compliance mark for device class M shall be a "C" as required in MIL-PRF-38535, appendix A.

3.6 Certificate of compliance. For device classes Q and V, a certificate of compliance shall be required from a QML-38535 listed manufacturer in order to supply to the requirements of this drawing (see 6.6.1 herein). For device class M, a certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.6.2 herein). The certificate of compliance submitted to DSCC-VA prior to listing as an approved source of supply for this drawing shall affirm that the manufacturer's product meets, for device classes Q and V, the requirements of MIL-PRF-38535 and herein or for device class M, the requirements of MIL-PRF-38535, appendix A and herein.

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

3.8 Notification of change for device class M. For device class M, notification to DSCC-VA of change of product (see 6.2 herein) involving devices acquired to this drawing is required for any change as defined in MIL-STD-973.

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

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

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. For device classes Q and V, sampling and inspection procedures shall be in accordance with MIL-PRF-38535 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. For device class M, sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 Screening. For device classes Q and V, screening shall be in accordance with MIL-PRF-38535, and shall be conducted on all devices prior to qualification and technology conformance inspection. For device class M, screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection.

##### 4.2.1 Additional criteria for device class M.

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

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

(2)  $T_A = +125^{\circ}\text{C}$ , minimum.

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

|                                                                                                 |           |                |            |
|-------------------------------------------------------------------------------------------------|-----------|----------------|------------|
| STANDARD<br>MICROCIRCUIT DRAWING<br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br>A |                | 5962-98637 |
|                                                                                                 |           | REVISION LEVEL | SHEET<br>5 |

TABLE I. Electrical performance characteristics.

| Test                                            | Symbol               | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified             | Group A<br>subgroups | Device<br>type | Limits |     | Unit  |
|-------------------------------------------------|----------------------|-----------------------------------------------------------------------------------------------|----------------------|----------------|--------|-----|-------|
|                                                 |                      |                                                                                               |                      |                | Min    | Max |       |
| Input offset voltage                            | V <sub>IO</sub>      | R <sub>S</sub> = 50 Ω 3/<br><br>M, D, L, R                                                    | 1                    | 01             | -0.5   | 0.5 | mV    |
|                                                 |                      |                                                                                               | 2, 3                 |                | -1.0   | 1.0 |       |
|                                                 |                      |                                                                                               | 1                    |                | -2.0   | 2.0 |       |
|                                                 |                      | +V <sub>CC</sub> = 35 V, -V <sub>CC</sub> = -5 V<br>V <sub>CM</sub> = -15 V<br><br>M, D, L, R | 1                    | 02             | -0.5   | 0.5 | mV    |
|                                                 |                      |                                                                                               | 2, 3                 |                | -1.0   | 1.0 |       |
|                                                 |                      |                                                                                               | 1                    |                | -0.5   | 0.5 |       |
|                                                 |                      | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -35 V<br>V <sub>CM</sub> = 15 V<br><br>M, D, L, R  | 1                    | 02             | -0.5   | 0.5 | mV    |
|                                                 |                      |                                                                                               | 2, 3                 |                | -1.0   | 1.0 |       |
|                                                 |                      |                                                                                               | 1                    |                | -0.5   | 0.5 |       |
|                                                 |                      | +V <sub>CC</sub> = 20 V, -V <sub>CC</sub> = 20 V<br>V <sub>CM</sub> = 0 V<br><br>M, D, L, R   | 1                    | 02             | -0.5   | 0.5 | mV    |
|                                                 |                      |                                                                                               | 2, 3                 |                | -1.0   | 1.0 |       |
|                                                 |                      |                                                                                               | 1                    |                | -0.5   | 0.5 |       |
|                                                 |                      | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -5 V<br><br>M, D, L, R                             | 1                    | 02             | -0.5   | 0.5 | mV    |
|                                                 |                      |                                                                                               | 2, 3                 |                | -1.0   | 1.0 |       |
|                                                 |                      |                                                                                               | 1                    |                | -0.5   | 0.5 |       |
| Input offset voltage<br>temperature sensitivity | ΔV <sub>IO</sub> /ΔT | 4/ 5/                                                                                         | 2, 3                 | All            | -5.0   | 5.0 | μV/°C |

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

6

TABLE I. Electrical performance characteristics - Continued.

| Test                                            | Symbol               | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified                                      | Group A<br>subgroups | Device<br>type | Limits |     | Unit  |
|-------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------|----------------------|----------------|--------|-----|-------|
|                                                 |                      |                                                                                                                        |                      |                | Min    | Max |       |
| Input offset current                            | I <sub>IO</sub>      | <u>3/</u><br><br>M, D, L, R                                                                                            | 1                    | 01             | -0.2   | 0.2 | nA    |
|                                                 |                      |                                                                                                                        | 2, 3                 |                | -0.4   | 0.4 |       |
|                                                 |                      |                                                                                                                        | 1                    |                | -1.0   | 1.0 |       |
|                                                 |                      | +V <sub>CC</sub> = 35 V, -V <sub>CC</sub> = -5 V,<br>V <sub>CM</sub> = -15 V, R <sub>S</sub> = 5 M Ω<br><br>M, D, L, R | 1                    | 02             | -0.2   | 0.2 | nA    |
|                                                 |                      |                                                                                                                        | 2, 3                 |                | -0.4   | 0.4 |       |
|                                                 |                      |                                                                                                                        | 1                    |                |        | 0.5 |       |
|                                                 |                      | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -35 V,<br>V <sub>CM</sub> = 15 V, R <sub>S</sub> = 5 M Ω<br><br>M, D, L, R  | 1                    | 02             | -0.2   | 0.2 | nA    |
|                                                 |                      |                                                                                                                        | 2, 3                 |                | -0.4   | 0.4 |       |
|                                                 |                      |                                                                                                                        | 1                    |                |        | 0.5 |       |
|                                                 |                      | R <sub>S</sub> = 5 M Ω<br><br>M, D, L, R                                                                               | 1                    | 02             | -0.2   | 0.2 | nA    |
|                                                 |                      |                                                                                                                        | 2, 3                 |                | -0.4   | 0.4 |       |
|                                                 |                      |                                                                                                                        | 1                    |                |        | 0.5 |       |
|                                                 |                      | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -5 V,<br>R <sub>S</sub> = 5 M Ω<br><br>M, D, L, R                           | 1                    | 02             | -0.2   | 0.2 | nA    |
|                                                 |                      |                                                                                                                        | 2, 3                 |                | -0.4   | 0.4 |       |
|                                                 |                      |                                                                                                                        | 1                    |                |        | 0.5 |       |
| Input offset current<br>temperature sensitivity | ΔI <sub>IO</sub> /ΔT | <u>4/</u> <u>5/</u>                                                                                                    | 2, 3                 | All            | -2.5   | 2.5 | pA/°C |

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

7

TABLE I. Electrical performance characteristics - Continued.

| Test                                   | Symbol          | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified                    | Group A<br>subgroups | Device<br>type | Limits |      | Unit |
|----------------------------------------|-----------------|------------------------------------------------------------------------------------------------------|----------------------|----------------|--------|------|------|
|                                        |                 |                                                                                                      |                      |                | Min    | Max  |      |
| Input bias current                     | ±I <sub>B</sub> | <u>3/</u>                                                                                            | 1                    | 01             | -0.1   | 2.0  | nA   |
|                                        |                 |                                                                                                      | 2                    |                | -1.0   | 2.0  |      |
|                                        |                 |                                                                                                      | 3                    |                | -0.1   | 3.0  |      |
|                                        |                 |                                                                                                      | M, D, L, R           |                | -25.0  | 25.0 |      |
|                                        |                 | +V <sub>CC</sub> = 35 V, -V <sub>CC</sub> = -5 V,<br>V <sub>CM</sub> = -15 V, R <sub>S</sub> = 5 M Ω | 1                    | 02             | -0.1   | 2.0  | nA   |
|                                        |                 |                                                                                                      | 2                    |                | -1.0   | 2.0  |      |
|                                        |                 |                                                                                                      | 3                    |                | -0.1   | 3.0  |      |
|                                        |                 |                                                                                                      | M, D, L, R           |                |        | 5.0  |      |
|                                        |                 | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -35 V,<br>V <sub>CM</sub> = 15 V, R <sub>S</sub> = 5 M Ω  | 1                    | 02             | -0.1   | 2.0  | nA   |
|                                        |                 |                                                                                                      | 2                    |                | -1.0   | 2.0  |      |
|                                        |                 |                                                                                                      | 3                    |                | -0.1   | 3.0  |      |
|                                        |                 |                                                                                                      | M, D, L, R           |                |        | 5.0  |      |
|                                        |                 | R <sub>S</sub> = 5 M Ω                                                                               | 1                    | 02             | -0.1   | 2.0  | nA   |
|                                        |                 |                                                                                                      | 2                    |                | -1.0   | 2.0  |      |
|                                        |                 |                                                                                                      | 3                    |                | -0.1   | 3.0  |      |
|                                        |                 |                                                                                                      | M, D, L, R           |                |        | 5.0  |      |
|                                        |                 | +V <sub>CC</sub> = 5 V, -V <sub>CC</sub> = -5 V,<br>R <sub>S</sub> = 5 M Ω                           | 1                    | 02             | -0.1   | 2.0  | nA   |
|                                        |                 |                                                                                                      | 2                    |                | -1.0   | 2.0  |      |
|                                        |                 |                                                                                                      | 3                    |                | -0.1   | 3.0  |      |
|                                        |                 |                                                                                                      | M, D, L, R           |                |        | 5.0  |      |
| Power supply<br>rejection ratio        | +PSRR           | +V <sub>CC</sub> = 10 V, R <sub>S</sub> = 50 Ω<br>-V <sub>CC</sub> = -20 V, <u>5/</u>                | 1, 2, 3              | ALL            | -16    | 16   | μV/V |
|                                        | -PSRR           | +V <sub>CC</sub> = 20 V, R <sub>S</sub> = 50 Ω<br>-V <sub>CC</sub> = -10 V, <u>5/</u>                | 1, 2, 3              | ALL            | -16    | 16   | μV/V |
| Input voltage common<br>mode rejection | CMR             | V <sub>CM</sub> = ±15 V <u>5/</u>                                                                    | 1, 2, 3              | ALL            | 96     |      | dB   |

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

8

TABLE I. Electrical performance characteristics - Continued.

| Test                                                     | Symbol                    | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified   | Group A<br>subgroups | Device<br>type | Limits                |      | Unit |
|----------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------|----------------------|----------------|-----------------------|------|------|
|                                                          |                           |                                                                                     |                      |                | Min                   | Max  |      |
| Adjustment for input<br>offset voltage                   | V <sub>IO</sub><br>ADJ(+) | ±V <sub>CC</sub> = ±20 V 5/                                                         | 1                    | 01             | No<br>external<br>ADJ |      | mV   |
| Adjustment for input<br>offset voltage                   | V <sub>IO</sub><br>ADJ(-) | ±V <sub>CC</sub> = ±20 V 5/                                                         | 1                    | 01             | No<br>external<br>ADJ |      | mV   |
| Output short-circuit<br>current (for positive<br>output) | I <sub>OS(+)</sub>        | ±V <sub>CC</sub> = ±15 V 5/ 6/<br>t ≤ 25 ms                                         | 1                    | ALL            | -15.0                 |      | mA   |
|                                                          |                           |                                                                                     | 2, 3                 | 02             | -15.0                 |      |      |
| Output short-circuit<br>current (for negative<br>output) | I <sub>OS(-)</sub>        | ±V <sub>CC</sub> = ±15 V 5/ 6/<br>t ≤ 25 ms                                         | 1                    | ALL            |                       | 15.0 | mA   |
|                                                          |                           |                                                                                     | 2, 3                 | 02             |                       | 15.0 |      |
| Supply current                                           | I <sub>CC</sub>           | ±V <sub>CC</sub> = ±15 V 5/                                                         | 1, 2                 | ALL            |                       | 0.6  | mA   |
|                                                          |                           |                                                                                     | 3                    |                |                       | 0.8  |      |
| Output voltage swing<br>(maximum)                        | ±V <sub>OP</sub>          | ±V <sub>CC</sub> = ±20 V, 5/<br>R <sub>L</sub> = 10 kΩ                              | 4, 5, 6              | 01             | -16.0                 | 16.0 | V    |
|                                                          | +V <sub>OP</sub>          | R <sub>L</sub> = 10 kΩ                                                              | 4, 5, 6              | 02             | -16.0                 |      | V    |
|                                                          | -V <sub>OP</sub>          | R <sub>L</sub> = 10 kΩ                                                              | 4, 5, 6              | 02             |                       | 16.0 | V    |
| Open loop voltage<br>gain (single ended)                 | A <sub>VS±</sub>          | ±V <sub>CC</sub> = ±15 V, 7/<br>R <sub>L</sub> = 10k Ω,<br>V <sub>OUT</sub> = ±10 V | 4                    | 01             | 80                    |      | V/mV |
|                                                          |                           |                                                                                     | 5, 6                 |                | 40                    |      |      |
|                                                          |                           |                                                                                     | M, D, L, R           |                | 10                    |      |      |
|                                                          | A <sub>VS(+)</sub>        | ±V <sub>CC</sub> = ±20 V, 7/<br>R <sub>L</sub> = 10k Ω,<br>V <sub>OUT</sub> = +15 V | 4                    | 02             | 80                    |      | V/mV |
|                                                          |                           |                                                                                     | 5, 6                 |                | 40                    |      |      |
|                                                          | A <sub>VS(-)</sub>        | ±V <sub>CC</sub> = ±20 V, 7/<br>R <sub>L</sub> = 10k Ω,<br>V <sub>OUT</sub> = -15 V | 4                    | 02             | 80                    |      | V/mV |
|                                                          |                           |                                                                                     | 5, 6                 |                | 40                    |      |      |

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

9

TABLE I. Electrical performance characteristics - Continued.

| Test                                     | Symbol             | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified            | Group A<br>Subgroups | Device<br>type | Limits |      | Unit   |
|------------------------------------------|--------------------|----------------------------------------------------------------------------------------------|----------------------|----------------|--------|------|--------|
|                                          |                    |                                                                                              |                      |                | Min    | Max  |        |
| Open loop voltage<br>gain (single ended) | A <sub>vs</sub>    | ±V <sub>CC</sub> = ±5 V, 7/<br>R <sub>L</sub> = 10k Ω,<br>V <sub>OUT</sub> = ±2 V            | 4, 5, 6              | 02             | 20     |      | V/mV   |
| Transient response<br>rise time          | TR <sub>(tr)</sub> | 5/<br>R <sub>L</sub> = 10k Ω, C <sub>L</sub> = 100 pF<br>F < 1 kHz, V <sub>IN</sub> = +50 mV | 9                    | 01             |        | 1000 | ns     |
|                                          |                    |                                                                                              | 9, 10, 11            | 02             |        | 1000 | ns     |
| Transient response<br>overshoot          | TR <sub>(os)</sub> | 5/<br>R <sub>L</sub> = 10k Ω, C <sub>L</sub> = 100 pF<br>F < 1 kHz, V <sub>IN</sub> = +50 mV | 9                    | 01             |        | 50   | %      |
|                                          |                    |                                                                                              | 9, 10, 11            | 02             |        | 50   | %      |
| Slew rate                                | SR(+)              | V <sub>IN</sub> = -5 V to +5 V; A <sub>V</sub> = 1<br>5/<br>.                                | 9, 10, 11            | 01             | 0.05   |      | V/μs   |
|                                          | SR(-)              | V <sub>IN</sub> = +5 V to -5 V; A <sub>V</sub> = 1<br>5/<br>.                                |                      |                |        |      |        |
|                                          | SR(+)              | V <sub>IN</sub> = -5 V to +5 V; A <sub>V</sub> = 1<br>.                                      | 9, 10, 11            | 02             | 0.05   |      |        |
|                                          | SR(-)              | V <sub>IN</sub> = +5 V to -5 V; A <sub>V</sub> = 1<br>.                                      |                      |                |        |      |        |
| Noise (referred to<br>input) broadband   | NI <sub>(BB)</sub> | ±V <sub>CC</sub> = ±20 V 5/<br>BW = 5 kHz,<br>T <sub>A</sub> = 25°C                          | 9                    | 01             |        | 15   | μV rms |
|                                          | NI <sub>(BB)</sub> | BW = 10 Hz to 5 kHz<br>R <sub>S</sub> = 0 Ω                                                  | 9                    | 02             |        | 15   | μV rms |

See footnotes at end of table.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

10

TABLE I. Electrical performance characteristics - Continued.

| Test                                 | Symbol | Conditions<br>-55°C ≤ T <sub>A</sub> ≤ +125°C 1/ 2/<br>unless otherwise specified | Group A<br>Subgroups | Device<br>type | Limits |     | Unit  |
|--------------------------------------|--------|-----------------------------------------------------------------------------------|----------------------|----------------|--------|-----|-------|
|                                      |        |                                                                                   |                      |                | Min    | Max |       |
| Noise (referred to<br>input) popcorn | NI(PC) | ±V <sub>CC</sub> = 20 V 5/<br>BW = 5 kHz,<br>T <sub>A</sub> = 25°C                | 9                    | 01             |        | 40  | μV pk |
|                                      |        | BW = 10 Hz to 5 kHz<br>RS = 100 kΩ                                                | 9                    | 02             |        | 40  | μV pk |

- 1/ Devices supplied to this drawing have been characterized through all levels M, D, L, 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.
- 2/ Unless otherwise specified test conditions include : V<sub>CC</sub> = ±20 V, T<sub>A</sub> = 25°C, R<sub>S</sub> = 50 Ω, V<sub>CM</sub> = 0 V.
- 3/ Tests at common-mode V<sub>CM</sub> = 0 V, V<sub>CM</sub> = -15 V, and V<sub>CM</sub> = +15 V.
- 4/ Calculated parameters for device type 02.
- 5/ This parameter not tested post radiation.
- 6/ Continuous short-circuit limits will be considerably less than the indicated test limits. Continuous I<sub>OS</sub> at T<sub>A</sub> ≤ 75°C will cause T<sub>J</sub> to exceed the maximum of 175°C.
- 7/ Note that gain is not specified at V<sub>IO(ADJ)</sub> extremes. For closed-loop applications (closed-loop gain less than 1000), the open-loop tests (A<sub>VS</sub>) prescribed herein should guarantee a positive, reasonably linear, transfer characteristic. They do not, however, guarantee that the open-loop gain is linear, or even positive over the operating range. If either of these requirements exist (positive open-loop gain or open-loop gain linearity), they should be specified in the individual procurement document as additional requirements.

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

REVISION LEVEL

**5962-98637**

SHEET

11

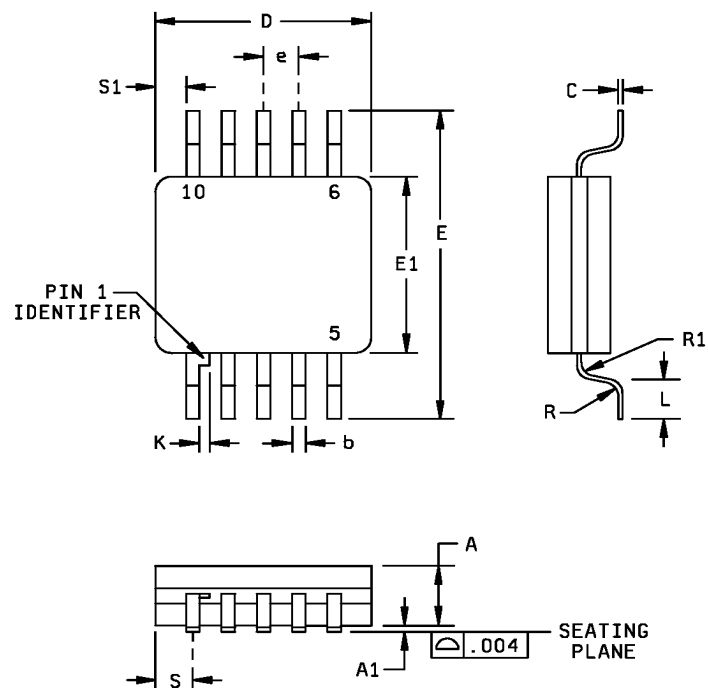


FIGURE 1. Case outline Z.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>12       |

| Letter | Inches |      | Millimeters |       | Notes |
|--------|--------|------|-------------|-------|-------|
|        | Min    | Max  | Min         | Max   |       |
| A      | .050   | .080 | 1.27        | 2.03  |       |
| A1     | .004   | .012 | 0.10        | 0.30  |       |
| b      | .015   | .019 | 0.38        | 0.48  | 2     |
| C      | .004   | .008 | 0.10        | 0.20  | 2     |
| D      | ---    | .270 | ---         | 6.86  |       |
| E      | .400   | .420 | 10.16       | 10.67 |       |
| E1     | .236   | .261 | 5.99        | 6.63  |       |
| e      | .048   | .052 | 1.22        | 1.32  |       |
| K      | .008   | .012 | 0.20        | 0.30  |       |
| L      | .037   | .043 | 0.94        | 1.09  |       |
| R      | .013   | .017 | 0.33        | 0.43  |       |
| R1     | .013   | .017 | 0.33        | 0.43  |       |
| S      | ---    | .045 | ---         | 1.14  |       |
| S1     | .005   | ---  | 0.13        | ---   |       |

NOTES:

1. The U.S. 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. Maximum limit may be increased by .003 inch after lead finish is applied.

FIGURE 1. Case outline Z – Continued.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>13       |

| Device types    | 01, 02          |       | 02   |       |
|-----------------|-----------------|-------|------|-------|
| Case outlines   | G, P            | H     | C    | Z     |
| Terminal number | Terminal symbol |       |      |       |
| 1               | COMP            | NC    | NC   | NC    |
| 2               | -IN             | NC    | COMP | NC    |
| 3               | +IN             | -IN   | NC   | -IN   |
| 4               | V-              | +IN   | -IN  | +IN   |
| 5               | NC              | NC    | +IN  | NC    |
| 6               | OUT             | V-    | NC   | V-    |
| 7               | V+              | OUT   | V-   | OUT   |
| 8               | COMP            | V+    | NC   | V+    |
| 9               | -----           | COMP  | NC   | COMP  |
| 10              | -----           | COMP  | OUT  | COMP  |
| 11              | -----           | ----- | V+   | ----- |
| 12              | -----           | ----- | COMP | ----- |
| 13              | -----           | ----- | NC   | ----- |
| 14              | -----           | ----- | NC   | ----- |

FIGURE 2. Terminal connections.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>14       |

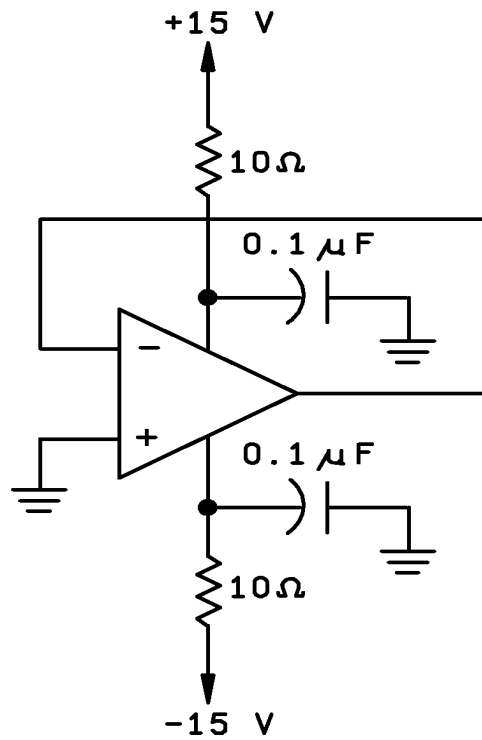


FIGURE 3. Radiation exposure circuit for device type 01.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>15       |

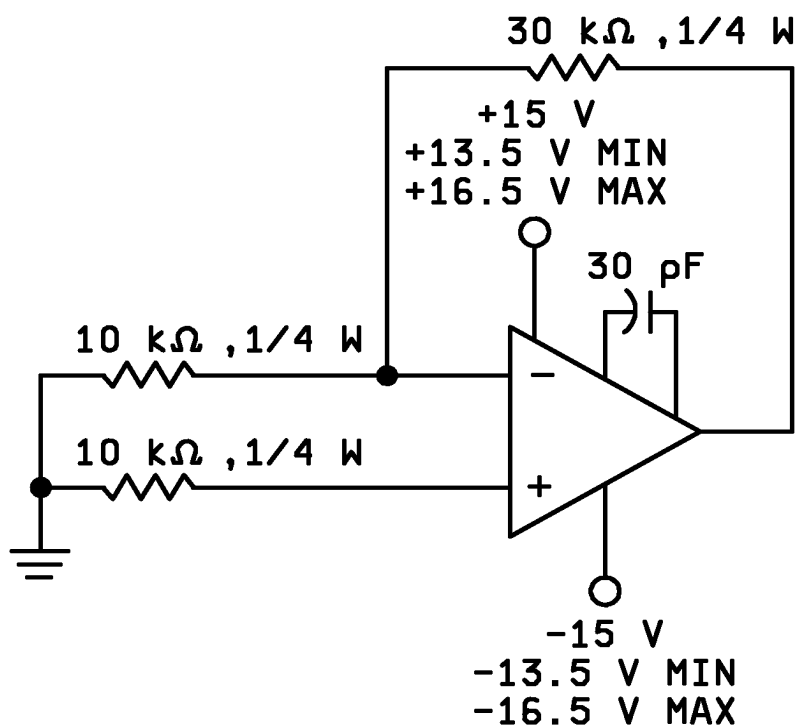


FIGURE 3. Radiation exposure circuit for device type 02 – Continued.

|                                                                                                         |                  |                |                   |
|---------------------------------------------------------------------------------------------------------|------------------|----------------|-------------------|
| <b>STANDARD<br/>MICROCIRCUIT DRAWING</b><br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br><b>A</b> |                | <b>5962-98637</b> |
|                                                                                                         |                  | REVISION LEVEL | SHEET<br>16       |

TABLE IIA. Electrical test requirements.

| Test requirements                                    | Subgroups<br>(in accordance with<br>MIL-STD-883,<br>method 5005, table I) | Subgroups<br>(in accordance with<br>MIL-PRF-38535, table III) |                                             |
|------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|
|                                                      | Device<br>class M                                                         | Device<br>class Q                                             | Device<br>class V                           |
| Interim electrical<br>parameters (see 4.2)           | 1                                                                         | 1                                                             | 1                                           |
| Final electrical<br>parameters (see 4.2)             | 1, 2, 3, 4<br><u>1/</u>                                                   | 1, 2, 3, 4<br><u>1/</u>                                       | 1, 2, 3, 4<br><u>1/</u> <u>2/</u> <u>3/</u> |
| Group A test<br>requirements (see 4.4)               | 1, 2, 3, 4, 5, 6, 9, 10,<br>11                                            | 1, 2, 3, 4, 5, 6,<br>9, 10, 11                                | 1, 2, 3, 4, 5,<br>6, 9, 10, 11              |
| Group C end-point electrical<br>parameters (see 4.4) | 1                                                                         | 1                                                             | 1, 2, 3<br><u>2/</u> <u>3/</u>              |
| Group D end-point electrical<br>parameters (see 4.4) | 1                                                                         | 1                                                             | 1, 2, 3                                     |
| Group E end-point electrical<br>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 electrical parameters.3/ For device type 02 delta is performed for Group C end point electrical only.Table IIB. 240 hour burn-in and group C end-point electrical parameters.

| Test                | Device type | Delta    |          |
|---------------------|-------------|----------|----------|
|                     |             | Min      | Max      |
| $V_{IO}$ <u>1/</u>  | ALL         | -0.25 mV | +0.25 mV |
| $+I_{IB}$ <u>1/</u> | ALL         | -0.5 nA  | +0.5 nA  |
| $-I_{IB}$ <u>1/</u> | ALL         | -0.5 nA  | +0.5 nA  |

1/  $V_{CC} = \pm 20\text{ V}$ ,  $V_{CM} = 0\text{ V}$ 

**STANDARD  
MICROCIRCUIT DRAWING**  
DEFENSE SUPPLY CENTER COLUMBUS  
COLUMBUS, OHIO 43216-5000

SIZE  
**A**

5962-98637

REVISION LEVEL

SHEET

17

#### 4.2.2 Additional criteria for device classes Q and V.

- a. The burn-in test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document revision level control of the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.
- b. Interim and final electrical test parameters shall be as specified in table IIA herein.
- c. Additional screening for device class V beyond the requirements of device class Q shall be as specified in MIL-PRF-38535, appendix B.

4.3 Qualification inspection for device classes Q and V. Qualification inspection for device classes Q and V shall be in accordance with MIL-PRF-38535. Inspections to be performed shall be those specified in MIL-PRF-38535 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

4.4 Conformance inspection. Technology conformance inspection for classes Q and V shall be in accordance with MIL-PRF-38535 including groups A, B, C, D, and E inspections and as specified herein except where option 2 of MIL-PRF-38535 permits alternate in-line control testing. Quality conformance inspection for device class M shall be in accordance with MIL-PRF-38535, appendix A and as specified herein. Inspections to be performed for device class M shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

#### 4.4.1 Group A inspection.

- a. Tests shall be as specified in table IIA herein.
- b. Subgroups 7 and 8 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 class M. Steady-state life test conditions, method 1005 of MIL-STD-883:

- a. Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.
- b.  $T_A = +125^{\circ}\text{C}$ , minimum.
- c. Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.4.2.2 Additional criteria for device classes Q and V. The steady-state life test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The test circuit shall be maintained under document revision level control by the device manufacturer's TRB in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

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

4.4.4 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels for device classes M, Q, and V shall be as specified in MIL-I-38535. End-point electrical parameters shall be as specified in table IIA herein.

4.4.4.1 Total dose irradiation testing. Total dose irradiation testing shall be performed in accordance with MIL-STD-883 method 1019 Condition A and as specified herein.

|                                                                                                 |           |                |             |
|-------------------------------------------------------------------------------------------------|-----------|----------------|-------------|
| STANDARD<br>MICROCIRCUIT DRAWING<br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br>A |                | 5962-98637  |
|                                                                                                 |           | REVISION LEVEL | SHEET<br>18 |

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

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

## 5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

## 6. NOTES

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

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

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

6.2 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-973 using DD Form 1692, Engineering Change Proposal.

6.3 Record of users. Military and industrial users should inform Defense Supply Center Columbus when a system application requires configuration control and which SMD's are applicable to that system. DSCC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0525.

6.4 Comments. Comments on this drawing should be directed to DSCC-VA , Columbus, Ohio 43216-5000, or telephone (614) 692-0674.

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

6.6 Sources of supply.

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

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

|                                                                                                 |           |                |             |
|-------------------------------------------------------------------------------------------------|-----------|----------------|-------------|
| STANDARD<br>MICROCIRCUIT DRAWING<br>DEFENSE SUPPLY CENTER COLUMBUS<br>COLUMBUS, OHIO 43216-5000 | SIZE<br>A |                | 5962-98637  |
|                                                                                                 |           | REVISION LEVEL | SHEET<br>19 |

## STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 99-02-12

Approved sources of supply for SMD 5962R98637 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38535 during the next revision. MIL-HDBK-103 and QML-38535 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DSCC-VA. This bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535.

| Standard microcircuit drawing<br>PIN <u>1</u> / | Vendor<br>CAGE<br>number | Vendor<br>similar<br>PIN <u>2</u> / |
|-------------------------------------------------|--------------------------|-------------------------------------|
| 5962R9863701VGA                                 | 24355                    | PM108AJ/QMLR                        |
| 5962R9863701VPA                                 | 24355                    | PM108AZ/QMLR                        |
| 5962R9863701VHA                                 | 24355                    | PM108AL/QMLR                        |
| 5962R9863702QCA                                 | 27014                    | LM108AJRQML                         |
| 5962R9863702QGA                                 | 27014                    | LM108AHRQML                         |
| 5962R9863702QPA                                 | 27014                    | LM108AJ-8RQML                       |
| 5962R9863702QHA                                 | 27014                    | LM108AWRQML                         |
| 5962R9863702QZA                                 | 27014                    | LM108AWGRQML                        |
| 5962R9863702VCA                                 | 27014                    | LM108AJRQMLV                        |
| 5962R9863702VGA                                 | 27014                    | LM108AHRQMLV                        |
| 5962R9863702VPA                                 | 27014                    | LM108AJ-8RQMLV                      |
| 5962R9863702VHA                                 | 27014                    | LM108AWRQMLV                        |
| 5962R9863702VZA                                 | 27014                    | LM108AWGRQMLV                       |

- 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.

STANDARD MICROCIRCUIT DRAWING BULLETIN - continued

| <u>Vendor CAGE<br/>number</u> | <u>Vendor name<br/>and address</u>                                                                                                                                           |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 24355                         | Analog Devices Inc.<br>Rt 1 Industrial Park<br>P.O. Box 9106<br>Norwood MA 02062<br>Point of Contact : 1500 Space Park Drive<br>P.O. Box 58020<br>Santa Clara, CA 95050-8020 |
| 27014                         | National Semiconductor<br>2900 Semiconductor Dr.<br>P.O. Box 58090<br>Santa Clara, CA 95052-8090                                                                             |

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