

**REVISIONS**

| REV | DESCRIPTION  | DATE (YR-MO-DA) | APPROVED            |
|-----|--|-----------------|---------------------|
| A   | Changed to reflect MIL-H-38534 processing. Editorial changes throughout. | 91-11-20        | <i>Greg A. Rude</i> |

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

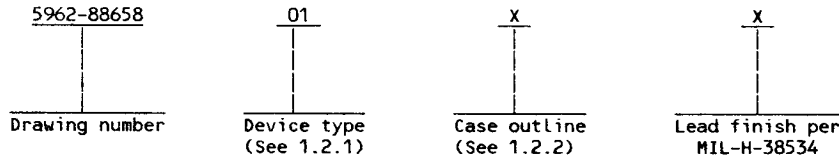
|  |                                    |  |                   |
|--|------------------------------------|--|-------------------|
| <p>PMIC N/A</p> <p align="center"><b>STANDARDIZED MILITARY DRAWING</b></p> <p>THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p> <p>AMSC N/A</p> | PREPARED BY<br><i>Greg A. Rude</i> | DEFENSE ELECTRONICS SUPPLY CENTER<br>DAYTON, OHIO 45444<br><br>MICROCIRCUITS, LINEAR, 12-BIT A/D CONVERTER, HYBRID |                   |
|  | CHECKED BY<br><i>Greg A. Rude</i>  |  |                   |
|  | APPROVED BY<br><i>Greg A. Rude</i> |  |                   |
|  | DRAWING APPROVAL DATE<br>89-07-31  |  |                   |
|  | REVISION LEVEL<br>A                |  |                   |
| SIZE<br><b>A</b>   |                                    | CAGE CODE<br><b>67268</b>  | <b>5962-88658</b> |
| SHEET 1  |                                    | OF 13  | 1                 |

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 5962-E130

1. SCOPE

1.1 Scope. This drawing describes device requirements for class H hybrid microcircuits to be processed in accordance with MIL-H-38534.

1.2 Part or Identifying Number (PIN). The complete PIN shall be as shown in the following example:



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

| Device type | Generic number | Circuit function                  |
|-------------|----------------|-----------------------------------|
| 01          | AD578SD        | A/D converter, 12 bit, high speed |
| 02          | AD578TD        | A/D converter, 12 bit, high speed |
| 03          | AD578ZSD       | A/D converter, 12 bit, high speed |
| 04          | AD578ZTD       | A/D converter, 12 bit, high speed |

1.2.2 Case outline(s). The case outline(s) shall be as designated in appendix C of MIL-M-38510, and as follows:

| Outline letter | Case outline   |
|----------------|--|
| X              | See figure 1 (32-lead, 1.640" x .605" x .280"), dual-in-line package |

1.3 Absolute maximum ratings.

|  |                 |
|--|-----------------|
| Supply voltages ( $\pm V_{CC}$ )         | ±18 V dc        |
| Logic supply voltage ( $+V_{DD}$ )       | +7 V dc         |
| Analog inputs (pins 27 and 28)           | ±25 V dc        |
| Digital inputs                           | +5.5 V dc       |
| Storage temperature range                | -65°C to +150°C |
| Lead temperature (soldering, 10 seconds) | +300°C          |
| Thermal resistance:                      |                 |
| Junction-to-case ( $\theta_{JC}$ )       | 8°C/W           |
| Junction-to-ambient ( $\theta_{JA}$ )    | 25°C/W          |
| Junction temperature ( $T_J$ )           | +175°C          |

1.4 Recommended operating conditions.

|   |                          |
|---|--------------------------|
| Supply voltage range ( $\pm V_{CC}$ ):        |                          |
| Device types 01 and 02                        | ±13.5 V dc to ±16.5 V dc |
| Device types 03 and 04                        | ±11.4 V dc to ±12.6 V dc |
| Logic supply voltage range ( $+V_{DD}$ )      | +4.75 V dc to +5.25 V dc |
| Ambient operating temperature range ( $T_A$ ) | -55°C to +125°C          |

2. APPLICABLE DOCUMENTS

2.1 Government specifications and standard. Unless otherwise specified, the following specifications and standard of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATIONS

MILITARY

|             |   |  |
|-------------|---|--|
| MIL-M-38510 | - | Microcircuits, General Specification for.        |
| MIL-H-38534 | - | Hybrid Microcircuits, General Specification for. |

|   |                   |                             |                    |
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## STANDARD

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MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Copies of the specifications and standard required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

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 shall take precedence.

## 3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.2 and figure 1.

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

3.2.3 Logic diagram. The logic diagram shall be as specified on figure 3.

3.2.4 Timing diagram. Timing diagram shall be as specified on figure 4.

3.2.5 Digital output data. Digital output data shall be as specified on figure 5.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. 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 QML-38534 (see 6.6 herein).

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall submit for DESC-ECT review and approval electrical test data (variables format) on 22 devices from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in QML-38534 (see 6.6 herein). The certificate of compliance submitted to DESC-ECT prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

## 4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

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TABLE I. Electrical performance characteristics.

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| Test                                      | Symbol           | Conditions 1/<br>-55°C ≤ T <sub>A</sub> ≤ +125°C<br>unless otherwise specified | Group A<br>subgroups | Device<br>types | Limits     |            | Unit              |
|---|------------------|--|----------------------|-----------------|------------|------------|-------------------|
|   |                  |  |                      |                 | Min        | Max        |                   |
| Gain error                                | V <sub>GE</sub>  | 10 V unipolar,<br>20 V bipolar,<br>end-point electrical                        | 1                    | ALL             | -0.25      | +0.25      | %FSR              |
|   |                  |  | 1                    | ALL             | -0.30      | +0.30      |                   |
| Gain drift                                | V <sub>GD</sub>  | 10 V unipolar,<br>20 V bipolar   | 2, 3                 | 01,03<br>02,04  | -50<br>-30 | +50<br>+30 | ppm/°C            |
| Unipolar offset error                     | V <sub>OSE</sub> | 10 V unipolar  | 1                    | ALL             | -0.25      | +0.25      | %FSR              |
| Unipolar offset drift                     | V <sub>OSD</sub> | 10 V unipolar  | 2, 3                 | 01,03<br>02,04  | -15<br>-10 | +15<br>+10 | ppm/°C            |
| Bipolar offset error                      | V <sub>OSE</sub> | 20 V bipolar,<br>end-point electrical  | 1                    | ALL             | -0.25      | +0.25      | %FSR              |
|   |                  |  | 1                    | ALL             | -0.30      | +0.30      |                   |
| Bipolar offset drift                      | V <sub>OSD</sub> | 20 V bipolar   | 2, 3                 | 01,03<br>02,04  | -25<br>-20 | +25<br>+20 | ppm/°C            |
| Linearity error                           | RA               | 10 V unipolar,<br>20 V bipolar   | 1                    | ALL             | -0.50      | +0.50      | LSB               |
|   |                  | 10 V unipolar,<br>20 V bipolar   | 2, 3                 | ALL             | -0.75      | +0.75      |                   |
| Differential linearity error              | DNL              | 10 V unipolar,<br>20 V bipolar   | 1, 2, 3              | ALL             | -1.0       | +1.0       |                   |
| 10 V reference error                      | V <sub>RE</sub>  |  | 1                    | ALL             | -100       | +100       | mV                |
|   |                  |  | 2,3                  | ALL             | -20        | +20        | ppm/°C            |
| +V <sub>DD</sub> Power supply sensitivity | PSRR             | 2/   | 1,2,3                | ALL             | -0.005     | +0.005     | %/V <sub>DD</sub> |

See footnotes at end of table.

|   |                            |                   |
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TABLE I. Electrical performance characteristics - Continued.

| Test                                      | Symbol           | Conditions 1/<br>-55°C ≤ T <sub>A</sub> ≤ +125°C<br>unless otherwise specified | Group A<br>subgroups | Device<br>types | Limits |        | Unit               |
|---|------------------|--|----------------------|-----------------|--------|--------|--------------------|
|   |                  |  |                      |                 | Min    | Max    |                    |
| ±V <sub>CC</sub> Power supply sensitivity | PSRR             | 2/   | 1,2,3                | 01,02           | -0.005 | +0.005 | %/±V <sub>CC</sub> |
| ±V <sub>CC</sub> Power supply sensitivity | PSRR             | 2/   | 1,2,3                | 03,04           | -0.007 | +0.007 |                    |
| Digital output high drive                 | V <sub>OH</sub>  | at -80 μA I <sub>OH</sub><br>2/  | 1,2,3                | ALL             | 2.4    |        | V dc               |
| Digital output low drive                  | V <sub>OL</sub>  | at 3.2 mA I <sub>OL</sub><br>2/  | 1,2,3                | ALL             |        | 0.4    |                    |
| +V <sub>DD</sub> Supply drain             | +I <sub>DD</sub> | All bits on<br>2/  | 1,2,3                | ALL             |        | 150    | mA                 |
| +V <sub>CC</sub> Supply drain             | +I <sub>CC</sub> | All bits on<br>2/  | 1,2,3                | ALL             |        | 8      |                    |
| -V <sub>CC</sub> Supply drain             | -I <sub>CC</sub> | All bits on<br>2/  | 1,2,3                | ALL             |        | 35     |                    |
| Power dissipation                         | P <sub>D</sub>   | T <sub>A</sub> = +25°C   |                      | ALL             |        | 715    | mW                 |
| Conversion speed                          | t <sub>C</sub>   | 3/   | 9,10,11              | 01,03           |        | 6      | μs                 |
|   |                  |  | 9,10,11              | 02,04           |        | 4.5    |                    |

1/ +V<sub>DD</sub> = +4.75 V to +5.25 V; ±V<sub>CC</sub> = ±13.5 V to ±16.5 V for device types 01 and 02; ±V<sub>CC</sub> = ±11.4 V to ±12.6 V for device types 03 and 04.

2/ Subgroups 2 and 3 shall be tested as part of device initial characterization and every 52 weeks thereafter. Subgroups 2 and 3 shall also be tested after all design and process changes and shall be guaranteed to the limits specified in table I for all lots not specifically tested. Subgroup 1 shall be tested with every lot.

3/ Subgroups 10 and 11 shall be tested as part of device initial characterization and after design and process changes. Parameter shall be guaranteed to the limits specified in table I for all lots not specifically tested.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

- a. Burn-in test, method 1015 of MIL-STD-883.
  - (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).
  - (2) T<sub>A</sub> as specified in accordance with table I of method 1015 of MIL-STD-883.
- b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

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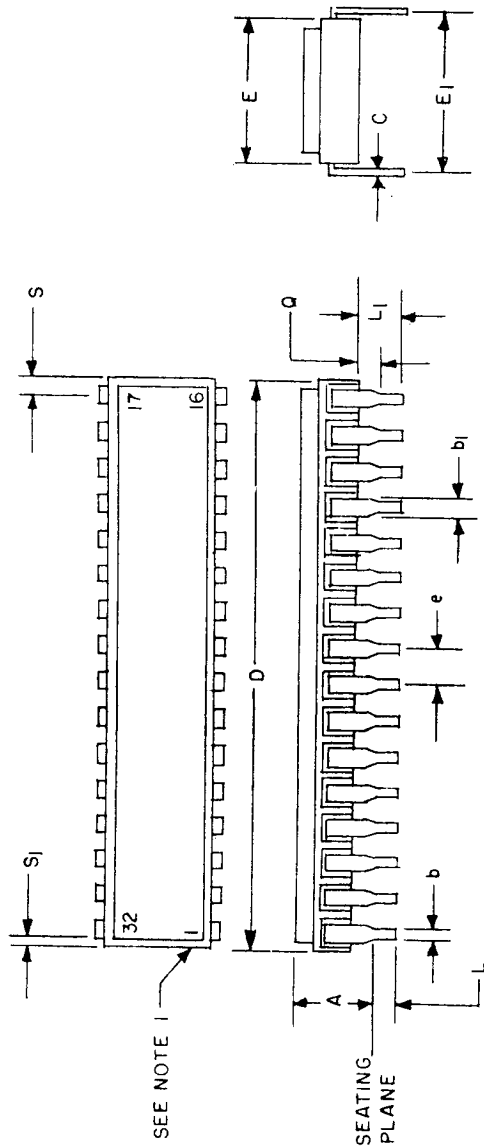


FIGURE 1. Case outline X.

|   |                  |                            |            |
|---|------------------|----------------------------|------------|
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| Symbol         | Inches   |       | Millimeters |       | Notes |
|----------------|----------|-------|-------------|-------|-------|
|                | Min      | Max   | Min         | Max   |       |
| A              |          | .280  |             | 7.11  |       |
| b              | .016     | .020  | 0.41        | 0.51  |       |
| b <sub>1</sub> | .035     | .045  | 0.89        | 1.14  | 2     |
| c              | .009     | .012  | 0.23        | 0.30  |       |
| D              | 1.584    | 1.640 | 40.23       | 41.66 |       |
| E              | .580     | .605  | 14.73       | 15.37 |       |
| E <sub>1</sub> | .590     | .610  | 14.99       | 15.49 | 6     |
| e              | .100 BSC |       | 2.54 BSC    |       | 4,7   |
| L              | .125     | .200  | 3.18        | 5.08  |       |
| L <sub>1</sub> | .180     |       | 4.57        |       |       |
| Q              | .015     | .060  | 0.38        | 1.52  | 3     |
| S              |          | .098  |             | 2.49  | 5     |
| S <sub>1</sub> | .005     |       | 0.13        |       | 5     |

NOTES:

1. Index area; a notch or a lead one identification mark is located adjacent to lead one.
2. The minimum limit for dimension b<sub>1</sub> may be .023 inch (0.58 mm) for all four corner leads only.
3. Dimension Q shall be measured from the seating plane to the base plane.
4. The basic pin spacing is .100 inch (2.54 mm) between centerlines.
5. Applies to all four corners.
6. E<sub>1</sub> shall be measured at the centerline of the leads.
7. Thirty spaces.
8. Dimensions are in inches.
9. Metric equivalents are given for general information only.

FIGURE 1. Case outline X - Continued.

|   |                   |                             |                    |
|---|-------------------|-----------------------------|--------------------|
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| Device types    | 01, 02, 03, and 04 |
|-----------------|--------------------|
| Case outline    | X                  |
| Terminal number | Terminal symbol    |
| 1               | BIT 12             |
| 2               | BIT 11             |
| 3               | BIT 10             |
| 4               | BIT 9              |
| 5               | BIT 8              |
| 6               | BIT 7              |
| 7               | BIT 6              |
| 8               | BIT 5              |
| 9               | BIT 4              |
| 10              | BIT 3              |
| 11              | BIT 2              |
| 12              | BIT 1              |
| 13              | BIT 1              |
| 14              | SHORT CYCLE        |
| 15              | DIGITAL GND        |
| 16              | +5 V               |
| 17              | CLOCK ADJ          |
| 18              | CLOCK OUT          |
| 19              | CLOCK IN           |
| 20              | EOC                |
| 21              | CONVERT START      |
| 22              | SERIAL OUT         |
| 23              | SERIAL OUT         |
| 24              | REF OUT            |
| 25              | GAIN (REF IN)      |
| 26              | BIPOLAR OFFSET     |
| 27              | 10 V SPAN INPUT    |
| 28              | 20 V SPAN INPUT    |
| 29              | ZERO ADJ           |
| 30              | ANALOG GND         |
| 31              | +15 V              |
| 32              | -15 V              |

FIGURE 2. Terminal connections.

|   |                   |                             |                    |
|---|-------------------|-----------------------------|--------------------|
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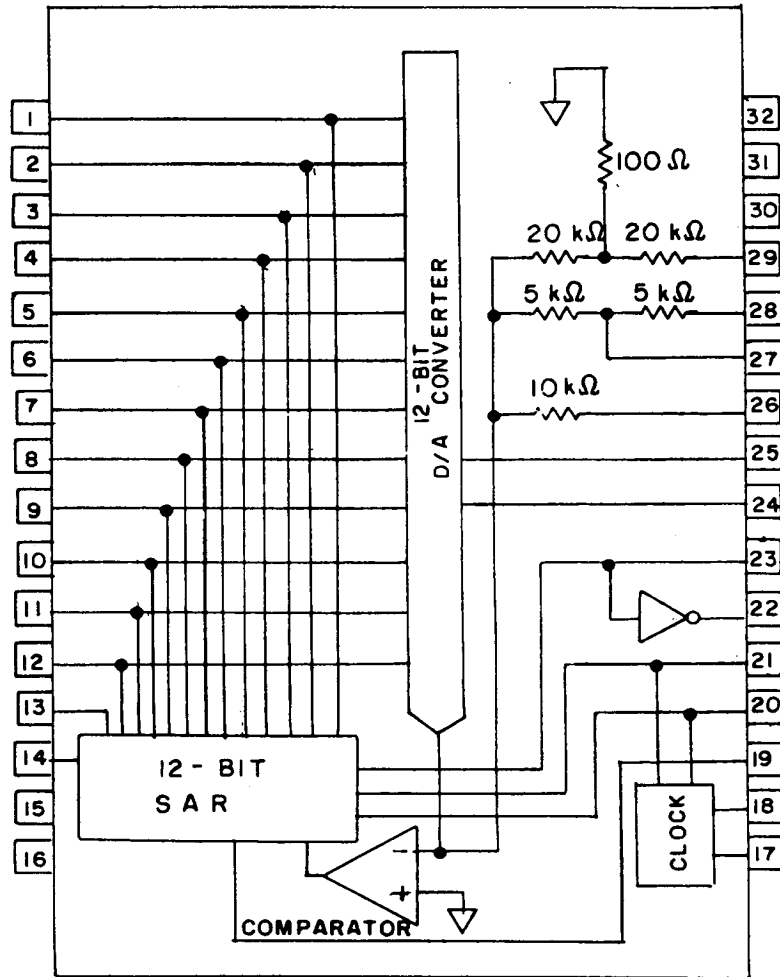


FIGURE 3. Logic diagram.

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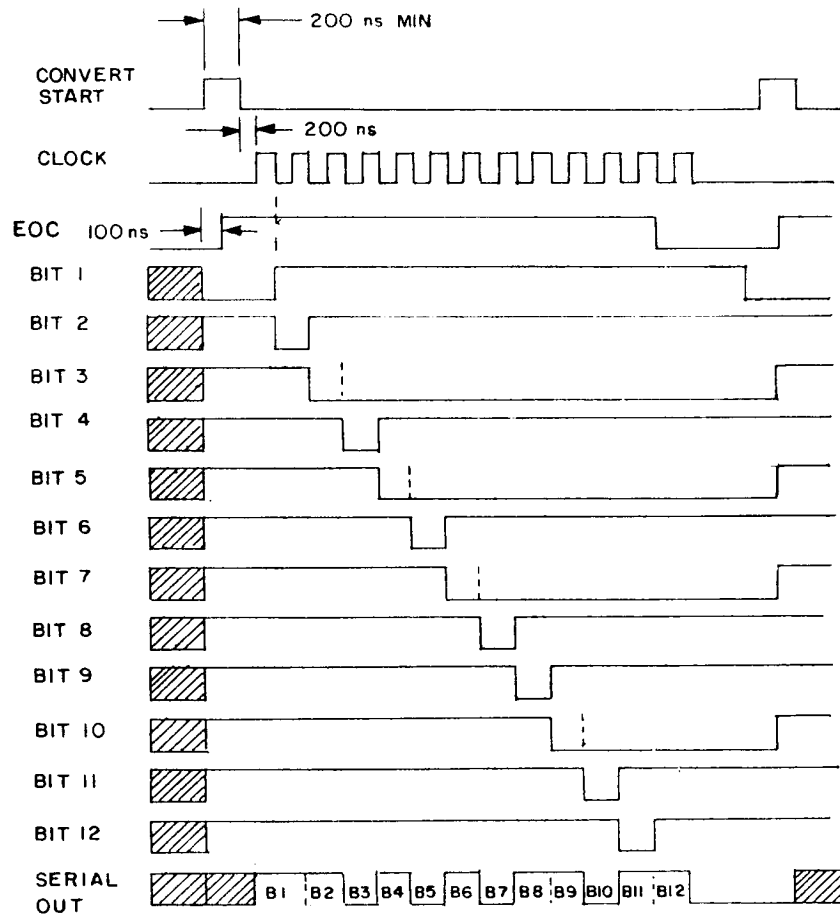
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Clock:  
 Internal: Connect clock out (18) to clock in (19).  
 External: Connect external clock to clock in (19),  
 clock should be at least 30 percent duty cycle with  
 minimum period,  $t_{MIN}$  of 100 ns.

Note: The rising edge of convert start pulse resets the MSB to zero,  
 and the LSB to one. The trailing edge initiates conversion.

FIGURE 4. Timing diagram.

|   |                  |                     |             |
|---|------------------|---------------------|-------------|
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| Analog input - volts<br>(center of quantization interval) |                     |                       | Digital output code<br>(binary for unipolar ranges;<br>offset binary for bipolar ranges) |                         |              |
|---|---------------------|-----------------------|--|-------------------------|--------------|
| 0 to +10 V<br>Range                                       | 0 to +20 V<br>Range | -5 V to +5 V<br>Range | -10 V to +10 V<br>Range  | B1<br>(MSB)             | B12<br>(LSB) |
| +9.9976   | +19.9951            | +4.9976               | +9.9951  | 1 1 1 1 1 1 1 1 1 1 1 1 | 1            |
| +9.9952   | +19.9902            | +4.9952               | +9.9902  | 1 1 1 1 1 1 1 1 1 1 1 0 | 0            |
| -   | -                   | -                     | -  | -                       | -            |
| -   | -                   | -                     | -  | -                       | -            |
| +5.0024   | +10.0049            | +0.0024               | +0.0049  | 1 0 0 0 0 0 0 0 0 0 0 1 | 1            |
| +5.0000   | +10.0000            | +0.0000               | +0.0000  | 1 0 0 0 0 0 0 0 0 0 0 0 | 0            |
| -   | -                   | -                     | -  | -                       | -            |
| -   | -                   | -                     | -  | -                       | -            |
| +0.0024   | +0.0051             | -4.9976               | -9.9951  | 0 0 0 0 0 0 0 0 0 0 0 1 | 1            |
| +0.0000   | +0.0000             | -5.0000               | -10.0000   | 0 0 0 0 0 0 0 0 0 0 0 0 | 0            |

FIGURE 5. Digital output data.

|   |                   |                             |                     |
|---|-------------------|-----------------------------|---------------------|
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4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

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~~4.3.1 Group A inspection.~~ Group A inspection shall be in accordance with MIL-H-38534 and as follows:

- a. Tests shall be as specified in table II herein.
- b. Subgroups 4, 5, 6, 7, and 8 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test conditions, method 1005 of MIL-STD-883.
  - (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).
  - (2)  $T_A$  as specified in accordance with table I of method 1005 of MIL-STD-883.
  - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

TABLE II. Electrical test requirements.

| MIL-STD-883 test requirements           | Subgroups<br>(per method<br>5008, group A<br>test table) |
|---|--|
| Interim electrical parameters           | 1  |
| Final electrical test parameters        | 1*, 2, 3, 9  |
| Group A test requirements               | 1, 2, 3, 9,<br>10,11                                     |
| Group C end-point electrical parameters | 1, 2, 3  |

\*PDA applies to subgroup 1.

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for original equipment design applications and logistic support of existing equipment.

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

6.3 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-481 using DD Form 1693, Engineering Change Proposal (Short Form).

|   |                  |                            |             |
|---|------------------|----------------------------|-------------|
| STANDARDIZED<br>MILITARY DRAWING<br>DEFENSE ELECTRONICS SUPPLY CENTER<br>DAYTON, OHIO 45444 | SIZE<br><b>A</b> |                            | 5962-88658  |
|   |                  | REVISION LEVEL<br><b>A</b> | SHEET<br>12 |

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6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this record shall be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DESC-ECT, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-ECT, Dayton, Ohio 45444, or telephone (513) 296-5374.

6.6 Approved sources of supply. Approved sources of supply are listed in QML-38534. Additional sources will be added to QML-38534 as they become available. The vendors listed in QML-38534 have agreed to this drawing and a certificate of compliance (see 3.7 herein) has been submitted to and accepted by DESC-ECT.

|   |                   |                             |                     |
|---|-------------------|-----------------------------|---------------------|
| <b>STANDARDIZED<br/>MILITARY DRAWING<br/>DEFENSE ELECTRONICS SUPPLY CENTER<br/>DAYTON, OHIO 45444</b> | <b>SIZE<br/>A</b> |                             | <b>5962-88658</b>   |
|   |                   | <b>REVISION LEVEL<br/>A</b> | <b>SHEET<br/>13</b> |

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