# INTEGRATED CIRCUITS, SILICON MONOLITHIC,

# 8-BIT HIGH SPEED MULTIPLYING D/A CONVERTOR,

# BASED ON TYPE DAC-08A

# ESCC Detail Specification No. 9407/001

**ISSUE 1**

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Pages 1 to 31

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# 8-BIT HIGH SPEED MULTIPLYING D/A CONVERTOR,

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space components
coordination group

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| | | | |
| | | | |

## DOCUMENTATION CHANGE NOTICE

| Rev. Letter | Rev. Date | CHANGE Reference / Item | Approved DCR No. |
|---|---|---|---|
| 'A' | June '92 | P1. Cover Page<br>P2. DCN<br>P14. Para. 4.2.2 : Reference to PIND test deleted<br>P30. Para. 4.8.1 : Table reference changed to '6' | None<br>None<br>21048<br>22919 |
| | | This specification has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist | |

## TABLE OF CONTENTS

## 1. GENERAL

### 1.1 SCOPE

This specification details the ratings, physical and electrical characteristics, test and inspection data for a silicon monolithic, 8 Bit, High Speed, Multiplying D/A Convertor, based on Type DAC08A. It shall be read in conjunction with ESA/SCC Generic Specification No. 9000, the requirements of which are supplemented herein.

### 1.2 COMPONENT TYPE VARIANTS

Variants of the basic type integrated circuits specified herein, which are also covered by this specification, are given in Table 1(a).

### 1.3 MAXIMUM RATINGS

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the integrated circuits specified herein, are as scheduled in Table 1(b).

### 1.4 PARAMETER DERATING INFORMATION

As per Figure 1.

### 1.5 PHYSICAL DIMENSIONS

The physical dimensions of the integrated circuits specified herein are shown in Figure 2.

### 1.6 PIN ASSIGNMENT

As per Figure 3(a).

### 1.7 TRUTH TABLE

Not applicable.

### 1.8 CIRCUIT SCHEMATIC

As per Figure 3(b).

### 1.9 FUNCTIONAL DIAGRAM

As per Figure 3(c).

**TABLE 1(a) - TYPE VARIANTS**

| DASH No. | CASE | FIGURE | LEAD FINISH |
|---|---|---|---|
| -01 | DIL | 2 | Gold-Plated |
| -02 | DIL | 2 | Tin-Plated/Solder-Dipped |

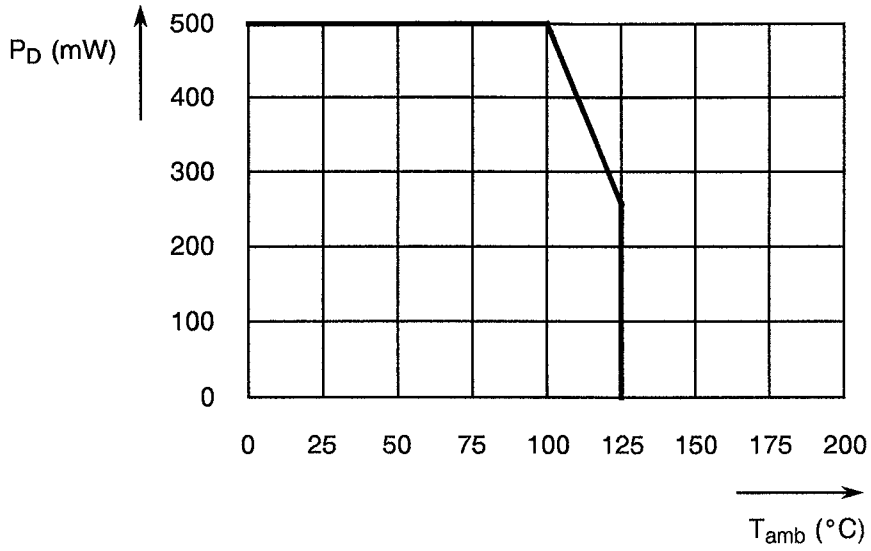
## TABLE 1(b) - MAXIMUM RATINGS

| No. | CHARACTERISTICS | SYMBOL | MAXIMUM RATINGS | UNITS | REMARKS |
|---|---|---|---|---|---|
| 1 | Supply Voltages | $V_{DD}/V_{SS}$ | ±18 | V | |
| 2 | Reference Input Current | $I_{REF}$ | 5.0 | mA | |
| 3 | Reference Input Differential Voltage | $V_{IREF}$ | ±18 | V | |
| 4 | Device Dissipation | $P_D$ | 500 | mWdc | Note 1 |
| 5 | Operating Temperature | $T_{op}$ | −55 to +125 | °C | |
| 6 | Storage Temperature | $T_{stg}$ | −65 to +150 | °C | |
| 7 | Soldering Temperature | $T_{sol}$ | 300 | °C | Note 2 |

**NOTES**

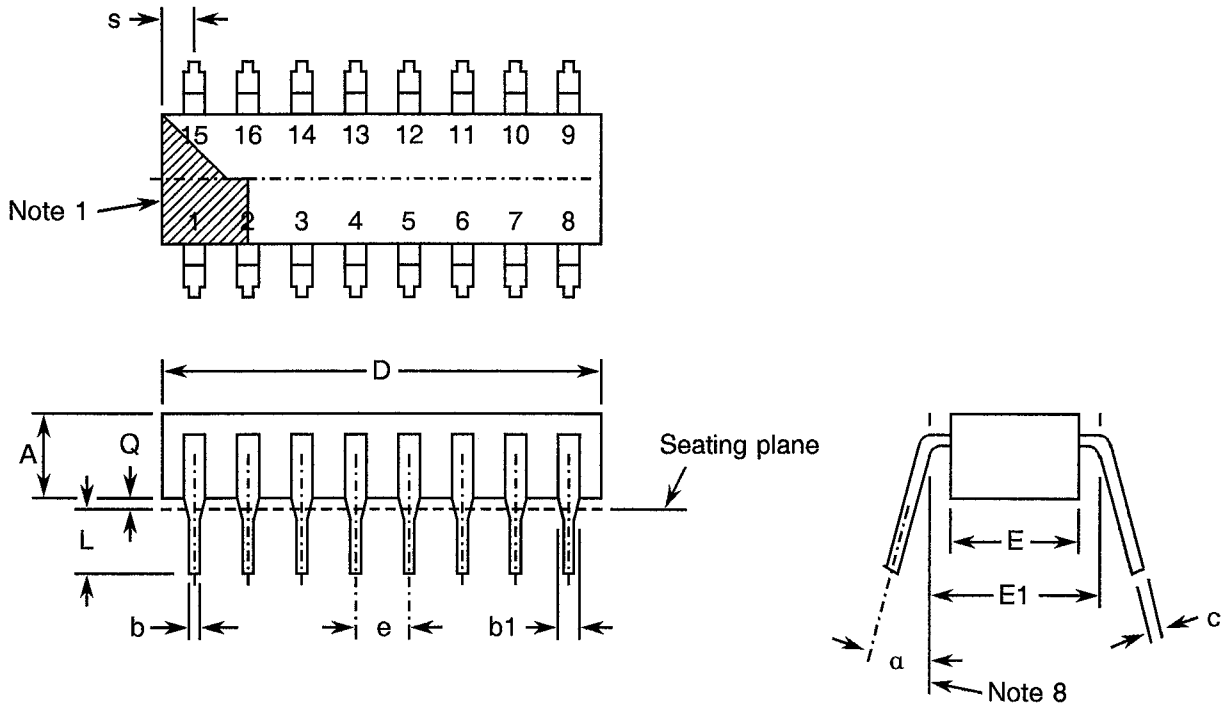
1. Derate above $T_{amb}$ = +100°C at 10mW/°C, up to $T_{amb}$ = +125°C.
2. Duration 10 seconds maximum at a distance of not less than 1.5mm from the can and the same lead shall not be resoldered until 3 minutes have elapsed.

**FIGURE 1 - DEVICE DISSIPATION DERATING WITH TEMPERATURE**



## FIGURE 2 - PHYSICAL DIMENSIONS

DUAL-IN-LINE PACKAGE




| SYMBOL | MILLIMETRES | | MILLIMETRES | | NOTES |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| A | - | 0.200 | - | 5.08 | |
| b | 0.014 | 0.023 | 0.36 | 0.58 | 6 |
| b1 | 0.030 | 0.070 | 0.76 | 1.78 | 6 |
| c | 0.008 | 0.015 | 0.20 | 0.38 | 6 |
| D | 0.725 | 0.840 | 18.41 | 21.34 | |
| E | 0.220 | 0.325 | 5.59 | 8.25 | |
| E1 | 0.290 | 0.320 | 7.37 | 8.13 | 3 |
| e | 0.100 T.P. | | 2.54 T.P. | | 4, 7 |
| L | 0.125 | 0.200 | 3.18 | 5.08 | |
| Q | 0.015 | 0.080 | 0.38 | 2.03 | 2 |
| S | - | 0.080 | - | 2.03 | 5 |
| α | 0° | 15° | 0° | 15° | 8 |

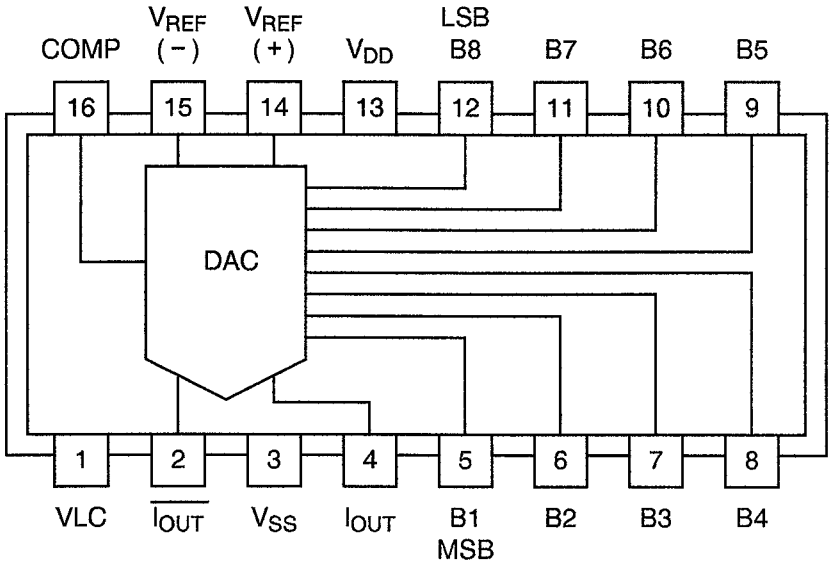
**NOTES:** See Page 10.

## FIGURE 2 - PHYSICAL DIMENSIONS (CONTINUED)

NOTES TO FIGURES 2(a), (b), (c) and (d)

1. Index area; a notch or a dot shall be located adjacent to pin 1 and shall be within the shaded area shown.
2. Dimension Q shall be measured from the seating plane to the base plane.
3. This dimensions allows for off-centre lids, meniscus and glass overrun.
4. The true position pin spacing is 0.100 (2.54mm) between centrelines. Each pin centreline shall be located within ±0.010 (0.25mm) of its true longitudinal position relative to pins 1 and 16.
5. Applies to all 4 corners.
6. All leads.
7. 14 spaces.
8. Lead centre when $\alpha$ is 0°.

**FIGURE 3(a) - PIN ASSIGNMENT**




(TOP VIEW)

**FIGURE 3(b) - PIN ASSIGNMENT**

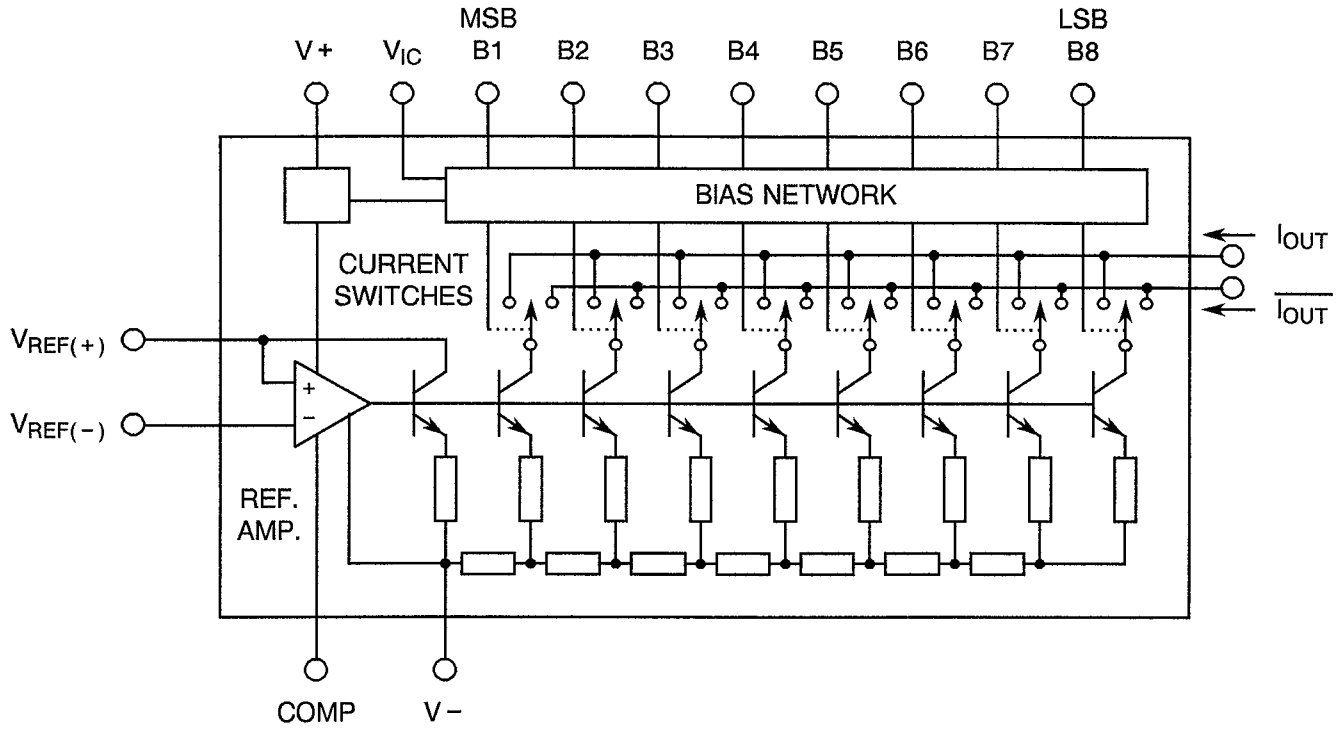
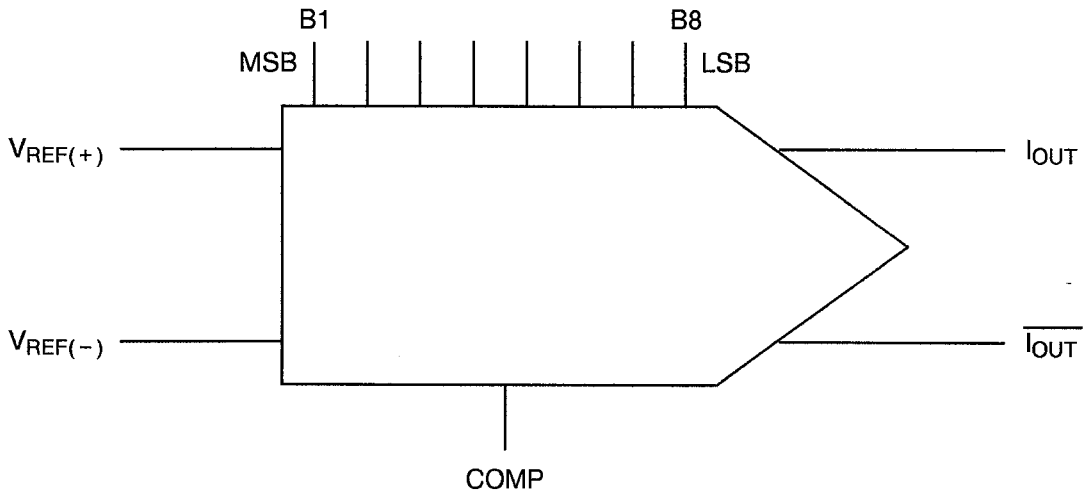



**FIGURE 3(c) - FUNCTIONAL DIAGRAM**



## 2. APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:-

(a) ESA/SCC Generic Specification No. 9000 for Integrated Circuits.

(b) MIL-STD-883, Test Methods and Procedures for Micro-electronics.

(c) MIL-STD-1276, Leads, Weldable, for Electronic Component Parts.

## 3. TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESA/SCC Basic Specification No. 21300 shall apply. In addition, the following abbreviations are used:-

$V_{REF}$ = Reference Voltage.
$I_{REF}$ = Reference Current.
$I_{OUT}$ = Output Current.
$I_{FS}$ = Full Scale Current.
$I_{FSS}$ = Full Scale Symmetry.
$I_{ZS}$ = Zero Scale Current.
PSS = Power Supply Sensitivity.
LN = Non-Linearity.
$V_{OC}$ = Output Voltage Compliance.
$I_{FSR}$ = Output Current Range.
$t_s$ = Settling Time.
$TCI_{FS}$ = Temperature Coefficient.

## 4. REQUIREMENTS

### 4.1 GENERAL

The complete requirements for procurement of the integrated circuits specified herein are stated in this specification and ESA/SCC Generic Specification No. 9000 for Integrated Circuits. Deviations from the Generic Specification applicable to this specification only, are listed in Para. 4.2.

4.2 DEVIATIONS FROM GENERIC SPECIFICATION

The following deviations from ESA/SCC Generic Specification No. 9000 shall apply.

4.2.1 Deviations from Special In-process Controls

None.

4.2.2 Deviations from Final Production Tests (Chart II)

None.

4.2.3 Deviations from Burn-in and Electrical Measurements (Chart III)

None.

4.2.4 Deviations from Environmental and Endurance Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the integrated circuits specified herein shall be checked. They shall conform to those shown in Figure 2.

4.3.2 Weight

The maximum weight of the integrated circuits specified herein shall be 2.0 grammes.

4.4 MATERIALS AND FINISHES

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the integrated circuits specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.

4.4.1 Case

The case shall be hermetically sealed and have a ceramic body and the lids shall be welded, brazed, preform-soldered or glass frit-sealed.

4.4.2 Lead Material and Finish

Kovar in accordance with Type 'K' of MIL-STD-1276, gold plated or solder dipped/tin plated. (See Table 1(a) for Type Vatiants).

4.5 MARKING

4.5.1 General

The marking of components delivered to this specification shall be in accordance with ESA/SCC Basic Specification No. 21700. Each component shall be marked in respect of:-

(a) Lead Identification.

(b) The SCC Component Number.

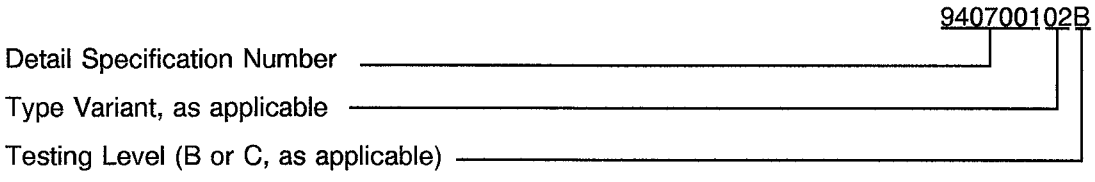
(c) Traceability Information.

4.5.2 Lead Identification

A tab shall be used to identify pin no. 1. The pin numbering must be read with the index or tab on the left-hand side.

4.5.3 The SCC Component Number

Each component shall bear the SCC Component Number which shall be constituted and marked as follows:



4.5.4 Traceability Information

Each component shall be marked in respect of traceability information in accordance with ESA/SCC Basic Specification No. 21700.

4.6 ELECTRICAL CHARACTERISTICS

4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2. Unless otherwise specified, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

4.6.2 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Table 3. The measurements shall be performed at $T_{amb} = +125$°C and $-55$°C respectively.

4.6.3 Circuits for Electrical Measurements

Circuits and functional test sequence for use in performing the electrical measurements listed in Tables 2 and 3 of this specification are shown in Figure 4.

4.7 BURN-IN TESTS

4.7.1 Parameter Drift Values

The parameter drift values applicable to burn-in are specified in Table 4 of this specification. Unless otherwise stated, measurements shall be performed at $T_{amb} = +25 \pm 3$ °C. The parameter drift values ($\Delta$) applicable to the parameters scheduled, shall not be exceeded. In addition to these drift value requirements, the appropriate limit value specified for a given parameter in Table 2 shall not be exceeded.

4.7.2 Conditions for Burn-in

The requirements for burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 9000. The conditions for burn-in shall be as specified in Table 5 of this specification.

4.7.3 Electrical Circuits for Burn-in

Circuits for use in performing the burn-in tests are shown in Figure 5 of this specification.

## TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - d.c. PARAMETERS

| No. | Characteristics | Symbol | Test Method MIL-STD 883 | Test Fig. | Test Conditions (Pins Under Test) (Note 1) | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max | |
| 1 to 8 | Logic Input Current, Low Level | $I_{IL}$ | 3010 | 4(a) | $V_{LC} = 0V$<br>$V_{IN} = -10V$<br>(Pins 5 to 12) | - | −10 | µA |
| 9 to 16 | Logic Input Current, High Level | $I_{IH}$ | 3009 | 4(b) | $V_{LC} = 0V$<br>$V_{IN} = +18V$<br>(Pins 5 to 12) | - | 10 | µA |
| 17 | Full Scale Current | $I_{FS}$ | - | 4(c) | $V_{REF} = 10V \pm 0.1\%$<br>(Pin 4) | 1.984 | 2.0 | mA |
| 18 to 19 | Full Scale Symmetry | $I_{FSS}$ | - | 4(d) | $V_{REF} = 10V \pm 0.1\%$<br>(Pins 2-4) | - | ±4.0 | µA |
| 20 | Zero Scale Current | $I_{ZS}$ | - | 4(c) | (Pin 4) | - | 1.0 | µA |
| 21 | Power Supply Sensitivity, Positive | PSS + | - | 4(c) | $I_{REF} = 1.0mA$<br>$V_{DD} = 4.5V$ to 18V<br>(Pin 13) | - | ±0.01 | %/% |
| 22 | Power Supply Sensitivity, Negative | PSS − | - | 4(c) | $I_{REF} = 1.0mA$<br>$V_{SS} = -4.5V$ to −18V<br>(Pin 3) | - | ±0.01 | %/% |
| 23 | Power Supply Current, Positive | $I_{DD}$ | - | 4(e) | (Pin 13) | - | 3.8 | mA |
| 24 | Power Supply Current, Negative | $I_{SS}$ | - | 4(e) | (Pin 3) | - | −7.8 | mA |
| 25 | Non-Linearity | LN | - | 4(c) | (Pin 4) | - | ±0.1 | %FS |

**NOTES:** See Page 20.

**TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - d.c. PARAMETERS (CONT'D)**

| No. | Characteristics | Symbol | Test Method MIL-STD 883 | Test Fig. | Test Conditions (Pins Under Test) (Note 1) | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max | |
| 26 | Output Voltage Compliance | $V_{OC}$ | - | 4(c) | Full scale current change $< \frac{1}{2}$ LSB (Pin 4) | −10 | 18 | V |
| 27 | Output Current Range (1) | $I_{FRS(1)}$ | - | 4(c) | $V_{SS}$ = −5V (Pin 4) | 0 | 2.1 | mA |
| 28 | Output Current Range (2) | $I_{FSR(2)}$ | - | 4(c) | $V_{SS}$ = −7V to −18V (Pin 4) | 0 | 4.2 | mA |

**NOTES:** See Page 20.

## TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - a.c. PARAMETERS

| No. | Characteristics | Symbol | Test Method MIL-STD 883 | Test Fig. | Test Conditions (Pins Under Test) (Note 1) | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max | |
| 29 to 30 | Settling Time | $t_s$ | - | 4(f) | To $\pm\frac{1}{2}$ LSB, all bits switched ON or OFF (Pin 4) | - | 135 | ns |
| 31 to 38 | Propagation Delay Time, Low to High | $t_{PLH}$ | 3003 | 4(g) | Each Bit (Pins 5 to 12, 4) | - | 60 | ns |
| 39 to 46 | Propagation Delay Time, High to Low | $t_{PHL}$ | 3003 | 4(g) | Each Bit (Pins 5 to 12, 4) | - | 60 | ns |

**NOTES**

1. Unless otherwise specified, the following conditions shall apply for each test:
   $V_{DD}$ = +15V.
   $V_{SS}$ = −15V.
   $I_{REF}$ = 2.0mA.

## TABLE 3(a) - ELECTRICAL MEASUREMENTS AT HIGH AND LOW TEMPERATURE, +125 °C, −55°C

| No. | Characteristics | Symbol | Test Method MIL-STD 883 | Test Fig. | Test Conditions (Pins Under Test) (Note 1) | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max | |
| 20 | Zero Scale Current | $I_{ZS}$ | - | 4(c) | (Pin 4) | - | 1.0 | µA |
| 23 | Power Supply Current, Positive | $I_{DD}$ | - | 4(c) | (Pin 13) | - | 3.8 | mA |
| 24 | Power Supply Current, Negative | $I_{SS}$ | - | 4(c) | (Pin 13) | - | −7.8 | mA |
| 25 | Non-Linearity | LN | - | 4(c) | (Pin 4) | - | ±0.1 | %FS |
| 26 | Output Voltage Compliance | $V_{OC}$ | - | 4(c) | Full scale current change $< \frac{1}{2}$ LSB (Pin 4) | −10 | +18 | V |
| 27 | Output Current Range (1) | $I_{FSR(1)}$ | - | 4(c) | $V_{SS}$ = −5.0V (Pin 4) | 0 | 2.1 | mA |
| 28 | Output Current Range (2) | $I_{FSR(2)}$ | - | 4(c) | $V_{SS}$ = −7.0V to −18V (Pin 4) | 0 | 4.2 | mA |

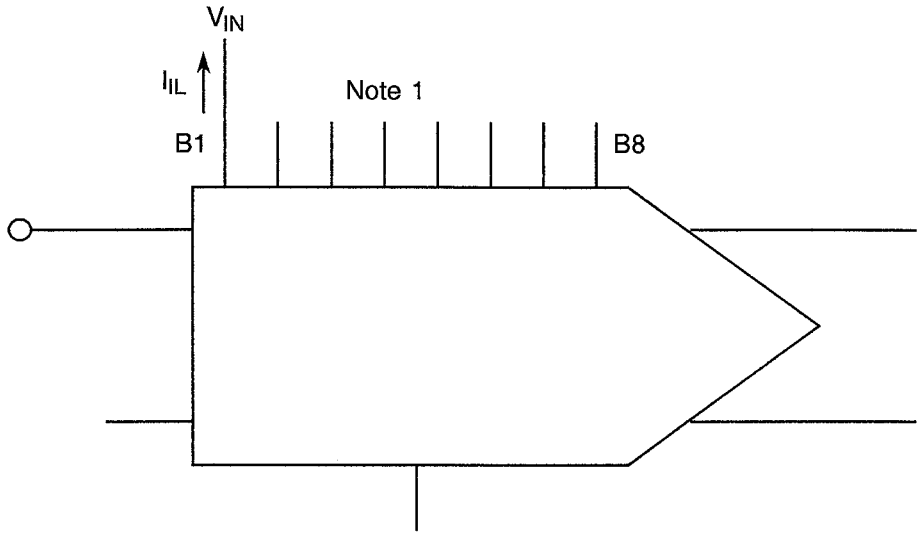
## TABLE 3(b) - ELECTRICAL MEASUREMENTS OVER OPERATING TEMPERATURE RANGE
## $T_{amb}$ = −55 TO +125 °C

| No. | Characteristics | Symbol | Test Method MIL-STD 883 | Test Fig. | Test Conditions (Pins Under Test) (Note 1) | Limits | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Min | Max | |
| 47 | Full Scale Temperature Coefficient | $TCI_{FS}$ | - | 4(c) | $V_{REF}$ = 10V (Pin 4) | - | ±50 | ppm/% |

**NOTES:** See Page 20.

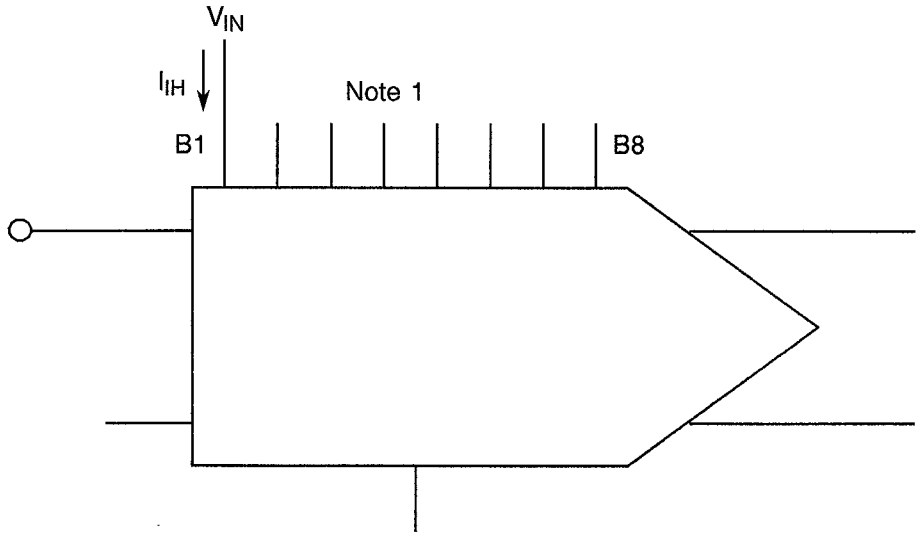
## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - LOGIC INPUT CURRENT, LOW LEVEL




**NOTES**
1. All other inputs to ground.
2. Each input tested separately.

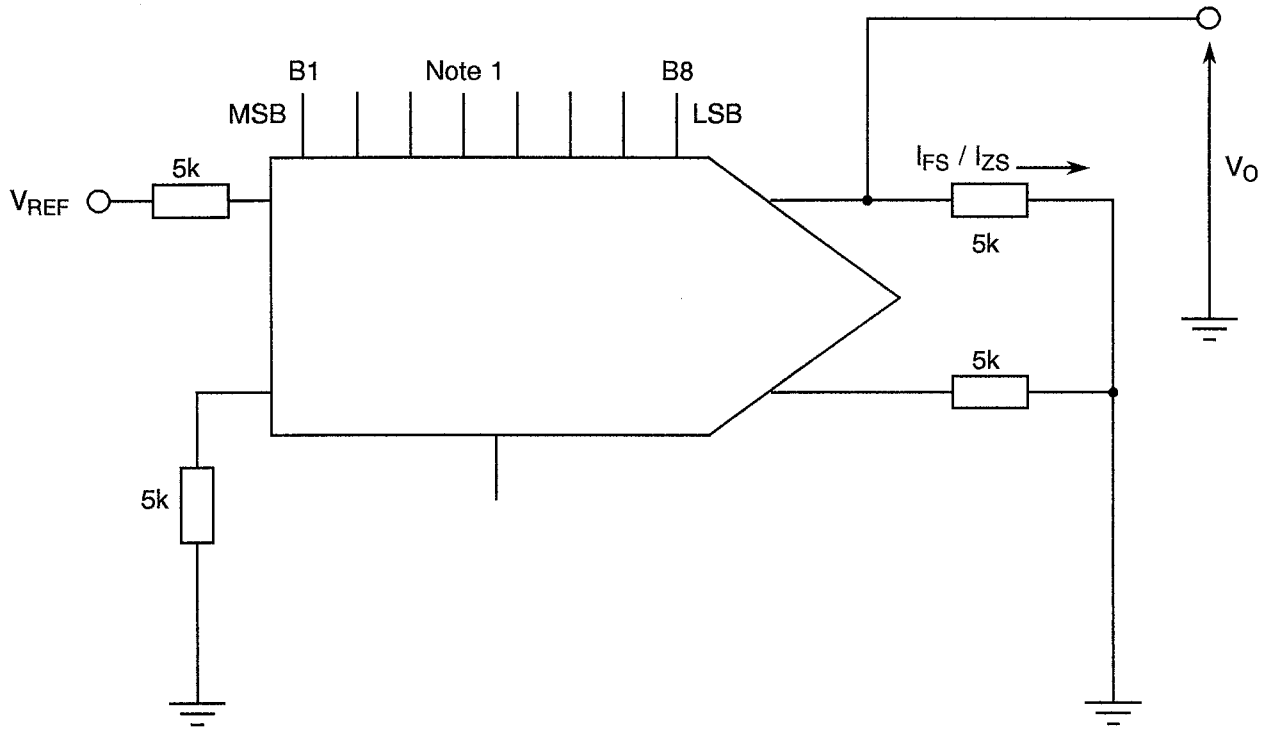
FIGURE 4(b) - LOGIC INPUT CURRENT, HIGH LEVEL




**NOTES**
1. All other inputs to ground.
2. Each input tested separately.

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(c) - FULL SCALE CURRENT, ZERO SCALE CURRENT, POWER SUPPLY SENSITIVITY, NON-LINEARITY, VOLTAGE COMPLIANCE, OUTPUT CURRENT RANGE AND FULL SCALE TEMPERATURE COEFFICIENT

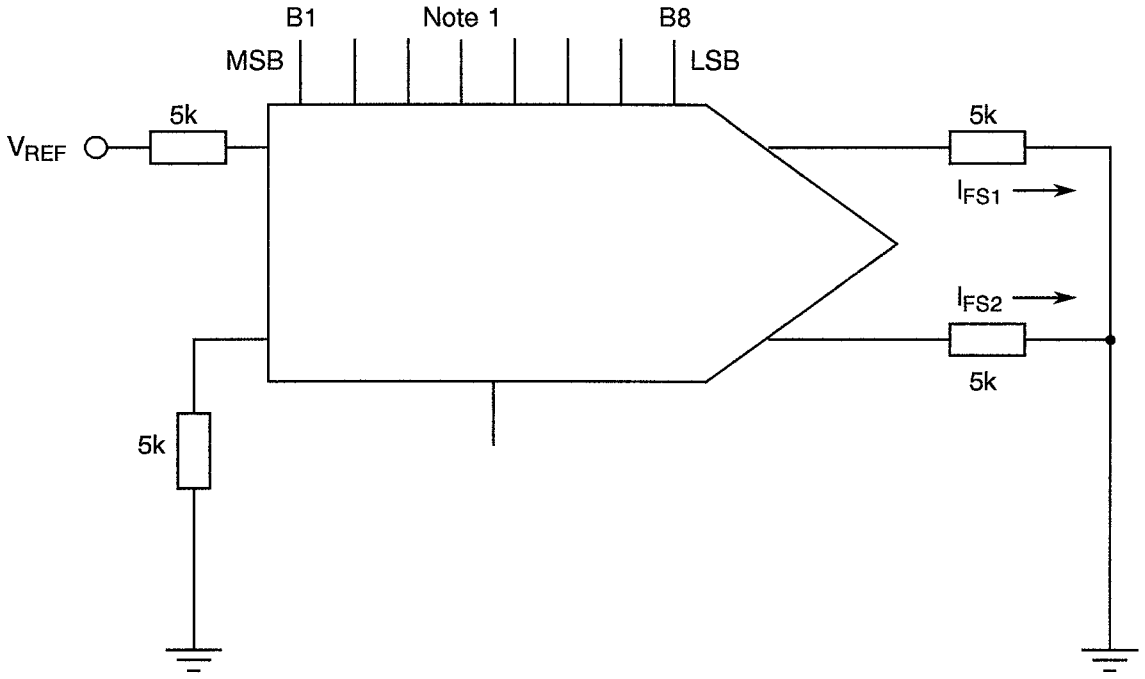



**NOTES**

1. (a) For $I_{FS}$ measurement all bit inputs to logical "1".
   (b) For $I_{ZS}$ measurement Bit 1 (MSB) to logical "1" with all other bit inputs to logical "0".
   (c) For PSS measurement all bit inputs to logical "1".
   (d) For LN measurement each bit input, in turn to logical "1" with all other bit inputs to logical "0".
   (e) For $V_{OC}$ measurement bit inputs as for (d).
   (f) For $I_{FSR}$ measurement bit inputs as for (a).

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(d) - FULL SCALE SYMMETRY

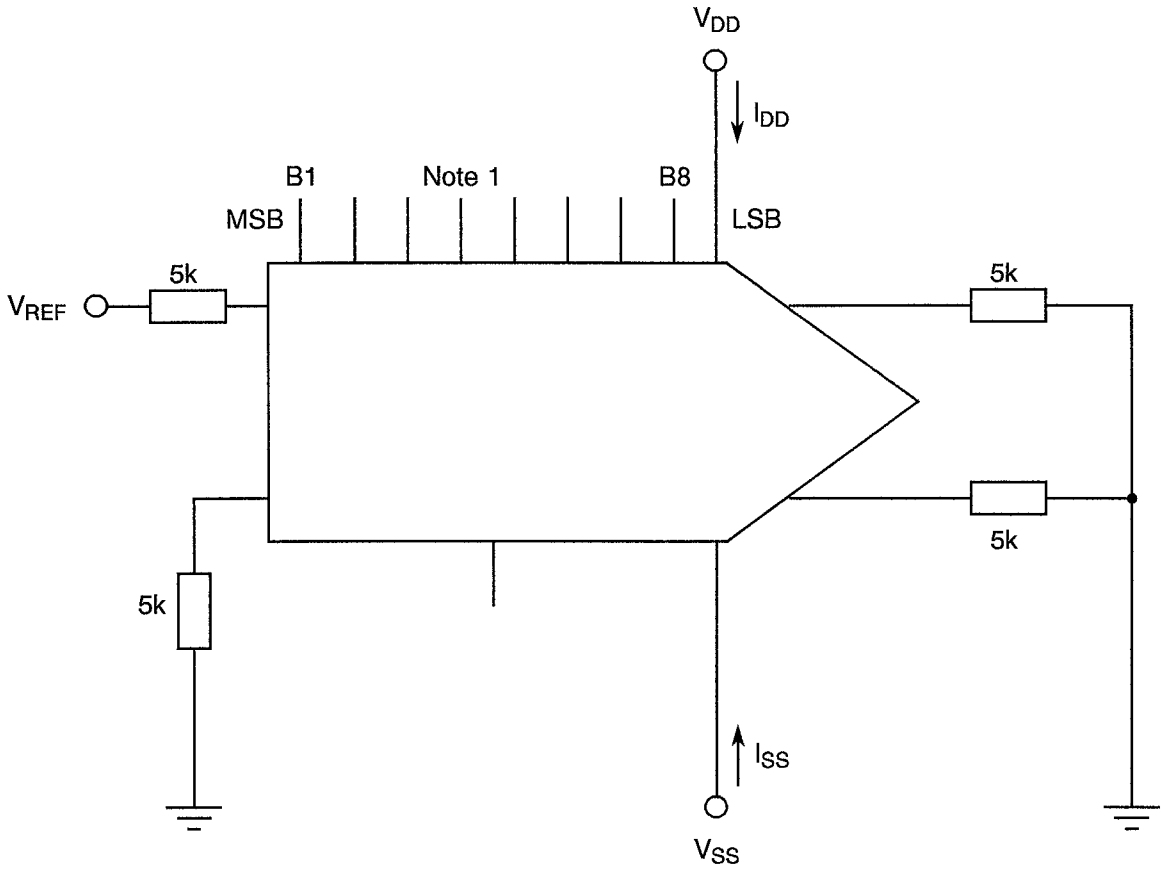



**NOTES**

1. Two Tests to be performed. Test 1 with all bit inputs switched to logical "1". Test 2 with all bit inputs switched to logical "0".
2. For both tests $I_{FSS} = I_{FS1} - I_{FS2}$.

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(e) - POWER SUPPLY CURRENT

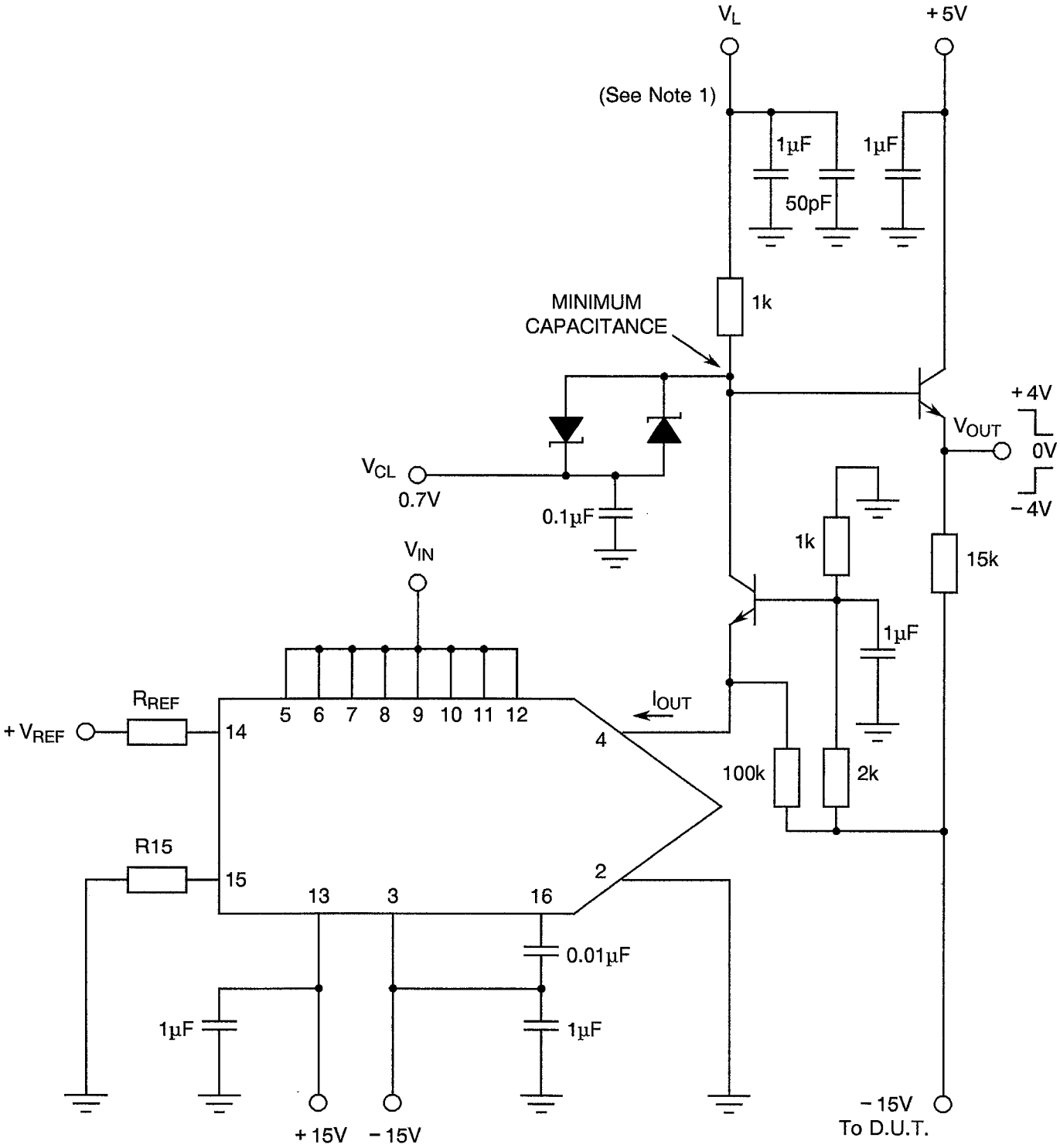



**NOTES**

1. All bit inputs to logical "1".

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(f) - SETTLING TIME

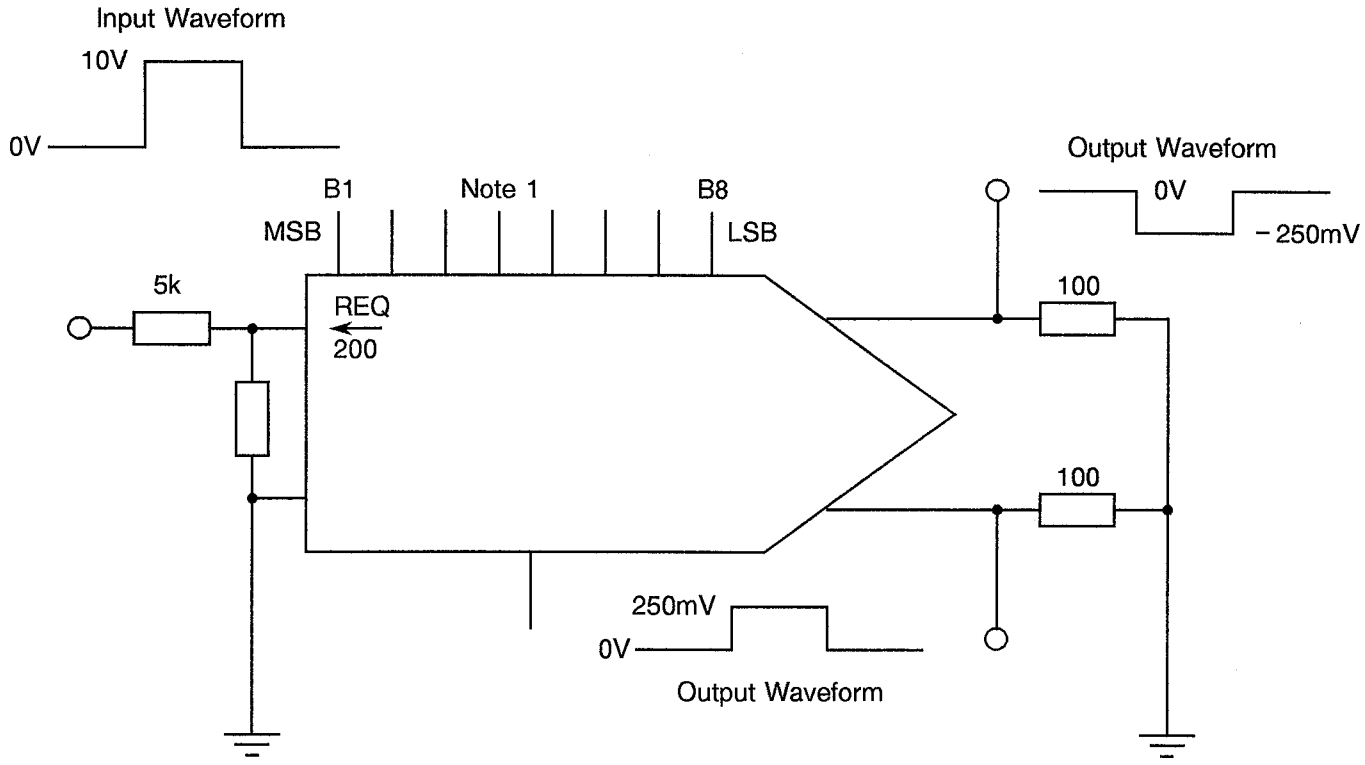



**NOTES**

1. For turn on, $V_L$ = 2.7V; for turn off, $V_L$ = 0.7V.
2. $V_{IN}$ = logical "1" for turn on, $V_{IN}$ = logical "0" for turn off.

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(g) - PROPAGATION DELAY




**NOTES**

1. Each input is tested in turn.

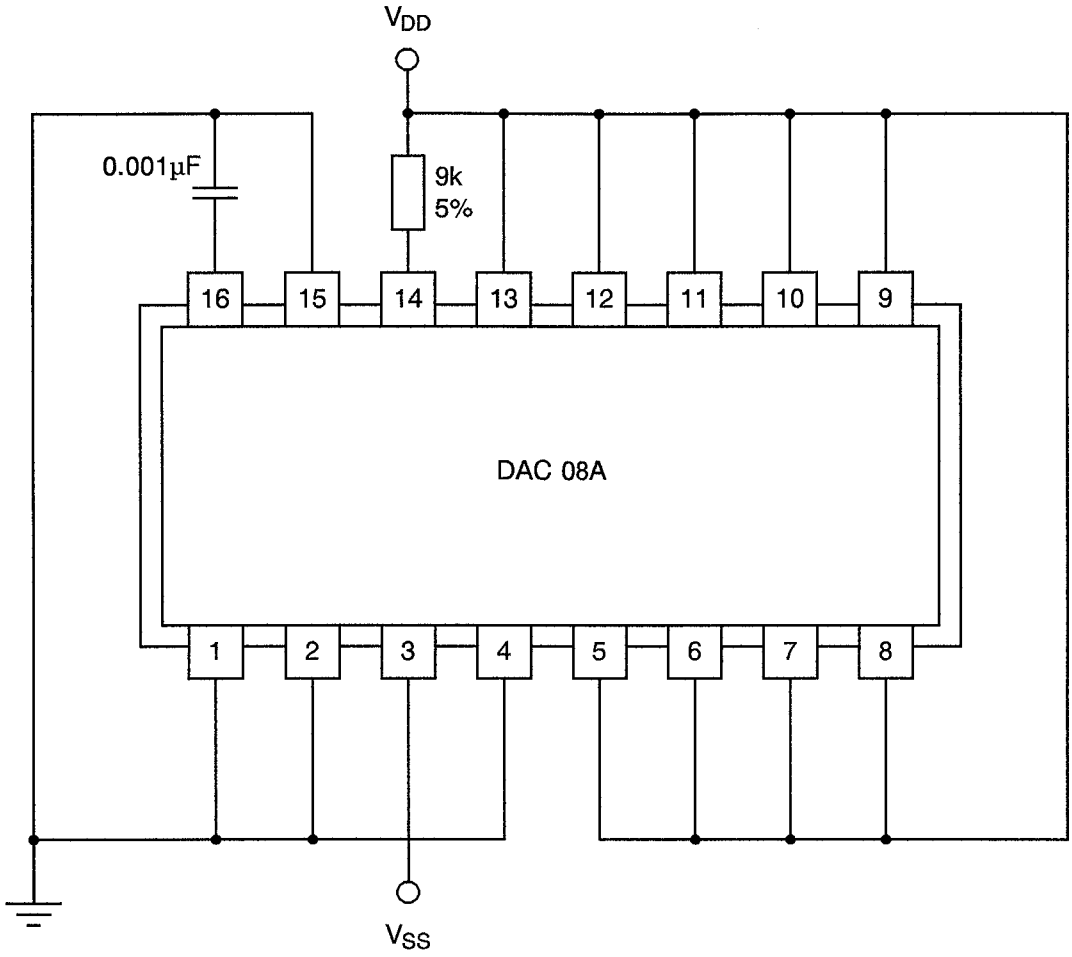
## TABLE 4 - PARAMETER DRIFT VALUES

| No. | CHARACTERISTICS | SYMBOL | SPEC. AND/OR TEST METHOD | TEST CONDITIONS | CHANGE LIMITS (Δ) | UNIT |
|---|---|---|---|---|---|---|
| 18 to 19 | Full Scale Symmetry | $I_{FSS}$ | As per Table 2 | As per Table 2 | ± 1.5 | μA |
| 29 to 30 | Settling Time | $t_s$ | As per Table 2 | As per Table 2 | ± 15 | % |

## TABLE 5 - CONDITIONS FOR BURN-IN AND OPERATING LIFE TESTS

| No. | CHARACTERISTICS | SYMBOL | CONDITION | UNIT |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | + 125( + 0 − 5) | °C |
| 2 | Positive Supply | $V_{DD}$ | + 18 | Vdc |
| 3 | Negative Supply | $V_{SS}$ | − 18 | Vdc |

**FIGURE 5 - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TEST**



## 4.8 ENVIRONMENTAL AND ENDURANCE TESTS

### 4.8.1 Electrical Measurements on Completion of Environmental Tests

The parameters to be measured on completion of environmental tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

### 4.8.2 Electrical Measurements at Intermediate Points during Endurance Tests

The parameters to be measured at intermediate points during endurance tests are as scheduled in Table 6 of this specification.

### 4.8.3 Electrical Measurements on Completion of Endurance Tests

The parameters to be measured on completion of endurance testing are as scheduled in Table 6 of this specification. Unless otherwise stated, the measurements shall be performed at $T_{amb} = +25 \pm 3$ °C.

### 4.8.4 Conditions for Operating Life Tests

The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 9000. The conditions for operating life testing shall be as specified in Table 5 of this specification.

### 4.8.5 Electrical Circuits for Operating Life Tests

Circuits for use in performing the operating life tests are shown in Figure 5.

### 4.8.6 Conditions for High Temperature Storage Test

The requirements for the high temperature storage test are specified in ESA/SCC Generic Specification No. 9000. The conditions for high temperature storage shall be $T_{amb} = +150(+0-5)$ °C.

**TABLE 6 - ELECTRICAL MEASUREMENTS AT INTERMEDIATE POINTS AND ON COMPLETION OF ENDURANCE TESTING**

| No. | CHARACTERISTICS | SYMBOL | SPEC. AND/OR TEST METHOD | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | | MIN | MAX | |
| 17 | Full Scale Current | $I_{FS}$ | As per Table 2 | As per Table 2 | 1.984 | 2.0 | mA |
| 18 to 19 | Full Scale Symmetry | $I_{FSS}$ | As per Table 2 | As per Table 2 | - | ±4.0 | µA |
| 20 | Zero Scale Current | $I_{ZS}$ | As per Table 2 | As per Table 2 | - | 1.0 | µA |
| 21 | Power Supply Sensitivity, Positive | PSS + | As per Table 2 | As per Table 2 | - | ±0.01 | %/% |
| 22 | Power Supply Sensitivity, Negative | PSS − | As per Table 2 | As per Table 2 | - | ±0.01 | %/% |
| 23 | Power Supply Current, Positive | $I_{DD}$ | As per Table 2 | As per Table 2 | - | 3.8 | mA |
| 24 | Power Supply Current, Negative | $I_{SS}$ | As per Table 2 | As per Table 2 | - | −7.8 | mA |
| 25 | Non-Linearity | LN | As per Table 2 | As per Table 2 | - | ±0.1 | %FS |
| 29 to 30 | Settling Time | $t_s$ | As per Table 2 | As per Table 2 | - | 135 | ns |