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Pages 1 to 30

**TRANSISTORS, MOSFET, N-CHANNEL, POWER,**

**BASED ON TYPES 2N6796, 2N6798,**

**2N6800 AND 2N6802**

**ESA/SCC Detail Specification No. 5205/019**



**space components  
coordination group**

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**DOCUMENTATION CHANGE NOTICE**

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| 'A'   | Sept. 89  | P1. Cover page<br>P2. DCN<br>P15. Para. 4.2.1 : Paragraph amended<br>P16. Para. 4.3.2 : Weight corrected   |             | None<br>None<br>22537<br>23366   |
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| <p>This document has been transferred from hardcopy to electronic format. The content is unchanged but minor differences in presentation exist.</p> |           |  |             |  |

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### **APPENDICES (Applicable to specific Manufacturers only)**

None.

**1. GENERAL****1.1 SCOPE**

This specification details the ratings, physical and electrical characteristics, test and inspection data for Transistors, MOSFET, N-Channel, Power, based on Types 2N6796, 2N6798, 2N6800 and 2N6802.

It shall be read in conjunction with ESA/SCC Generic Specification No. 5000, the requirements of which are supplemented herein.

**1.2 COMPONENT TYPE VARIANTS**

See 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 transistors specified herein, are as scheduled in Table 1(b).

**1.4 PARAMETER DERATING INFORMATION**

The parameter derating information applicable to the transistors specified herein is shown in Figure 1(a).

**1.5 SAFE OPERATING AREA**

The applicable safe operating area information for the transistors specified herein is shown in Figure 1(b).

**1.6 PHYSICAL DIMENSIONS**

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

**1.7 FUNCTIONAL DIAGRAM**

The functional diagram, showing lead identification, of the transistors specified herein, is shown in Figure 3.

**1.8 HANDLING PRECAUTIONS**

These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be taken for protection during all phases of manufacture, testing, packaging, shipment and any handling.



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

| VARIANT | (1)<br>LEAD<br>MATERIAL<br>AND FINISH | (2)<br>JEDEC<br>TYPE | (3)<br>V <sub>DS</sub><br>(MAX.)<br>(V) | (4)<br>I <sub>D</sub><br>(MAX.)<br>(NOTE 1)<br>(A) | (5)<br>I <sub>D</sub><br>(MAX.)<br>(NOTE 2)<br>(A) | (6)<br>I <sub>S</sub><br>(NOTE 1)<br>(A) | (7)<br>V <sub>DD</sub><br>(V) | (8)<br>V <sub>DS</sub><br>(80%)<br>(V) | (9)<br>I <sub>DM</sub><br>(MAX.)<br>(Apk) | (10)<br>V <sub>DG</sub><br>(V) |
|---------|---------------------------------------|----------------------|---|--|--|--|-------------------------------|--|---|--------------------------------|
| 01      | D2                                    | 2N6796               | 100                                     | 8.0  | 5.0  | 8.0                                      | 30                            | 80                                     | 25  | 100                            |
| 03      | D2                                    | 2N6798               | 200                                     | 5.5  | 3.5  | 5.5                                      | 77                            | 160                                    | 12.5                                      | 200                            |
| 05      | D2                                    | 2N6800               | 400                                     | 3.0  | 2.0  | 3.0                                      | 176                           | 320                                    | 6.0                                       | 400                            |
| 07      | D2                                    | 2N6802               | 500                                     | 2.5  | 1.5  | 2.5                                      | 225                           | 400                                    | 5.0                                       | 500                            |

**NOTES**

1. At T<sub>case</sub> = +25°C.
2. At T<sub>case</sub> = +100°C.

**TABLE 1(b) - MAXIMUM RATINGS**

| No. | CHARACTERISTICS                          | SYMBOL        | MAXIMUM RATINGS         | UNIT         | REMARKS   |
|-----|--|---------------|-------------------------|--------------|---|
| 1   | Drain-Source Voltage                     | $V_{DS}$      | Table 1(a)<br>Column 3  | Vdc          |   |
| 2   | Gate-Source Voltage                      | $V_{GS}$      | $\pm 20$                | Vdc          |   |
| 3   | Drain-Gate Voltage                       | $V_{DG}$      | Table 1(a)<br>Column 10 | Vdc          |   |
| 4   | Drain Current<br>(Continuous)            | $I_D$         | Table 1(a)<br>Column 4  | Adc          | At $T_{case} = +25^\circ C$<br>(2) (3)                |
| 5   | Drain Current<br>(Continuous)            | $I_D$         | Table 1(a)<br>Column 5  | Adc          | At $T_{case} = +100^\circ C$<br>(2) (3)               |
| 6   | Source Current<br>(Continuous)           | $I_S$         | Table 1(a)<br>Column 6  | Adc          | At $T_{case} = +25^\circ C$<br>(2) (3)                |
| 7   | Drain Current Pulsed<br>(Peak)           | $I_{DM}$      | Table 1(a)<br>Column 9  | Adc          | Note 2  |
| 8   | Total Power Dissipation                  | $P_{tot}$     | 25                      | W            | At $T_{case} = +25^\circ C$<br>(1)                    |
| 9   | Operating Temperature<br>Range           | $T_{op}$      | -55 to +150             | $^\circ C$   | $T_{amb}$   |
| 10  | Storage Temperature<br>Range             | $T_{stg}$     | -55 to +150             | $^\circ C$   |   |
| 11  | Soldering Temperature                    | $T_{sol}$     | +300                    | $^\circ C$   | Time: $\leq 10s$<br>Distance to<br>case: $\geq 1.5mm$ |
| 12  | Thermal Resistance<br>(Junction to Case) | $R_{TH(J-C)}$ | 5.0                     | $^\circ C/W$ |   |

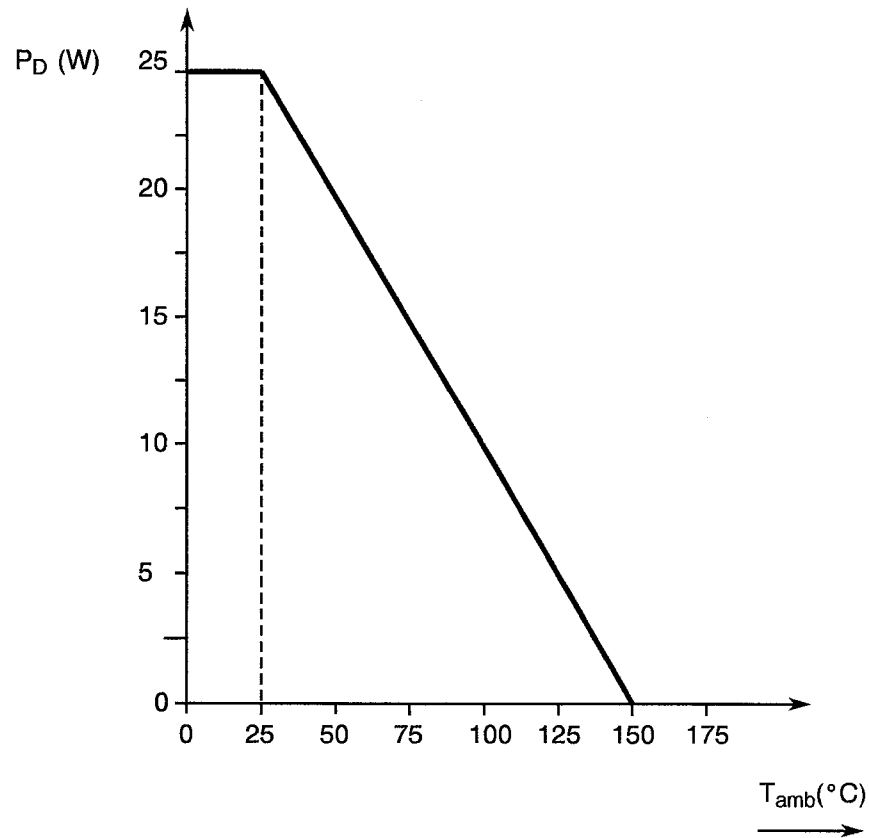
**NOTES**

- Derate linearly  $0.20W/^\circ C$  for  $T_{case} > +25^\circ C$  (See Figure 1(a)).
- These ratings apply at the case. Leads of TO-39 devices are not capable of carrying maximum drain currents beyond 2.0mm from the case without heatsink.
- Derate for  $T_{case} > +25^\circ C$  as follows:-

$$I_D = \sqrt{\frac{P(\text{rated})}{K}} \quad \text{where: } P(\text{rated}) = 25 - (T_{case} - 25) (0.20) \text{ watts.}$$
$$K = \text{rated } r_{DS(ON)} \text{ at } T_J = +150^\circ C.$$



**FIGURE 1(a) - PARAMETER DERATING INFORMATION (ALL VARIANTS)**



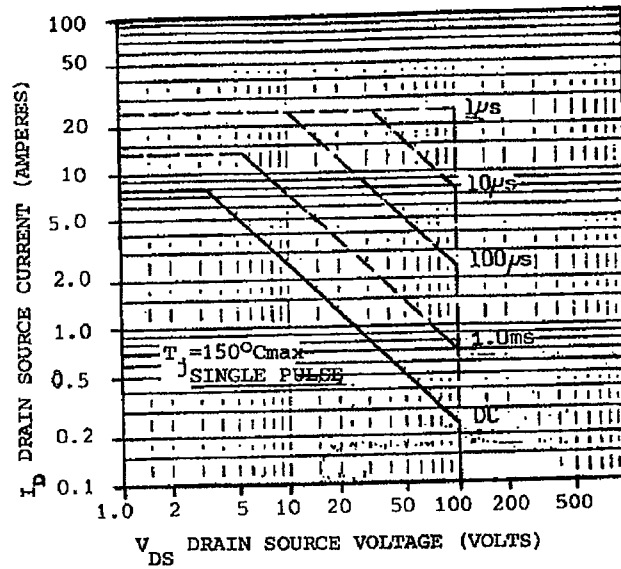
Power Dissipation versus Temperature





FIGURE 1(b) - MAXIMUM SAFE OPERATING AREA

VARIANT 01



VARIANT 03

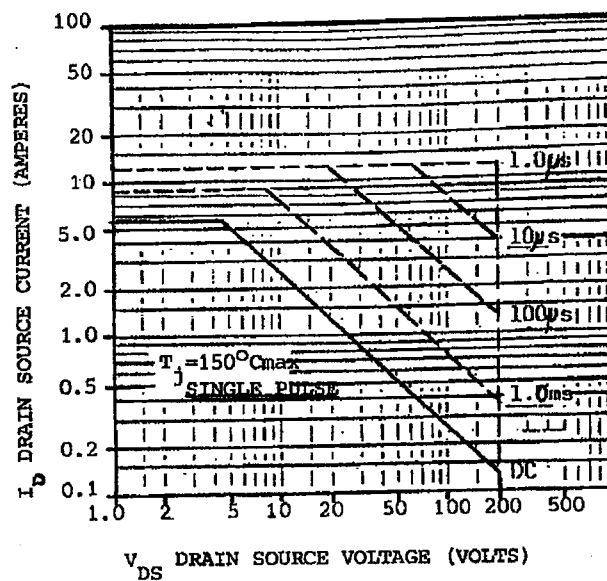
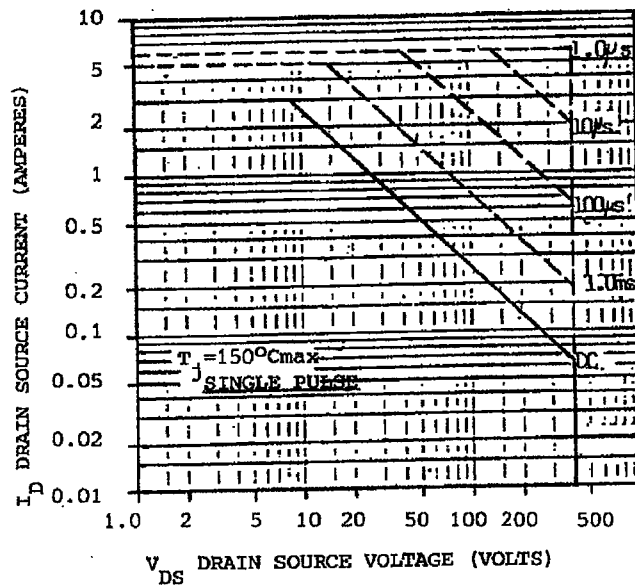


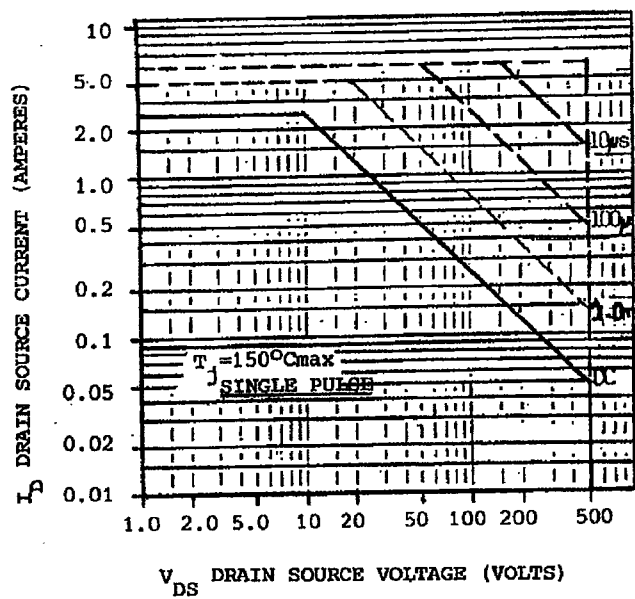


FIGURE 1(b) - MAXIMUM SAFE OPERATING AREA (CONTINUED)

VARIANT 05

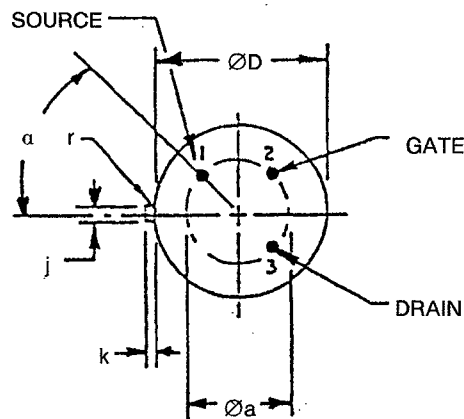
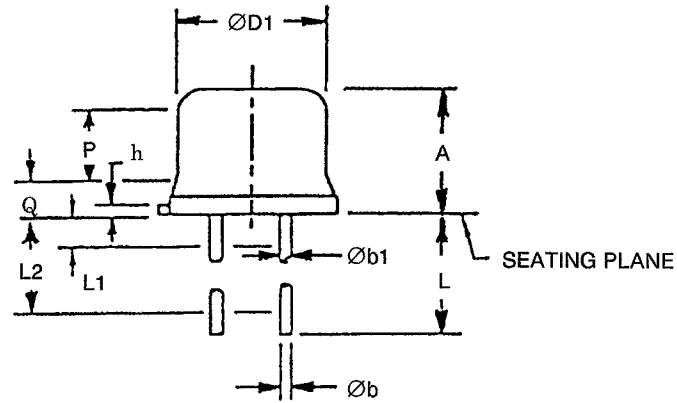


VARIANT 07






**FIGURE 2 - PHYSICAL DIMENSIONS**



| SYMBOL | MILLIMETRES  |       | INCHES        |       | NOTES<br>(See Note 1) |
|--------|--------------|-------|---------------|-------|-----------------------|
|        | MIN.         | MAX.  | MIN.          | MAX.  |                       |
| A      | 4.074        | 4.57  | 0.160         | 0.180 |                       |
| Øa     | 5.08 Typical |       | 0.200 Typical |       |                       |
| Øb     | 0.41         | 0.53  | 0.016         | 0.021 | 7, 8                  |
| Øb1    | 0.41         | 0.48  | 0.016         | 0.019 | 7, 8                  |
| ØD     | 8.51         | 9.40  | 0.335         | 0.370 |                       |
| ØD1    | 7.75         | 8.51  | 0.305         | 0.335 |                       |
| h      | 0.23         | 1.04  | 0.009         | 0.041 |                       |
| j      | 0.71         | 0.86  | 0.028         | 0.034 | 2                     |
| k      | 0.74         | 1.14  | 0.029         | 0.045 | 3                     |
| L      | 12.70        | 19.05 | 0.500         | 0.750 | 7, 8                  |
| L1     | -            | 1.27  | -             | 0.050 | 7, 8                  |
| L2     | 6.35         | -     | 0.250         | -     | 7, 8                  |
| P      | 2.54         | -     | 0.100         | -     | 5                     |
| Q      | -            | 1.27  | -             | 0.050 | 4                     |
| r      | -            | 0.25  | -             | 0.010 | 9                     |
| a      | 45° Typical  |       | 45° Typical   |       | 6                     |

**NOTES:** See Page 12.

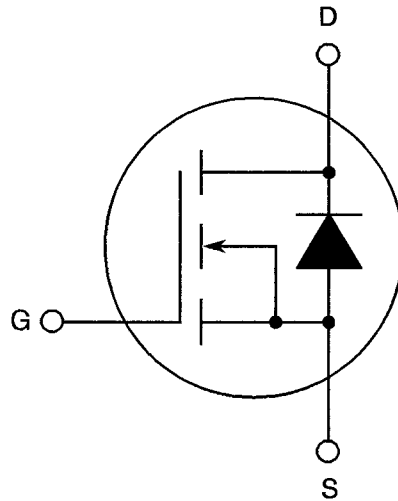
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### **NOTES TO FIGURE 2 - PHYSICAL DIMENSIONS**

1. Imperial equivalents are given for general information only and are based upon 25.4mm = 1inch.
2. Beyond r (radius) maximum, j shall be held for a minimum length of 0.28mm (0.11").
3. k measured from maximum  $\varnothing$ D.
4. Outline in this zone is not controlled.
5.  $\varnothing$ D1 shall not vary more than 0.25mm (0.010") in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane 1.37 + 0.03, -0.00 mm (0.054" + 0.001", -0.001", -0.000") below seating plane shall be within 0.18mm (0.007") radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods or by gauge.
7.  $\varnothing$ b1 applies between L1 and L2.  $\varnothing$ b applies between L2 and L minimum. Diameter is uncontrolled in L1 and beyond L minimum.
8. All three leads.
9. r (radius) applies to both inside corners of tab.



**FIGURE 3 - FUNCTIONAL DIAGRAM**



**NOTES**

1. The drain is electrically connected to the case.

**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. 5000 for Discrete Semiconductor Components.
- (b) MIL-STD-750, Test Methods and Procedures for Semiconductor Devices.
- (c) ESA/SCC Basic Specification No. 23500, Requirements for Lead Materials and Finishes for Components for Space Application.

**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:-

- $I_{GSS}$  = Gate Current.
- $B_{VGSS}$  = Gate to Source Breakdown Voltage.
- $V_{GS(th)}$  = Gate Threshold Voltage.
- $V_{GS}$  = Gate to Source Voltage.
- $V_{DG}$  = Drain to Gate Voltage.
- $V_{DS}$  = Drain to Source Voltage.
- $g_{fs}$  = Forward Transfer Conductance.
- $C_{iss}$  = Common Source Input Capacitance.
- $C_{oss}$  = Common Source Output Capacitance.
- $C_{rss}$  = Common Source Reverse Transfer Capacitance.
- $I_S$  = Source Current.
- $I_D$  = Drain Current.

**4. REQUIREMENTS****4.1 GENERAL**

The complete requirements for procurement of the transistors specified herein are stated in this specification and ESA/SCC Generic Specification No. 5000 for Discrete Semiconductor Components. Deviations from the Generic Specification applicable to this specification only, are listed in Para. 4.2.

Deviations from the applicable Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESA/SCC requirements and do not affect the components' reliability, are listed in the appendices attached to this specification.



## 4.2 DEVIATIONS FROM GENERIC SPECIFICATION

### 4.2.1 Deviations from Special In-process Controls

- (a) For testing levels 'B' and 'C', a Scanning Electron Microscope (SEM) inspection shall be performed on samples from each metallisation lot in accordance with ESA/SCC Basic Specification No. 21400.

### 4.2.2 Deviations from Final Production Tests (Chart II)

None.

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

- (a) Burn-in Test: The duration shall be 240 hours.
- (b) The following test shall be added to the Electrical Measurements at Room Temperature; to be performed after the burn-in test only:-

Verification of Safe Operating Area (See Figure 4(a))

Test 'A' Condition (Variant 01)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 80\text{Vdc}$ ;  $I_{\text{D}} = 310\text{mAdc}$

Test 'A' Condition (Variant 03)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 160\text{Vdc}$ ;  $I_{\text{D}} = 155\text{mAdc}$

Test 'A' Condition (Variant 05)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 200\text{Vdc}$ ;  $I_{\text{D}} = 125\text{mAdc}$

Test 'A' Condition (Variant 07)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 200\text{Vdc}$ ;  $I_{\text{D}} = 125\text{mAdc}$

Test 'B' Condition (Variant 01)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 3.12\text{Vdc}$ ;  $I_{\text{D}} = 8.0\text{Adc}$

Test 'B' Condition (Variant 03)

$T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec.

$V_{\text{DS}} = 4.5\text{Vdc}$ ;  $I_{\text{D}} = 5.5\text{Adc}$

Test 'B' Condition (Variant 05) $T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec. $V_{\text{DS}} = 8.3\text{Vdc}$ ;  $I_{\text{D}} = 3.0\text{Adc}$ Test 'B' Condition (Variant 07) $T_{\text{case}} = +25 \pm 10 \text{ }^\circ\text{C}$ ; duration = 0.1sec. $V_{\text{DS}} = 10\text{Vdc}$ ;  $I_{\text{D}} = 2.5\text{Adc}$ Test Method for Both Tests

Using a 0.1 second pulse width with a minimum of 1 minute between pulses, increase  $V_{\text{GS}}$  and the Drain Supply Voltage until the specified value of  $I_{\text{D}}$  and  $V_{\text{DS}}$  are obtained. A load resistor,  $R_{\text{L}}$ , shall be used and shall be selected such that  $I_{\text{D}} \cdot R_{\text{L}} = 2.5 \pm 1.0 \text{ Vdc}$  (All Variants).

Electrical Measurements

After performing both tests, the electrical measurements Nos. 1 to 7 inclusive of Table 2 shall be repeated.

4.2.4 Deviations from Qualification Tests (Chart IV)

None.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

None.

4.3 MECHANICAL REQUIREMENTS4.3.1 Dimension Check

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

4.3.2 Weight

The maximum weight of the transistors specified herein shall be 1.1 grammes.

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. The test conditions shall be as follows:-

Test Condition : 'E', Lead Fatigue.

Applied Force : 2.22 Newtons.

Duration : 10 seconds.





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 transistors 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

Metal case, hermetically sealed, similar to JEDEC TO-39.

4.4.2 Lead Material and Finish

The lead material shall be Type 'D' with Type '2' finish in accordance with the requirements of ESA/SCC Basic Specification No. 23500.

4.5 MARKING

4.5.1 General

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

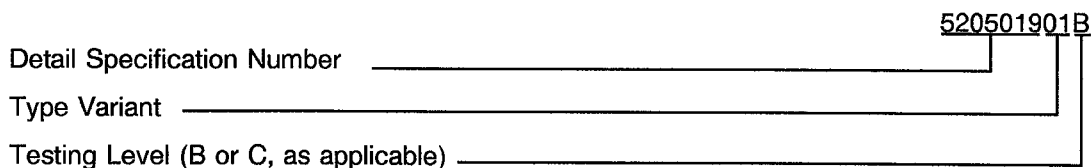
- (a) Lead Identification.
- (b) The SCC Component Number.
- (c) Traceability Information.

4.5.2 Lead Identification

Lead identification shall be as shown in Figures 2 and 3.

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 the requirements of ESA/SCC Basic Specification No. 21700.



#### 4.5.5 Marking of Small Components

When it is considered that the component is too small to accommodate the marking as specified above, as much as space permits shall be marked. The order of precedence shall be as follows:-

- (a) The SCC Component Number.
- (b) Date Code.
- (c) Serial Number
- (d) Manufacturers Identification or Symbol.

The marking information in full shall accompany each component in its primary package.

#### 4.6 ELECTRICAL MEASUREMENTS

##### 4.6.1 Electrical Measurements at Room Temperature

The parameters to be measured at room temperature are scheduled in Table 2. The measurements shall be performed at  $T_{amb} = +22 \pm 3$  °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  $T_{amb} = +125(+0 - 5)$  and  $-55(+5 - 0)$  °C respectively.

##### 4.6.3 Circuits for Electrical Measurements

Circuits 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  $T_{amb} = +22 \pm 3$  °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 H.T.R.B and Power Burn-in

The requirements for H.T.R.B. and Power burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5000. The conditions for H.T.R.B. and Power burn-in shall be as specified in Tables 5(a) and 5(b) of this specification.

4.7.3 Electrical Circuits for H.T.R.B. and Power Burn-in

Circuits for use in performing the H.T.R.B. and Power Burn-in tests are shown in Figures 5(a) and 5(b) of this specification.

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

| No. | CHARACTERISTICS   | SYMBOL       | MIL-STD 750<br>TEST METHOD | TEST CONDITIONS  | LIMITS                       |                              | UNIT     |
|-----|---|--------------|----------------------------|--|------------------------------|------------------------------|----------|
|     |   |              |                            |  | MIN                          | MAX                          |          |
| 1   | Breakdown Voltage<br>Drain-Source<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07   | $B_{VDSS}$   | 3407<br>Bias Cond. 'C'     | $I_D = 0.25\text{mAdc}$<br>$V_{GS} = 0\text{Vdc}$  | 100<br>200<br>400<br>500     | -<br>-<br>-<br>-             | Vdc      |
| 2   | Gate Threshold Voltage  | $V_{GS(th)}$ | 3403                       | $V_{DS} \geq V_{GS}$<br>$I_D = 1.0\text{mAdc}$   | 2.0                          | 4.0                          | Vdc      |
| 3   | Gate Current  | $I_{GSS}$    | 3411<br>Bias Cond. 'C'     | $V_{GS} = 20\text{Vdc}$<br>$V_{DS} = 0\text{Vdc}$  | -                            | 100                          | nAdc     |
| 4   | Drain Current   | $I_{DSS}$    | 3413<br>Bias Cond. 'C'     | $V_{DS} = \text{Note 2 Vdc}$<br>$V_{GS} = 0\text{V}$   | -                            | 0.25                         | mAdc     |
| 5   | Drain-Source ON<br>Resistance<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07       | $r_{DS(ON)}$ | 3421                       | $V_{GS} = 10\text{Vdc}$<br><br>$I_D = 5.0\text{Adc}$<br>$I_D = 3.5\text{Adc}$<br>$I_D = 2.0\text{Adc}$<br>$I_D = 1.5\text{Adc}$<br>Notes 1 and 6 | -<br>-<br>-<br>-             | 0.18<br>0.40<br>1.00<br>1.50 | $\Omega$ |
| 6   | Drain-Source ON Voltage<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07             | $V_{DS(ON)}$ | 3405                       | $V_{GS} = 10\text{Vdc}$<br>$I_D = 8.0\text{Adc}$<br>$I_D = 5.5\text{Adc}$<br>$I_D = 3.0\text{Adc}$<br>$I_D = 2.5\text{Adc}$<br>Notes 1 and 6     | -<br>-<br>-<br>-             | 1.56<br>2.20<br>3.00<br>3.75 | Vdc      |
| 7   | Body Drain Diode Forward<br>Voltage<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07 | $V_{SD}$     | 4011                       | $I_S = 8.0\text{Adc}$<br>$I_S = 5.5\text{Adc}$<br>$I_S = 3.0\text{Adc}$<br>$I_S = 2.5\text{Adc}$<br>Note 1                                       | 0.75<br>0.70<br>0.70<br>0.70 | 1.5<br>1.4<br>1.4<br>1.4     | Vdc      |

**NOTES**

1. Pulsed Measurement: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
2. See Column 3 of Table 1(a).
3. See Column 5 of Table 1(a).
4. See Column 7 of Table 1(a).
5. See Column 8 of Table 1(a).
6. Measured within 2.0mm of case.
7. Measurements to be performed on a sample basis, LTPD7.



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

| No. | CHARACTERISTICS  | SYMBOL       | MIL-STD 750 TEST METHOD | TEST FIG. | TEST CONDITIONS (NOTE 7)  | LIMITS                   |                          | UNIT |
|-----|--|--------------|-------------------------|-----------|---|--------------------------|--------------------------|------|
|     |  |              |                         |           |   | MIN                      | MAX                      |      |
| 8   | Forward Transconductance<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07                   | gfs          | 3455                    | -         | $V_{DS} = 5.0V$<br>$I_D = 5.0A_{dc}$<br>$I_D = 3.5A_{dc}$<br>$I_D = 2.0A_{dc}$<br>$I_D = 1.5A_{dc}$<br>Note 1 | 3.0<br>2.5<br>2.0<br>1.5 | 9.0<br>7.5<br>6.0<br>4.5 | S    |
| 9   | Turn-on Delay Time   | $t_{d(ON)}$  | 3459                    | 4(b)      | $I_D = (3) A_{dc}$<br>$V_{DD} = (4) V_{dc}$   | -                        | 30                       | ns   |
| 10  | Rise Time<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07                                  | $t_r$        | 3251                    |           |   | -                        | 75<br>50<br>35<br>30     | ns   |
| 11  | Turn-off Delay Time<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07                        | $t_{d(OFF)}$ | 3251                    |           |   | -                        | 40<br>50<br>55<br>55     | ns   |
| 12  | Fall Time<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07                                  | $t_f$        | 3251                    |           |   | -                        | 45<br>40<br>35<br>30     | ns   |
| 13  | Common Source Input Capacitance  | $C_{iss}$    | 3431                    | -         | $V_{DS} = 25V_{dc}$<br>$V_{GS} = 0V, f = 1.0MHz$  | 350                      | 900                      | pF   |
| 14  | Common Source Output Capacitance<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07           | $C_{oss}$    | 3453                    | 4(c)      | $V_{DS} = 25V_{dc}$<br>$V_{GS} = 0V_{dc}, f = 1.0MHz$   | 150<br>100<br>50<br>25   | 500<br>450<br>300<br>200 | pF   |
| 15  | Common Source Reverse Transfer Capacitance<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07 | $C_{rss}$    | 3433                    | -         | $V_{DS} = 25V_{dc}$<br>$V_{GS} = 0V_{dc}, f = 1.0MHz$   | 25<br>40<br>30<br>30     | 100<br>150<br>100<br>100 | pF   |

**NOTES:** See Page 20.



**TABLE 3(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE, +125(+0-5) °C**

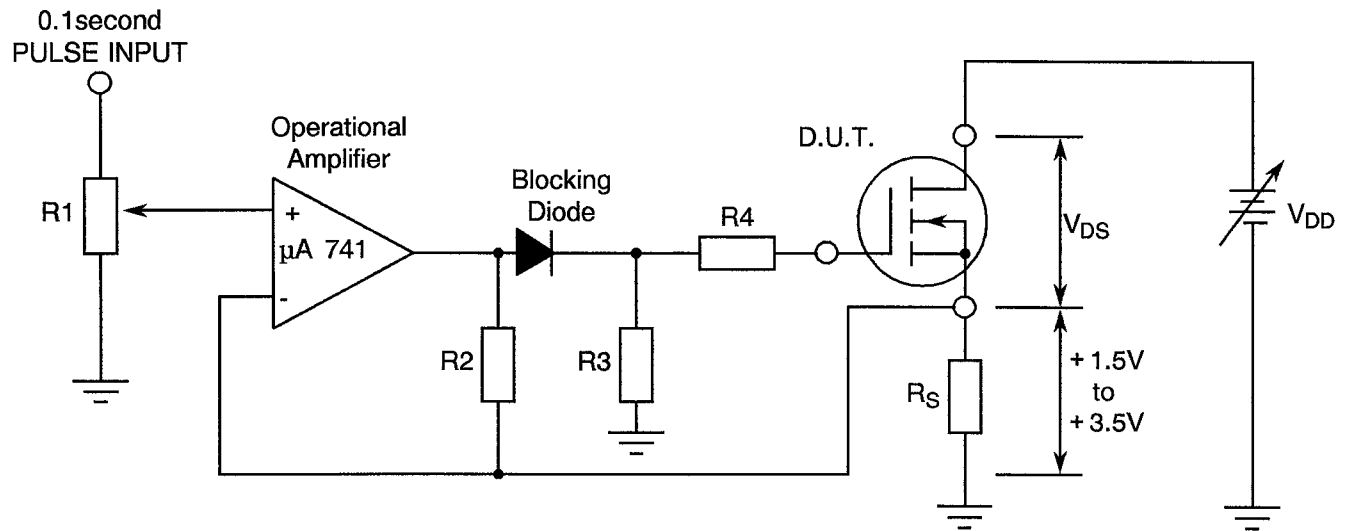
| No. | CHARACTERISTICS   | SYMBOL       | MIL-STD 750<br>TEST METHOD | TEST CONDITIONS  | LIMITS           |                              | UNIT     |
|-----|---|--------------|----------------------------|--|------------------|------------------------------|----------|
|     |   |              |                            |  | MIN              | MAX                          |          |
| 2   | Gate Threshold Voltage  | $V_{GS(th)}$ | 3403                       | $V_{DS} \geq V_{GS}$<br>$I_D = 1.0\text{mAdc}$   | 1.0              | -                            | Vdc      |
| 3   | Gate Current  | $I_{GSS}$    | 3411<br>Bias Cond. 'C'     | $V_{GS} = 20\text{Vdc}$<br>$V_{DS} = 0\text{Vdc}$  | -                | 200                          | nAdc     |
| 4   | Drain Current   | $I_{DSS}$    | 3413<br>Bias Cond. 'C'     | $V_{DS} = (2) \text{Vdc}$<br>$V_{GS} = 0\text{Vdc}$  | -                | 1.0                          | mAdc     |
| 5   | Drain Source ON<br>Resistance<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07 | $r_{DS(ON)}$ | 3421                       | $V_{GS} = 10\text{V}$<br><br>$I_D = 5.0\text{Adc}$<br>$I_D = 3.5\text{Adc}$<br>$I_D = 2.0\text{Adc}$<br>$I_D = 1.5\text{Adc}$<br>Notes 1 and 3 | -<br>-<br>-<br>- | 0.35<br>0.75<br>2.40<br>3.50 | $\Omega$ |

**TABLE 3(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE, -55 (+5-0) °C**

| No. | CHARACTERISTICS        | SYMBOL       | MIL-STD 750<br>TEST METHOD | TEST CONDITIONS                                | LIMITS |     | UNIT |
|-----|------------------------|--------------|----------------------------|--|--------|-----|------|
|     |                        |              |                            |  | MIN    | MAX |      |
| 2   | Gate Threshold Voltage | $V_{GS(th)}$ | 3403                       | $V_{DS} \geq V_{GS}$<br>$I_D = 1.0\text{mAdc}$ | -      | 5.0 | Vdc  |

**NOTES**

1. Pulsed: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .
2. See Column 8 of Table 1(a).
3. Measured within 2.0mm of case.

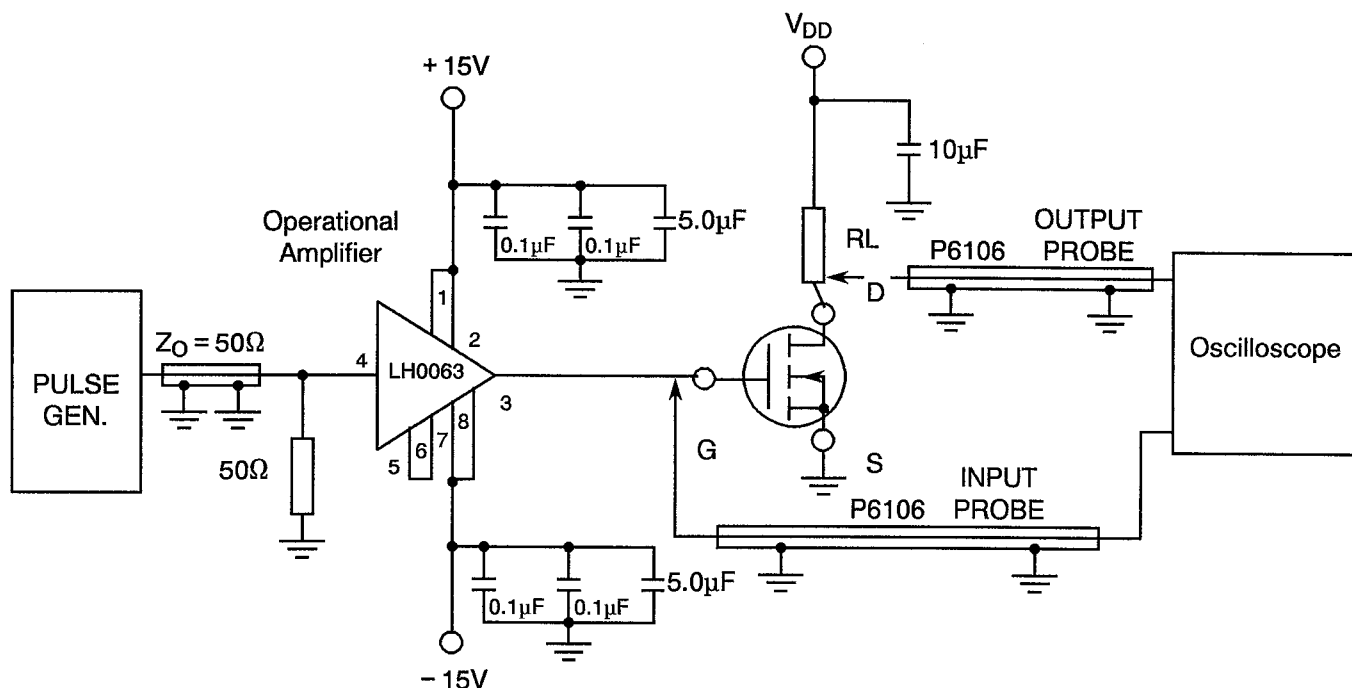
**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS****FIGURE 4(a) - SAFE OPERATING AREA TEST CIRCUIT****NOTES**

1. R = Variable resistor.  
R2 = 20k $\Omega$ .  
R3 = 20k $\Omega$ .  
R4 = 47 $\Omega$ .
2.  $R_S$  is non-inductive and selected such that  $I_D \times R_S$  gives the specified voltage +1.5V to +3.5V.



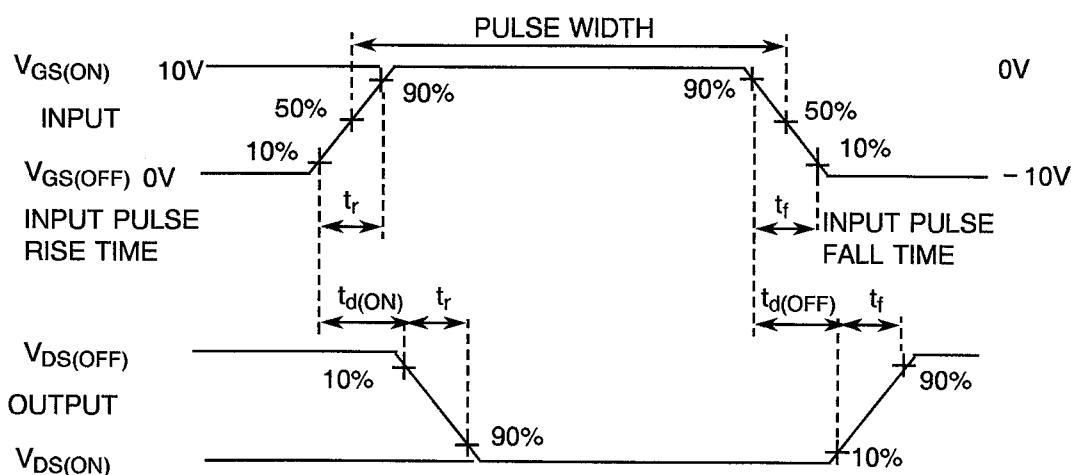
FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS (CONTINUED)

FIGURE 4(b) - SWITCHING TIMES TEST CIRCUIT



**NOTES**

1. LH0063 case grounded.
2. Grounded connections common to ground plane on board.
3. Pulse width  $\leq 3.0\mu s$ , Period  $\leq 1.0ms$ , Amplitude = 0V to +10V.



**NOTES**

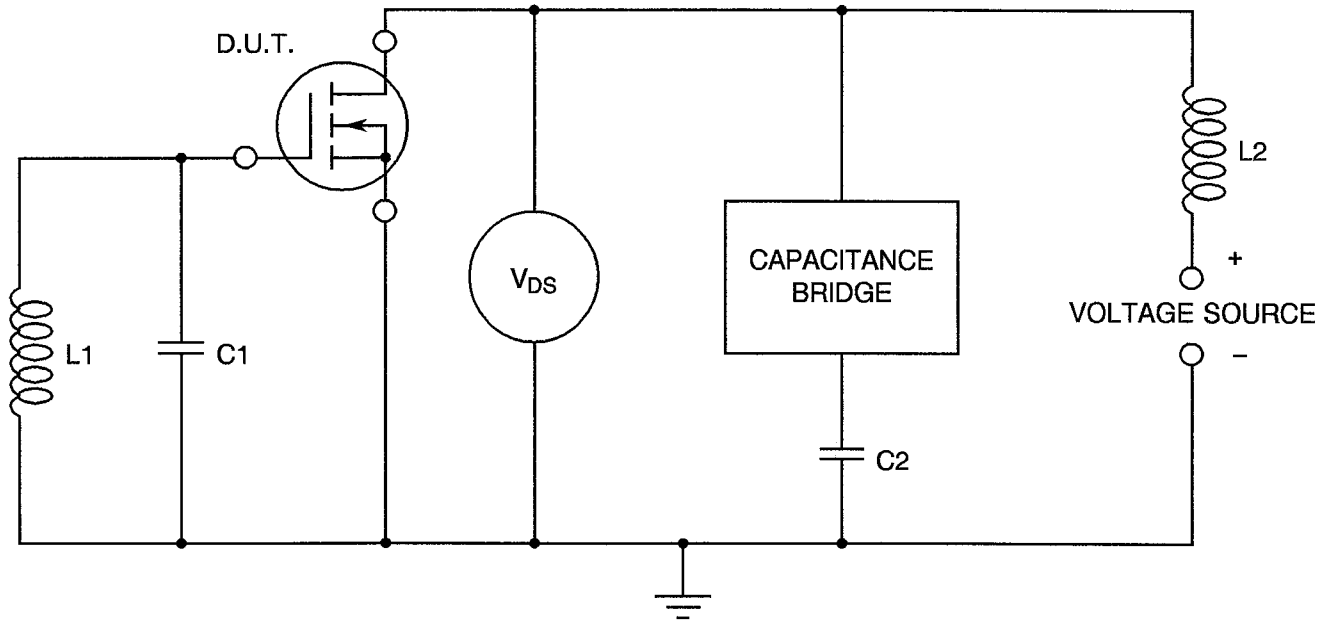
1. When measuring rise time,  $V_{GS(ON)}$  shall be as specified on the input waveform. When measuring fall time,  $V_{GS(OFF)}$  shall be as specified on the input waveform. The input transition and drain voltage response detector shall have rise and fall response times such that doubling these responses will not affect the results greater than the precision of measurement. The current shall be sufficiently small so that doubling it does not affect test results greater than the precision of measurement.





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

FIGURE 4(c) - COMMON SOURCE OUTPUT CAPACITANCE



**PROCEDURE**

The capacitors C1 and C2 shall present apparent short circuits at the test frequency. L1 and L2 shall present a high a.c. impedance at the test frequency for isolation. The bridge shall have low d.c. resistance between its output terminals and should be capable of carrying the test current without affecting the desired accuracy of measurement.



**TABLE 4 - PARAMETER DRIFT VALUES**

| No. | CHARACTERISTICS            | SYMBOL       | SPEC. AND/OR TEST METHOD | TEST CONDITIONS | CHANGE LIMITS ( $\Delta$ )      | UNIT            |
|-----|----------------------------|--------------|--------------------------|-----------------|---------------------------------|-----------------|
| 2   | Gate Threshold Voltage     | $V_{GS(th)}$ | As per Table 2           | As per Table 2  | $\pm 20$                        | %               |
| 3   | Gate Current               | $I_{GSS}$    | As per Table 2           | As per Table 2  | $\pm 20$<br>or (1)<br>$\pm 100$ | nA dc<br>%      |
| 4   | Drain Current              | $I_{DSS}$    | As per Table 2           | As per Table 2  | $\pm 25$<br>or (1)<br>$\pm 100$ | $\mu$ A dc<br>% |
| 5   | Drain-Source ON Resistance | $r_{DS(ON)}$ | As per Table 2           | As per Table 2  | $\pm 20$                        | %               |

**NOTES**

1. Whichever is greater referred to the initial value.

**TABLE 5(a) - CONDITIONS FOR HTRB (PRE-CONDITIONING STRESS)**

| No. | CHARACTERISTICS  | SYMBOL    | CONDITION               | UNIT |
|-----|--|-----------|-------------------------|------|
| 1   | Ambient Temperature  | $T_{amb}$ | + 150(+ 0 – 5)          | °C   |
| 2   | Drain-Source Voltage<br>Variant 01<br>Variant 03<br>Variant 05<br>Variant 07 | $V_{DS}$  | 80<br>160<br>320<br>400 | Vdc  |
| 3   | Gate-Source Voltage  | $V_{GS}$  | 0                       | Vdc  |
| 4   | Duration   | t         | 48                      | Hrs  |

**TABLE 5(b) - CONDITIONS FOR POWER BURN-IN AND OPERATING LIFE TESTS**

| No. | CHARACTERISTICS      | SYMBOL   | CONDITION      | UNIT |
|-----|----------------------|----------|----------------|------|
| 1   | Junction Temperature | $T_J$    | + 140 ± 10 (1) | °C   |
| 2   | Drain-Source Voltage | $V_{DS}$ | > + 10         | Vdc  |
| 3   | Gate-Source Voltage  | $V_{GS}$ | + 1.0 to + 16  | Vdc  |
| 4   | Duration             | t        | 240            | Hrs  |

**NOTES**

- Using the circuit shown in Figure 5(b), power shall be applied to the device to achieve the specified junction temperature. The junction temperature ( $T_J$ ) should be determined as follows:-

$$T_J = (P_T) \times (R_{TH(J-C)}) + T_{case}$$

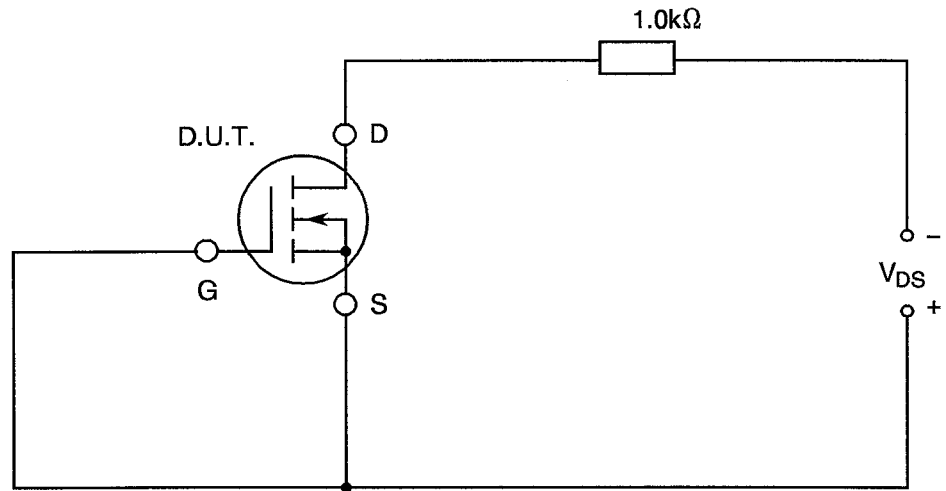
$$P_T = (V_{DS}) \times (I_D)$$

$$R_{TH(J-C)} = 5.0^\circ\text{C/W}$$

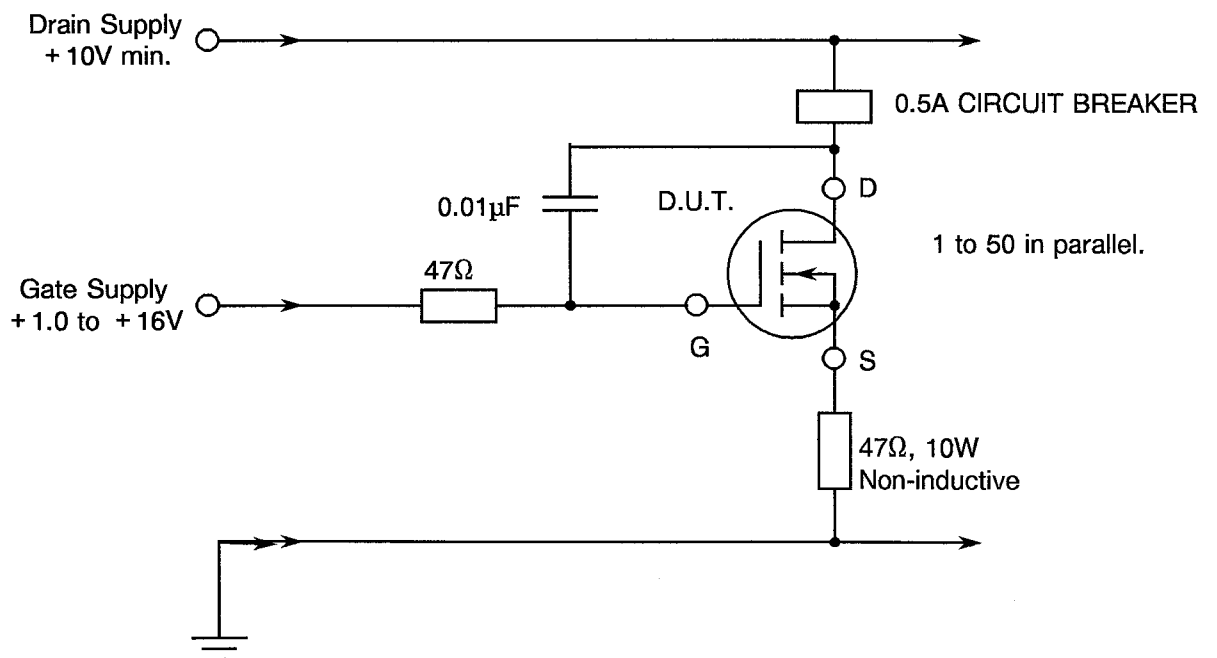
$$T_{case} = \text{Measured value at the hottest point on the case.}$$



**FIGURE 5(a) - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS**



**FIGURE 5(b) - ELECTRICAL CIRCUIT FOR BURN-IN AND OPERATING LIFE TESTS**





- 4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5000)
- 4.8.1 Electrical Measurements on Completion of Environmental Tests  
The parameters to be measured on completion of environmental tests are scheduled in Table 2. The measurements shall be performed at  $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$ .
- 4.8.2 Electrical Measurements at Intermediate Points and on Completion of Endurance Tests  
The parameters to be measured at intermediate points and on completion of endurance testing are scheduled in Table 6. The measurements shall be performed at  $T_{amb} = +22 \pm 3 \text{ }^\circ\text{C}$ .
- 4.8.3 Conditions for Operation Life Tests (Part of Endurance Testing)  
The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 5000. The conditions for operating life testing shall be the same as specified in Table 5(b) for the burn-in test.
- 4.8.4 Electrical Circuits for Operating Life Tests  
The circuit to be used for performance of the operating life tests shall be the same as shown in Figure 5(b) for the burn-in test.
- 4.8.5 Conditions for High Temperature Storage Test (Part of Endurance Testing)  
The requirements for the high temperature storage test are specified in ESA/SCC Generic Specification No. 5000. The conditions for high temperature storage shall be  $T_{amb} = 150(+0-5) \text{ }^\circ\text{C}$ .

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**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. |      |
| 2   | Gate Threshold Voltage    | $V_{GS(th)}$ | As per Table 2           | As per Table 2  | 2.0    | 4.0  | Vdc  |
| 3   | Gate-Body Leakage Current | $I_{GSS}$    | As per Table 2           | As per Table 2  | -      | 100  | nAdc |
| 5   | Drain Current             | $I_{DSS}$    | As per Table 2           | As per Table 2  | -      | 0.25 | mAdc |